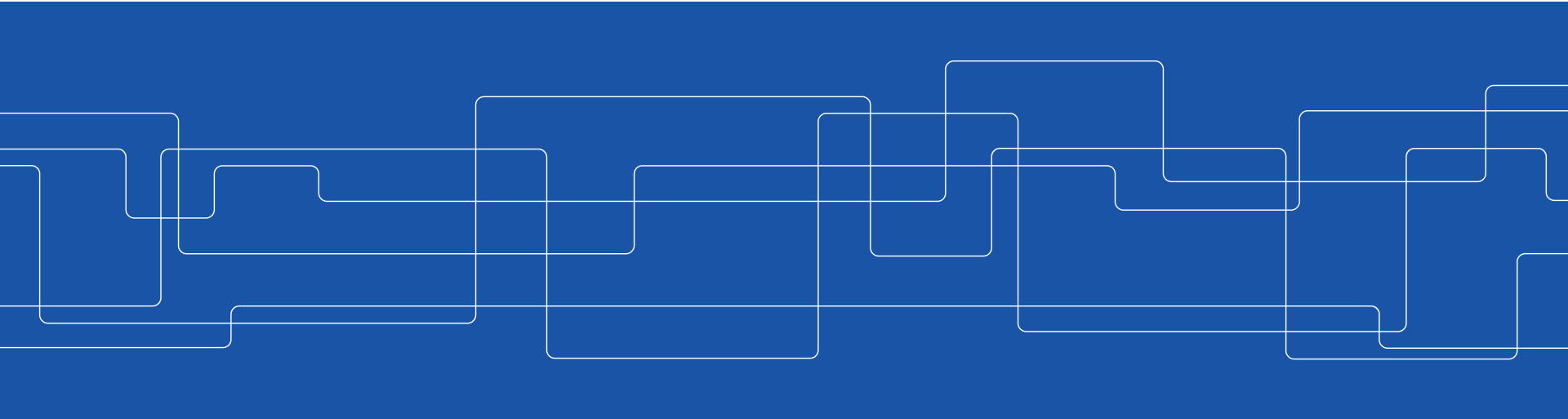
KTH ROYAL INSTITUTE
OF TECHNOLOGY

Name Services

Johan Montelius and Vladimir Vlassov



What's a name service

A service that provides information about remote resources given a name.

Terminology

Name or identifier:

- ***name*** - often human-readable
- ***identifier*** - not so

Pure names:

- ***pure*** - no internal information
- ***non-pure*** - contains information

Flat or hierarchical

- ***flat*** - all names directly comparable
- ***hierarchical*** - names interpreted in an environment

Resolving:

A name is ***resolved***, resulting in information about an object, often the address, so one can access the object.

Address:

An ***address***, at one level, could be a name on a lower level.

Flat or what

130.237.215.140

- Is this a pure name?
- Is it a flat name space?

```
> route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         net215.it.kth.s 0.0.0.0         UG    1024   0        0 eth0
dhcpsrv-4a.lan. net215.it.kth.s 255.255.255.255 UGH   1      0        0 eth0
130.237.215.0   *               255.255.255.0   U     0      0        0 eth0
```

flat or what

```
eth0 Link encap:Ethernet HWaddr  00:1e:8c:93:c6:da
```

- Is this a pure name?
- Is it a flat name space?

URI example

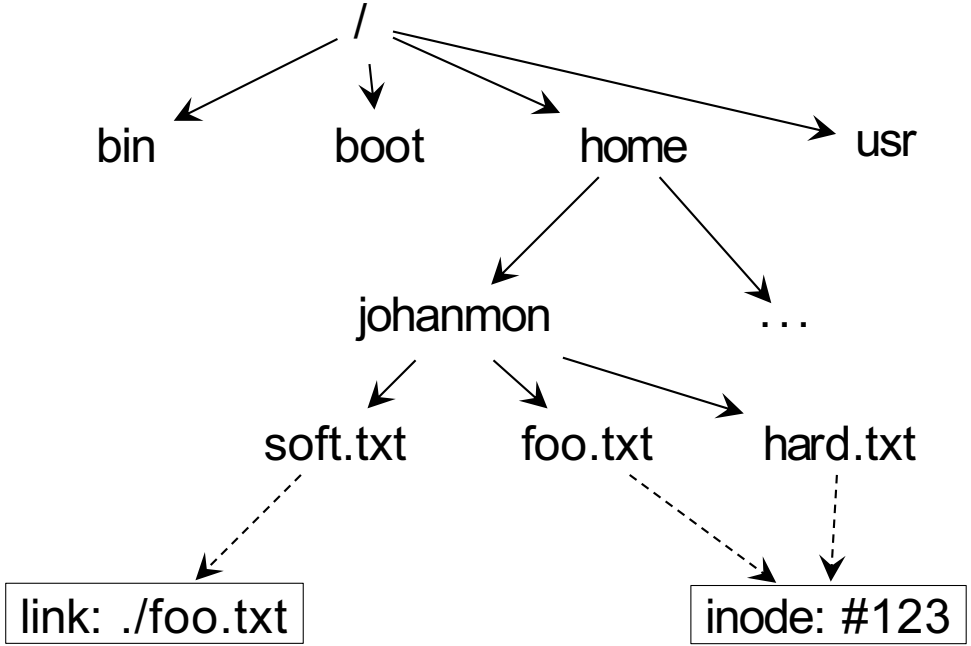
A scheme, a node, a port and a resource

```
http://www.kth.se:80/people/~johanmon
mailto:johanmon@kth.se?subject=Test& body=Hej
spotify:track:6JEK0CvvjDjjMUBFoXShNZ
spotify:album:2mCuMNdJkoyiXFhsQCLLqw
urn://isbn/0451450523
```

