The Brunel Network: How it works

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Network Technology

Ethernet: 10Mbit/s shared medium

Fast Ethernet: 100Mbit/s

Repeaters, Hubs, Bridges, Switches, Routers

Internet Protocol (IP)

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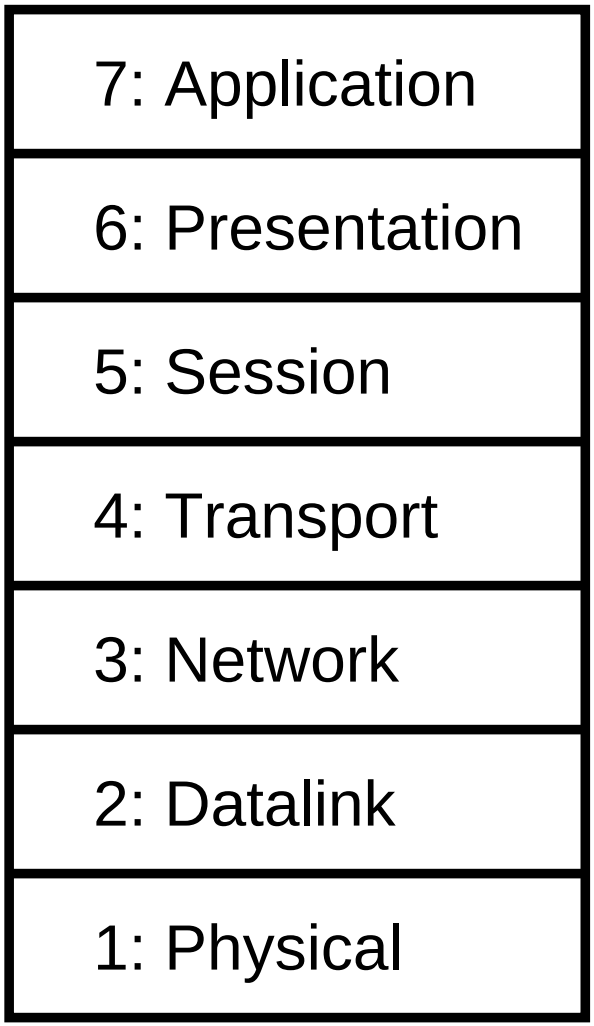
The ISO seven-layer model



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The Datalink Layer

Ethernet MAC (Medium Access Control)

CSMA/CD: Carrier-Sense Multiple Access with Collision Detection

(Can also run full-duplex)

MAC addresses: 48 bits

08:00:20:0f:f6:41

08-00-20-0f-f6-41

Broadcast and Multicast addresses

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The Network Layer

Internet Protocol (IP)

32-bit addresses

- 134.83.128.62
- 8653803E

On Ethernet, must map IP to MAC address

- ARP
- Broadcast and multicast mapping rules

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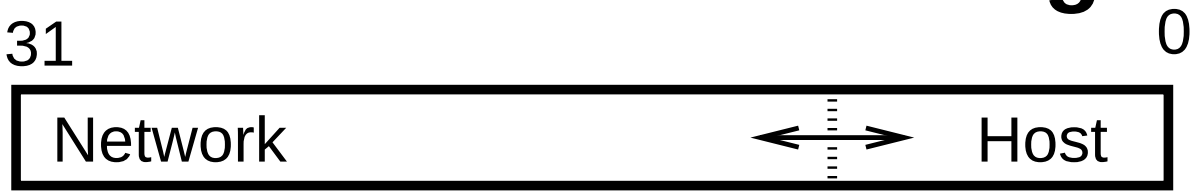
IP classes and routing



