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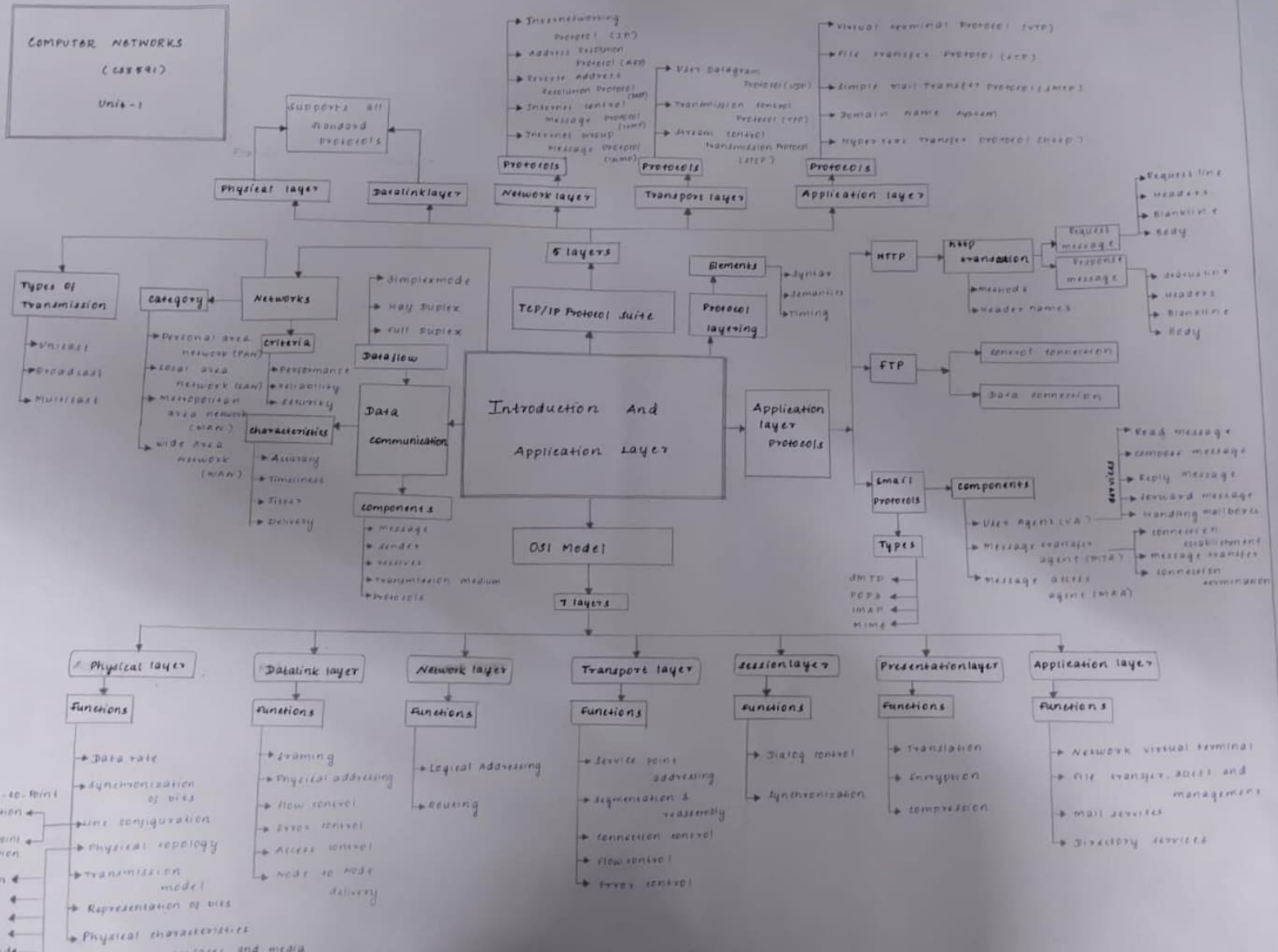
