The Domain Name System

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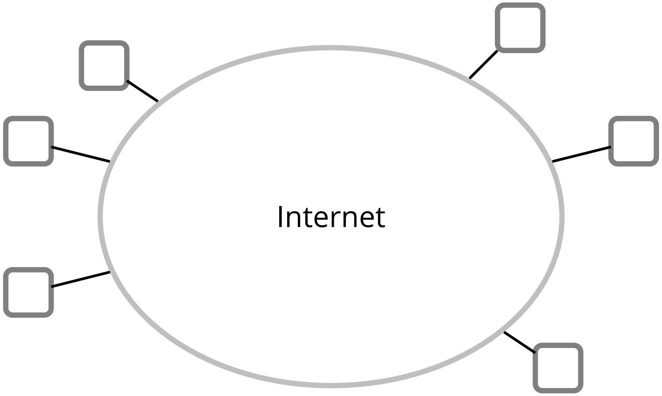
Outline

- IP addresses and host names
- DNS architecture
- DNS process
- DNS requests/replies

End Systems

Internet applications involve *end system communication*



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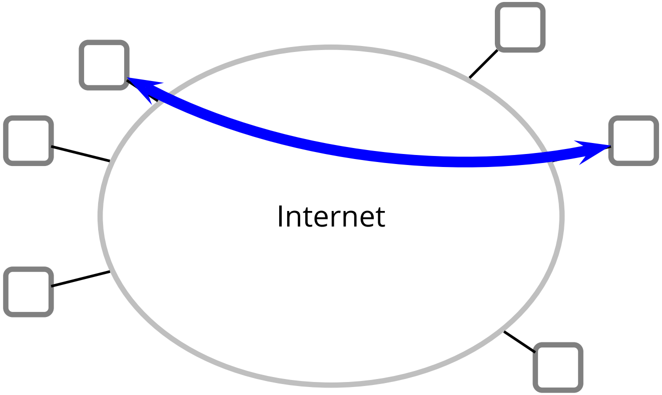

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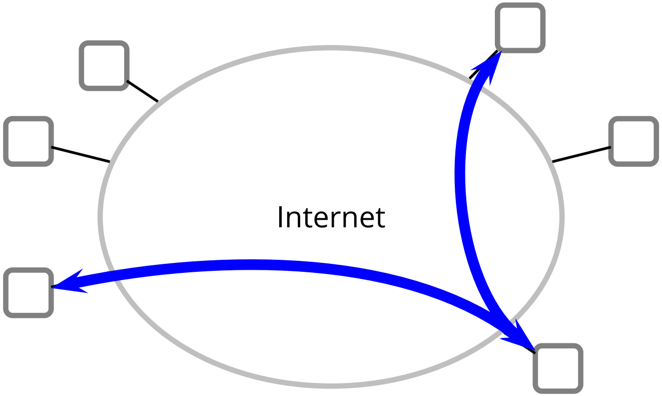

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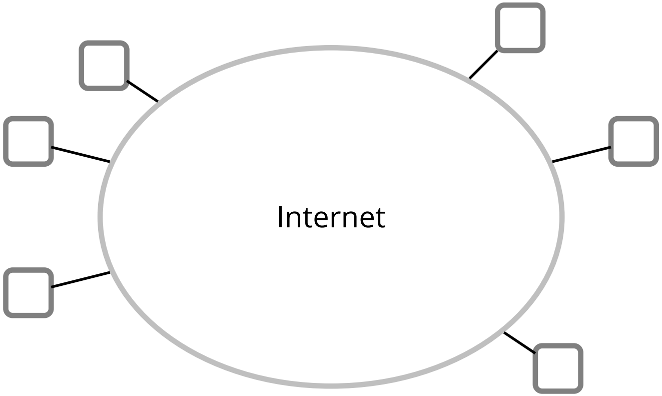

How does one end system *address* another end system?

IP Addresses

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  - computers (e.g., routers) are good at processing bits
  - especially in small packs of a size that is a power of two
- *Disadvantages*
  - not practical for use by *people*
  - i.e., not mnemonic
  - e.g., “look it up on 64.233.183.104!”

