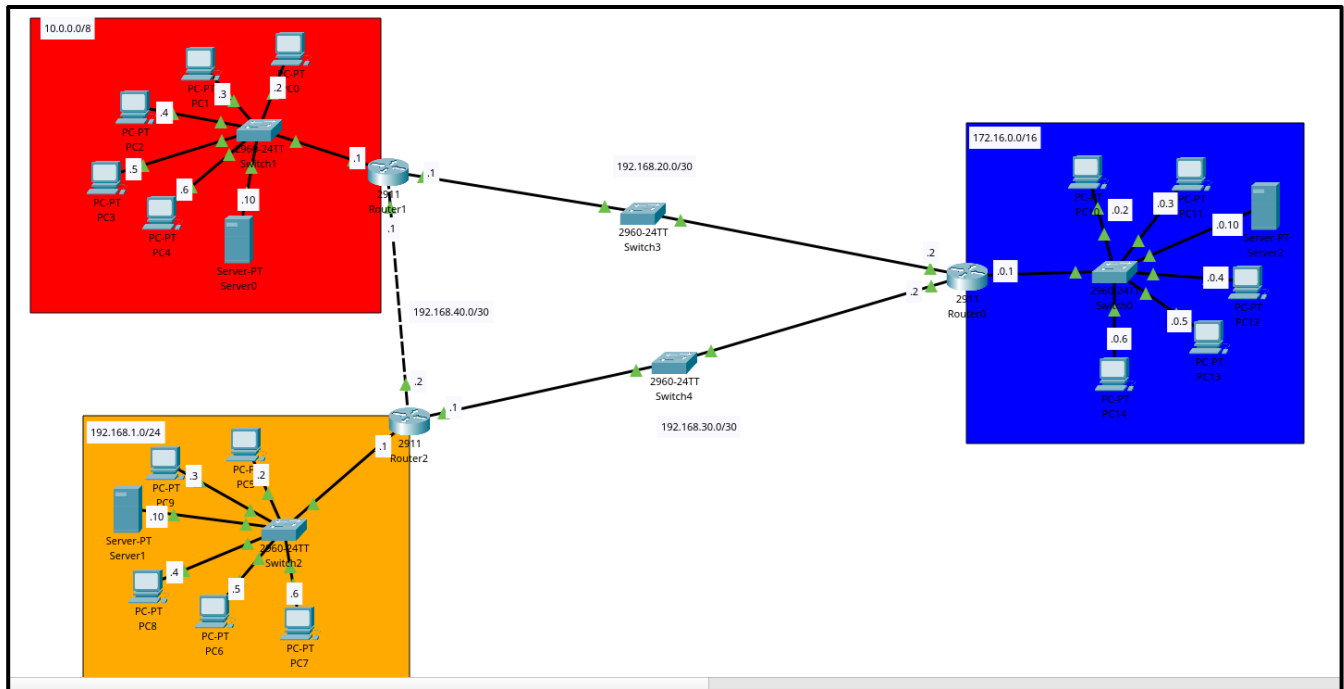# NETWORK TOPOLOGY AS CREATED IN PACKET TRACER

LAN CONFIGURATION

NOORAIN EQBAL

230953454

CCEC 50

___/___/___

LAN networks (switch, PC's and servers)

Switch	connected devices	network address	subnet mask	class
Switch 0	PC10, PC11, PC12 PC13, PC14, S2	172.16.0.0/16	255.0.0.0	B
Switch 1	PC0 – PC4 S1	10.0.0.0/8	255.0.0.0	A
Switch 2	PC5 – PC9 S0	192.168.1.0/24	255.255.255.0	C
Switch 3	R1, R0	192.168.20.0/30	255.255.255.252	classless
Switch 4	R0, R2	192.168.30.0/30	255.255.255.252	classless

IP ADDRESS ASSIGNED FOR EACH PC AND SERVER

NOORAIN EQBAL

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CCEC 50

___/___/___

Assigned IPs for PC's and servers

Device	IP address	Subnet mask	Gateway

ROUTER CONFIGURATION

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__/__/__

Router configuration

Router	interface	ip address	Subnet
R0	G 0/0	192.168.20.2	255.255.255.252
R0	G 0/0	172.16.0.1	255.255.0.0
R0	G 0/2	192.168.30.2	255.255.255.252

OSPF Configuration for the network

Parth Verma

OSPF

→ OSPF or Open Shortest Path First is a link-state routing protocol used in IP networks to dynamically exchange routing information. It is widely used in et enterprise networks due to its fast convergene, scalability and support for multiple areas.

