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X

Mac OS X



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# Mac OS X

## History & Technology

University of Utah  
Student Computing Labs  
Macintosh Support  
[mac@scl.utah.edu](mailto:mac@scl.utah.edu)

# Mac OS X Hist & Tech Overview

- **History**
- **What is Mac OS X?**
- **System Architecture**



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# History – Apple Computer

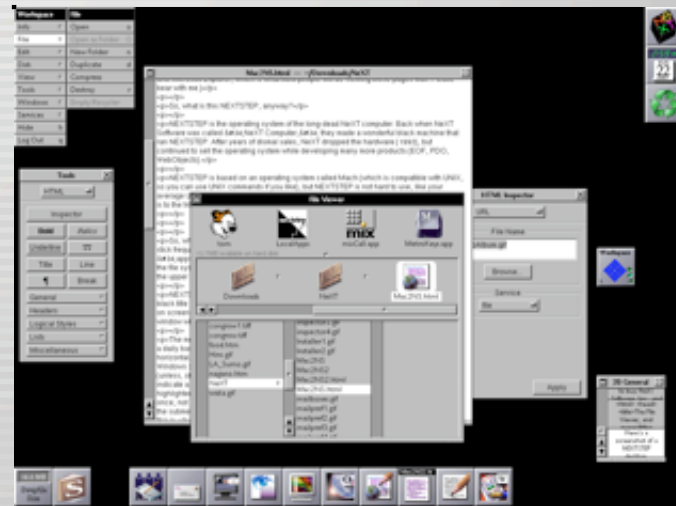
- 1976
  - Steve Wozniak & Steve Jobs
- 1977
  - Apple II
- 1981
  - IBM takes over “personal computer” market
- 1984
- Macintosh
  - Steve Jobs
  - System 1.0



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# 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



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# 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**



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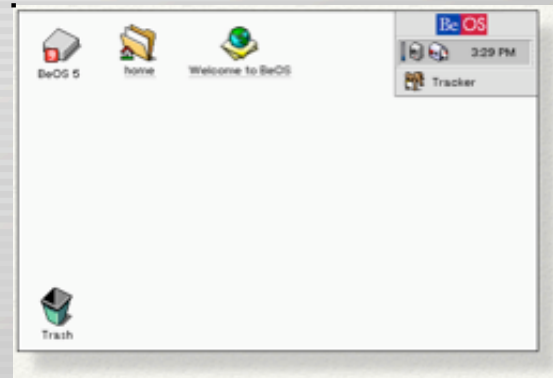
# History – Copland

- **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.



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# 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



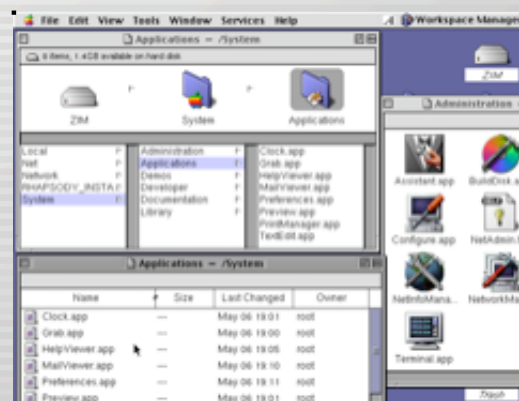
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# History – Mac OS X

- 1999

- Mac OS X Server “Rhapsody” released

- Missing a lot of functionality
- Server OS only



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# 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



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# History – Mac OS X 10.0 Hype



March 24th – Midnight Madness



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# 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**



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# 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



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# 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

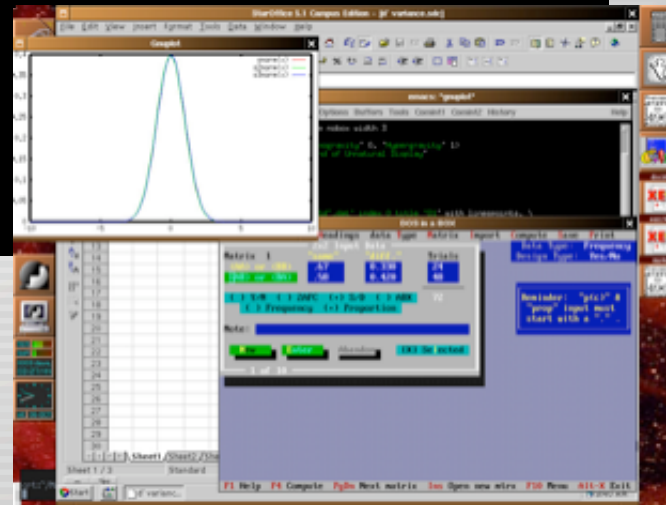


# What is Unix?

- Console
  - Command-line applications
- Xwindows, X11
  - GUI applications

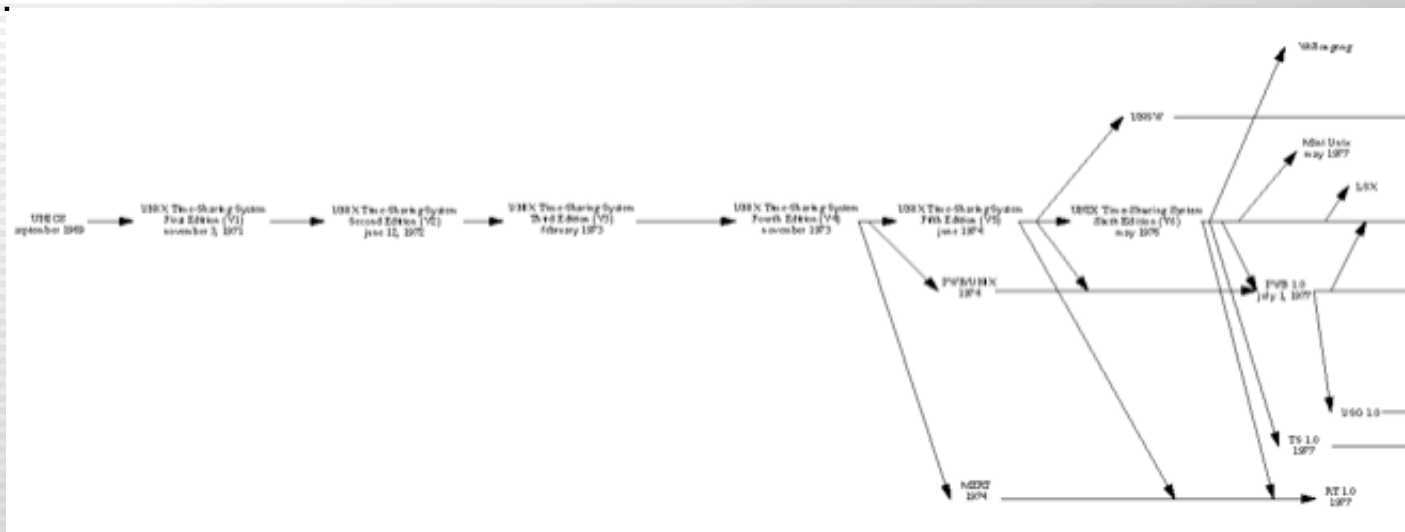
```
Last login: Thu Sep 26 2002 21:24:09 from msaac-9.slac.uta
Sun Microsystems Inc. SunOS 5.6 Generic August 1997

Current disk usage: 1188K (132K mail)
You have new local mail.
HIT RETURN
TERM = (vt100)
u.cc.utah.edu <d>
```



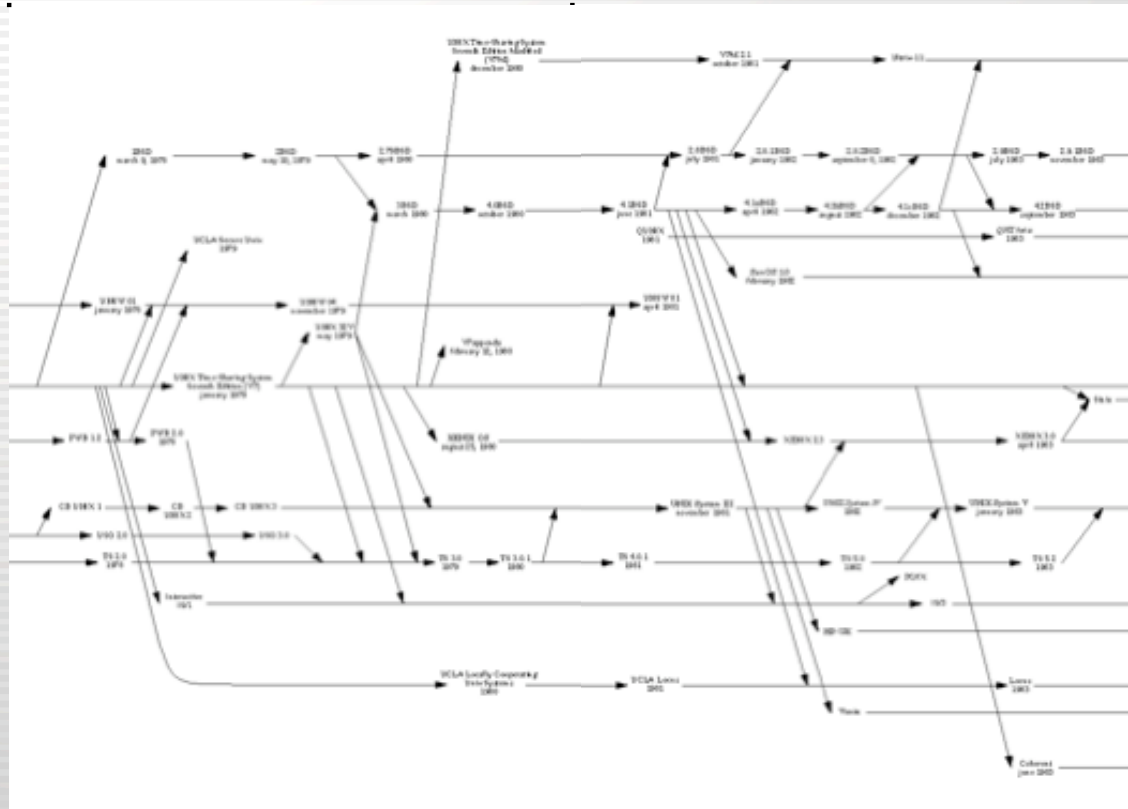
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# History of Unix 1969-1977



