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INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University u/s 3 of UGC Act, 1956)
DELHI-NCR CAMPUS, GHAZIABAD (U.P.)

COMPUTER COMMUNICATIONS LAB

(Subject Code: 18CSS202J)

B.TECH. (CoMpUTEr sCiENCE ANd ENGiNEEriNG) - i

ii YEAr / iV sEMEsTEr

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Experiment-3 Create Subnet and transfer the data.

Theory: In subnetting, a network is divided into several smaller subnetworks (subnets) with each subnetwork having its own subnetwork address.
The IP addresses were originally designed with two levels of addressing. To reach a host on the Internet, we must first reach the network and then the host. It soon became clear that we need more than two hierarchical levels, for two reasons. First, an organization that was granted a block in class A or B needed to divide its large network into several sub networks for better security and management. Second, since the blocks in class A and B were almost depleted and the blocks in class C were smaller than the needs of most organizations, an organization that has been granted a block in class A or B could divide the block into smaller sub blocks and share them with other organizations. The idea of splitting a block to smaller blocks is referred to as subnetting.

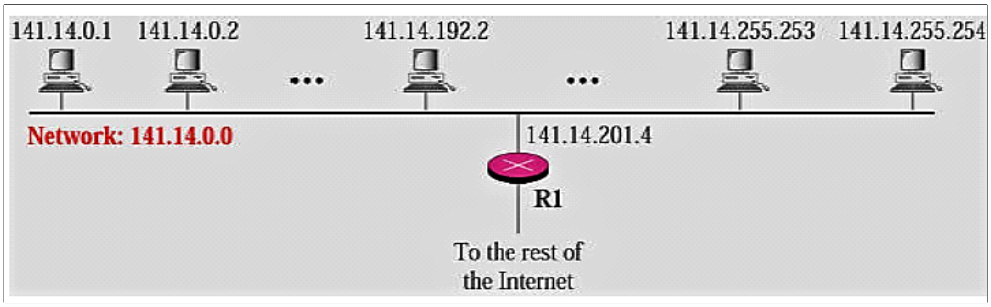


Figure: A network with two levels of hierarchy (not subnetted)

Figure shows a network using class B addresses before subnetting. We have just one network with almost 2^{16} hosts. The whole network is connected, through one single connection, to one of the routers in the Internet.

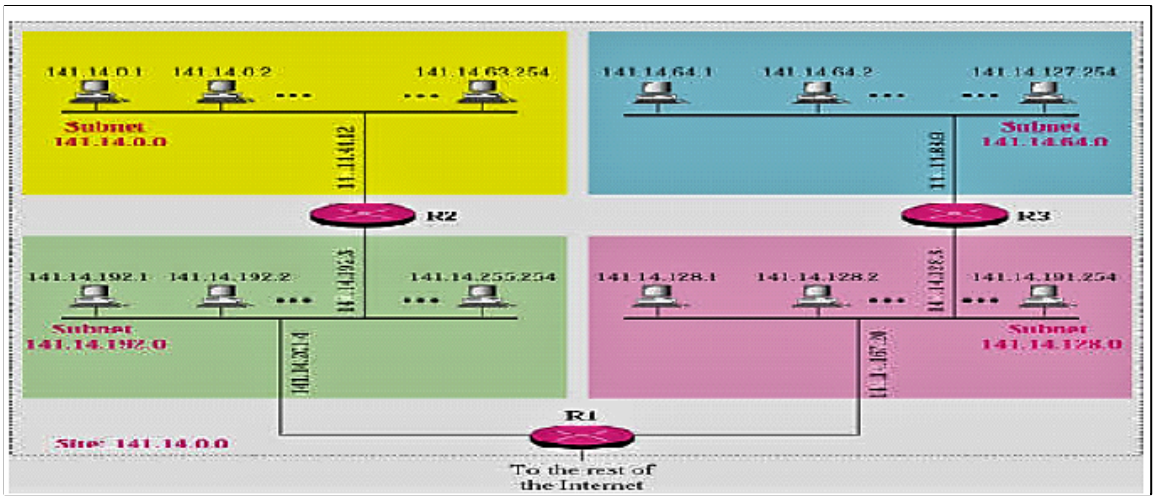
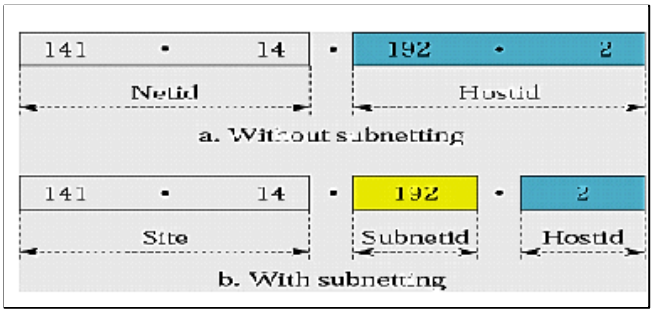


Figure: A network with three levels of hierarchy (subnetted)

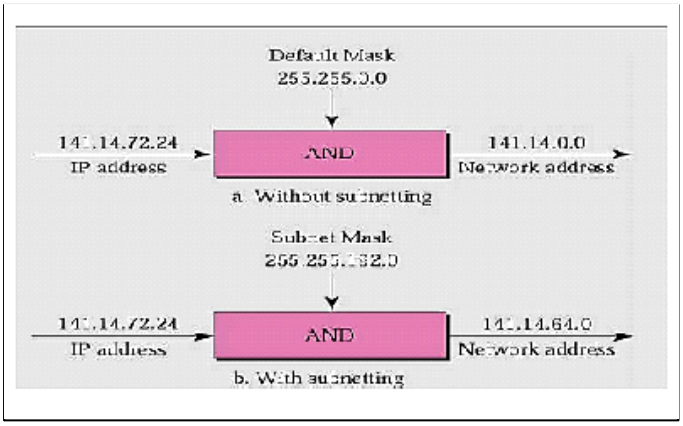
Figure shows the same network in Figure 2.2 after subnetting. The whole network is still connected to the Internet through the same router. However, the network has used a private router to divide the network into four subnetworks. The rest of the Internet still sees only one network; internally the network is made of four subnetworks. Each subnetwork can now have almost 2^{14} hosts. The network can belong to a university campus with four different schools (buildings). After subnetting, each school has its own subnetworks, but still the whole campus is one network for the rest of the Internet.

Subnet Mask

We discussed the network mask (default mask) before. The network mask is used when a network is not subnetted. When we divide a network to several subnetworks, we need to create a subnetwork mask (or subnet mask) for each subnetwork. A subnetwork has subnetid and hostid as shown in Figure.

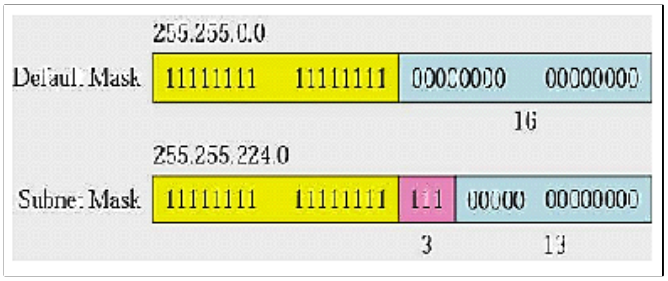


Subnetting increases the length of the netid and decreases the length of hostid. When we divide a network to s number of subnetworks, each of equal numbers of hosts, we can calculate the subnetid for each subnetwork.



- The number of 1s in a default mask is predetermined: 8, 16, or 24
- But, in a subnet mask, the number of 1s is more than the number of 1s in the corresponding default mask

Comparison of a Default Mask and a Subnet Mask



Number of Subnetworks

- Found by counting the number of extra bits that are added to the default mask in a subnet mask
- For example, in above figure o The number of extra 1s is 3 o The length of subnetid = 3 o The number of subnets is 2^3 = 8 **Number of Addresses per Subnet**
- Found by counting the number of 0s in the subnet mask
- For example, in above figure o The number of 0s is 13 o The length of hostid = 13
  - o The number of addressed in each subnet is 2^13 = 8192

