universidade de aveiro
theoria poiesis praxis

Redes e Serviços

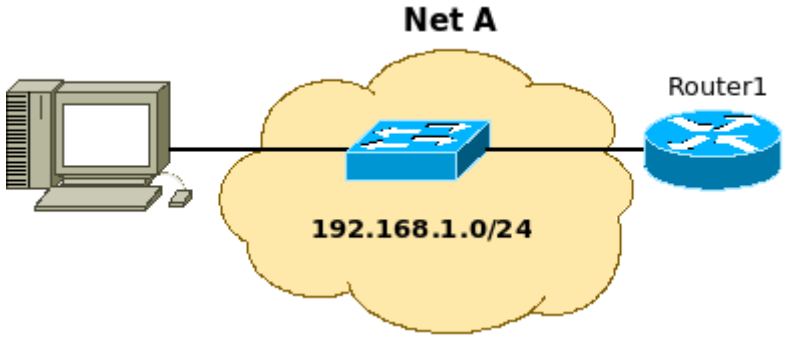
Objetivos

- Mecanismos básicos do protocolo IPv4
- Mecanismos básicos do protocolo IPv6
- Rotas estáticas IPv4 e IPv6

Duração

1 aula

IPv4 Basic Mechanisms



1. Considering the above depicted network, start by connecting the PC (Linux) to the switch. Configure the IPv4 address on the PC:

```
sudo ifconfig eth0 up
sudo ifconfig eth0 192.168.1.100/24
```

Configure the Router IPv4:

```
Router(config-if)# ip address 192.168.1.1 255.255.255.0
Router(config-if)# no shut
```

Note1: You can use GNS3, using a virtual machine with Linux as PC.

2. Start a new capture with the visualization filter. At the PC. To visualize the ARP table at the PC. execute the command:

```
arp -n
```

(If present) Erase the ARP entry of the Router IPv4 address:

```
sudo arp -d 192.168.1.1
```

Re-visualize the ARP table. Execute the command:

```
ping 192.168.1.1
```

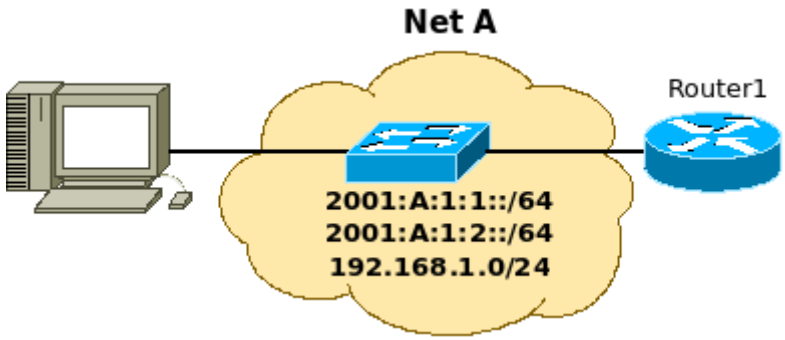
and re-visualize the ARP table at the PC. Explain the ARP protocol.

3. Start a new capture. At the PC, execute the command:

```
ping -s 3000 192.168.1.1
```

Analyze and explain the IPv4 fragmentation process.

IPv6 Basic Mechanisms



4. Considering the above depicted network, start by connecting the PC (running Linux) to the switch without any other connections. Also, with Wireshark start a capture on device Pseudo-any (all interfaces) in non-promiscuous mode. Turn off and on the PC's Ethernet interface:

```
sudo ifconfig eth0 down
sudo ifconfig eth0 up
```

Stop the capture and analyze the IPv6 packets.

5. Connect Router1 to the switch and with Wireshark (at the PC) start a capture on device Pseudo-any (all interfaces) in non-promiscuous mode. Power on Router1 and configure it's interface to network A.

```
Router1(config)# ipv6 unicast-routing
Router1(config)# interface <if-name>
Router1(config-if)# ipv6 enable
Router1(config-if)# no shutdown
```

Verify router's interfaces configuration:

```
Router1# show ipv6 interface
Router1# show ipv6 interface brief
```

Restart PC's ethernet interface and verify it's interface information:

```
sudo ifconfig eth0 down                 (sudo ifconfig eth1 down)
sudo ifconfig eth0 up                   (sudo ifconfig eth1 up)
ifconfig eth0                     (ifconfig eth1)
```

Stop the capture and analyze the IPv6 packets and equipments information. Use the command (show ipv6 interface brief) to verify interfaces' IPv6 addressing and the command (show ipv6 route) to verify router's IPv6 routing table.