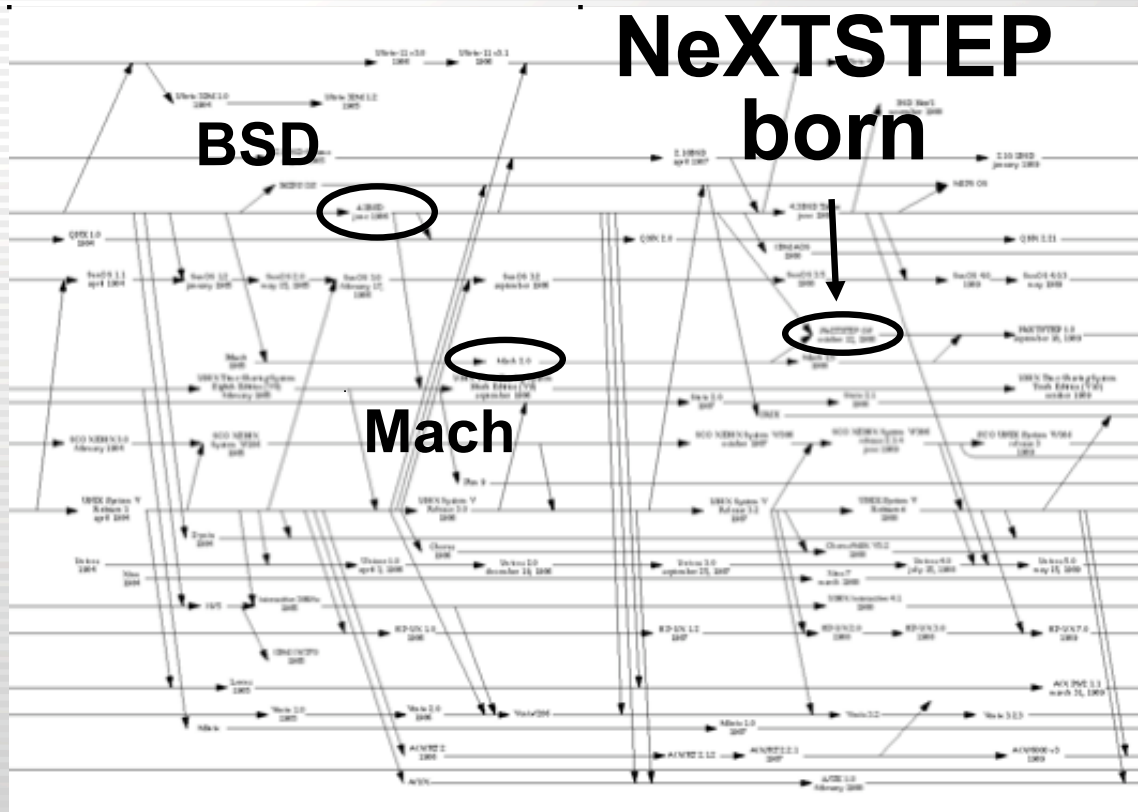
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# History of Unix 1978-1983



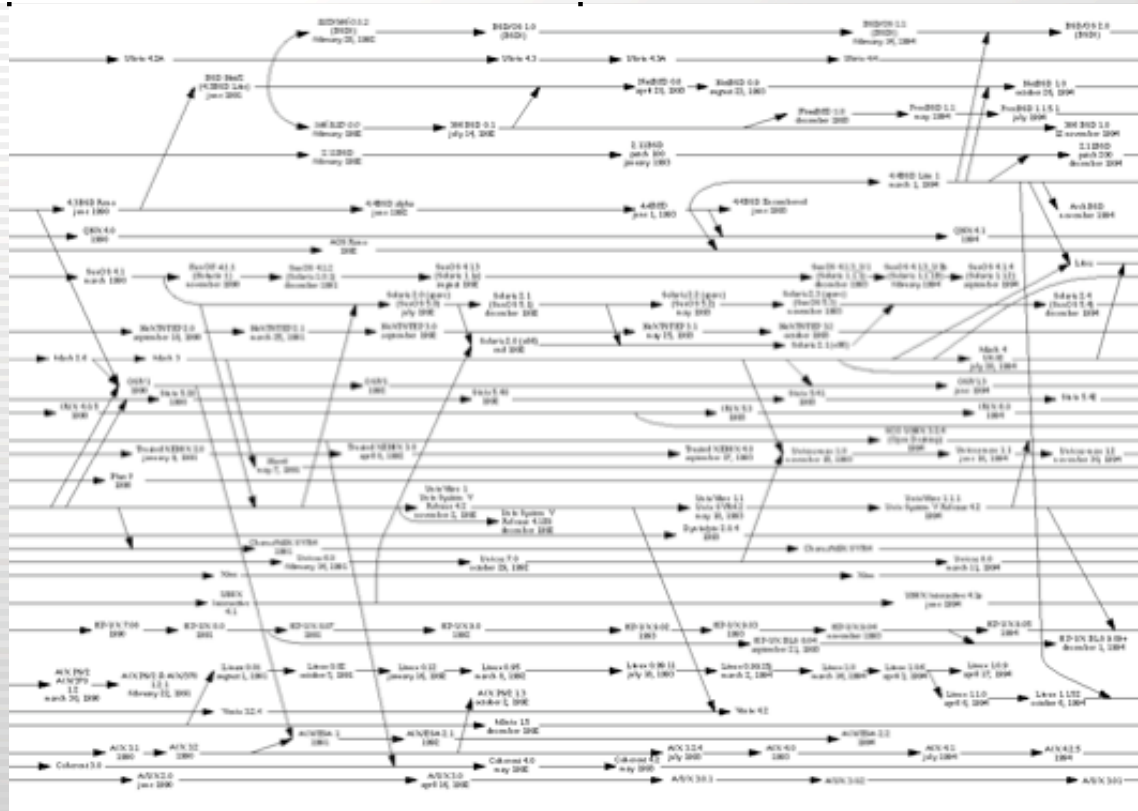
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# History of Unix 1984-1989



