Welcome

To Advance through Presentation
Use Page Up and Page Down Keys

Core Mac OS X File Systems

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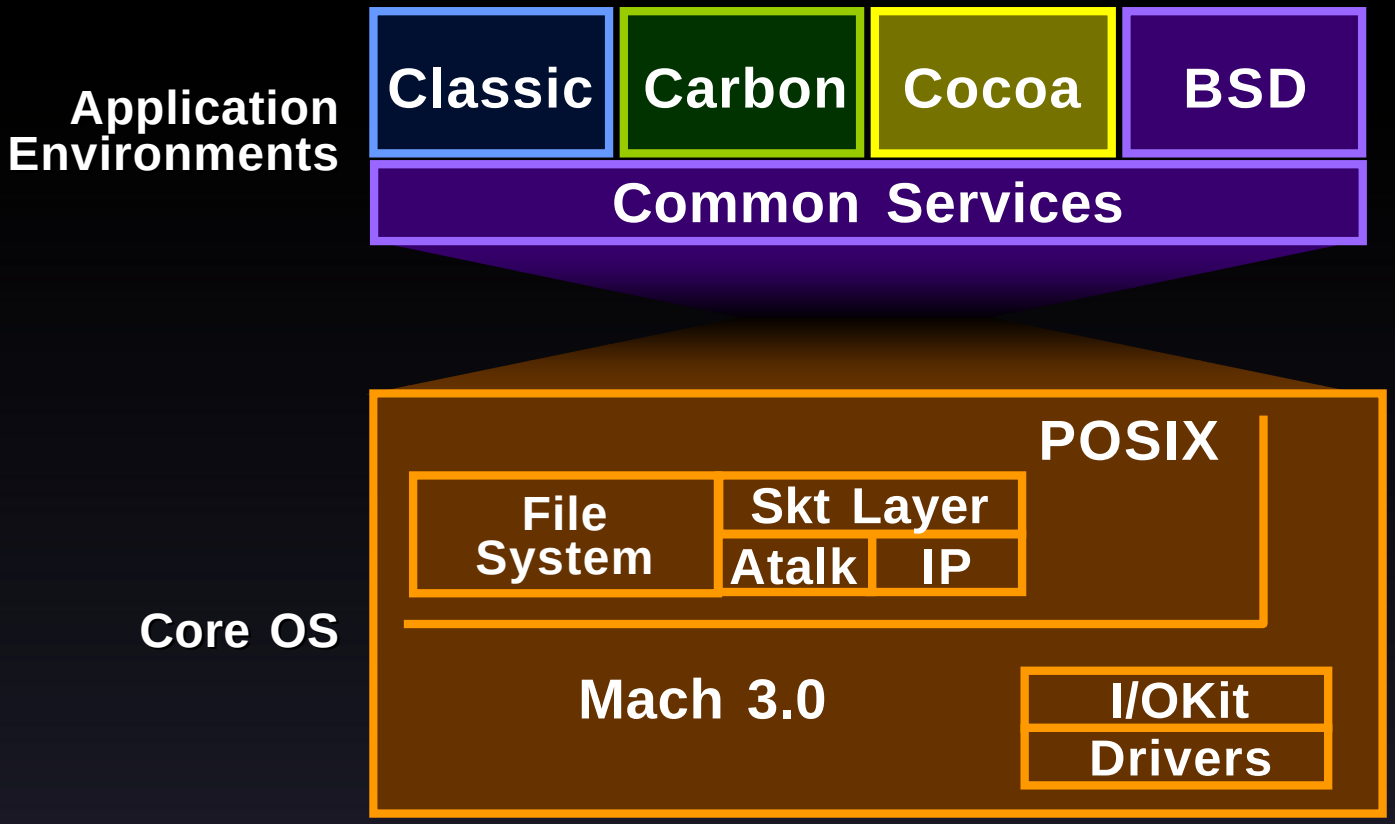
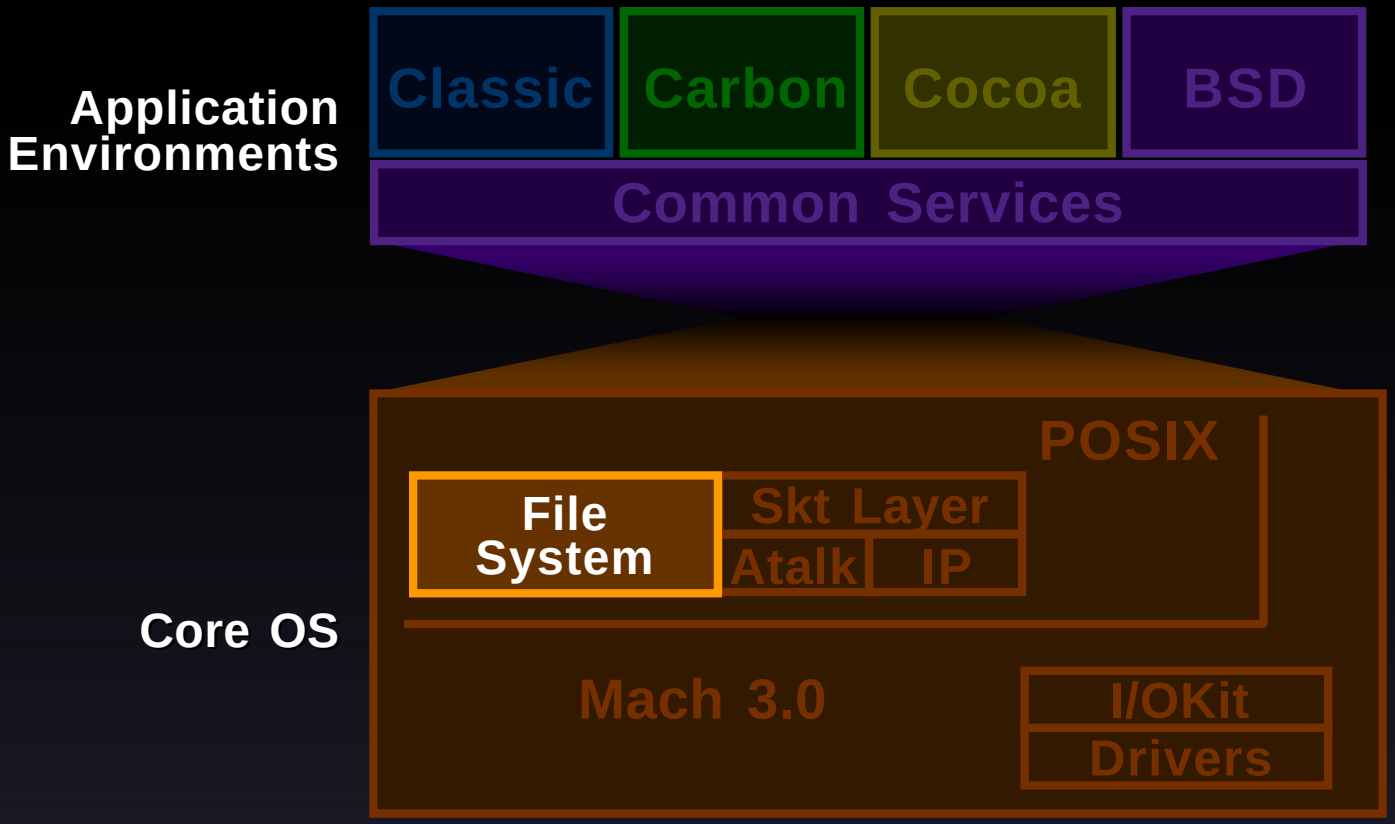
Welcome

