

Software



ICS 20



Software Layers



- Software can generally be divided into several layers for organizational purposes
 - Layer 1 – BIOS (Basic Input Output System)
 - Layer 2a – Operating System Kernel
 - Layer 2b – Operating System User Interface
 - Layer 3 - Applications

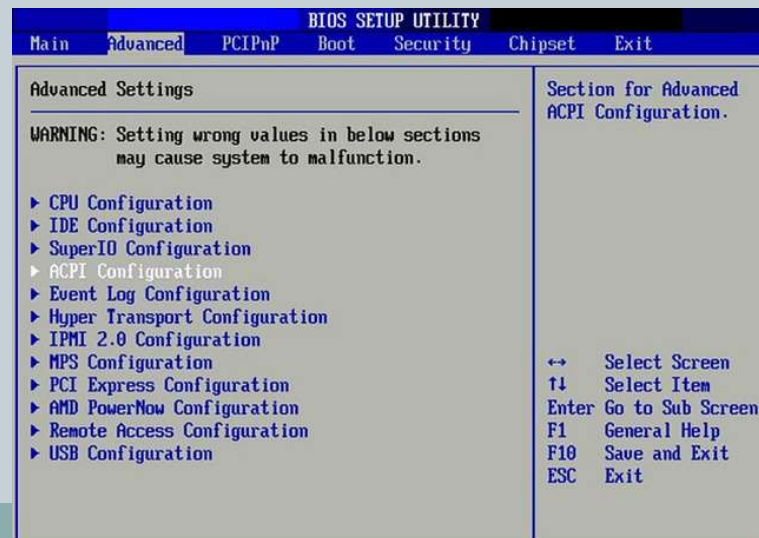
What is the BIOS?



Basic Input Output System

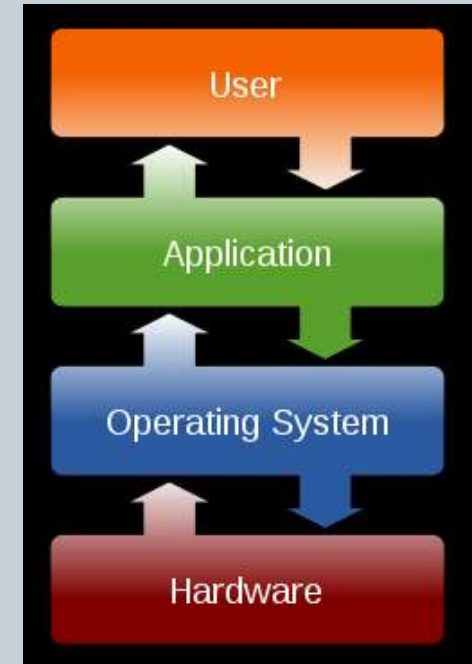
Including:

- Firmware (resides permanently on motherboard)
- Utilized during startup and initialization to test available hardware



What is an operating system?

- Often called an O/S or OS
- 3 Main Functions
 - Manage files and resources (CPU, memory etc.)
 - Provide a user interface
 - Provide a platform for application software
- Consists of 2 parts
 - **Kernel** – Nucleus of software that communicates with hardware
 - **User Interface** – Software that is designed for user interaction



Popular Operating Systems?

