Mac OS X
"for Unix Folks"

Massimo Marino, Fons Rademakers, Lassi Tuura

Impressions from WWDC 04
San Francisco, June 28 – July 2

Covered in this presentation

- Mac OS X: Overview & Unix environment
- Mac OS X: in the real world
- Future: News from WWDC and Tiger
- Q&A

Covered in this presentation

- Mac OS X:
    Overview & Unix environment

OS X Overview

- Completely new Mac operating system
  - Mach/FreeBSD core, Mac interface
- Ideal environment for desktop and development
  - Simple, easy to use desktop environment
  - "The Power of Unix, The Simplicity of Mac"© All the Unix/Linux when/where you want it
  - Runs numerous desktop and office programs
  - Reconstruction and PowerPoint on one computer

12M users and growing

OS X Distribution

- System
  - Mac OS X
  - Mac OS X Server
  - Darwin
- 3rd party sw - also from Apple site - in the thousands

Over 18000 applications for the Mac
Check out http://guide.apple.com/

OSXUnix4AAMeeting

New   Delete   Play   Themes   View   Masters   Text   Shapes   Table   Chart   Group   Ungroup   Front   Back   Inspector   Colors   Fonts
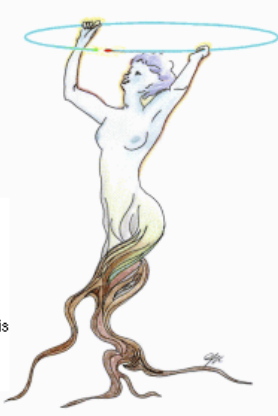
Slides

Features

Open source,
foundation
- Based on FreeB
- Support for PC
- High-performa
  vector/DSP an
- Optimized X11
- Open source c
  Darwin project

Standards-ba
- Open source T
  architecture, i
  L2TP/IPSec
- Interoperability
  Windows (SMB
- Powerful web s
- Open Directory
  services archite
- Single sign-on

Familiar UNIX
- Terminal emula
  functionality, in
  support
- Terminal applic
  and drag-and-c
- Comprehensive
  (including ema
- Comprehensive
  (including bash, Perl, PHP, Python, tcl, Ruby)
- Bundled GCC 3.3 compiler for fast compilation
  and execution of C, C++, and Objective-C
  source
- Rich set of command-line C, Java, and UNIX
  build tools (including make and distcc)

Terminal   File   Edit   Scrollback   Font   Window   Help   Wed 3:31 PM

Netropsin Presentation.ppt

DNA with Netropsin

Terminal — root — 91x46

Last login: Mon Jul 5 17:19:58 on ttyp3
Welcome to Darwin!
Welcome to Darwin!
Darwin Kernel Version 7.4.0: Wed May 12 16:58:24 PDT 2004; root:xnu/xnu-517.7.7.obj~7/RELEASE_PPC

19:20 CEST 2004
talking motion picture) premiere in New York, 1928
ia captures Aqaba, 1917

****
*   *
*   to R O O T   *
*   *
*   29 June 2004   *
*   *
* visit our Web site *
* .cern.ch   *
*   *
****

sed to render TrueType fonts.
thread support.

ter version 5.15.138, May 23 2004
s must be C++ statements.
nts between { }.

ROOT
Version 4

Conception: Rene Brun, Fons Rademakers

Lead Developers: Rene Brun, Philippe Canal,
    Fons Rademakers

Core Engineering: Ilka Antcheva, Maarten Ballintijn,
    Bertrand Bellenot, Olivier Couet, Valery Fine, Gerardo Ganis
    Eddy Offermann, Valeriy Onuchin

CINT C/C++ Intepreter: Masaharu Goto

Version 4.00/07

restore.pl   (Perl [search

Applications   GTX Cin
Show in Finder   Motif N
Hide   Tk Getl
Quit
Customi

100%

iDisk
20.1 MB

Costanza'sClass
640 x 480

Riven Hints – Gehn
Prison, 1 of 2

OS X Unix Environment

- Based on FreeBSD 5.5 and Mach 3

- Supports POSIX, Linux, and System V APIs

- Highly optimised math, image, sound and graphics libraries

- XFree86-based optimised X11

OS X Unix Environment...