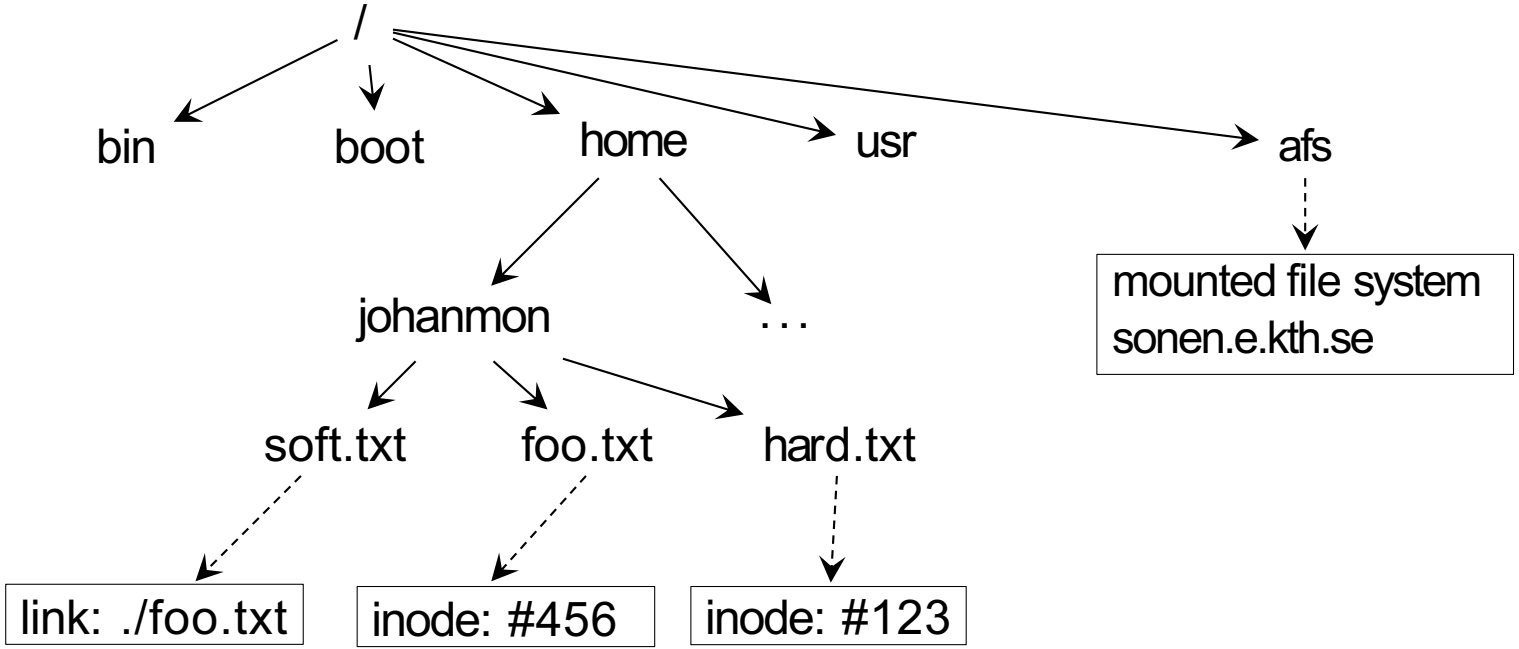
A scheme, a name space and an identifier

Uniform Resource Identifier *(URI) includes URL and URN*

File systems



File systems



DNS - Domain Name Service

- Originally the namespace was flat and stored in the hosts file on each client.
- John Postel developed DNS in -82, finally defined in Mockapetris RFC 1035 -87
- It grew from a few thousand entries to over 100 million entries!

DNS - Names and attributes

www.kth.se

A DNS name consist of:

- a top-level domain: se
- a sequence of subdomains: kth
- possibly a host name: www

Use **nslookup** to find the attributes of a name

```
> nslookup www.kth.se
Server:         127.0.1.1
Address:        127.0.1.1#53

Non-authoritative answer:
Name:   www.kth.se
Address: 130.237.28.40
```

DNS attributes

- A: the address of a host
- MX: the mail server of the subdomain
- CNAME: a symbolic link
- SOA: Start of Authority
- TXT: more stuff
- . . . and more

```
> nslookup -type=SOA kth.se a.ns.kth.s
Server: a.ns.kth.se
Address: 130.237.72.246#53

kth.se
    origin = a.ns.kth.se
    mail addr = hostmaster.kth.se
    serial = 2015081901
    refresh = 14400
    retry = 900
    expire = 604800
    minimum = 86400
```

