

CSE 486/586 Distributed Systems The Internet in 2 Hours: The First Hour

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Recap

- Please make an effort to come to every class.
- Please do the work yourself and get permissions for other sources. Also, acknowledge them.
- Please check if you have the background by doing PA1 all by yourself.
- This course is about:
 - Introducing common problems that arise when building a distributed system
 - Discussing algorithms, architectures, and abstractions that solve those problems
 - Practicing how to adapt those algorithms and concepts

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Today and Next

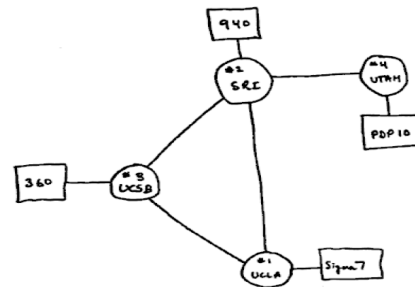
- A brief overview of the Internet
- Two things
 - The design philosophy of the Internet (“The Design Philosophy of the DARPA Internet Protocols” by David Clark): today
 - Transport & application layers: next lecture
- Obviously can’t replace a networking course; this should be just a recap for you.
- Why teach these?
 - Because I want to :-)
 - If there’s no network, there’s no distributed system.
 - Not just that: the design of the Internet is a great example of designing a solid distributed system.

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What Is the Internet?

- 1969

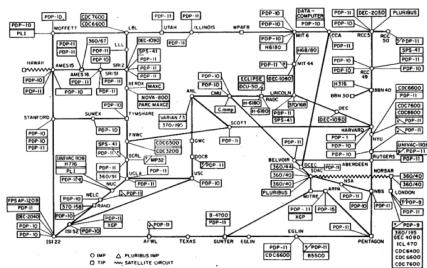


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What Is the Internet?

- 1977

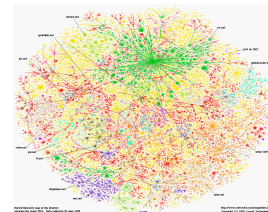


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What Is the Internet?

- Now



- A network of networks
- The fundamental goal of the original designers: interconnecting different networks by designing common protocols

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Why and What

- Why
 - “The whole can be greater than the sum of its parts”
- What
 - Internet communication **must continue** despite loss of networks or gateways.
 - The Internet must support **multiple types of communications service**.
 - The Internet architecture must accommodate **a variety of networks**.
 - The Internet architecture must permit distributed management of its resources.
 - The Internet architecture must be cost effective.
 - The Internet architecture must permit host attachment with a low level of effort.
 - The resources used in the Internet architecture must be accountable.

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How to Interconnect?

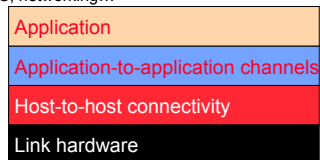
- There were **many types of networks** based on **various physical media**.
 - Coax, radio, satellite, etc.
- The original designers wanted to interconnect those somehow.
- A potential solution
 - Designing a “multi-media” network (e.g., via physical signal translator for various physical media)
- Solution chosen?
 - Hint: “All problems in computer science can be solved by another level of indirection.” --- David Wheeler
 - **Connecting by layering** with packet switching
 - (We will not cover packet switching vs. circuit switching)

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Layering: A Modular Approach

- Sub-divide the problem
 - Each layer relies on services from layer below
 - Each layer exports services to layer above
- Interface between layers defines interaction
 - Hides implementation details
 - Layers can change without disturbing other layers
- “The” computer science approach
 - ISA, OS, networking...



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Challenges in Layering

- **What to put** on top of physical networks?
- Assumption (for the sake of the discussion):
 - Packet switching (a conversation is divided into smaller units called packets).
- Basic things for enabling a conversation between remote hosts:
 - **Addressing** (where do I send a msg?)
 - **Routing** (how do I reach that address?)
- Most importantly, **survivability**
 - Protection of a conversation *as long as* there's a **physical path** between entities communicating and they are **alive**.
- What are some of the threats that disrupt a conversation?
 - Packet loss, out-of-order delivery, duplicate packets, etc.

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We Must Ask Ourselves...

- In a conversation, there are two components involved
 - Hosts
 - Network
- So, one more question: **where do we want to put the functionalities? More specifically, what would be a good network/host division of labor?**
- Addressing and routing?
 - Yeah, probably in the network
- What about conversation protection mechanisms?
 - The network or hosts?

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Summary

- The Internet
 - A network of networks
 - A case study as a distributed system
- Protocol
 - An agreement between multiple parties
 - Syntax & semantics
- Design a system
 - Why, what, and how
- The Internet
 - Connecting by layering

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Acknowledgements

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