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FEUP Faculdade de Engenharia

SCOM/ SRSI
DNS

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Naming

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- Network service
  - DNS is a network service
- Names are used to identify resources
  - Names identify resources
  - Addresses identify locations of resources
- Names are
  - More convenient than addresses
  - More transparent
- Names can be resolved to obtain information about the location of the resource
  - Binding: association between name and resource attributes

Name Service

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Stores bindings between names and entities

Name space: collection of all names recognised by a specific service

- Flat
- Structured
- Hierarchical

Name scope (computer science/ programming): part of a system/ program within which a name binding is valid

Naming domain (networking): name space for which there is only one administrative authority, and one binding

Resolution mechanism: return attributes when provided with a name

Name Resolution

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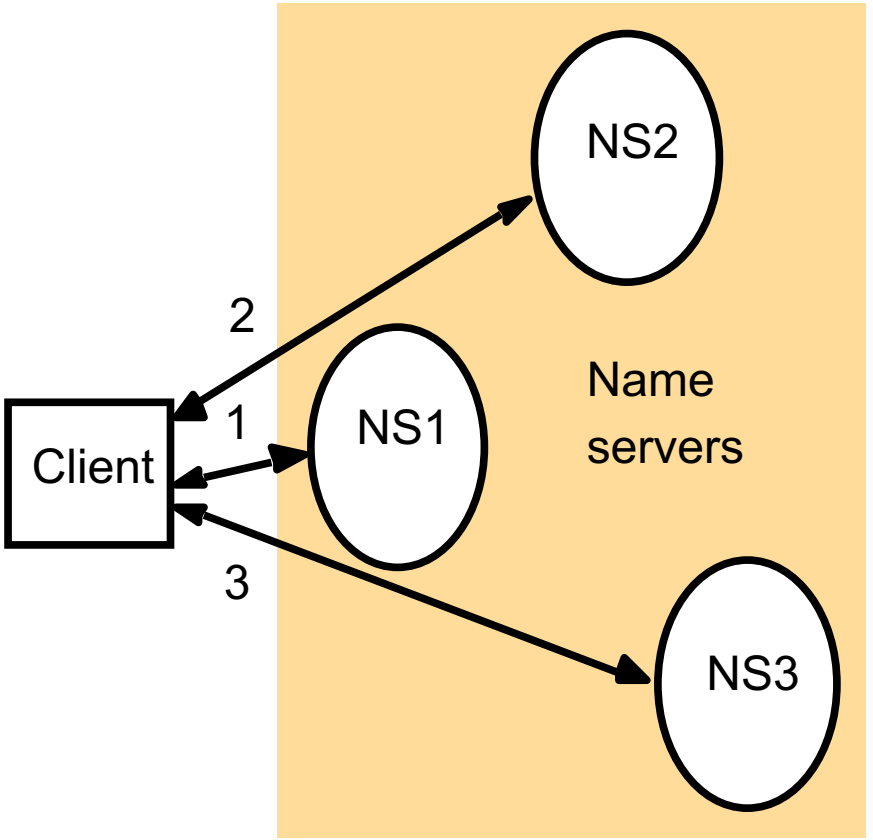
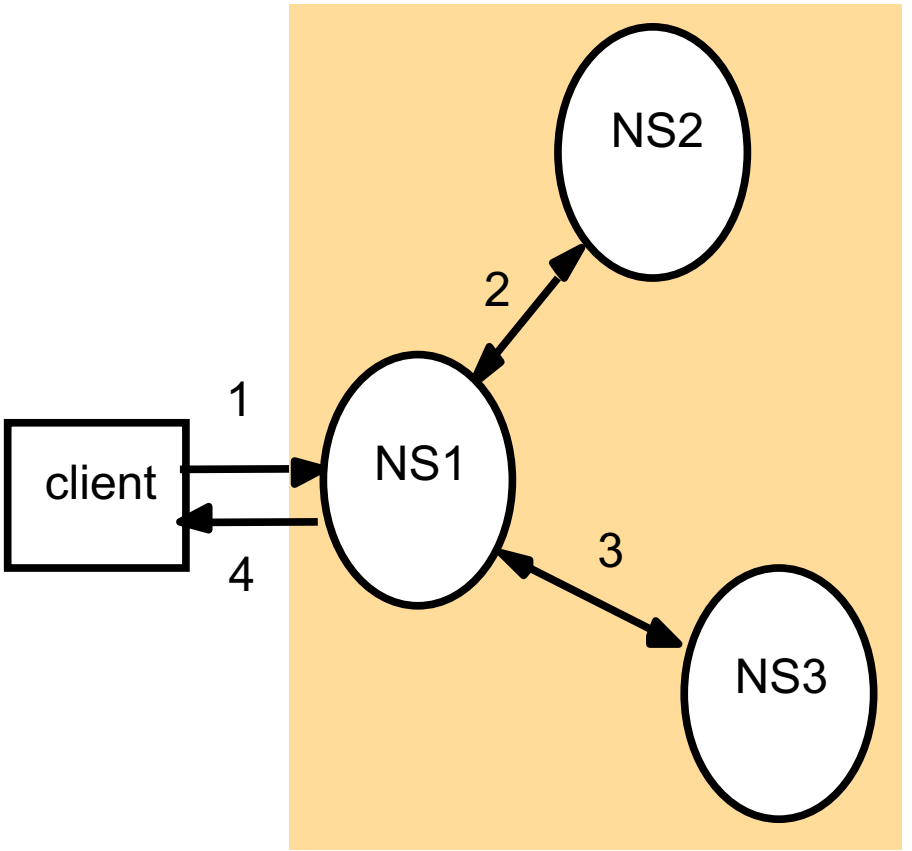
Iterative



