

Introduction to the Internet technologies

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Introduction

- Objective:
 - Provide an incomplete introduction to the internet technologies
- Gross simplifications
- Practical stuff
- System administrator won't always be there...

URI, URL

- Universal Resource Locator (RFC 1808)
 - Used by a browser to identify a single document
 - `ftp://ftp.ncbi.nih.gov/`
 - `mailto:John.Smith@bigcompany.com`
 - `http://www.cellcycleontology.org/html/index.html`
- Universal Resource Identifier (RFC 3986)
 - Identify an internet resource
 - `<scheme>://<net_loc>/<path>;<params>?<query>#<fragment>`
 - `http://www.cellcycleontology.org/html/index.html#Documentation`
- An URL refers to a Web page, including the scheme, but without a name location. An URI refers to a Web page including the location of the code fragment, if one exists, and the scheme.

Exercises

1. Find out the URL of your university or institution
2. Look for the URL of the Request For Comments (RFC) website
3. Are the following URI's?
 - tel:+32-98555-12
 - telnet://192.168.0.222:80/

Protocol

- Defined set of rules spoken by two computers (processes) to accomplish a given task
- Example:
 - Sending an email
 - Loading a website
 - Getting some files from an FTP server
- RFC's: <http://www.ietf.org/rfc.html>

Internet

- International Network
- Union of several networks using some protocols
 - IP, TCP, UDP, SNMP...
- “Unique identification”
 - IP address



IP address

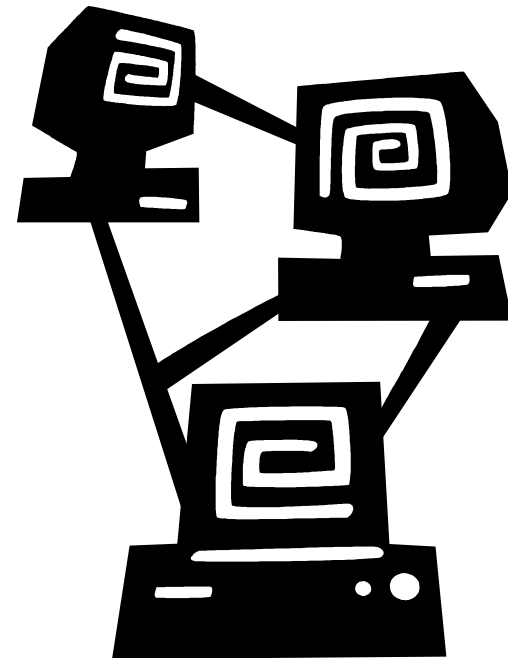
- “Unique”
 - ifconfig [unix]
 - ipconfig [WIN]
- Example:
 - 157.193.202.161
 - 192.168.0.1

Exercises

1. Find out the IP address of your computer
2. Are the following valid IP (v4) address?
 - 192.168.2.355
 - 155.125.25
3. Check out: <http://whatismyipaddress.com/>
4. Try:
<http://www.geobytes.com/IpLocator.htm?GetLocation>