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- Solution: *domain name system (DNS)*
  - host names
  - e.g., www.google.com
- Primary function of the domain name system

  $$\textit{name} \longrightarrow \textit{IP address}$$

  maps a name to an IP address

Host Names

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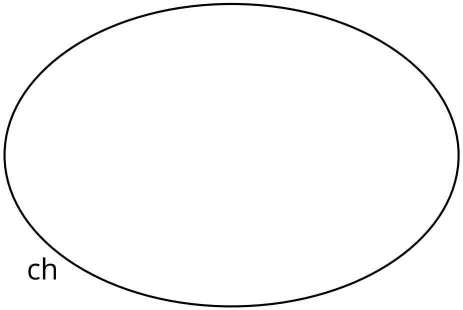

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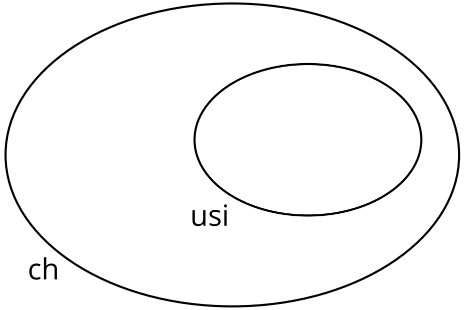

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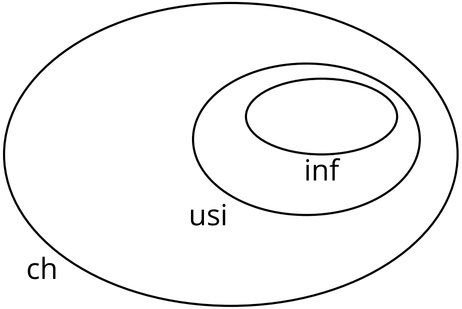

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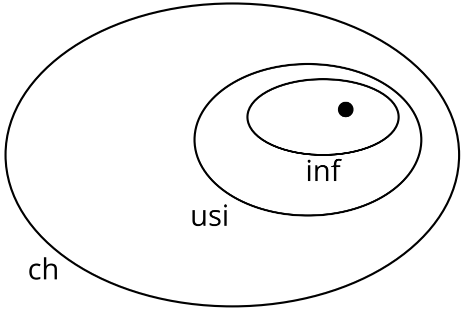

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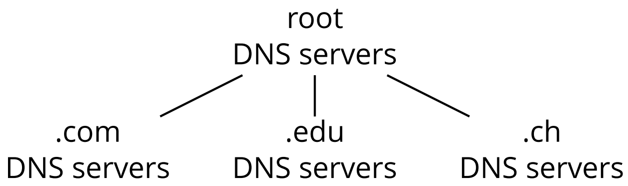

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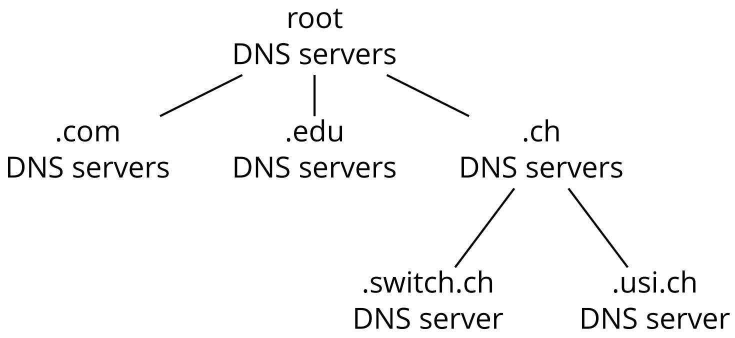

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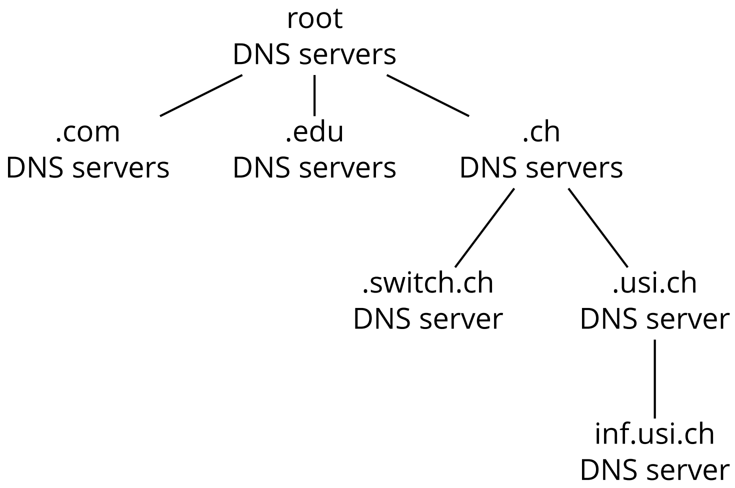

DNS Architecture

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- Most root “servers” as well as servers at lower levels are themselves implemenented by a distributed set of machines

