

Auto Save and Versions in Mac OS X 10.7 Lion

Session 107

Tony Parker

Software Engineer, Cocoa Frameworks

These are confidential sessions—please refrain from streaming, blogging, or taking pictures

Agenda



Auto Save



Versions



iCloud

NSDocument



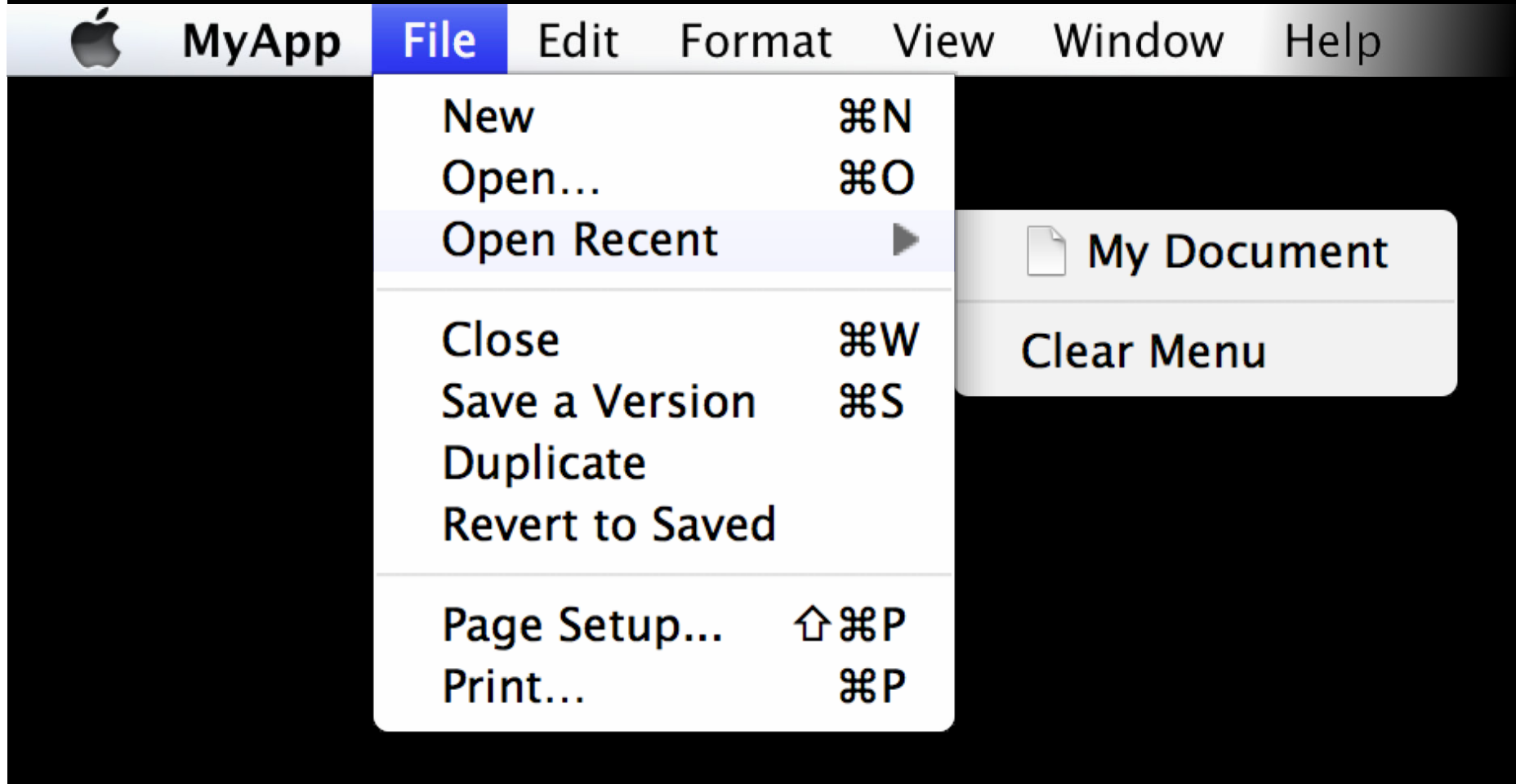
Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

