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Máster Universitario en Ingeniería de Telecomunicación

Trabajo Fin de Máster

Diseño e Implementación de Infraestructura de Red para un Operador Móvil e ISP.

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RESUMEN

A lo largo de este trabajo de fin de master se presenta un proceso de investigación sobre las tecnologías y protocolos IP que conforman un Core de ISP y un Core de Navegación Móvil (EPC), con el fin de crear una definición apropiada de lo que implica un Core ISP.

Por otro lado, y a partir de dicha definición se realiza una propuesta de diseño de un Core de ISP el cual toma en cuenta la integración de un EPC con sus respectivas interfaces de comunicación.

Asimismo, se despliega esta propuesta en una maqueta de pruebas virtualizable que permite corroborar el funcionamiento del diseño anteriormente propuesto.

PALABRAS CLAVE

ISP, Core IP, Core 4G, LTE, Core de Navegación Móvil.

ABSTRACT

Throughout this master thesis project, a research process is presented on the IP technologies and protocols that make up an ISP Core and a Mobile Navigation Core (EPC), in order to create an appropriate definition of what an ISP involves.

On the other hand, and based on this definition, a design proposal for an ISP Core is made, which takes into account the integration of an EPC with its respective communication interfaces.

Also, this proposal is deployed in a virtualizable test model that allows to corroborate the operation of the previously proposed design.

KEYWORDS

PS Core, IP Core, Evolved Packet Core, 4G, EPC, ISP.

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Chapter 1

1. INTRODUCTION

Internet by definition is a network of networks, basically consists of the interconnection of a large number of network devices that provide communication between computers or other devices, the massification of the Internet has been achieved thanks to the investment of large Internet Service Providers (ISPs), which have deployed enough infrastructure to support the current levels of traffic. Most of these providers not only serve as Internet providers but also as providers of private connectivity, with which people and companies can connect different geographically dispersed sites.

This type of connectivity is nothing new, but historically having a dedicated link implied (or implies depending on the conditions), of paying a high price and accessing reduced bandwidths. With the optimization of electronics service providers and their customers throughout history have seen a change in service paradigms, with the explosion of virtualization and mobile technology, ISPs are looking for a way to concentrate and offer as many services as possible and at the same time reduce costs to a greater extent.

The concept of Core as a region of an ISP's network is not new either, but with the regularization of technologies such as MPLS and VPN the Cores have become unified and have become more robust. But with the increasing technological evolution, new technologies such as NFV and SDN are gaining prominence, not only in the access and aggregation layers, but also depending on the characteristics and sizes, more Virtualized Cores will be seen.

This trend of virtualization has not only affected classic ISPs, it will also be present in Mobile technology, where 5G technology is expected to be completely virtualized, but will not differ much from the current 4G version (with respect to operating entities).

Although the IP network and mobile telephony technologies are based on open protocols and recommendations, the construction and design approach of both an ISP and a Mobile Operator depend on the methodology of each manufacturer, this is where the interest to develop this work comes, as a way of presenting a methodology and consistent application of current protocols in an environment outside of the telecommunications industry.

This project proposes the establishment of a Core of an ISP, and of a Core of 4G / Legacy, since both niches are part of a larger community. Reviewing current and intermediate technologies in the near future, using as a demo model versions of virtualizable equipment and finally defining the needs of the Core.

Chapter three reviews current and future technologies in the field of mobile networks and IP networks. In chapter four a proposal is made of how to relate all these technologies and how to apply them, condensing into a design of a national scale network, and then moving on to the fifth chapter where the necessary virtualization technologies are reviewed so that in the sixth chapter the proposed design can be deployed and tested.

Chapter 2

2. OBJECTIVES

As mentioned in the Master Thesis proposal, this is a project that in a generic way aims to design and implement the deployment of a unified IP network infrastructure that can provide and supply the services and needs for the implementation of a Mobile Operator (2g / 3g). / LTE) as well as for an IP Service Provider (ISP). Making use of different design methodologies, technologies and network protocols.

For this purpose, intermediate steps must first be reached, which are listed below:

- Conduct a review of current and future technologies in the fields of IP networks and mobile telephony at the Core level.
- With the information previously gathered, propose a Core network design of an ISP taking into account also the needs of a Packet Core (EPC).
- Using existing virtualization tools in the industry, deploy and test the previously proposed design.

Chapter 3

3. OVERVIEW OF THE PACKET CORE (EPC) AND ITS TRANSPORT TECHNOLOGIES CONCEPTS

The rapid evolution of services and content through the Internet has led to a consequent development in mobile telecommunications infrastructures, from the already legacy 2G technology, which initially made use of transport protocols that are only found in textbooks as a mere anecdote, to make way for the 3G version of the 3GPP in which the IP protocol began to be unified as a means of transport, technology in which voice was still part of the domain of circuit switching (CS), to give step to the current system of fourth generation 4G LTE, in which by definition all services including voice and data are contained in the domain of packet switching (PS). This evolution not only corresponds to the improvements in the treatment of digital signals in the terminals, but there has also been an evolution in the Core, giving way from the Packet Core to the Evolved Packet Core (EPC).

3.1. The Transport Technology Of The Packet Core And Internet Service Providers (ISPs)

As mentioned above, the entire infrastructure of an Internet Service Provider (ISP), and in the specific case of a fourth generation and above mobile operator, in the network layer is completely handled by the IP protocol, so before continuing to deepen the Mobile Core, the concept of Core IP must be handled.

The concept of IP Core comes from the Design Model in Layers of a Data Center (1), which is structured in a network with multi-layered architecture, the Core layer, Aggregation, and Access, which is shown in Figure 1. This architecture model extends not only to the design of a Data Center but also to the architecture model of an ISP, thanks to advantages such as improved scalability, performance, flexibility and availability.

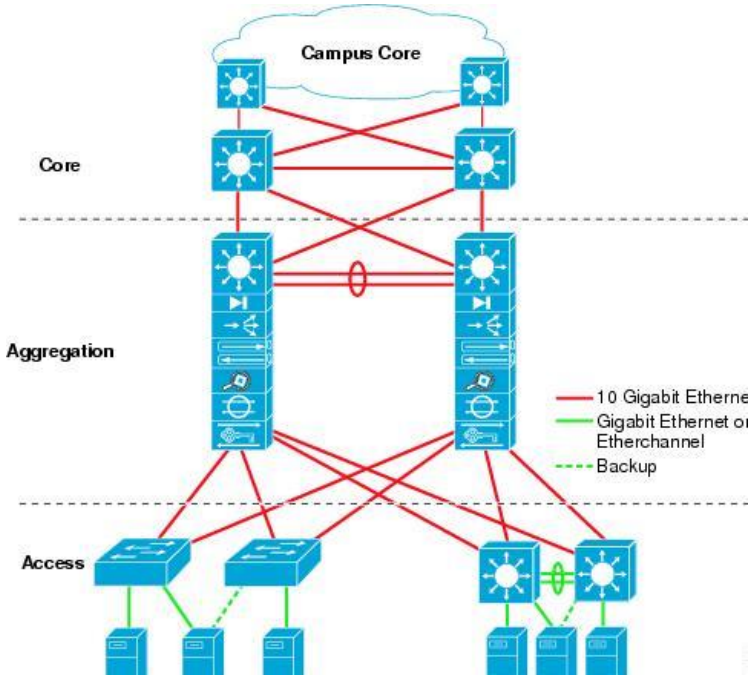


Figure 1 Basic Layer Design (1)

The Core layer by definition is the layer that provides the best available hardware for high packet switching, for all the flows that come from the aggregation devices, in the Core layer different protocols of level 3 redundancy are executed (HSRP, VRRP) as routing level 3 (OSPF, IS-IS), or mixed (MPLS).

For a better understanding of the network architecture capabilities, a review of the routing protocols currently used in the industry is presented.

3.1.1. Interior Gateway Protocols (IGPs)

As will be presented later, in the Core of a service provider the P routers use a dynamic IGP internal gateway protocol in order to find the best path between loopbacks (2), so the two most used in the industry open IGPs will be studied next.

3.1.1.1. Open Short Path First (OSPF)

OSPF (Open Short Path First) is an IGP for IP packet routing, which uses the Dijikstra algorithm to calculate the best route between two nodes within an autonomous system.

It refers to its cost by metric, which takes into account several parameters, but the most important is the bandwidth. These parameters characterize the state of the links, with which the protocol can build the link-state database (LSDB), a database that includes all the routers defined in a specific area.

OSPF uses the multicast of different types of packets to keep the routing information updated, which establishes the topology of the network and the state of the links of the various nodes.

Routers running OSPF have to establish neighbor relationships before they can exchange routes, OSPF being a link state protocol where neighbors do not exchange the routing tables, what it's

exchanged is information about the topology of the network, once they have this info every router runs the shortest path algorithm to calculate the best route and then add this to the routing table.

In order to function correctly, OSPF routers must contain several tables with information about topology and routing:

- Neighbors Table: Contains information about all OSPF neighbors.
- Topology Table: Contains the topology of the network.
- Routing Table: Only the best routes.

For two routers to be considered OSPF neighbors, specific fields in the Hello packets must match (3):

- Subnet
- Area ID
- Hello and Dead Interval timers.
- Authentication.
- MTU.

One of the peculiarities of OSPF is that it uses a hierarchical concept of Areas, where the area is a continuous logical grouping of networks and routers. All routers in the same area have the same topology table but are completely unaware of routers outside their area. Each area has to connect to the backbone area (Area 0). There may be routers that have interfaces in more than one area, this type of routers are called Area Border Router (ABR), and those routers that connect an area OSPF with a different kind of domain are called Autonomous System Border Router (ASBR) , as can be seen in Figure 2, R4 has interfaces in Area 1 and Area 0 which makes it an ABR, while R1 has interfaces in other routing domains which makes it an ASBR.

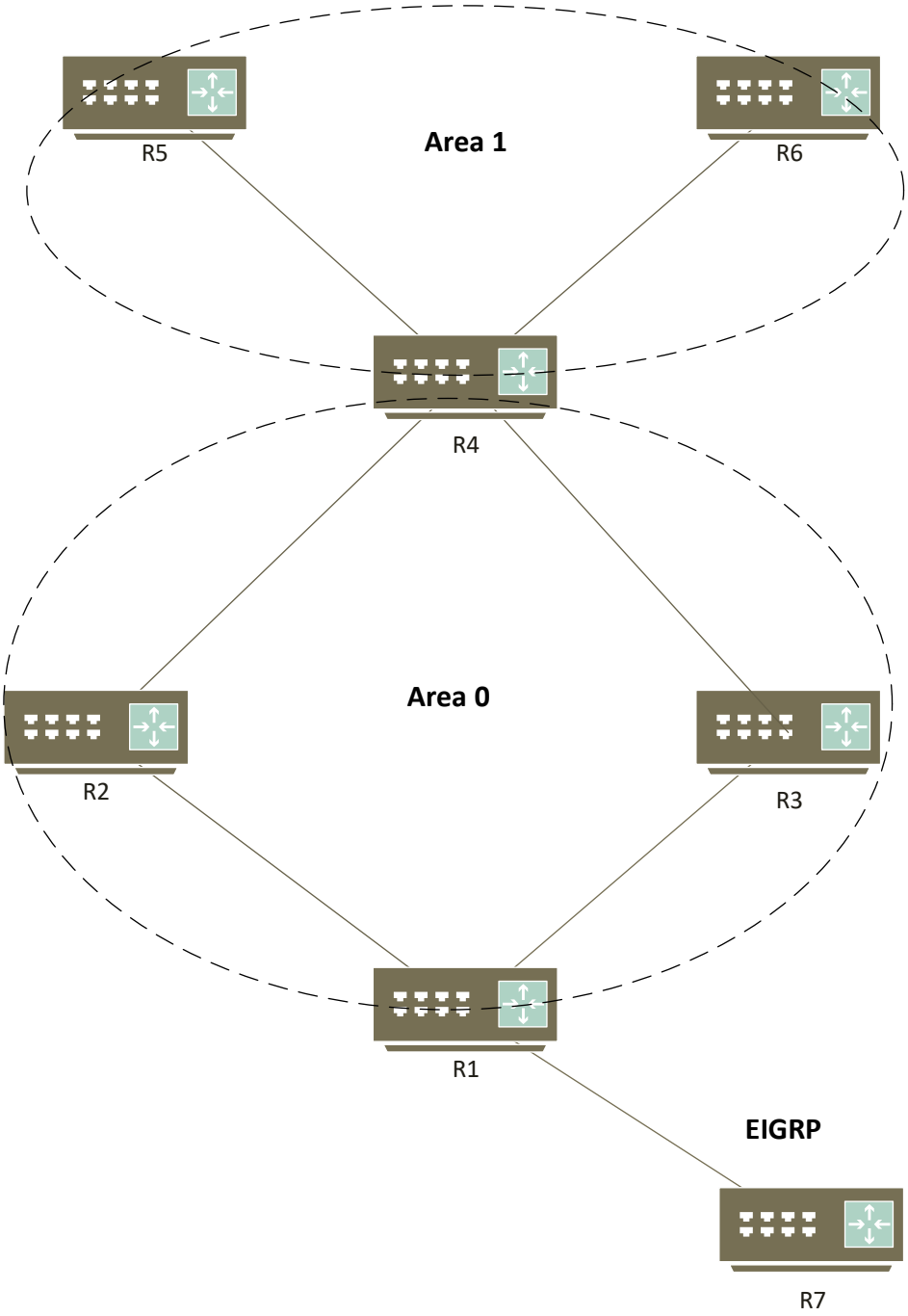


Figure 2 Different OSPF router types.

OSPF is a protocol in extensive use in the industry, so it has been updated to support both IPv6 (4) as well as extensions for traffic engineering through MPLS (5), which makes it a strong candidate to be used in the Core of an ISP.

3.1.1.2. Intermediate System To Intermediate System (IS-IS)

IS-IS is a protocol adopted by the International Organization for Standardization (ISO) as a routing protocol for the interconnection of Open Systems (6), just as OSPF, IS-IS is a link state protocol that uses the Dijikstra algorithm to calculate the optimal routes. It also uses Hello packets to allow neighbor discovery, as well as allow network convergence.

An IS-IS network consists of an AS formed by end-systems and intermediate systems. The end systems are considered entities that send and receive information, but the intermediate systems are entities that forward packets.

In IS-IS an AS can be subdivided into smaller groups called Areas, the routing between these areas is organized hierarchically, assigning the intermediate systems Levels 1 and Level 2. Where Level 1 information is only routed within the area, but when it's necessary to send data outside this Area, the packets are sent to Level 2 routers. Level 2 systems communicate between areas and between AS.

Updates and exchanges of status information only occur between routers belonging to the same level.

An IS is identified by an address known as NET (Network Entity Title), which is the address of a Network Service Access Point (NSAP), which in turn identifies the IS-IS instance that runs on the IS. The NET can consist of 8 to 20 octets in length and consists of three parts (6):

- Area Address: This field can be a 1 to 13 octets length.
- System ID: 6 octets, has to be unique when is operated between Level 1 and Level 2.
- NSEL: 1 octet length selector.

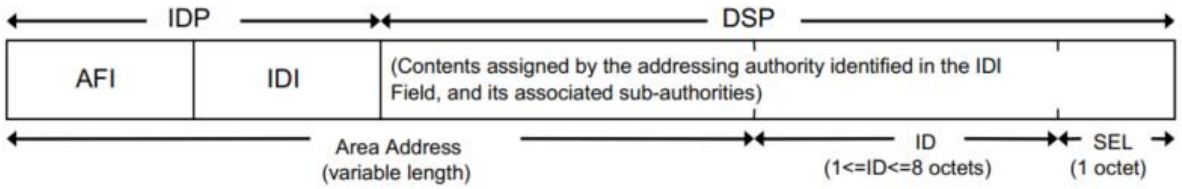


Figure 3 IS-IS Routing Address Structure (6)

IS-IS shares many similarities with OSPF, such as using the Dijikstra algorithm and supporting VLSM, but there are also notable differences such as that in IS-IS the area and host address are assigned to the router while in OSPF it is assigned per interface, IS-IS operates on layer 2, while OSPF on layer 3.

In addition, historically IS-IS has been used popularly in the ISP Cores (7).

3.1.2. Exterior Gateway Protocols (EGPs)

A diferencia de un IGP, un EGP es un tipo de protocolo que intercambia información de enrutamiento entre Sistemas Autónomos, este es el tipo de protocolo que se usa para soportar el Internet.

Unlike an IGP, an EGP is a type of protocol that exchanges routing information between Autonomous Systems; this is the type of protocol used to support the Internet.

3.1.2.1. Border Gateway Protocol (BGP)

BGP is an EGP, designed to be used between different networks, it is the protocol used to interconnect ISPs, but it can also be used between a Business Network and an ISP. It is a protocol designed to maintain reliability, scalability, and control.

Among the highlights of BGP are the following (8):

- Routers that run BGP are called BGP Speakers.
- BGP uses the concept of AS to separate domains, from 1 to 645111 are considered public and are assigned by the Internet Assigned Number Authority (IANA), from 54512 to 65535 are private.
- BGP neighbors are called peers and are configured statically.
- BGP uses TCP port 179.
- BGP is a vector-path protocol, its route to a network consists of a list of ASs.
- Its loop prevention mechanism is the number of AS, when an update on a network leaves the AS the number of this AS is added to the ASs list, when another router receives this update it is analyzed, and if it finds the number of AS of the same router, the route is discarded.
- It is used when the Autonomous System has different suppliers, and it is necessary to manipulate the networks.

In figure 4 we can see how a router belonging to the AS 65430 receives an update on the network 10.10.10.0/24 with a path of AS 65400 65410 65420.

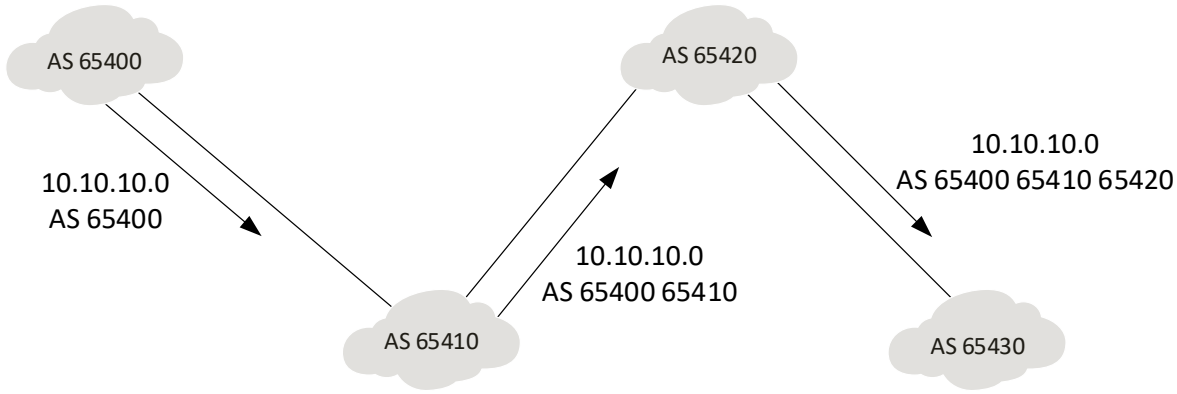


Figure 4 BGP basic functionality

BGP uses two proprietary databases:

- BGP Neighbors: The list of all BGP configured neighbors.
- BGP Database: A list of all known networks using BGP along with their paths and the other attributes.

It should also be mentioned that BGP can be executed in two different modes:

- Internal BGP (iBGP): corresponds to a relationship between routers belonging to the same autonomous system.
- External BGP (eBGP): This is when it is established between routers belonging to different AS.

BGP gives a different treatment to updates coming from internal peers or external peers; Figure 5 identifies the eBGP and iBGP peers:

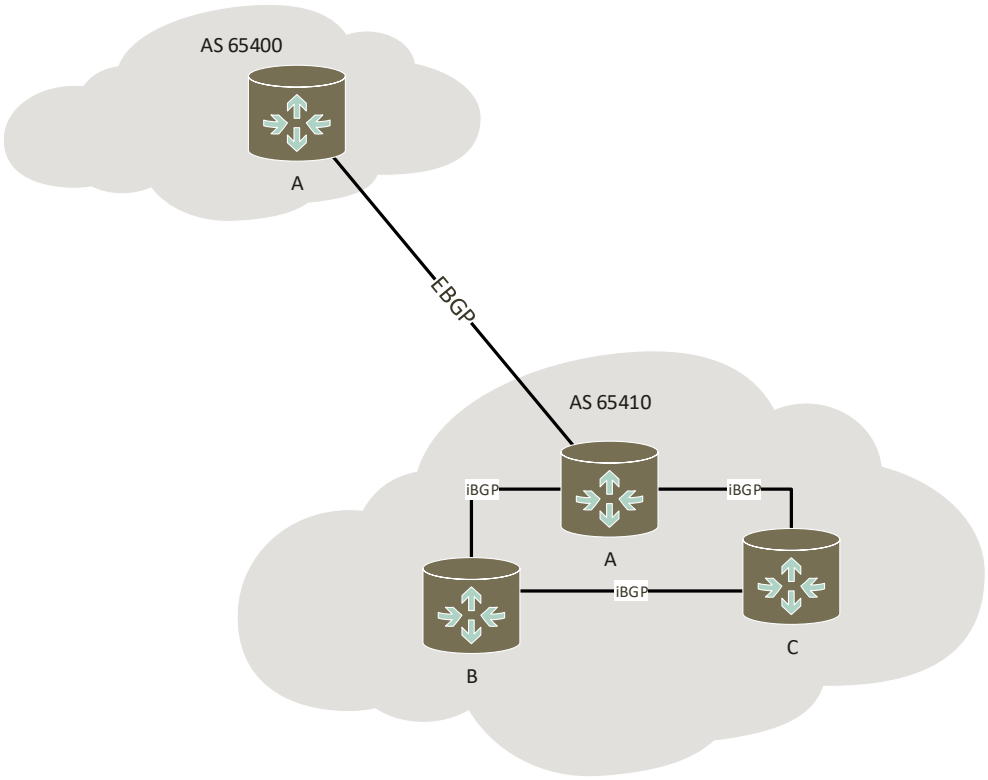


Figure 5 Routers EBGP e IBGP

3.1.3. Multi-Protocol Label Switching (MPLS)

Multiprotocol Label Switching (MPLS) is a type of data transport technique in telecommunications networks, which sends information from one network node to another based on small labels instead of using long network addresses, thus avoiding complex searches in the routing table.

It is a transport mechanism independent of the protocol, since data packets are assigned a label, and switching decisions are based on this label alone without the need to examine the complete packet, which avoids a dependency on layer technologies 2 and commutation speed is gained. MPLS can be considered as a protocol that resides between layers 2 and 3 of the OSI model.

Usually, when a packet enters a router, it analyzes the destination and source addresses and compares them with their routing table. In an MPLS network, only the index of the label is analyzed and then compared with an MPLS forwarding table, since the MPLS tables have a lower number of entries, the search consumes less time and fewer resources.

For the sending of information, MPLS defines a type of circuit or predefined path called Label-Switched Path (LSP), which are unidirectional paths from one network point to another.

Among the advantages of using MPLS, the following are presented (9):

- Layer 2 or Layer 3 VPN services can be offered.
- Bandwidth can be guaranteed using QoS.
- Manually control the utilization of the network thanks to Traffic Engineering (TE).
- You can have a BGP free Core.

MPLS introduces new concepts to be able to work with label forwarding, where different functionalities can be found:

- LSR: Label Switch Router, Any router that forwarded packets based on labels.
- Edge-LSR: Router that receives a packet without a label and this one push one or more labels.
- Ingress E-LSR: Router that pushes labels in a packet without labels.
- Egress E-LSR: Router that removes (POP) labels in a packet and forwards it free of labels.

As shown in Figure 6 the mechanism of Label Switching can be summarized in three steps (10):

i. The ingress-E-LSR receives an IP packet, and a label is placed (PUSH).
ii. A transit LSR router receives the labeled packet, changes the label and redirects it to the next LSR.
iii. The egress-E-LSR receives the labeled packet, removes the label and forwards the IP packet, (POP).

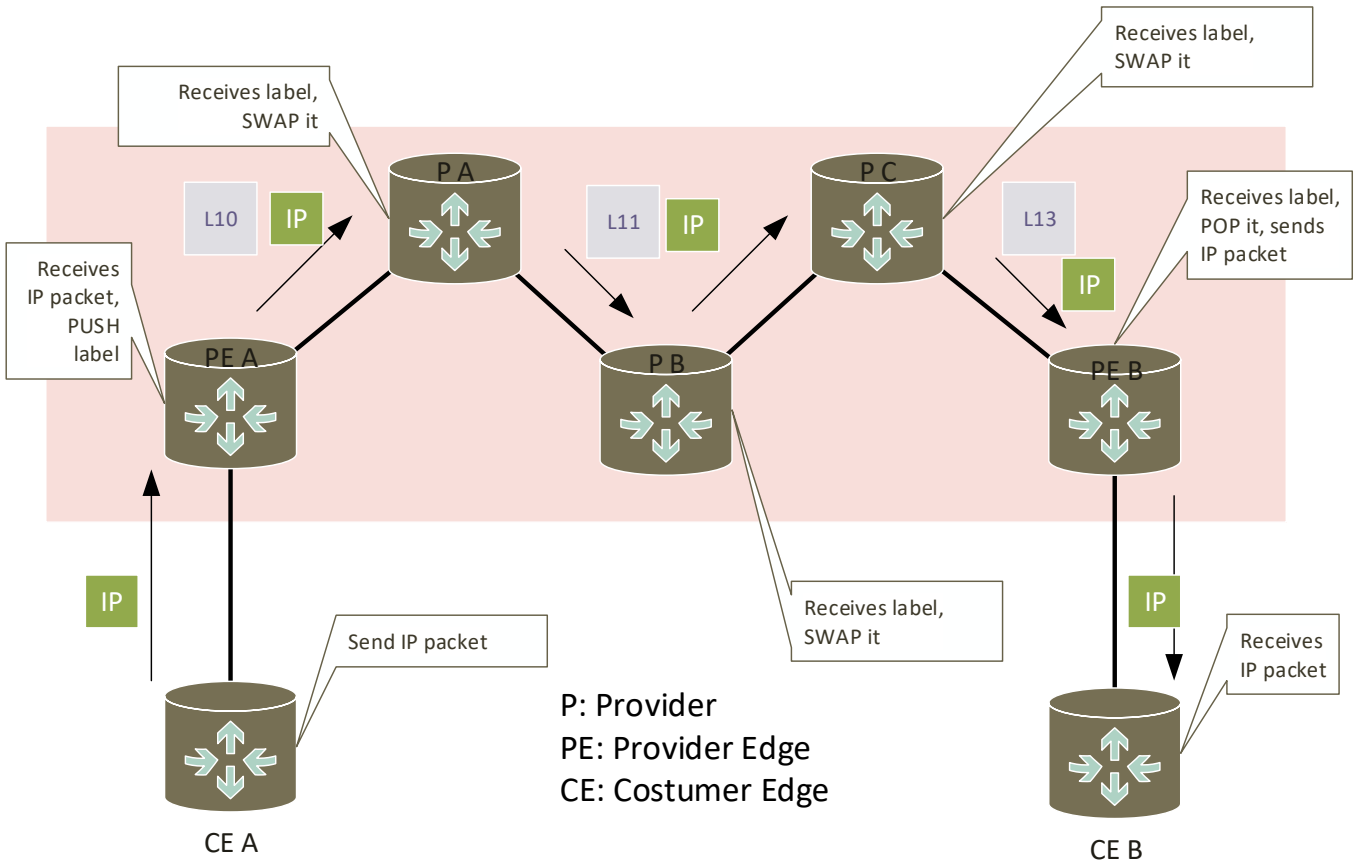


Figure 6 MPLS Label Mechanism

3.1.4. Multi-Protocol BGP (MP-BGP)

Multiprotocol Extensions for BGP it is an extension to BGP that allows different types of addresses to be used to be distributed in parallel. This version allows the support not only of IPv4 but also of IPv6, Multicast, and VPNv4 (11). Also, since MPBGP is an extension to BGP, the same rules apply for route selection, validation, etc. It maintains separate BGP tables for Unicast and Multicast.

In addition, MPBGP is widely used in the case of MPLS L3 VPN, to exchange VPN tags learned from the clients' sites through the MPLS network, to distinguish the networks between different clients and thus keep the routing tables separate.

3.1.5. Network Function Virtualization (NFV)

With improvements in the performance of hardware components, as well as the explosion of content and mobile devices, the telecommunications industry has been forced to restructure network and service architectures. This is where the Virtual Network Functionality (NFV) technology appears, which can implement network functions on software that run on traditional server hardware, deploying these functionalities at any time and any location without the need for new equipment (12).

It can be considered as an evolution or change of paradigm in which starting from the traditional approach for each network service a specific hardware device was needed (router, CDN, Firewall, DPI, etc.), which implied having fragmented hardware. To move to architecture in which there are a standard network device, one storage device and one processing device on which you can deploy any functionality that was previously dispersed.

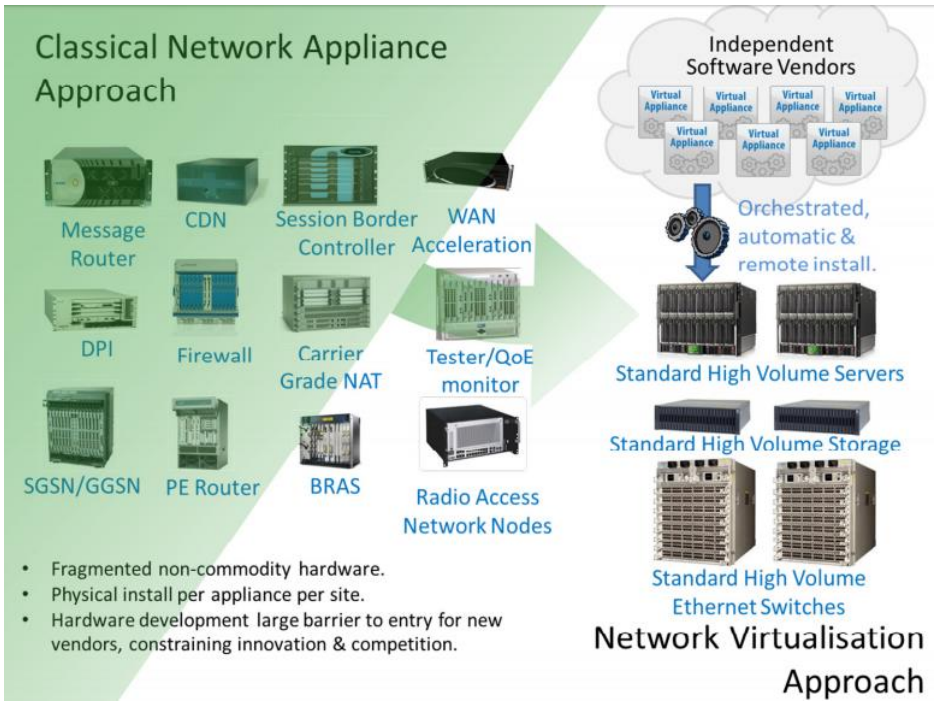


Figure 7 NFV objectives (12)

Among the advantages of NFV, there is a reduction in the costs of the devices and energy consumption since now the amount of hardware needed is reduced because the functionalities are condensed. Also, the times of deployment of the new services will be decreased, since now the scalability has been increased considerably.

Among the different and potential functions that can be virtualized are the following (13):

- Switching Elements: Routers.
- Mobile Network Nodes: HLR/HSS, MME, SGSN, GGSN, RNC.

- Tunnel Elements: VPN Gateways.
- Traffic Analysis: DPI.
- NGN Signaling: SBC e IMS.
- Security Functions: Firewalls, IDS, AntiSpam.

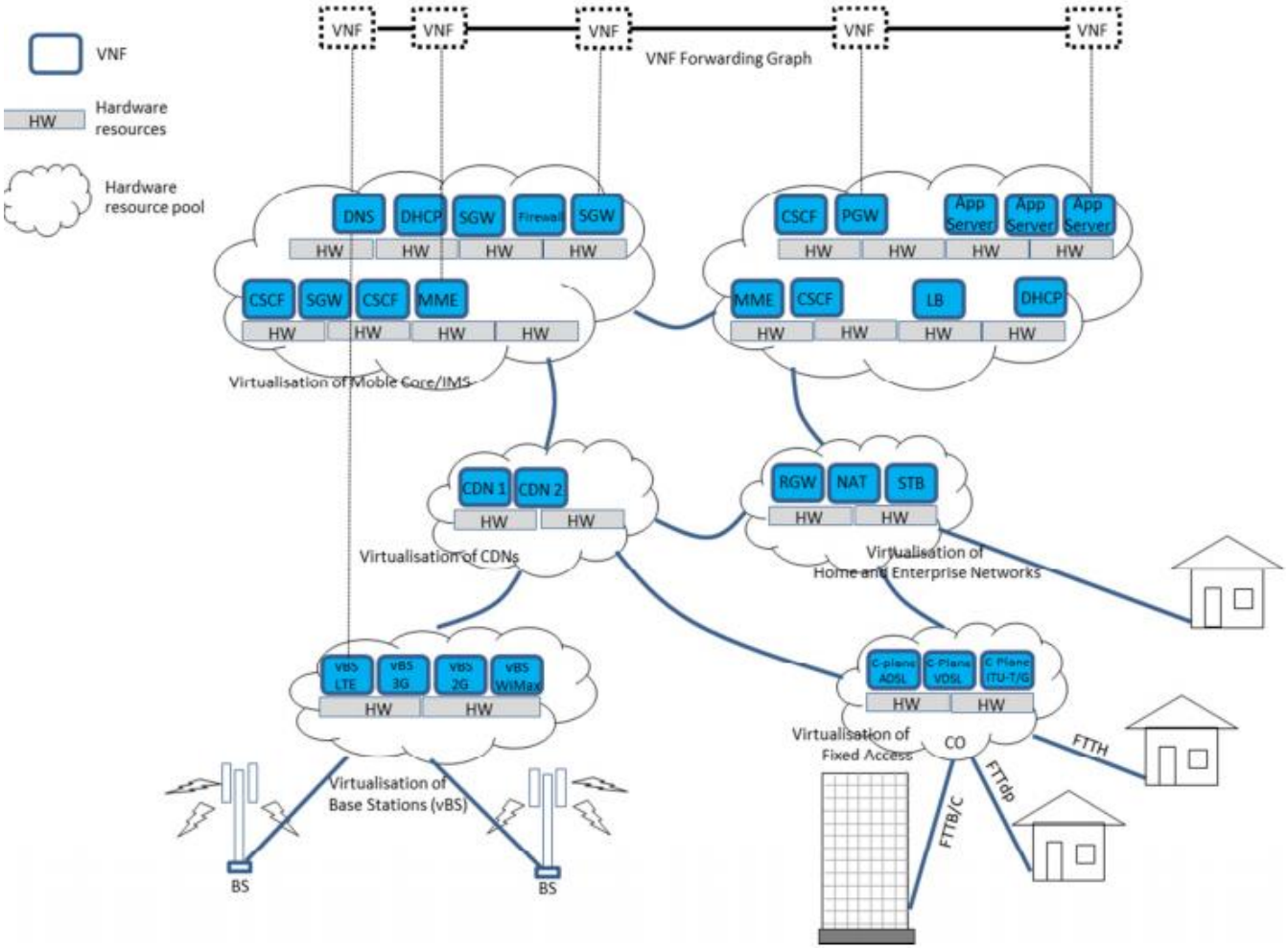


Figure 8 NFV use cases within an ISP (13)

3.1.6. Software-Defined Networking (SDN)

It is considered an emerging architecture that separates network control and forwarding functions, allowing the control of the network to be directly programmable and the infrastructure that supports it to become an abstraction for applications and services.

Among the advantages announced by SDN are the following:

- Network control is directly programmable because it is separated from the forwarding functions.
- Thanks to the control abstraction, administrators are allowed to adjust the flow of traffic to meet the needs dynamically.
- Network intelligence is centralized, which allows a global vision of the network as if it were a single switch.
- Open SDN standards simplify network design because the instructions come from SDN drivers instead of devices and protocols from multiple manufacturers.

3.1.6.1. Architecture

Figure 9 shows the SDN architecture, which consists of three layers: infrastructure, control, and application:

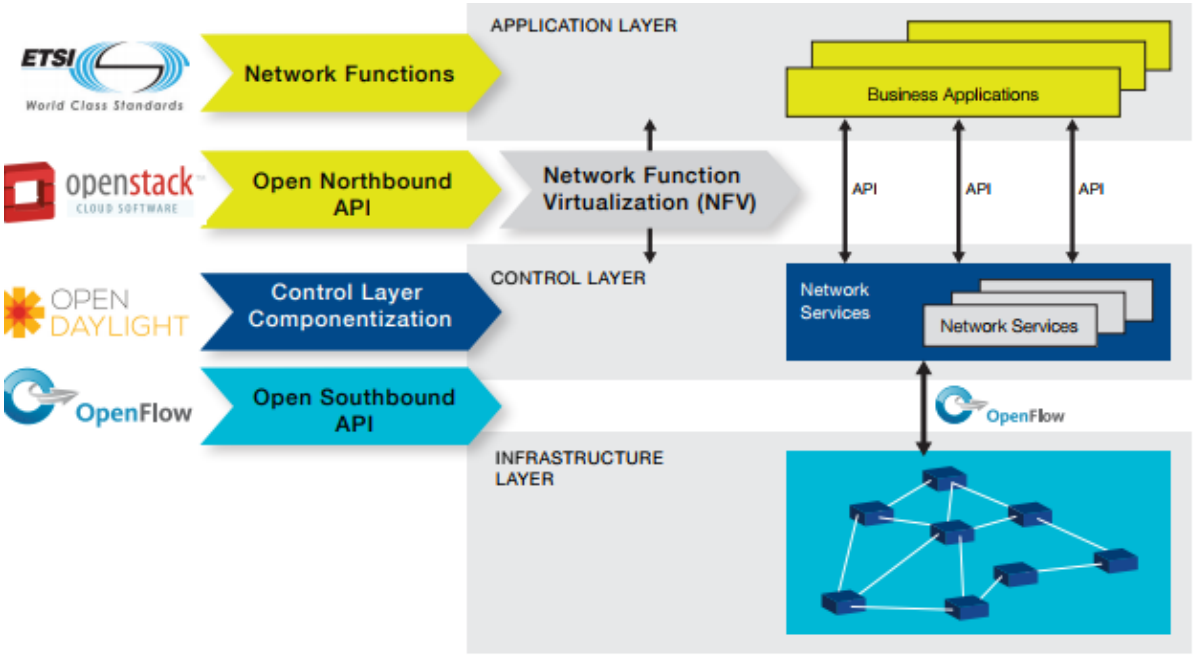


Figure 9 SDN Architecture (14)

- **Application Layer**: This layer consists of the applications that the operators of the SDN services will use, it is interconnected with the control layer through the Northbound Application Programming Interface (NBI). These APIs are open to clients, developers and the community for their development.
- **Control Layer:** This layer provides the centralized logical control that monitors the behavior of the network service through an open interface.
- **Infrastructure Layer:** It consists of network elements (NE) and devices that provide packet switching and forwarding. It communicates with the upper layer through the Southbound

protocol, for example, OpenFlow, which ensures that the highest number of options and flexibility in design and deployment are available.

We can mention other components of SDN architecture (15):

- SDN Applications (SDN App): These are programs that explicitly and directly communicate the network requirements and the expected network behavior through the SDN and NBI controllers.
- SDN Controller: It is a centralized entity in charge of translating the requirements of the application layer to the SDN DataPaths and also to provide the applications with an abstract view of the network elements.
- SDN Datapath: It is considered as a logical network device. They implement in software the devices like switches that forward packets in the network. This logical representation may include all or part of the physical resources.

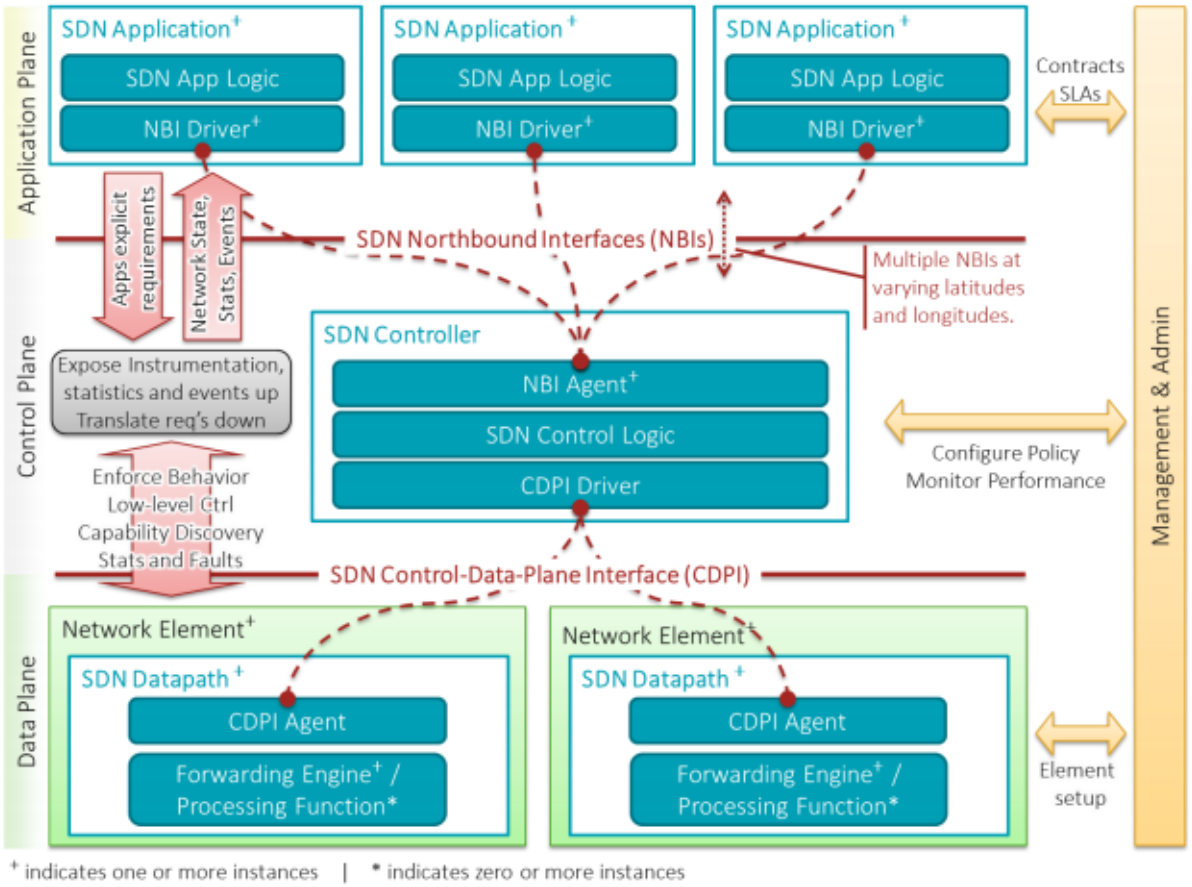


Figure 10 Another SDN architecture representation (15)

3.2. Legacy Mobile Packet Core

Despite the fact, that 2G and 3G technologies are quite old (since 2000 for 2G and 2005 for 3G), they're still are entirely used abroad the world. So is relevant to make a review of the Legacy Packet Core.

3.2.1. Packet Core Basic Functions And Architectural Elements

General Packet Radio Service (GPRS) and Wideband Code Division Multiple Access (WCDMA) are two technologies related to Global System for Mobile Communication (GSM) that serve a fast and efficient access to the Internet to end-users. We can separate the Voice service and the Internet service as two different domains, due to the nature of their switching approach.

The telephony is managed by a circuit-switch (CS) domain and the Internet by a packet switch (PS) domain, therefore in context GPRS is the packet data service in both GSM and WCDMA systems.

The architecture of GPRS network is depicted in Figure 11, and it's connected to different other networks and systems:

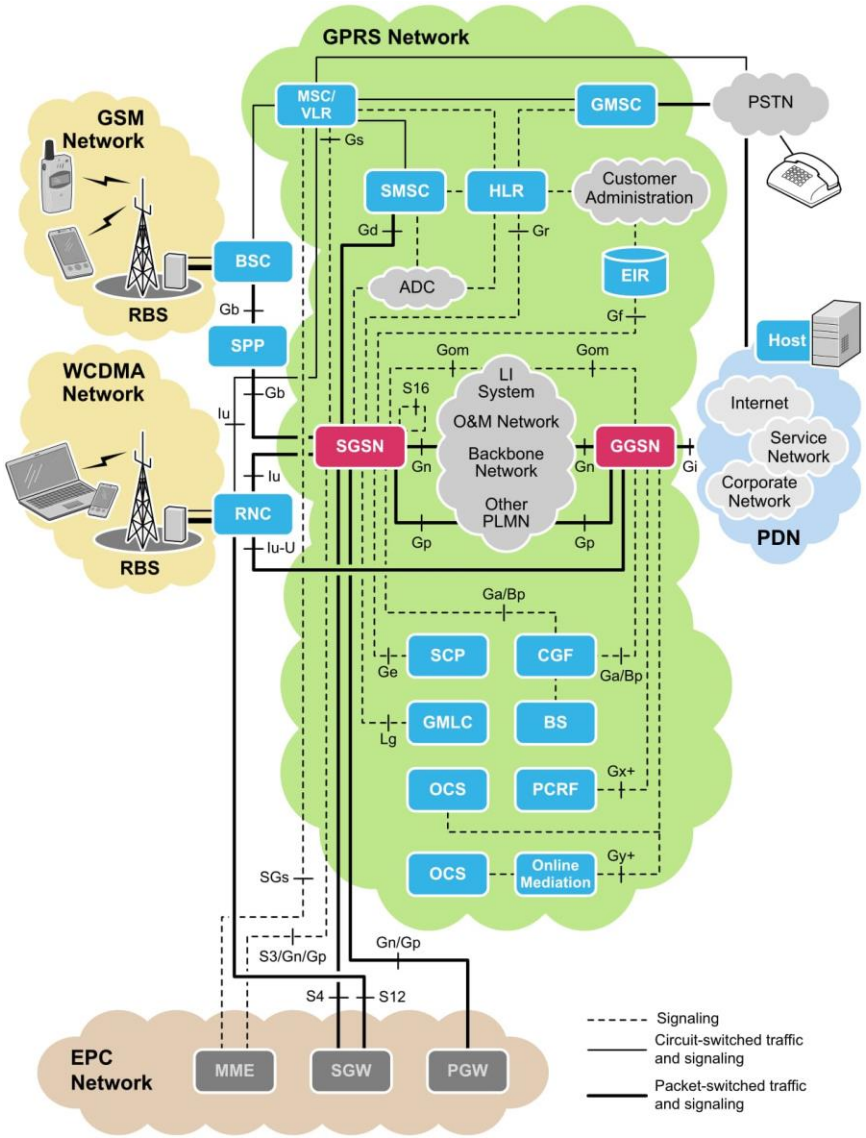


Figure 11 GPRS Network and Interfaces (16)

- To the GSM or WCDMA radio access network. (Where the User Equipment connects to the GPRS network).
- A Packet Data Network (PDN), which can be the Internet or a Private Network.
- An Evolved Packet Network, for mobility between 2G-3G-4G networks.
- The backbone network, to connect with another SGSNs and GGSNs.
- The Operation and Maintenance (O&M) network.
- Other PLMNs.