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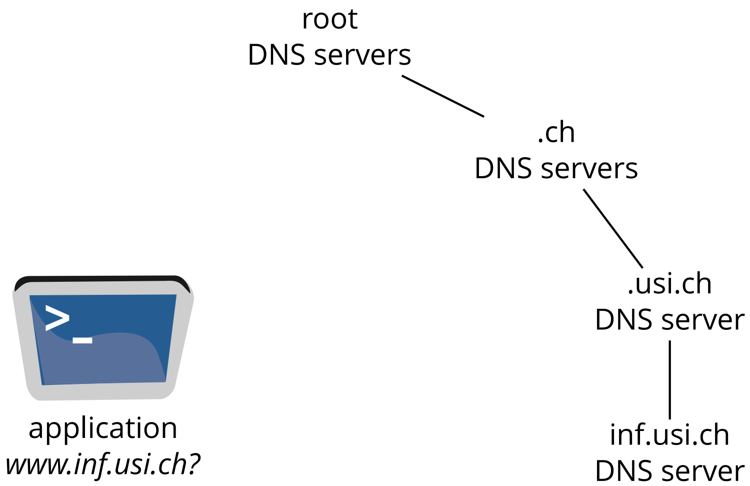

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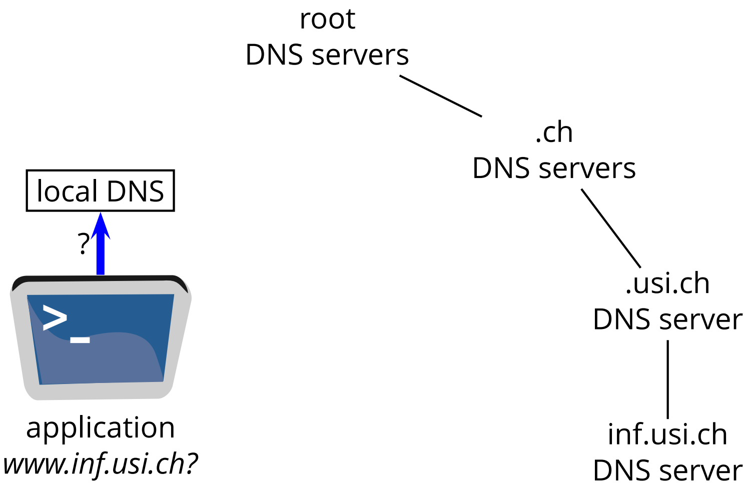

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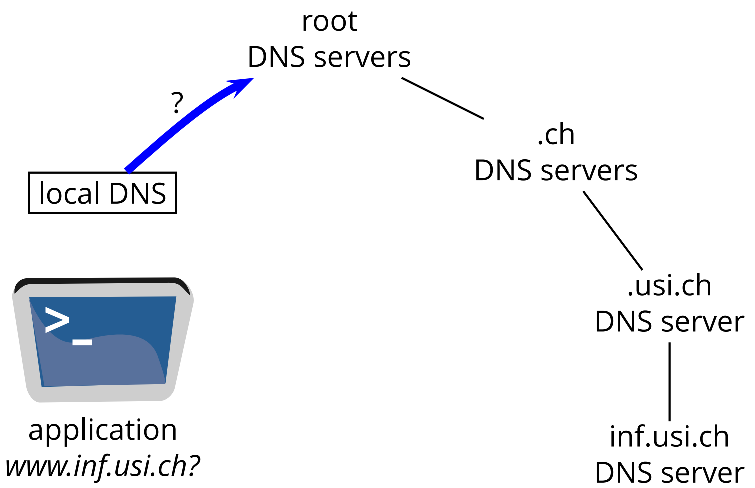

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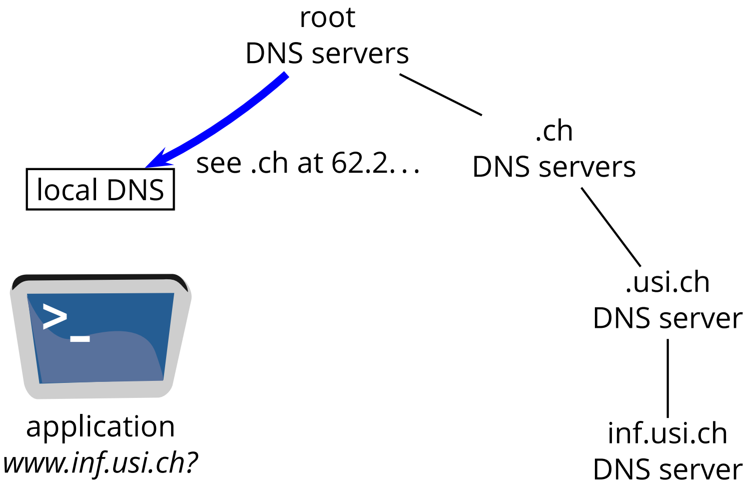

