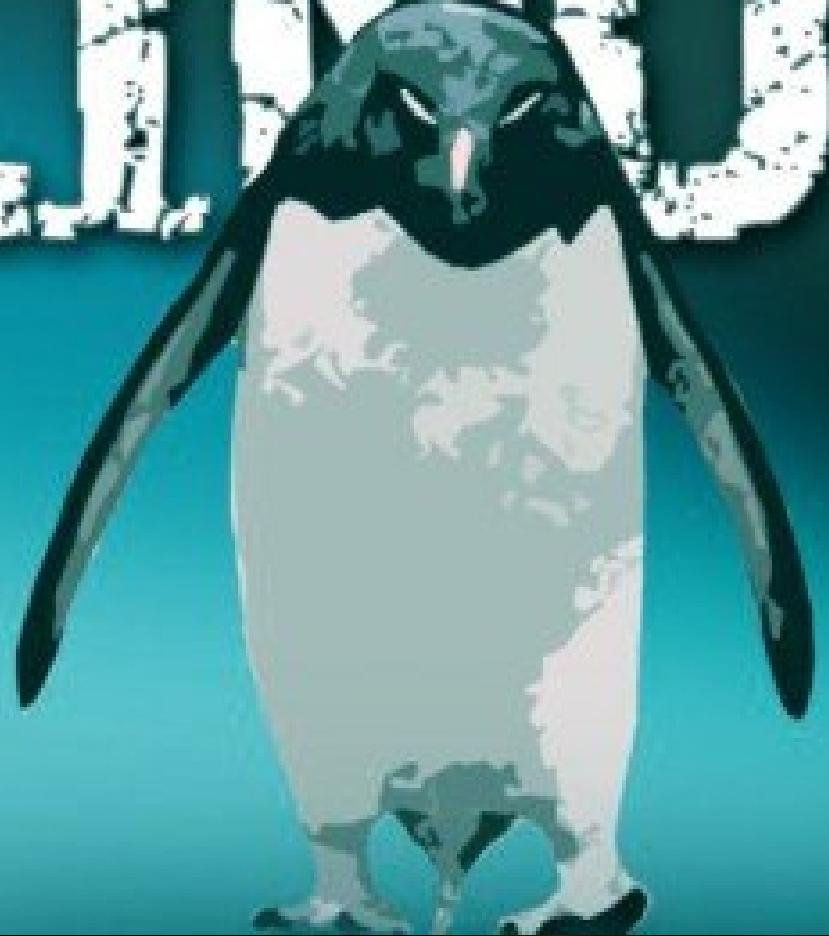


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LINUX



# Linux [Fundamentals]

## First Steps Overview



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## 1. Introduction

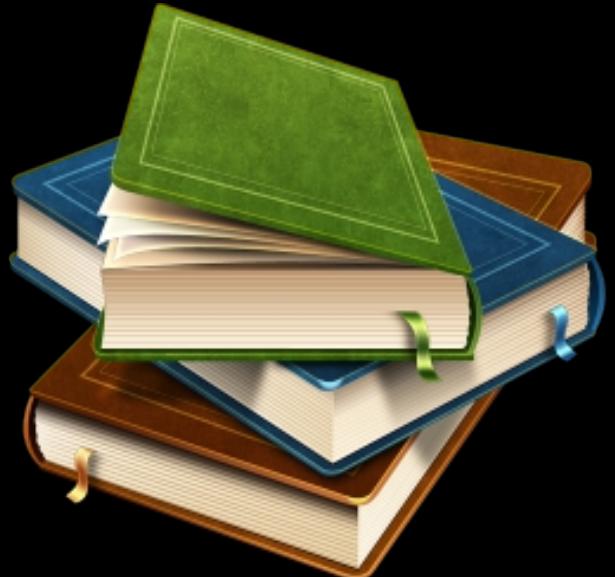
- Linux History

## 2. Partitions and Filesystems

- What is partition and what is filesystem
- Rooted-tree directory structure

## 3. First Steps

- Installing Linux [ VM install, HW install, DualBoot, USB sticks ]
- Booting Linux [Boot Loaders and Booting Process Overview ]
- Login in [ What is shell? , login terminals ]
- User Accounts and Groups [ UIDs/GIDs, special groups, superuser ]
- File and Directory Structure [Dir Structure, ENV vars, Links, Specials: /proc ]
- Basic Network Configuration



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## 3. Getting HELP!!!