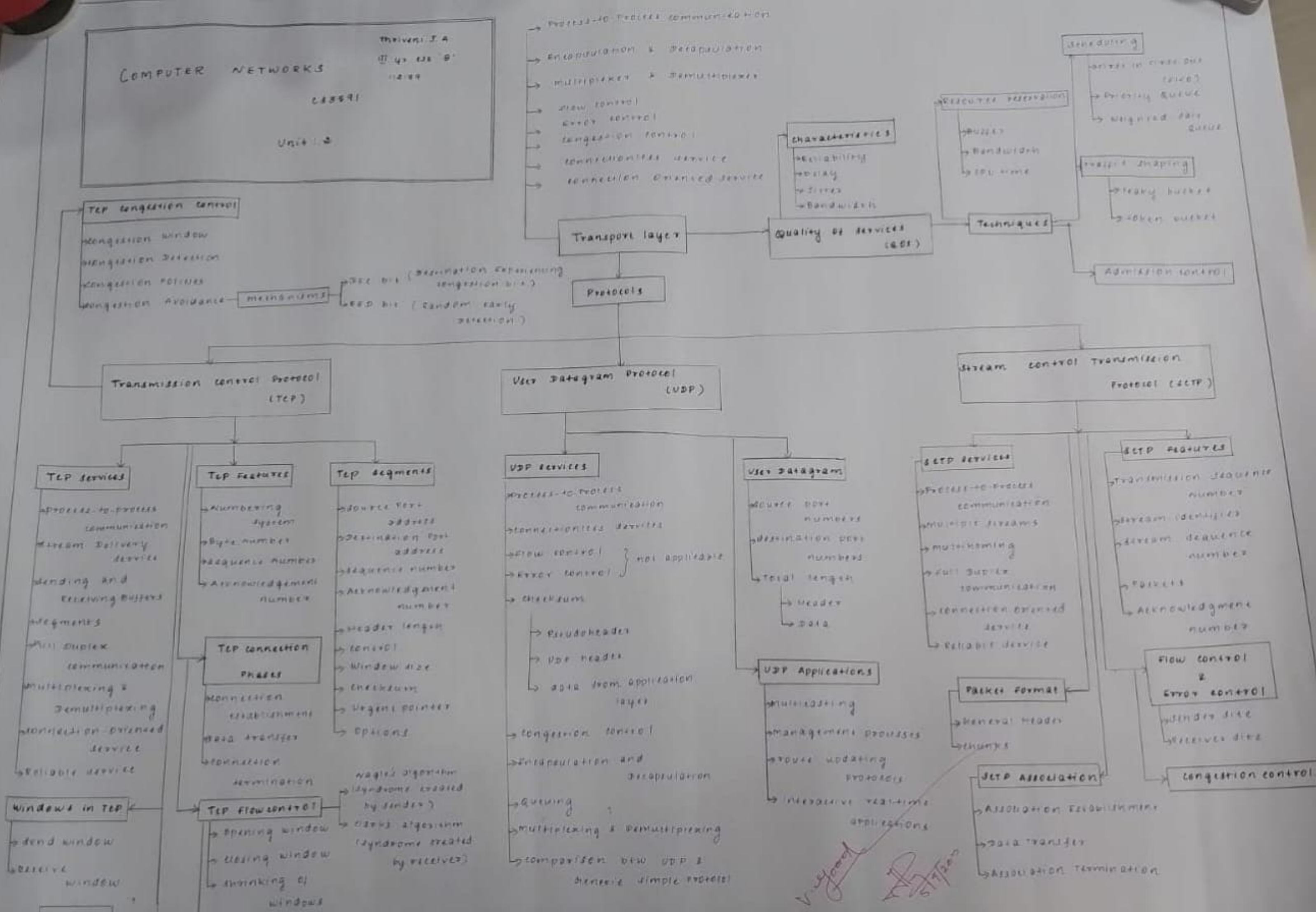
COMPUTER NETWORKS (CS8591)