6. With Wireshark (at the PC) restart a capture on PC's Ethernet interface (device eth0 or eth1) in promiscuous mode. Configure Router's interface with a manually defined IPv6 global address from network 2001:A:1:1::/64.

```
Router1(config)# interface <if-name>
Router1(config-if)# ipv6 address 2001:A:1:1::100/64
Router1(config-if)# no shutdown
```

Verify PC's Ethernet interface information. Stop the capture and analyze the IPv6 packets. Verify Router's interfaces IPv6 addresses and router's IPv6 routing table.

7 With Wireshark (at the PC) restart a capture on PC's Ethernet interface (device eth0 or eth1) in promiscuous mode. Configure Router's interface with a EUI-64 based IPv6 global address from network 2001:A:1:2::/64.

```
Router1(config)# interface <if-name>
Router1(config-if)# ipv6 address 2001:A:1:2::/64 eui-64
Router1(config-if)# no shutdown
```

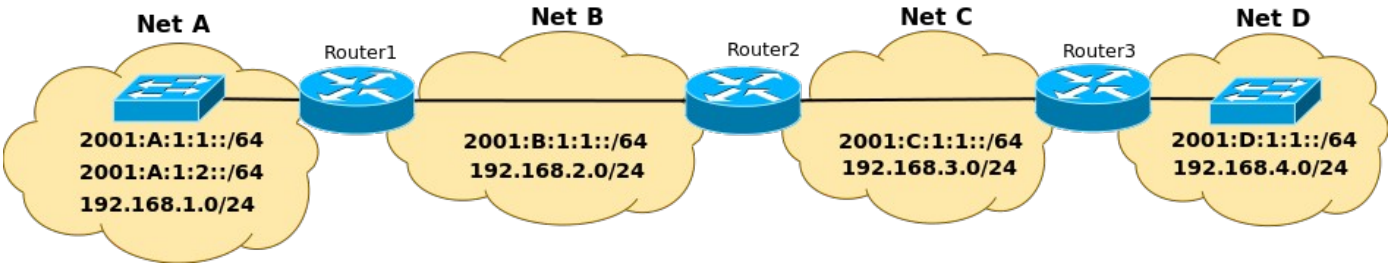
Verify PC's Ethernet interface information. Stop the capture and analyze the IPv6 packets. Verify Router's interfaces IPv6 addressing and the router's IPv6 routing table

8. With Wireshark (at the PC) restart a capture on on PC's Ethernet interface (device eth0 or eth1) in promiscuous mode. At the PC, using the command *ping6* perform a ping to:

a) Router's Link-Local address (you need to define the output interface with option “-I eth0” or “-I eth1”).
b) Router's Global address from network 2001:A:1:1::/64.
c) Router's Global address from network 2001:A:1:2::/64.

Stop the capture and analyze the IPv6/ICMPv6 packets. Explain the hardware addresses resolution process in IPv6.

IPv4 and IPv6 Static Routing



9.Assemble the above depicted network **using GNS3** and configure all IPv4 and IPv6 addresses. Verify the interfaces' configurations, routing tables, IPv4 ARP tables and IPv6 NDP tables (neighbors):

```
Router1# show ip interface brief
Router1# show ip route
Router1# show ip arp
---
Router1# show ipv6 interface brief
Router1# show ipv6 route
Router1# show ipv6 neighbors
```

Execute multiple ping commands to test the connectivity between the equipments.

10. Configure all necessary static routes to achieve full IPv4 connectivity:

```
Router1(config)# ip route <ipv4-net-id> <ipv4-net-mask> <ipv4_next_hop>
```

Reverify the routing tables and retest the connectivity between the equipments.

11. Configure all necessary static routes to achieve full IPv6 connectivity:

```
Router1(config)# ipv6 route <ipv6-netid/mask> <ipv6_next_hop>
```

Reverify the routing tables and retest the connectivity between the equipments.

12. Try to simplify your static routes using default routes (IPv4: 0.0.0.0/0, IPV6: ::/0) where appropriate. Reverify the routing tables and retest the connectivity between the equipments.

13. Execute a ping from Router1 to Router3. After capturing packets in NetB and NetC:
- Analyze the Ethernet headers of the packets, namely the source and destination addresses. Explain the differences of the Ethernet headers.
- Analyze the IPv4 *TTL* field and IPv6 *Hop Counter* field. Explain the purpose of these header fields.