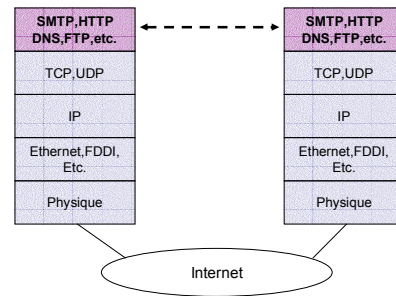


Applications

Séminaire 2005-2006

(diagrammes originaux de L. Peterson et A. Tanenbaum)

Couche application



Dynamic Name Server (DNS)

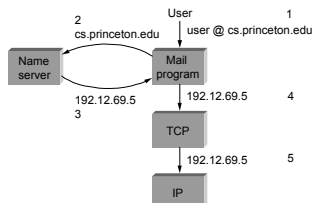
Introduction

- À quoi servent les noms?
 - Identifier les objets
 - Repérer les objets
 - Définir un membre d'un groupe
 - Spécifier un rôle
- Name space
 - Définit un ensemble de noms possibles
 - Ensembles de paires <nom,value>
- Exemples : Hosts

<code>cheltenham.cs.princeton.edu</code>	→	<code>192.12.69.17</code>
<code>www.unige.ch</code>		<code>129.194.9.50</code>

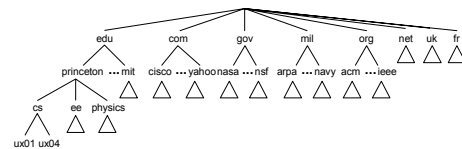
Exemple

- Mailboxes



Domain Naming System

- Hiérarchie

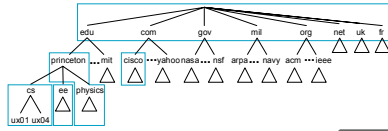


- Nom

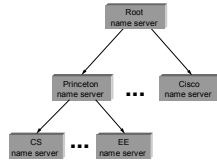
`ux01.cs.princeton.edu`

Name Servers

- Partition hiérarchique en zones



- Chaque zone implémente deux ou plusieurs name servers



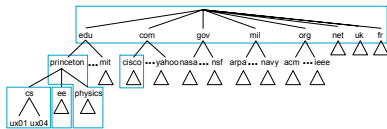
Resource Records

- Chaque name server contient une collection de *resource records* (Name, Value, Type, Class, TTL)
- Name/Value: pas toujours des noms de hosts et IP adresses
- Type
 - A: Adresse
 - NS: Retourne le nom du domaine contenant le name server capable de résoudre les noms du domaine spécifié
 - CNAME: Retourne le canonical name pour le host; utilisé pour définir des alias.
 - MX: Retourne le nom du domaine capable d'accepter des messages pour le domaine spécifié.
- Class: Permet aux entités de définir des classes (IN=Internet)
- TTL: Temps de validité du resource record.

Root Server

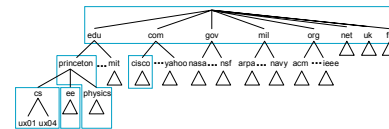
(princeton.edu, cit.princeton.edu, NS, IN)
 (cit.princeton.edu, 128.196.128.233, A, IN)
 (cisco.com, thumper.cisco.com, NS, IN)
 (thumper.cisco.com, 128.96.32.20, A, IN)

...



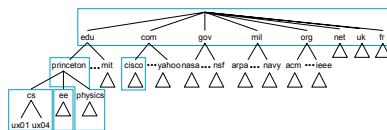
Princeton Server

(cs.princeton.edu, optima.cs.princeton.edu, NS, IN)
 (optima.cs.princeton.edu, 192.12.69.5, A, IN)
 (ee.princeton.edu, helios.ee.princeton.edu, NS, IN)
 (helios.ee.princeton.edu, 128.196.28.166, A, IN)
 (jupiter.physics.princeton.edu, 128.196.4.1, A, IN)
 (saturn.physics.princeton.edu, 128.196.4.2, A, IN)
 (mars.physics.princeton.edu, 128.196.4.3, A, IN)
 (venus.physics.princeton.edu, 128.196.4.4, A, IN)

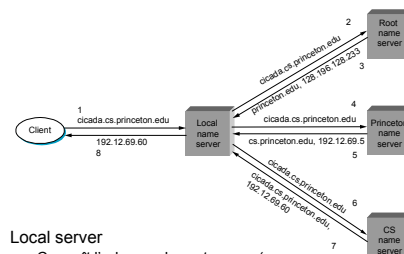


CS Server

(cs.princeton.edu, optima.cs.princeton.edu, MX, IN)
 (cheltenham.cs.princeton.edu, 192.12.69.60, A, IN)
 (che.cs.princeton.edu, cheltenham.cs.princeton.edu, CNAME, IN)
 (optima.cs.princeton.edu, 192.12.69.5, A, IN)
 (opt.cs.princeton.edu, optima.cs.princeton.edu, CNAME, IN)
 (baskerville.cs.princeton.edu, 192.12.69.35, A, IN)
 (bas.cs.princeton.edu, baskerville.cs.princeton.edu, CNAME, IN)