Unit - 1





COMPUTER NETWORKS
CS8591
Unit : 2
Transport layer
Process-to-Process communication
Encapsulation & Decapsulation
Multiplexer & Demultiplexer
Flow control
Error control
Congestion control
Connectionless service
Connection oriented service
Quality of services (QoS)
Characteristics
Reliability
Delay
Jitter
Bandwidth
Techniques
Resource reservation
Buffer
Bandwidth
CPU time
Scheduling
First in first out queue
Priority queue
Weighted fair queue
Traffic shaping
Leaky bucket
Token bucket
Admission control
TCP congestion control
Congestion window
Congestion detection
Congestion policies
Congestion Avoidance
Mechanisms
ECE bit (Destination Experiencing Congestion bit)
RED bit (Random early detection)
Protocols
Transmission control Protocol (TCP)
User Datagram Protocol (UDP)
Stream control Transmission Protocol (SCTP)
TCP services
Process-to-process communication
Stream Delivery service
Sending and receiving buffers
Segments
Full duplex communication
Multiplexing & Demultiplexing
Connection oriented service
Reliable service
TCP Features
Numbering system
Byte number
Sequence number
Acknowledgement number
TCP segments
Source port address
Destination port address
Sequence number
Acknowledgment number
Header length
Control
Window size
Checksum
Urgent pointer
Options
TCP connection Phases
Connection establishment
Data transfer
Connection termination
Windows in TCP
Send window
Receive window
TCP Flow control
Opening window
Closing window
Shrinking of windows
Nagle's algorithm (Syndrome created by sender)
Clark's algorithm (Syndrome created by receiver)
UDP services
Process-to-process communication
Connectionless services
Flow control
Error control
not applicable
Checksum
Pseudoheader
UDP header
data from application layer
Congestion control
Encapsulation and decapsulation
Queuing
Multiplexing & Demultiplexing
Comparison b/w UDP & Generic simple protocol
User Datagram
Source port numbers
Destination port numbers
Total length
Header
Data
UDP Applications
Multicasting
Management processes
Route updating protocols
Interactive real-time applications
SCTP services
Process-to-process communication
Multiple streams
Multihoming
Full Duplex communication
Connection oriented service
Reliable service
SCTP Features
Transmission sequence number
Stream identifier
Stream sequence number
Packets
Acknowledgment number
Flow control & Error control
Sender site
Receiver site
Congestion control
Packet Format
General Header
Chunks
SCTP Association
Association Establishment
Data Transfer
Association Termination
V. good

NETWORK LAYER

SWITCHING

- Circuit Switching
- Packet Switching
  - Datagram Approach (Connectionless)
  - Virtual circuit Approach (Connection-oriented)
    - Message is divided into manageable packets
    - Entire message is transformed
    - Transfer data from source ports to destination ports

INTERNET PROTOCOL VERSION 4 (IPv4)

- Unreliable and connectionless protocol, a best effort delivery service.
- Packets in IPv4 layer
  - Datagram
    - Header
    - Data
      - 6 fields
        - Identification
        - flags
        - fragmentation offset
      - Total length of data = total length - header length
- IPv4 Datagram format
  - Header checksum
  - Source address
  - Destination address
  - Options
  - Payload
- Address space
- IPv4 addresses (32 bit) long
  - Classless addressing
  - Classful addressing
    - 5 classes :- A, B, C, D, E
    - Class type
    - Net id
    - Host id
    - A: 2^{31}
      B: 2^{30}
      C: 2^{29}
      D: 2^{28}
      E: 2^{8}
    - Masking
    - Sub-netting
    - Super-netting
- Notations in IPv4
  - Binary
    - 32-bit address
  - Dotted Decimal
    - 0 - 255

INTERNET PROTOCOL VERSION IPv6

- Larger address space
- Better header format
- New options
- More Security
- Address Types
  - Unicast
  - Anycast
  - Multicast
- Notation
  - Dotted Decimal
  - Colon hexadecimal
- IPv6 Packet format
  - Version
  - Traffic class
  - Flow label
  - payload length
  - Next header
  - Hop limit
  - Source address
  - Destination address
- Extension headers
  - Hop by Hop
  - Destination
  - Source routing
  - Fragmentation
  - Authentication
  - ESP
- Transition from IPv4 to IPv6
  - 3 Transition Strategies
    - Dual stack
    - Tunneling
    - Header translation

