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Linux Introduction: a short expedition to the debian environment

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Linux Introduction

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Overview

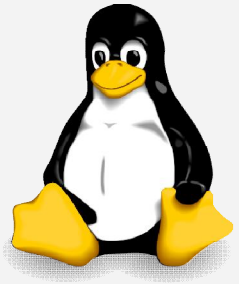
- Operating system
- Road to Linux
- GNU, Free Software movement
- Popularity of Linux
- Linux Overview
- Why should use Linux
- About Debian
- Debian Features
- Package, Repository
- GUI / CLI interface
- Tools under Menu panel
- Basic commands

Operating Systems

- Software
  - Collection of instructions that control the tasks a computer performs
  - Can be changed without disassembling the computer and rewiring
- Application
  - Software program that provides service for computer user
  - Cannot act without “permission” from operating system

Operating Systems (continued)

- Operating system (OS)
  - Software that helps other programs control computer hardware and interact with users
  - All computers need an OS
  - Popular OSes include Windows, Linux, Mac OSX



Operating System Functions

- Initialize computer hardware
- Allocate system resources to programs
- Keep track of multiple programs running at same time
- Provide organized method for all programs to use system devices

Before Linux

- In 80's, Microsoft's DOS was the dominated OS for PC
- Apple MAC was better, but expensive
- UNIX was much better, but much, much more expensive. Only for minicomputer for commercial applications
- People was looking for a UNIX based system, which is cheaper and can run on PC
- Both DOS, MAC and UNIX were proprietary, i.e., the source code of their kernel is protected
- No modification is possible without paying high license fees

Road to Linux

- Inspired by the UNIX OS, the Linux kernel was developed as a clone of UNIX
- GNU was started in 1984 with a mission to develop a free UNIX-like OS
- Linux was the best fit as the kernel for the GNU Project
- Linux kernel was passed onto many interested developers throughout the Internet
- Linux today is a result of efforts of **Linus Torvalds** and thousands of individuals, in 1991

Linux arrived

- Linux is basically a kernel, it was combined with the various software and compilers from GNU Project to form an OS, called **GNU/Linux**
- Linux is a full-fledged OS available in the form of various **Linux Distributions**
- **RedHat**, **Fedora**, **SuSE**, **Ubuntu**, **Debian** are examples of Linux distros
- Linux is supported by big names as IBM, Google, Sun, Novell, Oracle, HP, Dell, and many more

Linux arrived (continued)

- Linux development method
  - Person identifies need and begins writing program
  - Developer announces project on Internet
  - Others respond and work on different parts of project
  - Person leading project releases software
  - People download source code and try program; send back information about problems
  - Developers fix bugs
- Forking
  - Creating new project based on existing source code

GNU

- Stands for **G**NUs **N**ot **U**nix. GNU General Public License. GNU - GPL – Copyleft
- Free software, as defined by the FSF (Free Software Foundation), is a "matter of liberty, not price."
- Terms for using Linux
  - You can modify / copy / redistribute the source code at no cost provided you do so under the GPL
  - If you get source under the GPL, any changes / improvements / spin offs you make to it are also under GPL
  - You must always distribute source code + GPL of programs that you develop with the help of GPL software online.

Motivating Free Software Developers

- Why would so many people devote so much effort to something without expecting any reward?
  - Fills developer's specific technical need
  - Respect of like-minded professionals
  - Sense of contribution and community
  - Valuable boost to developer's resume

Why the popularity of Linux?

- Hardware
  - Cost of hardware always decreases.
  - Usage of a hardware required the device drivers to be available.
  - Writing new drivers for Linux is the easiest solution. (For unavailable devices)
  - Once the drivers were ready, they were incorporated into the main source so as to give everybody access to it!

Why the popularity of Linux?

- Cost of developing tools
  - Hardware developers rather than developing a complete OS for a processor, could simply port Linux to that platform.
  - Then everything that works in Linux will work seamlessly reducing cost to a fraction.
  - Driver Maintenance / Bug Fixes and improvements contributions from the FOSS community.

Why the popularity of Linux?

- Software Developers
  - A consistent software environments that is completely machine independent.
  - Every system will have a GNU toolchain to compile code for the resident platform!
  - If source distribution is given, the software can be distributed in C without worrying about hardware support.

Language of Linux

- Linux was written completely in C and ASM.
- UNIX (1969) was written in PDP-7 Assembly.
  - This version of UNIX was unportable to new hardware.
- Thomson developed B as a machine independent language to make UNIX portable.
- Dennis Ritchie rewrote UNIX in C, a language he developed from B and concepts from other languages.

