

DNS – Domain Name System

Seminar in distributed Computing 2007/08

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Overview

- Naming and Binding of Network Destinations
 - Terminology
 - Examples
 - Interpretation
- Development of the Domain Name System
 - Design
 - Surprises
 - Successes / Shortcomings
 - Conclusions
- Link between papers
- Things change 1988 <-> 2007

Naming and Binding

- Confusion about terminology
- Analogy to operating systems

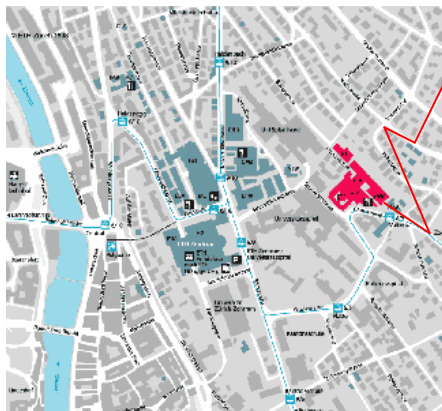
What are we looking at...

- 4 Objects:
 - Services
 - Nodes
 - Attachment Point
 - Routes
- 3 Bindings:
 - Service to node
 - Node to attachment point
 - Attachment point to route

Terminology

- Name
- Address
- Route

Via della Pace 11 (Piazza Navona)



Types of Network Destinations

- Service and users
 - Time of day, Notebook
- Nodes
 - PC on which a service runs, forwarding node
- Network attachment points
 - Ports of a network
- Paths
 - Run between network attachment points

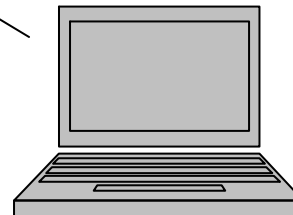
Name != Name

- Print name
- Machine Name
 - often called address
- Name – broad sense

“A-real-good-name”



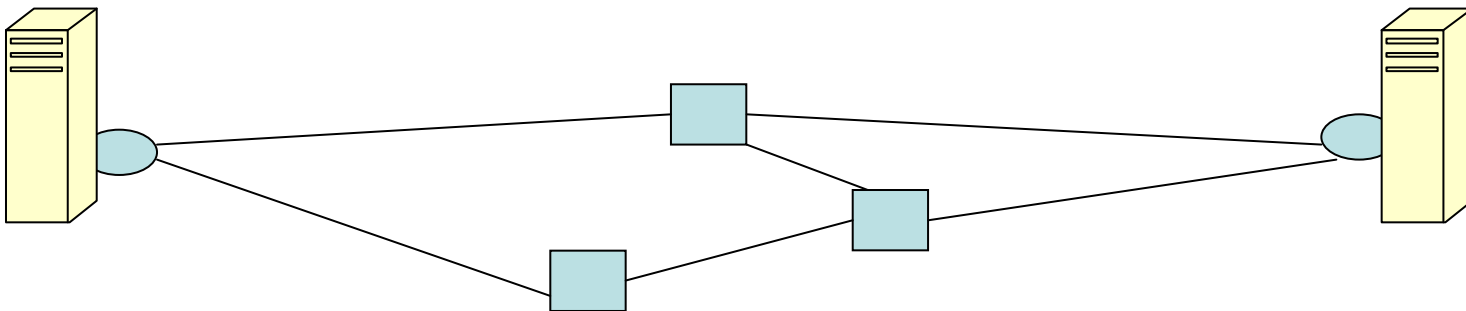
“01010010”





Binding among network destinations

- Service and Node
- Node and network attachment point
- Attachment points and paths