Intranet

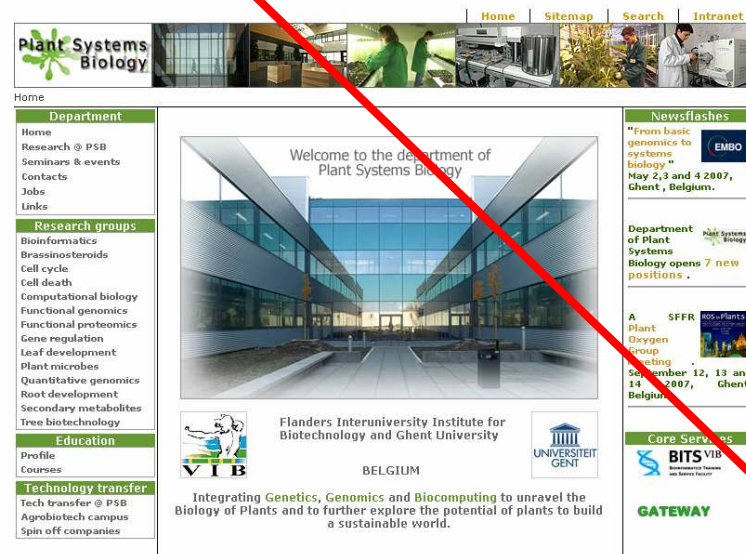
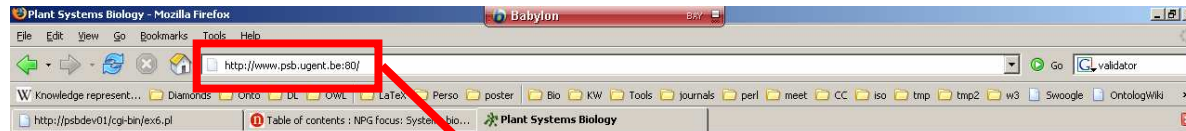
- 'Private internet'
- Login/password
- Identical services:
 - Web server
 - FTP server
 - ...



Port

- To communicate with a process
- Some already reserved
- Positive number
- UDP/TCP
- Example:
 - http => 80
 - ssh => 22
- /etc/services

http default port

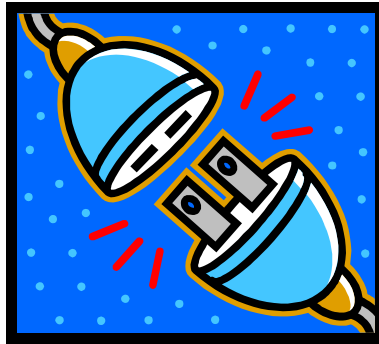


<http://www.psb.ugent.be:80/>



Socket

- Identifies a unique network process
- Defined by an IP address plus a port
- /etc/protocols
- /etc/services
- A pair of sockets define a connection



/etc/protocols

```
ip    0    IP          # internet protocol, pseudo protocol number
#hopopt 0    HOPOPT      # hop-by-hop options for ipv6
icmp  1    ICMP        # internet control message protocol
igmp  2    IGMP        # internet group management protocol
ggp   3    GGP         # gateway-gateway protocol
ipencap 4    IP-ENCAP    # IP encapsulated in IP (officially ``IP")
st    5    ST          # ST datagram mode
tcp   6    TCP         # transmission control protocol
cbt   7    CBT         # CBT, Tony Ballardie <A.Ballardie@cs.ucl.ac.uk>
egp   8    EGP         # exterior gateway protocol
igp   9    IGP         # any private interior gateway (Cisco: for IGRP)
bbn-rcc 10    BBN-RCC-MON # BBN RCC Monitoring
nvp   11    NVP-II      # Network Voice Protocol
pup   12    PUP        # PARC universal packet protocol
argus 13    ARGUS       # ARGUS
emcon 14    EMCON       # EMCON
xnet  15    XNET        # Cross Net Debugger
chaos 16    CHAOS       # Chaos
udp   17    UDP         # user datagram protocol
mux   18    MUX         # Multiplexing protocol
dcn   19    DCN-MEAS    # DCN Measurement Subsystems
...
...
```