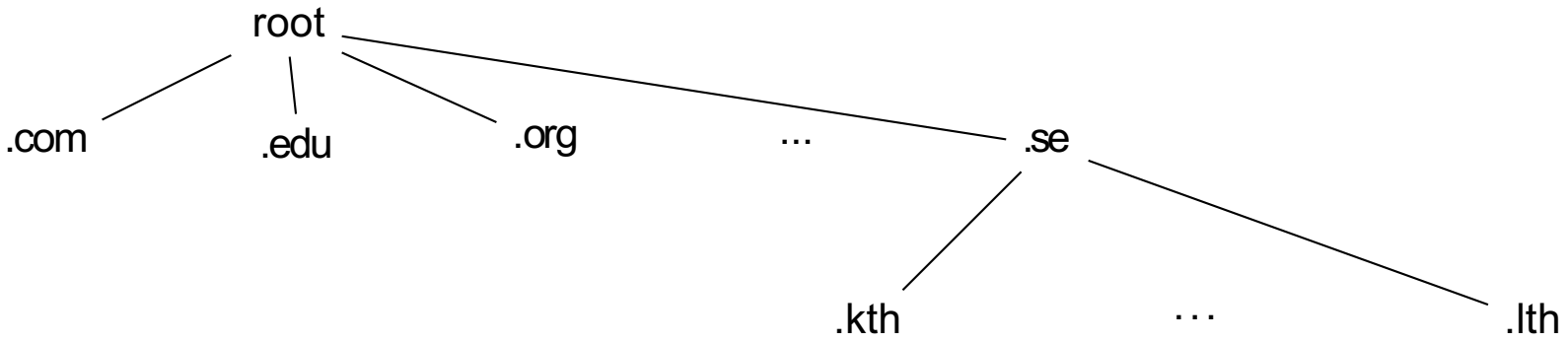
DNS attributes

```
> nslookup -type=TXT kth.se a.ns.kth.se
Server: a.ns.kth.se
Address: 130.237.72.246#53

kth.se text = "3 - SE-100 44  STOCKHOLM"
kth.se text = "2 - Kungliga Tekniska H|gskolan"
kth.se text = "5 - Tel. +46 8 790 60 00"
kth.se text = "1 - Royal Inst of Technology"
kth.se text = "v=spf1 a:mx5.kth.se a:mx6.kth.se a:mx7.kth.se a:smtp-3.sys.
kth.se text = "MS=ms86914267"
kth.se text = "4 - SWEDEN"
```

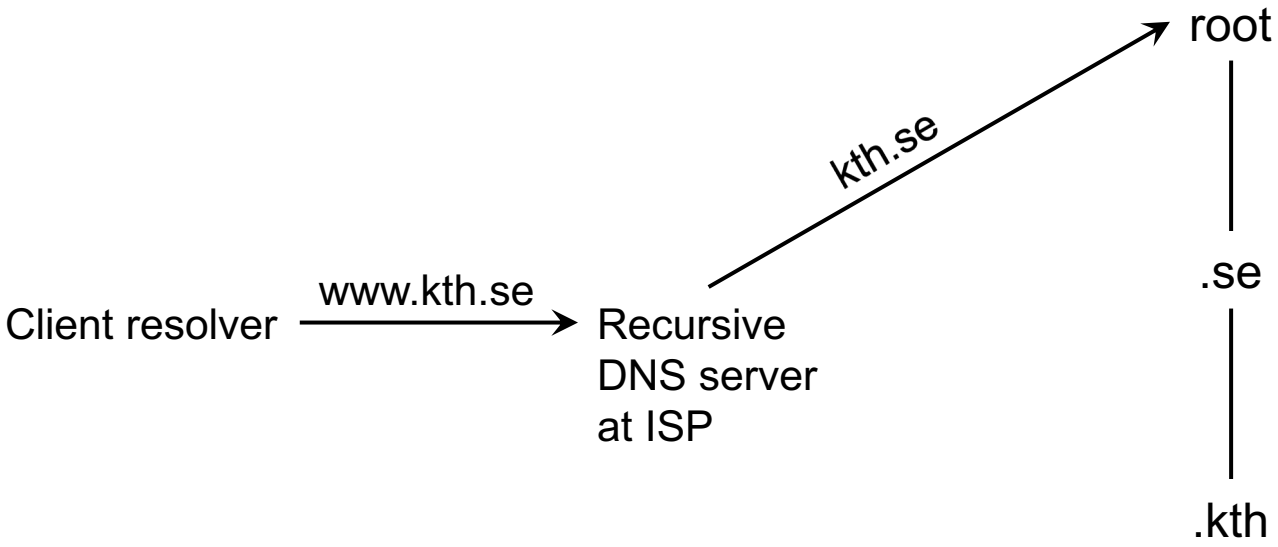
DNS architecture

A hierarchy of servers that divide the responsibility.

