LIMKOKWING UNIVERSITY OF CREATIVE TECHNOLOGY

ESWATINI

WEEK 10 : LECTURE 8 - LINUX BASICS

Bachelor's Degree in Information Technology
BITOS4111, OPERATING SYSTEMS
Trimester: 05
From **July 2024** to **October 2024**

OBJECTIVES/TOPICS

- Overview of Linux.
- Installation and Upgrade.
- Introduction to shell and commands.

- Commands: pwd, cd, mkdir, rmdir, ls, cat, cp, rm, mv, wc, split, cmp, comm, diff, head, tail, grep, sort, apt-get install, apt-get remove.

- Editing files with "vi", "vim", "gedit" etc.
- Linux Shell.

LINUX OVERVIEW

- UNIX has been a popular OS for more than two decades because of its multi-user, multi-tasking environment, stability, portability and powerful networking capabilities

- Linux is a free open source UNIX OS for PCs that was originally developed in 1991 by Linus Torvalds, a Finnish undergraduate student

- Linux is open-source

LINUX OVERVIEW

- The open source nature of Linux means that the source code for the Linux kernel is freely available so that anyone can add features and correct deficiencies.

- This approach has been very successful and what started as one person's project has now turned into a collaboration of hundreds of volunteer developers from around the globe.

- The open source approach has not just successfully been applied to kernel code, but also to application programs for Linux

LINUX OVERVIEW

- As Linux has become more popular, several different development streams or distributions have emerged,
  - e.g. Redhat, Slackware, Mandrake, Debian, and Caldera.

- A distribution comprises a prepackaged kernel, system utilities, GUI interfaces and application programs.

LINUX OVERVIEW

- Redhat is the most popular distribution because it has been ported to a large number of hardware platforms (including Intel, Alpha, and SPARC), it is easy to use and install.

- It alos comes with a comprehensive set of utilities and applications including the X Windows graphics system, GNOME and KDE GUI environments, and the StarOffice suite (an open source MS-Office clone for Linux).

LINUX OVERVIEW

- Linux has all of the components of a typical OS:
  - 1. Kernel
    - The kernel (in raw binary form that is loaded directly into memory at system startup time) is typically found in the file ***/boot/vmlinuz***, while the source files can usually be found in ***/usr/src/linux***.
    - The Linux kernel includes device driver support for a large number of PC hardware devices (graphics cards, network cards, hard disks etc.), advanced processor & memory management features, and support for many different types of filesystems

LINUX OVERVIEW

- Linux has all of the components of a typical OS:
  - 2. Shells and GUIs
    - Linux supports two forms of command input:
      - through textual command-line shells similar to those found on UNIX systems (e.g. sh - the Bourne shell, bash - the Bourne again shell & csh - the C shell)
      - through graphical interfaces (GUIs) such as the KDE and GNOME window managers.
    - If you are connecting remotely to a server your access will typically be through a command line shell.

LINUX OVERVIEW

- Linux has all of the components of a typical OS:
  - 3. System Utilities
    - Virtually every system utility that you would expect to find on standard implementations of UNIX (including every system utility described in the POSIX.2 specification) has been ported to Linux.
      - This includes commands such as ls, cp, grep, awk, sed, bc, wc, more, and so on.
    - These system utilities are designed to be powerful tools that do a single task extremely well.

LINUX OVERVIEW

- Linux has all of the components of a typical OS:
  - 3. System Utilities
    - Users can often solve problems by interconnecting these tools instead of writing a large monolithic application program.
    - Linux's system utilities also include server programs called daemons which provide remote network and administration services (e.g. telnetd and sshd provide remote login facilities, lpd provides printing services, httpd serves web pages, crond runs regular system administration tasks automatically)

LINUX OVERVIEW

- Linux has all of the components of a typical OS:
  - 3. System Utilities
    - A daemon (short for "Disk And Execution MONitor") is usually spawned automatically at system startup and spends most of its time lying dormant (lurking?) waiting for some event to occur.

LINUX OVERVIEW

- Linux has all of the components of a typical OS:
    - 4. Application programs
        - Linux distributions typically come with several useful application programs as standard.
            - E.g. the emacs editor, xv (an image viewer), gcc, g++, xfig (a drawing package), latex (a powerful typesetting language) and soffice
        - Redhat Linux also comes with rpm, the Redhat Package Manager which makes it easy to install and uninstall application programs.

