Mac OS X
History & Technology

University of Utah
Student Computing Labs
Macintosh Support
mac@scl.utah.edu
Mac OS X Hist & Tech Overview

- History
- What is Mac OS X?
- System Architecture
History – Apple Computer

- 1976
  - Steve Wozniak & Steve Jobs
- 1977
  - Apple II
- 1981
  - IBM takes over “personal computer” market
- 1984
  - Macintosh
    - Steve Jobs
    - System 1.0
History – Next Computer

• 1985
  • Steve Jobs left Apple, started NeXT Computer
  • “Do everything right”
    • Unix
      • Stable
      • Powerful
    • Objective-C
      • Easy to program
    • Easy to use
      • Emphasized GUI
  • High-end market only
History – Apple Computer

- 1990 – 1996
  - Apple in serious trouble
  - Tried to survive
    - Ported Mac OS to Intel
      - Never released
    - Allowed hardware clones
      - Competed against Apple instead of Intel market
    - Copland project
      - Expensive OS failure
    - Discussed Licensing SunOS and purchasing BeOS
History – Copland

- The first Mac OS
  - System 1.0 released in 1984
  - 19 years ago

- Copland
  - The successor to the original Mac OS
  - Focused on Four Areas of Enhancement
    - Performance, Stability, Portability and Ease of Use
  - Supposed to be release mid–1996
  - Canceled in late–1996
    - Due to costs and development issues
History – BeOS

- BeOS
  - Rumored to be a option for Apple’s new OS
  - The BeOS was incredibly fast, stable and scalable, and sports advanced features such as pervasive multithreading and symmetric multiprocessing.
  - But, there were very few applications available for the OS.
History – Apple Computer

- 1996
  - Purchases NeXT Computer, hires Steve Jobs
- 1998
  - iMac – future looks good for 1st time in years
- 1999
  - Mac OS X delayed
    - Added Java support
    - Hardware problems
    - Carbon
    - Removed PostScript printing and replaced it with PDF
History – Rhapsody

- Rhapsody
  - Apple purchases NeXT Software in 1996
    - NeXT operating system called OpenStep
    - WebObjects and other software
    - Steve Jobs & NeXT software/hardware engineers
  - Combination of OpenStep with Mac UI
  - Developed into Mac OS X
    - Basically the same OS
    - Support for legacy Mac OS
    - Simplify porting software
History – Mac OS X

- 1999
  - Mac OS X Server “Rhapsody” released
    - Missing a lot of functionality
    - Server OS only
History – Mac OS X Public Beta

- Mac OS X Public Beta
  - Released Sept 9th, 2000
  - Unfinished, incomplete preview
  - Allowed the public to test the Mac OS X waters
  - Cost $29.95
History – Mac OS X Public Beta

- More screen shots...
History – Mac OS X 10.0

• Released March 24th, 2001
• Complete overhaul of Mac OS
• Introduces
  - Preemptive Multitasking
  - Protected Memory
  - Advanced Memory Management
  - Symmetrical Multiprocessing (OS-wide)
  - Many other features
History – Mac OS X 10.0 Hype

March 24th – Midnight Madness
History – Mac OS X 10.1

• Mac OS X 10.1
  - Release September 29th, 2001
  - First, major revision of Mac OS X
    • Faster and more responsive
    • Launch programs 2 to 3 times faster than previous versions
    • Increased CD-burning capabilities
    • Better tools for DVD-Video disc creation
    • Several Aqua enhancements
      - System Preferences are now arranged by use
      - Dock on the left or right side of the screen
History – Mac OS X 10.2

- New in Mac OS X 10.2
  - Rendezvous
    - Zero configuration networking
    - Is open source
    - Companies love it
      - Philips, Canon, Xerox, Sybase and World Book
      - Hewlett-Packard, Epson and Lexmark
  - Quartz Extreme
  - CUPS
    - Common Unix Printing System
What is Mac OS X?

- **What is Unix?**
  - 1969 – today (33 years old!)
  - Designed with multiple users in mind
    - **Multitasking**
      - More than one user can use the computer at the same time and not be aware others are using it
    - **Multiuser**
      - Permissions restrict what users can do
    - **Stable**
      - One user can’t crash it
  - “Supercomputer”
    - Not “Desktop” or “Personal”
    - Responsible for the www
    - By programmers for programmers
What is Unix?

- Some other Unix OS names:
  - BSD
  - SunOS
  - Solaris
  - IRIX
  - UnixWare
  - Linux
  - Mach

- u.cc.utah.edu uses SunOS 5.6:

  Last login: Thu Sep 26 2002 06:55:10 from x.x.x.x
  Sun Microsystems Inc.  SunOS 5.6  Generic August 1997
What is Unix?

