Building from the Command Line with Xcode

Session 404

Anders Bertelrud
Xcode Architect

Roadmap

- Why use the command line?

Roadmap

- Why use the command line?
- Using `xcodebuild`

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- Customizing your project

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- Why use the command line?
- Using `xcodebuild`
- Customizing your project
- Automating `xcodebuild`
- Working outside Xcode

Why Use the Command Line?

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- Automation
  - Nightly release builds
  - Continuous Integration systems

Why Use the Command Line?

- Automation
  - Nightly release builds
  - Continuous Integration systems
- Make-based open source development
  - Cross-platform code
  - MacPorts, Fink, Homebrew…

Using `xcodebuild`

What Is `xcodebuild`?

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- Command line access to Xcode IDE

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- Works with projects and workspaces

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- Command line access to Xcode IDE
- Works with projects and workspaces
- Batch operations
  - Build
  - Archive
  - Query

What Is `xcodebuild`?

- Command line access to Xcode IDE
- Works with projects and workspaces
- Batch operations
  - Build
  - Archive
  - Query
- Use `man xcodebuild` for the details

Using `xcodebuild`

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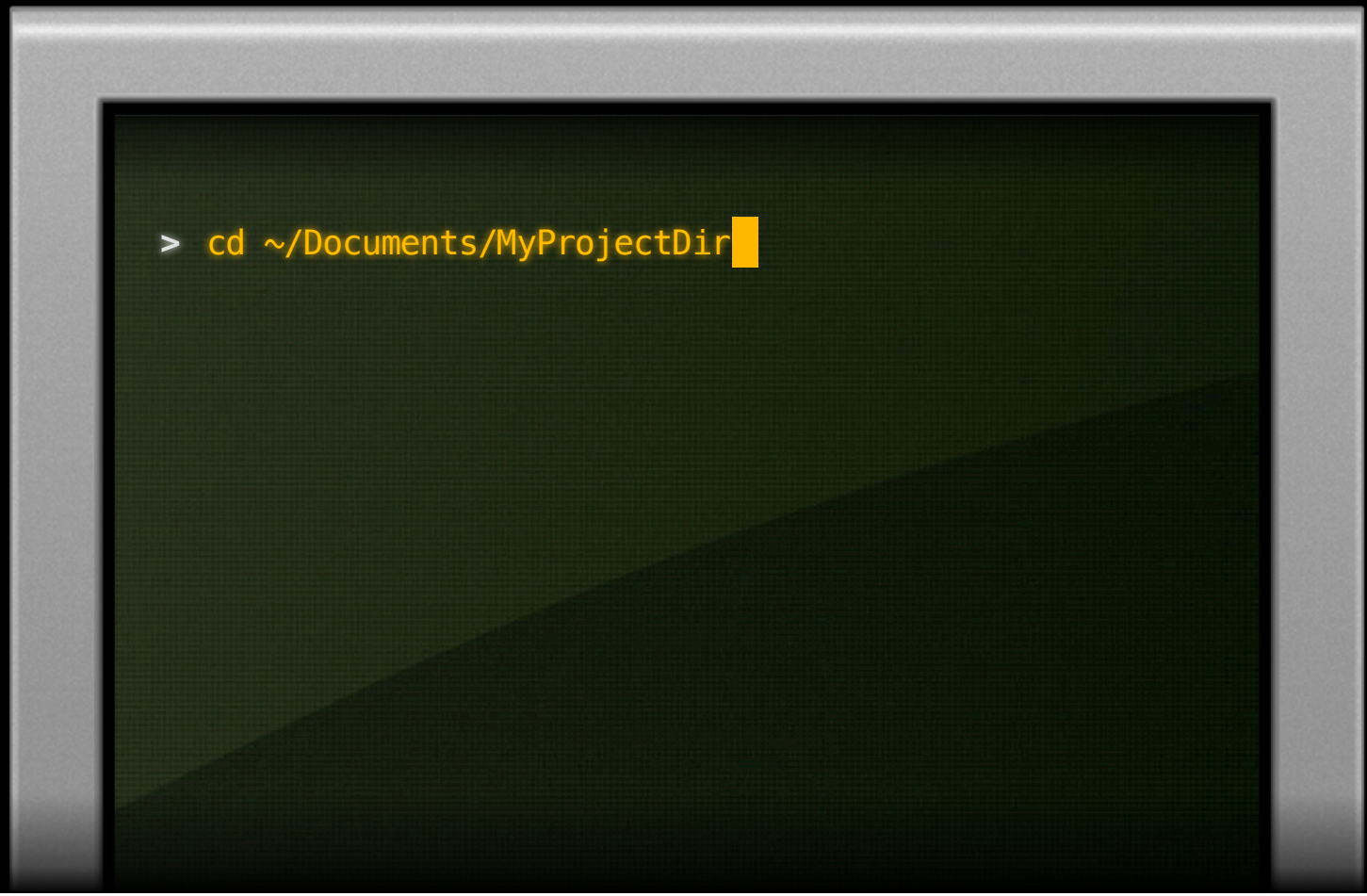
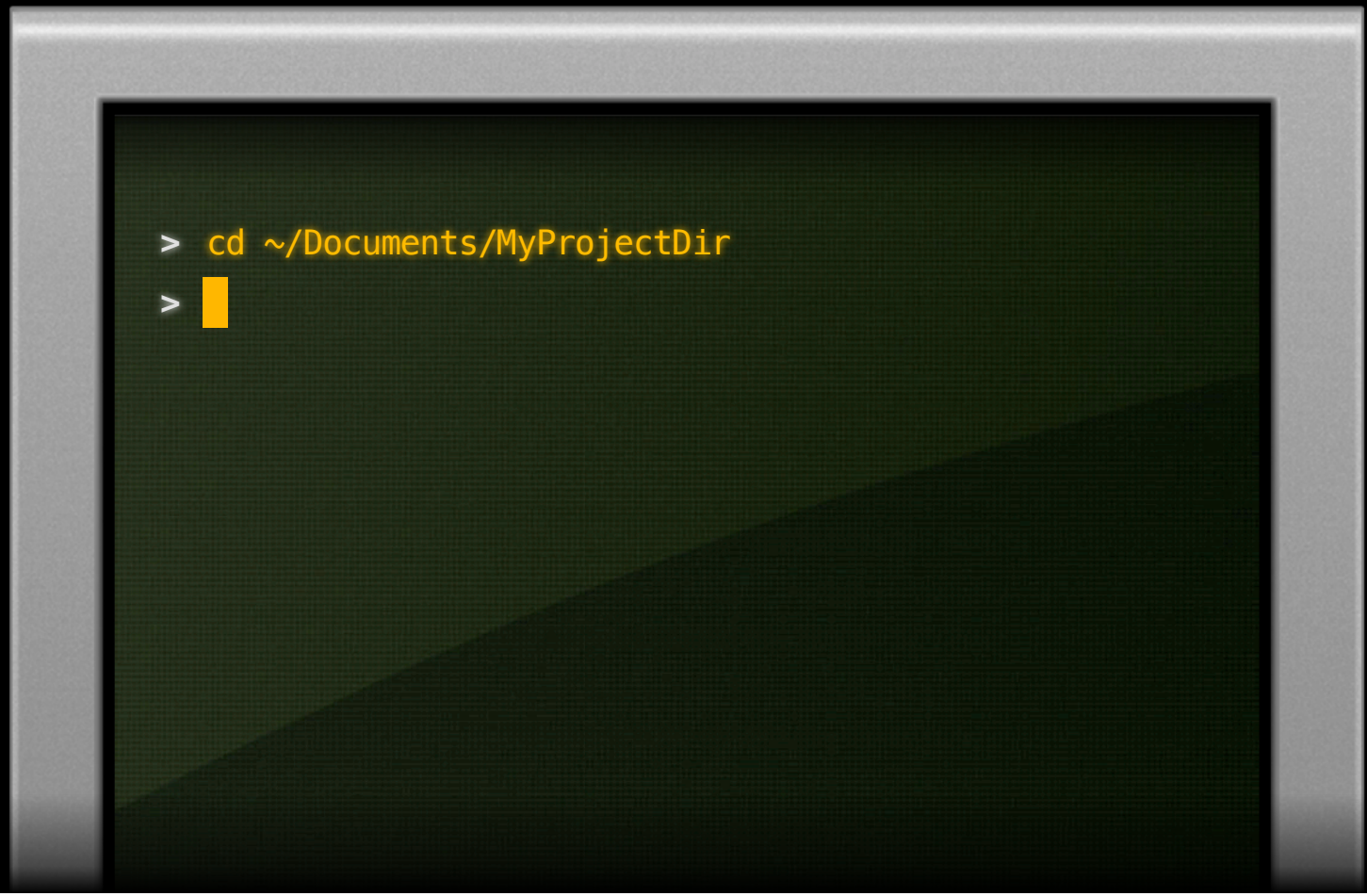


Using `xcodebuild`



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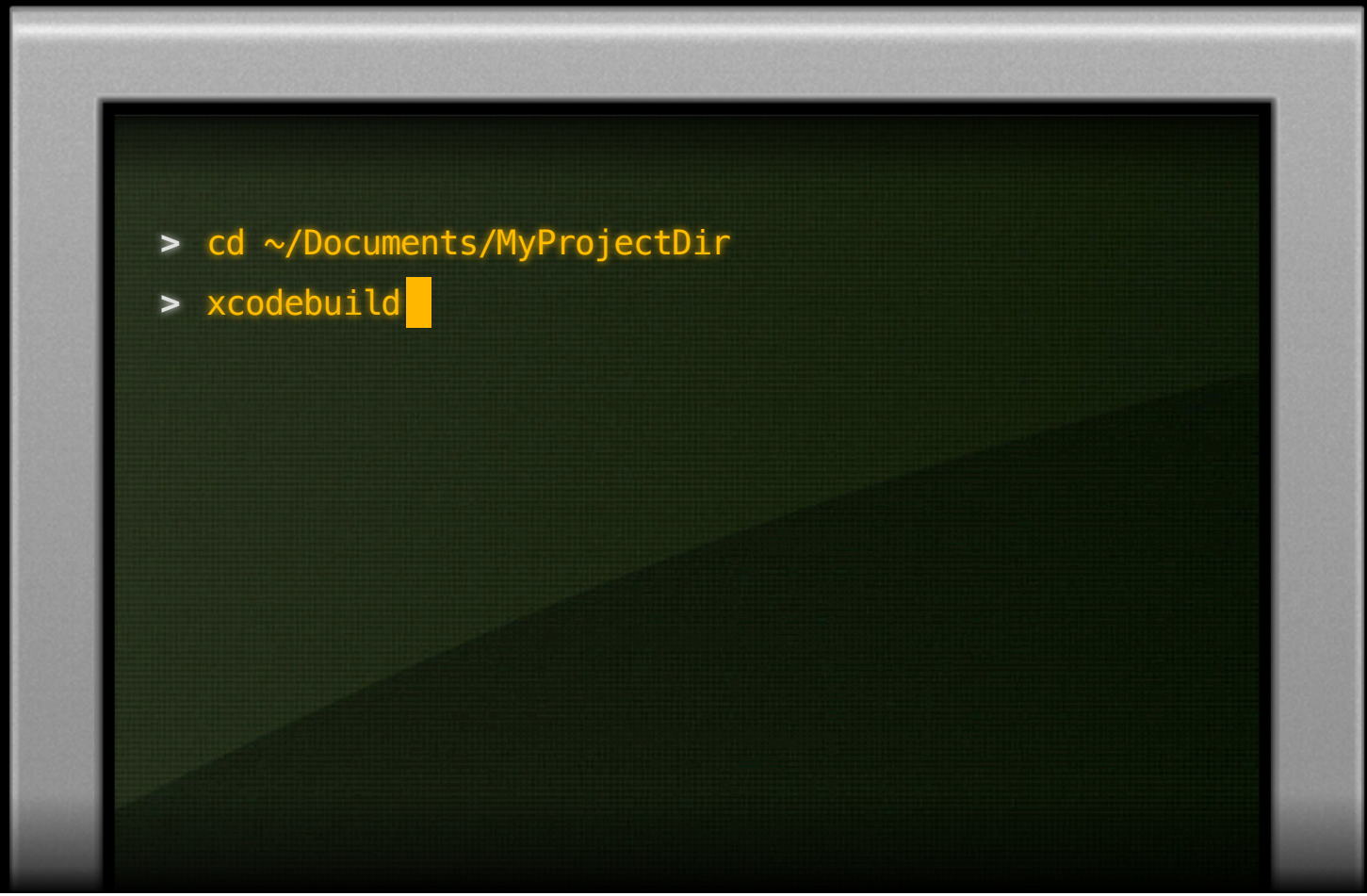


Using `xcodebuild`

```
> cd ~/Documents/MyProjectDir
> xcodebuild
=== BUILD NATIVE TARGET Baffle OSX OF PROJECT Baffle
OSX WITH CONFIGURATION Debug ===

ProcessPCH build/Intermediates/PrecompiledHeaders/Baff
leCocoa_Prefix-dkhujustkymhfqbdihrzilncxtxa/BaffleCoco
a_Prefix.pch.pth OtherSources/BaffleCocoa_Prefix.pch n
ormal x86_64 objective-c com.apple.compilers.llvm.clan
g.1_0.compiler

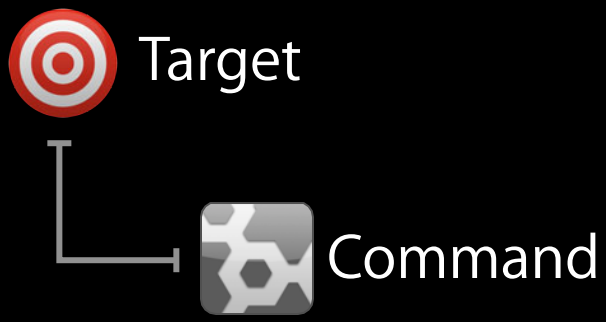
                          :
```

Build Log Structure

Build Log Structure

Target

Build Log Structure



Build Log Structure

Build Logs in the Console

```
=== BUILD NATIVE TARGET Baffle OSX OF PROJECT Baffle OSX

CpResource ../SharedResources/BGShake.png build/Debug/Ba
    cd /Users/anders/WWDC2012/Baffle
    builtin-copy -exclude .DS_Store -exclude CVS -exclud

CpResource ../SharedResources/BGCubeFace.png build/Debug
    cd /Users/anders/WWDC2012/Baffle
    builtin-copy -exclude .DS_Store -exclude CVS -exclud

CpResource ../SharedResources/BGSwirl-Green.png build/De
    cd /Users/anders/WWDC2012/Baffle
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CopyStringsFile build/Debug/Baffle\ OSX.app/Contents/Res
    cd /Users/anders/WWDC2012/Baffle
    builtin-copyStrings --validate --inputencoding utf-1
```

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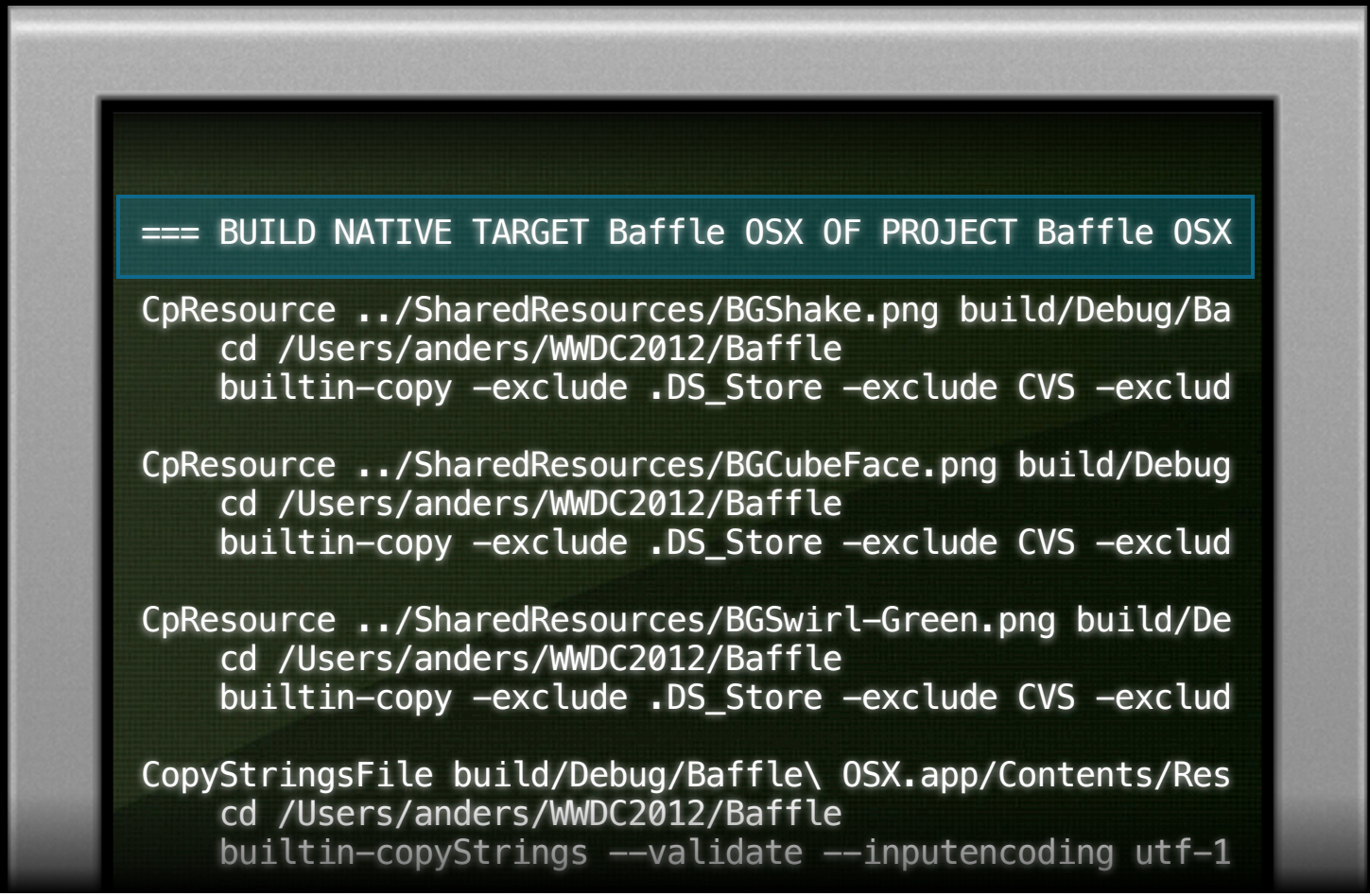