Recursive



How would you design a name service for the Internet?

Domain Name System

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Network service

Initially DNS was a file called hosts.txt

- Then, the Internet grew

DNS requirements

- Scalability
- Reliability
- Availability
- Manageable by distributed entities
- Freshness (but not strict consistency)

Domain Name System (DNS)

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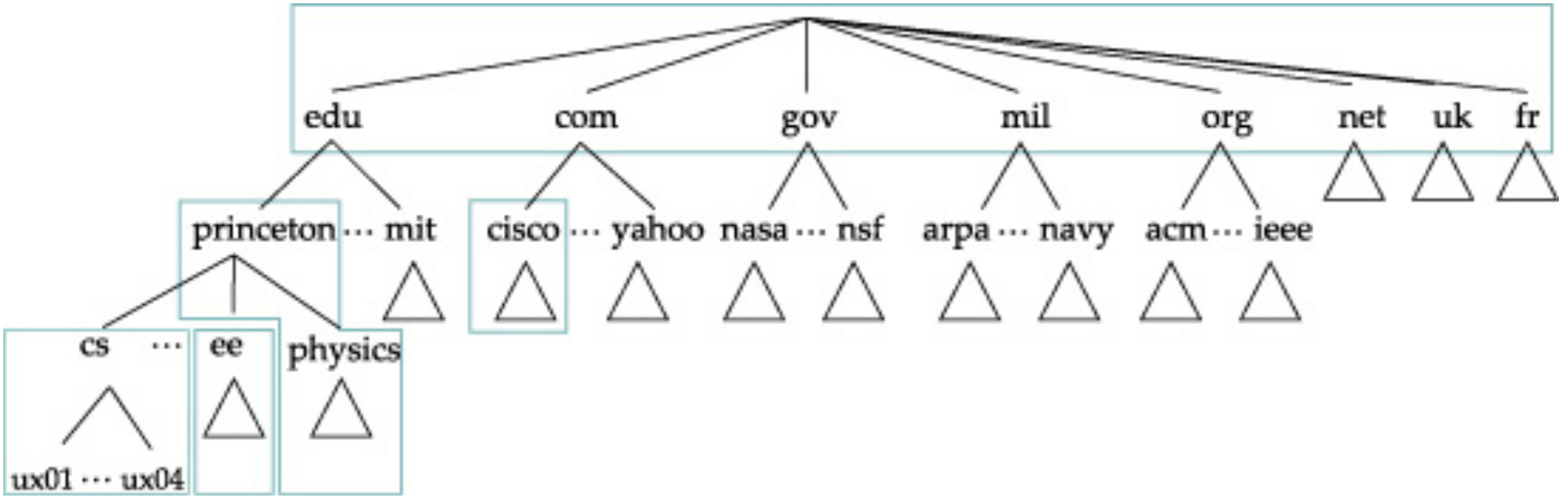
- Hierachical namespace
- Each zone is managed by an autority
  - ICANN (https://www.icann.org/) is responsible for the root
- Each zone has a name server that is responsible for the names in the zone: authoritative server
  - Each domain must have an authoritative server, and may have other servers
  - Authoritative server is also responsible for email and web server
- Explicit delegation
  - Authoritative server delegates on other servers
  - Other servers are responsible for answer