Document-Based Application Basics

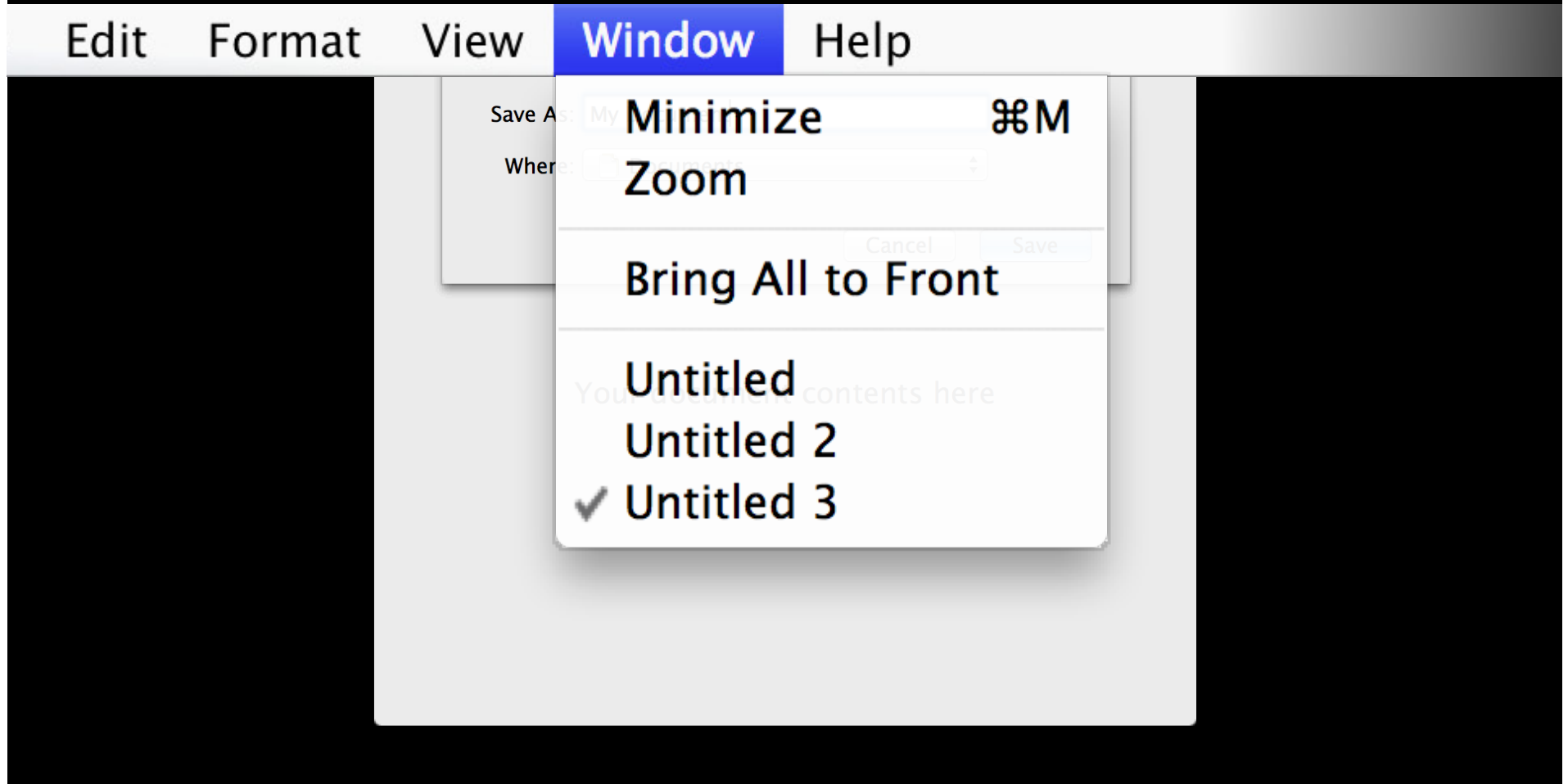
Document-Based Applications



NSDocument Features



NSDocument Features



NSDocument Features

- Edited state with undo integration
- Safe save
- Error presentation

NSDocument Features



- Sandboxing support
- File coordination
- Duplication
- Auto Save
- Versions
- Cloud document storage

Document Application Architecture

- NSDocumentController
- NSWindowController
- NSDocument

NSDocumentController

- Create, open, track, and manage documents

```
+ (id)sharedDocumentController;
- (NSArray *)documents;
- (IBAction)newDocument:(id)sender;
- (void)openDocumentWithContentsOfURL:(NSURL *)url
    display:(BOOL)displayDocument
    completionHandler:(void (^)(NSDocument *document,
                                BOOL documentWasOpen,
                                NSError *error))handler;
```

NSWindowController

- Manage one window associated with a document
- Typically customized by subclassing

