

The Internet and Sockets

Computer Security
Tom Chothia

This Time:

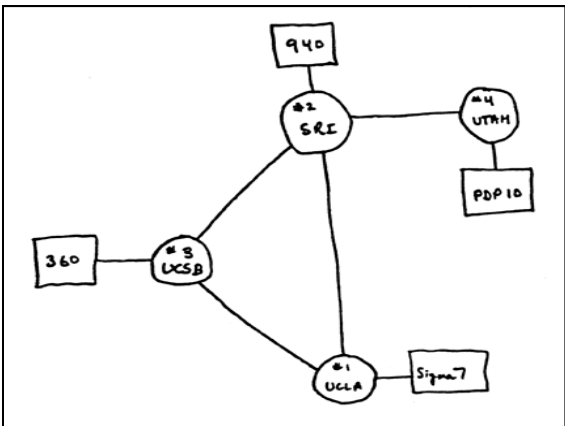
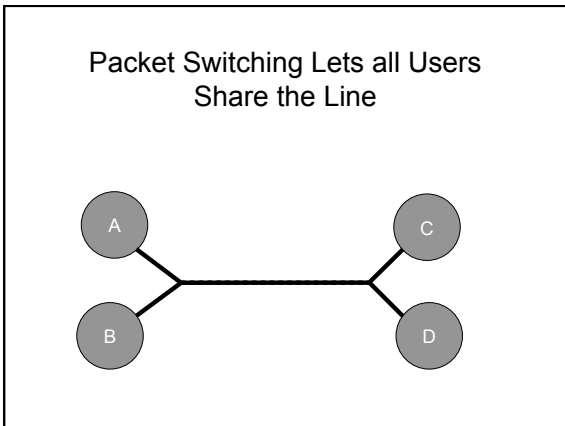
- How the Internet works.
 - Some History
 - TCP/IP
- Network address translation
- Uniform resource locators (URL)

Before the Internet

- Life was solitary, poor, nasty, brutish and short.
- Computer Networks:
 - local networks,
 - telephone line connections,
 - leased line.

The Start 1969

- The US Defense Advanced Research Projects Agency (then ARPA now DARPA) gives research grants to universities to buy computers.
- They decide to link their computers.
- But how?



The ARPAnet

- 1969 the birth of the ARPAnet.
- 1971 E-mail @
- 1977 the ARPAnet becomes a Inter-network.
- 1978 first Spam message send.
 - Admin assures users this will never happen again
- 1983 TCP/IP becomes standard.

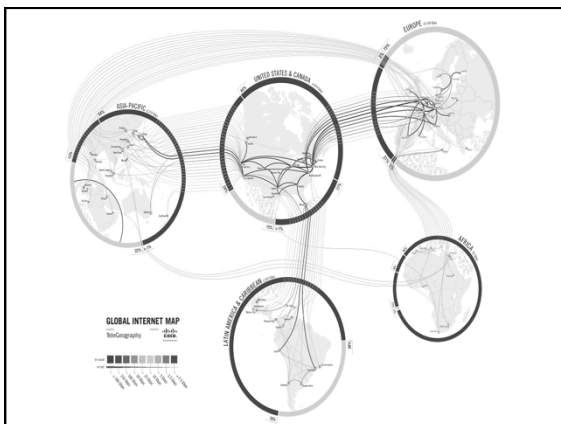


Domain Name Servers (DNS)

- Remembering IP address is to hard.
- So people associate names with addresses.
e.g. news.bbc.com → 212.58.226.141
- A hierarchy of servers list handle requests
- The route for most of Europe is RIPE based in Amsterdam.