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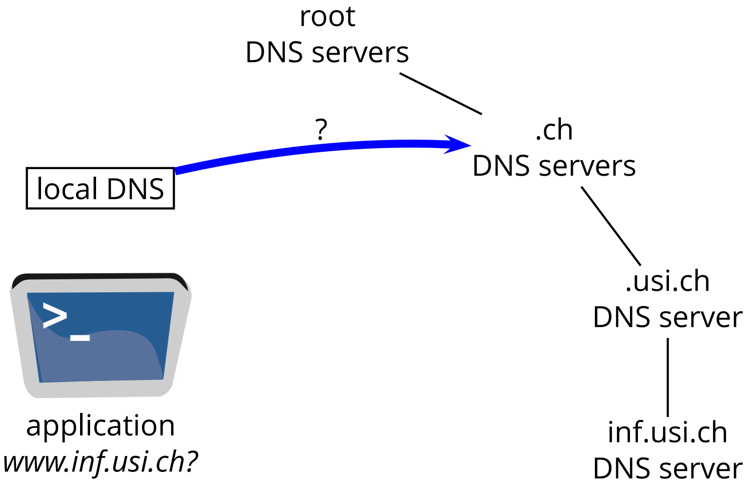

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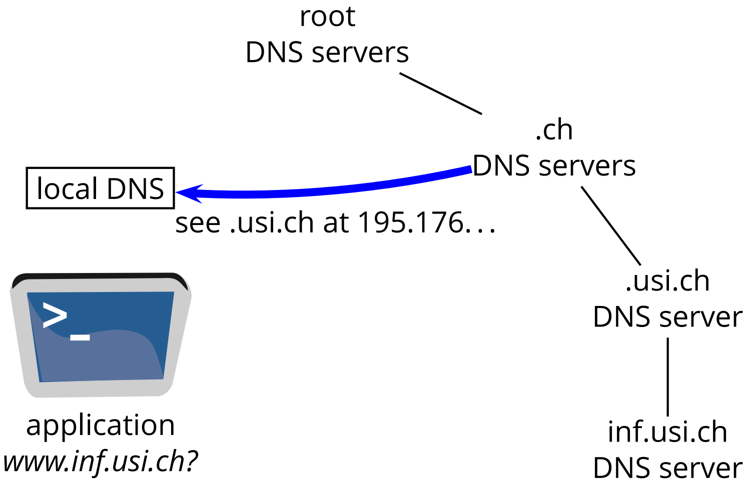

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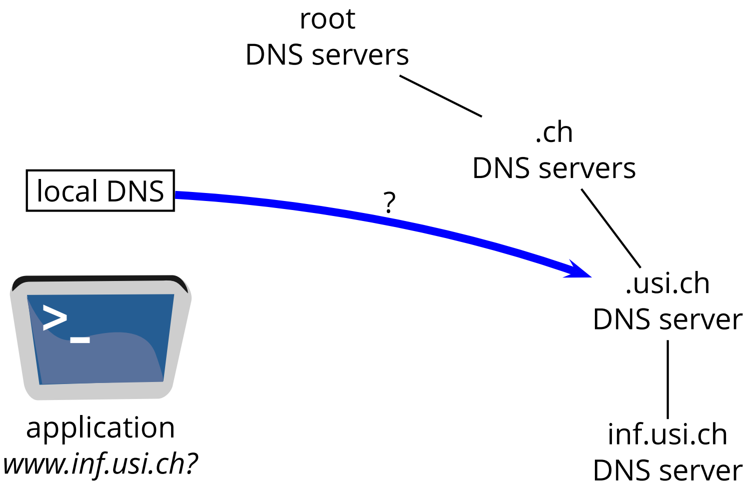

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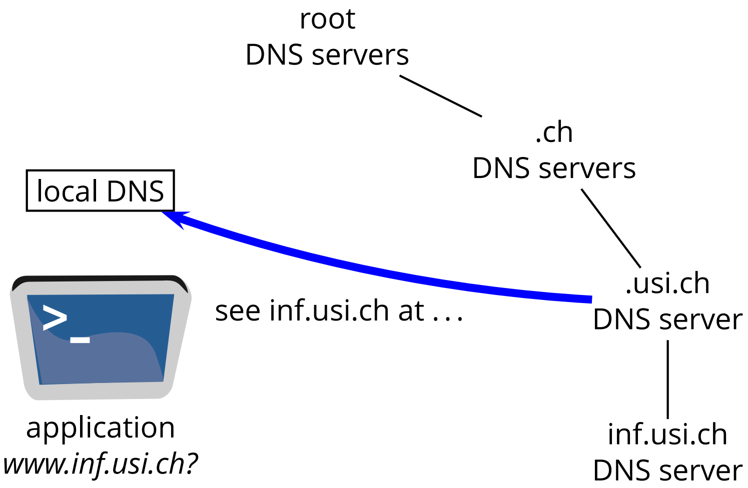