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# History of Unix 1990-1994

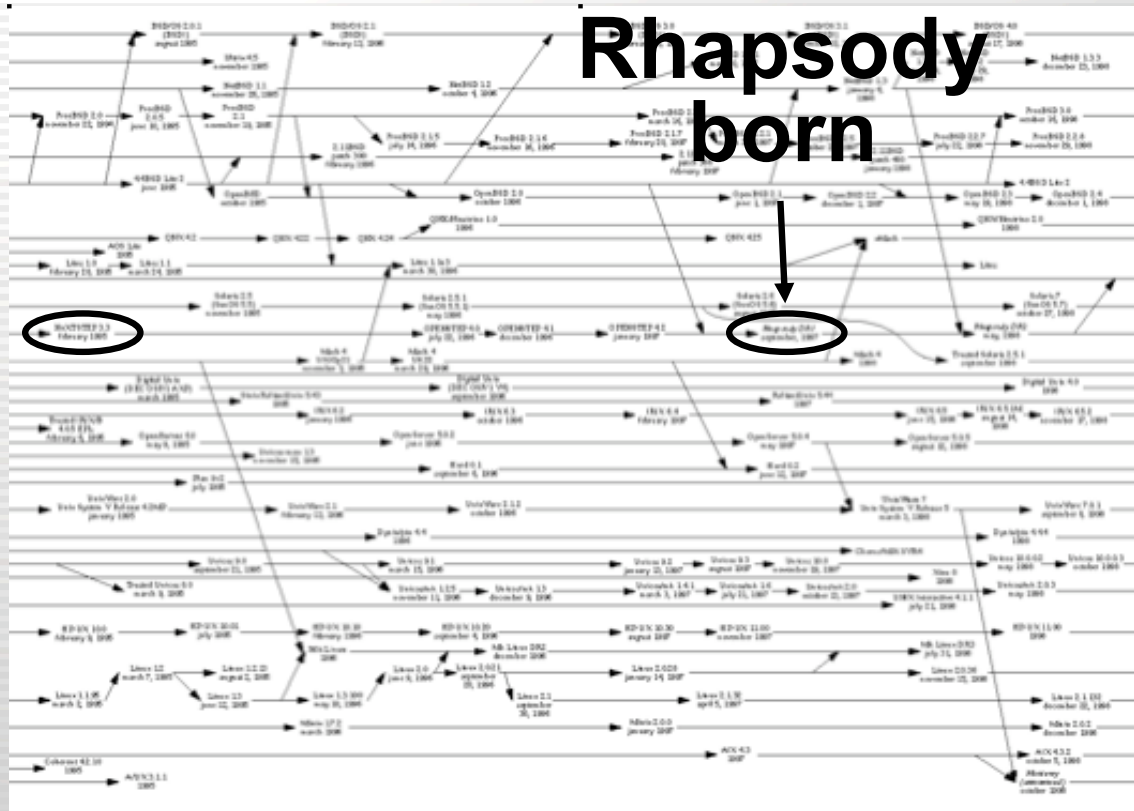


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# History of Unix 1995-1998

## Rhapsody born



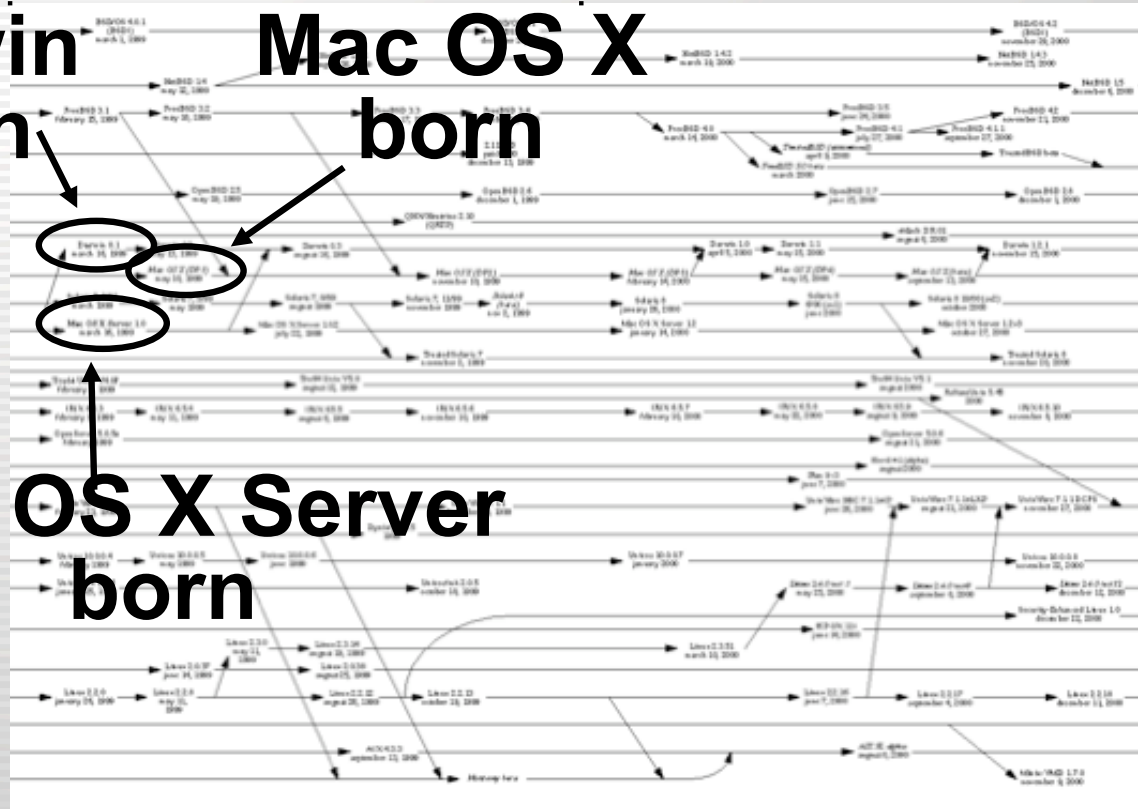
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# History of Unix 1999-2000

Darwin  
born

Mac OS X  
born

Mac OS X Server  
born



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# What is Mac OS X?

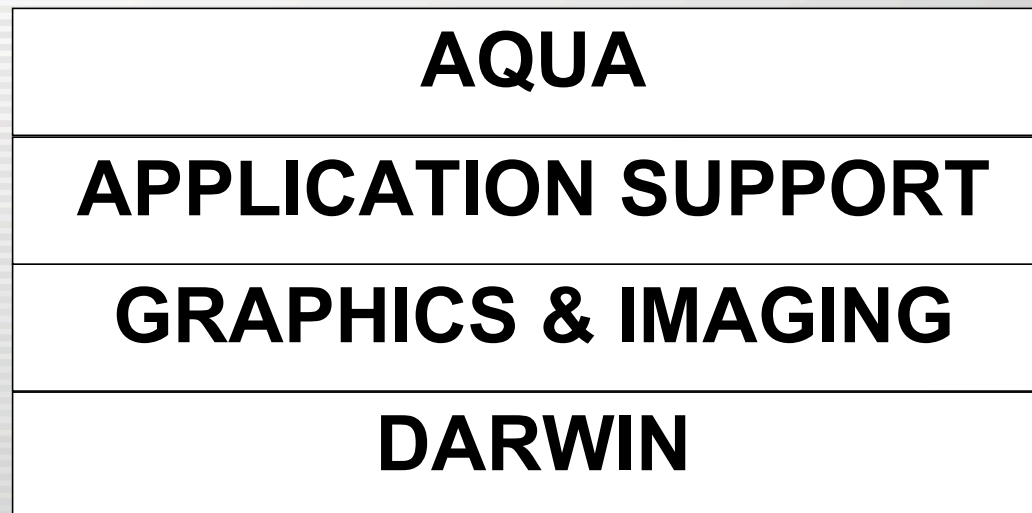
- Complete overhaul of Mac OS
- Some things Mac OS 9 didn't have
  - Preemptive Multitasking
  - Protected Memory
  - Advanced Memory Management
  - Symmetrical Multiprocessing (OS-wide)
  - Built in advanced graphics
  - Easy to program
  - Command line