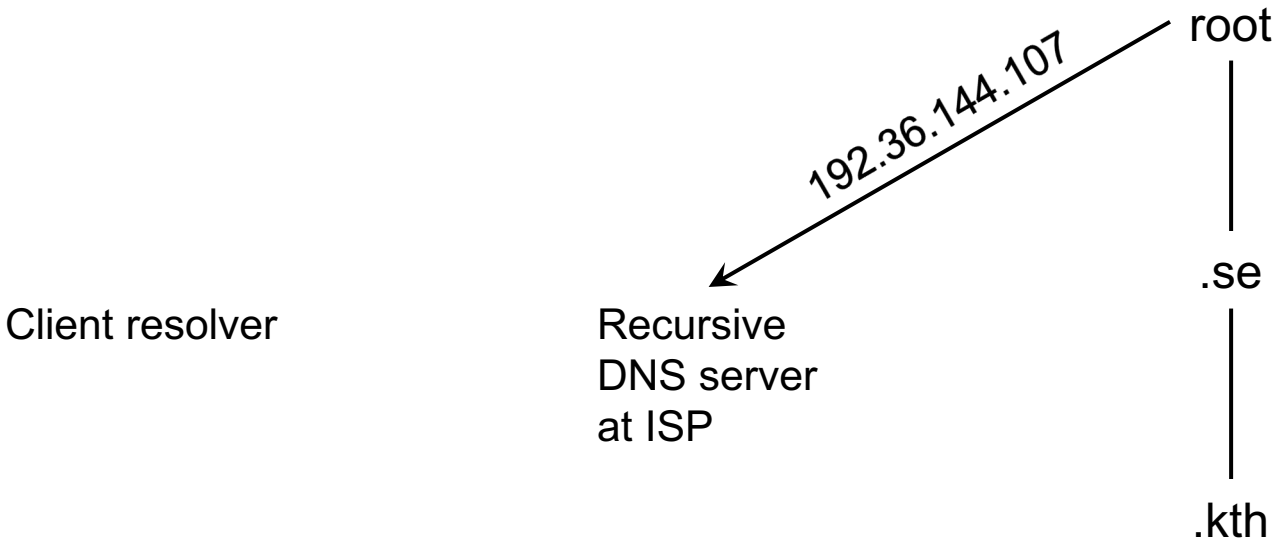


Each server is an *authoritative server* for a zone; it holds the master record for the nodes below it.
Authoritative servers also work as slave servers for other zones to provide redundancy.