11111111111111111111111100000000

Netmask: 255.255.255.0

So, for 134.83.128.62

Network part: 134.83.128

Host part: 62

Special addresses: all-0 and all-1

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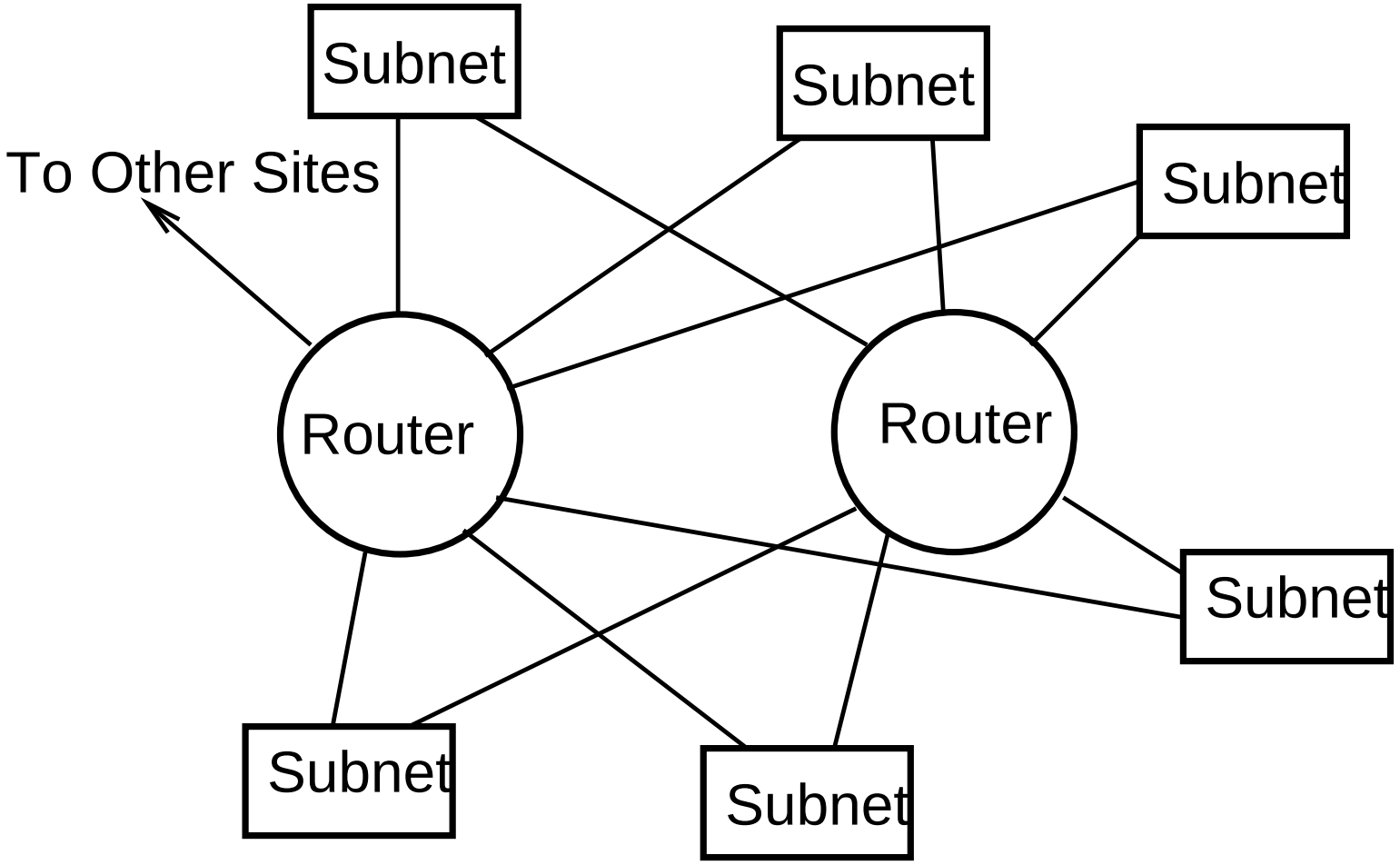
Site Network Topology: IP Layer