Built on Standards and Open Source

- 👁 Darwin (core os itself) is open sourced
- 👁 BSD networking, NFS, AFP, SMB/CIFS, AFS, RendezvousSDK released for Windows
- 👁 System ships with dozens of open-source packages

  perl, postfix, apache, openssl, gnu tools, openssh, openLDAP, ...
- 👁 Fink and Darwinports

  thousands of linux/unix packages, easy to install

Packages: 1710 Displayed, 38 Installed

Status	Name	Installed	Binary	Stable	Unstable	Category	Description
current	apt	0.5.4–36	0.5.4–36	0.5.4–36		base	Advanced front-end for dpkg
current	apt-shlibs	0.5.4–36	0.5.4–36	0.5.4–36		base	Advanced front-end for dpkg
current	autocutsel	0.6.2–11	0.6.2–11	0.6.2–11		x11	Merges two X11 cut buffers
current	base-files	1.9.1–1	1.9.1–1	1.9.1–1		base	Directory infrastructure
current	bzip2	1.0.2–12	1.0.2–12			bootstrap	Block-sorting file compressor
current	bzip2-dev	1.0.2–12	1.0.2–12			bootstrap	Developer files for bzip2 package
current	bzip2-shlibs	1.0.2–12	1.0.2–12			bootstrap	Shared libraries for bzip2 package
current	cctools-extra	1:495–3	1:495–3	1:495–3		base	Extra software from cctools
current	cvs	1.11.17–1	1.11.17–1	1.11.17–1		devel	Version control system
current	debianutils	1.23–11	1.23–11			bootstrap	Misc. utilities specific to Debian (and
current	dpkg	1.10.21–202	1.10.21–202	1.10.21–202		base	The Debian package manager
current	emacs21	21.2–26	21.2–26	21.2–26		editors	Flexible real-time text editor, v21.2 w
current	emacsen-common	1.4.13–2	1.4.13–2	1.4.13–2		editors	Common facilities for all emacsen
current	fink	0.20.5–1	0.20.5–1	0.20.5–1		base	The Fink package manager
current	fink-mirrors	0.20.2.1–1	0.20.2.1–1	0.20.2.1–1		base	Mirror infrastructure
current	fink-prebinding	0.7.1–2		0.7.1–2		base	Tools for enabling prebinding in Fink
current	gettext	0.10.40–18	0.10.40–18	0.10.40–18		base	Message localization support
current	gettext-bin	0.10.40–18	0.10.40–18	0.10.40–18		base	Executables for gettext package
current	gettext-dev	0.10.40–18	0.10.40–18	0.10.40–18		base	Developer files for gettext package
current	gzip	1.2.4a–6	1.2.4a–6			bootstrap	The gzip file compressor
current	libiconv	1.9.1–11	1.9.1–11			bootstrap	Character set conversion library
current	libiconv-bin	1.9.1–11	1.9.1–11			bootstrap	Executables for libiconv package
current	libiconv-dev	1.9.1–11	1.9.1–11			bootstrap	Developer files for libiconv package
current	libjpeg	6b–6	6b–6	6b–6		graphics	JPEG image format handling library
current	libjpeg-bin	6b–6	6b–6	6b–6		graphics	Executables for libjpeg package
current	libjpeg-shlibs	6b–6	6b–6	6b–6		graphics	Shared libraries for libjpeg package
current	libpng3	1.2.5–14	1.2.5–14	1.2.5–14		graphics	PNG image format handling library
current	libpng3-shlibs	1.2.5–14	1.2.5–14	1.2.5–14		graphics	Shared libraries for libpng3 package
current	libtiff	3.5.7–7	3.5.7–7	3.5.7–7		graphics	TIFF image format library and tools
current	libtiff-bin	3.5.7–7	3.5.7–7	3.5.7–7		graphics	Executables for libtiff package
current	libtiff-shlibs	3.5.7–7	3.5.7–7	3.5.7–7		graphics	Shared libraries for libtiff package
current	ncurses	5.3-20031018–2	5.3-20031018–2			bootstrap	Full-screen ascii drawing library
current	ncurses-dev	5.3-20031018–2	5.3-20031018–2			bootstrap	Development files for ncurses packag
current	ncurses-shlibs	5.3-20031018–2	5.3-20031018–2			bootstrap	Shared libraries for ncurses package

