COMP3721 – Final Exam Review

Data Link Layer:

- Error Detection and Error Correction,
- Redundancy for Error Control (Dataword, Codeword, number of valid and invalid codewords)
- Block Coding
- Hamming Distance and Error Detection (how many errors can be detected/corrected)
- Linear Block Codes (Parity Check Code)
- Cyclic Codes (CRC) and Syndrome value
- Checksum calculation, One's Complement Arithmetic and Wrapping (Hex)
- FEC
- Framing, Fixed and Variable Size (Byte oriented and Bit oriented approaches – Byte and Bit Stuffing)
- Flow Control, Error Control (Simple and Stop-and-wait Protocols)

Random-Access Protocols:

- Broadcast domain (VLANs to Separate) and Collision Domain
- Random Access Protocols
- Pure Aloha, Slotted Aloha, Vulnerable times, what is G and how do you calculate the Throughputs
- CSMA and its Vulnerable time (based on Propagation time of the Frame)
- Persistent Methods (1/Non/P-persistent methods)
- CSMA/CD and /CA

Network Layer:

- Packet Switch Network (Like Internet), Datagram Networks
- Packetizing
- Routing
- Error Control (Checksum at the header of the datagram, only used for
- corruption in the header not the whole packet)
- Performance (Total Delay, Propagation, Transmission, Queuing, and
- Processing Delays)
- Throughput vs. Bandwidth (Throughput is always less than Bandwidth)

COMP3721 – 期末考试复习

数据链路层：

- 错误检测与纠错，
- 用于错误控制的冗余（数据字、码字、有效和无效码字的数量）

- 分组编码
- 汉明距离与错误检测（可检测/纠正多少个错误）

- 线性分组码（奇偶校验码）
- 循环码（CRC）和伴随值
- 校验和计算、一的补码运算及封装（十六进制）

- 前向纠错（FEC）
- 成帧、固定与可变尺寸（面向字节和面向比特的方法——字节填充和比特填充）
- 流量控制、差错控制（简单协议和停等协议）

随机访问协议：

- 广播域（通过VLAN进行划分）和冲突域
- 随机访问协议
- 纯ALOHA、时隙ALOHA、易受攻击时间、G的含义以及如何计算吞吐量

- 载波侦听多路访问（CSMA）及其易受攻击时间（基于帧的传播时间）

- 持续方法（1-持续、非持续、P-持续方法）
- CSMA/CD 和 /CA

网络层：

- 分组交换网络（如互联网），数据报网络
- 分组化
- 路由
- 差错控制（数据报头部的校验和，仅用于
- 报头中的错误（不是整个数据包）
- 性能（总延迟、传播延迟、传输延迟、排队延迟以及
- 处理延迟）
- 吞吐量与带宽（吞吐量始终小于带宽）

- Packet Switch Network (Like Internet), Datagram Networks
- Packetizing
- Routing
- Error Control (Checksum at the header of the datagram, only used for corruption in the header not the whole packet)
- Performance (Total Delay, Propagation, Transmission, Queuing, and Processing Delays)
- Throughput vs. Bandwidth (Throughput is always less than Bandwidth)
- IPv4 Addressing (Classful and Classless)
- CIDR (slash) notation, total number of different networks and hosts
- Block Allocation and Subnetting, First Address (Network Address), First host address, Last host address, Broadcast address (Last Address) and subnet design
- Forwarding, Address Aggregation, and Routing Tables
- DHCP and NAT

IPv4:

- IPv4 Protocol and Datagram Format (Header specifically)
- Checksum calculation, One's Complement Arithmetic and Wrapping (Hex)
- MTU
- Fragmentation (ID, offset, and flag)
- ICMPv4 Protocol (Ping, Traceroute) and types of messages
- IPv6 and transition strategies

Routing and Transport Layer:

- Unicast Routing
- Network as a Weighted Graph
- Least cost trees, Bellman-Ford, and Distance Vectors (Distance Vector after Initialization, Updating DV using Bellman-Ford
- Link State (LS, LSP, and LSDB) and finding the shortest path using Dijkstra Algorithm
- Intra-domain Routing Protocols → RIP protocol (Based on DV and number of hops) and OSPF (Based on LS, customizable weight of the links by net admin)
- Transport Layer and its services (Sockets (IP + Port) for process-to-process delivery, Error Control, Flow Control, and Congestion Control

- 分组交换网络（如互联网），数据报网络
- 分组化
- 路由
- 差错控制（数据报头部的校验和，仅用于检测头部损坏而非整个分组）
- 性能（总时延、传播时延、传输时延、排队时延和处理时延）
- 吞吐量与带宽（吞吐量始终小于带宽）
- IPv4 地址划分（有类和无类）
- CIDR（斜线）表示法、不同网络的总数及主机数量
- 地址块分配与子网划分、第一个地址（网络地址）、第一个主机地址、最后一个主机地址、广播地址（最后一个地址）以及子网设计
- 转发、地址聚合和路由表
- DHCP 和 NAT

IPv4：

- IPv4 协议与数据报格式（特别是头部）
- 校验和计算、一的补码运算及进位（十六进制）
- MTU
- 分片（ID、偏移量和标志）
- ICMPv4 协议（Ping、Traceroute）及消息类型
- IPv6 及过渡策略

路由与传输层：

- 单播路由
- 网络作为带权图
- 最小代价树、Bellman-Ford算法和距离向量（初始化后的距离向量，使用Bellman-Ford更新距离向量）
- 链路状态（LS、LSP 和 LSDB）以及使用 Dijkstra 算法寻找最短路径
- 域内路由协议 → RIP 协议（基于距离向量和跳数）和 OSPF（基于链路状态，网络管理员可自定义链路权重）
- 传输层及其服务（用于进程到进程交付的套接字（IP + 端口）、差错控制、流量控制和拥塞控制）

(Using Seq numbers, ACKs, and where/when the error control is applied (corrupted packets, etc.)
- UDP (Connection-less Protocol without any of the features above) and its applications

TCP:
- TCP Buffers
- TCP Numbering system
- TCP Segment Format
- Connection-oriented protocol (Three-way handshake for Establishment and Termination)
- Flow control to prevent overwhelming the receiver (rwnd)
- Error control (ACKs (cumulative), SEQs, Retransmission, and Checksum (on whole segment, not just the header))
- Retransmission types (After Time-out, after Three Dup. ACKs)
- ACK and SEQ number calculation (after packet loss, timeout, etc.)
- Congestion Control to prevent overwhelming the network (cwnd)
- MSS and Congestion control algorithms (Slow Start, Congestion Avoidance)

（使用序列号、确认应答，以及错误控制的应用位置和时机（如数据包损坏等）
- UDP（不提供上述任何功能的无连接协议）及其应用

TCP:
- TCP 缓冲区
- TCP 编号系统
- TCP 段格式
- 面向连接的协议（建立和终止时使用的三次握手）
- 流量控制，以防止接收方不堪重负（rwnd）
- 错误控制（确认应答（累计）、序列号、重传以及校验和（针对整个段，而不仅仅是头部））
- 重传类型（超时后、收到三个重复确认后的重传）
- 确认号和序列号的计算（在丢包、超时等情况后）
- 拥塞控制，以防止网络过载（cwnd）
- MSS 和拥塞控制算法（慢启动、拥塞避免）