1. Part 1: Network Principles

This part of the course introduces all the concepts and the algorithms necessary for understanding how a network work. It corresponds to roughly chapter II of the book, plus other sources. We will not cover every part of chapter II, and not in the order that is presented, but my suggestion to study is, read the whole chapter for clarity, and consider as part of the program only the sections I reference hereafter. Not all lessons refer to the book, in those cases you need to study on the slides material, or the references I provide.

NOTE: this is a tentative program, the lessons may change based on many factors, including requests from the users to go deeper in some topics or cover topics that were not initially included.

1.1. Introduction

- Practical information
- Packet Switching
- Network Stack models

1.2. Physical Layer

- The physics of communication
- Nyquist and Shannon theorems

1.3. Datalink Layer (1)

- bit stuffing
- error detection: parity and IP checksum

Study references: first half of section 2.1, page 1-2 of RFC 1071

1.4. Datalink Layer (2)

- go-back-n
- selective repeat

Study references: second half of section 2.1

1.5. Datalink Layer (3)

libro 76-89, slides9 (poca roba)

- Network topologies
- TDMA
- ALOHA

Study references: first three pages of section 2.6, pag 86-88

1.6. Network Layer (1)

- datagrams, addresses
- Distance Vector routing

Study references: 27-43, excluding virtual circuits

1.7. Network Layer (2)

- counting to infinity, split horizon, poisoning
- link state routing

Study references: 44-49

1.8. Transport and Application layers

- services
- connectionless/connection-oriented
- data encoding, endianness
- Naming principles

Study references: 51-76

1.9. Security services

- Security services and security mechanisms
- Examples of what can go wrong

Study references: Material provided by the professor

1.10. Hash functions and Symmetric key cryptography

- Hash functions
- Secret key encryption
- HMAC

Study references: Material provided by the professor

1.11. Public Key Cryptography

- RSA
- DH

Study references: Material provided by the professor

1.12. PKI

- certificates

Study references: Material provided by the professor

2. Part 2: Protocols

2.1. The application Layer (DNS)

- DNS

Study references: 129-133, plus slides

2.2. The application Layer (E-MAIL)

- SMTP
- POP
- Security Extensions

Study references: 129-133, plus slides

2.3. The application Layer (HTTP)

- HTML
- HTTP

Study references: 144-160 (excluding base64 encoding)

2.4. The Transport Layer (part 1)

- UDP
- TCP

Study references: 181-203 (excluding the algorithms at page 194-195) and 208-209

2.5. The Transport Layer (part 2)

- TCP

Study references: 181-203 (excluding the algorithms at page 194-195) and 208-209

2.6. The Network Layer (IP)

- IPv4
- routing tables

Study references: slides or Tanenbaum's book 5.6-5.6.4

2.7. ICMP and intra domain routing

- IPv6
- ICMP
- OSPF

IPv6: book pages 211-220, 226-228 OSPF: 232-233, 234-238 ICMP: slides or Tannenbaum's book 442

2.8. Inter domain routing (BGP)

- inter-domain routing
- essentials of BGP

Study References: Slides + pages 239-244

2.9. The Data Link Layer: Ethernet and other related protocols

- Ethernet
- ARP
- DHCP

Study references:

- Ethernet: slides + pages 254-265
- ARP and DHCP: slides or Tanenbaum's book 5.6.4 sections ARP and DHCP

2.10. IEEE 802.11 (Wi-Fi)

- 802.11 - Wi-Fi

Study Material: slides + pages 94-97, 267-271

2.11. Secure protocols

- TLS
- TCP socket programming and their TLS version

Study Material:

- TLS: pages 168-176
- sockets: pages 275-281