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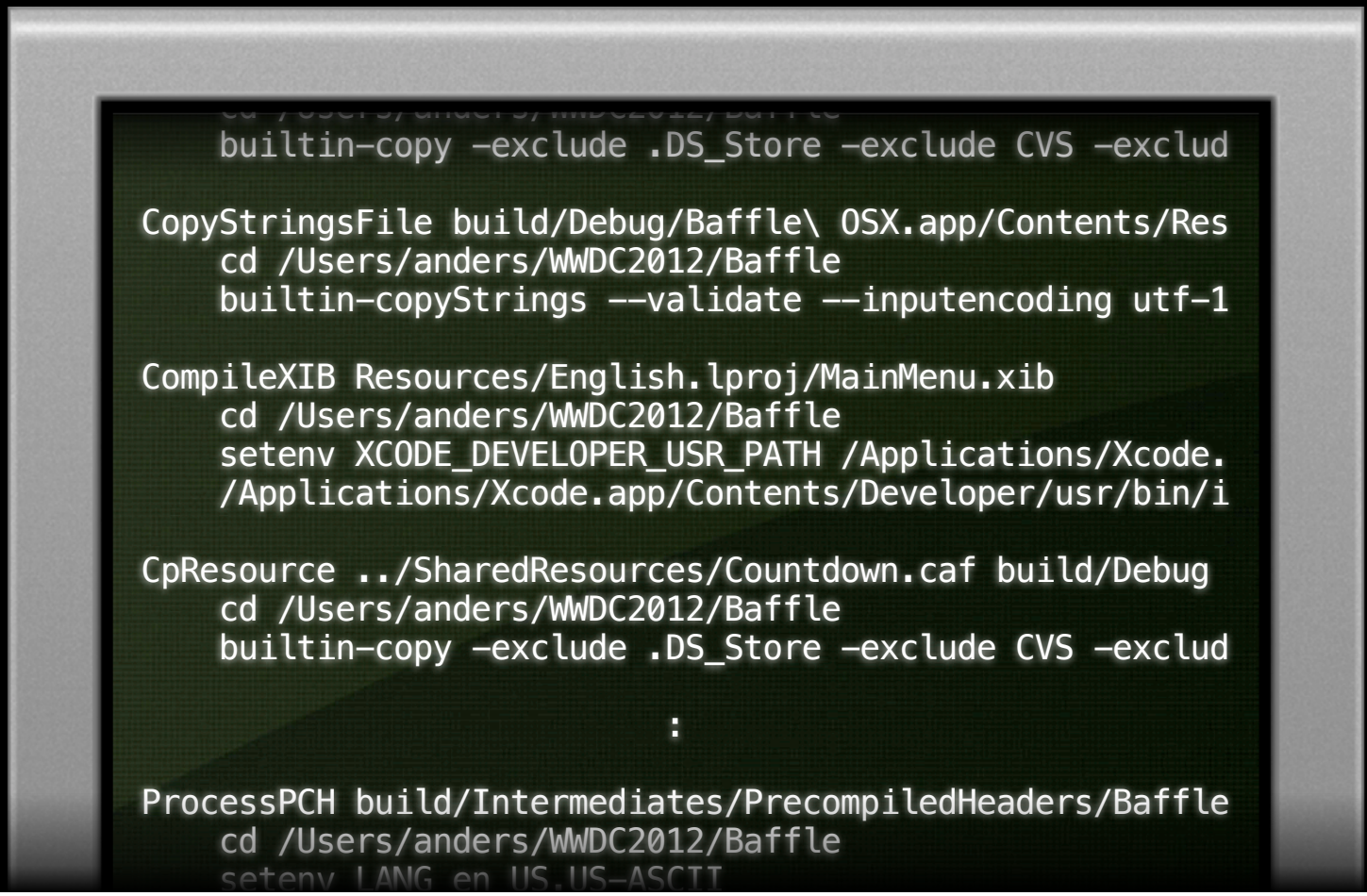

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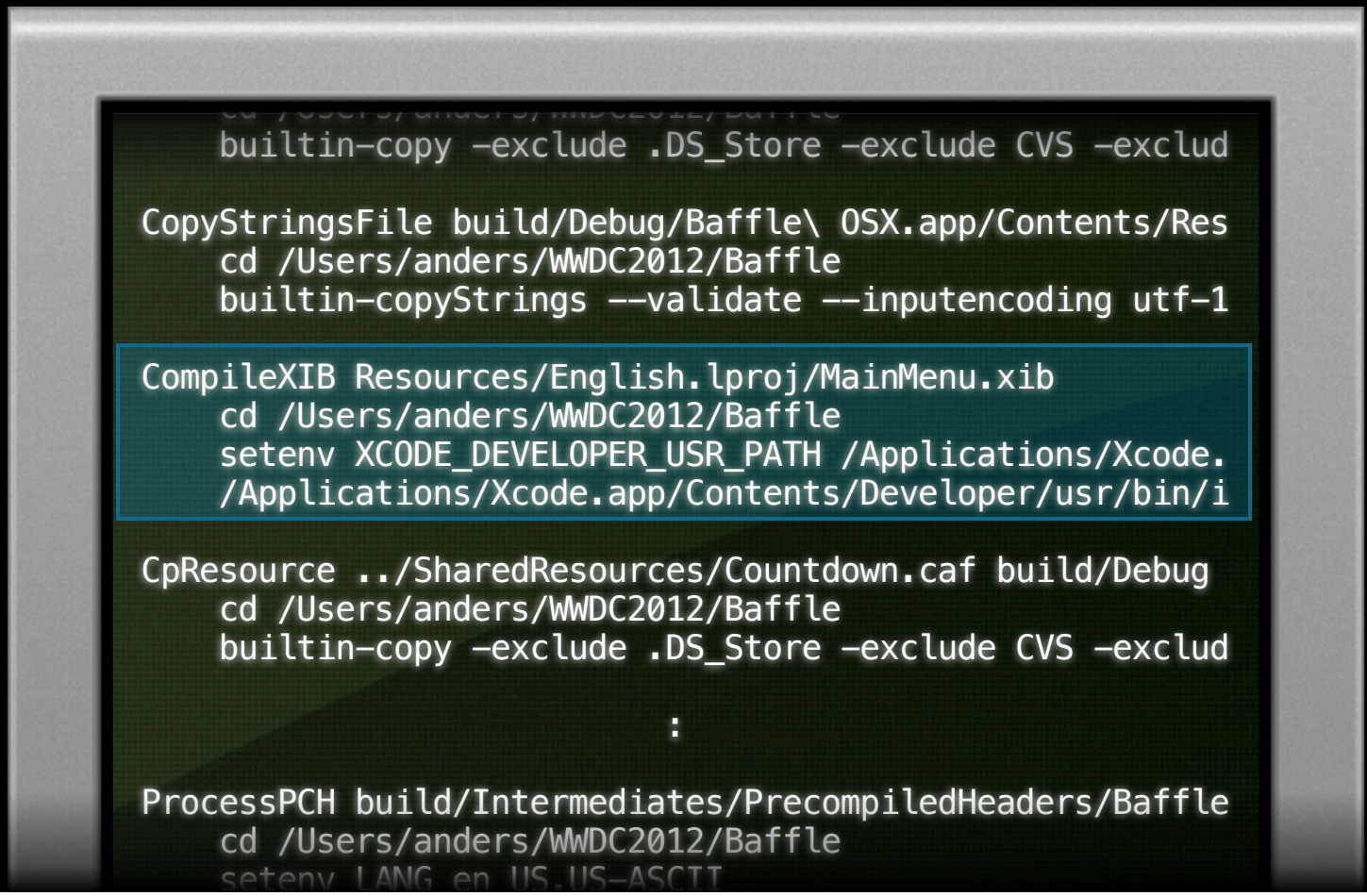

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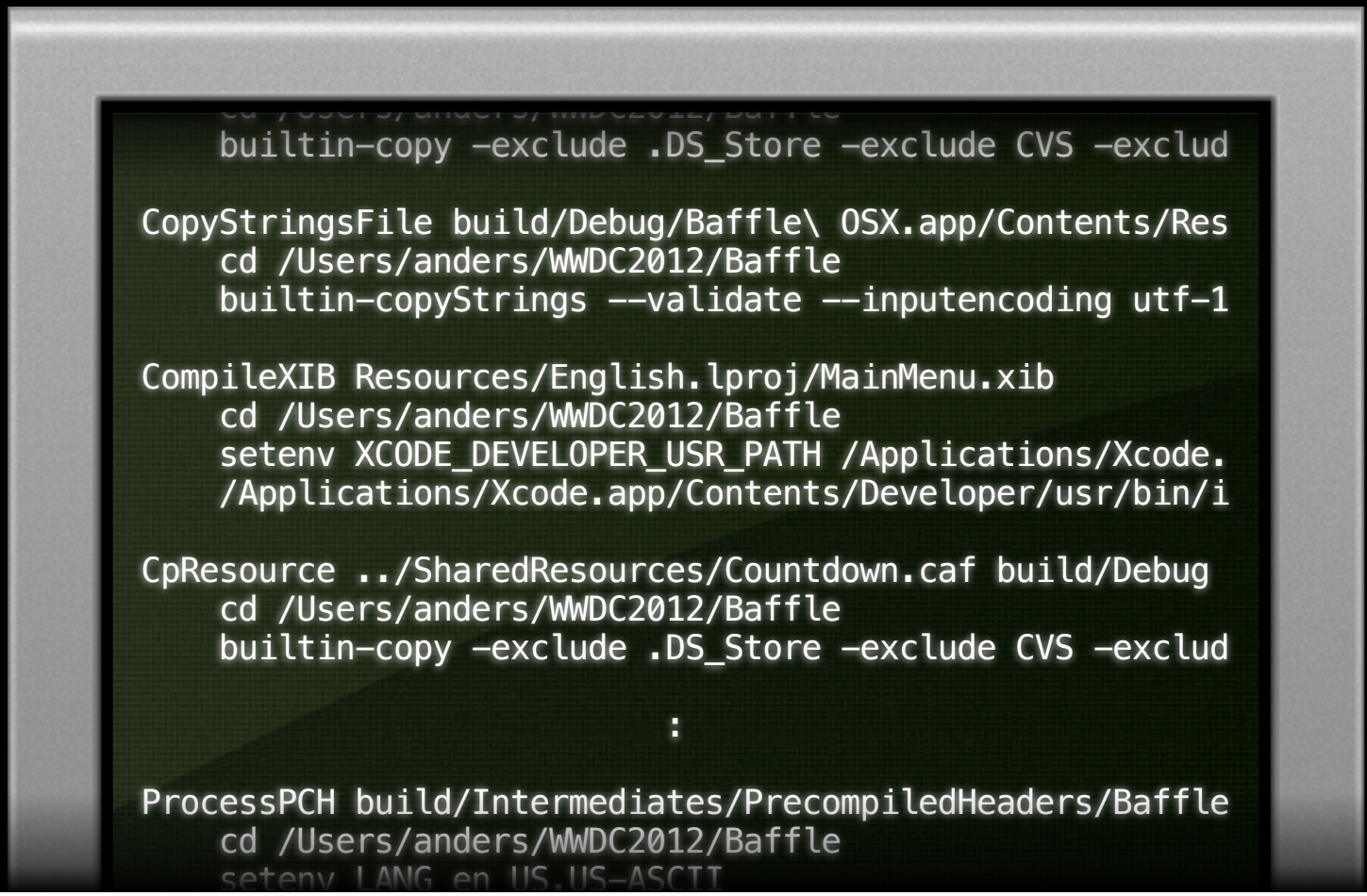

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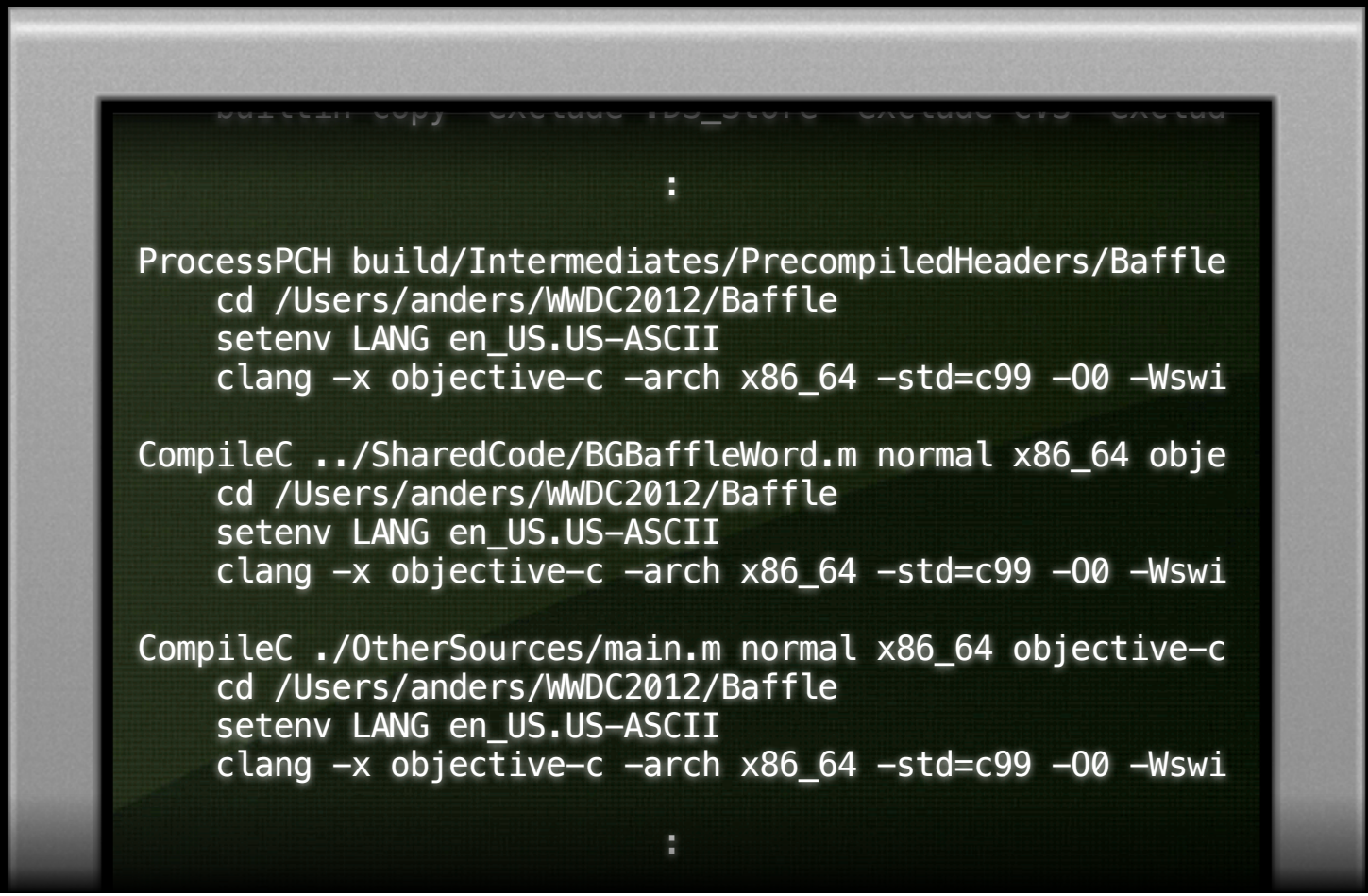

