Computer Software

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- Computer Software
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Introduction
Two Categories of Software

▷ **Software**: Stored instructions that specify the tasks and behavior of the hardware
  ◦ **Operating System**: Master control program of the entire computer
  ◦ **Application software**: A specific application that runs in a specific operating system to accomplish a specific task

Operating Systems

▷ A comprehensive OS is the most complex software that exists, containing tens of millions of lines of code
▷ An OS provides at least 4 different types of functions
  ◦ Resource Management: Interface with the hardware, e.g., virtual memory
  ◦ User Interface
  ◦ Application Management, e.g., multi-tasking
  ◦ File Management
Open vs. Closed Source

- Two general classes of operating systems left for most computers: Windows and Unix family
- Examples of Unix, generically defined:
  - Macintosh
  - Linux
- **Open Source Software**: Computer software for which the original source code is available for everyone and can be modified as long as the modifications are available to everyone
- Anyone can charge money for open source software, and in one business model companies that do so also provide support
- Windows is completely closed, Macintosh is in-between being built on an open-source version of Unix called BSD, and Linux is completely open

OS Versions for Windows and Mac

- **Windows 8 Desktop Versions**
  - Windows 8: Home Basic
  - Windows 8 Pro: Remote Desktop connections, participate in a Windows Server domain, Encrypting File System + more
  - Windows 8 Enterprise: all the features in Windows 8 Pro except the ability to install the Windows Media Center add-on, with additional features to assist with IT organization
  - Windows RT: ARM based, includes MS Office but only runs third-part software bought from the Windows store
- **Macintosh Desktop Version**
  - Mac OS X 10.9: Full OS with Unix core

Windows in the World

- Several more Windows 7 versions, including Starter and Ultimate
- The plethora of Windows versions are not for user functionality, otherwise only the most featured version would be available to consumers
- Part of the consideration is to provide cheaper versions for people in countries with less money
- However, in many places around the world, no one would ever dream of paying for any Windows version
- Windows also runs without a software key
- Instructors Conjecture: MS lets users use Windows without a software key probably because they do not want more people to start using Linux
Linux is Born

Open source operating systems

- In the late 1980’s a graduate computer science student in Finland, Linus Torvalds, decided to develop his own operating system.
- At that time there was a new development that became available to technologically oriented academics: the Internet.
- Torvalds asked for help over this new medium and to his surprise soon he there were many hundreds of volunteers, and then thousands.
- Linux grew until today it is a major operating system supported by major technology companies such as IBM, which has spent billions helping to develop Linux.
- Today the most famous person in the world of open source, Linux Torvalds, lives in Portland, one of the open-source centers of the world.

Linux

- The open-source world offers many choices.
- Even if focusing just on Linux, there are many variants, called distributions.
  - Third most widely installed OS world-wide is the Linux distribution call Ubuntu, ubuntu.com, but does not include proprietary software such as Flash and multi-media co-decs needed to do basic things such as view youtube videos.
  - Recommended (by your instructor) is an Ubuntu based Linux distribution called Mint, linuxmint.com, almost as popular as Ubuntu and ready to go right from the initial installation.
  - Particularly for business use, Novell sponsored openSUSE, opensuse.org, is often highly recommended, as is Red Hat sponsored open Fedora, fedoraproject.org.

Source Code

- Source Code: A language that resembles, to some extent, ordinary English, more than the raw machine code that actually runs on the computer, and is used by programmers to write computer programs, including the operating system.
- Examples include C, C++, objective C, Java, Fortran and Visual Basic.
- Compiler: A program that translates source code into machine language.
- Linux is a giant C program, and the thousands of lines of Linux C are available to anyone from kernel.org.
- Kernel: Basic core of an OS, of which other services such as the filesystem and user interface are added to form the complete OS.
Application Software

Accomplish the tasks that make the computer useful

- Consumption
  - Word processing, e.g., MS Word, LibreOffice, LaTeX
  - Spreadsheets
  - Slide presentation
  - E-mail, calendar, contacts
  - File uploads
  - Web browser
- Production
  - Database
  - Drawing, e.g., Adobe Illustrator
  - Photographic editing e.g., Adobe Photoshop
  - Web site authoring, e.g., Adobe DreamWeaver

```
Linux Source Code Snippet

static struct request *get_request(struct request_queue *q, int rw_flags,
        struct bio *bio, GFP_T gfp_mask)
{
    struct request *rq = NULL;
    struct request_list *rl = &q->ql;
    struct iog_context *loc = NULL;
    const bool is_sync = rw_is_sync(rw_flags) != 0;
    int may_queue, prq;

    may_queue = elv_may_queue(q, rw_flags);
    if (may_queue == ELV_NO_QUEUE)
        goto rq_started;

    if ((rl->count[is_sync] | 1) >= queue_congestion_on_threshold(q))
        if (rl->count[is_sync] | 1, q->nr_requests)
            loc = current_iog_context(GFP_ATOMIC, q->node);
        if (!blk_queue_full(q, is_sync))
            blk_queue_release(q, loc);
        blk_set_queue_FULL(q, is_sync);
    }
}
```
Type Primary Classes of Computer Interfaces

- **GUI**: Graphical user interface, such as the default interface of the Macintosh, Windows, and Linux Ubuntu
  - Historically the first elements of the GUI were developed at Xerox/Parc in the late 1970's, and then refined and commercialized on the Macintosh, which debuted in January of 1984
  - The inventor of the computer mouse in 1967, Douglas Engelbart, just recently passed away, July 2013
- **CLI**: Command line interface, such as found in the Macintosh Terminal application, the Windows Run command, or the Linux Ubuntu Terminal application
  - The CLI is the first computer interface, and still the source of most power and speed for those who are able to take advantage of the often rather arcane commands

Example of a (Unix) CLI: Mac Terminal App

Or, go the Utility folder in the Applications folder, and run the Terminal.app
A Unix Prompt

DG-3:~ David$

Ready to enter a Unix command

List Files: Input

DG-3:~ David$ ls -l

The `ls -l` command produces a vertical list of the contents of the current directory, which is represented as a Folder in a GUI.

List Files: Output

The contents of the directory David, here a list only of directories, as indicated by the `d` at the beginning of each line of output.
Change Directory

DG-3:$ David$ cd Dropbox

The cd command is for change directory, here to the directory Dropbox

List Files: Input

DG-3:Dropbox David$ ls -l
total 680
drwxr-xr-x 31 David staff 1054 Apr 8 19:23 S11Stuff
drwxr-xr-x 10 David staff 612 Jun 18 17:18 Academic
-rw-r--r-- 17 David staff 578 Mar 21 09:55 BA325
-drwxr-xr-x 24 David staff 816 Jun 7 13:03 Homes
-rw-r--r-- 12 David staff 408 Apr 14 15:23 Movies
drwxr-xr-x 27 David staff 918 Jul 20 00:46 Other
drwxr-xr-x 5 David staff 170 Jul 21 22:28 Photos
drwxr-xr-x 4 David staff 136 Jul 21 22:28 Public

The list of files in the Dropbox directory

▶ The End