OPERATING SYSTEM

Assignment

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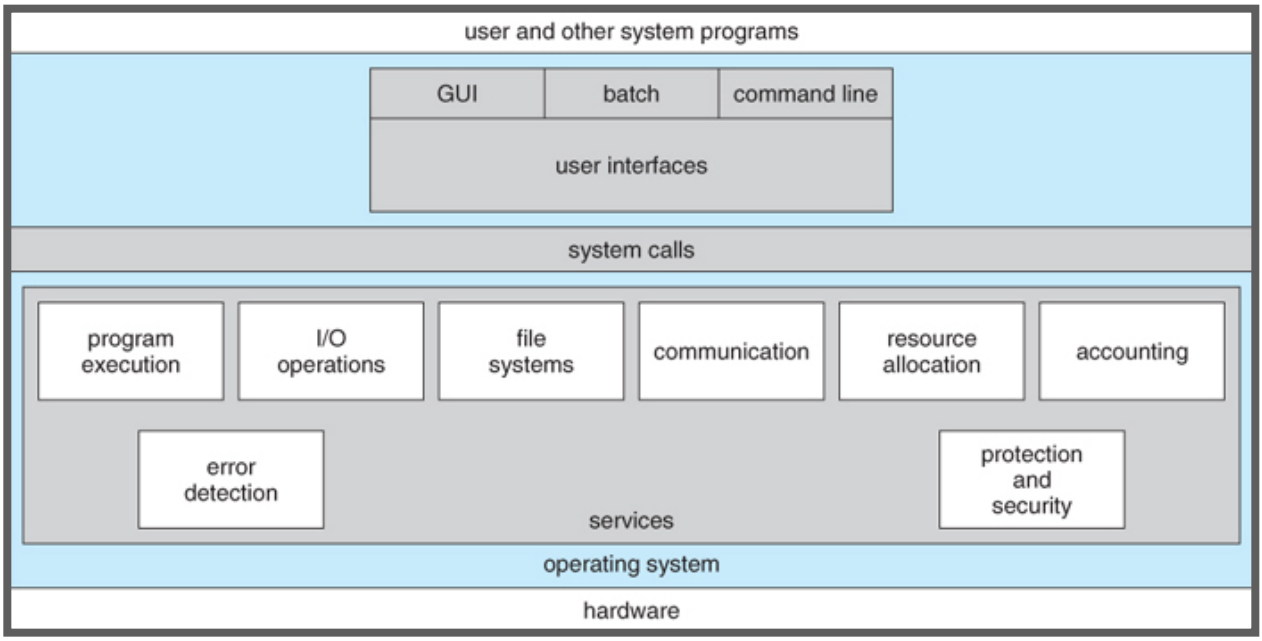
OPERATING-SYSTEM STRUCTURES

Operating-System Services

- **User Interfaces** - Means by which users can issue commands to the system. Depending on the system these may be a command-line interface (e.g. sh, csh, ksh, tcsh, etc.), a GUI interface (e.g. Windows, X-Windows, KDE, Gnome, etc.), or a batch command systems. The latter are generally older systems using punch cards of job-control language, JCL, but may still be used today for specialty systems designed for a single purpose.
- **Program Execution** - The OS must be able to load a program into RAM, run the program, and terminate the program, either normally or abnormally.
- **I/O Operations** - The OS is responsible for transferring data to and from I/O devices, including keyboards, terminals, printers, and storage devices.
- **File-System Manipulation** - In addition to raw data storage, the OS is also responsible for maintaining directory and subdirectory structures, mapping file names to specific blocks of data storage, and providing tools for navigating and utilizing the file system.
- **Communications** - Inter-process communications, IPC, either between processes running on the same processor, or between processes running on separate processors or separate machines. May be implemented as either shared memory or message passing, (or some systems may offer both.)
- **Error Detection** - Both hardware and software errors must be detected and handled appropriately, with a minimum of harmful repercussions. Some systems may include complex error

avoidance or recovery systems, including backups, RAID drives, and other redundant systems. Debugging and diagnostic tools aid users and administrators in tracing down the cause of problems.