- Info for developers of file system-centric applications
- Info for file system and plug-in developers
- Info for Darwin developers

Core OS and Mac OS X



Core OS and Mac OS X



Session Outline

I. Status Update
II. File System Interfaces
III. New File System Features
IV. Mac OS vs. BSD
V. Notes for Darwin Developers

Status Update—What's in Mac OS X Server

- In DR2
  - UFS for booting
  - ISO CDs
  - NFS vs. 3.0
- New in Mac OS X Server
  - HFS and HFS Plus suitable for Apple File Services (Mac OS X Server AFP server)

Status Update—What's in Mac OS X Server

- UTF-8 encoding throughout the kernel
  - And all BSD level system traps
- New BSD commands for HFS
  - fsck_hfs
  - newfs_hfs
  - mount_hfs

Status Update—What's Coming

- Rooting from HFS Plus (but not HFS)
- Booting from HFS Plus (but not HFS)
- AppleShare Client
  (courtesy of server group)
- UDF 1.5
- Features

Status Update—The Radar

- FAT (16,32)
- NTFS
- Joliet
- CIFS
- Change notification

Demo

Don “The Man” Brady

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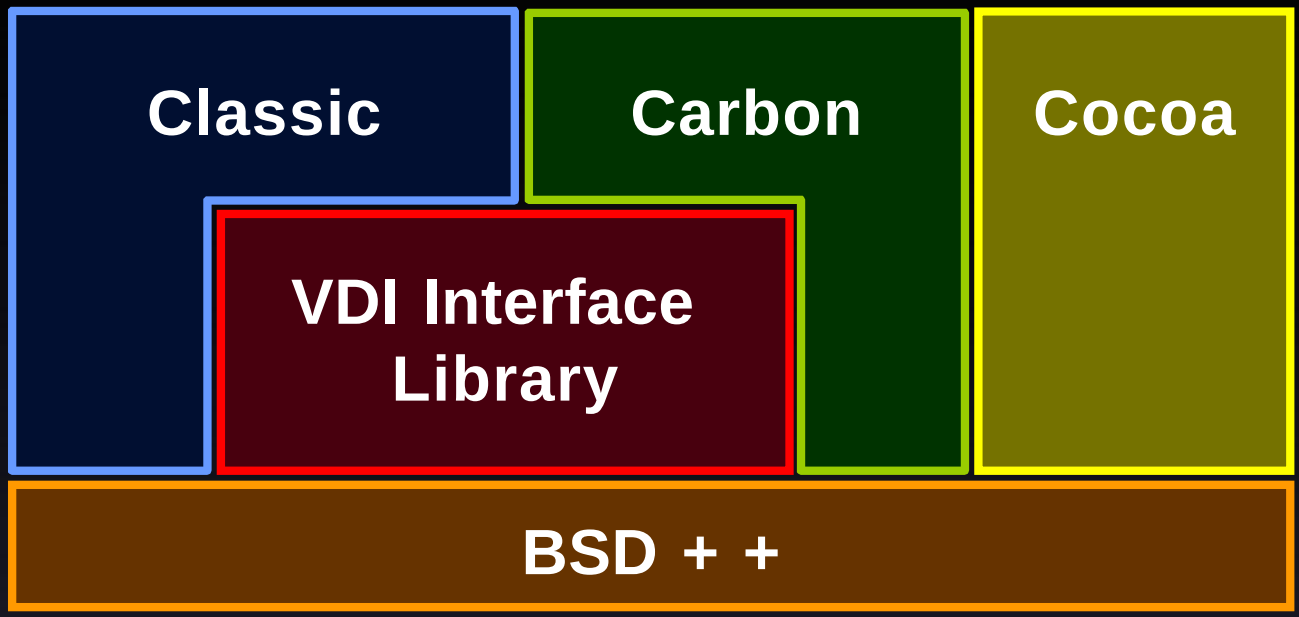
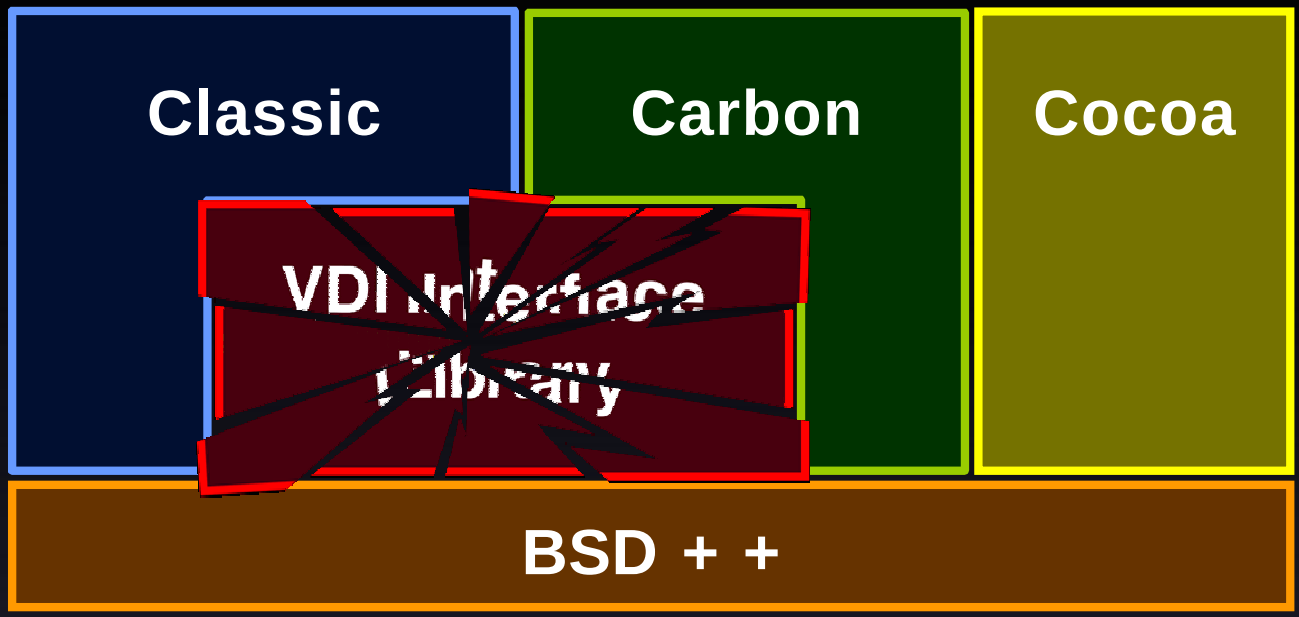
File System Interfaces



