

Announcements



Jan 17, 2001

CSCI {4,6}900: Ubiquitous Computing

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Distributed System Architectures

Central Server based

Web servers

Hierarchical Services

Domain Name System – DNS

Peer-to-Peer Systems

Napster, gnutella

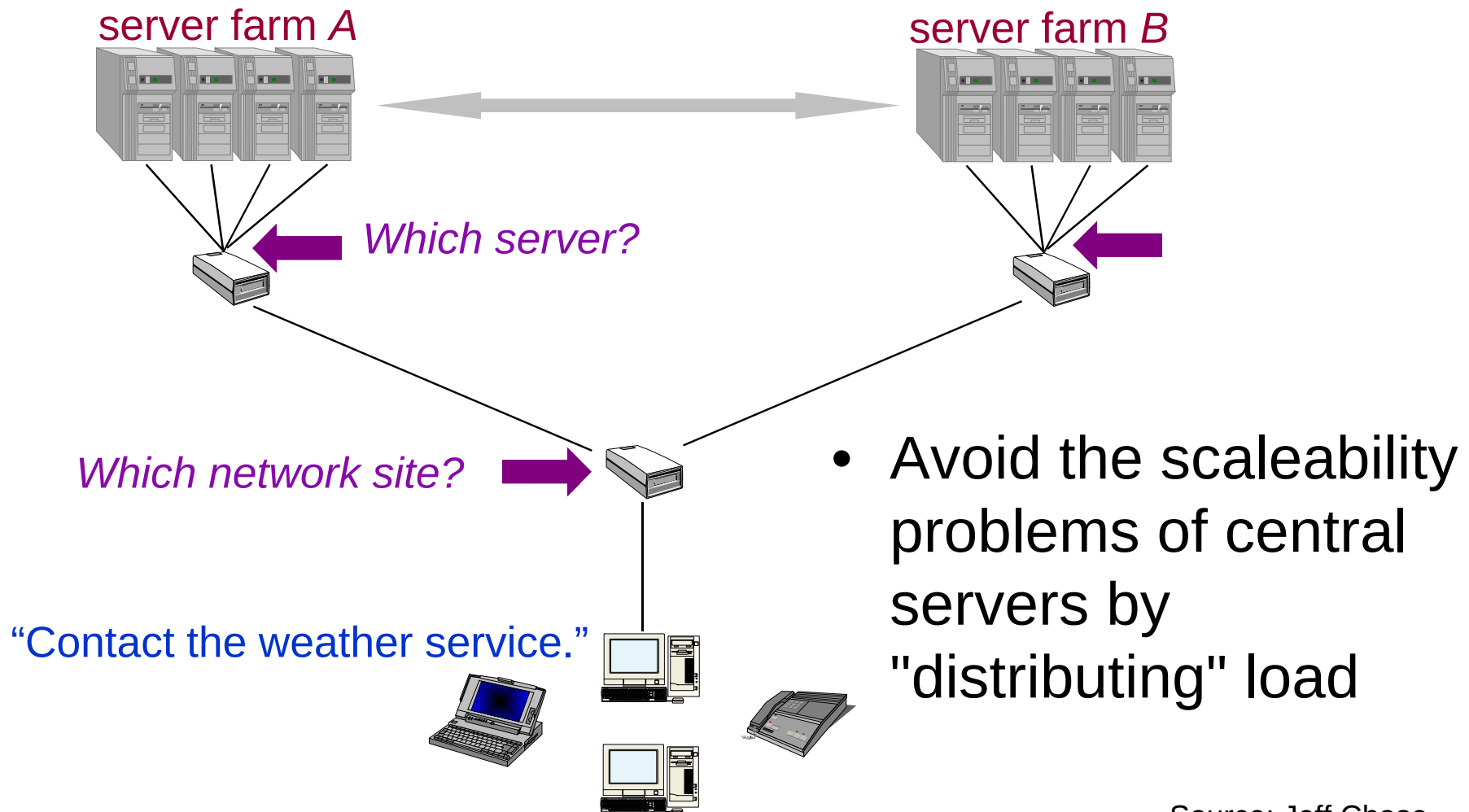


Central Server based

- A central server provides service
 - Reliability and fault tolerance
 - If server shuts down, then no service
 - Scalability
 - Performance bottle neck
 - E.g. if everyone accesses Microsoft.com from the east coast (new release of web browser), accesses to Yahoo.com in California might be slow because we share the same link from east coast till Utah (say)
 - Easy to deploy, administer



