Department of ICT

Faculty of Technology

University of Ruhuna

Computer Networks – ICT1253 **Level 1 - Semester - 2**

Lab Sheet 08 **| 2022**

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Goals:

Understand IPv4 and IPv6 addressing methods.

Understand static and DHCP IPv4 addressing.

Understand static, autoconfig and DHCP IPv6 addressing.

Testing examples in Cisco packet tracer.

Exercise 1:

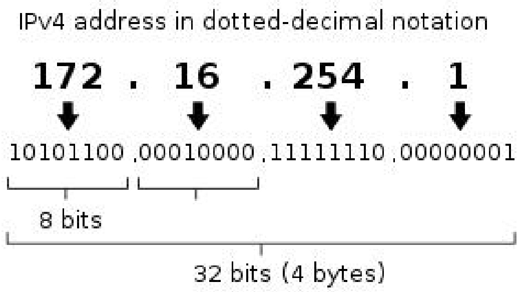
1. Read the description about IPv4.

Internet Protocol version 4 (IPv4) is the fourth version of the Internet Protocol (IP). It is one of the core protocols of standards-based internetworking methods in the Internet, and was the first version deployed for production in the ARPANET in 1983. It still routes most Internet traffic today, despite the ongoing deployment of a successor protocol, IPv6. IPv4 is described in IETF publication RFC 791 (September 1981), replacing an earlier definition (RFC 760, January 1980).

IPv4 is a connectionless protocol for use on packet-switched networks. It operates on a best effort delivery model, in that it does not guarantee delivery, nor does it assure proper sequencing or avoidance of duplicate delivery. These aspects, including data integrity, are addressed by an upper layer transport protocol, such as the Transmission Control Protocol (TCP).

IPv4 uses **32-bit** addresses which limits the address space to **4294967296 (2^{32})** addresses.

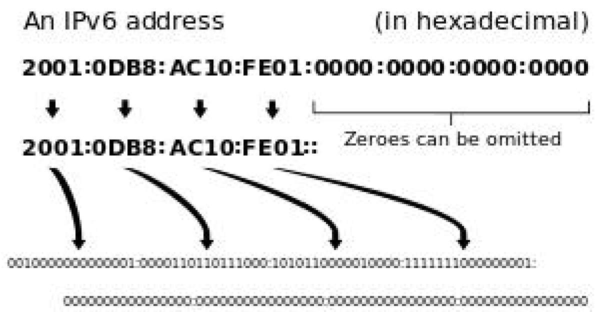
IPv4 reserves special address blocks for private networks (~18 million addresses) and multicast addresses (~270 million addresses).



2. Read the description about IPv6.

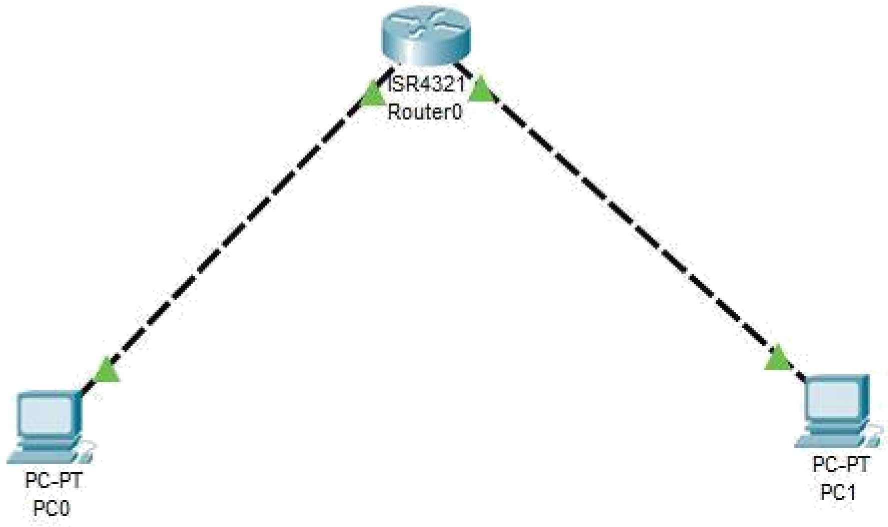
Internet Protocol version 6 (IPv6) is the most recent version of the Internet Protocol (IP), the communications protocol that provides an identification and location system for computers on networks and routes traffic across the Internet. IPv6 was developed by the Internet Engineering Task Force (IETF) to deal with the long-anticipated problem of IPv4 address exhaustion. IPv6 is intended to replace IPv4. IPv6 became a Draft Standard in December 1998, and became an Internet Standard on 14 July 2017.