Parth Verma

⇒ <u>Router 0</u>

→ Router ID : Not explicitly set
→ OSPF Area : Area 0 (Backbone)
→ Connected Networks :
  - 172.16.0.0/16 → Cover a large subnet
  - 192.168.20.0/30 → PTP link to Router 1
  - 192.168.30.0/30 → PTP link to Router 2

→ Role :
  - Backbone Router
  - Facilitates communication between Router 1 and Router 2

⇒ <u>Router 1</u>

→ Router ID : Not explicitly set, so highest IP address of an active interface will be used

→ OSPF Area : Area 0 (Backbone)

Parth Verma

⇒ **Router 2**

→ Router ID: Not explicitly set
~ OSPF Area: Area 0
→ Connect Networks:
  • 192.168.1.0/24 → Local subnet
  • 192.168.30.0/30 → PTP link to Router 0
  • 192.168.40.0/30 → PTP link to Router 1

→ Role:
  • Backbone Router
  • Connects both Router 0 and Router 1

BGP configuration for the networ

BGP (Border Gateway Protocol)

Router 0

en

conf t

router bgp 65000

bgp router-id 0.0.0.0

neighbour 192.168.20.1 remote-as 65001

neighbour 192.168.30.1 remote-as 65002

network 172.16.0.0 mask 255.255.0.0

Router 1

en

conf t

router bgp 65001

bgp router-id 1.1.1.1

neighbour 192.168.20.2 remote-as 65000

neighbour 192.168.40.2 remore-as 65002

network 10.0.0.0 mask 255.0.0.0

Router 2

en

conf t

router bgp 65002

bgp router-id 2.2.2.2

neighbour 192.168.30.2 remore-as 65000

neighbour 192.168.40.1 remore-as 65001

network 192.168.1.0 mask 255.255.255.0

→ Introduction :-

BGP (Border Gateway Protocol) is an inter domain routing protocol used to exchange routing information between different autonomous systems (AS). It helps in determining the best path for data to travel across the internet.

Each Router is part of Autonomous system (AS) and is configured to establish BGP peering with its neighbours.

→ BreakDown :-

Router 0 (AS 65000) peers with Router 1 (AS 65001) and Router 2
It advertises the 172.16.0.0/16 network

Router 1 (AS 65001) peers with Router 0 (AS 65000) and Router 2 (AS 65002)
It advertises the 10.0.0.0/8 network

Router 2 (AS 65002) peers with Router 0 (AS 65000) and Router 1 (AS 65001)
It advertises the 192.168.1.0/24

OSPF ROUTING TABLE

ROUTER 0

```
Router>show ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
192.168.40.1     1    FULL/BDR        00:00:30    192.168.20.1    GigabitEthernet0/0
192.168.40.2     1    FULL/DR         00:00:30    192.168.30.1    GigabitEthernet0/2
Router>show ip route ospf
     192.168.40.0/30 is subnetted, 1 subnets
O       192.168.40.0 [110/2] via 192.168.20.1, 04:37:48, GigabitEthernet0/0
                     [110/2] via 192.168.30.1, 04:37:48, GigabitEthernet0/2
```

ROUTER 1

```
Router>show ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
192.168.40.2     1    FULL/DR         00:00:37    192.168.40.2    GigabitEthernet0/1
192.168.30.1     1    FULL/DR         00:00:31    192.168.20.2    GigabitEthernet0/0
Router>show ip route ospf
     192.168.30.0/30 is subnetted, 1 subnets
O       192.168.30.0 [110/2] via 192.168.20.2, 04:38:41, GigabitEthernet0/0
                     [110/2] via 192.168.40.2, 04:38:41, GigabitEthernet0/1
```

