Practical work using Routing Protocols OSPF and BGP4

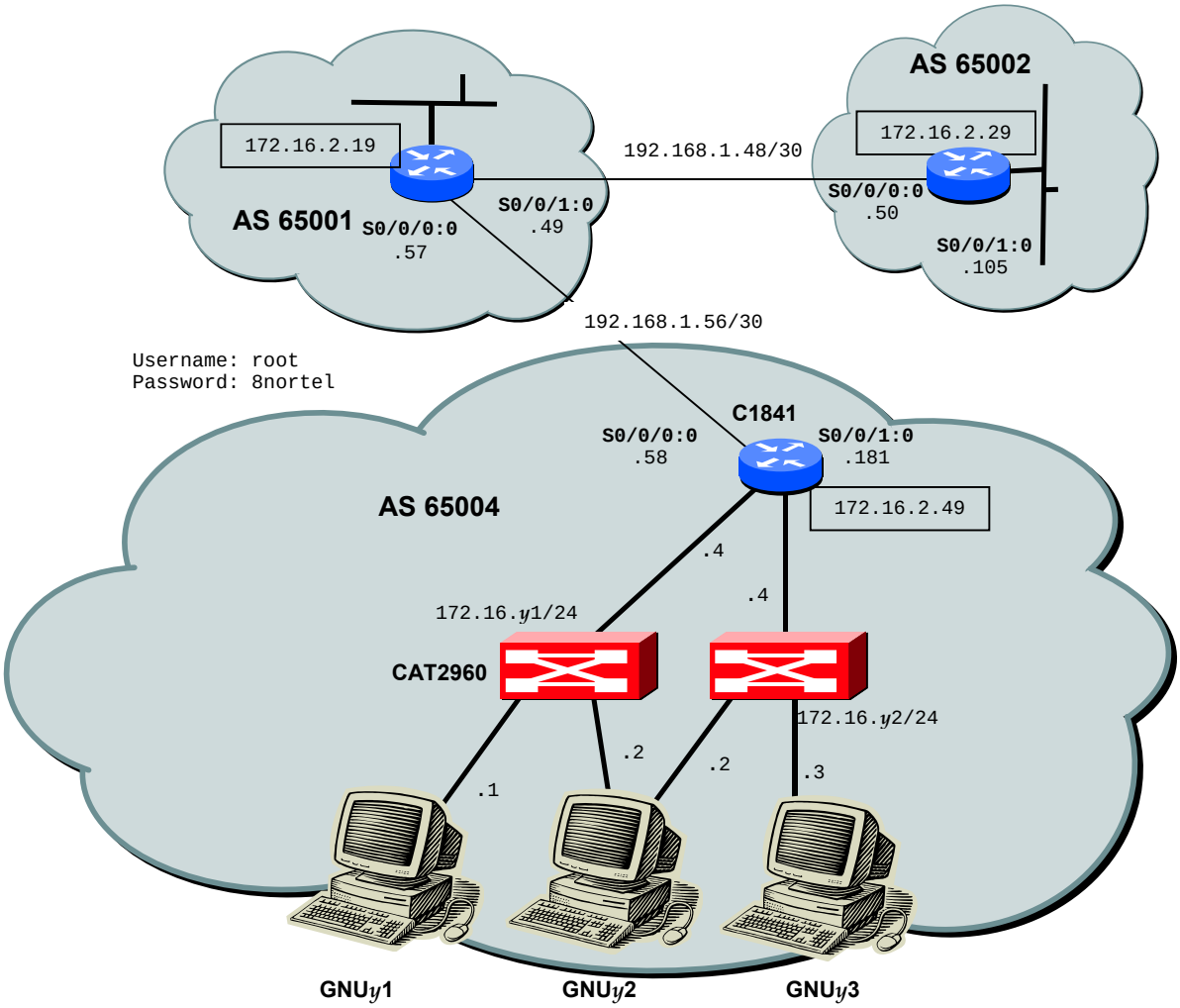
Introduction

The aim of this work is to enable the student to understand clearly, using a case study, the concepts of Autonomous System (AS), Routing Interior and Exterior Routing Protocols respective examples of OSPF and BGP4.

Brief Description

Consider the following topology:

- The routers are interconnected by serial interfaces with links to 2 Mb / s.
- There are six Autonomous Systems (AS): AS65001 - AS65006.
- All routers in same AS run an OSPF process and are in OSPF area 0.
- The routers C1841 have functions of area border router (ABR) and exchange the routing information with other AS via BGP-4.