Domain Name System



DNS Resolution

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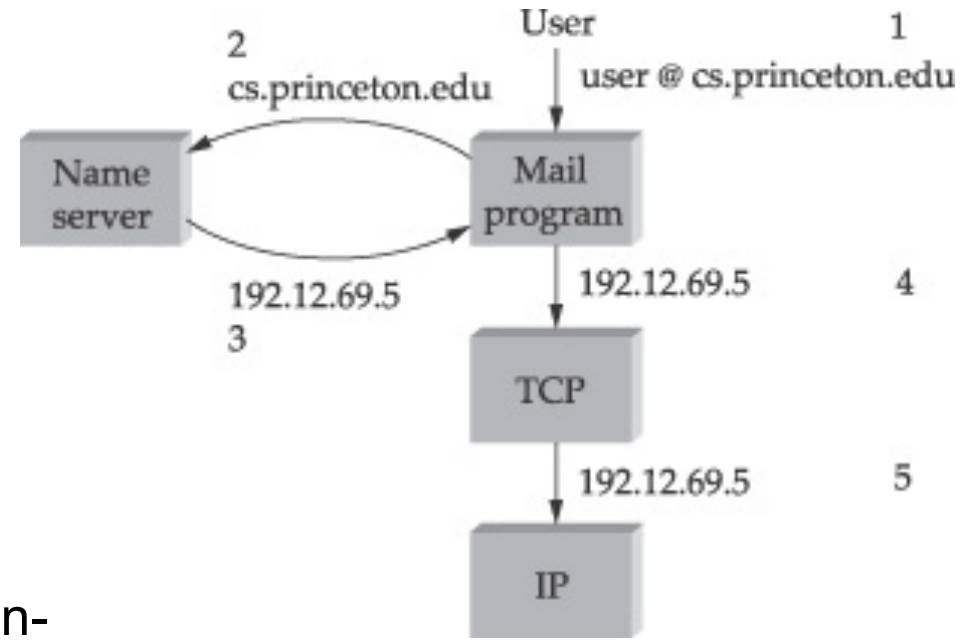
- Lookup queries
  - “what is the IP for this name?”
  - No search
- Bootstrap
  - Root servers are known out-of-band
  - Local name server is configurable
- Caching
  - Local name servers cache entries to reduce iterative resolution
- Transport Protocol
  - Uses UDP
  - Why not TCP?