CLASS A:-

P.1 127.0.0.0/(8) → IP

max. no. of hosts → 60 hosts

CLASS - A

Ans →

step(i) write given network →

127 . 0 . 0 . 0

↓ ↓ ↓ ↓

N H H H

step(ii) convert host id into binary →

01111111 . 00000000 . 00000000 . 00000000

step(iii) find maximum no. of hosts in area →

i.e., to hosts

from formula → $2^n - 2 \geq 60$

$62 \geq 60$, $n = 6$

$n = 6$ ✓

step(iv) write IP with binary form →

127 . 00000000 . 00000000 . 00000000

gives to N/w — 6 use for host

N/w = 1 bit , host = 0 bit

11111111 . 11111111 . 11111111 . 11000000

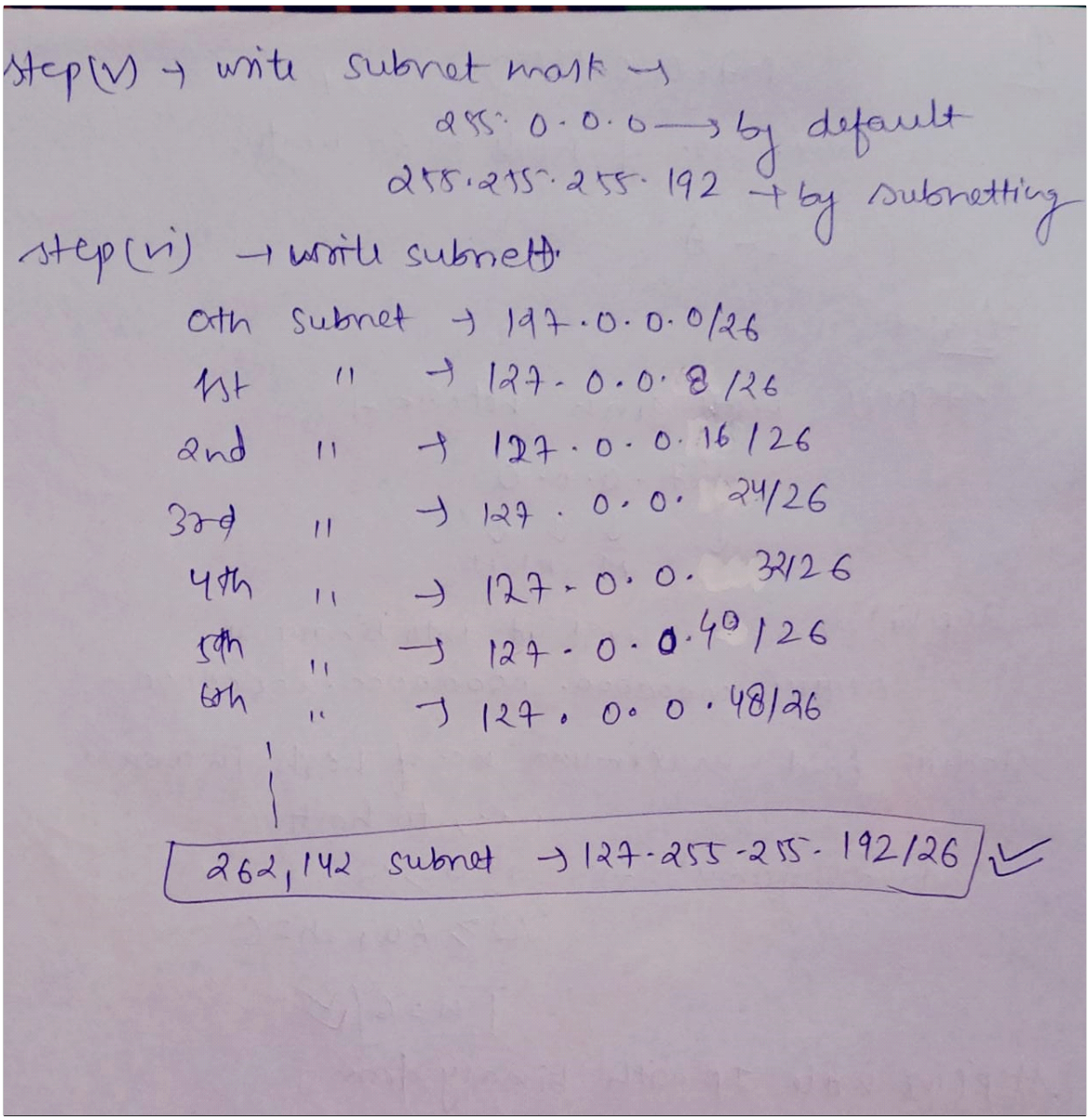
26

↓↓

255 . 255 . 255 . 192

Add N/w bits →

128 + 64



CLASS B:-

Q.2 140.25.0.0/16 ⟶ IP Address
maximum no. of hosts 60 hosts on each subnet.

CLASS – B

Ans →

Step (i) write given network →

140. 25. 0. 0
↓ ↓ ↓ ↓
N N H H

Step (ii) convert host id into binary →

10001100.00011001.00000000.00000000

or

140.25.00000000.00000000

Step (iii) find maximum no. of Hosts in area →
i.e., 60 hosts

from formula → $2^n - 2 \geq 60$

$0 \geq 60$, $n=1$
$2 \geq 60$, $n=2$
$6 \geq 60$, $n=3$
$14 \geq 60$, $n=4$
$30 \geq 60$, $n=5$
$62 \geq 60$, $n=6$