As we can see from Figure 11, the GPRS network and the GSM network are composite of different nodes; each node has a role in the general service, table 1 describes each node functionality (16):

AAA	Handles authentication, authorization, and accounting functions for UE.
BS	The Billing System (BS) retrieves Charging Data Records (CDRs) from the SGSN, GGSN, PGW, and SGW.
BSC	The Base Station Controller (BSC) sets up, supervises, and disconnects circuit-switched calls and packet-switched data sessions. It has a high-capacity switch providing, for example, handover, cell configuration data, and channel assignment. One or several BSCs are served by one Mobile service Switching Center (MSC) for call handling, and one SGSN serves some BSCs for packet data transmission.
CGF	The Charging Gateway Function (CGF) receives CDRs from the SGSN, GGSN, PGW, and SGW in near real-time and may store the CDRs in a persistent storage. The CGF performs preprocessing of the CDRs before delivery to a BS. The preprocessing may include validation, consolidation, and reformatting of the CDRs.
EIR	The Equipment Identity Register (EIR) holds information about UE and is involved in the International Mobile Equipment Identity (IMEI) check procedure. The IMEI check procedure may be performed to control the access to the network for a specific ME, for example, to check if the ME has been stolen or is considered illegal.
HLR	The Home Location Register (HLR) is a database holding subscription information for all UE subscribing to the GSM or WCDMA systems network. The HLR stores information for circuit-switched and packet-switched communication, for example, the location of UE, supplementary services, authentication parameters, and whether packet communication is enabled. For the packet-switched part of the network, subscription information is fetched by the SGSN, and the HLR is used for the authentication procedure of the UE. In addition, the HLR stores the subscription information regarding UE-terminated SMS messages and whether to transfer SMS message through the SGSN.
MSC/VLR	The Mobile services Switching Center (MSC) provides connections from GSM or WCDMA services to other networks, such as standard telephone networks or ISDN. It handles circuit-switched transactions with the UE located in a geographical area designated as the MSC area. It is responsible for the setup, routing, control, and termination of the call, for management of inter-MSC handover and supplementary services, and for collecting charging information. The Visitor Location Register (VLR) is a database containing temporary information about all the UE currently located in the area served by one MSC.
OCS	The Online Charging System (OCS) enables real-time credit control and charging of user traffic. The OCS is responsible for applying rates to the service usage reported by the GGSN or PGW. In case online charging is performed by a proprietary charging system not compliant with the 3GPP Gy or Gy+ interface, an Online Mediation system may be used.
OSS-RC	The Operational Support System for Radio and Core (OSS-RC) provides support for parameter setting and alarm surveillance of the nodes. The OSS-RC provides functionality for network management, configuration management, installation and upgrade, and high availability solutions.

PCRF	The Policy and Charging Rules Function (PCRF) handles policy control decisions and flow-based charging control functionality. The main functionality of the PCRF is subscriber handling, device handling, access-aware handling, and flow based charging.
RNC	The Radio Network Controller (RNC) is in charge of controlling the use and the integrity of the radio resources. It is responsible for handover decisions requiring signaling to the UE. An RNC supports combined or split information streams. One MSC serves one or several RNCs for call handling, and one SGSN serves some RNCs for packet data transmission. The RNC forwards the circuit-switched calls to the MSC/VLR and packet data to the SGSN.

Table 1 GPRS Nodes Functionality

3.2.1.1. Serving GPRS Support Node (SGSN)

The SGSN is one of the main nodes of the GPRS network, responsible for handling all packet switched in the network, forwarding all incoming and outgoing IP packets addressed to and from the UE.

In addition to route and transfer all packets in its coverage area, the SGSN provides the Session (UE and GGSN connection) and Mobility Management (roaming and handover within and between mobile networks), covering the UE Authentication and Ciphering too.

3.2.1.2. Gateway GPRS Support Node (GGSN)

The GGSN is the second central element in a GPRS network, and as its name says it provides the access functions needed to connect external Internet network, acting as a router for the traffic of all subscribers exchanging routing information with the PDNs.

Together with the SGSN is responsible for the session management and the dynamic IP address allocation of the subscribers. Also collects the charging information for each subscriber.

3.2.2. Interfaces

Figure 11 shows the GPRS Core nodes and its interfaces, but in Figure 12 we have a more straightforward depiction of the Core and a brief explanation of the interfaces (17).

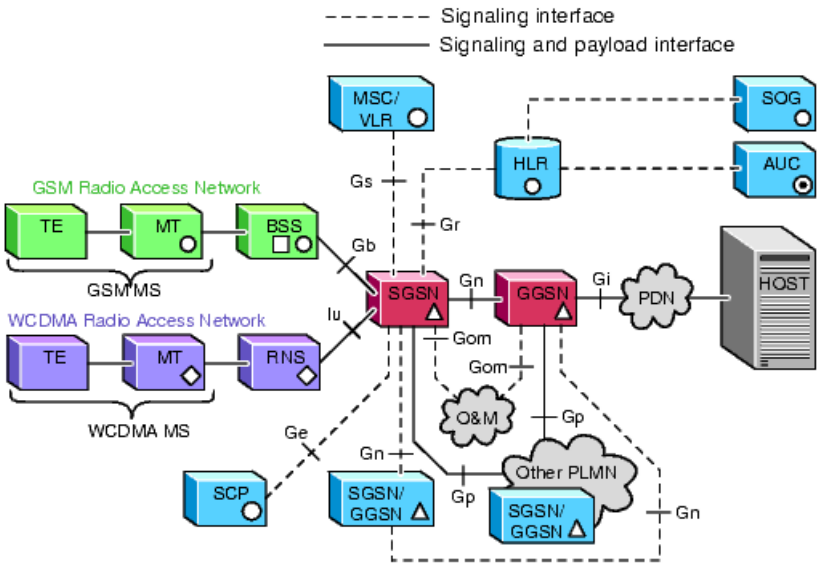


Figure 12 Logical View of GPRS Core Network (18)

- Iu interface connects the SGSN to the RNC, allowing the exchange of signaling and payload. The Iu interface consists of two parts, Iu-C (control plane) and Iu-U (user plane). The control traffic is transported over Signaling System No 7 (SS7). The user plane carries payload over IP. (WCDMA only).
- Gb interface connects the SGSN to BSSs and MSs, allowing the exchange of signaling and payload. (GSM only).
- Gn interface connects the SGSN to other SGSNs and GGSNs, allowing the exchange of signaling and payload.
- Gp interface connects the SGSN to SGSNs and GGSNs in other PLMNs, allowing the exchange of signaling and payload.
- Gom interface connects Operation and Maintenance (O&M) equipment to the SGSN and GGSN, making it possible for an operator to communicate with the SGSN.
- Ge interface connects the SGSN to the SCP, allowing exchange of signaling
- Gr interface connects the SGSN to the HLR, allowing subscriber data management.
- Gs interface connects the SGSN to the MSC, allowing the exchange of signaling (supported by GSM only).
- Gi interface connects the GGSN to the PDN, allowing the exchange of signaling and payload.

The transport protocol for each Interface is IP based, but over the IP layer can be different protocols depending the user needed user application, for example in Gn interface over the IP layer is GTP protocol as seen in Figure 13.

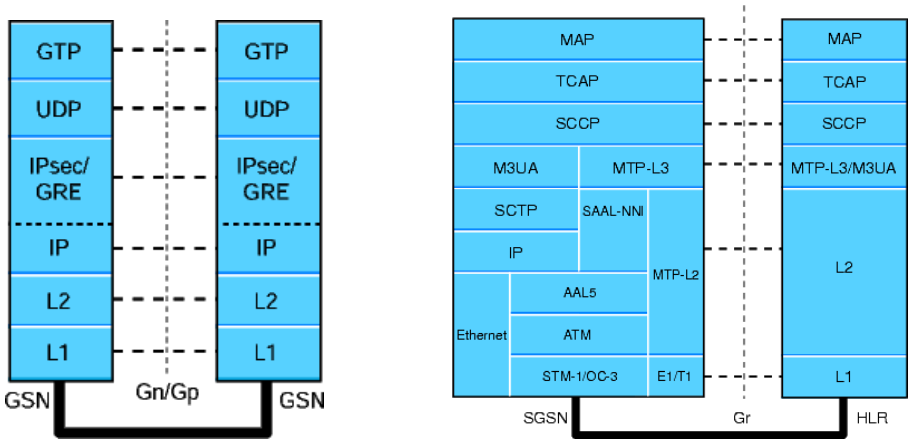


Figure 13 Gn and Gr Interface Protocols (16)

3.3. Evolved Packet Core

The Evolved Packet Core or System Architecture Evolution (SAE) is the core network evolution that supports the LTE wireless communication standard.

It's an improved version of the GPRS with a simplified architecture, an all-IP Network, support for higher throughput and lower latency and support for mobility between different access networks, including LTE air interface, legacy systems (2G and 3G), and non-3GPP systems (WiFI, WiMAX).

3.3.1. Evolved Packet Core Basic Functions And Architectural Elements

This new approach delivers new, different nodes from the legacy packet core, Figure 14. describes the new network nodes and interfaces.

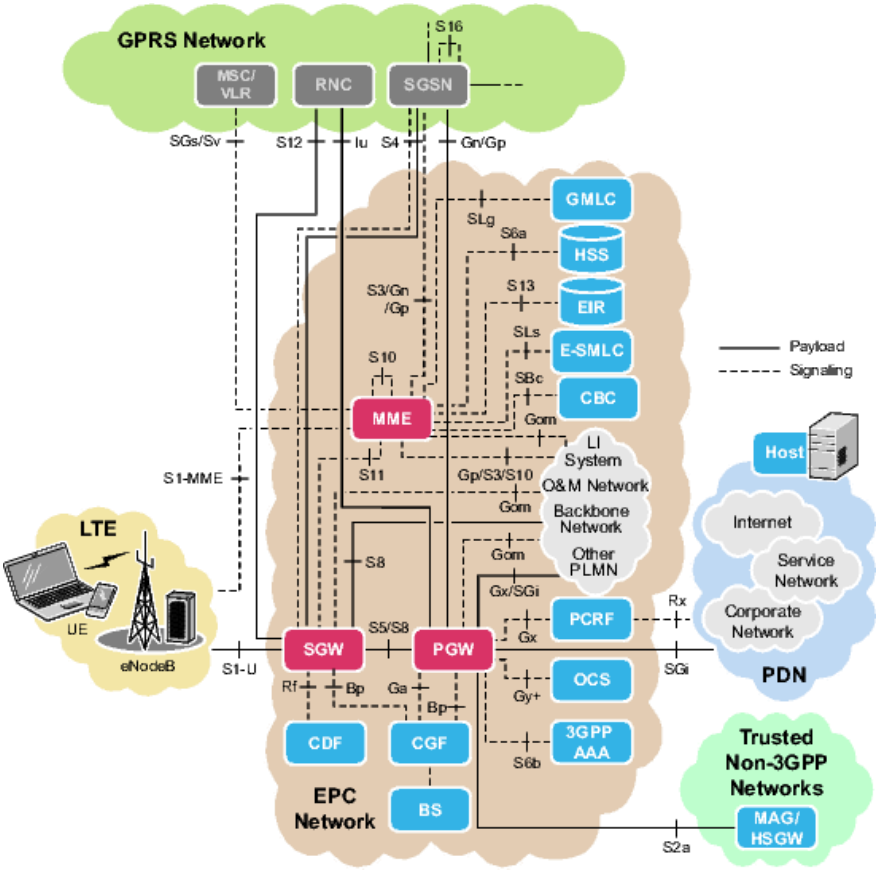


Figure 14 EPC Architecture Network

The EPC network is connected to the following other networks and systems (16):

- An LTE radio network, containing the eNodeB, which is the access network where the UE connects to the EPC network.
- A PDN, which can be the Internet, a corporate network, or a dedicated service network.
- The GPRS network, providing mobility between LTE and GSM or WCDMA radio access networks.
- The backbone network, which connects the central nodes.
- The O&M network, which is the network for O&M systems.
- Other PLMNs.
- And the LI (Lawful Interception) interface.

Table 2. Describes the remaining new nodes in the EPC (16):

CBC	The Cell Broadcast Center (CBC) connects to the MME over the SBc interface. The CBC is responsible for the management of warning messages.
CDF	The SGW connects to a Charging Data Function (CDF) over the Diameter-based Rf interface. The Diameter network consists of client peers, server peers, and agents.
eNodeB	The eNodeB is an enhanced base station that connects the UE with the EPC network. The main functionality of the eNodeB is radio bearer control, radio admission control, connection mobility control, and dynamic resource handling. The eNodeB is used for LTE networks.
E-SMLC	The Evolved Serving Mobile Location Center (E-SMLC) manages the overall coordination and scheduling of resources required for the location of a UE that is attached to E-UTRAN.
HSS	The Home Subscriber Server (HSS) is a database holding subscription information for UE subscribing to the EPC network. The HSS stores, for example, the location of the UE on MME node level, and provides authentication and authorization functions. The HSS is similar to the HLR and Authentication Center (AUC).
MAG	The MAG (in CDMA2000 networks called HSGW) manages the mobility-related signaling in the non-3GPP network for the UE device. The MAG tracks the movements of the UE and signals to the PGW. The MAG acts as a default router for the UE device.

3.3.1.1. Mobility Management Entity (MME)

The MME is the central control node in the new EPC architecture (19), it manages all the Mobility Management between the UE and the network, providing the attachment, detachment, authentication, the bearer establishment, and the choosing of SGW and PGW. Also for the tracking and the paging of UE in idle-mode. It is the termination point of the Non-Access Stratum (NAS).

3.3.1.2. Serving Gateway (SGW)

The Serving Gateway (SGW) routes and forwards the user packet data from the UE to the PGW or from the PGW to the UE (19). The SGW acts as a local mobility anchor for the user plane during inter-eNodeB handovers and provides charging functionality. The SGW duties also consist of taking care of the mobility interface to other networks such as 2G /3G. The SGW monitors and maintains context information related to UE during its idle state and generates paging requests when data arrives in the UE in the downlink direction (from Internet towards the UE).

3.3.1.3. Packet Data Network Gateway (PDN-GW)

The PDN Gateway (PGW) is the gateway between the internal EPC network and external PDNs, for example, the Internet or a corporate LAN. The PGW provides IP connectivity towards external PDNs, policy and admission control, and packet filtering per user. The PGW can also be used for charging.

3.3.1.4. Policy Control Enforcement Function (PCRF)

The Policy and Charging Rules Function (PCRF) handles policy control decisions and flow-based charging control functionality. The main feature of the PCRF is subscriber handling, device handling, access-aware handling, and flow based charging (19).

3.3.2. Interfaces

As in the GPRS system, the EPC has many interfaces (Table 2.) to interconnect all the nodes, all interfaces are IP based, and new protocols (Figure 17.) above the IP layer (Diameter, GTPv2).

S1-MME interface	The S1-MME interface connects the MME to eNodeBs. The S1-MME interface is based on SCTP. S1 Application Protocol (S1-AP) messages are transferred between the MME and eNodeB, and Non-Access Stratum (NAS) messages are transferred between the MMEand UE.
S1-U interface	The S1-U interface connects the SGW to an eNodeB. The S1-U interface transports user data packets. The S1-U interface is based on the GTPv1-U protocol.
S10 interface	The S10 interface connects the MME to other MMEs. It acts as a reference point between MMEs for MME relocation and enables MME to MME information transfer. The S10 interface is based on the GTPv2-C protocol.
S11 interface	The S11 interface connects the MME to the SGW. The S11 interface is an IP-based interface used for EPC signaling between the MMEand the SGW. The S11 interface is based on the GTPv2-C protocol.
S12 interface	The S12 interface connects the RNC to the SGW, enabling the possibility to establish the direct tunnel. The S12 interface is based on the GTPv1-U protocol.
S13 interface	The S13 interface connects the MME to the EIR. Information for the optional licensed feature IMEI Check is transferred between the MME and the EIR. The S13 interface is based on the Diameter protocol.
S16 interface	The S16 interface connects two or more SGSNs that supports the S3 interface or the S4 interface, through IP over Ethernet or ATM, enabling signal exchange. The S16 interface is based on the GTPv2 protocol.
S2a interface	The S2a interface connects the PGW to an HSGW (also called MAG) in a trusted non-3GPP network. The S2a interface transports control data between the PGW and the HSGW.
S3 interface	The S3 interface connects an MME and an SGSN, which supports the S3 interface and the S4 interface, using IP over Ethernet, making it possible for an SGSN and an MME to communicate. The S3 interface is based on the GTPv2 protocol.
S4 interface	The S4 interface connects the SGSN and the SGW, enabling signal exchange and payload. The S4 interface is based on the GTPv2-Cand GTPv1-U protocol.
S5/S8 interface	The S5/S8 interface connects the SGW to a PGW. The S5/S8 interface transports user data packets and handles control plane signaling. The S5/S8 interface is based on the GTPv2 protocol.
S6a interface	The S6a interface connects the MME to the HSS. It enables transfer of subscription and authentication data for authenticating and authorizing user access. The S6a interface is based on the Diameter protocol.
S6b interface	The S6b interface connects the PGW to a 3GPP AAA server. The S6b interface is used for authorization of UE devices in a trusted non-3GPP network.
S6d interface	The S6d interface connects the SGSN supporting the S4 interface to the HSS. It enables transfer of subscription and authentication data for authenticating and authorizing user access. The S6d interface is based on the Diameter protocol.
SBc interface	The SBc interface connects the MME to the Cell Broadcast Center (CBC). The SBc interface is based on SCTP.
SGi and Gi interface	The SGi interface connects the PGW to a PDN, and the Gi interface connects the GGSN to a PDN. The interfaces transport user data IP packets between gateway and PDN, enabling the exchange of signaling and payload. The interfaces also connect the gateway to the SASN. If Remote Access Dial-In User Service (RADIUS) is used, the interfaces connect the gateway to the RADIUS server.
SGs interface	The SGs interface connects the MME to the MCS/VLR. It is used for registration in the MSC/VLR of UE performing the combined procedure, to page the UE on behalf of the MSC/VLR, and to convey circuit-switched related procedures through the MME.
SLg interface	The SLg interface connects the MME to the GMLC. The SLg interface enables transfer of UE location data to the GMLC. The SLg interface is based on the Diameter protocol.
SLs interface	The SLs interface connects the MME to the E-SMLC. The interface is used for obtaining the location estimate for a target UE in EPS.
Sv interface	The Sv interface connects the SGSN-MME, and the 3GPP MSC server enhanced for Single Radio Voice Call Continuity (SRVCC). The Sv interface enables SRVCC from E-UTRAN/UTRAN (HSPA) access to 3GPP UTRAN CS accesses for voice calls that are anchored in the IMS.

Table 2 EPC Interfaces Description (16)

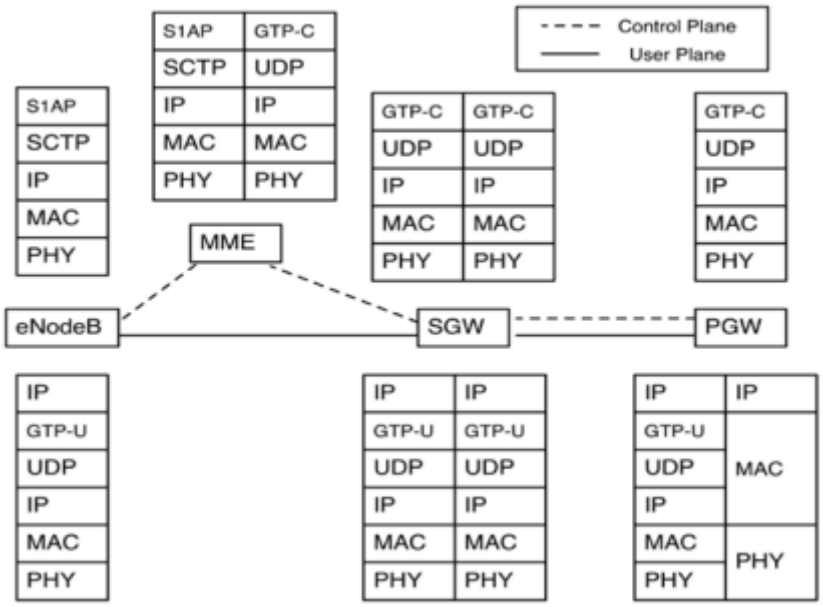


Figure 15 EPC Protocol Stack (19)

3.4. 5G Packet Core

As many operators are using virtualized core networks to bring new services, such as cellular IoT or Autonomous-Cars, these virtualized cores are becoming more 5G-ready due to a new Cloud-Native designs principle. Some examples are (20):

- Network slice, support for multiple services user groups and commercial opportunities.
- Automated operations to enable lifecycle management of individual core elements.

The main functional elements of the NG Core are outlined in (21):

- Access and Mobility Management Function (AMF): This is a control-plane component that manages access control and mobility.
- Session Management Function (SMF): Sets up and manages sessions, according to network policies.
- User Plane Function (UPF): This is equivalent to a gateway (SGW, PGW in 4G), distributed or centralized locations.
- Policy Control Function (PCF): This provides a common policy framework incorporating network slicing, roaming and mobility management.
- Unified Data Management (UDM): Stores subscriber data and profiles.
- NF Repository Function (NRF): New functionality, provides registration and discovery so that NFs can discover each other.

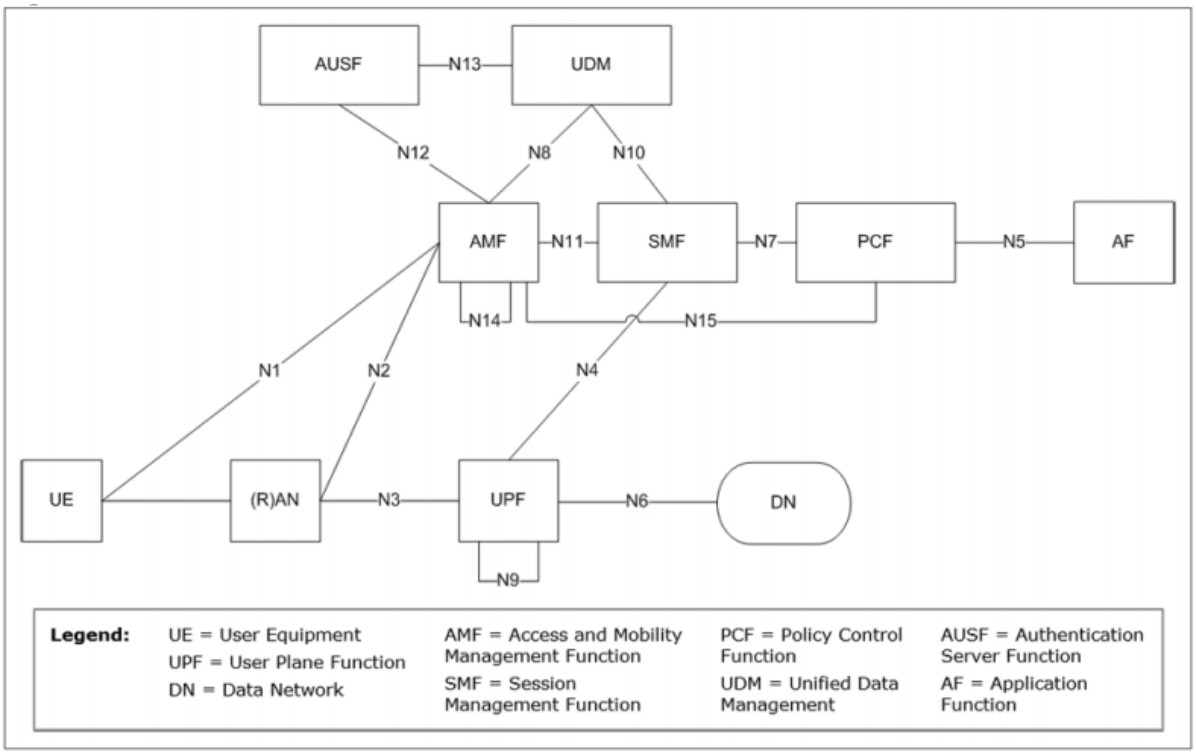


Figure 16 Next-Gen Reference Architecture (21)

Some points will be characteristic of the 5G network architecture (22):

- Cloud-enabled Core. Interconnects multiple central and distributed data centers to create a single, virtual data center. When virtualized network functions (VNFs) are deployed in a virtual datacenter, each function maps to the datacenter best able to process it. Core network workloads can be dynamically placed throughout the cloud-enabled network, for example distributing the core network user plane with the radio access user plan to meet stringent latency requirements for specific use cases.
- Network slicing. It's a division of the network into multiple slices, isolated in the control, management, and user planes, with each slice optimized for the use cases being supported. The network slices can be optimized based on performance characteristics, such as latency, capacity, throughput, and speed.
- Management and Orchestration (MANO). As its name says, management of the virtualized and distributed network resources, providing basic analytics and exposure information to new types of applications.

3GPP and 5GPP working groups are currently developing the new standards for the 5G architecture, the industry timetable for the commercial release of 5G is beginning of 2020

Chapter 4

4. PROPOSED SYSTEM DESIGN

The design of the Mobile Core connectivity requires the deployment of a complex IP infrastructure that provides not only connectivity, also security, network separation, reliability, redundancy, and flexibility, so first design an IP Backbone with all these qualities.

The design proposal will be divided into two parts, a part focused only on the design of the IP Core of the ISP, which in this case will develop a complete IP Backbone for an ISP, and the second part will focus only on the design of the Mobile Core (PS), Figure 17. For this scheme, the Mobile part will be considered as a Business Unit that makes use of the infrastructure as a service.

Among the premises that must be taken into consideration for the design of both Cores (ISP and Mobile) are the following:

- It will be a Physical Architecture Distributed throughout the peninsula of Spain (at least the most important sites).
- Layer 1 and Layer 2 details, such as transmission and connectivity, will be simplified and simulated as 10Gbps Ethernet links.
- Location of Data Centers: Madrid, Barcelona, Valencia, Seville, Cáceres, Gijón and Bilbao.

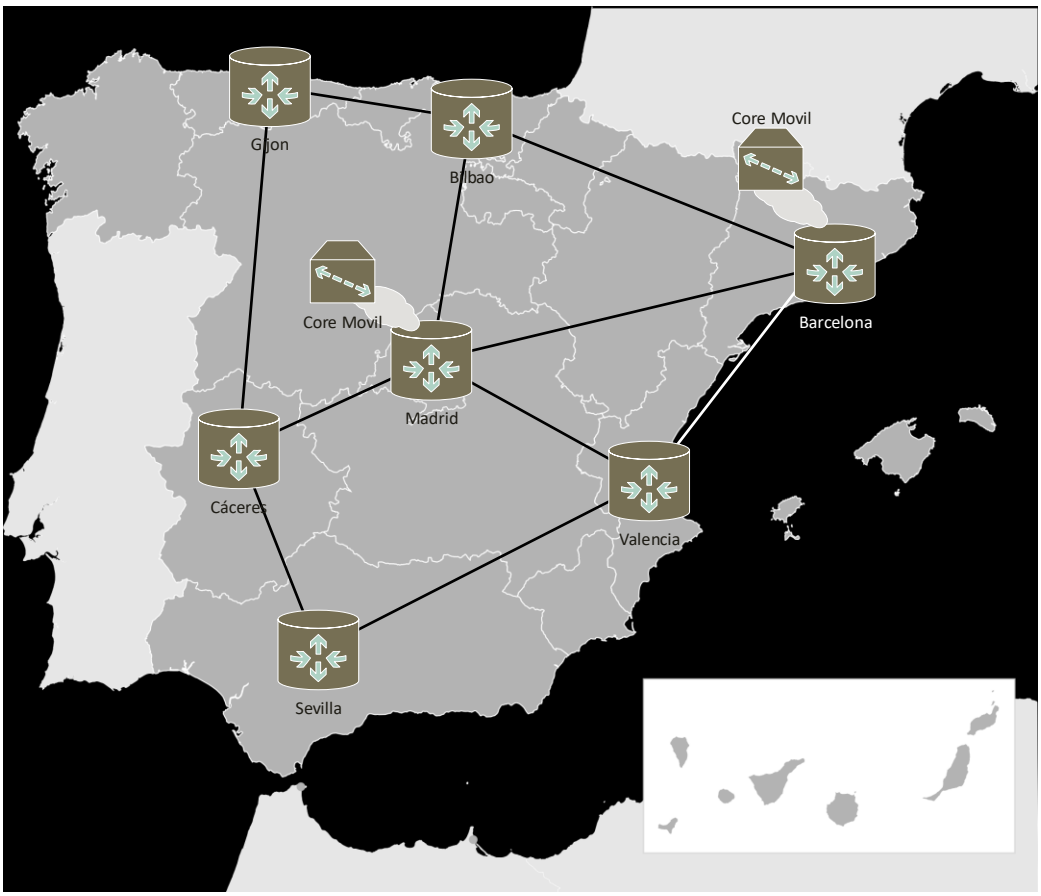


Figure 17 ISP Core Proposal.

4.1. ISP IP Core.

4.1.1. Transport and Physical Topology.

It is assumed that the transport network (DWDM) is already deployed, with the necessary redundancy rings, for practical purposes the transport network layer is invisible or simulated as fiber-ethernet links so that no further efforts will be devoted respect to this subject.

Our Core network includes the creation of 2 separate autonomous systems (AS), one public and one private, with rules of different and own routing, for Internet service and data service. These will have the following characteristics:

- Both autonomous systems will share the same physical equipment, the separation of autonomous systems will be realized through the virtualization of logical routers.
- Each autonomous system will have its physical links to the transport network and a different topology.
- Protocols, redundancy and signaling schemes separation in each autonomous system.
- Two redundant routers per city.

4.1.2. Logical Internet ASN Topology.

The design of the Internet network will be based on the following considerations:

- A logical router for the Internet will be created in each of the routers that make up the Core network.
- Each business unit, with its own ASN, will connect with at least two regional PEs.
- All Internet logical routers in the Core Network will belong to the same
- Autonomous system.
- All routes must know the networks published and received by the other routers of the network, to maintain consistency, scalability, and flexibility in the routing layer.
- All routers will use the same IGP.
- Convergence will be optimized using MPLS and traffic engineering.

Figure 18 shows the proposed Internet Service Topology.

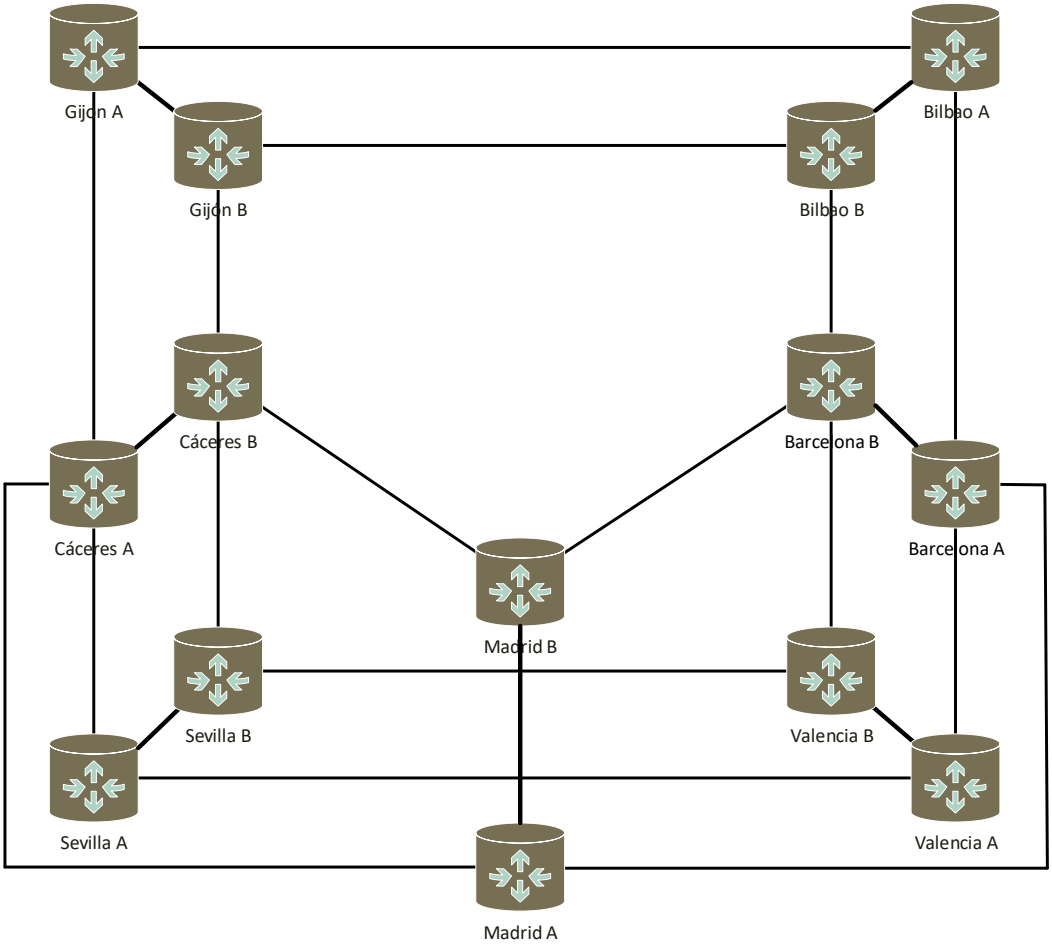


Figure 18 Internet Service Topology

4.1.2.1. IP Loopback Addressing

To deploy an ISP, it is necessary to become a member of RIPE and request the assignment of an ASN and also of an IPv6 and IPV4 address (in a state of exhaustion) (23).

For purposes of this work, we will assign a 16-bit ASN, and a / 24 block of IPv4 addresses corresponding to the RIPE region.

```
ASN: AS58296

IPv4: 84.120.0.0/27 for Loopbacks

IPv4: 84.120.0.32/27 for inter-router links.

IPv4: 84.120.0.64/26 for inter-router links.
```

Loopback Address	Site
84.120.0.1/32	Madrid A
84.120.0.2/32	Madrid B
84.120.0.3/32	Barcelona A
84.120.0.4/32	Barcelona B
84.120.0.5/32	Caceres A
84.120.0.6/32	Caceres B

84.120.0.7/32	Valencia A
84.120.0.8/32	Valencia B
84.120.0.9/32	Bilbao A
84.120.0.10/32	Bilbao B
84.120.0.11/32	Gijon A
84.120.0.12/32	Gijon B
84.120.0.13/32	Sevilla A
84.120.0.14/32	Sevilla B

Table 3 Loopback Internet Addressing

4.1.2.2. IGP Protocol

The IGP protocol will allow knowledge of the network infrastructure and will basically advertise the loopbacks of the routers, and the IP addressing of the interfaces between routers It is important to maintain this infrastructure to guarantee the stability of the network in In general, the IGP will be designed to be robust, secure and stable as the basis of the operation of other dependent protocols.

The protocol to be used is OSPF for the following reasons:

- The protocol used for many years in the carrier industry especially.
- Proven performance.
- Redundancy and Traffic Engineering mechanisms.

For its implementation, it is considered:

- All routers will belong to Area 0; there will be no other areas.
- All areas will be normal without distribution restrictions of LSAs between routers.
- MD5 authentication will be used for the OSPF adjacencies.
- BFD will be configured as a control mechanism for rapid convergence.
- Traffic engineering extensions enabled on all routers in the network.
- There will be no redistribution of other protocols into OSPF.
- Route summarization will not be performed.
- The protocol's default timers will be used.
- There will be no exchange of IGP routes with the B.U.s
- All Ethernet connections in the network will be point-to-point
- The detection of BFD will have intervals of 50ms with a multiplier of 3, for a 150ms failure detection.
- The loopback interfaces will be configured as passive interfaces.
- Log of the adjacency changes of the network will be kept.
- Graceful restart will be configured.

In order to provide rapid convergence, BFD will be used as a complement to the IGP as mentioned in the next section.

4.1.2.2.1. OSPF Global Design

The maximum reference bandwidth that can be configured in JUNOS is 1Tbps. An optimal reference bandwidth is one that allows a clear differentiation between the different speeds of the interfaces involved in the network.

With a 1000Gbps reference bandwidth the new cost table for OSPF is presented in Table 4:

Bandwidth	Cost
1 Gbps	1000
10 Gbps	100
20 Gbps	50
40 Gbps	25
100 Gbps	10

Table 4 OSPF cost with a 1000Gbps reference bandwidth

All interfaces are configured as point-to-point links.

4.1.2.2.2. OSPF Authentication

The use of authentication between OSPF sessions is highly recommended since OSPF is a common target for spoofing and DOS attacks.

It is recommended to use MD5 with 16 ASCII chars, below is an example of OSPF authentication:

```
user@host# show protocols ospf
area 0.0.0.0 {
interface so-0/2/0.0 {
authentication {
md5 5 key "$9$pXXhuIhreWx-wQF9puBEh"; ## SECRET-DATA
}
}
}
```

4.1.2.2.3. High Availability

The IGP has a process of convergence that is determined by the following aspects:

- Hello and Dead Interval
- Distribution of LSAs
- SPF calculation time

The failure detection times are the main factors that affect the times of OSPF convergence, specifically the Hello and Dead intervals. However, it is not advisable to modify these parameters because they are not designed to offer convergences less than 1 second.

BFD, on the other hand, provides the necessary functionalities to achieve the detection of link failures in times less than 1 second, in the order of 50ms. Communication between two OSPF neighbors is constantly monitored during time intervals specified in the protocol, after losing a certain amount of messages BFD informs of the failure and the convergence process starts, which is why the use of BFD is recommended as a protocol for the high availability of OSPF.

After detection of the fault, the LSAs are sent through the network depending solely on the distance between sites, in order of a few milliseconds in most cases. After receiving an LSA each router must perform the SPF algorithm calculation in the database, this calculation is done in a few milliseconds even for thousands of routes.

Therefore the use of BFD will significantly improve the convergence time in case of failures of links between routers within the CoreNetwork.

In case of a physical failure, which is detected as link down, the router is informed immediately of the problem so in that situation BFD does not act but the convergence is initiated immediately, that is to say, that with a physical failure the times of convergence can become of the order of the 50ms, using other techniques that will be described later as MPLS and engineering of traffic, with indirect faults that are not detected as physical faults, using BFD the convergence will be of the order of 150ms.

4.1.2.3. BFD Design.

BFD is required to have an efficient failure detection mechanism to operate in a network with OSPF. For this purpose, the times used in OSPF do not need to be so fast since BFD will be used to accelerate the SPF calculation thus providing a fast convergence and time of recovery of the network in case of a failure within it.

With BFD, a faster convergence of the IGPs involved is achieved, thus providing a better control. BFD provides shorter failure arrest times than conventional mechanisms of failure arrest.

The BFP timers can be configured to a few milliseconds thus achieving a very fast convergence. Although BFD can dramatically reduce the time to detect a link failure, it is necessary to be very careful when configuring very short intervals. A very aggressive BFD configuration can cause a link failure to be detected despite the fact that it was a small disturbance causing the network to converge. Current good practices indicate that you must manage a time of 50ms and a multiplier of 3, which implies 150ms for the detection of a fault. The above is considered adequate in most environments, and only in very specific cases, a more aggressive configuration is recommended.

An example of a BFD configuration with an OSPF client:

```
user@host# show protocols ospf
area 0.0.0.0 {
       interface fe-0/0/1.0
              {bfd-liveness-detection {
                     minimum-interval 150;
                     multiplier 3;
                     full-neighbors-only;
              }
       }
}
```

4.1.2.4. Router ID Configuration.

Router ID is the identification of each router within the network; each protocol uses this information to send and receive respective packets of each protocol and thus fill the routing database. In JUNOS the router ID is enabled within the hierarchy routing-options and is a global configuration.

For the entire logical system, the following configuration is shown:

```
user@host# show routing-options router-id
router-id 192.0.2.24;
```

4.1.2.5. BGP

On the Internet network you will manage BGP for two levels:

- EBGP: for communication with the peers of the BUs and with the internet connection peers.
- IBGP: for communication between PE routers and exchange of local internet tables

The design of BGP is fundamental to the operation of Internet services, so it's necessary to emphasize in the design considerations and logical topologies of the proposed sessions.

4.1.2.5.1. iBGP Design.

For the IBGP functionalities, the following considerations will be taken into account:

- The functionality will be applied exclusively to PE routers
- It will mainly have the function of informing among the PE routers the prefixes that are received of eBGP sessions.
- P routers will not be neighbors in the IBGP neighborhood
- The next hop of the routes in the PEs will be associated with labels of the corresponding LSP; more detail will be given in the MPLS section.

Within the Core Network, the iBGP sessions will allow consistency in the routing tables of all the routers, so that the same routes that are received by the BU are known every city, Figure 19 diagram illustrates the recommended iBGP sessions for the Core Network Internet network design.

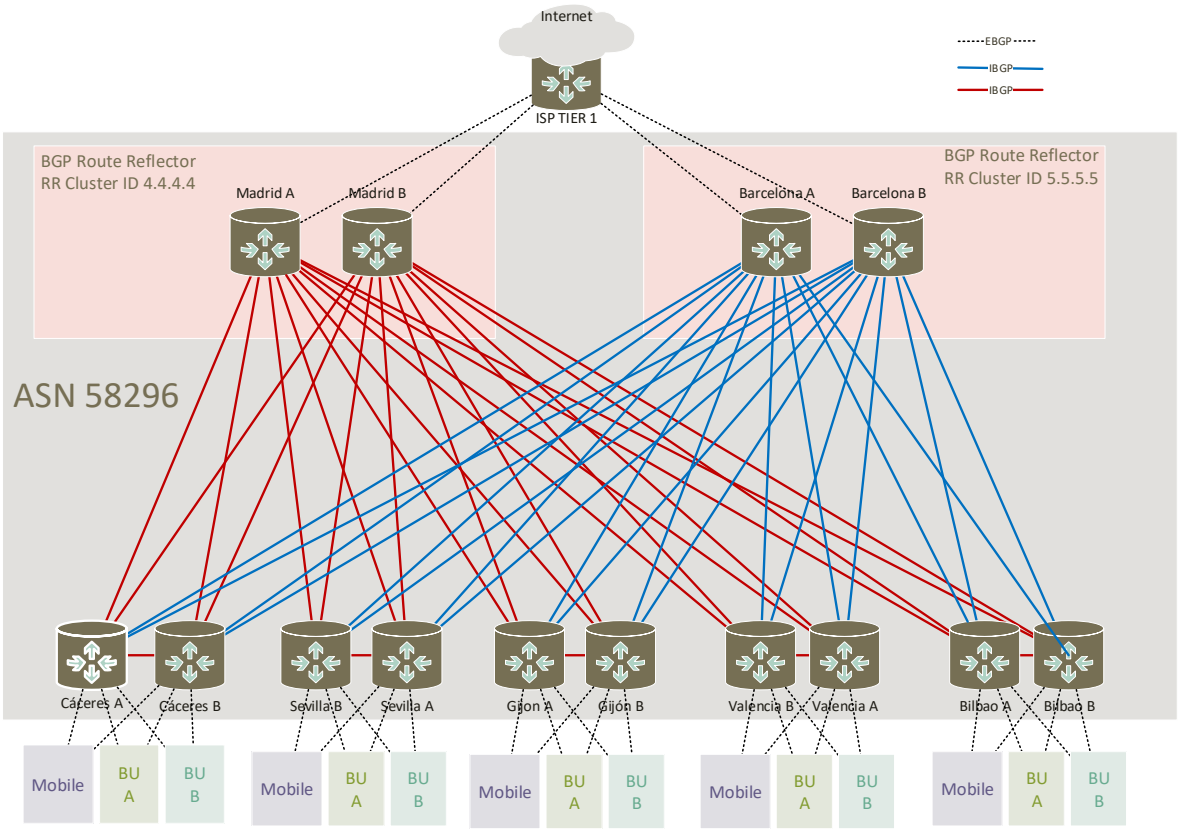


Figure 19 eBGP and iBGP Network Design

4.1.2.5.2. iBGP Basic Configuration

The Core Network iBGP sessions for the Internet topology have the purpose of external routes advertisement between all routers, therefore:

- Import or export filters will not be applied in the iBGP sessions.
- The next-hop of the advertisements from the routers of each city will be changed to the address loopback of the router so that traffic is sent through the LSPs that will be created, according to the MPLS design described in the following pages.

