Network Layer

Comprehensive Presentation on Logical Addressing, Routing, ICMP, IGMP, and Internetworking

Introduction to Network Layer

- • Third layer of the OSI Model
- • Responsible for source-to-destination delivery
- • Provides logical addressing and routing
- • Ensures packet forwarding across networks

Functions of Network Layer

- • Logical addressing
- • Routing
- • Packet forwarding
- • Internetworking
- • Congestion control
- • Fragmentation and reassembly

Logical Addressing

- • Provides unique identification to devices
- • Uses IP addresses
- • Supports communication across multiple networks

IPv4 Addressing

- • 32-bit address
- • Divided into network and host parts
- • Example: 192.168.1.1

IPv6 Addressing

- • 128-bit addressing scheme
- • Large address space
- • Improved security and efficiency

Internetworking

- • Connecting multiple networks together
- • Achieved using routers and gateways
- • Enables global communication

Devices Used in Internetworking

- • Routers
- • Gateways
- • Layer-3 Switches

Tunneling

- • Encapsulation of one protocol inside another
- • Used in VPNs and IPv6 transition
- • Provides secure communication

Address Mapping

- • Mapping logical addresses to physical addresses
- • Essential for packet delivery

ARP – Address Resolution Protocol

- • Maps IP address to MAC address
- • Used in local area networks

RARP – Reverse Address Resolution Protocol

- • Maps MAC address to IP address
- • Used by diskless workstations

ICMP – Internet Control Message Protocol

- • Error reporting and diagnostics protocol
- • Works with IP
- • Used in ping and traceroute

Functions of ICMP

- • Error reporting
- • Congestion control
- • Route testing
- • Network diagnostics

IGMP – Internet Group Management Protocol

- • Manages multicast group membership
- • Used in video streaming and conferencing

Functions of IGMP

- • Joining multicast groups
- • Leaving multicast groups
- • Group membership management

Forwarding

- • Process of sending packets toward destination
- • Routers use forwarding tables

Routing

- • Determines best path for packets
- • Uses routing algorithms and protocols

Types of Routing

- • Static Routing
- • Dynamic Routing

Unicast Routing Protocols

- • Used for one-to-one communication
- • Examples:
- • RIP
- • OSPF
- • BGP

RIP – Routing Information Protocol

- • Distance vector routing protocol
- • Uses hop count metric
- • Simple and easy to configure

OSPF – Open Shortest Path First

- • Link-state routing protocol
- • Uses shortest path algorithm
- • Faster convergence

BGP – Border Gateway Protocol

- • Exterior gateway protocol
- • Used between autonomous systems
- • Backbone routing protocol of Internet

Multicast Routing Protocols

- • Used for one-to-many communication
- • Efficient bandwidth utilization

Types of Multicast Routing

- • Dense mode routing
- • Sparse mode routing

Applications of Multicast

- • Video conferencing
- • Online streaming
- • Distance education
- • Live broadcasting

Advantages of Network Layer

- • Supports global communication
- • Efficient routing
- • Reliable packet delivery
- • Logical addressing

Challenges in Network Layer

- • Congestion
- • Security threats
- • Packet loss
- • Routing complexity

Comparison of Unicast and Multicast

- Unicast:
- • One-to-one communication

- Multicast:
- • One-to-many communication

Conclusion

- • Network Layer provides routing and addressing
- • ICMP and IGMP improve communication management
- • Routing protocols enable efficient data delivery