

Introduction

- **Introduction**

- What Operating Systems Do
- Computer-System Architecture
- Operating-System Structure
- Operating-System Operations
- **Operating-System Services**
- **User Operating System Interface**
- System Calls
- Types of System Calls
- System Programs
- System Boot

- **Process Concept**

- Process Scheduling
- Operations on Processes
- Interprocess Communication

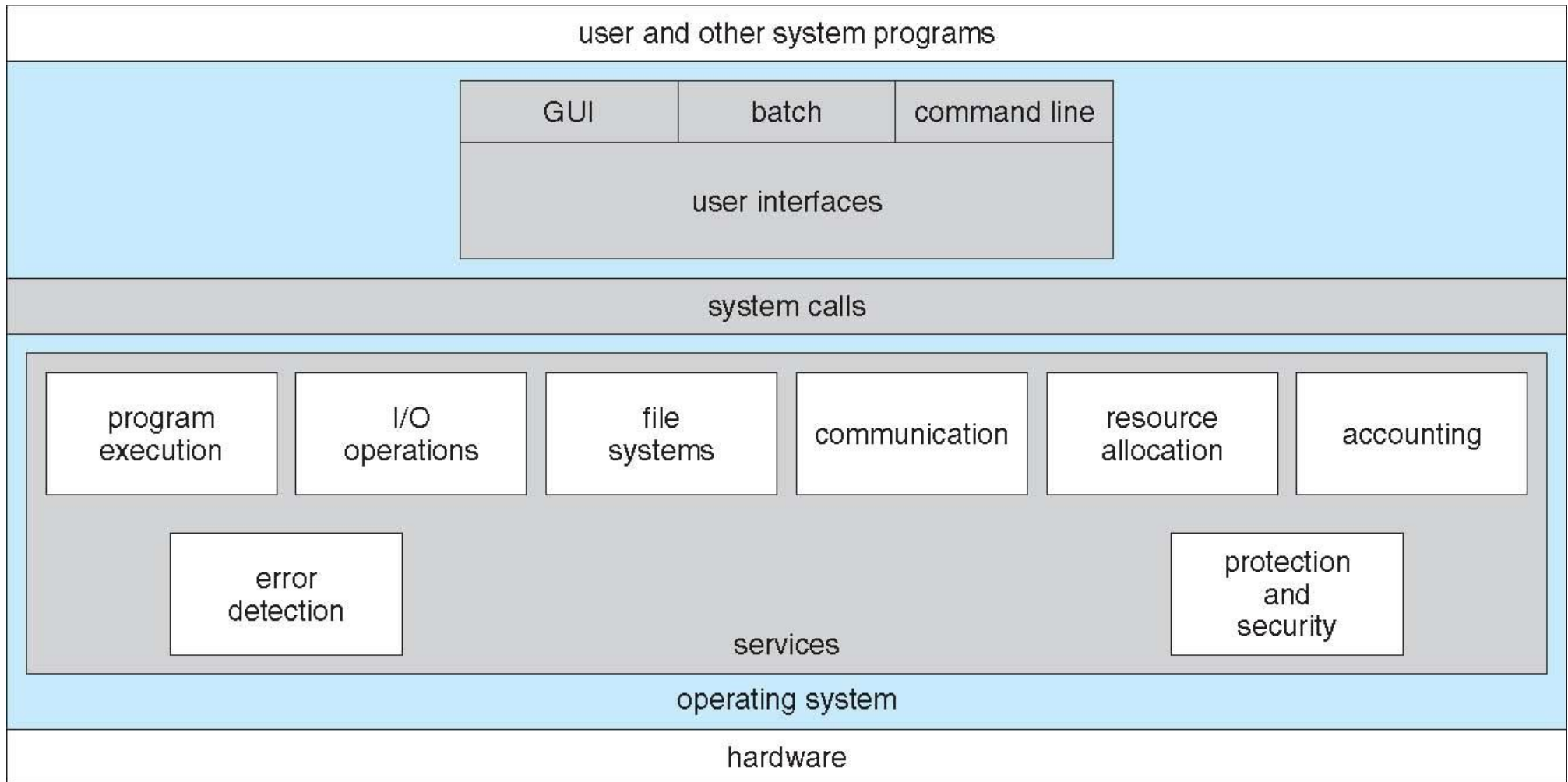
OPERATING SYSTEM SERVICES

- **User interface** - Almost all operating systems have a user interface (**UI**).
- Varies between **Command-Line (CLI)**, **Graphics User Interface (GUI)**, **Batch**
- **Program execution** - The system must be able to load a program into memory and to run that program, end execution, either normally or abnormally (indicating error)
- **I/O operations** - A running program may require I/O, which may involve a file or an I/O device
- **File-system manipulation** - Programs need to read and write files and directories, create and delete them, search them, list file information, permission management.
- **Error detection** – OS needs to be constantly aware of possible errors

- **Communications** – Processes may exchange information, on the same computer or between computers over a network may be **via shared memory or through message passing**
- **Resource allocation** - When multiple users or multiple jobs running concurrently, resources must be allocated to each of them - CPU cycles, main memory, file storage, I/O devices.
- **Accounting** - To keep track of which users use how much and what kinds of computer resources
- **Protection and security** - The owners of information stored in a multiuser or networked computer system may want to control use of that information, concurrent processes should not interfere with each other



A View of Operating System Services





CLI or **command interpreter** allows direct command entry

- Sometimes implemented in **kernel**, sometimes by **systems program**