File System Interfaces



File System Interfaces

- Carbon
  - The primary file system interface for Mac OS applications
  - Covered in Mac OS File Mgr Session
- Cocoa
- Classic
  - For legacy Mac OS applications
- BSD++
- VFS
  - For file system and plug in developers

New Carbon Interfaces

- Replacement calls
  - Unicode file names (16 bit)
  - Large file access (> 2GB)
  - FSRefs instead of FSSpecs
    - Opaque structure for files and directories
  - Multiple Forks
  - New Catalog Information
- New feature
  - GetCatalogInfoBulk

New Carbon Calls—Files

- Make FSRef
- Create(File,Directory)Unicode
- (Delete,Move,Exchange)object
- RenameUnicode
- (Get,Set)CatalogInfo
- Search
- (Get,Set)VolumeInfo

New Carbon Calls—Forks

- (Open,Read,Write,Allocate,Flush,Close)Fork
- (Get,Set)ForkPosition
- (Get,Set)ForkSize
- GetForkCBInfo

Carbon—New Feature

- GetCatalogInfoBulk
  - Returns arrays of:
    - FSSPecs
    - FSRefs
    - Catalog Information
    - Names

Core OS X File Systems

Pat Dirks

Technical Lead,
Core OS File Systems

New BSD Calls

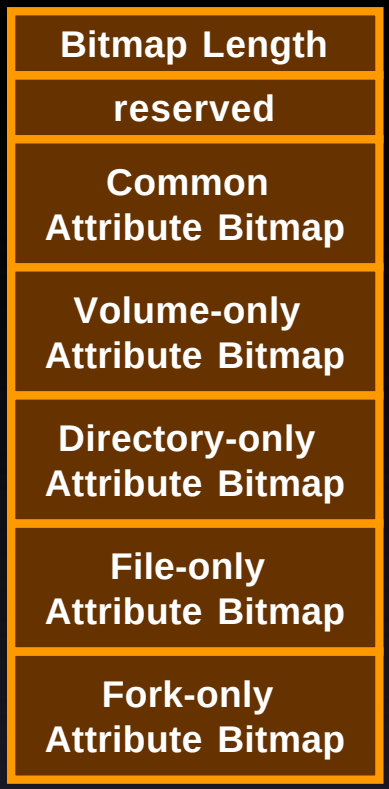
- exchangedata
  - Matches PBExchangeFiles
- getattrlist
  - Matches PBGetCatInfo, PBGetVInfo
- setattrlist
  - Matches PBSetCatInfo,PBSetVInfo
- searchfs
  - Matches PBCatSearch

exchangedata

```
exchangedata  (path1,path2)
        const char* path1;
        const char* path2;
        {

        }
```

attrlist structure

```
struct attrlist{
        u_short bitmapcount;
        u_short reserved;
        attrgroup_t commonattr;
        attrgroup_t volattr
        attrgroup_t dirattr;
        attrgroup_t fileattr;
        attrgroup_t forkattr;
        } attrlist
```