LINUX OVERVIEW

- To log into (& out of) Linux Systems, there are 2 methods used:
  - 1. Text-based (TTY) terminals:
    - When you connect to a UNIX computer remotely (using telnet) or when you log in locally using a text-only terminal, you will see the login prompt:
    - At this prompt, type in your username and press the enter/return/ key. Remember that UNIX is case sensitive (i.e. Will, WILL and will are all different logins).
      - You should then be prompted for your password:

LINUX OVERVIEW

- To log into (& out of) Linux Systems, there are 2 methods used:
  - 1. Text-based (TTY) terminals:
    - Type your password in at the prompt and press the enter/return/ key.
      - Note that your password will not be displayed on the screen as you type it in.

    - To log out of a text-based UNIX shell, type "exit" at the shell prompt (or if that doesn't work try "logout"; if that doesn't work press ctrl-d).

LINUX OVERVIEW

- To log into (& out of) Linux Systems, there are 2 methods used:
  - 2. Graphical terminals:
    - If you're logging into a UNIX computer locally, or if you are using a remote login facility that supports graphics, you might instead be presented with a graphical prompt with login and password fields.
    - Enter your user name & password then press ENTER
    - To log out of a graphical window manager, look for menu options similar to "Log out" or "Exit"

LINUX OVERVIEW

- To change your Linux password:
  - The UNIX command to change your password is passwd:

    $ passwd

  - The system will prompt you for your old password, then for your new password.
  - To eliminate any possible typing errors you have made in your new password, it will ask you to reconfirm your new password.

LINUX OVERVIEW

- General format of UNIX commands
  - A UNIX command line consists of the name of a UNIX command (actually the "command" is the name of a built-in shell command, a system utility or an application program) followed by its "arguments" (options and the target filenames and/or expressions).
  - The general syntax for a UNIX command is
    $ ***command -options targets***

LINUX OVERVIEW

- The UNIX/Linux filesystems
  - The UNIX operating system is built around the concept of a filesystem which is used to store all of the information that constitutes the long-term state of the system.
  - This state includes the operating system kernel itself, the executable files for the commands supported by the operating system, configuration information, temporary workfiles, user data, and various special files that are used to give controlled access to system hardware and operating system functions.

LINUX OVERVIEW

- The UNIX/Linux filesystems
  - Every item stored in a UNIX filesystem belongs to one of four types:
    - 1. Ordinary files
      - Ordinary files can contain text, data, or program information. Files cannot contain other files or directories.
    - 2. Directories
      - Directories are containers or folders that hold files, and other directories

LINUX OVERVIEW

- The UNIX/Linux filesystems
  - 3. Devices
    - To provide applications with easy access to hardware devices, UNIX allows them to be used in much the same way as ordinary files.
    - There are 2 types of devices in UNIX:
      - block-oriented devices which transfer data in blocks (e.g. hard disks) and
      - character-oriented devices that transfer data on a byte-by-byte basis (e.g. modems and dumb terminals).

LINUX OVERVIEW

- The UNIX/Linux filesystems
  - 4. Links
    - A link is a pointer to another file.
    - There are two types of links –
      - a hard link to a file is indistinguishable from the file itself.
      - A soft link (or symbolic link) provides an indirect pointer or shortcut to a file.
        - A soft link is implemented as a directory file entry containing a pathname.

