CS3200: Computer Networks

Lecture 30

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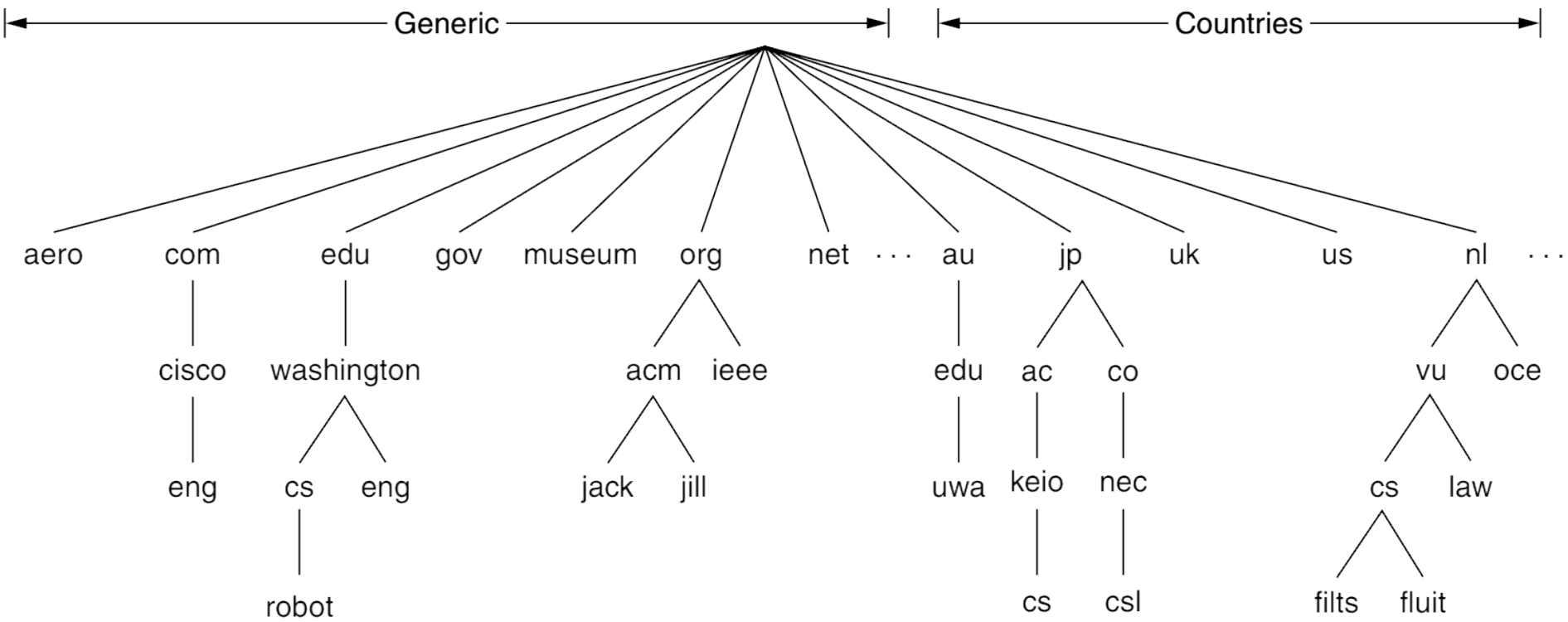
DNS — The Domain Name System

- Managing a large and constantly changing set of names is a nontrivial problem.
- For the Internet, the top of the naming hierarchy is managed by an organization called **ICANN (Internet Corporation for Assigned Names and Numbers)**.
- Conceptually, the Internet is divided into over 250 top-level domains, where each domain covers many hosts. Each domain is partitioned into subdomains, and these are further partitioned, and so on.