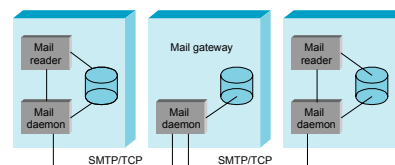
Name Resolution



- Local server
 - Connait l'adresse du root server (pas besoin que tous les clients le sachent)
 - Un cache est maintenu avec les noms résolus

Electronic Mail (Email)

Infrastructure



- Pour envoyer : Protocole SMTP (connexion TCP).
- Pour lire : Protocoles POP, IMAP

Message Formats – RFC 822

Header	Meaning
To:	E-mail address(es) of primary recipient(s)
Cc:	E-mail address(es) of secondary recipient(s)
Bcc:	E-mail address(es) for blind carbon copies
From:	Person or people who created the message
Sender:	E-mail address of the actual sender
Received:	Line added by each transfer agent along the route
Return-Path:	Can be used to identify a path back to the sender

Message Formats – RFC 822 (2)

Header	Meaning
Date:	The date and time the message was sent
Reply-To:	E-mail address to which replies should be sent
Message-Id:	Unique number for referencing this message later
In-Reply-To:	Message-Id of the message to which this is a reply
References:	Other relevant Message-Ids
Keywords:	User-chosen keywords
Subject:	Short summary of the message for the one-line display

MIME – Multipurpose Internet Mail Extensions

- Pour gérer différents langages (codes de caractères)
- Pour gérer les images et les vidéos (pas seulement de texte)

Header	Meaning
MIME-Version:	Identifies the MIME version
Content-Description:	Human-readable string telling what is in the message
Content-Id:	Unique identifier
Content-Transfer-Encoding:	How the body is wrapped for transmission
Content-Type:	Type and format of the content

MIME (2)

Type	Subtype	Description
Text	Plain	Unformatted text
	Enriched	Text including simple formatting commands
Image	Gif	Still picture in GIF format
	Jpeg	Still picture in JPEG format
Audio	Basic	Audible sound
Video	Mpeg	Movie in MPEG format
Application	Octet-stream	An uninterpreted byte sequence
	Postscript	A printable document in PostScript
Message	Rfc822	A MIME RFC 822 message
	Partial	Message has been split for transmission
	External-body	Message itself must be fetched over the net
Multipart	Mixed	Independent parts in the specified order
	Alternative	Same message in different formats
	Parallel	Parts must be viewed simultaneously
	Digest	Each part is a complete RFC 822 message

MIME (3)

Exemple d'un message contenant plusieurs parties (texte,audio,...)

```
From: elinor@abcd.com
To: carolyn@xyz.com
MIME-Version: 1.0
Message-Id: <0704760941.AA00747@abcd.com>
Content-Type: multipart/alternative; boundary=quertyuopasdfghjklzxcvbnm
Subject: Earth orbits sun integral number of times
```

This is the preamble. The user agent ignores it. Have a nice day.

```
--quertyuopasdfghjklzxcvbnm
Content-Type: text/enriched
```

```
Happy birthday to you
Happy birthday to you
Happy birthday dear <bold> Carolyn </bold>
Happy birthday to you
```

```
--quertyuopasdfghjklzxcvbnm
Content-Type: message/external-body;
access-type="anon-ftp";
site="bicycle.abcd.com";
directory="pub";
name="birthday.snd"
```

```
content-type: audio/basic
content-transfer-encoding: base64
--quertyuopasdfghjklzxcvbnm--
```

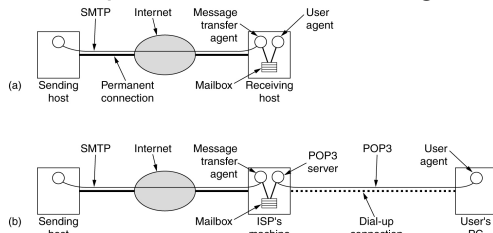
Envoie d'un message

from elinore@abc.com
to carolyn@xyz.co

Utilisation du protocole SMTP

```
S: 220 xyz.com SMTP service ready
C: HELO abcd.com
S: 250 xyz.com says hello to abcd.com
C: MAIL FROM: <elinor@abcd.com>
S: 250 sender ok
C: RCPT TO: <carolyn@xyz.com>
S: 250 recipient ok
C: DATA
S: 354 Send mail; end with "." on a line by itself
C: From: elinor@abcd.com
C: To: carolyn@xyz.com
C: MIME-Version: 1.0
C: Message-Id: <0704760941.AA00747@abcd.com>
C: Content-Type: multipart/alternative; boundary=quertyuopasdfghjklzxcvbnm
C: Subject: Earth orbits sun integral number of times
C:
C: This is the preamble. The user agent ignores it. Have a nice day.
C:
C: --quertyuopasdfghjklzxcvbnm
C: Content-Type: text/enriched
C:
C: Happy birthday to you
C: Happy birthday to you
C: Happy birthday dear <bold> Carolyn </bold>
C: Happy birthday to you
C:
C: --quertyuopasdfghjklzxcvbnm
C: Content-Type: message/external-body;
C: access-type="anon-ftp";
C: site="bicycle.abcd.com";
C: directory="pub";
C: name="birthday.snd"
C:
C: content-type: audio/basic
C: content-transfer-encoding: base64
C: --quertyuopasdfghjklzxcvbnm
C:
C: QUIT
S: 250 message accepted
S: 221 xyz.com closing connection
```

Reception finale d'un message



- (a) Le destinataire a une connexion permanente à l'Internet et son poste de travail est dans le poste mailbox.
- (b) Le destinataire n'a pas de connexion permanente à l'Internet et son mailbox est dans un autre host.