Preserve identity



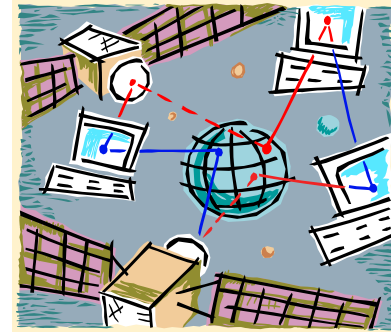
Concrete Examples

my-service.ch  128.12.4.6  08:00:00:3a:12:80

file  storage region  physical location

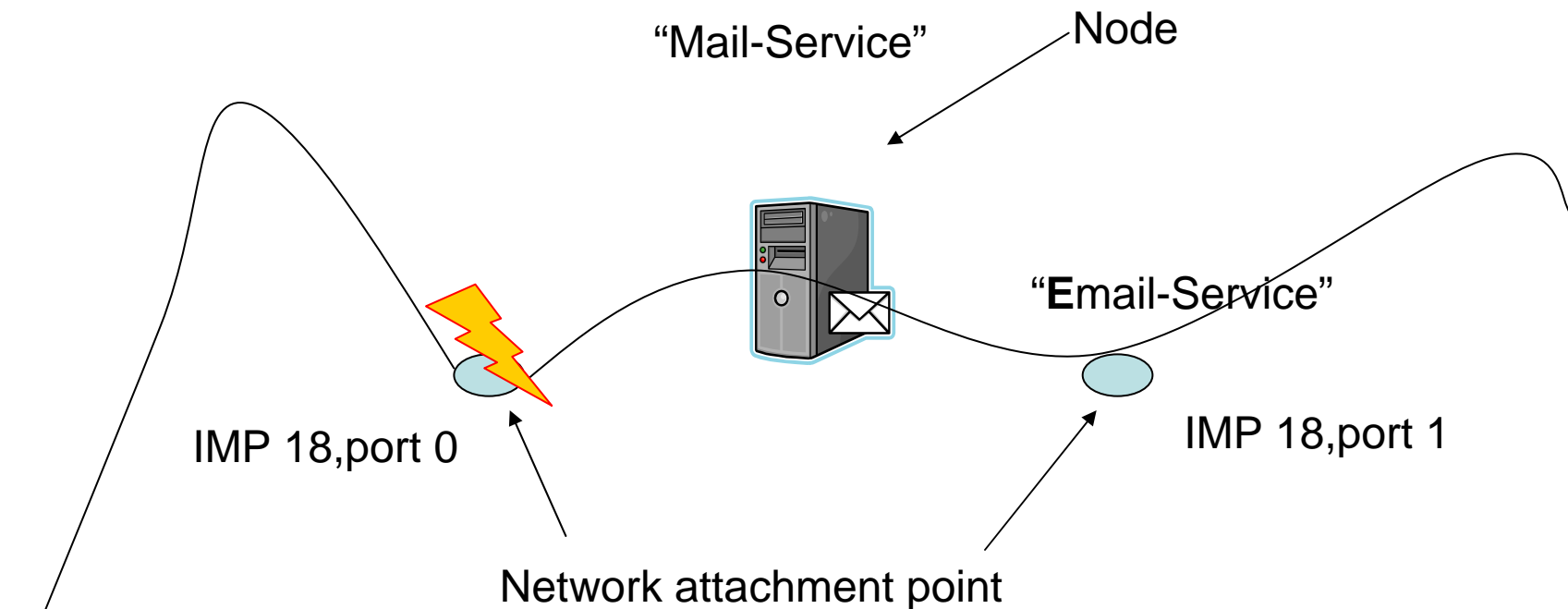
- Bind network attachment point to path?

