

Introduction to computer hardware

23 February 1999

Opening announcements

- 3 handouts in back (including this one)
- How is assignment 3?
- Extra help on PCs with Jon
- Study group?
- Sections are mandatory
- Taking advantage of bulletin boards; Q&A with David

Topics

- Packets and TCP/IP in action
- Traceroute
- Packet sniffing and security; shortcomings of firewalls
- What is a computer?
- Computers as calculators: registers and operations
- Bits: 0s and 1s; bytes (kilo-, mega-, and giga- revisited); transistors; analog and digital
- Central processing units (CPUs); Hertz
 - Intel: 80x86 and Pentium; CISC
 - Motorola: 680x0; Motorola/IBM: PowerPC; RISC
 - AMD and Cyrix
- Motherboards (attaching keyboards, mice, and monitors for input/output)
- ROM, BIOS (calculators revisited; microwave ovens; cars), POST
 - Input arbitration (interrupts)
 - ASCII
- RAM (VCR clocks; digital watches; Scrabble)
 - SIMMs, DIMMs, EDO, SDRAM
- Hard drives (bigger, installable programs)
- Cache (SRAM)
- Virtual memory
- Buses
- Expansion buses (ISA, PCI, SCSI) and cards
 - Modems, network, sound, video, *etc.*
- Ports
 - Display, keyboard, mouse, parallel, power, serial, *etc.*
- Input/Output (I/O) devices

- Keyboard, microphone, monitor, mouse, printer, scanner, speaker, *etc.*

TCP/IP

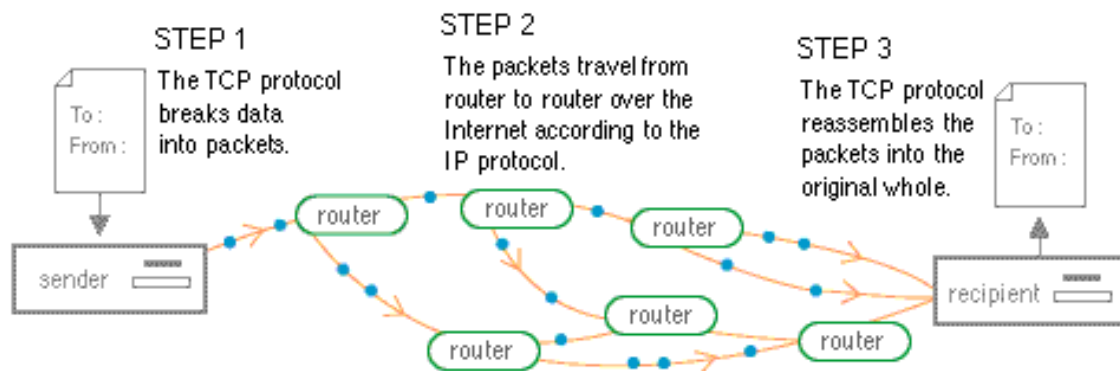


Figure 2. How data travels over the Net.

Who runs the Internet?

The World Wide Web Consortium (W3C)

HTML standards

The Internet Engineering Task Force (IETF)

Focuses on Internet evolution

Internet Engineering Steering Group (IESG)

Manages IETF activities and the Internet standards process

The Internet Architecture Board (IAB)

Defines Internet architecture

Internet Society (ISOC)

Comments on Internet policies and practices

The Internet Assigned Numbers Authority (IANA)

Responsible for assigning IP addresses

The Internet Network Information Center (InterNIC)

Responsible for assigning domain names

Traceroute

Discovering the path from harvard.edu to yahoo.com

```
fas% traceroute www.yahoo.com
```

```
traceroute to www.YAHOO.com (204.71.200.68), 30 hops max, 40 byte packets
```

```
 1  scmr-gw.fas.harvard.edu (140.247.30.1)  1 ms  1 ms  1 ms
 2  sc-gw.fas.harvard.edu (140.247.6.2)    1 ms  0 ms  1 ms
 3  vbns gw1-fas.harvard.edu (140.247.20.3)  0 ms  1 ms  1 ms
 4  192.5.66.9 (192.5.66.9)  2 ms  2 ms  2 ms
 5  12.126.99.5 (12.126.99.5)  2 ms  3 ms  2 ms
 6  gbr1-a30s3.cb1ma.ip.att.net (12.127.5.38)  3 ms  3 ms  4 ms
 7  gbr2-p03.n54ny.ip.att.net (12.122.4.6)  8 ms  7 ms  7 ms
 8  br2-a340s9.n54ny.ip.att.net (12.123.1.82)  8 ms  9 ms  8 ms
 9  ar6-a300s4.n54ny.ip.att.net (12.126.7.181) 11 ms 69 ms 90 ms
10  12.126.119.10 (12.126.119.10)  8 ms  9 ms  9 ms
11  pos2-1-155M.cr2.LGA2.globalcenter.net (206.41.19.97)  9 ms  9 ms  9 ms
12  pos7-0-622M.cr2.SNV.globalcenter.net (206.132.151.22) 70 ms 71 ms 70 ms
13  pos1-0-2488M.hr8.SNV.globalcenter.net (206.132.254.41) 72 ms 70 ms 71 ms
14  bas1r-ge3-0-hr8.snv.yahoo.com (208.178.103.62) 72 ms 70 ms 70 ms
15  www3.yahoo.com (204.71.200.68) 71 ms 74 ms 71 ms
malan@is07 (~): traceroute www.cnn.com
```

The binary system

| Decimal | Binary |
|---------|--------|
| 0 | 0 |
| 1 | 1 |
| 2 | 10 |
| 3 | 11 |
| 4 | 100 |
| 5 | 101 |
| 6 | 110 |
| 7 | 111 |
| 8 | 1000 |
| 9 | 1001 |
| 10 | 1010 |
| 11 | 1011 |
| 12 | 1100 |
| 13 | 1101 |
| 14 | 1110 |
| 15 | 1111 |

Kilo-, mega-, and giga- revisited

| Value | Name | Shorthand | Power |
|-------------------|---------------------|--------------|----------|
| 1 | byte or bit | 1 | 2^0 |
| 1,024 | kilobyte or kilobit | 1 KB or 1 Kb | 2^{10} |
| 1,048,576 | megabyte or megabit | 1 MB or 1 Mb | 2^{20} |
| 1,073,741,824 | gigabyte or gigabit | 1 GB or 1 Gb | 2^{30} |
| 1,099,511,627,776 | terabyte or terabit | 1 TB or 1 Tb | 2^{40} |

CPU's

| PC | Macintosh |
|---------------------|------------|
| '286 | '000 |
| '386 | '010 |
| '486 | '020 |
| Pentium | '030 |
| Pentium Pro | '040 |
| Pentium with MMX | PowerPC |
| Pentium II with MMX | PowerPC G3 |

ASCII

| Letter | Code |
|--------|------|
| A | 65 |
| B | 66 |
| C | 67 |
| D | 68 |
| E | 69 |
| F | 70 |
| G | 71 |
| H | 72 |
| I | 73 |
| J | 74 |
| K | 75 |
| L | 76 |
| M | 77 |
| N | 78 |
| O | 79 |
| P | 80 |
| Q | 81 |
| R | 82 |
| S | 83 |
| T | 84 |
| U | 85 |
| V | 86 |
| W | 87 |
| X | 88 |
| Y | 89 |
| Z | 90 |