

# Network Documentation

---

## General info

- Switch / Router console password: Console2019
- Switch / Router configuration password: Admin2019
- Switch / Router telnet(vty) password: Telnet2019
- No L3 switches available on site: replaced with router + L2 switch
- Pings won't work on Hogent environment
- OSPF needed
- Configure NAT on outside & inside interfaces
- Use PAT and ACL to ensure connectivity -> each network separate in ACL, no summarize
- Workaround for patch panel not working: insert cable on island from internetport to management port (eg 2 -> 14)
- DHCP on interface to ISP for getting IP address -> static IP from lecturer -> 172.22.192.10
- Linuxteam IP to Router4: 172.16.2.1
- Static default route on every router to outside
- Static routes when using firewall: doesn't support OSPF

## TODO

## DONE

- Complete topology in Packet Tracer
- Added firewall server
- Rearranged using L2 switches
- VLAN 200 + 300 + 500 created + assigned to interfaces
- Ping between clients & router in VLAN 200 OK
- Ping between servers & router in VLAN 300 OK
- Ping between servers & router in VLAN 500 OK
- Ping between VLAN 500 & VLAN 300 OK
- Ping between VLANs OK
- Ping to Linuxteam OK
- Overall pings OK
- VPN configuration
- Routers
  - Serial connections
  - Hostname
  - Console password
  - Configuration password
  - Telnet(VTY) lines password
  - Copy running config -> startup config (not in practice)
  - IPs on interfaces
  - OSPF
  - ACL on edge router

- NAT configuration
- Static default route
- Ensure overall connection (physical testing needed) -> OK
- Switches
  - Hostname
  - Console password
  - Configuration password
  - Telnet(VTY) lines password
  - Copy running config -> startup config (not in practice)
  - VLANs
- Clients & Servers
  - IP configuration (DHCP + static)
  - DNS configuration
  - Default Gateways
  - Enable kilo2 DHCP + add pool

## Physical connections

Device	S0/1/0	S0/1/1	G0/0/0	G0/0/1	F0/1
Router 1	(If no firewall) Router 6	Router 3	Zulu2	-	-
Router 3	Router 4	Router 1	Router 2 (To LINUX)	-	-
Router 4	Router 3	Router 2 (To LINUX)	WAN connection		-
Router 5	Router 6	-	Switch 5	Switch 4	-
Router 6	Router 5	(If no firewall) Router 1	Switch 7	Zulu2	-
Switch 4	-	-	-	-	Router 5
Switch 5	-	-	-	-	Router 5
Switch 7	-	-	-	-	Router 6

## Documentation per device

### On every router

- Set a hostname:
  - `hostname RouterX`
- Add an elevated access password:
  - `enable secret Admin2019`
- Secure console line:
  - `line console 0`

- `password Console2019`
  - `login`
- Secure VTY lines:
  - `line vty 0 15`
  - `password Telnet2019`
  - `login`
- Enable encryption of passwords:
  - `service password-encryption`

## Router 1

- Configure interface to Zulu2 firewall:
  - `int g0/0/0`
  - `ip address 172.18.1.105 255.255.255.252`
  - `no shut`
- Configure interface to Router 3:
  - `int s0/1/1`
  - `ip address 172.18.3.2 255.255.255.252`
  - `no shut`
- Add a static default route to allow traffic to WAN:
  - `ip route 0.0.0.0 0.0.0.0 s0/1/1`
- Add a static route for firewall:
  - `ip route 172.18.0.0 255.255.0.0 g0/0/0 172.18.1.106`
- Configure OSPF with ID 10:
  - `router ospf 10`
- Give Router 1 a router ID:
  - `router-id 1.1.1.1`
  - `clear ip ospf process`
- Add connected networks to OSPF configuration:
  - `network 172.18.1.104 0.0.0.3 area 0`
  - `network 172.18.3.0 0.0.0.3 area 0`
  - `network 172.18.1.108 0.0.0.3 area 0`
- Optional configuration to bypass Zulu2 firewall:
  - `int s0/1/0`
  - `ip address 172.18.1.109 255.255.255.252`
  - `no shut`
- Configure the Tunnel0 interface for VPN:
  - `int Tunnel0`
- Configure the GRE tunnel:
  - `tunnel mode gre ip`
  - `ip address 172.17.4.2 255.255.255.252`
- Add a source and destination IP:
  - `tunnel source 172.18.3.2`
  - `tunnel destination 172.16.1.109`
- Add the networks and routes to OSPF configuration:
  - `router ospf 10`
  - `network 172.17.4.0 0.0.0.3 area 0`