- Sometimes multiple flavors implemented – **shells**
- Primarily fetches a command from user and executes it
- Sometimes commands built-in, sometimes just names of programs
 - If the latter, adding new features doesn't require shell modification



SNS

Bourne Shell Command Interpreter

7

```
Default
New Info Close Execute Bookmarks
Default Default
FBG-Mac-Pro:~ pbg$ w
15:24 up 56 mins, 2 users, load averages: 1.51 1.53 1.65
USER      TTY      FROM          LOGIN@  IDLE WHAT
pbg       console -            14:34   50 -
pbg       s000    -            15:05   - w
FBG-Mac-Pro:~ pbg$ iostat 5
          disk0          disk1          disk10         cpu         load average
  KR/t tps MR/s    KR/t tps MR/s    KR/t tps MR/s  us sy id  1m  5m  15m
  33.75 343 11.30    64.31 14  0.88    39.67 0  0.02  11 5 84  1.51 1.53 1.65
   5.27 320  1.65     0.00 0  0.00     0.00 0  0.00   4 2 94  1.39 1.51 1.65
   4.28 329  1.37     0.00 0  0.00     0.00 0  0.00   5 3 92  1.44 1.51 1.65
^C
FBG-Mac-Pro:~ pbg$ ls
Applications                Music                        WebEx
Applications (Parallels)    Pando Packages             config.log
Desktop                      Pictures                     getsmartdata.txt
Documents                   Public                      imp
Downloads                   Sites                       log
Dropbox                     Thumbs.db                   panda-dist
Library                     Virtual Machines            prob.txt
Movies                      Volumes                     scripts
FBG-Mac-Pro:~ pbg$ pwd
/Users/pbg
FBG-Mac-Pro:~ pbg$ ping 192.168.1.1
PING 192.168.1.1 (192.168.1.1): 56 data bytes
64 bytes from 192.168.1.1: icmp_seq=0 ttl=64 time=2.257 ms
64 bytes from 192.168.1.1: icmp_seq=1 ttl=64 time=1.262 ms
^C
--- 192.168.1.1 ping statistics ---
2 packets transmitted, 2 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 1.262/1.760/2.257/0.498 ms
FBG-Mac-Pro:~ pbg$
```



