CS 4410
Operating Systems

Networking: Application Layer

Summer 2011

Cornell University

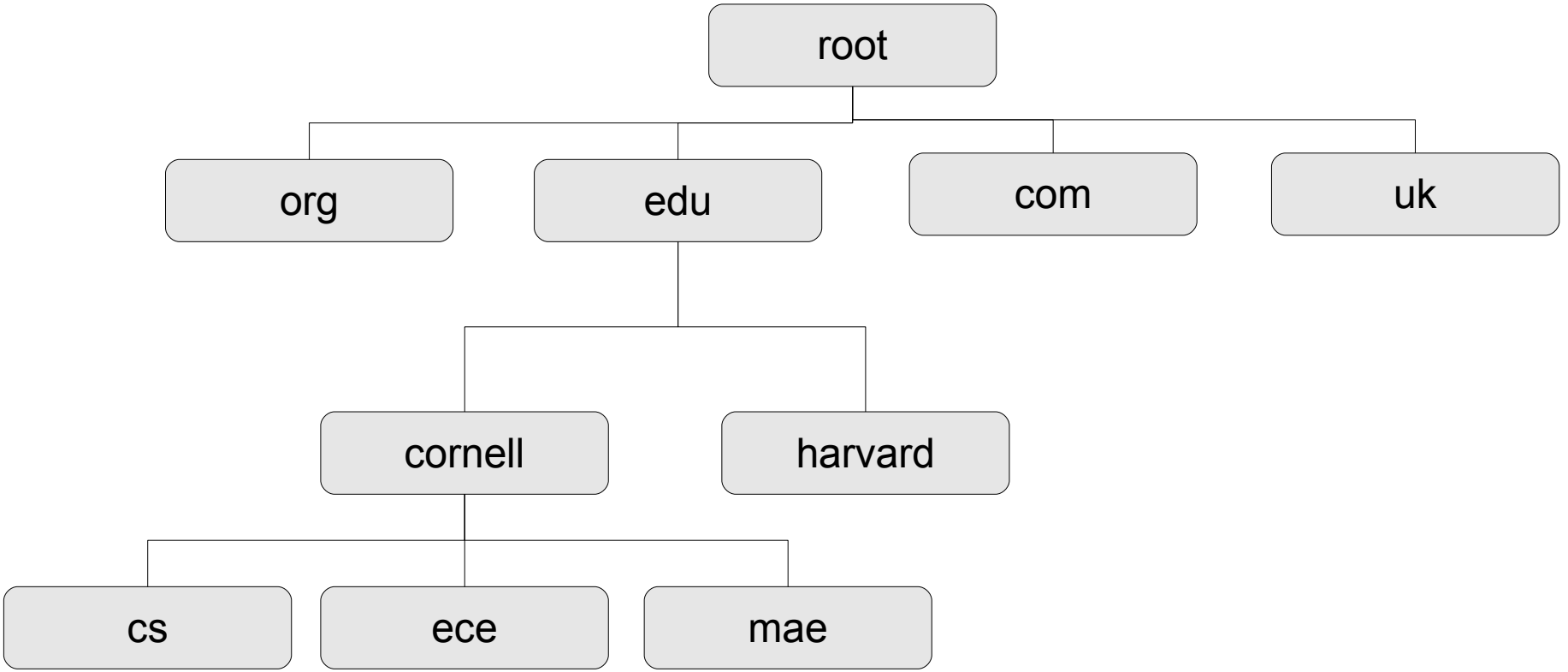
Today

- DNS
- End-to-End Argument

DNS

- When a user wants to communicate with a remote node, is it easier to remember 69.63.176.13 or www.facebook.com?
- Human-friendly names are given to nodes.
- Simultaneously, a translation mechanism should exist between names and IP addresses.
  - Packets need IP addresses to be transmitted.
- Will we use arbitrary or well-structured names? Why?
  - It affects the efficiency of the translation mechanism.
- Nowadays, we use Domain Names.
  - Well-structured strings.
  - Multiple labels separated by dots.
  - They create a hierarchical Domain Name Space.
- Use:
  - Emails, web sites

DNS



- Hierarchical Domain Space
  - Every domain name should belong to this tree.
- When a process wants to send data to www.facebook.com, somebody needs to provide the IP translation. Who?
- Domain Name Service

DNS

- Can we have only one server in the network which would provide the translations of all domain names? Why?
- DNS uses multiple DNS resolvers (servers) in the network and the translations are distributed among them. How?
- Each DNS resolver is responsible for a subset of the Domain Name space.

DNS

- Example:
  - Suppose we want to access www.cs.cornell.edu.
  - First, the DNS resolver in the OS contacts root DNS server and asks if it knows the translation of www.cs.cornell.edu.
  - The root does not know the translation, but it knows the DNS server that is responsible for .edu addresses. Thus, it forwards the request there.
  - The DNS server for .edu does not know the translation, but it knows the DNS server responsible for the cornell.edu addresses. Thus, it forwards the request there.
  - The DNS server for cornell.edu does not know the translation, but it knows the DNS server responsible for the cs.cornell.edu addresses. Thus, it forwards the request there.
  - Finally, the DNS server for cs.cornell.edu addresses sends the IP address of the wed site www.cs.cornell.edu.
- Improvement:
  - One or more of these DNS servers may have cached the translation from previous requests, accelerating the DNS query.

End-to-End Argument

- Should the network guarantee packet delivery ?
  - Think about a file transfer program
  - Read file from disk, send it, the receiver reads packets and writes them to the disk
- If the network guaranteed packet delivery, one might think that the applications would be simpler
  - No need to worry about retransmits
  - But still need to check that the file was written to the remote disk intact
- A check is necessary if nodes can fail
  - Consequently, applications need to be written to perform their own retransmits
  - No need to burden the internals of the network with properties that can, and must, be implemented at the periphery

End-to-End Argument

- Application-specific properties are best provided by the applications, not the network
  - Guaranteed, or ordered, packet delivery, duplicate suppression, security, etc.
- The Internet performs the simplest packet routing and delivery service it can
  - Packets are sent on a best-effort basis
  - Higher-level applications do the rest