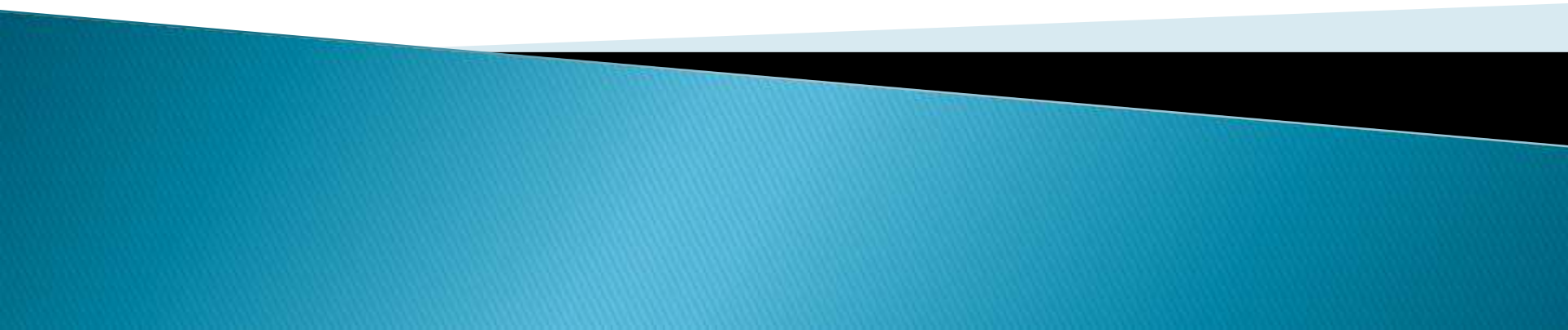


Introduction to Operating Systems

Damian Gordon





Computer
Hardware



Software Applications



Computer Hardware



Software
Applications



OPERATING SYSTEM

Computer
Hardware



Software Applications



UNIX

Computer Hardware



Two Types of Interfaces

CLI (Command-Line Interface)

GUI (Graphical User Interface)

Two Types of Interfaces

CLI (Command-Line Interface)

```
Loading CPM.SYS...

CP/M-86 for the IBM PC/XT/AT, Vers. 1.1 (Patched)
Copyright (C) 1983, Digital Research

Hardware Supported :

    Diskette Drive(s) : 3
    Hard Disk Drive(s) : 1
    Parallel Printer(s) : 1
    Serial Port(s) : 1
    Memory (Kb) : 640

D>a:
A>dir
A: PIP      CMD : STAT      CMD : SUBMIT  CMD : ASMB6   CMD
A: GENCMD   CMD : DDT86     CMD : TOD     CMD : ED      CMD
A: HELP     CMD : HELP     HLP : SYS   CMD : ASSIGN  CMD
A: FORMAT   CMD : CLDIR    CMD : WRTLDL  CMD : BOOTPCDS SYS
A: BOOTWIN  SYS : CPM      H86 : WINSTALL SUB : PD     CMD
A: WCPM     SYS : DISKUTIL CMD

A>_      User 0      0:00:11      Jan. 1, 2000
```

GUI (Graphical User Interface)

