


Overview


- General network terminology

- Chapter 9.1: DNS

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Connection mechanisms

- Connectionless or packet switching
 - Each packet carries with it the source and destination address
 - No time is wasted in setting up a communication link, and in order delivery need not be guaranteed
 - However each packet carries the addresses (waste)
 - E.g. postal letters
- Connection oriented or circuit switched
 - Spend effort to initialize a link, but once it is setup all future packets follow the same route
 - Does not adapt to changing conditions gracefully
 - E.g. telephone connections

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Delivery mechanism

- Lossless vs lossy network
 - The question is “who should deal with a lost packet - the network or the application”. This is the end-to-end argument. We will read a paper on this argument next Thursday
 - There is a performance penalty for ensuring that all packets are received in an at-most once, in order semantics. Easier to let the applications deal with loss
 - E.g. Certified mail vs first class mail

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Group communications

- Unicast - one sender and one receiver
- Broadcast - one sender and multiple (all) receivers
 - Bother all clients whether they are interested or not
 - Wasteful unless the communication medium supports it
 - It costs the same to send a SMS page to all users in the same coverage area because all pagers receive the wireless signal (think of broadcast TV)
 - Its expensive to broadcast a FAX message; you have to send a separate FAX to each machine (the underlying medium does not support broadcasting)
 - Reliable broadcasting is harder



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Group communications (cont.)

- Multicast - one sender and multiple (not necessarily all) receivers
 - Clients join in on a conversation. Data is broadcasted to all the clients that have joined in the conversation
 - Not wasteful as clients actively participate
 - Useful for Intranets. Apple Rendezvous technology, (iTunes, iChat etc. use multicast)
 - More complex to implement on the Internet scale
 - Not clear what the pricing model should be: If I multicast my videocast to a million users through a DSL link, should the ISP charge me for a million times DSL charge?



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Group communications (cont.)

- Anycast - one sender, one of many receivers
 - When you a redundant set of servers, any of which can service your requests
 - E.g. google.com. Google maintains thousands of servers; any of which can service your web requests [note Google does not actually use anycast]
- Geocast - some receiver in the geographical area
 - Send to someone in SBN
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- Collectcast talk today at 3:30 PM



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Applications - Naming

- What do names do?
 - Help identify objects
 - help locate objects
 - define membership in a group
 - specify a role
 - convey knowledge of a secret
- Name space
 - defines set of possible names
 - consists of a set of name to value bindings



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Examples

- Hosts
 - Wizard.cse.nd.edu or 129.74.25.101 (IP address) or 00:03:ba:16:c5:7a (ethernet address)
- Peers for your HWP1
 - Name → host:port
- Files
 - /usr/lip/tmp/foo → (server, fileid)
- Users
 - Larry Peterson lip@cs.princeton.edu



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Domain Name Service (DNS)

- Provides Internet domain name to IP address translation
 - Domain name translation (nd.edu)
 - Hostname translation (wizard.cse.nd.edu)
 - Service location (MX records, mail service for ND)
- ```
$ nslookup -query=mx aol.com
aol.com preference = 15, mail exchanger = mailin-01.mx.aol.com
aol.com preference = 15, mail exchanger = mailin-02.mx.aol.com
aol.com preference = 15, mail exchanger = mailin-03.mx.aol.com
aol.com preference = 15, mail exchanger = mailin-04.mx.aol.com
```

Authoritative answers can be found from:  
aol.com nameserver = dns-07.ns.aol.com  
aol.com nameserver = dns-01.ns.aol.com  
aol.com nameserver = dns-02.ns.aol.com  
aol.com nameserver = dns-06.ns.aol.com  
mailin-01.mx.aol.com internet address = 64.12.136.57  
mailin-01.mx.aol.com internet address = 64.12.137.89  
mailin-01.mx.aol.com internet address = 64.12.137.184  
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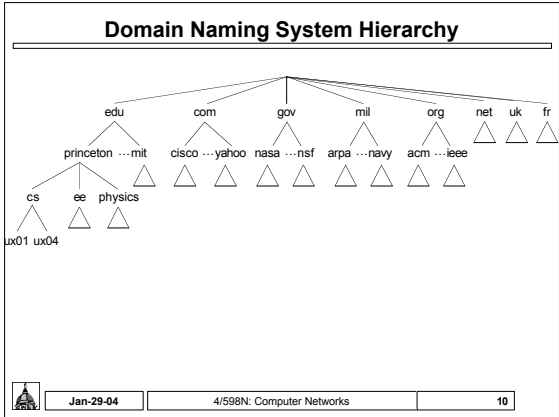
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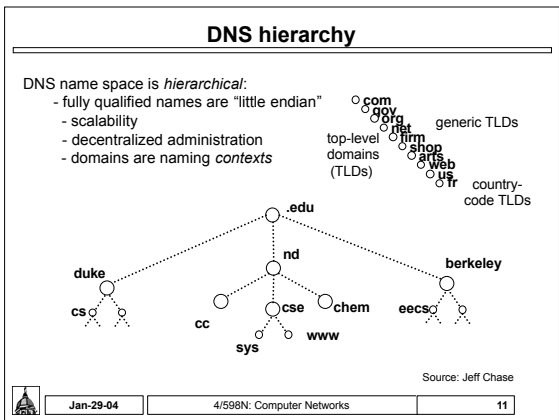
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- ### Resource Records
- Each name server maintains a collection of resource records
    - (Name, Value, Type, Class, TTL)
  - Name/Value: not necessarily host names to IP addresses
  - Type
    - NS: Value gives domain name for host running name server that knows how to resolve names within specified domain.
    - CNAME: Value gives canonical name for particle host; used to define aliases.
    - MX: Value gives domain name for host running mail server that accepts messages for specified domain.
  - Class: allow other entities to define types
  - TTL: how long the resource record is valid
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### DNS Protocol