- [www.google.com](http://www.google.com) , Tutorials links and Howtos
- Linux way: info , help, man , everything has –help

## 4. Command Line Operations

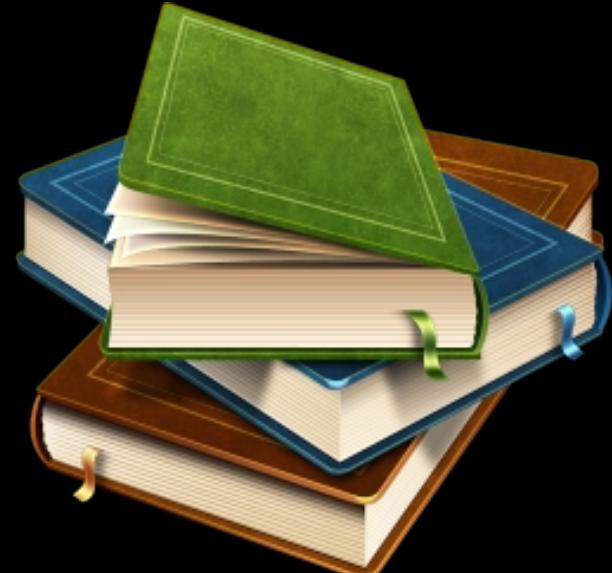
- Most Basic Commands [ mkdir,cd,ls,rm,cp,mv,cat ]
- Little less Basic Commands [ grep,tail,head,find ]
- Basic Editors [ vi/vim, nano ]
- Other usefull commands/tools [ ps, top, kill, scp, rsync ]
- Shell Scripting and regex Overview [ examples: for/while, basic regex ]



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## 5. Installing Software

- Distributions package systems and managers [ rpm,deb ]
- Compiling from source [ make,automake ]
- Example Install: Java 8 , Eclipse



# When and Who ‘invited’ Linux

## What is Linux

## What is Linux Distribution

The Short Story

# The Beginning and the GNU

**Software Distribution:** hand-by-hand, man-to-man, university-to-university

1969- AT&T at BellLabs, create own OS, the First Unix Release, written on assembler

1973 - rewrites on C and widely adopted ,C is written by Ken Thompson and Dennis Ritchie ( from AT&T )

1982 - System III , first commersial UNIX , after that a lot of derivatives are created

1983/1984 - SystemV is released. All of SystemIII derivates are documented and standarted as Unix.

~198{1,2,3} - ‘Richard Stallman’ , system programmer, and the printer story😊

1983 27 September - The GNU Project is Released. Started to be an OS, Stallman creates

**GNU: (GNU is not Unix)**

**GNU:** "a sufficient body of free software [...] to get along without any software that is not free."

Links:

[http://en.wikipedia.org/wiki/History\\_of\\_Linux](http://en.wikipedia.org/wiki/History_of_Linux)

[http://www.tldp.org/LDP/intro-linux/html/sect\\_01\\_01.html](http://www.tldp.org/LDP/intro-linux/html/sect_01_01.html)

# 25 August 1991, Linus Benedict Torvalds

**1991 - Linux 0.01, starts as a Linus's personal project, the goal was creating free operating system kernel**

- under GNU
- A lot of contributors starts using it, make drivers etc.

The NAME: First Linus called the project Freax (free, freak, x from Unix), BUT the FTP administrator renamed it to: Linux, Torvalds says OK ☺

**1992 - Linux 0.99, under GNU GPL**

Hello everybody out there using minix -

I'm doing a (free) operating system (just a hobby, won't be big and professional like gnu) for 386(486) AT clones.....  
PS. Yes – it's free of any minix code, and it has a multi-threaded fs. It is NOT portable (uses 386 task switching etc), and it probably never will support anything other than AT-harddisks, as that's all I have :-(.