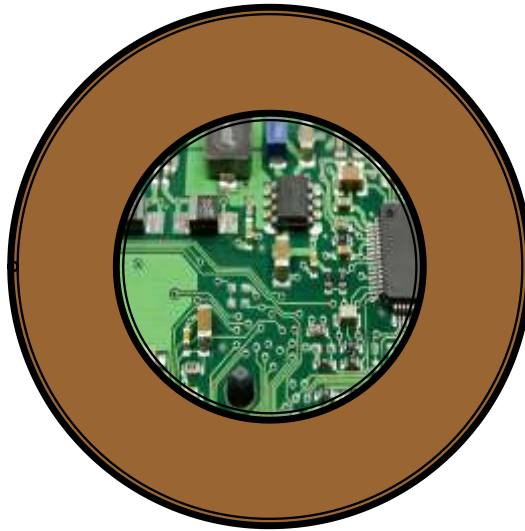


Typical OS Architecture



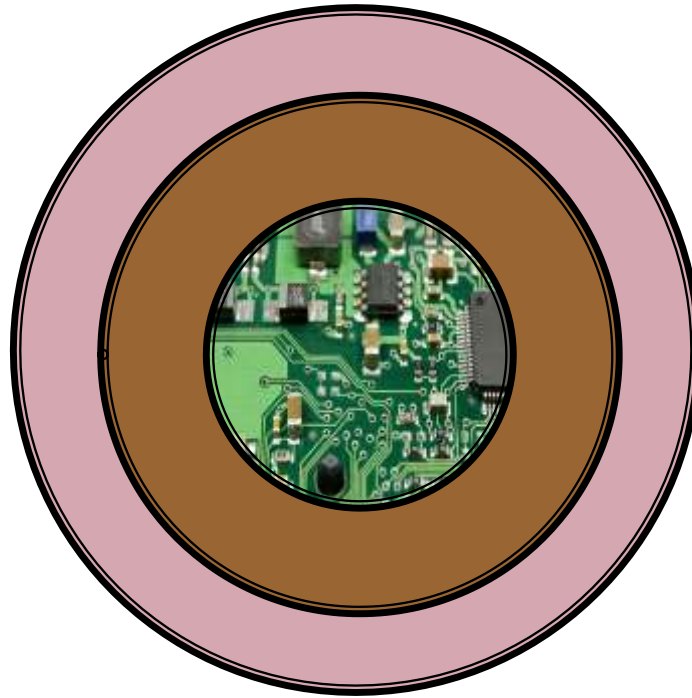
Hardware

Typical OS Architecture



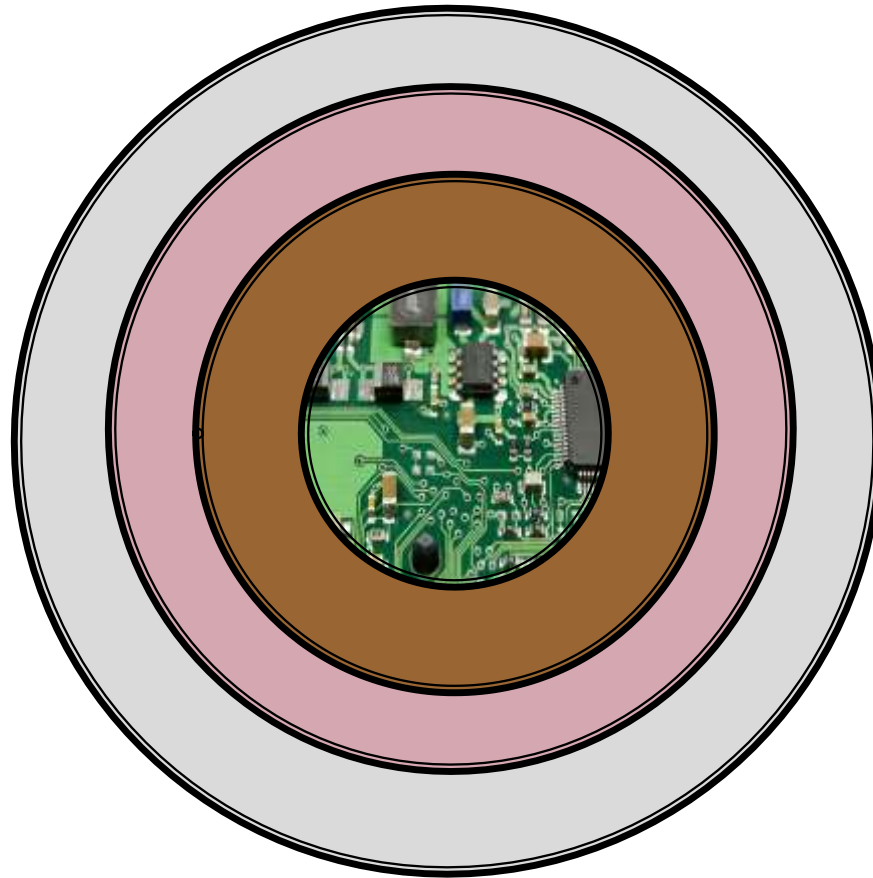
Kernel

Typical OS Architecture



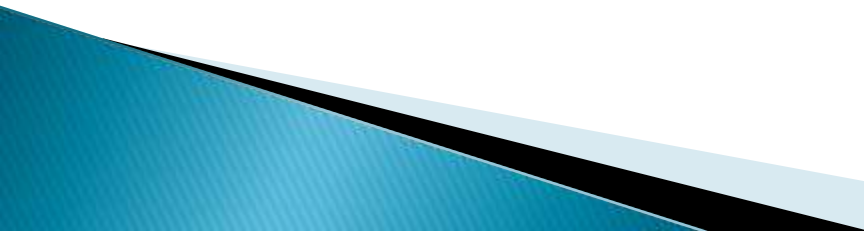
Shell

Typical OS Architecture



**User
Applications**

Terminology

- ▶ Hardware is the physical elements of a computer system. It is the physical parts of a computer, such as the monitor, mouse, keyboard, computer data storage, hard disk drive (HDD), graphic cards, sound cards, memory, motherboard, and so on.
 - ▶ The Kernel is a computer program that manages input/output requests from software, and translates them into data processing instructions for the central processing unit and other electronic components of a computer.
