ASSIGNMENT # 03

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Subject:

Computer's Networking(cc-214)

Submitted to:

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Question # 01:

How Router taking routing decisions? What algorithm are used in taking such decisions, discuss in detail.

Answer:

Routers taking routing decisions using complex algorithms to determine the best path for forwarding packets. Here we discuss detail about them.

Routing decision process:

- Packet reception: Router receives a packet from a device or another router.
- Destination IP address extraction: Router extracts the destination IP address from the header router.

- Routing table lookup: Router searches its routing table for matching entries.
- Best path selection: Routers selects the best path based on routing metrices.
- Packet forwarding: Routers forward the packet to next hop.

Routing algorithms:

They are software programs that implement different routing protocols. They work by assigning a cost number to each link; the cost number is calculated using various network metrics. Every router tries to forward to best link with the lowest cost.

Distance-vector routing algorithms:

RIP(Routing information protocol): Use hop count as metric ; max 15 hops.

IGRP (Interior Gateway Routing Protocol): Uses composite metric (bandwidth, delay, reliability.

EIGRP (Enhanced IGRP): Improves upon IGRP with advanced metrics.

Link-State Routing Algorithms:

OSPF (Open Shortest Path First): Uses Dijkstra's algorithm; supports large networks.

IS-IS (Intermediate System to-Intermediate System): Similar to OSPF; used in ISP networks.

Path-Vector Routing Algorithms:

BGP (Border Gateway Protocol): Uses path vectors; primary internet routing protocol.

Hybrid Routing Algorithms:

GRP: Combines distance-vector and link-state features.

MPLS (Multiprotocol Label Switching): Uses label switching for efficient forwarding.

Routing Metrics:

- Hop Count: Number of routers between source and destination.
- Bandwidth: Available bandwidth on each link.
- . Delay: Transmission delay between routers.
- Reliability: Link uptime and packet loss statistics.
- Cost: Administrative cost assigned to each link.
- MTU (Maximum Transmission Unit): Largest packet size supported.

Routing Table Components:

- Destination Network: IP address range.
- Next Hop: IP address of adjacent router.
- Metric: Routing metric value.
- Interface: Outgoing interface.
- Flags: Route status (e.g., active, passive).

Factors Influencing Routing Decisions:

- Network Topology: Physical and logical connections.
- Traffic Patterns: Packet distribution and congestion.
- Link Quality: Bandwidth, delay, and reliability.
- Router Capacity: Processing power and memory.
- Administrative Policies: Routing protocols, metrics, and constraints

Advanced Routing Concepts:

- QoS (Quality of Service): Prioritizes traffic based on policies.
- Traffic Engineering: Optimizes traffic flow and network utilization.
- MPLS Traffic Engineering: Efficiently routes traffic using labels.
- Segment Routing: Simplifies traffic engineering using source-routing.

Real-World Applications:

- ISP Networks: BGP and OSPF for scalable routing.
- Enterprise Networks: EIGRP and OSPF for reliable connectivity.
- Data Centers: MPLS and segment routing for efficient traffic management.
- IoT Networks: Optimized routing for low-power devices.

Key Considerations:

- Scalability: Routing algorithm performance with network growth.
- Convergence Time: Time taken for routing tables to stabilize.
- Route Flapping: Frequent route changes causing instability.
- Security: Routing protocol authentication and authorization.

Thanks