CSE561 – Naming and DNS

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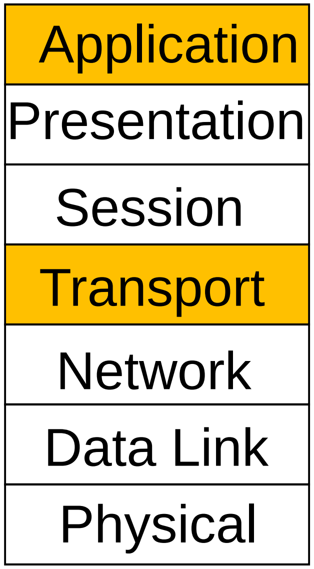
SST Discussion

- What are the contributions of the paper?
- How does SST separate reliability & congestion control?
  - What is numbered, acknowledged; compare to TCP
- What does a developer do to implement HTTP/1.1?
- Could we use SST for DNS?
- What’s the best way to evaluate SST?

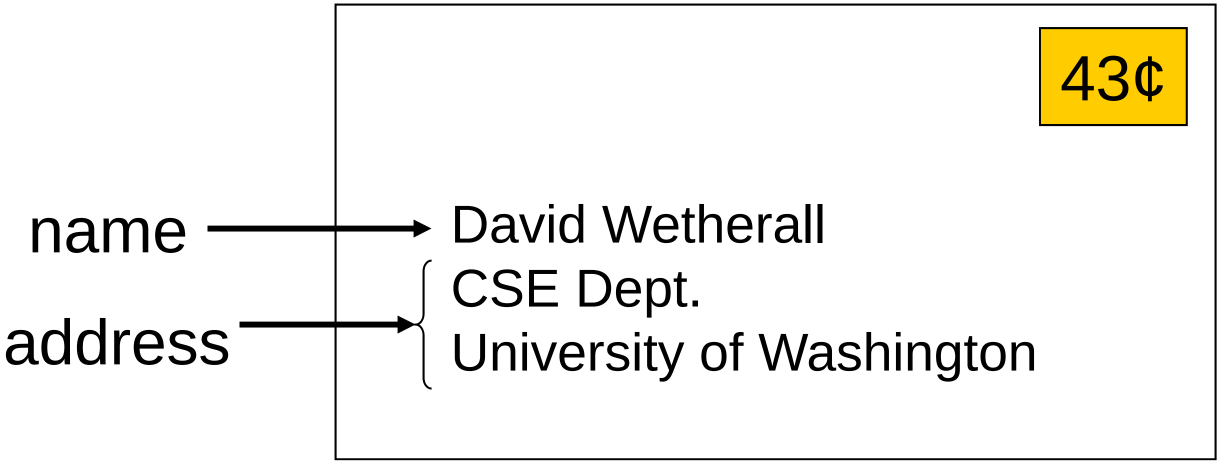
Naming and DNS

- Focus:
  - How do we resolve names to addresses

- Names and addresses
- DNS as a system design3


Application
Presentation
Session
Transport
Network
Data Link
Physical

Names and Addresses



- Names are identifiers for objects/services (high level)
- Addresses are locators for objects/services (low level)
- Resolution is the process of mapping name to address
- But, addresses are really lower-level names; many levels used

Naming in Systems

- Ubiquitous
  - Files in filesystem, processes in OS, pages on the web, …
- Decouple identifier for object/service from location
  - Hostnames provide a level of indirection for IP addresses
- Key issue is the resolution system
  - Likely to constrain names or addresses to function
  - DNS names are hierarchical, IP addresses constrained by location

Example: Original Hostname System

- When the Internet was really young …
- Flat namespace
  - Simple (host, address) pairs
- Centralized management
  - Updates via a single master file called HOSTS.TXT
  - Manually coordinated by the Network Information Center (NIC)
- Resolution process
  - Look up hostname in the HOSTS.TXT file

Scaling Problems

- Coordination
  - Between all users to avoid conflicts
- Inconsistencies
  - Between update and distribution of new version
- Reliability
  - Single point of failure
- Performance
  - Competition for centralized resources

Today: Domain Name System (DNS)

