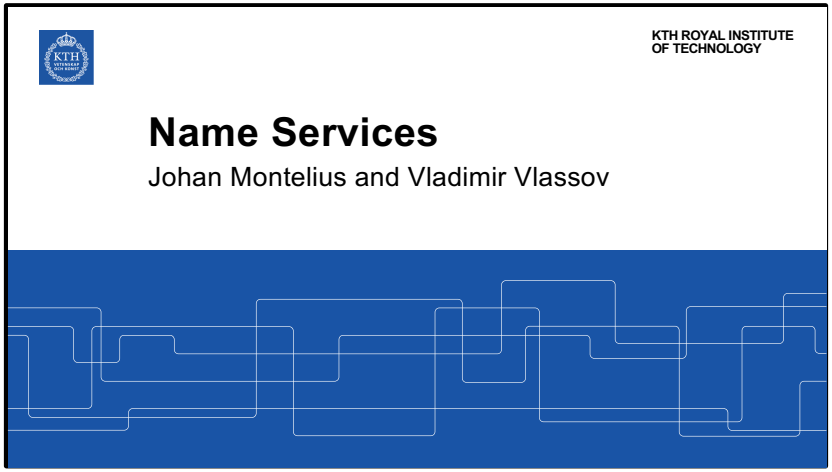
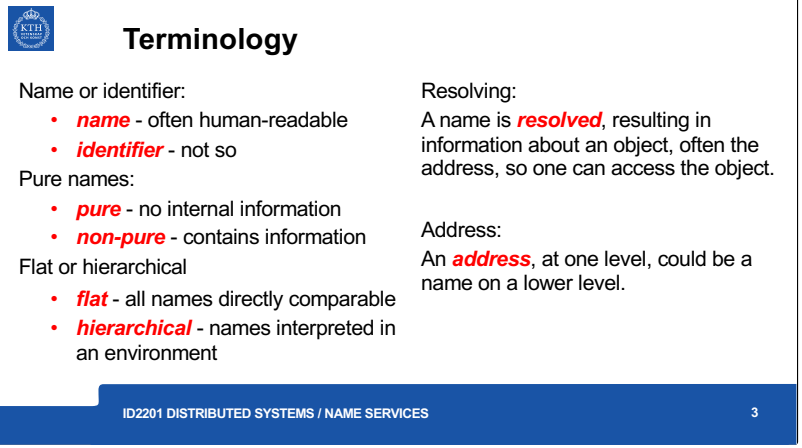
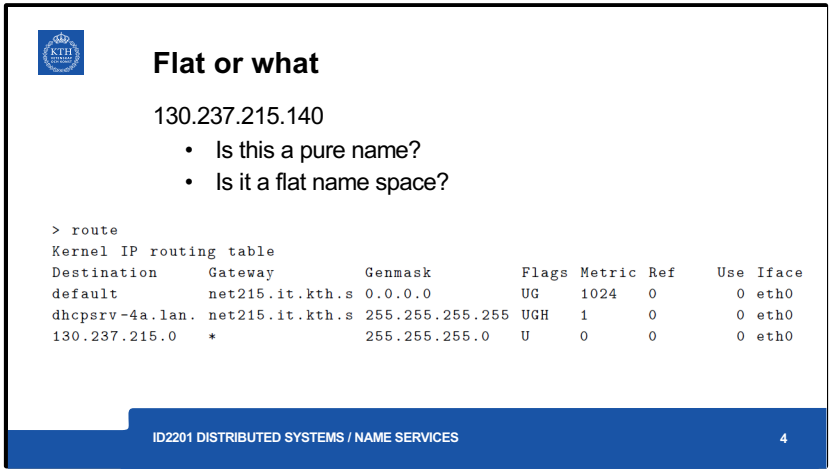

KTH ROYAL INSTITUTE
OF TECHNOLOGY
Name Services
Johan Montelius and Vladimir Vlassov