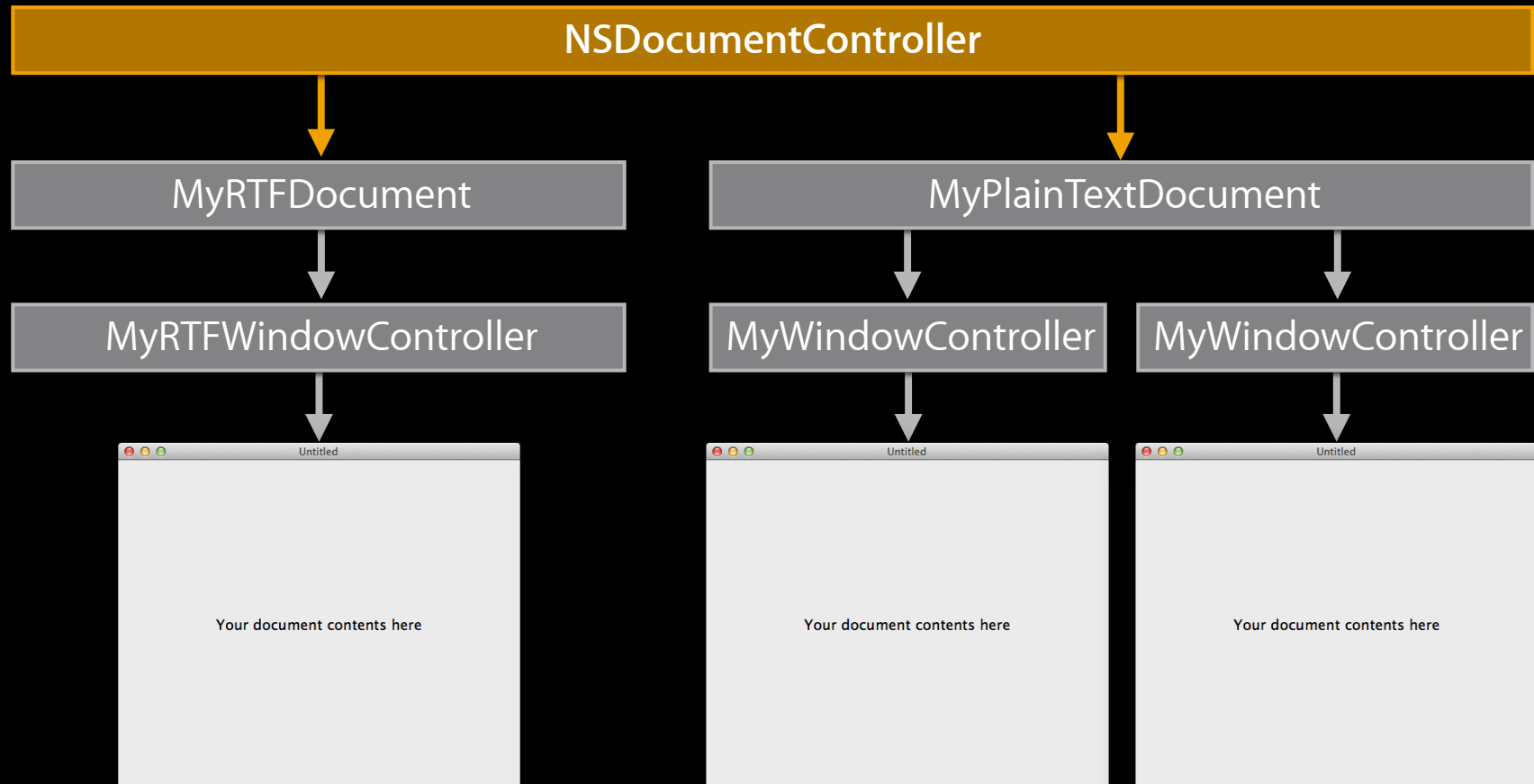
```
- (id)initWithWindowNibName:(NSString *)windowNibName  
                    owner:(id)owner;  
  
- (id)document;
```

NSDocument

- Represent, store, and load persistent data
- Always subclassed

- (BOOL)readFromData:(NSData *)data
 ofType:(NSString *)typeName
 error:(NSError **)outError;
- (NSData *)dataOfType:(NSString *)typeName
 error:(NSError **)outError;
- (IBAction)saveDocument:(id)sender;
- (NSURL *)fileURL;
- (BOOL)isDocumentEdited;

Document Application Architecture



Opening a Document

NSDocumentController

- openDocument:
- URLsFromRunningOpenPanel:
- openDocumentWithContentsOfURL:display:error:
- typeForContentsOfURL:error:
- makeDocumentWithContentsOfURL:ofType:error:

MyRTFDocument

NSDocumentController

-addDocument:

MyRTFDocument

-initWithContentsOfURL:ofType:error:

-readFromURL:ofType:error:

-readFromFileWrapper:ofType:error:

or

-readFromData:ofType:error:

-makeWindowControllers:

MyRTFWindowController

-initWithWindowNibName:
owner:

-showWindows:

-showWindow:

Saving a Document

MyRTFDocument

`-saveDocument:`

`-saveToURL:ofType:forSaveOperation:completionHandler:`

`-writeSafelyToURL:ofType:forSaveOperation:error:`

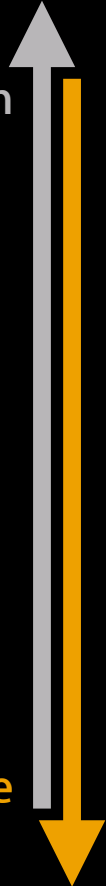
`-writeToURL:ofType:forSaveOperation:originalContentsURL:error:`

`-writeToURL:ofType:error:`

`-dataOfType:error: or -fileWrapperOfType:error:`

More custom

More for free



Auto Save

History of Flight

Lock
Duplicate
Revert to Last Opened
Browse All Versions...

View Outline Sections Text Box Shapes Tables Inspector Media Colors Fonts

Helvetica Neue Light

HISTORY OF FLIGHT

Travis Olsen, History 301

1783: First hot air balloon
1903: Wright bros. flight
1927: Charles Lindbergh
1937: Hindenburg disaster
1947: Spruce Goose
1947: Sound barrier broken
1970: Boeing 747
2004: SpaceShipOne

“Of all human endeavors, none have captured people’s imaginations quite like flight.”

HIGHLIGHTS

EARLY MODERN AVIATION

During the industrial revolution British chemists made discoveries about the properties of gases. These discoveries paved the way for Joseph and Etienne Montgolfier to build and fly the world’s first hot-air balloon in 1783.

Continued on Page 2

THE GOLDEN AGE

The advancements in aviation spurred by the necessity of war led to a blossoming of aviation during what is widely considered the Golden Age of flight (1919-1939). It would soon be clear that aviation would play a central role in defining society’s journey into the future.