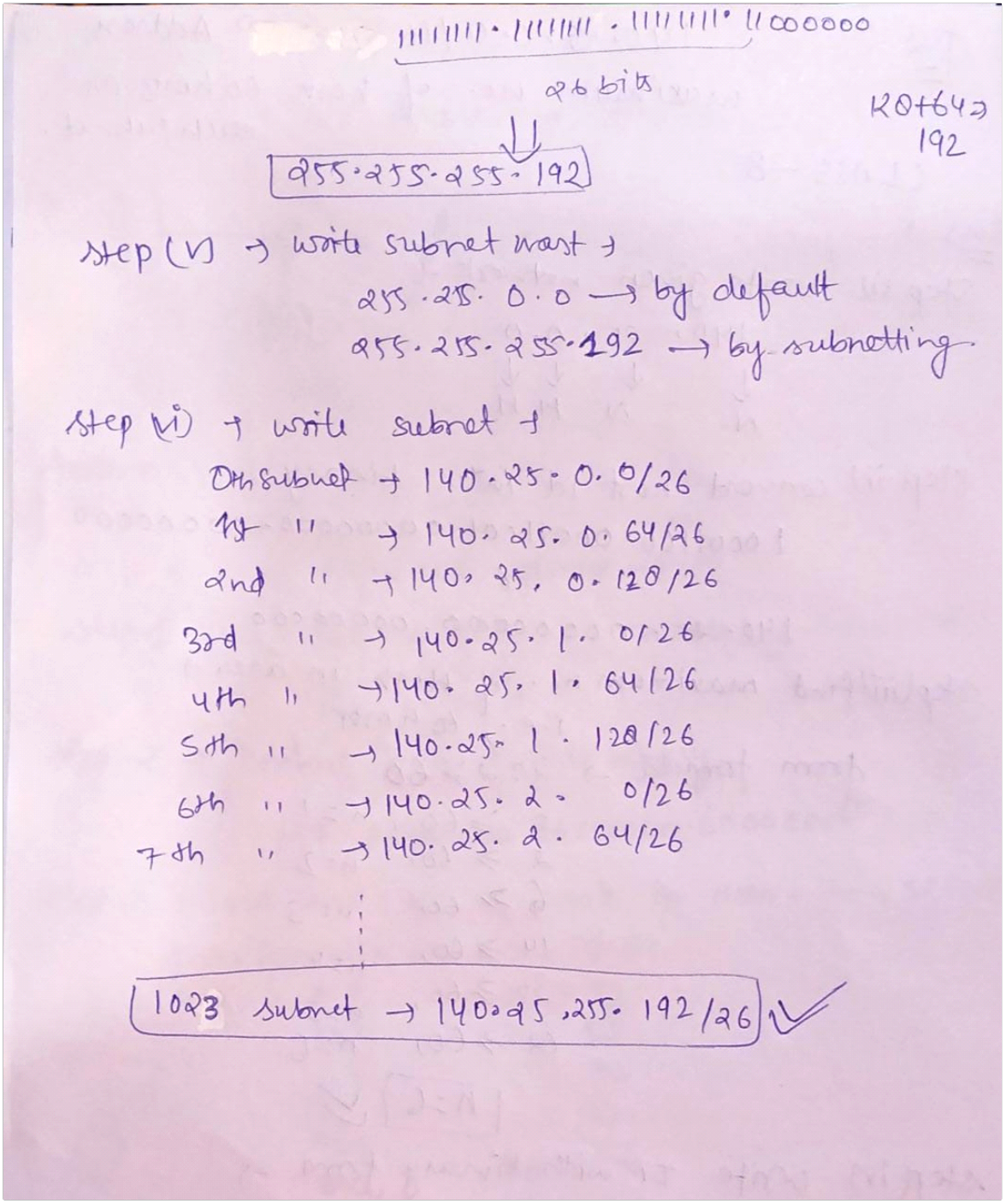
$\boxed{n=6}$ ✓

Step (iv) write IP with binary form →

140.25. 00000000.00000000
↳ gives to N/W ↳ use for host

N/W = 2 bit

Host → 0 bit



CLASS C:-

Q. 3 $193.1.1.0/24$ → IP Address

maximum no. of hosts = 25

required network = 6

CLASS — C

Ans →

Step (i) With given network →

193.1.1.0

N N N H

Step (ii) convert host id into binary →

193.1.1.00000000 or → 11000001.00000001.00000001.00000000

Step (iii) find maximum no. of Hosts in area →

i.e., 25 hosts

from formula → $2^n - 2 \geq 25$

$0 \geq 25$, $n=1$

$2 \geq 25$, $n=2$

$6 \geq 25$, $n=3$

$14 \geq 25$, $n=4$

$30 \geq 25$, $n=5$

$n=5$ ✓

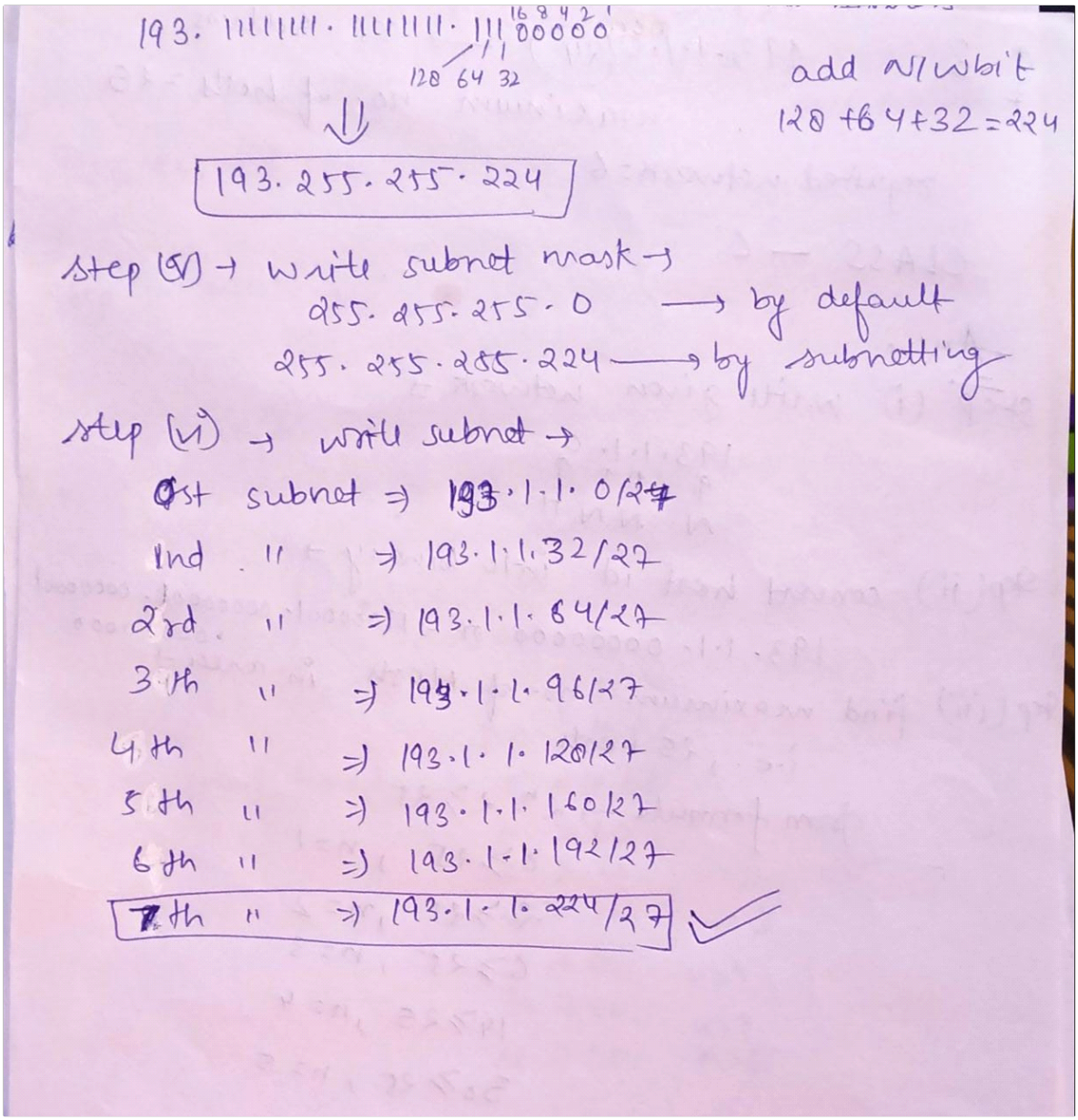
Step (iv) write IP with binary form →

193.1.1.00000000

↳ gives to N/w ↳ use for host

N/W = 1 bit

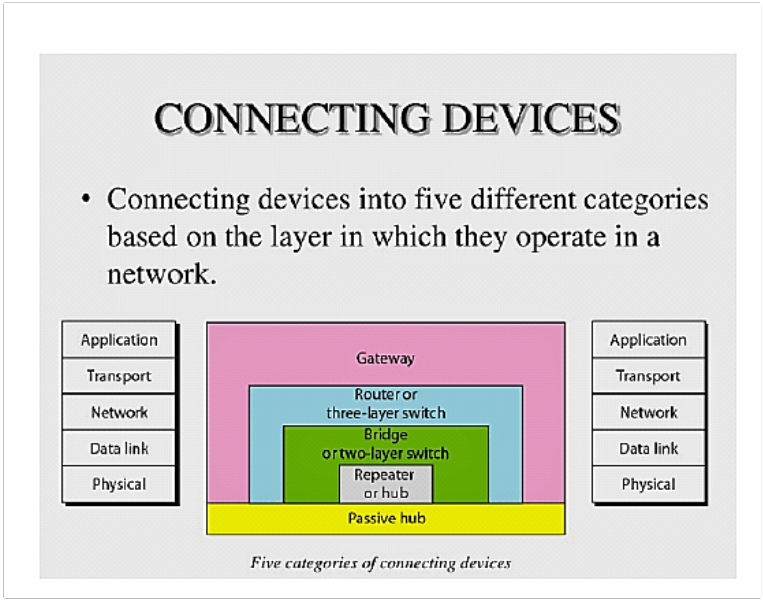
host = 0 bit



Result: Subnetting of a network has been carried out.

Experiment-4 Router Configuration (Configuring Interface)

Theory:



• Repeater: Functioning at Physical Layer. A repeater is an electronic device that receives a signal and retransmits it at a higher level and/or higher power, or onto the other side of an obstruction, so that the signal can cover longer distances. Repeater have two ports, so cannot be use to connect for more than two devices

• Hub: An Ethernet hub, active hub, network hub, repeater hub, hub or concentrator is a device for connecting multiple twisted pair or fiber optic Ethernet devices together and making them act as a single network segment. Hubs work at the physical layer (layer 1) of the OSI model. The device is a form of multiport repeater. Repeater hubs also participate in collision detection, forwarding a jam signal to all ports if it detects a collision.

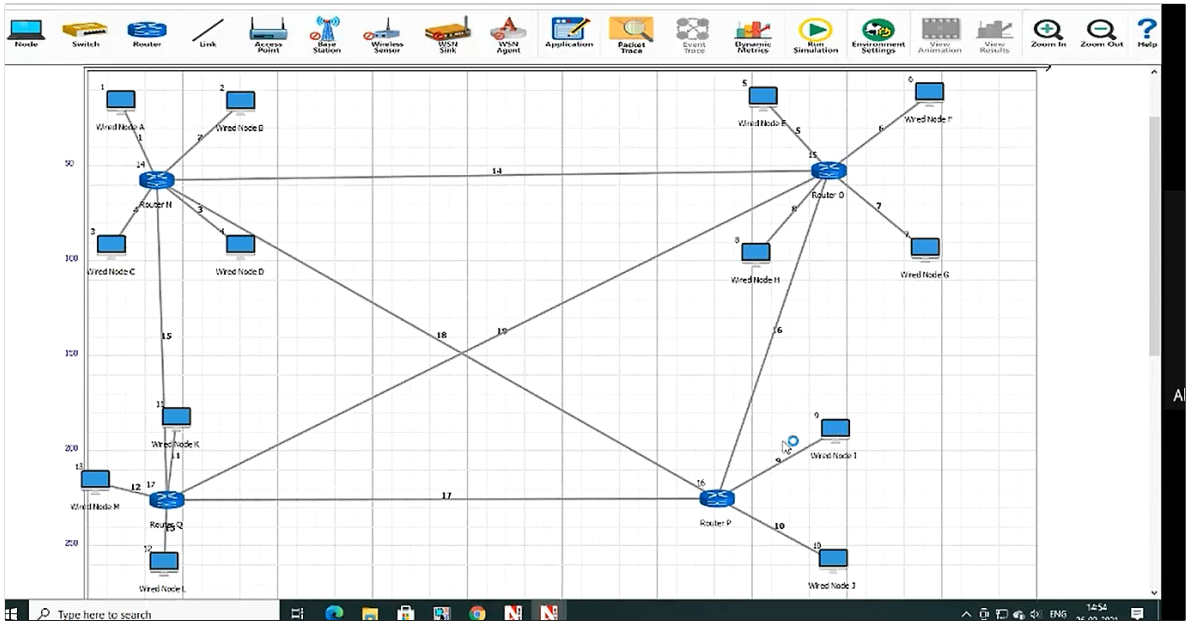
• Switch: A network switch or switching hub is a computer networking device that connects network segments. The term commonly refers to a network bridge that processes and routes data at the data link layer (layer 2) of the OSI model. Switches that additionally process data at the network layer (layer 3 and above) are often referred to as Layer 3 switches or multilayer switches.

• Bridge: A network bridge connects multiple network segments at the data link layer (Layer 2) of the OSI model. In Ethernet networks, the term bridge formally means a device that behaves according to the IEEE 802.1 D standard. A bridge and switch are very much alike; a switch being a bridge

with numerous ports. Switch or Layer 2 switch is often used interchangeably with bridge .Bridges can analyze incoming data packets to determine if the bridge is able to send the given packet to another segment of the network.

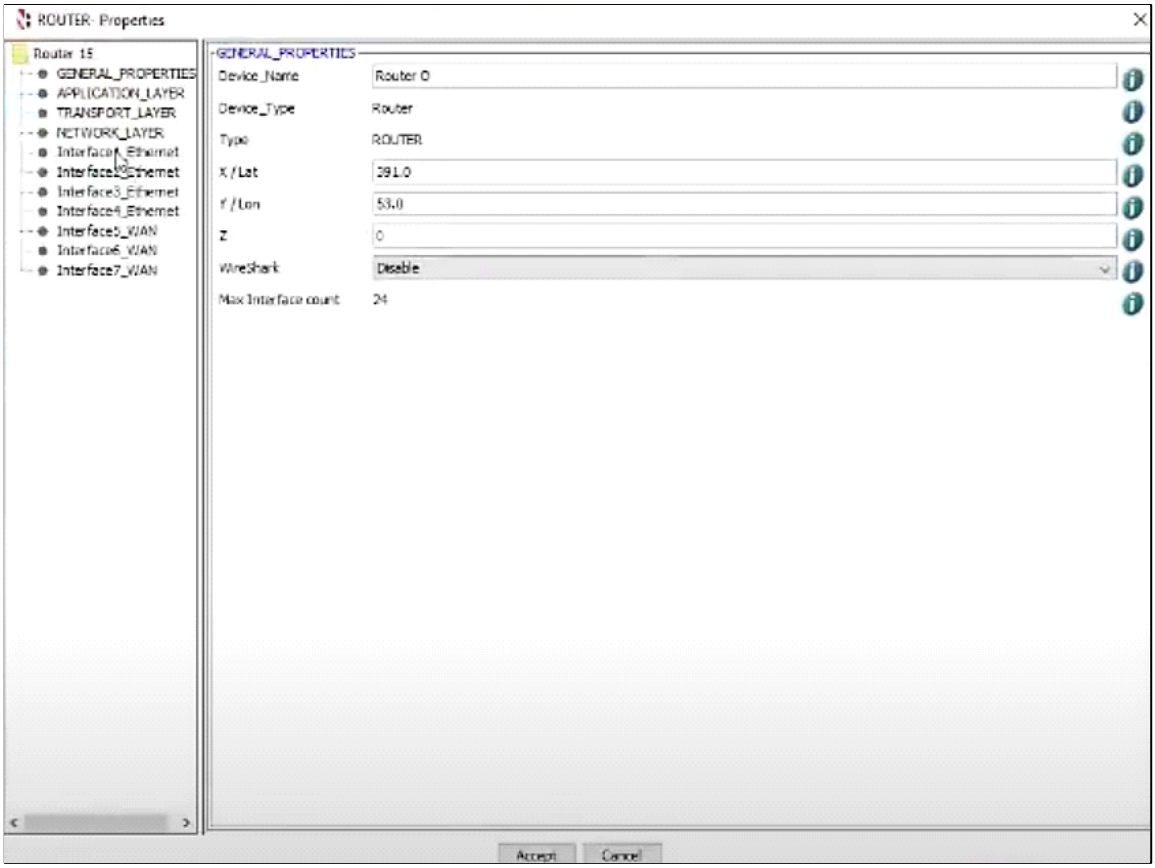
- **Router**: A router is an electronic device that interconnects two or more computer networks, and selectively interchanges packets of data between them. Each data packet contains address information that a router can use to determine if the source and destination are on the same network, or if the data packet must be transferred from one network to another. Where multiple routers are used in a large collection of interconnected networks, the routers exchange information about target system addresses, so that each router can build up a table showing the preferred paths between any two systems on the interconnected networks.
- Gate Way: In a communications network, a network node equipped for interfacing with another network that uses different protocols.
- A gateway may contain devices such as protocol translators, impedance matching devices, rate converters, fault isolators, or signal translators as necessary to provide system interoperability. It also requires the establishment of mutually acceptable administrative procedures between both networks.
- A protocol translation/mapping gateway interconnects networks with different network protocol technologies by performing the required protocol conversions.