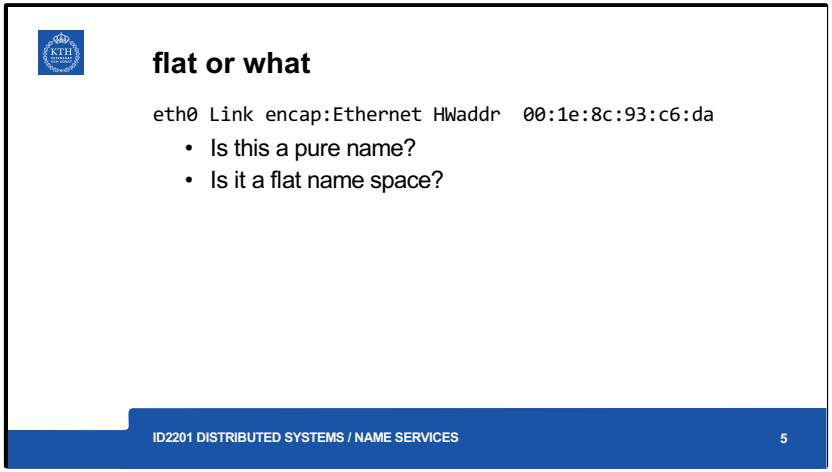
What's a name service

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.
ID2201 DISTRIBUTED SYSTEMS / NAME SERVICES
3



IP address is non-pure name because it contains a location information (class, net id and host id)



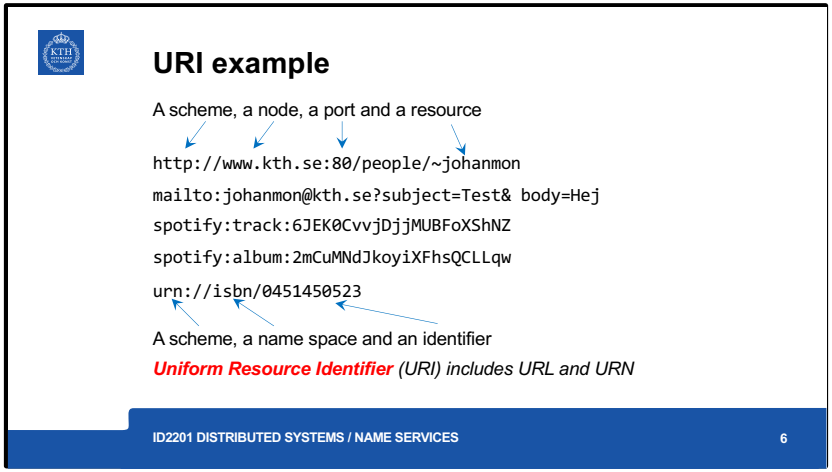
http://www.aboutlinux.info/2006/11/ifconfig-dissected-and-demystified.html

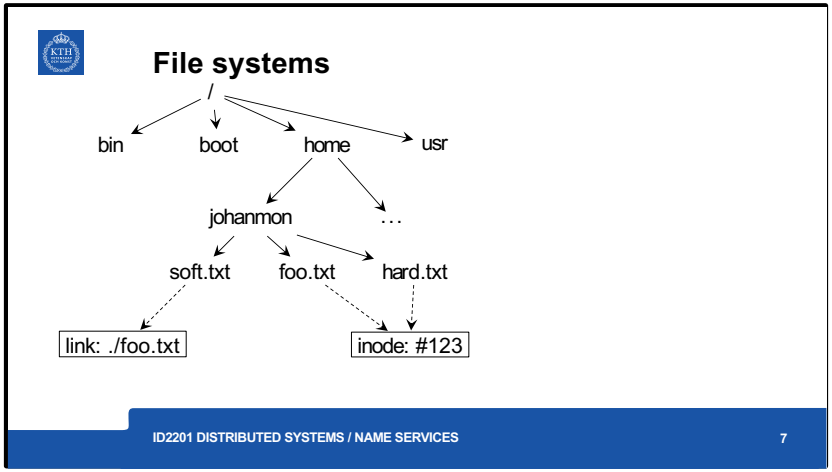
eth0 is the first ethernet interface

Link encap:Ethernet - This denotes that the interface is an Ethernet-related device

HWaddr 00:1e:8c:93:c6:da - This is the hardware address or MAC address unique to each Ethernet card manufactured. Usually, the first

half of this address will contain the manufacturer code, which is common for all Ethernet cards manufactured by the same manufacturer. The rest will denote the device Id, which should not be the same for any two devices manufactured at the same place.