The iBGP sessions for the Internet topology will be used to advertise public IPv4 address prefixes, so the inet protocol family with IPv4 addresses will be enabled in the BGP groups configuration as shown in the following configuration:

```
protocols {
      bgp {
            group ibgp {
                  type internal;
                  family inet {
                        unicast;
                  }
                  family l2vpn{
                        signaling;
                  }
                  local-address x.x.x.x;
                  neighbor z.z.z.z;
                  neighbor y.y.y.y;
                  neighbor w.w.w.w;
                  neighbor v.v.v.v;
            }
      }
}
```

Where:

- Local-address: own router loopback.
- Neighbor: loopback address of route reflectors.

4.1.2.5.3. Route Reflectors

In the network there will be two router reflectors clusters, one in Madrid and another in Barcelona for redundancy effects, both route reflectors will be in charge of maintaining communication and forwarding of updates between each of the routers that make up the Core Network.

The following table shows the assignment of cluster-id for the route reflectors of Madrid and Barcelona:

Router	Cluster-ID
Madrid A	4.4.4.4
Madrid B	4.4.4.4
Barcelona A	5.5.5.5
Barcelona B	5.5.5.5

Table 5 Cluster-ID Assignment

Each of the route reflectors within the cluster has the task of reflecting the routes received by its customers, for reasons of redundancy each cluster will be made up of two routers. It is also recommended that each of the routers within the cluster have a normal iBGP session between them so that there is a complete redundancy of routes between both routers.

```
protocols {

bgp {
```

```
            group ibgp-cluster {
                  type internal;
                  cluster 4.4.4.4;
                  family inet {
                        unicast;
                  }
                  family l2vpn{
                        signaling;
                  }
                  local-address x.x.x.x;
                  neighbor a.a.a.a;
                  neighbor b.b.b.b;
                  neighbor c.c.c.c;

                  }

            group ibgp {
                  type internal;
                  family inet {
                        unicast;
                  }
                  family l2vpn{
                        signaling;
                  }
                  local-address x.x.x.x;
                  neighbor z.z.z.z;

            }
      }
}
```

Where:

- cluster: Cluster ID.
- Group ibgp-cluster: group that contains each route-reflector client
- Neighbor within Cluster: each neighbor loopback.
- Group ibgp: BGP Sessions with neighbors that are not route-reflector clients.

4.1.2.5.4. eBGP Design

For the EBGP functionalities, the following considerations are considered:

- The relationship with the neighbors will be established using the interface addresses (not loopbacks).
- It will be the routing border between the Business Units, so there will be no transport network information, but only the public internet networks assigned to each Business Unit.
- Will contain the corresponding protection filters, and will maintain with the Internet peers complete internet tables, and routes will be sent to the Business Units that are established according to the particular need (complete routing tables, route default, other alternatives).

Each Business Unit in each of the cities will have the availability to connect to the Core Network to receive and send Internet traffic, the eBGP session established Core Network towards the business units will work according to the previous guidelines, will establish a trust relationship, for the assignment of attributes in BGP advertisements from and towards the Core Network.

4.1.2.5.5. eBGP Basic Configuration

There will be two types of sessions in the Core Network, specifically in the Internet topology:

- Sessions for Internet providers
- Sessions towards Business Units

Both will share certain parameters in common but will have differences in some; the following configuration shows the general parameters of the eBGP sessions:

```
protocols {
      bgp {
            group example-peername {
                  type external;
                  peer-as 56;
                  neighbor 10.0.0.1;
                  import "example import policy";
                  export "example export policy";
}
}
}
```

With the above configuration, the eBGP sessions will work. However it is important to consider the differences of each type of session, the details will be given in the export policies and import for eBGP sessions.

4.1.2.5.6. Communities Assignment

Because the Core Network will receive network advertisements from different neighbors in different cities and different operators or suppliers, it is important to distinguish which prefixes are advertised by each neighbor, this distinction is recommended by the following reasons:

- To be able to use the assigned communities to make classifications, changes of attributes in the advertisement, filters, etc. based on the community assigned to the prefixes.
- During troubleshooting procedures or network analysis be able to find advertisements corresponding to each operation without needing to know exactly the prefixes that each of them announces.
- Allow the different business units to choose the desired provider to make their advertisements.

Business Unit	Community	Community Name
Mobile	58297:200	bu-mobile
BU A	58298:200	bu-a
BU B	58299:200	bu-b

4.1.2.5.7. eBGP Filters for BUs and ISPs.

To determine the functioning of an eBGP session and the relationship of trust that is established between BGP neighbors it is necessary to create filters that are applied directly in the session. Each filter must contain the terms and actions that enforce the policies.

- BUs eBGP Filter Sessions:

```
prefix-list mobile {
84.120.1.0/24
}
policy-statement mobile-import {
      term 1 {
            from {
                  as-path mobile;
                  prefix-list mobile;
            }
            then {
                  community add mobile;
                  accept;
            }
      term 2 {
                  then reject;
            }
      }
community mobile members 58297:200;
as-path mobile "58297(1,)^";
```

The previous configuration is an example of the import filter for the session mobile business unit. The filter does the following:

- In term 1, select the prefixes that contain the as-path mobile, which indicates that the as-path must start with the Mobile ASN 58297 and can contain any number of repetitions of this same ASN, also select all the prefixes that are specified in the prefix-list mobile. This term gives security to the session so that only the corresponding prefixes to Mobile BU are received.
- In term one prefixes that meet the two conditions of as-path and prefix-list will be accepted and the corresponding community is added to Mobile BU, according to the table of communities.
- In term two a reject of all the prefixes not specified in term one is made.

This prefix-list can be applied in all eBGP sessions to the business units, in the same way, modifying the networks and the corresponding as-path.

The next configuration shows applies when a special customer with its own ASN want to advertise through a BU:

```
prefix-list mobile {
84.120.1.0/24
}
prefix-list buA-customerA {
84.120.2.0/24
}

policy-statement mobile-import {
      term 1 {
            from {
                  as-path mobile;
                  prefix-list mobile;
            }
            then {
                  community add mobile;
                  accept;
            }
```

```
      term 2 {
            from {
                  as-path buA-customerA;
                  prefix-list buA-customerA;
            }
            then {
                  community add mobile;
                  accept;
            }

      term 3 {
                  then reject;
            }
      }
community mobile members 58297:200;
as-path mobile "58297(1,)^";
as-path buA-customerA  "58297(1,)55555(1,)^";
```

- ISP Session Filter
  Because private networks are not imported or exported into the Internet, it is necessary to block all RFC1918 networks from the internet which is shown in the following configuration:

```
policy-statement isp-filter {
      term 1 {
            from {
                  route-filter 192.168.0.0/24 longer reject;
                  route-filter 10.0.0.0/8 orlonger reject;
                  route-filter 127.0.0.0/8 orlonger reject;
                  route-filter 169.254.0.0/16 orlonger reject;
                  route-filter 172.16.0.0/12 orlonger reject;
                  route-filter 224.0.0.0/3 orlonger reject;
                  route-filter 0.0.0.0/0 orlonger reject;
            }
            then {
                  accept;
            }
      term 2 {
                  then reject;
            }
      }
```

4.1.2.6. IPv6

For the establishment of eBGP sessions for IPv6 with Internet providers, one should use a configuration different from that of IPv4 sessions.

We can use the next session configuration:

```
protocols {
      bgp {
            group ipv6-peers {
                  type external;
                  neighbor 2001:0600:8000::2; {
                  peer-as 56
            }
      }
}
```

4.1.2.7. MPLS

Although the traffic that will flow through the Internet Core Network will be IP and there will be no services associated with MPLS, MPLS will be implemented for the following reasons:

- Because it will allow the network to converge from link failures in a time close to 50ms.
- As the Core Network grows, Ps routers will not need to know all the routes of the network; they will only use label switching.
- Transit routers, P or PEs, will only perform label switching.
- The network will be ready to transport other services associated with the Internet that require being transported by MPLS.

4.1.2.7.1. MPLS Signaling

The communication for the transport between two PEs routers is signaled through some protocol of distribution of labels, which is responsible for creating logical maps with the necessary labels for encapsulated packets from the entry PE to the destination PE.

MPLS can be implemented with LDP or with RSVP. The signaling mechanism of MPLS to be used will be RSVP for the following reasons:

- Rapid convergence.
- Traffic engineering.
- Versatility for transporting any traffic
- Bandwidth Reservation.
- Ability to manipulate the LSP path.
- Capacity to transport tunnels with LDP if required.

Because MPLS, in this case, will become the logical transport medium for the traffic of Internet the following considerations will be taken into account:

- A full mesh of LSP between PE routers.
- Protection link configuration that will allow:
    - Rapid convergence.
    - Redundant paths automatically creation.
- The LSP nomenclature will refer to the router, the output router.
- Transport protection schemes of LSPs with Link Protection will be configured.
- Trace marking will be established with link coloring, to allow the creation of rules of service and particular routes.
- All routes of the business units and the internet will be transported by LSP between PEs.

4.1.2.7.2. RSVP Basic Configuration

RSVP as well as LDP must be enabled in each of the interfaces in order to create adjacencies with each of its neighboring routers, in addition to the "family mpls" configuration in each of the interfaces in order to tell the router that said interface would be transmitting and receiving MPLS encapsulated packets.

The following table shows an example of the configuration required for that purpose:

```
interfaces {
```

```
      ge-1/0/0 {
            unit 0 {
                  family mpls;
            }
      }
}
protocols{
      mpls{
            interface ge-1/0/0.0;
            }
      rsvp{
            interface ge-1/0/3.0;
      }
}
```

4.1.2.7.3. Traffic Engineering Extensions.

In order to enable traffic engineering to RSVP, it is required to know what is the available bandwidth in the network. This information is provided by the IGP protocol that is running on the network, in this case, OSPF. OSPF does not have default functionalities enabled for traffic engineering, so it is necessary to enable it manually.

The required configuration is shown below:

```
protocols{
      ospf{
            traffic-engineering;
      }
}
```

4.1.2.7.4. RSVP Authentication.

It is recommended to use MD5 authentication for RSVP in order to protect the operation of the protocol. The necessary configuration for this purpose is simple, but it is necessary to coordinate other parts for the correct establishment of the session.

```
protocols{
      rsvp{
            interface ge-1/0/3.0;
            authentication-key unex
      }
}
```

4.1.2.7.5. Link Coloring

The use of link coloring reduces the complexity of the design of a network with traffic engineering. The main rule is to use groups of colors in the interfaces where the LSPs are allowed to cross. The colors must be configured in each interface, and each LSP must have a list of colors for which can transit.

This solution is made using the traffic engineering extension in OSPF and specifically the sub-TLV type 9 specified in RFP 3630 as an administrative group. The following table shows the coloring groups to be used and the value assigned to each one:

Group	Numeric Value	Bits Value
Blue	4	00100
Red	8	01000
Green	16	10000

Table 6 Link Coloring Group Values

The values selected for each administrative group allow a clear differentiation between the same values since there is a bit of position of difference in each of the groups. For example, the link "Blue red" is the product of the combination (a logical "or") between them, i.e., 01100, which corresponds to the decimal value of 12.

Below is an example of a basic configuration of these groups and their assignment to the interfaces:

```
protocols{
      mpls{
            admin-groups {
                  blue 4;
            }
            interface ge-1/0/0.0{
            admin-group blue;
            }
      }
}
```

The LSPs will be created with dynamic Paths respecting the color assignment of the links, the goal of this implementation is to create a simple logical infrastructure to operate and maintain, with the benefits of being able to manipulate traffic, make a traffic balance and know the route backup that traffic will take in case of failures.

Figure 20 and 21 illustrate, in general, the implementation of the LSPs link coloring functionality for the case of Cáceres.

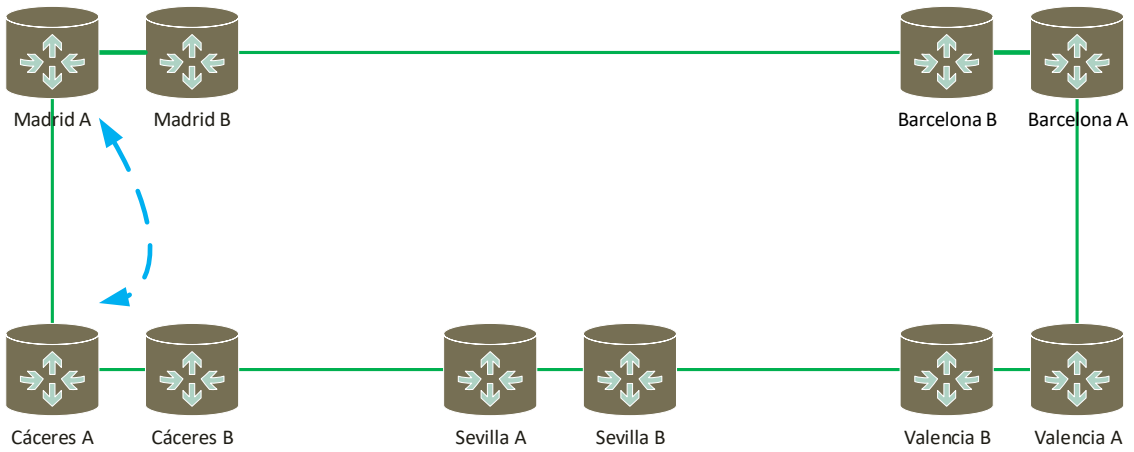


Figure 20 LSP Ring for Caceres and Madrid Shortest Active Path

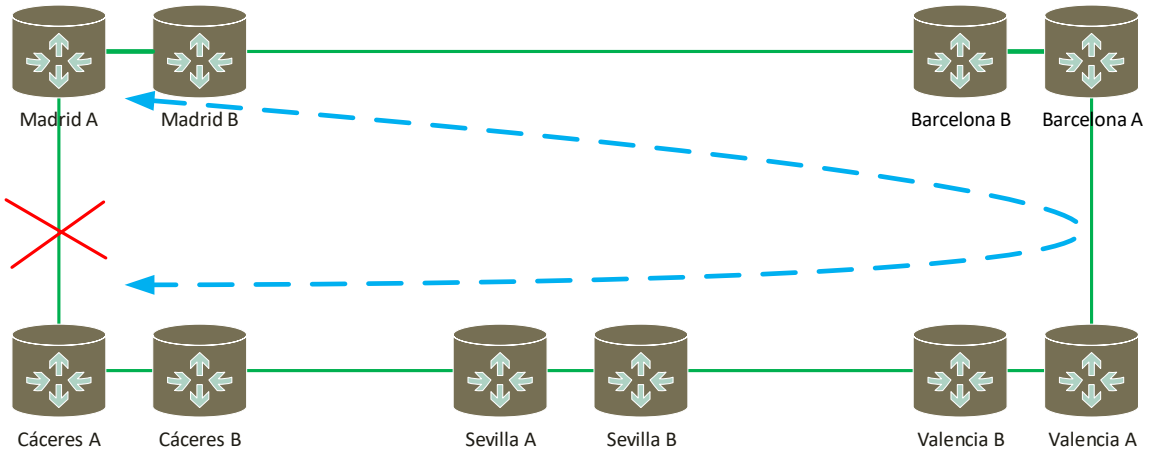


Figure 21 LSP Ring for Caceres and Madrid Shortest Backup Path

4.1.3. Logical Data ASN Topology.

The physical topology of the Data network remains the same as the Internet topology; a logical instance will be created with a private ASN and a private addressing scheme. The details of IGP, BFD, and MPLS will remain the same as the Internet network. Below we will only mention the details that differ from the Internet network.

```
ASN: AS65500

IPv4: 10.21.21.0/24
```

Loopback Address	Site
10.21.21.1/32	Madrid A
10.21.21.2/32	Madrid B
10.21.21.3/32	Barcelona A
10.21.21.4/32	Barcelona B
10.21.21.5/32	Caceres A
10.21.21.6/32	Caceres B
10.21.21.7/32	Valencia A
10.21.21.8/32	Valencia B
10.21.21.9/32	Bilbao A
10.21.21.10/32	Bilbao B
10.21.21.11/32	Gijon A
10.21.21.12/32	Gijon B

Table 7 Loopback Data Addressing

4.1.3.1. BGP

In the data network, BGP will be managed on two levels:

- EBGP: for communication with the BUs peers.
- IBGP: for communication between PE routers and exchange of local tables

4.1.3.1.1. iBGP Design

For the IBGP functionalities, the following considerations will be taken into account:

- The functionality will be applied exclusively to PE routers.
- It will mainly have the function of informing among the PE routers the prefixes that are received of eBGP sessions.

In the Data Core Network, the iBGP sessions will be a **Full Mesh** type and will be allowed to be maintained consistency in the routing tables of all routers.

4.1.3.2. Carrier of Carriers Transport

Each Business Unit that requires inter-city communication for a data service can do it through the infrastructure of the Core Network, for which it will use the Carrier of Carriers functionality for VPNs over MPLS according to RFC 4364.

Figure 22 depicts the solution.

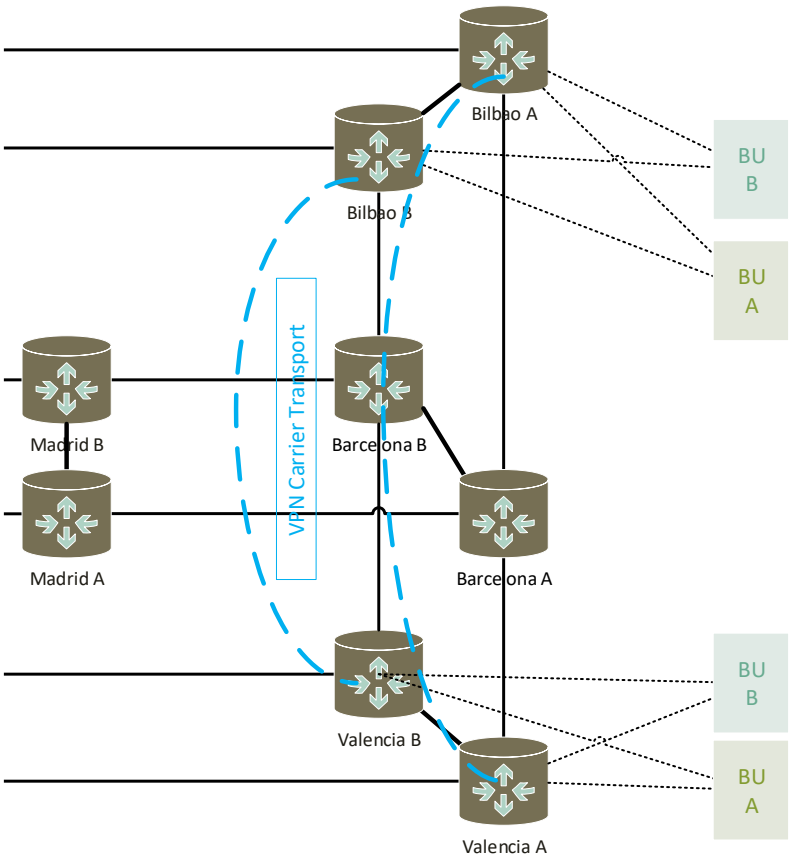


Figure 22 Carrier of Carrier Topology

For the proper functioning of the solution, there must be rules of route distribution, assignment of VPN targets, filters that allow communication between countries without affecting or compromising the remaining traffic.

The Carrier of Carrier structure uses a two layer scheme or VPN levels in MPLS, i.e., that a VPN can be transported within another VPN, as shown in Figure 23:

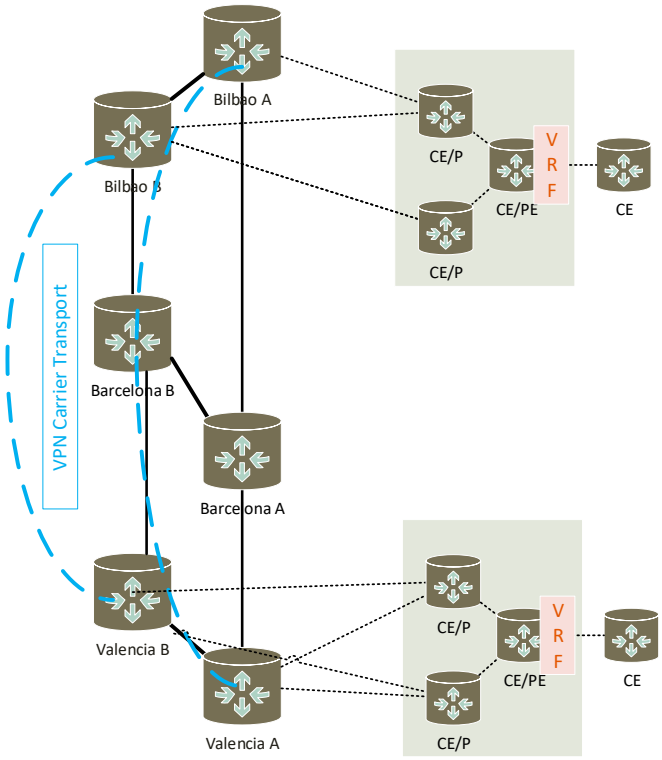


Figure 23 Carrier Supporting Carrier on the Core Network

4.1.4. Operation and Maintenance Related Topics

Almost every vendor equipment has several methods of administration as well as protection methods to allow the access, for this reason, is important to discuss these features:

- Out-of-band management
  The devices must have an access password configured in the console to which they can only access users who have administrator privileges.
- Access protection
  All users must have a protection password to access the device, as well access should be granted only using SSH or HTTPS protocol.
- High availability configuration
  The equipment must be configured to provide high availability in case of a failure of an element such as a power source or the routing-engine.
- Parameterization of chassis and alarms
  The configuration will be carried out in the equipment so that they send the temperature alarms and a voltage generating a log file within the same equipment as well as sending the logs to an external server.
- Graceful restart
  The devices must have the Graceful restart functionality configured which allows the equipment to continue sending the packets in the interfaces while the controllers are in a scheduled restart process.
- SNMP v2
  The devices will be configured with the read-only mode so that a specific SNMP client can obtain the equipment information such as the bandwidth of the interfaces and the value of the CPU process.
- Send traps for alarms

The equipment will be configured so they can send TRAP type SNMP notifications to a specific management device.

- Configuring Syslog and local message files
  The equipment will be configured so that they can send the logs to an external server, as well as it will be configured to save a copy.
- NTP
  The NTP server must be configured on the devices, and it will be verified that they are synchronized with the server, the goal of this is to all devices have the same time, and all logs and events are consistent.
- Access to equipment
  Types of access
  i. Command line
  There will be access to the equipment through the command line and either by remote access or through access to the console.
  ii. Graphic mode
  Have access to the equipment through the GUI graphic mode using the HTTPS protocol.

4.1.4.1. Radius or TACACS Authentication

Users who have access to manage the computers in the Core Network will be authenticated through a TACAC/RADIUS server. The TACAC/RADIUS server will have the users and passwords necessary for each user to receive granted access.

4.1.4.2. SNMP

For monitoring purposes, the SNMP agent within the routers must have a community configured to which the monitoring system can perform readings (gets) to obtain information.

This community is the first level of security to prevent the theft of information by computers not authorized. Additionally, with the purpose of increasing security, the equipment can be configured to respond *gets* from specific networks. The necessary configuration in the routers is the following:

```
snmp{
	community ejemplo{
		authorization read-only;
		client{
			4.4.4.4
		}
	}
}
```

4.1.4.3. Traps

The information of the events within the equipment is also an important function of the protocol SNMP. There are defined events that cause the router to send an SNMP trap to the NMS with the purpose of reporting an event. The configuration of these traps must include the IP and the NMS system community.

4.2. Mobile Core

Now that we have an IP backbone with national coverage, we will proceed with the design proposal of the Mobile Core network (EPC), considering the following points:

- The core IP network will be used as a backbone to communicate the mobile network throughout the country.
- As a conceptual example, two mobile Cores will be created in the cities of Madrid and Barcelona that will serve both as a redundancy and as a user load balancing. The IP Backbone will be ready to deploy any other service in any city.

4.2.1. Mobile Network Proposal

As mentioned above, two EPC networks will be created in two important urban centers of Spain, which will serve to meet the needs of their populations and at the same time as a redundancy scheme in case of failure.

The necessary IP network will be designed to provide connectivity to the main nodes of the EPC, by doing this the infrastructure for the other nodes of the EPC is practically being deployed.

Figure 24 shows the proposed EPC Network.

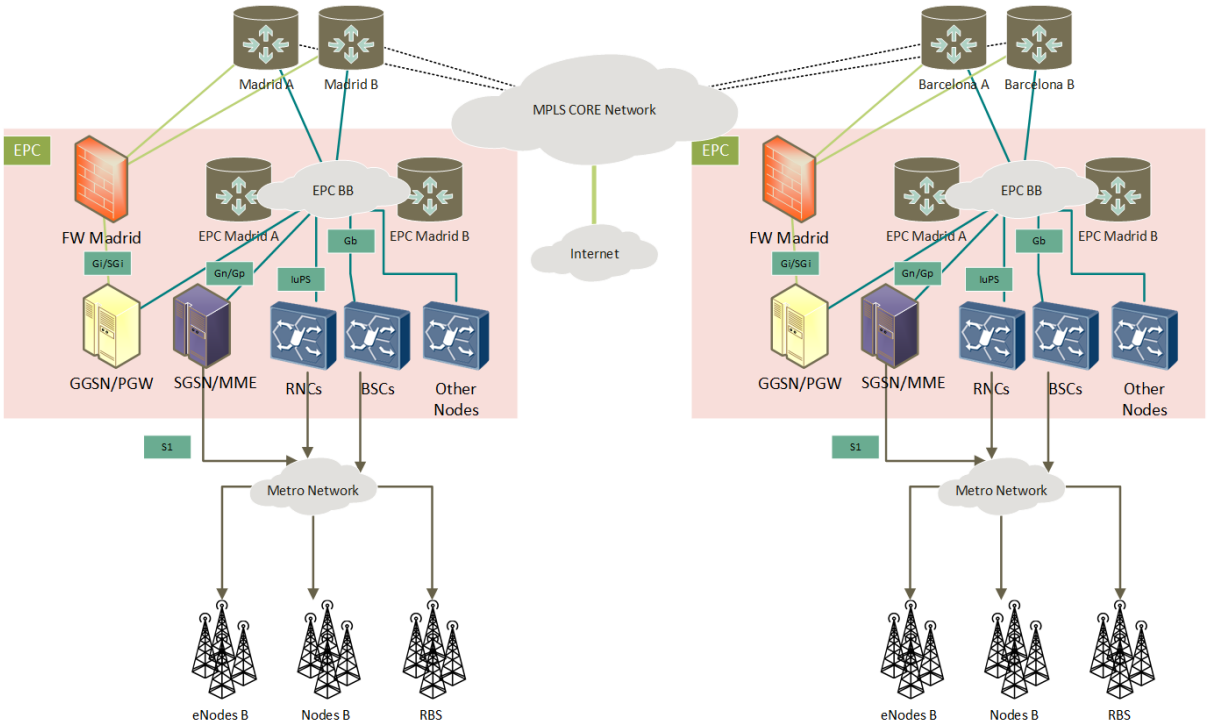


Figure 24 Proposed EPC Network

As mentioned before, the communication between cities will be provided by the Core MPLS network, separating the traffic through VPNs, each logical interface of the standard EPC architecture can correspond to a single VPN or several included in one VPN.

4.2.2. Mobile Core Interfaces and Services Review

Due to the complexity of the EPC architecture, it is necessary to show again Figure 14 as Figure 25,

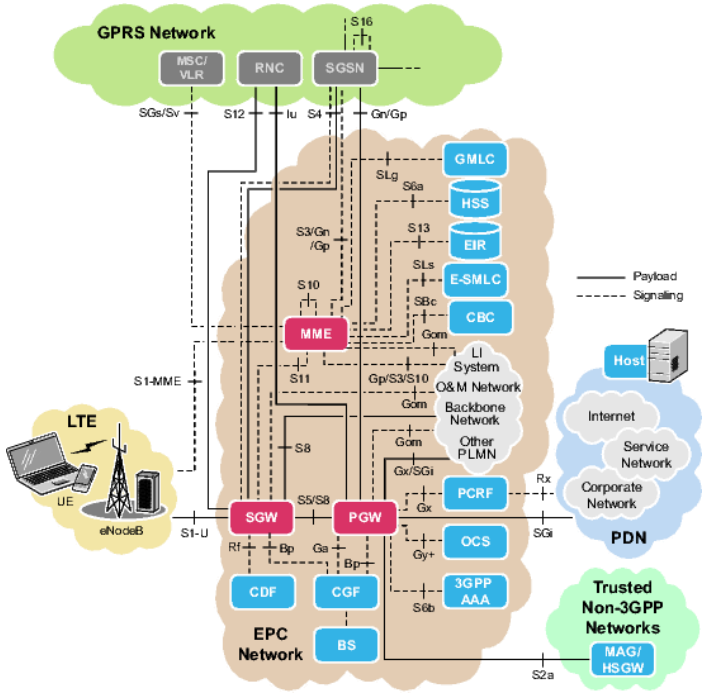


Figure 25 EPC Architecture (16)

Independently of the vendor architecture, there are some details that cannot change from vendor to vendor due to the EPC architecture is based on a 3GPP standard, therefore each network device must interoperate with other nodes from within and outside the EPC.

The first step will be to list all the common interfaces between the EPC and the legacy PC:

- Gn interface: Connects SGSN/MME to GGSNs and other SGSN/MMEs in the same PLMN.
- O&M interface: Connects to the O&M network
- Gp interface: Same as Gn but connects to nodes in other PLMNs.
- S3 interface: Signaling between SGSNs and MMEs.
- Gi interface: Connects the GGSN/PGW to the PDN.
- Gx interface: Connects the GGSN/PGW to the PCRF

The second step, to list exclusive GPRS interfaces:

- Gb interface: Connects the SGSN to Base Station Controllers (BSCs).
- Gd interface: Connects the SGSN to both the (SMS-GMSC) and (SMS-IWMSC). Signaling can also be transported over Gr.
- Ge interface: Connects the SGSN to SCP, signaling can also be transported over Gr.
- Gf interface: Connects the SGSN to EIR, signaling can also be transported over Gr.
- Gr interface: Connects the SGSN to HLR
- Gs interface: Connects the SGSN to MSC/VLR, signaling can also be transported over Gr.
- Iu-U interface: Connects the SGSN to RNC, for payload transport.
- Iu-C interface: Connects the SGSN to RNC, for signaling transport.
- Lg interface: Connects the SGSN to GMLC, signaling can also be transported over Gr.

- S4 interface: Connects the SGSN to SGW
- S6d interface: Connects the SGSN to HSS, through Diameter.
- S16 interface: Connects the SGSN to other SGSNs.

The third step, list all exclusive EPC interfaces:

- S1-MME interface: Connects the MME to eNodesB, it is based in SCTP.
- S6a interface: Connects the MME to HSS.
- S10 interface: Connects the MME to other MMEs
- S11 interface: Connects the MME to SGW.
- S13 interface: Connects the MME to EIR.
- SGs interface: Connects the MME to MSC/VLR.

To improve security, capacity, the capability of QoS, and facilitate O&M the traffic will be separated into VPNs (24), but this choice can vary from operator to operator. Factors as equipment ownership, security restrictions, and radio access support can influence the way that this separation is made, even though there are protocols that need the VPN separation as in the case of SCTP (25).

Several interfaces will be grouped into a common VPN, i.e. all the signaling related services because they share the same client protocol and carry the same type of information (HLR, EIR, SCP, etc.).

Fourth Step, List all IP Services:

Service	Protocol	Number of IP Address
O&M, Logs, Events, LI, Charging Records, NTP	FTP, SFTP, NTP, HTTP, SNMP, Telnet, SSH	1
DNS	DNS	1
Gn	GTP-C	1
S3	GTP-C	1
Signaling	SCTP	1-2
Gb	UDP	1
S4-C	GTP-C	1
S4-U	GTP-U	1
Gn-U	GTP-U	≥ 1
Iu-GTP-U	GTP-U	≥ 1
Iu-C	SCTP	1-2
S16-U	GTP-U	1
S1-MME	SCTP	1-2
S10-C	GTP-C	1
S11-C	GTP-C	1
S13	SCTP	1-2
SGs	SCTP	1-2

Table 8 Connectivity Services

4.2.3. Vendors Technology Survey

There is a limited number of EPC suppliers in the market, some of them only offer virtualized EPC solution and others offer virtual and appliance-based EPC solutions (26), Table 8 list them:

Company	Traditional/Virtual	Product Offerings
Affirmed Networks	vEPC only	http://www.affirmednetworks.com/products-solutions/virtualization/
Alcatel-Lucent	Traditional EPC	https://www.alcatel-lucent.com/solutions/ip-mobile-core
Brocade	Both	http://www.brocade.com/en/products-services/mobile-networking/vepc.html

Cisco	vEPC only	http://www.cisco.com/c/en/us/solutions/service-provider/virtualized-packet-core/index.html
Ericsson	Both	http://www.ericsson.com/ourportfolio/telecom-operators/virtual-evolved-packet-core
Hitachi	Traditional EPC	http://www.hitachi-cta.com/mtc-m2m
Huawei	Both	http://www.huawei.com/uk/products/core-network/singleepc/index.htm
Mitel	Traditional EPC	http://www.mitel.com/evolved-packet-core
NEC	Both	http://www.nec.com/en/global/solutions/tcs/vepc/
Nokia Networks	Traditional EPC	http://networks.nokia.com/fr/portfolio/products/evolved-packet-core
Samsung	Both	http://www.samsung.com/global/business/networks/core-network/
ZTE	Traditional EPC	http://wwwen.zte.com.cn/en/solutions/core_network/packet_core/

Table 9 EPC Suppliers

Due to intellectual property restrictions, specific details about EPC solutions are not available or not able to be reproduced in this document. Both solutions (appliance and virtual) share some characteristics that allow us to plan our network.

Figure 26 shows the general architecture of an EPC appliance i.e. MME, where there are some key services that run in virtual instances associated with some processing board groups. Depending on the vendor, these groups can be one-peer-board groups to many-boards groups so they can share the load of the service and bring redundancy to the system. And these service-board groups rely on other board-group specifically designed to the connectivity task (routing boards).

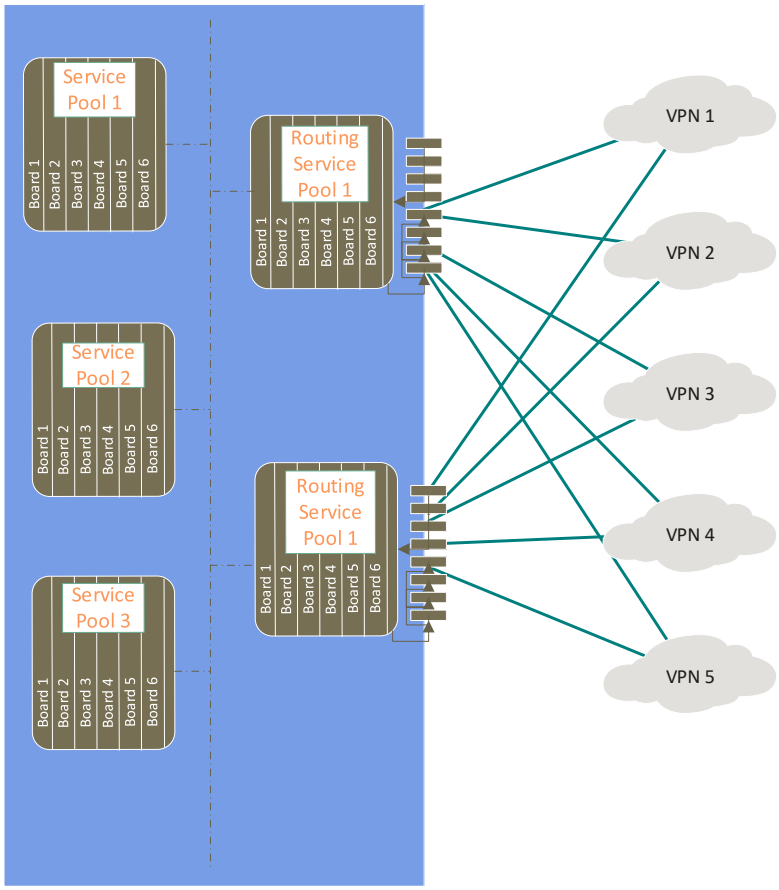


Figure 26 Service and Routing Board Pools

The routing boards must be capable to provide routing services like Dynamic and Static Routing, L3-VPN, IP-SEC and other services to be able to connect to the Backbone.

4.2.4. IP Address & VPN Planning

After listing all the IP services, we are ready to plan our addressing scheme.

The service IP addresses can be treated as virtual-IP addresses like a loopback IP address in a router, and the routing boards will have a physical IP address bound to a specific VPN, exchanging routes dynamically or statically configured. Figure 27 shows an example of how this scheme can be done and how can it be simulated.

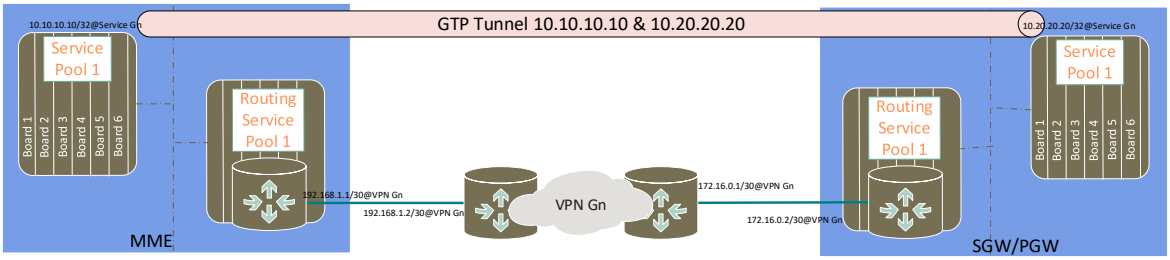


Figure 27 EPC services communication path

Next task is to group the services by VPN, the services are bound to a particular VPN to transport the packets through the network. Services belonging to the same VPN share the same Service IP address.

Service	Protocol	VPN Name
O&M, Logs, Events, LI, Charging Records, NTP	FTP, SFTP, NTP, HTTP, SNMP, Telnet, SSH	OM
DNS	DNS	Gn
Gn-C	GTP-C	
Gn-U	GTP-U	
S3	GTP-C	
Gp	GTP	
S10-C	GTP-C	
Gb	UDP	Gb
S4-C	GTP-C	S4
S4-U	GTP-U	
Signaling 1	SCTP	C1
Signaling 2	SCTP	C2
Iu-U	GTP-U	IuU
Iu-C 1	SCTP	IuC1
Iu-C 2	SCTP	IuC2
S1-MME 1	SCTP	S1MME1
S1-MME 2	SCTP	S1MME2
S11 C	GTP-C	S11
S13 1	SCTP	S131
S13 2	SCTP	S132
SGs 1	SCTP	SG1
SGs 2	SCTP	SG2
Gi	IP	Gi
SGi	IP	
S6a 1	SCTP	S6a1

S6a 2	SCTP	S6a2

Table 10 VPN Service Groups

Purpose	IP Network
Service IP Private addresses	172.21.0.0/16
Service IP Public Addresses	84.120.1.0/24
Physical IP Addresses	10.100.0.0/16

Table 11 General IP Planning

Table 11 and 12 show the General IP Planning for the EPC, assigning Public and Private IPv4 addresses to the Services, and private IPv4 to the physical boards.

Purpose	City	IP Network
Service IP Private addresses		172.21.0.0/16
	Barcelona	172.21.0.0/19
	Bilbao	172.21.32.0/19
	Cáceres	172.21.64.0/19
	Gijón	172.21.96.0/19
	Madrid	172.21.128.0/19
	Sevilla	172.21.160.0/19
	Valencia	172.21.192.0/19
Service IP Public Addresses		84.120.2.0/23
	Barcelona	84.120.2.0/26
	Bilbao	84.120.2.64/26
	Cáceres	84.120.2.128/26
	Gijón	84.120.2.192/26
	Madrid	84.120.3.0/26
	Sevilla	84.120.3.64/26
	Valencia	84.120.3.128/26
Physical IP Addresses		10.100.0.0/16
	Barcelona	10.100.0.0/19
	Bilbao	10.100.32.0/19
	Cáceres	10.100.64.0/19
	Gijón	10.100.96.0/19
	Madrid	10.100.128.0/19
	Sevilla	10.100.160.0/19
	Valencia	10.100.192.0/19

Table 12 City IP Planning

Node	Service	Virtual/Physical	IP Address	VPN Name
Madrid MME 1	O&M	Virtual	172.21.128.1	OM
		Physical 1	10.100.128.1	
		Physical 2	10.100.128.2	
	Gn-GTP	Virtual	84.120.3.1	Gn
	S3 S16	Virtual	84.120.3.2 84.120.3.3	
	Gn/S3/S16	Physical 1	10.100.130.1	
	Gn/S3/S16	Physical 2	10.100.130.2	

	Gb	Virtual	172.21.131.1	Gb
		Physical 1	10.100.131.1	
		Physical 2	10.100.131.2	
	S4	Virtual	172.21.132.1	
		Physical 1	10.100.132.1	S4
		Physical 2	10.100.132.2	
	C1	Virtual	172.21.133.1	C1
		Physical 1	10.100.133.1	
	C2	Virtual	172.21.134.1	C2
		Physical 1	10.100.134.1	
	IuU	Virtual	172.21.135.1	IuU
		Physical 1	10.100.135.1	
		Physical 2	10.100.135.2	
	IuC1	Virtual	172.21.136.1	IuC1
		Physical 1	10.100.136.1	
	IuC2	Virtual	172.21.137.1	IuC2
		Physical 1	10.100.137.1	
	S1MME1	Virtual	172.21.138.1	S1MME1
		Physical 1	10.100.138.1	
	S1MME2	Virtual	172.21.139.1	S1MME2
		Physical 1	10.100.139.1	
				S11
	S13-1	Virtual	172.21.140.1	S131
		Physical 1	10.100.140.1	
	S13-2	Virtual	172.21.141.1	S132
		Physical 1	10.100.141.1	
	SG1	Virtual	172.21.142.1	SG1
		Physical 1	10.100.142.1	
	SG2	Virtual	172.21.143.1	SG2
		Physical 1	10.100.143.1	
	S6a1	Virtual	172.21.144.1	S6a1
		Physical 1	10.100.144.1	
	S6a2	Virtual	172.21.145.1	S6a2
		Physical 1	10.100.145.1	

Table 13 Madrid MME 1 IP Addresses

Node	Service	Virtual/Physical	IP Address	VPN Name
Barcelona MME 1	O&M	Virtual	172.21.0.1	OM
		Physical 1	10.100.0.1	
		Physical 2	10.100.0.2	
	Gn-GTP	Virtual	84.120.2.1	Gn
	S3 S16	Virtual	84.120.2.2 84.120.2.3	
	Gn/S3/S16	Physical 1	10.100.2.1	
	Gn/S3/S16	Physical 2	10.100.2.2	
	Gb	Virtual	172.21.3.1	Gb
		Physical 1	10.100.3.1	

		Physical 2	10.100.3.2	
	S4	Virtual	172.21.4.1	S4
		Physical 1	10.100.4.1	
		Physical 2	10.100.4.2	
	C1	Virtual	172.21.5.1	C1
		Physical 1	10.100.5.1	
	C2	Virtual	172.21.6.1	C2
		Physical 1	10.100.6.1	
	IuU	Virtual	172.21.7.1	IuU
		Physical 1	10.100.7.1	
		Physical 2	10.100.7.2	
	IuC1	Virtual	172.21.8.1	IuC1
		Physical 1	10.100.8.1	
	IuC2	Virtual	172.21.9.1	IuC2
		Physical 1	10.100.9.1	
	S1MME1	Virtual	172.21.10.1	S1MME1
		Physical 1	10.100.10.1	
	S1MME2	Virtual	172.21.11.1	S1MME2
		Physical 1	10.100.11.1	
				S11
	S13-1	Virtual	172.21.12.1	S131
		Physical 1	10.100.12.1	
	S13-2	Virtual	172.21.13.1	S132
		Physical 1	10.100.13.1	
	SG1	Virtual	172.21.14.1	SG1
		Physical 1	10.100.14.1	
	SG2	Virtual	172.21.15.1	SG2
		Physical 1	10.100.15.1	
	S6a1	Virtual	172.21.16.1	S6a1
		Physical 1	10.100.16.1	
	S6a2	Virtual	172.21.17.1	S6a2
		Physical 1	10.100.17.1	

Table 14 Barcelona MME 1 IP Addresses

Node	Service	Virtual/Physical	IP Address	VPN Name
Madrid PGW/SGW/GGSN 1	O&M	Virtual	172.21.128.17	OM
		Physical 1	10.100.128.17	
		Physical 2	10.100.128.18	
	Gn/Gp/S5/S8	Virtual	84.120.3.4	Gn/GP/S5/S8
		Physical 1	10.100.146.1	
		Physical 2	10.100.146.2	
	Gi	Virtual	172.21.147.1	Gi
		Physical 1	10.100.147.1	
		Physical 2	10.100.147.2	
	Ga	Virtual	172.21.148.1	Ga
		Physical 1	10.100.148.1	
		Physical 2	10.100.148.2	
	S1U	Virtual	172.21.149.1	S1U

		Physical 1	10.100.149.1	
		Physical 2	10.100.149.2	
	Gx	Virtual	172.21.150.1	Gx
		Physical 1	10.100.150.1	
		Physical 2	10.100.150.2	

Table 15 Madrid PGW/SGW/GGSN 1 IP Addresses

Node	Service	Virtual/Physical	IP Address	VPN Name
Barcelona PGW/SGW/GGSN 1	O&M	Virtual	172.21.0.17	OM
		Physical 1	10.100.0.17	
		Physical 2	10.100.0.18	
	Gn/Gp/S5/S8	Virtual	84.120.2.4	Gn/GP/S5/S8
		Physical 1	10.100.18.1	
		Physical 2	10.100.18.2	
	Gi	Virtual	172.21.19.1	Gi
		Physical 1	10.100.19.1	
		Physical 2	10.100.19.2	
	Ga	Virtual	172.21.20.1	
		Physical 1	10.100.20.1	Ga
		Physical 2	10.100.20.2	
	S1U	Virtual	172.21.21.1	S1U
		Physical 1	10.100.21.1	
		Physical 2	10.100.21.2	
	Gx	Virtual	172.21.22.1	Gx
		Physical 1	10.100.22.1	
		Physical 2	10.100.22.2	

Table 16 Barcelona PGW/SGW/GGSN 1 IP Addresses

Chapter 5

5. TECHNOLOGIES AND SIMULATION TOOLS

This chapter presents the NFV tools and technologies used to be able to deploy a complete simulation of the proposed network. The first part refers to the Virtualization Environments that allow us to use the virtualization solutions of two well-known network vendors.