Server selection problem



Source: Jeff Chase

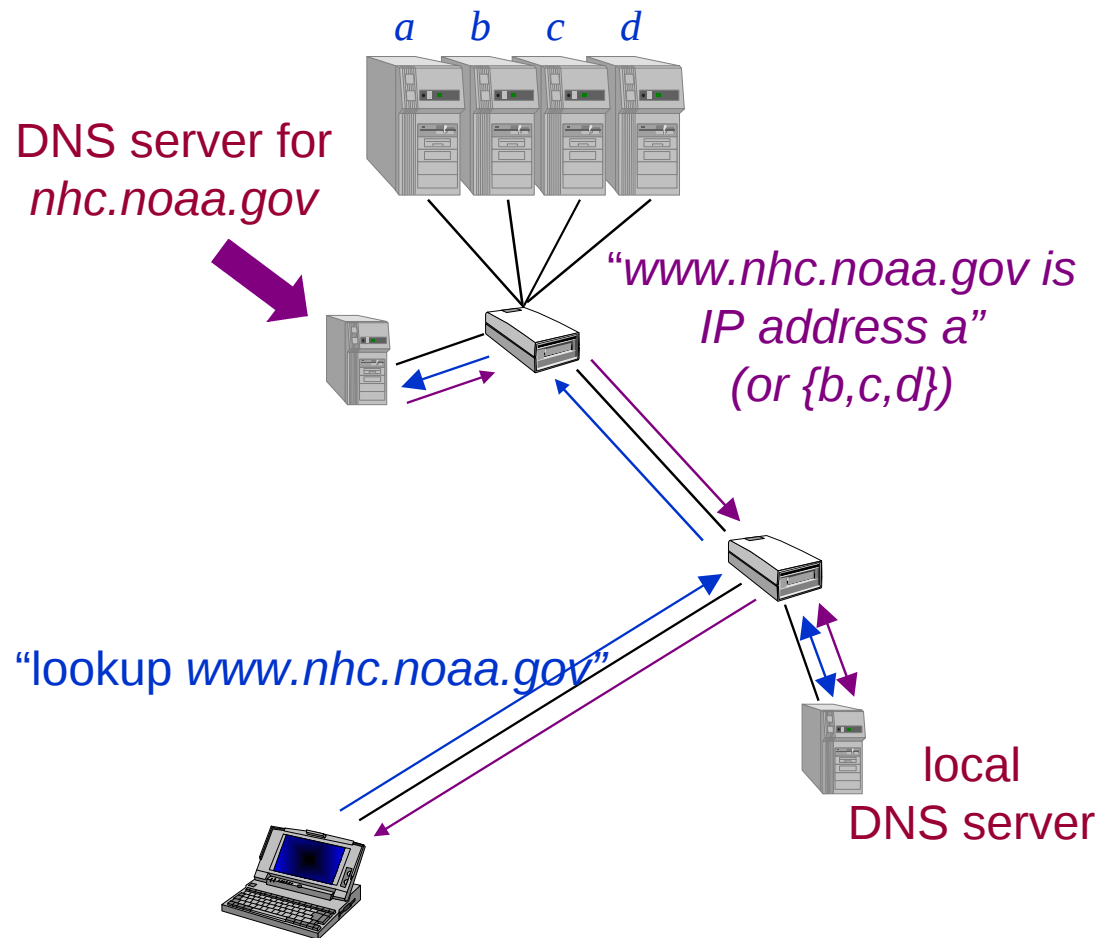


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DNS round robin



DNS server returns one of multiple addresses based on load
e.g. *www1.aol.com*
www2.aol.com