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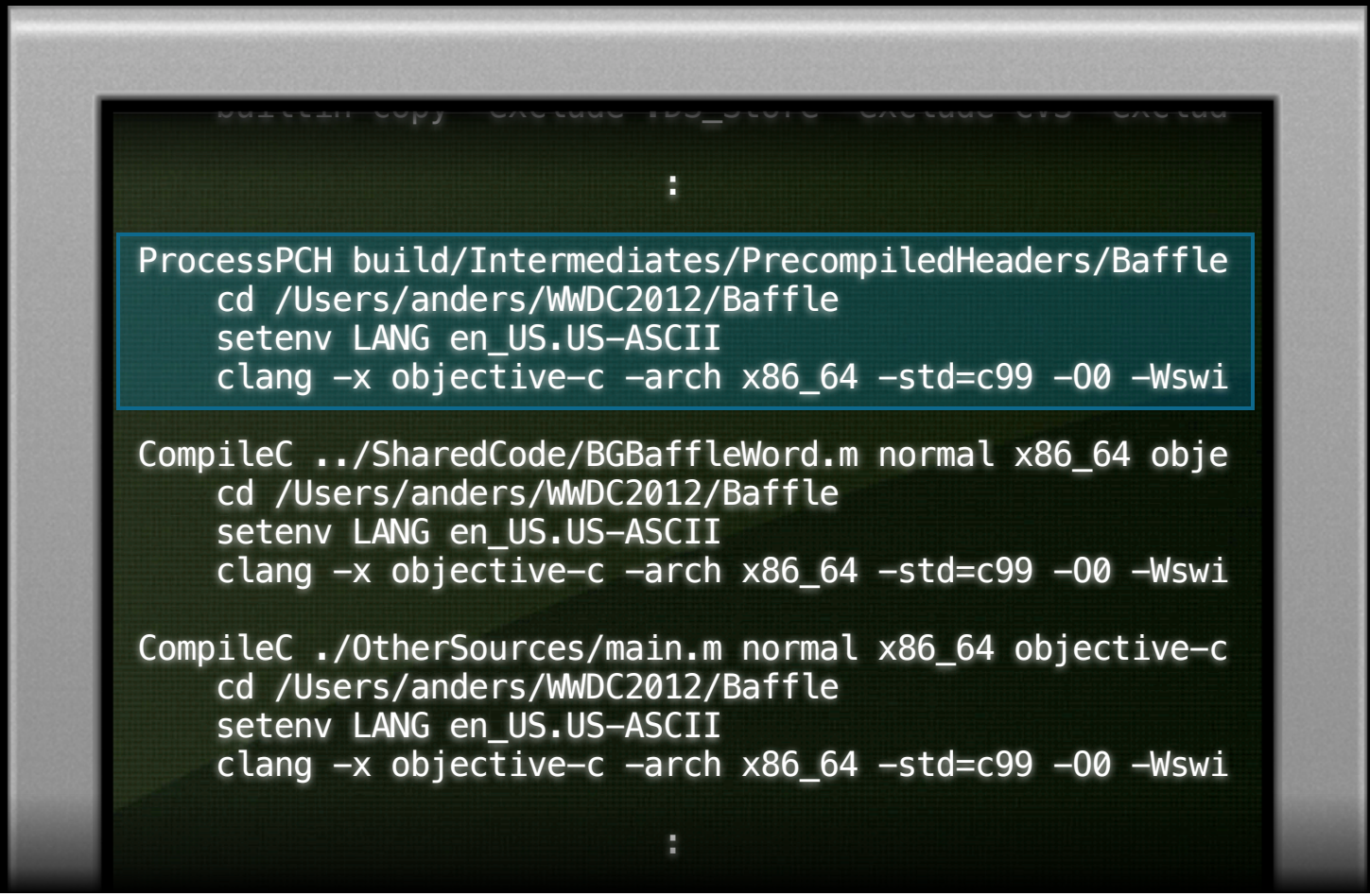

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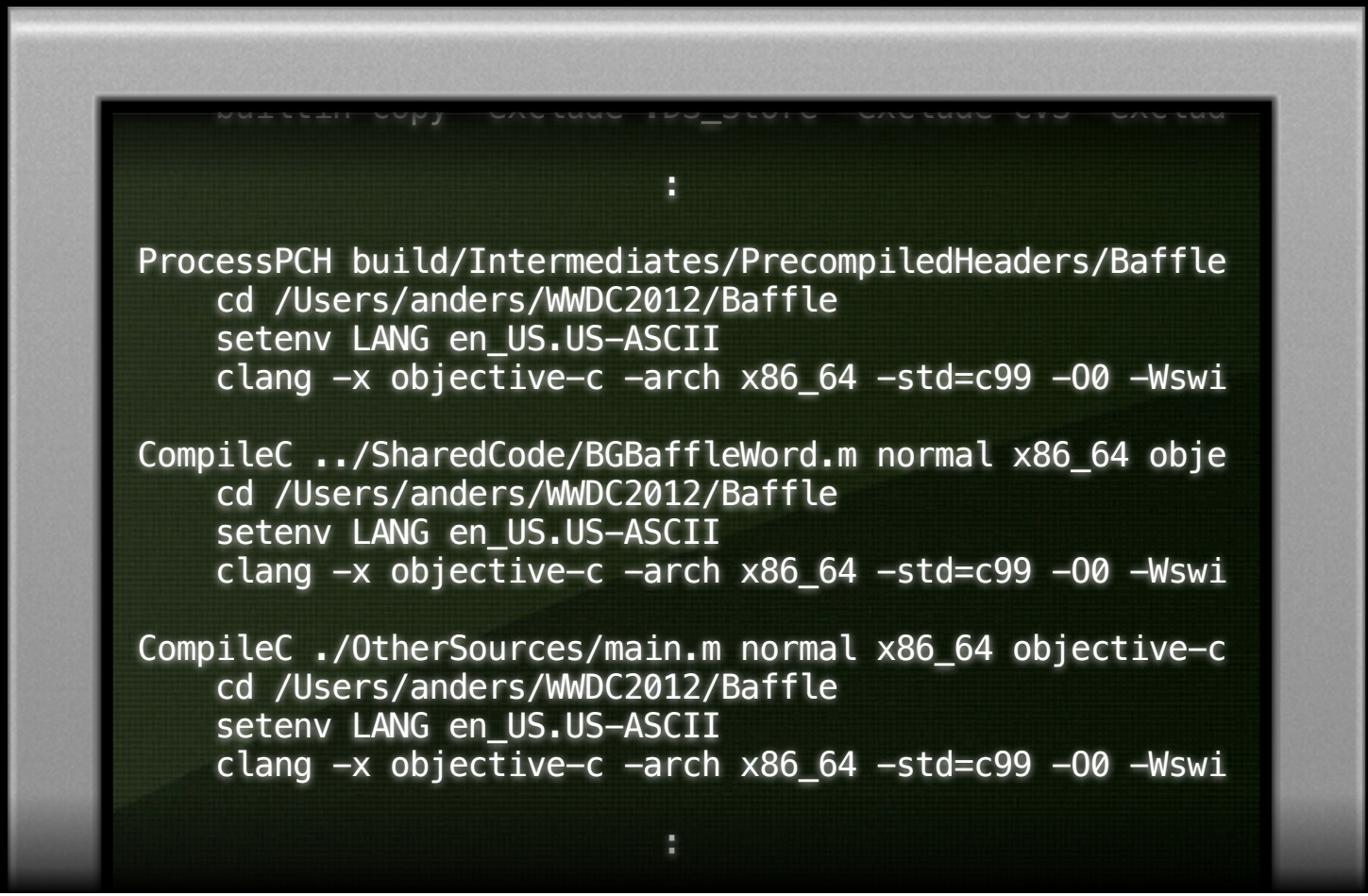

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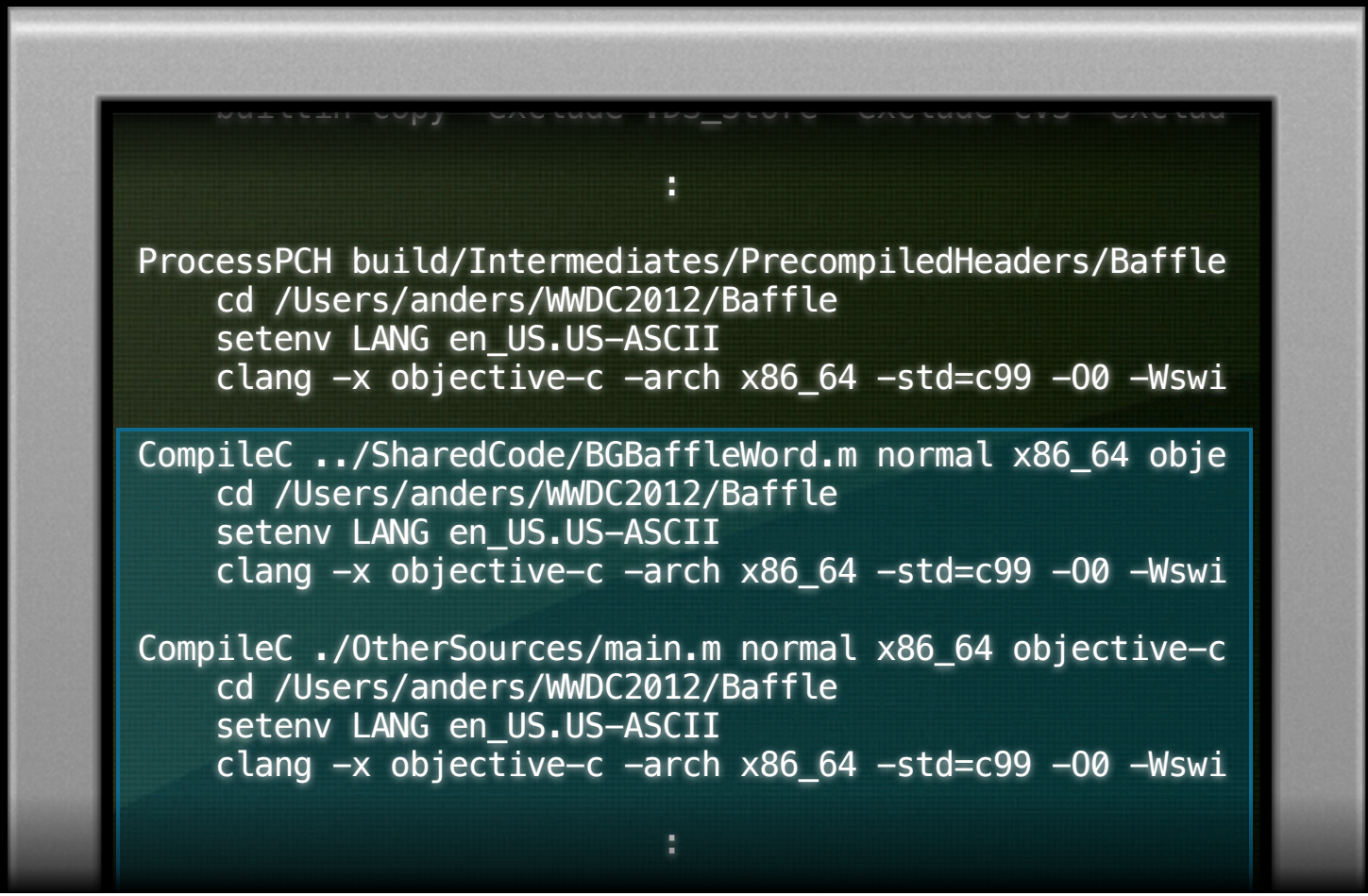

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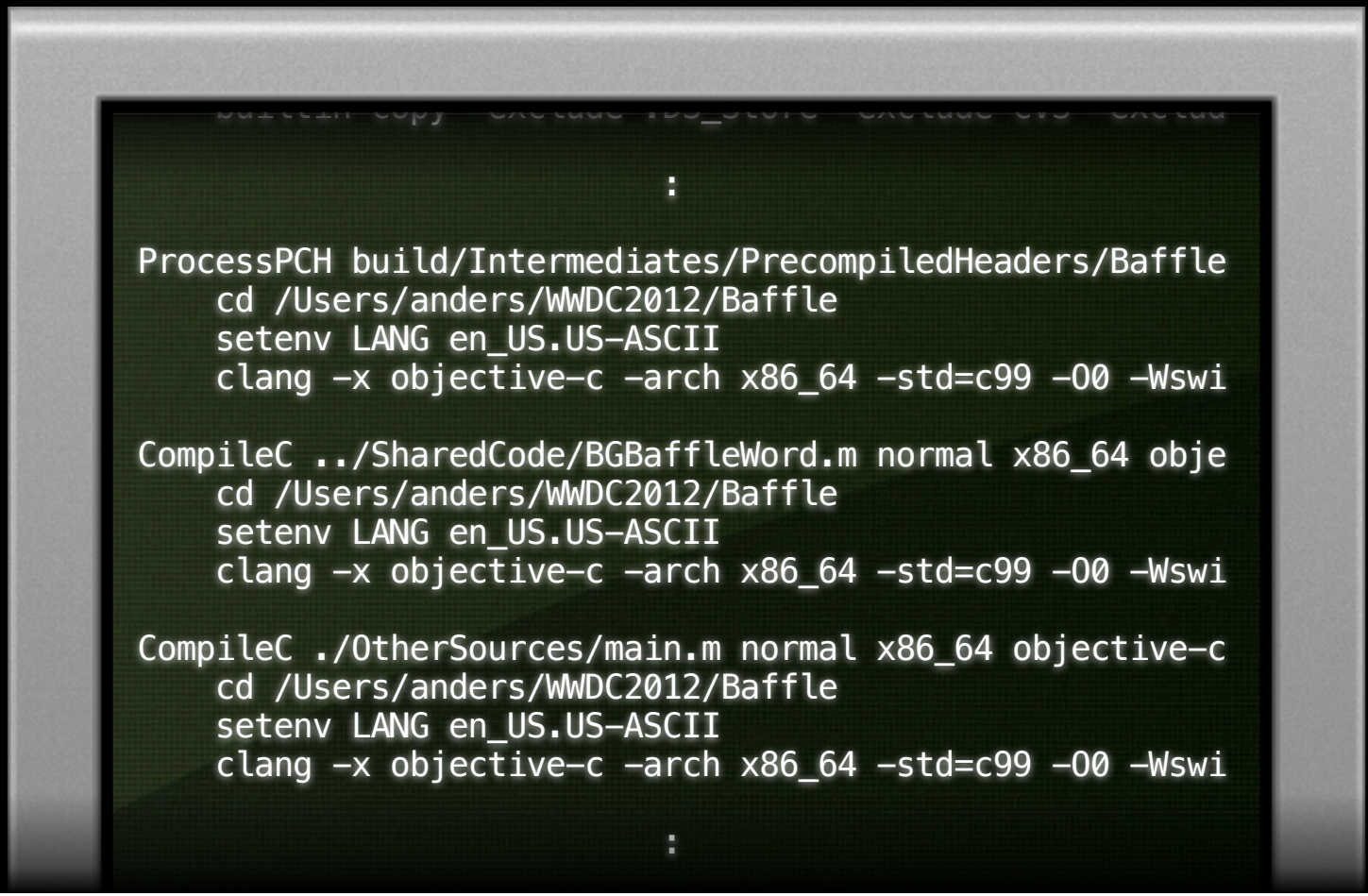

