



University of
Massachusetts
Amherst

ECE697AA – Lecture 1

Introduction

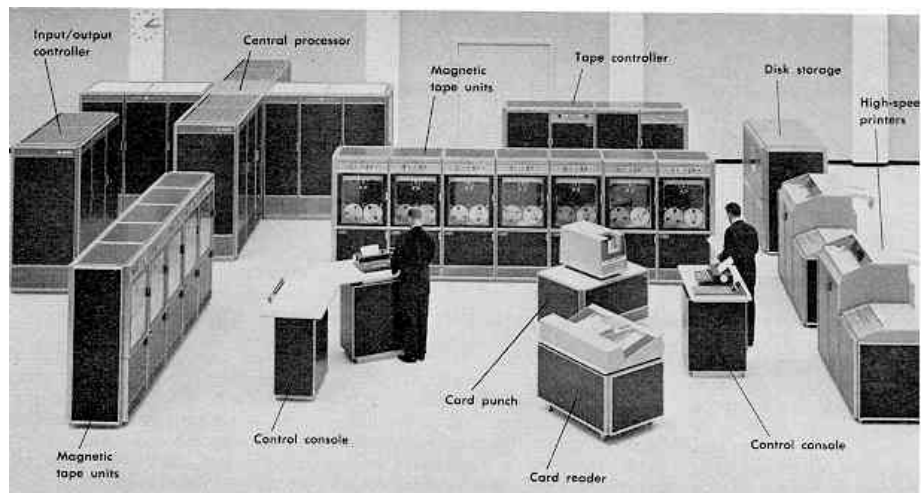
Tilman Wolf
Department of Electrical and Computer Engineering
09/02/08

Today's Lecture

- Introduction
 - Why do we study computer networks?
 - What are the technical challenges in networking?
- Networking concepts
 - Terminology
 - Structure of networks
- Course details

What are networks used for?

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What are networks used for?



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What are networks used for?



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Why study networks?

- Networks provide fundamental infrastructure to access distributed resources
 - Resources
 - » Physical resources (printers, processors)
 - » Data storage, information
 - Access
 - » Wired
 - » Wireless, mobile
 - Purpose
 - » Mainframe computing
 - » Access to information (email, web, ...)
 - » Communication (phone, TV, ...)
 - » Business (shopping, services, ...)
 - » Entertainment (chat, games, virtual worlds, ...)
- Technology is justified through applications

What are the technical challenges?

- What is difficult about designing, implementing, and operating networks?

Computer networks

- Simplest scenario



Computer networks

- Scalability is important

Routers

- Routers represent “nodes” in the network
 - Determine what happens with the data traffic



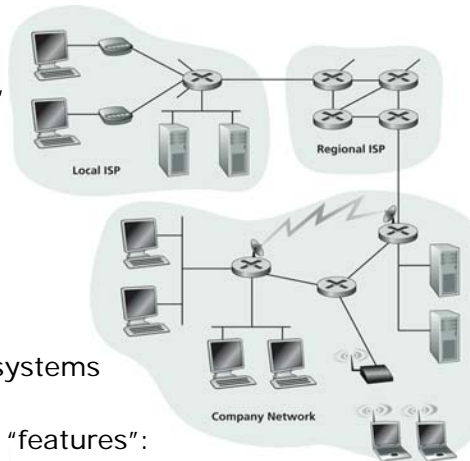
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The generic network figure

- Network components
 - Systems (nodes)
 - » End-systems (workstation, server, etc.)
 - » Routers (also switches, gateways, etc.)
 - Links
 - » Wired
 - » Wireless
- Network operation
 - Data is sent between end systems
 - » Protocols define rules
 - Network provides different “features”:
 - » Connectivity (ability to communicate)
 - » Functionality (error detection, reliability, etc.)
 - » Performance (throughput, delay, etc.)