Done

Packages: 14 Displayed, 38 Installed

roo

Status	Name	Installed	Binary	Stable	Unstable	Category	Description
	blackbox-rootless		0.65.0-1	0.65.0-1		x11-wm	Alternate Window Manager, works in XDarwin's rootless
	roofitcore		1.00.03-21	1.00.03-21		sci	Toolkit for modeling physics event distributions
	roofitcore-shlibs		1.00.03-21	1.00.03-21		sci	Shared libs of RooFitCore built against root3
	roofitmodels		1.00.03-21	1.00.03-21		sci	Models of physics event distributions
	roofitmodels-shlibs		1.00.03-21	1.00.03-21		sci	Shared libs of RooFitModels built against root3
	root-pythia		1-11	1-11		sci	Interface libraries Pythia – ROOT
	root-pythia-shlibs		1-11	1-11		sci	Interface libraries Pythia – ROOT
	root3		3.10.02-13	3.10.02-14		sci	Object-oriented data analysis framework
	root3-cernlib		3.10.02-26	3.10.02-27		sci	Object-oriented data analysis framework
	root3-cernlib-shlib		3.10.02-26	3.10.02-27		sci	Shared libraries for root3-cernlib
	root3-shlibs		3.10.02-13	3.10.02-14		sci	Shared libraries for root3
	root3-threaded		3.10.02-11	3.10.02-11		sci	Obsolete, replaced by root3
	xfree86-rootless-th						virtual package
	xfree86-rootless-th						virtual package

Done

Packages: 7 Displayed, 38 Installed

Name   cern

Status	Name	Installed	Binary	Stable	Unstable	Category	Description
	cernlib		2003-13	2003-13		sci	Paw and other basic executables
	cernlib-dev		2003-13	2003-13		sci	Basic libraries and include files
	cernlib-geant321		2003-13	2003-13		sci	GEANT 3.2.1
	cernlib-mclibs		2003-13	2003-13		sci	Monte-carlo libraries and files
	cernlib-paw++		2003-13	2003-13		sci	Paw++: Motif enhanced paw
	root3-cernlib		3.10.02-26	3.10.02-27		sci	Object-oriented data analysis framework
	root3-cernlib-shlib		3.10.02-26	3.10.02-27		sci	Shared libraries for root3-cernlib

Done

Language Options

- C, C++, Objective-C, Objective-C++, Java
- Perl, Tcl, PHP, Python & Ruby
- Third parties: IBM, Metrowerks, AbSoft, NAG
- Download+install the rest: g77, gnat, lisp, ...

Terminal — bash — 91x46

```
in: Tue Jul  6 15:24:48 on ttyp2
```

X emacs@pb-d-128-141-49-84.cern.ch

File   Edit   Options   Buffers   Tools   Help

GNU Emacs is one component of the GNU operating system.
You can do basic editing with the menu bar and scroll bar using the mouse.

Useful File menu items:

Exit Emacs   (Or type Control-x followed by Control-c)
Recover Session   Recover files you were editing before a crash

This is GNU Emacs 21.2.1 (powerpc-apple-darwin, X toolkit)
  of 2004-06-23 on cobra.local
Copyright (C) 2001 Free Software Foundation, Inc.

```
---- GNU Emacs ----
Loading places from /Users/marino/.emacs-places...done
```

Left terminal (partially hidden):
```
 6 Jul  L
 7 Jul  F
pb-d-128-
[1] 976
pb-d-128-
/usr/bin/
Password:
rsync -az
I will no

rsync -rt
e='10.3/s
nkinfo/*/
*' --incl
.3/stable
le/crypto
clude='**
/usr/bin/
/usr/bin/
f
Reading p
Updating
Informati
No packag

The core
using com

pb-d-128-
pb-d-128-
pb-d-128-
pb-d-128-
pb-d-128-
pb-d-128-
[2] 1051
[1]  Done                emacs
pb-d-128-141-49-84:marino:$ fink install g77
```