ROUTER 2

```
Router>show ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
192.168.30.1     1    FULL/BDR        00:00:38    192.168.30.2    GigabitEthernet0/0
192.168.40.1     1    FULL/BDR        00:00:31    192.168.40.1    GigabitEthernet0/2
Router>show ip route ospf
     192.168.20.0/30 is subnetted, 1 subnets
O       192.168.20.0 [110/2] via 192.168.30.2, 04:39:33, GigabitEthernet0/0
                     [110/2] via 192.168.40.1, 04:39:33, GigabitEthernet0/2
```

BGP ROUTING TABLE

ROUTER 0

```
Router>show ip bgp
BGP table version is 6, local router ID is 0.0.0.0
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
*> 10.0.0.0/8       192.168.20.1           0      0      0 65001 i
*                   192.168.30.1           0      0      0 65002 65001 i
*> 172.16.0.0/16    0.0.0.0                0      0 32768 i
*> 192.168.1.0/24   192.168.30.1           0      0      0 65002 i
*                   192.168.20.1           0      0      0 65001 65002 i

Router>show ip route bgp
B    10.0.0.0/8 [20/0] via 192.168.20.1, 00:00:00
B    192.168.1.0/24 [20/0] via 192.168.30.1, 00:00:00
```

ROUTER 1

```
Router>show ip bgp
BGP table version is 6, local router ID is 1.1.1.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
*> 10.0.0.0/8       0.0.0.0                0      0 32768 i
*> 172.16.0.0/16    192.168.20.2           0      0      0 65000 i
*                   192.168.40.2           0      0      0 65002 65000 i
*  192.168.1.0/24   192.168.20.2           0      0      0 65000 65002 i
*>                  192.168.40.2           0      0      0 65002 i

Router>show ip route bgp
B    172.16.0.0/16 [20/0] via 192.168.20.2, 00:00:00
B    192.168.1.0/24 [20/0] via 192.168.40.2, 00:00:00
```

ROUTER 2

```
Router>show ip bgp
BGP table version is 6, local router ID is 2.2.2.2
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
             r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop         Metric LocPrf Weight Path
*> 10.0.0.0/8       192.168.40.1          0      0      0 65001 i
*                   192.168.30.2          0      0      0 65000 65001 i
*  172.16.0.0/16    192.168.40.1          0      0      0 65001 65000 i
*>                  192.168.30.2          0      0      0 65000 i
*> 192.168.1.0/24   0.0.0.0               0      0  32768 i

Router>show ip route bgp
B    10.0.0.0/8 [20/0] via 192.168.40.1, 00:00:00
B    172.16.0.0/16 [20/0] via 192.168.30.2, 00:00:00
```

ROUTING TABLES

Router 0

```
Router>show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

B    10.0.0.0/8 [20/0] via 192.168.20.1, 00:00:00
     172.16.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       172.16.0.0/16 is directly connected, GigabitEthernet0/1
L       172.16.0.1/32 is directly connected, GigabitEthernet0/1
B    192.168.1.0/24 [20/0] via 192.168.30.1, 00:00:00
     192.168.20.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.20.0/30 is directly connected, GigabitEthernet0/0
L       192.168.20.2/32 is directly connected, GigabitEthernet0/0
     192.168.30.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.30.0/30 is directly connected, GigabitEthernet0/2
L       192.168.30.2/32 is directly connected, GigabitEthernet0/2
     192.168.40.0/30 is subnetted, 1 subnets
```