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# System Architecture

- The Mac OS X layers



# 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 ttty1
Welcome to Darwin!
[msmac-9:~] james% █
```



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# Darwin – Mach

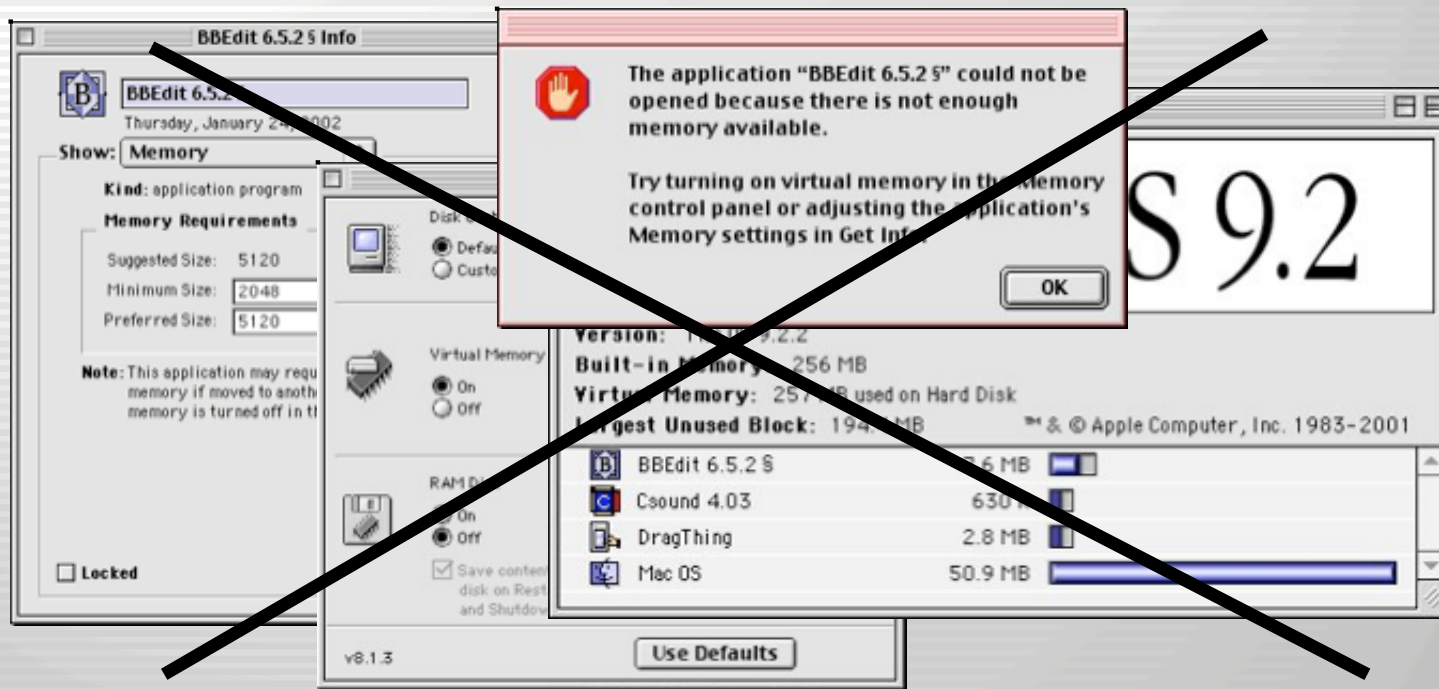
- **Mach 3.0**
  - **UNIX technology**
  - **Developed at Carnegie–Mellon University**
  - **Robust “Open Source” OS**
  - **Provides most critical functions of OS**
    - **Memory Management**
    - **Protected Memory**
    - **Preemptive Multitasking**
    - **Advanced Virtual Memory**
    - **Real–Time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





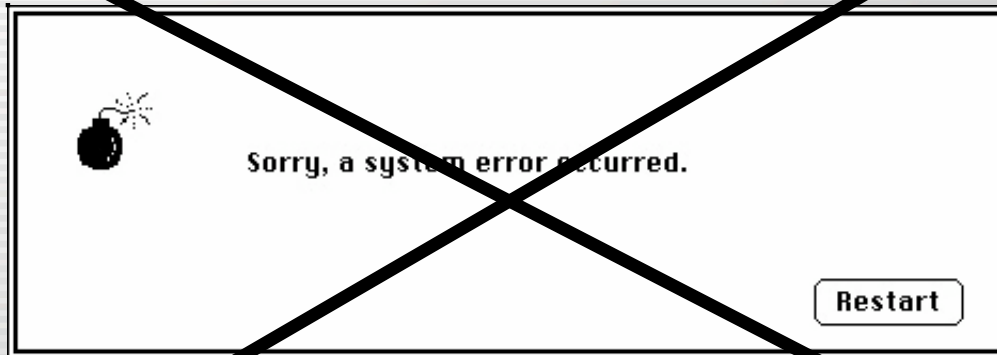
# Memory Management

- Mac OS X handles program memory



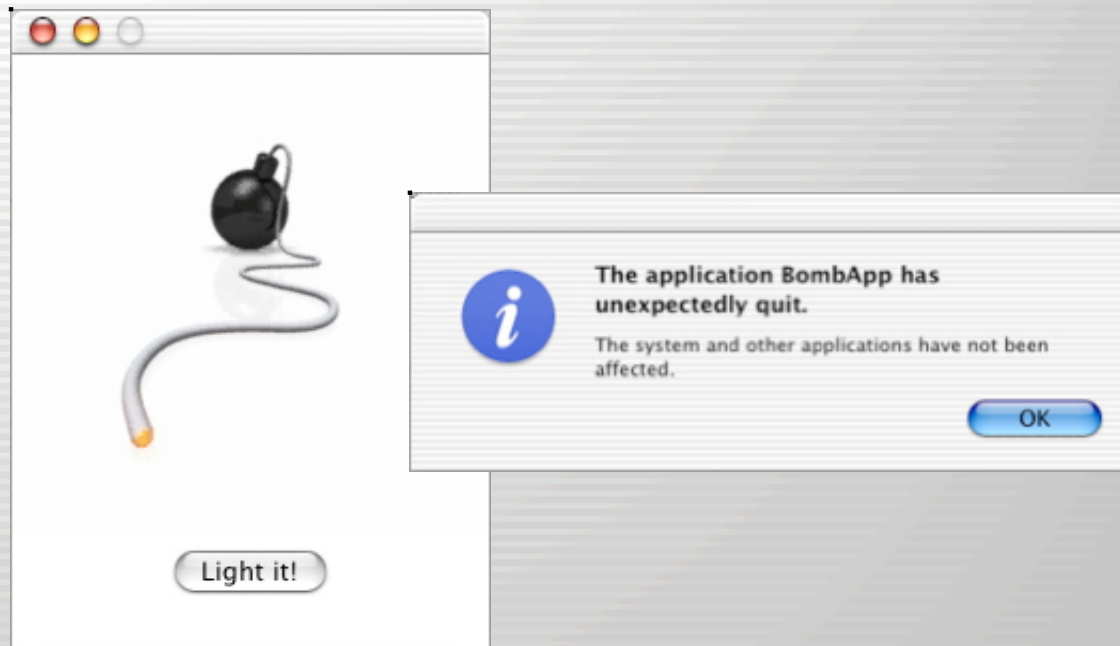
# Protected Memory

- Protects OS and Applications



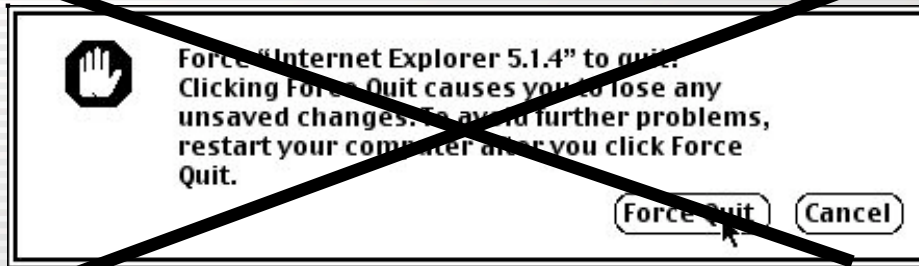
# Demonstration - Mach

- Protected Memory



# Preemptive Multitasking

- No more application freezing the system

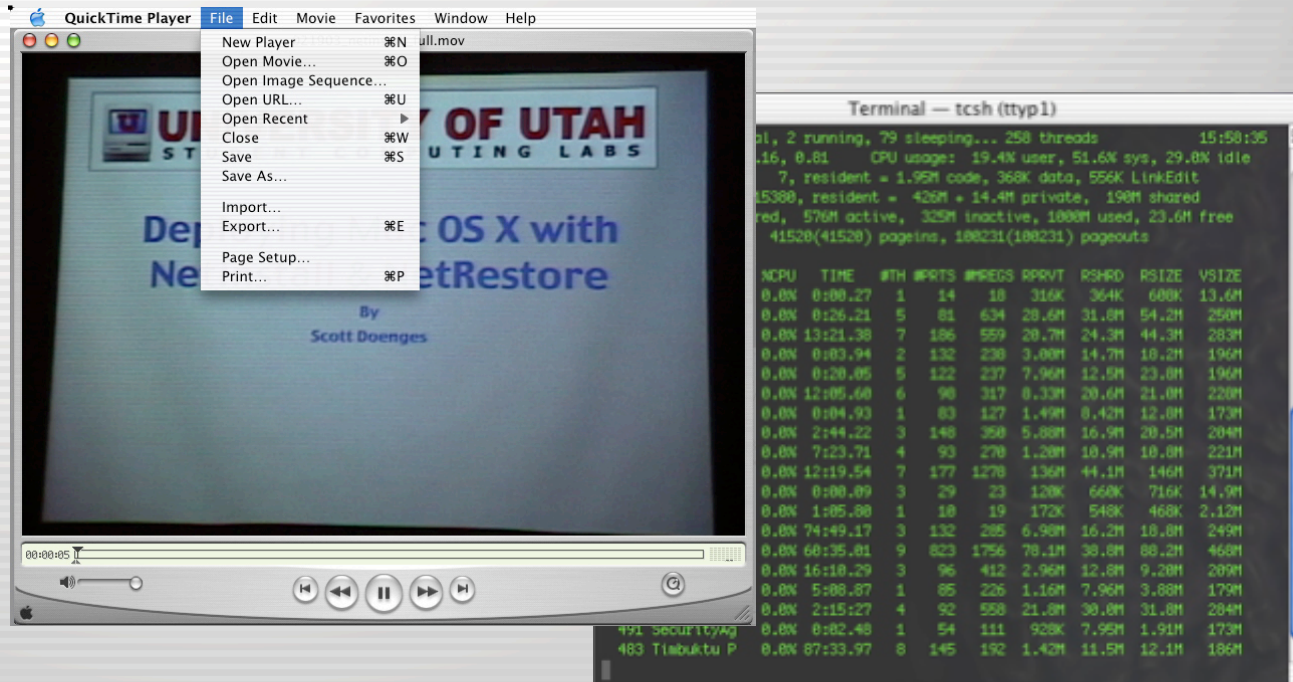


- No more mouse clicks freezing the system
- Use multiple applications at the same time



# 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



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- **BSD 4.4**

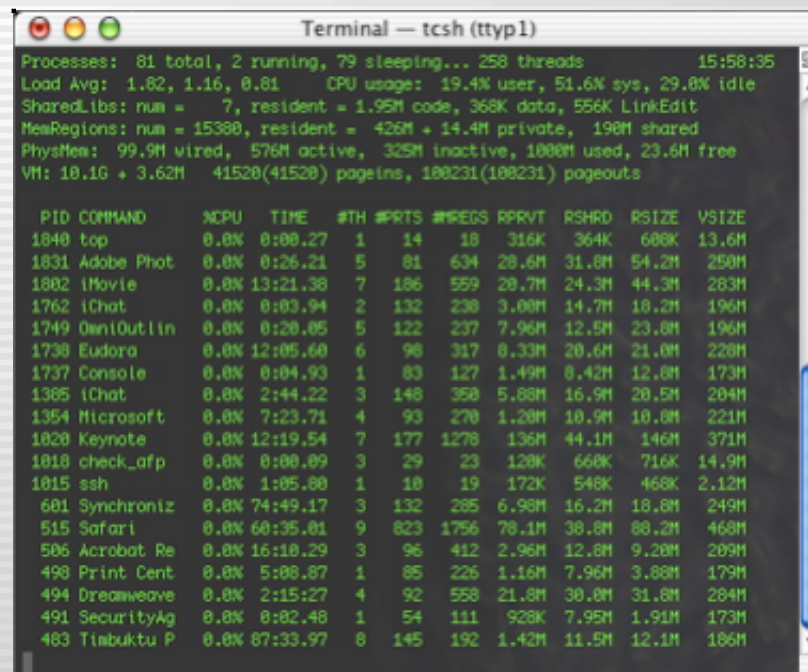
- **Berkeley Software Distribution**
- **Developed at University of California at Berkeley**
- **Darwin incorporates elements of BSD**
- **Support for “shell” environment**
- **Also provides...**
  - **File systems**
  - **Networking**
  - **Miscellaneous Programming Interfaces**



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# Demonstration - BSD

- Terminal



