

Systems Integration

Making Many Protocols and Networks Interoperate

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A computing department

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So Many Protocols

Standard Protocols:

- TCP/IP
- SMTP
- HTTP
- FTP
- SSH
- LDAP
- telnet
- DHCP
- DNS
- PPP
- XML
- SNMP
- SOAP
- RADIUS
- TLS
- NTP
- NNTP
- POP3
- IMAP
- Kerberos

Proprietary Protocols:

- NetBIOS (Microsoft file sharing)
- Active Directory
- WINS
- Novell Directory Services
- Database services from many providers
- Appletalk
- Novell IPX

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The Problem

There are so many Operating Systems:

- Microsoft:
 - Windows 9x
 - Windows CE
 - Windows NT
 - Windows 2000
 - Windows XP
 - Windows 2003
- Linux, from various vendors
- Unix
 - Sun Solaris
 - AIX from IBM
 - HPUX from Hewlett Packard
- Apple: OS X, and the previous MAC OS
- Cisco: IOS, various others (e.g., for Catalyst switches, PIX firewall, . . .)

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Many Different Hardware Platforms

So many computing platforms:

- IBM mainframes
- handheld devices
- RAID systems
- Cluster systems
- PCs
- Notebooks

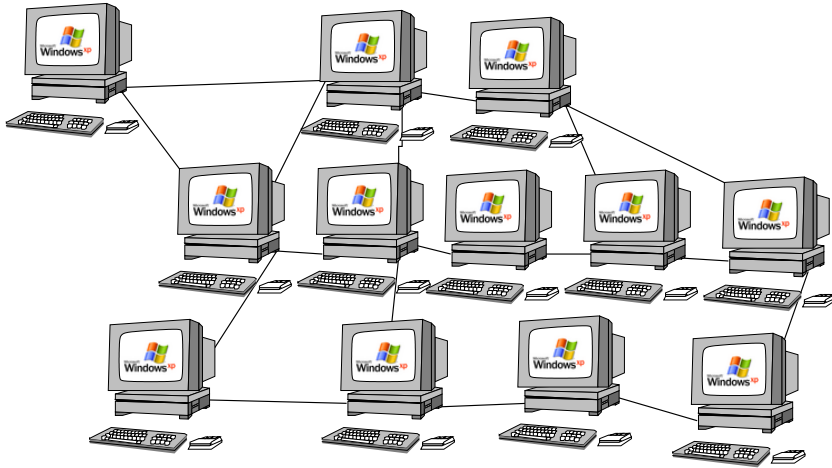
So many different communication media:

- CAT5 network cabling
- Wireless LANS
- Gigabit Ethernet
- Optic fibre

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Monoculture

- Why not just buy from one supplier?



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Prefer Open Protocols

- Use *open* and standard protocols as much as possible
- Avoid “locking in” to proprietary solutions *where a good open solution exists*

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How to Make them Work Together?

- Free Software works hard to *include* as many protocols, file systems, vendor products, hardware platforms as possible
- Solutions are cross-platform
 - Java, Perl, Python, C, C++
 - Linux (runs on tiny handhelds to huge mainframes, almost everything between)
 - Samba for integration with Windows Networks
 - *Netatalk* for integration with *Appletalk* (for older Macintosh OSS)
 - Apache Web server runs on almost any platform
 - OpenLDAP for directory services

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Samba

- Implements Microsoft’s SMB protocol
- SMB = Symmetric Message Block, gave project its name
- achieved through reverse engineering Microsoft’s proprietary protocols (no help from MS, but hindrance)
- good reputation for stability and performance outperforming MS servers in both respects
- Current production version supports use as a Windows NT compatible server (file sharing, printing, support for network browsing)
- Runs on many platforms, including very powerful Solaris machines
 - Most powerful windows servers run Solaris, not Microsoft software!

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Samba 2.2.x

- The release provided with current Linux systems
- Works as an NT 4 compatible PDC
- *Winbind* (part of samba) allows Linux and Unix machines to join a Windows Domain

Limitations of Samba 2.2.x

- Does not support Active Directory in the way that a Windows 2000 server does
- Samba 2.2 can neither be a Backup Domain Controller (BDC) nor use one
- User information stored on a Samba PDC is not as complete as that stored on a Windows PDC
- Samba obeys Linux group file access permissions on the PDC, but it does not tell the client machine about it properly. Group file permissions are hard to set from a client.
- Full support for ACLs (access control lists) depends on applying a patch to the Linux kernel and recompiling the kernel, or waiting till the Linux 2.6.x kernel is released

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Samba Version 3 (alpha release)

- Currently used in some commercial systems, but documentation not complete
- See <http://us1.samba.org/samba/ftp/alpha/WHATSNEW.txt>
- Supports Active Directory: a Samba 3 server can join an ADS realm as a member server and authenticate users using LDAP/kerberos
- Supports migrating from a Windows NT 4 domain
- Supports trust relationships with Windows NT domain controllers

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Using LDAP to Authenticate

- LDAP = Lightweight Directory Protocol
- A network directory
- Can be used to store user accounts, group information, and information about network devices
- Any application can be made to authenticate against LDAP
- Samba can use LDAP to authenticate against
- Can build an infrastructure that uses LDAP to authenticate *everything*

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A Case Study: ICT

- We use OpenLDAP to hold all user accounts (thousands), both full-time, part-time and staff
- All Linux systems authenticate against this directory
- Maintained only by me as a (very!) part time activity
- I did the programming in my spare time
- All home directories are on the same server

Next Step

- The next steps are:
 - Provide better hardware
 - We have an Adaptec clustering system with a dedicated shared RAID system
 - Will run Red Hat Advanced Server
 - Provide home directories via NFS (as currently do) and via samba
 - Provide support for old Macintosh clients via Netatalk
 - Provide a single sign-on for all services for all students and staff
- Time frame: by next academic year.