**Introduction to UNIX**

**Operating Systems**

* allocate resources and schedule tasks
* resources include CPU, memory, disk, tape, printers, terminals, modems, etc.
* only one user allowed at a time for each resource
* keeps track of filenames and directory structure
* multi-tasking (one task at a time per processor actually executing)
* multi-processing (schedules multiple processors)
* multi-user

**History of UNIX**

* developed at Bell Labs (AT&T) in 1969
* unlike most OS's at the time, UNIX was multi-user, interactive, and simplified sharing of data & programs
* became popular in industry as college and university graduates were trained in it
* open system, ported to many different hardware platforms (unlike IBM, Burroughs, Univac mainframes)
* software written for one UNIX system will often run on other systems with little or no modification
* still very weak in areas of system management - tape management, security, hardware accounting, capacity planning tools, performance management including prioritization of jobs
* hardware manufacturers modified UNIX to run on their systems and added enhancements
* standardization was begun in response to Windows NT threat
* System V Release 4 is one of the steps to address standardization
* SVR4 includes many of the modifications that were being done by hardware manufacturers, if they were universally useful and applicable

**History of Linux**

* GNU (Gnu's not Unix) was started in early 80's to create and promote free software
* Linux was created by Linus Torvalds in the 1990's, released to the Internet in 1994, mostly using GNU C compiler
* about 1/3 of Linux is GNU code from the Free Software Foundation - a Linux distribution consists of Linux kernel + GNU compilers/tools/utilities + other free software
* Linux uses the Open Source model for development - code is placed on the Internet, users download and test it, programmers improve it and place it back on the web
* there is competition among programmers to fix bugs and improve Linux

**UNIX Structure**

* hardware, surrounded by
* UNIX kernel (basic OS), surrounded by
* shell (user interface, command interpreter, and some built-in commands), surrounded by
* utilities (or commands)
* most common shells: Bourne shell (sh), C shell (csh), Korn shell (ksh), Bourne again shell (bash), TC shell (tcsh), Z shell (zsh)
* we'll mostly be concerned with the Bash shell, which is the most popular Linux shell
* the Korn shell is the most popular Unix shell, and is very similar to the Bash shell

**Common Commands**

* pwd will show your current directory
* cd is used to change current directory, eg. cd directory-name
* ls - lists information about files and directories
* ls -a - all files (including hidden)
* ls -l - long form, gives more information about files`
* ls -d - gives information about the directory itself, not contained files
* these options can be mixed and matched, eg. ls -ld
* touch - creates a new file, or updates stats (eg. timestamp) on an existing file
* mkdir - to create directories
* mkdir -p - to create a directory & any parent directories not already existing
* rmdir - to delete empty directories, eg. rmdir directory-list
* mv existing-file new-file - to rename or move files & directories
* cp source-file destination-file - to copy files (careful, overwrites destination with no warning)
* cp -r - to copy directories including files and subdirectories
* rm - to delete files, eg. rm file-list
* rm -r - to delete directories including files and subdirectories
* cat filename - display contents of file
* more or less - displays file contents one page at a time
* <space bar> - will go to next page
* b - will go to previous page
* /string - will search for string within document being viewed
* q - will quit
* file filename - gives info about the contents of the file
* man command - online manual (or help) for command, uses more to display information
* man -k keyword - eg. man -k calendar
* searches through man sections for keyword, displays one-line summary of each related command
* diff file1 file2 - displays differences between 2 files
* echo text or $variable (eg. $HOME)
* echo -n "Hello" - doesn't skip to a new line
* echo -e "Hello\nthere" - enables escapes, eg. \n (newline) \t (tab)
* eg. echo -ne "This is a menu\n\t1. Item 1\n\t2. Item2\n\t3. Item3\nEnter choice: "
* printf - similar to echo but can use C-style formatting
* allows escapes: eg. \n (newline) \t (tab)
* allows string length specifications
* eg. printf "%-20s%20s%10.2f\n\n" "$name" "$phone" "$price"
* date - gives date and time
* which utility - lists pathname that would be used to access this utility
* who - displays information about users logged on to system
* whoami - displays your userid

**Permissions**

* permissions can only be changed by file owner or superuser (system administrator)
* chmod is used to alter access permissions to an existing file or directory
* the 9 permission bits displayed in an ls -al listing are read/write/execute for user(owner)/group/other
* chmod xxx filename
* xxx is 3 octal digits representing the binary string rwxrwxrwx where the first three characters are read/write/execute permission for the user, the next three for the user's group, and the last three for all others
* eg. chmod 640 file1 - would give the user read and write permission, everyone in his group would have read permission, and all others would have no permission
* this is called the "octal" or "absolute" method of changing permissions
* chmod u+r filename
* u represents user, could also be g for group, o for other, a for all
* + represents addition of permission, could also be - for removal, = for set
* r represents read permission, could also be w for write, x for execute
* eg. chmod u+x file1 - would give the user execute permission in addition to whatever he had before
* eg. chmod g-w file1 - would take away write permission from the user's group if they had it before
* eg. chmod o=r file1 - would set all others' permission to read only regardless of what they had before
* this is called the "symbolic" or "relative" method of changing permissions

**Directory Permissions**

* r permission for a directory allows viewing of file names in the directory, but no access to the files themselves (regardless of the files' permission settings)
* x gives passthrough permission for a directory, which allows access to any files in the directory which have appropriate permissions set, but doesn't allow viewing of file names in the directory
* x also gives permission to cd to the directory, changing the pwd
* r and x permissions allow viewing of file names, and access to any files which have appropriate permissions set
* w and x permissions allow adding or removing of files, but don't allow viewing of file names
* r and w and x permissions allow viewing of file names, access to any files which have appropriate permissions set, and adding and removing of files

**umask**

* umask defines default permissions for newly created files, doesn't change permissions on existing files
* default permissions will be 777 minus umask for directories, remove any remaining executes for files
* eg. umask - by itself, shows current umask setting
* eg. umask 077 - new directories will be 700, new files will be 600
* eg. umask 023 - new directories will be 754, new files will be 644