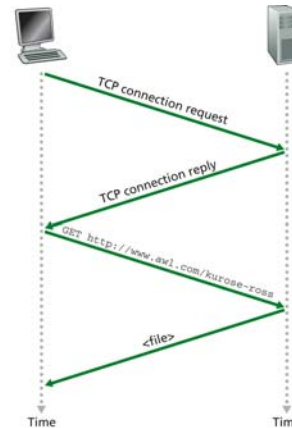
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Protocols

- Communication needs to follow protocol rules
 - “A protocol defines the format and the order of messages exchanged between two or more communicating entities, as well as the actions taken on the transmission and/or receipt of a message or other event.”
- Protocols define...
 - ...who talks to whom
 - ...what names are used
 - ...how data is formatted
 - ...in what order messages are sent
 - ...how to respond to messages
 - ...etc.
- Illustration of in space-time diagram

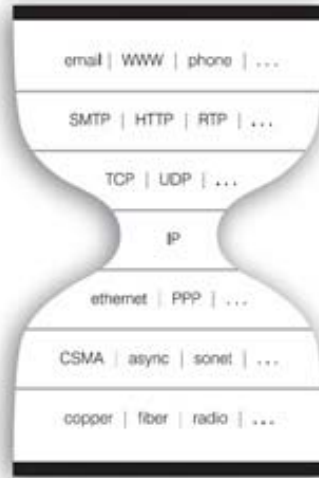


Universal networking protocol

- Why or why not should there be a single networking protocol?

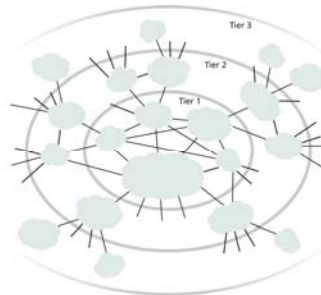
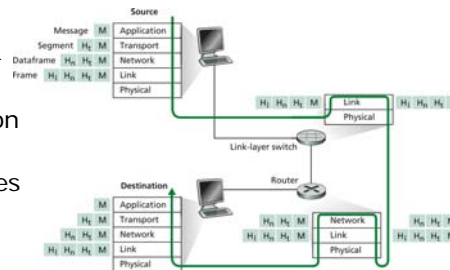
Hourglass architecture of Internet

- IP is the common protocol across the Internet
 - Diversity above and below



Structure of computer networks

- Service model view:
 - Layered structure of network (“protocol stack”)
 - » Abstraction of implementation complexities
 - » Modularization of technologies
- Topological view:
 - Organizational structure
 - » Tier-structure of Internet



What are the technical challenges?

- Network design and architecture challenges:
 - How can we develop a scalable system (millions of nodes)?
 - How can we achieve a stable, reliable network?
 - How can we determine what is really happening?
- Systems and algorithmic challenges:
 - How can we determine quickly what to do with packets?
 - How can we achieve higher performance?
 - How can we assure performance on share infrastructure?

What will we cover in this course?

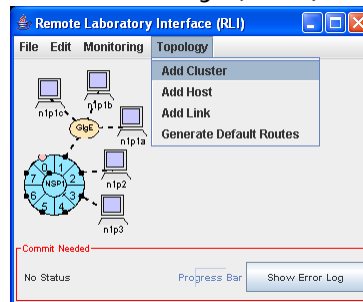
- Part I: Basic Protocols and Functionality
 - Review of Internet (layers 5 through 2)
 - Software router
- Part II: Network-Level Issues
 - Routing algorithms
 - Congestion control
 - Network security
- Part III: System-Level Issues
 - Interconnects and queuing
 - Bridges and switches (spanning tree algorithm)
 - Routers (lookups, classification, scheduling)
 - End-systems (servers, and data centers)
 - Specialized hardware
- Next-generation Internet

Course details

- Read the syllabus
- Up-to-date information on course web site:
 - <http://www.ecs.umass.edu/ece/wolf/courses/ECE697AA/>
 - Schedule, slides, etc.
- Course components:
 - Exam I 20%
 - Exam II 20%
 - Exam III 20%
 - Homework assignments 10%
 - Lab assignments 20%
 - Final project 10%
- Final grades will be norm-referenced (“curved”)

Labs

- Virtual laboratory: Open Network Laboratory (ONL)
- Lab setup
 - Interface on your computer
 - Hardware located at Washington University in St. Louis
- Interaction
 - Local GUI setup of experiment
 - “Commit” setup to actual hardware (requires reservation)
 - Remote login access to all machines
 - Monitoring of bandwidth, queue length, etc. on GUI
 - No worries about crashing machines
- Simplifies setup, configuration, management
 - More focus on networking than on artifacts



Assignments

- Read
 - Kurose & Ross: Chapters 1 & 2
- Log on to SPARK