Linux : More than an OS

- Like as OS Linux supports
  - Memory Management
  - Device management
  - Task Scheduling
  - User Management
  - And more…
- But it also comes with a set of tools and utilities that make life easier for the user/developers

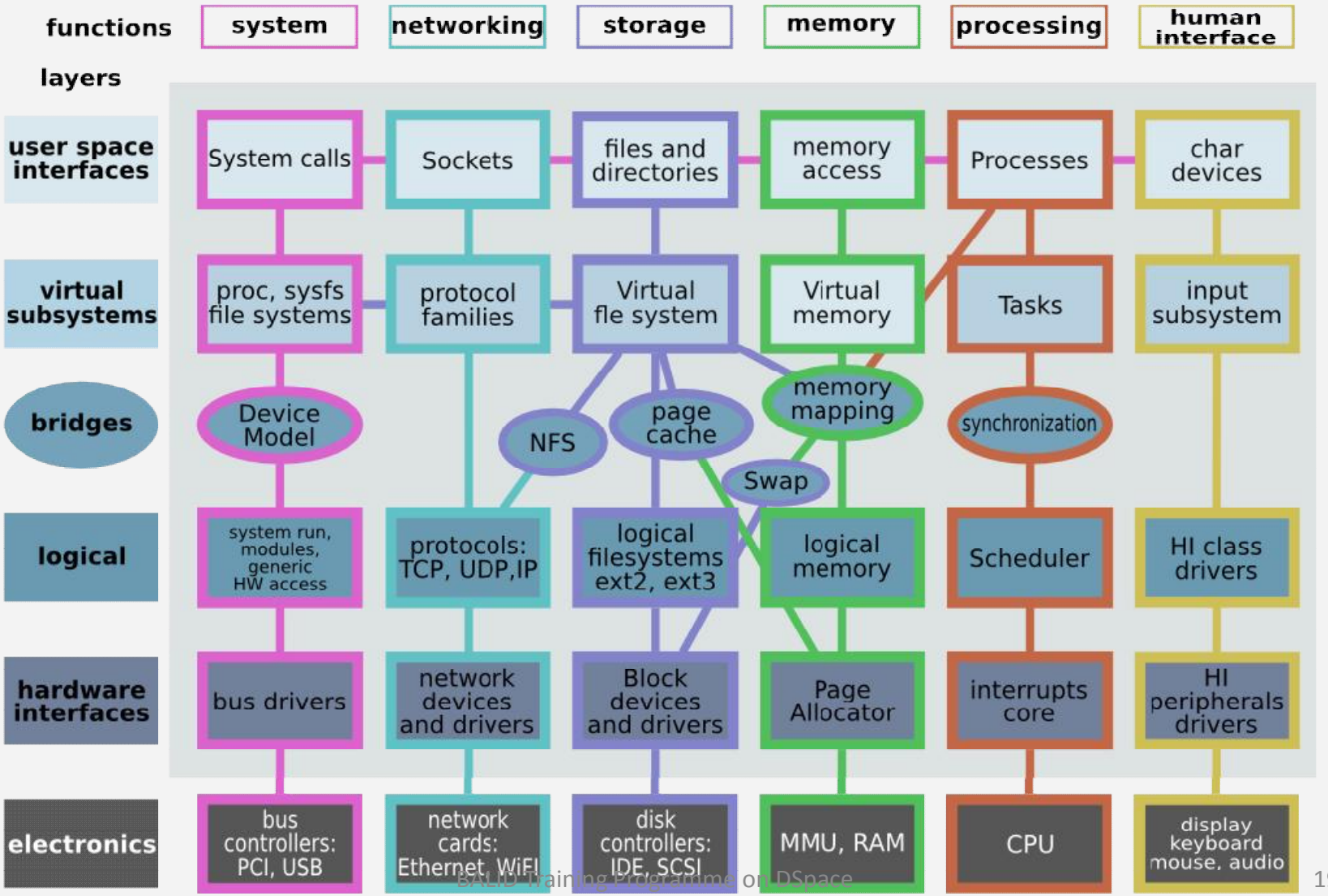
Overview of Linux

- Kernel Interface
- Multi-user , Multiprocessing, MultiTasking, Multithreading
- Hierarchical Filesystem
- A Shell Interpreter for the OS
- Device independent I/O
- Inter Process Communication
- Security
- GUI
- Software Development

Kernel Interface

- Kernel is the Heart of the linux OS.
- Handles all the background OS tasks.
  - Divides system resources
  - Manages memory
  - Gives access to devices
- Kernel abstracts the hardware from the rest of the processes.
- Different Hardware need different setup and compiled kernels, and all other functionality will be unchanged.