Send data packet to Service



- Find node
- Find net. att. Point
- Find path
- Service name resolution
- Node name resolution
- Route service

Example: ARPANET NCP protocol






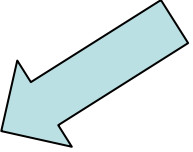
Confusion:

- Different Name

Authors Interpretation of terminology

- **Name** – human readable character string
- **Address:**

Service  Node  Network attachment point

■ **Route**  **Path** 

Development of the DNS

The following slides summarize the paper 'Development of the Domain Name System, Mockapetris, Dunlap, SIGCOMM 1988'

- Today – largest name service in operation
- History with hosts.txt

DNS Design assumptions

- Same information as hosts.txt
- Distribution
- No size limits
- Interoperate in many environments
- Performance

“Leanness Criterion”

Lean service

- More implementation effort and early availability

general distributed database

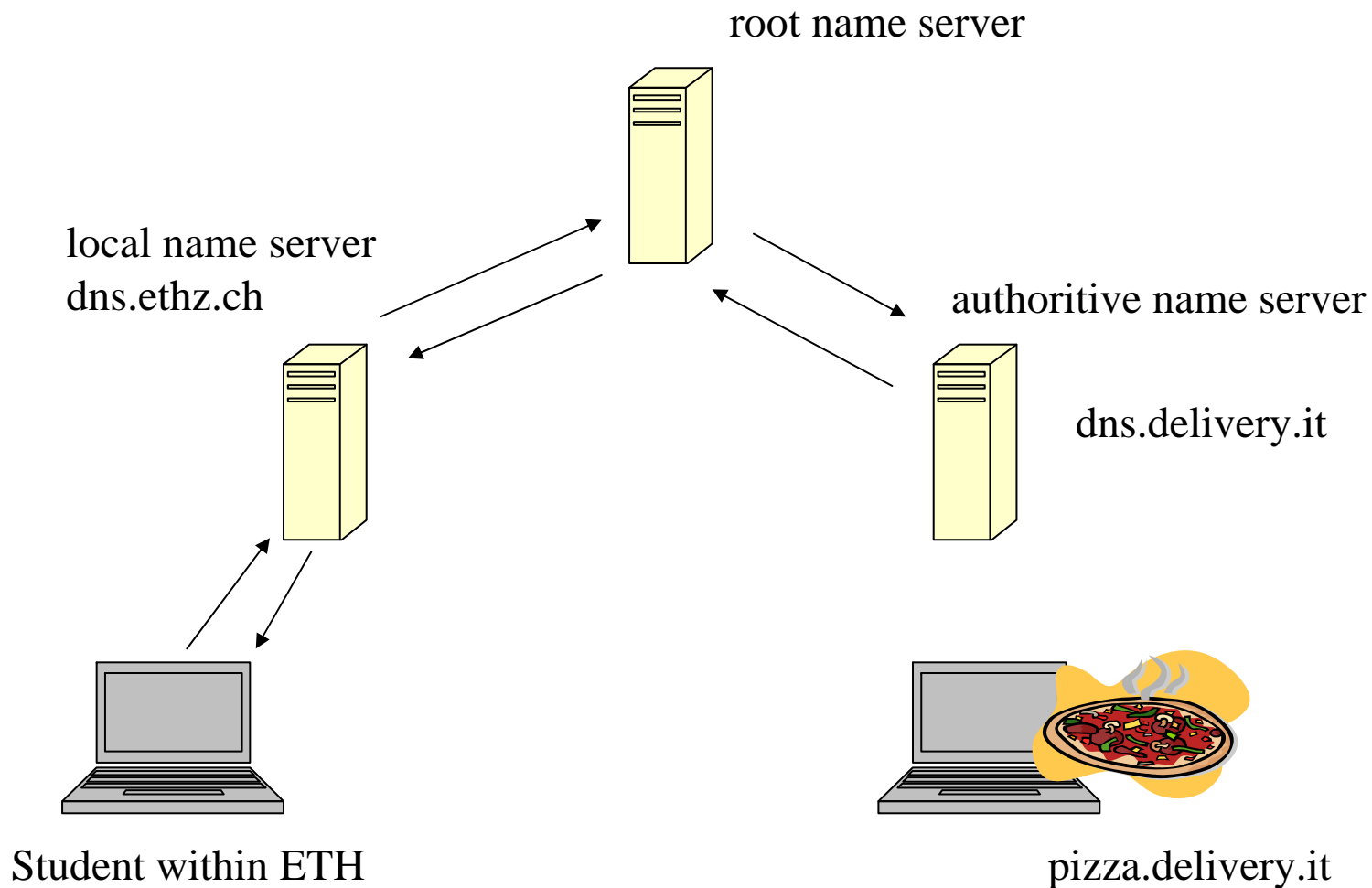
- More applications
- Greater functionality
- Operate in more environments