Links:

[http://en.wikipedia.org/wiki/History\\_of\\_Linux](http://en.wikipedia.org/wiki/History_of_Linux)

[http://www.tldp.org/LDP/intro-linux/html/sect\\_01\\_01.html](http://www.tldp.org/LDP/intro-linux/html/sect_01_01.html)

# Linux is the linux kernel

**Linux** – is the linux kernel

**Linux Distribution** – is a set of tools that form complete OS

**POSIX** - POSIX is the Portable Operating System standard. It describes certain utilities, APIs, and services a compliant operating system must provide to software. The idea is that a program written for one POSIX-Compliant OS would be easier to port to another POSIX-compliant OS

# Linux Distributions: The Three Giants

1992 – Softlanding Linux System (SLS) , spawned to the well-known Slackware – the OLDEST linux distribution

1993 – Debian GNU/Linux

- not a fork of any previous work
- absolutely independent project , community driven
- today: the largest non-commercial linux distribution (according to linux magazine)

1994 – Red Hat Linux

- designed for the corporate world
- was and IS a commercial distribution build upon free software

Links:

<http://www.linux-mag.com/id/7721/>

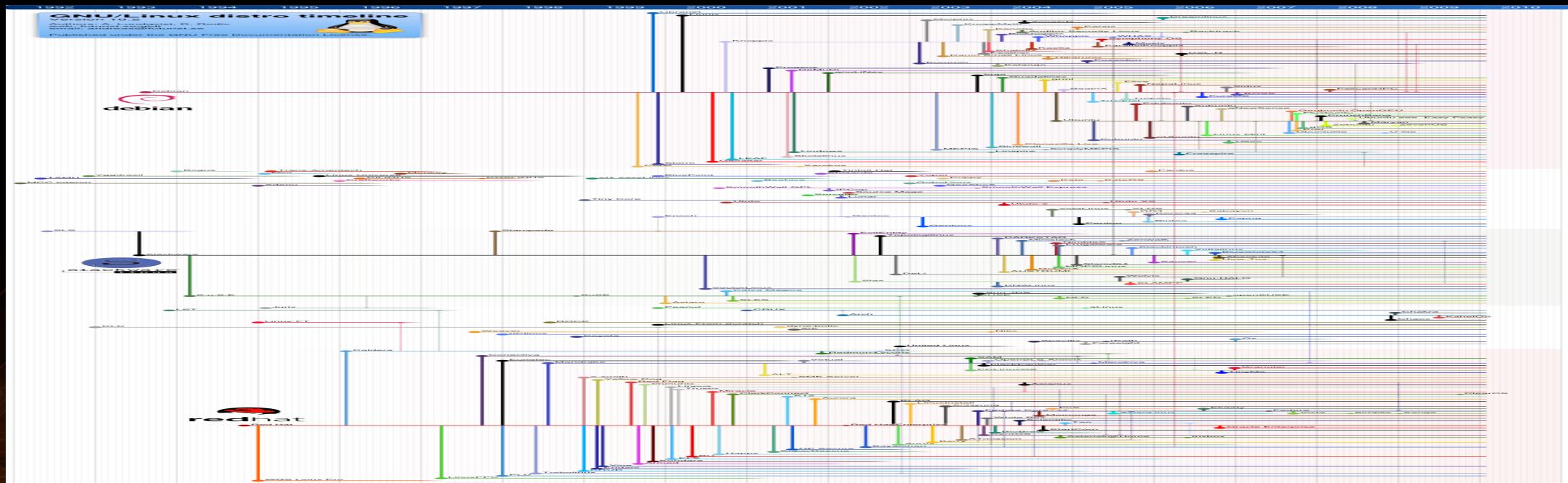
# Debian, RedHat, SUSE, etc.