- UDP-based client/server
  - client-side *resolvers*
    - typically in a library
    - *gethostbyname*, *gethostbyaddr*
  - cooperating servers
    - query-answer-referral model
    - forward queries among servers
    - server-to-server may use TCP (“zone transfers”)

Source: Jeff Chase

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### DNS Name Server Hierarchy

DNS servers are organized into a hierarchy that mirrors the name space.

Specific servers are designated as *authoritative* for portions of the name space.

Servers may delegate management of *subdomains* to child name servers.

Parents refer subdomain queries to their children.

Root servers list servers for every TLD.

Subdomains correspond to organizational (*administrative*) boundaries, which are not necessarily geographical.

Servers are bootstrapped with pointers to selected peer and parent servers.

Resolvers are bootstrapped with pointers to one or more local servers; they issue *recursive* queries.

Source: Jeff Chase

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### Server selection problem

- Avoid the scalability problems of central servers by "distributing" load

Source: Jeff Chase

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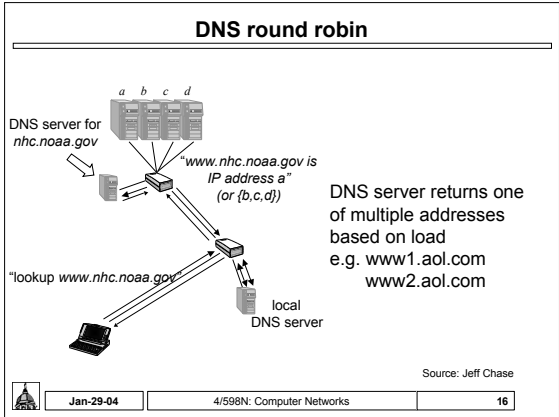
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### DNS record for www.yahoo.com

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www.yahoo.com. 1002 IN CNAME www.yahoo.akadns.net.
www.yahoo.akadns.net. 292 IN A 64.58.76.223
www.yahoo.akadns.net. 292 IN A 64.58.76.224
www.yahoo.akadns.net. 292 IN A 64.58.76.225
www.yahoo.akadns.net. 292 IN A 64.58.76.227
www.yahoo.akadns.net. 292 IN A 64.58.76.228
www.yahoo.akadns.net. 292 IN A 64.58.76.229
www.yahoo.akadns.net. 292 IN A 64.58.76.176
www.yahoo.akadns.net. 292 IN A 64.58.76.177
www.yahoo.akadns.net. 292 IN A 64.58.76.178
www.yahoo.akadns.net. 292 IN A 64.58.76.179
www.yahoo.akadns.net. 292 IN A 64.58.76.222

;; AUTHORITY SECTION:
akadns.net. 984 IN NS ZF.akadns.net.
akadns.net. 984 IN NS ZG.akadns.net.
akadns.net. 984 IN NS ZH.akadns.net.
akadns.net. 984 IN NS ZA.akadns.net.
akadns.net. 984 IN NS ZB.akadns.net.
akadns.net. 984 IN NS ZC.akadns.net.
akadns.net. 984 IN NS ZD.akadns.net.
akadns.net. 984 IN NS ZE.akadns.net.

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- ### Multicast DNS (Apple Rendezvous)
- Situations where there are no DNS servers (local intranet - for example home users who want to name the machines without dealing with the complexities of maintaining DNS servers) or where you may not know where the DNS servers are
  - Create names in the .local domain. For example, my laptop can be called surendar.local.
  - Zeroconf initiative
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