Source: Jeff Chase



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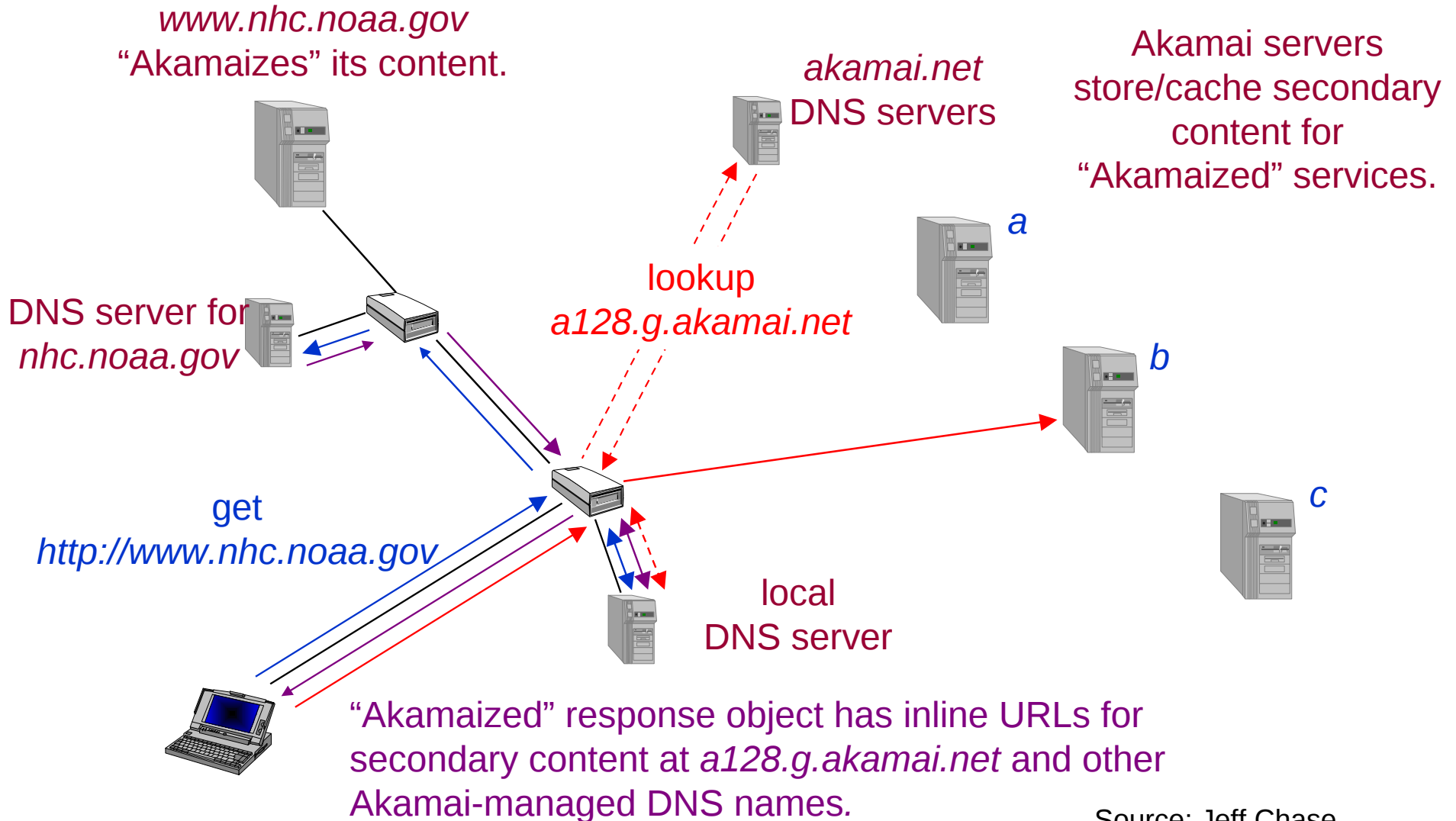
Content Delivery Network

- CDN (e.g., Akamai) creates new domain names for each client content provider.
 - e.g., *a128.g.akamai.net*
- The CDN's DNS servers are authoritative for the new domains.
- The client content provider modifies its content so that embedded URLs reference the new domains.
 - “Akamaize” content
 - e.g.: <http://www.cnn.com/image-of-the-day.gif> becomes <http://a128.g.akamai.net/image-of-the-day.gif>
- Using multiple domain names for each client allows the CDN to further subdivide the content into groups.
 - DNS sees only the requested domain name, but it can route requests for different domains independently.

Source: Jeff Chase



Akamai with DNS hooks



Source: Jeff Chase



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Hierarchical Services

- Domain Name Service (DNS)
 - Provides Internet domain name to IP address translation
 - Domain name translation (uga.edu)
 - Hostname translation (greenhouse.cs.uga.edu)
 - Service location (MX records, mail service for UGA)

```
$ nslookup -query=mx home.net
```

```
home.net      preference = 100, mail exchanger = mx-b-east.mail.home.com
```

```
home.net      preference = 100, mail exchanger = mx-c-east.mail.home.com
```

```
home.net      preference = 100, mail exchanger = mx-a-rwc.mail.home.com
```