Router 1

```
Router>show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       10.0.0.0/8 is directly connected, GigabitEthernet0/2
L       10.0.0.1/32 is directly connected, GigabitEthernet0/2
B    172.16.0.0/16 [20/0] via 192.168.20.2, 00:00:00
B    192.168.1.0/24 [20/0] via 192.168.40.2, 00:00:00
     192.168.20.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.20.0/30 is directly connected, GigabitEthernet0/0
L       192.168.20.1/32 is directly connected, GigabitEthernet0/0
     192.168.30.0/30 is subnetted, 1 subnets
O       192.168.30.0/30 [110/2] via 192.168.20.2, 04:44:30, GigabitEthernet0/0
                        [110/2] via 192.168.40.2, 04:44:30, GigabitEthernet0/1
     192.168.40.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.40.0/30 is directly connected, GigabitEthernet0/1
L       192.168.40.1/32 is directly connected, GigabitEthernet0/1
```
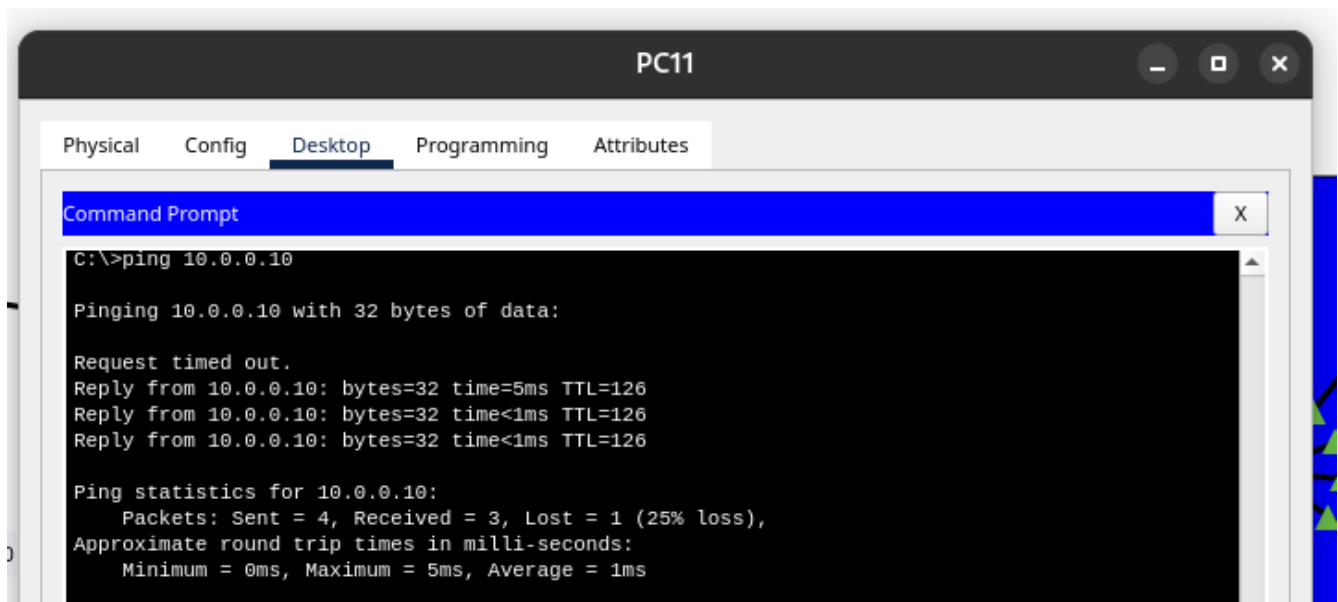
Router 2

```
Router>show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

B    10.0.0.0/8 [20/0] via 192.168.40.1, 00:00:00
B    172.16.0.0/16 [20/0] via 192.168.30.2, 00:00:00
     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/1
L       192.168.1.1/32 is directly connected, GigabitEthernet0/1
     192.168.20.0/30 is subnetted, 1 subnets
O       192.168.20.0/30 [110/2] via 192.168.30.2, 04:45:14, GigabitEthernet0/0
                        [110/2] via 192.168.40.1, 04:45:14, GigabitEthernet0/2
     192.168.30.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.30.0/30 is directly connected, GigabitEthernet0/0
L       192.168.30.1/32 is directly connected, GigabitEthernet0/0
     192.168.40.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.40.0/30 is directly connected, GigabitEthernet0/2
L       192.168.40.2/32 is directly connected, GigabitEthernet0/2
```

CHECKING CONNECTIVITY


```
C:\>ping 10.0.0.10

Pinging 10.0.0.10 with 32 bytes of data:

Request timed out.
Reply from 10.0.0.10: bytes=32 time=5ms TTL=126
Reply from 10.0.0.10: bytes=32 time<1ms TTL=126
Reply from 10.0.0.10: bytes=32 time<1ms TTL=126

Ping statistics for 10.0.0.10:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 5ms, Average = 1ms
```