- Designed by Mockapetris and Dunlap in the mid 80s

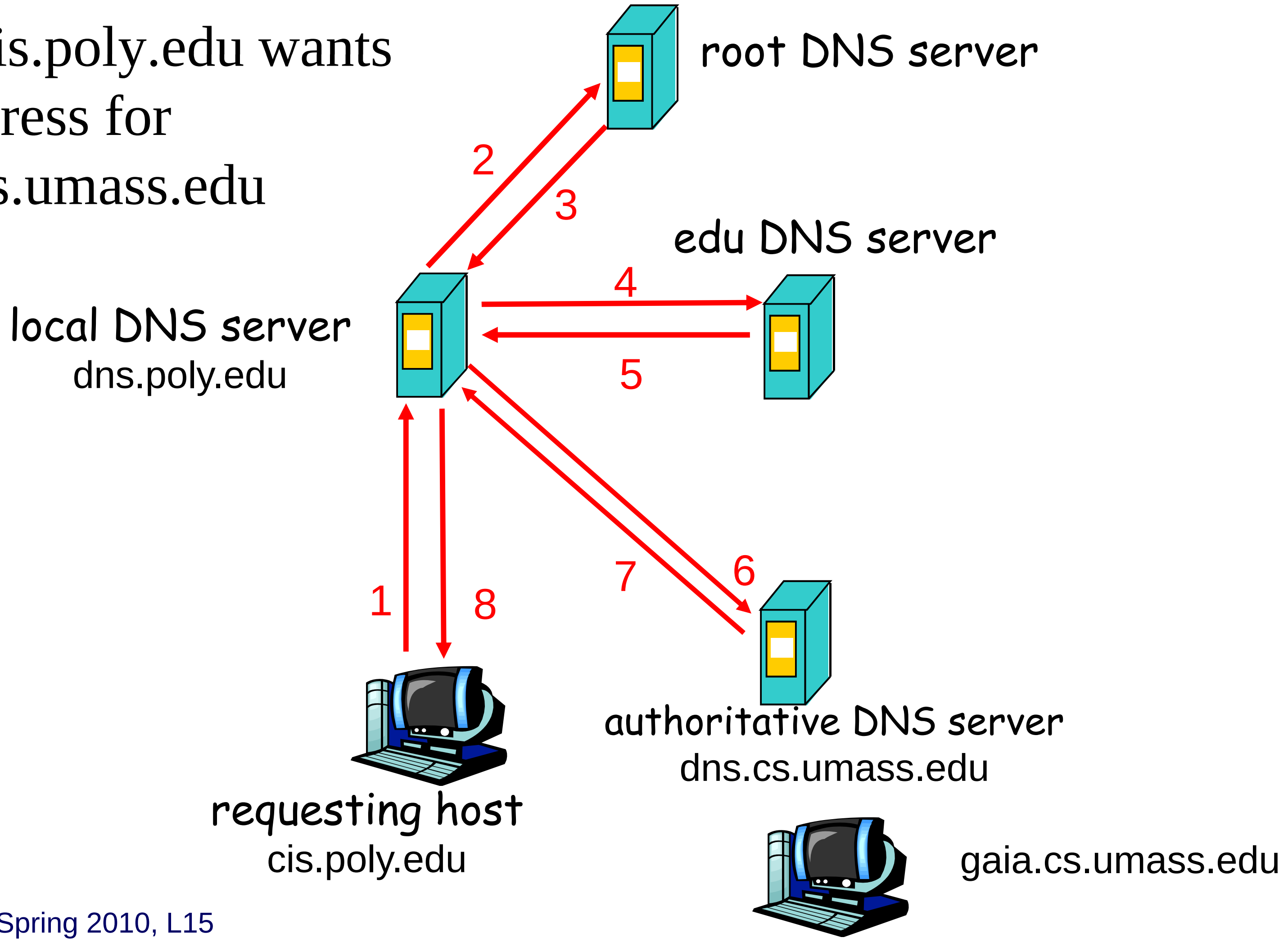
- Namespace is hierarchical
  - Allows much better scaling of data structures
  - e.g., galah.cs.washington.edu

- Namespace is distributed
  - Decentralized administration and access
  - e.g., galah managed by CSE

- Resolution is by query/response
  - With replicated servers for redundancy
  - With heavy use of caching for performance

DNS Lookups / Resolution

Host at cis.poly.edu wants
IP address for
gaia.cs.umass.edu



root DNS server

edu DNS server

local DNS server
dns.poly.edu

requesting host
cis.poly.edu

authoritative DNS server
dns.cs.umass.edu

gaia.cs.umass.edu

Design requirements

- Work well at large scale
- Provide highly available service
- Rapid name resolution
- Serve many organizations

Design Issues

- Scaling up
  - Use hierarchy and replication to spread work over servers
  - Use caching (TTL on replies) to cut down on work
- Reliability
  - Replicated servers
- Performance
  - Caching resolutions
  - Request/reply over UDP, not TCP
  - Replicated servers
- Administration
  - Use hierarchy to carve up namespace; but TLDs are contentious
  - Use local nameservers to relieve client of responsibility

DNS futures

- DNS works great to map hostname to IP!

- What has changed:
  - A static mapping is no longer what many applications want
  - e.g., return "an IP with the content I want"
  - e.g., return "the nearest IP with the content I want"

- This is tied up with CDNs …