DNS – The Domain Name System



DNS – The Domain Name System

- Getting a second-level domain, such as *name-of-company.com*, is easy. The top-level domains are run by registrars appointed by ICANN. If desired name, the requester pays the registrar a small annual fee and gets the name.
- Each domain is named by the path upward from it to the (unnamed) root. The components are separated by periods (pronounced "dot").
- Domain names can be either absolute or relative. An absolute domain name always ends with a period (e.g., eng.cisco.com.), whereas a relative one does not.
- Domain names are case-insensitive, so edu, Edu, and EDU mean the same thing. Component names can be up to 63 characters long, and full path names must not exceed 255 characters.

Domain Resource Records

- Every domain, whether it is a single host or a top-level domain, can have a set of **resource records** associated with it. These records are the DNS database.
- For a single host, the most common resource record is just its IP address.
- The primary function of DNS is to map domain names onto resource records.
- A resource record is a five-tuple.
  (*Domain_name*, *Time_to_live*, *Class*, *Type*, *Value*).

Domain Resource Records

- *Domain_name* tells the domain to which this record applies. Normally, many records exist for each domain and each copy of the database holds information about multiple domains.

- *Time_to_live* field gives an indication of how stable the record is. Information that is highly stable is assigned a large value, such as 86400 (the number of seconds in 1 day). Information that is highly volatile is assigned a small value, such as 60 (1 minute).

- The third field of every resource record is the *Class*. For Internet information, it is always IN. For non-Internet information, other codes can be used, but in practice these are rarely seen

Domain Resource Records

- The *Type* field tells what kind of record this is. There are many kinds of DNS records.

Type	Meaning	Value
SOA	Start of authority	Parameters for this zone
A	IPv4 address of a host	32-Bit integer
AAAA	IPv6 address of a host	128-Bit integer
MX	Mail exchange	Priority, domain willing to accept email
NS	Name server	Name of a server for this domain
CNAME	Canonical name	Domain name
PTR	Pointer	Alias for an IP address
SPF	Sender policy framework	Text encoding of mail sending policy
SRV	Service	Host that provides it
TXT	Text	Descriptive ASCII text

- Finally, we have the Value field. This field can be a number, a domain name, or an ASCII string.

Domain Resource Records

```
; Authoritative data for cs.vu.nl
cs.vu.nl.        86400   IN   SOA     star boss (9527,7200,7200,241920,86400)
cs.vu.nl.        86400   IN   MX      1 zephyr
cs.vu.nl.        86400   IN   MX      2 top
cs.vu.nl.        86400   IN   NS      star

star             86400   IN   A       130.37.56.205
zephyr           86400   IN   A       130.37.20.10
top              86400   IN   A       130.37.20.11
www              86400   IN   CNAME   star.cs.vu.nl
ftp              86400   IN   CNAME   zephyr.cs.vu.nl

flits            86400   IN   A       130.37.16.112
flits            86400   IN   A       192.31.231.165
flits            86400   IN   MX      1 flits
flits            86400   IN   MX      2 zephyr
flits            86400   IN   MX      3 top

rowboat                  IN   A       130.37.56.201
                         IN   MX      1 rowboat
```

Name Servers

- A single name server could contain the entire DNS database and respond to all queries about it.
- This server would be so overloaded as to be useless. Furthermore, if it ever went down, the entire Internet would be crippled.
- To avoid the problems associated with having only a single source of information, the DNS name space is divided into nonoverlapping **zones**.
- Each zone is also associated with one or more name servers. These are hosts that hold the database for the zone.
- The process of looking up a name and finding an address is called **name resolution**.

Name Servers

- When a resolver has a query about a domain name, it passes the query to a local name server.
- If the domain being sought falls under the jurisdiction of the name server, such as *top.cs.vu.nl* falling under *cs.vu.nl*, it returns the authoritative resource records.
- An **authoritative record** is one that comes from the authority that manages the record and is thus always correct.
- In contrast, **cached records** may be out of date.

Address Resolution

What happens when the domain is remote, such as when *flits.cs.vu.nl* wants to find the IP address of *robot.cs.washington.edu*?