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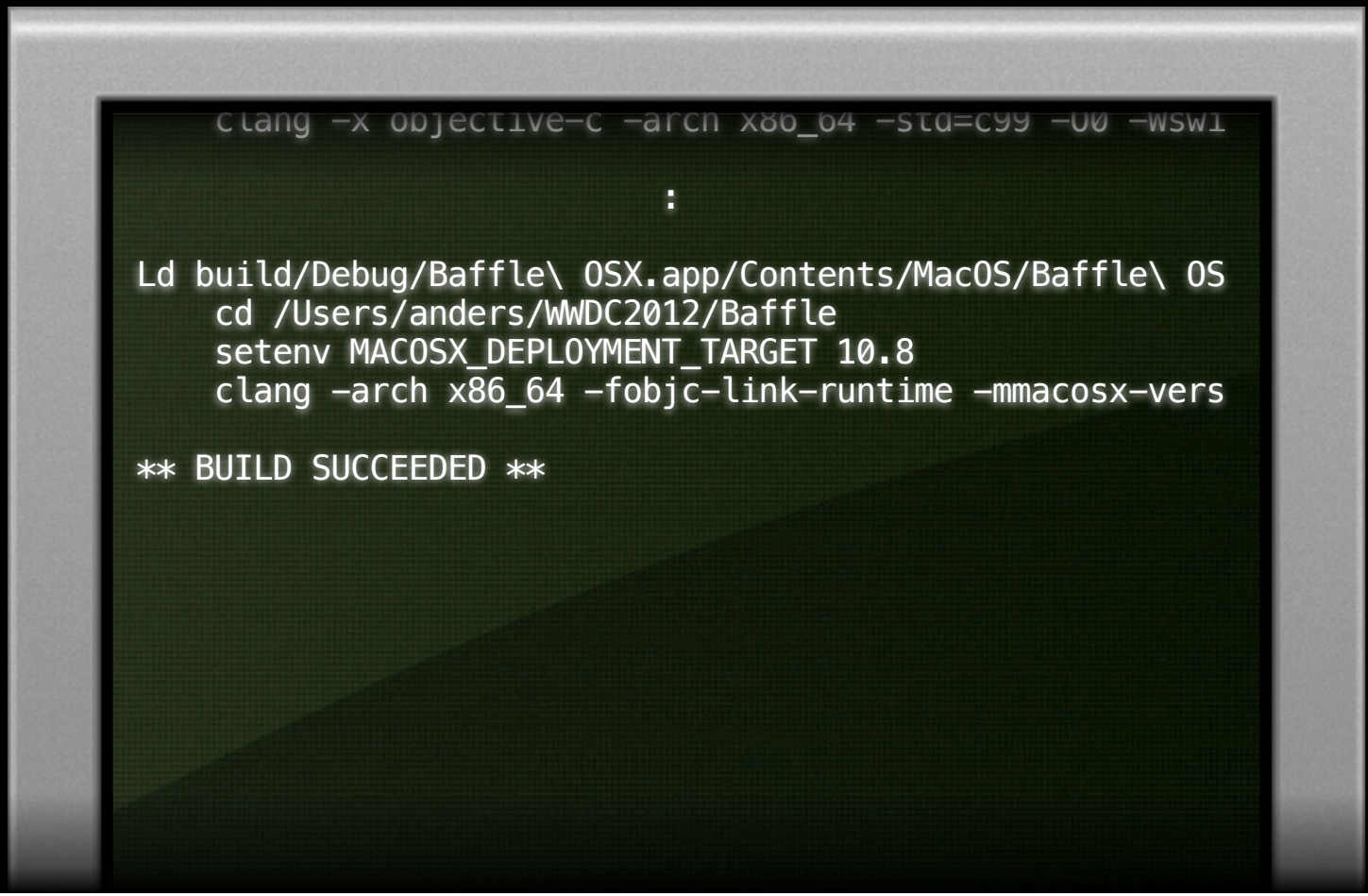

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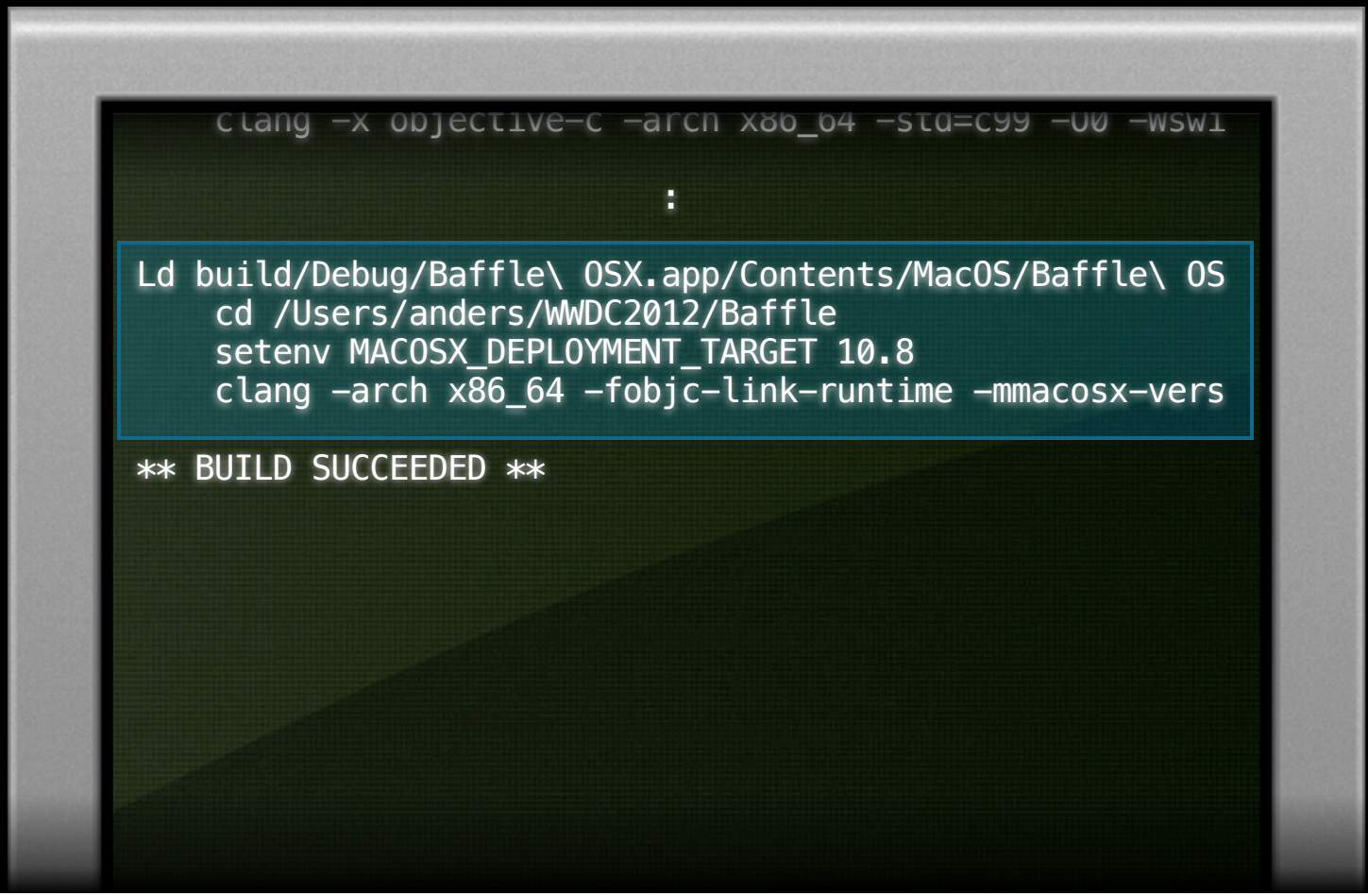

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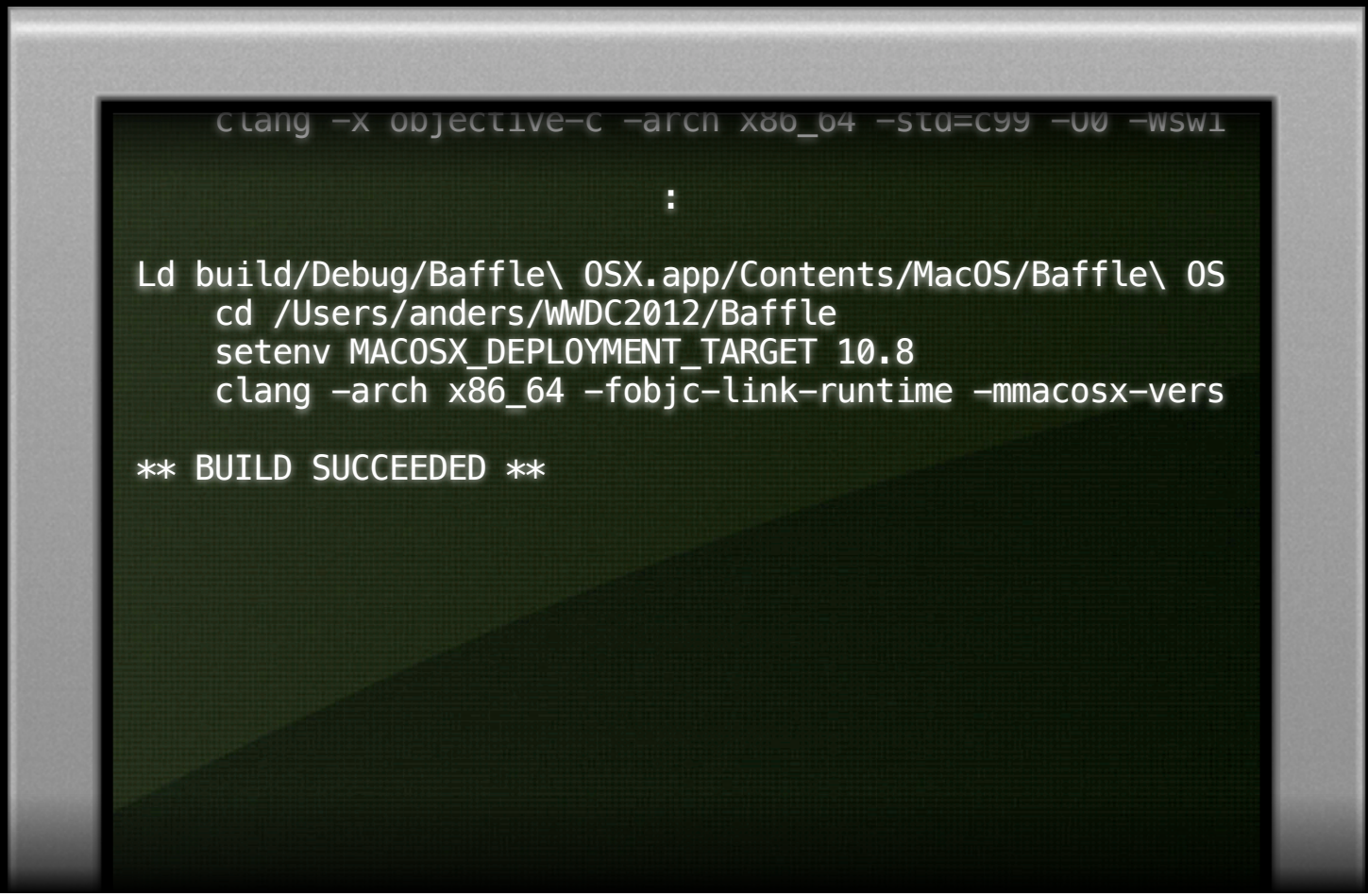

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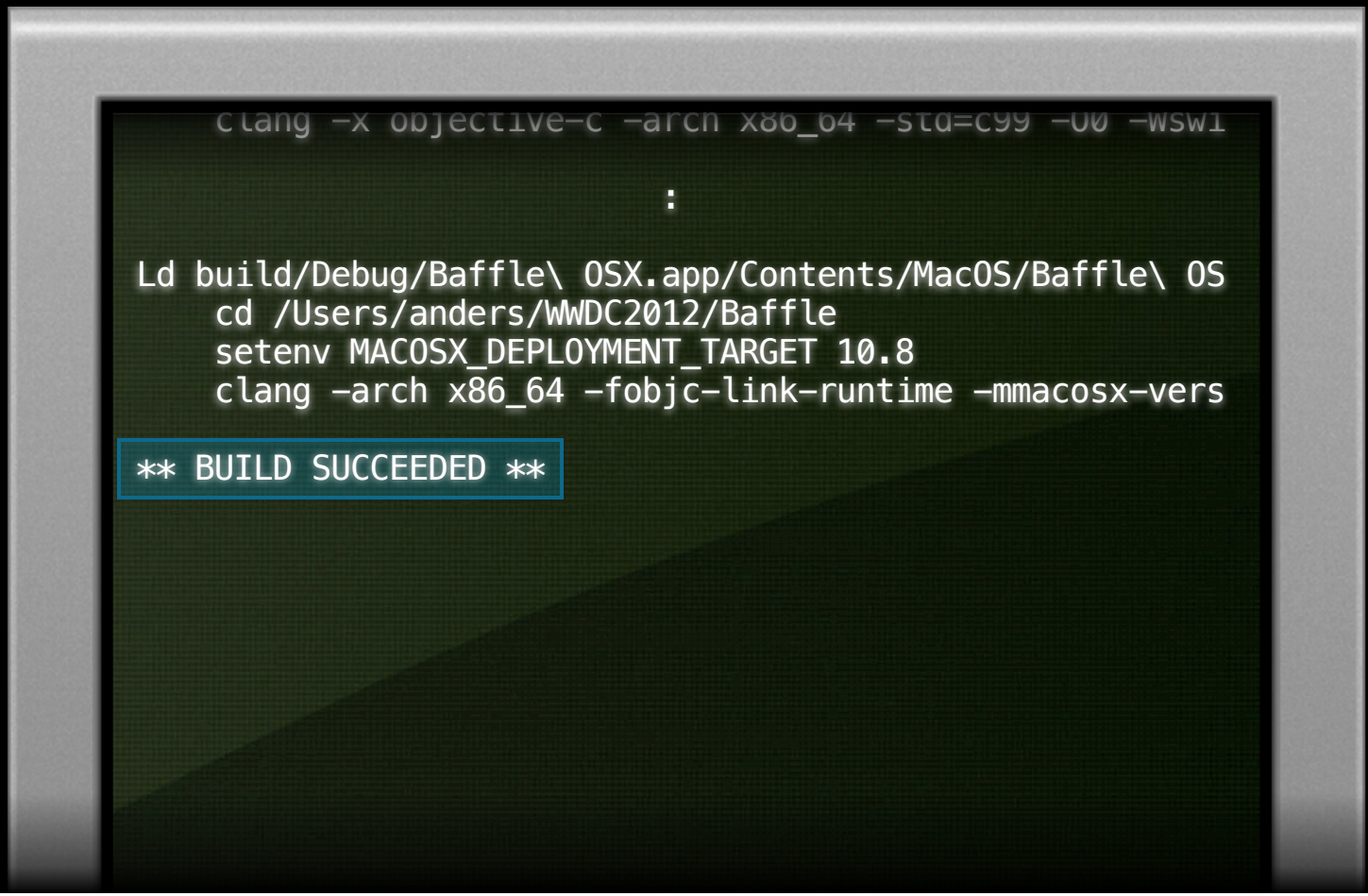

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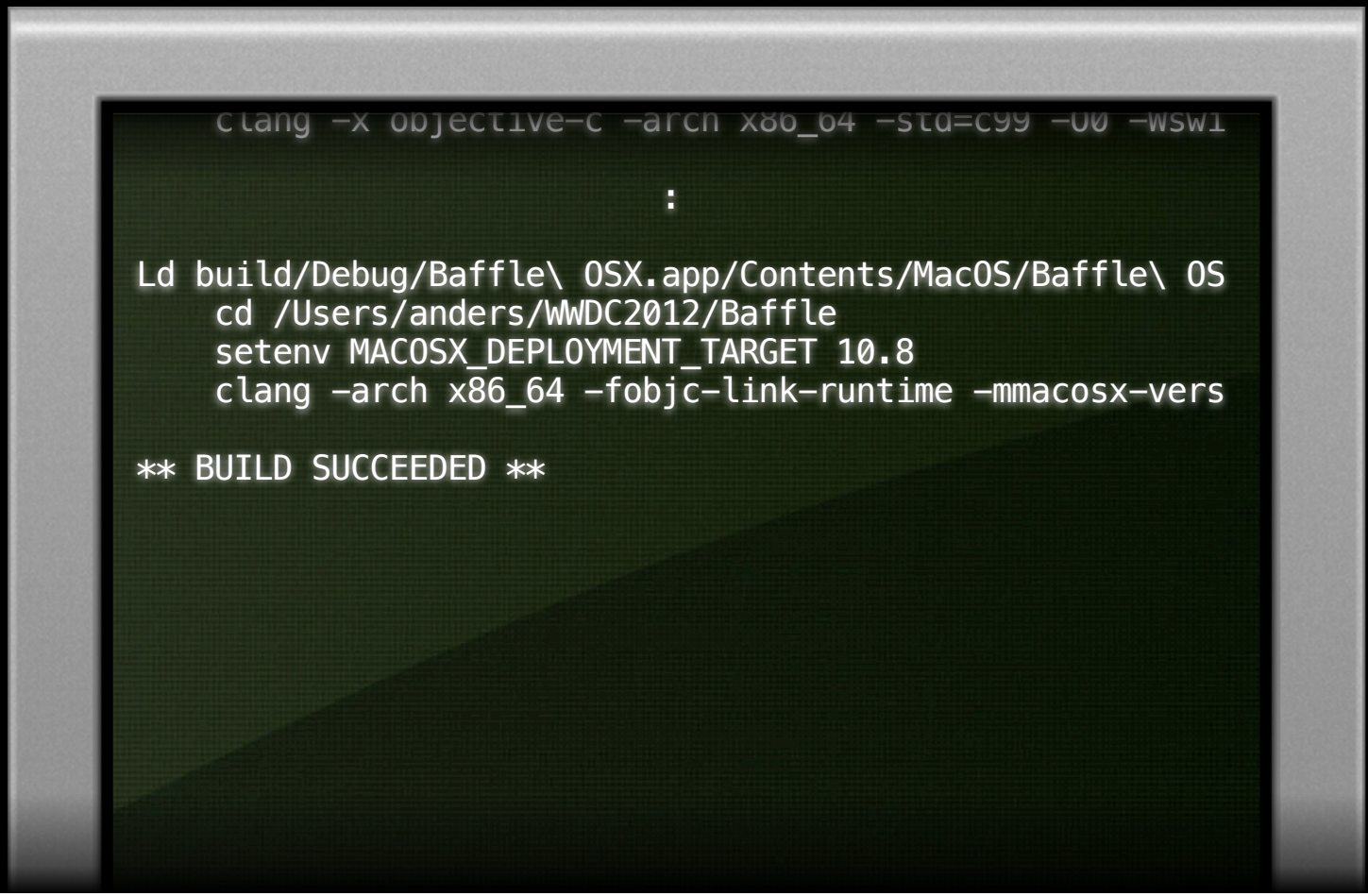

