Unit 10: Interoperability

10.1. Windows 2000 - UNIX Interoperability

Windows 2000 – UNIX Interoperability

SMB/CIFS Resource sharing:

- Samba – de.samba.org

POSIX libraries/tool chains for Win32:

- Cygwin – sources.redhat.com/cygwin/
- U/WIN – www. research.att.com/sw/tools/uwin/
- NuTCracker / MKS Toolkit – www.datafocus.com
- Interix, SFU – www.microsoft.com/unix/interop/

Internet Explorer for UNIX:

- www. microsoft.com/unix/ie/ (Solaris, HP/UX)

What's Samba all about?

- Free SMB and CIFS client/server for UNIX & other OS
- Functionality:
  - a SMB server, to provide Windows NT and LAN Manager-style file and print services to SMB clients such as Windows 95, Warp Server, smbfs and others.
  - a NetBIOS (rfc1001/1002) nameserver, which amongst other things gives browsing support. Samba can be the master browser on your LAN if you wish.
  - a ftp-like SMB client so you can access PC resources (disks and printers) from UNIX, Netware and other operating systems
  - a tar extension to the client for backing up PCs
  - limited command-line tool that supports some of the NT administrative functionality, which can be used on Samba, NT WS and NT Server.

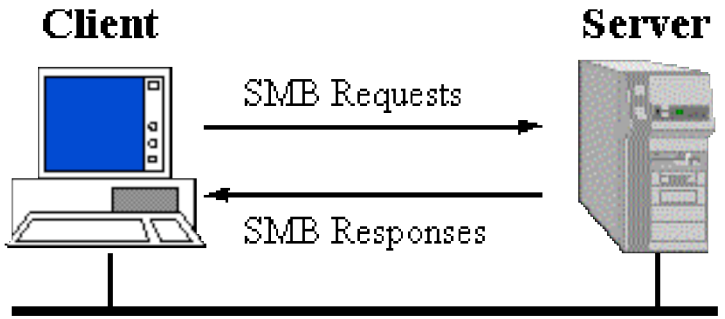
Samba & related packages

- overview at http://samba.org/samba;
  - See user survey.
- Related packages include:
  - smbfs, a linux-only filesystem allowing you to mount remote SMB filesystems from PCs on your linux box. This is included as standard with Linux 2.0 and later.
  - tcpdump-smb, a extension to tcpdump to allow you to investigate SMB networking problems over netbeui and tcp/ip.
  - smblib, a library of smb functions which are designed to make it easy to smb-ise any particular application.
    See ftp://samba.org/pub/samba/smblib.

What is SMB

- SMB is a client server, request-response protocol.

Addl. info at
http://anu.samba.org/
cifs/docs/what-is-smb.html



- The only exception to the request-response nature of SMB is when the client has requested opportunistic locks (oplocks) and the server subsequently has to break an already granted oplock because another client has requested a file open with a mode that is incompatible with the granted oplock.
- In this case, the server sends an unsolicited message to the client signaling the oplock break.

SMB and the OSI model

<table>
<tr><th>OSI</th><th colspan="4"></th><th>TCP/IP</th></tr>
<tr><td>Application
Presentation</td><td colspan="4">SMB</td><td rowspan="2">Application</td></tr>
<tr><td>Session</td><td>NetBIOS</td><td rowspan="3">NetBEUI</td><td>NetBIOS</td><td>NetBIOS</td></tr>
<tr><td>Transport</td><td rowspan="2">IPX[1]</td><td rowspan="2">DECnet</td><td>TCP&UDP</td><td>TCP/UDP</td></tr>
<tr><td>Network</td><td>IP</td><td>IP</td></tr>
<tr><td rowspan="2">Link</td><td rowspan="2">802.2,
802.3,802.5</td><td>802.2</td><td rowspan="2">Ethernet V2</td><td rowspan="2">Ethernet V2</td><td rowspan="2">Ethernet or
others</td></tr>
<tr><td>802.3,802.5</td></tr>
<tr><td>Physical</td><td colspan="4"></td></tr>
</table>

