

# MOBILE IP NETWORK LAYER

## Lesson 03

# Subnet, Unicast, Multicast, UDP and ICMP

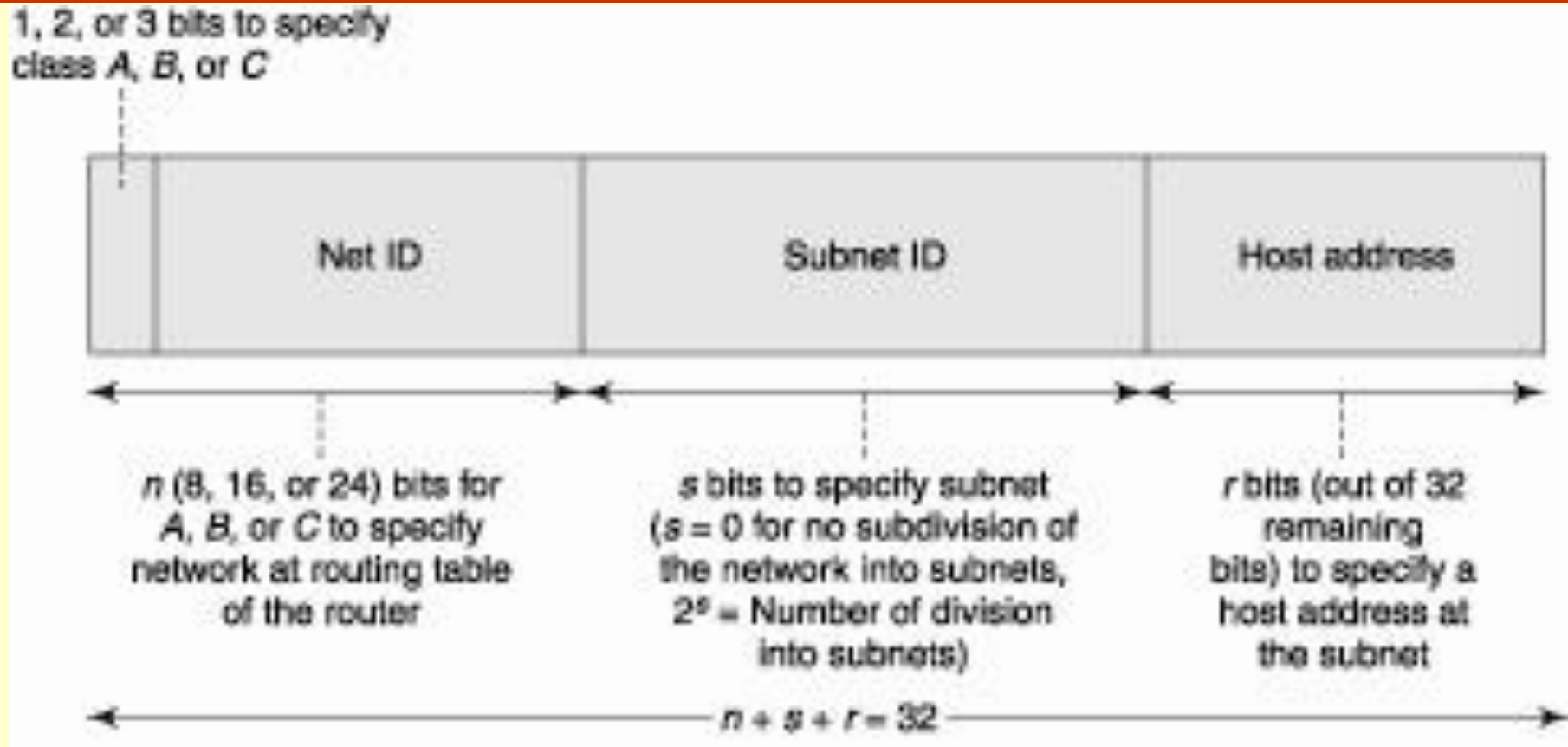
# CONCEPT OF SUBNETS ON THE INTERNET

- A subnet— a sub-network using standard specifications and protocols when connecting to the Internet on one end and to the host on the other end

# SUBNET

- Each router has a 32-bit IP address
- A router can connect to a maximum of  $2^7$ ,  $2^{14}$ , or  $2^{21}$  other routers depending upon the subnet in which class (A or B or C) that router belongs

# AN IP ADDRESS AND ITS STRUCTURE



# MSBS FOR CLASSES A, B AND C

- Identify *A*, *B*, and *C* type of networks
- Msbs = 0, 10, and 110 (1 or 2 or 3 bits before netID)

# NETID BITS FOR CLASSES A, B AND C AFTER MSBS

- 7 or 14 or 24
- Specify network ID among  $2^7$ ,  $2^{14}$  or  $2^{21}$  class A or B or C networks

# **SUBNET ID— *S* BITS AND HOST ADDRESS— *R* BITS**

- $s + r = 24$  or  $16$  or  $8$  for A or B or C class subnets

# SUBNET ROUTER FOR MULTICASTING— CLASS *D* NETWORK

- Uses four msbs (1110) for network identification and  $32 - 4 = 28$  bits specify the address of the multicasting subnet



# SUBNET ROUTER— CLASS *E* NETWORK

- Five msbs (11110) used for network identification
- Reserved for future applications

