The University Of Alabama in Huntsville Computer Science

cs570

Application layer

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Topics we'll discuss

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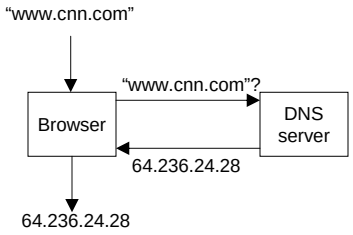
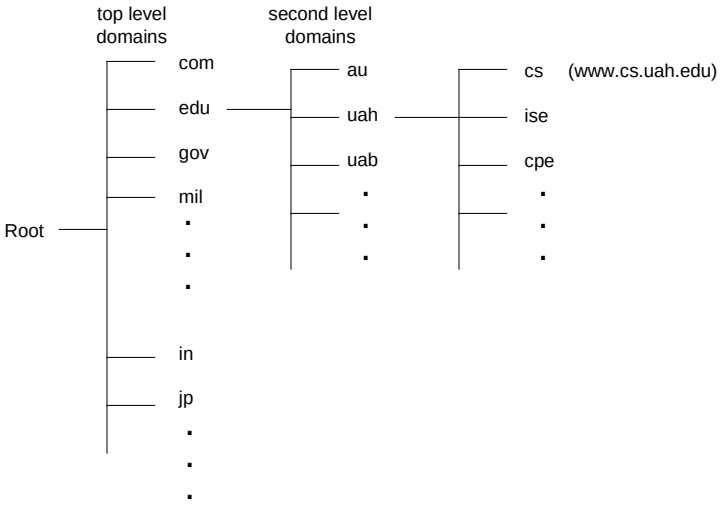
- Domain Name Service
- Email
- World Wide Web
- Real-time Transport Protocol

Domain Name Service (DNS)

- Purpose: Translates URI's into IP addresses



The Internet Domain Name Space



Name Servers

- Name servers are the computers that actually do the translation. They contain a *resource record* for each domain they handle
- Resource record contents:
  - Domain name ("www.cs.uah.edu")
  - Time to live (# seconds that this can be considered valid in cache)
  - Class ("IN" for Internet)
  - Type (Identifies one of several types of resource record, IP address, alias, address of another name server, …)
  - Value
- There is considerable redundancy built into the Name Server network

DNS zones

- The DNS name space is divided into Zones
- Each zone has:
  - a Primary Name Server that holds all of the resource records for that zone (there may be multiple Primaries for redundancy). These are the "authoritative resource records".
  - Secondary Name Servers that get copies of resource records from the Primary

DNS query processing

- An originator (say, a browser) gets a URI, “www.cs.uah.edu”
- Originator sends a query (UDP seg) to the local Name Server
- If the Local Name Server knows this URI, it returns the IP address.
- If the Local Name Server does not know, it forwards the request to the Name Server for the edu top-level domain
- The edu Name Server will forward the query to the Name Server for uah.edu.
- Responses are forwarded back to the originator.

DNS caching

- In order to speed up name translation, responses are cached throughout the network
- When a Name Server gets a query, it checks its cache before forwarding the query. When the response is returned, the Name Server adds it to its cache.
- Note that cache contents time out (based on the time-to-live field of the resource record) so that caches are kept reasonably fresh.

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Email

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Email systems

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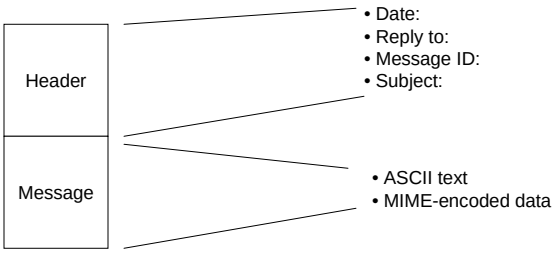
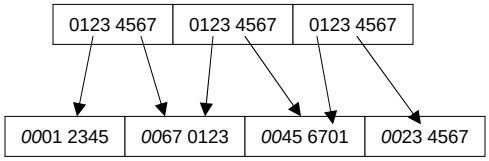
- Components:
  - "email program"
    - Allows reading and writing
    - Supports mailing lists
    - Manages mailboxes
    - Etc
  - Message transfer agent
    - Moves mail from sender to receiver

Email message format



MIME

- MIME = “Multipurpose Internet Mail Extensions”
- The idea:
  - Some mail programs are built to handle only ASCII text
  - Need a way to send graphics, documents, multimedia,…
  - MIME translates data in any format into bytes with values in the normal ASCII character range



SMTP

- SMTP = “Simple Mail Transfer Protocol”
- Transfers mail from source to destination
- When mail is available:
  - Sending SMTP establishes TCP connection to port 25 at destination where receiving SMTP is listening (DNS used to determine IP address)
  - Destination SMTP accepts or refuses message based on host and user address

Mailbox managers

- POP3 (“Post Office Protocol v.3”)
  - Manages mailboxes on a server (e.g, at an ISP)
  - Makes sure mail is delivered to the right box
  - Downloads all mail from the server wherever the user logs in
  - The most common mailbox manager
- IMAP (“Internet Message Access Protocol”)
  - Does what POP3 does, plus other features
  - Mail can be kept on the server or downloaded at the user’s discretion

World-Wide Web

- Components:
  - Language for laying out web pages (HTML, XML)
  - Browser
  - Transfer protocol (Hypertext Transfer Protocol -- HTTP)

HTTP

- HTTP = HyperText Transfer Protocol
- Sets rules for requesting, transferring web pages

HTTP Interactions

- General process:
  - Client sets up TCP connect to port 80 on server
  - Client sends GET instruction for requested web page
  - Server sends response code + web page
    - Example response codes:
      - 100 – ACK
      - 204 – no content
      - 301 – page moved
      - 404 – page not found

- Two versions of HTTP:
  - v 1.0 – closes connection after each response
  - v 1.1 – keeps connection open for succeeding transfers