Terminal — bash — 91x46

```
Last login: Tue Jul  6 15:27:00 on ttyp1
Welcome to Darwin!
Welcome to Darwin!
Darwin Kernel Version 7.4.0: Wed May 12 16:58:24 PDT 2004; root:xnu/xnu-517.7.7.obj~7/RELEA
SE_PPC
Stardate: Tue Jul  6 15:27:01 CEST 2004
 6 Jul  First `talkie' (talking motion picture) premiere in New York, 1928
 6 Jul  Lawrence of Arabia captures Aqaba, 1917
 7 Jul  First radio broadcast of "Dragnet", 1949
pb-d-128-141-49-84:marino:$ fink info g77
Information about 1711 packages read in 1 seconds.

g77-3.4.0-2: GNU Fortran compiler
  g77 consists of several components:
  .
  1) The g77 command itself.
  2) The libg2c run-time library.  This library contains the
     machine code needed to support capabilities of the Fortran
     language that are not directly provided by the machine code
     generated by the g77 compilation phase.
  3) The compiler itself, internally named f771.
     f771 does not generate machine code directly --
     it generates assembly code, leaving the conversion to
     actual machine code to an assembler, usually named as.
  .
  g77 supports some fortran90 features, like automatic arrays,
  free source form, and DO WHILE.
  .
Usage Notes:
  If you get unresolved symbol '_saveFP', add -lcc_dynamic when linking.
  .
  Does not support -framework argument, to link frameworks use -Wl flag
  (for example, to link vecLib use "-Wl,-framework -Wl,vecLib").
  .
  No man page, use "info g77".
  .
Web site: http://gcc.gnu.org/onlinedocs/g77/
  .
Maintainer: Jeffrey Whitaker <jswhit@fastmail.fm>

pb-d-128-141-49-84:marino:$
pb-d-128-141-49-84:marino:$
```
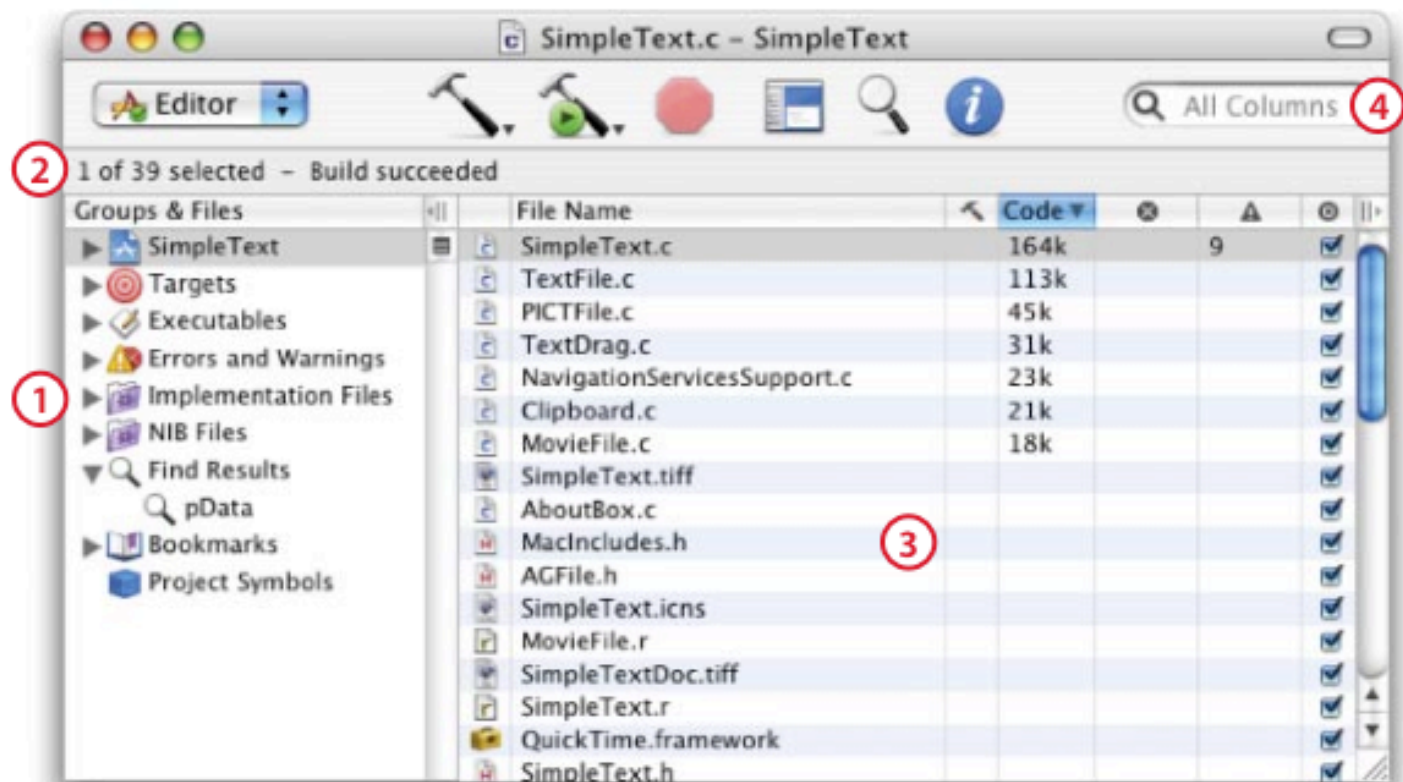
Familiar Development environment