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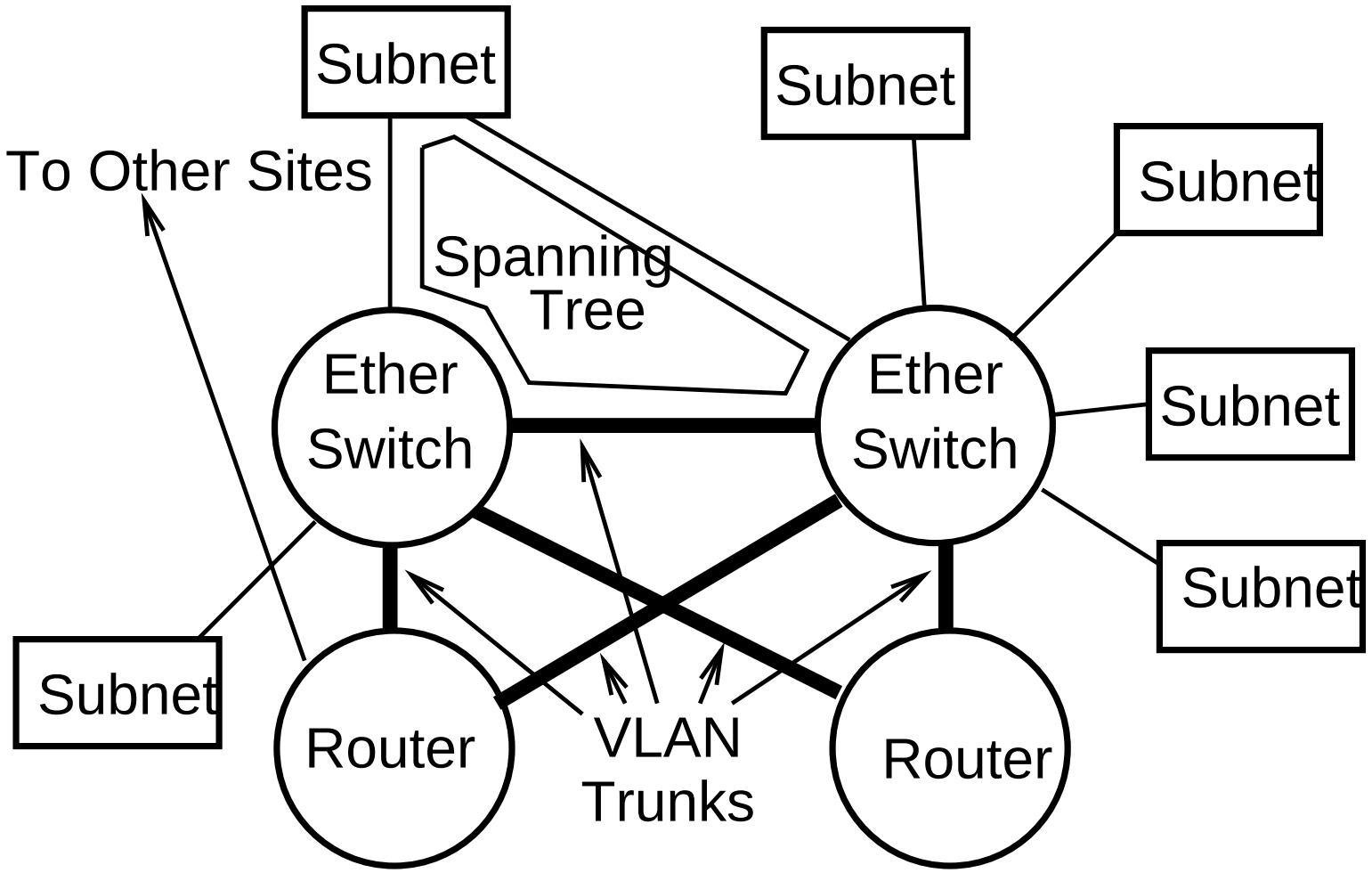
Site Network Topology: Link Layer