Linux Kernel Diagram



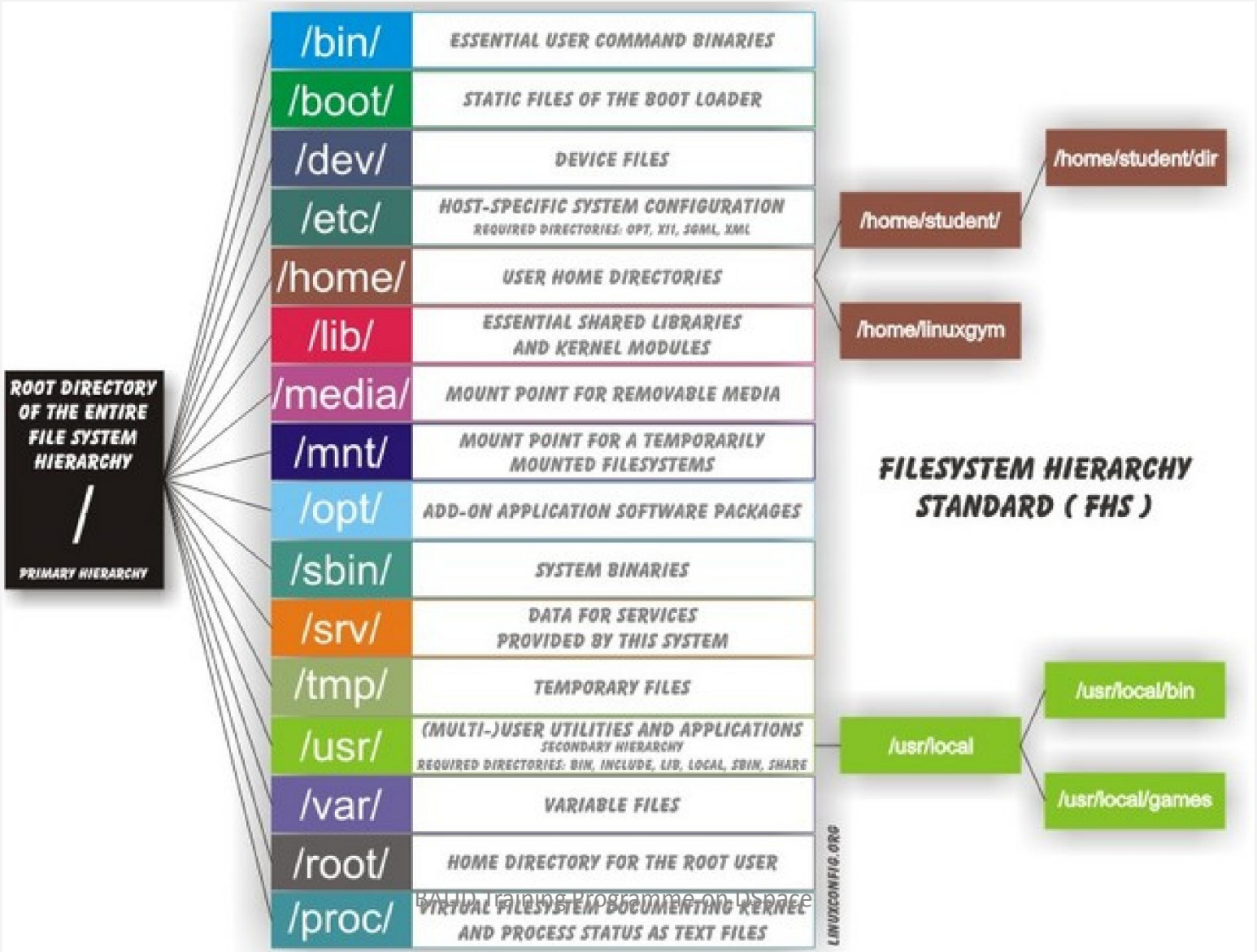
MultiTasking

- Linux was always a fully protected multitasking OS.
- Jobs can be run in background, and owned by different users – on the same processor.
- Linux manages resource between active processes / background processors and keeps in sync seamlessly.
- capable of supporting and utilizing more than one computer processor.
- allow different parts of a software program to run concurrently.