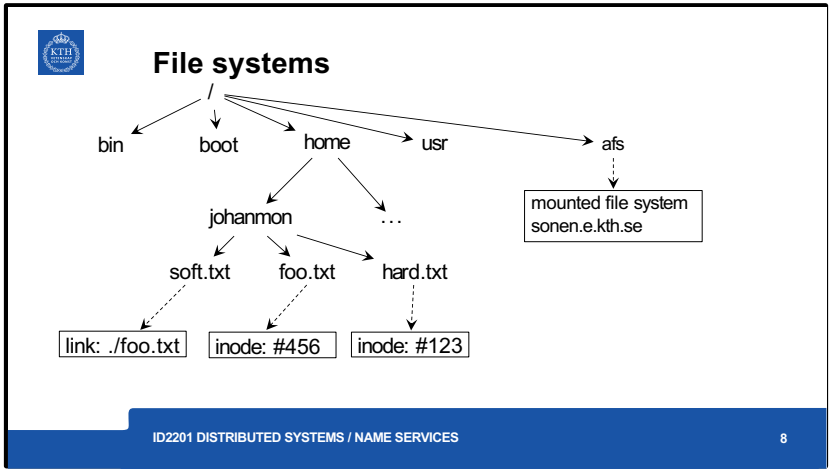

URI example
A scheme, a node, a port and a resource
http://www.kth.se:80/people/~johanmon
mailto:johanmon@kth.se?subject=Test& body=Hej
spotify:track:6JEK0CvvjDjjMUBFoXShNZ
spotify:album:2mCuMNdJkoyiXFhsQCLLqw
urn://isbn/0451450523
A scheme, a name space and an identifier
Uniform Resource Identifier (URI) includes URL and URN
ID2201 DISTRIBUTED SYSTEMS / NAME SERVICES
6



In a Unix-style file system, the **inode** is a data structure used to represent a filesystem object, which can be one of the various things, including a file or a directory. **Each inode stores the attributes and disk block location(s) of the filesystem object's data.** An inode is referenced by number.

A **hard link** to a file will point to the place where the file is stored or the

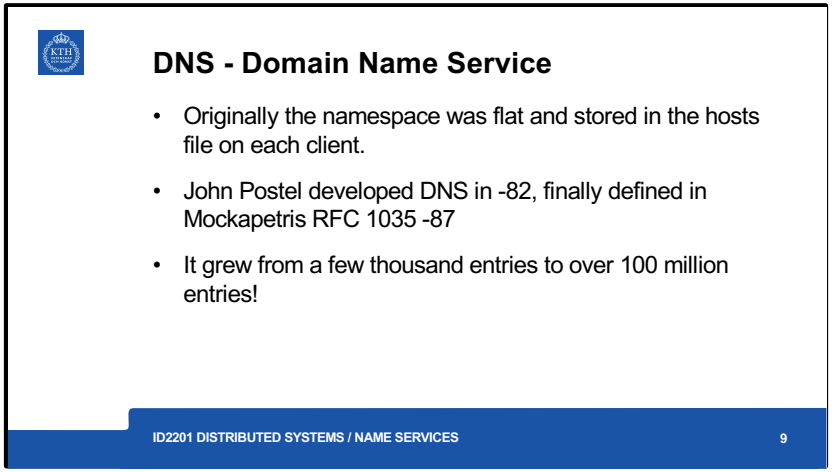
inode of that file. A **symbolic (soft) link** will point to the actual file itself. Because file “soft.txt" points to file “foo.txt" itself, if file "foo.txt" is deleted, then file “soft.txt" will have nothing to point to; it is also deleted.