5.1. NFV-Virtualization Environments

The ability to run different instances of operating systems and segment a large system into smaller parts plus the isolation of processes apart of other processes, make the virtualization one the preferred solutions in IT domains.

Nowadays there are many existing virtualization tools such as: VMware, VirtualBox, Kernel based Virtual Machine (KVM), Proxmox, Virtual Machine Manager (VMM), etc. In this project, two of them are presented: VMware and GNS3 which were used to set up the simulation test environment.

5.1.1. VMware

VMware Workstation and VMware Sphere are two Virtualized Environments provided by VMware.

The Sphere/Workstation software enables to run multiple OSs (Figure 28) on a single PC or server at once, Workstation works over a Windows or Linux PC and Sphere acts as bare-metal Hypervisor OS for servers in data centers. Both offer the deployment of complete virtual networking and network condition simulation.

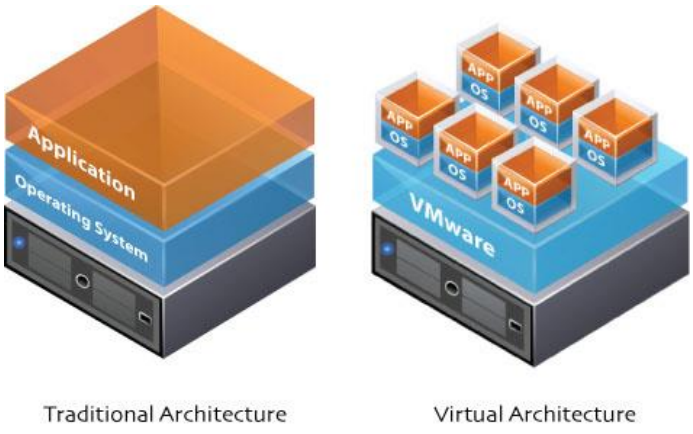


Figure 28 VMware Virtual Architecture (27)

You can set different networking configurations in VMware's solutions (28):

- **Bridged Networking:** Bridged networking connects a virtual machine to a network by using the network adapter on the host system. If the host system is on a network, bridged networking is often the easiest way to give the virtual machine access to that network.
- **NAT Networking:** With NAT, a virtual machine does not have its own IP address on the external network. Instead, a separate private network is set up on the host system. In the default configuration, a virtual machine gets an address on this private network from the

virtual DHCP server. The virtual machine and the host system share a single network identity that is not visible on the external network.

- **Host-Only Networking:** Host-only networking creates a network that is completely contained within the host computer. Host-only networking provides a network connection between the virtual machine and the host system by using a virtual network adapter that is visible on the host operating system.
- **Custom Networking Configurations:** With the Workstation virtual networking components, you can create sophisticated virtual networks. The virtual networks can be connected to one or more external networks, or they can run entirely on the host system. You can use the virtual network editor to configure multiple network cards in the host system and create multiple virtual networks.

5.1.2. GNS3

Graphical Network Simulator-3 (GNS3), is a network software emulator that allows the combination of virtual and real devices, and used to simulate complex networks.

Among others, this application provides the user with general characteristics such as the possibility of using the simulation we perform as proof of concept or demonstration of the client for commercial purposes. It is undoubtedly a great platform for learning and teaching a network environment. At the same time, with the use of a virtual laboratory, an interoperability of multiple providers in the network can be tested.

Another very noteworthy feature is that it is a good option for real-time network simulation for pre-deployment tests. This application will also give us the possibility to quickly run and test several hardwares without the need for physical hardware.

In reference to network certifications, you can customize topologies and labs within GNS3. In addition, you can connect GNS3 to a real network environment.

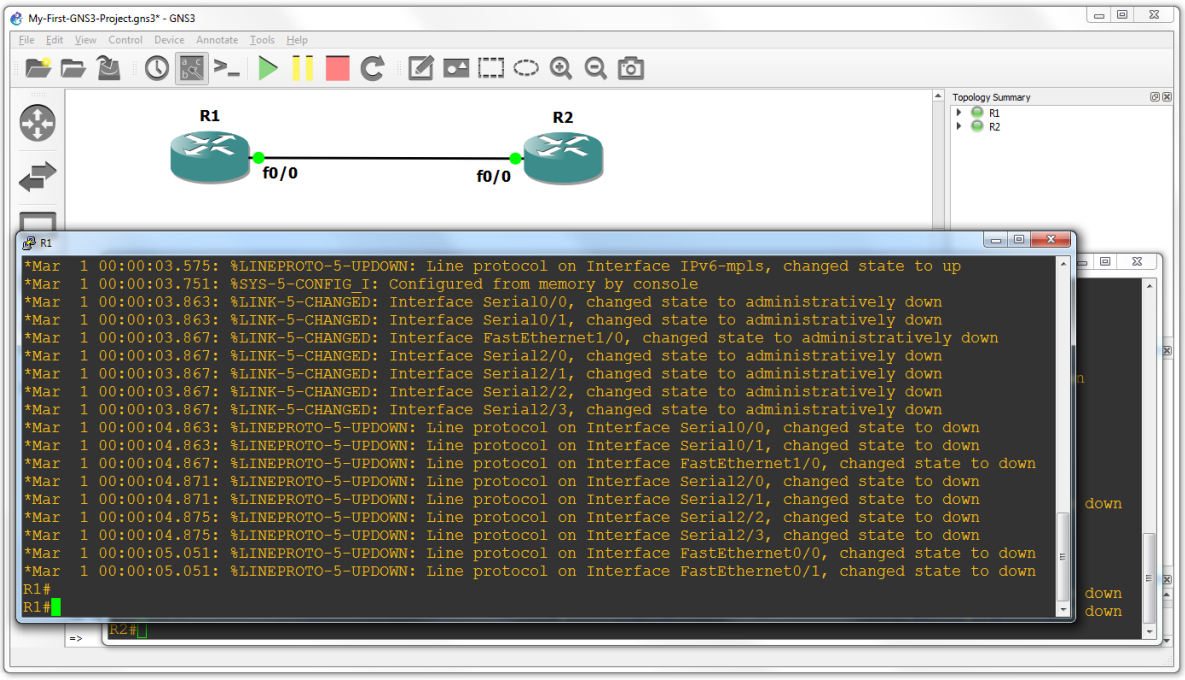


Figure 29 A GNS3 GUI print-screen.

5.2. NFV Solutions

In the telecom market there are some great vendor names, like Cisco, Juniper, HPE, Arista and Nokia (former Alcatel-Lucent), for the development of this project, we used the Cisco and Juniper NFV solutions.

5.2.1. Juniper vMX

vMX is the NFV solution provided by Juniper, maintaining complete feature and operational consistency with physical MX Series 3D Universal Edge Routers, it runs the Junos operating system.

vMX provides the same routing services that support Providers-Edge, Route-Reflectors and CPEs application, and it's available as a licensed software for deployment on x86-based servers, with granular licensing model that accommodates uncertain forecasts, enabling users to purchase only the amount of capacity they need (29).

Architecture and Key Components.

vMX consists of two separate instances that must be run together:

- Virtual control plane (VCP), which comprehends the Junos OS running on a VM.
- Virtual forwarding plane (VFP), which runs the packet forwarding engine.

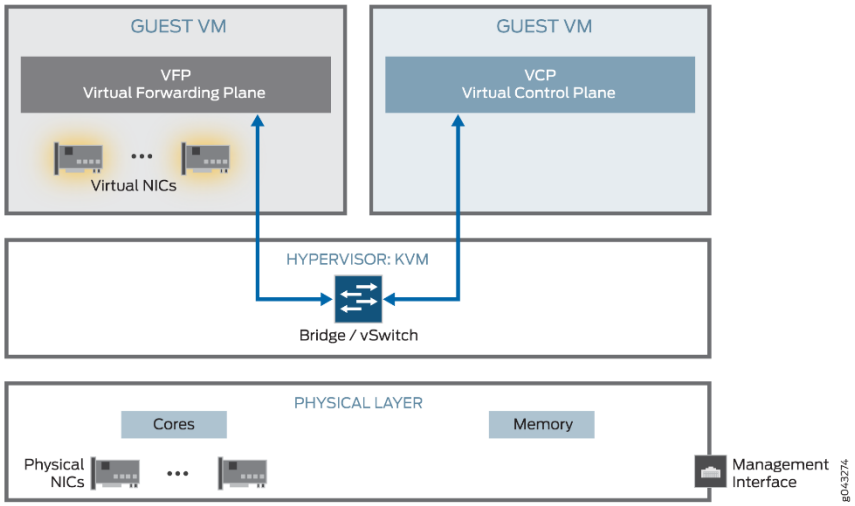


Figure 30 vMX VMs Architecture (30)

As shown in Figure 30 we see that the server at the physical layer contains the physical NICs, CPUs, and Management port, the middle layer contains the hypervisor OS, at the top of the layer there is the vMX instance separated in two VMs, one for the VFP and another for the VFP.

It is mandatory a Layer 2 connectivity between the VFP and VCP VMs, and connectivity to the management port on the server.

According to Juniper, the vMX enables the customers to scale out their networks without impacting operations, and satisfy immediate needs. It supports the full set of IPv4/IPv6 capabilities like L2VPN and EVPNs, MPLS (LDP,RSVP, P2MP LDP, CoS/QoS), layer 3(unicast and multicast l3VPNs with CoS/QoS).

vMX Minimum Hardware Requirements

Description	Value
CPU Low-Bandwidth applications High-Bandwidth applications	 Nehalem Intel Processor Generation. Ivy-Bridge Intel Processor Generation.
Memory	Minimum 8 GB
Storage	Local or NAS
Other	VT-d capability

Table 17 vMX Minimum Hardware Requirements (29)

vMX Minimum Software Requirements

Description	Value
Operating System	Ubuntu 14.04 LTS Linux 3.13.0-32-generic CentOS 7.1 RedHat 7.2
Virtualization	QEMU-KVM 2.0.0 VMware ESXI 5.5/6.0

Table 18 vMX Minimum Hardware Requirements (29)

5.2.2. Cisco XRv

XRv router is the virtualization carrier class solution offered by Cisco, it's based on the IOS-XR operative system. It runs on virtualized general x86 computer platforms.

Main Features of the Cisco IOS XRv 9000 Router (31)**:**

- End-to-end solution with network functions virtualization (NFV) infrastructure, virtual network functions, and service orchestration and management.
- Based on the extremely resilient, stable, and feature-rich Cisco IOS-XR Software, with the same northbound and management features as Cisco IOS XR Software, which helps ensure smooth integration with existing OSS and business support systems (BSS).
- High-performance data plane with service provider edge features, such as Quality of Service, access control list, and NetFlow.
- Architecture that separates the control plane and data plane, which allows for scaling up and down with multicore, multisocket, and multiserver systems.

Same as Juniper's vMX Cisco's XRv is divided in two planes; control plane and forwarding plane, but can be deployed with only of these functionalities. For control plane functionality as a virtual route reflector or as a high-performance data plane as a provider edge.

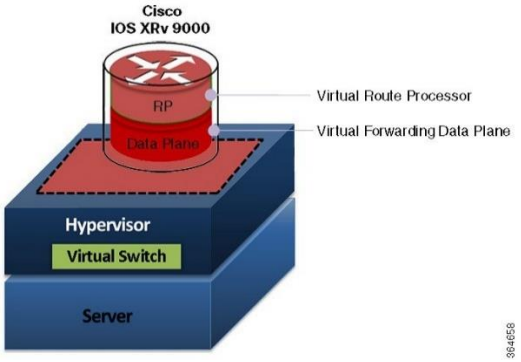


Figure 31 Cisco XRv VM Architecture (31)

XRv Specifications:

Features	Description
Cisco IOS XR packages	ISO, VMDK, OVA and qcow2 formats.
Supported hypervisors	VMware ESXi 5.5 Red Hat Kernel-Based Virtual Machine (KVM) (Red Hat Enterprise Virtualization 3.1 and Red Hat Enterprise Linux 6.3) KVM on Ubuntu 14.04 LTS
Resource specifications	The Cisco IOS XRv 9000 Router can run on Cisco Unified Computing System (Cisco UCS) servers, as well as servers from vendors that support VMware ESXi, Red Hat KVM, and Ubuntu KVM. The server must supply at least the following resources: • CPU: 4 cores • Memory: 16 G • Disk space: 50 G • Network interfaces: 2 or more virtual network interface cards (vNICs), up to the maximum allowed by the hypervisor
Supported features	• NFV: virtual PE (vPE) and virtual RR (vRR) • Routing: Border Gateway Protocol (BGP), Open Shortest Path First (OSPF), Intermediate System to Intermediate System (IS-IS) Protocol, Static Routing, Multiprotocol Label Switching (MPLS), and Label Distribution Protocol (LDP), RFC 3107 • Encapsulations: IEEE802.1Q VLAN, IEEE 802.1ad (QinQHigh Availability: Process-Restart, SMU, Bidirectional Forwarding Detection (BFD), BGP Prefix-Independent Convergence (PIC) • Data plane features: Hierarchical QoS (H-QoS), access control list (ACL), Lawful Intercept, and Unicast Reverse Path Forwarding (uRPF)

Table 19 XRv Specifications (31)

Chapter 6

6. TESTING AND EVALUATION

6.1. Final Topology Design

For the deployment part of the infrastructure simulation, as shown in the previous chapter, virtual routers from the Cisco and Juniper manufacturers will be used. For the part of the Core MPLS, Juniper vMX routers will be used and for customer devices Cisco XRv routers, both virtual routers correspond to high-end equipment, which can be used in a real environment.

As can be seen in Figure 32, a P-PE-CE scheme with different ASNs has been used. Therefore, the following differentiations must be made:

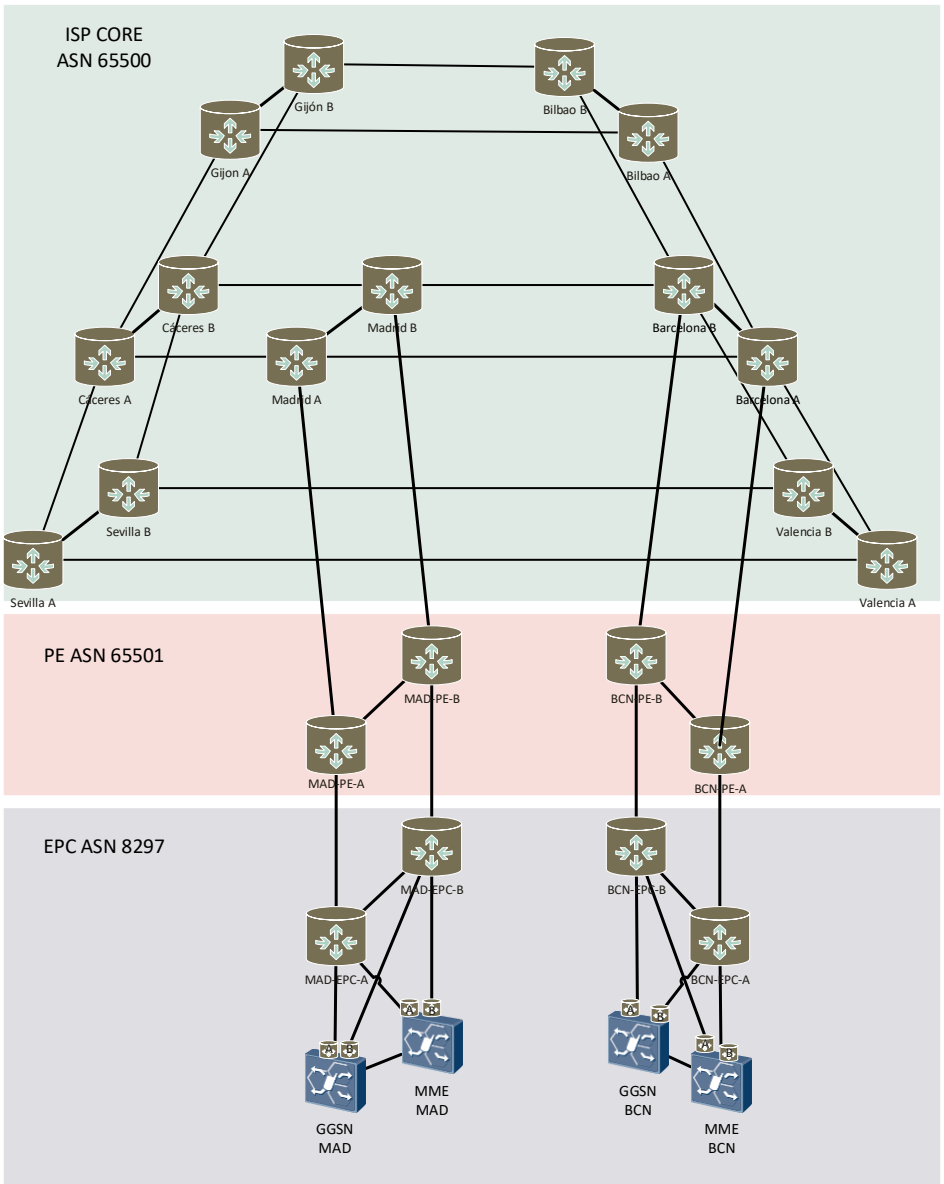


Figure 32 Final Topology

- The ISP Core (P routers) is formed only by the Juniper vMX router, consisting of the Madrid A, Madrid B ... routers. etc., they belong to AS 65000.
- Juniper vMX routers were used to create the network of the Mobile business unit, these routers work as hub routers within the B.U. because they can not only serve the Core EPC. They belong to AS 65501.
- The EPC Core is also made up of vMX routers, these routers concentrate exclusively everything related to the EPC, to this you can connect nodes such as MME, PGW, SGW, HSS, HLR, GGSN, or any other equipment related to the part of mobility. These belong to AS 8297, and are the routers that have knowledge and configuration of all VPNs (VRFs) such as Gn, Gi, etc.
- Both logical instances of routers (logical-instance) were created, for Data and Internet in the whole ISP Core, but in the Mobile BU we only with the Data Instance (this is due to the fact that making the entire Internet instance lacks of meaning since it is the same configuration process, as with the other VPNs).
- One of the goals is to achieve connectivity between final elements from one city to another, in this case MAD-BCN, using the Gn VPN, from GGSN-MAD to GGSN BCN.

Figure 33 and 34 show the IP assignments as well as the interfaces assigned in the Core for the Internet and Data instances:

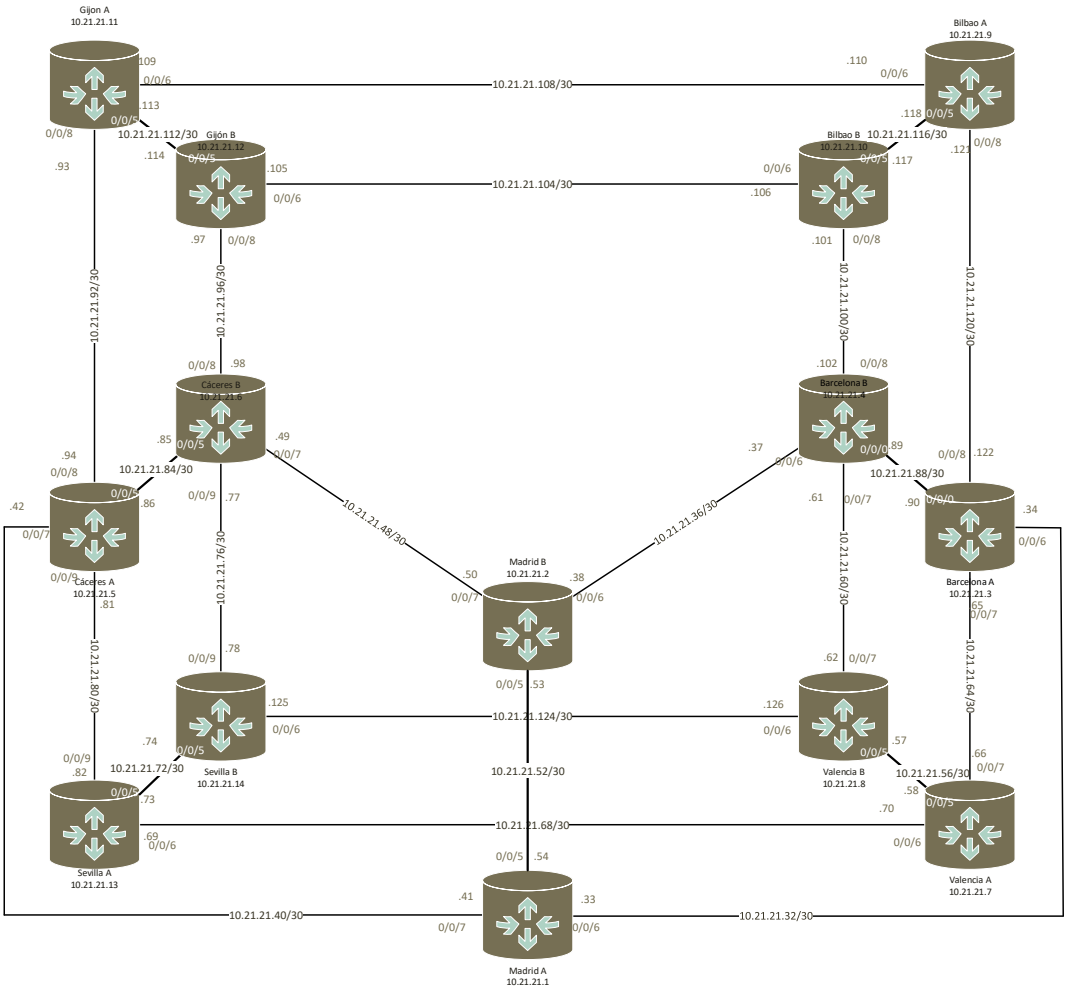


Figure 33 Data Instance IP addressing.

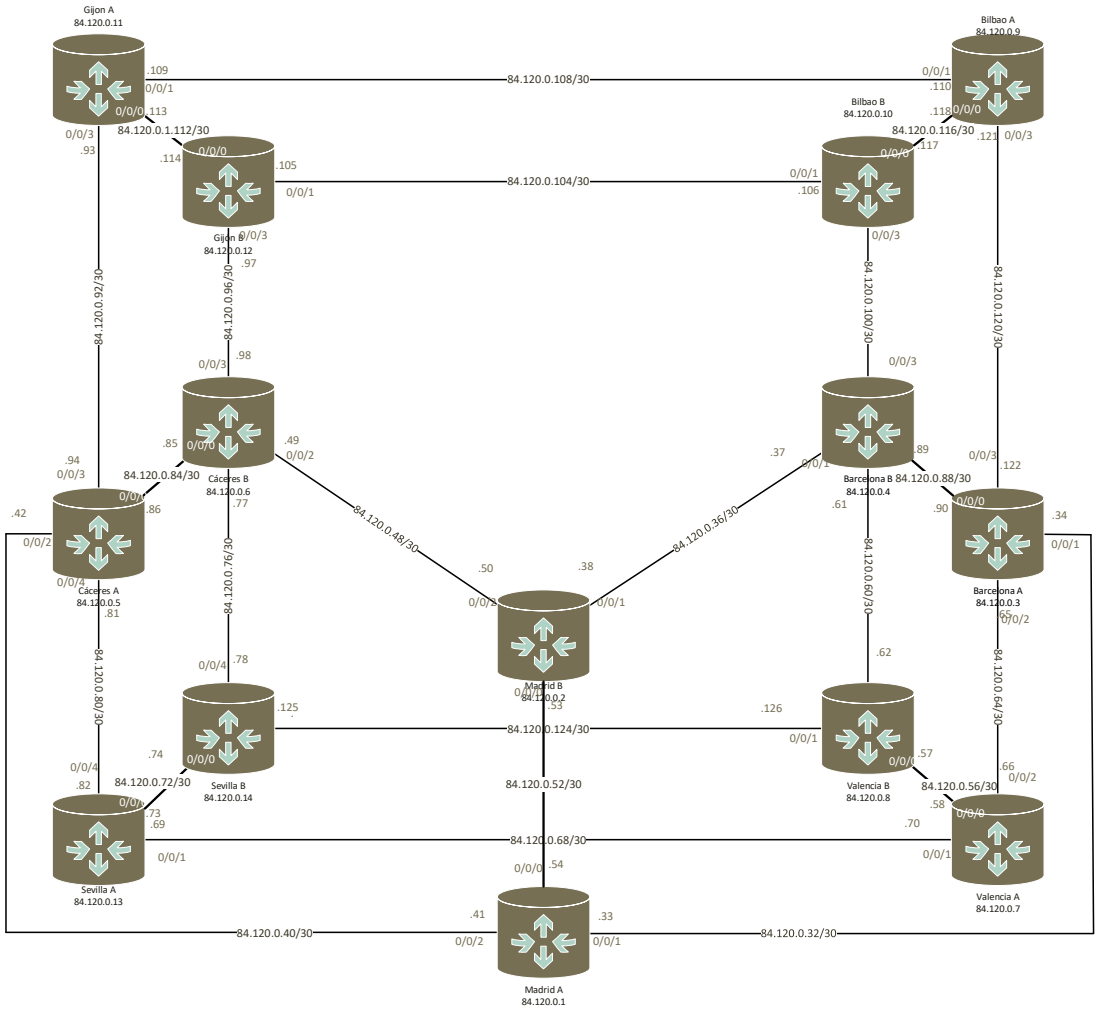


Figure 34 Internet Instance IP Addressing

And finally in Figure 35 the address of the part corresponding to the EPC Data instance is shown:

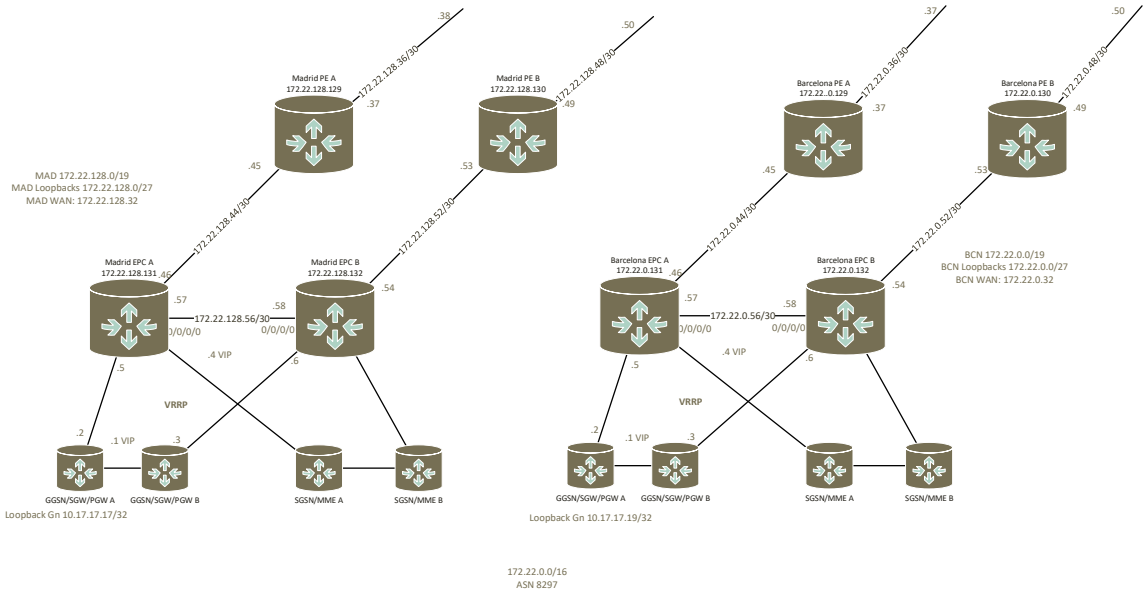


Figure 35 EPC IP Addressing

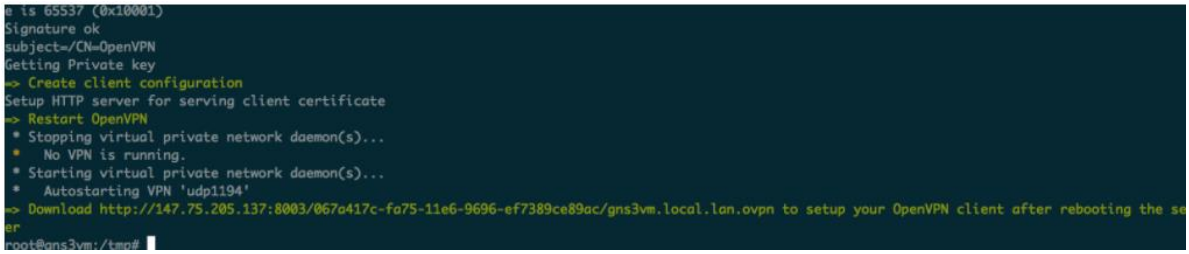
6.2. Virtual Environment Setup

Due to the large number of network nodes that are simulated and the minimum amount of resources needed for each, it was decided to use a dedicated server only to this task, but with local management. These functionalities are supported by GNS3, in addition to which you can create virtual machines that execute the images of both vMX and XRv.

The following are the steps required to establish the simulation environment:

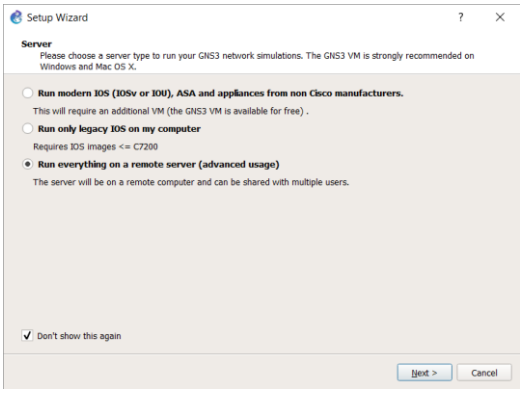
a) Own a server with Ubuntu 16.04, give it a Hostname of gns3vm, with Internet access (Public IP) and sufficient resources (CPU, RAM).
b) Install GNS3: Through terminal commands:

```
cd /tmp

curl https://raw.githubusercontent.com/GNS3/gns3-server/master/scripts/remote-install.sh > gns3-remote-install.sh

bash gns3-remote-install.sh --with-openvpn --with-iou --with-i386-repository
```

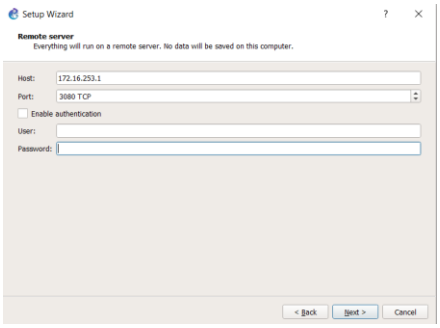


c) Restart the server and download the OpenVPN profile that is displayed at the start of the server startup.

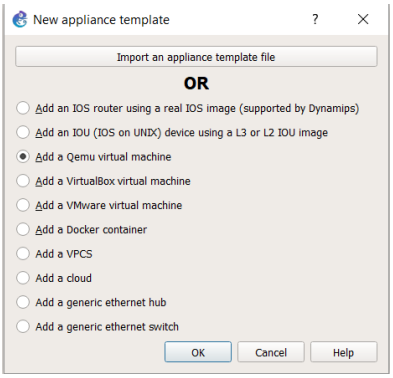
d) Install OpenVPN in the management computer, import the previously downloaded profile and connect.
e) Open the GNS3 application on the client, and choose in the Setup Wizard, the option to run everything on a remote server.



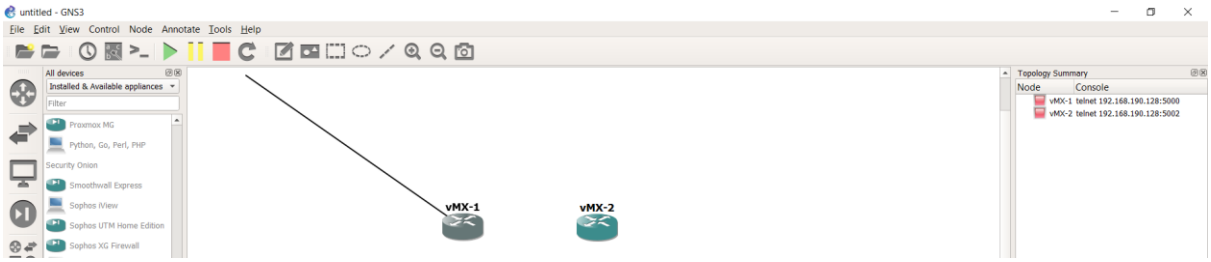
f) Enter the connection parameters, (172.16.253.1, 3080 TCP, Disable authentication).



g) Add the vMX and XRv routers as QEMU virtual machines, and enter the assigned name, image and resource parameters.



h) Start configuring and build the topology.



6.3. Connectivity Tests

After having made all the initial configurations, we proceeded to build the topology (router, connections, and interfaces), and then introduce the necessary configurations (Annex I) to establish the appropriate connectivity to each of the routers and at each level of abstraction. (L3, IGP, MPLS,

RSVP, L3VPN, CsC, etc). Figure 36 shows the final topology in the simulation environment.

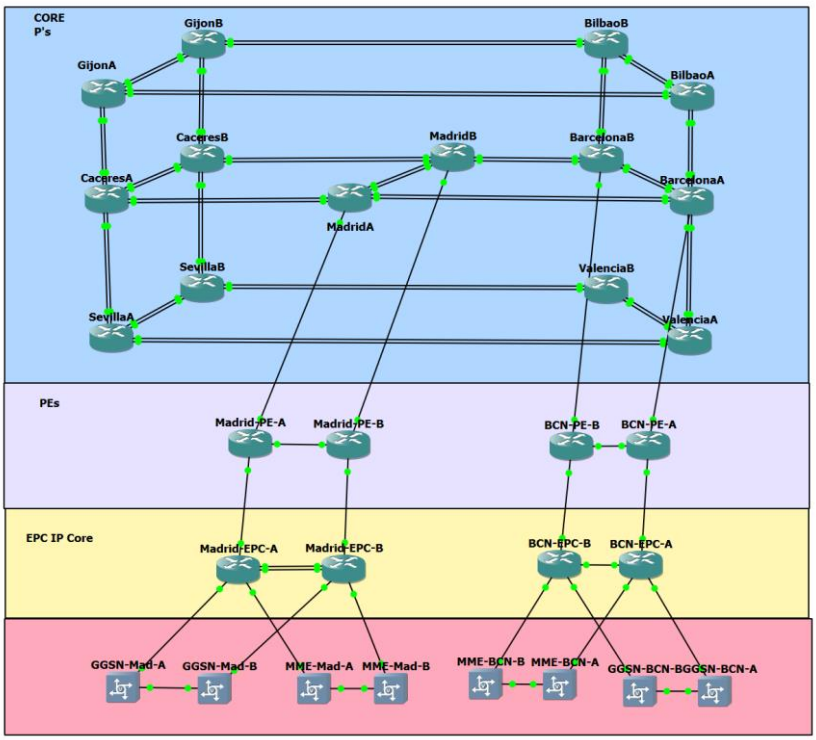


Figure 36 GNS3 Final Topology

As a first test of functionality it is shown that all OSPF neighbors of Madrid-A are UP Figure 37:

```
root@Madrid-A> show ospf neighbor logical-system Datos
Address          Interface              State     ID               Pri   Dead
10.21.21.53      ge-0/0/5.0             Full      10.21.21.2       128     32
10.21.21.34      ge-0/0/6.0             Full      10.21.21.3       128     33
10.21.21.42      ge-0/0/7.0             Full      10.21.21.5       128     34
```

Figure 37 MAD-A OSPF Neighbors State

Thanks to the correct establishment of the IGP (OSPF), now the BGP peers are Established:

```
root@Madrid-A> show bgp summary logical-system Datos
Groups: 2 Peers: 14 Down peers: 1
Table          Tot Paths  Act Paths Suppressed    History Damp State    Pending
inet.0
                       0          0          0          0          0          0
bgp.l3vpn.0
                      16         16          0          0          0          0
bgp.l3vpn.2
                       0          0          0          0          0          0
bgp.l2vpn.0
                       0          0          0          0          0          0
Peer                     AS      InPkt     OutPkt    OutQ   Flaps Last Up/Dwn State|#Ac
10.21.21.2            65500        179        170       0       1     1:13:52 Establ
  inet.0: 0/0/0/0
  bgp.l3vpn.0: 5/5/5/0
  bgp.l3vpn.2: 0/0/0/0
  bgp.l2vpn.0: 0/0/0/0
  vpn-epc.inet.0: 3/5/5/0
10.21.21.3            65500       2024       2032       0       2     1:13:31 Establ
  inet.0: 0/0/0/0
  bgp.l3vpn.0: 5/5/5/0
  bgp.l3vpn.2: 0/0/0/0
  bgp.l2vpn.0: 0/0/0/0
  vpn-epc.inet.0: 5/5/5/0
10.21.21.4            65500        167        168       0       2     1:13:28 Establ
  inet.0: 0/0/0/0
  bgp.l3vpn.0: 6/6/6/0
  bgp.l3vpn.2: 0/0/0/0
  bgp.l2vpn.0: 0/0/0/0
  vpn-epc.inet.0: 4/6/6/0
10.21.21.5            65500         87         86       0       2       39:13 Establ
  inet.0: 0/0/0/0
  bgp.l2vpn.0: 0/0/0/0
10.21.21.6            65500        166        171       0       1     1:14:07 Establ
  inet.0: 0/0/0/0
  bgp.l3vpn.0: 0/0/0/0
  bgp.l3vpn.2: 0/0/0/0
```

Figure 38 MAD-A BGP Peers

In another part of the network (BCN-A) you can see the correct establishment of the RSVP sessions between the routers, and the backup LSPs:

```
root@Barcelona-A> show rsvp session logical-system Datos
Ingress RSVP: 18 sessions
To              From            State   Rt Style Labelin Labelout LSPname
10.21.21.1      10.21.21.3      Up       0  1 SE       -        3 BarA-MadA
10.21.21.1      10.21.21.3      Up       0  1 SE       -   302592 Bypass->10.21.21.33
10.21.21.2      10.21.21.3      Up       0  1 SE       -   301072 BarA-MadB
10.21.21.4      10.21.21.3      Up       0  1 SE       -   301088 BarA-BarB
10.21.21.5      10.21.21.3      Up       0  1 SE       -   301152 BarA-CacA
10.21.21.6      10.21.21.3      Up       0  1 SE       -   301200 BarA-CacB
10.21.21.7      10.21.21.3      Up       0  1 SE       -        3 BarA-ValA
10.21.21.7      10.21.21.3      Up       0  1 SE       -   300608 Bypass->10.21.21.66
10.21.21.9      10.21.21.3      Up       0  1 SE       -        3 BarA-BilA
10.21.21.9      10.21.21.3      Up       0  1 SE       -   300272 Bypass->10.21.21.121
10.21.21.10     10.21.21.3      Up       0  1 SE       -   299888 BarA-BilB
10.21.21.10     10.21.21.3      Up       0  1 SE       -   300256 Bypass->10.21.21.121->10.21.21.117
10.21.21.11     10.21.21.3      Up       0  1 SE       -   300480 BarA-GijA
10.21.21.11     10.21.21.3      Up       0  1 SE       -   300240 Bypass->10.21.21.121->10.21.21.109
10.21.21.12     10.21.21.3      Up       0  1 SE       -   301216 BarA-GijB
10.21.21.13     10.21.21.3      Up       0  1 SE       -   299856 BarA-SevA
10.21.21.13     10.21.21.3      Up       0  1 SE       -   300560 Bypass->10.21.21.66->10.21.21.69
10.21.21.14     10.21.21.3      Up       0  1 SE       -   300304 BarA-SevB
Total 18 displayed, Up 18, Down 0

Egress RSVP: 18 sessions
To              From            State   Rt Style Labelin Labelout LSPname
10.21.21.3      10.21.21.5      Up       0  1 SE       3        - CacA-BarA
10.21.21.3      10.21.21.1      Up       0  1 SE       3        - MadA-BarA
10.21.21.3      10.21.21.1      Up       0  1 SE       3        - Bypass->10.21.21.34
10.21.21.3      10.21.21.9      Up       0  1 SE       3        - BilA-BarA
10.21.21.3      10.21.21.9      Up       0  1 SE       3        - Bypass->10.21.21.122
10.21.21.3      10.21.21.10     Up       0  1 SE       3        - BilB-BarA
10.21.21.3      10.21.21.10     Up       0  1 SE       3        - Bypass->10.21.21.118->10.21.21.122
10.21.21.3      10.21.21.11     Up       0  1 SE       3        - GijA-BarA
10.21.21.3      10.21.21.11     Up       0  1 SE       3        - Bypass->10.21.21.110->10.21.21.122
10.21.21.3      10.21.21.13     Up       0  1 SE       3        - SevA-BarA
10.21.21.3      10.21.21.13     Up       0  1 SE       3        - Bypass->10.21.21.70->10.21.21.65
10.21.21.3      10.21.21.7      Up       0  1 SE       3        - ValA-BarA
10.21.21.3      10.21.21.7      Up       0  1 SE       3        - Bypass->10.21.21.65
10.21.21.3      10.21.21.6      Up       0  1 SE       3        - CacB-BarA
10.21.21.3      10.21.21.2      Up       0  1 SE       3        - MadB-BarA
10.21.21.3      10.21.21.4      Up       0  1 SE       3        - BarB-BarA
10.21.21.3      10.21.21.12     Up       0  1 SE       3        - GijB-BarA
```

```
Transit RSVP: 41 sessions
To              From            State   Rt Style Labelin Labelout LSPname
10.21.21.1      10.21.21.5      Up       0  1 SE  302832        3 CacA-MadA
10.21.21.1      10.21.21.9      Up       0  1 SE  302112        3 BilA-MadA
10.21.21.1      10.21.21.10     Up       0  1 SE  302864        3 BilB-MadA
10.21.21.1      10.21.21.11     Up       0  1 SE  302160        3 GijA-MadA
10.21.21.1      10.21.21.13     Up       0  1 SE  302128        3 SevA-MadA
10.21.21.1      10.21.21.7      Up       0  1 SE  301904        3 ValA-MadA
10.21.21.1      10.21.21.6      Up       0  1 SE  302880        3 CacB-MadA
10.21.21.1      10.21.21.2      Up       0  1 SE  302912        3 MadB-MadA
10.21.21.1      10.21.21.4      Up       0  1 SE  302896        3 BarB-MadA
10.21.21.1      10.21.21.12     Up       0  1 SE  302848        3 GijB-MadA
10.21.21.1      10.21.21.14     Up       0  1 SE  302352        3 SevB-MadA
10.21.21.2      10.21.21.1      Up       0  1 SE  302736   300944 MadA-MadB
10.21.21.4      10.21.21.1      Up       0  1 SE  302720   300896 MadA-BarB
10.21.21.4      10.21.21.7      Up       0  1 SE  302704   300864 ValA-BarB
10.21.21.5      10.21.21.1      Up       0  1 SE  302464   300640 MadA-CacA
10.21.21.5      10.21.21.9      Up       0  1 SE  302336   299936 Bypass->10.21.21.109->10.21.21.94
10.21.21.5      10.21.21.7      Up       0  1 SE  302512   300672 Bypass->10.21.21.69->10.21.21.81
10.21.21.6      10.21.21.1      Up       0  1 SE  302752   300224 MadA-CacB
10.21.21.7      10.21.21.5      Up       0  1 SE  302272        3 Bypass->10.21.21.82->10.21.21.70
10.21.21.7      10.21.21.1      Up       0  1 SE  301984        3 MadA-ValA
10.21.21.7      10.21.21.9      Up       0  1 SE  301968        3 BilA-ValA
10.21.21.7      10.21.21.10     Up       0  1 SE  301952        3 BilB-ValA
10.21.21.7      10.21.21.11     Up       0  1 SE  302000        3 GijA-ValA
10.21.21.7      10.21.21.13     Up       0  1 SE  302304        3 Bypass->10.21.21.70
10.21.21.7      10.21.21.14     Up       0  1 SE  302656        3 Bypass->10.21.21.73->10.21.21.70
10.21.21.9      10.21.21.5      Up       0  1 SE  302672        3 Bypass->10.21.21.93->10.21.21.110
10.21.21.9      10.21.21.1      Up       0  1 SE  301616        3 MadA-BilA
10.21.21.9      10.21.21.13     Up       0  1 SE  302144        3 SevA-BilA
10.21.21.9      10.21.21.7      Up       0  1 SE  301840        3 ValA-BilA
10.21.21.10     10.21.21.1      Up       0  1 SE  301648   300144 MadA-BilB
10.21.21.10     10.21.21.7      Up       0  1 SE  301872   300384 ValA-BilB
10.21.21.11     10.21.21.1      Up       0  1 SE  302624   300688 MadA-GijA
10.21.21.11     10.21.21.7      Up       0  1 SE  301856   300368 ValA-GijA
10.21.21.12     10.21.21.1      Up       0  1 SE  302480   300656 MadA-GijB
10.21.21.12     10.21.21.7      Up       0  1 SE  301936   300400 ValA-GijB
10.21.21.13     10.21.21.1      Up       0  1 SE  302640   300064 MadA-SevA
10.21.21.13     10.21.21.9      Up       0  1 SE  302192   299872 BilA-SevA
10.21.21.13     10.21.21.7      Up       0  1 SE  302400   300624 Bypass->10.21.21.69
10.21.21.14     10.21.21.1      Up       0  1 SE  302496   299968 MadA-SevB
10.21.21.14     10.21.21.7      Up       0  1 SE  302768   300976 Bypass->10.21.21.69->10.21.21.74
10.21.21.14     10.21.21.2      Up       0  1 SE  302688   300176 Bypass->10.21.21.49->10.21.21.78
```