 - ▶ The Shell is an interface for access to an operating system's services. In general, operating system shells use either a command-line interface (CLI) or graphical user interface (GUI).
 - ▶ User Applications are computers program designed to perform a group of coordinated functions, tasks, or activities for the benefit of the user.
- 

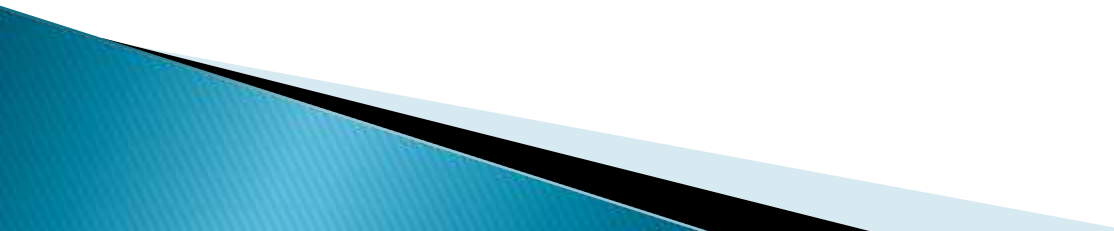
Introduction to common Operating Systems

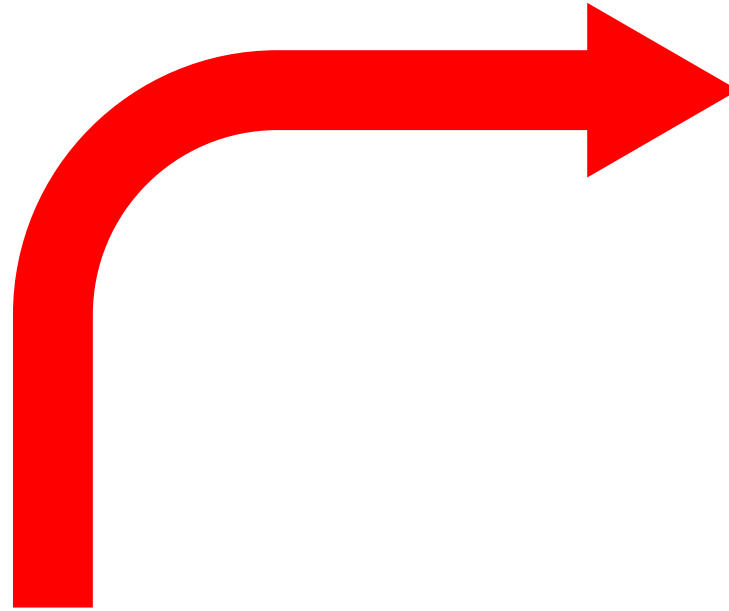




UNIX

Whose logo is this?

- ▶ Developed by Ken Thompson and Dennis Ritchie
 - ▶ Unix was launched in 1969
 - ▶ It is a CLI (Command-Line Interface)
 - ▶ Written in the C programming language
 - ▶ Led to a variety of academic and commercial variants, e.g. University of California, Berkeley (BSD), Microsoft (Xenix), IBM (AIX) and Sun Microsystems (Solaris)
- 