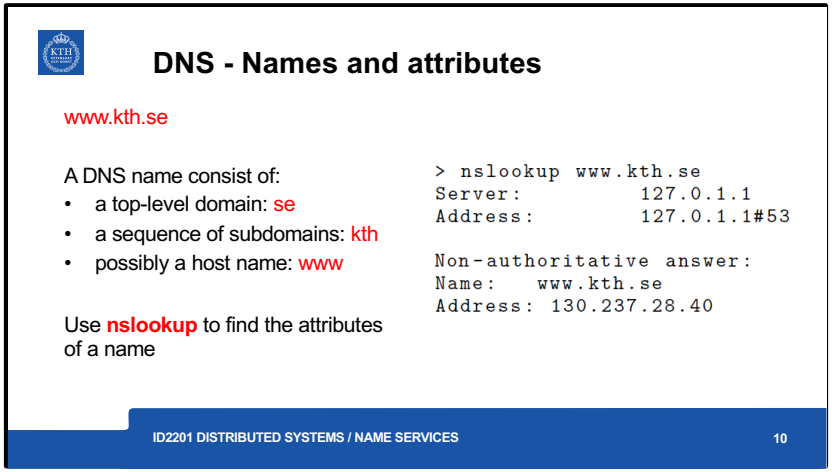
In a Unix-style file system, the **inode** is a data structure used to represent a filesystem object, which can be one of the various things, including a file or a directory. **Each inode stores the attributes and disk block location(s) of the filesystem object's data.** An inode is referenced by number.

A **hard link** to a file will point to the place where the file is stored or the

inode of that file. A **symbolic (soft) link** will point to the actual file itself. Because file “soft.txt" points to file “foo.txt" itself, if file "foo.txt" is deleted, then file “soft.txt" will have nothing to point to; it is also deleted.



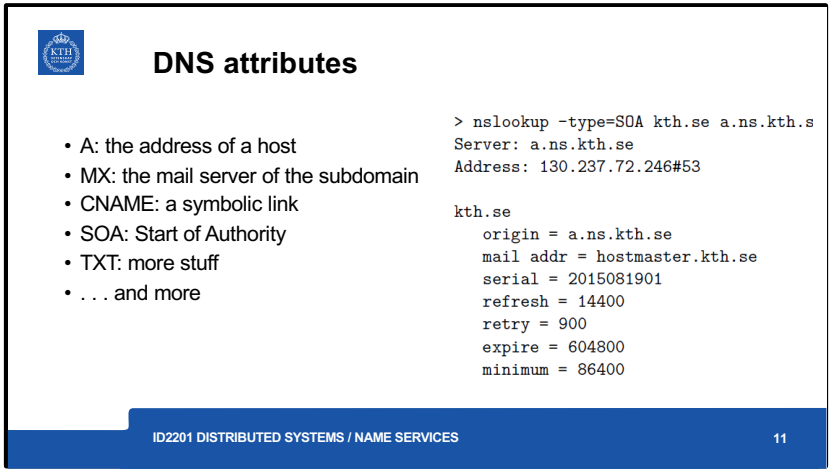
Paul V. Mockapetris is an American computer scientist and Internet pioneer who, together with Jon Postel, invented the Internet Domain Name System. The Domain Name System is a name service design whose central naming database is used across the Internet.



A naming domain is a namespace for which there exists a single overall administrative authority responsible for assigning names within it. This authority is in overall control of which names may be bound within the domain, but it is free to delegate this task. **Domains in DNS are collections of domain names**; **syntactically, a domain's name is the common suffix** within it. Otherwise, it cannot be distinguished from, for example, a computer name.