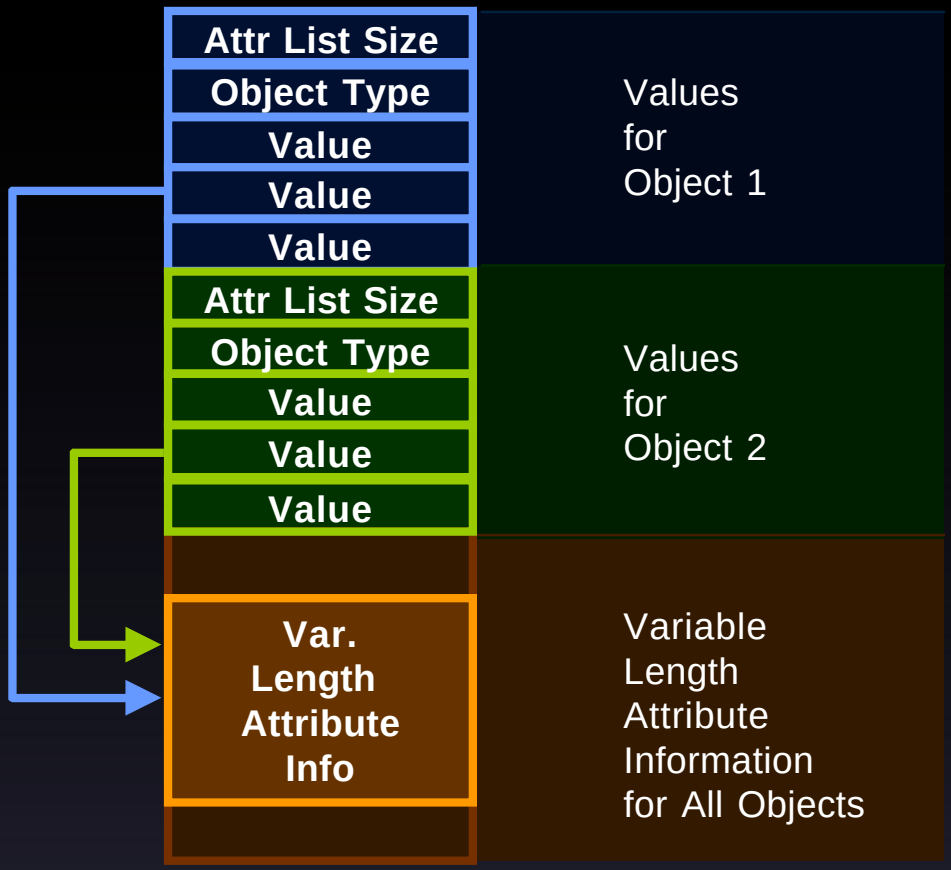
getattrlist,setattrlist

```
Int getattrlist ( path,attrlist,attributeBuffer,bufferSize)
        const char* path;
        struct attrlist * attributeList;
        void * attributeBuffer;
        size_t bufferSize;
        {

        }
```

searchfs

```
searchfs  (path,searchBlock,numMatches,scriptCode,options,state)
        const char *  path;
        struct fssearchblock * searchBlock;
        u_long * numMatches;
        u_long scriptCode;
        u_long options;
        struct searchstate * state;
        {

        }
```

Attribute Buffer Layout



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readdirattr

- Bulk Call for getting list of files with attributes
  - Callable by BSD apps
    - DIR* based enumeration
  - Will support GetCatalogInfoBulk

Directory Change Notification

- Performance acceleration
  - Eliminates need for continuous polling
- Directory level
- Interface under consideration
- Possible notification types
  - New file
  - File modification
  - File rename

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File Deletion

- Goal is semantic fidelity in Mac OS and Unix regardless of volume format
  - BSD allows open file deletion via unlink() call
  - Mac OS does not
- Option 1: New delete() call for Mac OS clients
- Option 2: New open() flag for Mac OS clients
- Developer Preview implements option 1
  - Classic/Carbon will use new delete() call