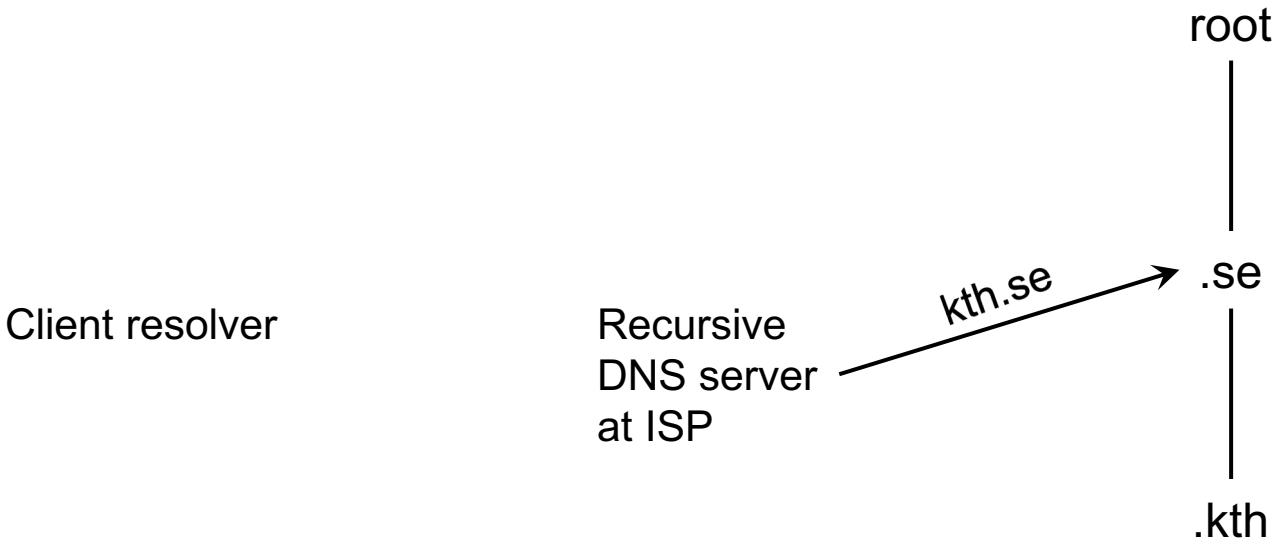
DNS resolution



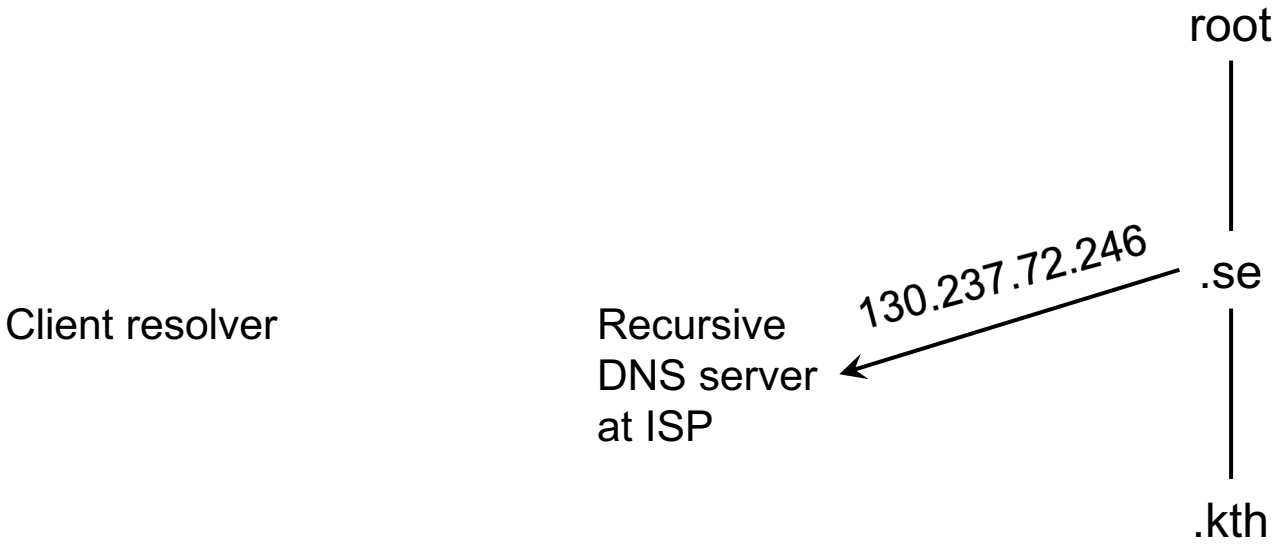
DNS resolution



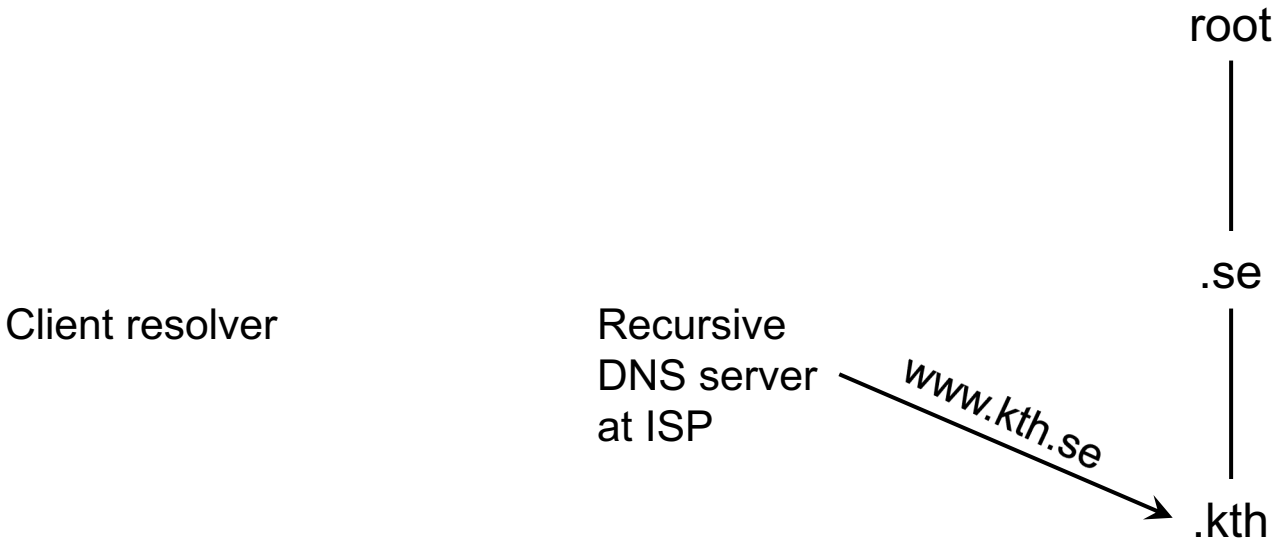
DNS resolution



DNS resolution