Hierarchical FileSystem

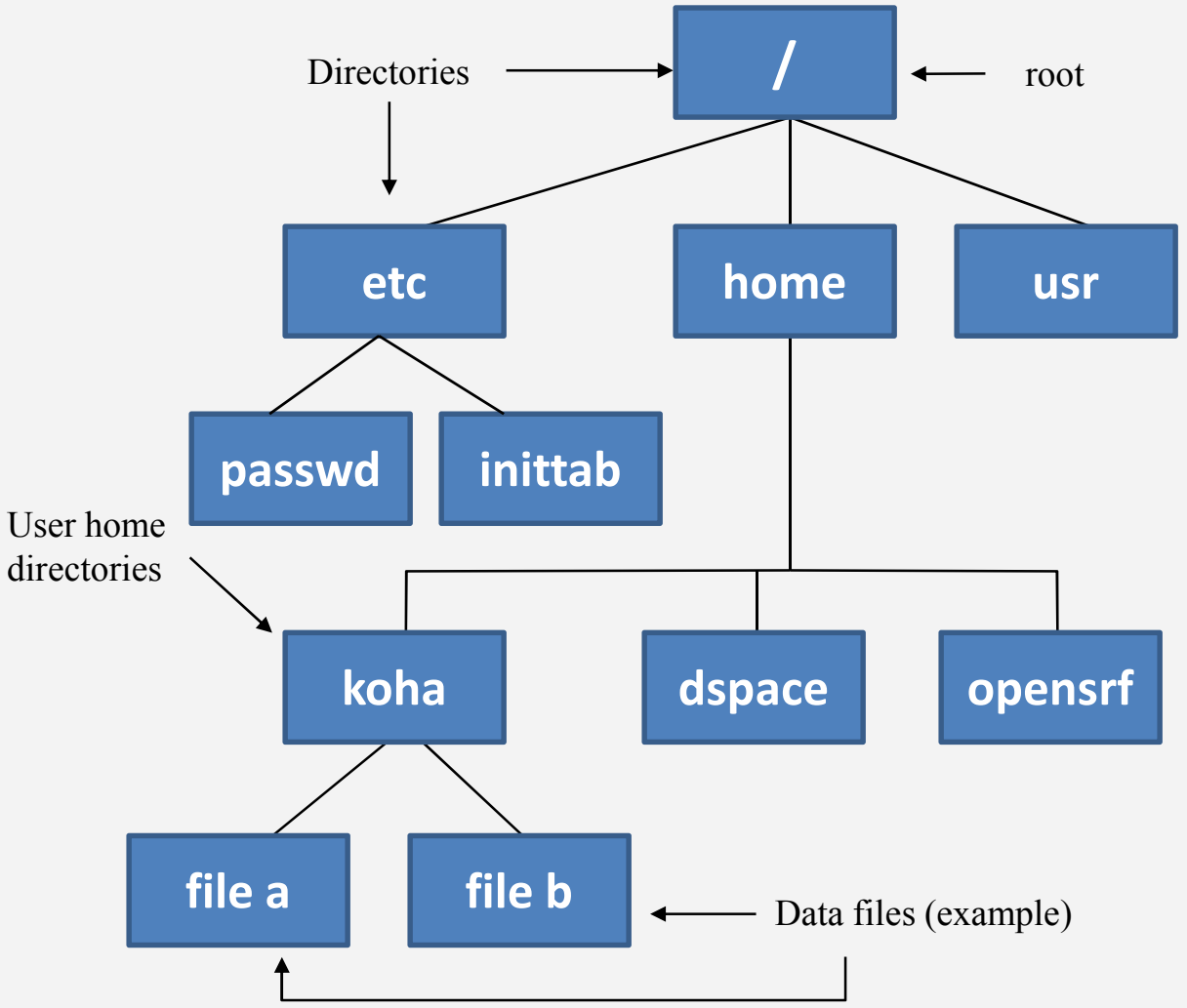
- Files are kept in directories
- Directories can hold other directories.
- FHS – Filesystem Hierarchy Standard defines the rules for where certain files will always be kept.
- The “root” of the Linux FS is always ‘/’
- Files & directories can be owned by users to enforce security privileges.

Hierarchical File System



Hierarchical File System

- Data files are stored in directories (folders)
- Directories may be nested as deep as needed



BASH – the Linux Shell system

- **B**ourne **A**gain **Sh**ell is s command processor
- It acts as an interface between the user and the operating system
- Commands / applications can be given to this interpreter which can then make the operating system do various tasks
- Commands can be stored in shell scripts for ease of access

Device independent I/O

- All physical devices – monitor, mouse, keyboard printer appear as files in the Linux file system that are manipulated by the kernel.
- This means that if a program is written to manipulate this file, then the kernel will take it to mean an action on the physical I/O device.
- This allows for a standard API for I/O in all Linux systems.

Linux User Interface

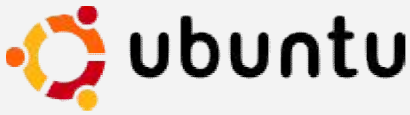
- Can be controlled through command Line Interface(CLI) or Graphical User Interface (GUI)
- GUI run through Desktop Environments (DE)
- KDE, GNOME, Xfce, E17 are popular Des
- The GUI interface is easy-to-use and much like that of Windows and Mac OSX
- The CLI is similar to that of UNIX/BSD

Programming in Linux

- Modern languages are cross-platform, like **Python**, **Ruby**, **Perl**, **Java**
- Most Linux distros support these languages and have their runtimes pre-installed
- **GTK+** and **Qt** are widely used to design applications for Linux
- IDEs like NetBeans, Anjuta, KDevelop, MonoDevelop, Eclipse are available for Linux too

Linux on the Desktop

- Linux is desktop computer ready
- Large number of distros targeted at Desktop users are available
- Linux desktop distros come with many commonly used pre-installed softwares
- The modern Linux interface is user-friendly and makes the interaction with computer easy



Linux on Servers and Supercomputers

- Linux is the most used OS on servers
- 6 out of 10 reliable web hosting companies use Linux
- Linux is the cornerstone of the LAMP server-software combination (Linux, Apache, MySQL, Perl/PHP/Python) which has achieved popularity among developers
- Out of top 500 supercomputers, Linux is deployed on 427 of them

Why should you use Linux?