PC11 in subnet 172.16.0.0/16 pings Server 0 in subnet 10.0.0.0/8

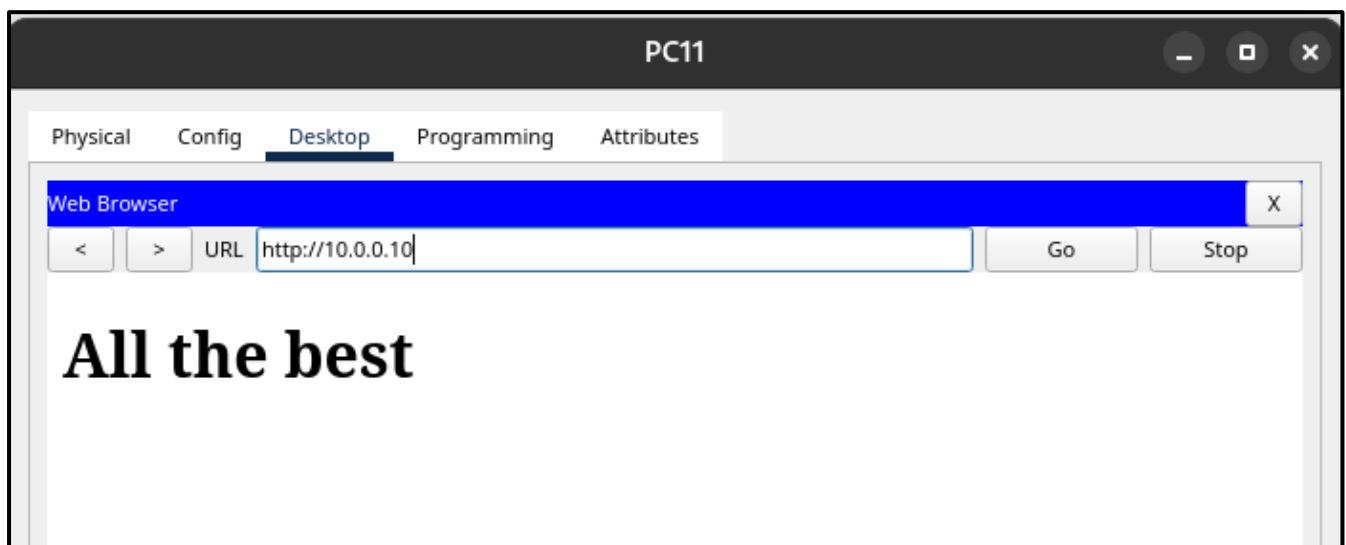Displaying "ALL THE BEST" message on PC0 from server 0