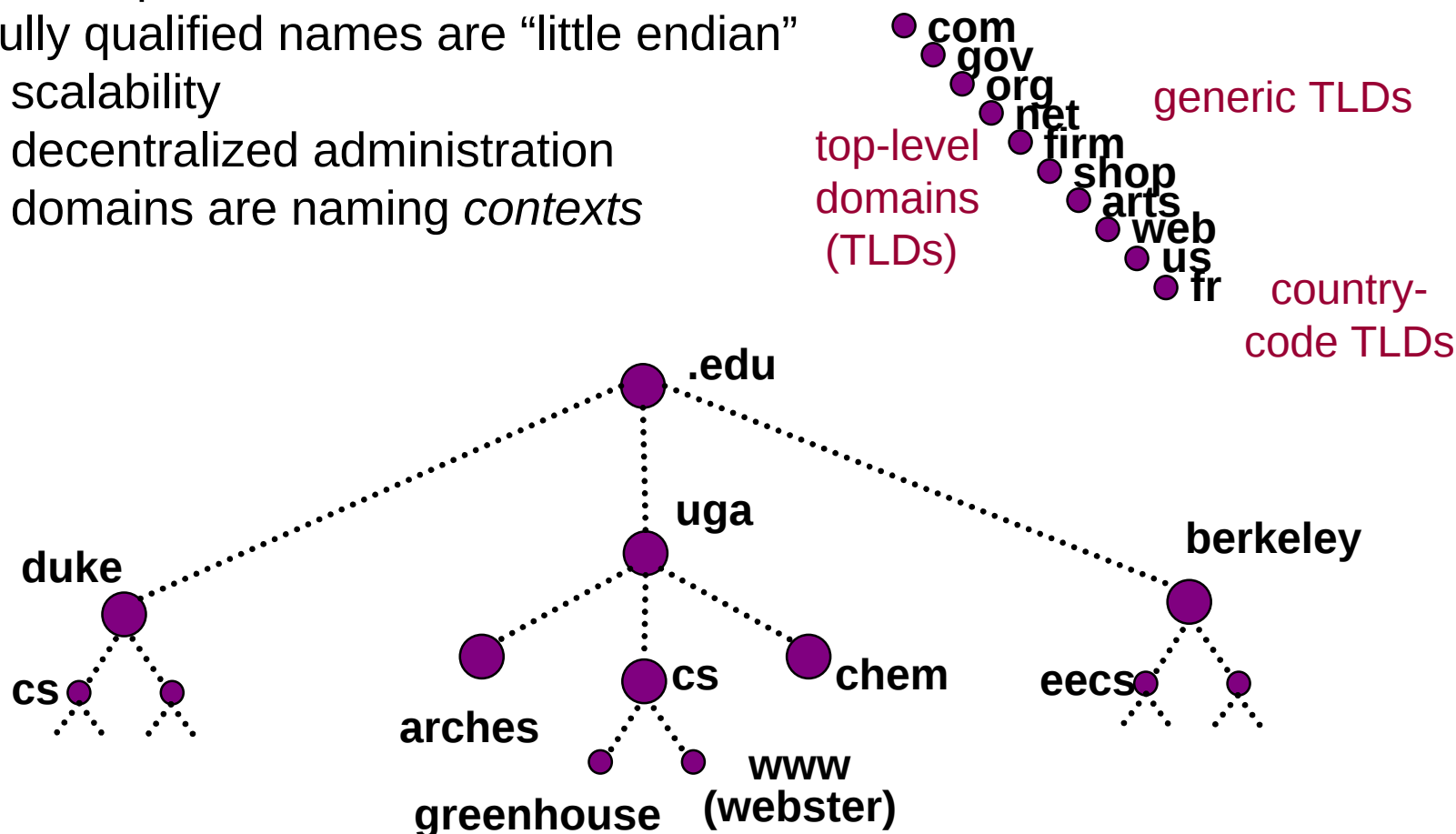
- Hierarchical
 - Decentralized administration of name space
 - Hierarchy of authority and trust



DNS hierarchy

DNS name space is *hierarchical*:

- fully qualified names are “little endian”
- scalability
- decentralized administration
- domains are naming *contexts*