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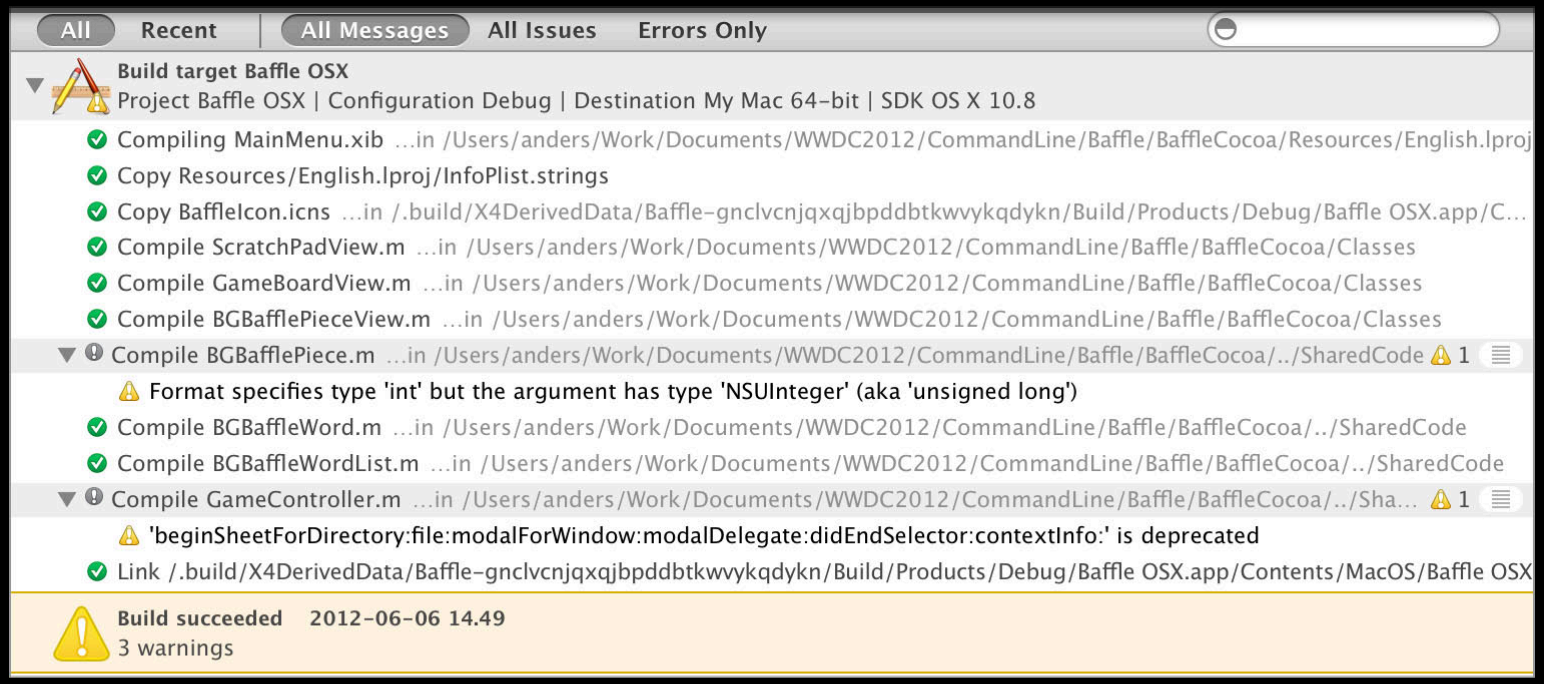

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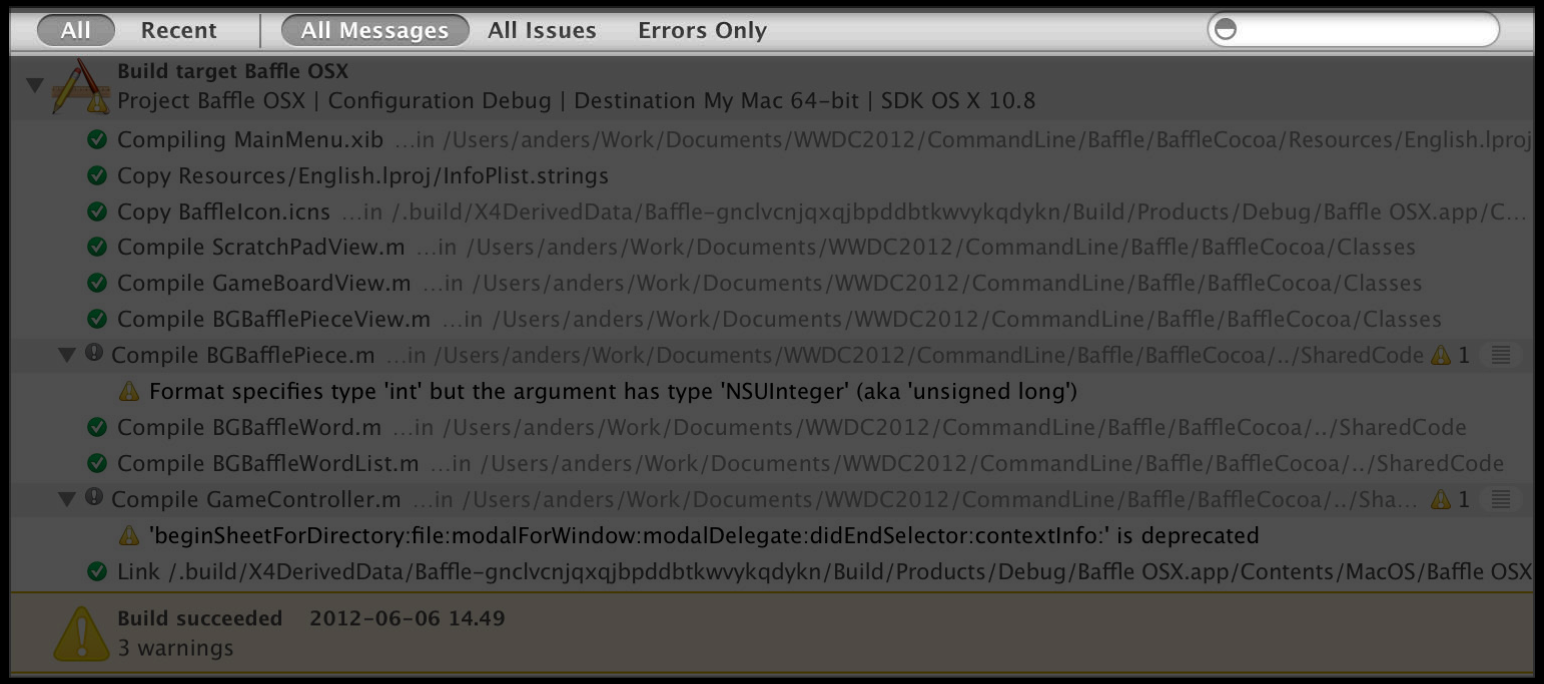

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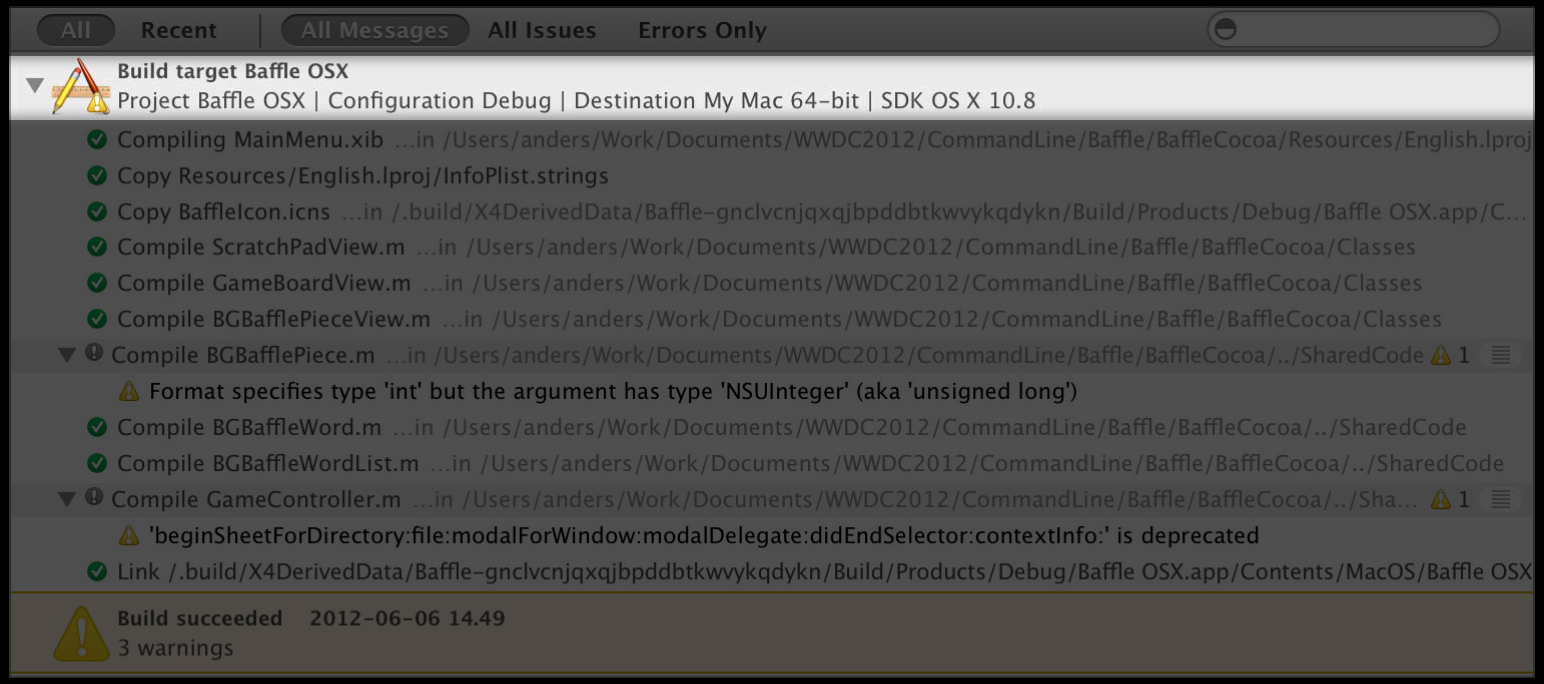

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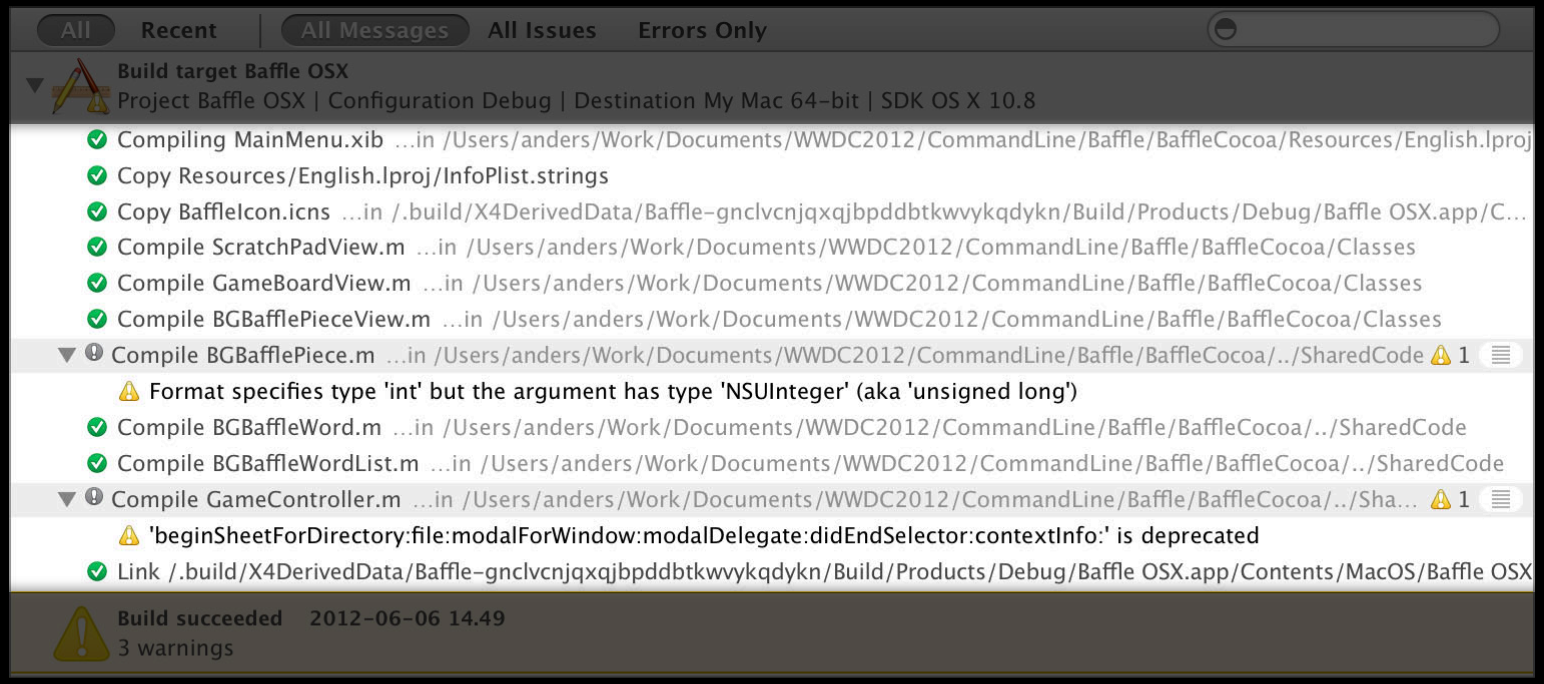

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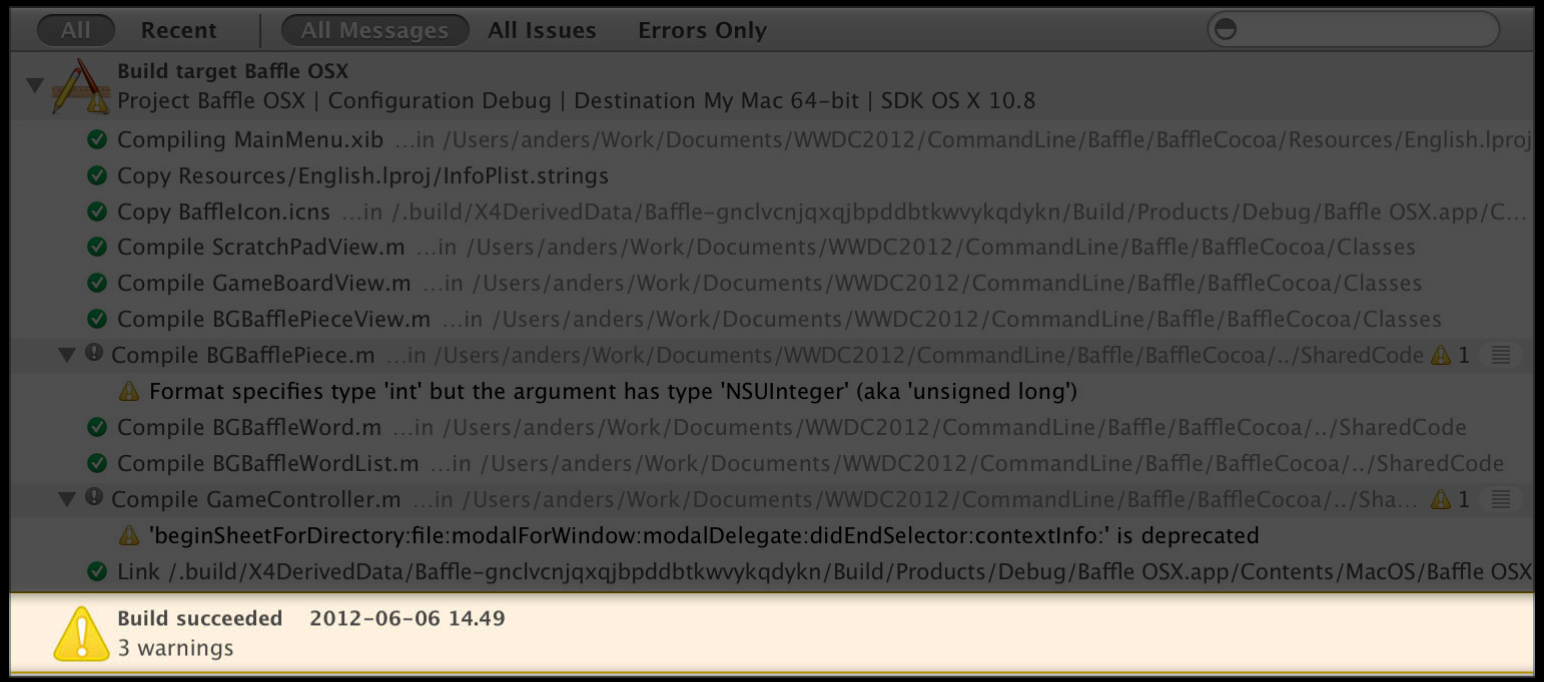