- `network 172.18.6.1 0.0.0.3 area 0`
- `ip route 172.16.0.0 255.255.0.0 tunnel0`
- `ip route 172.16.1.108 255.255.255.252 s0/1/1`

## Router 3

- Configure interface to Router 4:
  - `int s0/1/0`
  - `ip address 172.18.2.2 255.255.255.252`
  - `no shut`
- Configure interface to Router 1:
  - `int s0/1/1`
  - `ip address 172.18.3.1 255.255.255.252`
  - `no shut`
- Configure interface to Router 2:
  - `int g0/0/0`
  - `ip address 172.16.3.1 255.255.255.252`
  - `no shut`
- Add a static default route to allow traffic to WAN:
  - `ip route 0.0.0.0 0.0.0.0 s0/1/0`
- Add a static route for firewall:
  - `ip route 172.18.0.0 255.255.0.0 s0/1/1 172.18.3.2`
- Configure OSPF with ID 10:
  - `router ospf 10`
- Give Router 3 a router ID:
  - `router-id 3.3.3.3`
  - `clear ip ospf process`
- Add connected networks to OSPF configuration:
  - `network 172.18.2.0 0.0.0.3 area 0`
  - `network 172.18.3.0 0.0.0.3 area 0`
  - `network 172.16.3.0 0.0.0.3 area 0`

## Router 4

- Configure inside interface Windowsteam (NAT/PAT) to Router 3:
  - `int s0/1/0`
  - `ip address 172.18.2.1 255.255.255.252`
  - `ip nat inside`
  - `no shut`
- Configure inside interface Linuxteam (NAT/PAT) to Router 2:
  - `int s0/1/1`
  - `ip address 172.16.2.1 255.255.255.252`
  - `ip nat inside`
  - `no shut`
- Configure outside interface using DHCP (NAT/PAT) to WAN:
  - `int g0/0/0`
  - `ip address dhcp`

- `ip nat outside`
- `no shut`
- Add a static default route to allow traffic to WAN:
  - `ip route 0.0.0.0 0.0.0.0 g0/0/0`
- Add static routes to split Linux & Windows traffic:
  - `ip route 172.18.0.0 255.255.0.0 s0/1/0 172.18.2.2`
  - `ip route 172.16.0.0 255.255.0.0 s0/1/1 172.16.2.2`
- Configure an access list which permits all LAN networks to connect to the internet via the outside interface:
  - `access-list 1 permit 172.18.2.0 0.0.0.3`
  - `access-list 1 permit 172.18.1.0 0.0.0.63`
  - `access-list 1 permit 172.18.0.0 0.0.0.255`
  - `access-list 1 permit 172.18.1.96 0.0.0.3`
  - `access-list 1 permit 172.18.1.100 0.0.0.3`
  - `access-list 1 permit 172.18.1.64 0.0.0.31`
  - `access-list 1 permit 172.18.1.104 0.0.0.3`
  - `access-list 1 permit 172.18.1.108 0.0.0.3`
  - `access-list 1 permit 172.16.0.0 0.0.0.255`
  - `access-list 1 permit 172.16.1.0 0.0.0.63`
  - `access-list 1 permit 172.16.1.96 0.0.0.3`
  - `access-list 1 permit 172.16.1.64 0.0.0.31`
  - `access-list 1 permit 172.16.1.100 0.0.0.3`
  - `access-list 1 permit 172.16.1.104 0.0.0.3`
  - `access-list 1 permit 172.16.2.0 0.0.0.3`
- Assign the access list to the outside interface (PAT usage):
  - `ip nat inside source list 1 interface g0/0/0 overload`
- Verify the NAT configuration:
  - `show ip nat translations`
  - `show ip nat statistics`
- Configure OSPF with ID 10:
  - `router ospf 10`
- Give Router 4 a router ID:
  - `router-id 4.4.4.4`
  - `clear ip ospf process`
- Add connected networks to OSPF configuration:
  - `network 172.18.2.0 0.0.0.3 area 0`
  - `network 172.16.2.0 0.0.0.3 area 0`
  - `network 172.22.0.0 0.0.255.255 area 0`

