Lesson 1: Introduction

- Computer Networking Overview
- What This Class is Not About

Lesson 2: Architecture & Principles

- A Brief History of the Internet
- Architectural Design Principles
- Packet Switching
- File Transfer
- End to End Argument Violations

Lesson 3: Switching

- Switching and Bridging
- Bootstrapping: Networking Two Hosts
- ARP: Address Resolution Protocol
- Interconnecting LANs with Hubs
- Switches: Traffic Isolation
- Spanning Tree
- Switches vs. Routers
- Buffer Sizing for a TCP Sender

Lesson 4: Routing

- Internet Routing
- Intra-AS Topology
- Distance-Vector Routing
- Link State Routing
- Interdomain Routing
- IGP vs. iBGP
- BGP Route Selection
- Multiple Exit Discriminator (MEI)
- Interdomain Routing Business Models

Lesson 5: Naming, Addressing & Forwarding

- IP Addressing
- Pre-1994: "Classful" Addressing
- IP Address Allocation
- Classless Interdomain Routing (CIDR)

- Multihoming Frustrates Aggregation
- Address Lookup Using Tries
- Memory Efficiency and Fast Lookup
- Alternatives to LPM with Tries
- NAT and IPv6
- Network Address Translation (NAT)

Lesson 5.1: Router Design Basics

- Router Design
- Basic Router Architecture
- Decision: Crossbar Switching
- Switching Algorithm: Maximal Matching
- Head of Line Blocking
- Scheduling and Fairness
- Max-Min Fairness

Lesson 5.2: Domain Name System (DNS)

- Record Types
- Examples (using "dig")
- Lookup IP Address

Lesson 6: Congestion Control & Streaming

- Congestion Control
- AIMD (TCP Congestion Control)
- Data Centers & TCP "Incast"
- Barrier Synchronization & Idle Time
- Multimedia & Streaming
- Digitizing Audio & Video
- Streaming Video
- Skype

Lesson 7: Rate Limiting and Traffic Shaping

- Traffic Classification & Shaping
- Source Classification
- Leaky Bucket Traffic Shaping
- (r, t) Traffic Shaping
- Shaping Bursty Traffic Patterns
- Power Boost
- Effects on Latency
- Buffer Bloat

- Packet Monitoring

Lesson 8: Content Distribution

- The Web and Caching
- HTTP Requests
- Persistent Connections
- Content Distribution Networks (CDNs)
- Server Selection
- Content Routing
- Bit Torrent
- Solution to Freeriding: "Choking"
- Distributed Hash Tables
- Consistent Hashing

Lesson 9: Software Defined Networking

- Network Management Overview
- Software Defined Networking (SDN)
- Control and Data Planes
- Different SDN Controllers
- NOX: Overview
- Ryu, Floodlight, Nox and Pox
- Customizing Control

Lesson 10: Traffic Engineering

- Traffic Engineering Overview
- Interdomain Traffic Engineering
- Measuring, Modeling and Controlling Traffic
- Link Utilization Function
- BGP in Interdomain Traffic Engineering
- Multipath Routing
- Data Center Networking
- Valiant Load Balance
- Jellyfish Data Center Topology

Lesson 11: Network Security

- Internet is Insecure
- Resource Exhaustion
- Routing Security
- Origin and Path Authentication
- DNS Security

- DNS Cache Poisoning

Lesson 11.1: Internet Worms

- Viruses and Internet Worms
- Internet Worm Lifecyle
- First Worm: "Morris" Worm
- Worm Outbreaks in Detail
- Modeling Fast-Spreading Worms

Lesson 11.2: Spam

- Spam
- IP Blacklisting

Lesson 11.3: Denial of Service (DoS) Attacks

- TCP 3-Way Handshake
- Inferring Denial of Service Activity using Backscatter
- Automated DoS Attack Mitigation
- MTPCP