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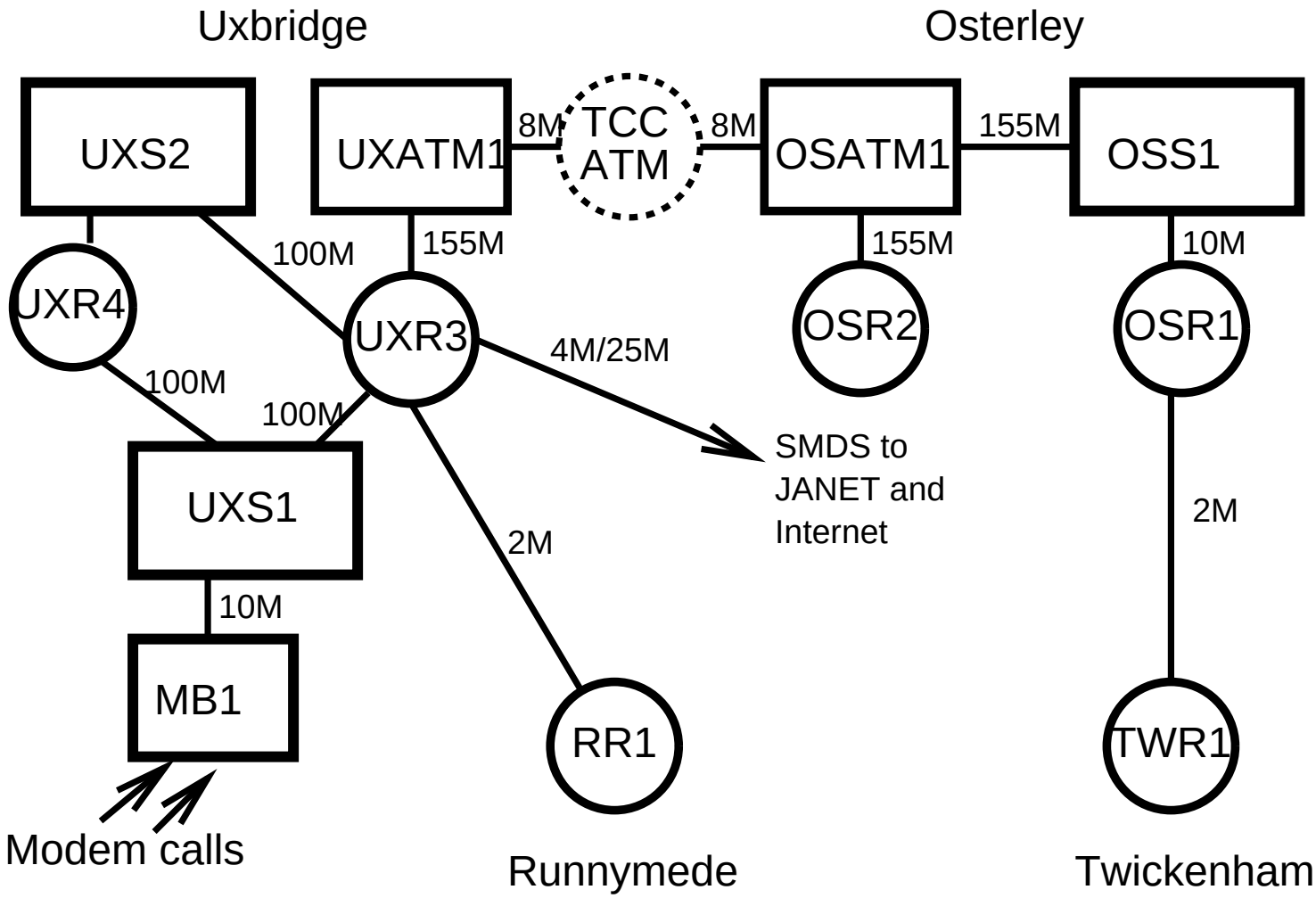
Inter-site connections



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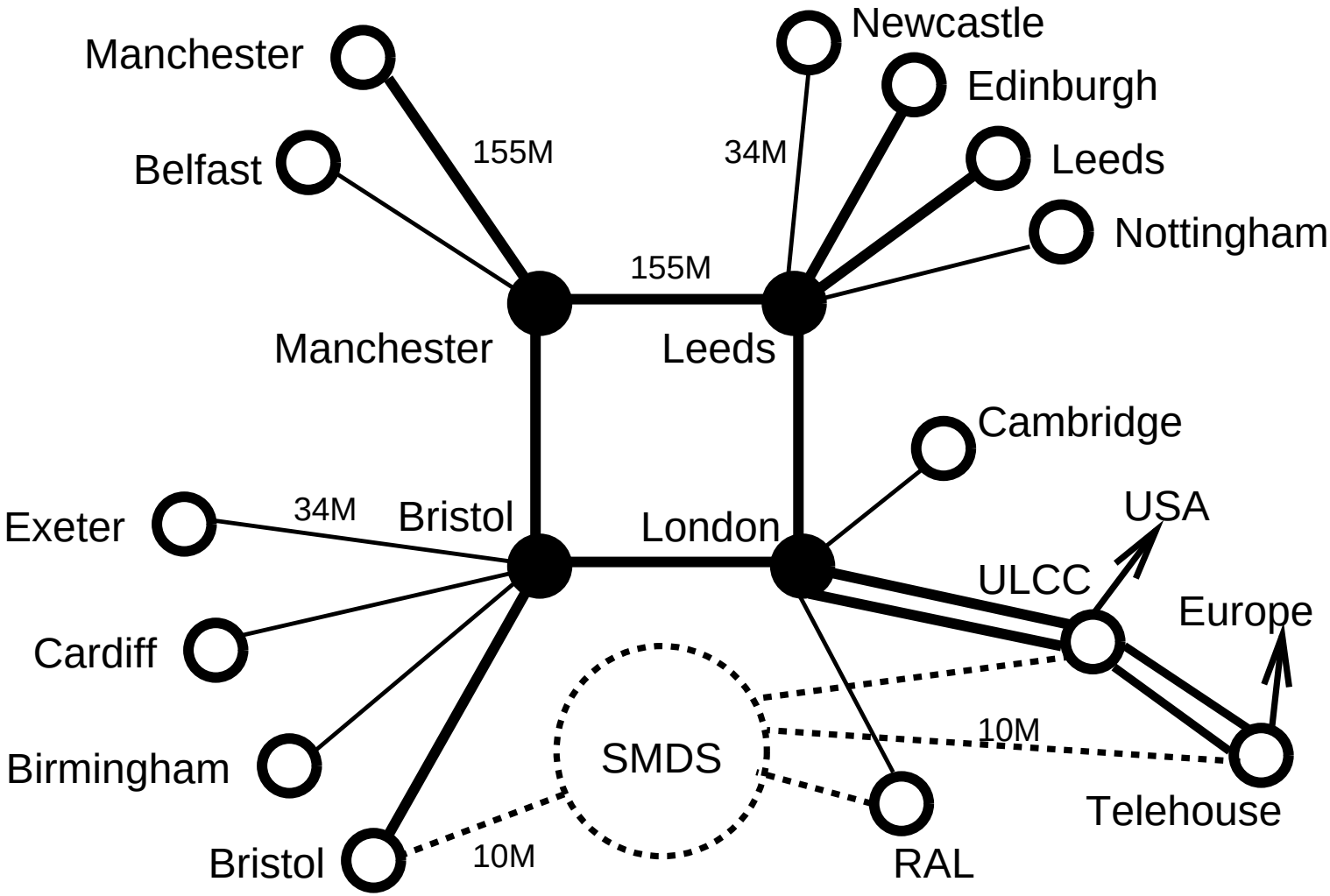
JANET topology