- **Types:** Commercial or non-commercial; Desktop/Embedded/Server; Built primarily for security, usability, portability, or comprehensiveness;
- **Components:** Installer; Kernel binary; Compilation tools; Packet manager
- **Popular Distributions:**
  1. **Debian** – non-commercial; one of the earliest(1993); over 37,500 pkgs; APT manager; Stable/Testing/Unstable;
    - Ubuntu - Debian derivative for Desktop users; most popular desktop Linux; APT; has Server/Tablet variant
    - Backtrack / Kali – Debian derivative for security experts; preinstalled many sec. Tools. Used mainly for pen. Testing, digital forensics.
    - SteamOS – Debian based commercial derivate from valve; mainly for gamers; high hardware requirements;
  2. **Fedora Core** – owned by Red Hat; Linus uses it; YUM/RPM; Mainly for desktop users
    - RedHat - Red Hat Enterprise Linux (RHEL); Server Distro; Targeted toward the commercial market;
    - Centos – Community Enterprise Operating System; free, enterprise-class; 100% binary compatible with its
  3. **Android** – By Google inc.; for mobiles and tablets; designed to save power; mainly runs on ARM arch;

# Linux Distributions: The Three Giants

Please Look inside the big picture:

<http://www.linux-mag.com/s/i/articles/7721/gldt102-full.png>



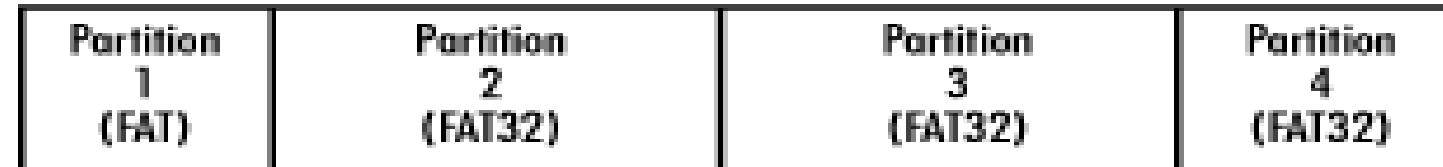
# What is PARTITION?

HDD Space is divided(or partitioned) into Partitions:

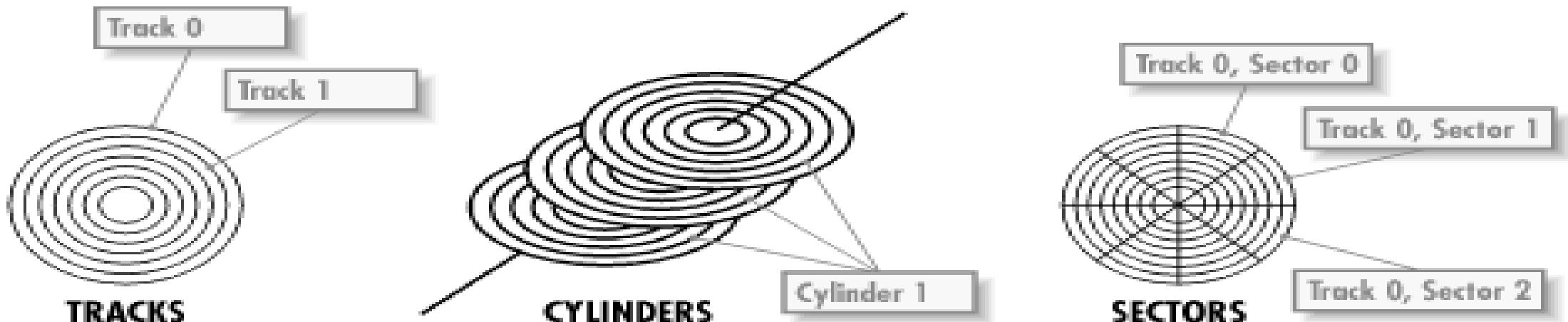
Partitions cannot be overlap

HDD space that is not allocated into partition is Free Space

**LOGICAL STRUCTURE**



**PHYSICAL STRUCTURE**



# Partition Types

MBR formatted partitions: (maximum 2TB disk size)

