

Packet Processing and Switching (ENTS 689L)

Fall 2007

Schedule/Location

Time: Mon 6:30pm-9:15pm
Room: CSS 2428

Instructor

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Main References

A. Leon-Garcia, I. Widjaja, "Communication Networks: Fundamentals, Concepts and Key Architectures." 2nd ed., McGraw-Hill.

P. C. Lekkas, "Network Processors Architectures, Protocols, and Platforms", McGraw-Hill

Office hours

Monday 5:30 pm-6:30pm, or by appointment

Grading System:

Midterm exam 40% (October 29 in class)
Final exam 60%

Course Objective and description:

The goal of this course is to understand functionality, architecture and main components of a switching/routing system.

We study three main elements of a switching system:

(1) Network Processor (NP), (2) Traffic Manager (TM) and (3) Switch Fabric (SF).

We discuss important operations that need to happen in real time at wire speed in a switching/routing system.

We look at different algorithms and architectures that are proposed for these operations.

We review relevant standards and protocols and architectures for routing and QoS provisioning.

Syllabus:

- Introduction: Evolution of Network Technology
 - Connectionless and Connection Oriented Networks
 - Wide area and local area networks
 - Ethernet Technology
 - Internet Architecture
 - Interconnection by IP routers
 - Layering and TCP/IP
 - Routing Protocols
 - Internet Addresses
 - Routing IP Packets
- Anatomy of a Switch
 - Network Contexts: Access, Edge, and Core
 - Block Diagram of a Switch
 - Data and Control Plane Processing
 - Evolution of Router Architecture
 - Line cards and switch cards
 - Router Functions
 - ASIC vs. Network Processor
 - Looking at an examples (Cisco Router)
- Network Processors
 - Definition
 - Justification
 - Alternative Approaches: ASIC and Off-the-Shelf CPU
 - Sample Architectures
- Peripheral Chips Supporting Network Processors
 - Search Engines and Content-Addressable Memory (CAM)
 - Classification Engines

MIDTERM EXAM

- Switch Fabric
 - Speedup
 - Connection
 - Backplane, serdes, Flow control (lossless concept)
 - Shared Memory architecture
 - Crossbar architecture
 - Arbitration (matching, iSLIP, QoS provisioning)
- Traffic Managers
 - Definition
 - QoS Protocols
 - RSVP, IntServ, DiffServ, MPLS
 - Traffic Marking, Shaping, and Policing

- Congestion Management
 - RED, WRED
- Scheduling and Buffer Management
 - Strict Priority, WRR, WFQ