- Clients connect to servers using TCP/IP (actually NetBIOS over TCP/IP as specified in RFC1001 and RFC1002), NetBEUI or IPX/SPX.
- SMB was also sent over the DECnet protocol.
  Digital (now Compaq) did this for their PATHWORKS product

Samba (SMB) charcteristics

- NetBIOS Names
  - If SMB is used over TCP/IP, DECnet or NetBEUI, then NetBIOS names must be used in a number of cases.
  - NetBIOS names are up to 15 characers long, and are usually the name of the computer that is running NetBIOS.
  - Microsoft, and some other implementors, insist that NetBIOS names be in upper case, especially when presented to servers as the CALLED NAME.
- Protocol functionality (Core protocol):
  - connecting to and disconnecting from file and print shares
  - opening and closing files
  - opening and closing print files
  - reading and writing files
  - creating and deleting files and direcories
  - searching directories
  - getting and setting file attributes
  - Locking and unlocking byte ranges in files

SMB characteristics (contd.)

Security

- The SMB model defines two levels of security:
- Share level.
  - Each share can have a password, and a client only needs that password to access all files under that share.
  - This was the first security model that SMB had and is the only security model available in the Core and CorePlus protocols.
- User Level.
  - Protection is applied to individual files in each share and is based on user access rights.
  - Each user (client) must log in to the server and be authenticated by the server.
  - When it is authenticated, the client is given a UID which it must present on all subsequent accesses to the server.
  - This model has been available since LAN Manager 1.0.

SMB Clients and Servers Currently Available

- Clients:
  - Included in WfW 3.x, Win 95, Win98, Win ME and Win NT/2000.
  - smbclient from Samba
  - smbfs for Linux
  - SMBlib (an SMB client library that is in development)
- Servers:
  - **Samba** (Linux, Solaris, SunOS, HP-UX, ULTRIX, DEC OSF/1, Digital UNIX, Dynix (Sequent), IRIX (SGI), SCO Open Server, DG-UX, UNIXWARE, AIX, BSDI, NetBSD, NEXTSTEP, A/UX)
  - Microsoft Windows for Workgroups 3.x, Win95, Win98, Win ME, **Win NT/2000**
  - The PATHWORKS family of servers from Digital
  - LAN Manager for OS/2, SCO, etc
  - VisionFS from SCO
  - TotalNET Advanced Server from Syntax
  - Advanced Server for UNIX from AT&T (NCR?)
  - LAN Server for OS/2 from IBM

CIFS – the Common Internet File System

- The filesharing protocol at the heart of CIFS is an updated version of the Server Message Block (SMB) protocol
  - dates back to the mid-1980s.
  - in 1996/97, Microsoft submitted draft CIFS specifications to the IETF.
- The SMB protocol was originally developed to run over NetBIOS (Network Basic Input Output System) LANs.
  - Until Windows 2000, NetBIOS support was required for SMB transport.
  - The machine and service names visible in the Windows Network Neighborhood are, basically, NetBIOS addresses (Windows 2000 uses DNS names).
- Windows 3.11 (WfW) introduced:
  - service announcement and location system called Browsing.
  - The browser service provides the list of available file and print services presented in the Network Neighborhood.
- WfW Workgroup concept:
  - simplified network management, user groups users
  - Workgroup concept was expanded to create NT Domains1.

Samba 2.2.0 – (April, 17, 2001)
Powering the next generation of Network Attached Storage

- Integration of server terminated leases (Windows "oplocks") with UNIX NFS sharing (Linux 2.4 kernel and IRIX only). Complete data and locking integrity when sharing files between UNIX and Windows.
- Ability to act as an authentication source for Windows 2000® and Windows NT® clients, allowing savings on the purchase of Microsoft® Client Access Licenses.
- Full support for the automatic downloading of Windows 2000 and Windows NT printer drivers, providing the first full implementation of the Windows NT point-and-print functionality independent of Microsoft code.

Samba 2.2.0 (contd.)