Primary , Logical and Extended Partition types

Primary Partition – maximum 4 primary partitions on a MBR layout

Extended Partition – just a container for logical partitions (max 11)

GUID formatted partitions:

Have Only primary partitions

Support up to 128 primary partitions by default

# Linux Partition Types

Total 97 supported partition types

The most important ones:

- 05      Extended
- 82      Linux swap / Solaris
- 83      Linux
- 85      Linux extended
- 88      Linux plaintext
- 8E      Linux LVM
- EE      GPT
- FD      Linux raid autodetect

# Device Naming scheme in Linux

hda1

```
| | \--- 1-x - partition numbers
| \---\
|   |- a      - primary master
|   |- b      - primary slave
|   |- c      - secondary master
|   \- d      - secondart slave
\--- hd      - IDE hard disk or CDROM
```

sda1

```
| | \--- 1-x - partition numbers (1-4 primary , 5-x logical )
| \----- a-z - device name
\----- sd   - SCSI/SATA hard disk
sr1 – SCSI CDROM/DVD
```

# Why we need partitioning? And what is FHS?

FHS – FileSystem Hierarchy Standard

**FHS directories in /**

/ → **root of the tree**

/Bin → Essential command binaries

/Boot → Static files of the boot loader

/Dev → Device files

/Etc → Host-specific system configuration

/Lib → Essential shared libraries and kernel modules

/Media → Mount point for removable media

/Mnt → Mount point for mounting a filesystem temporarily

/Opt → Add-on application software packages

/Sbin → Essential system binaries

/Srv → Data for services provided by this system

/Tmp → Temporary files

/Usr → Secondary hierarchy

/Var → Variable data

# What Partition schemes to use?

Desktop: more /home? Swap?

Server:

- /boot, /tmp and the rest?
- /boot, /etc, /tmp, /usr, /var & /home at different partitions?
- /boot, /tmp, /home and the rest?
- swap?

# First Steps in Linux

- Installing Linux
  - VirtualBox [ example ]
  - Live CD/USB install
  - Dual-Boot OS Installs
- Installation Media:
  - Full ISOs [ on many CDs/DVDs ]
  - Netinstall iso / Minimal install iso

# Booting Into Linux

## ■ Linux Boot Loaders:

- LILO – can boot from floppy and HDD; supports boot parameters; /etc/lilo.conf, lilo(8)
  - GRUB - from the GNU Project;
  - GRUB1(legacy) and GRUB2
    - can boot from floppy, usb disk/cdrom,
    - HDD etc.
    -
- EXAMPLES: menu list; configuration at startup, grub-setup(8), grub-install(8)

# Login into Linux

- Shells:
  - Bash shell
  - /bin/sh ; bin/csh
- Login Terminals:
  - tty is a regular terminal device (the console on your server, for example).
  - pts is a psuedo terminal slave (an xterm or an ssh connection).

# Users and Groups

## ■ Users:

User is anyone with access to this computer; different access for different people; username must be unique; superuser(root); sudo, su;

## ■ Groups:

mechanism to manage a collection of computer system users. UID/GID: POSIX standard; numerical value used by kernel to identify users and groups; id(1)

## ■ /etc/passwd; /etc/shadow Special groups: bin, sys, man

[ EXAMPLES ]

# Linux Network Config and little firewalling



- Network Interfaces: Example: ethtool, miimon
- Network configuration: Example: ifconfig, ip route, route
- Permanent Network Configuration: [ dhcp,static,resolv.conf, gw ]

# Always Getting Help

# Where and How to get help

- Local documentation:
  - manual pages; /usr/share/doc; --help arg
  - Useful commands: man, info, help
- Online sources:

Google is your friend; Howtos; Forums; Articles/ Tutorials; TLDP;