A view of operating system services



User Operating-System Interface

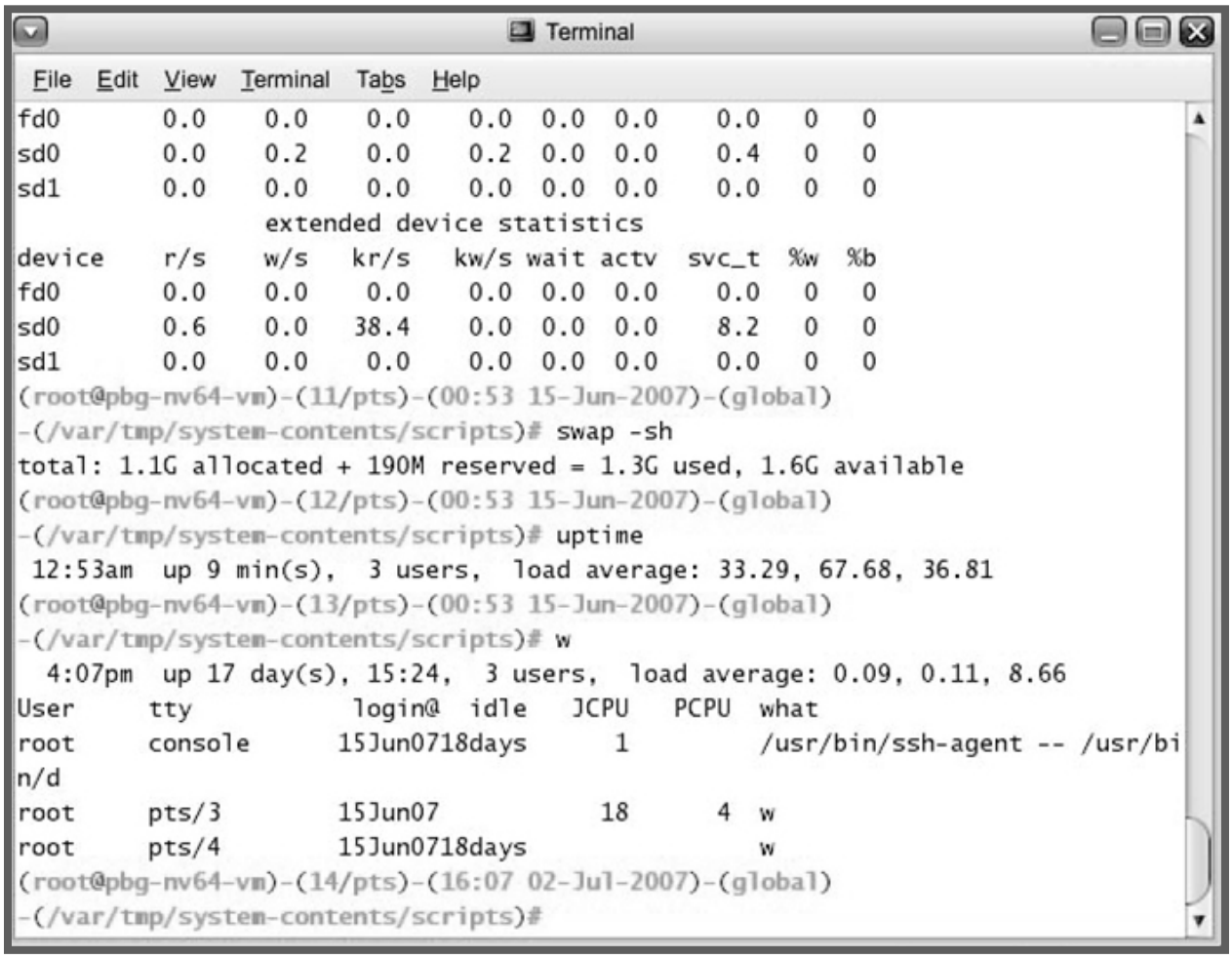
Command Interpreter

- Gets and processes the next user request, and launches the requested programs.
- In some systems the CI may be incorporated directly into the kernel.
- More commonly the CI is a separate program that launches once the user logs in or otherwise accesses the system.
- UNIX, for example, provides the user with a choice of different shells, which may either be configured to launch automatically at login, or which may be changed on the fly. (Each of these shells

uses a different configuration file of initial settings and commands that are executed upon startup.)

- Different shells provide different functionality, in terms of certain commands that are implemented directly by the shell without launching any external programs. Most provide at least a rudimentary command interpretation structure for use in shell script programming (loops, decision constructs, variables, etc.)
- An interesting distinction is the processing of wild card file naming and I/O re-direction. On UNIX systems those details are handled by the shell, and the program which is launched sees only a list of filenames generated by the shell from the wild cards. On a DOS system, the wild cards are passed along to the programs, which can interpret the wild cards as the program sees fit.

The Bourne shell command interpreter in Solaris 10



The iPad touchscreen

Graphical User Interface, GUI

- Generally implemented as a desktop metaphor, with file folders, trash cans, and resource icons.
- Icons represent some item on the system, and respond accordingly when the icon is activated.

- First developed in the early 1970's at Xerox PARC research facility.
- In some systems the GUI is just a front end for activating a traditional command line interpreter running in the background. In others the GUI is a true graphical shell in its own right.
- Mac has traditionally provided ONLY the GUI interface. With the advent of OSX (based partially on UNIX), a command line interface has also become available.
- Because mice and keyboards are impractical for small mobile devices, these normally use a touch-screen interface today, that responds to various patterns of swipes or "gestures". When these first came out they often had a physical keyboard and/or a trackball of some kind built in, but today a virtual keyboard is more commonly implemented on the touch screen.

The Mac OS X GUI

Choice of interface

- Most modern systems allow individual users to select their desired interface, and to customize its operation, as well as the ability to switch between different interfaces as needed. System administrators generally determine which interface a user starts with when they first log in.
- GUI interfaces usually provide an option for a terminal emulator window for entering command-line commands.
- Command-line commands can also be entered into **shell scripts**, which can then be run like any other programs.