- Console
  - Command-line applications
- Xwindows, X11
  - GUI applications
History of Unix 1969–1977
History of Unix 1978–1983
History of Unix 1984–1989

NeXTSTEP born

BSD

Mach
History of Unix 1990–1994

Rhapsody born
History of Unix 1999–2000

Darwin born

Mac OS X born

Mac OS X Server born
History of Unix 2001–2002

Darwin 1.4.1  
Mac OS X 10.2.1

Mac OS X  
Server 10.2.1
What is Mac OS X?

- Complete overhaul of Mac OS
- Some things Mac OS 9 didn’t have
  - Preemptive Multitasking
  - Protected Memory
  - Advanced Memory Management
  - Symmetrical Multiprocessing (OS-wide)
  - Built in advanced graphics
  - Easy to program
  - Command line
System Architecture

- The Mac OS X layers

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Darwin

- **OS Core Foundation**
  - Industrial-strength
  - UNIX-based
- **Open Source**
  - Allows developers to create & customize
  - Collaborate with Apple Engineers
  - Faster and more reliable OS
- **Notable components**
  - Mach 3.0
  - BSD 4.4
Last login: Thu Sep 26 17:00:38 on ttys01
Welcome to Darwin!
[msmac-9:~] james%
Darwin – Mach

• Mach 3.0
  - UNIX technology
  - Developed at Carnegie–Mellon University
  - Robust “Open Source” OS
  - Provides most critical functions of OS
    • Memory Management
    • Protected Memory
    • Preemptive Multitasking
    • Advanced Virtual Memory
    • Real–Time Support
Memory Management

- Mac OS X handles program memory
Protected Memory

- Protects OS and Applications
Demonstration – Mach

- Protected Memory
Preemptive Multitasking

- No more application freezing the system
- No more mouse clicks freezing the system
- Use multiple applications at the same time
Demonstration – Mach

• Preemptive Multitasking
Real-Time Support

- Audio or video improved
  - Guarantees low latency access to processor for time-sensitive application
    - iMovie
    - iTunes
    - Quicktime Player
• BSD 4.4
  - Berkeley Software Distribution
  - Developed at University of California at Berkeley
  - Darwin incorporates elements of BSD
  - Support for “shell” environment
  - Also provides...
    • File systems
    • Networking
    • Miscellaneous Programming Interfaces
Demonstration – BSD

- Terminal
Graphics & Imaging

- The second layer we will discuss is...

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Graphics & Imaging

• Combination of three graphics technologies
  - Quartz
  - OpenGL
  - QuickTime

• Gives you support for things like...
  - Full screen movies
  - Monitors with huge & millions of colors
  - 3D Games
  - Elements of User Interface
Graphics & Imaging – Quartz

• Quartz
  - Two-Dimensional graphics/images
  - Portable Document Format (PDF) Support
    • On-the-fly rendering
    • Anti-aliasing
  - Windowing System
    • Aqua uses the Quartz Engine
      - Translucent controls & Menus
      - Drop Shadows
    • Quartz Extreme
      • 16MB of VRAM and AGP2x bus
      • Can process massive amounts of graphic data real time
Quartz Extreme

Without Quartz Extreme

App
Quartz2D
Quickdraw
Buffer
App
Open GL
Buffer
App
QuickTime
Buffer
Quartz Compositor
Frame Buffer
Display

Software
Hardware Accelerated
Quartz Extreme

With Quartz Extreme

App
Quartz2D Quickdraw
App
Open GL
App
QuickTime

Window Backing Store
Surface
Surface
Quartz Extreme
GPU Frame Buffer
Display

Software Hardware Accelerated
Graphics & Imaging – OpenGL

• OpenGL
  - Delivers high-end 2D & 3D graphics
  - Open Source Industry Standard
  - Replaces QuickDraw 3D (from older Mac OS)
  - Specifically designed for...
    • Games, Animation, CAD/CAM, Medical Imaging, etc.
  - Set of imaging functions
    • Texture Mapping,
    • Alpha Blending
    • Anti-aliasing
Demonstration – OpenGL

- Quake III – Team Arena
Demonstration – OpenGL

- Maya from Alias | Wavefront
Graphics & Imaging – QuickTime

• QuickTime
  – Comes with QuickTime 6.1
  – Multimedia Technology
    • Video
    • Sound
    • Animation
    • Graphics & Text
    • 360–Degree Virtual Reality
    • Support most major file formats
      – PICT, BMP, GIF, JPEG, TIFF, and PNG
    • Support most major video formats
      – AVI, AVR, DV, M–JPEG, MPEG–1
    • For web it supports..
      – HTTP and RTP and RTSP (Live Broadcasts)
Demonstration – QuickTime

- Finder Inline Previews

![Finder Inline Previews](image.png)
Application Support

- The third layer we will discuss is...