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External Links

Modems: Uxbridge and London numbers

Speeds to 56k and ISDN

PPP with PAP authentication

JANET link via SMDS from Uxbridge

UXR3 acts as weak firewall

- Outgoing connections OK except SMB, Mail
- Incoming connections restricted
- Telnet, FTP, Mail, Web to specified hosts
- SMB, rsh, rlogin etc blocked

Charging for international traffic from August 1st

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Names and Addresses

DNS: maps between hostname and IP addresses

- Many servers: master and slave copies
- **`/vol/network/named`**
- ‘host’ and ‘dig’ commands to get info

YP/NIS: networked database

- ‘ypwhich’ ‘ypmatch’ ‘ypcat’ commands
- **`ypcat networks`**
- **`ypmatch ee97ikb passwd`**
- **`/vol/network/etc /vol/network/amd`**
- **`/vol/network/pc.mount`**

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Users and Groups

```
iain:2@%xPXaxdaRd6:221:200:Iain G Liddell:
                    /user/ccos/iain:/bin/csh

ccus:*:200:ROOT,ccedtch,pcmndsk,linda,dave
```

UID is used by Unix and NFS to identify the user

GID specifies a group.

- Each user has a default group
- Group file can list user in other groups

DHCP and RARP

Dont want to hand-configure PC addresses

PCs and printers get IP address at boot time

Reverse ARP: maps MAC address to IP address

`/vol/network/etc/ethers`

DHCP supplies more info: router, DNS etc

Addresses are leased and can be re-used

`/vol/network/dhcp`

Logs to /var/adm/messages on COW and Calves

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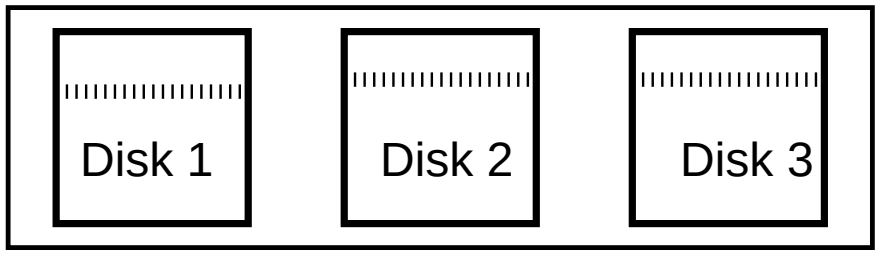
Filestore