The administration of domains may be devolved to subdomains. The domain dcs.qmul.ac.uk – the Department of Computer Science at the Queen Mary University of London in the UK – can contain any name the department wishes. But the domain name dcs.qmul.ac.uk itself had to be agreed with the college authorities, who

domains) in use across the Internet were: com – Commercial organizations; edu – Universities and other educational institutions; gov – US governmental agencies; mil – US military organizations; net – Major network support centers; org – Organizations not mentioned above; int – International organizations.



Name servers store zone data in files in one of several fixed types of resource records, e.g., A, MX, CNAME, …

-type=SOA SOA: Specifies the start-of-authority for a DNS zone.

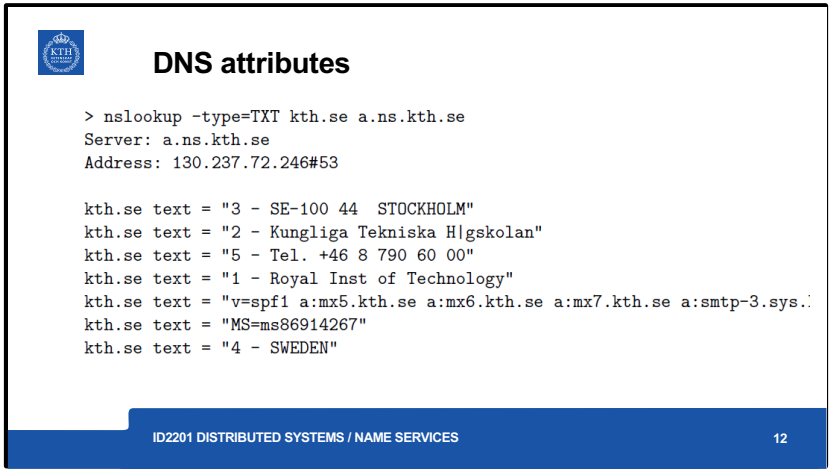
The SOA ("Start Of Authority") Record for a domain provides technical information about the domain. It can be queried with the option -type=soa.

origin: The authority from which the information originated.

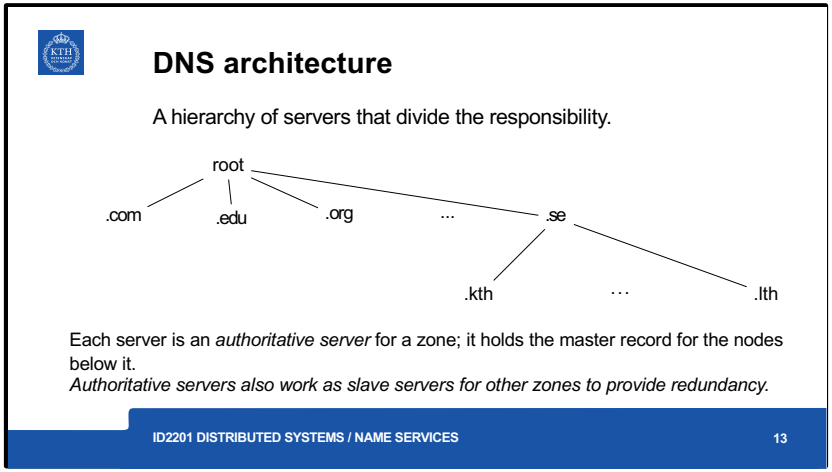
mail addr: The email address of the domain administrator (The first dot would be an @ symbol in an email address, so here the email address is hostmaster@kth.se).
serial: Revision data for this information, in the form YYYYMMDDNN. Here, the information is current as of August 19, 2015; 01 means it was the first revision made that day.

the secondary KTH name server's information is never more than 4 hours (14400 seconds) out of date.
retry: The secondary nameserver will wait this many seconds before attempting to reconnect to the primary name server after a failed attempt.
expire: The secondary nameserver's cache of the primary nameserver's

the last refresh.



