

# FINAL EXAM REVIEW

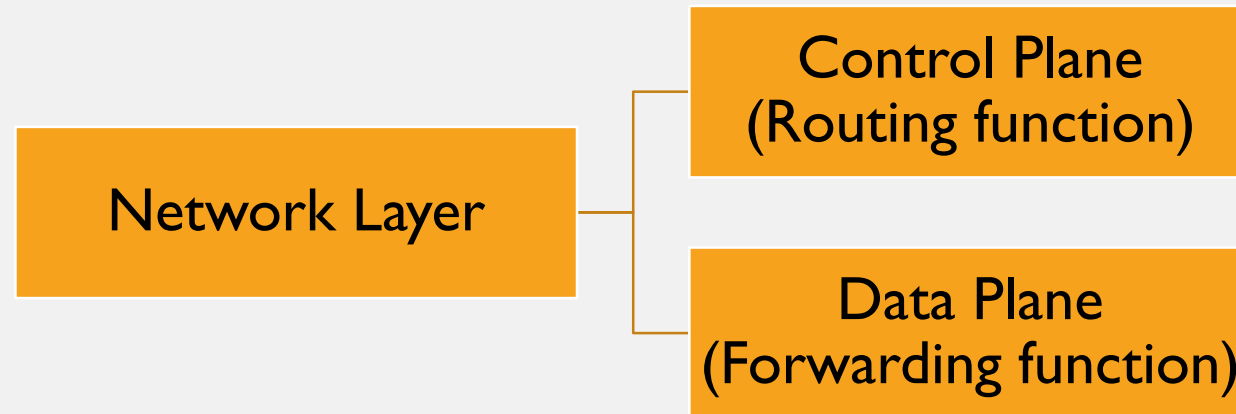
CPSC 441 - Tutorial 15

Winter 2018

## TYPE OF QUESTIONS

1. Multiple Choice Questions (12 marks)
2. Protocol Stack Operations (12 marks)
3. Networking Concepts and Definitions (12 marks) – Similarities and key differences
4. Networking Details (10 marks)
5. MAC Protocols (12 marks)
6. Routing Protocols (12 marks)
7. Networking Trends (10 marks)

## CHAPTER 4



- ✓ Definitions and properties of each plane
- ✓ What are different kind of service models? (best effort, CBR,...) What do they guarantee? (Bandwidth, Loss,...) Do they have congestion feedback?

## CHAPTER 4

- ✓ Router Architecture (two main components: routing processor, switching fabric)
- ✓ Input port functions: line termination (physical layer), link layer protocol (receive), lookup, forwarding, queuing (if arrival rate > forwarding rate)
- ✓ Two types of forwarding: destination-based (longest prefix matching-TCAM) and generalized
- ✓ Three types of switching fabrics: memory, bus, crossbar

## CHAPTER 4

- ✓ Input port queuing and Head-of-the-line (HOL) blocking problem
- ✓ Output ports: buffering packets (arrival rate via switch > output line speed) and scheduling packets (give priority)
- ✓ Queuing delay and loss → output buffer overflow
- ✓ Different types of scheduling: FIFO, Priority, Round Robin, Weighted Fair Queuing

## CHAPTER 4

- ✓ Network layer protocols: IP (addressing and packet handling conventions), ICMP (error handling and router signaling)
- ✓ IP datagram format
- ✓ IP fragmentation and reassembly due to link MTU
- ✓ IP addresses are associated with each interface in host/router
- ✓ Interfaces are connected through Ethernet switches or WiFi base station
- ✓ Subnets, Classless InterDomain Routing (a.b.c.d./x), subnet part (subnet mask) and host part

## CHAPTER 4

- ✓ Dynamic Host Configuration Protocol (DHCP): dynamically get address from as server
- ✓ How a new host get IP address (DHCP discover msg, DHCP offer msg, DHCP request msg and DHCP ack)
- ✓ What does DHCP return other than IP address? address of first-hop router for client, name and IP address of DNS sever and network mask
- ✓ Hierarchal addressing (organizations, ISPs, Internet Corporation for Assigned Names and Numbers - ICANN)

## CHAPTER 4

- ✓ NAT (network address translation): Translate local network address to global address and vice versa
- ✓ IPv6 vs IPv4
- ✓ Generalized Forwarding and SDN: logically centralized routing controller define router's match+action (match address – action: drop or permit or...) rules (OpenFlow)
- ✓ Asynchronous Transfer Mode (ATM) technology properties (packet-switched, small fixed size packets, connection-oriented,...) and cell format

# CHAPTER 5

- ✓ Routing algorithms classification: global(link state algorithms)/decentralized(distance vector algorithms), static/dynamic
- ✓ Link State (LS) algorithm: Dijkstra
- ✓ Distance Vector (DV) algorithm: Bellman-Ford
- ✓ LS vs DV (message complexity, speed convergence and robustness)
- ✓ For scalable routing → Autonomous Systems (aggregate routers into regions)
- ✓ Intra-AS routing vs inter-AS routing

# CHAPTER 5

- ✓ Inter-AS routing (BGP): find address ranges for each connected AS (eBGP) and propagate to all routers in the AS (iBGP)
- ✓ Intra-AS routing (RIP, OSPF-based on Dijkstra, IGRP)
- ✓ Inter-AS vs Intra-AS routing
- ✓ SDN: Usage in Traffic Engineering, Components, OpenFlow protocol, Challenges
- ✓ ICMP: message type and code
- ✓ SNMP protocol for network management, message types and format

# CHAPTER 6

- ✓ Data link layer responsibility: transferring datagram from one node to physically adjacent node over a link
- ✓ Services: framing, MAC protocol, reliable delivery, flow control, error detection/correction (parity, checksum and CRC), half/full-duplex
- ✓ MAC protocols (TDMA, FDMA, slotted ALOHA, ALOHA, CSMA/CD, CSMA/CA)
- ✓ ARP (address resolution protocol) – Data Link layer routing
- ✓ IEEE 802.3 (Ethernet) vs IEEE 802.11 (WiFi)
- ✓ Multiprotocol label switching (MPLS)
- ✓ Data center networks and challenges

# CHAPTER 7

- ✓ Wireless networks: infrastructure modes vs ad hoc
- ✓ CDMA to minimize interference
- ✓ IEEE 802.11 Wireless LAN and CSMA/CA, frame, advanced capabilities
- ✓ IEEE 802.15- personal area network: ad hoc, master/slave, evolved from Bluetooth
- ✓ Sharing mobile-to-BS radio spectrum via combined FDMA/TDMA or CDMA
- ✓ 2G vs 3G vs 4G
- ✓ Mobility handling – direct routing vs indirect routing

## CHAPTER 9

- ✓ Multimedia (audio, video) – Streaming stored video challenges: continuous payout constraint-jitter, client interactivity, packet loss and retransmission and using buffering to resolve the problem
- ✓ Streaming stored multimedia via HTTP/TCP
- ✓ Voice over IP
- ✓ Real-Time Protocol (uses UDP) properties and header
- ✓ Real-Time Control Protocol (RTCP)
- ✓ Session Initiation Protocol (SIP): provides mechanisms for call setup, determine current IP address of callee and call management – may use RTP to send media
- ✓ QoS support for Multimedia (best effort, differentiated service, per-connection QoS)