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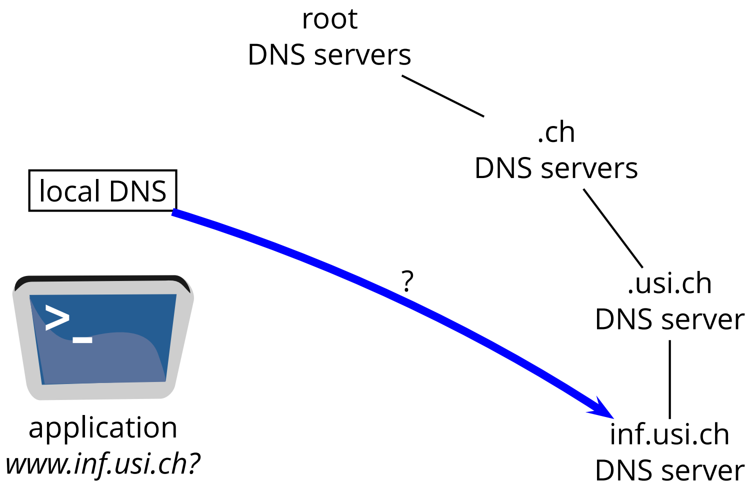

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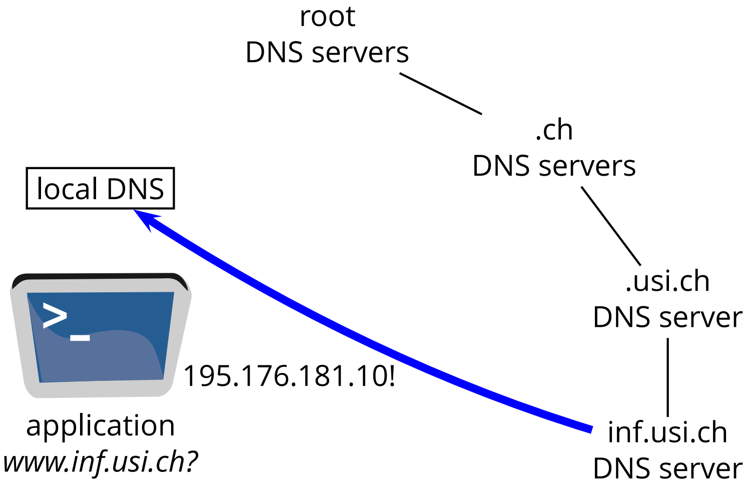

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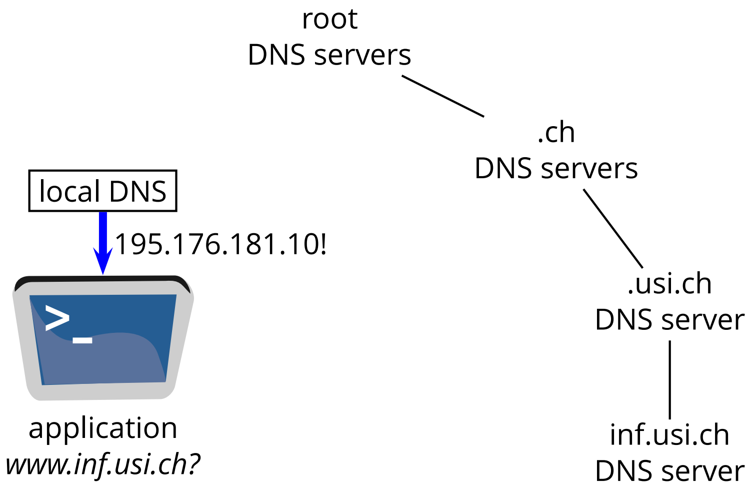

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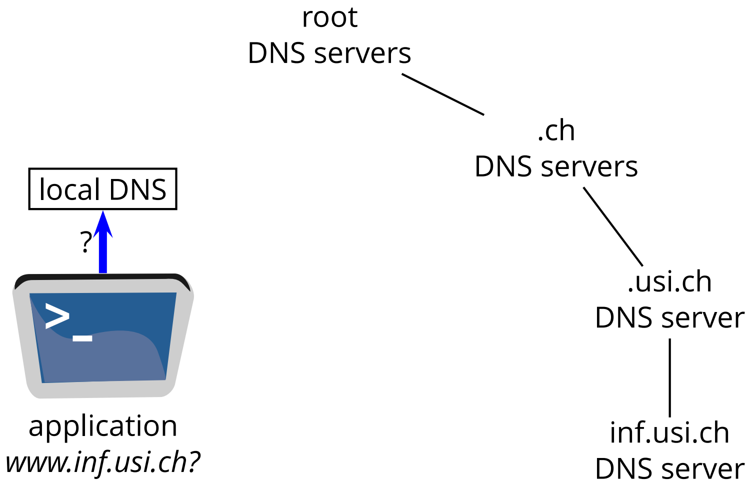