```
Terminal - tcsh (tty1)
Processes: 81 total, 2 running, 79 sleeping... 258 threads      15:58:35
Load Avg: 1.82, 1.16, 0.81      CPU usage: 19.4% user, 51.6% sys, 29.0% idle
Shared.lbs: num = 7, resident = 1.95M code, 368K data, 556K LinkEdit
MemRegions: num = 15380, resident = 426M + 14.4M private, 198M shared
PhysMem: 99.9M wired, 576M active, 325M inactive, 1000M used, 23.6M free
VM: 10.1G + 3.62M 41528(41528) pageins, 100231(100231) pageouts

  PID COMMAND      NCPU  TIME   #TH  #PRTS  #PAGES  PPRVT  RSHRD  RSIZE  VSIZE
1840 top              0.0%  0:00.27  1    14     18    316K   364K   608K  13.6M
1831 Adobe Phot      0.0%  0:26.21  5    81    634   28.6M   31.8M  54.2M  250M
1882 iMovie          0.0%  13:21.38  7   186   559   28.7M   24.3M  44.3M  283M
1762 iChat           0.0%  0:03.94  2   132   238    3.00M   14.7M  10.2M  196M
1749 OmniOutlin      0.0%  0:28.05  5   122   237    7.96M   12.5M  23.8M  196M
1738 Eudora           0.0%  12:05.60  6    98   317    8.33M   20.6M  21.0M  228M
1737 Console         0.0%  0:04.93  1    83   127    1.49M   8.42M  12.8M  173M
1385 iChat           0.0%  2:44.22  3   148   358    5.88M   16.9M  20.5M  204M
1354 Microsoft       0.0%  7:23.71  4    93   278    1.20M   10.9M  10.8M  221M
1820 Keynote         0.0%  12:19.54  7   177  1278   136M   44.1M  146M  371M
1818 check_afp       0.0%  0:00.89  3    29    23   128K   668K   716K  14.9M
1815 ssh             0.0%  1:05.80  1    18    19   172K   548K   468K  2.12M
681 Synchroniz      0.0%  74:49.17  3   132   285    6.98M   16.2M  18.8M  249M
515 Safari           0.0%  68:35.81  9   823  1756   78.1M   38.8M  88.2M  468M
586 Acrobat Re      0.0%  16:18.29  3    96   412    2.96M   12.8M  9.20M  209M
498 Print Cent      0.0%  5:08.87  1    85   226    1.16M   7.96M  3.88M  179M
