****

**Proyecto Final: Redes Empresariales [GNS3]**

Documentation

**Cristian Rodrigo Meneses Zambrana** *77832*

**Professor:** Hermann Medrano Larrain

*MS. Telecommunications – Networking Engineer*

**Bolivian Private University**

**Faculty of Engineering and Architecture**

**Computer Systems Engineering**

Cochabamba, Bolivia August 2025

# Network Topology Documentation

## Overview

This document details a complex enterprise network topology featuring multiple VLANs, routers, switches, and end devices. The network implements a hierarchical design with core routers, distribution switches, and access layer connectivity.

## Network Architecture

### Core Layer (Routers)

The network core consists of 6 routers (R1-R6) providing inter-VLAN routing and WAN connectivity:

**Router Interconnections:**

* **ISP Router**: Central internet gateway
  + Connected to R3, R4, R5, R6
* **R1**
  + Connected to: R2, R3
* **R2**
  + Connected to: R1, R3, R4, ARHuawei device(cloud)
* **R3**
  + Connected to: ISP, R1, R2
* **R4**
  + Connected to: ISP, R2
* **R5**
  + Connected to: ISP, SW1
* **R6**
  + Connected to: ISP, SW2

### Distribution/Access Layer (Switches)

Six switches (SW1-SW6) provide access layer connectivity and VLAN segmentation:

**Switch Infrastructure:**

* **SW1**: Connected to R5 and with SW2, SW3, SW4, SW5 SW6
* **SW2**: Connected to R6 and with SW1, SW3, SW4, SW5 SW6
* **SW3**: Connected to SW1, SW2 and with Windows1 (cloud), PC1
* **SW4**: Connected to SW1, SW2 and with PC2, Windows2 (cloud)
* **SW5**: Connected to SW1, SW2 and with DNS\_Web(cloud), DHCP\_Server (cloud), WindowsServer (cloud), PBX (cloud)
* **SW6**: Connected to SW1, SW2 and with DNS\_Web(cloud), DHCP\_Server (cloud), WindowsServer (cloud), PBX (cloud)

## Network Segmentation Analysis

### Point-to-Point Router Networks (/30 subnets)

Each /30 network connects exactly two router interfaces:

**192.10.0.0/30 Network:**

* ISP Router (interface)
* R3 (interface)

**192.10.1.0/30 Network:**

* ISP Router (interface)
* R4 (interface)

**192.10.2.0/30 Network:**

* R4 (interface)
* R2 (interface)

**192.10.3.0/30 Network:**

* R2 (interface)
* R3 (interface)

**192.10.4.0/30 Network:**

* R3 (interface)
* R1 (interface)

**192.10.5.0/30 Network:**

* R1 (interface)
* R2 (interface)

**192.168.10.0/30 Network:**

* R2 (interface)
* ARHuawei device (cloud)

**145.0.10.0/28 Network:**

* R5 (interface)
* ISP Router (interface)

**66.2.10.0/28 Network:**

* R6 (interface)
* ISP Router (interface)

### VLAN Networks (End Device Networks)

**VLAN 10 Network (10.0.10.0/24):**

* Windows1: 10.0.10.10
* PC2: 10.0.10.11
* name: gerencia

**VLAN 11 Network (192.168.10.0/24):**

* PC1: 192.168.10.10
* Windows2: 192.168.10.11
* name administracion

**VLAN 12 Network (172.16.10.0/24):**

* PBX: 172.16.10.10
* name: VoIP

**VLAN 13 Network (10.1.10.0/24):**

* DNS\_Web Server: 10.1.10.10
* DHCP\_Server: 10.1.10.11
* WindowsServer: 10.1.10.12
* name: IT

**VLAN 15 Network (172.1.10.0/24):**

* name: Admin\_Equipos

**VLAN 18 Network (10.12.10.0/28):**

### Notes

* SW5 and SW6 are connected to the same end devices, this means there is only one dhcp server and so on

# FIRST REVIEW: Network Topology Documentation

## Overview

This document details a complex enterprise network topology featuring multiple VLANs, routers, switches, and end devices. The network implements a hierarchical design with core routers, distribution switches, and access layer connectivity.

## Network Architecture

### Core Layer (Routers)

The network core consists of 6 routers (R1-R6) providing inter-VLAN routing and WAN connectivity:

**Router Interconnections:**

* **ISP Router**: Central internet gateway
  + Connected to R3, R4, R5, R6
  + Provides external connectivity
* **R1**
  + Connected to: R2, R3
  + Acts as edge router
* **R2**
  + Connected to: R1, R3, R4, ARHuawei device(cloud)
  + Provides redundant paths
* **R3**
  + Connected to: ISP, R1, R2
  + Central distribution point
* **R4**
  + Connected to: ISP, R2
  + Multiple network segments
* **R5**
  + Connected to: ISP, SW1
  + Access layer connection
* **R6**
  + Connected to: ISP, SW2
  + Access layer connection

### Distribution/Access Layer (Switches)

Six switches (SW1-SW6) provide access layer connectivity and VLAN segmentation:

**Switch Infrastructure:**

* **SW1**: Connected to R5 and with SW2, SW3, SW4, SW5 SW6
* **SW2**: Connected to R6 and with SW1, SW3, SW4, SW5 SW6
* **SW3**: Connected to SW1, SW2 and with Windows1 (cloud), PC1
* **SW4**: Connected to SW1, SW2 and with PC2, Windows2 (cloud)
* **SW5**: Connected to SW1, SW2 and with DNS\_Web(cloud), DHCP\_Server (cloud), WindowsServer (cloud), PBX (cloud)
* **SW6**: Connected to SW1, SW2 and with DNS\_Web(cloud), DHCP\_Server (cloud), WindowsServer (cloud), PBX (cloud)