- Unification of Windows 2000 and Windows NT Access control lists (ACLs) with UNIX Access control lists. Allow Windows clients to directly manipulate UNIX Access control entries as though they were Windows ACLs.
- Single sign-on integration using the winbind server (available separately). Allow UNIX servers to use Windows 2000 and Windows NT Domain controllers as a user and group account server. Manage all user and group accounts from a single source.
- Microsoft Distributed File System® (DFS) support. Samba 2.2.0 can act as a DFS server in a Microsoft network.
- Share level security setting. Allow security on Samba shares to be set by Microsoft client tools.
- Many other feature enhancements and bug fixes.

Cygwin – principles and problems

- When a binary linked against the library is executed, the Cygwin DLL is loaded into the application's text segment.
- Because we are trying to emulate a UNIX kernel which needs access to all processes running under it, the first Cygwin DLL to run creates **shared memory areas that other processes** using separate instances of the DLL **can access**.
- This is used to **keep track of open file descriptors** and **assist fork and exec**, among other purposes.
- In addition to the shared memory regions, every process also has a per_process structure that contains information such as process id, user id, signal masks, and other similar process-specific information.

Highlights of Cygwin Functionality

- Supporting both Windows 2000/NT and 9x
- Permissions and Security
  - maps Win32 file ownership and permissions to the more standard, older UNIX model
- File Access
  - Win32- and POSIX-style paths,
  - Using either forward or back slashes as the directory delimiter
  - Symbolic links are emulated by files containing a magic cookie followed by the path to which the link points
- Text Mode vs. Binary Mode
  - compatibility at the expense of violating the POSIX standard that states that text and binary mode will be identical

Cygwin features (contd.)

- **Process Creation**
  - The fork call in Cygwin is particularly interesting because it does not map well on top of the Win32 API.
  - Currently, the Cygwin fork is a non-copy-on-write implementation similar to what was present in early flavors of UNIX.
- **Signals**
  - When a Cygwin process starts, the library starts a secondary thread for use in signal handling.
  - This thread waits for Windows events used to pass signals
  - When a process notices it has a signal, it scans its signal bitmask and handles the signal in the appropriate fashion.
  - Most standard UNIX signals are provided.
  - Job control works as expected in shells that support it.

Cygwin features (contd.)

- **Sockets**
  - Socket-related calls in Cygwin are mapped onto Winsock
  - Cygwin has to perform winsock initialization when appropriate.
  - Child proc. initialize winsock if any inherited file descriptor is a socket
- **Select**
  - The UNIX select function is another call that does not map cleanly on top of the Win32 API.
  - Win32 select in Winsock only works on socket handles.
  - Cygwin select works for different types of file descriptors (sockets, pipes, handles, and a custom /dev/windows Windows messages pseudo-device).

Software, that has been ported to Cygwin

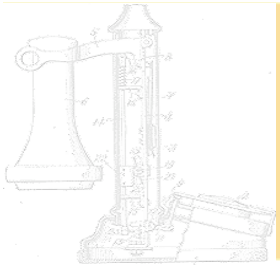
- Apache 1.3.9 and php-4.0b2,
- CD Recording Software
- Data Plotting Library DISLIN 7.3
- Differential X Protocol Compressor 3.8.0
- DirectX
- FreeCIV 1.8.0
- gcc 2.95.2
- Gimp for Win32
- groff 1.16.1
- IBM's OpenDX
- Icarus Verilog
- Insight debugger, pine, wget, info, other ports
- Kerberos V4 eBones Distribution v1.0.3
- LAPACK Libraries
- LessTif 0.89.9

Install Cygwin now

- libstdc++-v3 2.90.7
- lynx-2.8.2r1
- mc-4.1.36, tcltk-8.3.1
- Open PTC for Windows
- perl-5.6.0
- Perl, gdbm, cvs, and cygipc
- PGPlot 5.2
- Python headers for mingw
- RPM 3.04, Lynx 2.8.3
- RXVT
- screen-3.9.8, xchat-1.6.0
- Screen Saver Library
- TCL/Tk 8.1
- UCD SNMP
- X11R6.4 Archive and Zyacc
- XChat-text 1.5.7