Continued on Page 3

THE COMING OF THE JET

The invention of the jet engine that began with the Germans at the end of World War II completely revolutionized aviation. Aircraft



Future Flight



War Planes



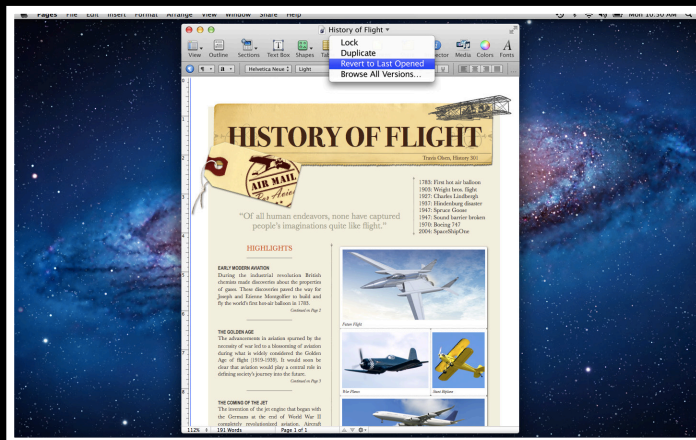
Stunt Biplane



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Auto Save

New



- Saves automatically at key times
- Frees user from worry of data loss
- Relieves user of manual and repetitive task
- Document on disk is document on screen

Enabling Auto Save



```
@implementation MyDocument
+ (BOOL)autosavesInPlace { return YES; }
@end
```

Demo

Kevin Perry

Software Engineer, Cocoa Frameworks

Polishing Auto Save User Experience

- Be smart about when to save
- Allow the user to cancel a save
- Save on background threads

Polishing Auto Save User Experience

Be smart about when to save

- NSDocument triggers autosave
- Quit
- Document close
- Switching applications
- Timer
- Reverting
- Your application can also trigger autosave

File Coordination

Saving and loading on demand

- Serializes access to files between applications
- NSDocument implements it for you
 - Autosaves when read is requested
 - Notifies when write is completed

Polishing Auto Save User Experience

Spend less time saving

- Saves now happen more frequently
- Avoid interrupting the user
- Only save what's changed
 - Use NSFileWrapper
 - Resources are stored in natural format
 - Allows quick copies

Polishing Auto Save User Experience

Avoid interrupting the user

- Two kinds of autosaving
 - Normal
 - Application quit
 - Document close
 - Too long since last save
 - Implicitly cancellable
 - Timer

Canceling Saving

```
- (BOOL)writeToURL:(NSURL *)url
    ofType:(NSString *)type
    error:(NSError **)err
{
    while (stillSaving) {
        // Do some work
        if ([self autosavingIsImplicitlyCancellable] && checkForUserActivity()) {
            // Abort save
            if (err) *err = [NSError errorWithDomain:NSCocoaErrorDomain
                                           code:NSUserCancelledError
                                           userInfo:nil];

            return NO;
        }
    }
}
```

Polishing Auto Save User Experience



Enable asynchronous saving

```
@implementation MyDocument
```

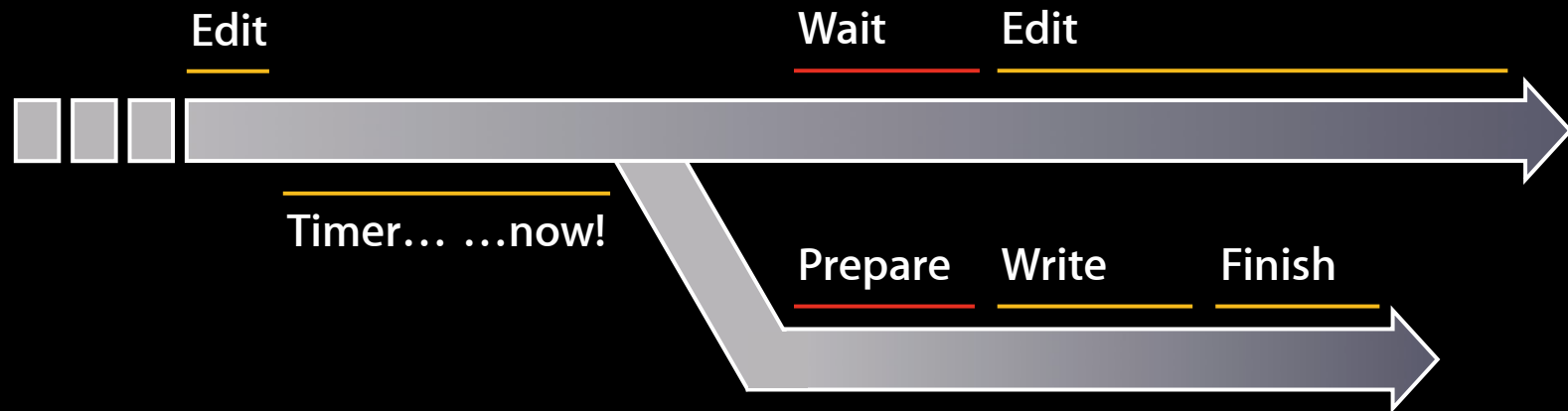
```
- (BOOL)canAsynchronouslyWriteToURL:(NSURL *)url  
                                ofType:(NSString *)type  
                                forSaveOperation:(NSSaveOperationType)op  
{  
    return YES;  
}
```

```
@end
```

Synchronous Autosaving



Asynchronous Autosaving



Asynchronous Saving

Use background threads

- Save operation starts on main thread
 - `saveToURL:ofType:forSaveOperation:completionHandler:`
- Main thread blocks
- Saving started on background thread
 - `writeSafelyToURL:ofType:forSaveOperation:error:`
- Background thread allows main thread to continue after snapshot
 - `unlockUserInteraction`
- Background thread finishes saving