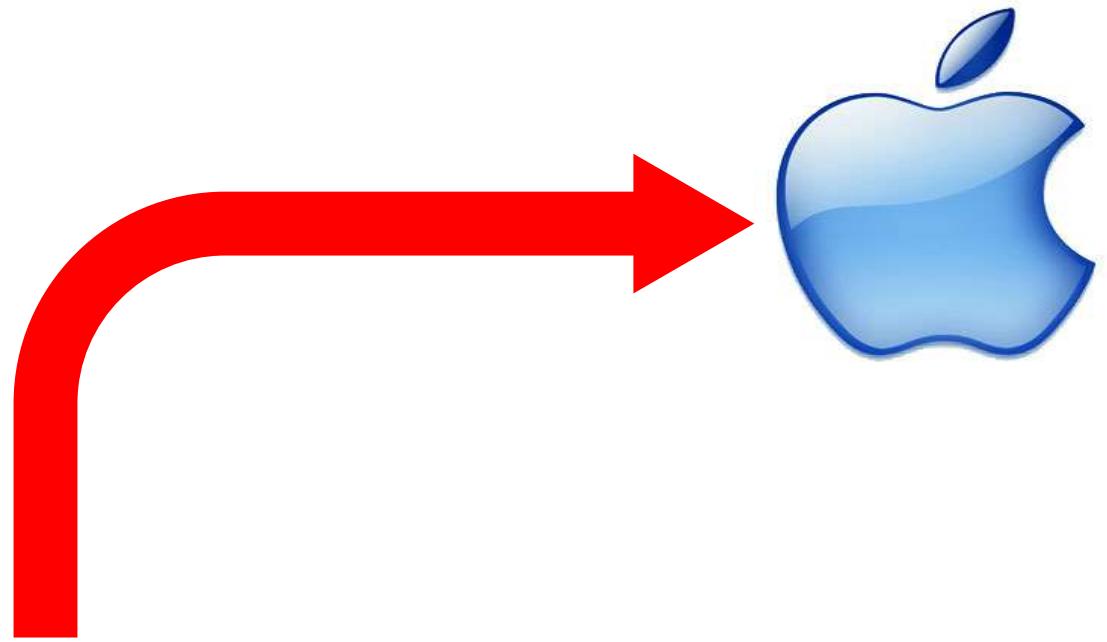


Whose logo is this?

Windows



- ▶ Developed by Microsoft – Bill Gates & Paul Allen
- ▶ Windows was launched in 1985
- ▶ Built on DOS (Disk Operating System), which is a CLI (Command-Line Interface)
- ▶ Has two modes User Mode (the user cannot directly access the hardware) and Kernel Mode (the user can access the hardware)
- ▶ Runs on Computers, Tablets (Surface), and integration with Xbox

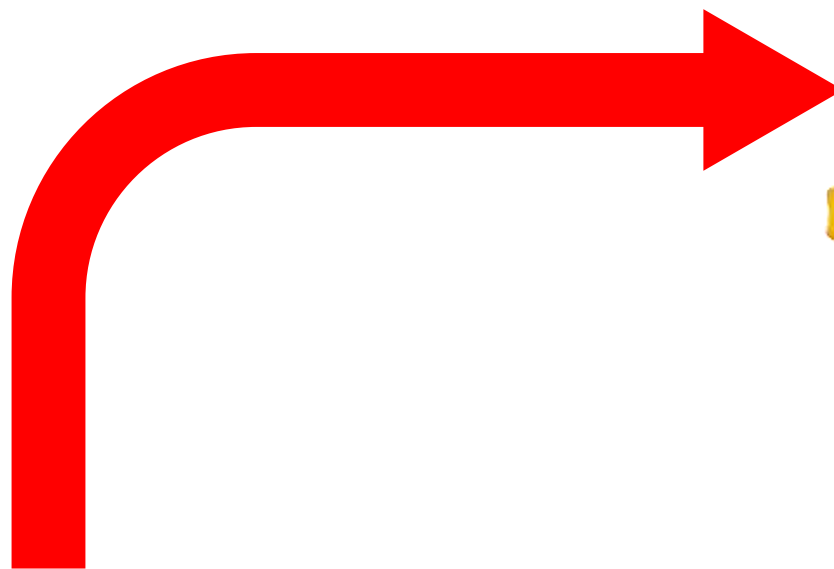


Whose logo is this?

Apple MacOS (later OS X)



- ▶ Developed by Apple – Steve Wozniak & Steve Jobs
- ▶ MacOS was launched in 1984
- ▶ MacOS is a native GUI (Graphical User Interface)
- ▶ MacOS evolved into OS X, which combined technologies from MacOS, Unix, and NeXT
- ▶ Runs on Computers and other devices.