Figure 39 BCN-A RSVP Sessions

To be able to transport the traffic of a client of a client (final client) it is first necessary to create a VPN in the CORE that allows to add another label in order to separate between clients.

```
policy-statement Redes-EPC-CarrierImport {
    term 1 {
        from {
            route-filter 172.22.128.0/19 orlonger;
            route-filter 172.22.0.0/19 orlonger;
            route-filter 10.0.0.0/8 orlonger;
        }
        then accept;
    }
    term 2 {
        then reject;
    }
}
policy-statement vpn-epc-export {
    term 1 {
        from protocol [ bgp direct ];
        then {
            community add vpn-epc-comm;
            accept;
        }
    }
    term 2 {
        then reject;
    }
}
policy-statement vpn-epc-import {
    term 1 {
        from {
            protocol [ bgp direct ];
            community vpn-epc-comm;
        }
        then accept;
    }
    term 2 {
        then reject;
```

```
routing-instances {
    vpn-epc {
        instance-type vrf;
        interface ge-0/0/4.0;
        route-distinguisher 65500:100;
        vrf-import vpn-epc-import;
        vrf-export vpn-epc-export;
        protocols {
            bgp {
                group EPC {
                    import Redes-EPC-CarrierImport;
                    export Redes-EPC-CarrierExport;
                    peer-as 65501;
                    neighbor 172.22.128.37 {
                        description EPC-Mad-A;
                        family inet {
                            labeled-unicast;
                        }
                        as-override;
                    }
                }
            }
        }
    }
}
routing-options {
    router-id 10.21.21.1;
    autonomous-system 65500;
`
```

```
vpn-epc.mpls.0: 7 destinations, 7 routes (7 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

302240             *[VPN/170] 00:30:00, metric2 1000, from 10.21.21.2
                    > to 10.21.21.34 via ge-0/0/6.0, label-switched-path MadA-MadB
                      to 10.21.21.42 via ge-0/0/7.0, label-switched-path Bypass->10.21.21.34->10.21.21.121
302256             *[VPN/170] 00:30:00, metric2 1000, from 10.21.21.2
                    > to 10.21.21.34 via ge-0/0/6.0, label-switched-path MadA-MadB
                      to 10.21.21.42 via ge-0/0/7.0, label-switched-path Bypass->10.21.21.34->10.21.21.121
302272             *[VPN/170] 00:30:00, metric2 2000, from 10.21.21.4
                    > to 10.21.21.34 via ge-0/0/6.0, label-switched-path MadA-BarB
                      to 10.21.21.42 via ge-0/0/7.0, label-switched-path Bypass->10.21.21.34->10.21.21.121
302288             *[VPN/170] 00:30:00, metric2 2000, from 10.21.21.4
                    > to 10.21.21.34 via ge-0/0/6.0, label-switched-path MadA-BarB
                      to 10.21.21.42 via ge-0/0/7.0, label-switched-path Bypass->10.21.21.34->10.21.21.121
302304             *[VPN/170] 00:30:00, metric2 2000, from 10.21.21.4
                    > to 10.21.21.34 via ge-0/0/6.0, label-switched-path MadA-BarB
                      to 10.21.21.42 via ge-0/0/7.0, label-switched-path Bypass->10.21.21.34->10.21.21.121
302320             *[VPN/170] 00:30:00, metric2 1000, from 10.21.21.3
                    > to 10.21.21.34 via ge-0/0/6.0, label-switched-path MadA-BarA
                      to 10.21.21.42 via ge-0/0/7.0, label-switched-path Bypass->10.21.21.34
302336             *[VPN/170] 00:30:00, metric2 1000, from 10.21.21.3
                    > to 10.21.21.34 via ge-0/0/6.0, label-switched-path MadA-BarA
                      to 10.21.21.42 via ge-0/0/7.0, label-switched-path Bypass->10.21.21.34
```

Figure 40 EPC VPN Configuration and Forwarding Label Table

In the EPC routers, for the correct functioning of the Gn VPN, it is necessary to configure all the other protocols such as ospf, bgp. In the case of VRRP, it is configured as a measure of redundancy towards the elements of the EPC:

```
root@Madrid-EPC-A> show ospf neighbor logical-system Datos
Address          Interface              State     ID               Pri  Dead
172.22.128.58    ge-0/0/0.0             Full      172.22.128.132   128    39
172.22.128.45    ge-0/0/3.0             Full      172.22.128.129   128    37
```

```
root@Madrid-EPC-A> show bgp summary logical-system Datos
Groups: 1 Peers: 3 Down peers: 0
Table          Tot Paths  Act Paths Suppressed    History Damp State    Pending
inet.0
                       9          9          0          0          0          0
bgp.l3vpn.0
                       4          4          0          0          0          0
bgp.l3vpn.2
                       0          0          0          0          0          0
Peer                     AS      InPkt     OutPkt    OutQ   Flaps Last Up/Dwn State|#Active/Received/Accepted/Damped...
172.22.0.131          65501        109        131       0       2       57:47 Establ
  bgp.l3vpn.0: 3/3/3/0
  bgp.l3vpn.2: 0/0/0/0
  gn.inet.0: 3/3/3/0
172.22.0.132          65501       1965       1969       0       3       23:31 Establ
  bgp.l3vpn.0: 1/1/1/0
  bgp.l3vpn.2: 0/0/0/0
  gn.inet.0: 1/1/1/0
172.22.128.129        65501       2130       2090       0       0    15:46:35 Establ
  inet.0: 9/9/9/0
```

```
root@Madrid-EPC-A> show vrrp brief logical-system Datos
Interface     State       Group   VR state VR Mode   Timer    Type   Address
irb.50        up             50   master   Active       A  0.762 lcl    10.100.146.5
                                                                vip    10.100.146.4
```

```
root@Madrid-EPC-A> show route logical-system Datos table gn.inet.0

gn.inet.0: 9 destinations, 9 routes (9 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.17.17.17/32     *[Static/5] 14:59:24
                    > to 10.100.146.1 via irb.50
10.17.17.19/32     *[BGP/170] 00:56:59, localpref 100, from 172.22.0.131
                      AS path: I, validation-state: unverified
                    > to 172.22.128.45 via ge-0/0/3.0, Push 299792, Push 300176(top)
10.100.18.0/29     *[BGP/170] 00:56:59, localpref 100, from 172.22.0.131
                      AS path: I, validation-state: unverified
                    > to 172.22.128.45 via ge-0/0/3.0, Push 299792, Push 300176(top)
10.100.146.0/29    *[Direct/0] 15:50:10
                    > via irb.50
10.100.146.4/32    *[Local/0] 15:50:02
                      Local via irb.50
10.100.146.5/32    *[Local/0] 15:50:32
                      Local via irb.50
172.22.23.1/32     *[Direct/0] 15:50:32
                    > via lo0.50
172.22.23.2/32     *[BGP/170] 00:56:59, localpref 100, from 172.22.0.131
                      AS path: I, validation-state: unverified
                    > to 172.22.128.45 via ge-0/0/3.0, Push 299776, Push 300176(top)
172.22.23.4/32     *[BGP/170] 00:22:43, localpref 100, from 172.22.0.132
                      AS path: I, validation-state: unverified
                    > to 172.22.128.45 via ge-0/0/3.0, Push 299776, Push 300208(top)
```

Figure 41 MAD-EPC-A Protocols Status and gn-vpn routing table.

In the last part of Figure 41 it can be seen that this router has a static route configured to reach the GGSN service IP of Madrid (10.17.17.17), but also the service IP of the GGSN of Barcelona (10.17.17.19), known by means of BGP, with which we have achieved the objective of the exchange of routes, now it only remains to prove the connectivity of the edge element to the edge element.

Now, from the routing board of the GGSN in Madrid, we will try to verify the connectivity to the GGSN in Barcelona, first a traceroute is made to verify the path:

```
RP/0/0/CPU0:GGSN-PGW-A#traceroute 10.17.17.19 source 10.17.17.17
Sat Jan 13 11:44:56.450 UTC

Type escape sequence to abort.
Tracing the route to 10.17.17.19

 1  10.100.146.5 0 msec  0 msec  0 msec
 2   *  *  *
 3   *  *  *
 4   *  *  *
 5   *  *  *
 6  172.22.0.46 [MPLS: Label 299792 Exp 0] 0 msec  0 msec  0 msec
 7  10.100.18.2 0 msec  *  0 msec
```

It can be seen that connectivity is reached, but intermediate hops are not seen, this is an expected behavior given the nature of MPLS labeling, the ICMP tunneling is enabled in the routers and the command is executed again:

```
RP/0/0/CPU0:GGSN-PGW-A#traceroute 10.17.17.19 source 10.17.17.17
Sat Jan 13 11:59:44.239 UTC

Type escape sequence to abort.
Tracing the route to 10.17.17.19

 1  10.100.146.5 0 msec  0 msec  0 msec
 2  172.22.128.45 [MPLS: Labels 300176/299792 Exp 0] 0 msec  0 msec  0 msec
 3  172.22.128.38 [MPLS: Labels 302336/299792 Exp 0] 0 msec  0 msec  0 msec
 4   *  *  *
 5  172.22.0.37 [MPLS: Labels 299984/299792 Exp 0] 0 msec  0 msec  0 msec
 6  172.22.0.46 [MPLS: Label 299792 Exp 0] 0 msec  0 msec  0 msec
 7  10.100.18.2 0 msec  *  0 msec
```

Finally, connectivity with PING from edge to edge is verified:

```
RP/0/0/CPU0:GGSN-PGW-A#ping 10.17.17.19 source 10.17.17.17 repeat 25
Sat Jan 13 12:08:27.343 UTC
Type escape sequence to abort.
Sending 25, 100-byte ICMP Echos to 10.17.17.19, timeout is 2 seconds:
!!!!!!!!!!!!!!!!!!!!!!!!!
Success rate is 100 percent (25/25), round-trip min/avg/max = 1/4/9 ms
```

Chapter 7

7. CONCLUSIONS AND FUTURE WORK

7.1. Conclusions

As mentioned throughout this project, it has been possible to propose a design topology for the deployment of an ISP Core, taking as a scenario a national deployment, which can be adapted directly to any other scale, and also the connectivity design of a Mobile Core of fourth and third generation, applying concepts such as NFV, making direct use of the virtualized versions of routing devices of two of the largest manufacturers of IP technology in the market.

This master's thesis presented step by step the points concerning the necessary considerations that should be taken for the conformation of an ISP Core, at the same time it was studied in depth and a network separation approach was formulated for the EPC interfaces, with this, at least the critical points that must be taken when implementing one of these infrastructures were established. It is worth noting that each case of practical application will depend on the conditions in which the supplier's topology and needs are at that moment. Therefore this project only presents basic guidelines but essentials to take in account for a successful integration.

As mentioned, this project only describes basic guidelines, since in the real application an ISP will have several interconnections with clients, suppliers, and IXP exchange points, deriving to specific policies that over time can complicate the topology and the filter management, the connectivity and the services.

7.2. Future Work

The world of IP technology and Mobile telephony is always in constant evolution, in which any proposal may be outdated, knowing the limitations of this project can be deepened in certain aspects that were not taken into account:

- Implement a Full IPv6 Core; although currently by tradition and ease the IPv4 stack continues to be used, IPv6 is the future and medium present, at least in public addressing. Since IPv4 blocks are already in the exhaustion phase and new technologies such as IoT or 5G promise a large number of IP addresses need, which the IPv4 stack cannot supply. It is worth mentioning that our Core is capable of transporting IPv6, but not in a native way and it would need an additional device (Carrier Grade NAT) for a coexistence between both stacks.
- A completely oriented design to 5G EPC, until a full standardization by 3GPP and other working entities to be finished, and meanwhile the waiting for the commercial releases, try to design a full virtualized scheme.
- Implement Class of Service (CoS) and Quality of Service (QoS), analyze in which cases it is permissive and practical to use any of these concepts.

Chapter 8

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APPENDIX A: Network Nodes Configuration Files

8.1. MAD-A

```
} root@Madrid-A> show configuration
## Last commit: 2018-01-13 12:58:40 CET by root
version 14.1R1.10;
system {
    host-name Madrid-A;
    time-zone Europe/Madrid;
    root-authentication {
        encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"; ## SECRET-DATA
    }
    services {
        ftp;
        ssh {
            connection-limit 20;
            rate-limit 10;
        }
        telnet {
            connection-limit 20;
            rate-limit 10;
        }
    }
    syslog {
        archive size 1m files 10 world-readable;
        user * {
            any emergency;
        }
        file messages {
            any notice;
            authorization info;
        }
        file interactive-commands {
            interactive-commands any;
        }
        time-format year millisecond;
    }
    ntp {
        server 216.239.35.0;
    }
}
logical-systems {
    Datos {
        interfaces {
            ge-0/0/4 {
                unit 0 {
                    description "to EPC Madrid A";
                    family inet {
                        address 172.22.128.38/30;
                    }
                    family mpls;
                }
            }
            ge-0/0/5 {
                unit 0 {
                    description "to Madrid B ge-0/0/5";
                    family inet {
                        address 10.21.21.54/30;
                    }
                    family mpls;
```

```
            }
        }
        ge-0/0/6 {
            unit 0 {
                description "to Barcelona A ge-0/0/6";
                family inet {
                    address 10.21.21.33/30;
                }
                family mpls;
            }
        }
        ge-0/0/7 {
            unit 0 {
                description "to Caceres A ge-0/0/7";
                family inet {
                    address 10.21.21.41/30;
                }
                family mpls;
            }
        }
        ge-0/0/8 {
            unit 0 {
                family inet;
                family mpls;
            }
        }
        lo0 {
            unit 1 {
                description "Loopback Madrid 1";
                family inet {
                    address 10.21.21.1/32;
                }
            }
        }
    }
    protocols {
        rsvp {
            interface ge-0/0/5.0 {
                link-protection;
            }
            interface ge-0/0/6.0 {
                link-protection;
            }
            interface ge-0/0/7.0 {
                link-protection;
            }
        }
        mpls {
            statistics {
                file mpls-stats;
            }
            admin-groups {
                blue 4;
                red 8;
                green 16;
            }
            no-propagate-ttl;
            icmp-tunneling;
            label-switched-path MadA-MadB {
                from 10.21.21.1;
                to 10.21.21.2;
                admin-group include-any blue;
                node-link-protection;
            }
```

```
            label-switched-path MadA-BarA {
                from 10.21.21.1;
                to 10.21.21.3;
                ldp-tunneling;
                admin-group include-any blue;
                node-link-protection;
            }
            label-switched-path MadA-BarB {
                from 10.21.21.1;
                to 10.21.21.4;
                admin-group include-any blue;
                node-link-protection;
            }
            label-switched-path MadA-CacA {
                from 10.21.21.1;
                to 10.21.21.5;
                admin-group include-any blue;
                node-link-protection;
            }
            label-switched-path MadA-CacB {
                from 10.21.21.1;
                to 10.21.21.6;
                admin-group include-any blue;
                node-link-protection;
            }
            label-switched-path MadA-ValA {
                from 10.21.21.1;
                to 10.21.21.7;
                admin-group include-any blue;
                node-link-protection;
            }
            label-switched-path MadA-ValB {
                from 10.21.21.1;
                to 10.21.21.8;
                admin-group include-any blue;
                node-link-protection;
            }
            label-switched-path MadA-BilA {
                from 10.21.21.1;
                to 10.21.21.9;
                admin-group include-any blue;
                node-link-protection;
            }
            label-switched-path MadA-BilB {
                from 10.21.21.1;
                to 10.21.21.10;
                admin-group include-any blue;
                node-link-protection;
            }
            label-switched-path MadA-GijA {
                from 10.21.21.1;
                to 10.21.21.11;
                admin-group include-any blue;
                node-link-protection;
            }
            label-switched-path MadA-GijB {
                from 10.21.21.1;
                to 10.21.21.12;
                admin-group include-any blue;
                node-link-protection;
            }
            label-switched-path MadA-SevA {
                from 10.21.21.1;
                to 10.21.21.13;
```

```
                admin-group include-any blue;
                node-link-protection;
            }
            label-switched-path MadA-SevB {
                from 10.21.21.1;
                to 10.21.21.14;
                admin-group include-any blue;
                node-link-protection;
            }
            interface ge-0/0/5.0 {
                admin-group blue;
            }
            interface ge-0/0/6.0 {
                admin-group blue;
            }
            interface ge-0/0/7.0 {
                admin-group blue;
            }
            interface all;
        }
        bgp {
            group ibgp {
                type internal;
                local-address 10.21.21.1;
                family inet {
                    unicast;
                }
                family inet-vpn {
                    any;
                }
                family l2vpn {
                    signaling;
                }
                neighbor 10.21.21.2;
                neighbor 10.21.21.3;
                neighbor 10.21.21.4;
                neighbor 10.21.21.5;
                neighbor 10.21.21.6;
                neighbor 10.21.21.7;
                neighbor 10.21.21.8;
                neighbor 10.21.21.9;
                neighbor 10.21.21.10;
                neighbor 10.21.21.11;
                neighbor 10.21.21.12;
                neighbor 10.21.21.13;
                neighbor 10.21.21.14;
            }
        }
        ospf {
            traffic-engineering;
            reference-bandwidth 1000g;
            area 0.0.0.0 {
                interface ge-0/0/5.0 {
                    interface-type p2p;
                    authentication {
                        md5 20 key "$9$KDaM7Vji.Qz6fTRhcSeKgoaJHq"; ## SECRET-DATA
                    }
                    inactive: bfd-liveness-detection {
                        minimum-interval 50;
                        multiplier 3;
                    }
                }
                interface ge-0/0/6.0 {
                    interface-type p2p;
```

```
                    authentication {
                        md5 20 key "$9$40ajqCA0Ehr1R-Vbwg4TzF3tu"; ## SECRET-DATA
                    }
                    inactive: bfd-liveness-detection {
                        minimum-interval 50;
                        multiplier 3;
                    }
                }
                interface ge-0/0/8.0 {
                    authentication {
                        md5 20 key "$9$Nud2a5T3AtO/CKMW87NjHkqQF"; ## SECRET-DATA
                    }
                }
                interface lo0.0;
                interface ge-0/0/7.0 {
                    interface-type p2p;
                    authentication {
                        md5 20 key "$9$gYoDk9CuREyBINdVb2g5QzFAp"; ## SECRET-DATA
                    }
                    inactive: bfd-liveness-detection {
                        minimum-interval 50;
                        multiplier 3;
                    }
                }
                interface lo0.1 {
                    passive;
                }
            }
        }
    }
    policy-options {
        policy-statement Redes-EPC-CarrierExport {
            term 1 {
                from {
                    route-filter 172.22.0.0/19 orlonger;
                    route-filter 172.22.128.0/19 orlonger;
                    route-filter 10.0.0.0/8 orlonger;
                }
                then accept;
            }
            term 2 {
                then reject;
            }
        }
        policy-statement Redes-EPC-CarrierImport {
            term 1 {
                from {
                    route-filter 172.22.128.0/19 orlonger;
                    route-filter 172.22.0.0/19 orlonger;
                    route-filter 10.0.0.0/8 orlonger;
                }
                then accept;
            }
            term 2 {
                then reject;
            }
        }
        policy-statement vpn-epc-export {
            term 1 {
                from protocol [ bgp direct ];
                then {
                    community add vpn-epc-comm;
                    accept;
                }
```

```
            }
            term 2 {
                then reject;
            }
        }
        policy-statement vpn-epc-import {
            term 1 {
                from {
                    protocol [ bgp direct ];
                    community vpn-epc-comm;
                }
                then accept;
            }
            term 2 {
                then reject;
            }
        }
        community vpn-epc-comm members target:100:100;
    }
    routing-instances {
        vpn-epc {
            instance-type vrf;
            interface ge-0/0/4.0;
            route-distinguisher 65500:100;
            vrf-import vpn-epc-import;
            vrf-export vpn-epc-export;
            protocols {
                bgp {
                    group EPC {
                        import Redes-EPC-CarrierImport;
                        export Redes-EPC-CarrierExport;
                        peer-as 65501;
                        neighbor 172.22.128.37 {
                            description EPC-Mad-A;
                            family inet {
                                labeled-unicast;
                            }
                            as-override;
                        }
                    }
                }
            }
        }
    }
    routing-options {
        router-id 10.21.21.1;
        autonomous-system 65500;
    }
}
Internet {
    interfaces {
        ge-0/0/0 {
            unit 0 {
                description "to Madrid B ge-0/0/0";
                family inet {
                    address 84.120.0.54/30;
                }
                family mpls;
            }
        }
        ge-0/0/1 {
            unit 0 {
                description "to Barcelona A ge-0/0/1";
                family inet {
```

```
                    address 84.120.0.33/30;
                }
                family mpls;
            }
        }
        ge-0/0/2 {
            unit 0 {
                description "to Caceres A ge-0/0/2";
                family inet {
                    address 84.120.0.41/30;
                }
                family mpls;
            }
        }
        lo0 {
            unit 0 {
                description "Loopback Madrid 1";
                family inet {
                    address 84.120.0.1/32;
                }
            }
        }
    }
    protocols {
        rsvp {
            interface ge-0/0/0.0 {
                link-protection;
            }
            interface ge-0/0/1.0 {
                link-protection;
            }
            interface ge-0/0/2.0 {
                link-protection;
            }
        }
        mpls {
            statistics {
                file mpls-stats;
            }
            admin-groups {
                blue 4;
                red 8;
                green 16;
            }
            no-propagate-ttl;
            label-switched-path MadA-MadB {
                from 84.120.0.1;
                to 84.120.0.2;
                admin-group include-any blue;
                node-link-protection;
            }
            label-switched-path MadA-BarA {
                from 84.120.0.1;
                to 84.120.0.3;
                admin-group include-any blue;
                node-link-protection;
            }
            label-switched-path MadA-BarB {
                from 84.120.0.1;
                to 84.120.0.4;
                admin-group include-any blue;
                node-link-protection;
            }
            label-switched-path MadA-CacA {
```

```
        from 84.120.0.1;
        to 84.120.0.5;
        admin-group include-any blue;
        node-link-protection;
    }
    label-switched-path MadA-CacB {
        from 84.120.0.1;
        to 84.120.0.6;
        admin-group include-any blue;
        node-link-protection;
    }
    label-switched-path MadA-ValA {
        from 84.120.0.1;
        to 84.120.0.7;
        admin-group include-any blue;
        node-link-protection;
    }
    label-switched-path MadA-ValB {
        from 84.120.0.1;
        to 84.120.0.8;
        admin-group include-any blue;
        node-link-protection;
    }
    label-switched-path MadA-BilA {
        from 84.120.0.1;
        to 84.120.0.9;
        admin-group include-any blue;
        node-link-protection;
    }
    label-switched-path MadA-BilB {
        from 84.120.0.1;
        to 84.120.0.10;
        admin-group include-any blue;
        node-link-protection;
    }
    label-switched-path MadA-GijA {
        from 84.120.0.1;
        to 84.120.0.11;
        admin-group include-any blue;
        node-link-protection;
    }
    label-switched-path MadA-GijB {
        from 84.120.0.1;
        to 84.120.0.12;
        admin-group include-any blue;
        node-link-protection;
    }
    label-switched-path MadA-SevA {
        from 84.120.0.1;
        to 84.120.0.13;
        admin-group include-any blue;
        node-link-protection;
    }
    label-switched-path MadA-SevB {
        from 84.120.0.1;
        to 84.120.0.14;
        admin-group include-any blue;
        node-link-protection;
    }
    interface ge-0/0/0.0 {
        admin-group blue;
    }
    interface ge-0/0/1.0 {
        admin-group blue;
```

```
            }
            interface ge-0/0/2.0 {
                admin-group blue;
            }
        }
        bgp {
            group ibg-cluster {
                type internal;
                local-address 84.120.0.1;
                family inet {
                    unicast;
                }
                family l2vpn {
                    signaling;
                }
                cluster 4.4.4.4;
                neighbor 84.120.0.5;
                neighbor 84.120.0.6;
                neighbor 84.120.0.7;
                neighbor 84.120.0.8;
                neighbor 84.120.0.9;
                neighbor 84.120.0.10;
                neighbor 84.120.0.11;
                neighbor 84.120.0.12;
                neighbor 84.120.0.13;
                neighbor 84.120.0.14;
            }
            group ibgp {
                type internal;
                local-address 84.120.0.1;
                family inet {
                    unicast;
                }
                family l2vpn {
                    signaling;
                }
                neighbor 84.120.0.2;
            }
        }
        ospf {
            traffic-engineering;
            reference-bandwidth 1000g;
            area 0.0.0.0 {
                interface ge-0/0/0.0 {
                    interface-type p2p;
                    authentication {
                        md5 20 key "$9$HqT3REyMWxevoJZGiHApu0hS"; ## SECRET-DATA
                    }
                    inactive: bfd-liveness-detection {
                        minimum-interval 50;
                        multiplier 3;
                    }
                }
                interface ge-0/0/1.0 {
                    interface-type p2p;
                    authentication {
                        md5 20 key "$9$YcgGi6/t1Ic0BxN-dsYP5TQ9A"; ## SECRET-DATA
                    }
                    inactive: bfd-liveness-detection {
                        minimum-interval 50;
                        multiplier 3;
                    }
                }
                interface ge-0/0/2.0 {
```

```
                        interface-type p2p;
                        authentication {
                            md5 20 key "$9$QolsFCuKvLdVY7-Hq.mTQRhcSM8"; ## SECRET-DATA
                        }
                        inactive: bfd-liveness-detection {
                            minimum-interval 50;
                            multiplier 3;
                        }
                    }
                    interface lo0.0 {
                        passive;
                    }
                }
            }
        }
        routing-options {
            router-id 84.120.0.1;
            autonomous-system 8296;
        }
    }
}
interfaces {
    ge-0/0/0 {
        description "to Madrid B ge-0/0/0";
    }
    ge-0/0/1 {
        description "to Barcelona A ge/0/0/1";
    }
    ge-0/0/2 {
        description "to Caceres A ge/0/0/2";
    }
    ge-0/0/4 {
        description "to EPC Madrid A ge0/0/0/4";
        mtu 2000;
    }
    ge-0/0/5 {
        description "to Madrid B ge-0/0/5";
    }
    ge-0/0/6 {
        description "to Barcelona A ge/0/0/6";
    }
    ge-0/0/7 {
        description "to Caceres A ge/0/0/7";
    }
}
```

8.2. MAD-B

```
root@Madrid-B> show configuration | display set
set version 14.1R1.10
set system host-name Madrid-B
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
```

```
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/4 unit 0 description "to Madrid PE B"
set logical-systems Datos interfaces ge-0/0/4 unit 0 family inet address 172.22.128.50/30
set logical-systems Datos interfaces ge-0/0/4 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/5 unit 0 description "to Madrid A ge-0/0/5"
set logical-systems Datos interfaces ge-0/0/5 unit 0 family inet address 10.21.21.53/30
set logical-systems Datos interfaces ge-0/0/5 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/6 unit 0 description "to Barcelona B ge-0/0/6"
set logical-systems Datos interfaces ge-0/0/6 unit 0 family inet address 10.21.21.38/30
set logical-systems Datos interfaces ge-0/0/6 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/7 unit 0 description "to Caceres B ge-0/0/7"
set logical-systems Datos interfaces ge-0/0/7 unit 0 family inet address 10.21.21.50/30
set logical-systems Datos interfaces ge-0/0/7 unit 0 family mpls
set logical-systems Datos interfaces lo0 unit 1 description "Loopback Madrid 2"
set logical-systems Datos interfaces lo0 unit 1 family inet address 10.21.21.2/32
set logical-systems Datos protocols rsvp interface ge-0/0/5.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/6.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/7.0 link-protection
set logical-systems Datos protocols mpls statistics file mpls-stats
set logical-systems Datos protocols mpls admin-groups blue 4
set logical-systems Datos protocols mpls admin-groups red 8
set logical-systems Datos protocols mpls admin-groups green 16
set logical-systems Datos protocols mpls label-switched-path MadB-MadA from 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path MadB-MadA to 10.21.21.1
set logical-systems Datos protocols mpls label-switched-path MadB-MadA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path MadB-MadA node-link-protection
set logical-systems Datos protocols mpls label-switched-path MadB-BarA from 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path MadB-BarA to 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path MadB-BarA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path MadB-BarA node-link-protection
set logical-systems Datos protocols mpls label-switched-path MadB-BarB from 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path MadB-BarB to 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path MadB-BarB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path MadB-BarB node-link-protection
set logical-systems Datos protocols mpls label-switched-path MadB-CacA from 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path MadB-CacA to 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path MadB-CacA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path MadB-CacA node-link-protection
set logical-systems Datos protocols mpls label-switched-path MadB-CacB from 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path MadB-CacB to 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path MadB-CacB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path MadB-CacB node-link-protection
set logical-systems Datos protocols mpls label-switched-path MadB-ValA from 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path MadB-ValA to 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path MadB-ValA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path MadB-ValA node-link-protection
set logical-systems Datos protocols mpls label-switched-path MadB-ValB from 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path MadB-ValB to 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path MadB-ValB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path MadB-ValB node-link-protection
set logical-systems Datos protocols mpls label-switched-path MadB-BilA from 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path MadB-BilA to 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path MadB-BilA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path MadB-BilA node-link-protection
set logical-systems Datos protocols mpls label-switched-path MadB-BilB from 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path MadB-BilB to 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path MadB-BilB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path MadB-BilB node-link-protection
set logical-systems Datos protocols mpls label-switched-path MadB-GijA from 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path MadB-GijA to 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path MadB-GijA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path MadB-GijA node-link-protection
set logical-systems Datos protocols mpls label-switched-path MadB-GijB from 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path MadB-GijB to 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path MadB-GijB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path MadB-GijB node-link-protection
set logical-systems Datos protocols mpls label-switched-path MadB-SevA from 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path MadB-SevA to 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path MadB-SevA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path MadB-SevA node-link-protection
set logical-systems Datos protocols mpls label-switched-path MadB-SevB from 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path MadB-SevB to 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path MadB-SevB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path MadB-SevB node-link-protection
set logical-systems Datos protocols mpls interface ge-0/0/5.0 admin-group blue
```

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set logical-systems Datos protocols mpls interface ge-0/0/6.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/7.0 admin-group blue
set logical-systems Datos protocols mpls interface all
set logical-systems Datos protocols bgp group ibgp type internal
set logical-systems Datos protocols bgp group ibgp local-address 10.21.21.2
set logical-systems Datos protocols bgp group ibgp family inet unicast
set logical-systems Datos protocols bgp group ibgp family inet-vpn any
set logical-systems Datos protocols bgp group ibgp family l2vpn signaling
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.1
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.3
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.4
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.5
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.6
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.7
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.8
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.9
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.10
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.11
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.12
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.13
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.14
set logical-systems Datos protocols ospf traffic-engineering
set logical-systems Datos protocols ospf reference-bandwidth 1000g
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 authentication md5 20 key
"$9$BoxIyKsYoDjqZU/CAtOBX7N-24"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 authentication md5 20 key
"$9$cGcyMXaJD.mTHquOB1hcVwsYZU"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 authentication md5 20 key
"$9$8bnXVYq.5n6Az3SrleW8JGUDmf"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.0
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1 passive
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 from route-filter 172.22.0.0/
orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 from route-filter 172.22.128.
orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 from route-filter 10.0.0.0/8
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 then accept
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 2 then reject
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 from route-filter 172.22.128.
orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 from route-filter 172.22.0.0/
orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 from route-filter 10.0.0.0/8
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 then accept
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 2 then reject
set logical-systems Datos policy-options policy-statement vpn-epc-export term 1 from protocol bgp
set logical-systems Datos policy-options policy-statement vpn-epc-export term 1 from protocol direct
set logical-systems Datos policy-options policy-statement vpn-epc-export term 1 then community add vpn-epc-comm
set logical-systems Datos policy-options policy-statement vpn-epc-export term 1 then accept
set logical-systems Datos policy-options policy-statement vpn-epc-export term 2 then reject
set logical-systems Datos policy-options policy-statement vpn-epc-import term 1 from protocol bgp
set logical-systems Datos policy-options policy-statement vpn-epc-import term 1 from protocol direct
set logical-systems Datos policy-options policy-statement vpn-epc-import term 1 from community vpn-epc-comm
set logical-systems Datos policy-options policy-statement vpn-epc-import term 1 then accept
set logical-systems Datos policy-options policy-statement vpn-epc-import term 2 then reject
set logical-systems Datos policy-options community vpn-epc-comm members target:100:100
set logical-systems Datos routing-instances vpn-epc instance-type vrf
set logical-systems Datos routing-instances vpn-epc interface ge-0/0/4.0
set logical-systems Datos routing-instances vpn-epc route-distinguisher 10.21.21.2:100
set logical-systems Datos routing-instances vpn-epc vrf-import vpn-epc-import
set logical-systems Datos routing-instances vpn-epc vrf-export vpn-epc-export
set logical-systems Datos routing-instances vpn-epc protocols bgp group EPC import Redes-EPC-CarrierImport
set logical-systems Datos routing-instances vpn-epc protocols bgp group EPC export Redes-EPC-CarrierExport
set logical-systems Datos routing-instances vpn-epc protocols bgp group EPC peer-as 65501
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set logical-systems Datos routing-instances vpn-epc protocols bgp group EPC neighbor 172.22.128.49 description MAD-PE-
set logical-systems Datos routing-instances vpn-epc protocols bgp group EPC neighbor 172.22.128.49 family inet labeled
set logical-systems Datos routing-instances vpn-epc protocols bgp group EPC neighbor 172.22.128.49 as-override
set logical-systems Datos routing-options router-id 10.21.21.2
set logical-systems Datos routing-options autonomous-system 65500
set logical-systems Internet interfaces ge-0/0/0 unit 0 description "to Madrid A ge-0/0/0"
set logical-systems Internet interfaces ge-0/0/0 unit 0 family inet address 84.120.0.53/30
set logical-systems Internet interfaces ge-0/0/0 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/1 unit 0 description "to Barcelona B ge-0/0/1"
set logical-systems Internet interfaces ge-0/0/1 unit 0 family inet address 84.120.0.38/30
set logical-systems Internet interfaces ge-0/0/1 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/2 unit 0 description "to Caceres B ge-0/0/2"
set logical-systems Internet interfaces ge-0/0/2 unit 0 family inet address 84.120.0.50/30
set logical-systems Internet interfaces ge-0/0/2 unit 0 family mpls
set logical-systems Internet interfaces lo0 unit 0 description "Loopback Madrid 2"
set logical-systems Internet interfaces lo0 unit 0 family inet address 84.120.0.2/32
set logical-systems Internet protocols rsvp interface ge-0/0/0.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/1.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/2.0 link-protection
set logical-systems Internet protocols mpls statistics file mpls-stats
set logical-systems Internet protocols mpls admin-groups blue 4
set logical-systems Internet protocols mpls admin-groups red 8
set logical-systems Internet protocols mpls admin-groups green 16
set logical-systems Internet protocols mpls label-switched-path MadB-MadB from 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path MadB-MadB to 84.120.0.1
set logical-systems Internet protocols mpls label-switched-path MadB-MadB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path MadB-MadB node-link-protection
set logical-systems Internet protocols mpls label-switched-path MadB-BarA from 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path MadB-BarA to 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path MadB-BarA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path MadB-BarA node-link-protection
set logical-systems Internet protocols mpls label-switched-path MadB-BarB from 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path MadB-BarB to 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path MadB-BarB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path MadB-BarB node-link-protection
set logical-systems Internet protocols mpls label-switched-path MadB-CacA from 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path MadB-CacA to 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path MadB-CacA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path MadB-CacA node-link-protection
set logical-systems Internet protocols mpls label-switched-path MadB-CacB from 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path MadB-CacB to 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path MadB-CacB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path MadB-CacB node-link-protection
set logical-systems Internet protocols mpls label-switched-path MadB-ValA from 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path MadB-ValA to 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path MadB-ValA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path MadB-ValA node-link-protection
set logical-systems Internet protocols mpls label-switched-path MadB-ValB from 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path MadB-ValB to 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path MadB-ValB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path MadB-ValB node-link-protection
set logical-systems Internet protocols mpls label-switched-path MadB-BilA from 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path MadB-BilA to 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path MadB-BilA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path MadB-BilA node-link-protection
set logical-systems Internet protocols mpls label-switched-path MadB-BilB from 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path MadB-BilB to 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path MadB-BilB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path MadB-BilB node-link-protection
set logical-systems Internet protocols mpls label-switched-path MadB-GijA from 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path MadB-GijA to 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path MadB-GijA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path MadB-GijA node-link-protection
set logical-systems Internet protocols mpls label-switched-path MadB-GijB from 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path MadB-GijB to 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path MadB-GijB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path MadB-GijB node-link-protection
set logical-systems Internet protocols mpls label-switched-path MadB-SevA from 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path MadB-SevA to 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path MadB-SevA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path MadB-SevA node-link-protection
set logical-systems Internet protocols mpls label-switched-path MadB-SevB from 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path MadB-SevB to 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path MadB-SevB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path MadB-SevB node-link-protection
set logical-systems Internet protocols mpls label-switched-path MadB-MadA from 84.120.0.2
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set logical-systems Internet protocols mpls label-switched-path MadB-MadA to 84.120.0.1
set logical-systems Internet protocols mpls label-switched-path MadB-MadA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path MadB-MadA node-link-protection
set logical-systems Internet protocols mpls interface ge-0/0/0.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/1.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/2.0 admin-group blue
set logical-systems Internet protocols bgp group ibg-cluster type internal
set logical-systems Internet protocols bgp group ibg-cluster local-address 84.120.0.2
set logical-systems Internet protocols bgp group ibg-cluster family inet unicast
set logical-systems Internet protocols bgp group ibg-cluster family l2vpn signaling
set logical-systems Internet protocols bgp group ibg-cluster cluster 4.4.4.4
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.5
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.6
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.7
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.8
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.9
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.10
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.11
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.12
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.13
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.14
set logical-systems Internet protocols bgp group ibgp type internal
set logical-systems Internet protocols bgp group ibgp local-address 84.120.0.2
set logical-systems Internet protocols bgp group ibgp family inet unicast
set logical-systems Internet protocols bgp group ibgp family l2vpn signaling
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.1
set logical-systems Internet protocols ospf traffic-engineering
set logical-systems Internet protocols ospf reference-bandwidth 1000g
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 authentication md5 20 key "$9$7--
Yof5FCA069evMWx7DiHkTz"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection minimum-interval
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 authentication md5 20 key
"$9$rtTeLNGUHf5F.PBIREyrs2g4Di"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection minimum-interval
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 authentication md5 20 key
"$9$aAZHmtpBcSeRhVwsYoaz3n6uO"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection minimum-interval
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface lo0.0 passive
set logical-systems Internet protocols ospf area 0.0.0.0 interface lo0.1
set logical-systems Internet routing-options router-id 84.120.0.2
set logical-systems Internet routing-options autonomous-system 8296
set interfaces ge-0/0/0 description "to Madrid A ge-0/0/0"
set interfaces ge-0/0/1 description "to Barcelona B ge/0/0/1"
set interfaces ge-0/0/2 description "to Caceres B ge/0/0/2"
set interfaces ge-0/0/4 description "to EPC Madrid A ge0/0/0/4"
set interfaces ge-0/0/4 mtu 2000
set interfaces ge-0/0/5 description "to Madrid A ge-0/0/5"
set interfaces ge-0/0/6 description "to Barcelona B ge/0/0/6"
set interfaces ge-0/0/7 description "to Caceres B ge/0/0/7"}
```

8.3. BCN-A

```
set version 14.1R1.10
set system host-name Barcelona-A
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
```