UWIN

- The UWIN package contains the following three elements:
  - Libraries that provide the UNIX Application Programming Interface (API)
  - Include files and development tools such as cc, yacc, lex, and make.
  - Korn Shell and over 200 utilities such as ls, sed, cp, stty etc.
  - www.research.att.com/sw/tools/uwin/ (free non-commercial license)
- The library functions are implemented in a DLL (POSIX.DLL).
- Programs linked with POSIX.DLL run under the WIN32 subsystem instead of the POSIX subsystem.
- A cc command is provided to compile and link programs for UWIN on Windows NT. CC calls
  - either the Microsoft Visual C/C++ 2.X compiler,
  - the Visual C/C++ 4.X compiler,
  - the Visual C/C++ 5.0 compiler,
  - the Visual C/C++ 6.0 compiler,
  - or the Microsoft Tools C compiler to perform the actual compilation and linking.



UWIN features

- Process control and management:
  - UWIN includes a spawn family of functions that combines the functionality of fork/exec for efficiency.
  - With exec (), an existing process can be overlaid with another process.
  - Each process has a unique process id and belongs to a process group.
  - The vfork() function is also an efficient way to create processes.
- File descriptor semantics:
  - Open files, pipes, sockets, fifos, and character and block special devices files have file descriptors associated with them.
  - They can be duped and inherited with UNIX semantics.
- UNIX signal semantics:
  - Nearly all of the UNIX signals are provided including job control signals so that ksh can stop and restart jobs.
  - A process can catch, block or ignore signals.
  - Signals can be sent to processes or to process groups.
  - Applications compiled with the -D_BSDCOMPAT flag obey UCB UNIX signal semantics.

UWIN features (contd.)

- Support for devices
  - UWIN provides character and block devices with major and minor numbers as found on UNIX systems.
  - Support for direct access to floppy drives (/dev/fd0), and SCSI tape drives (/dev/mt0), as well as ptys and ttys is available.
- Terminal interface for consoles, sockets, and serial lines:
  - The POSIX termios interface is supported for consoles with vt100 emulation. Serial lines, and sockets that have been designated as virtual terminals. UWIN supports pseudo-ttys.
- Use of the mouse with console windows:
  - The left mouse button in a console window can be used to select text and copy to the clipboard.
  - The right button (or middle button on a three button mouse) can be used to paste text from the clipboard.
  - The /dev/clipboard pseudo-device can be used to redirect command input and output to the clipboard.
  - The /dev/windows pseudo-device can be used within select() to block until mouse or keyboard events are received.

UWIN features (contd.)

- UCB sockets based on WINSOCK:
  - Sockets are file descriptors and obey file descriptor semantics.
  - Internet domain protocol (AF_INET) and UNIX domain sockets are provided.
  - The multicast socket protocol is supported.
- Pathname mapping from UNIX to NT:
  - UNIX style naming for all files with / as the delimiter by creating mounts.
  - The / directory location can be selected at installation.
  - Each drive letter in Windows is mounted in a single letter directory name under / so that /a/file is the UWIN name for a:\file.
  - certain directories are implicitly mounted such as /sys on the system directory, /win on the windows directory, and /msdev on the directory containing the Microsoft development kit if installed.
  - Character and block special devices are in /dev and use naming conventions found on most UNIX systems.
  - UWIN also supports UNC names for files that begin with //.
  - An API function is provided to map the UNIX name into the Windows NT name. The mapping is available from ksh as well.

UWIN features (contd.)

- UNIX naming conventions:
  - The PATH variable is a : separated list rather than a ; separated list.
  - The cc command generates files with a .o suffix by default, etc.
- Mapping to and from UNIX ids/permissions to NT permissions:
  - Windows NT subject identifiers are mapped to UNIX user ids and group ids.
  - UNIX permissions are mapped onto Windows NT file ACLs.
  - The Administrator can use chown() to change the owner and or group of a file.
- File control locking:
  - UNIX file control advisory locking is supported with deadlock detection.
- Memory mapping and shared memory and System V IPC:
  - mmap() and the system V shared memory, semaphores an message calls facilities are provided.
- Runtime linking of dynamically linked libraries:
  - The dlopen(), dlsym() interface from System V Release 4 is provided.
- Error mapping from NT to UNIX:
  - Errors returned by WIN32 functions are mapped into UNIX *errnos.*

UWIN features (contd.)