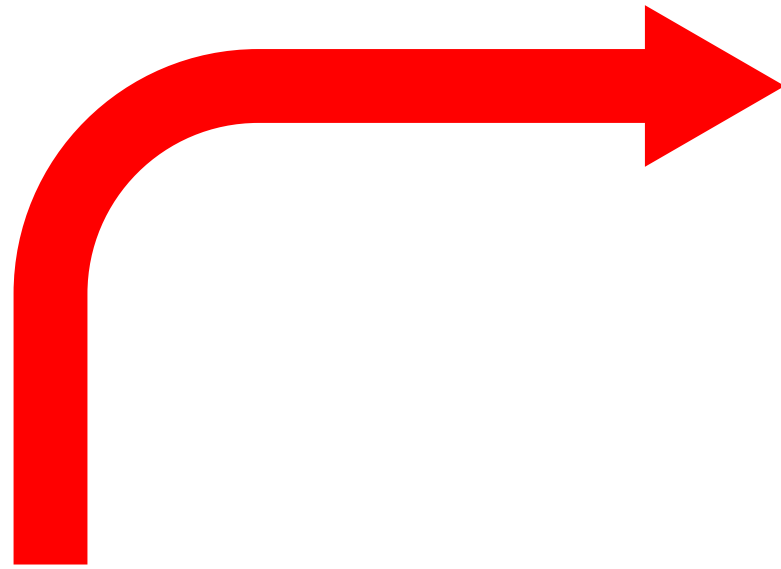


Whose logo is this?

Linux



- ▶ Developed by Linus Benedict Torvalds
- ▶ Linux was launched in 1992
- ▶ Linux is a CLI (Command-Line Interface)
- ▶ Torvalds made the code of Linux freely available to everyone on the internet, and therefore lots of people created their own versions of Linux, e.g. Debian, RedHat, SUSE, SlackWare, Gentoo, Ubuntu



Whose logo is this?

Android



- ▶ Developed by Andy Rubin, Rich Miner, Nick Sears, and Chris White
- ▶ Android was launched in 2003
- ▶ Based on the Linux kernel
- ▶ Android is a GUI designed primarily for touchscreen mobile devices such as smartphones and tablets



iOS

Whose logo is this?