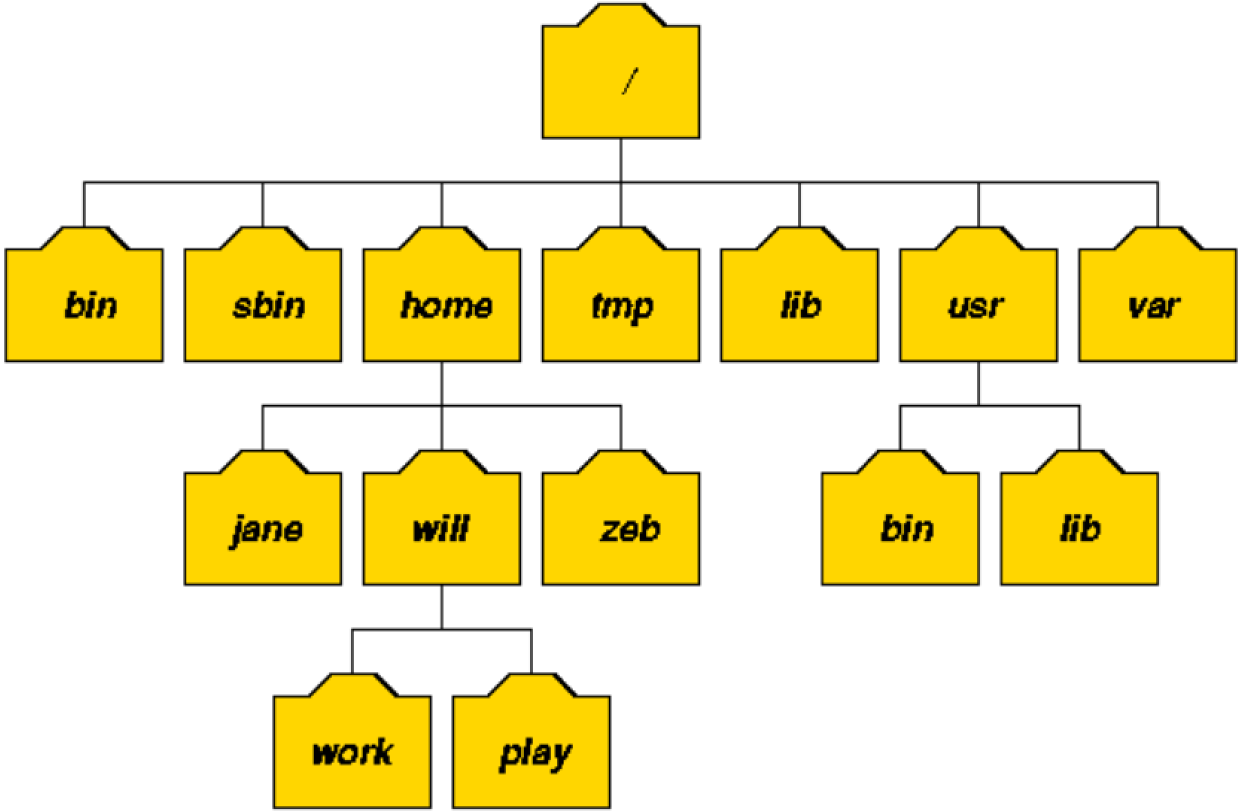
LINUX OVERVIEW

- The UNIX filesystem is laid out as a hierarchical tree structure which is anchored at a special top-level directory known as the root (designated by a slash '/’).

- Because of the tree structure, a directory can have many child directories, but only one parent directory.

- An example is shown in the diagram on the next slide

LINUX OVERVIEW



Part of a typical UNIX filesystem tree

LINUX OVERVIEW

- To specify a location in the directory hierarchy, we must specify a path through the tree.

- The path to a location can be defined by an absolute path from the root /, or as a relative path from the current working directory.

- To specify a path, each directory along the route from the source to the destination must be included in the path, with each directory in the sequence being separated by a slash.

LINUX OVERVIEW

- To help with the specification of relative paths, UNIX provides the shorthand "." for the current directory and ".." for the parent directory.

- For example, the absolute path to the directory "play" is /home/will/play, while the relative path to this directory from "zeb" is ../will/play.

INSTALLATION AND UPGRADE

- To install linux on a machine read the guide on https://medium.com/@kc_clintone/installing-linux-a-step-by-step-guide-77471a47322d

- To install Linux on Windows, install Windows Subsystem for Linux (WSL) by opening command prompt as an administrator & type the following command & press Enter:
  - ***wsl –install***
  - *Alternatively, go to https://learn.microsoft.com/en-us/windows/wsl/install for more information.*

INSTALLATION AND UPGRADE

- To update the system type the following commands:
  - First command is ***sudo apt update***
  - Second commend is ***sudo apt upgrade***

- The above commends will install the latest Linux update of that particular distribution

- Verify the changes with the comment ***uname -r***

COMMANDS

- This section describes some of the more important directory and file handling commands.
  - pwd: ***pwd*** displays the full absolute path to the your current location in the filesystem.
  - cd: ***cd path*** changes your current working directory to path (which can be an absolute or a relative path)
  - mkdr : ***mkdir directory*** creates a subdirectory called directory in the current working directory
  - rmdir: ***rmdir directory*** removes the subdirectory directory from the current working directory