Serialized Resources

User Activities



Save
Revert
Duplicate
Print

File Access



URL
Modification date
On-disk contents
Edit state

Asynchronous Saving

Coordinating threads during save

- Main thread needs to present something to the user

- `(void)performActivityWithSynchronousWaiting:(BOOL)waitSynchronously
usingBlock:
(void (^)(void (^)(^activityCompletionHandler)(void)))block;`


- Any thread needs to access the document file

- `(void)performSynchronousFileAccessUsingBlock:(void (^)(void))block;`

- `(void)performAsynchronousFileAccessUsingBlock:
(void (^)(void (^)(^fileAccessCompletionHandler)(void)))block;`

Asynchronous File Access Example

Asynchronous file access
Perform background work
End asynchronous file access



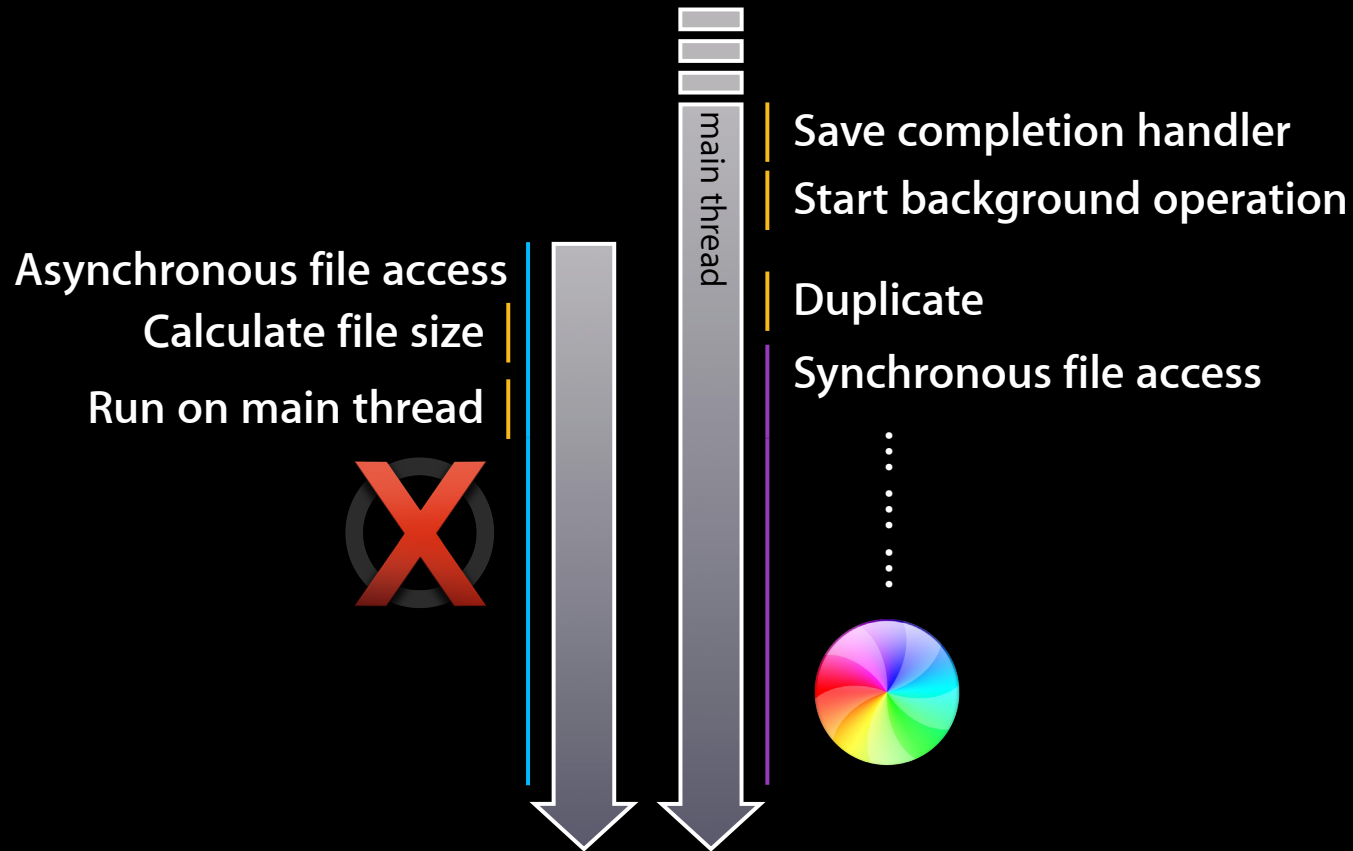
Save completion handler
Start background operation