```
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/4 unit 0 description "to EPC BCN A"
set logical-systems Datos interfaces ge-0/0/4 unit 0 family inet address 172.22.0.38/30
set logical-systems Datos interfaces ge-0/0/4 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/5 unit 0 description "to Barcelona-B A ge-0/0/5"
set logical-systems Datos interfaces ge-0/0/5 unit 0 family inet address 10.21.21.90/30
set logical-systems Datos interfaces ge-0/0/5 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/6 unit 0 description "to Madrid A ge-0/0/6"
set logical-systems Datos interfaces ge-0/0/6 unit 0 family inet address 10.21.21.34/30
set logical-systems Datos interfaces ge-0/0/6 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/7 unit 0 description "to Valencia A ge-0/0/7"
set logical-systems Datos interfaces ge-0/0/7 unit 0 family inet address 10.21.21.65/30
set logical-systems Datos interfaces ge-0/0/7 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/8 unit 0 description "to Bilbao A ge-0/0/8"
set logical-systems Datos interfaces ge-0/0/8 unit 0 family inet address 10.21.21.122/30
set logical-systems Datos interfaces ge-0/0/8 unit 0 family mpls
set logical-systems Datos interfaces lo0 unit 1 description "Loopback Barcelona A"
set logical-systems Datos interfaces lo0 unit 1 family inet address 10.21.21.3/32
set logical-systems Datos protocols rsvp interface ge-0/0/5.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/6.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/7.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/8.0 link-protection
set logical-systems Datos protocols mpls statistics file mpls-stats
set logical-systems Datos protocols mpls admin-groups blue 4
set logical-systems Datos protocols mpls admin-groups red 8
set logical-systems Datos protocols mpls admin-groups green 16
set logical-systems Datos protocols mpls no-propagate-ttl
set logical-systems Datos protocols mpls label-switched-path BarA-MadB from 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path BarA-MadB to 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path BarA-MadB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarA-MadB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarA-MadA from 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path BarA-MadA to 10.21.21.1
set logical-systems Datos protocols mpls label-switched-path BarA-MadA ldp-tunneling
set logical-systems Datos protocols mpls label-switched-path BarA-MadA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarA-MadA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarA-BarB from 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path BarA-BarB to 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path BarA-BarB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarA-BarB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarA-CacA from 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path BarA-CacA to 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path BarA-CacA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarA-CacA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarA-CacB from 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path BarA-CacB to 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path BarA-CacB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarA-CacB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarA-ValA from 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path BarA-ValA to 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path BarA-ValA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarA-ValA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarA-ValB from 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path BarA-ValB to 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path BarA-ValB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarA-ValB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarA-BilA from 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path BarA-BilA to 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path BarA-BilA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarA-BilA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarA-BilB from 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path BarA-BilB to 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path BarA-BilB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarA-BilB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarA-GijA from 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path BarA-GijA to 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path BarA-GijA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarA-GijA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarA-GijB from 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path BarA-GijB to 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path BarA-GijB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarA-GijB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarA-SevA from 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path BarA-SevA to 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path BarA-SevA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarA-SevA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarA-SevB from 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path BarA-SevB to 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path BarA-SevB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarA-SevB node-link-protection
set logical-systems Datos protocols mpls interface ge-0/0/5.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/6.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/7.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/8.0 admin-group blue
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set logical-systems Datos protocols mpls interface all
set logical-systems Datos protocols bgp group ibgp type internal
set logical-systems Datos protocols bgp group ibgp local-address 10.21.21.3
set logical-systems Datos protocols bgp group ibgp family inet unicast
set logical-systems Datos protocols bgp group ibgp family inet-vpn any
set logical-systems Datos protocols bgp group ibgp family l2vpn signaling
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.1
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.2
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.4
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.5
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.6
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.7
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.8
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.9
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.10
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.11
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.12
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.13
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.14
set logical-systems Datos protocols ospf traffic-engineering
set logical-systems Datos protocols ospf reference-bandwidth 1000g
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 authentication md5 20 key "$9$WXpLdskqf3nCQFcyrlMWaZGU.P"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 authentication md5 20 key "$9$dyb4ZQz6pu1CtM8LX-dHq.mFn"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 authentication md5 20 key "$9$W8NLdskqf3nCQFcyrlMWaZGU.P"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 authentication md5 20 key "$9$Lwjxb2.mT6/tFnyleK8LZUDjP5"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1 passive
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 from route-filter 172.22.0.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 from route-filter 172.22.128.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 from route-filter 10.0.0.0/8 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 then accept
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 2 then reject
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 from route-filter 172.22.0.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 from route-filter 172.22.128.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 from route-filter 10.0.0.0/8 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 then accept
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 2 then reject
set logical-systems Datos policy-options policy-statement vpn-epc-export term 1 from protocol bgp
set logical-systems Datos policy-options policy-statement vpn-epc-export term 1 from protocol direct
set logical-systems Datos policy-options policy-statement vpn-epc-export term 1 then community add vpn-epc-comm
set logical-systems Datos policy-options policy-statement vpn-epc-export term 1 then accept
set logical-systems Datos policy-options policy-statement vpn-epc-export term 2 then reject
set logical-systems Datos policy-options policy-statement vpn-epc-import term 1 from protocol bgp
set logical-systems Datos policy-options policy-statement vpn-epc-import term 1 from protocol direct
set logical-systems Datos policy-options policy-statement vpn-epc-import term 1 from community vpn-epc-comm
set logical-systems Datos policy-options policy-statement vpn-epc-import term 1 then accept
set logical-systems Datos policy-options policy-statement vpn-epc-import term 2 then reject
set logical-systems Datos policy-options community vpn-epc-comm members target:100:100
set logical-systems Datos routing-instances vpn-epc instance-type vrf
set logical-systems Datos routing-instances vpn-epc interface ge-0/0/4.0
set logical-systems Datos routing-instances vpn-epc route-distinguisher 65500:100
set logical-systems Datos routing-instances vpn-epc vrf-import vpn-epc-import
set logical-systems Datos routing-instances vpn-epc vrf-export vpn-epc-export
set logical-systems Datos routing-instances vpn-epc protocols bgp group EPC import Redes-EPC-CarrierImport
set logical-systems Datos routing-instances vpn-epc protocols bgp group EPC export Redes-EPC-CarrierExport
set logical-systems Datos routing-instances vpn-epc protocols bgp group EPC peer-as 65501
set logical-systems Datos routing-instances vpn-epc protocols bgp group EPC neighbor 172.22.0.37 description EPC-Mad-A
set logical-systems Datos routing-instances vpn-epc protocols bgp group EPC neighbor 172.22.0.37 family inet labeled-unicast
set logical-systems Datos routing-instances vpn-epc protocols bgp group EPC neighbor 172.22.0.37 as-override
set logical-systems Datos routing-options router-id 10.21.21.3
set logical-systems Datos routing-options autonomous-system 65500
set logical-systems Internet interfaces ge-0/0/0 unit 0 description "to Barcelona-B A ge-0/0/0"
set logical-systems Internet interfaces ge-0/0/0 unit 0 family inet address 84.120.0.90/30
set logical-systems Internet interfaces ge-0/0/0 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/1 unit 0 description "to Madrid A ge-0/0/1"
set logical-systems Internet interfaces ge-0/0/1 unit 0 family inet address 84.120.0.34/30
set logical-systems Internet interfaces ge-0/0/1 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/2 unit 0 description "to Valencia A ge-0/0/2"
set logical-systems Internet interfaces ge-0/0/2 unit 0 family inet address 84.120.0.65/30
set logical-systems Internet interfaces ge-0/0/2 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/3 unit 0 description "to Bilbao A ge-0/0/3"
set logical-systems Internet interfaces ge-0/0/3 unit 0 family inet address 84.120.0.122/30
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set logical-systems Internet interfaces ge-0/0/3 unit 0 family mpls
set logical-systems Internet interfaces lo0 unit 0 description "Loopback Barcelona A"
set logical-systems Internet interfaces lo0 unit 0 family inet address 84.120.0.3/32
set logical-systems Internet protocols rsvp interface ge-0/0/0.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/1.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/2.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/3.0 link-protection
set logical-systems Internet protocols mpls statistics file mpls-stats
set logical-systems Internet protocols mpls admin-groups blue 4
set logical-systems Internet protocols mpls admin-groups red 8
set logical-systems Internet protocols mpls admin-groups green 16
set logical-systems Internet protocols mpls label-switched-path BarA-MadB from 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path BarA-MadB to 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path BarA-MadB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarA-MadB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarA-MadA from 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path BarA-MadA to 84.120.0.1
set logical-systems Internet protocols mpls label-switched-path BarA-MadA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarA-MadA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarA-BarB from 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path BarA-BarB to 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path BarA-BarB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarA-BarB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarA-CacA from 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path BarA-CacA to 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path BarA-CacA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarA-CacA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarA-CacB from 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path BarA-CacB to 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path BarA-CacB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarA-CacB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarA-ValA from 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path BarA-ValA to 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path BarA-ValA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarA-ValA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarA-ValB from 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path BarA-ValB to 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path BarA-ValB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarA-ValB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarA-BilA from 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path BarA-BilA to 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path BarA-BilA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarA-BilA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarA-BilB from 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path BarA-BilB to 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path BarA-BilB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarA-BilB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarA-GijA from 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path BarA-GijA to 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path BarA-GijA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarA-GijA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarA-GijB from 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path BarA-GijB to 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path BarA-GijB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarA-GijB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarA-SevA from 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path BarA-SevA to 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path BarA-SevA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarA-SevA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarA-SevB from 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path BarA-SevB to 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path BarA-SevB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarA-SevB node-link-protection
set logical-systems Internet protocols mpls interface ge-0/0/0.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/1.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/2.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/3.0 admin-group blue
set logical-systems Internet protocols bgp group ibg-cluster type internal
set logical-systems Internet protocols bgp group ibg-cluster local-address 84.120.0.3
set logical-systems Internet protocols bgp group ibg-cluster family inet unicast
set logical-systems Internet protocols bgp group ibg-cluster family l2vpn signaling
set logical-systems Internet protocols bgp group ibg-cluster cluster 5.5.5.5
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.5
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.6
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.7
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.8
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.9
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.10
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.11
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.12
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.13
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.14
set logical-systems Internet protocols bgp group ibgp type internal
set logical-systems Internet protocols bgp group ibgp local-address 84.120.0.3
set logical-systems Internet protocols bgp group ibgp family inet unicast
set logical-systems Internet protocols bgp group ibgp family l2vpn signaling
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.4
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set logical-systems Internet protocols ospf traffic-engineering
set logical-systems Internet protocols ospf reference-bandwidth 1000g
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 authentication md5 20 key "$9$d7b4ZQz6pu1CtM8LX-
dHq.mFn"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 authentication md5 20 key
"$9$qmz6hcl8LNvWJGUDkqp0OBSr"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 authentication md5 20 key
"$9$eR2vxdDjqTQnP5IEhcle24oaik"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 authentication md5 20 key
"$9$aSZHmtpBcSeRhVwsYoaz3n6uO"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface lo0.0 passive
set logical-systems Internet routing-options router-id 84.120.0.3
set logical-systems Internet routing-options autonomous-system 8296
set interfaces ge-0/0/0 description "to Barcelona-B ge-0/0/0"
set interfaces ge-0/0/1 description "to Madrid A ge/0/0/1"
set interfaces ge-0/0/2 description "to Valencia A ge/0/0/2"
set interfaces ge-0/0/3 description "to Bilbao A ge/0/0/3"
set interfaces ge-0/0/4 description "to EPC BCN A ge0/0/0/4"
set interfaces ge-0/0/4 mtu 2000
set interfaces ge-0/0/5 description "to Barcelona-B ge-0/0/5"
set interfaces ge-0/0/6 description "to Madrid A ge/0/0/6"
set interfaces ge-0/0/7 description "to Valencia A ge/0/0/7"
set interfaces ge-0/0/8 description "to Bilbao A ge/0/0/8"}
```

8.4. BCN-B

```
set version 14.1R1.10
set system host-name Barcelona-B
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/4 unit 0 description "to EPC BCN B"
set logical-systems Datos interfaces ge-0/0/4 unit 0 family inet address 172.22.0.50/30
set logical-systems Datos interfaces ge-0/0/4 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/5 unit 0 description "to Barcelona A ge-0/0/5"
set logical-systems Datos interfaces ge-0/0/5 unit 0 family inet address 10.21.21.89/30
set logical-systems Datos interfaces ge-0/0/5 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/6 unit 0 description "to Madrid B ge-0/0/6"
set logical-systems Datos interfaces ge-0/0/6 unit 0 family inet address 10.21.21.37/30
set logical-systems Datos interfaces ge-0/0/6 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/7 unit 0 description "to Valencia B ge-0/0/7"
set logical-systems Datos interfaces ge-0/0/7 unit 0 family inet address 10.21.21.61/30
set logical-systems Datos interfaces ge-0/0/7 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/8 unit 0 description "to Bilbao B ge-0/0/8"
set logical-systems Datos interfaces ge-0/0/8 unit 0 family inet address 10.21.21.102/30
set logical-systems Datos interfaces ge-0/0/8 unit 0 family mpls
set logical-systems Datos interfaces lo0 unit 1 description "Loopback Barcelona B"
set logical-systems Datos interfaces lo0 unit 1 family inet address 10.21.21.4/32
set logical-systems Datos protocols rsvp interface ge-0/0/5.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/6.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/7.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/8.0 link-protection
set logical-systems Datos protocols mpls statistics file mpls-stats
set logical-systems Datos protocols mpls admin-groups blue 4
```

```
set logical-systems Datos protocols mpls admin-groups red 8
set logical-systems Datos protocols mpls admin-groups green 16
set logical-systems Datos protocols mpls label-switched-path BarB-MadB from 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path BarB-MadB to 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path BarB-MadB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarB-MadB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarB-MadA from 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path BarB-MadA to 10.21.21.1
set logical-systems Datos protocols mpls label-switched-path BarB-MadA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarB-MadA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarB-BarA from 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path BarB-BarA to 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path BarB-BarA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarB-BarA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarB-CacA from 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path BarB-CacA to 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path BarB-CacA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarB-CacA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarB-CacB from 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path BarB-CacB to 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path BarB-CacB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarB-CacB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarB-ValA from 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path BarB-ValA to 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path BarB-ValA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarB-ValA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarB-ValB from 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path BarB-ValB to 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path BarB-ValB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarB-ValB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarB-BilA from 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path BarB-BilA to 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path BarB-BilA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarB-BilA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarB-BilB from 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path BarB-BilB to 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path BarB-BilB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarB-BilB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarB-GijA from 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path BarB-GijA to 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path BarB-GijA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarB-GijA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarB-GijB from 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path BarB-GijB to 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path BarB-GijB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarB-GijB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarB-SevA from 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path BarB-SevA to 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path BarB-SevA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarB-SevA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BarB-SevB from 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path BarB-SevB to 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path BarB-SevB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BarB-SevB node-link-protection
set logical-systems Datos protocols mpls interface ge-0/0/5.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/6.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/7.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/8.0 admin-group blue
set logical-systems Datos protocols mpls interface all
set logical-systems Datos protocols bgp group ibgp type internal
set logical-systems Datos protocols bgp group ibgp local-address 10.21.21.4
set logical-systems Datos protocols bgp group ibgp family inet unicast
set logical-systems Datos protocols bgp group ibgp family inet-vpn any
set logical-systems Datos protocols bgp group ibgp family l2vpn signaling
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.1
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.2
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.3
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.5
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.6
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.7
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.8
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.9
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.10
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.11
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.12
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.13
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.14
set logical-systems Datos protocols ospf traffic-engineering
set logical-systems Datos protocols ospf reference-bandwidth 1000g
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 authentication md5 20 key "$9$A8NxpIcN-
woaU24QF3nCAKMW8db"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 authentication md5 20 key "$9$5Q/tleWN-wX7jHkqf51REhKM"
```

```
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 authentication md5 20 key "$9$7p-Yof5FCA069evMWx7DiHkTz"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 authentication md5 20 key "$9$k.QnEhrW87KMaZGUHktu0Ocy"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1 passive
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 from route-filter 172.22.0.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 from route-filter 172.22.128.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 from route-filter 10.0.0.0/8 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 then accept
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 2 then reject
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 from route-filter 172.22.128.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 from route-filter 172.22.0.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 from route-filter 10.0.0.0/8 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 then accept
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 2 then reject
set logical-systems Datos policy-options policy-statement vpn-epc-export term 1 from protocol bgp
set logical-systems Datos policy-options policy-statement vpn-epc-export term 1 from protocol direct
set logical-systems Datos policy-options policy-statement vpn-epc-export term 1 then community add vpn-epc-comm
set logical-systems Datos policy-options policy-statement vpn-epc-export term 1 then accept
set logical-systems Datos policy-options policy-statement vpn-epc-export term 2 then reject
set logical-systems Datos policy-options policy-statement vpn-epc-import term 1 from protocol bgp
set logical-systems Datos policy-options policy-statement vpn-epc-import term 1 from protocol direct
set logical-systems Datos policy-options policy-statement vpn-epc-import term 1 from community vpn-epc-comm
set logical-systems Datos policy-options policy-statement vpn-epc-import term 1 then accept
set logical-systems Datos policy-options policy-statement vpn-epc-import term 2 then reject
set logical-systems Datos policy-options community vpn-epc-comm members target:100:100
set logical-systems Datos routing-instances vpn-epc instance-type vrf
set logical-systems Datos routing-instances vpn-epc interface ge-0/0/4.0
set logical-systems Datos routing-instances vpn-epc route-distinguisher 10.21.21.4:100
set logical-systems Datos routing-instances vpn-epc vrf-import vpn-epc-import
set logical-systems Datos routing-instances vpn-epc vrf-export vpn-epc-export
set logical-systems Datos routing-instances vpn-epc vrf-table-label
set logical-systems Datos routing-instances vpn-epc protocols bgp group EPC import Redes-EPC-CarrierImport
set logical-systems Datos routing-instances vpn-epc protocols bgp group EPC export Redes-EPC-CarrierExport
set logical-systems Datos routing-instances vpn-epc protocols bgp group EPC peer-as 65501
set logical-systems Datos routing-instances vpn-epc protocols bgp group EPC neighbor 172.22.0.49 description EPC-BCN-B
set logical-systems Datos routing-instances vpn-epc protocols bgp group EPC neighbor 172.22.0.49 family inet labeled-unicast
set logical-systems Datos routing-instances vpn-epc protocols bgp group EPC neighbor 172.22.0.49 as-override
set logical-systems Datos routing-options router-id 10.21.21.4
set logical-systems Datos routing-options autonomous-system 65500
set logical-systems Internet interfaces ge-0/0/0 unit 0 description "to Barcelona A ge-0/0/0"
set logical-systems Internet interfaces ge-0/0/0 unit 0 family inet address 84.120.0.89/30
set logical-systems Internet interfaces ge-0/0/0 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/1 unit 0 description "to Madrid B ge-0/0/1"
set logical-systems Internet interfaces ge-0/0/1 unit 0 family inet address 84.120.0.37/30
set logical-systems Internet interfaces ge-0/0/1 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/2 unit 0 description "to Valencia B ge-0/0/2"
set logical-systems Internet interfaces ge-0/0/2 unit 0 family inet address 84.120.0.61/30
set logical-systems Internet interfaces ge-0/0/2 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/3 unit 0 description "to Bilbao B ge-0/0/3"
set logical-systems Internet interfaces ge-0/0/3 unit 0 family inet address 84.120.0.102/30
set logical-systems Internet interfaces ge-0/0/3 unit 0 family mpls
set logical-systems Internet interfaces lo0 unit 0 description "Loopback Barcelona B"
set logical-systems Internet interfaces lo0 unit 0 family inet address 84.120.0.4/32
set logical-systems Internet protocols rsvp interface ge-0/0/0.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/1.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/2.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/3.0 link-protection
set logical-systems Internet protocols mpls statistics file mpls-stats
set logical-systems Internet protocols mpls admin-groups blue 4
set logical-systems Internet protocols mpls admin-groups red 8
set logical-systems Internet protocols mpls admin-groups green 16
set logical-systems Internet protocols mpls label-switched-path BarB-MadB from 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path BarB-MadB to 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path BarB-MadB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarB-MadB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarB-MadA from 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path BarB-MadA to 84.120.0.1
set logical-systems Internet protocols mpls label-switched-path BarB-MadA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarB-MadA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarB-BarA from 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path BarB-BarA to 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path BarB-BarA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarB-BarA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarB-CacA from 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path BarB-CacA to 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path BarB-CacA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarB-CacA node-link-protection
```

```
set logical-systems Internet protocols mpls label-switched-path BarB-CacB from 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path BarB-CacB to 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path BarB-CacB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarB-CacB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarB-ValA from 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path BarB-ValA to 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path BarB-ValA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarB-ValA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarB-ValB from 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path BarB-ValB to 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path BarB-ValB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarB-ValB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarB-BilA from 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path BarB-BilA to 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path BarB-BilA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarB-BilA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarB-BilB from 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path BarB-BilB to 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path BarB-BilB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarB-BilB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarB-GijA from 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path BarB-GijA to 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path BarB-GijA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarB-GijA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarB-GijB from 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path BarB-GijB to 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path BarB-GijB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarB-GijB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarB-SevA from 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path BarB-SevA to 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path BarB-SevA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarB-SevA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BarB-SevB from 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path BarB-SevB to 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path BarB-SevB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BarB-SevB node-link-protection
set logical-systems Internet protocols mpls interface ge-0/0/0.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/1.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/2.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/3.0 admin-group blue
set logical-systems Internet protocols bgp group ibg-cluster type internal
set logical-systems Internet protocols bgp group ibg-cluster local-address 84.120.0.4
set logical-systems Internet protocols bgp group ibg-cluster family inet unicast
set logical-systems Internet protocols bgp group ibg-cluster family l2vpn signaling
set logical-systems Internet protocols bgp group ibg-cluster cluster 5.5.5.5
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.5
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.6
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.7
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.8
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.9
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.10
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.11
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.12
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.13
set logical-systems Internet protocols bgp group ibg-cluster neighbor 84.120.0.14
set logical-systems Internet protocols bgp group ibgp type internal
set logical-systems Internet protocols bgp group ibgp local-address 84.120.0.4
set logical-systems Internet protocols bgp group ibgp family inet unicast
set logical-systems Internet protocols bgp group ibgp family l2vpn signaling
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.3
set logical-systems Internet protocols ospf traffic-engineering
set logical-systems Internet protocols ospf reference-bandwidth 1000g
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 authentication md5 20 key
"$9$02CcBclbwgGUHaZn/9Cu08Xx7s2"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 authentication md5 20 key
"$9$GjD.50ORrlMcys2g4ZGn/9CBI"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 authentication md5 20 key
"$9$cs.yMXaJD.mTHquOB1hcVwsYZU"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 authentication md5 20 key
"$9$uP/HOhrVb2ZGioJ36/9puWLXxwY"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface lo0.0 passive
```

```
set logical-systems Internet routing-options router-id 84.120.0.4
set logical-systems Internet routing-options autonomous-system 8296
set interfaces ge-0/0/0 description "to Barcelona-A ge-0/0/0"
set interfaces ge-0/0/1 description "to Madrid B ge/0/0/1"
set interfaces ge-0/0/2 description "to Valencia B ge/0/0/2"
set interfaces ge-0/0/3 description "to Bilbao B ge/0/0/3"
set interfaces ge-0/0/4 description "to EPC BCN B ge0/0/0/4"
set interfaces ge-0/0/4 mtu 2000
set interfaces ge-0/0/5 description "to Barcelona-A ge-0/0/5"
set interfaces ge-0/0/6 description "to Madrid-B ge/0/0/6"
set interfaces ge-0/0/7 description "to Valencia-B ge/0/0/7"
set interfaces ge-0/0/8 description "to Bilbao-B ge/0/0/8"}
```

8.5. BILBAO-A

```
set version 14.1R1.10
set system host-name Bilbao-A
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/5 unit 0 description "to Bilbao-B ge-0/0/5"
set logical-systems Datos interfaces ge-0/0/5 unit 0 family inet address 10.21.21.118/30
set logical-systems Datos interfaces ge-0/0/5 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/6 unit 0 description "to Gijon-A ge-0/0/6"
set logical-systems Datos interfaces ge-0/0/6 unit 0 family inet address 10.21.21.110/30
set logical-systems Datos interfaces ge-0/0/6 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/8 unit 0 description "to Barcelona-A ge-0/0/8"
set logical-systems Datos interfaces ge-0/0/8 unit 0 family inet address 10.21.21.121/30
set logical-systems Datos interfaces ge-0/0/8 unit 0 family mpls
set logical-systems Datos interfaces lo0 unit 1 description "Loopback Bilbao-A"
set logical-systems Datos interfaces lo0 unit 1 family inet address 10.21.21.9/32
set logical-systems Datos protocols rsvp interface ge-0/0/5.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/6.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/8.0 link-protection
set logical-systems Datos protocols mpls statistics file mpls-stats
set logical-systems Datos protocols mpls admin-groups blue 4
set logical-systems Datos protocols mpls admin-groups red 8
set logical-systems Datos protocols mpls admin-groups green 16
set logical-systems Datos protocols mpls label-switched-path BilA-MadB from 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path BilA-MadB to 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path BilA-MadB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilA-MadB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilA-MadA from 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path BilA-MadA to 10.21.21.1
set logical-systems Datos protocols mpls label-switched-path BilA-MadA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilA-MadA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilA-BarB from 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path BilA-BarB to 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path BilA-BarB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilA-BarB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilA-CacA from 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path BilA-CacA to 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path BilA-CacA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilA-CacA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilA-CacB from 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path BilA-CacB to 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path BilA-CacB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilA-CacB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilA-BarA from 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path BilA-BarA to 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path BilA-BarA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilA-BarA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilA-ValB from 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path BilA-ValB to 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path BilA-ValB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilA-ValB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilA-ValA from 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path BilA-ValA to 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path BilA-ValA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilA-ValA node-link-protection
```

```
set logical-systems Datos protocols mpls label-switched-path BilA-BilB from 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path BilA-BilB to 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path BilA-BilB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilA-BilB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilA-GijA from 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path BilA-GijA to 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path BilA-GijA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilA-GijA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilA-GijB from 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path BilA-GijB to 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path BilA-GijB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilA-GijB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilA-SevA from 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path BilA-SevA to 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path BilA-SevA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilA-SevA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilA-SevB from 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path BilA-SevB to 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path BilA-SevB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilA-SevB node-link-protection
set logical-systems Datos protocols mpls interface ge-0/0/5.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/6.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/8.0 admin-group blue
set logical-systems Datos protocols bgp group ibgp type internal
set logical-systems Datos protocols bgp group ibgp local-address 10.21.21.9
set logical-systems Datos protocols bgp group ibgp family inet unicast
set logical-systems Datos protocols bgp group ibgp family inet-vpn any
set logical-systems Datos protocols bgp group ibgp family l2vpn signaling
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.1
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.3
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.4
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.5
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.6
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.7
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.8
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.2
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.10
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.11
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.12
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.13
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.14
set logical-systems Datos protocols ospf traffic-engineering
set logical-systems Datos protocols ospf reference-bandwidth 1000g
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 authentication md5 20 key "$9$oLJi.AtOhclIEdbws4oQF3np0"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 authentication md5 20 key "$9$YQgGi6/t1Ic0BxN-dsYP5TQ9A"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 authentication md5 20 key "$9$P5nCyrvx7V8XUjiHmPO1IRlK"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1 passive
set logical-systems Datos routing-options router-id 10.21.21.9
set logical-systems Datos routing-options autonomous-system 65500
set logical-systems Internet interfaces ge-0/0/0 unit 0 description "to Bilbao-B ge-0/0/0"
set logical-systems Internet interfaces ge-0/0/0 unit 0 family inet address 84.120.0.118/30
set logical-systems Internet interfaces ge-0/0/0 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/1 unit 0 description "to Gijon-A ge-0/0/1"
set logical-systems Internet interfaces ge-0/0/1 unit 0 family inet address 84.120.0.110/30
set logical-systems Internet interfaces ge-0/0/1 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/3 unit 0 description "to Barcelona-A ge-0/0/3"
set logical-systems Internet interfaces ge-0/0/3 unit 0 family inet address 84.120.0.121/30
set logical-systems Internet interfaces ge-0/0/3 unit 0 family mpls
set logical-systems Internet interfaces lo0 unit 0 description "Loopback Bilbao-A"
set logical-systems Internet interfaces lo0 unit 0 family inet address 84.120.0.9/32
set logical-systems Internet protocols rsvp interface ge-0/0/0.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/1.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/3.0 link-protection
set logical-systems Internet protocols mpls statistics file mpls-stats
set logical-systems Internet protocols mpls admin-groups blue 4
set logical-systems Internet protocols mpls admin-groups red 8
set logical-systems Internet protocols mpls admin-groups green 16
set logical-systems Internet protocols mpls label-switched-path BilA-MadB from 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path BilA-MadB to 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path BilA-MadB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilA-MadB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilA-MadA from 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path BilA-MadA to 84.120.0.1
set logical-systems Internet protocols mpls label-switched-path BilA-MadA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilA-MadA node-link-protection
```

```
set logical-systems Internet protocols mpls label-switched-path BilA-BarB from 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path BilA-BarB to 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path BilA-BarB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilA-BarB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilA-CacA from 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path BilA-CacA to 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path BilA-CacA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilA-CacA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilA-CacB from 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path BilA-CacB to 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path BilA-CacB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilA-CacB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilA-BarA from 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path BilA-BarA to 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path BilA-BarA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilA-BarA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilA-ValB from 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path BilA-ValB to 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path BilA-ValB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilA-ValB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilA-ValA from 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path BilA-ValA to 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path BilA-ValA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilA-ValA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilA-BilB from 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path BilA-BilB to 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path BilA-BilB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilA-BilB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilA-GijA from 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path BilA-GijA to 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path BilA-GijA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilA-GijA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilA-GijB from 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path BilA-GijB to 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path BilA-GijB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilA-GijB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilA-SevA from 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path BilA-SevA to 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path BilA-SevA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilA-SevA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilA-SevB from 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path BilA-SevB to 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path BilA-SevB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilA-SevB node-link-protection
set logical-systems Internet protocols mpls interface ge-0/0/0.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/1.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/3.0 admin-group blue
set logical-systems Internet protocols bgp group ibgp type internal
set logical-systems Internet protocols bgp group ibgp local-address 84.120.0.9
set logical-systems Internet protocols bgp group ibgp family inet unicast
set logical-systems Internet protocols bgp group ibgp family l2vpn signaling
set logical-systems Internet protocols bgp group ibgp export nhs
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.1
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.2
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.3
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.4
set logical-systems Internet protocols ospf traffic-engineering
set logical-systems Internet protocols ospf reference-bandwidth 1000g
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 authentication md5 20 key
"$9$nR3a/u18LNsYoVwmf5T3nSrleX7"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 authentication md5 20 key "$9$Tz9peK8-
dsxNikq.5TIEhcvW"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 authentication md5 20 key
"$9$DqiPQB1heK8yl24oaUD/CAtIE"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface lo0.0 passive
set logical-systems Internet policy-options policy-statement nhs term 1 from protocol bgp
set logical-systems Internet policy-options policy-statement nhs term 1 then next-hop self
set logical-systems Internet routing-options router-id 84.120.0.9
set logical-systems Internet routing-options autonomous-system 8296
set interfaces ge-0/0/0 description "to Bilbao-B ge-0/0/0"
set interfaces ge-0/0/1 description "to Gijon-A ge/0/0/1"
set interfaces ge-0/0/3 description "to Barcelona-A ge/0/0/3"
set interfaces ge-0/0/5 description "to Bilbao-B ge-0/0/5"
set interfaces ge-0/0/6 description "to Gijon-A ge/0/0/6"
set interfaces ge-0/0/8 description "to Barcelona-A ge/0/0/8"
```

```
}
```

8.6. BILBAO-B

```
set version 14.1R1.10
set system host-name Bilbao-B
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/5 unit 0 description "to Bilbao-A ge-0/0/5"
set logical-systems Datos interfaces ge-0/0/5 unit 0 family inet address 10.21.21.117/30
set logical-systems Datos interfaces ge-0/0/5 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/6 unit 0 description "to Gijon-B ge-0/0/6"
set logical-systems Datos interfaces ge-0/0/6 unit 0 family inet address 10.21.21.106/30
set logical-systems Datos interfaces ge-0/0/6 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/8 unit 0 description "to Barcelona-B ge-0/0/8"
set logical-systems Datos interfaces ge-0/0/8 unit 0 family inet address 10.21.21.101/30
set logical-systems Datos interfaces ge-0/0/8 unit 0 family mpls
set logical-systems Datos interfaces lo0 unit 1 description "Loopback Bilbao-B"
set logical-systems Datos interfaces lo0 unit 1 family inet address 10.21.21.10/32
set logical-systems Datos protocols rsvp interface ge-0/0/5.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/6.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/8.0 link-protection
set logical-systems Datos protocols mpls statistics file mpls-stats
set logical-systems Datos protocols mpls admin-groups blue 4
set logical-systems Datos protocols mpls admin-groups red 8
set logical-systems Datos protocols mpls admin-groups green 16
set logical-systems Datos protocols mpls label-switched-path BilB-MadB from 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path BilB-MadB to 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path BilB-MadB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilB-MadB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilB-MadA from 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path BilB-MadA to 10.21.21.1
set logical-systems Datos protocols mpls label-switched-path BilB-MadA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilB-MadA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilB-BarB from 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path BilB-BarB to 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path BilB-BarB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilB-BarB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilB-CacA from 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path BilB-CacA to 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path BilB-CacA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilB-CacA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilB-CacB from 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path BilB-CacB to 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path BilB-CacB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilB-CacB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilB-BarA from 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path BilB-BarA to 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path BilB-BarA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilB-BarA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilB-ValB from 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path BilB-ValB to 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path BilB-ValB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilB-ValB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilB-ValA from 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path BilB-ValA to 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path BilB-ValA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilB-ValA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilB-BilA from 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path BilB-BilA to 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path BilB-BilA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilB-BilA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilB-GijA from 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path BilB-GijA to 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path BilB-GijA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilB-GijA node-link-protection
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set logical-systems Datos protocols mpls label-switched-path BilB-GijB from 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path BilB-GijB to 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path BilB-GijB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilB-GijB node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilB-SevA from 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path BilB-SevA to 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path BilB-SevA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilB-SevA node-link-protection
set logical-systems Datos protocols mpls label-switched-path BilB-SevB from 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path BilB-SevB to 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path BilB-SevB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path BilB-SevB node-link-protection
set logical-systems Datos protocols mpls interface ge-0/0/5.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/6.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/8.0 admin-group blue
set logical-systems Datos protocols bgp group ibgp type internal
set logical-systems Datos protocols bgp group ibgp local-address 10.21.21.10
set logical-systems Datos protocols bgp group ibgp family inet unicast
set logical-systems Datos protocols bgp group ibgp family inet-vpn any
set logical-systems Datos protocols bgp group ibgp family l2vpn signaling
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.1
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.3
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.4
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.5
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.6
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.7
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.8
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.9
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.2
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.11
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.12
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.13
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.14
set logical-systems Datos protocols ospf traffic-engineering
set logical-systems Datos protocols ospf reference-bandwidth 1000g
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 authentication md5 20 key "$9$v4ZWNbiHmzF/5QEcSyKv4aJZk."
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 authentication md5 20 key "$9$6-ii90ILX-
Y2absP5TQn6yleKxN"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 authentication md5 20 key "$9$QQUjFCuKvLdVY7-
Hq.mTQRhcSM8"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1 passive
set logical-systems Datos routing-options router-id 10.21.21.10
set logical-systems Datos routing-options autonomous-system 65500
set logical-systems Internet interfaces ge-0/0/0 unit 0 description "to Bilbao-A ge-0/0/0"
set logical-systems Internet interfaces ge-0/0/0 unit 0 family inet address 84.120.0.117/30
set logical-systems Internet interfaces ge-0/0/0 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/1 unit 0 description "to Gijon-B ge-0/0/1"
set logical-systems Internet interfaces ge-0/0/1 unit 0 family inet address 84.120.0.106/30
set logical-systems Internet interfaces ge-0/0/1 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/3 unit 0 description "to Barcelona-B ge-0/0/3"
set logical-systems Internet interfaces ge-0/0/3 unit 0 family inet address 84.120.0.101/30
set logical-systems Internet interfaces ge-0/0/3 unit 0 family mpls
set logical-systems Internet interfaces lo0 unit 0 description "Loopback Bilbao-B"
set logical-systems Internet interfaces lo0 unit 0 family inet address 84.120.0.10/32
set logical-systems Internet protocols rsvp interface ge-0/0/0.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/1.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/3.0 link-protection
set logical-systems Internet protocols mpls statistics file mpls-stats
set logical-systems Internet protocols mpls admin-groups blue 4
set logical-systems Internet protocols mpls admin-groups red 8
set logical-systems Internet protocols mpls admin-groups green 16
set logical-systems Internet protocols mpls label-switched-path BilB-MadB from 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path BilB-MadB to 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path BilB-MadB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilB-MadB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilB-MadA from 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path BilB-MadA to 84.120.0.1
set logical-systems Internet protocols mpls label-switched-path BilB-MadA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilB-MadA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilB-BarB from 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path BilB-BarB to 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path BilB-BarB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilB-BarB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilB-CacA from 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path BilB-CacA to 84.120.0.5
```

```
set logical-systems Internet protocols mpls label-switched-path BilB-CacA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilB-CacA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilB-CacB from 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path BilB-CacB to 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path BilB-CacB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilB-CacB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilB-BarA from 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path BilB-BarA to 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path BilB-BarA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilB-BarA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilB-ValB from 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path BilB-ValB to 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path BilB-ValB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilB-ValB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilB-ValA from 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path BilB-ValA to 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path BilB-ValA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilB-ValA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilB-BilA from 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path BilB-BilA to 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path BilB-BilA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilB-BilA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilB-GijA from 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path BilB-GijA to 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path BilB-GijA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilB-GijA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilB-GijB from 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path BilB-GijB to 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path BilB-GijB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilB-GijB node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilB-SevA from 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path BilB-SevA to 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path BilB-SevA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilB-SevA node-link-protection
set logical-systems Internet protocols mpls label-switched-path BilB-SevB from 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path BilB-SevB to 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path BilB-SevB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path BilB-SevB node-link-protection
set logical-systems Internet protocols mpls interface ge-0/0/0.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/1.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/3.0 admin-group blue
set logical-systems Internet protocols bgp group ibgp type internal
set logical-systems Internet protocols bgp group ibgp local-address 84.120.0.10
set logical-systems Internet protocols bgp group ibgp family inet unicast
set logical-systems Internet protocols bgp group ibgp family l2vpn signaling
set logical-systems Internet protocols bgp group ibgp export nhs
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.1
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.2
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.3
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.4
set logical-systems Internet protocols ospf traffic-engineering
set logical-systems Internet protocols ospf reference-bandwidth 1000g
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 authentication md5 20 key
"$9$RO4heWg4ZHkPDiApu0IRNdVboJ"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 authentication md5 20 key "$9$2r4UH/9pIRSO17-
dVY2fTQzCt"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 authentication md5 20 key "$9$A5xYpIcN-
woaU24QF3nCAKMW8db"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface lo0.0 passive
set logical-systems Internet policy-options policy-statement nhs term 1 from protocol bgp
set logical-systems Internet policy-options policy-statement nhs term 1 then next-hop self
set logical-systems Internet routing-options router-id 84.120.0.10
set logical-systems Internet routing-options autonomous-system 8296
set interfaces ge-0/0/0 description "to Bilbao-A ge-0/0/0"
set interfaces ge-0/0/1 description "to Gijon-B ge/0/0/1"
set interfaces ge-0/0/3 description "to Barcelona-B ge/0/0/3"
set interfaces ge-0/0/5 description "to Bilbao-A ge-0/0/5"
set interfaces ge-0/0/6 description "to Gijon-B ge/0/0/6"
set interfaces ge-0/0/8 description "to Barcelona-B ge/0/0/8"

root@Bilbao-B> }
```

8.7. CACERES-A

```
set system host-name Caceres-A
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/5 unit 0 description "to Caceres-B A ge-0/0/5"
set logical-systems Datos interfaces ge-0/0/5 unit 0 family inet address 10.21.21.86/30
set logical-systems Datos interfaces ge-0/0/5 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/7 unit 0 description "to Madrid A ge-0/0/7"
set logical-systems Datos interfaces ge-0/0/7 unit 0 family inet address 10.21.21.42/30
set logical-systems Datos interfaces ge-0/0/7 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/8 unit 0 description "to Gijon A ge-0/0/8"
set logical-systems Datos interfaces ge-0/0/8 unit 0 family inet address 10.21.21.94/30
set logical-systems Datos interfaces ge-0/0/8 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/9 unit 0 description "to Sevilla A ge-0/0/9"
set logical-systems Datos interfaces ge-0/0/9 unit 0 family inet address 10.21.21.81/30
set logical-systems Datos interfaces ge-0/0/9 unit 0 family mpls
set logical-systems Datos interfaces lo0 unit 1 description "Loopback Caceres A"
set logical-systems Datos interfaces lo0 unit 1 family inet address 10.21.21.5/32
set logical-systems Datos protocols rsvp interface ge-0/0/5.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/7.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/8.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/9.0 link-protection
set logical-systems Datos protocols mpls statistics file mpls-stats
set logical-systems Datos protocols mpls admin-groups blue 4
set logical-systems Datos protocols mpls admin-groups red 8
set logical-systems Datos protocols mpls admin-groups green 16
set logical-systems Datos protocols mpls label-switched-path CacA-MadB from 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path CacA-MadB to 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path CacA-MadB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacA-MadB node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacA-MadA from 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path CacA-MadA to 10.21.21.1
set logical-systems Datos protocols mpls label-switched-path CacA-MadA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacA-MadA node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacA-BarB from 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path CacA-BarB to 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path CacA-BarB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacA-BarB node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacA-BarA from 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path CacA-BarA to 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path CacA-BarA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacA-BarA node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacA-CacB from 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path CacA-CacB to 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path CacA-CacB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacA-CacB node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacA-ValA from 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path CacA-ValA to 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path CacA-ValA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacA-ValA node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacA-ValB from 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path CacA-ValB to 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path CacA-ValB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacA-ValB node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacA-BilA from 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path CacA-BilA to 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path CacA-BilA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacA-BilA node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacA-BilB from 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path CacA-BilB to 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path CacA-BilB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacA-BilB node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacA-GijA from 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path CacA-GijA to 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path CacA-GijA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacA-GijA node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacA-GijB from 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path CacA-GijB to 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path CacA-GijB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacA-GijB node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacA-SevA from 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path CacA-SevA to 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path CacA-SevA admin-group include-any blue
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```
set logical-systems Datos protocols mpls label-switched-path CacA-SevA node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacA-SevB from 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path CacA-SevB to 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path CacA-SevB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacA-SevB node-link-protection
set logical-systems Datos protocols mpls interface ge-0/0/5.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/7.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/8.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/9.0 admin-group blue
set logical-systems Datos protocols bgp group ibgp type internal
set logical-systems Datos protocols bgp group ibgp local-address 10.21.21.5
set logical-systems Datos protocols bgp group ibgp family inet unicast
set logical-systems Datos protocols bgp group ibgp family l2vpn signaling
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.1
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.3
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.4
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.2
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.6
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.7
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.8
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.9
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.10
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.11
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.12
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.13
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.14
set logical-systems Datos protocols ospf traffic-engineering
set logical-systems Datos protocols ospf reference-bandwidth 1000g
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 authentication md5 20 key "$9$mf39SyKXxdWLGDji.m0B1Ire"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 authentication md5 20 key "$9$a8ZHmtpBcSeRhVwsYoaz3n6uO"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 authentication md5 20 key "$9$Q4-3FCuKvLdVY7-
Hq.mTQRhcSM8"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 authentication md5 20 key "$9$xb1Ns4Pfz9Cun/lKvMXxUjiH5Q"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1 passive
set logical-systems Datos routing-options router-id 10.21.21.5
set logical-systems Datos routing-options autonomous-system 65500
set logical-systems Internet interfaces ge-0/0/0 unit 0 description "to Caceres-B A ge-0/0/0"
set logical-systems Internet interfaces ge-0/0/0 unit 0 family inet address 84.120.0.86/30
set logical-systems Internet interfaces ge-0/0/0 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/2 unit 0 description "to Madrid A ge-0/0/2"
set logical-systems Internet interfaces ge-0/0/2 unit 0 family inet address 84.120.0.42/30
set logical-systems Internet interfaces ge-0/0/2 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/3 unit 0 description "to Gijon A ge-0/0/3"
set logical-systems Internet interfaces ge-0/0/3 unit 0 family inet address 84.120.0.94/30
set logical-systems Internet interfaces ge-0/0/3 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/4 unit 0 description "to Sevilla A ge-0/0/4"
set logical-systems Internet interfaces ge-0/0/4 unit 0 family inet address 84.120.0.81/30
set logical-systems Internet interfaces ge-0/0/4 unit 0 family mpls
set logical-systems Internet interfaces lo0 unit 0 description "Loopback Caceres A"
set logical-systems Internet interfaces lo0 unit 0 family inet address 84.120.0.5/32
set logical-systems Internet protocols rsvp interface ge-0/0/0.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/2.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/3.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/4.0 link-protection
set logical-systems Internet protocols mpls statistics file mpls-stats
set logical-systems Internet protocols mpls admin-groups blue 4
set logical-systems Internet protocols mpls admin-groups red 8
set logical-systems Internet protocols mpls admin-groups green 16
set logical-systems Internet protocols mpls no-propagate-ttl
set logical-systems Internet protocols mpls label-switched-path CacA-MadB from 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path CacA-MadB to 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path CacA-MadB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacA-MadB node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacA-MadA from 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path CacA-MadA to 84.120.0.1
set logical-systems Internet protocols mpls label-switched-path CacA-MadA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacA-MadA node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacA-BarB from 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path CacA-BarB to 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path CacA-BarB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacA-BarB node-link-protection
```

```
set logical-systems Internet protocols mpls label-switched-path CacA-BarA from 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path CacA-BarA to 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path CacA-BarA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacA-BarA node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacA-CacB from 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path CacA-CacB to 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path CacA-CacB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacA-CacB node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacA-ValA from 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path CacA-ValA to 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path CacA-ValA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacA-ValA node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacA-ValB from 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path CacA-ValB to 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path CacA-ValB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacA-ValB node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacA-BilA from 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path CacA-BilA to 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path CacA-BilA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacA-BilA node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacA-BilB from 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path CacA-BilB to 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path CacA-BilB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacA-BilB node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacA-GijA from 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path CacA-GijA to 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path CacA-GijA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacA-GijA node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacA-GijB from 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path CacA-GijB to 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path CacA-GijB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacA-GijB node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacA-SevA from 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path CacA-SevA to 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path CacA-SevA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacA-SevA node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacA-SevB from 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path CacA-SevB to 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path CacA-SevB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacA-SevB node-link-protection
set logical-systems Internet protocols mpls interface ge-0/0/0.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/2.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/3.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/4.0 admin-group blue
set logical-systems Internet protocols bgp group ibgp type internal
set logical-systems Internet protocols bgp group ibgp local-address 84.120.0.5
set logical-systems Internet protocols bgp group ibgp family inet unicast
set logical-systems Internet protocols bgp group ibgp family l2vpn signaling
set logical-systems Internet protocols bgp group ibgp export nhs
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.1
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.2
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.3
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.4
set logical-systems Internet protocols ospf traffic-engineering
set logical-systems Internet protocols ospf reference-bandwidth 1000g
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 authentication md5 20 key
"$9$RMiheWg4ZHkPDiApu0IRNdVboJ"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 authentication md5 20 key
"$9$/lAGCORXxd2gJwYfTQz6/reKv7-"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 authentication md5 20 key
"$9$8e0XVYq.5n6Az3SrleW8JGUDmf"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 authentication md5 20 key
"$9$HqT3REyMWxevoJZGiHApu0hS"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface lo0.0 passive
set logical-systems Internet policy-options policy-statement nhs term 1 from protocol bgp
set logical-systems Internet policy-options policy-statement nhs term 1 then next-hop self
set logical-systems Internet routing-options router-id 84.120.0.5
set logical-systems Internet routing-options autonomous-system 8296
set interfaces ge-0/0/0 description "to Caceres-B ge-0/0/0"
set interfaces ge-0/0/2 description "to Madrid-A ge/0/0/2"
set interfaces ge-0/0/3 description "to Gijon-A ge/0/0/3"
```

```
set interfaces ge-0/0/4 description "to Sevilla-A ge/0/0/4"
set interfaces ge-0/0/5 description "to Caceres-B ge-0/0/5"
set interfaces ge-0/0/7 description "to Madrid-A ge/0/0/7"
set interfaces ge-0/0/8 description "to Gijon-A ge/0/0/8"
set interfaces ge-0/0/9 description "to Sevilla-A ge/0/0/9"

root@Caceres-A> }
```

8.8. CACERES-B

```
set version 14.1R1.10
set system host-name Caceres-B
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/5 unit 0 description "to Caceres-A A ge-0/0/5"
set logical-systems Datos interfaces ge-0/0/5 unit 0 family inet address 10.21.21.85/30
set logical-systems Datos interfaces ge-0/0/5 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/7 unit 0 description "to Madrid-B ge-0/0/7"
set logical-systems Datos interfaces ge-0/0/7 unit 0 family inet address 10.21.21.49/30
set logical-systems Datos interfaces ge-0/0/7 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/8 unit 0 description "to Gijon-B ge-0/0/8"
set logical-systems Datos interfaces ge-0/0/8 unit 0 family inet address 10.21.21.98/30
set logical-systems Datos interfaces ge-0/0/8 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/9 unit 0 description "to Sevilla-B ge-0/0/9"
set logical-systems Datos interfaces ge-0/0/9 unit 0 family inet address 10.21.21.77/30
set logical-systems Datos interfaces ge-0/0/9 unit 0 family mpls
set logical-systems Datos interfaces lo0 unit 1 description "Loopback Caceres B"
set logical-systems Datos interfaces lo0 unit 1 family inet address 10.21.21.6/32
set logical-systems Datos protocols rsvp interface ge-0/0/5.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/7.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/8.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/9.0 link-protection
set logical-systems Datos protocols mpls statistics file mpls-stats
set logical-systems Datos protocols mpls admin-groups blue 4
set logical-systems Datos protocols mpls admin-groups red 8
set logical-systems Datos protocols mpls admin-groups green 16
set logical-systems Datos protocols mpls label-switched-path CacB-MadB from 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path CacB-MadB to 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path CacB-MadB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacB-MadB node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacB-MadA from 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path CacB-MadA to 10.21.21.1
set logical-systems Datos protocols mpls label-switched-path CacB-MadA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacB-MadA node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacB-BarB from 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path CacB-BarB to 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path CacB-BarB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacB-BarB node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacB-BarA from 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path CacB-BarA to 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path CacB-BarA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacB-BarA node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacB-CacA from 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path CacB-CacA to 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path CacB-CacA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacB-CacA node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacB-ValA from 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path CacB-ValA to 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path CacB-ValA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacB-ValA node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacB-ValB from 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path CacB-ValB to 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path CacB-ValB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacB-ValB node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacB-BilA from 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path CacB-BilA to 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path CacB-BilA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacB-BilA node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacB-BilB from 10.21.21.6
```