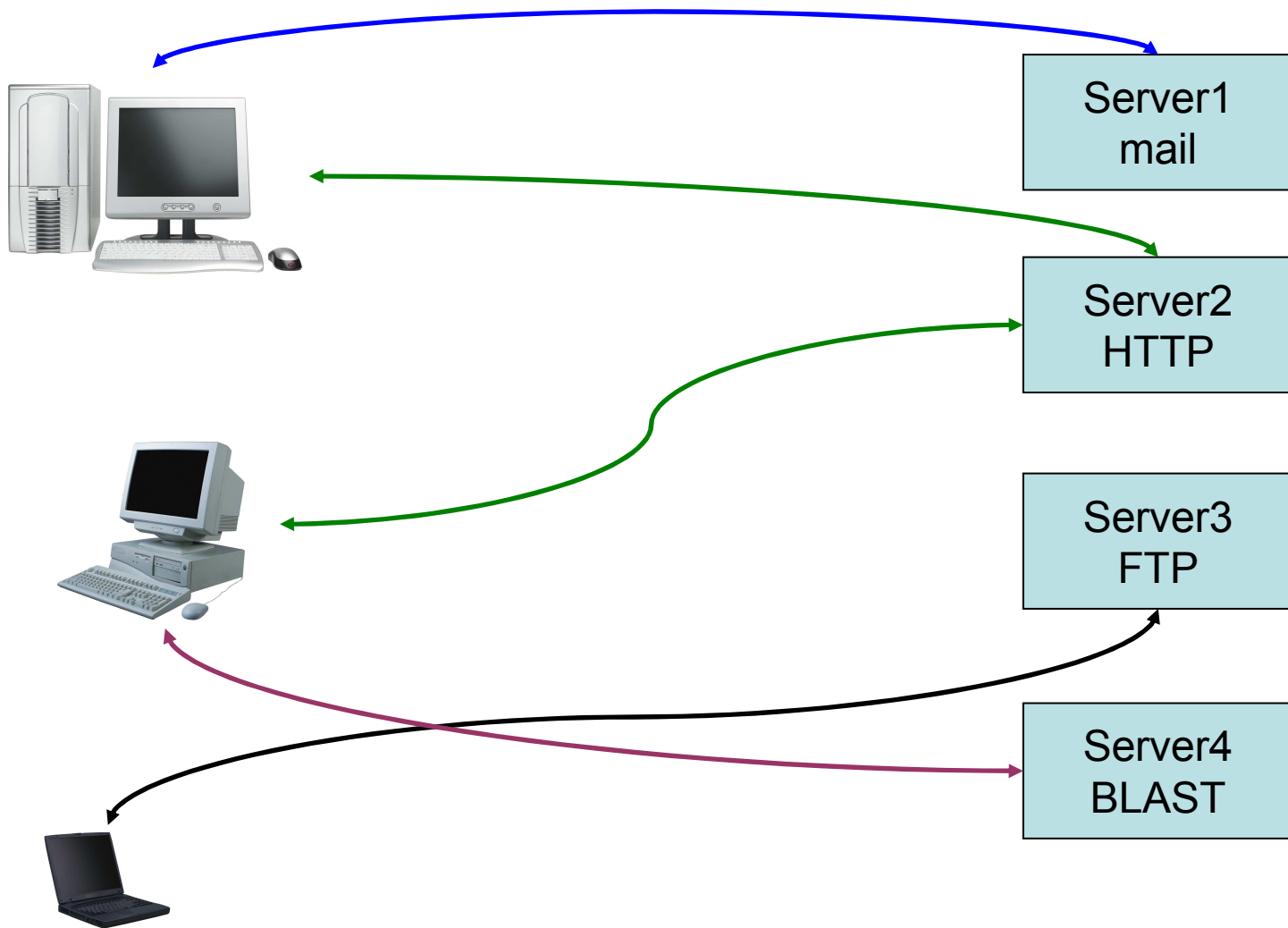
/etc/services

```
tcpmux      1/tcp          # TCP port service multiplexer
tcpmux      1/udp          # TCP port service multiplexer
rje         5/tcp          # Remote Job Entry
rje         5/udp          # Remote Job Entry
echo        7/tcp
echo        7/udp
discard     9/tcp          sink null
discard     9/udp          sink null
systat      11/tcp         users
systat      11/udp         users
daytime     13/tcp
daytime     13/udp
qotd        17/tcp         quote
qotd        17/udp         quote
msp         18/tcp         # message send protocol
msp         18/udp         # message send protocol
chargen     19/tcp         ttytst source
chargen     19/udp         ttytst source
ftp-data    20/tcp
ftp-data    20/udp
# 21 is registered to ftp, but also used by fsp
ftp         21/tcp
ftp         21/udp         fsp fspd
ssh         22/tcp         # SSH Remote Login Protocol
ssh         22/udp         # SSH Remote Login Protocol
...
...
```

Client/Server

- Server: provide services
- Client: ask for/use services
- C/S: linked by a connection
- A server/client can be a client/server
- Services:
 - Web
 - Email
 - Files
 - ...