- Linux systems are extremely stable
- Linux is Free
- No/Very few threat of viruses
- Linux comes with most of the required software pre-installed
- Update all your software with minimum fuss
- Linux never gets slow
- Linux does not need defragmentation
- Linux can even run on oldest hardware
- Adding more software is a matter of a few clicks
- Most Windows-only apps have their either their native version or alternatives for Linux
- With Linux, you get the highest degree of possible customizability

Debian: about

- **Debian** is an operating system composed of free software mostly carrying the GNU General Public License
- Its focus of different kernels makes it appeal to different titles, such as **Debian GNU/Linux** and **Debian GNU/kFreeBSD**
- **Debian GNU/Linux** is one of the most popular Linux distributions for personal and Internet server machines
- Debian is seen as a solid Linux, and as a consequence has been used as a base for other Linux distributions
- More than 20 awards have been awarded throughout Debian's lifetime including *Best Linux Distribution*

Debian: Features

- Beside Linux and kFreeBSD, Debian has more two kernels in development, GNU Hurd and NetBSD
- The kernel is offered for Intel/AMD 32-bit and 64-bit architecture machines
- Debian is still primarily known as a Linux distribution with access to online repositories hosting over 37,500 software packages

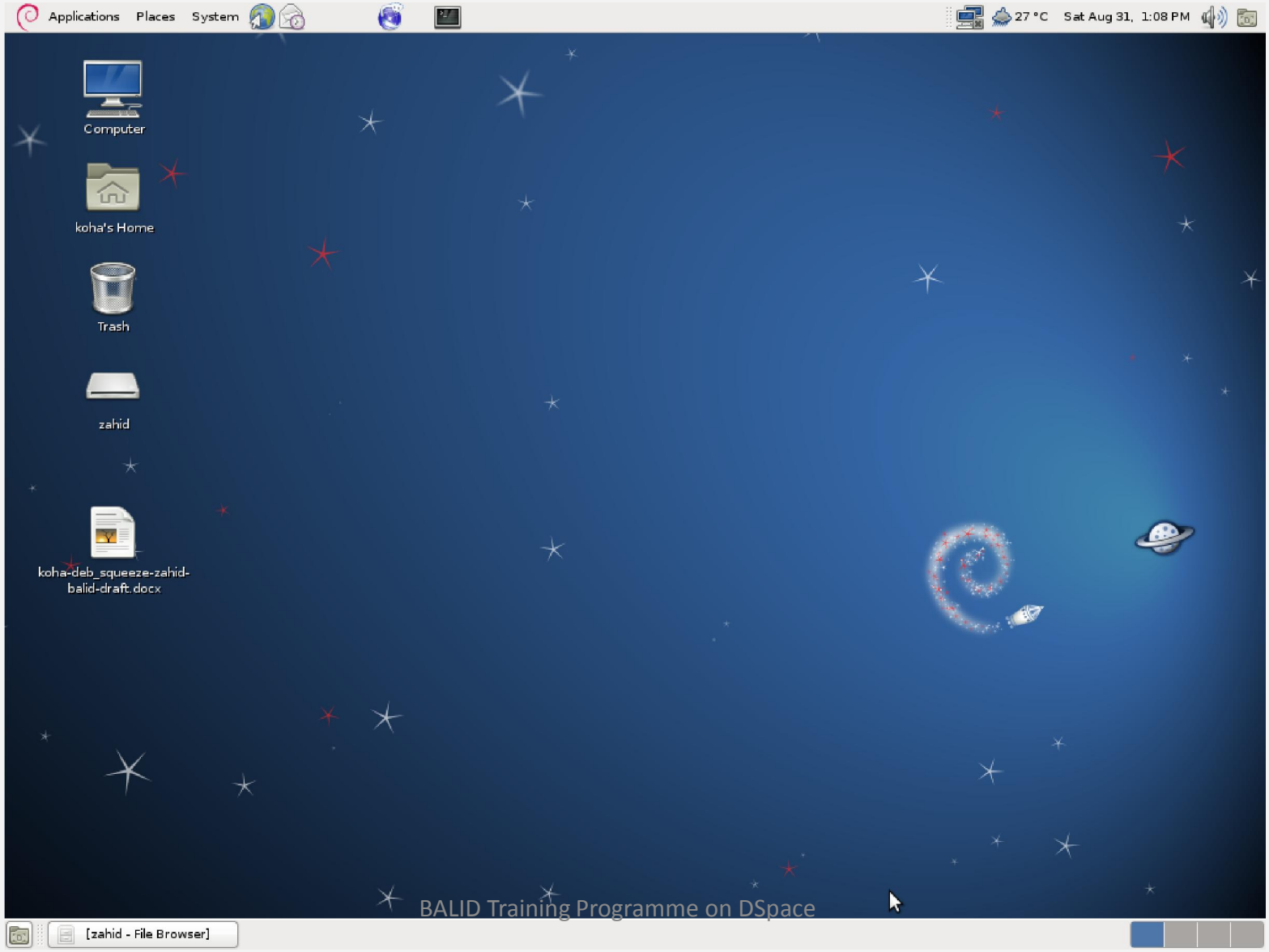
Debian: Features

- Debian officially hosts *free* software on its repositories but also allows non-free software to be installed
- Debian offers 10 DVD and 69 CD images for download and installation, but only the first optical iso image of any of its downloadable sets is sufficient
- Debian requires the first installable image, but uses online repositories for additional software
- Debian offers different network installation methods for expert users.