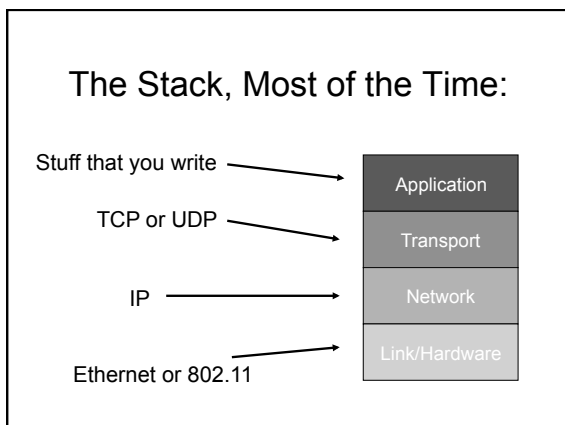
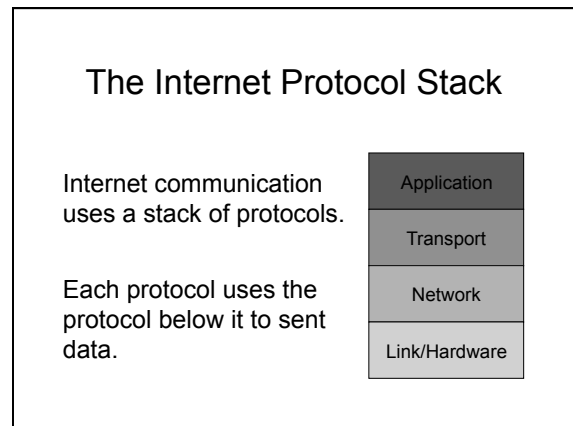
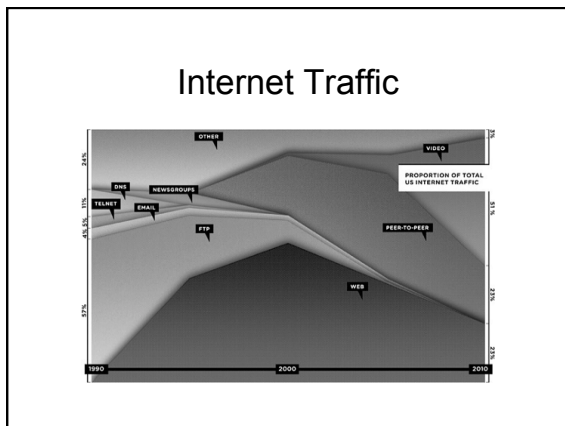
The Internet

- 1988 The Morris Worm, CERT formed.
- 1989 The Web: HTTP and HTML.
- 1992 The first ISPs and *Mosaic* the first web browser.
- 1994 Yahoo



Today

- All computers on the Internet have an IP address.
- Key Internet Protocols: TCP/IP
- DNS to turn names into numbers.



- ### Sockets
- A computer is identified by an IP address.
 - To allow multiple connections each computer has a port number.
 - A simple connection between two computers is called a socket.
 - Sockets are uniquely identified by (IP sender, port sender, IP receiver, port receiver).

Port numbers

IANA registers port numbers. E.g. WWW runs on port 80, ssh on port 22, dns on 53, (free wifi).

0-1023: "well known ports" assigned by IANA (best not to use these)

1023-49151 "registered ports" IANA allows anyone to register and use these.

49151-65535: cannot be registered.

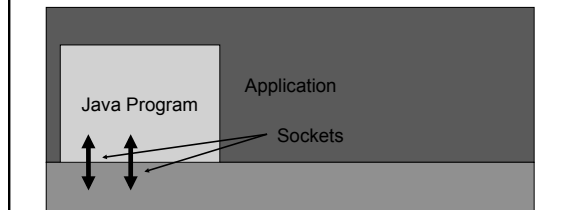
Nmap: <http://nmap.org/>

A network scanning tool: tells you which ports are open.

```
> nmap 127.0.0.01
```

Many other functions (see man nmap)

Our View of the Stack in Java



Sockets in Java

- Use `java.io.Socket` to make a socket that connects to a remote computer.
- Use `java.io.ServerSocket` to make a socket that listens for an incoming connection.
- Sockets just give bytes, so then need a wrapper.

WireShark www.wireshark.org

A network protocol analyzer.

It records all Internet traffic, so it can then be views and analysed.

Excellent for debugging, protocols and finding out how Internet applications work.

Network Address Translation

How many IP address are there?

0.0.0.0 to 255.255.255.255

Therefore

$256 * 256 * 256 * 256 = 4\ 294\ 967\ 296$ address

Not enough for 1 per person (I have 4)

Network Address Translation

Answer IP6: Internet Protocol version 6

- 2^{128} addresses! Enough for everyone
- Not backwards compatible ☹

Another answer: Network Address Translation (NAT), Share an address.

NAT

Address in the ranges:

192.168.*, 172.16.*, 172.31.*, 10.*.*

are local only.

Local machines communicate with the outside Internet use a NAT router that shares it's IP address.

Ports used to tells the machines apart.