- *i*-node numbers:
  - An *i*-node number is returned when reading a file and when stating a file.
- Hard links
  - Hard links are supported on both NTFS and FAT file systems.
- Symbolic links
  - Symbolic links to files and directories can be created in UWIN and are implemented as Windows shortcuts.
  - A .lnk suffix will be appended to these file names but will not appear when reading directories with UWIN.
  - Shortcuts created by Windows 95, Windows 98, and Windows NT appear as symbolic links in UWIN but do not have the .lnk suffix removed.
- Fifo's
  - Fifo's (UNIX named pipes) can be created with mkfifo() and opened as an ordinary file.

UWIN features (contd.)

- Setuid and setgid programs
  - Use chmod() to turn on setuid permission for a program.
  - The program must be on an NTFS file system.
- inet Daemons and commands
  - UWIN 2.25 comes with the UCB inet daemon, the telnet daemon, the rlogin daemon, and the rsh daemon.
  - It also includes the telnet, ftp, rsh, and rlogin programs.
  - The ssh daemon and program can be built from the source
- Access of Registry through the File System
  - UWIN treats the Windows registry as a file system with registry keys treated as files, and keys that have sub-keys treated as directories.
  - You can use UWIN tools directly on registry keys. The registry is automatically mounted under /reg during startup.
- Cron daemon
  - UWIN comes with a cron daemon that is used for running at and cron jobs. The cron daemon is started by /etc/rc on Windows NT.

MKS Interoperability Products

Mortice Kern Systems - http://www.datafocus.com/

MKS Toolkit for Developers Features

- Over 300 UNIX and Windows command-line utilities
  - (full POSIX.2 specification).
- MKS Korn shell (ksh) and MKS C shell (csh)
- Command-line build utilities including
  - ar, cc, make, grep, vi.
  - Tools and utilities for manipulating HTML content (htdiff, htsplit, url, mkurl).
  - Web CGI scripting, and active Perl scripting (web, mkscgi, PScript™)
- File system commands (mount, umount) and symbolic link support.
- smtpmail and mapimail.
- Win32 file and user security utilities (chacl, lsacl, su).
- Utilities for setting up users, groups, and permissions on Windows
  - userinfo, groupinfo, member
- Tape and archive commands
  - tar, pax, cpio, mt
  - UNIX-compatible backups.

NuTCracker Packaging

MKS Toolkit features (contd.):

- Commands to manipulate
  - device drivers,
  - Windows domains, and
  - file associations (dev, domain, ftype).
- Remote utilities:
  - rsh, rexec, rcp, rlogin

Packaging:

- N*u*TCRACKER Workstation, N*u*TCRACKER Server, Power User Utilities
- MKS Toolkit contains the SCO XVision Eclipse X Server.
- Hummingbird 3D OpenGL X Server
  - an add-on to MKS Toolkit for Enterprise Developers

Services for UNIX

- Windows® Services for UNIX 2.0
  - provides the ability to share network resources among Windows NT®-, Windows 2000-, and UNIX-based operating systems.
- Client for NFS.
  - Allows Windows NT and Windows 2000 clients to mount exported file systems directly from UNIX NFS servers.
- Server for NFS.
  - Shares directories from Windows-NT based and Windows 2000-based servers as if they were native UNIX exports.
- Gateway for NFS.
  - Shares UNIX NFS exports as Windows-based shared directories.
- Server for PCNFS.
  - Enables Windows 2000 to act as a PCNFS daemon (PCNFSD) server, seamless user authentication services when connecting to NFS servers.

Leverage Existing Knowledge

- Microsoft Windows Services for UNIX 2.0 provides
  - a subset of UNIX utilities and a Korn Shell to give UNIX users and administrators their familiar set of tools and shell environment.
- Over 60 UNIX Utilities.
  - Enables you to run familiar UNIX commands such as cat, grep, ls, ps, rshsvc, and vi natively from Windows NT or Windows 2000.
- Korn Shell.
  - Provides a full-featured implementation that enables you to run UNIX shell scripts from Windows NT and Windows 2000.