494 Dreamweave      0.0%  2:15:27  4    92   558   21.8M   38.8M  31.8M  284M
491 SecurityAg      0.0%  0:82.48  1    54   111   928K   7.95M  1.91M  173M
483 Tinbuktu P      0.0%  87:33.97  8   145   192    1.42M   11.5M  12.1M  186M
```



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# Graphics & Imaging

- The second layer we will discuss is...

**AQUA**

**APPLICATION SUPPORT**

**GRAPHICS & IMAGING**

**DARWIN**



# 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



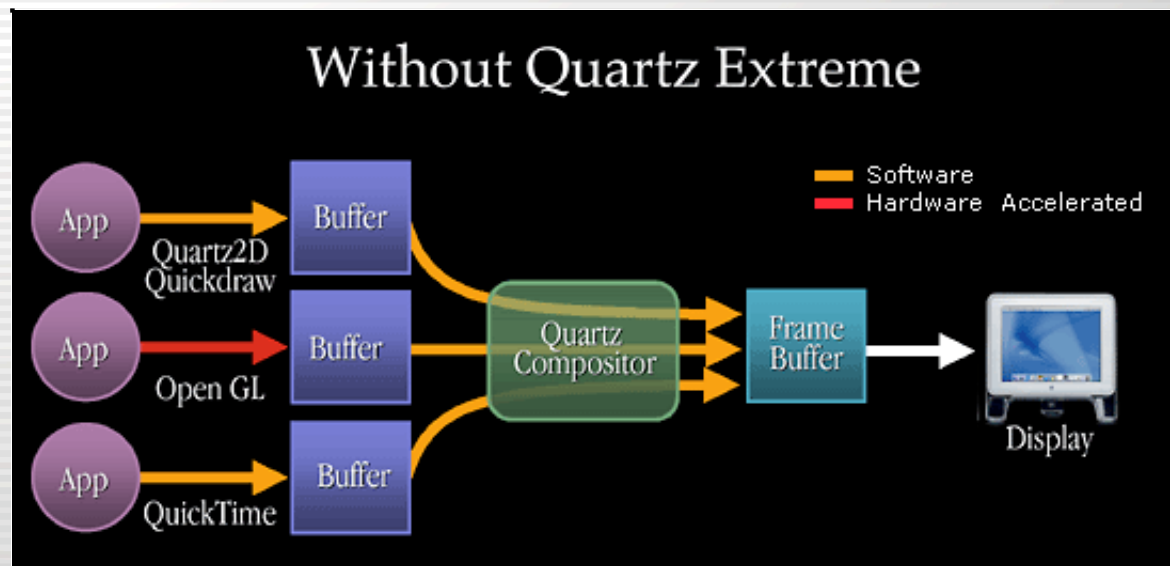
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# Graphics & Imaging - Quartz

- 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

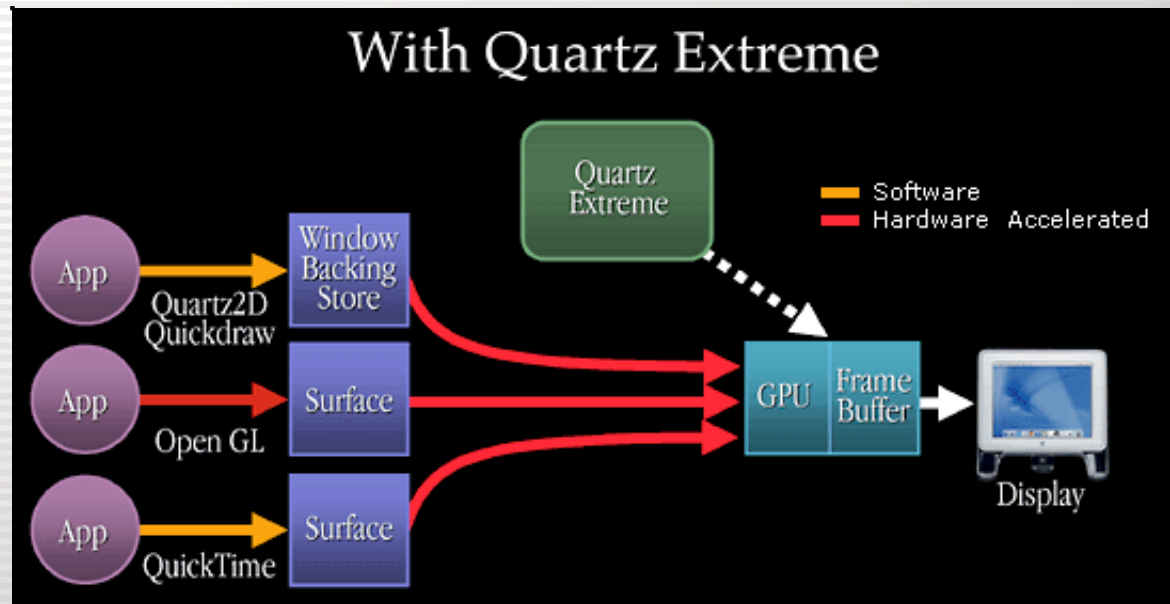


# Quartz Extreme



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# Quartz Extreme



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# Graphics & Imaging - OpenGL

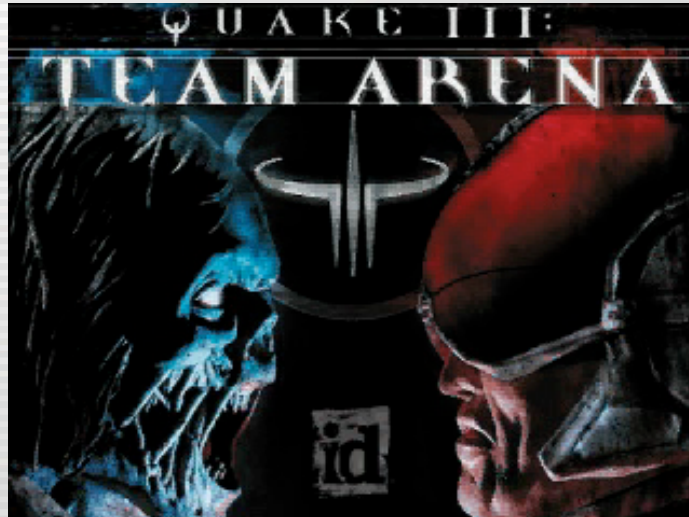
- **OpenGL**
  - **Delivers high-end 2D & 3D graphics**
  - **Open Source Industry Standard**
  - **Replaces QuickDraw 3D (from older Mac OS)**
  - **Specifically designed for...**
    - **Games, Animation, CAD/CAM, Medial Imaging, etc.**
  - **Set of imaging functions**
    - **Texture Mapping,**
 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



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# Demonstration - OpenGL

- Quake III - Team Arena



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# Demonstration - OpenGL

- Maya from Alias | Wavefront



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# 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, JPEF, 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)



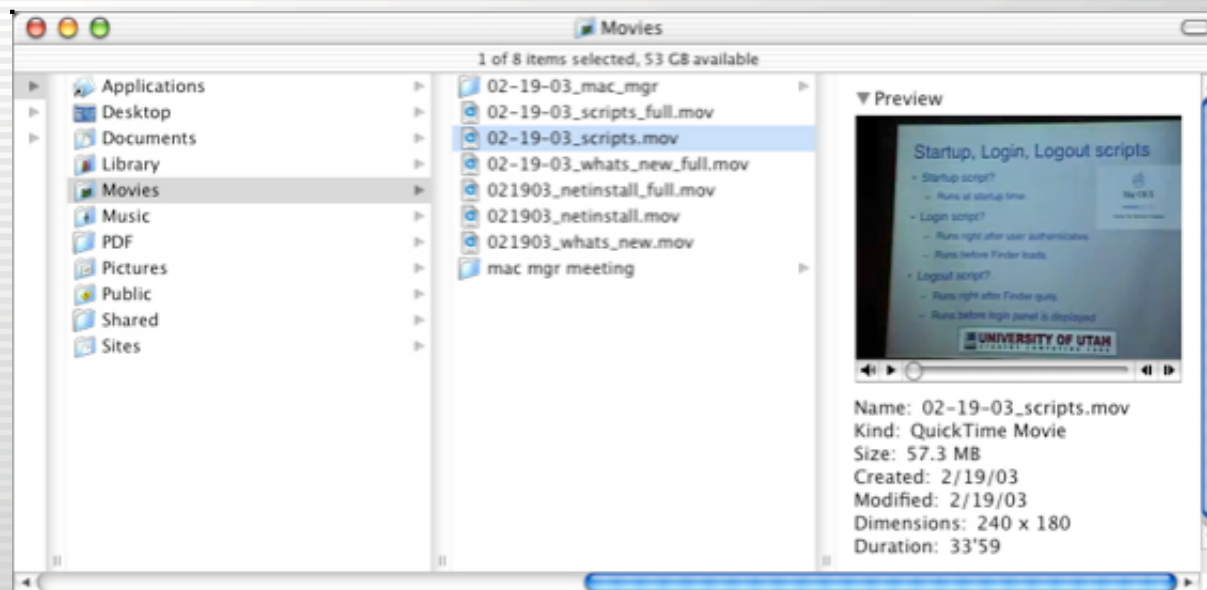
QuickTime



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# Demonstration - QuickTime

- Finder Inline Previews