- Standard core os tools
  emacs, vi/vim, gnutar, sed, make, distcc, etc

- GCC 3.3 system compiler, GDB debugger
  - and actually works! -

- Xcode
  very nice and powerful graphical GUI on top of it all, no need to care much about the details

The Project window is a central dashboard for your development projects.

① Smart Groups organize every aspect of your project and provide quick access.

② The status bar tells you what's going on in the background.

③ The detail view presents data for each Smart Group in tabular form.

④ Fast searching refines results as you type.

SKTToolPaletteController.m

Build Build and Go Tasks Fix

SKTToolPaletteController.m:1 ◆ <No selected sy

```
// SKTToolPaletteController.m
// Sketch Example
//

#import "SKTToolPaletteController.h"
#import "SKTGraphic.h"
#import "SKTRectangle.h"
#import "SKTCircle.h"
#import "SKTLine.h"
#import "SKTTextArea.h"

enum {
    SKTArrowToolRow = 0,
    SKTRectToolRow,
    SKTCircleToolRow,
    SKTLineToolRow,
    SKTTextToolRow,
};

NSString *SKTSelectedToolDidChangeNo

@implementation SKTToolPaletteContro

+ (id)sharedToolPaletteController {
    static SKTToolPaletteController

    if (!sharedToolPaletteController
        sharedToolPaletteController
    }

    return sharedToolPaletteControll
```

SKTGraphic.m – Sketch

Create Disk I ⏷   ⚙ ⏷

Active Target   Action   Build Build and Go Tasks Info Editor   Search by All   Search

Groups & Files

- Sketch
  - CreateDiskImage.sh
  - ▶ View & Controller Classes
  - ▶ Model Classes
  - ▶ Other Sources
  - ▶ Resources
  - ▶ Notes
  - ▶ External Frameworks and Libraries
  - ▶ Products
- Targets
  - ▶ Sketch
  - ▶ Create Disk Image
- ▶ Executables
- ▶ Errors and Warnings
- ▶ Find Results
- ▶ Bookmarks
- ▶ SCM
- Project Symbols
- ▶ Implementation Files
- ▶ NIB Files