POP3

```
S: +OK POP3 server ready
C: USER carolyn
S: +OK
C: PASS vegetables
S: +OK login successful
C: LIST
S: 1 2505
S: 2 14302
S: 3 8122
S: .
C: RETR 1
S: (sends message 1)
C: DELE 1
C: RETR 2
S: (sends message 2)
C: DELE 2
C: RETR 3
S: (sends message 3)
C: DELE 3
C: QUIT
S: +OK POP3 server disconnecting
```

Utilisation de POP3 pour lire le mailbox.

IMAP

Feature	POP3	IMAP
Where is protocol defined?	RFC 1939	RFC 2060
Which TCP port is used?	110	143
Where is e-mail stored?	User's PC	Server
Where is e-mail read?	Off-line	On-line
Connect time required?	Little	Much
Use of server resources?	Minimal	Extensive
Multiple mailboxes?	No	Yes
Who backs up mailboxes?	User	ISP
Good for mobile users?	No	Yes
User control over downloading?	Little	Great
Partial message downloads?	No	Yes
Are disk quotas a problem?	No	Could be in time
Simple to implement?	Yes	No
Widespread support?	Yes	Growing

Comparaison entre POP3 et IMAP.

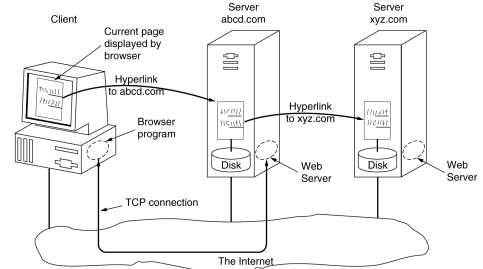
World Wide Web (HTTP)

Infrastructure (1)



Navigateur web (Internet Explorer, Mozilla, etc.) dans le côté client.

Infrastructure (2)



Client : Envoi des requêtes

Operation	Description
OPTIONS	request information about available options
GET	retrieve document identified in URL
HEAD	retrieve metainformation about document identified in URL
POST	give information (e.g., annotation) to server
PUT	store document under specified URL
DELETE	delete specified URL
TRACE	loopback request message
CONNECT	for use by proxies

Par exemple: Pour afficher une page HTML dans le navigateur, le client utilise la requête GET.

Serveur: Réponses aux requêtes

Code	Type	Example Reasons
1xx	Informational	request received, continuing process
2xx	Success	action successfully received, understood, and accepted
3xx	Redirection	further action must be taken to complete the request
4xx	Client Error	request contains bad syntax or cannot be fulfilled
5xx	Server Error	server failed to fulfill an apparently valid request

HTML – HyperText Markup Language

```
<html>
<head>
<title> AMALGAMATED WIDGET, INC. </title>
</head>
<body>
<h1> Welcome to AWI's Home Page</h1>

<br>
We are so happy that you have chosen to visit <b>Amalgamated Widget's</b>
home page. We hope <b>you</b> will find all the information you need here.
<br>
<b>Below we have links to information about our many fine products.
You can order electronically (by WWW), by telephone, or by fax.</b>
<br>
<b>Product information</b>
<ul>
<li><a href="http://www.widget.com/products/h1"> Big widgets</a>
</li>
<li><a href="http://www.widget.com/products/h2"> Little widgets</a>
</li>
</ul>
<b>Telephone numbers</b>
<ul>
<li>By telephone: 1-800 WIDGETS
</li>
<li>By fax: 1-415-765-4321
</li>
</ul>
</body>
</html>
```



(a) Le code HTML d'une page web.

(b) La page web affichée dans le navigateur.

HTML (2)

Tag	Description
<html> ... </html>	Declares the Web page to be written in HTML
<head> ... </head>	Delimits the page's head
<title> ... </title>	Defines the title (not displayed on the page)
<body> ... </body>	Delimits the page's body
<h1> ... </h1>	Delimits a level 1 heading
 ... 	Set ... in boldface
<i> ... </i>	Set ... in italics
<center> ... </center>	Center ... on the page horizontally
 ... 	Brackets an unordered (bulleted) list
 ... 	Brackets a numbered list
 ... 	Starts a list item (there is no)
 	Forces a line break here
<p>	Starts a paragraph
<hr>	Inserts a Horizontal rule
	Displays an image here
 ... 	Defines a hyperlink