## Router 5 (Formerly L3 Switch5)

- Configure interface to Switch 5:
  - `int g0/0/0`
  - `ip address 172.18.1.7 255.255.255.192`
  - `no shut`
- Configure interface to Switch 4:
  - `int g0/0/1`

- `ip address 172.18.0.1 255.255.255.0`
  - `no shut`
- Add a IP helper address to forward DHCP packets:
  - `ip helper-address 172.18.1.1`
- Configure interface to Router 6:
  - `int s0/1/0`
  - `ip address 172.18.1.97 255.255.255.252`
  - `no shut`
- Add a static default route to allow traffic to WAN:
  - `ip route 0.0.0.0 0.0.0.0 s0/1/0`
- Control access to private network using ACL:
  - `access-list 10 permit 172.18.1.64 0.0.0.31`
- Configure OSPF with ID 10:
  - `router ospf 10`
- Give Router 5 a router ID:
  - `router-id 5.5.5.5`
  - `clear ip ospf process`
- Add connected networks to OSPF configuration:
  - `network 172.18.1.0 0.0.0.63 area 0`
  - `network 172.18.0.0 0.0.0.255 area 0`
  - `network 172.18.1.96 0.0.0.3 area 0`
- Configure passive interfaces to suppress OSPF updates to switches:
  - `passive-interface g0/0/0`
  - `passive-interface g0/0/1`

## Router 6 (Formerly L3 Switch 6)

- Configure interface to Switch 7:
  - `int g0/0/0`
  - `ip address 172.18.1.65 255.255.255.224`
  - `no shut`
- Configure interface to Zulu2 firewall:
  - `int g0/0/1`
  - `ip address 172.18.1.101 255.255.255.252`
  - `no shut`
- Configure interface to Router 5:
  - `int s0/1/0`
  - `ip address 172.18.1.98 255.255.255.252`
  - `no shut`
- Add a static default route to allow traffic to WAN:
  - `ip route 0.0.0.0 0.0.0.0 g0/0/1`
- Optional configuration to bypass Zulu2 firewall:
  - `int s0/1/1`
  - `ip address 172.18.1.110 255.255.255.252`
  - `no shut`
  - `ip route 0.0.0.0 0.0.0.0 g0/0/1`
  - `ip route 0.0.0.0 0.0.0.0 s0/1/1`

- Configure OSPF with ID 10:
  - `router ospf 10`
- Give Router 6 a router ID:
  - `router-id 6.6.6.6`
  - `clear ip ospf process`
- Add connected networks to OSPF configuration:
  - `network 172.18.1.100 0.0.0.3 area 0`
  - `network 172.18.1.64 0.0.0.31 area 0`
  - `network 172.18.1.96 0.0.0.3 area 0`
  - `network 172.18.1.108 0.0.0.3 area 0`
- Configure passive interfaces to suppress OSPF updates to switch:
  - `passive-interface g0/0/0`

## On every switch

- Set a hostname:
  - `hostname SwitchX`
- Add an elevated access password:
  - `enable secret Admin2019`
- Secure console line:
  - `line console 0`
  - `password Console2019`
  - `login`
- Secure VTY lines:
  - `line vty 0 4`
  - `password Telnet2019`
  - `login`
- Enable encryption of passwords:
  - `service password-encryption`

## Switch 4

- Create a new VLAN with ID 200:
  - `vlan 200`
  - `name vlan200`
- Assign VLAN 200 to interfaces:
  - `int range f0/1-10`
  - `switchport mode access`
  - `switchport access vlan 200`

## Switch 5

- Create a new VLAN with ID 300:
  - `vlan 300`
  - `name vlan300`
- Assign VLAN 300 to interfaces & allow traffic:
  - `int range f0/1-10`
  - `switchport mode trunk`

- `switchport trunk allowed vlan 200,300,500`

## Switch 7

- Create a new VLAN with ID 500:
  - `vlan 500`
  - `name vlan500`
- Assign VLAN 500 to interfaces & allow traffic:
  - `int range f0/1-10`
  - `switchport mode trunk`
  - `switchport trunk allowed vlan 200,300,500`