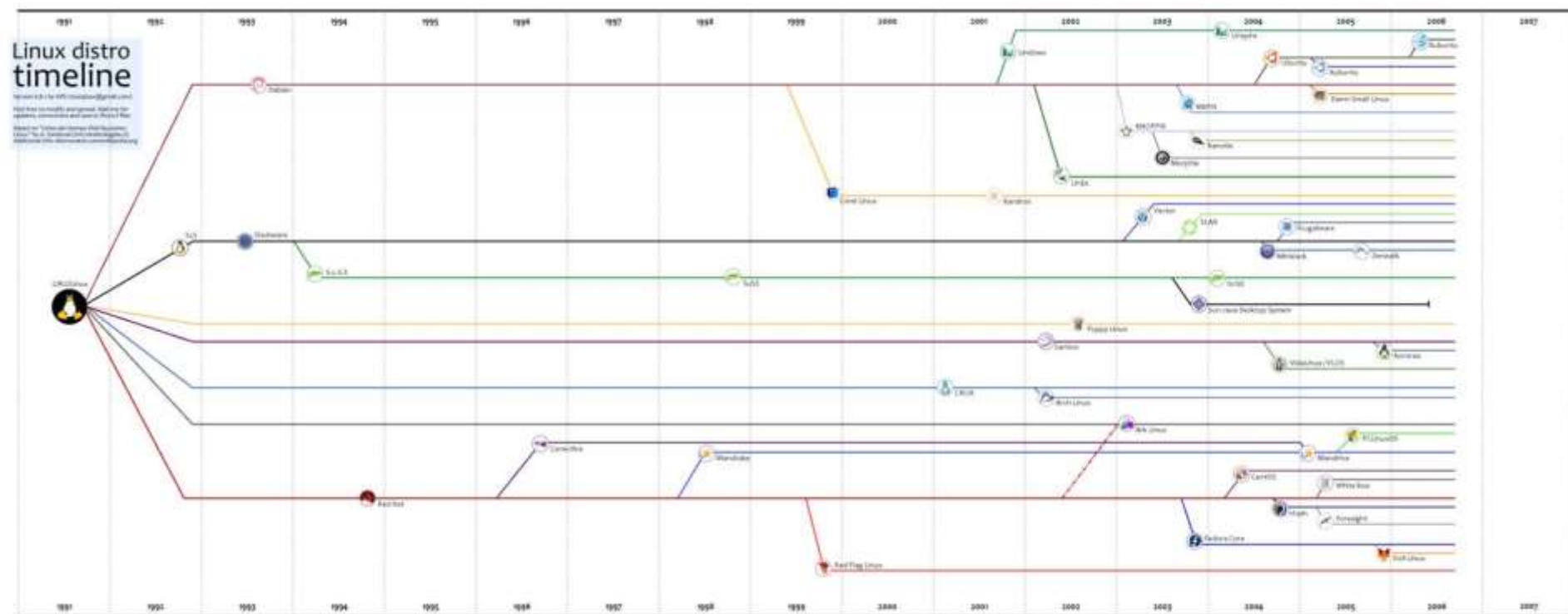
iOS



- ▶ Developed by Steve Jobs and Scott Forstall
- ▶ iOS was launched in 2007
- ▶ Based on the MacOS
- ▶ iOS is a GUI designed primarily for touchscreen mobile devices such as iPhones, iPods, iPads, and AppleTV.

A few more notes on Linux

Linux



Linux



- ▶ A Linux distribution (often called a distro for short) is an operating system made from a software collection, which is based upon the Linux kernel and, often, a package management system.
- ▶ Almost six hundred Linux distributions exist, with close to five hundred out of those in active development, constantly being revised and improved.
- ▶ There are commercially backed distributions, such as Fedora (Red Hat), openSUSE (SUSE) and Ubuntu (Canonical Ltd.), and entirely community-driven distributions, such as Debian, Slackware, Gentoo and Arch Linux.

LAMP



Linux



Apache



MySQL



Php



Perl

LAMP



Linux



Apache



MySQL



Python



Php



perl Perl

LAMP



User
Interface



Web Server



Database



Operating
System

Linux



LAMP



- ▶ LAMP is an model of web service solution stacks, named as an acronym of the names of its original four open-source components: the Linux operating system, the Apache HTTP Server, the MySQL relational database management system (RDBMS), and the PHP programming language.
- ▶ The LAMP components are largely interchangeable and not limited to the original selection. As a solution stack, LAMP is suitable for building dynamic web sites and web applications.

XAMPP



X Cross-Platform



Apache



MariaDB



Python



Php



Perl

XAMPP



User
Interface

P_{hp}  P_{erl} perl  P_{ython} 

Web Server

A_{pache} 

Database

M_{ariaDB}

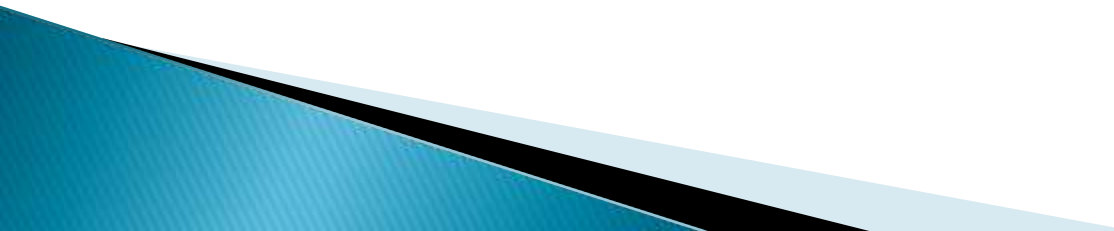


Operating
System

X Cross-
Platform



OTHER VARIANTS

- ▶ WAMP (Microsoft Windows)
 - ▶ MAMP (OS X)
 - ▶ SAMP (Solaris)
 - ▶ FAMP (FreeBSD)
 - ▶ iAMP (iSeries)
-
- ▶ WIMP (IIS in place of Apache)
 - ▶ LEMP (Nginx in place of Apache)
-
- ▶ LAPP (PostgreSQL in place of MySQL)
- 

Anything much happen in
OSs in the past year?

Linux V4.0

12th April
2015

- ▶ A *fairly* small release, some VM clean-ups
- ▶ The unification of the PROTNONE and NUMA handling for page tables.