Address Resolution Protocol (ARP)

- maps logical address to physical address
- Hardware type
- protocol type
- Hardware length
- protocol length
- Operation
- Sender hardware address
- Sender protocol address
- Target hardware address
- Target protocol

REVERSE ADDRESS RESOLUTION PROTOCOL (RARP)

- maps physical address to logical address

INTERNET CONTROL MESSAGE PROTOCOL (ICMP)

- Unreliable connectionless datagram delivery
- Uses
  - Traceroute
  - ping
- Messages
  - Error Reporting
    - Destination unreachable
    - Source quench
    - Time exceeded
    - parameter problems
    - Redirection
  - Query
    - Echo Request
    - Echo reply

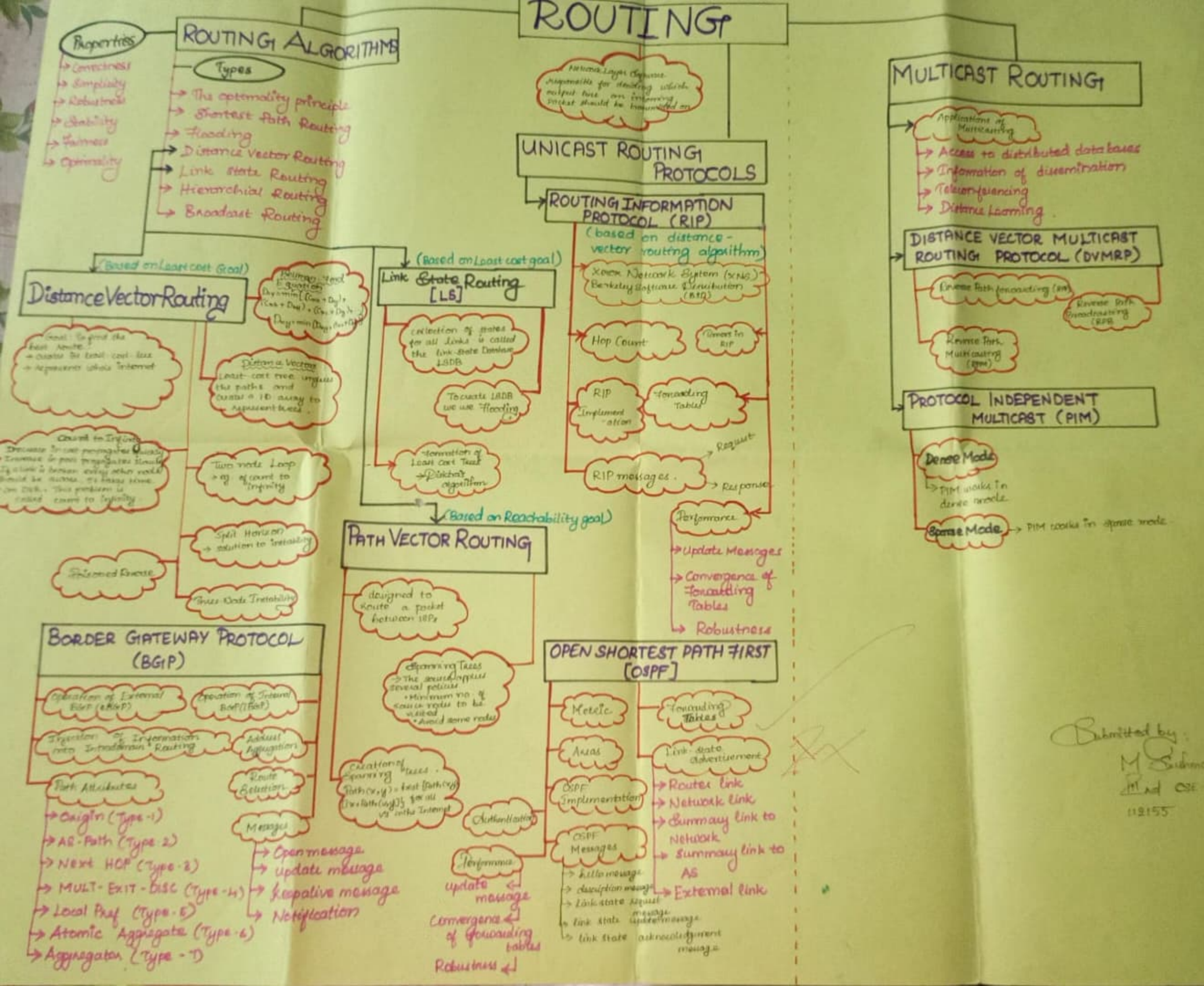
DYNAMIC HOST CONFIGURATION PROTOCOL (DHCP)