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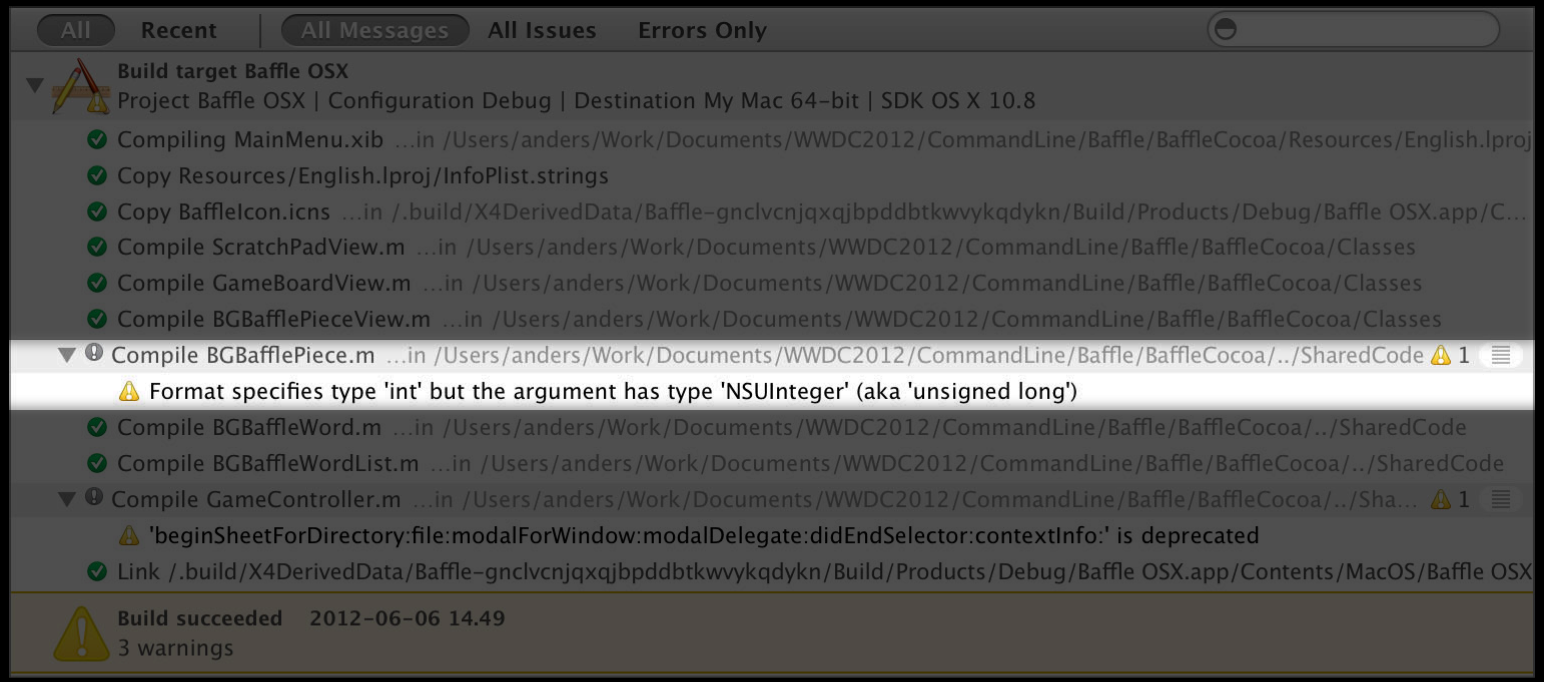

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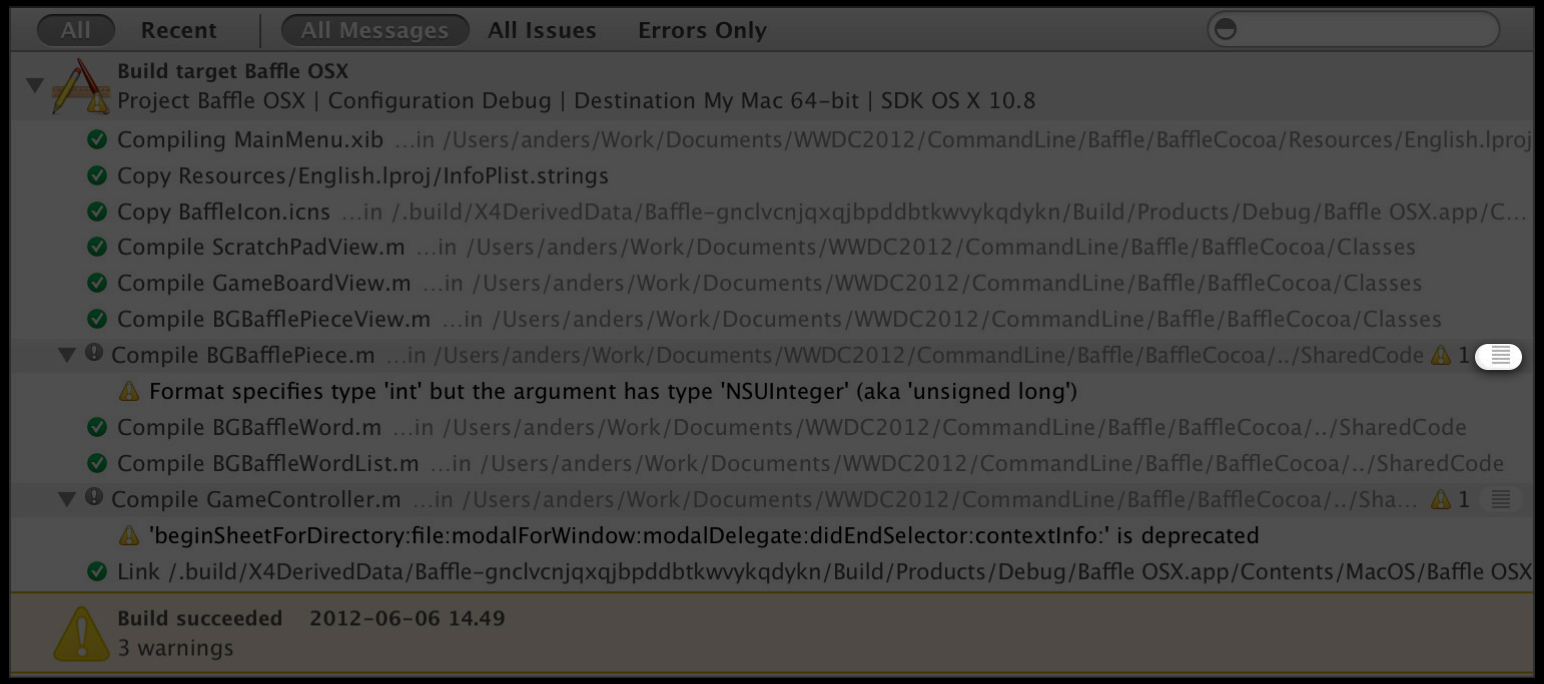

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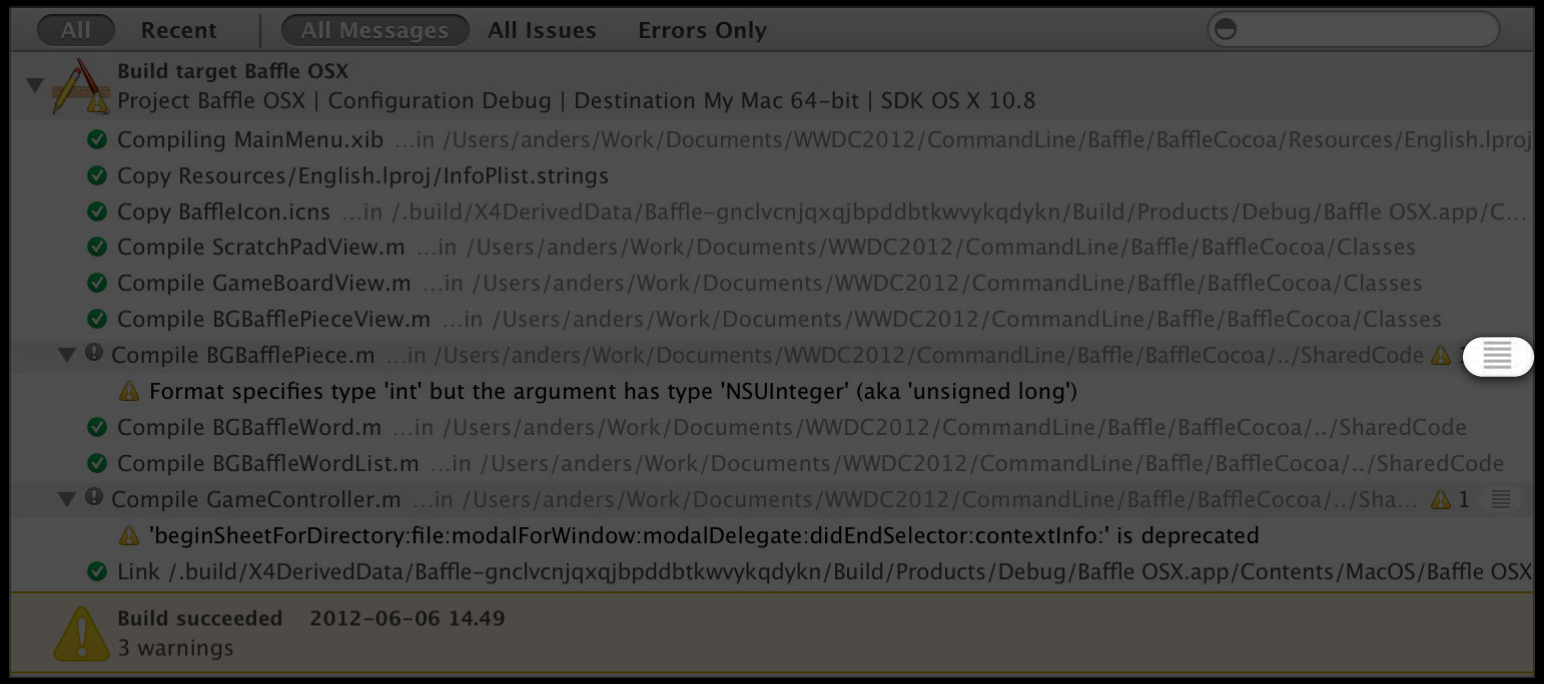

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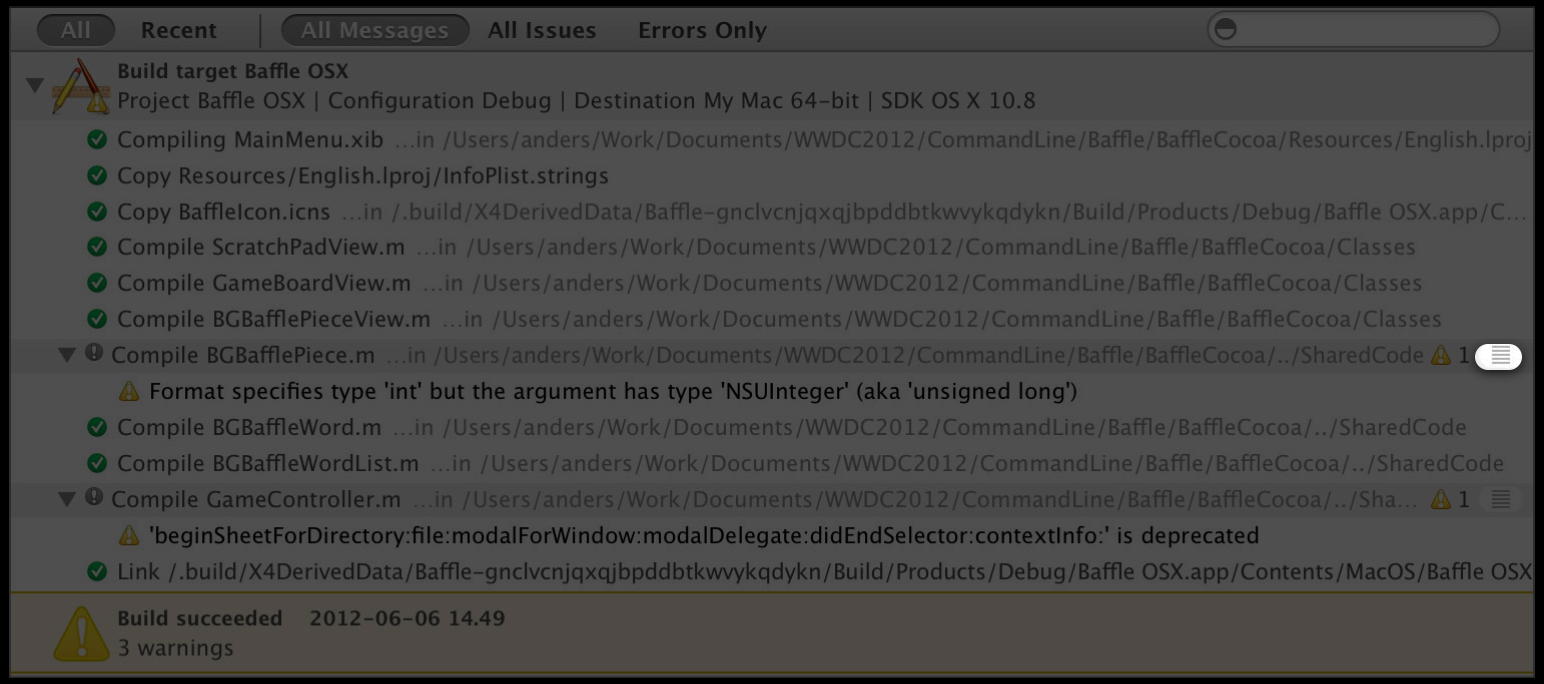

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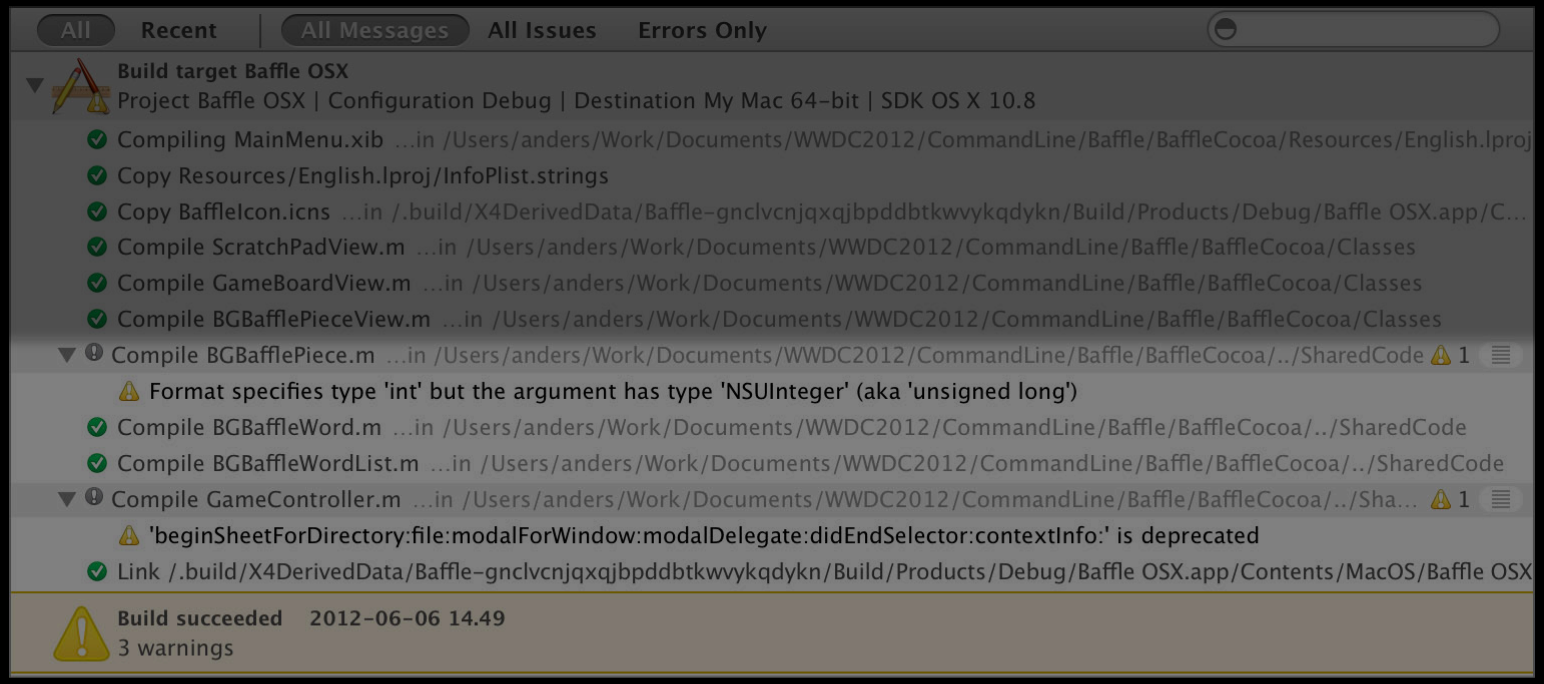