Debian: Environment

- Command Line Interface
- Desktop environments
  - Most popular GNOME (the default), KDE Plasma Workspaces, Xfce and LXDE
- Debian-Live
  - A Debian-Live system can be booted from removable media
  - Debian-Live allows a user to try a Debian desktop without actually installing

Debian: Default GUI



Debian: Logging into CLI

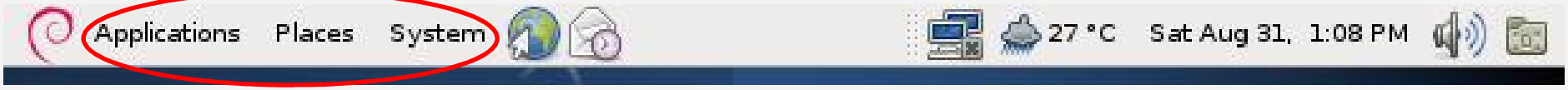
- To go to the command prompt from GUI, press

  Alt+Ctrl+F1

- To return to the GUI, press

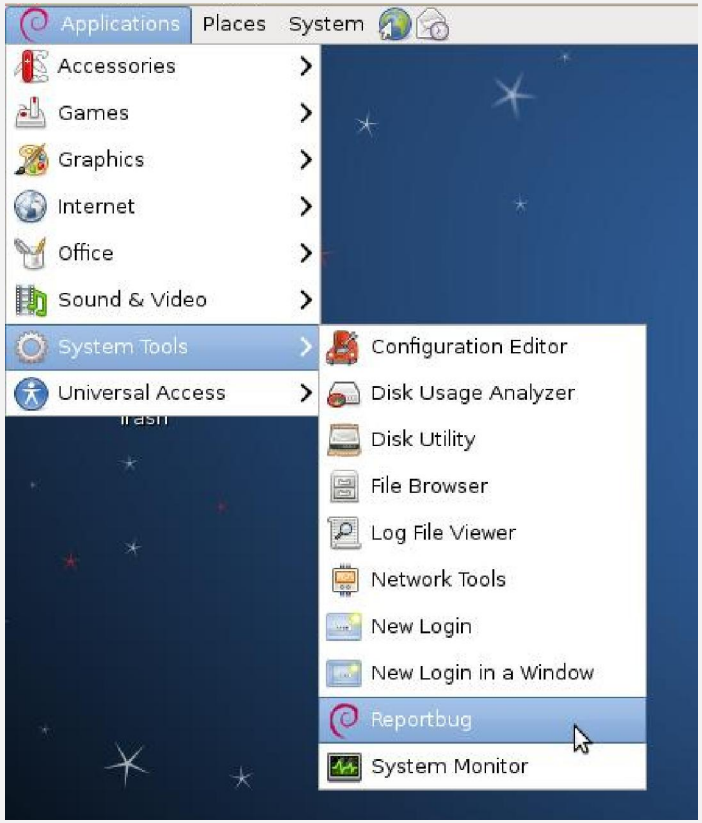
  Alt+Ctrl+F7

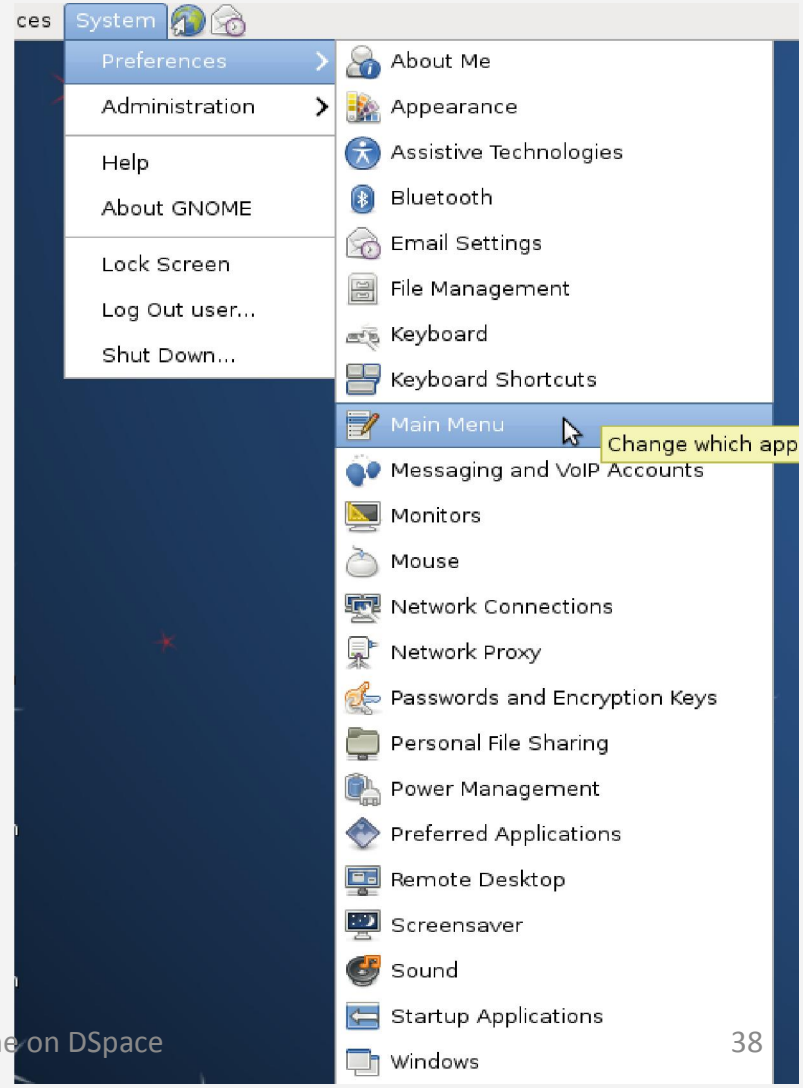
Debian: The Menu Panel



- Applications
  - The Applications menu contains a variety of icons that start software applications. It is similar to the Microsoft Windows Start menu
- Places
  - The Places menu contains a customizable list of directories like, Home, Desktop, Documents, Downloads, Picture, Search, Recent documents, Computer places etc.
- System