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# Application Support

- The third layer we will discuss is...

**AQUA**

**APPLICATION SUPPORT**

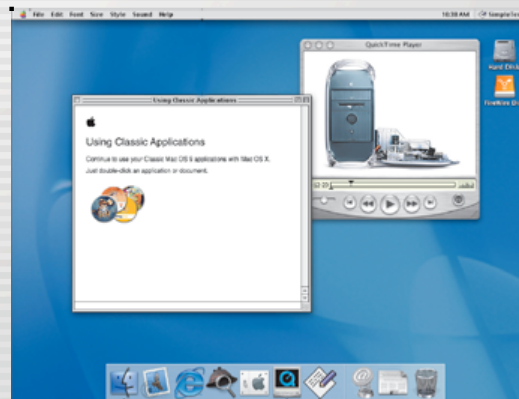
**GRAPHICS & IMAGING**

**DARWIN**



# Application Support

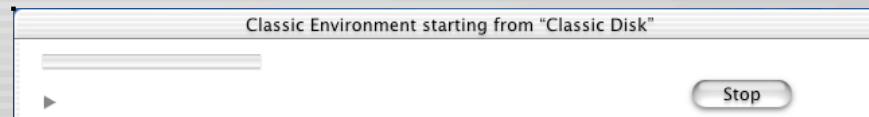
- Mac OS X multiple application environments
  - 6 environments
    - Classic
    - Carbon
    - Cocoa
    - Java
    - BSD
    - X11
  - Support for older Mac OS apps (i.e. Classic)
  - Support/ease porting older apps (i.e. Carbon)
  - Provide modern environment for new apps (i.e. Cocoa)



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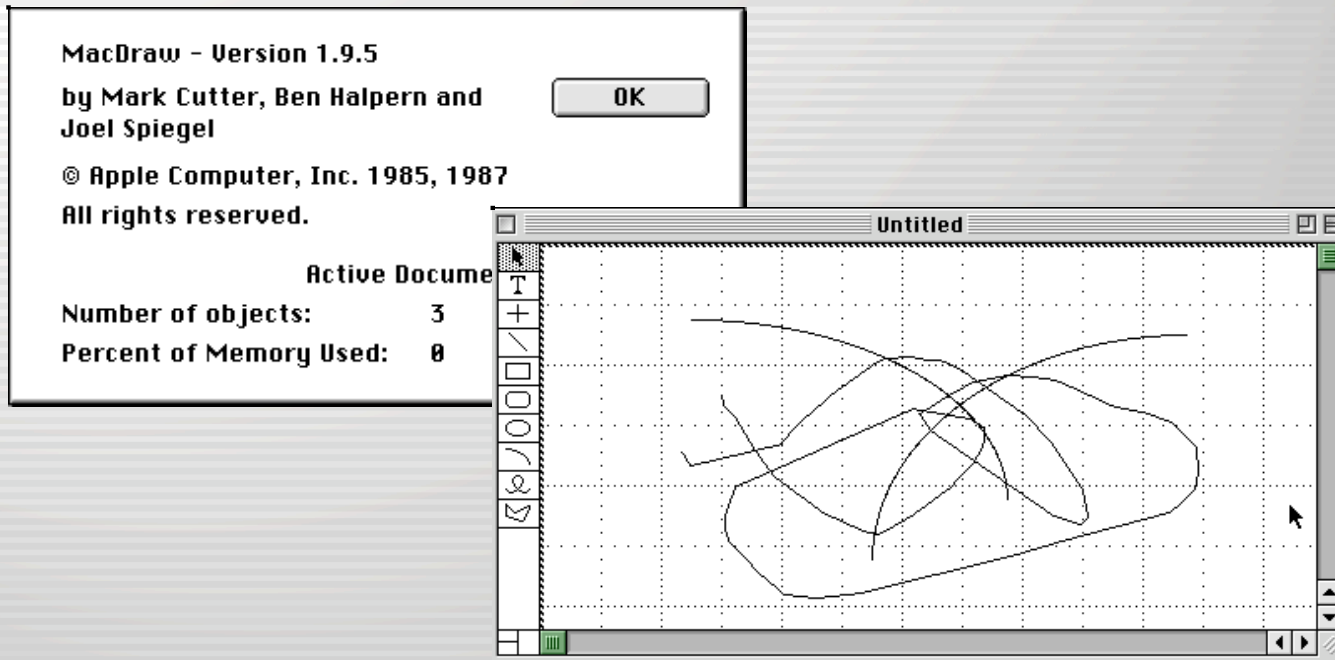
# Application Support – Classic

- **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)



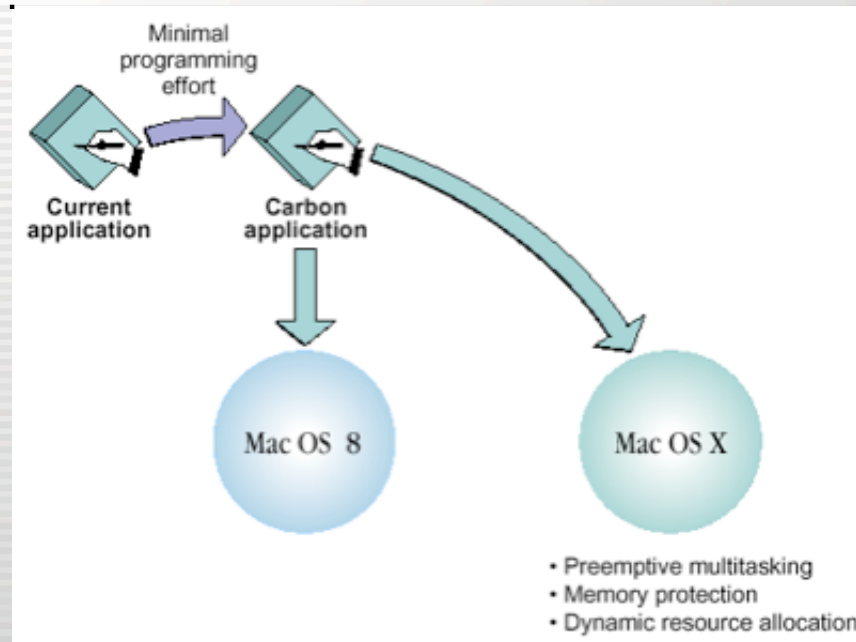
# Application Support – Carbon

- **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

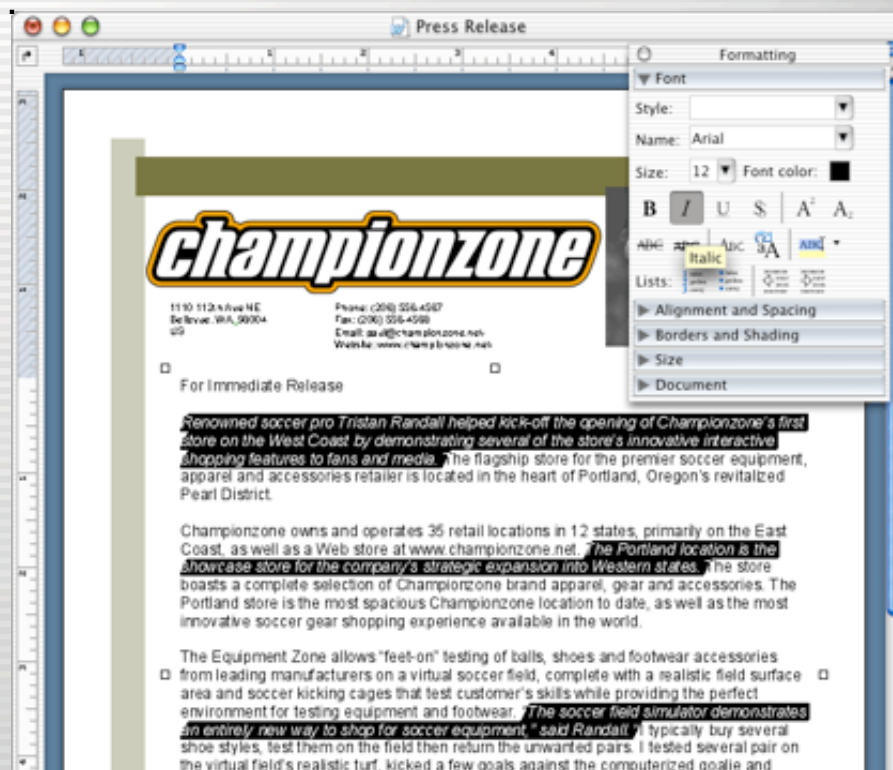
- A pragmatic approach...



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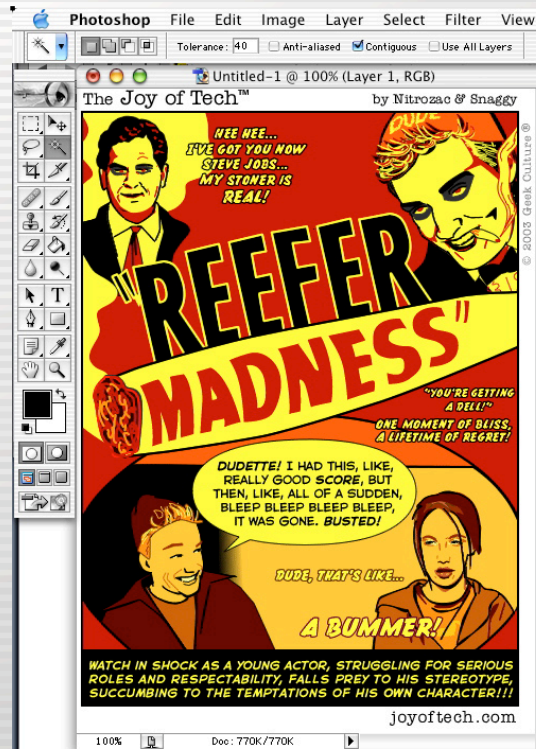


# Carbon Examples – Office X



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# Carbon Examples - Photoshop



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# 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.**



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# Cocoa Examples - Terminal



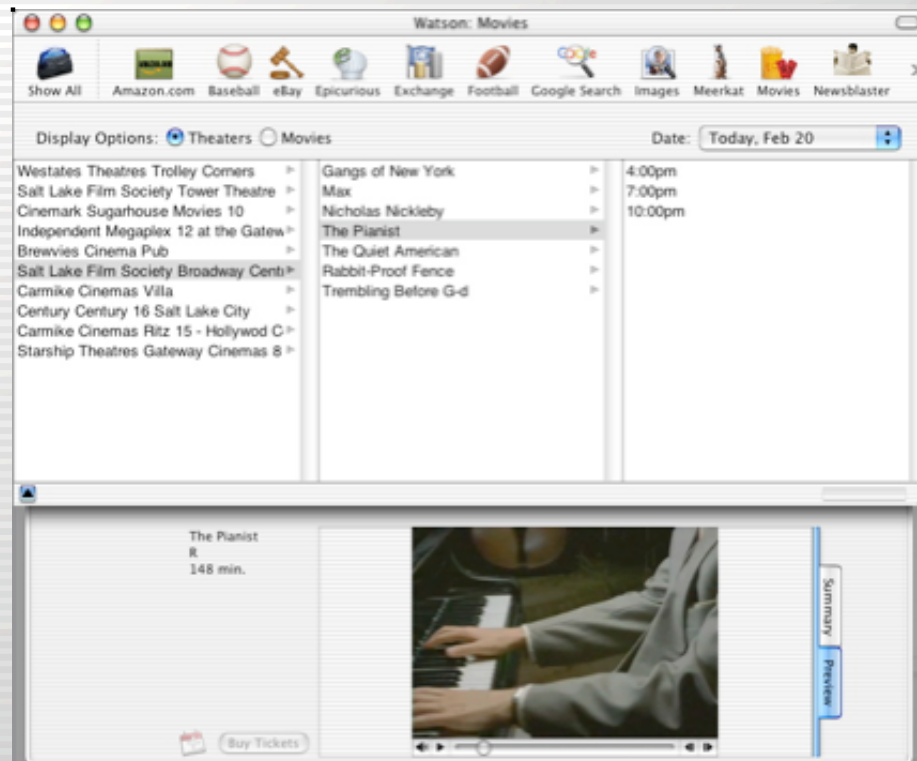
```
Terminal — tcsh (tty1)
Processes: 81 total, 2 running, 79 sleeping... 258 threads      15:58:35
Load Avg: 1.82, 1.16, 0.81   CPU usage: 19.4% user, 51.6% sys, 29.0% idle
SharedLibs: num = 7, resident = 1.95M code, 368K data, 556K LinkEdit
MemRegions: num = 15388, resident = 426M + 14.4M private, 198M shared
PhysMem: 99.9M wired, 576M active, 325M inactive, 1000M used, 23.6M free
VM: 10.1G + 3.62M 41528(41528) pageins, 100231(100231) pageouts