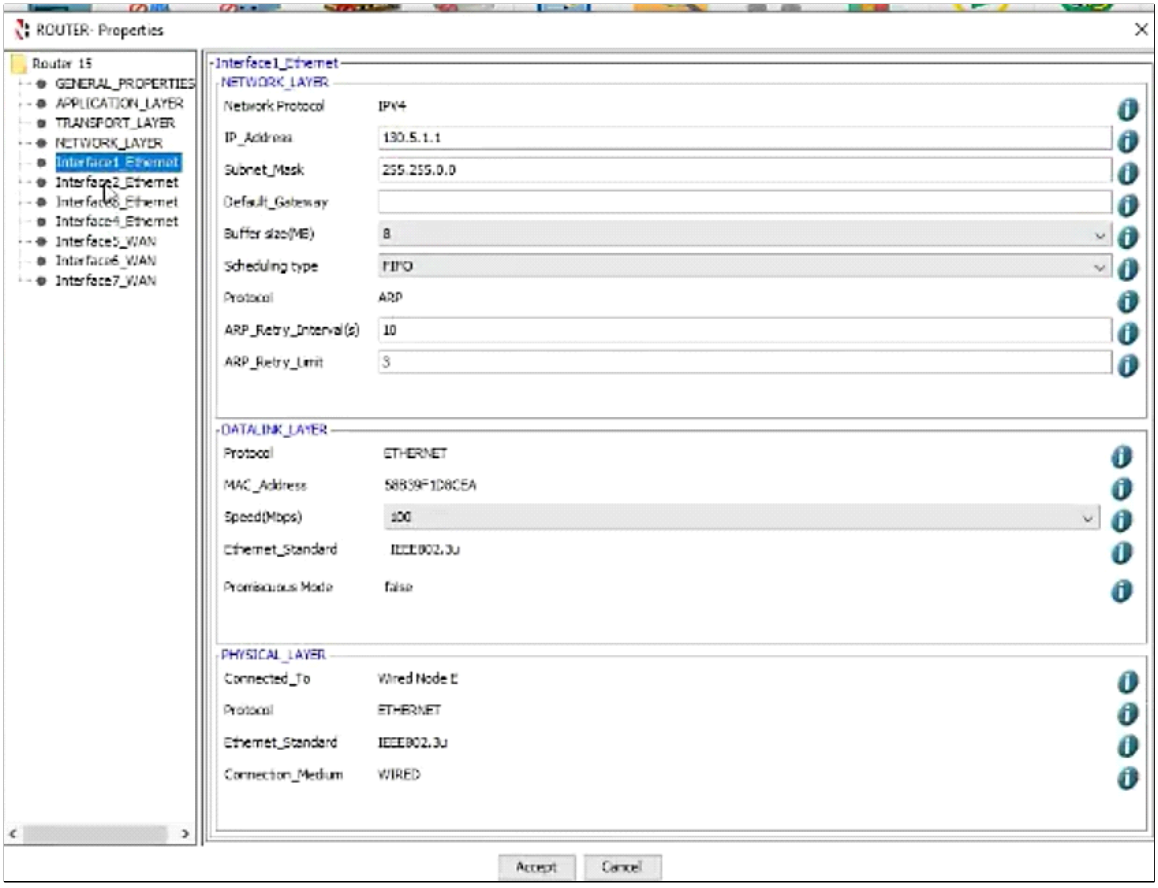
Configuration diagram:

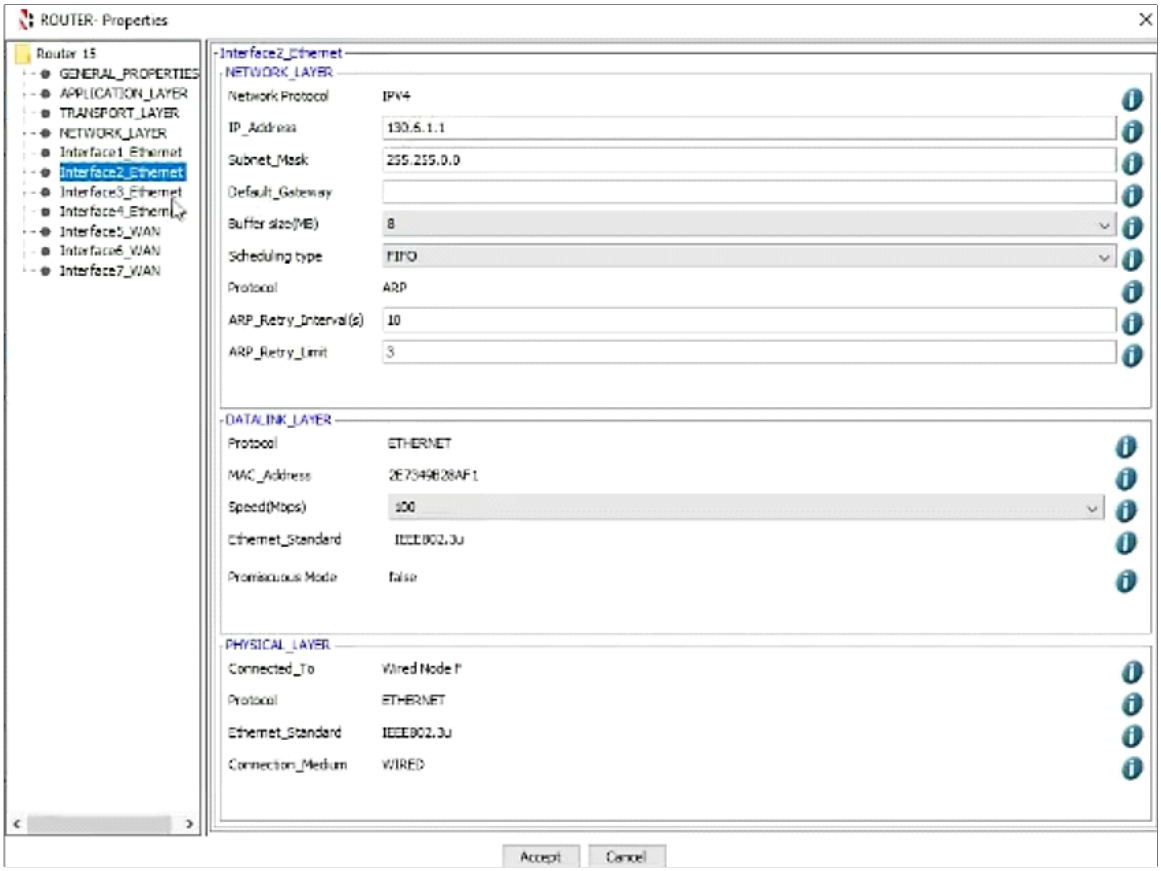


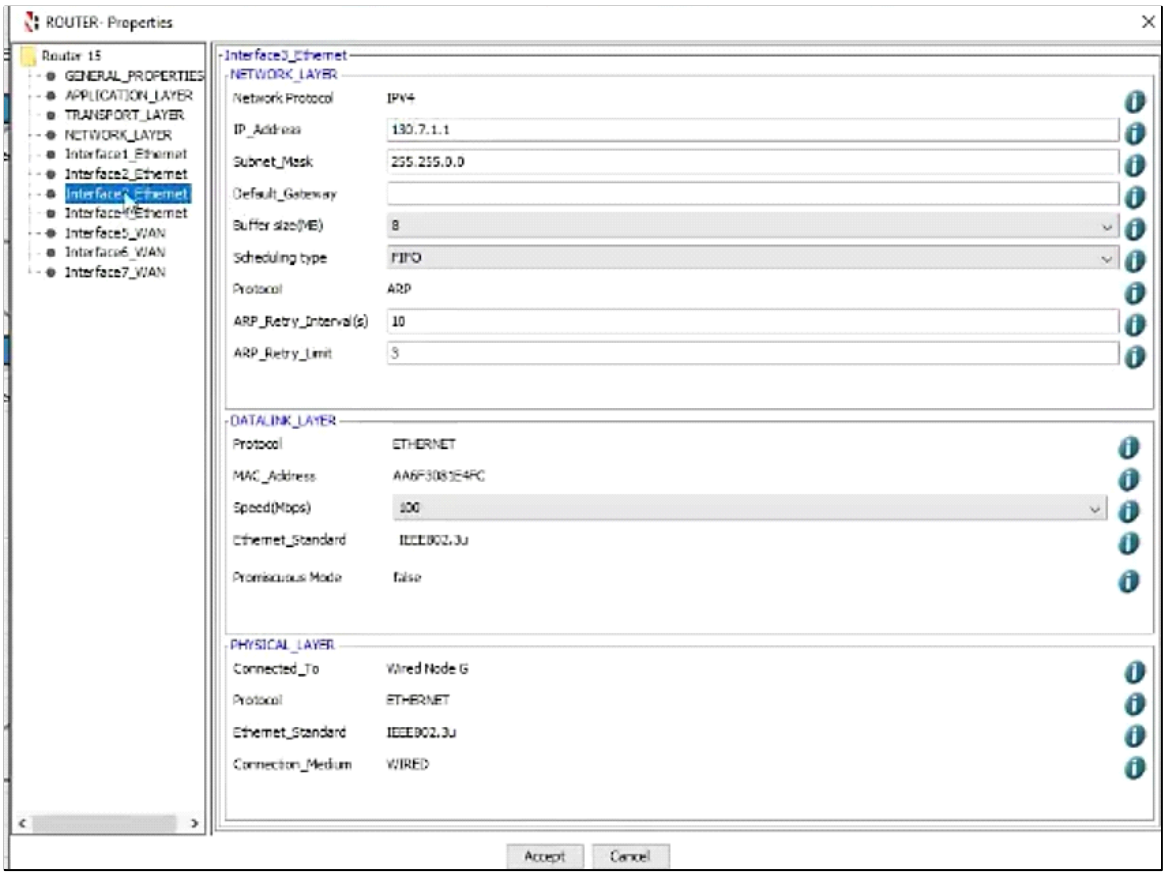
Router Properties:-

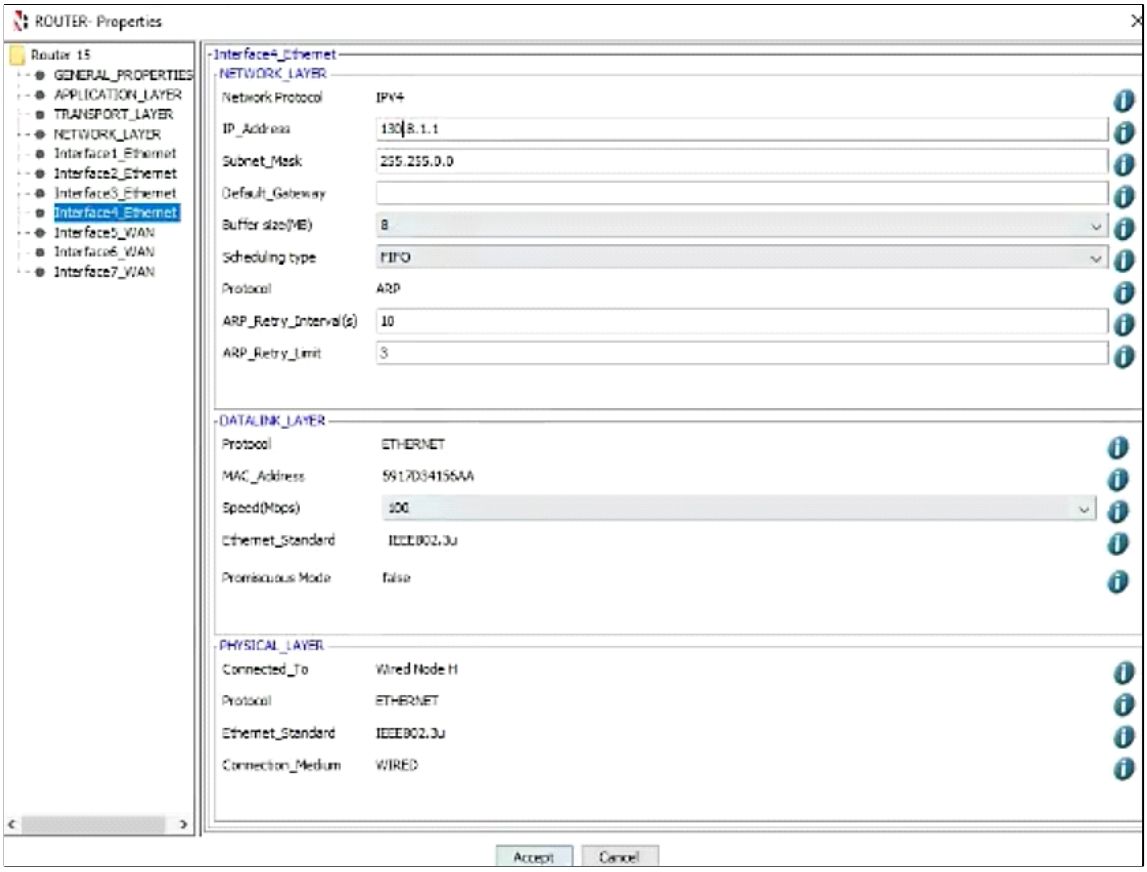
Router 15-



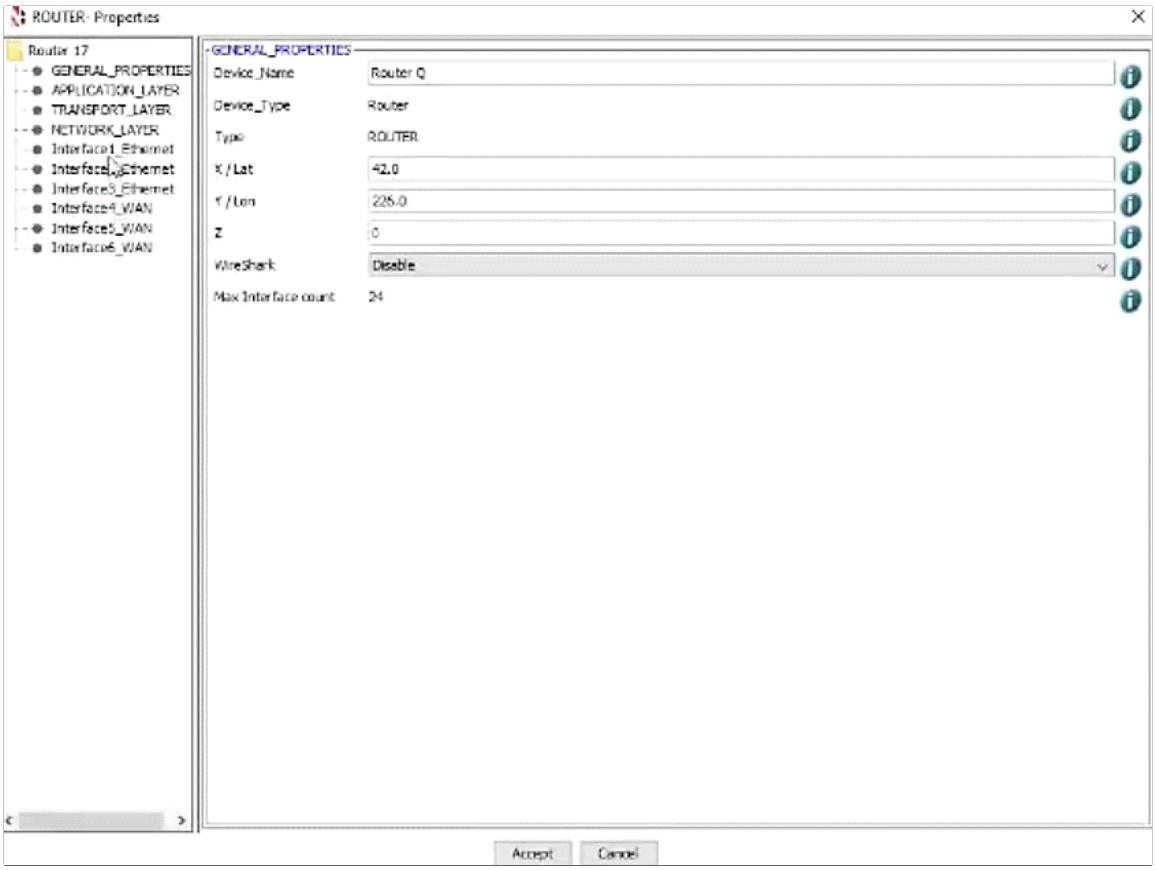


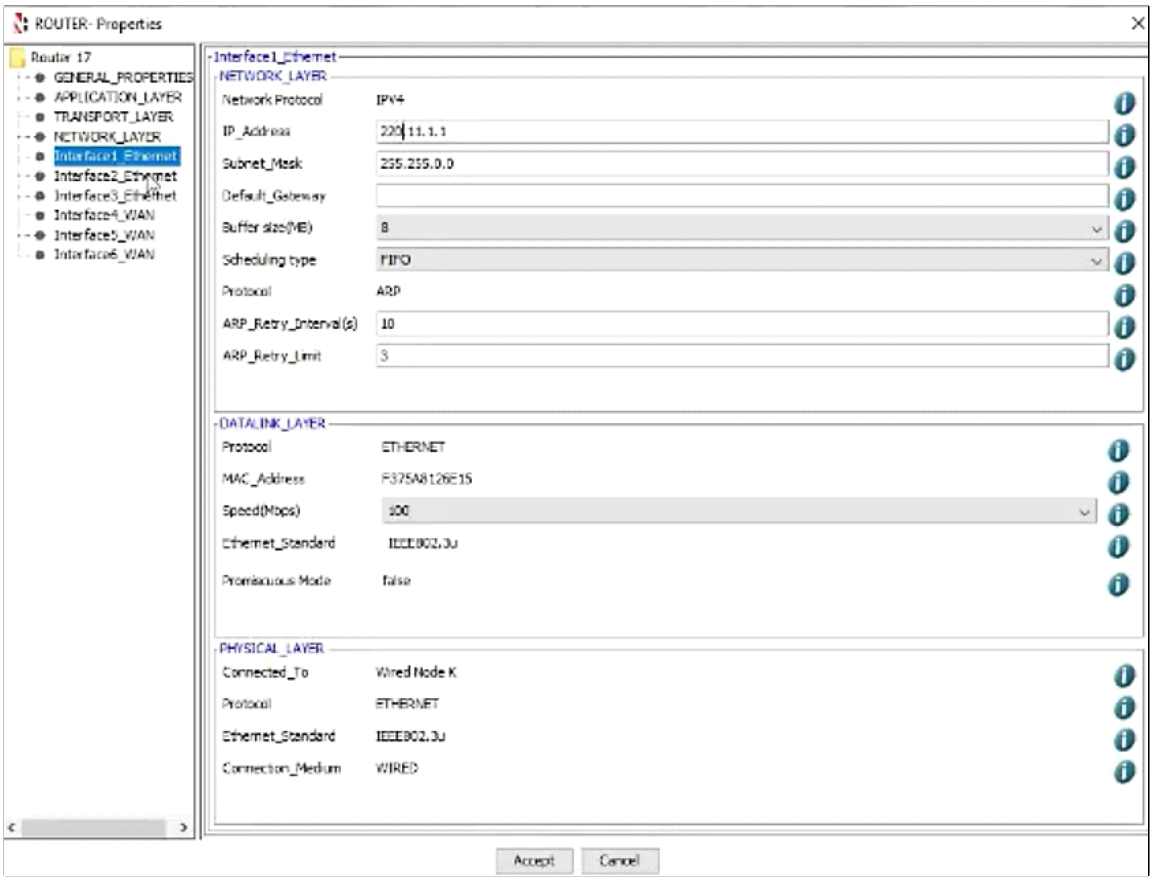