  - The System menu contains a variety of Systems Administration related items like, Software Sources, Update, Package Manager, Printing, Network, Services etc. along with Logout and Shutdown option

Debian: Menu items





Debian: Package and Rpository

- Package management
  - Debian's official standard for administering packages on its system is the APT (Advanced Package Management) toolset
  - An APT tool allows administration of an installed Debian system for retrieving and resolving package dependencies from online repositories
  - APT tools depend on verifying what is installed in the *dpkg* database in order to determine missing packages for requested installs.

Debian: Package and Rpository (cont..)

- dpkg database
  - dpkg is the storage information center of installed package
  - database is located at /var/lib/dpkg/available
  - contains the list of "installed" software on the current system

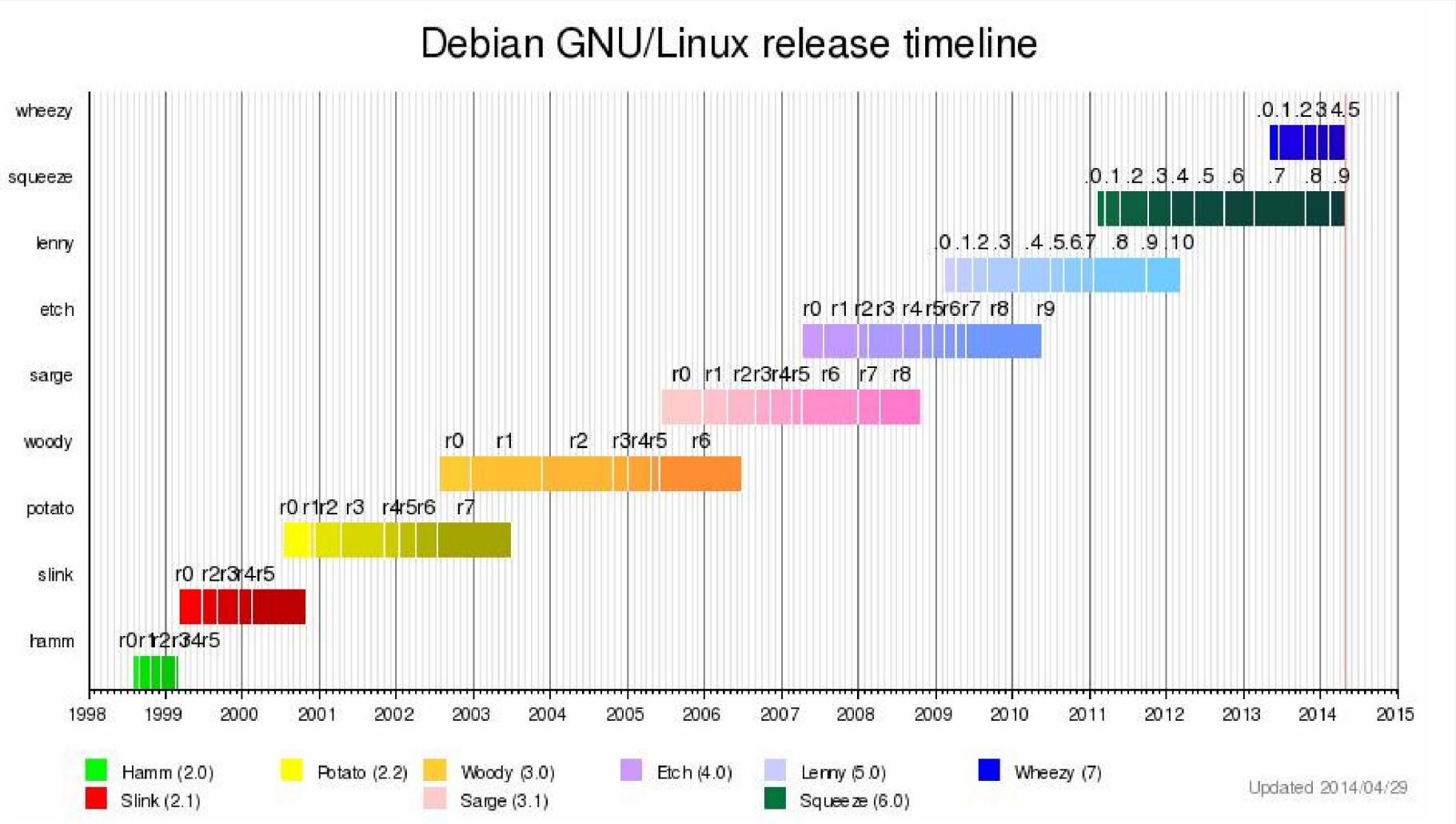
Debian: Package and Rpository (cont..)