COMMANDS

- This section describes some of the more important directory and file handling commands.
  - ls: ***ls*** lists the contents of a directory. If no target directory is given, then the contents of the current working directory are displayed
  - cat: ***cat target-file(s)*** displays the contents of target-file(s) on the screen, one after the other
  - cp: cp is used to make copies of files or entire directories. To copy files, use:
    $ ***cp source-file(s) destination***

COMMANDS

- This section describes some of the more important directory and file handling commands.
  - rm : **rm target-file(s)** removes the specified files
  - mv: **mv** is used to rename files/directories and/or move them from one directory into another. Exactly one source and one destination must be specified:

    ```
    $ mv source destination
    ```

  - wc: wc command calculates a file's word, line, character, or byte count

COMMANDS

- This section describes some of the more important directory and file handling commands.
  - split: split large files into smaller files
  - cmp: is used to compare the two files byte by byte and helps you to find out whether the two files are identical or not
  - comm: ***comm*** command is used for line-by-line comparison of two sorted files
  - diff: is used to compare the contents of two files and display the differences between them

COMMANDS

- This section describes some of the more important directory and file handling commands.
  - Head: The head command, as the name implies, print the top N number of data of the given input. By default, it prints the first 10 lines of the specified files.
  - tail: The tail command, as the name implies, prints the last N number of data of the given input. By default, it prints the last 10 lines of the specified files

COMMANDS

- This section describes some of the more important directory and file handling commands.
  - grep: grep command can be used to find or search a regular expression or a string in a text file
  - sort: sort command is used to sort a file, arranging the records in a particular order
  - apt-get install: use to install a package
  - apt-get remove: used to remove a package

EDITING FILES

- To edit text files, you can use command-line text editors or graphical text editors

- Command-line text editors include:
  - 1. Nano
    - Type ` nano filename.txt ` and press Enter
    - Edit the text file as needed.
    - To save the file, press ` Ctrl + O `, then Enter.
    - To exit Nano, press ` Ctrl + X `

EDITING FILES

- Command-line text editors include:
  - 2. Vim
    - Type ` vim filename.txt ` and press Enter.
    - Press ` i ` to enter insert mode and start editing.
    - Press Esc to exit insert mode.
    - To save and exit, ` type :wq ` and press Enter.`
    - Alternatively, you can use the command *vi*

EDITING FILES

- Command-line text editors include:
  - 3. Emacs
    - First install Emacs by the writing the command in the terminal : ***apt install e3***
    - Type ` emacs filename.txt ` and press Enter.
    - Edit the file directly
    - To save the file, press ` Ctrl + X ` followed by ` Ctrl + S `.
    - To exit Emacs, press ` Ctrl + X ` followed by ` Ctrl + C `.

EDITING FILES

- Graphical text editors include:
  - 1. Gedit
    - Locate the text file by opening the file manager and opening it.
    - When you do a right-click on the file, choose "Open with Gedit."
    - Make changes to the file and save it

EDITING FILES

- Graphical text editors include:
  - 2. Kate
    - From the apps menu, launch Kate.
    - Drop the text file into the Kate window by dragging it there.
    - After making changes, click "Save" to close the file.

LINUX SHELL

- A shell is a program which reads and executes commands for the user.

- Shells also usually provide features such job control, input and output redirection and a command language for writing shell scripts.

- A shell script is simply an ordinary text file containing a series of commands in a shell command language (just like a "batch file" under MS-DOS).

LINUX SHELL

- There are many different shells available on UNIX systems (e.g. sh, bash, csh, ksh, tcsh etc.), and they each support a different command language.

- Here we will discuss the command language for the Bourne shell sh since it is available on almost all UNIX systems (and is also supported under bash and ksh).

LINUX SHELL

- A shell lets you define variables (like most programming languages).

- A variable is a piece of data that is given a name. Once you have assigned a value to a variable, you access its value by prepending a $ to the name:

```
$ bob='hello world'
$ echo $bob
hello world
$
```

LINUX SHELL

- Variables created within a shell are local to that shell, so only that shell can access them.

- The ***set*** command will show you a list of all variables currently defined in a shell.

- If you wish a variable to be accessible to commands outside the shell, you can export it into the environment:

$ export bob

LINUX SHELL

- Variables created within a shell are local to that shell, so only that shell can access them.

- The ***set*** command will show you a list of all variables currently defined in a shell.

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  $ export bob

LINUX SHELL

- READ ON
  - ***BOURNE SHELL***
  - ***BASH***

THE END