Some people advocated the 4.0 version number, to eventually see 4.1.15 – because "*that was the version of Linux SkyNet used for the T-800 Terminator*".

```
[ 0.953693] serio: i8042 KBD port at 0x60,0x64 irq 1
[ 0.954816] serio: i8042 AUX port at 0x60,0x64 irq 12
[ 0.956069] mousedev: PS/2 mouse device common for all mice
[ 0.957743] input: AT Translated Set 2 keyboard as /devices/platform/i8042/serio0/input/input0
[ 0.960144] rtc_cmos rtc_cmos: rtc core: registered rtc_cmos as rtc0
[ 0.961230] rtc0: alarms up to one day, 114 bytes nvram
[ 0.962307] cpuidle: using governor ladder
[ 0.963320] cpuidle: using governor menu
[ 0.964366] TCP cubic registered
[ 0.965316] NET: Registered protocol family 10
[ 0.967271] Mobile IPv6
[ 0.970938] NET: Registered protocol family 17
[ 0.972209] Registering the dns_resolver key type
[ 0.973334] Using IPI No-Shortcut mode
[ 0.974557] registered taskstats version 1
[ 0.976637] rtc_cmos rtc_cmos: setting system clock to 2011-09-09 20:32:52 UTC (1315600372)
[ 0.982005] Initializing network drop monitor service
[ 0.983351] Freeing unused kernel memory: 404k freed
[ 0.984627] Write protecting the kernel text: 2768k
[ 0.985825] Write protecting the kernel read-only data: 1068k
[ 0.986935] NX-protecting the kernel data: 3376k
Loading, please wait...
```

Linux V4.0

Version	Original release date	Current Version	Support Model
4.0	12 April 2015	4.0.9	Maintained from April 2015 to July 2015
4.1	22 June 2015	4.1.15	Maintained from July 2015 to September 2017
4.2	30 August 2015	4.2.8	Maintained from August 2015 to December 2015
4.3	1 November 2015	4.3.3	Supported version
4.4	10 January 2016	4.4	Maintained from January 2016 to February 2018

Windows 10

29th
July
2015

Threshold

- Return of 'Start' button, a virtual desktop system, integration with Windows Phone
- Device dependent interface

Incorporates
Microsoft's intelligent
personal assistant
Cortana



iOS 9

Monarch

16th
September
2015

- Focuses less on new features and more on under-the-hood optimizations, as well as battery improvements. iOS 9 also adds a number of features to the iPad to improve productivity. These include Slide Over, Split View, and Picture in Picture, for enhanced multitasking.

iOS 9 includes a new News app which displays news from sources such as The New York Times, CNN, Wired, and ESPN



OS X v10.11

El Capitan

30th
September
2015

- Focuses mainly on performance, stability and security. Adds multi-touch gestures to applications like Mail and Messages

Has a new security feature called System Integrity Protection (SIP, aka "rootless") that protects system processes, files and folders from being tampered with.