C/S



Vocabulary

- Session: connected state
 - ssh
 - mysql
- Stateless (web server: URL)
- Timeout
- Certificate
- Process



Some services

- [R]ARP: [Reverse] Address Resolution Protocol
 - Physical address $\Leftrightarrow$ IP address
- Name resolution:
 - IP address $\Leftrightarrow$ symbolic name
 - DNS: Domain Name Service [BIND]
 - /etc/hosts
 - NIS, NIS plus : Network Information Service
 - /etc/nsswitch.conf

Exercises

1. What's the physical address of:
 - psbora01.fvms.ugent.be
 - (use /sbin/arp)
2. Find out the IP address of the following servers using the command 'host':
 - www.psb.ugent.be
 - www.whitehouse.gov

Security

- SSL = Secure Socket Layer
 - Library for encrypting and authentication (sockets communication)
- SSH = Secure Shell
 - Remote connections
 - Based on SSL
 - ssh, scp, sftp
- Firewall : packets control



Exercise

- `ssh host -l user`
- **Advanced users:**
`ssh -L 8888:psbdev01:80 <user>@psbdev01 -N`
Launch: `firefox localhost:8888`

File services

- FTP
 - File Transfer Protocol
- NFS
 - Network File System
 - Mounting, exporting
- SMB
 - Server Message Block [Win]
- Samba: SMB open source [unix/win]

Exercise

- Checkout any database from the ExPASy FTP server: `ftp://ftp.expasy.org/`
- List the mounted file systems
 - `mount`
- List the SMB shares:
 - `smbclient -L psbdev01`

E-mail

- SMTP: Simple Mail Transfer Protocol
- Sendmail [c/s], qmail
- MIME: Multipurpose Internet Mail Extensions
- POP: Post Office Protocol
- IMAP: Internet Message Access Protocol



Web concepts

- HTTP
 - Port 80
- HTTPS
 - Secure: SSL
 - Port 443
- Hypertext
 - associated to an URL
- HTML derived from SGML

C/S web

- Browsers (clients)
 - Safari, Firefox, IE, ...
- Web servers
 - Apache
 - IIS
 - ...



The **Apache Software Foundation**

<http://www.apache.org/>



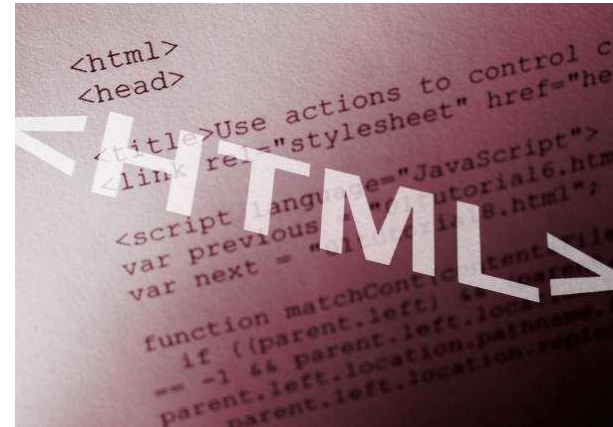
More web concepts

- Hypertext
 - Text bound to a URL
- DTD=Document Type Definition
 - Structure of a document (SGML, XML)
- HTML
 - Derived from SGML
 - <http://en.wikipedia.org/wiki/SGML>
- Docbook
 - for authoring technical documentation
- CGI
 - interface between app's and HTTP server



HTML

- Servers send back their HTML code and each browser will display it in a different way
- Static HTML
- Dynamic HTML: PERL, PHP, etc
- Cookie: manage state connection



References

- <http://www.rfc-editor.org/>
- <http://www.isoc.org/>
- <http://www.w3.org/>
- <http://www.w3schools.com/html/default.asp>
- <http://en.wikipedia.org/wiki/Client-server>