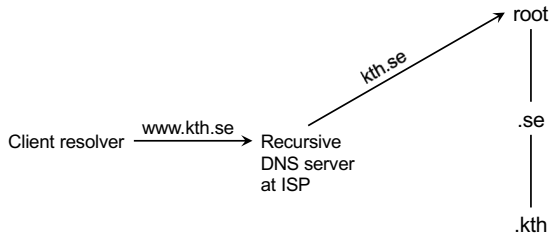
-type=TXT Specifies the text information.
A TXT record (short for text record) is a type of resource record in the Domain Name System (DNS) used to provide the ability to associate some arbitrary and unformatted text with a host or other name, such as human-readable information about a server, network, data center, and other accounting information.



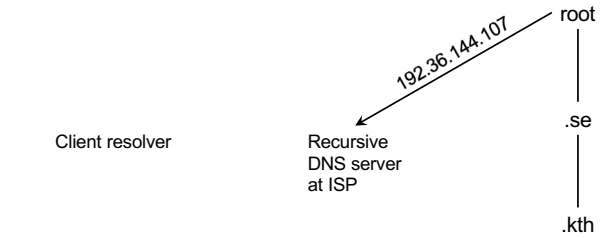
The problems of scale are treated by a combination of partitioning the naming database and replicating and caching parts of it close to the points of need. The DNS database is distributed across a logical network of servers. Each server holds part of the naming database – primarily data for the local domain. Queries concerning computers in the local domain are satisfied by servers within that domain. However, each server records the domain names and addresses of other name

servers so that queries about objects outside the domain can be satisfied.