Devices on the Internet are assigned a unique IP address for identification and location definition. With the rapid growth of the Internet after commercialization in the 1990s, it became evident that far more addresses would be needed to connect devices than the IPv4 address space had available. By 1998, the Internet Engineering Task Force (IETF) had formalized the successor protocol. IPv6 uses a 128-bit address, theoretically allowing $\mathbf{2^{128}}$, or approximately $\mathbf{3.4\times10^{38}}$ addresses. The actual number is slightly smaller, as multiple ranges are reserved for special use or completely excluded from use. The total number of possible IPv6 addresses is more than 7.9×10^{28} times as many as IPv4, which uses 32-bit addresses and provides approximately 4.3 billion addresses. The two protocols are not designed to be interoperable, complicating the transition to IPv6. However, several IPv6 transition mechanisms have been devised to permit communication between IPv4 and IPv6 hosts.



Exercise 2 (IPv4 static addressing):

1. Open Cisco packet tracer.
2. Add a router and two PCs.
3. Connect those using proper cables.



4. Assign these IP addresses to relevant PCs

PC/Interface name	IP address	Default gateway
PC0	192.168.1.1	192.168.1.254
PC1	192.168.2.1	192.168.2.254
GigabitEthernet 0/0/0	192.168.1.254	
GigabitEthernet 0/0/1	192.168.2.254	

5. Subnet mask is **255.255.255.0**. No DNS server.
6. Ping between PCs. It might be successful.
7. Save the workspace.

Exercise 3 (IPv4 DHCP addressing):

1. Read the document about DHCP addressing.

The **Dynamic Host Configuration Protocol** (DHCP) is a network management protocol used on UDP/IP networks whereby a DHCP server dynamically assigns an IP address and other network configuration parameters to each device on a network so they can communicate with other IP networks. A DHCP server enables computers to request IP addresses and networking parameters automatically from the Internet service provider (ISP), reducing the need for a network administrator or a user to manually assign IP addresses to all network devices. In the absence of a DHCP server, a computer or other device on the network needs to be manually assigned an IP address, or to assign itself an APIPA address, which will not enable it to communicate outside its local subnet.

DHCP can be implemented on networks ranging in size from home networks to large campus networks and regional Internet service provider networks. A router or a residential gateway can be enabled to act as a DHCP server. Most residential network routers receive a globally unique IP address within the ISP network. Within a local network, a DHCP server assigns a local IP address to each device connected to the network.

2. Open a new workspace in Cisco Packet Tracer.

3. Add components stated in exercise 2.

4. Assign these IP addresses to relevant PCs

PC/Interface name	**IP address**	**Default gateway**
PC0	DHCP	
PC1	DHCP	
GigabitEthernet 0/0/0	192.168.1.254	
GigabitEthernet 0/0/1	192.168.2.254	

5. DHCP might unsuccessful and an APIPA configuration will be used.

APIPA is short for **Automatic Private IP Addressing**, a feature of Windows and linux operating systems, meant for non-routed small business environments, usually less than 25 clients.

With APIPA, DHCP clients can automatically self-configure an IP address and subnet mask when a DHCP server isn't available. When a DHCP client boots up, it first looks for a DHCP server in order to obtain an IP address and subnet mask.

If the client is unable to find the information, it uses APIPA to automatically configure itself with an IP address. The IP address range is 169.254.0.1 through 169.254.255.254. The client also configures itself with a default class B subnet mask of 255.255.0.0. A client uses the self-configured IP address until a DHCP server becomes available.

The APIPA service also checks regularly for the presence of a DHCP server (every five minutes, according to Microsoft). If it detects a DHCP server on the network, APIPA stops, and the DHCP server replaces the APIPA networking addresses with dynamically assigned addresses.

6. Ping between PCs using APIPA. It might be unsuccessful because of APIPA addresses will not be routed.

7. Log into the router and use DHCP server facility.

```
Router>en

Router#configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#ip dhcp pool NETone Router(dhcp-

config)#network 192.168.1.0 255.255.255.0 Router(dhcp-

config)#default-router 192.168.1.254 Router(dhcp-config)#exit


Router(config)#ip dhcp pool NETtwo Router(dhcp-

config)#network 192.168.2.0 255.255.255.0

Router(dhcp-config)#default-router 192.168.2.254

Router(dhcp-config)#exit
```

8. Ping between PCs using DHCP address. Now it might successful.

9. Save the workspace.

Exercise 4 (IPv6 static addressing):

1. Open a new workspace in Cisco Packet Tracer.

2. Add components stated in exercise 2.

3. Assign these IP addresses to relevant PCs

PC/Interface name	IPv6 address	IPv6 gateway
PC0	2401:AAAA::1/64	2401:AAAA::FFFF
PC1	2401:BBBB::1/64	2401:BBBB::FFFF
GigabitEthernet 0/0/0	2401:AAAA::FFFF/64	
GigabitEthernet 0/0/1	2401:BBBB::FFFF/64	