## Network Segmentation Analysis

### Point-to-Point Router Networks (/30 subnets)

Each /30 network connects exactly two router interfaces:

**192.X.0.0/30 Network:**

* ISP Router (interface)
* R3 (interface)

**192.X.1.0/30 Network:**

* ISP Router (interface)
* R4 (interface)

**192.X.2.0/30 Network:**

* R4 (interface)
* R2 (interface)

**192.X.3.0/30 Network:**

* R2 (interface)
* R3 (interface)

**192.X.4.0/30 Network:**

* R3 (interface)
* R1 (interface)

**192.X.5.0/30 Network:**

* R1 (interface)
* R2 (interface)

**192.168.X.0/30 Network:**

* R2 (interface)
* ARHuawei device (cloud)

### Router-to-Switch Networks

**145.0.X.0/28 Network:**

* R5 (interface)
* SW1 (interface)

**66.2.X.0/28 Network:**

* R6 (interface)
* SW2 (interface)

### VLAN Networks (End Device Networks)

**VLAN 10 Network (10.0.X.0/24):**

* Windows1: 10.0.X.10
* PC2: 10.0.X.11
* name: gerencia

**VLAN 11 Network (192.168.X.0/24):**

* PC1: 192.168.X.10
* Windows2: 192.168.X.11
* name administracion

**VLAN 12 Network (172.16.X.0/24):**

* PBX: 172.16.X.10
* name: VoIP

**VLAN 13 Network (10.1.X.0/24):**

* DNS\_Web Server: 10.1.X.10
* DHCP\_Server: 10.1.X.11
* WindowsServer: 10.1.X.12
* name: IT

**VLAN 15 Network (172.1.X.0/24):**

* name: Admin\_Equipos

**VLAN 18 Network (10.12.X.0/28):**

* Internal VLAN to server connections between switches

## Router Interface Analysis

Based on the topology, each router has multiple interfaces in different networks:

**R1 Interfaces:**

* Interface 1: 192.X.4.0/30 network (connects to R3)
* Interface 2: 192.X.5.0/30 network (connects to R2)

**R2 Interfaces:**

* Interface 1: 192.X.5.0/30 network (connects to R1)
* Interface 2: 192.X.2.0/30 network (connects to R4)
* Interface 3: 192.168.X.0/30 network (connects to ARHuawei)
* Additional interfaces for VLAN routing

**R3 Interfaces:**

* Interface 1: 192.X.0.0/30 network (connects to ISP)
* Interface 2: 192.X.4.0/30 network (connects to R1)
* Interface 3: 192.X.1.0/30 network (connects to R4)

**R4 Interfaces:**

* Interface 1: 192.X.1.0/30 network (connects to R3)
* Interface 2: 192.X.2.0/30 network (connects to R2)
* Additional interfaces for routing to other networks

**R5 Interfaces:**

* Interface 1: Connected to ISP (network not explicitly shown)
* Interface 2: 145.0.X.0/28 network (connects to SW1)

**R6 Interfaces:**

* Interface 1: Connected to ISP (network not explicitly shown)
* Interface 2: 66.2.X.0/28 network (connects to SW2)

## End Devices and Servers

### Servers

1. **DNS\_Web Server**: 10.1.X.10 (VLAN 13)
2. **DHCP\_Server**: 10.1.X.11 (VLAN 13)
3. **WindowsServer**: 10.0.X.12 (VLAN 13)
4. **PBX**: 172.16.X.10 (VLAN 12)

### Client Devices

* **PC1**: 192.168.X.10 (VLAN 11)
* **PC2**: 10.0.X.11 (VLAN 10)
* **Windows1**: 10.0.X.10 (VLAN 10)
* **Windows2**: 192.168.X.11 (VLAN 11)
* **ARHuawei**: External device (192.X.5.0/30)

## Network Redundancy and Design

### Redundancy Features

* Multiple router interconnections provide path redundancy
* Full mesh connectivity between switches ensures no single point of failure
* Dual-homed connections from core routers to distribution switches

### Traffic Flow Patterns

* North-South traffic: Client devices → Switches → Routers → ISP
* East-West traffic: Inter-VLAN communication through core routers
* Server access: Centralized in VLAN 13 for management efficiency

## Key Network Segments

### Production Networks

* **10.0.X.0/24**: Primary user network
* **192.168.X.0/24**: Administrative network
* **172.16.X.0/24**: VoIP infrastructure

### Infrastructure Networks

* **Point-to-Point Router Links**: /30 subnets connecting routers (192.X.0.0/30, 192.X.1.0/30, 192.X.2.0/30, 192.X.4.0/30, 192.X.5.0/30, 192.168.X.0/30)
* **Router-to-Switch Links**: /28 subnets for access connections (145.0.X.0/28, 66.2.X.0/28)

## Topology Characteristics

### Design Pattern

* **Hierarchical Three-Tier**: Core (Routers) → Distribution (Switches) → Access (End Devices)
* **Partial Mesh**: Routers with selective interconnection
* **Full Mesh Switching**: Complete switch-to-switch connectivity

### Scalability Features

* VLAN segmentation allows for network growth
* Multiple uplinks provide bandwidth aggregation
* Modular design supports additional VLANs and devices

## Connection Summary

**Total Network Components:**

* 6 Routers (R1-R6 + ISP)
* 6 Switches (SW1-SW6)
* 8+ End devices (servers, PCs, specialized equipment)
* 6 Primary VLANs with multiple subnets
* External connectivity via ISP router and ARHuawei device

This topology demonstrates enterprise-grade network design with proper segmentation, redundancy, and hierarchical structure suitable for medium to large organizations.

**PODRIA SER INFORMACION INNECESARIA/INCORRECTA**

**CORRECION**