Symbol	Symbol Type	Location
__gFlags	Structure	SKTGraphic.h:45
__gvFlags	Structure	SKTGraphicView.h:30
_bounds	Instance Variable	SKTGraphic.h:40
_cachedImage	Instance Variable	SKTImage.h:10
_contents	Instance Variable	SKTTextArea.h:9
_creatingGraphic	Instance Variable	SKTGraphicView.h:19
_document	Instance Variable	SKTGraphic.h:39
_editingGraphic	Instance Variable	SKTGraphicView.h:22
_editorView	Instance Variable	SKTGraphicView.h:23
_fillColor	Instance Variable	SKTGraphic.h:43
_flippedHorizontally	Instance Variable	SKTImage.h:11
_flippedVertically	Instance Variable	SKTImage.h:12
_gFlags	Instance Variable	SKTGraphic.h:50
_graphics	Instance Variable	SKTDrawDocument.h:11
_graphics	Instance Variable	SKTRenderingView.h:9
_gridColor	Instance Variable	SKTGraphicView.h:28
_gridSpacing	Instance Variable	SKTGraphicView.h:27
_gvFlags	Instance Variable	SKTGraphicView.h:37
_horizontalRulerLineRect	Instance Variable	SKTGraphicView.h:39
_image	Instance Variable	SKTImage.h:9
_inspectingGraphicView	Instance Variable	SKTInspectorController.h:22
_inspectingGraphicView	Instance Variable	SKTGridPanelController.h:18
_lineWidth	Instance Variable	SKTGraphic.h:42
_origBounds	Instance Variable	SKTGraphic.h:41
_pad	Field	SKTGraphicView.h:36
_pad	Field	SKTGraphic.h:49
_pasteboardChangeCount	Instance Variable	SKTGraphicView.h:24
_pasteCascadeDelta	Instance Variable	SKTGraphicView.h:26

Build Build and G

Xcode 1.5

Xcode 1.5

You can always get back
the *Show Older Release*

User Interface

General Improven

- All secondary w
- Support for re-o
  the time the proj
- A global activity viewer (via the *Window→Tools* menu).
- Support to setup defaults for new projects and existing projects (via the *Window→Defaults…* menu).
- You may change the behavior of showing and hiding the *Build Results* pane either via the *Building* preferences panel or via the new pull down menu on the pane itself. Changes made in the *Building* preferences panel will effect all projects while changes made in the *Build Results* build pane's pull down menu will only have effect for that pane until the project is closed.
- Double-clicking on the project group now brings up a *Get Info* window for the project.
- *Add Files…* has been renamed *Add To Project…* to better reflect its general nature (i.e. it can be used for adding more than just files).
- Separate editor windows remember their position and size.
- Double-clicking a group now expands the group.
- Buttons to add and remove splits have been added back. The preference for showing these buttons is in the *General* preference pane.
- The *Toggle Editor* button now will maximize the embedded editor. If the editor was already at its maximum size, then it returns the editor to the

- Normal unix man pages
18 □ Current porting issues
- Turn off precompiled headers
- Always build libraries with –si
- Always link using two–level na
  - Must link libraries against
- Problems with shared libraries
- Constructors, symbol coal

Documentation

- Extensive documentation in /Developer
- Even more documentation at website
- Normal unix man pages

Current porting issues

- Compiler/linker options

  - Turn off precompiled headers with -no-cpp-precomp

  - Always build libraries with -single_module

  - Always link using two-level namespace

    - Must link libraries against each other

- Problems with shared libraries

  - Constructors, symbol coalescing

  - Solved in Tiger

- HFS+ case preserving, case insensitive

  - foo.c and Foo.C in same directory

```
pb-d-128-141-49-84:marino:$ touch killme
pb-d-128-141-49-84:marino:$ touch KillMe
pb-    lxplus043:marino:$ touch killme
kil    lxplus043:marino:$ ls *ill*
pb-    killme
pb-    lxplus043:marino:$ touch KillMe       1e
pb-    lxplus043:marino:$ ls *ill*           ne
pb-    KillMe  killme
Kil    lxplus043:marino:$ []
pb-
```

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- Q&A

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- Mac OS X: in the real world

The real world

- 'System X', Virginia Tech Supercluster
- 'Mach 5', US Army Supercomputer
- UCLA Dawson Project
- Many other smaller clusters (hundred units)
  - popular in bio-informatics
- First steps at CERN

Virginia Tech System X

- 1100 dual-processor Power Mac G5 (now moving to Xserve G5) computers at 2.0 GHz

  - Running Mac OS X v10.3 "Panther"

  - Wide variety of open-source software

- Interconnection

  - Primary: InfiniBand communications fabric over Mellanox host channel adapters and switches

  - Secondary: Gigabit Ethernet (built-in) over Cisco switches

- The Power Mac G5 cluster ranked 3rd overall supercomputer, fastest cluster in the world: 10.3 TFlops

