Name Services

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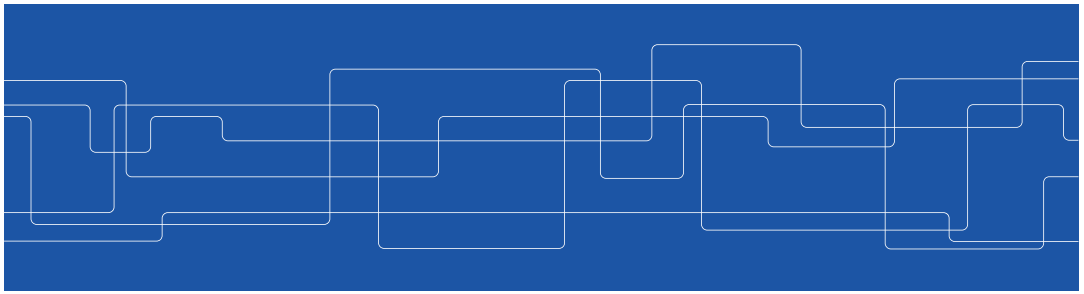


What's a name service

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 that 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

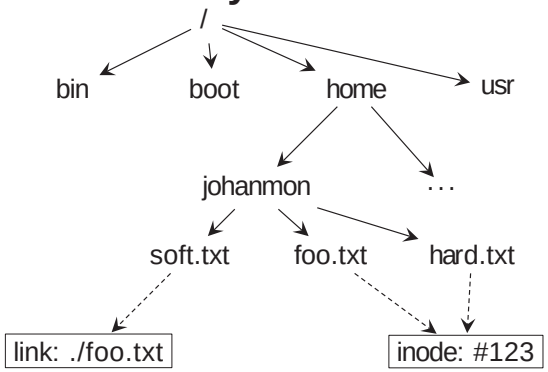
A scheme, a node, a port and a resource

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

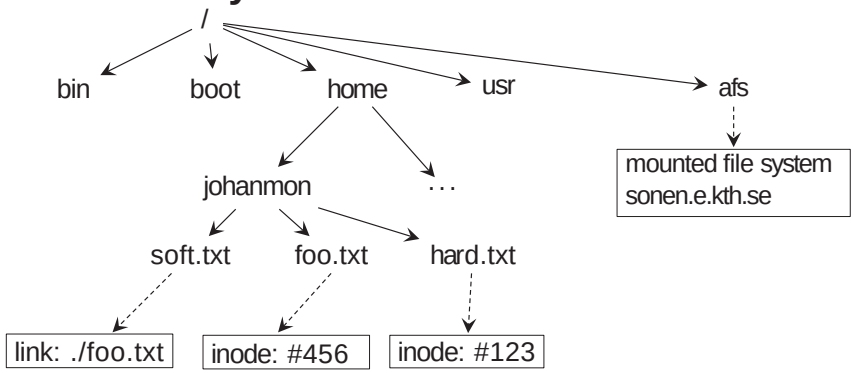
A scheme, a name space and an identifier

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

File systems



File systems



DNS - Domain Name Service

- Originally the name space was flat and stored in the hosts file on each client.
- John Postel developed DNS in -82, finally defined in Mockapetris RFC 1035 -87
- 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
```

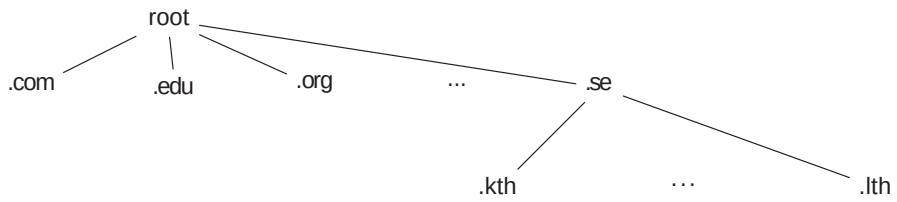

DNS attributes