Requirements and Goals

Interior Routing

1. Using equipment available in your workbench, configure the topology shown above,

- (Lab. I320) Each group will set up an AS in his workbench and should be linked to two other workbenches via the serial WAN interfaces, according to the following configuration:

Workbench	AS	Peering
1	65001	AS65002, AS65004
2	65002	AS65001, AS65006
3	65003	AS65005, AS65006
4	65004	AS65001, AS65005
5	65005	AS65003, AS65004
6	65006	AS65003, AS65002

- (Lab. I321) Each group will set up an AS in his workbench and should be linked to two other workbenches via the serial WAN interfaces, according to the following configuration:

Bancada	AS	Peering
1	65001	AS65002, AS65005
2	65002	AS65001, AS65003, AS65004
3	65003	AS65002, AS65006
4	65004	AS65002, AS65005
5	65005	AS65001, AS65004, AS65006
6	65006	AS65003, AS65005

- The point-to-point WAN links have addresses like 192.168.1. (*xy* * 4) / 30, where *x* and *y* are the numbers of the connected workbenches in ascending order, with the lowest IP address for the router's interface of the workbench *x*;
- Each group will set up two local area networks (or two VLANs on the switch) that will connect to the CAT2960;
- Assign addresses to interfaces as indicated in the topological representation;
- Install and configure the OSPF on the servers GNU***y***[1-3] using the software package "Quagga";
- Configure the router C1841 as the default gateway for the network and make its announcement by OSPF;
- Present the routing tables of all systems running OSPF.

2. Simulate a fault in the circuit linking the GNU*y*2 to the network it shares with the GNU*y*1. Check the resulting changes in the routing tables of the multiple routers.

3. Present the results of the *traceroute* from the system GNU***y***1 to GNU***y***2.

Exterior Routing

4. Activate BGP peering between the various AS, allowing only the advertisement of the networks listed in this guide (cannot appear in routing tables any other networks in the laboratory). Present the routing table of the ABR of each AS.

5. Test connectivity between the systems GNU*y*3 of an AS with the correspondents of the neighboring ASes. Present the results of *traceroute* between these two systems.
6. Only the ABR of each AS should know all the routes. The routers inside an AS only know the routes of their AS and make default routing to the ABR (will be the gateway to the network 0.0.0.0). Configure your BGP routing process to ensure that your AS's traffic with neighbors is done using the neighbor with the highest AS #.

Conclusion

7. As a conclusion you should elaborate a summary report in PDF format, with answers to previous questions and present attached configurations that had the equipment needed to make it work on the workbench, including: router, switch and the various daemons with OSPF "Quagga".

Annexes

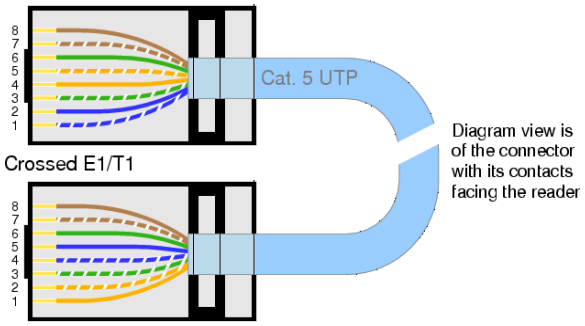
- Como activar o *IP forwarding* no kernel do Linux

```
# echo 1 > /proc/sys/net/ipv4/ip_forward
```

- Comandos Cisco IOS para criar processos OSPF e BGP

```
rtr(config)#! Criar processo OSPF
rtr(config)#router ospf process-nmb
rtr(config-router)#! Como forçar um ID ao router
rtr(config-router)#router-id interface-IP
rtr(config)#! Criar processo BGP
rtr(config)#router bgp AS-nmb
rtr(config-router)#no synchronization
rtr(config-router)# neighbor Next-hop-IP remote-as AS-neighbor
```

- Cabo *crossover* para as ligações E1



- Comandos Cisco IOS para configurar as interfaces E1 no Cisco 1841

```
gnu-rtr(config)#! Configurar os controladores
gnu-rtr(config)#card type e1 0 0
gnu-rtr(config)#controller E1 0/0/0
gnu-rtr(config-controller)#channel-group 0 timeslots 1-31
```

```
gnu-rtr(config)#controller E1 0/0/1
gnu-rtr(config-controller)#channel-group 0 timeslots 1-31
gnu-rtr(config)#! Depois de configurar o controlador as interfaces
gnu-rtr(config)#! Serie passam a existir e podem ser configuradas
gnu-rtr(config)#int Serial0/0/0:0
gnu-rtr(config-if)#ip address ...
gnu-rtr(config)#int Serial0/0/1:0
gnu-rtr(config-if)#ip address ...
```

Reference Material

- Tanenbaum, Andrew S., *Computer Networks, 3rd Ed.*
- Comer, Douglas E., *Internetworking with TCP/IP, Vol I*
- Documentação online dos routers Cisco http://cisco.com
- http://www.quagga.net
- Configuração das interfaces WAN, HWIC T1/E1, do Cisco 1841 http://cisco.com/univercd/cc/td/doc/product/access/acs_mod/1700/1700cnts/t1e11700.pdf
- Exemplo de configuração do "Zebra" http://www-106.ibm.com/developerworks/linux/library/l-emu/?ca=dgr-lnxw02Zebra
- RFC's.