Key Concepts

Note:

- K&R refers to 7th ed. Computer Networking: A Top-Down Approach by Kurose and Ross
- RB refers to Redbook TCP/IP Tutorial

Internetworking: Concept, Architecture and Model

(K&R Ch.1)

- Property of the Internet (RB 1.1)
- Internet Architecture (K&R 1.1)
- Bandwidth and Delays (K&R 1.4)
- Packet vs Circuit Switching (K&R 1.3.2, 1.3.3)
- How Packets are Delivered?
- Layer Abstraction and Encapsulation (K&R 1.5)
- End-to-End Principle
- Internet: A Network of Networks
- Hosts, Routers and Switches (K&R 4.1, 6.4.1, 6.4.2)

Internet Addressing (IPv4)

- Network vs Interface (K&R 6.4.1) (RB 2.1)
- IP Address Classes (K&R 4.3.3) (RB 3.1)
- Special Addresses (RB 3.1.1)
- Network Layer vs Link Layer Addresses
- Ethernet (CSMA/CD) and Physical Addresses (K&R 6.4.2)
- Internet Addresses to Physical Addresses (ARP) (RB 3.4.1)
- Classless Addresses (CIDR) (K&R 4.3.3) (RB 3.1.8)
- Routers and Switches (K&R 4.1, 6.4.1, 6.4.2)
- Subnetting and Supernetting (K&R 4.3.3)
- Network Address Translation (NAT) (K&R 4.3.4) (RB 3.1.7)
- ARP and RARP (RB 3.5)
- Dynamic Host Control Protocol (DHCP) (K&R p.342) (RB 3.7)

Internet Protocol and Routers

- Datagram Delivery
- A Virtual Network
- Purpose of the IP Protocol (K&R 4.3)
- A Connectionless Delivery System
- Routers and Switches (Revisited) (K&R 4.2)
- Packet Filter and Firewall (K&R 8.9.1) (RB 22.3)

Protocol Layering and Abstraction

- End-To-End Principle
- Transport (TCP/UDP) vs Network (IP) Layers (K&R 3.1.1)
- Encapsulation and Abstraction
- Multiplexing and Demultiplexing (K&R 3.2)
- Application Layer vs Transport Layer (K&R 2.1.5)
- NAT and Port Forwarding (K&R 4.3.4)
- Building Applications Around NAT

Client/Server Model of Interaction

(K&R Ch.2)

- Client/Server Model (K&R 2.1) (RB 11.1)
- Socket Interface (K&R 2.7) (RB 11.2.1)
- Domain Name System (DNS) (K&R 2.4) (RB 12.1-12.1.5)
- Telnet, FTP (RB 14.1, 14.3)
- HTTP (K&R 2.2) (RB 16.1-3)
- Email and SMTP (K&R 2.3) (RB 15.1, 15.3, 15.4)

User Datagram Protocol (UDP)

(K&R 3.3)

- Multiplexing IP Datagrams (K&R 3.2) (RB 4.1)
- Datagram Format (K&R 3.3) (RB 4.2)
- UDP Encapsulation and Layering
- DNS (Revisited)

- UDP Pseudo-Header and Checksum (K&R 3.3.2)
- Multiplexing, Demultiplexing and Ports (K&R 3.2)
- Reserved and Available Port Numbers

Reliable Stream Transport Service (TCP)

(K&R 3.4 to 3.7) (RB 4.3)

- The Need for Reliable Stream Delivery (K&R 3.4)
- Properties of a Reliable Delivery Service (K&R 3.4)
- Alternating Bit Protocol (ABP) (K&R 3.4.1)
- Sliding Window Protocols (K&R 3.4.2, 3.4.3, 3.4.4)
- Transmission Control Protocol (TCP) (K&R 3.5)
- Ports, Connections and Endpoints (K&R 3.5.1)
- Segments, Streams and Sequence Numbers
- Flow Control (K&R 3.5.5)
- TCP Header Format and Checksum
- Acknowledgements and Retransmission
- Timeout and Retransmission
- Accurate Measurement of Round-Trip-Time
- Establishing a TCP Connection (3-Way Handshake) (K&R 3.5.6)
- Initial Sequence Numbers
- Closing a TCP Connection (4-way Takedown)
- TCP State Machine
- Congestion Control (K&R 3.6, 3.7)
- Additive Increase and Multiplicative Decrease (AIMD)
- Bandwidth Probing

Routing IP Datagrams

(K&R 4.1, 5.1 to 5.3)

- What is a Router? (K&R 4.2)
- Routing in an Internet
- Direct and Indirect Delivery
- Table-Driven IP Routing
- Next-Hop Routing
- Default Routes
- Routing Algorithms

- Establishing Routing Tables
- The Origin of Routing Tables
- Internet Architecture and Core Routers
- Peer Backbones
- Route Propagation
- Distance-Vector (Bellman-Ford) Routing (K&R 5.2.2)
- Gateway-to-Gateway Protocol (K&R 5.3)
- Link-State (Dijkstra) Routing (K&R 5.2.1)
- Autonomous System Concept (K&R 5.4) (RB 5.1)
- Exterior Gateway Protocol (K&R 5.4.1) (RB 5.9)
- Interior or Routing Information Protocol (RIP)
- Open Shortest Path First Protocol (OSPF)

Miscellaneous Topics

- Internet Multicasting (RB 6.1)
- Hardware Broadcast
- Hardware Multicast
- IP Multicast and Addresses
- IP to Ethernet Multicast
- Random Access Protocols, ALOHA and Ethernet (K&R 6.3.2)
- Performance of Ethernet (CSMA/CD)
- Error-Detection and Correction (CRC) (K&R 6.2)

Wireshark

- What is a Packet Sniffer?
- Capture Filter
- Display Filter
- Network Interfaces
- Packet Encapsulation
- MAC and IP Addresses
- Protocols
- Payloads