```
> 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"
```

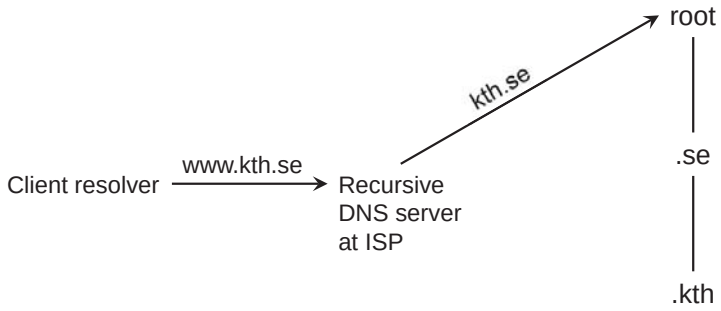
DNS architecture

A hierarchy of servers that divide the responsibility.

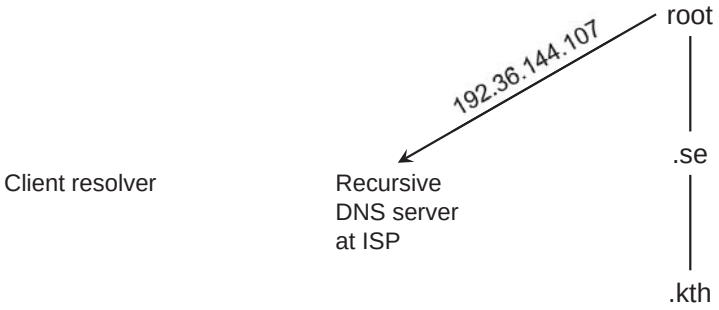


Each server is an *authoritative server* for a zone, it holds the master record for the nodes below it.
Authoritative servers also work as slave servers for other zones to provide redundancy.

DNS resolution



DNS resolution



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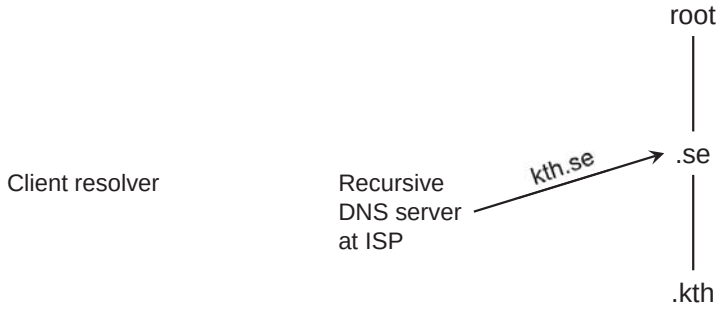

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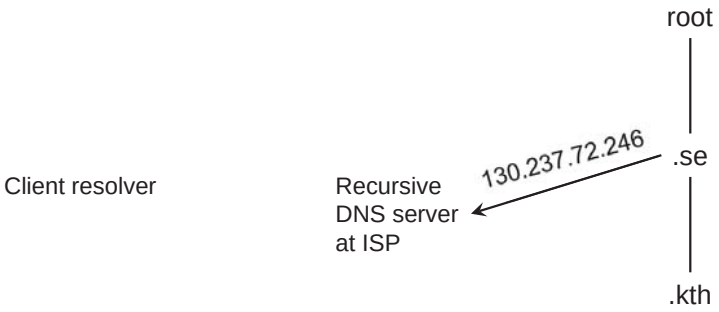

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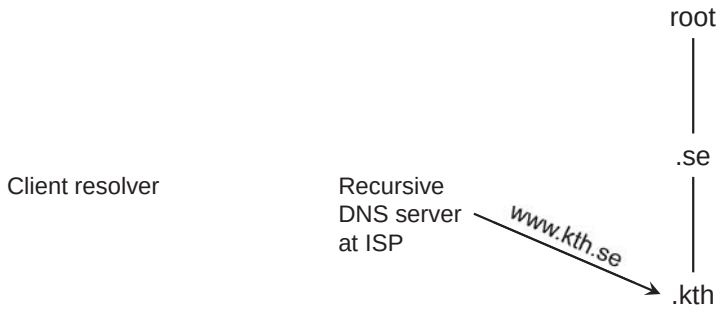

