Final Exam Review Guideline

CS204: Advanced Computer Networks
Fall 2023
Overview

• Final Exam:
  • 12/11, Monday, WCH 138
  • Closed book but 1 cheat sheet (US letter size, both sides) allowed
  • A sample final has been posted
  • Important to understand “why”

• This guide: Highlight the important concepts covered by this class
  • If any of them appear in the final, I’ll assume you are familiar with its definition, pros/cons, usages, ...
  • For anything not mentioned in this guide, I will introduce it if it does appear
  • Use this guide to make best use of the cheat sheet
Week 1: Network Basics

• What is the layered design in networking? What are major layers for the today’s Internet?
• What is a network protocol?
• Internet Architecture: edge (Hosts, ...), access network (communication links, ...), core (routers, ...)
• Different types of access networks
• Packet switching vs circuit switching
• Internet structure: Networks of networks (ISP, IXP, etc.)
Week 1: Design Principles

- Internet protocol suite; how packet travels
- Narrow waist of IP
- Control vs. Data Plane (Also Management Plane)
- Internet: Packet switching and best-effort delivery
- Design philosophy: Inter networking
- Key principles of the Internet design
Week 2: HTTP

- Why latency is important for Web
- General strategies to reduce HTTP latency
  - Connection based and content based
- Evolution from HTTP/1.1 -> 2 (SPDY)
- Drawbacks in HTTP/1.1
- SPDY design: Design principles, details, especially how it addressed latency issues
- Mobile SPDY: Issues of running SPDY in cellular networks
Week 2: P2P

• Biggest challenge for P2P: Where to find contents

• Main approaches: How they are designed to address the challenge
  • Central directory (Napster)
  • Query Flooding (Gnutella)
  • Hierarchical overlay (Kazaa)
  • Distributed hash table (BitTorrent)

• Distributed hash table: how it’s used for P2P
  • Chord: How it handles lookup, join, and churn

• BitTorrent: Strategy to request chunks
Week 3: TCP and Beyond

• TCP basics: congestion window control
• Multi-Path TCP
  • Design idea and intuition
  • Connection establishment procedure (negotiation, handle middlebox, ...)
  • Securely adding new subflows
  • Consideration on sequence numbers and retransmission
• TCP CUBIC: Design idea and how it achieves fairness
• BBR: Design idea and how to find optimal point
  • Definition and usage of Bandwidth-Delay Product
Week 5: IP and BGP

• NAT, how it works, why it helps address IPV4 depletion, pros and cons
• IPv6 basics
• Strategies to enable transition from v4 to v6
  • Tunneling, translation, dual-stack
• Inter-AS routing and intra-AS routing
• How BGP works
• Economic policies in BGP
  • Peering vs. transit; whether an ISP will announce another ISP
Week 6: Wireless

• Wireless networks: Basic architecture, choices, benefits
  • Challenges to enable wireless
  • Cross-layer design: Benefits and disadvantages

• WiFi: From CSMA/CD to CSMA/CA
  • Ideas of CD and why that doesn’t work for WiFi
  • Hidden and exposed terminal problems
  • How DCF works for WiFi MAC

• Cellular basic architecture: major components and protocols
  • Device power-on procedure and control plane state
  • Voice service
  • Mobility: Low Level (BS) vs. high level (Controller), idle-state vs. active-state
Week 8: Emerging

• Datacenter networking
  • Challenges in datacenter design and implications
  • North-South vs. east-west traffic
  • Bisection bandwidth and why conventional tree design is no good
  • Fat-tree topology and 2-level lookups

• Edge computing
  • Basic concept and benefits
  • Mobile cloud computing; how MEC is integrated in cellular infrastructure
Week X: Your paper

• Understand what your paper is about (high level)
• Benefits and limitation of the technology mentioned in paper
• Whether technology would be used in a certain scenario