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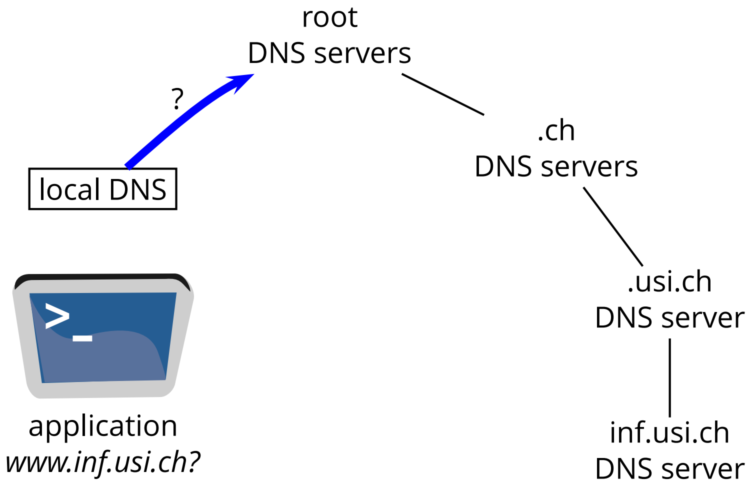

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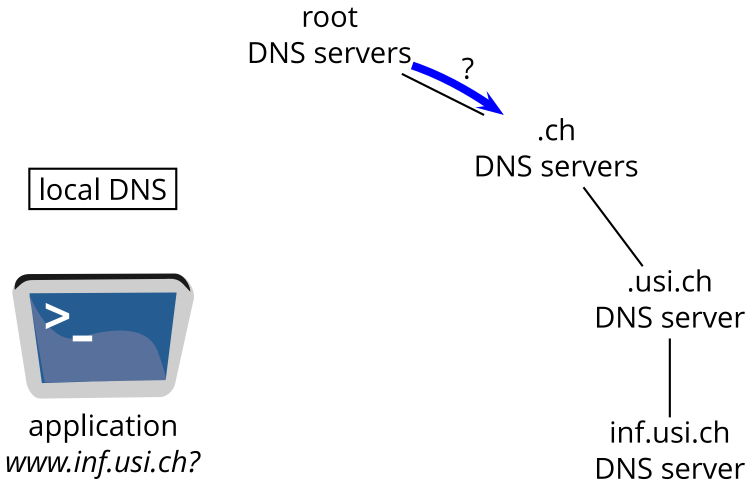

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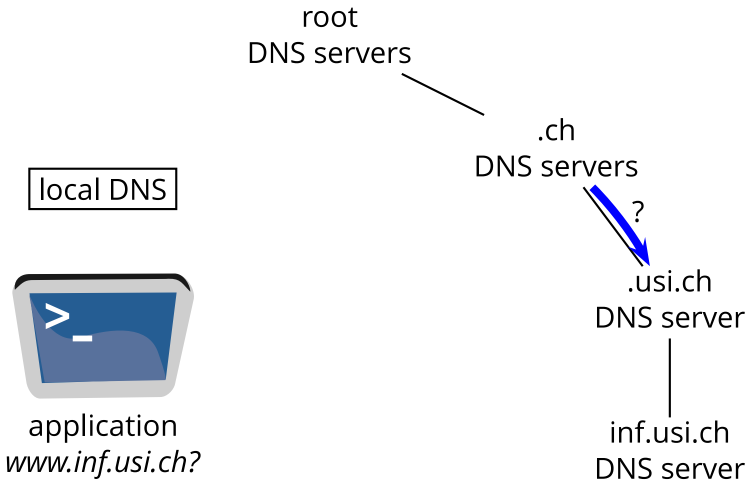

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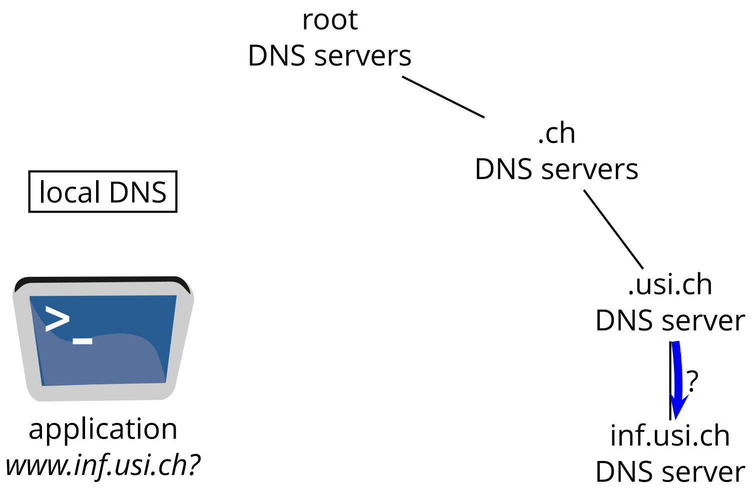