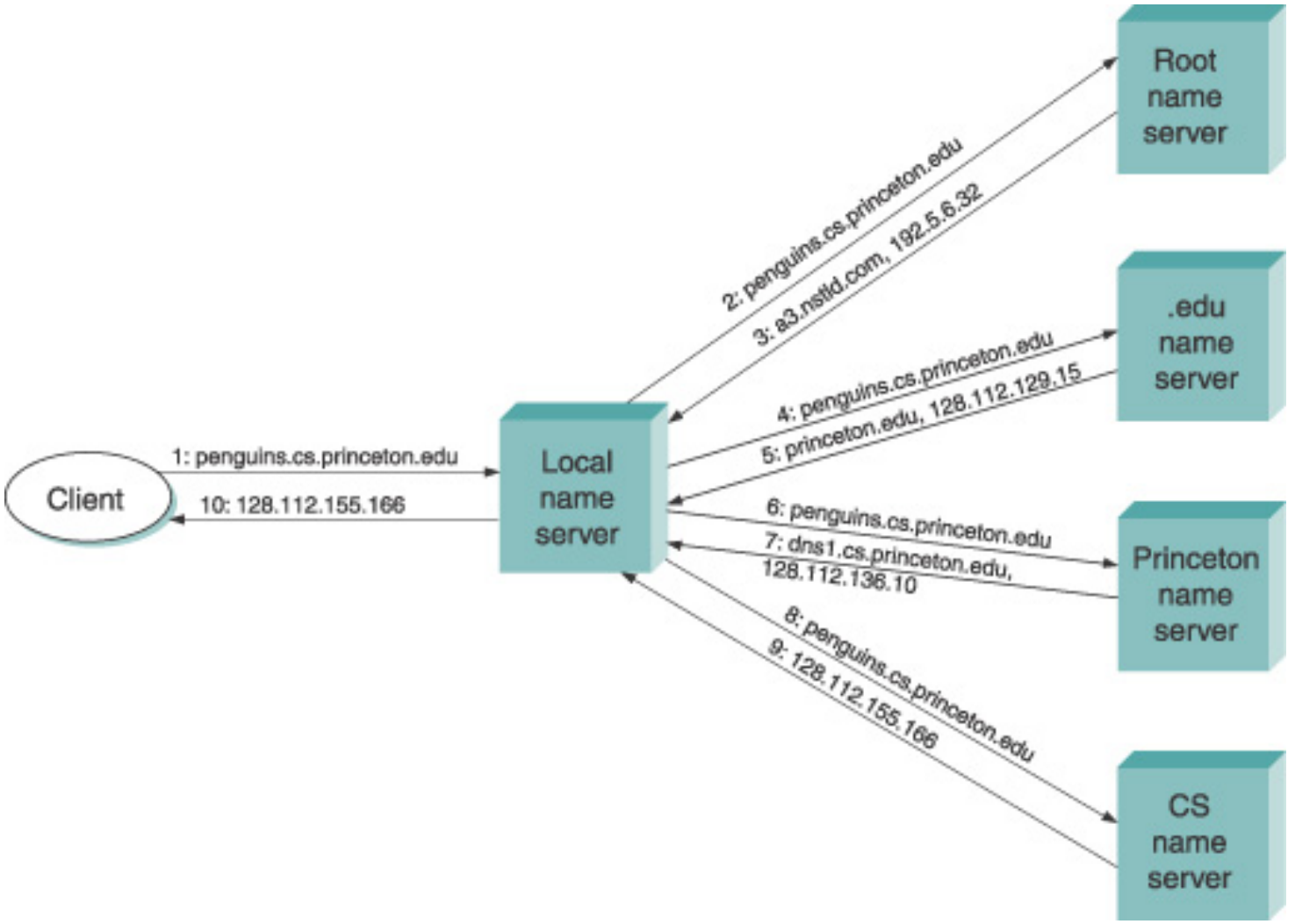
Resource Record

<Name, Value, Class, Type, TTL>

- Value: address
- Type
  - A: Address
  - NS: Name Server
  - CNAME: Canonical name
  - MX: Mail Exchange
- TTL: time to live
  - Maximum time for caching at non-authoritative server



DNS Resolution



Exercise

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- Use dig to resolve a name, e.g. fe.up.pt, by hand
  - `dig +trace` or `dig +norecurse`
  - Find out the names of the root servers
- How many steps did it take?
- How much time did it take?
  - Do not consider the time you took for writing the commands.
- Does it make sense to cache?
  - If yes, what and where?

Can you answer these questions?

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- Are all DNS entries for a certain domain always consistent?
  - Why/ why not?
- What is the longest period that a service may be unreachable after an IP change?
  - What is the cause of the inconsistency?
- If you want to use DNS to dynamically direct accesses to e.g. the least loaded server, should you use a large or a small TTL?