# Linux Commands

# First Steps Linux Commands

- Files and Directories
  - cd / ls / mkdir / rmdir [ Examples ]
  - cp / mv [ Examples ]
  - file / type / stat [ Examples ]
  - cat [ Examples ]
  - grep [ Examples ]
  - tail [ Examples ]
  - head [ Examples ]

# Usefull Commands and tools , Editors

## ■ Commands:

- find / locate / which [ Examples ]
- ps / top / kill ☺
- tar / gzip
- scp / rsync

## ■ Editors

- vi / vim [ Examples ]
- Others: nano , pico

# Shell Scripting and regex Overview

## [ EXAMPLES ]

- Basic scripts
  - for/while loops etc..

# Files and File Systems Overview

- Everything is file / directory is just a link /

- File Permissions:

File, directory and device (special file) permissions are granted based on "user", "group" or "other" (world) identification status. Permission is granted (or denied) for read, write and execute access.

- Permissions are valid for users, groups and others

Read permission: r || 4

Write (change) permission: w || 2

Execute script of binary executable: x || 1

Read and Execute: rx 5

Read and Write: rw 6

Read, Write and Execute: rwx 7

# Linux File Systems: ext2

- Ext2 - second extended filesystem
  - Inodes - "index node" - The inode includes data about the size, permission, ownership, and location on disk of the file or directory.
  - POSIX ACLs and extended attributes
  - Some limits:
    - Max. volume size 2–32 TiB
    - Max. file size 16 GiB – 2 TiB
    - Max. number of files 1018

# Linux File Systems: ext3

- ext3, or third extended filesystem, is a journaled file system
- It is the default file system for many popular Linux distributions.
- Its main advantage over ext2 is journaling, which improves reliability and eliminates the need to check the file system after an unclean shutdown.
- backwards compatible with the earlier ext2,
- Lack of snapshots support
- Some limits:
  - Max. volume size 4 TiB – 32 TiB
  - Max. file size 16 GiB – 2 TiB
  - Max. number of files Variable, allocated at creation time[1]
  - Max. filename length 255 bytes

# Linux File Systems: ext4

- ext4 or fourth extended filesystem is a journaling file system for Linux, developed as the successor to ext3.
- backward compatible extensions to ext3
- **Features:** Journal checksumming(better reliability), Faster file system checking(skips unallocated block groups), Large file system(up to 1 exabyte (EiB) and files with sizes up to 16 tebibytes (TiB)),
- Some limits:
  - Max. volume size 1 EiB
  - 16 TiB (recommended)
  - Max. file size 16 TiB (for 4k block filesystem)
  - Max. number of files 4 billion (specified at filesystem creation time)
  - Max. filename length

# Linux File Systems: xfs

- XFS[1] is a high-performance 64-bit journaling file system created by Silicon Graphics, Inc (SGI)
- XFS allows file systems to be created with block sizes ranging between 512 bytes and 64 KB
- XFS provides the `xfs_growfs` utility to perform online resizing of XFS file systems.
- XFS ensures the consistency of data by employing metadata journaling, journal log can be placed on different device(say ssd)
- XFS provides the `xfsdump` and `xfsrestore` utilities to aid in the backup of data stored in XFS file systems.
- XFS does not provide direct support for snapshots
- An XFS file system cannot be shrunk, what would be useful, for example, in some virtualized environments.

# Installing Software in Linux

- Debian specific packet manager: `dpkg` / `apt`
  - `dpkg` is the software at the base of the Debian package management system.  
`dpkg` is used to install, remove, and provide information about `.deb` packages.  
[ Examples: `dpkg` ]
  - `dpkg` itself is a low level tool; higher level tools, such as APT, are used to fetch packages from remote locations or deal with complex package relations. Tools like `aptitude` or `synaptic` are more commonly used than `dpkg` on its own, as they have a more sophisticated way of dealing with package relationships and a friendlier interface.  
[ Examples: `apt-get install` ]

# Linux Install Software: java8 and eclipse

- Example: installing java8 and setting it as default jre
- Example: installing eclipse, creating Desktop shortcuts