Simplify Network Administration

- Microsoft Windows Services for UNIX 2.0 simplifies:
  - local and remote network administration, and supports either graphical or character-based administration.
- Telnet Client.
  - Enables faster character-based and script-based remote access and administration.
- Telnet Server.
  - Provides security and simplified logins, and supports both stream and console mode.
- Microsoft Management Console.
  - Enables administrators to centralize all Windows Services for UNIX 2.0 management from a single application, as well as from the command line.
- ActiveState ActivePerl 5.6.
  - Provides the ability to automate network administrative tasks by running new or existing Perl scripts natively on Windows NT or Windows 2000.

Simplify Account Management

- NIS to Active Directory Migration Wizard.
  - Consolidates account management by moving UNIX source files, such as password and host files, from NIS domains into the Windows 2000 Active Directory™ service.
- Server for NIS.
  - Enables a Windows 2000 domain controller to act as the primary NIS server, integrating NIS domains with Windows 2000 domains, allowing administrators to manage an NIS domain from Active Directory.
- 2-way Password Synchronization.
  - Provides the ability to synchronize passwords from both platforms, making it easier for users to maintain one password for both Windows and UNIX.
- User Name Mapping.
  - Associates Windows and UNIX user names, allowing users to connect to NFS network resources seamlessly.

Interix – POSIX subsystem for NT/2000

- KornShell, C Shell and Bourne Shell
  - with full job control
- Over 300 utilities,
  - including scripting tools such as awk, sed, perl, Tcl/Tk
- Berkeley System Distribution (BSD)
  - sockets mapped to Winsock
  - Memory-mapped files
- System V (SVID) interprocess communication (IPC):
  - semaphores, message queues and shared memory
- UNIX Look and Feel:
  - Pseudo-terminal support
  - Color curses support
  - Ability to execute Win32 applications from Interix
  - Full tty semantics mapped to console windows
  - Pseudo-terminal support
  - File-link support and true case-sensitive file names

Interix Features (contd.)

- Full integration with Windows NT security model, administration, file systems, networking and printers
- Support for POSIX.1 (system services) and POSIX.2 (shell and utilities)
- X11R5 runtime, including X clients:
  - *xterm, twm, xrdb,* and *xlsclients*
- Support for daemons running as Windows NT services
- *telnetd* & *rlogind* services (multiuser login support)
- Berkeley r-utilities (servers and clients)
- *cron, syslogd* & other daemon/service support
- Internet clients: *ftp, telnet, ping, rsh*
- Integrated tape device support

Interix Software Development Kit

- Development tools, including
  - *make, RCS, lex, yacc, cc, c89, nm, ar, strip*
- ANSI C, POSIX.1 and POSIX.2 interfaces
- Color curses library
- BSD-style sockets library support
- X11R5 libraries and header files
- *gcc* (GNU C) compiler
- *g++* (GNU C++) compiler
- *g77* (GNU FORTRAN77) compiler
- Support for Microsoft Visual C/C++ versions 4.0 and 5.0

Internet Explorer for UNIX (Solaris or HP/UX)

System Requirements

- A Sparcstation 2 or greater
- English Solaris 2.5 and above
- 32 MB of RAM (64 MB recommended)
- 68 MB of hard-disk space to perform the installation

- HP 9000 Enterprise Server, HP 9000 Workstation or HP Visualize Workstation
- English HP-UX Operating System version 10.20 or later
- 64 MB of RAM (96 MB recommended)
- 87 MB of hard-disk space to perform the installation

Features







- Intellisense
  - Internet Explorer 5 uses IntelliSense everywhere to give you automated features that save time when you're on the Web.
- Search Assistant
  - New and improved, the Search Assistant even lets you search your searches!
- AutoSearch
  - AutoSearch takes you exactly where you want to go. (!!)
- Related Links
- Improved Favorites
  - Easily scan your favorite files, folders, and Web sites (still no search!)
- Improved History
  - The History bar keeps track of where you've been by date, by site, by site visited most often, or by the order of sites you've visited today.
- Offline Browsing