- Static or dynamic address allocation
- DHCP Packet
  - Flag
  - Client IP address
  - Server IP address
  - Gateway IP
  - Client hardware
  - Server name
  - Boot filename
  - Options
  - Operation code
  - Hardware type
  - Hardware length
  - Hop count
  - Transaction ID

Submitted By:

M. Sushma

III CSE - B



ROUTING
ROUTING ALGORITHMS
Properties
Correctness
Simplicity
Robustness
Stability
Fairness
Optimality
Types
The optimality principle
Shortest Path Routing
Flooding
Distance Vector Routing
Link state Routing
Hierarchial Routing
Broadcast Routing
(Based on Least cost Goal)
Distance Vector Routing
Bellman-Ford Equation
Count to Infinity
Two node Loop
Split Horizon
Three-Node Instability
(Based on Least cost goal)
Link State Routing [LS]
To create LSDB we use Flooding
Formation of Least cost Tree
Dijkstra algorithm
(Based on Reachability goal)
PATH VECTOR ROUTING
designed to Route a packet between ISPs
Spanning Trees
Creation of Spanning trees
BORDER GATEWAY PROTOCOL (BGP)
Operation of External BGP (eBGP)
Operation of Internal BGP (iBGP)
Injection of Information into Intradomain Routing
Address Aggregation
Path Attributes
Route Selection
Messages
Origin (Type-1)
AS-Path (Type-2)
Next HOP (Type-3)
MULT-EXIT-DISC (Type-4)
Local Pref (Type-5)
Atomic Aggregate (Type-6)
Aggregator (Type-7)
Open message
update message
Keepalive message
Notification
UNICAST ROUTING PROTOCOLS
ROUTING INFORMATION PROTOCOL (RIP)
(based on distance-vector routing algorithm)
Xerox Network System (XNS)
Berkeley Software Distribution (BSD)
Hop Count
Timers in RIP
RIP Implementation
Forwarding Tables
RIP messages
Request
Response
Performance
Update Messages
Convergence of Forwarding Tables
Robustness
OPEN SHORTEST PATH FIRST [OSPF]
Metric
Forwarding Tables
Areas
Link-state advertisement
OSPF Implementation
Router link
Network link
Summary link to Network
Summary link to AS
External link
OSPF Messages
hello message
database description message
link state request
link state update message
link state acknowledgement message
Authentication
Performance
update message
Convergence of forwarding tables
Robustness
MULTICAST ROUTING
Applications of Multicasting
Access to distributed databases
Information of dissemination
Teleconferencing
Distance Learning
DISTANCE VECTOR MULTICAST ROUTING PROTOCOL (DVMRP)
Reverse Path Forwarding (RPF)
Reverse Path Broadcasting (RPB)
Reverse Path Multicasting (RPM)
PROTOCOL INDEPENDENT MULTICAST (PIM)
Dense Mode
PIM works in dense mode
Sparse Mode
PIM works in sparse mode
Submitted by:

DATALINK LAYER ↔ PHYSICAL LAYER

DATALINK LAYER

- TYPES OF LINKS
  - Point-point link
  - Broadcast link
- SUBLAYERS
- DATALINK CONTROL
  - Framing: Packbits into frames
  - Error control, interference, single bit error, burst error
- POINT-POINT PROTOCOL [PPP]
  - services provided by PPP
  - services not provided by PPP
  - Framing → Flag → Payload, Address → IP, Control, Protocol
  - Transition states → Dead, Terminate, Establish, Authenticate, Network → open
- HIGH-LEVEL DLC [HDLC]
  - configurations: Normal Response Mode (NRM), Asynchronous Balanced mode (ABM)
  - frames: Information frames, Supervisory frames, Unnumbered frames
  - Flag field, Address field, control field, Information field, FCS field (frame types)
  - Control field for I-Frames
  - Control field for S-frames
    - Receive Ready (RR)
    - Receive Not Ready (RNR)
    - Reject (REJ)
    - Selective Reject (SREJ)
  - Control field for U-frames
- MEDIA ACCESS CONTROL [MAC]

- WIRELESS LAN
  - IEEE 802.11 Wireless Fidelity
  - ARCHITECTURE
    - Basic Service Set (BSS) / Extended Service Set (ESS)
    - Ad-hoc network (BSS without an AP)
    - Infrastructure network (BSS with AP)
    - made up of 2 or more BSs with APs
  - STATION TYPES
    - No transition
    - BSS transition
    - ESS transition
  - MAC SUBLAYER
    - Distributed coordination function (DCF)
    - Point coordination function (PCF)
    - RTS - Request to send
    - CTS - Clear to send
    - SIFS - Short Interframe space
  - FRAME FORMAT
    - Management frames
    - control frames
    - Data frames
  - Addressing Mechanism
  - Hidden station Problem
- BLUETOOTH
  - piconet
  - scatternet

- ETHERNET
  - Connect devices in wired LAN or WAN, Outside Internet
  - FOUR GENERATIONS
    - Standard Ethernet (10 Mbps)
    - Fast Ethernet (100 Mbps)
    - Gigabit Ethernet (1 Gbps)
    - 10-Gigabit Ethernet (10 Gbps)
  - FRAME FORMAT
    - SFD, Preamble, DA, SA, length or type of data unit, upper layer Data, CRC
  - Addressing
    - MAC address, Physical address, Data link address
- CARRIER SENSE MULTIPLE ACCESS PROTOCOL [CSMA]
  - TWO STATES
    - Carrier busy
    - carrier idle
  - Vulnerable Time
  - TYPES
    - (1) 1-Persistent CSMA
    - (2) non-Persistent CSMA
    - (3) p-Persistent CSMA
- CSMA/CD
  - CSMA - collision Detection, collision abation

PHYSICAL LAYER

- DATA & SIGNALS
  - ANALOG & DIGITAL SIGNALS
    - Analog data are continuous & take continuous values
    - Digital data have discrete states and take discrete values
  - PERIODIC AND NON-PERIODIC SIGNALS
  - PERIODIC ANALOG SIGNALS
    - SIMPLE
    - COMPOSITE
    - Sine Wave
      - Peak amplitude, frequency, Phase
      - $f = 1/T$, $T = 1/f$
      - 360° = 2π rad; 1° = 2π/360 rad = 360/(2π)
      - Wavelength = Propagation speed × Period
  - COMPOSITE SIGNALS
    - Bandwidth - range of frequencies contained in a composite signal
  - DIGITAL SIGNALS
    - Bit rate: represented in bit per second (bps)
    - Bit length: Propagation speed × Bit duration
  - TRANSMISSION OF DIGITAL SIGNALS
    - Baseband Transmission
    - Broadband Transmission
- PERFORMANCE
  - Bandwidth (in hertz) (in bps)
  - Throughput
  - Latency: propagation time + transmission time + queuing time + processing delay
- TRANSMISSION MEDIUM
  - WIRED / GUIDED MEDIA
    - Twisted Pair Cable
      - unshielded
      - shielded
    - Coaxial Cable
    - Fibre Optic cable
  - WIRELESS / UNGUIDED MEDIA
    - Radio waves 3KHz - 1GHz
    - Microwaves 1GHz - 300GHz
    - Infrared

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