# SUBNET MASK

- Unmasks the  $r$ -bits ( $nd4$  when  $r = 8$  and finds  $nd4$  of the computer)
- Finds the addressed host's IP address ( $nd1 . nd2 . nd3 . nd4$ )

# ADDRESS RESOLUTION PROTOCOL (ARP)

- An Ethernet LAN computer has a 48-bit MAC (medium access control) address
- ARP maps  $r$ -bits to the 48-bit MAC address

# ADDRESS RESOLUTION PROTOCOL (ARP)

- ARP— finds the destination computer MAC address on the LAN and forwards the packet to the destined computer

# ARP CACHE

- An ARP cache— stores the MAC address to enable ARP to translate the host IP address into the MAC address

# SUBNET MASK

$s + r$  subnet mask bits from which host computer address is found using ARP and subnet is found when host connects the subnet using RARP

# REVERSE ADDRESS RESOLUTION PROTOCOL (RARP)

- From the source computer, the packet is transmitted to a source router, using RARP (reverse ARP) and subnet mask
- The subnet mask masks the extra bits (nd4 when  $r = 8$ )

# RARP CACHE

- An RARP cache— saves the IP address and the computer address
- Enables the RARP to reverse translate the MAC address into the IP address



# REVERSE ADDRESS RESOLUTION PROTOCOL (RARP)

- The packet forwards to the source router on the subnet with an  $n$ -bit source router net ID (for example,  $(ns1 . ns2 . ns3)$  on class C)

# POINT TO POINT UNICAST TRANSFER

- Message or packet transmits to the destined IP address only

# MULTICAST TRANSFER

- Message or packet transmits to a group of IP addresses
- The IP protocol specifies the use of a class *D* subnet for multicasting

# MULTICAST IP ADDRESS BITS

- Multicasting subnet four msbs (1110) in the net ID part of the IP address for defining subnet as *multicast* network
- $32 - 4 = 28$  bits specify the address for the multicasting net ID and the subnet and host (s and r) addresses

# EXAMPLE

- The address (224 . 0 . 0 .1) multicasts to all hosts in the links of a router
- ( $ns1 = 224$  in decimal system = 11100000 in binary system)

# MULTICAST TREE

- A multicasting source (root) multicasting to select multicast nodes (subnets) at level 1
- Each level 1 node, then, transmits to multicast nodes (subnets) at level 2 and so on

# MULTICAST TREE

- A hierarchy of nodes present in a multicast tree
- Multicast tree nodes at one level can transmit to multicast nodes at another level simultaneously, via multiple paths
- Time taken in multicasting a message greatly reduced

# MULTICASTING APPLICATIONS

- Flooding a UDP (user datagram protocol) datagram on the network
- Sending information along many paths
- Required for advertisement



# SPANNING TREE PROTOCOL

- Protocol to block nodes, which have already received the relevant information during flooding

# BROADCASTING

- Message or packet transmits to all the IP addresses which are set for listening
- The IP protocol specifies an address for broadcasting
- All 32 bits— 1s (255 . 255 . 255 . 255)
- Used when broadcasting to all hosts and links of a router

# DATAGRAM

- Provides independent information
- A datagram is stateless
- Not necessarily a sequential successor of a previous one or a predecessor of the next
- Data sent using a connectionless protocol

# CONNECTIONLESS PROTOCOL

- No session establishment before the data transfer begins
- Example— , on phones there are hotlines where one can just speak without the usual dialling and waiting business

# UDP AND DATAGRAM

- UDP (User datagram protocol) for sending datagram using a connectionless protocol
- Maximum of  $2^{16}$  bytes, transmitted as sequences of words, each of 32-bits (4 bytes)

# UDP 6 FIELDS AT HEADER

- Source port number
- Destination port number
- Source IP address
- Destination IP address
- Length of data
- Checksum bytes for the header (to check erroneous receipt of header)

# INTERNET CONTROL MESSAGE PROTOCOL

- Another connectionless protocol
- A part of the IP network protocol suite
- ICMP uses a datagram

# ICMP USES

- Sending the messages for querying to find information
- Reporting errors
- Making route address advertisement
- Router seeking (soliciting) messages to get the IP addresses of the linked subnets



# ICMP HEADER

- First word of 32-bits to specify a byte for type of message, a byte for the code, and a two-byte checksum
- Second word of 32-bits, which specifies the number of addresses for advertising along with the address field size and the lifetime of message validity

# ICMP HEADER REMAINING WORDS

- A set of pairs of words
- Router address and preference
- The router of higher preference gets the messages earlier than the others
- The pairs arranged in sequence for level 1, level 2, and so on in a tree

# ICMP HEADER REMAINING WORDS

- Options— extended words in headers
- First byte = 16 means that options being used
- One example of option use— the mobile IP protocol extension when an agent advertises

# SUMMARY

- Class A or B or C
- Subnet msbs, netID, subnetID and hostID bits
- ARP to use subnet mask to find host MAC from IP address
- RARP to use subnet mask to find IP from MAC address

## ... SUMMARY

- Unicast, multicast and broadcast
- Multicasting for advertising
- Spanning tree protocol
- Datagram stateless data
- UDP connectionless protocol for datagram
- ICMP for sending the messages for querying, reporting errors, route

## ... SUMMARY

- UDP connectionless protocol for datagram
- ICMP for sending the messages for querying, reporting errors, route address advertisement and solicitation

## End of Lesson 03

# Subnet, Unicast, Multicast, UDP and ICMP