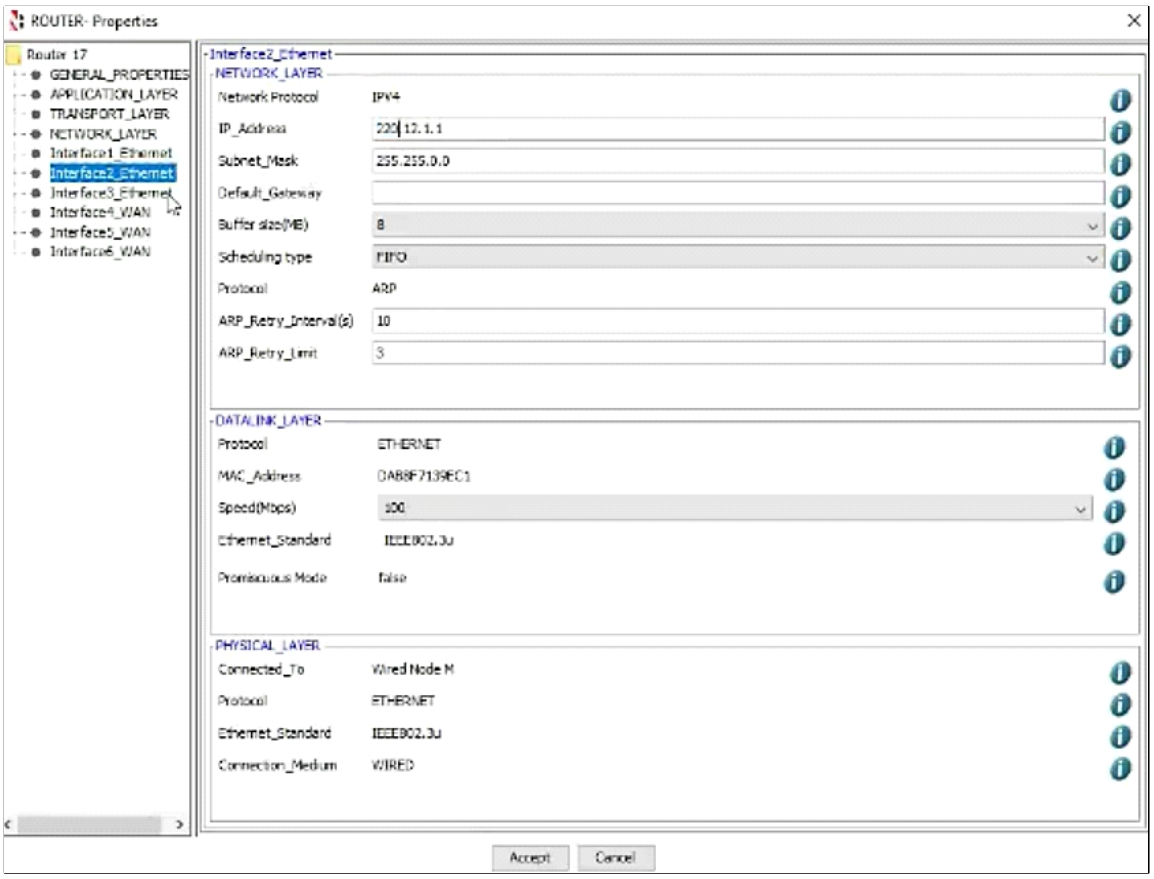


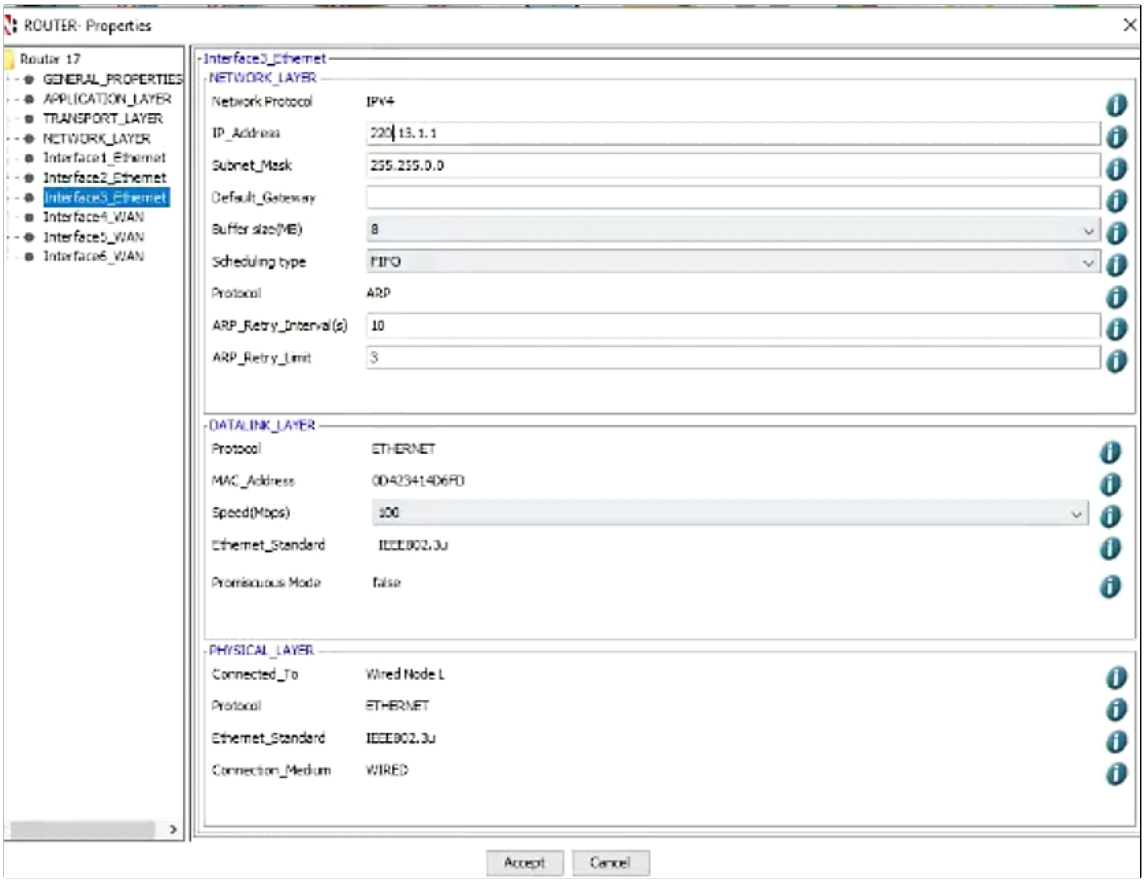


Router 17 -

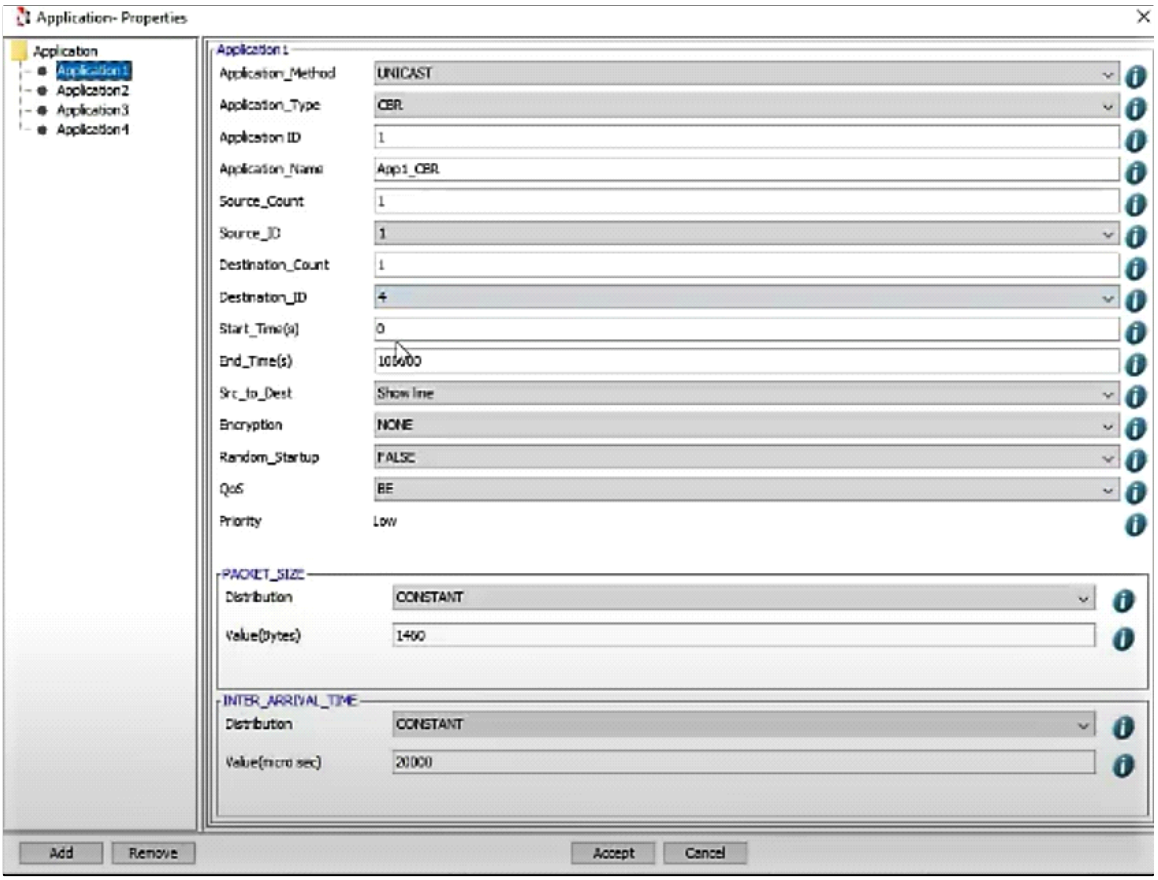


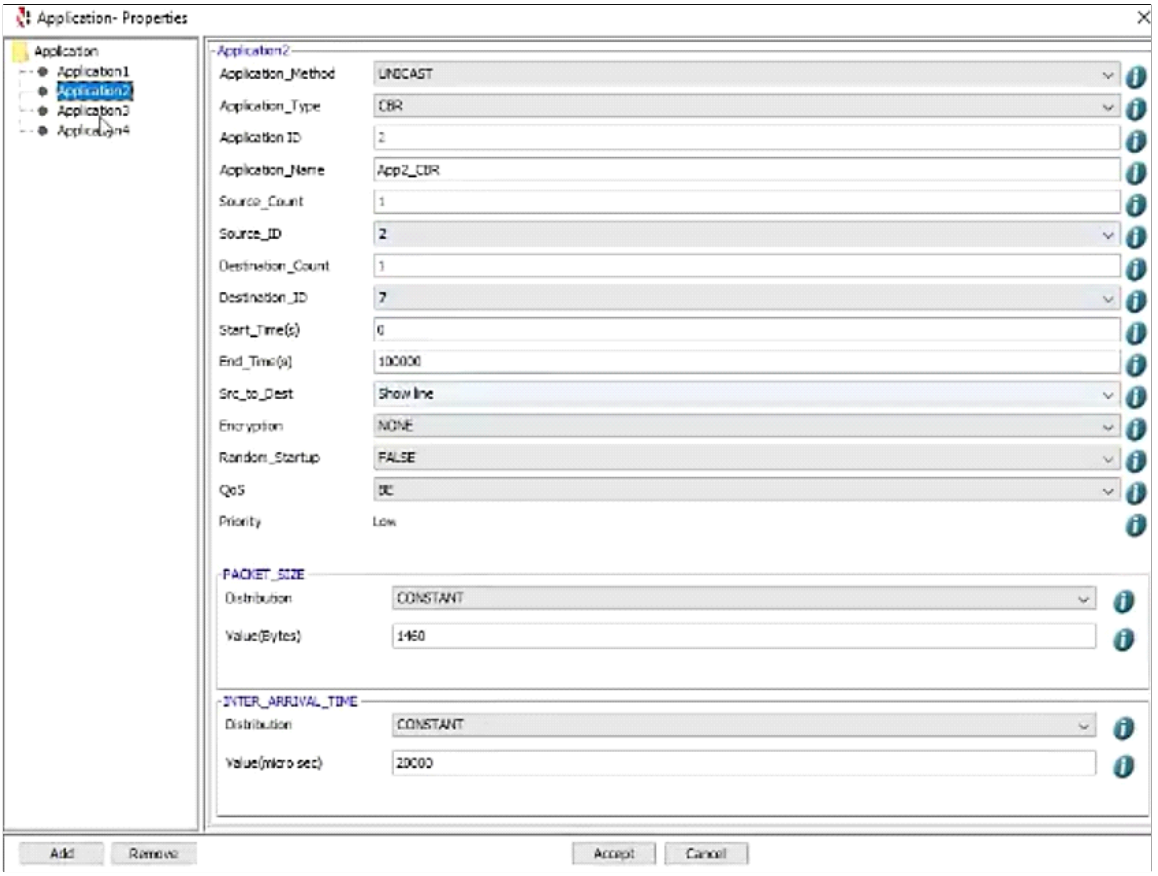


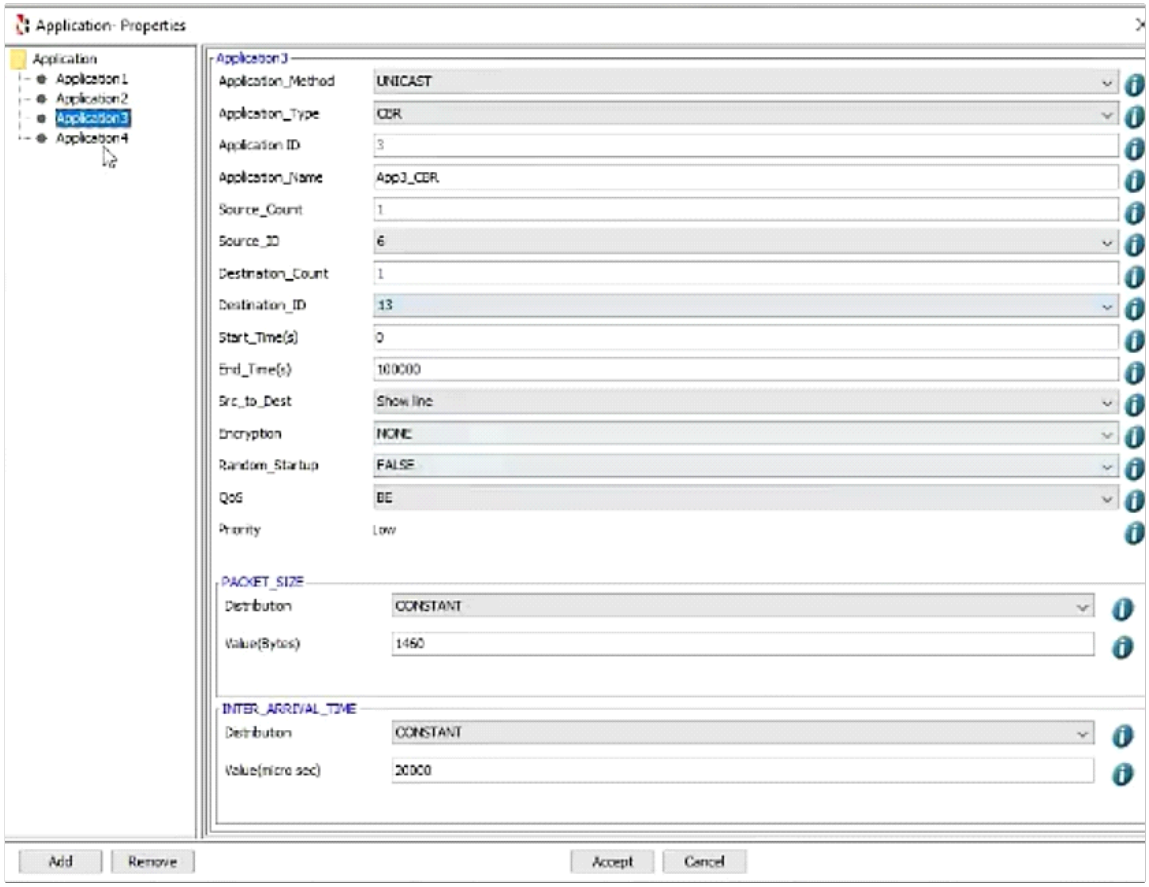