Asynchronous Saving

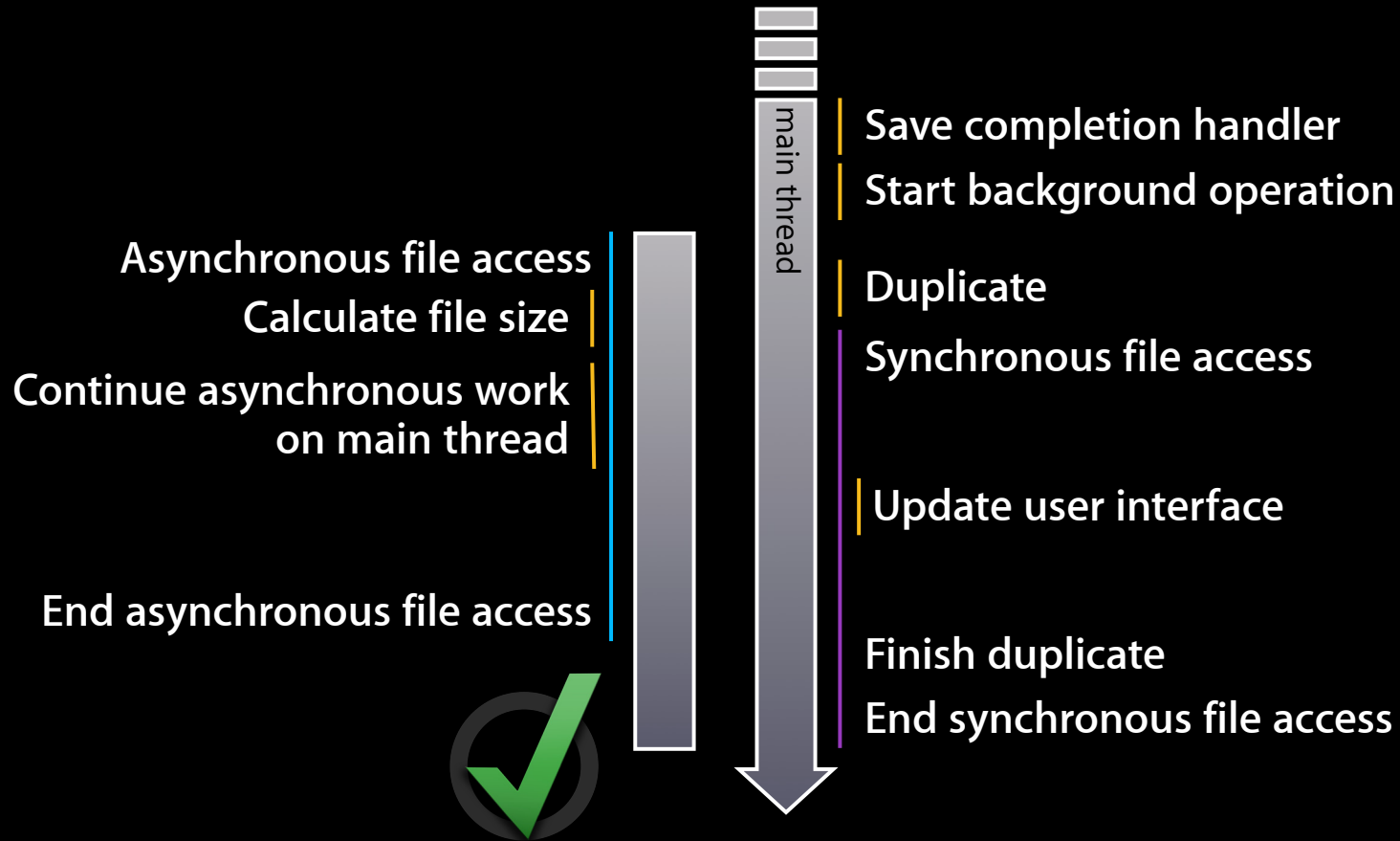
Avoiding deadlock

- User activities and file access must be coordinated
- Use NSDocument methods
 - `(void)continueAsynchronousWorkOnMainThreadUsingBlock:(void (^)(void))block;`
 - `(void)continueActivityUsingBlock:(void (^)(void))block;`
- Example
 - After save, calculate file size
 - Display to user in inspector panel