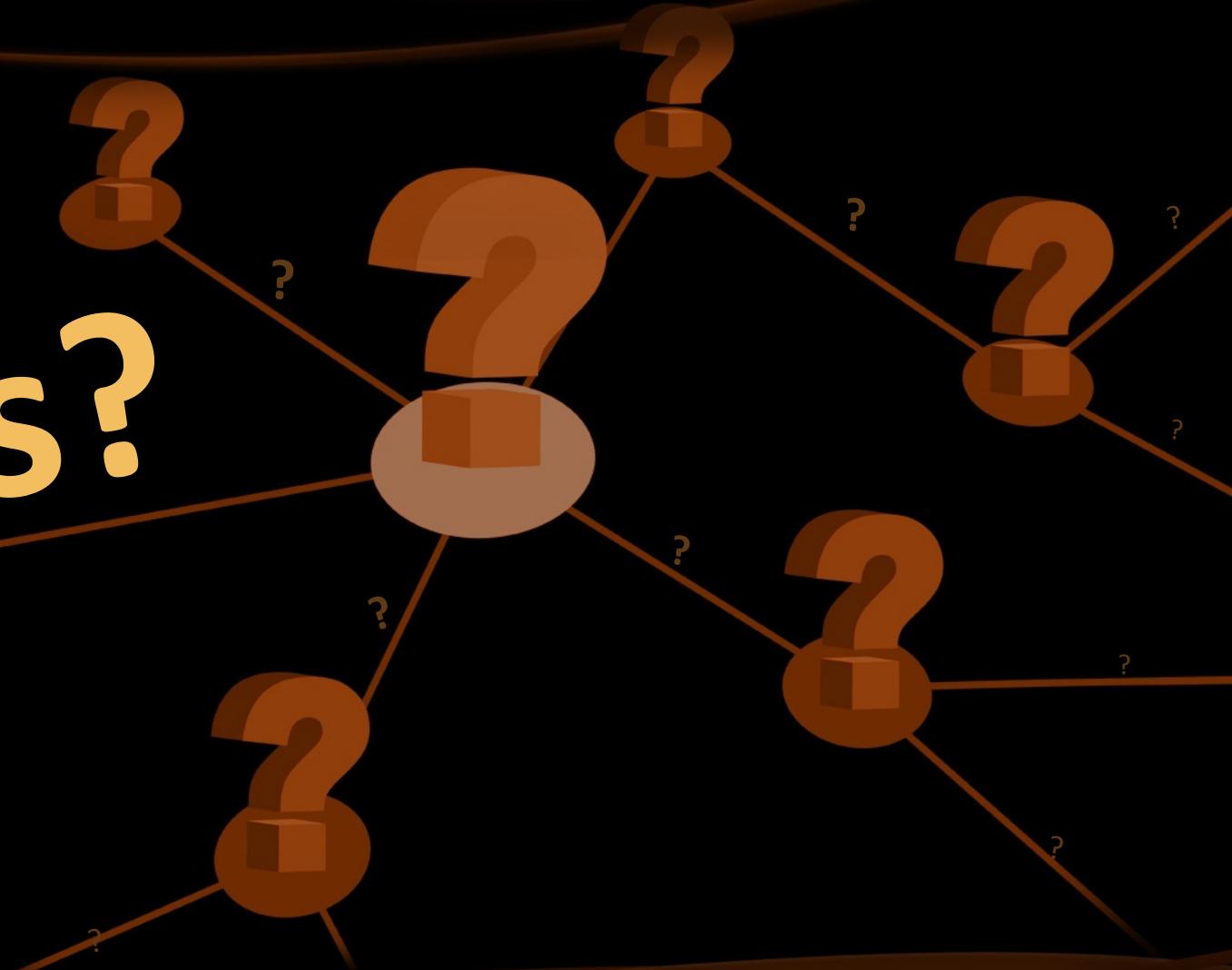
# Summary

- Linux is the best



Linux is the best

# Questions?



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