- Package management
  - In TUI apt-get and apt-cache are command tools of the standard APT-class tool set apt package, aptitude command supports better search on package metadata
  - In GUI gdebi is an APT combines the functionality of the *dpkg* tool and APT package resolving with online repositories

Debian: Package and Rpository (cont..)

- Repositories – Official, unofficial and third-party
  - Official: stable (current), old stable (prior release), backports (more recent), testing (next major release), unstable (under development), snapshot (older version), experimental (temporary stage for developers)
  - Unofficial: non-free, contrib
  - Third-party: not part of Debian Project

Debian: Release timeline



Debian: Basic commands

- Basic Linux Commands
  - File Handling
  - Text Processing
  - System Administration
  - Process Management
  - Archival
  - Network
  - File Systems
  - Advanced Commands

Debian: Basic commands (cont..)

- File Handling commands

`mkdir` – make directories

- Usage: **`mkdir`** [OPTION] DIRECTORY...
- Example: **`mkdir`** zahid

`ls` – list directory contents

- Usage: **`ls`** [OPTION]... [FILE]...
- Example: **`ls`**, **`ls l`**, **`ls`** zahid

`cd` – changes directories

- Usage: **`cd`** [DIRECTORY]
- Example: **`cd`** zahid

Debian: Basic commands (cont..)

- File Handling(contd...)

  `pwd` -print name of current working directory
  - Usage: **`pwd`**

  `vim` – Vi Improved, a programmers text editor
  - Usage: **`vim`** [OPTION] [file]...
  - Example: **`vim`** file1.txt

Debian: Basic commands (cont..)

- File Handling(contd...)

  cp – copy files and directories

  - Usage: **cp** [OPTION]... SOURCE DEST
  - Example: **cp** sample.txt sample_copy.txt

    cp sample_copy.txt target_dir

  mv – move (rename) files

  - Usage: **mv** [OPTION]... SOURCE DEST
  - Example: **mv** source.txt target_dir

    mv old.txt new.txt

Debian: Basic commands (cont..)

- File Handling(contd...)

  `rm` -remove files or directories

  - Usage: **`rm`** [OPTION]... FILE...
  - Example: **`rm`** file1.txt , rm rf

  `find` – search for files in a directory hierarchy

  - Usage: **`find`** [OPTION] [path] [pattern]
  - Example: **`find`** file1.txt, find name

  `history -` prints recently used commands

  - Usage: **`history`**

Debian: Basic commands (cont..)

- Text Processing

  cat – concatenate files and print on the standard output

  - Usage: **cat** [OPTION] [FILE]...
  - Example: **cat** file1.txt file2.txt

    cat -n file1.txt

  echo – display a line of text

  - Usage: **echo** [OPTION] [string] ...
  - Example: **echo** I love Debian

    echo $

Debian: Basic commands (cont..)

- Text Processing(contd...)

  grep - print lines matching a pattern

  - Usage: **grep** [OPTION] PATTERN [FILE]...
  - Example: **grep** I

  wc - print the number of newlines, words, and bytes in files

  - Usage: **wc** [OPTION]... [FILE]...
  - Example: **wc** file1.txt

    wc L file1.txt

Debian: Basic commands (cont..)

- System Administration

  chmod – change file access permissions

  - Usage: **chmod** [OPTION] [MODE] [FILE]
  - Example: **chmod** 744 calculate.sh

  chown – change file owner and group

  - Usage: **chown** [OPTION]... OWNER[:[GROUP]] FILE...
  - Example:. **chown** remo myfile.txt

Debian: Basic commands (cont..)

- System Administration (contd...)

  su – change user ID or become superuser
  - Usage: **su** [OPTION] [LOGIN]
  - Example: **su** -remo

  passwd – update a user's authentication tokens(s)
  - Usage: **passwd** [OPTION]
  - Example: **passwd**

  who – show who is logged on
  - Usage: **who** [OPTION]
  - Example: **who** , **who** b, **who** q

Debian: Basic commands (cont..)

- Advanced Commands

  `reboot` – reboot the system

  - Usage: **`reboot`** [OPTION]
  - Example: **`reboot`**

  `poweroff` – power off the system

  - Usage: **`poweroff`** [OPTION]
  - Example: **`poweroff`**

Thank you