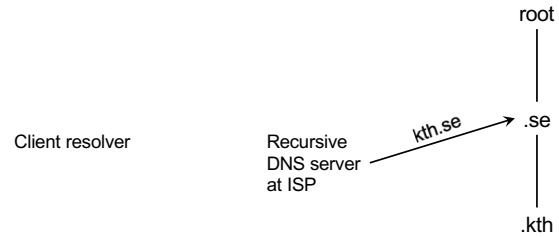
DNS resolution



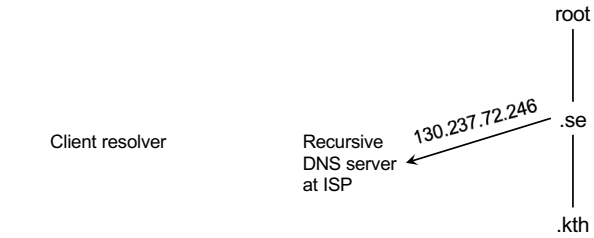
DNS resolution



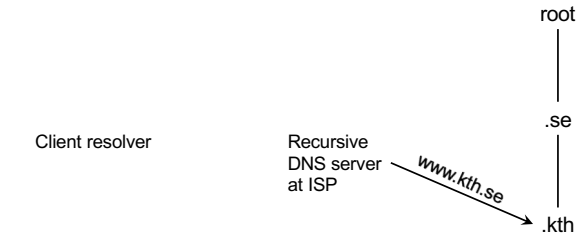
DNS resolution



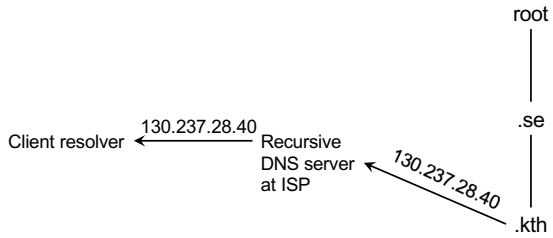
DNS resolution



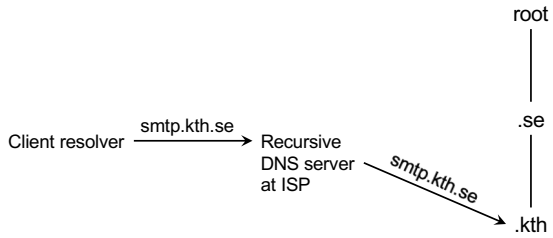
DNS resolution



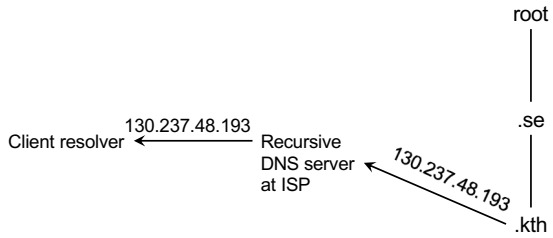
DNS resolution



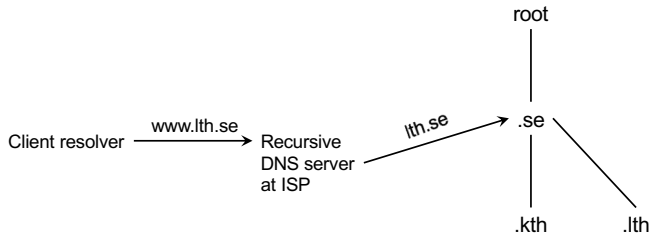
DNS resolution



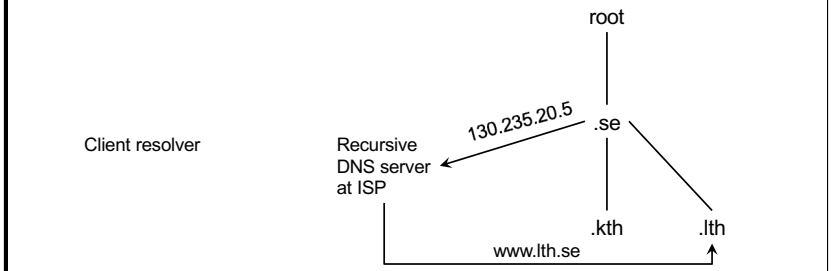
DNS resolution



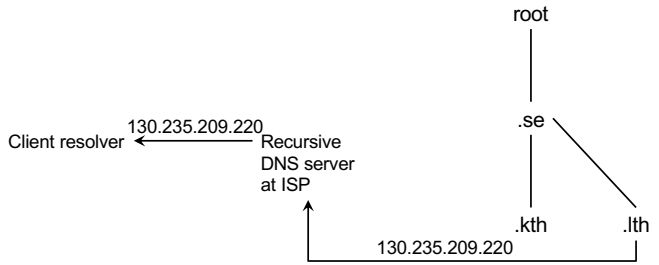
DNS resolution



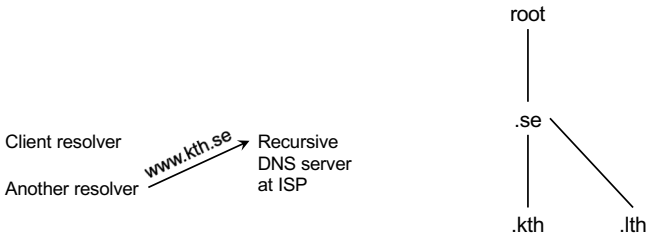
DNS resolution



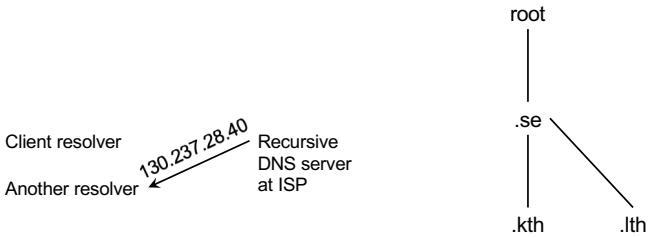
DNS resolution



DNS resolution



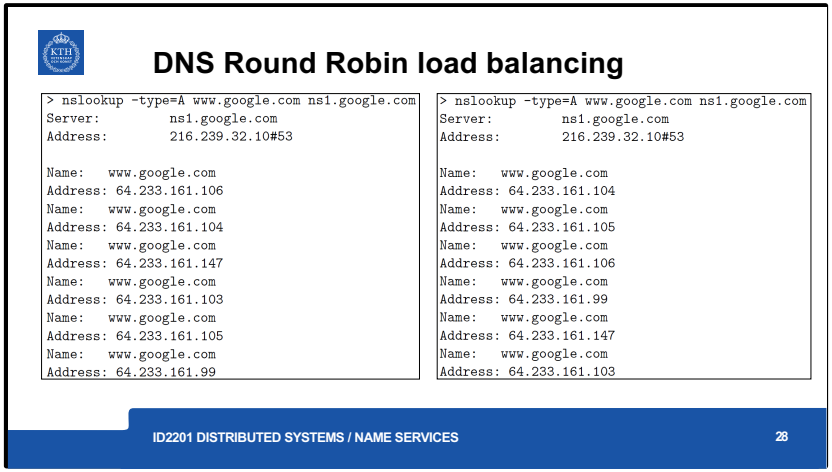
DNS resolution



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.