Source: Jeff Chase

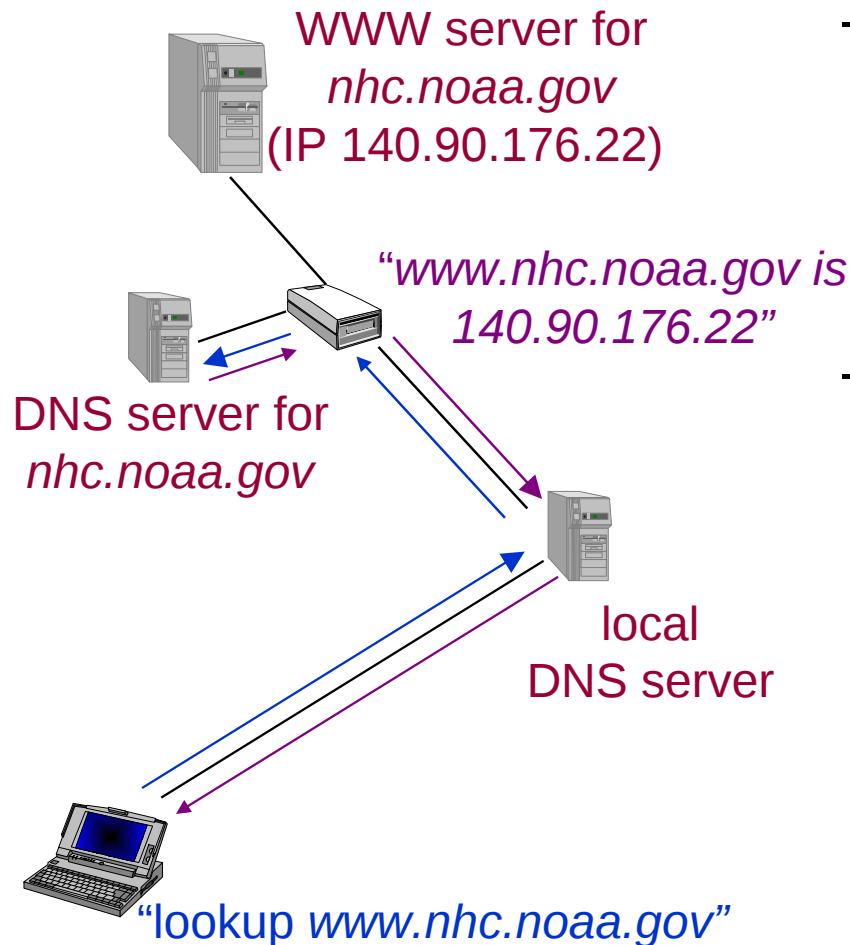


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DNS Protocol



- 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



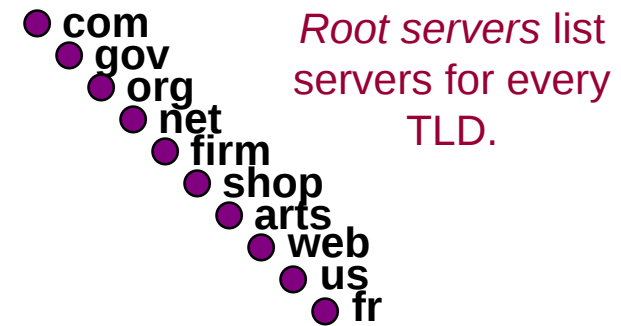
DNS Name Server Hierarchy

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.

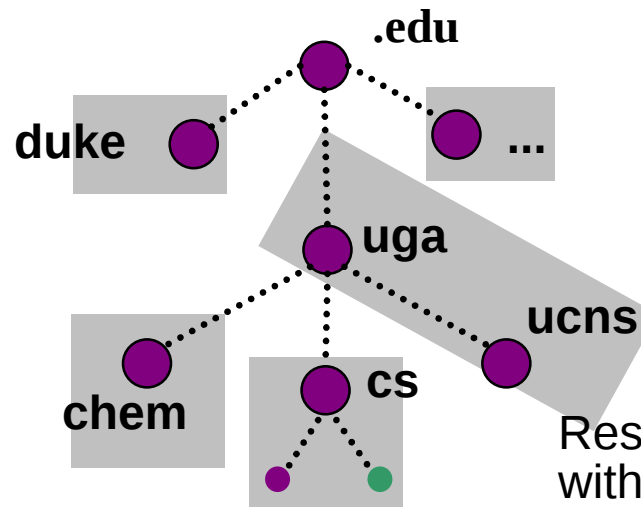


Subdomains correspond to organizational (administrative) boundaries, which are not necessarily geographical.

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



Peer-to-peer systems

- Decentralized, no "server"
- Robust – no single point of failure
- "Will perform work for others since they will work for us" computing
- Can scale up
- Locating resources harder
- E.g. napster (has a central directory server)
gnutella



Gnutella

- Queries issued by a servant at a given node propagate out to neighbor nodes
- The neighbors propagate the query to their neighbors, and so on, for a given number of hops.
- Depending on where a user's query is first issued, it may or may not reach a node that has the file sought by the user.