  PID COMMAND      %CPU  TIME    #TH  #PRTS  #PAGES  PPRVT  RSHRD  RSIZE  VSIZE
1840 top              0.0%  0:00.27  1    14     18    316K   364K   608K  13.6M
1831 Adobe Phot      0.0%  0:26.21  5    81    634   28.6M   31.8M   54.2M  250M
1802 iMovie          0.0%  13:21.38  7   186   559   20.7M   24.3M   44.3M  283M
1762 iChat            0.0%  0:03.94  2    132   238   3.00M   14.7M   18.2M   196M
1749 OmniOutlin     0.0%  0:20.05  5   122   237   7.96M   12.5M   23.0M   196M
1738 Eudora           0.0%  12:05.60  6    98   317   8.33M   20.6M   21.0M   228M
1737 Console         0.0%  0:04.93  1    83   127   1.49M   8.42M   12.0M   173M
1385 iChat            0.0%  2:44.22  3   148   358   5.88M   16.9M   20.5M   204M
1354 Microsoft       0.0%  7:23.71  4    93   278   1.20M   10.9M   10.8M   221M
1820 Keynote         0.0%  12:19.54  7   177  1278   136M   44.1M   146M   371M
1818 check_afp       0.0%  0:00.09  3    29    23   128K    668K   716K   14.9M
1815 ssh              0.0%  1:05.80  1    18    19   172K    548K   468K   2.12M
  601 Synchroniz     0.0%  74:49.17  3   132   285   6.98M   16.2M   18.8M   249M
  515 Safari          0.0%  68:35.81  9   823  1756   78.1M   38.8M   88.2M   468M
  506 Acrobat Re     0.0%  16:18.29  3    96   412   2.96M   12.8M   9.28M   209M
  498 Print Cent     0.0%  5:00.87  1    85   226   1.16M   7.96M   3.88M   179M
  494 Dreamweave     0.0%  2:15:27  4    92   558   21.8M   30.8M   31.8M   284M
  491 SecurityAg     0.0%  0:02.48  1    54   111   928K    7.95M   1.91M   173M
  483 Timbuktu P     0.0%  87:33.97  8   145   192   1.42M   11.5M   12.1M   186M
```



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# Cocoa Examples - Watson



# 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



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# Java Examples - Moneydance

The screenshot displays the Moneydance 3.0-BETA (165) application window. The title bar indicates the file path: /Users/sreilly/Projects/moneydance/Accounts.md \*. The window is titled "Checking" and shows a "Bank" dropdown menu. The current balance is \$ 10927.52 and the cleared balance is \$ 4773.30. A "New Transaction" button is visible in the top right.

The main window contains a table of transactions with the following columns: Date, Description, Account, C (checked), Payment, Deposit, and Balance. The transactions listed are:

Date	Description	Account	C	Payment	Deposit	Balance
09/10/2000	Union National Bank	Loan	✓	319.00		5175.42
09/10/2000	CAIS Internet	Computer	✓	718.15		4457.27
09/10/2000	Fargo Home Mortgage, Inc.	Loan		1171.81		3285.46
09/10/2000	vice Charge	Bank Chrg	✓	9.95		3275.51
09/10/2000	e Fin Technologies	Computer	◇	79.00		3196.51
09/10/2000	vice Charge	Bank Chrg	✓	1.50		3096.51
09/10/2000	vice Charge	Bank Chrg	✓	1.50		3095.01
09/10/2000	izeon	Phone	✓	177.97		2917.04
09/10/2000	ve's Hardware	Maintenance	◇	5.16		2911.88
09/10/2000	Ukrop's	Groceries		111.08		2800.80
09/19/2000	ATM	Cash		60.00		2740.80
09/20/2000	Pizzeria Uno's	Dining		7.57		2733.23
09/23/2000	Kristoferjon	Misc		48.00		2685.23
09/25/2000	Ukrop's	Groceries		88.48		2596.75

Below the table, there is a form for a new transaction. The date is set to 09/10/2000 and the check number is 1434. The payee is "CAIS Internet" with a payment of 718.15 and a deposit of 0.00. The account is "Business:Computer". The memo is "DSL Payment Customer# 00000123343". Buttons for "Record", "Cancel", "Delete", "Split...", "Delete Splits", and "Memorize" are visible.

# 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**



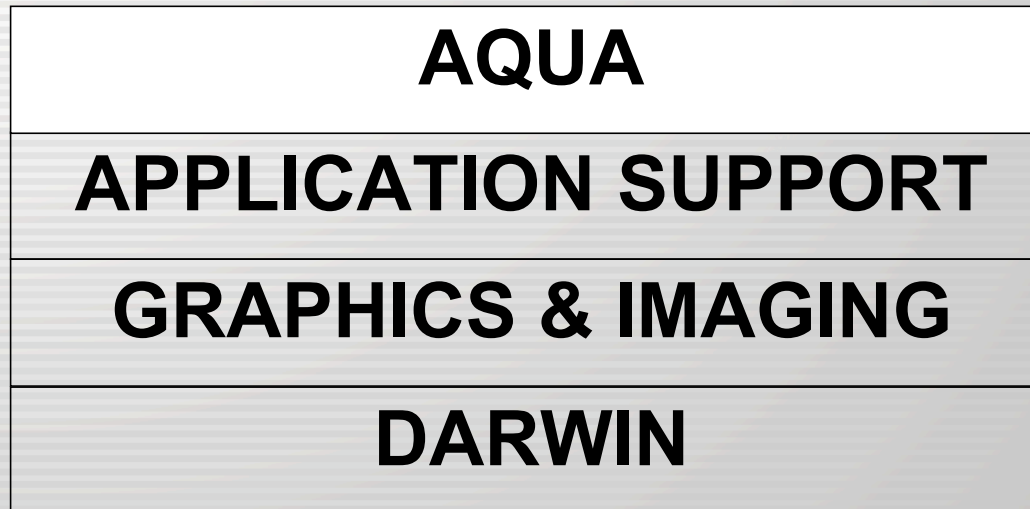


# Application Support – X11



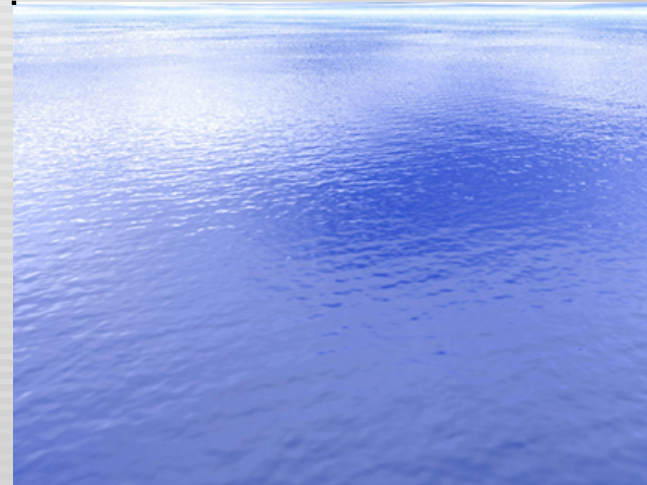
# Aqua

- The last layer is...



# Aqua – User Interface

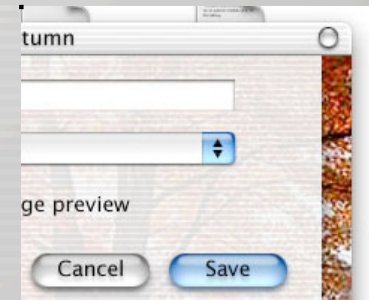
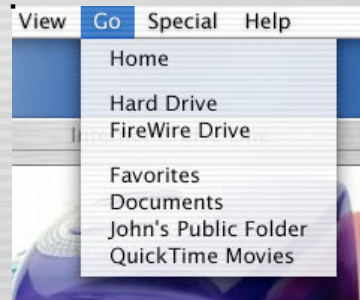
- **Apple’s goal was to create a User Interface**
  - **Easier to use**
  - **More appealing to users**
  -
- **Aqua**
  - **Properties of water**
    - **Translucence**
    - **Drop shadows**
    - **Animations**
    - **Etc.**



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# 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...



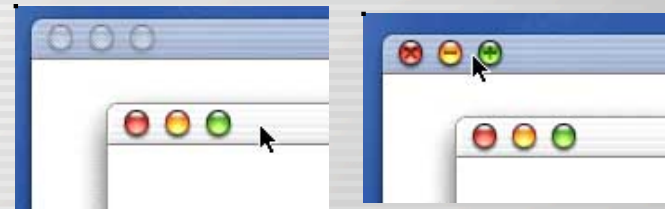
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# Aqua – Windows

- **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)**



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# 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



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# Contact Information

- **Web Site**
  - [www.macos.utah.edu](http://www.macos.utah.edu)
- **Email**
  - [mac@sci.utah.edu](mailto:mac@sci.utah.edu)
- **Address**
  - Marriott Library Multimedia Center
  - Room 1705