The following was omitted:

- Dynamic updates with atomicity
- Backup considerations

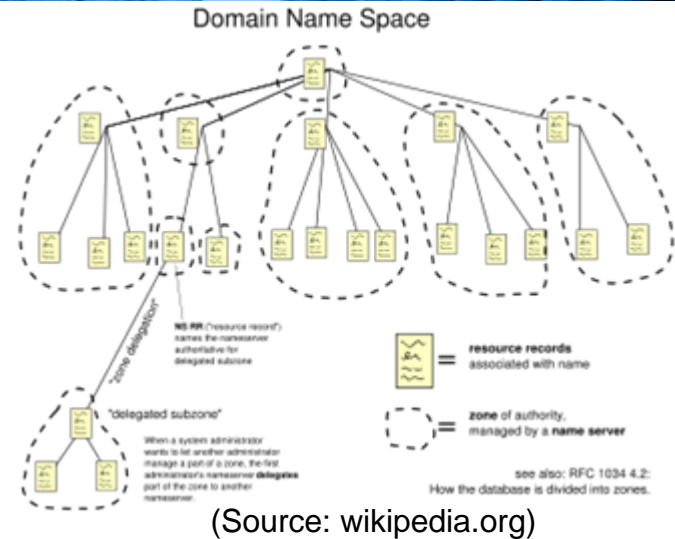


Quick “Refresher”



Design points

- Architecture
 - Name servers
 - Resolvers
- Hierarchical name space
- Database distribution
 - Zones
 - Caching



Resource Record

Name (Variable length)
Type (16 bits)
Class (16 bits)
TTL (32 bits)
Data Length (16 bits)
Data (Variable length)

Surprises for developers

- Semantics well-understood?
 - Example: multiple addr. for single host
- Performance of underlying network
 - Response time 30-60 sec (worst case)
- Negative caching

Successes

- Datagram access
 - ✓ 512 byte restriction, better performance than TCP
 - ✗ Develop/Refine retransmission strategies
- Additional section processing
- Caching

Shortcomings

- Type and class growth
- Easy upgrading of applications
 - Transient failure of a distributed naming system
- Distribution of control vs. distribution of expertise

Conclusions

- What the “dns-team” learned:
 - Caching and also negative caching
 - Difficulty of removing fkt. vs. adding new fkt.
 - Implementers don't like optimizing ...

