Naming

March 8, 2001

What is naming?

- Associations between some elements in a set of names and some elements in a set of values
  - Binding - One such association
- Name resolution - Determining the value associated with a name
- Context - A set of name to value associations
  - The same name can be bound to different objects in different contexts
- Alias - a name that references a value that already has a name

Name Services

- A service that resolves names in a given context
- May or may not be fully automated
  - Examples:
    - DNS on the Internet
    - Grapevine
    - Ethernet cards
- Objectives: speed, availability, scalability

Ethernet Card Naming

- Each Ethernet Card has a 48-bit name
  - e.g., C0 39 FB 23 5E 9A
- Name used by link-layer to differentiate between other Ethernet cards
- Manufacturers get blocks of addresses from a naming authority
- Issue - What happens if we run out of names? (How likely is this?)

DNS

- Domain name - a name associated with an IP address
  - generically: <name2>.<name1>
  - <name1> is a top-level domain
  - <name3>.<name2>.<name1> is a subdomain of <name2>.<name1>
- Use hierarchy to reduce complexity and improve scalability of name resolution
- Use caching to improve lookup speed and availability
- Typically implemented on top of UDP

DNS, cont.

- Name resolution done hierarchically, split into zones
- A zone contains:
  - Specific info for some hosts in a domain (types)
    - e.g., A, MX, NS, CNAME
  - Names of servers providing DNS for sub-domains
  - Zone governing properties (caching, replication)

Name resolution in DNS

- Query - ask for a type of info on a domain name
  - e.g., photo.net MX (mail exchanger)
- Start with top-level, well known root DNS server
  - These root servers service mit.edu, arsdigita.com, ...
- Get the name of the DNS server with info about your sub-domain
- Resolve the name of the DNS server
- Iterate - Send your query to the new DNS server

Name resolution in DNS, cont.

- Full name resolution takes at least 2 steps
- Optimization: Use caching
- Three types of DNS servers: authoritative, non-authoritative, caching
  - Two authoritative servers required for each domain name

Name resolution in DNS, cont.

- Authoritative server is primary source of info
- Non-authoritative servers replicate data in authoritative servers
  - e.g., 1-2 times per day
- Caching servers cache DNS info
- Clients must be told whether IP is from authoritative source or not

Name resolution in DNS, cont.

- No mechanism to guarantee consistency between DNS servers at all times
- To address cache consistency, use Time To Live
  - DNS Server can specify a TTL for a resolved domain name
- A caching server invalidates an entry based on its TTL

DNS issues

- DNS changes can take hours or days to propagate
  - Partially depends on TTL
  - Clients must decide how to determine whether an IP address is valid
- DNS can be spoofed
  - Need higher-layer security to ensure you are talking to the right host
- Simple errors can create disasters
  - One small change to a root-level authoritative server can throw the Internet into chaos