DNS resolution



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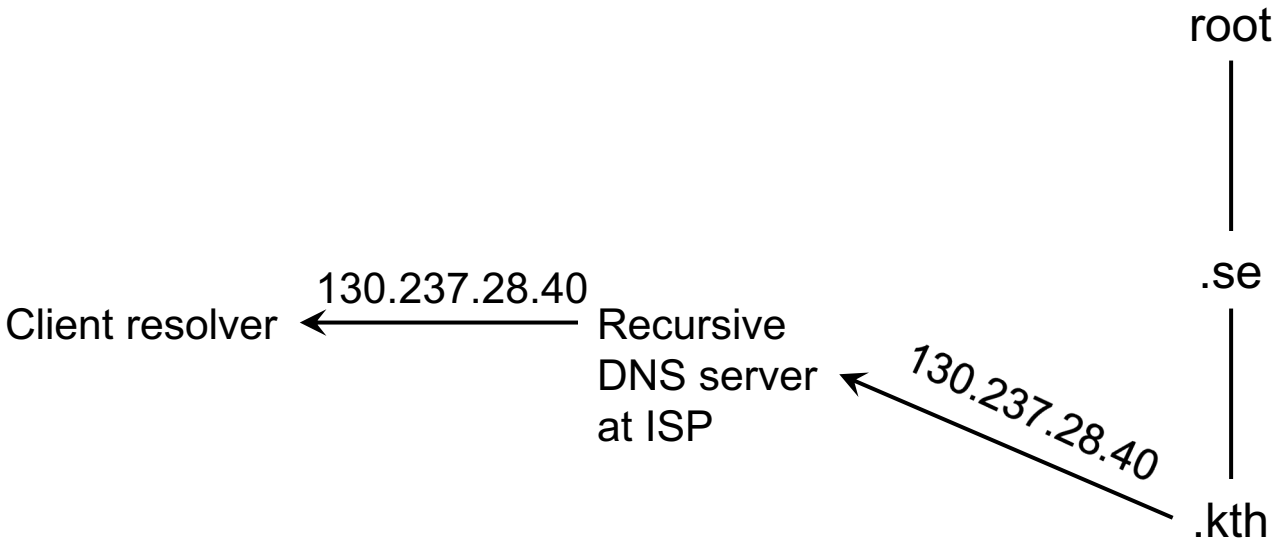
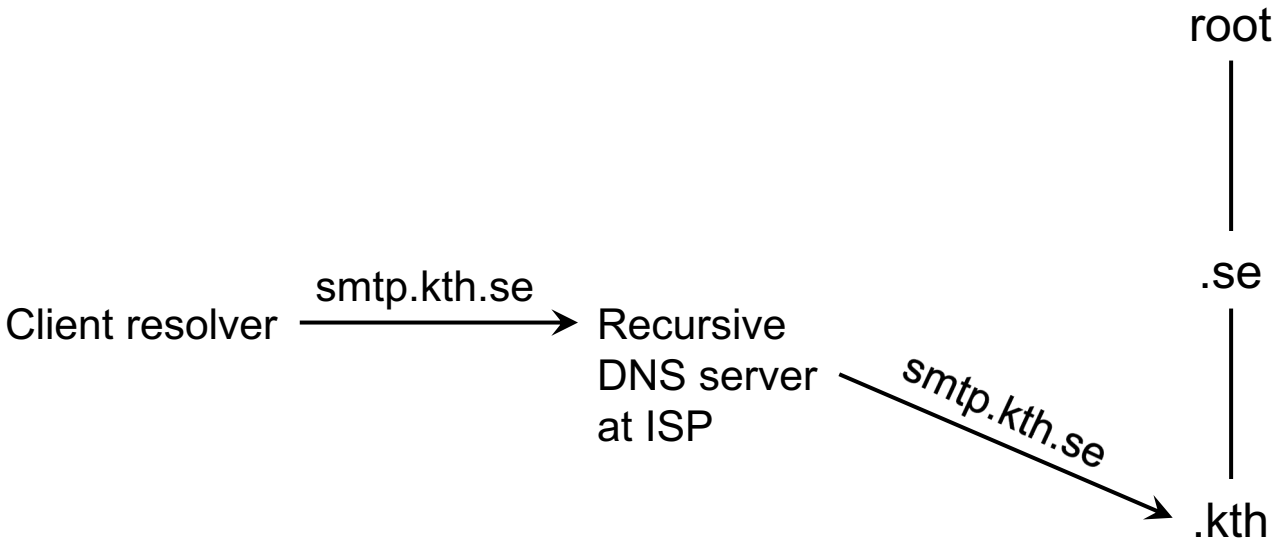
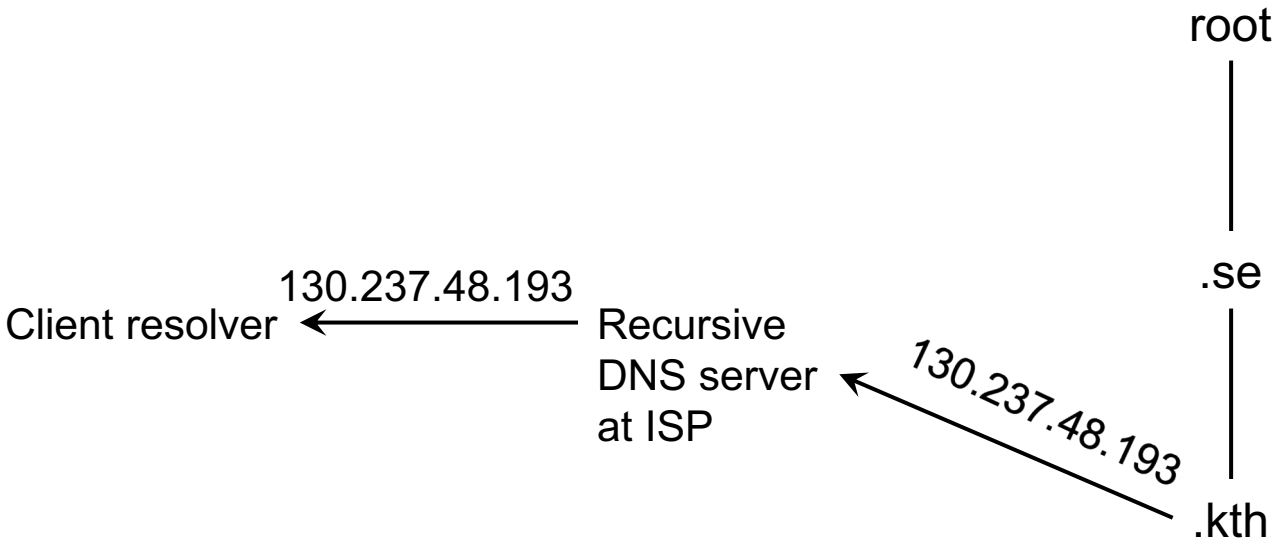