## Resources

### OSPF Configuration

- [https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/iproute\\_ospf/configuration/xe-16/iro-xe-16-book/iro-cfg.html](https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/iproute_ospf/configuration/xe-16/iro-xe-16-book/iro-cfg.html)

### DHCP on WAN

- [https://www.cisco.com/c/en/us/td/docs/ios/12\\_2sb/12\\_2sba/feature/guide/sbaandhp.pdf](https://www.cisco.com/c/en/us/td/docs/ios/12_2sb/12_2sba/feature/guide/sbaandhp.pdf)
- <https://community.cisco.com/t5/routing/configure-router-with-dynamic-ip-from-isp/td-p/2833165>
- <https://community.cisco.com/t5/switching/dhcp-on-outside-interface-with-nat/td-p/1748357>
- <https://study-ccna.com/configure-cisco-router-as-a-dhcp-client/>

### Gateway of last resort (static routing)

- <https://www.cisco.com/c/en/us/support/docs/ip/routing-information-protocol-rip/16448-default.html>
- <https://community.cisco.com/t5/switching/changing-gateway-of-last-resort/td-p/2187625>

### NAT / PAT

- <https://www.networkstraining.com/configuring-nat-on-cisco-routers/>
- <https://www.cisco.com/c/en/us/support/docs/ip/network-address-translation-nat/13773-2.html>
- <https://community.cisco.com/t5/security-documents/pat/ta-p/3114711>
- <https://www.computernetworkingnotes.com/ccna-study-guide/configure-pat-in-cisco-router-with-examples.html>

### VLAN

- <https://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst4500/12-2/25ew/configuration/guide/conf/vlans.html>
- <https://www.cisco.com/c/en/us/td/docs/switches/datacenter/nexus5000/sw/configuration/guide/cli/CLIConfigurationGuide/VLANs.html>
- <https://www.ccnablog.com/inter-vlan-routing/>

### Static routing



- <https://community.cisco.com/t5/networking-documents/static-routes-with-next-hop-as-an-exit-interface-or-an-ip/ta-p/3146984>
- <https://www.cisco.com/c/en/us/support/docs/dial-access/floating-static-route/118263-technote-nexthop-00.html>
- <https://nurhariawanbulu.wordpress.com/2012/11/05/2-8-1-basic-static-route-configuration-lab/>
- <https://www.learnisco.net/courses/icnd-1/ip-routing-technologies/static-routing.html>

## ACL

- [https://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst2960/software/release/12-2\\_52\\_se/configuration/guide/2960scg/swacl.html](https://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst2960/software/release/12-2_52_se/configuration/guide/2960scg/swacl.html)
- <https://www.cisco.com/c/en/us/support/docs/security/ios-firewall/23602-confaccesslists.html>
- <https://www.orbit-computer-solutions.com/access-control-lists/>
- <https://www.certificationkits.com/cisco-certification/cisco-ccna-640-802-exam-certification-guide/cisco-ccna-acl-part-iv/>

## Internet Access

- <https://www.yourictmagazine.com/howtos/434-basics-to-configure-a-cisco-router-to-connect-to-internet.html>
- <https://www.cisco.com/c/en/us/support/docs/ip/domain-name-system-dns/24182-reversedns.html>
- <https://deltaconfig.com/cisco-router-initial-internet-access/>
- CCNA Routing & Switching Course

## VPN

- <http://www.firewall.cx/cisco-technical-knowledgebase/cisco-routers/867-cisco-router-site-to-site-ipsec-vpn.html>
- [https://www.cisco.com/c/en/us/td/docs/security/vpn\\_modules/6342/vpn\\_cg/6342site3.html](https://www.cisco.com/c/en/us/td/docs/security/vpn_modules/6342/vpn_cg/6342site3.html)
- <https://www.cisco.com/c/en/us/support/docs/routers/1700-series-modular-access-routers/71462-rtr-l2l-ipsec-split.html>
- <http://www.firewall.cx/cisco-technical-knowledgebase/cisco-routers/868-cisco-router-gre-ipsec.html>
- <https://community.cisco.com/t5/networking-documents/how-to-configure-a-gre-tunnel/ta-p/3131970>