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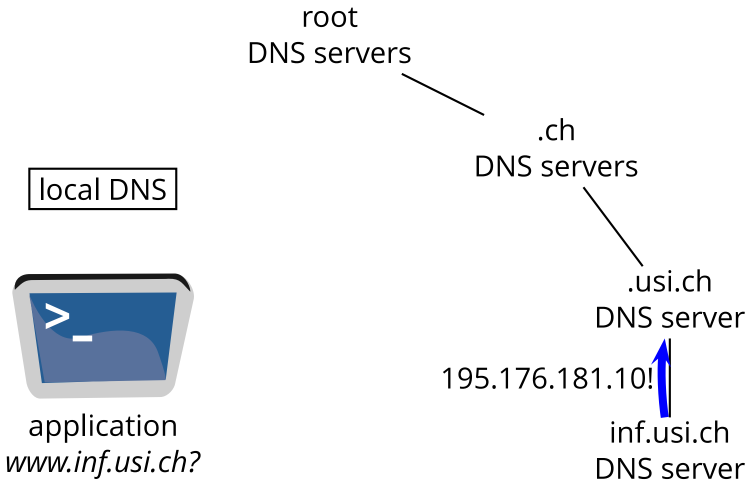

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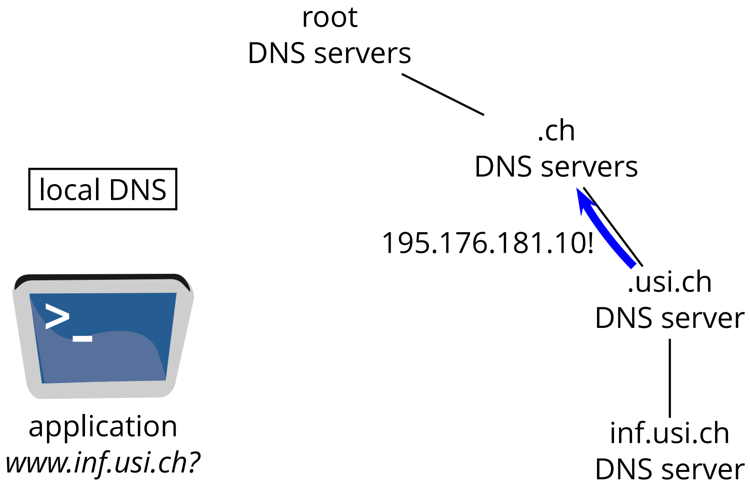

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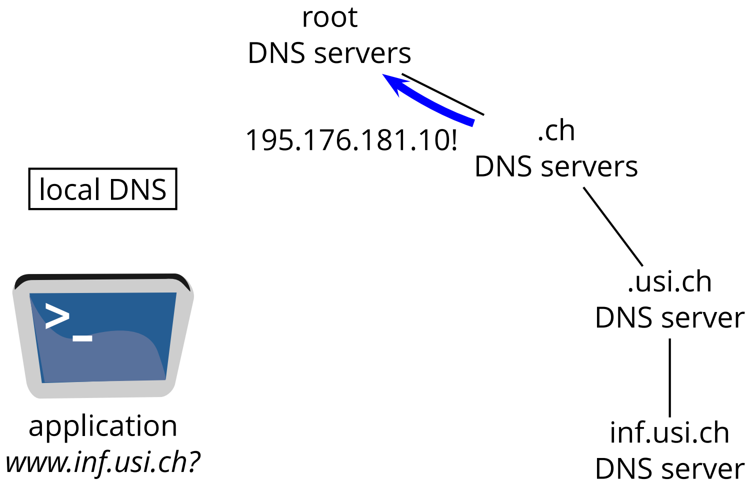