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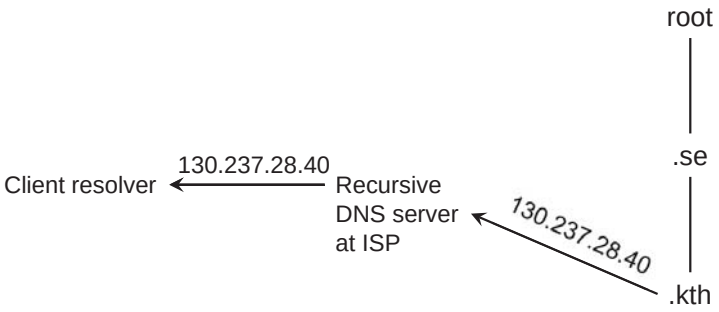

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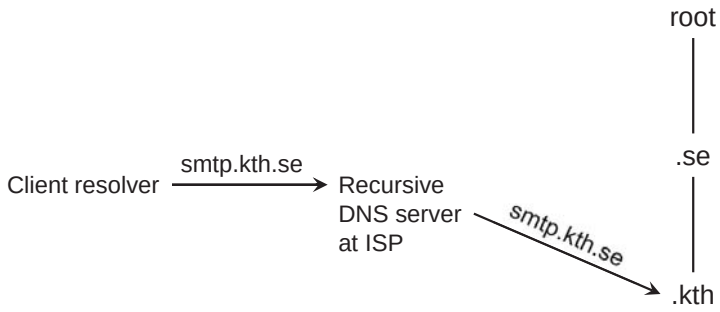

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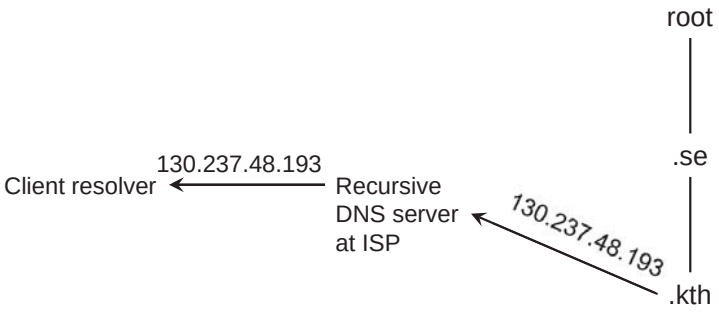

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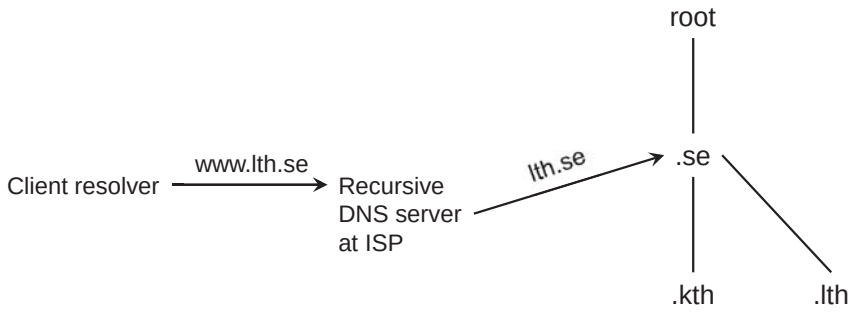

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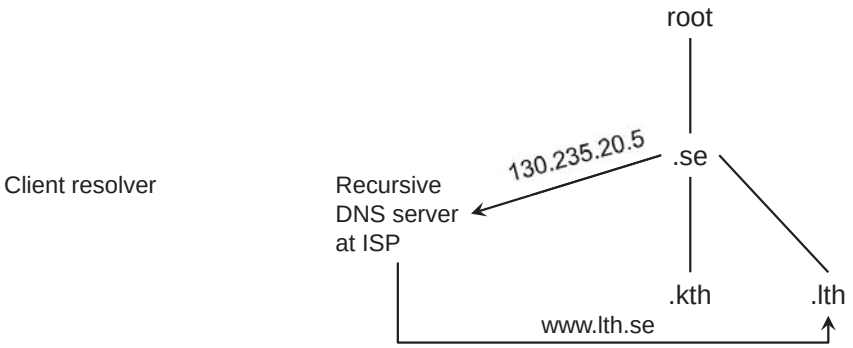

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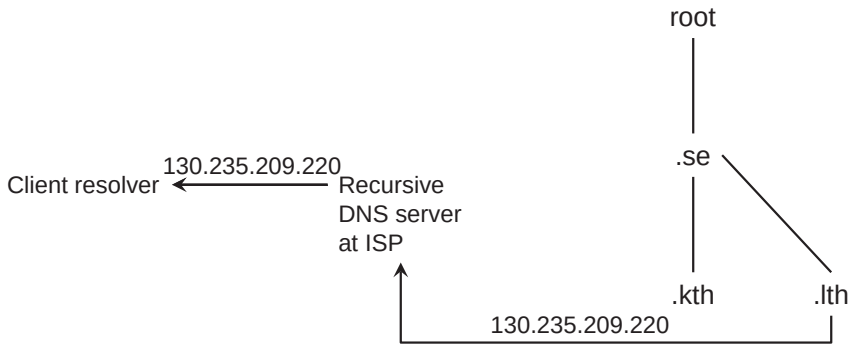
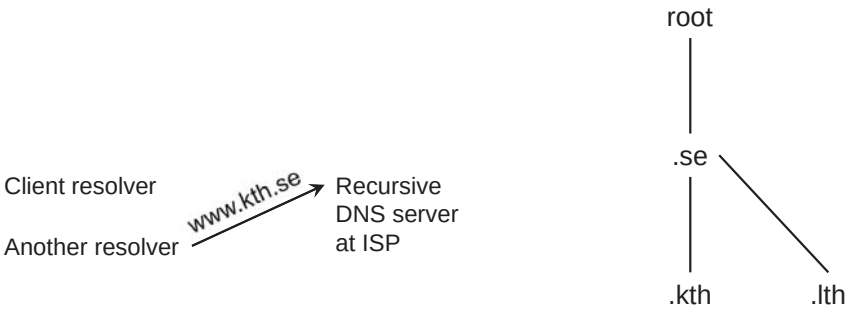


DNS resolution



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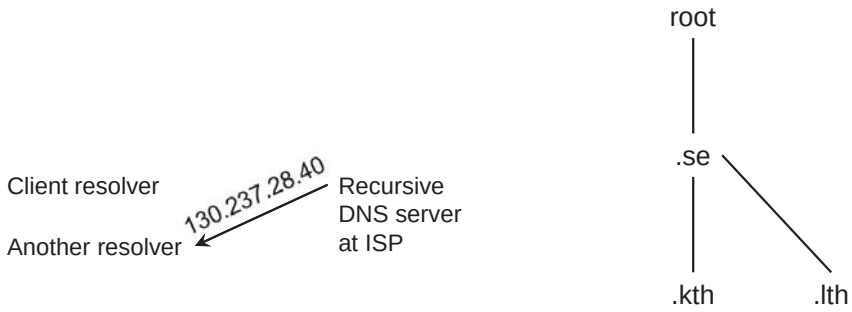

The recursive, or caching-only DNS server, is essential for performance.

DNS infrastructure

- There are 13 DNS ***logical root servers*** in operations.
- Each *logical root server* is replicated at up to 20 locations world wide, but share the same IP-address.
- An ISP have several recursive DNS servers that are used by their subscribers (i.e. you).
- Due to caching, there could be delays in updates to up to 24 hours.
- DNS servers can be used a 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 requires 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)
```


Summary

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

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
  :
  :
```