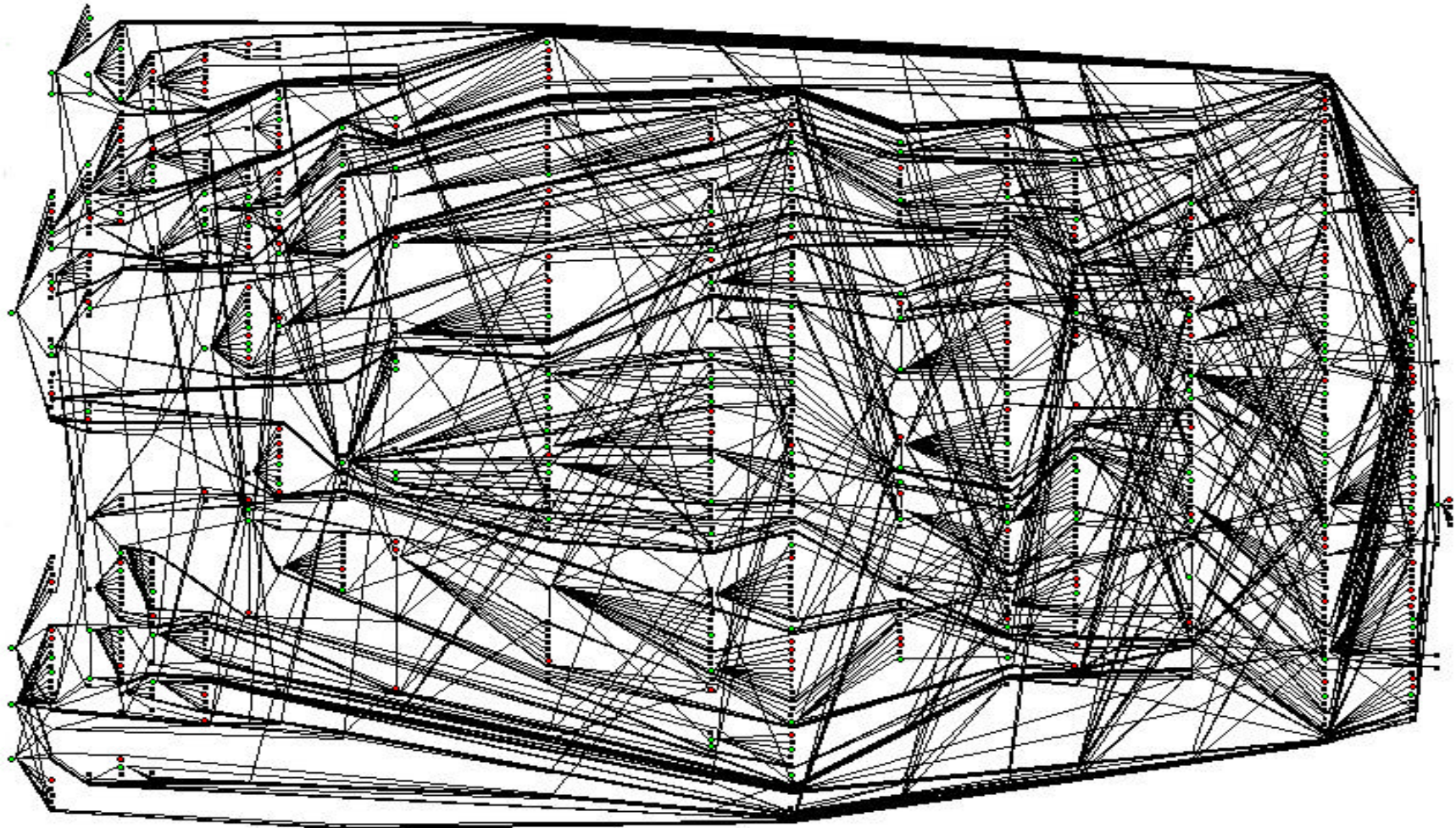


Partial Map of Gnutella Network - 7/27/00

Clip2 Distributed Search Services

<http://dss.clip2.com>

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Scalability

- The scalability of a Gnutella network to accommodate more users performing more searches is limited by the lowest bandwidth links prevalent within the network
- For dial-up users it is 10 requests per second and has been reached