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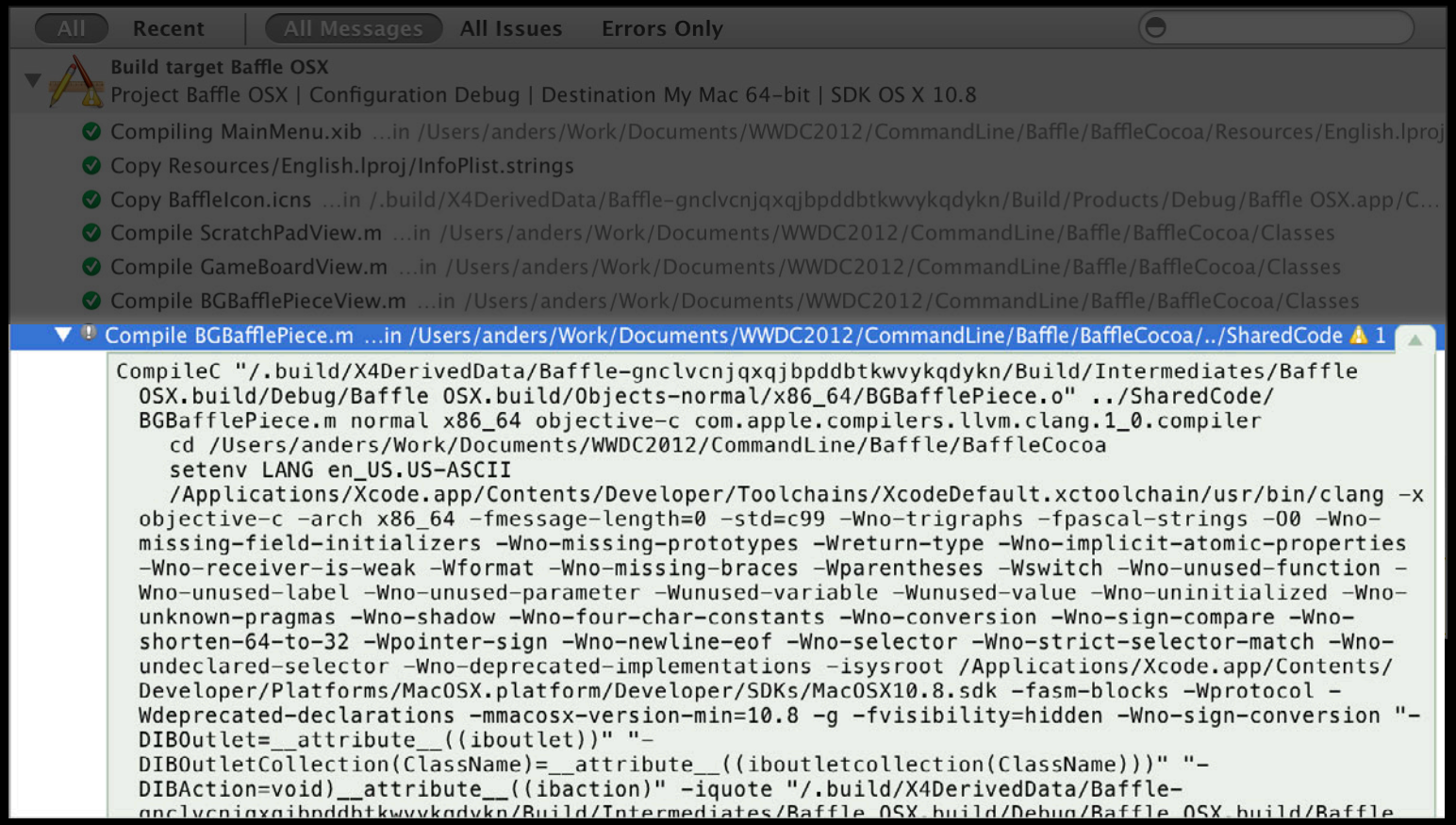

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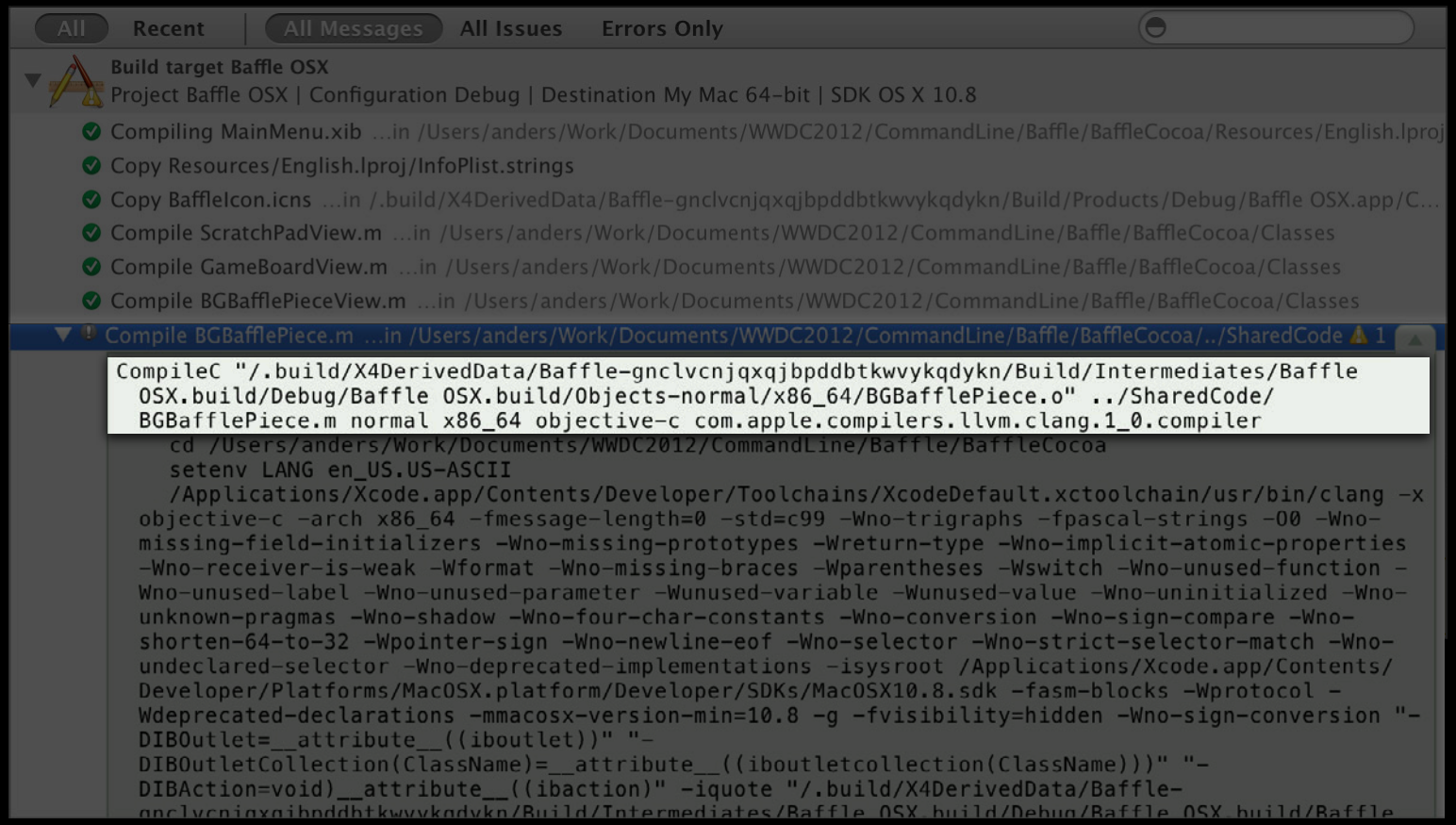

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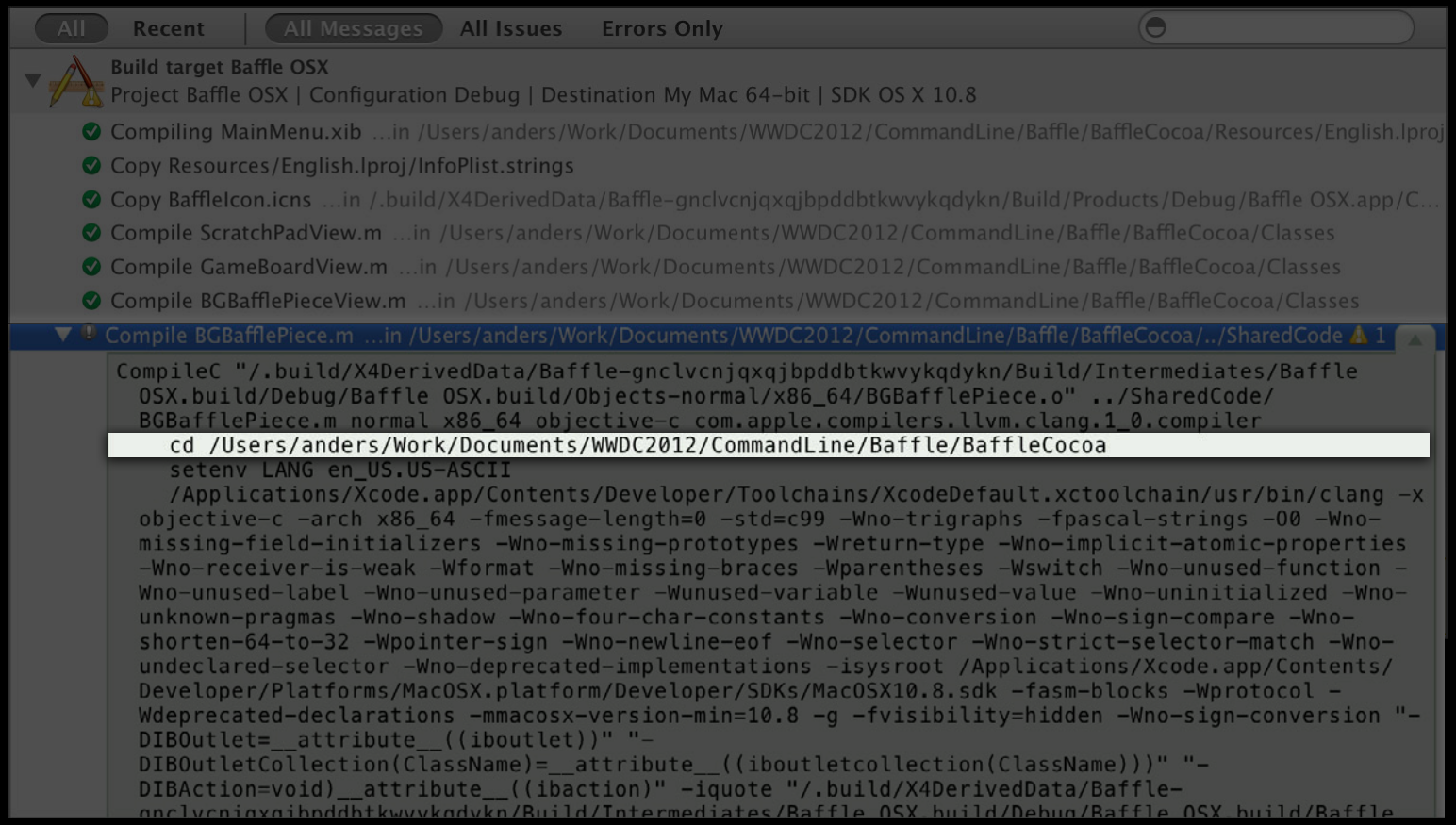

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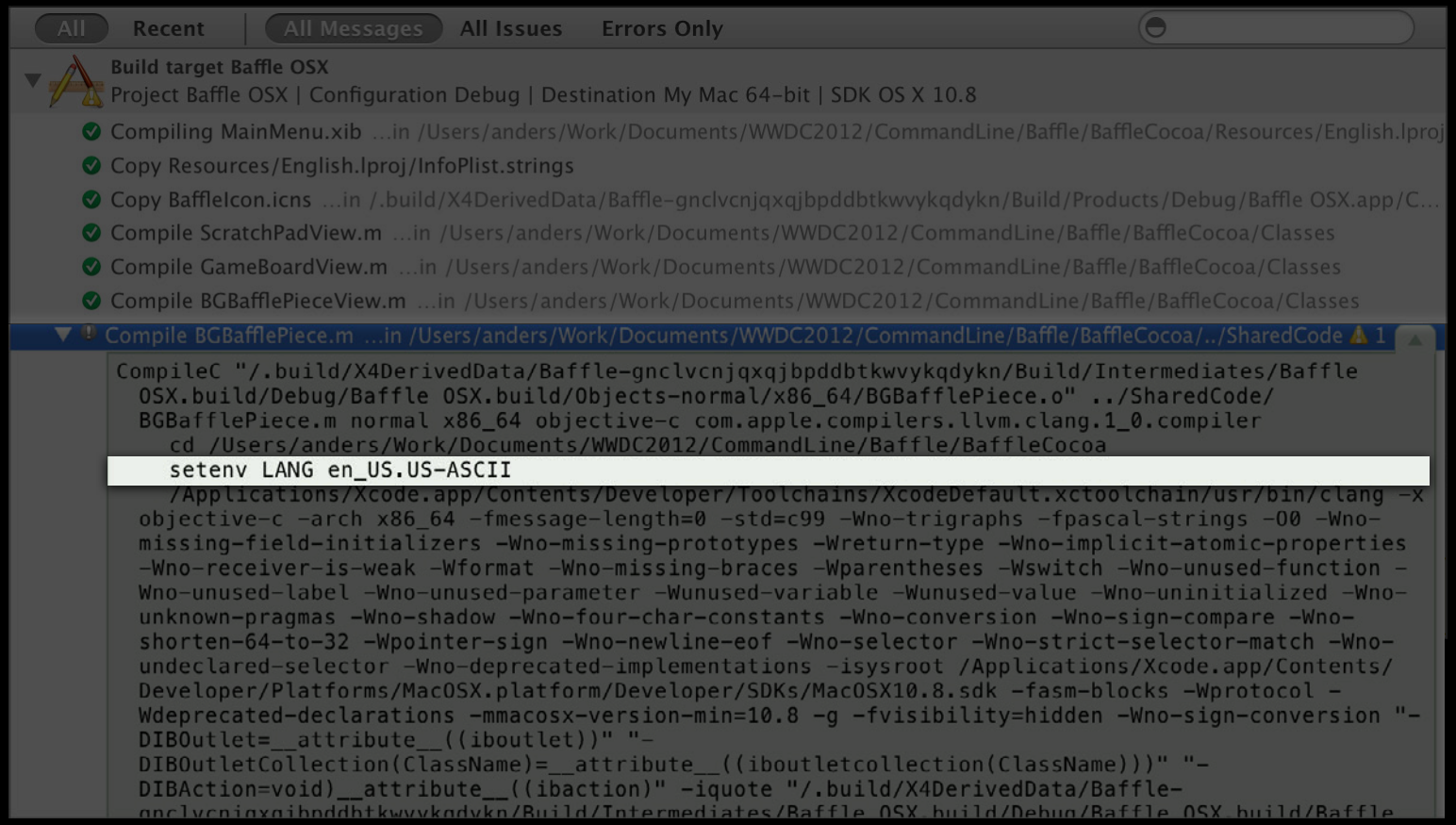