Server 0 configuration
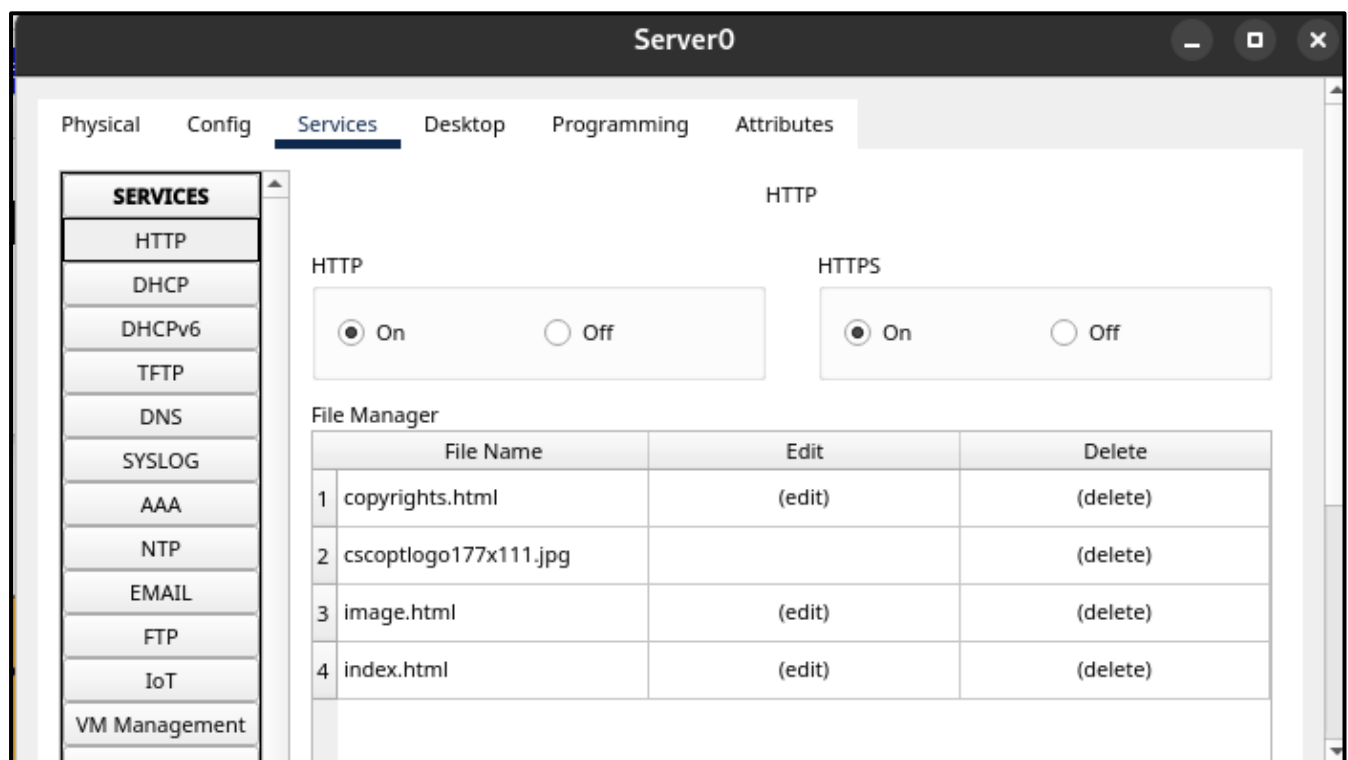
index.html file on server 0
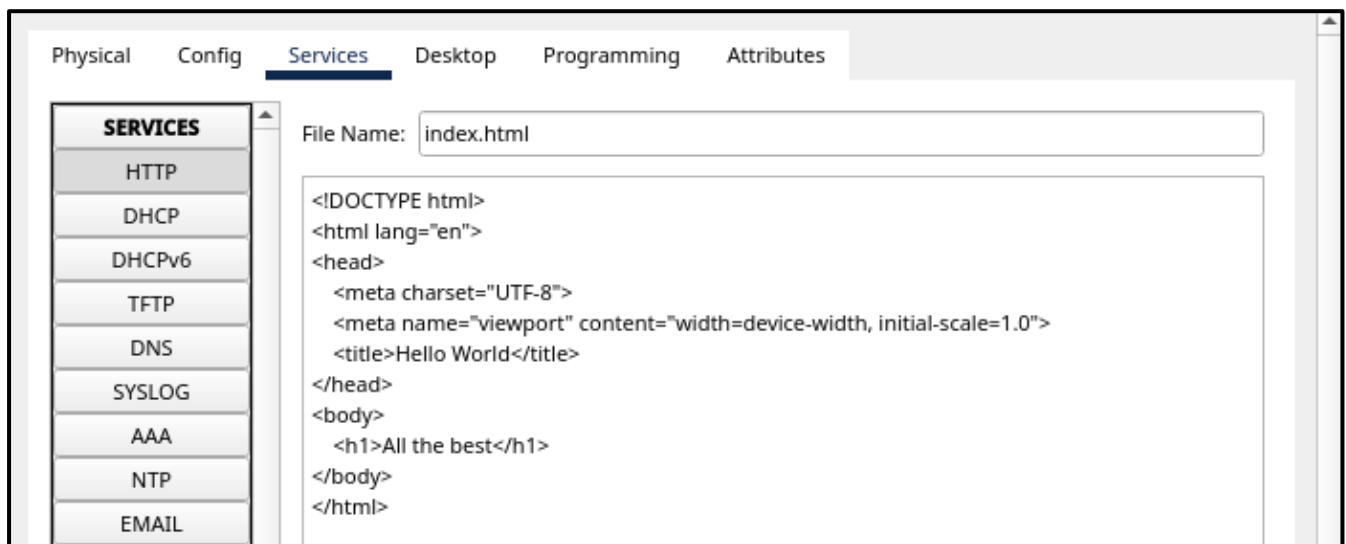
All the best message on PC11

ETHERNET FRAME

Ethernet Frame

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Introduction to Ethernet Frames

Ethernet is one of the most widely used networking technologies. It defines the structure of data packets known as Ethernet frames, are which are used for communications over a network. Ethernet frames encapsulate data and provide essential information for addressing and error checking.