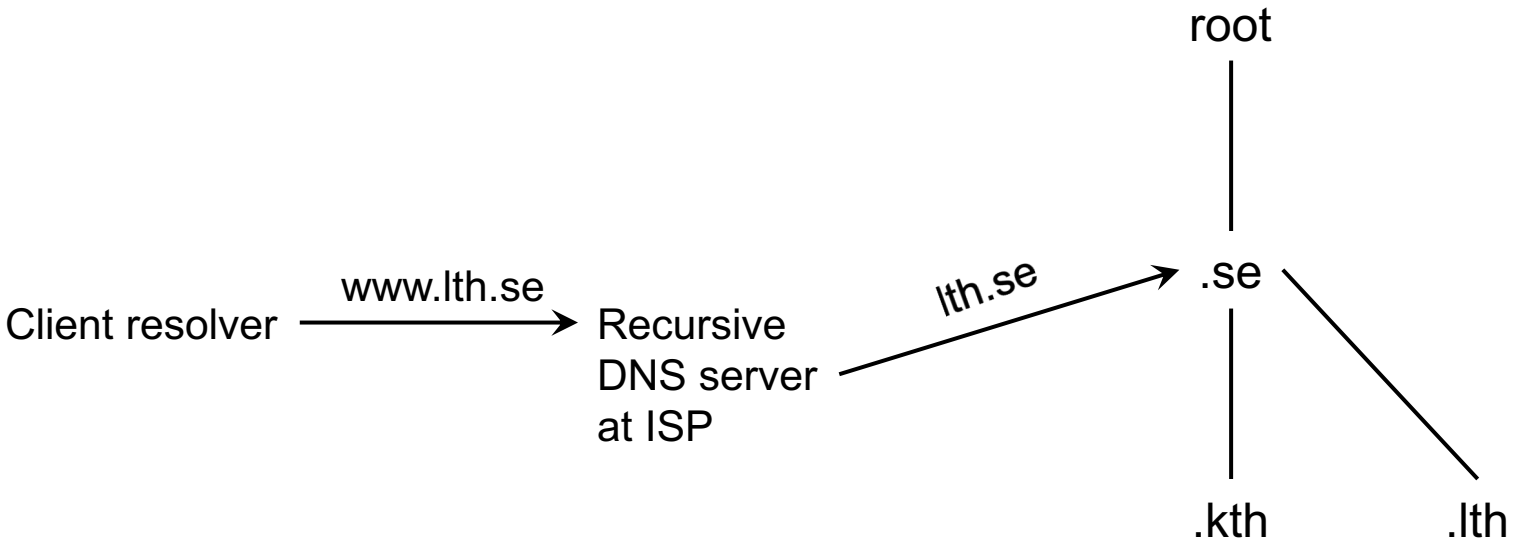
DNS resolution



DNS resolution

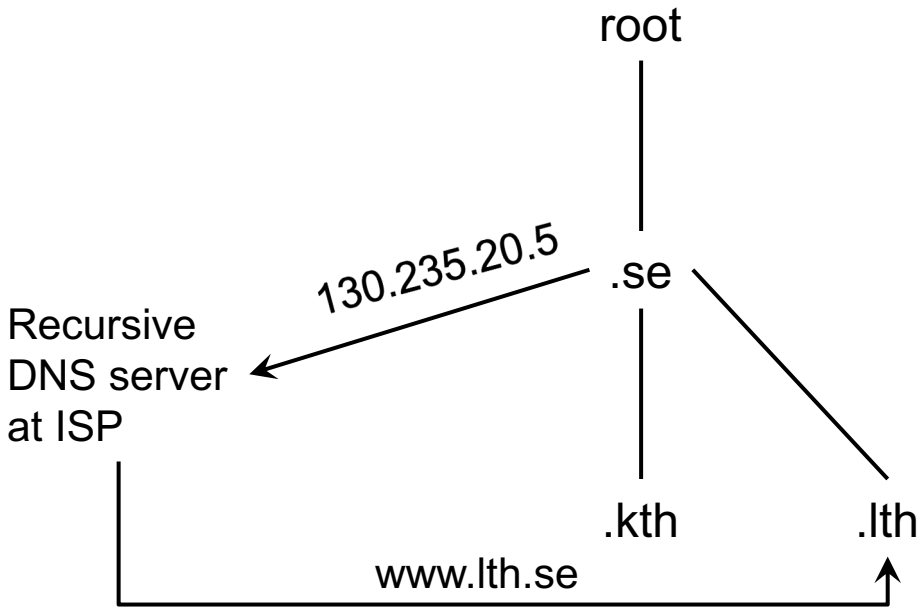


DNS resolution

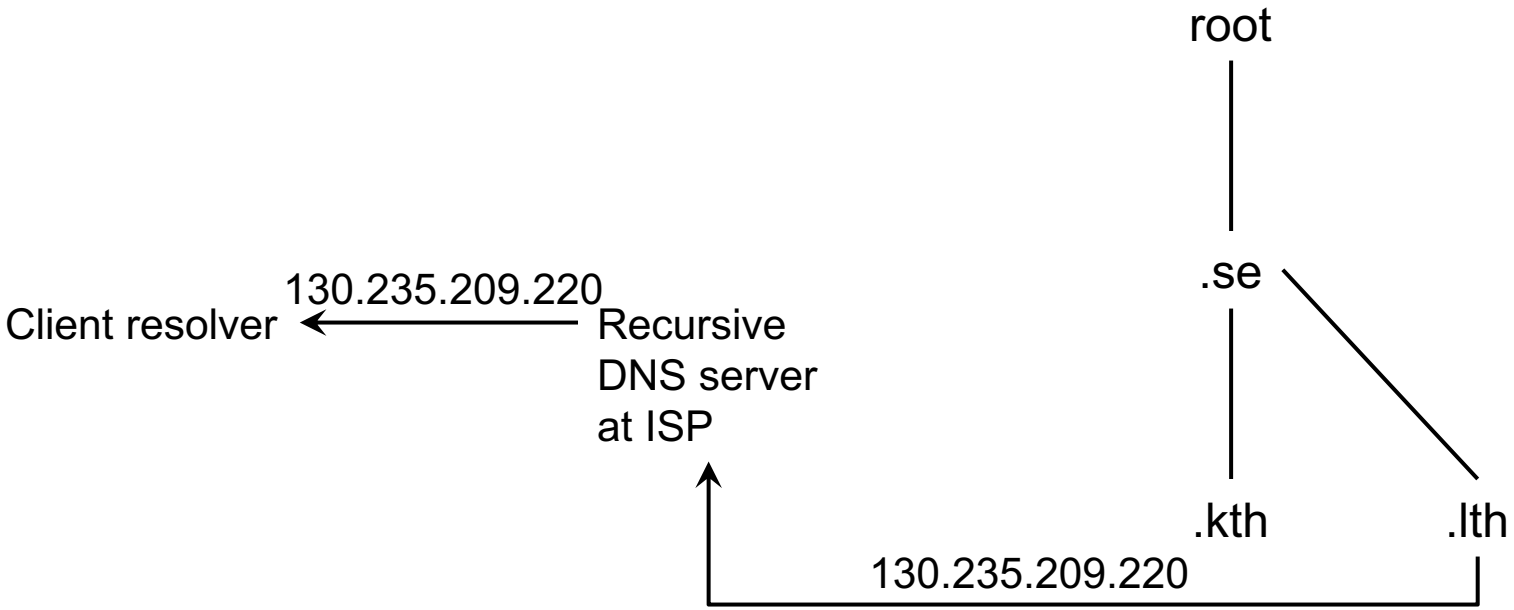


DNS resolution

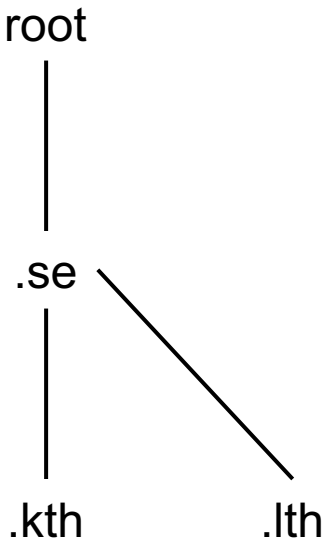
Client resolver



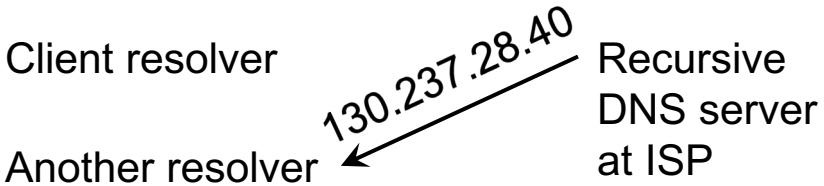
DNS resolution

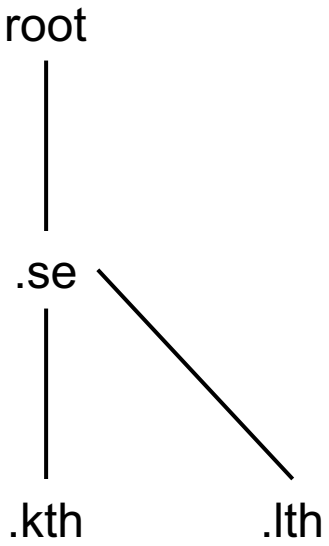


DNS resolution



DNS resolution





The recursive or caching-only DNS server is essential for performance.

DNS infrastructure

- There are 13 DNS ***logical root servers*** in operations.
- Each *logical root server* is replicated at up to 20 locations worldwide but shares the same IP address.
- An ISP has several recursive DNS servers used by subscribers (i.e., you).
- Due to caching, there could be delays in updates to up to 24 hours.
- DNS servers can be used as load balancers and hand out different or multiple replies based on time and location.

DNS Round Robin load balancing

```
> nslookup -type=A www.google.com ns1.google.com
Server:         ns1.google.com
Address:        216.239.32.10#53

Name:   www.google.com
Address: 64.233.161.106
Name:   www.google.com
Address: 64.233.161.104
Name:   www.google.com
Address: 64.233.161.147
Name:   www.google.com
Address: 64.233.161.103
Name:   www.google.com
Address: 64.233.161.105
Name:   www.google.com
Address: 64.233.161.99
```

```
> nslookup -type=A www.google.com ns1.google.com
Server:         ns1.google.com
Address:        216.239.32.10#53

Name:   www.google.com
Address: 64.233.161.104
Name:   www.google.com
Address: 64.233.161.105
Name:   www.google.com
