Computer Networks

Lecture on
Domain Name System

DNS *Domain Name System*

RFC 882, 883	– first proposals	1983
RFC1034	– concepts and facilities	1987
RFC1035	– implementation and specification	1987
....		1990 – 2017

There are more than 100 related RFCs

They define:

- host dynamic configuration DHCP
- dynamic recognition of systems and actualizations
- IPv6 address processing
- address translations
- security issues
- MIB extensions
- load balancing and tests
- …

DNS Names

Internet Assigned Numbers Authority www.iana.org/domains

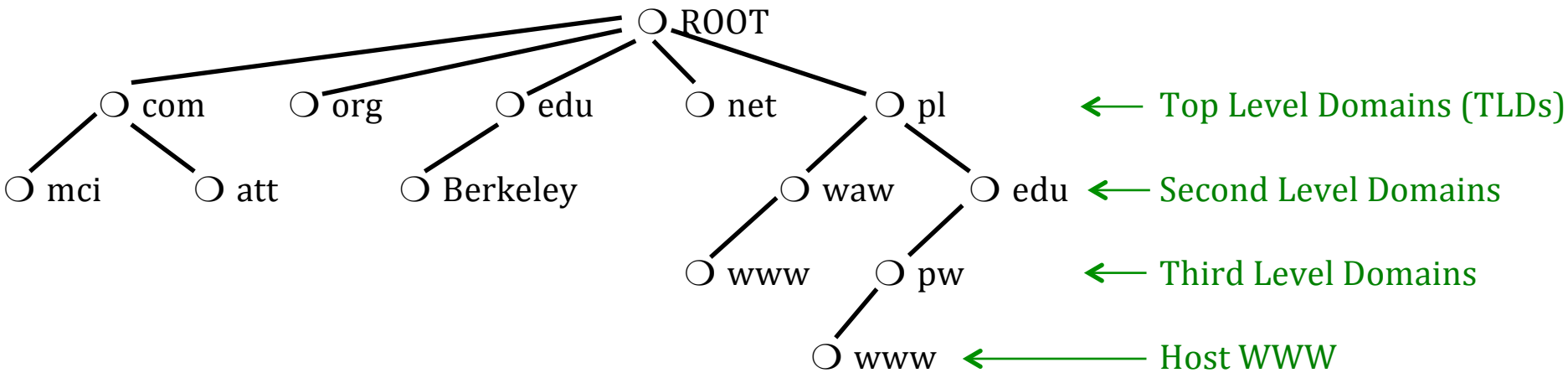
governs Top-Level Domains

.gov, .edu, .com, .mil, .org – names from 1984

.cn, .fr, .pl, .us, … – ISO-3166 country codes

new ones appear e.g. .cat for the Catalan language

Internet Corporation for Assigned Names and Numbers www.icann.org



DNS Principles

Domain names reflect:

- geographical structure
- organization structure

Every DNS server:

- is responsible for its domain
  - all hosts from the domain
  - all DNS servers of direct sub-domains
- returns authoritative information

Communication:

- client –server model
- over TCP & UDP

- iterative requests
- recurring requests – DNS client
- shortcuts resolution – DNS client