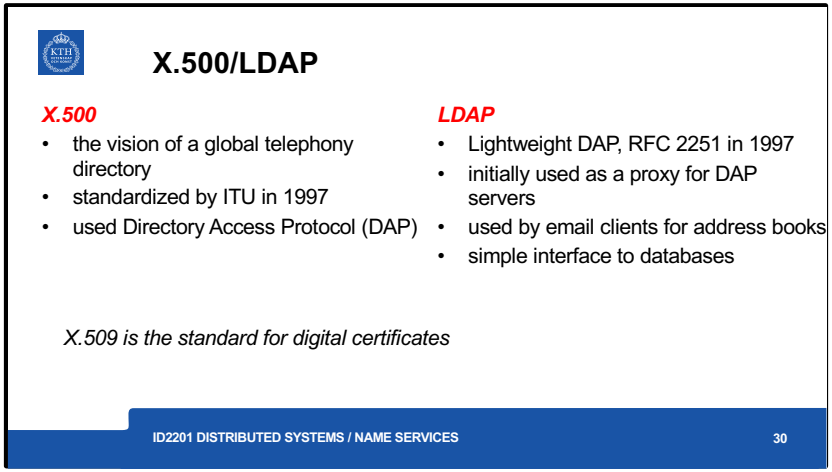


-Type=A Specifies a computer's IP address

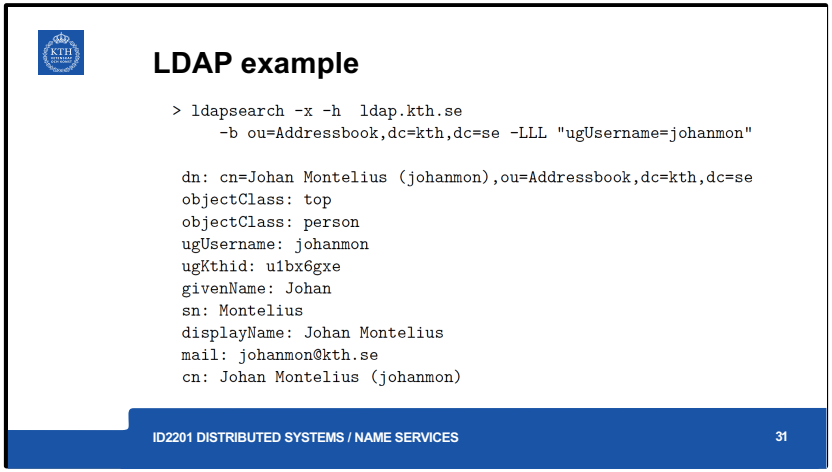
Directory service

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.



ITU: International Telecommunication Union is the United Nations specialized agency for information and communication technologies – ICTs.



The **ldapsearch** command-line utility can locate and retrieve directory entries. This utility opens a connection to the specified server using the specified distinguished name and password and locates entries based on a specified search filter. The search scope can include a single entry, an entry's immediate subentries, or an entire tree or subtree.

Search results are returned in LDIF format.

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