CPS 514
Day 3: DarpaNet
Agenda

- DarpaNet
- HW #1
- Survey
DarpaNet: Design Goals

- Allow people to access resources on ARPANET
- Best Effort service
- Build on what we know and what we know works well
Requirements: Military Context
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- Survivability (Robustness)
- Different services
- Different network technologies
- Management of different networks
- Cost effective; easy to add hosts; accountability
Survivability: Fate-Sharing

• Failure in the network ≠ failure of application

• Fate-sharing: app breaks iff:
  • App dies (either end)
  • Network partitions i.e. breaks in two
  • Implication: No state in network
  • Network state does exist: soft-state
Fate-Sharing V. End-to-End

• Fate-sharing: reliability
  • Keep at the end so failure in network doesn’t affect communication
  • Focuses on State

• End-to-End: innovation
  • keep at the edge because network doesn’t know what the edge knows
  • Functions in the network will be used by all Apps: new Apps may conflict with old function —> may have to change H/W overtime a new app comes out.
  • Focuses on functionality
What are Different types of Services that the network should provide?
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• in-order delivery
• reliability
• Deliver to multiple parties: multicast
• Performance guarantees: Quality of Service
• Security/privacy
Type of Service in DarpaNet

- Implement at the edge or Network?
  - Network: must reimplement on all hardware
    - Hardware is expensive and time consuming
    - But potentially faster and provide more efficient versions, e.g. multicast
  - Edge: in software!
    - Software is cheap and reusable: easily upgradable
    - You can DO ANYTHING in software.
    - potential performance and overhead constraints.
Transport Level ToS

- Done in transport level!!! Using TCP
- Provides: reliability, in order deliver, and acknowledgements
- Hard to provide QoS and efficient multicast
Support Different Networks

• Minimum requirement for a network:
  • Have addresses: so we can specify destination
  • Carry packets of a minimum certain size: 100B
Options for Supporting Different Networks

- Datagram (packet switch) Versus virtual circuit
- Cut-through Versus Store and Forward
- Best-effort Versus support for services
Other Requirements

• Efficiency: lots of inefficiencies in N/W
  • Retransmit during packet loss
  • Redundant data on the internet
  • Application level multicast

• Ease of adding hosts to the network
  • Must have specialized Network Stacks. Many hosts now have IPv4 and IPv6 stacks

• Accountability
  • Did not get around to this :(
What other Requirements would be added for a commercial context
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- Thinks of cellular networks, IPTV, video streaming, voice streaming
What other Requirements would be added for a commercial context

- Accountability: Mobile network…
- Security: SPAM, DoS attack preventions
- cost of management
- Measurement: to find faults, to find policy violation
- Mechanisms to enforce policies.
The Internet is More Complex!

• DARPANET: Allow people to access resources on ARPANET

• The Internet:
  • Allow music lovers to share with each other
    • But copyright holders want to prevent this

• ISPs must cooperate to deliver packets
  • But they are competitors

• People want to share secrets with each other
  • But the government want to learn about them.
Lots of Optimizations for Specific Application use-case

- To improve web-browsing: add caches and proxies
  - People use HTTPS: cache/proxy no longer useful.

- To monitor people: add data duplication switches
  - requires specialized and H/W with capacity constraints: makes networks very expensive.

- Violations of End to End and Fate-Sharing
HW #1

• Write a click element and configuration to
  • Scan a file and search for DNS requests
  • When DNS requests are found then:
    • Check to see if the request for a hostname in a blacklist. if true, then drop the packet and write to a log file.

• Groups of 2: please form groups now and email the TA by midnight tonight.

• Please No Cheating: Do not copy code from the internet or elsewhere.
Survey Time