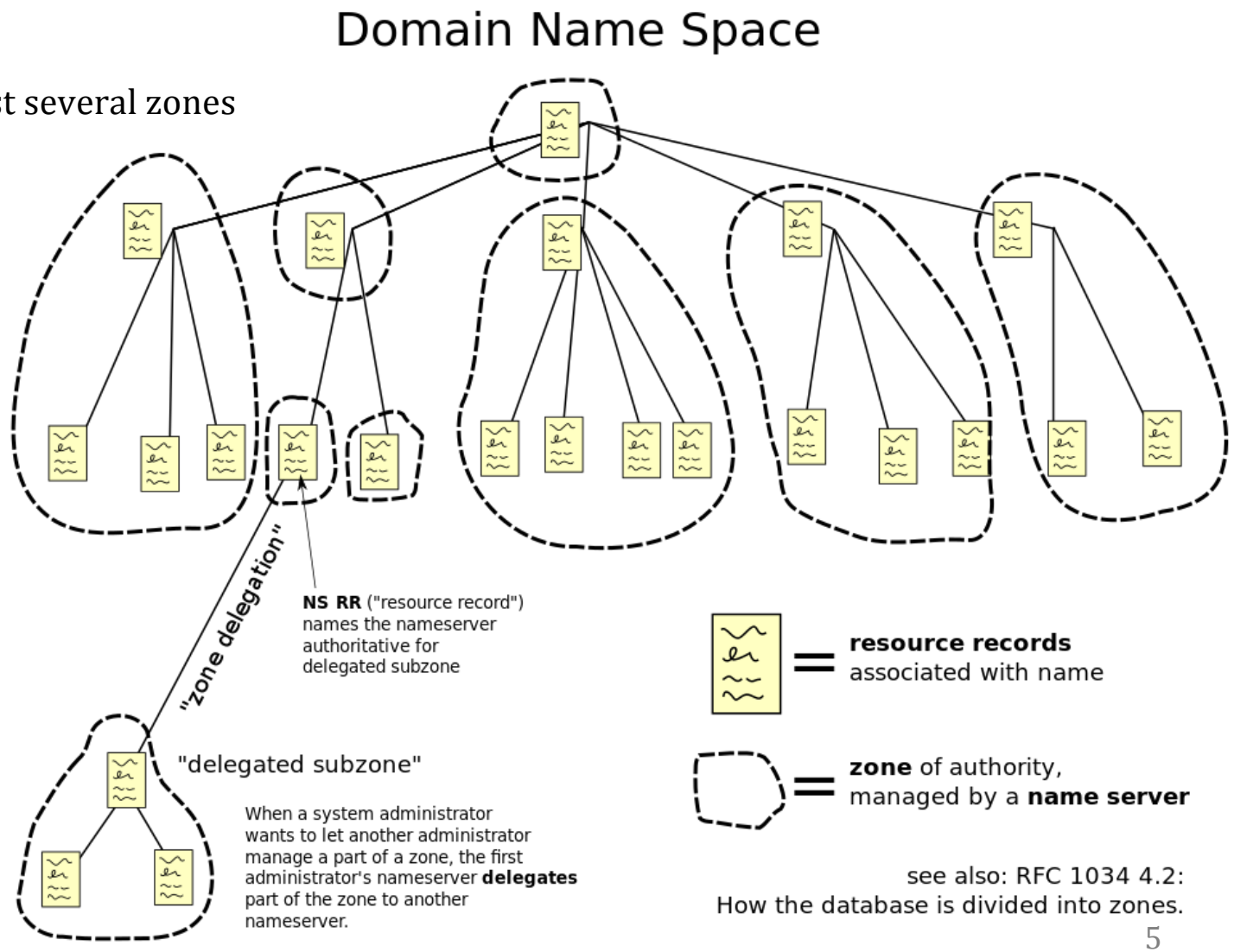
Built-in extensibility

- 1 IP address can be assigned to many DNs
- 1 DN can be assigned to many IP addresses

- DNS is case-insensitive
- internationalized domain name based on Unicode

A **zone** is a collection of connected nodes
that are authoritatively served by an authoritative DNS server

A single name server can host several zones



Main DNS Record Types

SOA	Start of authority	Start of data zone
NS	Name server	Domain servers
A, AAAA	Address	Name → Address
PTR	Pointer	Address → Name
MX	Mail Exchange	Mail servers
CNAME	Canonical name	Alternative name
HINFO	Host information	Hardware and OS
RR	Resource Record	SSHFP - the node fingerprint
WKS	Well known services	Network services, e.g. POP
SRV	Service	Information on available services e.g. SIP, LDAP, SMTP
TXT	Arbitrary text	

An Example of a DNS query

```
import javax.naming.directory.*;

DirContext ictx = new InitialDirContext();

Attributes attrs = ictx.getAttributes("dns://corp.example.com", "MX");
```

DNS Implementations

BIND Berkeley Internet Domain Name

- Resolver DLL configuration by: resolv.conf
  Dynamic Linked Library to application processes
- Server process named
  - can be local or remote
  - can be:
    - caching
    - secondary
    - primary