```
set logical-systems Datos protocols mpls label-switched-path CacB-BilB to 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path CacB-BilB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacB-BilB node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacB-GijA from 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path CacB-GijA to 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path CacB-GijA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacB-GijA node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacB-GijB from 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path CacB-GijB to 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path CacB-GijB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacB-GijB node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacB-SevA from 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path CacB-SevA to 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path CacB-SevA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacB-SevA node-link-protection
set logical-systems Datos protocols mpls label-switched-path CacB-SevB from 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path CacB-SevB to 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path CacB-SevB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path CacB-SevB node-link-protection
set logical-systems Datos protocols mpls interface ge-0/0/5.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/7.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/8.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/9.0 admin-group blue
set logical-systems Datos protocols bgp group ibgp type internal
set logical-systems Datos protocols bgp group ibgp local-address 10.21.21.6
set logical-systems Datos protocols bgp group ibgp family inet unicast
set logical-systems Datos protocols bgp group ibgp family inet-vpn any
set logical-systems Datos protocols bgp group ibgp family l2vpn signaling
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.1
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.3
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.4
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.5
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.2
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.7
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.8
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.9
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.10
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.11
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.12
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.13
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.14
set logical-systems Datos protocols ospf traffic-engineering
set logical-systems Datos protocols ospf reference-bandwidth 1000g
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 authentication md5 20 key
"$9$n9Rx/u18LNsYoVwmf5T3nSrleX7"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 authentication md5 20 key "$9$a2ZHmtpBcSeRhVwsYoaz3n6uO"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 authentication md5 20 key "$9$6pht90ILX-
Y2absP5TQn6yleKxN"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 authentication md5 20 key "$9$RiTheWg4ZHkPDiApu0IRNdVboJ"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1 passive
set logical-systems Datos routing-options router-id 10.21.21.6
set logical-systems Datos routing-options autonomous-system 65500
set logical-systems Internet interfaces ge-0/0/0 unit 0 description "to Caceres-A A ge-0/0/0"
set logical-systems Internet interfaces ge-0/0/0 unit 0 family inet address 84.120.0.85/30
set logical-systems Internet interfaces ge-0/0/0 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/2 unit 0 description "to Madrid-B ge-0/0/2"
set logical-systems Internet interfaces ge-0/0/2 unit 0 family inet address 84.120.0.49/30
set logical-systems Internet interfaces ge-0/0/2 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/3 unit 0 description "to Gijon-B ge-0/0/3"
set logical-systems Internet interfaces ge-0/0/3 unit 0 family inet address 84.120.0.98/30
set logical-systems Internet interfaces ge-0/0/3 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/4 unit 0 description "to Sevilla-B ge-0/0/4"
set logical-systems Internet interfaces ge-0/0/4 unit 0 family inet address 84.120.0.77/30
set logical-systems Internet interfaces ge-0/0/4 unit 0 family mpls
set logical-systems Internet interfaces lo0 unit 0 description "Loopback Caceres B"
set logical-systems Internet interfaces lo0 unit 0 family inet address 84.120.0.6/32
set logical-systems Internet protocols rsvp interface ge-0/0/0.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/2.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/3.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/4.0 link-protection
set logical-systems Internet protocols mpls statistics file mpls-stats
```

```
set logical-systems Internet protocols mpls admin-groups blue 4
set logical-systems Internet protocols mpls admin-groups red 8
set logical-systems Internet protocols mpls admin-groups green 16
set logical-systems Internet protocols mpls label-switched-path CacB-MadB from 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path CacB-MadB to 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path CacB-MadB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacB-MadB node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacB-MadA from 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path CacB-MadA to 84.120.0.1
set logical-systems Internet protocols mpls label-switched-path CacB-MadA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacB-MadA node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacB-BarB from 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path CacB-BarB to 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path CacB-BarB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacB-BarB node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacB-BarA from 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path CacB-BarA to 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path CacB-BarA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacB-BarA node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacB-CacA from 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path CacB-CacA to 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path CacB-CacA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacB-CacA node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacB-ValA from 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path CacB-ValA to 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path CacB-ValA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacB-ValA node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacB-ValB from 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path CacB-ValB to 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path CacB-ValB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacB-ValB node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacB-BilA from 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path CacB-BilA to 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path CacB-BilA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacB-BilA node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacB-BilB from 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path CacB-BilB to 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path CacB-BilB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacB-BilB node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacB-GijA from 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path CacB-GijA to 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path CacB-GijA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacB-GijA node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacB-GijB from 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path CacB-GijB to 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path CacB-GijB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacB-GijB node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacB-SevA from 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path CacB-SevA to 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path CacB-SevA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacB-SevA node-link-protection
set logical-systems Internet protocols mpls label-switched-path CacB-SevB from 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path CacB-SevB to 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path CacB-SevB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path CacB-SevB node-link-protection
set logical-systems Internet protocols mpls interface ge-0/0/0.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/2.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/3.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/4.0 admin-group blue
set logical-systems Internet protocols bgp group ibgp type internal
set logical-systems Internet protocols bgp group ibgp local-address 84.120.0.6
set logical-systems Internet protocols bgp group ibgp family inet unicast
set logical-systems Internet protocols bgp group ibgp family l2vpn signaling
set logical-systems Internet protocols bgp group ibgp export nhs
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.1
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.2
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.3
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.4
set logical-systems Internet protocols ospf traffic-engineering
set logical-systems Internet protocols ospf reference-bandwidth 1000g
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 authentication md5 20 key
"$9$ik5FIRSvMXlK4aJZjiCtpuEc"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 authentication md5 20 key "$9$AbfhpIcN-
woaU24QF3nCAKMW8db"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 authentication md5 20 key
"$9$Z2Uqfu0IyrvhSwY2gJZ36/9O1"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection multiplier 3
```

```
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 authentication md5 20 key
"$9$30C/6pBW87ws4db.Pf5F3cyrlLx"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface lo0.0 passive
set logical-systems Internet policy-options policy-statement nhs term 1 from protocol bgp
set logical-systems Internet policy-options policy-statement nhs term 1 then next-hop self
set logical-systems Internet routing-options router-id 84.120.0.6
set logical-systems Internet routing-options autonomous-system 8296
set interfaces ge-0/0/0 description "to Caceres-A ge-0/0/0"
set interfaces ge-0/0/2 description "to Madrid-B ge/0/0/2"
set interfaces ge-0/0/3 description "to Gijon-B ge/0/0/3"
set interfaces ge-0/0/4 description "to Sevilla-B ge/0/0/4"
set interfaces ge-0/0/5 description "to Caceres-A ge-0/0/5"
set interfaces ge-0/0/7 description "to Madrid-B ge/0/0/7"
set interfaces ge-0/0/8 description "to Gijon-B ge/0/0/8"
set interfaces ge-0/0/9 description "to Sevilla-B ge/0/0/9"

root@Caceres-B> }
```

8.9. VALENCIA-A

```
set version 14.1R1.10
set system host-name Valencia-A
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/5 unit 0 description "to Valencia-B ge-0/0/5"
set logical-systems Datos interfaces ge-0/0/5 unit 0 family inet address 10.21.21.58/30
set logical-systems Datos interfaces ge-0/0/5 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/6 unit 0 description "to Sevilla-A ge-0/0/6"
set logical-systems Datos interfaces ge-0/0/6 unit 0 family inet address 10.21.21.70/30
set logical-systems Datos interfaces ge-0/0/6 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/7 unit 0 description "to Barcelona-A ge-0/0/7"
set logical-systems Datos interfaces ge-0/0/7 unit 0 family inet address 10.21.21.66/30
set logical-systems Datos interfaces ge-0/0/7 unit 0 family mpls
set logical-systems Datos interfaces lo0 unit 1 description "Loopback Valencia-A"
set logical-systems Datos interfaces lo0 unit 1 family inet address 10.21.21.7/32
set logical-systems Datos protocols rsvp interface ge-0/0/5.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/6.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/7.0 link-protection
set logical-systems Datos protocols mpls statistics file mpls-stats
set logical-systems Datos protocols mpls admin-groups blue 4
set logical-systems Datos protocols mpls admin-groups red 8
set logical-systems Datos protocols mpls admin-groups green 16
set logical-systems Datos protocols mpls label-switched-path ValA-MadB from 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path ValA-MadB to 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path ValA-MadB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValA-MadB node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValA-MadA from 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path ValA-MadA to 10.21.21.1
set logical-systems Datos protocols mpls label-switched-path ValA-MadA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValA-MadA node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValA-BarB from 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path ValA-BarB to 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path ValA-BarB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValA-BarB node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValA-CacA from 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path ValA-CacA to 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path ValA-CacA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValA-CacA node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValA-CacB from 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path ValA-CacB to 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path ValA-CacB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValA-CacB node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValA-BarA from 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path ValA-BarA to 10.21.21.3
```

```
set logical-systems Datos protocols mpls label-switched-path ValA-BarA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValA-BarA node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValA-ValB from 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path ValA-ValB to 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path ValA-ValB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValA-ValB node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValA-BilA from 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path ValA-BilA to 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path ValA-BilA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValA-BilA node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValA-BilB from 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path ValA-BilB to 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path ValA-BilB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValA-BilB node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValA-GijA from 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path ValA-GijA to 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path ValA-GijA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValA-GijA node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValA-GijB from 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path ValA-GijB to 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path ValA-GijB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValA-GijB node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValA-SevA from 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path ValA-SevA to 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path ValA-SevA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValA-SevA node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValA-SevB from 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path ValA-SevB to 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path ValA-SevB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValA-SevB node-link-protection
set logical-systems Datos protocols mpls interface ge-0/0/5.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/6.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/7.0 admin-group blue
set logical-systems Datos protocols bgp group ibgp type internal
set logical-systems Datos protocols bgp group ibgp local-address 10.21.21.7
set logical-systems Datos protocols bgp group ibgp family inet unicast
set logical-systems Datos protocols bgp group ibgp family inet-vpn any
set logical-systems Datos protocols bgp group ibgp family l2vpn signaling
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.1
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.3
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.4
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.5
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.6
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.2
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.8
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.9
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.10
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.11
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.12
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.13
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.14
set logical-systems Datos protocols ospf traffic-engineering
set logical-systems Datos protocols ospf reference-bandwidth 1000g
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 authentication md5 20 key "$9$IVpElM2gJiHmUjCtpu1I7-dV4a"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 authentication md5 20 key "$9$sD2Zjn6AB1huOX7N-wsmf5T/C"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 authentication md5 20 key "$9$S04rWxJZjmPQk.0B1IcSbsY2GD"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1 passive
set logical-systems Datos routing-options router-id 10.21.21.7
set logical-systems Datos routing-options autonomous-system 65500
set logical-systems Internet interfaces ge-0/0/0 unit 0 description "to Valencia-B ge-0/0/0"
set logical-systems Internet interfaces ge-0/0/0 unit 0 family inet address 84.120.0.58/30
set logical-systems Internet interfaces ge-0/0/0 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/1 unit 0 description "to Sevilla-A ge-0/0/1"
set logical-systems Internet interfaces ge-0/0/1 unit 0 family inet address 84.120.0.70/30
set logical-systems Internet interfaces ge-0/0/1 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/2 unit 0 description "to Barcelona-A ge-0/0/2"
set logical-systems Internet interfaces ge-0/0/2 unit 0 family inet address 84.120.0.66/30
set logical-systems Internet interfaces ge-0/0/2 unit 0 family mpls
set logical-systems Internet interfaces lo0 unit 0 description "Loopback Valencia-A"
set logical-systems Internet interfaces lo0 unit 0 family inet address 84.120.0.7/32
set logical-systems Internet protocols rsvp interface ge-0/0/0.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/1.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/2.0 link-protection
set logical-systems Internet protocols mpls statistics file mpls-stats
set logical-systems Internet protocols mpls admin-groups blue 4
```

```
set logical-systems Internet protocols mpls admin-groups red 8
set logical-systems Internet protocols mpls admin-groups green 16
set logical-systems Internet protocols mpls label-switched-path ValA-MadB from 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path ValA-MadB to 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path ValA-MadB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValA-MadB node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValA-MadA from 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path ValA-MadA to 84.120.0.1
set logical-systems Internet protocols mpls label-switched-path ValA-MadA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValA-MadA node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValA-BarB from 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path ValA-BarB to 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path ValA-BarB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValA-BarB node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValA-CacA from 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path ValA-CacA to 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path ValA-CacA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValA-CacA node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValA-CacB from 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path ValA-CacB to 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path ValA-CacB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValA-CacB node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValA-BarA from 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path ValA-BarA to 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path ValA-BarA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValA-BarA node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValA-ValB from 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path ValA-ValB to 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path ValA-ValB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValA-ValB node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValA-BilA from 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path ValA-BilA to 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path ValA-BilA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValA-BilA node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValA-BilB from 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path ValA-BilB to 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path ValA-BilB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValA-BilB node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValA-GijA from 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path ValA-GijA to 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path ValA-GijA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValA-GijA node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValA-GijB from 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path ValA-GijB to 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path ValA-GijB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValA-GijB node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValA-SevA from 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path ValA-SevA to 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path ValA-SevA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValA-SevA node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValA-SevB from 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path ValA-SevB to 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path ValA-SevB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValA-SevB node-link-protection
set logical-systems Internet protocols mpls interface ge-0/0/0.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/1.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/2.0 admin-group blue
set logical-systems Internet protocols bgp group ibgp type internal
set logical-systems Internet protocols bgp group ibgp local-address 84.120.0.7
set logical-systems Internet protocols bgp group ibgp family inet unicast
set logical-systems Internet protocols bgp group ibgp family l2vpn signaling
set logical-systems Internet protocols bgp group ibgp export nhs
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.1
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.2
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.3
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.4
set logical-systems Internet protocols ospf traffic-engineering
set logical-systems Internet protocols ospf reference-bandwidth 1000g
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 authentication md5 20 key "$9$-CVgJTQntpB9AvW8LN-
ikq.z3"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 authentication md5 20 key
"$9$rv.eLNGUHf5F.PBIREyrs2g4Di"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 authentication md5 20 key "$9$4tajqCA0Ehr1R-
Vbwg4TzF3tu"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface lo0.0 passive
```

```
set logical-systems Internet policy-options policy-statement nhs term 1 from protocol bgp
set logical-systems Internet policy-options policy-statement nhs term 1 then next-hop self
set logical-systems Internet routing-options router-id 84.120.0.7
set logical-systems Internet routing-options autonomous-system 8296
set interfaces ge-0/0/0 description "to Valencia-B ge-0/0/0"
set interfaces ge-0/0/1 description "to Sevilla-A ge/0/0/1"
set interfaces ge-0/0/2 description "to Barcelona-A ge/0/0/2"
set interfaces ge-0/0/5 description "to Valencia-B ge-0/0/5"
set interfaces ge-0/0/6 description "to Sevilla-A ge/0/0/6"
set interfaces ge-0/0/7 description "to Barcelona-A ge/0/0/7"

root@Valencia-A> }
```

8.10. VALENCIA-B

```
set version 14.1R1.10
set system host-name Valencia-B
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/5 unit 0 description "to Valencia-A ge-0/0/5"
set logical-systems Datos interfaces ge-0/0/5 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/6 unit 0 description "to Sevilla-B ge-0/0/6"
set logical-systems Datos interfaces ge-0/0/6 unit 0 family inet address 10.21.21.126/30
set logical-systems Datos interfaces ge-0/0/6 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/7 unit 0 description "to Barcelona-B ge-0/0/7"
set logical-systems Datos interfaces ge-0/0/7 unit 0 family inet address 10.21.21.62/30
set logical-systems Datos interfaces ge-0/0/7 unit 0 family mpls
set logical-systems Datos interfaces lo0 unit 1 description "Loopback Valencia-B"
set logical-systems Datos interfaces lo0 unit 1 family inet address 10.21.21.8/32
set logical-systems Datos protocols rsvp interface ge-0/0/5.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/6.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/7.0 link-protection
set logical-systems Datos protocols mpls statistics file mpls-stats
set logical-systems Datos protocols mpls admin-groups blue 4
set logical-systems Datos protocols mpls admin-groups red 8
set logical-systems Datos protocols mpls admin-groups green 16
set logical-systems Datos protocols mpls label-switched-path ValB-MadB from 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path ValB-MadB to 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path ValB-MadB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValB-MadB node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValB-MadA from 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path ValB-MadA to 10.21.21.1
set logical-systems Datos protocols mpls label-switched-path ValB-MadA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValB-MadA node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValB-BarB from 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path ValB-BarB to 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path ValB-BarB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValB-BarB node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValB-CacA from 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path ValB-CacA to 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path ValB-CacA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValB-CacA node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValB-CacB from 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path ValB-CacB to 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path ValB-CacB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValB-CacB node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValB-BarA from 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path ValB-BarA to 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path ValB-BarA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValB-BarA node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValB-ValA from 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path ValB-ValA to 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path ValB-ValA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValB-ValA node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValB-BilA from 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path ValB-BilA to 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path ValB-BilA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValB-BilA node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValB-BilB from 10.21.21.8
```

```
set logical-systems Datos protocols mpls label-switched-path ValB-BilB to 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path ValB-BilB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValB-BilB node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValB-GijA from 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path ValB-GijA to 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path ValB-GijA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValB-GijA node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValB-GijB from 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path ValB-GijB to 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path ValB-GijB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValB-GijB node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValB-SevA from 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path ValB-SevA to 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path ValB-SevA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValB-SevA node-link-protection
set logical-systems Datos protocols mpls label-switched-path ValB-SevB from 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path ValB-SevB to 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path ValB-SevB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path ValB-SevB node-link-protection
set logical-systems Datos protocols mpls interface ge-0/0/5.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/6.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/7.0 admin-group blue
set logical-systems Datos protocols bgp group ibgp type internal
set logical-systems Datos protocols bgp group ibgp local-address 10.21.21.8
set logical-systems Datos protocols bgp group ibgp family inet unicast
set logical-systems Datos protocols bgp group ibgp family inet-vpn any
set logical-systems Datos protocols bgp group ibgp family l2vpn signaling
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.1
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.3
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.4
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.5
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.6
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.7
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.2
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.9
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.10
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.11
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.12
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.13
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.14
set logical-systems Datos protocols ospf traffic-engineering
set logical-systems Datos protocols ospf reference-bandwidth 1000g
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 authentication md5 20 key "$9$L6bxb2.mT6/tFnyleK8LZUDjP5"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 authentication md5 20 key "$9$rI8eLNGUHf5F.PBIREyrs2g4Di"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/7.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 authentication md5 20 key "$9$YXgGi6/t1Ic0BxN-dsYP5TQ9A"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1 passive
set logical-systems Datos routing-options router-id 10.21.21.8
set logical-systems Datos routing-options autonomous-system 65500
set logical-systems Internet interfaces ge-0/0/0 unit 0 description "to Valencia-A ge-0/0/0"
set logical-systems Internet interfaces ge-0/0/0 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/1 unit 0 description "to Sevilla-B ge-0/0/1"
set logical-systems Internet interfaces ge-0/0/1 unit 0 family inet address 84.120.0.126/30
set logical-systems Internet interfaces ge-0/0/1 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/2 unit 0 description "to Barcelona-B ge-0/0/2"
set logical-systems Internet interfaces ge-0/0/2 unit 0 family inet address 84.120.0.62/30
set logical-systems Internet interfaces ge-0/0/2 unit 0 family mpls
set logical-systems Internet interfaces lo0 unit 0 description "Loopback Valencia-B"
set logical-systems Internet interfaces lo0 unit 0 family inet address 84.120.0.8/32
set logical-systems Internet protocols rsvp interface ge-0/0/0.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/1.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/2.0 link-protection
set logical-systems Internet protocols mpls statistics file mpls-stats
set logical-systems Internet protocols mpls admin-groups blue 4
set logical-systems Internet protocols mpls admin-groups red 8
set logical-systems Internet protocols mpls admin-groups green 16
set logical-systems Internet protocols mpls label-switched-path ValB-MadB from 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path ValB-MadB to 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path ValB-MadB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValB-MadB node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValB-MadA from 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path ValB-MadA to 84.120.0.1
set logical-systems Internet protocols mpls label-switched-path ValB-MadA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValB-MadA node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValB-BarB from 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path ValB-BarB to 84.120.0.4
```

```
set logical-systems Internet protocols mpls label-switched-path ValB-BarB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValB-BarB node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValB-CacA from 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path ValB-CacA to 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path ValB-CacA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValB-CacA node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValB-CacB from 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path ValB-CacB to 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path ValB-CacB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValB-CacB node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValB-BarA from 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path ValB-BarA to 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path ValB-BarA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValB-BarA node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValB-ValA from 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path ValB-ValA to 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path ValB-ValA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValB-ValA node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValB-BilA from 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path ValB-BilA to 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path ValB-BilA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValB-BilA node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValB-BilB from 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path ValB-BilB to 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path ValB-BilB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValB-BilB node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValB-GijA from 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path ValB-GijA to 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path ValB-GijA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValB-GijA node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValB-GijB from 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path ValB-GijB to 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path ValB-GijB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValB-GijB node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValB-SevA from 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path ValB-SevA to 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path ValB-SevA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValB-SevA node-link-protection
set logical-systems Internet protocols mpls label-switched-path ValB-SevB from 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path ValB-SevB to 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path ValB-SevB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path ValB-SevB node-link-protection
set logical-systems Internet protocols mpls interface ge-0/0/0.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/1.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/2.0 admin-group blue
set logical-systems Internet protocols bgp group ibgp type internal
set logical-systems Internet protocols bgp group ibgp local-address 84.120.0.8
set logical-systems Internet protocols bgp group ibgp family inet unicast
set logical-systems Internet protocols bgp group ibgp family l2vpn signaling
set logical-systems Internet protocols bgp group ibgp export nhs
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.1
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.2
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.3
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.4
set logical-systems Internet protocols ospf traffic-engineering
set logical-systems Internet protocols ospf reference-bandwidth 1000g
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 authentication md5 20 key
"$9$CXXgt1h7Nb4oGYgTzF39CevMW-V"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 authentication md5 20 key
"$9$mf39SyKXxdWLGDji.m0B1Ire"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/2.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 authentication md5 20 key
"$9$e9JvxdDjqTQnP5IEhcle24oaik"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface lo0.0 passive
set logical-systems Internet policy-options policy-statement nhs term 1 from protocol bgp
set logical-systems Internet policy-options policy-statement nhs term 1 then next-hop self
set logical-systems Internet routing-options router-id 84.120.0.8
set logical-systems Internet routing-options autonomous-system 8296
set interfaces ge-0/0/0 description "to Valencia-A ge-0/0/0"
set interfaces ge-0/0/1 description "to Sevilla-B ge/0/0/1"
set interfaces ge-0/0/2 description "to Barcelona-B ge/0/0/2"
set interfaces ge-0/0/5 description "to Valencia-A ge-0/0/5"
set interfaces ge-0/0/6 description "to Sevilla-B ge/0/0/6"
set interfaces ge-0/0/7 description "to Barcelona-B ge/0/0/7"

root@Valencia-B> }
```

8.11. GIJON-A

```
set version 14.1R1.10
set system host-name Gijon-A
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/5 unit 0 description "to Gijon-B ge-0/0/5"
set logical-systems Datos interfaces ge-0/0/5 unit 0 family inet address 10.21.21.113/30
set logical-systems Datos interfaces ge-0/0/5 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/6 unit 0 description "to Bilbao-A ge-0/0/6"
set logical-systems Datos interfaces ge-0/0/6 unit 0 family inet address 10.21.21.109/30
set logical-systems Datos interfaces ge-0/0/6 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/8 unit 0 description "to Caceres-A ge-0/0/8"
set logical-systems Datos interfaces ge-0/0/8 unit 0 family inet address 10.21.21.93/30
set logical-systems Datos interfaces ge-0/0/8 unit 0 family mpls
set logical-systems Datos interfaces lo0 unit 1 description "Loopback Gijon-A"
set logical-systems Datos interfaces lo0 unit 1 family inet address 10.21.21.11/32
set logical-systems Datos protocols rsvp interface ge-0/0/5.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/6.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/8.0 link-protection
set logical-systems Datos protocols mpls statistics file mpls-stats
set logical-systems Datos protocols mpls admin-groups blue 4
set logical-systems Datos protocols mpls admin-groups red 8
set logical-systems Datos protocols mpls admin-groups green 16
set logical-systems Datos protocols mpls label-switched-path GijA-MadB from 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path GijA-MadB to 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path GijA-MadB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijA-MadB node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijA-MadA from 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path GijA-MadA to 10.21.21.1
set logical-systems Datos protocols mpls label-switched-path GijA-MadA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijA-MadA node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijA-BarB from 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path GijA-BarB to 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path GijA-BarB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijA-BarB node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijA-CacA from 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path GijA-CacA to 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path GijA-CacA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijA-CacA node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijA-CacB from 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path GijA-CacB to 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path GijA-CacB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijA-CacB node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijA-BarA from 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path GijA-BarA to 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path GijA-BarA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijA-BarA node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijA-ValB from 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path GijA-ValB to 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path GijA-ValB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijA-ValB node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijA-ValA from 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path GijA-ValA to 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path GijA-ValA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijA-ValA node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijA-BilB from 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path GijA-BilB to 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path GijA-BilB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijA-BilB node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijA-BilA from 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path GijA-BilA to 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path GijA-BilA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijA-BilA node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijA-GijB from 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path GijA-GijB to 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path GijA-GijB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijA-GijB node-link-protection
```

```
set logical-systems Datos protocols mpls label-switched-path GijA-SevA from 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path GijA-SevA to 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path GijA-SevA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijA-SevA node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijA-SevB from 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path GijA-SevB to 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path GijA-SevB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijA-SevB node-link-protection
set logical-systems Datos protocols mpls interface ge-0/0/5.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/6.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/8.0 admin-group blue
set logical-systems Datos protocols bgp group ibgp type internal
set logical-systems Datos protocols bgp group ibgp local-address 10.21.21.11
set logical-systems Datos protocols bgp group ibgp family inet unicast
set logical-systems Datos protocols bgp group ibgp family inet-vpn any
set logical-systems Datos protocols bgp group ibgp family l2vpn signaling
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.1
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.3
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.4
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.5
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.6
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.7
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.8
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.9
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.10
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.2
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.12
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.13
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.14
set logical-systems Datos protocols ospf traffic-engineering
set logical-systems Datos protocols ospf reference-bandwidth 1000g
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 authentication md5 20 key "$9$B3xIyKsYoDjqZU/CAtOBX7N-24"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 authentication md5 20 key
"$9$nZji/u18LNsYoVwmf5T3nSrleX7"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 authentication md5 20 key
"$9$p1o50EydVYJZj4aFn6/tpM8LXbs"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1 passive
set logical-systems Datos routing-options router-id 10.21.21.11
set logical-systems Datos routing-options autonomous-system 65500
set logical-systems Internet interfaces ge-0/0/0 unit 0 description "to Gijon-B ge-0/0/0"
set logical-systems Internet interfaces ge-0/0/0 unit 0 family inet address 84.120.0.113/30
set logical-systems Internet interfaces ge-0/0/0 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/1 unit 0 description "to Bilbao-A ge-0/0/1"
set logical-systems Internet interfaces ge-0/0/1 unit 0 family inet address 84.120.0.109/30
set logical-systems Internet interfaces ge-0/0/1 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/3 unit 0 description "to Caceres-A ge-0/0/3"
set logical-systems Internet interfaces ge-0/0/3 unit 0 family inet address 84.120.0.93/30
set logical-systems Internet interfaces ge-0/0/3 unit 0 family mpls
set logical-systems Internet interfaces lo0 unit 0 description "Loopback Gijon-A"
set logical-systems Internet interfaces lo0 unit 0 family inet address 84.120.0.11/32
set logical-systems Internet protocols rsvp interface ge-0/0/0.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/1.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/3.0 link-protection
set logical-systems Internet protocols mpls statistics file mpls-stats
set logical-systems Internet protocols mpls admin-groups blue 4
set logical-systems Internet protocols mpls admin-groups red 8
set logical-systems Internet protocols mpls admin-groups green 16
set logical-systems Internet protocols mpls label-switched-path GijA-MadB from 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path GijA-MadB to 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path GijA-MadB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijA-MadB node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijA-MadA from 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path GijA-MadA to 84.120.0.1
set logical-systems Internet protocols mpls label-switched-path GijA-MadA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijA-MadA node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijA-BarB from 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path GijA-BarB to 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path GijA-BarB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijA-BarB node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijA-CacA from 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path GijA-CacA to 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path GijA-CacA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijA-CacA node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijA-CacB from 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path GijA-CacB to 84.120.0.6
```

```
set logical-systems Internet protocols mpls label-switched-path GijA-CacB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijA-CacB node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijA-BarA from 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path GijA-BarA to 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path GijA-BarA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijA-BarA node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijA-ValB from 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path GijA-ValB to 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path GijA-ValB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijA-ValB node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijA-ValA from 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path GijA-ValA to 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path GijA-ValA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijA-ValA node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijA-BilB from 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path GijA-BilB to 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path GijA-BilB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijA-BilB node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijA-BilA from 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path GijA-BilA to 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path GijA-BilA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijA-BilA node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijA-GijB from 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path GijA-GijB to 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path GijA-GijB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijA-GijB node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijA-SevA from 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path GijA-SevA to 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path GijA-SevA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijA-SevA node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijA-SevB from 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path GijA-SevB to 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path GijA-SevB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijA-SevB node-link-protection
set logical-systems Internet protocols mpls interface ge-0/0/0.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/1.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/3.0 admin-group blue
set logical-systems Internet protocols bgp group ibgp type internal
set logical-systems Internet protocols bgp group ibgp local-address 84.120.0.11
set logical-systems Internet protocols bgp group ibgp family inet unicast
set logical-systems Internet protocols bgp group ibgp family l2vpn signaling
set logical-systems Internet protocols bgp group ibgp export nhs
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.1
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.2
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.3
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.4
set logical-systems Internet protocols ospf traffic-engineering
set logical-systems Internet protocols ospf reference-bandwidth 1000g
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 authentication md5 20 key
"$9$Nwd2a5T3AtO/CKMW87NjHkqQF"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 authentication md5 20 key
"$9$k.QnEhrW87KMaZGUHktu0Ocy"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 authentication md5 20 key
"$9$0z2pBclbwgGUHaZn/9Cu08Xx7s2"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface lo0.0 passive
set logical-systems Internet policy-options policy-statement nhs term 1 from protocol bgp
set logical-systems Internet policy-options policy-statement nhs term 1 then next-hop self
set logical-systems Internet routing-options router-id 84.120.0.11
set logical-systems Internet routing-options autonomous-system 8296
set interfaces ge-0/0/0 description "to Gijon-B ge-0/0/0"
set interfaces ge-0/0/1 description "to Bilbao-A ge/0/0/1"
set interfaces ge-0/0/3 description "to Caceres-A ge/0/0/3"
set interfaces ge-0/0/5 description "to Gijon-B ge-0/0/5"
set interfaces ge-0/0/6 description "to Bilbao-A ge/0/0/6"
set interfaces ge-0/0/8 description "to Caceres-A ge/0/0/8"

root@Gijon-A> }
```

8.12. GIJON-B

```
set system host-name Gijon-B
set system time-zone Europe/Madrid
```

```
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/5 unit 0 description "to Gijon-A ge-0/0/5"
set logical-systems Datos interfaces ge-0/0/5 unit 0 family inet address 10.21.21.114/30
set logical-systems Datos interfaces ge-0/0/5 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/6 unit 0 description "to Bilbao-B ge-0/0/6"
set logical-systems Datos interfaces ge-0/0/6 unit 0 family inet address 10.21.21.105/30
set logical-systems Datos interfaces ge-0/0/6 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/8 unit 0 description "to Caceres-B ge-0/0/8"
set logical-systems Datos interfaces ge-0/0/8 unit 0 family inet address 10.21.21.97/30
set logical-systems Datos interfaces ge-0/0/8 unit 0 family mpls
set logical-systems Datos interfaces lo0 unit 1 description "Loopback Gijon-B"
set logical-systems Datos interfaces lo0 unit 1 family inet address 10.21.21.12/32
set logical-systems Datos protocols rsvp interface ge-0/0/5.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/6.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/8.0 link-protection
set logical-systems Datos protocols mpls statistics file mpls-stats
set logical-systems Datos protocols mpls admin-groups blue 4
set logical-systems Datos protocols mpls admin-groups red 8
set logical-systems Datos protocols mpls admin-groups green 16
set logical-systems Datos protocols mpls label-switched-path GijB-MadB from 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path GijB-MadB to 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path GijB-MadB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijB-MadB node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijB-MadA from 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path GijB-MadA to 10.21.21.1
set logical-systems Datos protocols mpls label-switched-path GijB-MadA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijB-MadA node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijB-BarB from 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path GijB-BarB to 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path GijB-BarB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijB-BarB node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijB-CacA from 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path GijB-CacA to 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path GijB-CacA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijB-CacA node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijB-CacB from 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path GijB-CacB to 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path GijB-CacB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijB-CacB node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijB-BarA from 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path GijB-BarA to 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path GijB-BarA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijB-BarA node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijB-ValB from 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path GijB-ValB to 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path GijB-ValB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijB-ValB node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijB-ValA from 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path GijB-ValA to 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path GijB-ValA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijB-ValA node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijB-BilB from 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path GijB-BilB to 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path GijB-BilB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijB-BilB node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijB-BilA from 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path GijB-BilA to 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path GijB-BilA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijB-BilA node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijB-GijA from 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path GijB-GijA to 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path GijB-GijA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijB-GijA node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijB-SevA from 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path GijB-SevA to 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path GijB-SevA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijB-SevA node-link-protection
set logical-systems Datos protocols mpls label-switched-path GijB-SevB from 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path GijB-SevB to 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path GijB-SevB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path GijB-SevB node-link-protection
set logical-systems Datos protocols mpls interface ge-0/0/5.0 admin-group blue
```

```
set logical-systems Datos protocols mpls interface ge-0/0/6.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/8.0 admin-group blue
set logical-systems Datos protocols bgp group ibgp type internal
set logical-systems Datos protocols bgp group ibgp local-address 10.21.21.12
set logical-systems Datos protocols bgp group ibgp family inet unicast
set logical-systems Datos protocols bgp group ibgp family inet-vpn any
set logical-systems Datos protocols bgp group ibgp family l2vpn signaling
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.1
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.3
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.4
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.5
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.6
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.7
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.8
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.9
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.10
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.11
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.2
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.13
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.14
set logical-systems Datos protocols ospf traffic-engineering
set logical-systems Datos protocols ospf reference-bandwidth 1000g
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 authentication md5 20 key "$9$RJYheWg4ZHkPDiApu0IRNdVboJ"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 authentication md5 20 key "$9$awZHmtpBcSeRhVwsYoaz3n6uO"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/8.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 authentication md5 20 key "$9$L.Axb2.mT6/tFnyleK8LZUDjP5"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection minimum-interval 50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1 passive
set logical-systems Datos routing-options router-id 10.21.21.12
set logical-systems Datos routing-options autonomous-system 65500
set logical-systems Internet interfaces ge-0/0/0 unit 0 description "to Gijon-A ge-0/0/0"
set logical-systems Internet interfaces ge-0/0/0 unit 0 family inet address 84.120.0.114/30
set logical-systems Internet interfaces ge-0/0/0 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/1 unit 0 description "to Bilbao-B ge-0/0/1"
set logical-systems Internet interfaces ge-0/0/1 unit 0 family inet address 84.120.0.105/30
set logical-systems Internet interfaces ge-0/0/1 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/3 unit 0 description "to Caceres-B ge-0/0/3"
set logical-systems Internet interfaces ge-0/0/3 unit 0 family inet address 84.120.0.97/30
set logical-systems Internet interfaces ge-0/0/3 unit 0 family mpls
set logical-systems Internet interfaces lo0 unit 0 description "Loopback Gijon-B"
set logical-systems Internet interfaces lo0 unit 0 family inet address 84.120.0.12/32
set logical-systems Internet protocols rsvp interface ge-0/0/0.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/1.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/3.0 link-protection
set logical-systems Internet protocols mpls statistics file mpls-stats
set logical-systems Internet protocols mpls admin-groups blue 4
set logical-systems Internet protocols mpls admin-groups red 8
set logical-systems Internet protocols mpls admin-groups green 16
set logical-systems Internet protocols mpls label-switched-path GijB-MadB from 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path GijB-MadB to 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path GijB-MadB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijB-MadB node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijB-MadA from 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path GijB-MadA to 84.120.0.1
set logical-systems Internet protocols mpls label-switched-path GijB-MadA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijB-MadA node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijB-BarB from 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path GijB-BarB to 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path GijB-BarB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijB-BarB node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijB-CacA from 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path GijB-CacA to 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path GijB-CacA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijB-CacA node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijB-CacB from 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path GijB-CacB to 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path GijB-CacB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijB-CacB node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijB-BarA from 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path GijB-BarA to 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path GijB-BarA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijB-BarA node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijB-ValB from 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path GijB-ValB to 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path GijB-ValB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijB-ValB node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijB-ValA from 84.120.0.12
```

```
set logical-systems Internet protocols mpls label-switched-path GijB-ValA to 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path GijB-ValA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijB-ValA node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijB-BilB from 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path GijB-BilB to 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path GijB-BilB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijB-BilB node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijB-BilA from 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path GijB-BilA to 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path GijB-BilA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijB-BilA node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijB-GijA from 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path GijB-GijA to 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path GijB-GijA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijB-GijA node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijB-SevA from 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path GijB-SevA to 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path GijB-SevA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijB-SevA node-link-protection
set logical-systems Internet protocols mpls label-switched-path GijB-SevB from 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path GijB-SevB to 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path GijB-SevB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path GijB-SevB node-link-protection
set logical-systems Internet protocols mpls interface ge-0/0/0.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/1.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/3.0 admin-group blue
set logical-systems Internet protocols bgp group ibgp type internal
set logical-systems Internet protocols bgp group ibgp local-address 84.120.0.12
set logical-systems Internet protocols bgp group ibgp family inet unicast
set logical-systems Internet protocols bgp group ibgp family l2vpn signaling
set logical-systems Internet protocols bgp group ibgp export nhs
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.1
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.2
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.3
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.4
set logical-systems Internet protocols ospf traffic-engineering
set logical-systems Internet protocols ospf reference-bandwidth 1000g
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 authentication md5 20 key
"$9$wvYJD3nCOBEp0Lx7Nbw.Pf569"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 authentication md5 20 key
"$9$zcFA3A0vMXVb2Ndk.mPQzEcSyWL"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/3.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 authentication md5 20 key "$9$IzDElM2gJiHmUjCtpu1I7-
dV4a"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection minimum-interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface lo0.0 passive
set logical-systems Internet policy-options policy-statement nhs term 1 from protocol bgp
set logical-systems Internet policy-options policy-statement nhs term 1 then next-hop self
set logical-systems Internet routing-options router-id 84.120.0.12
set logical-systems Internet routing-options autonomous-system 8296
set interfaces ge-0/0/0 description "to Gijon-A ge-0/0/0"
set interfaces ge-0/0/1 description "to Bilbao-B ge/0/0/1"
set interfaces ge-0/0/3 description "to Caceres-B ge/0/0/3"
set interfaces ge-0/0/5 description "to Gijon-A ge-0/0/5"
set interfaces ge-0/0/6 description "to Bilbao-B ge/0/0/6"
set interfaces ge-0/0/8 description "to Caceres-B ge/0/0/8"

root@Gijon-B> }
```

8.13. SEVILLA-A

```
set version 14.1R1.10
set system host-name Sevilla-A
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
```

```
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/5 unit 0 description "to Sevilla-B ge-0/0/5"
set logical-systems Datos interfaces ge-0/0/5 unit 0 family inet address 10.21.21.73/30
set logical-systems Datos interfaces ge-0/0/5 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/6 unit 0 description "to Valencia-A ge-0/0/6"
set logical-systems Datos interfaces ge-0/0/6 unit 0 family inet address 10.21.21.69/30
set logical-systems Datos interfaces ge-0/0/6 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/9 unit 0 description "to Caceres-A ge-0/0/9"
set logical-systems Datos interfaces ge-0/0/9 unit 0 family inet address 10.21.21.82/30
set logical-systems Datos interfaces ge-0/0/9 unit 0 family mpls
set logical-systems Datos interfaces lo0 unit 1 description "Loopback Sevilla A"
set logical-systems Datos interfaces lo0 unit 1 family inet address 10.21.21.13/32
set logical-systems Datos protocols rsvp interface ge-0/0/5.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/6.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/9.0 link-protection
set logical-systems Datos protocols mpls statistics file mpls-stats
set logical-systems Datos protocols mpls admin-groups blue 4
set logical-systems Datos protocols mpls admin-groups red 8
set logical-systems Datos protocols mpls admin-groups green 16
set logical-systems Datos protocols mpls label-switched-path SevA-MadB from 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path SevA-MadB to 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path SevA-MadB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevA-MadB node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevA-MadA from 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path SevA-MadA to 10.21.21.1
set logical-systems Datos protocols mpls label-switched-path SevA-MadA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevA-MadA node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevA-BarB from 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path SevA-BarB to 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path SevA-BarB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevA-BarB node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevA-BarA from 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path SevA-BarA to 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path SevA-BarA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevA-BarA node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevA-CacB from 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path SevA-CacB to 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path SevA-CacB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevA-CacB node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevA-ValA from 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path SevA-ValA to 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path SevA-ValA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevA-ValA node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevA-ValB from 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path SevA-ValB to 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path SevA-ValB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevA-ValB node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevA-BilA from 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path SevA-BilA to 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path SevA-BilA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevA-BilA node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevA-BilB from 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path SevA-BilB to 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path SevA-BilB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevA-BilB node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevA-GijA from 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path SevA-GijA to 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path SevA-GijA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevA-GijA node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevA-GijB from 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path SevA-GijB to 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path SevA-GijB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevA-GijB node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevA-CacA from 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path SevA-CacA to 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path SevA-CacA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevA-CacA node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevA-SevB from 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path SevA-SevB to 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path SevA-SevB admin-group include-any blue
```

```
set logical-systems Datos protocols mpls label-switched-path SevA-SevB node-link-protection
set logical-systems Datos protocols mpls interface ge-0/0/5.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/6.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/9.0 admin-group blue
set logical-systems Datos protocols bgp group ibgp type internal
set logical-systems Datos protocols bgp group ibgp local-address 10.21.21.13
set logical-systems Datos protocols bgp group ibgp family inet unicast
set logical-systems Datos protocols bgp group ibgp family inet-vpn any
set logical-systems Datos protocols bgp group ibgp family l2vpn signaling
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.1
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.3
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.4
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.5
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.6
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.7
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.8
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.9
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.10
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.11
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.12
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.2
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.14
set logical-systems Datos protocols ospf traffic-engineering
set logical-systems Datos protocols ospf reference-bandwidth 1000g
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 authentication md5 20 key
"$9$aEZHmtpBcSeRhVwsYoaz3n6uO"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection minimum-interval
50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 authentication md5 20 key "$9$.PF/cSeLX-
M8ZUDjq.uOB1yl"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 bfd-liveness-detection minimum-interval
50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 authentication md5 20 key
"$9$4RajqCA0Ehr1R-Vbwg4TzF3tu"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection minimum-interval
50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1 passive
set logical-systems Datos routing-options router-id 10.21.21.13
set logical-systems Datos routing-options autonomous-system 65500
set logical-systems Internet interfaces ge-0/0/0 unit 0 description "to Sevilla-B ge-0/0/0"
set logical-systems Internet interfaces ge-0/0/0 unit 0 family inet address 84.120.0.73/30
set logical-systems Internet interfaces ge-0/0/0 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/1 unit 0 description "to Valencia-A ge-0/0/1"
set logical-systems Internet interfaces ge-0/0/1 unit 0 family inet address 84.120.0.69/30
set logical-systems Internet interfaces ge-0/0/1 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/4 unit 0 description "to Caceres-A ge-0/0/4"
set logical-systems Internet interfaces ge-0/0/4 unit 0 family inet address 84.120.0.82/30
set logical-systems Internet interfaces ge-0/0/4 unit 0 family mpls
set logical-systems Internet interfaces lo0 unit 0 description "Loopback Sevilla A"
set logical-systems Internet interfaces lo0 unit 0 family inet address 84.120.0.13/32
set logical-systems Internet protocols rsvp interface ge-0/0/0.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/1.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/4.0 link-protection
set logical-systems Internet protocols mpls statistics file mpls-stats
set logical-systems Internet protocols mpls admin-groups blue 4
set logical-systems Internet protocols mpls admin-groups red 8
set logical-systems Internet protocols mpls admin-groups green 16
set logical-systems Internet protocols mpls no-propagate-ttl
set logical-systems Internet protocols mpls label-switched-path SevA-MadB from 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path SevA-MadB to 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path SevA-MadB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevA-MadB node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevA-MadA from 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path SevA-MadA to 84.120.0.1
set logical-systems Internet protocols mpls label-switched-path SevA-MadA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevA-MadA node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevA-BarB from 84.120.0.13
```