- New Terascale Cluster: 1100-node dual 2.0 GHz Xserve G5 VT report quotes the performance as 17.6 Tflops. Would be number 2 on the most recent June Top 500 list, behind only Japan's Earth Simulator

- More than double the performance of the current number 3, 1152-node dual 2.4 GHz Xeon MCR Linux cluster at 2% of Japan's supercomputer cost

Mach 5

- Colsa Corp. is deploying 1566 Apple's Xserve DP G5 processors for a US Army & NASA project

  - Multiple Advanced Computers for Hypersonic research

- Used to model the aerothermodynamics for hypersonic flight

- Peak performance of over 25 Teraflops

  - To enter "Top 500" ranks in November

No pictures of US Army cluster

UCLA Dawson Project

- Being deployed for the Physics Plasma Group

  - 256 Dual G5 Xserve running Mac OS X Server

- Many platforms evaluated. Xserve proved to be the most cost-effective, straightforward and appropriate choice for the plasma physics research applications

- 2nd UCLA Physics Xserve cluster. In 2002 a group working with NASA's Jet Propulsion Laboratory created a parallel computing cluster using 33 dual-processor 1GHz Xserves G4 to achieve over 217 Gigaflops

What others are saying

"Apple's delivery of its Xserve-based supercomputers means more than validation of its role in the world of high-performance computing" - Horst Simon.

Director of computing sciences at Berkeley Lab (LBL) and co-author of the "Top 500" supercomputers list

http://www.macnewsworld.com/story/34734.html

OS X @ CERN

Mainly started with laptops

- OS X as supported OS at CERN
- Accepted as development platform by LHC Experiments

Apple became interested

- 5 G5 (1 Xserve, 4 dual G5)
- CERN is now "Gold Customer"
- WWDC invitation
- Developer Elite account soon

OS X @ LHC

Porting at various stages

Alice

   AliRoot

CMS

   SEAL, Iguana, most externals

Atlas

   CMT, Athena (selected packages)

LHCb

   POOL, Panoramix, Gaudi

Demo

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News from WWDC

- Developers are back! +17%
  - 3500 participants, 3499 Powerbook laptops, 1 PC laptop (Fons!)
- Tiger Preview released
- New series of sexy LCD's: 20", 23" and 30"
- Powerful developers tools
  - Xcode, Shark, Guard Malloc, ...
- Remote Desktop 2 (free for WWDC attendees)

20-inch   23-inch   30-inch

Still believing in FUDs? ("Macs do not integrate heterogeneous networks")

Tiger - OS X 10.4

- New and improved dyld
  - Much faster startup (forget pre-binding)
  - C++ libraries behave sanely
    - Global constructors run on load
    - Correct semantics for templates, commons
    - Bundle vs. dylib distinction irrelevant to us (bundles don't export symbols)
- gcc 3.5 (Apple skips 3.4)
  - gfortran replaces g77

Tiger - OS X 10.4

- 64-bit application support

- Accelerated graphics, math, sound libraries

- Global indexing and search (BeOS/Longhorn is here!)

    - Smart folders

    - Spotlight finds anything, system settings included

- Automator
    Graphical scripting

- New XCode 2.0

- New Shark 4.0

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Before Q&A some last info...

Mailing Lists

- Apple (http://lists.apple.com)
  - apple-cdsa
  - unix-porting
  - darwin-development
  - darwinos-users
  - darwin-kernel
  - darwin-userlevel
  - darwin-86
  - fortran-dev

Web sites

- http://www.apple.com

- http://www.opensource.apple.com

- http://www.opendarwin.org

- http://fink.sourceforge.net

Books

- Mac OS X Panther for Unix Geeks (O'Reilly)

- Mac OS X for Unix Developers (O'Reilly)

- UNIX Porting Guide

  http://developer.apple.com/documentation/Porting/Porting.html

- Inside Mac OS X: Mach-O Runtime Architecture

  http://developer.apple.com/documentation/DeveloperTools/
  Conceptual/MachORuntime/

- Additional developer toolchain documents

  http://developer.apple.com/documentation/DeveloperTools/
  http://developer.apple.com/techpubs/

Q&A

Any questions?