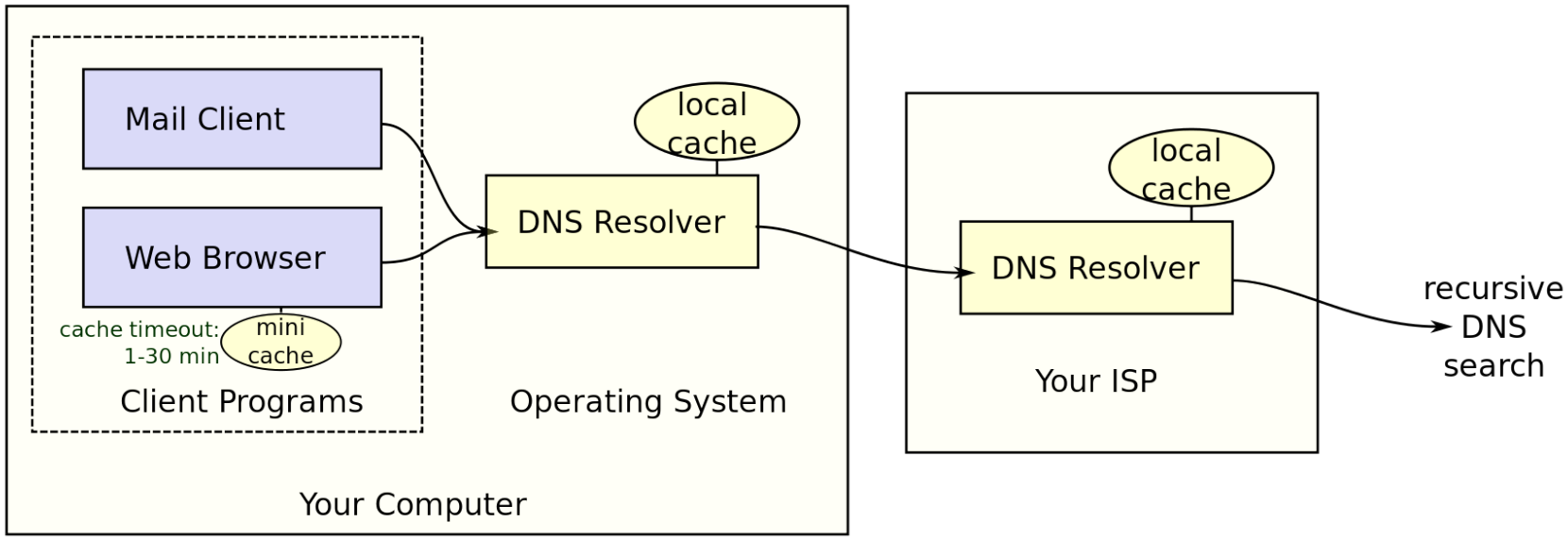
mysqlBind – free administration tool for DNS servers

Play with nslookup, dig and host commands!

DNS Caches

DNS server are defined

- manually
- by DHCP



Particular DNS Solutions

Dynamic DNS services

to cope with frequent changes of IP addresses e.g. servers behind NATs

- There are standards for secure DNS updates
- Dynamic DNS providers offer a software client program

  that automates the discovery and registration of the client system's public IP addresses

Multicast DNS

mDNS protocol resolves host names to IP addresses within small networks

- Distributed solution without a server
- Uses standard DNS records

DNS Service Discovery

DNS-SD protocol discovers a named list of service instances

- Distributed solution without a server
- Uses standard DNS records
- Is a part of zero-configuration networking

  the other *zeroconf* parts:

  - automatic assignment of numeric network addresses
  - automatic distribution and resolution of computer hostnames

Zeroconf implementations

- Apple Bonjour
- Linux Avahi
- Microsoft LLMNR

Summary

- Domain Name System
  - names
  - principles
  - main record types
  - implementations
  - cashes
  - particular solutions: DDNS, mDNS, DNS-SD

Questions

1. What is the difference between DNS domain and DNS zone?
2. How many IP addresses can be assigned to a domain name?
3. What for one IP address can be assigned to many domain names?
4. Mention at least 3 main DNS record types.
5. Where DNS caches are located?
6. Is it possible to have DNS services inside a home network?

Questions for curious minds

1. How round-robin DNS works?