Symbolic Links vs. Aliases

- Mac OS will not follow symbolic links
- Like aliases, opening symbolic links in Mac OS will access link file contents
    - Symbolic link files have their own type

Case Sensitivity

- UFS: Yes (even through Carbon)
- HFS/HFS Plus: No (even through BSD)
- Volume format dictates

Sparse Files

- UFS: Yes
- HFS: No
    - HFS will allocate all space and zero fill

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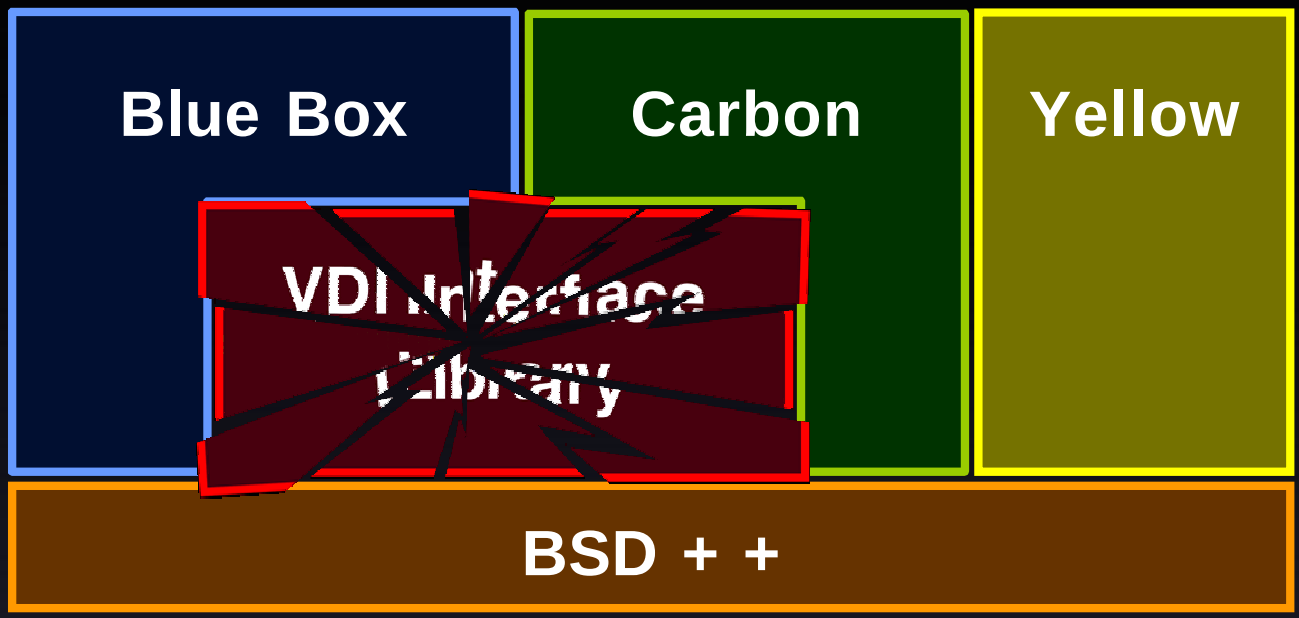
Outside Opportunities

- Coda
- Logical Volume Management
- Even more new commands
    - dumpfs for HFS

Things to Avoid

- Stay away from libVDI
  - It's "private" and going away

File System Interfaces



Things To Avoid

- Don’t assume you know Mac OS HFS internals
  - Mac OS 8.x has already changed
  - Mac OS X will be significantly different
  - Rate of change may increase with Darwin
- Harsh Judgement
  - “Hack Hack Hack” doesn’t mean it wasn’t the right thing to do

Roadmap

160: File Manager Mac OS 8	Tape
104: Mac OS 8 Compatibility Environment Update	Tape
106: Carbon on Mac OS X	Tape
910: Mac OS X Core OS Feedback Forum	Hall B **Today, 4:00pm**
103: Developing with Darwin	Tape

Roadmap

116: Core OS Overview	Tape
117: Mac OS X Kernel	Tape
118: Mac OS X BSD Support	Tape
119: I/O Drivers—Mac OS X	Tape
609: Mac OS X Networking Overview	Tape

Thank You and Goodnight

- Darwin brings open source development
- New file systems are on their way
- New features to appear soon
- Watch for more info on plug-ins

Q&A

Think different.™

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