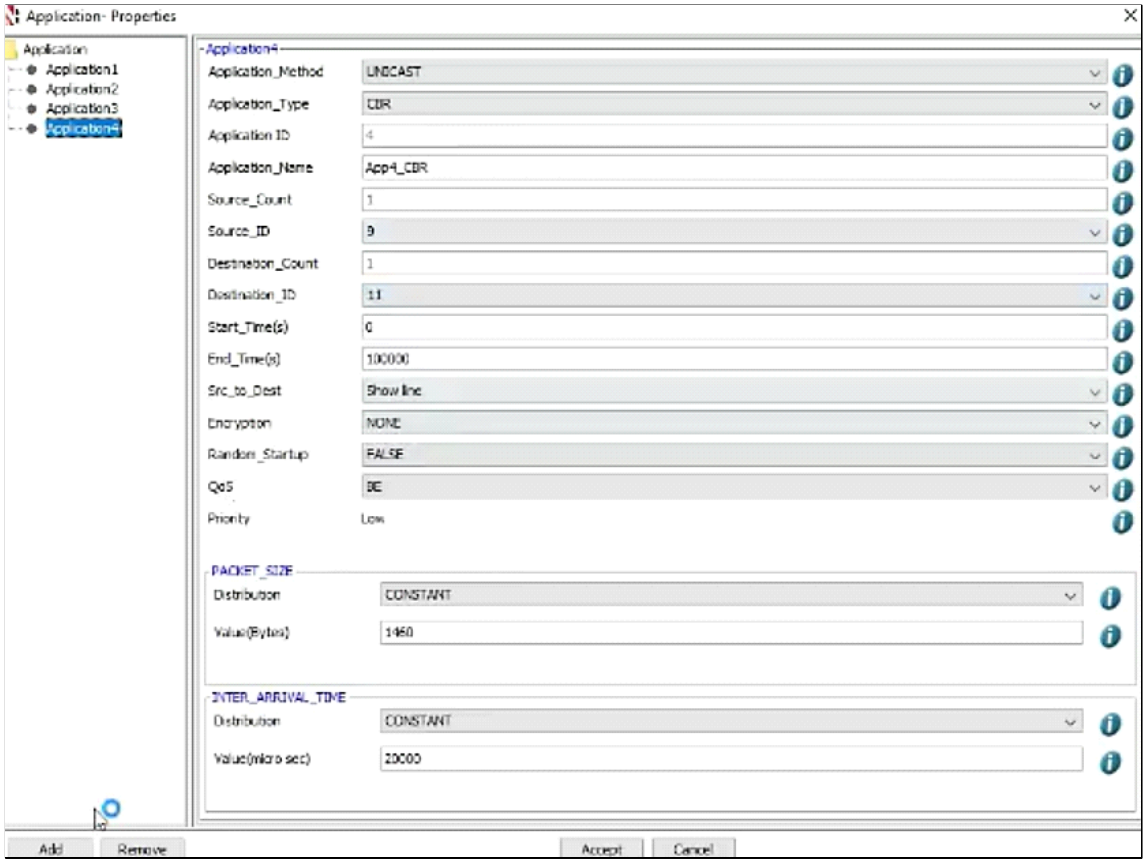


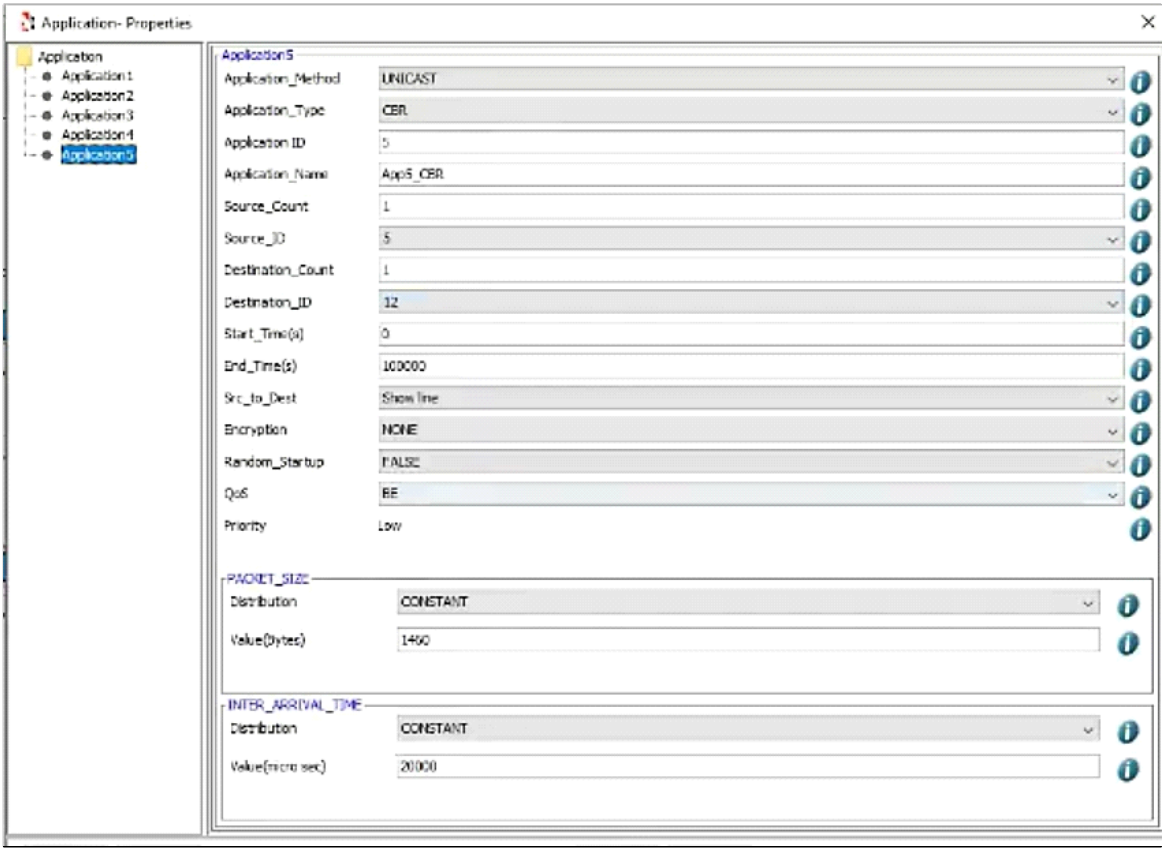
Application properties-

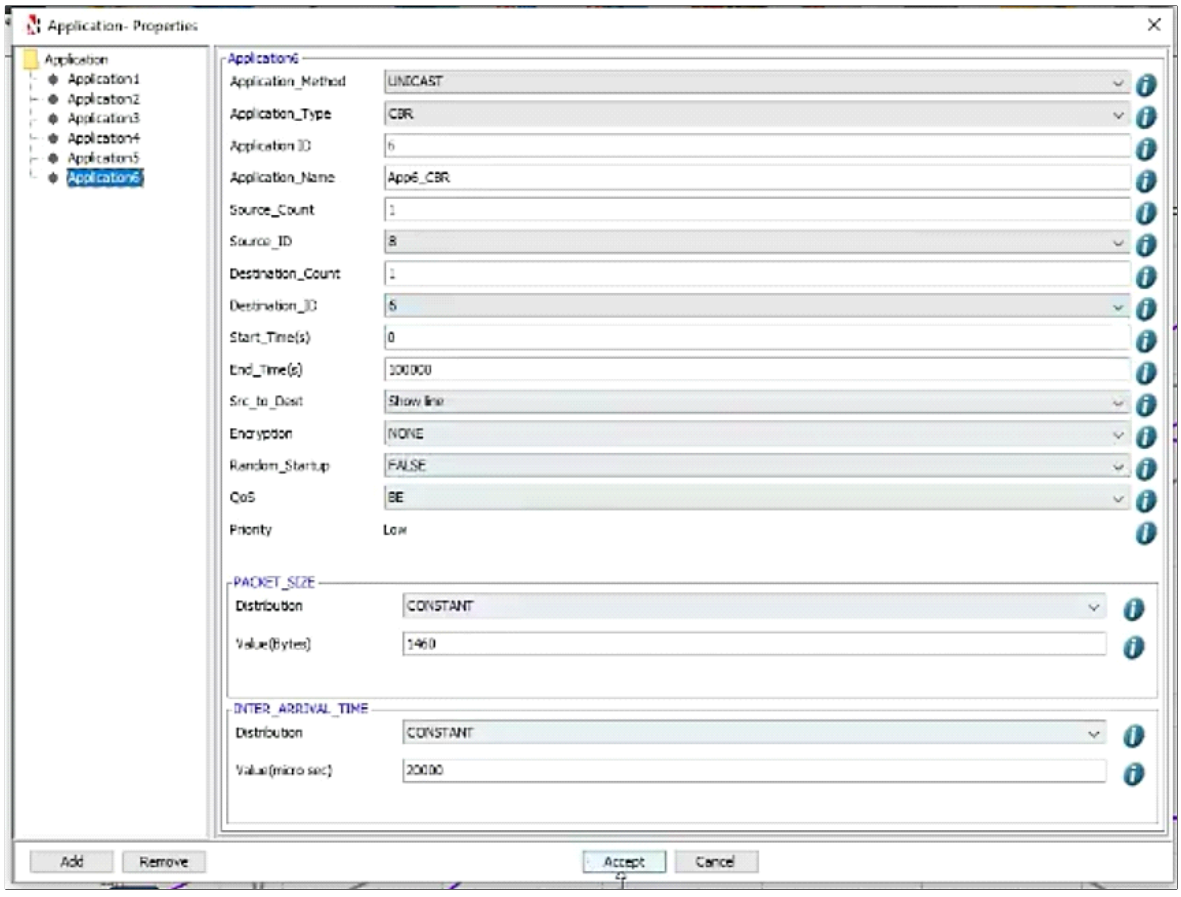




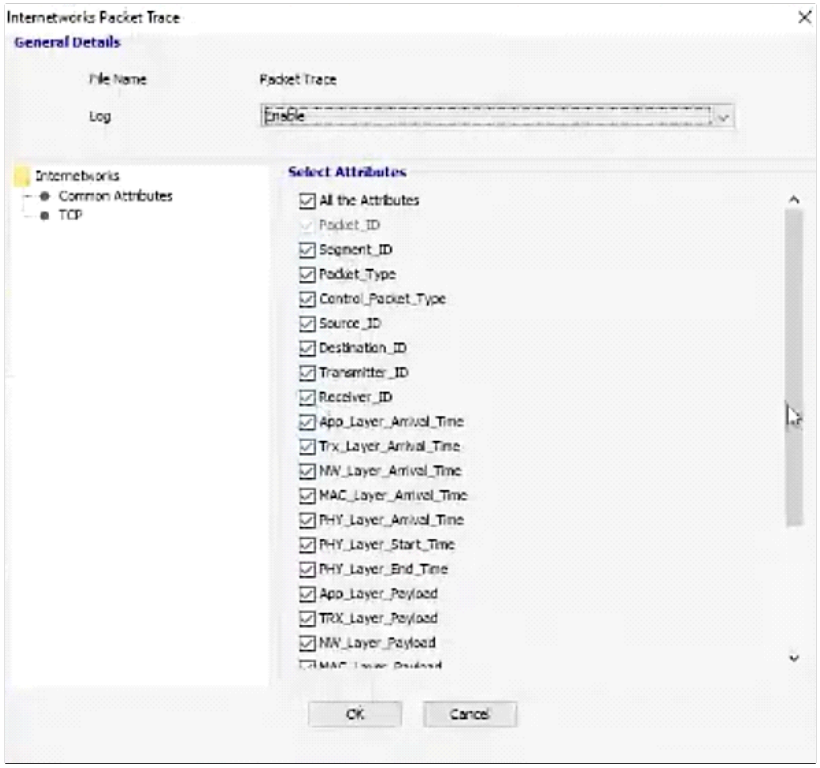