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Application Support

- Mac OS X multiple application environments
  - 6 environments
    - Classic
    - Carbon
    - Cocoa
    - Java
    - BSD
    - X11
  - Support for older Mac OS apps (i.e. Classic)
  - Support/ease porting older apps (i.e. Carbon)
  - Provide modern environment for new apps (i.e. Cocoa)
Application Support – Classic

- Full version of Mac OS 9.2
  - Runs in a protected memory space
- Supports Mac OS 9.2 Compatible Applications
  - PowerPC-native applications
  - Older 68K applications
- Supports launching Mac OS 9.2 as process
  - If “Classic” application crashes or hangs, it will only effect “Classic” environment.
Demonstration – Classic

- MacDraw 1.9.5 (16 years old)

MacDraw - Version 1.9.5
by Mark Cutter, Ben Halpern and Joel Spiegel
© Apple Computer, Inc. 1985, 1987
All rights reserved.

Active Document
Number of objects: 3
Percent of Memory Used: 0
Application Support – Carbon

- Backwards compatible programming
  - API’s from Mac OS 9 “ported” to Mac OS X
    - Programmer just has to recompile the program using Carbon
  - Native Mac OS 8.6 – 9.2 with CarbonLib system extension
  - Native Mac OS X
    - Support modern features of Mac OS X
      - Protected Memory
      - Preemptive Multitasking
      - Interface features of Aqua
  - Helps developers port older “classic” application with relatively small modification in code
Application Support – Carbon

- A pragmatic approach...
Carbon Examples – Office X

For Immediate Release

Renowned soccer pro Tristan Randall helped kick-off the opening of ChampionZone’s first store on the West Coast by demonstrating several of the store’s innovative interactive shopping features to fans and media. The flagship store for the premier soccer equipment, apparel and accessories retailer is located in the heart of Portland, Oregon’s revitalized Pearl District.

ChampionZone owns and operates 36 retail locations in 12 states, primarily on the East Coast, as well as a Web store at www.championzone.net. The Portland location is the first of a series of ChampionZone stores across Western states. The store boasts a complete selection of ChampionZone brand apparel, gear and accessories. The Portland store is the most spacious ChampionZone location to date, as well as the most innovative soccer gear shopping experience available in the world.

The Equipment Zone allows ‘feel-on’ testing of balls, shoes and football accessories from leading manufacturers on a virtual soccer field, complete with a realistic field surface area and soccer kicking cages that test customers’ skills while providing the perfect environment for testing equipment and footwear. The overall theme and appearance of the store is an entirely new way to shop for soccer equipment, "said Randall," typically buy several show styles, test them on the field and then return the unwanted pairs. I tested several pairs on the virtual field’s realistic turf, kicked a few goals against the computerized goalie and...
Carbon Examples – Photoshop
Application Support – Cocoa

- Object-oriented framework
- Provides development tools and services that allow applications to interact with each other to take advantage of variety of advanced libraries.
- Cocoa applications look the same as Carbon applications to the end users.
- Basically, Cocoa is an environment that allows developers easily build applications that are fast, efficient and advanced.
Cocoa Examples – Terminal

```
> 
```

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Application Support – Java

- A highly-optimized, tightly integrated implementation of Java
- Java environment supports 100%
- Java 2 applications and applets.
- All Java applications use Aqua (new user interface)
- Native preemptive multitasking threads
  Includes Applet Launcher to let you run
  - Java Applets
  - Local or on internet
  - Do not need a browser
Java Examples – Moneydance
Application Support – X11

- X11 is an implementation of X Window System
  - Makes it possible to run X11-based applications in Mac OS X
  - Based on open source XFree86
  - Currently available as beta preview
  - Rumored to be fully released with Mac OS X 10.3
Application Support – X11
Aqua

- The last layer is...

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Aqua – User Interface

- Apple’s goal was to create a User Interface
  - Easier to use
  - More appealing to users

- Aqua
  - Properties of water
    - Translucence
    - Drop shadows
    - Animations
    - Etc.
Aqua

• The Mac OS X new look and feel
  - Makes extensive use of animation and rendering.
  - Semi-transparent elements
  - Drop shadows 128 by 128 pixel icons (Photographic)
  - And much more...
Aqua – Windows

- Windows
  - Controls
    - Close (X)
      Click to close window
    - Minimize(–)
      Which put it in the Dock
    - Zoom (+)
      Click to enlarge or reduce
    - Resemble traffic lights
      - Red to close the window (stop),
      - Yellow to minimize the window (slow)
      - Green to zoom the window (go)
Dialogs

- Dialogs
  - Sheets
    A new type of dialog that is “attached” to a particular window.

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Demonstration – Aqua

- Transparency, effects, etc.
Mac OS X Short Courses

- **Mac OS X Basics**  
  Friday, March 7th at 10:45 AM  
  Marriott Library Multimedia Center – Room 1745

- **Mac OS X Intermediate**  
  Monday, March 24th at 10:45 AM  
  Marriott Library Multimedia Center – Room 1745

- **Mac OS X Advanced**  
  Thursday – April 3rd at 10:45 AM  
  Marriott Library Multimedia Center – Room 1745
Questions & Answers
Contact Information

- Web Site
  - www.macos.utah.edu

- Email
  - mac@scl.utah.edu

- Address
  - Marriott Library Multimedia Center
  - Room 1705