Address: 64.233.161.106
Name:   www.google.com
Address: 64.233.161.99
Name:   www.google.com
Address: 64.233.161.147
Name:   www.google.com
Address: 64.233.161.103
```

Directory service

A directory service will look up an object given a description of its *attributes*.

More general than name services that typically require a *name* to be given.

X.500/LDAP

X.500

- the vision of a global telephony directory
- standardized by ITU in 1997
- used Directory Access Protocol (DAP)

LDAP

- Lightweight DAP, RFC 2251 in 1997
- initially used as a proxy for DAP servers
- used by email clients for address books
- simple interface to databases

X.509 is the standard for digital certificates

LDAP example

```
> ldapsearch -x -h  ldap.kth.se
     -b ou=Addressbook,dc=kth,dc=se -LLL "ugUsername=johanmon"

 dn: cn=Johan Montelius (johanmon),ou=Addressbook,dc=kth,dc=se
 objectClass: top
 objectClass: person
 ugUsername: johanmon
 ugKthid: u1bx6gxe
 givenName: Johan
 sn: Montelius
 displayName: Johan Montelius
 mail: johanmon@kth.se
 cn: Johan Montelius (johanmon)
```

LDAP example

```
> ldapsearch ... "(&(sn=Montelius)(objectClass=eduPerson))" givenName

dn: cn=Erika Montelius (erikamo),ou=Addressbook,dc=kth,dc=se
givenName: Erika

dn: cn=Hans Montelius (hansmo),ou=Addressbook,dc=kth,dc=se
givenName: Hans

dn: cn=Johan Montelius (johanmon),ou=Addressbook,dc=kth,dc=se
givenName: Johan
  :
  :
```

Summary

- name services - maps unique names to resources
  - DNS - distributed hierarchical architecture
- directory services - query directory given attributes
  - X.500
  - LDAP