Structure of an Ethernet Frame

An Ethernet frame consists of several fields, each serving a specific function. The standard frame structure follows the IEEE 802.3 protocol and consists of the following components:

1) Preamble (7 bytes)

A sequence of alternating 1s and 0s.

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Helps synchronize the sender and receiver clock

2) Start Frame Delimiter (SFD) (1 Byte)

Marks the end of the preamble and the beginning of the actual frame.

Value : 10101011 (binary)

3) Destination MAC Address (6 Bytes)

Identifies the intended recipient of the frame. If the destination MAC is FF: FF: FF: FF: FF: FF, the frame is a broadcast message sent to all devices in the network.

4) Source MAC Address (6 Bytes)

Specifies the sender's MAC address. Enables the recipient to send a response back to the sender.

5) EtherType / Length (2 Bytes)

If the value is greater than 1536 (0x0600) it represents an EtherType, indicating the protocol (e.g. IPV4, IPv6, ARP).

If the value is less than or equal to 1500, it represents the length of the payload (used in IE 802.3 frames).

6) Payload / Data (46-1500) Bytes)

Contains the actual data being transmitted.

Minimum payload size is 46 bytes; padding is added if necessary.

7) Frame Check Sequence (FCS) (4 Bytes)

Uses a Cyclic Redundancy Check (CRC) to detect errors in the frame.
If an error is detected, the frame is discarded.

Ethernet Frame Variants.

There are different types of Ethernet frames based on standards and use cases:

1) Ethernet II (DIX Ethernet)

Commonly used in modern networks.

2) IEEE 802.3 Frame

Supports IEEE 802.2 Logical Link Control (LLC) and SNAP headers.

3) VLAN Tagged Frame (IEEE 802.1Q)

Used for Virtual LAN (VLAN) segmentation.

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4) Jumbo Frames

Improve Efficiency by reducing overhead
in high-speed networks.

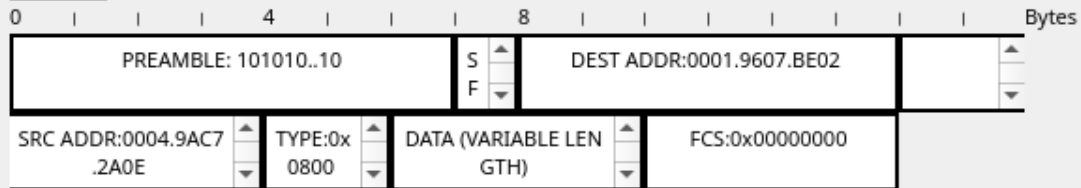ETHERNET FRAME AS VIEWED IN SIMULATION MODE OF PACKET TRACER

PDU Formats

EthernetII

```
0         |   |   |   4   |   |   |   8   |   |   |   |   |   |   |   Bytes
```

PREAMBLE: 101010..10	S F	DEST ADDR:0001.9607.BE02	

SRC ADDR:0004.9AC7.2A0E	TYPE:0x 0800	DATA (VARIABLE LENGTH)	FCS:0x00000000

IP

```
0   |   |   |   4   |   |   |   8   |   |   |   |   |   |   |   16   |   |   |   20   |   |   |   24   |   |   |   |   |   |   Bits
```

VER:4	IHL:5	DSCP:0x00	TL:128

ID:0x000d	FLAGS:0x0	FRAG OFFSET:0x000

TTL:128	PRO:0x01	CHKSUM

SRC IP:172.16.0.2

DST IP:192.168.1.4

DATA (VARIABLE LENGTH)