Types: Home Directory, PC/Package, others

9 Home servers: large filesystems, RAID-1



Filesystem ‘striped’ across several disks

Server typically Ultra-1 with 100M ether

PC/Package servers: data mostly read-only

- Big memory (128M+) and little r/w load
- Often have many ethernet interfaces

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Filestore Naming

User store: /user/groupname/username

Filesystems: /vol/fileservers/srvnam/fsname

Packages: /vol/PACK/packagename_version

Main PC binaries: /vol/pc

PC Packages: /vol/pcpack

Main NT binaries: /vol/nt

Mapping between namespaces by Amd

/vol/network/amd/amd.vol

/vol/network/amd/amd.user

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Filestore access methods

Local filestore usually fastest

NFS v2: used by most Unix and all DOS

NFS v3: more efficient. Not supported by Amd

- Authentication by UID (very weak)
- Suns can do strong (crypto) authentication

SMB: Microsoft protocol: NT (and Win95)

- Runs on TCP
- Authentication by username/password
- Semi-crypto authentication also possible

Filestore Replication

Replicate for availability and performance

Master machine runs SUP server

Slave machines run SUP client (usually 1/day)

All changes MUST be made on the master copy

Amd and pc.mount to choose which copy to use

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Filestore Backup

Manual system: ufsdump and Exabyte tapes

- Daily increments kept for 1 week
- Weekly complete dumps kept for 6 weeks
- Monthly complete dumps kept for 6 months
- Quarterly complete dumps kept for 2 years
- Some servers not backed up as often

Automatic system: Networker and DLT tapes

- Daily increments and weekly completes
- Tapes kept 5-6 weeks
- Index entries kept 2 weeks

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PC (DOS) startup process

Local disk holds drivers and little else

Uses RARP or DHCP to get IP address

Subnet mask, Router, YP server located

Standard mounts using mount -s and PCGROUP:

```
DEFAULT.drives f: /vol/pc/general;
    j: /vol/pc/nfs_${NFSVERSION}
/vol/pc akiko-180, akiko-216, bes-164

merit.134.83.164.0 134.83.164.0 134.83.54.0 134.83.60.0
```

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PC (DOS) login process

Username/Password sent to pcnfsd on server

UID, GID, group list returned

mount -u finds home and group dirs

User and Group startup scripts run

H:\dos\lib\loginrc.bat

G:\dos\lib\loginrc.bat

NT startup and login process

DHCP finds IP address, router, DNS etc

IP address is leased (1 week max)

Currently, standard NT local login

NISGINA will authenticate using passwd map

mount program will cache passwd

mount program uses pc.mount - nearest copy

SMB sharenames derived from pc.mount

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Unix startup process

Whole O/S (usually) on local disk

IP address fixed to allow remote login

Run states: S, 1, 2, 3 (Controlled by /etc/rc*)

Amd is an internal NFS server for /user & /vol

Workstations start X and XDM

Servers start server daemons

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Unix login process

Username/Password verified using NIS map

Amd mounts filesystems dynamically

/bin/csh reads .cshrc (and .login)

.cshrc refers to /usr/local/lib/profiles/CSHRC

On X display, .xinitrc is run

On terminal session, .login is run

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Mail service

Sending mail:

- User interface (ELm, Simeon) to compose mail
- ‘Send’ uses SMTP to pass message to mailhost
- mailhost is really several machines (DNS trick)

Routing mail:

- PP has local users configured
- Mailing lists etc: ~pp/tables (replicated)
- Offsite routing uses DNS ‘MX’ records

Two internal mailhubs, one for incoming mail

Mail Service 2

Mail delivery: .mailfilter and .mailbox

Mail reading: direct file access or IMAP or POP

Simeon/ECS use IMAP for mail reading (and folders)

Elm (and pine?) use direct file access

Internal mailhosts run IMAP and POP servers

Web service

www.brunel.ac.uk and int-cgi.brunel.ac.uk

/vol/PACK/brunel-html-data (use html-data on PC)

WWW logs: /vol/PACK/httpd/*/logs

int-cgi logs: /vol/PACK/int-cgi/logs

Web cache: currently one. Will be more.

Web cache peers with other sites

Web traffic is 75% of our chargeable JANET use

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Printing

Each printer controlled by one server

Other servers send jobs to the controlling server

`/etc/printcap`

`/vol/network/printcap`

Control: lpc lpq lprm

DOS PCs submit jobs via NFS and pcnfsd

NT send jobs via SMB to SAMBA server

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Miscellaneous Servers and Info

We manage for Library, Admin, etc

Interactive: molnir loki (juno)

Batch: thor

`/vol/logger/hostinfo/hostinfo`
`/etc/hostinfo`

sysinfo

Logs: /var/adm /var/log /var/samba

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