4. No DNS server. Interface IPv6 addresses are not available in config tab. It have to be assigned in CLI.

```
Router>en

Router#config terminal

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#interface gigabitEthernet 0/0/0
```

```
Router(config-if)#ipv6 address 2401:AAAA::FFFF/64

Router(config-if)#no shutdown

Router(config-if)#

%LINK-5-CHANGED: Interface GigabitEthernet0/0/0, changed
state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/0/0, changed state to up

Router(config-if)#exit

Router(config)#interface gigabitEthernet 0/0/1

Router(config-if)#ipv6 address 2401:BBBB::FFFF/64

Router(config-if)#no shutdown

Router(config-if)#

%LINK-5-CHANGED: Interface GigabitEthernet0/0/1, changed
state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/0/1, changed state to up
```

5. Ping between PCs. It might be successful.
6. Save the workspace.

Exercise 5 (IPv6 auto configuration):

1. Open a new workspace in Cisco Packet Tracer.
2. Add components stated in exercise 2.
3. Assign these IP addresses to relevant PCs

PC/Interface name	**IPv6 address**
PC0	Auto config
PC1	Auto config
GigabitEthernet 0/0/0	2401:AAAA::FFFF/64
GigabitEthernet 0/0/1	2401:BBBB::FFFF/64

4. No DNS server. Interface IPv6 addresses are not available in config tab. It have to be assigned in CLI.

```
Router>en

Router#config terminal

Enter configuration commands, one per line.  End with CNTL/Z.

Router(config)#interface gigabitEthernet 0/0/0

Router(config-if)#ipv6 address 2401:AAAA::FFFF/64

Router(config-if)#no shutdown

Router(config-if)#

%LINK-5-CHANGED: Interface GigabitEthernet0/0/0, changed
state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/0/0, changed state to up

Router(config-if)#exit

Router(config)#interface gigabitEthernet 0/0/1

Router(config-if)#ipv6 address 2401:BBBB::FFFF/64

Router(config-if)#no shutdown

Router(config-if)#

%LINK-5-CHANGED: Interface GigabitEthernet0/0/1, changed
state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/0/1, changed state to up

Router(config-if)#exit

Router(config)#ipv6 unicast-routing
```

5. IPv6 auto assignment will be successful. Ping between PCs. It might be successful.

6. Save the workspace.

Exercise 6 (IPv6 DHCP):

1. Open a new workspace in Cisco Packet Tracer.

2. Add components stated in exercise 2.

3. Assign these IP addresses to relevant PCs

PC/Interface name	**IPv6 address**
PC0	DHCP
PC1	DHCP
GigabitEthernet 0/0/0	2401:AAAA::FFFF/64
GigabitEthernet 0/0/1	2401:BBBB::FFFF/64

4. No DNS server. Interface IPv6 addresses are not available in config tab. It have to be assigned in CLI.

```
Router>en

Router#config terminal

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#interface gigabitEthernet 0/0/0 Router(config-

if)#ipv6 address 2401:AAAA::FFFF/64 Router(config-if)#ipv6

dhcp server LAN1 Router(config-if)#ipv6 enable


Router(config-if)#no

shutdown Router(config-if)#

%LINK-5-CHANGED: Interface GigabitEthernet0/0/0, changed
state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/0/0, changed state to up

Router(config-if)#exit Router(config)#interface

gigabitEthernet 0/0/1 Router(config-if)#ipv6

address 2401:BBBB::FFFF/64 Router(config-

if)#ipv6 dhcp server LAN2 Router(config-if)#ipv6

enable Router(config-if)#no shutdown

Router(config-if)#
```

```
%LINK-5-CHANGED: Interface GigabitEthernet0/0/1, changed
state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/0/1, changed state to up

Router(config-if)#exit

Router(config)#ipv6 dhcp pool LAN1

Router(config-dhcpv6)#address prefix 2401:AAAA::/64

Router(config-dhcpv6)#prefix-delegation pool LAN1

Router(config-dhcpv6)#exit

Router(config)#ipv6 dhcp pool LAN2

Router(config-dhcpv6)#address prefix 2401:BBBB::/64

Router(config-dhcpv6)#prefix-delegation pool LAN2

Router(config-dhcpv6)#exit

Router(config)#ipv6 local pool LAN1 2401:AAAA::/112 64

Router(config)#ipv6 local pool LAN2 2401:BBBB::/112 64
```

5. IPv6 DHCP will be successful. Ping between PCs. It might be successful.
6. Save the workspace.

Command	Description
ipv6 dhcp pool *poolname*	To configure a Dynamic Host Configuration Protocol (DHCP) for IPv6 server configuration information pool and enter DHCP for IPv6 pool configuration mode
ipv6 dhcp server *poolname*	To enable Dynamic Host Configuration Protocol (DHCP) for IPv6 service on an interface, use the ipv6 dhcp server in interface configuration mode.
prefix-delegation pool *poolname*	Prefix delegation, also known as PD, is one of the methods available in IPv6 for communicating information to a device about what networks are available for subnetting. Service providers can assign customers a prefix to be used on their own internal networks.