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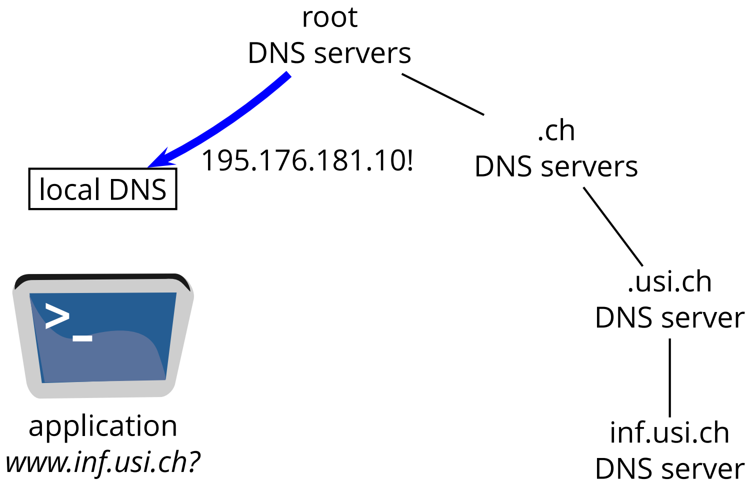

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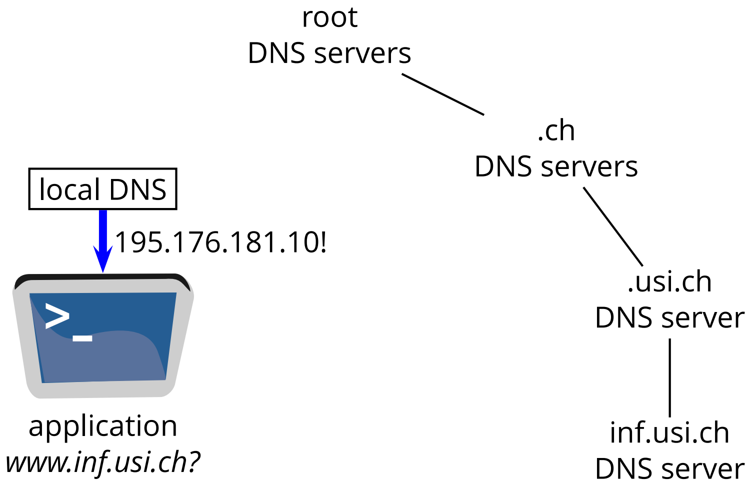

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- It is a perfect demonstration of the “end-to-end principle”
  - it implements a (crucial) network functionality at the end-system level
- Any idea how to improve the performance and reliability of DNS?

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  - improve the performance of DNS
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- How does caching work in DNS?
- Same as always
  - a DNS server may cache a reply (i.e., the mapping) for a name *n*
  - if the server receives a subsequent request for *n*, it may respond directly with the cached address, even though the server is not the authoritative server for that domain

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name	*value*	*type*	*ttl*
www.inf.usi.ch	195.176.181.10	A	...
research.inf.usi.ch	195.176.181.11	A	...
...	...	...	...

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- *Name* and *value* have the intuitive meaning
- What about *type*?

DNS Query Types

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usi.ch	one.ti-edu.ch	NS	...

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CNAME this is a query for a ***canonical name***. The canonical name is the "primary" name of a host. A host may have one or more mnemonic *aliases*. For example,

name	*value*	*type*	*ttl*
www.google.com	www.l.google.com	CNAME	...

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MX this is a query for the ***mail exchange*** server for a given domain, so *name* is a host or domain name and *value* is the name of the mail server that handles (incoming) mail for that host or domain. For example,

name	*value*	*type*	*ttl*
lu.usi.ch	spamfilter.usilu.net	MX	. . .

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...several other types

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- Runs on top of UDP (port 53)
- DNS has ***query*** and ***reply*** messages
  - since DNS is connectionless, queries and replies are linked by an identifier
- Both queries and replies have the same format
  - *a DNS message can carry queries and answers*

DNS Message Format

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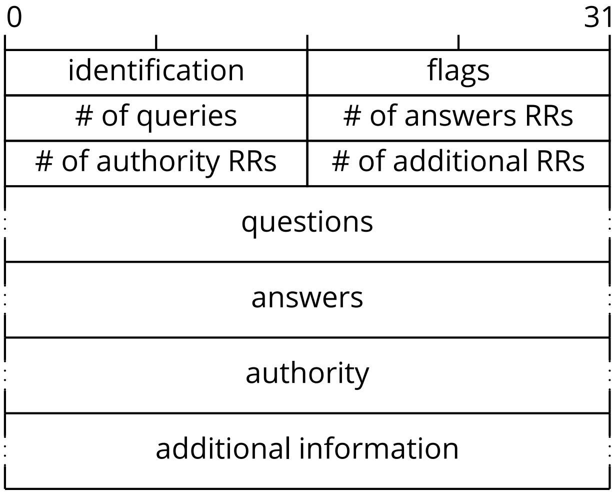
0
31
identification
flags
# of queries
# of answers RRs
# of authority RRs
# of additional RRs
questions
answers
authority
additional information