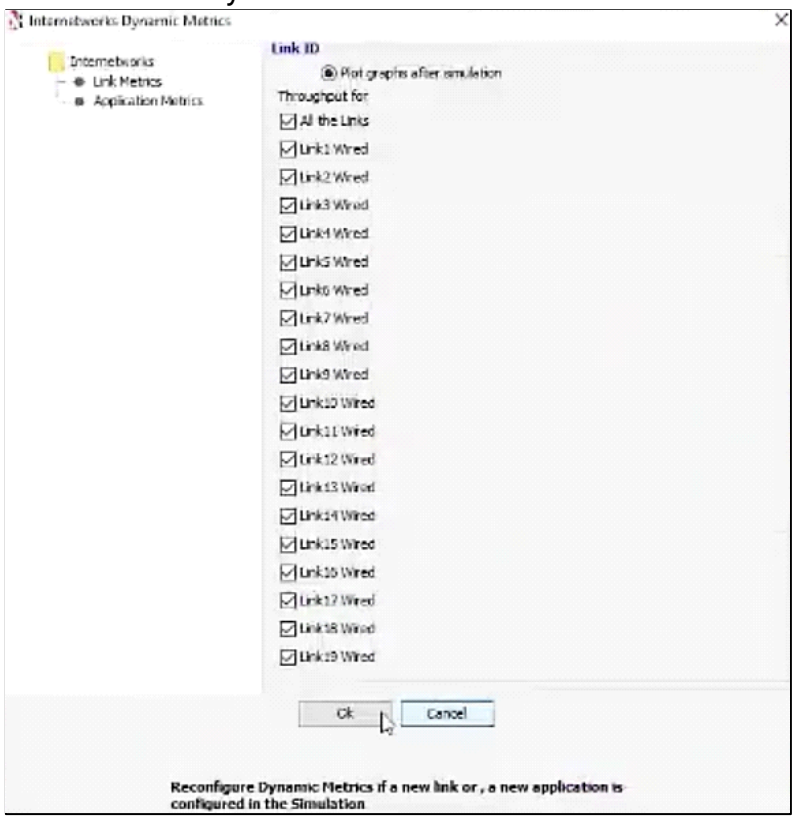




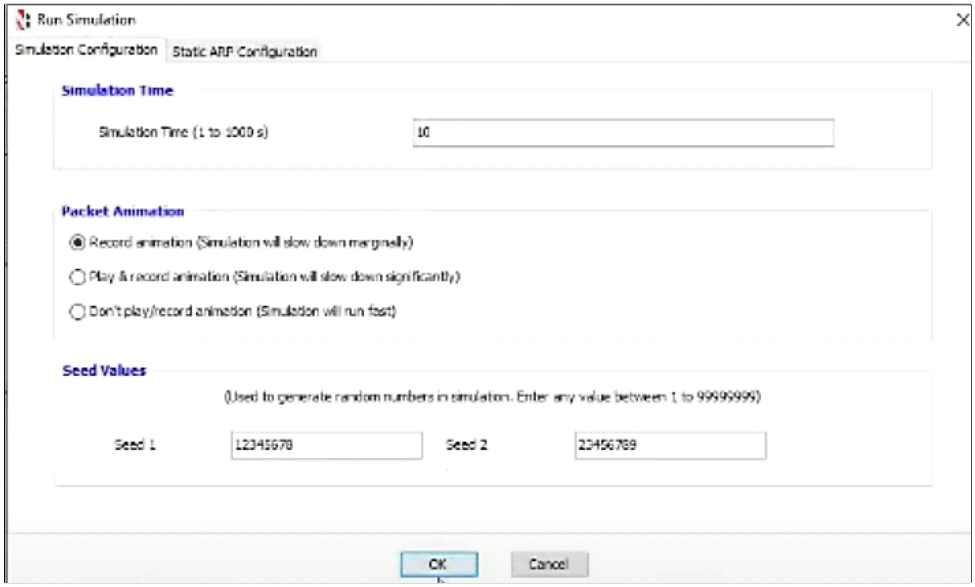
Internetwork packet trace:-



Internetworks dynamic metrics:-



Run simulation :-



Result: Router is configured with different type of Interface