

Detailed Outline - Final

All the material, comments, etc. in the slides.

I. EXPONENTIAL AND POISSON (EXPONENTIAL POISSON IN RESOURCES)

PDF in resources:

- Exponential distribution (inter arrival, service) + Poisson process
- Properties: memoryless (+ proof), minimum interarrival time of multiple exponential processes (distribution, average, probability of arrival from process i), aggregate of exponential processes, sub-sampled exponential process.

II. QUEUEING AND BUFFERS

Leon-Garcia - Appendix A + Notes:

- M/M/1/K - characterization of the system, number of packets in the system, blocking probability, empty buffer probability, average time in the system (sketch of the proofs, $E[N]$ and $E[T]$, memorize formulas only with $K=\infty$).
- Erlang B formula - M/M/c/c (no proof).

III. ARCHITECTURE

Not included in final.

IV. APPLICATION LAYER

Kurose:

- 2.1: client-server and peer-to-peer architectures, processes and sockets, transport services, TCP and UDP services, Application layer protocols
- 2.2: architecture, non-persistent and persistent connections (no header format), cookies
- 2.4: architecture, SMTP (operations, skip the message part), comparison with HTTP, mail access protocols, POP3, Imap (functioning, no need to memorize the commands).
- 2.6: architecture and motivation, bitTorrent (architecture and operations).
- 7.1: whole sub-chapter
- 7.2: 7.2.1, 7.2.2
- 7.3: best-effort and QoS (packet loss, delay, jitter), Removing jitter, Recovering packet loss (FEC, interleaving)
- 7.4: RTP (basics, fields)
- 7.5: dimensioning, multiple classes of service (motivation, scheduling, policing), Per-connection QoS

V. TRANSPORT LAYER

Kurose:

- 3.1: interaction between transport and network layers, overview.
- 3.2: connection-oriented and connectionless multiplexing and demultiplexing.
- 3.3: UDP services, pro and cons of connectionless transport
- 3.4: principles (retransmission, feedback, error detection, numbering, timeouts), stop-and-wait, Go-Back-N, selective repeat
- 3.5: timeout and RTT, timeout and fast retransmit, flow control
- 3.6: congestion control principles and approaches
- 3.7: TCP congestion control: principles of congestion estimation (lost segment, acknowledgment, probing), slow start, congestion avoidance, fast recovery. TCP Reno

VI. NETWORK LAYER

Kurose:

- 2.5 - DNS: services, overview, hierarchical architecture.
- 5.4.1 - Link layer addressing: MAC addresses.
- 4.2 - transport layer vs network layer services, datagram networks (forwarding tables, forwarding rules).
- 4.3 - Routers: architecture and components, input processing, switching, output processing, queueing.
- 4.4 - ICMP (overview).
- 4.5 - graph model, shortest path, global vs decentralized routing algorithms, Link State protocol, Distance Vector, comparison LS vs DV, Hierarchical routing.
- 4.6 - intra-AS routing, RIP and OSPF (overview), inter-AS routing, BGP basics, BGP route selection, routing policy, why inter and intra-AS routing.
- 4.7 - Broadcast routing, uncontrolled and controlled flooding, spanning tree, multicast routing, multicast trees

VII. LAN

Kurose:

- 5.1 - services, adapters and interfaces.
- 5.2 - error detection and correction principles, checksum and CRC
- 5.3 - MAC protocols: taking turns and random access protocols, TDMA and FDMA, slotted aloha, aloha, CSMA, carrier sensing, collision detection.
- 5.4 - switched local area networks: MAC addressing and ARP, ethernet (hub and switches), link layer switches, and switches vs routers.
- 6.3 - architecture, 802.11 MAC protocol, RTS and CTS