Calculate File Size



Calculate File Size



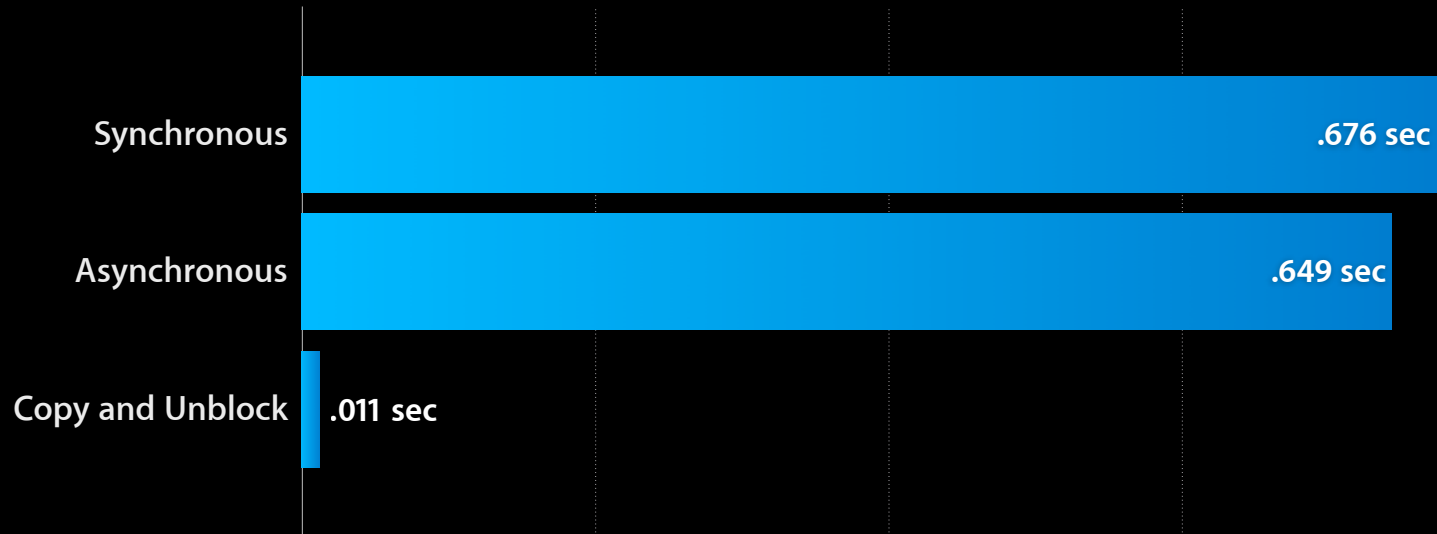
Demo

Kevin Perry

Software Engineer, Cocoa Frameworks

Performance Gains from Unblocking Early

Time to user responsiveness



Time the main thread spends blocked during autosave of Sketch document with 10,000 shapes. MacBook Pro, 2.8 GHz Core 2 Duo, 4 GB RAM.

Versions

History of Flight.pages (Page Layout)

View Outline Pages Text Box Shapes Table Charts Comment Share Inspector Media Colors

Opacity: Shadow Reflection

HISTORY OF FLIGHT


Travis Olsen, History 301

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"Of all human endeavors, none have captured people's imaginations quite like flight."

HIGHLIGHTS


EARLY MODERN AVIATION
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Continued on Page 2



Fair Flight



War Plane



Over Riplane

THE GOLDEN AGE
The advancements in aviation spurred by the necessity of war led to a blossoming of aviation during what is widely considered the Golden Age of flight (1919-1939). It would soon be clear that aviation would play a central role in defining society's journey into the future.
Continued on Page 3

THE COMING OF THE JET
The invention of the jet engine that began with
Continued on Page 3

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Continued on Page 3

THE COMING OF THE JET
The invention of the jet engine that began with the Germans at the end of World War II completely revolutionized aviation. Aircraft could now fly at unheard-of speeds, including supersonic.
Continued on Page 3

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Current Document

Done

Restore

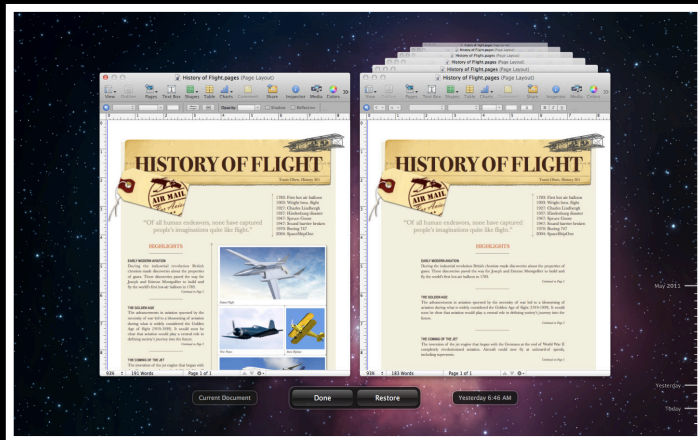
Yesterday 6:46 AM

May 2011

Yesterday

Today

Versions Browser



- Expands revert options
 - Further back in time
 - Selective reverting
- Protects against unintentional change
- Compressed storage
- Automatically manages versions
- Integrated with Time Machine

Polishing Versions User Experience

- Adopt asynchronous document opening
- Show only relevant controls in Versions browser
- Resize windows to best viewing dimensions
- Allow discardable changes

Polishing Versions User Experience



Show different interface for versions

- Provide focused interface, including hiding toolbars and inspectors
- Notifications are posted on version browser enter and exit

`NSNotificationWillEnterVersionBrowserNotification`

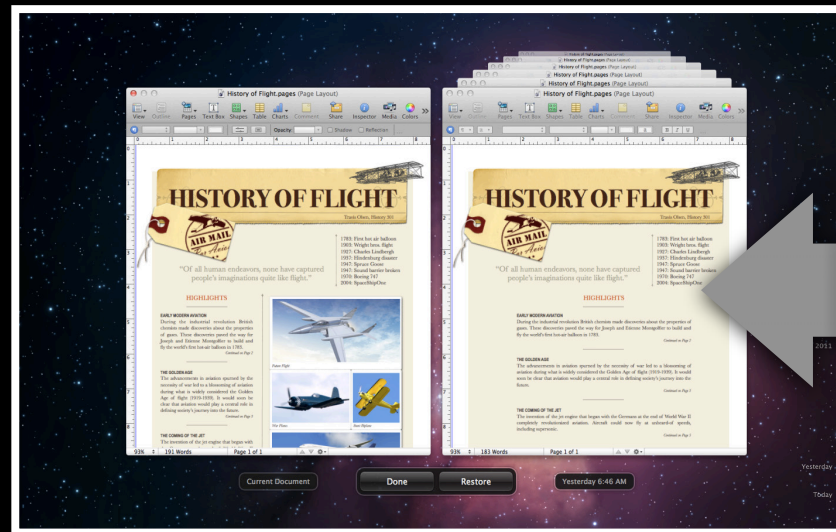
`NSNotificationDidExitVersionBrowserNotification`