```
set logical-systems Internet protocols mpls label-switched-path SevA-BarB to 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path SevA-BarB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevA-BarB node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevA-BarA from 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path SevA-BarA to 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path SevA-BarA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevA-BarA node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevA-CacB from 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path SevA-CacB to 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path SevA-CacB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevA-CacB node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevA-ValA from 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path SevA-ValA to 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path SevA-ValA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevA-ValA node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevA-ValB from 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path SevA-ValB to 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path SevA-ValB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevA-ValB node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevA-BilA from 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path SevA-BilA to 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path SevA-BilA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevA-BilA node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevA-BilB from 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path SevA-BilB to 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path SevA-BilB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevA-BilB node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevA-GijA from 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path SevA-GijA to 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path SevA-GijA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevA-GijA node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevA-GijB from 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path SevA-GijB to 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path SevA-GijB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevA-GijB node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevA-CacA from 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path SevA-CacA to 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path SevA-CacA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevA-CacA node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevA-SevB from 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path SevA-SevB to 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path SevA-SevB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevA-SevB node-link-protection
set logical-systems Internet protocols mpls interface ge-0/0/0.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/1.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/4.0 admin-group blue
set logical-systems Internet protocols bgp group ibgp type internal
set logical-systems Internet protocols bgp group ibgp local-address 84.120.0.13
set logical-systems Internet protocols bgp group ibgp family inet unicast
set logical-systems Internet protocols bgp group ibgp family l2vpn signaling
set logical-systems Internet protocols bgp group ibgp export nhs
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.1
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.2
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.3
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.4
set logical-systems Internet protocols ospf traffic-engineering
set logical-systems Internet protocols ospf reference-bandwidth 1000g
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 authentication md5 20 key
"$9$If5ElM2gJiHmUjCtpu1I7-dV4a"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection minimum-
interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 authentication md5 20 key
"$9$dxb4ZQz6pu1CtM8LX-dHq.mFn"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 bfd-liveness-detection minimum-
interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 authentication md5 20 key
"$9$FQ90ntOMWxbwg-VqmPfzFhSyr8X"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection minimum-
interval 50
```

```
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface lo0.0 passive
set logical-systems Internet policy-options policy-statement nhs term 1 from protocol bgp
set logical-systems Internet policy-options policy-statement nhs term 1 then next-hop self
set logical-systems Internet routing-options router-id 84.120.0.13
set logical-systems Internet routing-options autonomous-system 8296
set interfaces ge-0/0/0 description "to Sevilla-B ge-0/0/0"
set interfaces ge-0/0/1 description "to Valencia-A ge/0/0/1"
set interfaces ge-0/0/4 description "to Caceres-A ge/0/0/4"
set interfaces ge-0/0/5 description "to Sevilla-B ge-0/0/5"
set interfaces ge-0/0/6 description "to Valencia-A ge/0/0/6"
set interfaces ge-0/0/9 description "to Caceres-A ge/0/0/9"

root@Sevilla-A> }
```

8.14. SEVILLA-B

```
set system host-name Sevilla-B
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/5 unit 0 description "to Sevilla-A ge-0/0/5"
set logical-systems Datos interfaces ge-0/0/5 unit 0 family inet address 10.21.21.74/30
set logical-systems Datos interfaces ge-0/0/5 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/6 unit 0 description "to Valencia-B ge-0/0/6"
set logical-systems Datos interfaces ge-0/0/6 unit 0 family inet address 10.21.21.125/30
set logical-systems Datos interfaces ge-0/0/6 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/9 unit 0 description "to Caceres-B ge-0/0/9"
set logical-systems Datos interfaces ge-0/0/9 unit 0 family inet address 10.21.21.78/30
set logical-systems Datos interfaces ge-0/0/9 unit 0 family mpls
set logical-systems Datos interfaces lo0 unit 1 description "Loopback Sevilla B"
set logical-systems Datos interfaces lo0 unit 1 family inet address 10.21.21.14/32
set logical-systems Datos protocols rsvp interface ge-0/0/5.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/6.0 link-protection
set logical-systems Datos protocols rsvp interface ge-0/0/9.0 link-protection
set logical-systems Datos protocols mpls statistics file mpls-stats
set logical-systems Datos protocols mpls admin-groups blue 4
set logical-systems Datos protocols mpls admin-groups red 8
set logical-systems Datos protocols mpls admin-groups green 16
set logical-systems Datos protocols mpls label-switched-path SevB-MadB from 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path SevB-MadB to 10.21.21.2
set logical-systems Datos protocols mpls label-switched-path SevB-MadB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevB-MadB node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevB-MadA from 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path SevB-MadA to 10.21.21.1
set logical-systems Datos protocols mpls label-switched-path SevB-MadA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevB-MadA node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevB-BarB from 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path SevB-BarB to 10.21.21.4
set logical-systems Datos protocols mpls label-switched-path SevB-BarB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevB-BarB node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevB-BarA from 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path SevB-BarA to 10.21.21.3
set logical-systems Datos protocols mpls label-switched-path SevB-BarA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevB-BarA node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevB-CacB from 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path SevB-CacB to 10.21.21.6
set logical-systems Datos protocols mpls label-switched-path SevB-CacB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevB-CacB node-link-protection
```

```
set logical-systems Datos protocols mpls label-switched-path SevB-ValA from 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path SevB-ValA to 10.21.21.7
set logical-systems Datos protocols mpls label-switched-path SevB-ValA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevB-ValA node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevB-ValB from 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path SevB-ValB to 10.21.21.8
set logical-systems Datos protocols mpls label-switched-path SevB-ValB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevB-ValB node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevB-BilA from 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path SevB-BilA to 10.21.21.9
set logical-systems Datos protocols mpls label-switched-path SevB-BilA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevB-BilA node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevB-BilB from 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path SevB-BilB to 10.21.21.10
set logical-systems Datos protocols mpls label-switched-path SevB-BilB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevB-BilB node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevB-GijA from 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path SevB-GijA to 10.21.21.11
set logical-systems Datos protocols mpls label-switched-path SevB-GijA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevB-GijA node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevB-GijB from 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path SevB-GijB to 10.21.21.12
set logical-systems Datos protocols mpls label-switched-path SevB-GijB admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevB-GijB node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevB-CacA from 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path SevB-CacA to 10.21.21.5
set logical-systems Datos protocols mpls label-switched-path SevB-CacA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevB-CacA node-link-protection
set logical-systems Datos protocols mpls label-switched-path SevB-SevA from 10.21.21.14
set logical-systems Datos protocols mpls label-switched-path SevB-SevA to 10.21.21.13
set logical-systems Datos protocols mpls label-switched-path SevB-SevA admin-group include-any blue
set logical-systems Datos protocols mpls label-switched-path SevB-SevA node-link-protection
set logical-systems Datos protocols mpls interface ge-0/0/5.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/6.0 admin-group blue
set logical-systems Datos protocols mpls interface ge-0/0/9.0 admin-group blue
set logical-systems Datos protocols bgp group ibgp type internal
set logical-systems Datos protocols bgp group ibgp local-address 10.21.21.14
set logical-systems Datos protocols bgp group ibgp family inet unicast
set logical-systems Datos protocols bgp group ibgp family inet-vpn any
set logical-systems Datos protocols bgp group ibgp family l2vpn signaling
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.1
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.3
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.4
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.5
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.6
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.7
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.8
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.9
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.10
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.11
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.12
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.13
set logical-systems Datos protocols bgp group ibgp neighbor 10.21.21.2
set logical-systems Datos protocols ospf traffic-engineering
set logical-systems Datos protocols ospf reference-bandwidth 1000g
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 authentication md5 20 key
"$9$e5evxdDjqTQnP5IEhcle24oaik"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection minimum-interval
50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/5.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 authentication md5 20 key
"$9$SZ8rWxJZjmPQk.0B1IcSbsY2GD"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 bfd-liveness-detection minimum-interval
50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0 bfd-liveness-detection
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 interface-type p2p
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 authentication md5 20 key
"$9$S/lrWxJZjmPQk.0B1IcSbsY2GD"
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection minimum-interval
50
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/6.0 bfd-liveness-detection
```

```
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1 passive
set logical-systems Datos routing-options router-id 10.21.21.14
set logical-systems Datos routing-options autonomous-system 65500
set logical-systems Internet interfaces ge-0/0/0 unit 0 description "to Sevilla-A ge-0/0/0"
set logical-systems Internet interfaces ge-0/0/0 unit 0 family inet address 84.120.0.74/30
set logical-systems Internet interfaces ge-0/0/0 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/1 unit 0 description "to Valencia-B ge-0/0/1"
set logical-systems Internet interfaces ge-0/0/1 unit 0 family inet address 84.120.0.125/30
set logical-systems Internet interfaces ge-0/0/1 unit 0 family mpls
set logical-systems Internet interfaces ge-0/0/4 unit 0 description "to Caceres-B ge-0/0/4"
set logical-systems Internet interfaces ge-0/0/4 unit 0 family inet address 84.120.0.78/30
set logical-systems Internet interfaces ge-0/0/4 unit 0 family mpls
set logical-systems Internet interfaces lo0 unit 0 description "Loopback Sevilla B"
set logical-systems Internet interfaces lo0 unit 0 family inet address 84.120.0.14/32
set logical-systems Internet protocols rsvp interface ge-0/0/0.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/1.0 link-protection
set logical-systems Internet protocols rsvp interface ge-0/0/4.0 link-protection
set logical-systems Internet protocols mpls statistics file mpls-stats
set logical-systems Internet protocols mpls admin-groups blue 4
set logical-systems Internet protocols mpls admin-groups red 8
set logical-systems Internet protocols mpls admin-groups green 16
set logical-systems Internet protocols mpls label-switched-path SevB-MadB from 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path SevB-MadB to 84.120.0.2
set logical-systems Internet protocols mpls label-switched-path SevB-MadB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevB-MadB node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevB-MadA from 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path SevB-MadA to 84.120.0.1
set logical-systems Internet protocols mpls label-switched-path SevB-MadA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevB-MadA node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevB-BarB from 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path SevB-BarB to 84.120.0.4
set logical-systems Internet protocols mpls label-switched-path SevB-BarB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevB-BarB node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevB-BarA from 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path SevB-BarA to 84.120.0.3
set logical-systems Internet protocols mpls label-switched-path SevB-BarA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevB-BarA node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevB-CacB from 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path SevB-CacB to 84.120.0.6
set logical-systems Internet protocols mpls label-switched-path SevB-CacB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevB-CacB node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevB-ValA from 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path SevB-ValA to 84.120.0.7
set logical-systems Internet protocols mpls label-switched-path SevB-ValA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevB-ValA node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevB-ValB from 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path SevB-ValB to 84.120.0.8
set logical-systems Internet protocols mpls label-switched-path SevB-ValB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevB-ValB node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevB-BilA from 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path SevB-BilA to 84.120.0.9
set logical-systems Internet protocols mpls label-switched-path SevB-BilA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevB-BilA node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevB-BilB from 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path SevB-BilB to 84.120.0.10
set logical-systems Internet protocols mpls label-switched-path SevB-BilB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevB-BilB node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevB-GijA from 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path SevB-GijA to 84.120.0.11
set logical-systems Internet protocols mpls label-switched-path SevB-GijA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevB-GijA node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevB-GijB from 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path SevB-GijB to 84.120.0.12
set logical-systems Internet protocols mpls label-switched-path SevB-GijB admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevB-GijB node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevB-CacA from 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path SevB-CacA to 84.120.0.5
set logical-systems Internet protocols mpls label-switched-path SevB-CacA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevB-CacA node-link-protection
set logical-systems Internet protocols mpls label-switched-path SevB-SevA from 84.120.0.14
set logical-systems Internet protocols mpls label-switched-path SevB-SevA to 84.120.0.13
set logical-systems Internet protocols mpls label-switched-path SevB-SevA admin-group include-any blue
set logical-systems Internet protocols mpls label-switched-path SevB-SevA node-link-protection
set logical-systems Internet protocols mpls interface ge-0/0/0.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/1.0 admin-group blue
set logical-systems Internet protocols mpls interface ge-0/0/4.0 admin-group blue
```

```
set logical-systems Internet protocols bgp group ibgp type internal
set logical-systems Internet protocols bgp group ibgp local-address 84.120.0.14
set logical-systems Internet protocols bgp group ibgp family inet unicast
set logical-systems Internet protocols bgp group ibgp family l2vpn signaling
set logical-systems Internet protocols bgp group ibgp export nhs
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.1
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.2
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.3
set logical-systems Internet protocols bgp group ibgp neighbor 84.120.0.4
set logical-systems Internet protocols ospf traffic-engineering
set logical-systems Internet protocols ospf reference-bandwidth 1000g
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 authentication md5 20 key
"$9$9w07ABEx7Vg4Zs25QzF/9lKvMNd"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection minimum-
interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/0.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 authentication md5 20 key
"$9$LUixb2.mT6/tFnyleK8LZUDjP5"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 bfd-liveness-detection minimum-
interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/4.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 interface-type p2p
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 authentication md5 20 key
"$9$VXwoGzF/u0IApWLXxdVk.mP36"
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection minimum-
interval 50
set logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection multiplier 3
deactivate logical-systems Internet protocols ospf area 0.0.0.0 interface ge-0/0/1.0 bfd-liveness-detection
set logical-systems Internet protocols ospf area 0.0.0.0 interface lo0.0 passive
set logical-systems Internet policy-options policy-statement nhs term 1 from protocol bgp
set logical-systems Internet policy-options policy-statement nhs term 1 then next-hop self
set logical-systems Internet routing-options router-id 84.120.0.14
set logical-systems Internet routing-options autonomous-system 8296
set interfaces ge-0/0/0 description "to Sevilla-A ge-0/0/0"
set interfaces ge-0/0/1 description "to Valencia-B ge/0/0/1"
set interfaces ge-0/0/4 description "to Caceres-B ge/0/0/4"
set interfaces ge-0/0/5 description "to Sevilla-A ge-0/0/5"
set interfaces ge-0/0/6 description "to Valencia-B ge/0/0/6"
set interfaces ge-0/0/9 description "to Caceres-B ge/0/0/9"

root@Sevilla-B> }
```

8.15. MAD-PE-A

```
set version 14.1R1.10
set system host-name Madrid-PE-A
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/3 unit 0 description "To Madrid-EPC-A ge-0/0/3"
set logical-systems Datos interfaces ge-0/0/3 unit 0 family inet address 172.22.128.45/30
set logical-systems Datos interfaces ge-0/0/3 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/4 unit 0 description "to Madrid A ge-0/0/6"
set logical-systems Datos interfaces ge-0/0/4 unit 0 family inet address 172.22.128.37/30
set logical-systems Datos interfaces ge-0/0/4 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/9 unit 0 description "to Madrid-PE-B ge-0/0/11"
```

```
set logical-systems Datos interfaces ge-0/0/9 unit 0 family inet address 172.22.128.41/30
set logical-systems Datos interfaces ge-0/0/9 unit 0 family mpls
set logical-systems Datos interfaces lo0 unit 1 description "Loopback Madrid-PE-A"
set logical-systems Datos interfaces lo0 unit 1 family inet address 172.22.128.129/32
set logical-systems Datos protocols mpls traffic-engineering bgp-igp
set logical-systems Datos protocols mpls icmp-tunneling
set logical-systems Datos protocols mpls interface ge-0/0/4.0
set logical-systems Datos protocols mpls interface ge-0/0/3.0
set logical-systems Datos protocols bgp group toCore import Redes-EPC-CarrierImport
set logical-systems Datos protocols bgp group toCore export internal
set logical-systems Datos protocols bgp group toCore peer-as 65500
set logical-systems Datos protocols bgp group toCore neighbor 172.22.128.38 family inet labeled-unicast
set logical-systems Datos protocols bgp group internal type internal
set logical-systems Datos protocols bgp group internal local-address 172.22.128.129
set logical-systems Datos protocols bgp group internal neighbor 172.22.128.131 family inet labeled-unicast
set logical-systems Datos protocols bgp group internal neighbor 172.22.128.130 family inet labeled-unicast
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/3.0
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0
set logical-systems Datos protocols ldp interface ge-0/0/3.0
deactivate logical-systems Datos protocols ldp interface ge-0/0/3.0
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 from route-filter
172.22.0.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 from route-filter
172.22.128.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 from route-filter
10.0.0.0/8 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 then accept
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 2 then reject
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 from route-filter
172.22.128.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 from route-filter
172.22.0.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 from route-filter
10.0.0.0/8 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 then accept
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 2 then reject
set logical-systems Datos policy-options policy-statement internal term 1 from protocol ospf
set logical-systems Datos policy-options policy-statement internal term 1 from protocol direct
set logical-systems Datos policy-options policy-statement internal term 1 then accept
set logical-systems Datos policy-options policy-statement internal term 2 then reject
set logical-systems Datos routing-options router-id 172.22.128.129
set logical-systems Datos routing-options autonomous-system 65501
set interfaces ge-0/0/3 description "To Madrid-EPC-A ge-0/0/3"
set interfaces ge-0/0/4 description "to Madrid A ge-0/0/6"
set interfaces ge-0/0/9 description "to Madrid-PE-B ge-0/0/9"

root@Madrid-PE-A> }
```

8.16. MAD-PE-B

```
set version 14.1R1.10
set system host-name Madrid-PE-B
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/3 unit 0 description "To Madrid-EPC-B ge-0/0/3"
set logical-systems Datos interfaces ge-0/0/3 unit 0 family inet address 172.22.128.53/30
set logical-systems Datos interfaces ge-0/0/3 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/4 unit 0 description "to Madrid A ge-0/0/6"
set logical-systems Datos interfaces ge-0/0/4 unit 0 family inet address 172.22.128.49/30
```

```
set logical-systems Datos interfaces ge-0/0/4 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/9 unit 0 description "to Madrid-PE-B ge-0/0/11"
set logical-systems Datos interfaces ge-0/0/9 unit 0 family inet address 172.22.128.42/30
set logical-systems Datos interfaces ge-0/0/9 unit 0 family mpls
set logical-systems Datos interfaces lo0 unit 1 description "Loopback Madrid-PE-A"
set logical-systems Datos interfaces lo0 unit 1 family inet address 172.22.128.130/32
set logical-systems Datos protocols mpls traffic-engineering bgp-igp
set logical-systems Datos protocols mpls interface ge-0/0/4.0
set logical-systems Datos protocols mpls interface ge-0/0/3.0
set logical-systems Datos protocols bgp group toCore import Redes-EPC-CarrierImport
set logical-systems Datos protocols bgp group toCore export internal
set logical-systems Datos protocols bgp group toCore peer-as 65500
set logical-systems Datos protocols bgp group toCore neighbor 172.22.128.50 family inet labeled-unicast
set logical-systems Datos protocols bgp group internal type internal
set logical-systems Datos protocols bgp group internal local-address 172.22.128.130
set logical-systems Datos protocols bgp group internal neighbor 172.22.128.132 family inet labeled-unicast
set logical-systems Datos protocols bgp group internal neighbor 172.22.128.129 family inet labeled-unicast
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/3.0
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0
set logical-systems Datos protocols ldp interface ge-0/0/3.0
deactivate logical-systems Datos protocols ldp interface ge-0/0/3.0
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 from route-filter
172.22.0.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 from route-filter
172.22.128.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 from route-filter
10.0.0.0/8 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 then accept
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 2 then reject
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 from route-filter
172.22.128.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 from route-filter
172.22.0.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 from route-filter
10.0.0.0/8 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 then accept
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 2 then reject
set logical-systems Datos policy-options policy-statement internal term 1 from protocol ospf
set logical-systems Datos policy-options policy-statement internal term 1 from protocol direct
set logical-systems Datos policy-options policy-statement internal term 1 then accept
set logical-systems Datos policy-options policy-statement internal term 2 then reject
set logical-systems Datos routing-options router-id 172.22.128.130
set logical-systems Datos routing-options autonomous-system 65501
set interfaces ge-0/0/3 description "To Madrid-EPC-A ge-0/0/3"
set interfaces ge-0/0/4 description "to Madrid A ge-0/0/6"
set interfaces ge-0/0/9 description "to Madrid-PE-B ge-0/0/9"

root@Madrid-PE-B> }
```

8.17. BCN-PE-A

```
set version 14.1R1.10
set system host-name BCN-PE-A
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/3 unit 0 description "To BCN-EPC-A ge-0/0/3"
set logical-systems Datos interfaces ge-0/0/3 unit 0 family inet address 172.22.0.45/30
set logical-systems Datos interfaces ge-0/0/3 unit 0 family mpls
```

```
set logical-systems Datos interfaces ge-0/0/4 unit 0 description "to Madrid A ge-0/0/6"
set logical-systems Datos interfaces ge-0/0/4 unit 0 family inet address 172.22.0.37/30
set logical-systems Datos interfaces ge-0/0/4 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/9 unit 0 description "to BCN-PE-B ge-0/0/9"
set logical-systems Datos interfaces ge-0/0/9 unit 0 family inet address 172.22.0.41/30
set logical-systems Datos interfaces ge-0/0/9 unit 0 family mpls
set logical-systems Datos interfaces lo0 unit 1 description "Loopback Madrid-PE-A"
set logical-systems Datos interfaces lo0 unit 1 family inet address 172.22.0.129/32
set logical-systems Datos protocols mpls traffic-engineering bgp-igp
set logical-systems Datos protocols mpls icmp-tunneling
set logical-systems Datos protocols mpls interface ge-0/0/4.0
set logical-systems Datos protocols mpls interface ge-0/0/3.0
set logical-systems Datos protocols bgp group toCore export internal
set logical-systems Datos protocols bgp group toCore peer-as 65500
set logical-systems Datos protocols bgp group toCore neighbor 172.22.0.38 family inet labeled-unicast
set logical-systems Datos protocols bgp group internal type internal
set logical-systems Datos protocols bgp group internal local-address 172.22.0.129
set logical-systems Datos protocols bgp group internal neighbor 172.22.0.131 family inet labeled-unicast
set logical-systems Datos protocols bgp group internal neighbor 172.22.0.130 family inet labeled-unicast
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/3.0
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1 passive
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0
set logical-systems Datos protocols ldp interface ge-0/0/3.0
deactivate logical-systems Datos protocols ldp
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 from route-filter
10.0.0.0/8 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 from route-filter
10.0.0.0/8 orlonger
set logical-systems Datos policy-options policy-statement internal term 1 from protocol ospf
set logical-systems Datos policy-options policy-statement internal term 1 from protocol direct
set logical-systems Datos policy-options policy-statement internal term 1 then accept
set logical-systems Datos policy-options policy-statement internal term 2 then reject
set logical-systems Datos routing-options router-id 172.22.0.129
set logical-systems Datos routing-options autonomous-system 65501
set interfaces ge-0/0/3 description "To Madrid-EPC-A ge-0/0/3"
set interfaces ge-0/0/4 description "to Madrid A ge-0/0/6"
set interfaces ge-0/0/9 description "to BCN-PE-B ge-0/0/9"

root@BCN-PE-A> }
```

8.18. BCN-PE-B

```
set version 14.1R1.10
set system host-name BCN-PE-B
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/3 unit 0 description "To BCN-EPC-B ge-0/0/3"
set logical-systems Datos interfaces ge-0/0/3 unit 0 family inet address 172.22.0.53/30
set logical-systems Datos interfaces ge-0/0/3 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/4 unit 0 description "to BCN A ge-0/0/6"
set logical-systems Datos interfaces ge-0/0/4 unit 0 family inet address 172.22.0.49/30
set logical-systems Datos interfaces ge-0/0/4 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/9 unit 0 description "to BCN-PE-B ge-0/0/11"
set logical-systems Datos interfaces ge-0/0/9 unit 0 family inet address 172.22.0.42/30
set logical-systems Datos interfaces ge-0/0/9 unit 0 family mpls
set logical-systems Datos interfaces lo0 unit 1 description "Loopback Madrid-PE-A"
set logical-systems Datos interfaces lo0 unit 1 family inet address 172.22.0.130/32
set logical-systems Datos protocols mpls traffic-engineering bgp-igp
set logical-systems Datos protocols mpls interface ge-0/0/4.0
```

```
set logical-systems Datos protocols mpls interface ge-0/0/3.0
set logical-systems Datos protocols bgp group toCore export internal
set logical-systems Datos protocols bgp group toCore peer-as 65500
set logical-systems Datos protocols bgp group toCore neighbor 172.22.0.50 family inet labeled-unicast
set logical-systems Datos protocols bgp group internal type internal
set logical-systems Datos protocols bgp group internal local-address 172.22.0.130
set logical-systems Datos protocols bgp group internal neighbor 172.22.0.132 family inet labeled-unicast
set logical-systems Datos protocols bgp group internal neighbor 172.22.0.129 family inet labeled-unicast
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/3.0
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/9.0
set logical-systems Datos protocols ldp interface ge-0/0/3.0
deactivate logical-systems Datos protocols ldp interface ge-0/0/3.0
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 from route-filter
172.22.0.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 from route-filter
172.22.128.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 from route-filter
10.0.0.0/8 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 1 then accept
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierExport term 2 then reject
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 from route-filter
172.22.128.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 from route-filter
172.22.0.0/19 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 from route-filter
10.0.0.0/8 orlonger
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 1 then accept
set logical-systems Datos policy-options policy-statement Redes-EPC-CarrierImport term 2 then reject
set logical-systems Datos policy-options policy-statement internal term 1 from protocol ospf
set logical-systems Datos policy-options policy-statement internal term 1 from protocol direct
set logical-systems Datos policy-options policy-statement internal term 1 then accept
set logical-systems Datos policy-options policy-statement internal term 2 then reject
set logical-systems Datos routing-options router-id 172.22.0.130
set logical-systems Datos routing-options autonomous-system 65501
set interfaces ge-0/0/3 description "To Madrid-EPC-A ge-0/0/3"
set interfaces ge-0/0/4 description "to Madrid A ge-0/0/6"
set interfaces ge-0/0/9 description "to Madrid-PE-B ge-0/0/9"

root@BCN-PE-B> }
```

8.19. MAD-EPC-A

```
set version 14.1R1.10
set system host-name Madrid-EPC-A
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/0 unit 0 description "To Madrid-EPC-A ge-0/0/0"
set logical-systems Datos interfaces ge-0/0/0 unit 0 family inet address 172.22.128.57/30
set logical-systems Datos interfaces ge-0/0/0 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/3 unit 0 description "To Madrid-PE-A ge-0/0/3"
set logical-systems Datos interfaces ge-0/0/3 unit 0 family inet address 172.22.128.46/30
set logical-systems Datos interfaces ge-0/0/3 unit 0 family mpls
set logical-systems Datos interfaces irb unit 50 family inet address 10.100.146.5/29 vrrp-group 50 virtual-address
10.100.146.4
set logical-systems Datos interfaces irb unit 50 family inet address 10.100.146.5/29 vrrp-group 50 priority 254
set logical-systems Datos interfaces irb unit 50 family inet address 10.100.146.5/29 vrrp-group 50 accept-data
set logical-systems Datos interfaces lo0 unit 1 family inet address 172.22.128.131/32
set logical-systems Datos interfaces lo0 unit 50 family inet address 172.22.23.1/32
```

```
set logical-systems Datos protocols mpls icmp-tunneling
set logical-systems Datos protocols bgp group internal type internal
set logical-systems Datos protocols bgp group internal local-address 172.22.128.131
set logical-systems Datos protocols bgp group internal neighbor 172.22.128.129 family inet labeled-unicast resolve-
vpn
set logical-systems Datos protocols bgp group internal neighbor 172.22.0.131 family inet-vpn any
set logical-systems Datos protocols bgp group internal neighbor 172.22.0.132 family inet-vpn any
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/3.0
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1 passive
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/0.0
set logical-systems Datos protocols ldp interface ge-0/0/3.0
set logical-systems Datos policy-options policy-statement gn-export term 1 from protocol bgp
set logical-systems Datos policy-options policy-statement gn-export term 1 from protocol direct
set logical-systems Datos policy-options policy-statement gn-export term 1 from protocol static
set logical-systems Datos policy-options policy-statement gn-export term 1 from protocol ospf
set logical-systems Datos policy-options policy-statement gn-export term 1 then community add gn-comm
set logical-systems Datos policy-options policy-statement gn-export term 1 then accept
set logical-systems Datos policy-options policy-statement gn-export term 2 then reject
set logical-systems Datos policy-options policy-statement gn-import term 1 from protocol direct
set logical-systems Datos policy-options policy-statement gn-import term 1 from protocol bgp
set logical-systems Datos policy-options policy-statement gn-import term 1 from protocol static
set logical-systems Datos policy-options policy-statement gn-import term 1 from protocol ospf
set logical-systems Datos policy-options policy-statement gn-import term 1 from community gn-comm
set logical-systems Datos policy-options policy-statement gn-import term 1 then accept
set logical-systems Datos policy-options policy-statement gn-import term 2 then reject
set logical-systems Datos policy-options community gn-comm members target:200:2001
set logical-systems Datos routing-instances gn instance-type vrf
set logical-systems Datos routing-instances gn interface irb.50
set logical-systems Datos routing-instances gn interface lo0.50
set logical-systems Datos routing-instances gn route-distinguisher 65501:50
set logical-systems Datos routing-instances gn vrf-import gn-import
set logical-systems Datos routing-instances gn vrf-export gn-export
set logical-systems Datos routing-instances gn vrf-table-label
set logical-systems Datos routing-instances gn routing-options static route 10.17.17.17/32 next-hop 10.100.146.1
set logical-systems Datos routing-options autonomous-system 65501
set interfaces ge-0/0/0 description "to Madrid EPC B"
set interfaces ge-0/0/1 unit 0 family bridge interface-mode access
set interfaces ge-0/0/1 unit 0 family bridge vlan-id 50
set interfaces ge-0/0/3 description "to Madrid EPC A"
set interfaces ge-0/0/4 unit 0 family bridge interface-mode trunk
set interfaces ge-0/0/4 unit 0 family bridge vlan-id-list 50
set bridge-domains gn domain-type bridge
set bridge-domains gn vlan-id 50
set bridge-domains gn routing-interface irb.50

root@Madrid-EPC-A> }
```

8.20. MAD-EPC-B

```
set version 14.1R1.10
set system host-name Madrid-EPC-B
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/0 unit 0 description "To Madrid-EPC-A ge-0/0/0"
set logical-systems Datos interfaces ge-0/0/0 unit 0 family inet address 172.22.128.58/30
set logical-systems Datos interfaces ge-0/0/0 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/3 unit 0 description "To Madrid-PE-B ge-0/0/3"
set logical-systems Datos interfaces ge-0/0/3 unit 0 family inet address 172.22.128.54/30
set logical-systems Datos interfaces ge-0/0/3 unit 0 family mpls
```

```
set logical-systems Datos interfaces irb unit 50 family inet address 10.100.146.6/29 vrrp-group 50 virtual-address
10.100.146.4
set logical-systems Datos interfaces irb unit 50 family inet address 10.100.146.6/29 vrrp-group 50 priority 200
set logical-systems Datos interfaces irb unit 50 family inet address 10.100.146.6/29 vrrp-group 50 accept-data
set logical-systems Datos interfaces lo0 unit 1 family inet address 172.22.128.132/32
set logical-systems Datos interfaces lo0 unit 50 family inet address 172.22.23.3/32
set logical-systems Datos protocols bgp group internal type internal
set logical-systems Datos protocols bgp group internal local-address 172.22.128.132
set logical-systems Datos protocols bgp group internal neighbor 172.22.128.130 family inet labeled-unicast resolve-
vpn
set logical-systems Datos protocols bgp group internal neighbor 172.22.0.132 family inet-vpn any
set logical-systems Datos protocols bgp group internal neighbor 172.22.0.131 family inet-vpn any
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/3.0
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1 passive
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/0.0
set logical-systems Datos protocols ldp interface ge-0/0/3.0
set logical-systems Datos policy-options policy-statement gn-export term 1 from protocol bgp
set logical-systems Datos policy-options policy-statement gn-export term 1 from protocol direct
set logical-systems Datos policy-options policy-statement gn-export term 1 from protocol ospf
set logical-systems Datos policy-options policy-statement gn-export term 1 from protocol static
set logical-systems Datos policy-options policy-statement gn-export term 1 then community add gn-comm
set logical-systems Datos policy-options policy-statement gn-export term 1 then accept
set logical-systems Datos policy-options policy-statement gn-export term 2 then reject
set logical-systems Datos policy-options policy-statement gn-import term 1 from protocol direct
set logical-systems Datos policy-options policy-statement gn-import term 1 from protocol bgp
set logical-systems Datos policy-options policy-statement gn-import term 1 from protocol static
set logical-systems Datos policy-options policy-statement gn-import term 1 from protocol ospf
set logical-systems Datos policy-options policy-statement gn-import term 1 from community gn-comm
set logical-systems Datos policy-options policy-statement gn-import term 1 then accept
set logical-systems Datos policy-options policy-statement gn-import term 2 then reject
set logical-systems Datos policy-options community gn-comm members target:200:2001
set logical-systems Datos routing-instances gn instance-type vrf
set logical-systems Datos routing-instances gn interface irb.50
set logical-systems Datos routing-instances gn interface lo0.50
set logical-systems Datos routing-instances gn route-distinguisher 172.22.128.132:50
set logical-systems Datos routing-instances gn vrf-import gn-import
set logical-systems Datos routing-instances gn vrf-export gn-export
set logical-systems Datos routing-instances gn vrf-table-label
set logical-systems Datos routing-options autonomous-system 65501
set interfaces ge-0/0/0 description "to Madrid EPC B"
set interfaces ge-0/0/1 unit 0 family bridge interface-mode access
set interfaces ge-0/0/1 unit 0 family bridge vlan-id 50
set interfaces ge-0/0/3 description "to Madrid EPC A"
set interfaces ge-0/0/4 unit 0 family bridge interface-mode trunk
set interfaces ge-0/0/4 unit 0 family bridge vlan-id-list 50
set bridge-domains gn domain-type bridge
set bridge-domains gn vlan-id 50
set bridge-domains gn routing-interface irb.50

root@Madrid-EPC-B> }
```

8.21. BCN-EPC-A

```
set version 14.1R1.10
set system host-name BCN-EPC-A
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/0 unit 0 description "To BCN-EPC-B ge-0/0/0"
set logical-systems Datos interfaces ge-0/0/0 unit 0 family inet address 172.22.0.57/30
set logical-systems Datos interfaces ge-0/0/0 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/3 unit 0 description "To BCN-PE-A ge-0/0/3"
```

```
set logical-systems Datos interfaces ge-0/0/3 unit 0 family inet address 172.22.0.46/30
set logical-systems Datos interfaces ge-0/0/3 unit 0 family mpls
set logical-systems Datos interfaces irb unit 50 family inet address 10.100.18.5/29 vrrp-group 50 virtual-address
10.100.18.4
set logical-systems Datos interfaces irb unit 50 family inet address 10.100.18.5/29 vrrp-group 50 priority 254
set logical-systems Datos interfaces irb unit 50 family inet address 10.100.18.5/29 vrrp-group 50 accept-data
set logical-systems Datos interfaces lo0 unit 1 family inet address 172.22.0.131/32
set logical-systems Datos interfaces lo0 unit 50 family inet address 172.22.23.2/32
set logical-systems Datos protocols mpls icmp-tunneling
set logical-systems Datos protocols mpls interface ge-0/0/3.0
set logical-systems Datos protocols bgp group internal type internal
set logical-systems Datos protocols bgp group internal local-address 172.22.0.131
set logical-systems Datos protocols bgp group internal neighbor 172.22.0.129 family inet labeled-unicast resolve-vpn
set logical-systems Datos protocols bgp group internal neighbor 172.22.128.131 family inet-vpn any
set logical-systems Datos protocols bgp group internal neighbor 172.22.128.132 family inet-vpn any
set logical-systems Datos protocols bgp group internal neighbor 172.22.0.132 family inet-vpn any
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/3.0
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1 passive
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/0.0
set logical-systems Datos protocols ldp interface ge-0/0/3.0
set logical-systems Datos policy-options policy-statement gn-export term 1 from protocol bgp
set logical-systems Datos policy-options policy-statement gn-export term 1 from protocol direct
set logical-systems Datos policy-options policy-statement gn-export term 1 from protocol static
set logical-systems Datos policy-options policy-statement gn-export term 1 from protocol ospf
set logical-systems Datos policy-options policy-statement gn-export term 1 then community add gn-comm
set logical-systems Datos policy-options policy-statement gn-export term 1 then accept
set logical-systems Datos policy-options policy-statement gn-export term 2 then reject
set logical-systems Datos policy-options policy-statement gn-import term 1 from protocol direct
set logical-systems Datos policy-options policy-statement gn-import term 1 from protocol bgp
set logical-systems Datos policy-options policy-statement gn-import term 1 from protocol static
set logical-systems Datos policy-options policy-statement gn-import term 1 from protocol ospf
set logical-systems Datos policy-options policy-statement gn-import term 1 from community gn-comm
set logical-systems Datos policy-options policy-statement gn-import term 1 then accept
set logical-systems Datos policy-options policy-statement gn-import term 2 then reject
set logical-systems Datos policy-options community gn-comm members target:200:2001
set logical-systems Datos routing-instances gn instance-type vrf
set logical-systems Datos routing-instances gn interface irb.50
set logical-systems Datos routing-instances gn interface lo0.50
set logical-systems Datos routing-instances gn route-distinguisher 65501:50
set logical-systems Datos routing-instances gn vrf-import gn-import
set logical-systems Datos routing-instances gn vrf-export gn-export
set logical-systems Datos routing-instances gn routing-options static route 10.17.17.19/32 next-hop 10.100.18.1
set logical-systems Datos routing-options router-id 172.22.0.131
set logical-systems Datos routing-options autonomous-system 65501
set interfaces ge-0/0/0 description "to BCN EPC B"
set interfaces ge-0/0/1 unit 0 family bridge interface-mode access
set interfaces ge-0/0/1 unit 0 family bridge vlan-id 50
set interfaces ge-0/0/3 description "to BCN EPC A"
set interfaces ge-0/0/4 unit 0 family bridge interface-mode trunk
set interfaces ge-0/0/4 unit 0 family bridge vlan-id-list 50
set bridge-domains gn domain-type bridge
set bridge-domains gn vlan-id 50
set bridge-domains gn routing-interface irb.50

root@BCN-EPC-A> }
```

8.22. BCN-EPC-B

```
set version 14.1R1.10
set system host-name BCN-EPC-B
set system time-zone Europe/Madrid
set system root-authentication encrypted-password "$1$W0mZ1K6m$Prsa8.RFG344RVDhY6Li/1"
set system services ftp
set system services ssh connection-limit 20
set system services ssh rate-limit 10
set system services telnet connection-limit 20
set system services telnet rate-limit 10
set system syslog archive size 1m
set system syslog archive files 10
set system syslog archive world-readable
set system syslog user * any emergency
set system syslog file messages any notice
set system syslog file messages authorization info
set system syslog file interactive-commands interactive-commands any
```

```
set system syslog time-format year
set system syslog time-format millisecond
set system ntp server 216.239.35.0
set logical-systems Datos interfaces ge-0/0/0 unit 0 description "To BCN-EPC-A ge-0/0/0"
set logical-systems Datos interfaces ge-0/0/0 unit 0 family inet address 172.22.0.58/30
set logical-systems Datos interfaces ge-0/0/0 unit 0 family mpls
set logical-systems Datos interfaces ge-0/0/3 unit 0 description "To BCN-PE-A ge-0/0/3"
set logical-systems Datos interfaces ge-0/0/3 unit 0 family inet address 172.22.0.54/30
set logical-systems Datos interfaces ge-0/0/3 unit 0 family mpls
set logical-systems Datos interfaces lo0 unit 1 family inet address 172.22.0.132/32
set logical-systems Datos interfaces lo0 unit 50 family inet address 172.22.23.4/32
set logical-systems Datos protocols mpls interface ge-0/0/3.0
set logical-systems Datos protocols bgp group internal type internal
set logical-systems Datos protocols bgp group internal local-address 172.22.0.132
set logical-systems Datos protocols bgp group internal neighbor 172.22.0.130 family inet labeled-unicast resolve-vpn
set logical-systems Datos protocols bgp group internal neighbor 172.22.128.132 family inet-vpn any
set logical-systems Datos protocols bgp group internal neighbor 172.22.128.131 family inet-vpn any
set logical-systems Datos protocols bgp group internal neighbor 172.22.0.131 family inet-vpn any
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/3.0
set logical-systems Datos protocols ospf area 0.0.0.0 interface lo0.1 passive
set logical-systems Datos protocols ospf area 0.0.0.0 interface ge-0/0/0.0
set logical-systems Datos protocols ldp interface ge-0/0/3.0
set logical-systems Datos policy-options policy-statement gn-export term 1 from protocol bgp
set logical-systems Datos policy-options policy-statement gn-export term 1 from protocol direct
set logical-systems Datos policy-options policy-statement gn-export term 1 then community add gn-comm
set logical-systems Datos policy-options policy-statement gn-export term 1 then accept
set logical-systems Datos policy-options policy-statement gn-export term 2 then reject
set logical-systems Datos policy-options policy-statement gn-import term 1 from protocol direct
set logical-systems Datos policy-options policy-statement gn-import term 1 from protocol bgp
set logical-systems Datos policy-options policy-statement gn-import term 1 from community gn-comm
set logical-systems Datos policy-options policy-statement gn-import term 1 then accept
set logical-systems Datos policy-options policy-statement gn-import term 2 then reject
set logical-systems Datos policy-options community gn-comm members target:200:2001
set logical-systems Datos routing-instances gn instance-type vrf
set logical-systems Datos routing-instances gn interface lo0.50
set logical-systems Datos routing-instances gn route-distinguisher 172.22.0.132:50
set logical-systems Datos routing-instances gn vrf-import gn-import
set logical-systems Datos routing-instances gn vrf-export gn-export
set logical-systems Datos routing-options router-id 172.22.0.132
set logical-systems Datos routing-options autonomous-system 65501
set interfaces ge-0/0/0 description "to BCN EPC B"
set interfaces ge-0/0/3 description "to BCN EPC A"

root@BCN-EPC-B> }
```

8.23. MAD-GGSN-A

```
hostname GGSN-PGW-A
cdp
virtual-service ip-ping
!
interface Loopback0
 ipv4 address 10.17.17.17 255.255.255.255
!
interface MgmtEth0/0/CPU0/0
 shutdown
!
interface GigabitEthernet0/0/0/0
 shutdown
!
interface GigabitEthernet0/0/0/1
 shutdown
!
interface GigabitEthernet0/0/0/2
 shutdown
!
interface GigabitEthernet0/0/0/3
 ipv4 address 10.100.146.2 255.255.255.248
!
interface GigabitEthernet0/0/0/4
```

```
 shutdown
!
interface GigabitEthernet0/0/0/5
 shutdown
!
interface GigabitEthernet0/0/0/6
 shutdown
!
interface GigabitEthernet0/0/0/7
 shutdown
!
interface GigabitEthernet0/0/0/8
 shutdown
!
router static
 address-family ipv4 unicast
  10.17.17.19/32 10.100.146.4
 !
!
router vrrp
 interface GigabitEthernet0/0/0/3
  address-family ipv4
   vrrp 50
    priority 254
    address 10.100.146.1
   !
  !
 !
!
mpls oam
!
end}
```

8.24. MAD-GGSN-B

```
cdp
interface Loopback0
 ipv4 address 10.17.17.18 255.255.255.255
!
interface MgmtEth0/0/CPU0/0
 shutdown
!
interface GigabitEthernet0/0/0/0
 shutdown
!
interface GigabitEthernet0/0/0/1
 shutdown
!
interface GigabitEthernet0/0/0/2
 shutdown
!
interface GigabitEthernet0/0/0/3
 ipv4 address 10.100.146.3 255.255.255.248
!
interface GigabitEthernet0/0/0/4
!
interface GigabitEthernet0/0/0/5
 shutdown
!
interface GigabitEthernet0/0/0/6
 shutdown
```

```
!
interface GigabitEthernet0/0/0/7
 shutdown
!
interface GigabitEthernet0/0/0/8
 shutdown
!
router static
 address-family ipv4 unicast
  10.17.17.19/32 10.100.146.4
 !
!
router vrrp
 interface GigabitEthernet0/0/0/3
  address-family ipv4
   vrrp 50
    address 10.100.146.1
   !
  !
 !
!
end}
```

8.25. BCN-GGSN-A

```
hostname GGSN-PGW-A-BCN
cdp
virtual-service ip-ping
!
interface Loopback0
 ipv4 address 10.17.17.19 255.255.255.255
!
interface MgmtEth0/0/CPU0/0
 shutdown
!
interface GigabitEthernet0/0/0/0
 shutdown
!
interface GigabitEthernet0/0/0/1
 shutdown
!
interface GigabitEthernet0/0/0/2
 shutdown
!
interface GigabitEthernet0/0/0/3
 ipv4 address 10.100.0.2 255.255.255.248
!
interface GigabitEthernet0/0/0/4
 shutdown
!
interface GigabitEthernet0/0/0/5
 shutdown
!
interface GigabitEthernet0/0/0/6
 shutdown
!
interface GigabitEthernet0/0/0/7
 shutdown
!
interface GigabitEthernet0/0/0/8
 shutdown
!
router static
```

```
 address-family ipv4 unicast
  10.17.17.17/32 10.100.0.4
 !
!
router vrrp
 interface GigabitEthernet0/0/0/3
  address-family ipv4
   vrrp 50
    priority 254
    address 10.100.0.1
   !
  !
 !
!
mpls oam
!
end}
}
```

8.26. BCN-GGSN-B

```
cdp
interface Loopback0
 ipv4 address 10.17.17.20 255.255.255.255
!
interface MgmtEth0/0/CPU0/0
 shutdown
!
interface GigabitEthernet0/0/0/0
 shutdown
!
interface GigabitEthernet0/0/0/1
 shutdown
!
interface GigabitEthernet0/0/0/2
 shutdown
!
interface GigabitEthernet0/0/0/3
 ipv4 address 10.100.0.3 255.255.255.248
!
interface GigabitEthernet0/0/0/4
!
interface GigabitEthernet0/0/0/5
 shutdown
!
interface GigabitEthernet0/0/0/6
 shutdown
!
interface GigabitEthernet0/0/0/7
 shutdown
!
interface GigabitEthernet0/0/0/8
 shutdown
!
router static
 address-family ipv4 unicast
  10.17.17.17/32 10.100.0.4
 !
!
router vrrp
 interface GigabitEthernet0/0/0/3
  address-family ipv4
   vrrp 50
```

```
    address 10.100.0.1
   !
  !
 !
!
end}
}
```