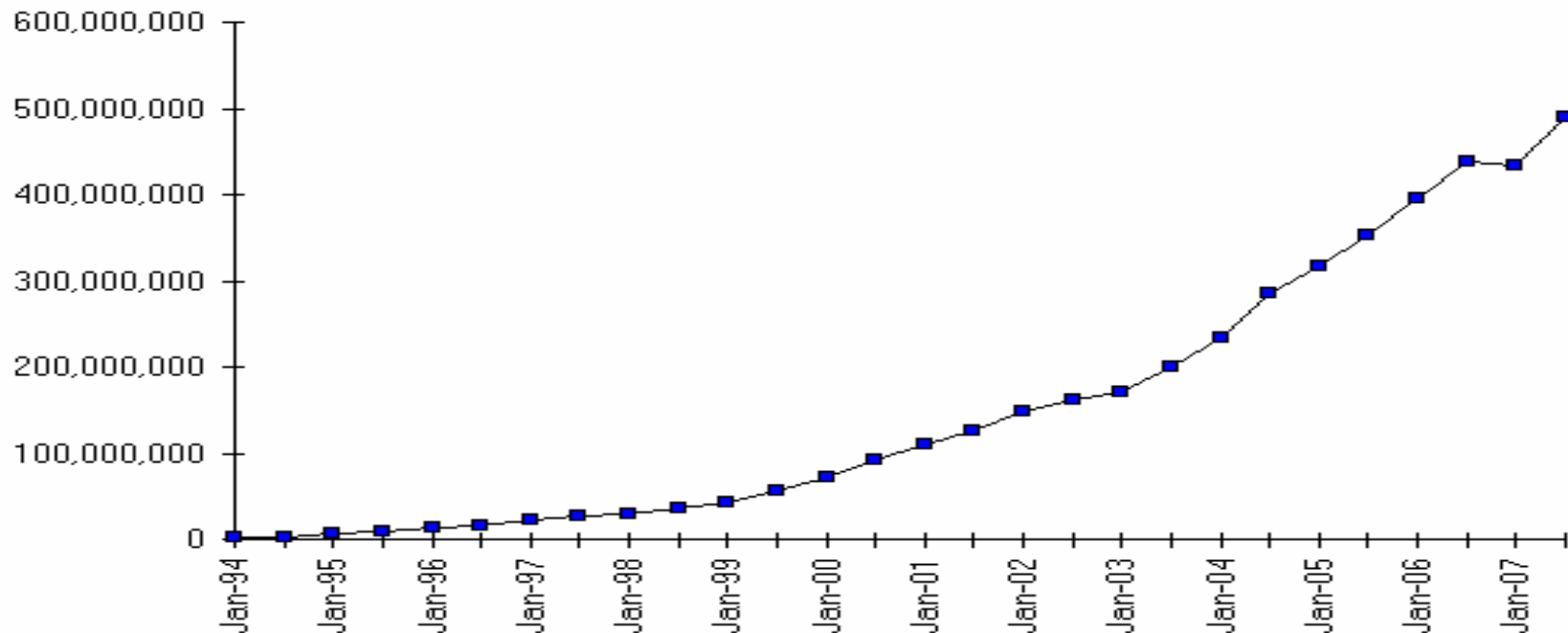
Link between the two papers

- DNS provides binding between Service and Node
- Remove DNS ??
 - Address the host directly with IP
 - “google” for it
- Problems:
 - Moving service to another node

Figures ...

Paper(1988) : 20 000 hosts

Internet Domain Survey Host Count



Source: Internet Systems Consortium (www.isc.org)

1988 <-> 2007 : things change...

- DDoS attack (distributed denial of service)
 - October 2002 – 9 of 13 root servers down
 - February 2007 – 2 root servers down
- Phishing attacks:
 - DNS-spoofing
 - Cache poisoning
- Networks change:
 - Mobility (WLAN, GSM, ad-hoc, P2P, ...)

DNS Extensions to support IPv6

- New resource record type (AAAA)
- New domain to support lookups based on addr.
 - 4321:0:....:89ab -> b.a.9.8 ... 0.1.2.3.4.IP6.INT
- Additional section processing redefined for processing both IPv4 and IPv6

The papers...

- **On The Naming and Binding of Network Destinations.**

Jerome H. Saltzer, in Pier Ravasio et al.

- **Development of the domain name system.**

Mockapetris, P. and Dunlap, K. J.

Additional papers ...

- RFC 1886, S.Thomson and C.Huitema
- GSEC Paper Practical Assignment Version 1.4b,
David Hinshelwood – DNS,DNSSEC and the
Future

Burning Questions at this moment?

Discussion inputs ...

- Bindings (more/less – examples?)
- What about an open name space? (whatever.I.want)
- Future: DNSSec (secure DNS)
- Alternative root servers
- Politics:
 - VeriSign ... “SiteFinder”
 - ICANN ... “influenced by ...” (.xxx discussion)

Thanks for your attention....