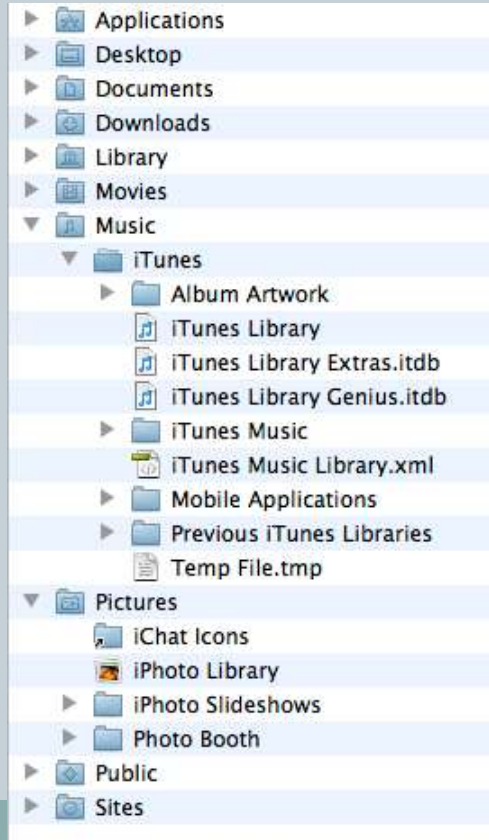
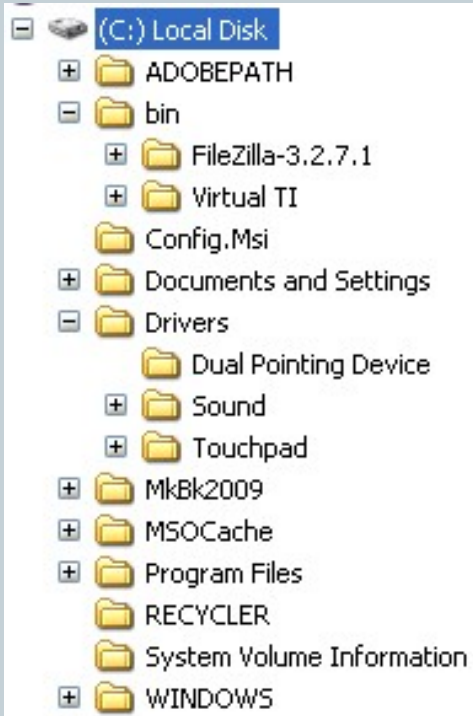


- Microsoft Windows (3.1 / 95 / 98 / XP / 7 / 10 / ...)
- Apple Mac OS
- Linux
 - This is a generic term, there are MANY kinds of Linux



Managing Files

- File management is a central feature of almost all operating systems



```
emmellst@boulder:~/mnt/raid5/bigShare$ ls
:2eDS_Store      music-nontechno      Temporary Items
:2eTemporaryItems music-techno          Videos
Apps             Network Trash Folder Videos-Camcorder-Raw
books            pics                  Videos-iMac.iMovie.Backup
emmellst@boulder:~/mnt/raid5/bigShare$ cd ..
emmellst@boulder:~/mnt/raid5$ ls
backups  bigShare  home  tc-imac  tc-jenny  temp
emmellst@boulder:~/mnt/raid5$ cd home
emmellst@boulder:~/mnt/raid5/home$ ls
dave  emmellst  ftp  jenny
emmellst@boulder:~/mnt/raid5/home$ cd emmellst
emmellst@boulder:~/mnt/raid5/home/emmellst$ ls
:2eDS_Store
:2e_Screen shot 2009-09-15 at 11.51.50 PM.png
:2eTemporaryItems
backups
files
_ICCS20-200930
iTunes9.dmg
Library
logs
Maildir
_MDM4U-200930
_MFC3C-200930
Network Trash Folder
Screen shot 2009-09-15 at 11.51.50 PM.png
scripts
SMARTNotebook10-Install.exe
temp
Temporary Items
torrents
emmellst@boulder:~/mnt/raid5/home/emmellst$
```

Managing Files



- Differences between operating systems?
 - Allowed characters, length of names, case sensitivity
 - File security
- Many different file & disk formats
 - FAT32, NTFS, HFS, EXT

<https://www.youtube.com/watch?v=KN8YgJnShPM>

User Interface



- Brings structure to the interaction between a user and the computer
- A program or set of programs that sits as a layer above the operating system itself.
- Two types
 - Graphical User Interface (GUI)
 - Text Based User Interface (Shell/Command Line)