Android V6

Marshmallow

5th
October
2015

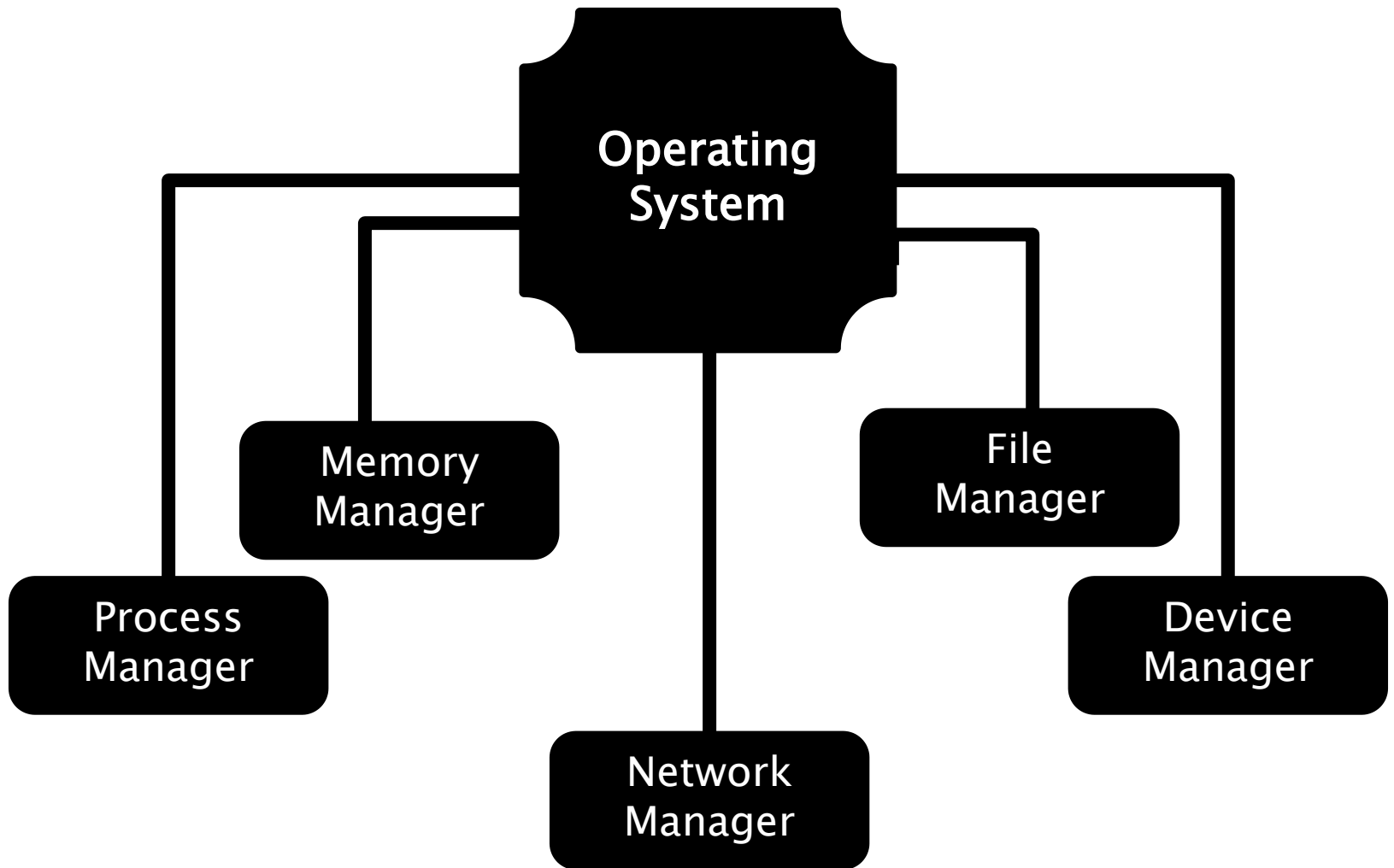
- ▶ Marshmallow focuses on improving the overall user experience of the previous version, introducing a new permissions architecture, new APIs for contextual assistants and a new power management system.

A new "Assist" API allows information from a currently-opened app to be sent to a designated "assistant" application for analysis and processing.



Main features of an Operating System





Process Manager

- ▶ The OS must allocate resources to processes, enable processes to share and exchange information, protect the resources of each process from other processes and enable synchronisation among processes. To meet these requirements, the OS must maintain a data structure for each process, which describes the state and resource ownership of that process, and which enables the OS to exert control over each process.

Memory Manager

- ▶ The memory management function keeps track of the status of each memory location, either allocated or free. It determines how memory is allocated among competing processes, deciding which gets memory, when they receive it, and how much they are allowed. When memory is allocated it determines which memory locations will be assigned. It tracks when memory is freed or unallocated and updates the status.

File Manager

- ▶ A file manager or file browser is a computer program that provides a user interface to manage files and folders. The most common operations performed on files or groups of files include creating, opening (e.g. viewing, playing, editing or printing), renaming, moving or copying, deleting and searching for files, as well as modifying file attributes, properties and file permissions. Folders and files may be displayed in a hierarchical tree based on their directory structure.

Device Manager

- ▶ The device manager is responsible for detecting and managing devices, performing power management, and exposing devices to userspace. Device drivers allow user applications to communicate with a system's devices. They provide a high-level abstraction of the hardware to user applications while handling the low-level device-specific I/O and interrupts.

Network Manager

- ▶ The network manager manages the relationship between the operating system and the network(s) that it is connected to. This means that the user can be unaware of issues like connectivity, and network speed.

Thank you.

**TO BE
CONTINUED...** 