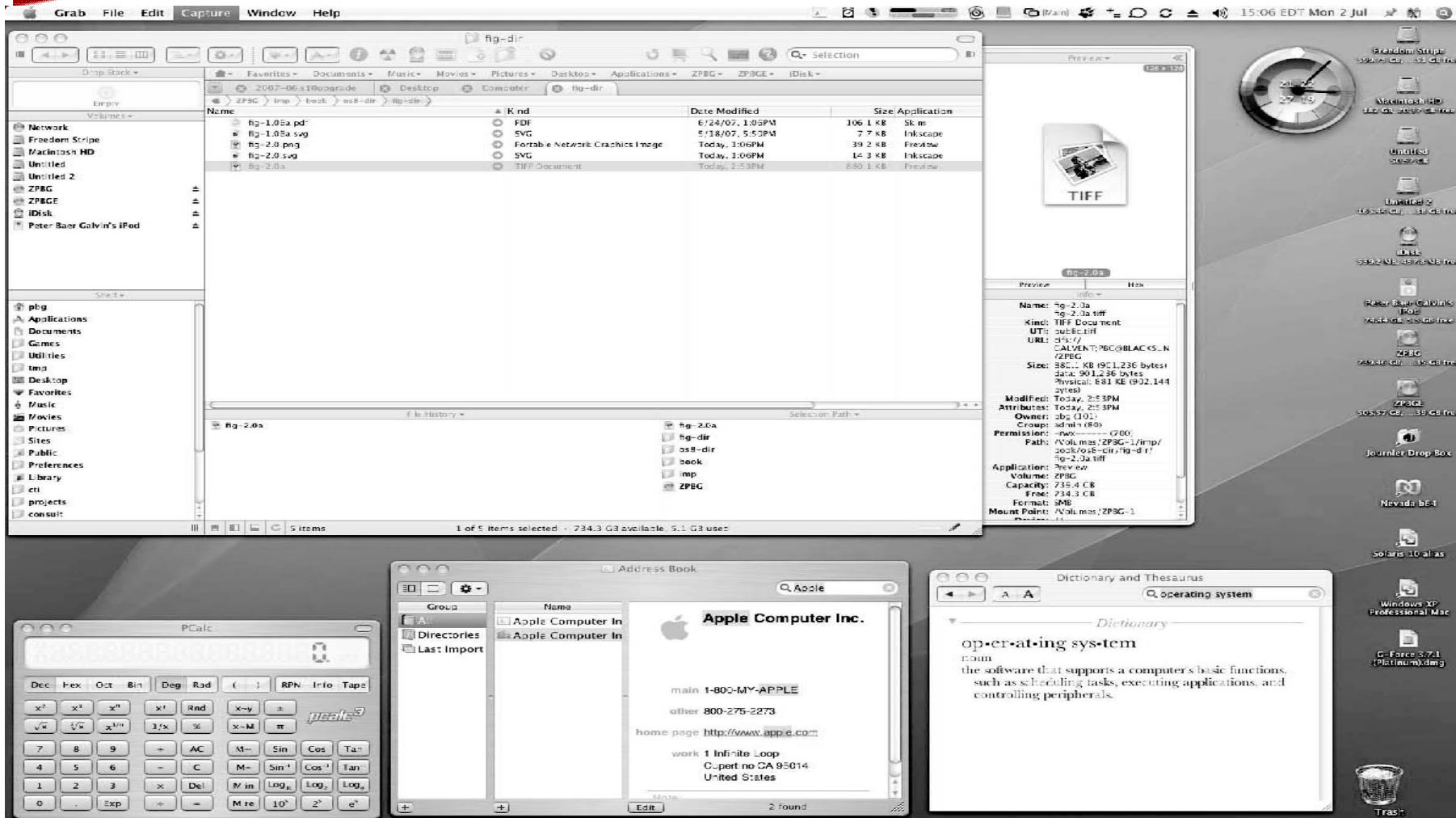
- User-friendly **desktop** metaphor interface , Invented at Xerox PARC
 - Usually mouse, keyboard, and monitor
 - **Icons** represent files, programs, actions, etc
 - Various mouse buttons over objects in the interface cause various actions
- Many systems now include **both CLI and GUI interfaces**
 - **Microsoft Windows** is GUI with CLI “command” shell
 - **Apple Mac OS X** is “Aqua” GUI interface with UNIX kernel underneath and shells available
 - Unix and Linux have CLI with optional GUI interfaces (CDE, KDE, GNOME)

- Touchscreen devices require new interfaces
 - Mouse not possible or not desired
 - Actions and selection based on gestures
 - **Virtual keyboard** for text entry
- **Voice commands.**





The Mac OS X GUI





TEXT BOOK

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3. Andrew S Tanenbaum, Herbert Bos, Modern Operating Pearson , 2015.

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3. P.C.Bhatt, "An Introduction to Operating Systems–Concepts and Practice", 4th Edition, Prentice Hall of India., 2013.

THANK YOU