GUI



- Graphical User Interface



Shell/Command Line



- Text Based User Interface

```
Starten von MS-DOS...

HIMEM testet den erweiterten Speicher...beendet.

This driver is provided by Oak Technology, Inc..
DTI-91X ATAPI CD-ROM device driver, Rev D91X0352
(C)Copyright Oak Technology Inc. 1987-1997
Device Name      : CDROM
Transfer Mode    : Programmed I/O
Number of drives : 1

C:\>C:\DOS\SMARTDRV.EXE /X
MSCDEX Version 2.23
Copyright (C) Microsoft Corp. 1986-1993. Alle Rechte vorbehalten.
Laufwerk D: = Treiber CDROM Gerat 0
C:\>_
```

```
C:\WINDOWS\system32\cmd.exe
Volume in drive C is OS_Install
Volume Serial Number is 3CD8-0714

Directory of C:\Documents and Settings\Dan

06/27/2011  03:13 PM  <DIR>      .
06/27/2011  03:13 PM  <DIR>      ..
06/27/2011  03:13 PM  <DIR>      .gem
11/05/2008  02:21 AM           341,831 AdobeFnt10.lst
11/01/2011  09:50 PM  <DIR>      Desktop
09/23/2008  07:52 AM  <DIR>      Favorites
06/27/2011  03:23 PM  <DIR>      My Documents
09/28/2008  10:08 PM  <DIR>      Start Menu
               1 File(s)           341,831 bytes
               7 Dir(s)      6,398,414,848 bytes free

C:\Documents and Settings\Dan>cd "My Documents"
C:\Documents and Settings\Dan\My Documents>cd rubystuff
C:\Documents and Settings\Dan\My Documents\rubystuff>ruby hello_world.rb
hello world
I'm doing this ina windows text editor
C:\Documents and Settings\Dan\My Documents\rubystuff>_
```

```
andrea@ubuntu: ~
File Edit View Search Terminal Help
andrea@ubuntu:~$ pwd
/home/andrea
andrea@ubuntu:~$ ls
Desktop  Downloads  flash  Pictures  Railapp  Templates
Documents  examples.desktop  Music  Public  sequences  Videos
andrea@ubuntu:~$ mkdir bioinfo
andrea@ubuntu:~$ ls
Desktop  Downloads  examples.desktop  Music  Public  sequences  Videos
andrea@ubuntu:~$ cd bioinfo
andrea@ubuntu:~/bioinfo$ ls
andrea@ubuntu:~/bioinfo$ touch mysequence.fasta
andrea@ubuntu:~/bioinfo$ ls
mysequence.fasta
andrea@ubuntu:~/bioinfo$ mv mysequence.fasta mysequence.txt
andrea@ubuntu:~/bioinfo$ ls
mysequence.txt
andrea@ubuntu:~/bioinfo$ mv mysequence.txt ..
andrea@ubuntu:~/bioinfo$ ls
andrea@ubuntu:~/bioinfo$ cd ..
andrea@ubuntu:~$ ls
Desktop  Downloads  Music  Public  Templates
Documents  examples.desktop  mysequence.txt  Railapp  Videos
Documents  Flash  Pictures  sequences
andrea@ubuntu:~$ rm mysequence.txt
andrea@ubuntu:~$ ls
Desktop  Downloads  examples.desktop  Music  Public  sequences  Videos
andrea@ubuntu:~$ cd bioinfo
andrea@ubuntu:~/bioinfo$ ls
Desktop  Downloads  flash  Pictures  Railapp  Templates
Documents  examples.desktop  flash  Music  Public  sequences  Videos
andrea@ubuntu:~/bioinfo$ touch sequences/myseq.fasta
andrea@ubuntu:~/bioinfo$ rmdir sequences
rmdir: failed to remove 'sequences': Directory not empty
andrea@ubuntu:~/bioinfo$ rm -rf sequences
andrea@ubuntu:~/bioinfo$ ls
Desktop  Downloads  flash  Pictures  Railapp  Videos
Documents  examples.desktop  Music  Public  Templates
andrea@ubuntu:~/bioinfo$
```

Types of Operating Systems



- **Real-Time Operating System (RTOS)**
 - For control machinery, scientific / industrial equipment
 - Little (if any) user interface
 - Good at doing something specific

- **Single-User, Single-Task**
 - More features, but simple
 - Just one thing at a time
 - Original iPhone/iPod, Palm OS, etc

Types of Operating Systems



- **Single-User, Multi-Task**
 - The type most people have today
 - Designed for one person to do a variety of tasks, possibly at the same time
 - Ex: Windows, Mac OS, Linux
- **Multi-User, Multi-Task**
 - Allows many users to make full use of the computer's resources simultaneously
 - Must make sure to balance each user to make sure they don't affect each other.
 - Ex: Mainframes, large UNIX systems, etc

Device Driver



- All devices need a driver
- A “translator”
 - Allows the operating system to talk to any specific device
- Why don't your printers work right away?
 - You need a driver!