Polishing Versions User Experience

Show different interface for versions

New

- Document displayed in version browser
 - (BOOL)isInViewingMode;



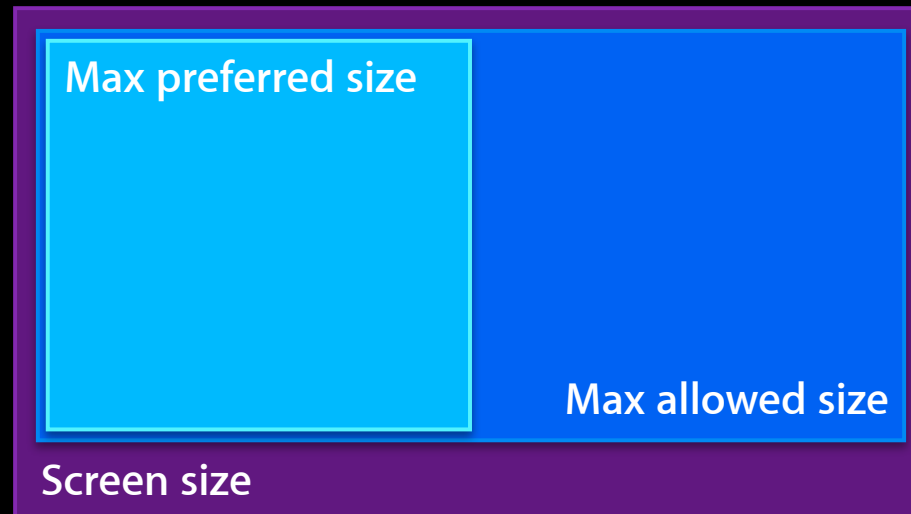
Polishing Versions User Experience

New

Make document window the best size

- NSWindowDelegate method

```
- (NSSize)window:(NSWindow *)window  
willResizeForVersionBrowserWithMaxPreferredSize:(NSSize)prefSize  
maxAllowedSize:(NSSize)allowedSize;
```



Polishing Versions User Experience

A blue rectangular badge with rounded corners and a subtle starry pattern, containing the word "New" in white text.

Allow some changes to viewing mode documents

- Changes to viewing mode documents are automatically undone
- To allow, the change must be discardable
 - Normally autosaved
 - May be discarded on locked or viewing mode documents
- Examples
 - Expanded or hidden state of slide group in Keynote
 - Currently displayed chart in Numbers

Polishing Versions User Experience

Allow some changes to viewing mode versions



- Use via NSUndoManager

```
[myUndoManager setActionIsDiscardable:YES];
```

NSFileVersion



- Foundation-level access to versions without NSDocument
- Caller responsible for file coordination and version management

NSFileVersion

- Get an array of NSFileVersion instances for a file
+ (NSArray *)otherVersionsOfItemAtURL:(NSURL *)url;

NSFileVersion

- Revert to an old version of a file

```
- (NSURL *)replaceItemAtURL:(NSURL *)url options:  
  (NSFileVersionReplacingOptions)options error:(NSError **)error;
```

Demo

Kevin Perry

Software Engineer, Cocoa Frameworks

iCloud

Cloud Storage



- NSDocument will use Versions to resolve conflicts
- File coordination will update contents when needed
- Move document to cloud
- Find documents in cloud

Moving a Document to iCloud

- Use NSFileManager

- Find container

- (NSURL *)URLForUbiquityContainerIdentifier:(NSString *)identifier;

- Make document ubiquitous

- (BOOL)setUbiquitous:(BOOL)flag
 itemAtURL:(NSURL *)url
 destinationURL:(NSURL *)destinationURL
 error:(NSError **)error;

Finding iCloud Documents

- Use NSMetadataQuery

- New search scope

`NSMetadataQueryUbiquitousDocumentsScope`

- NSURL properties

`NSURLIsUbiquitousItemKey`

`NSURLUbiquitousItemIsDownloadedKey / NSURLUbiquitousItemIsDownloadingKey`

`NSURLUbiquitousItemPercentDownloadedKey`

`NSURLUbiquitousItemIsUploadedKey / NSURLUbiquitousItemIsUploadingKey`

`NSURLUbiquitousItemPercentUploadedKey`

Demo

Kevin Perry

Software Engineer, Cocoa Frameworks

What We Learned

Make your document-based app a first-class Lion citizen

- Auto Save

- `+ (BOOL)autosavesInPlace { return YES; }`

- Polish by saving fast and adopting async saving

More Information

Bill Dudney

Application Frameworks Evangelist
dudney@apple.com

Documentation

Mac OS X Dev Center
<http://developer.apple.com/devcenter/mac>

Apple Developer Forums

<http://devforums.apple.com>

NSDocument header files

87% comments!

Related Sessions

Taking Advantage of File Coordination

Pacific Heights
Tuesday 4:30PM

Resume and Automatic Termination in Lion

Marina
Thursday 9:00AM

Labs

Cocoa Lab	App Frameworks Lab A Tuesday 2:00-6:00PM
Cocoa and Autolayout Lab	App Frameworks Lab A Wednesday 9:00-11:15AM
Cocoa, Full Screen, and Aqua Lab	App Frameworks Lab A Wednesday 2:00-6:00PM
Cocoa, Auto Save, File Coordination, and Resume Lab	App Frameworks Lab A Thursday 2:00-4:15PM