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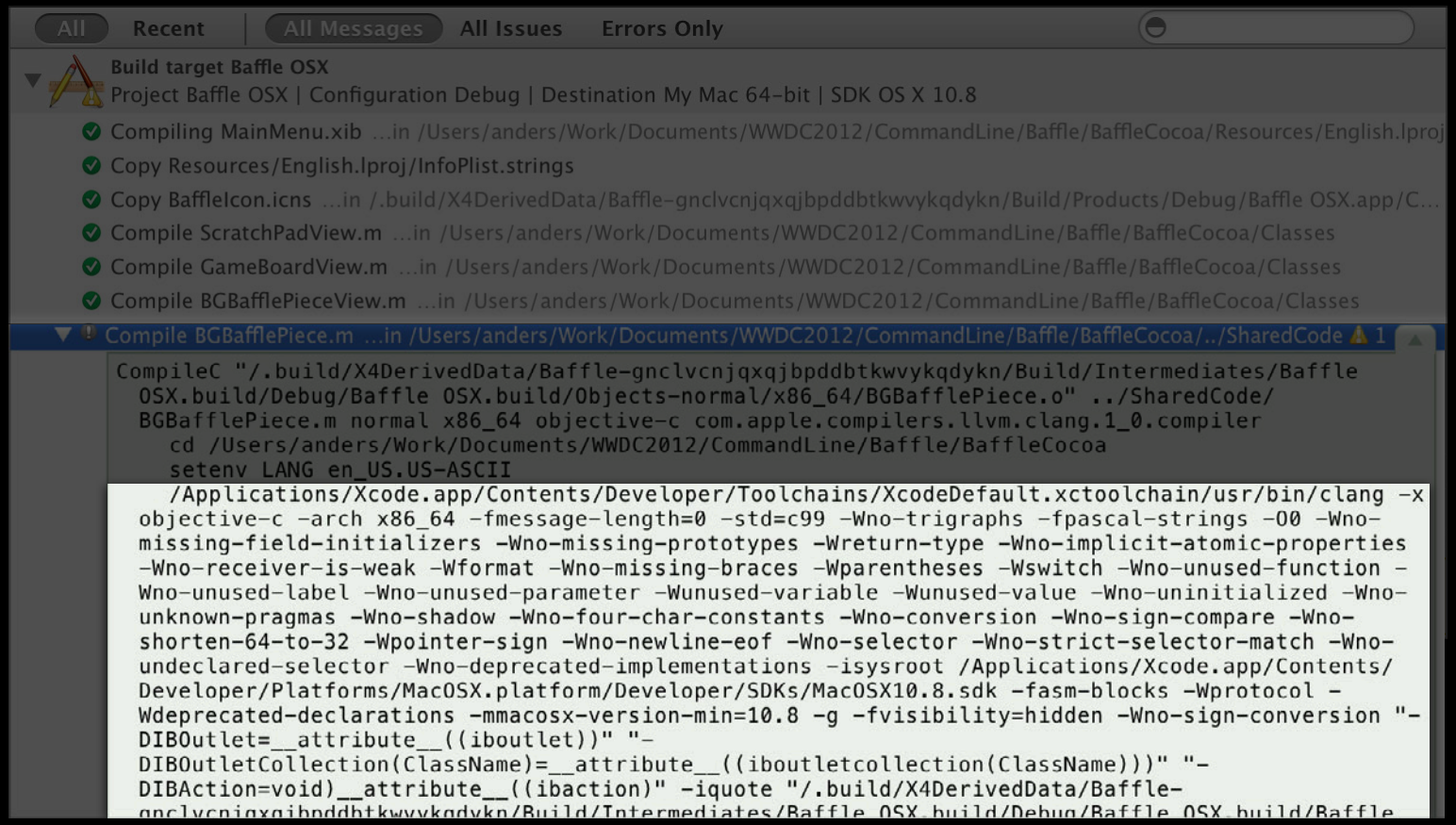

Where Do the Outputs Go?

Kind	Contents	Controlling Build Setting
Intermediates	Compiled Code (“Objects”)	OBJROOT
	Generated Sources	
	Precompiled Headers	SHARED_PRECOMPS_DIR
Debug Products	Products, in debug locations	SYMROOT
	Debug Symbols (.dSYMs)	
Release Products	Products, in release locations	DSTROOT

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Customizing Your Project

Controlling the Build

- Schemes

Controlling the Build

- Schemes
- Overriding build settings

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- Schemes
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  - Configuration files

Controlling the Build

- Schemes
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  - Architectures

Controlling the Build

- Schemes
- Overriding build settings
  - Configuration files
  - Architectures
  - SDKs

Controlling the Build

- Schemes
- Overriding build settings
  - Configuration files
  - Architectures
  - SDKs
  - Other build settings

Schemes

- A scheme defines:

Schemes

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  - A collection of targets to build

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Schemes

- A scheme defines:
  - A collection of targets to build
  - A configuration to use when building
  - An optional collection of tests to execute
  - User-defined pre- and post-processing actions

Listing the Schemes

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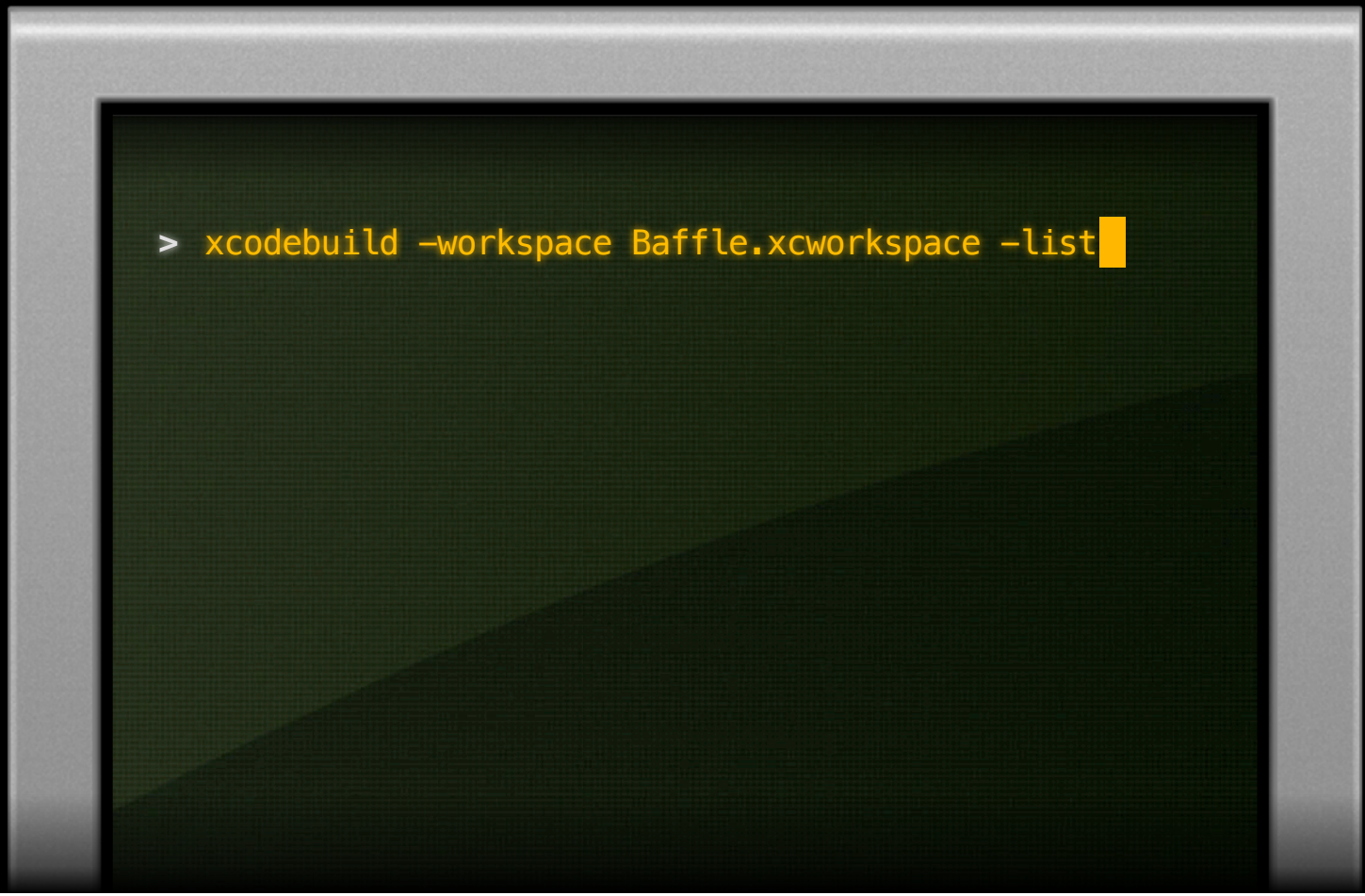

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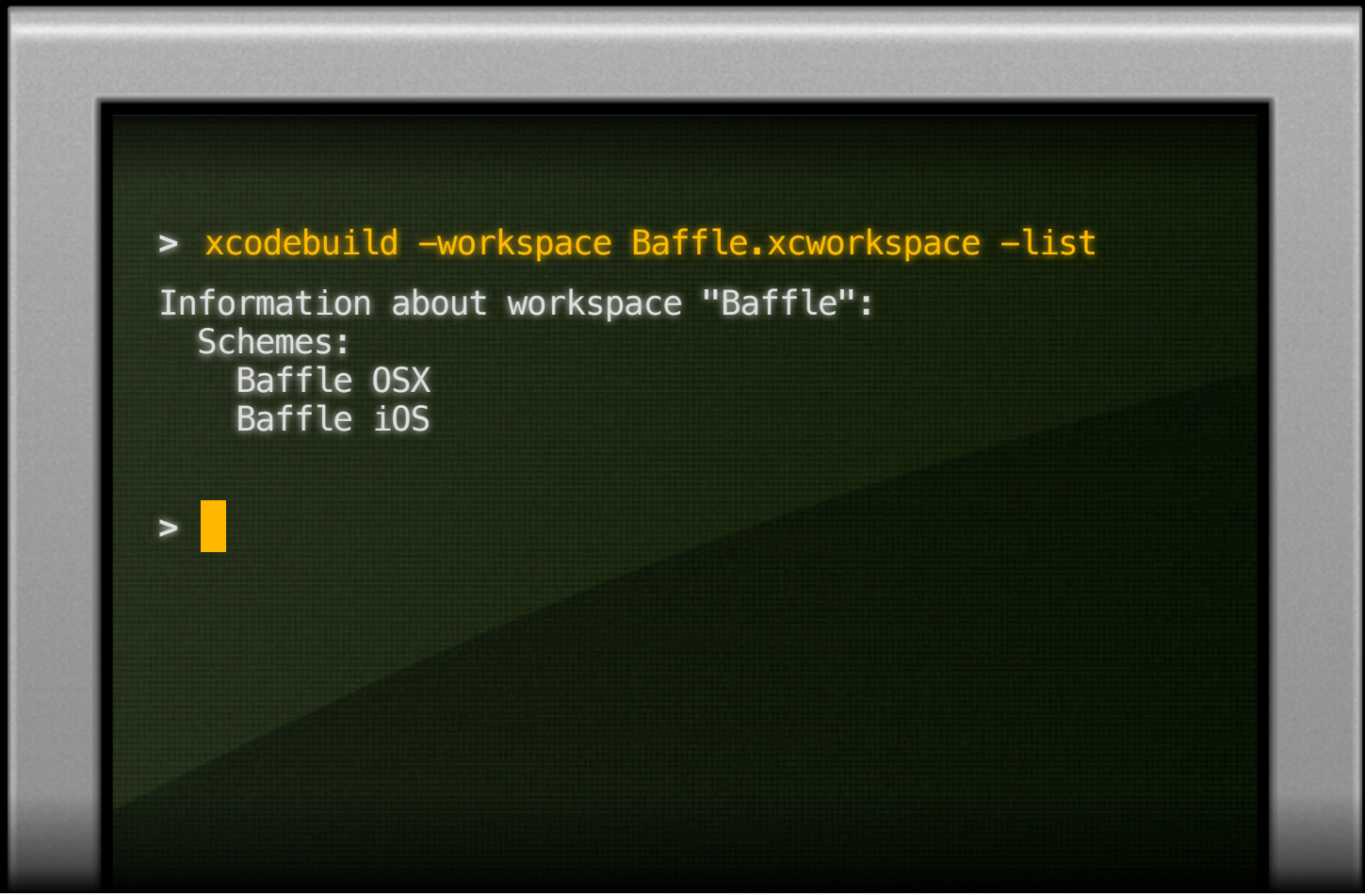

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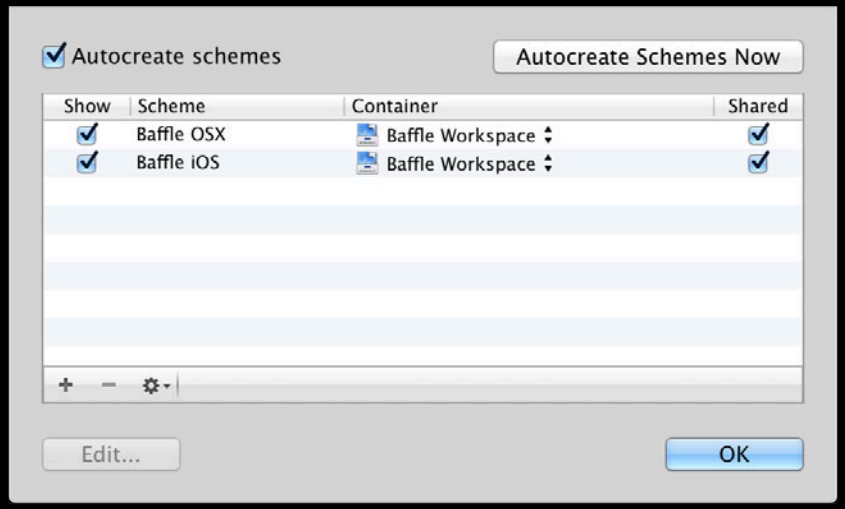

Using Schemes

- Configure in Xcode
  - Build configuration
  - Scheme actions
  - Other options

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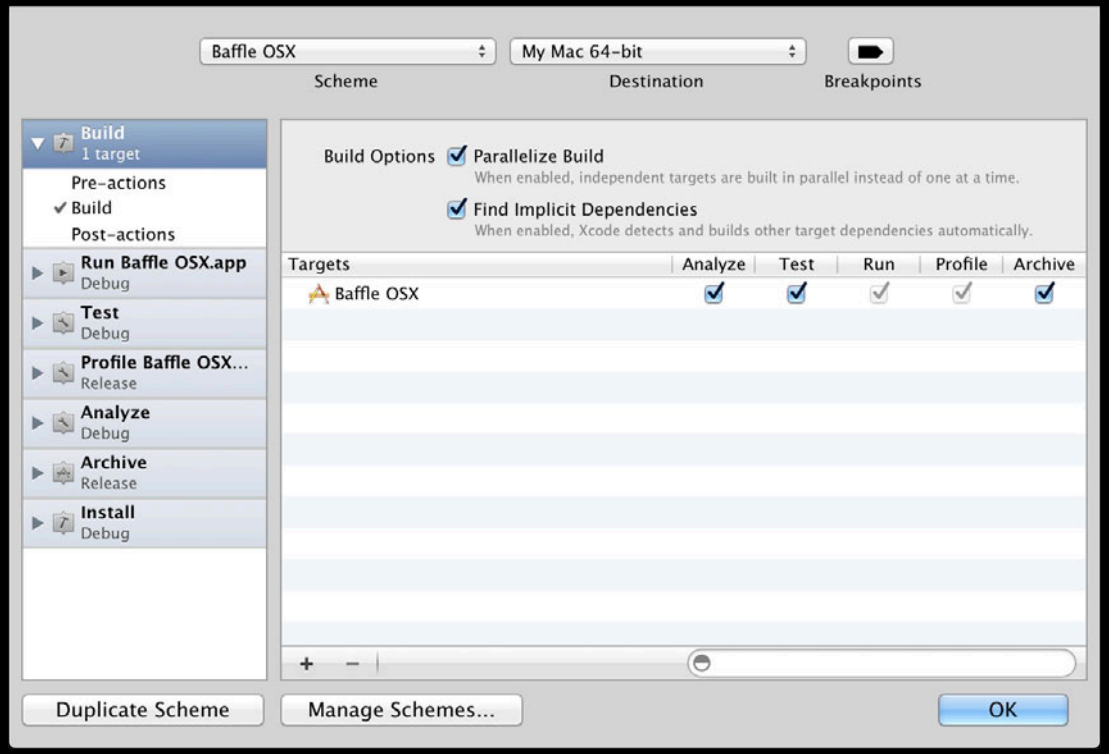
- Configure in Xcode
  - Build configuration
  - Scheme actions
  - Other options
- Use in `xcodebuild`
  - Use `-scheme` flag to select scheme to use

Customizing Schemes



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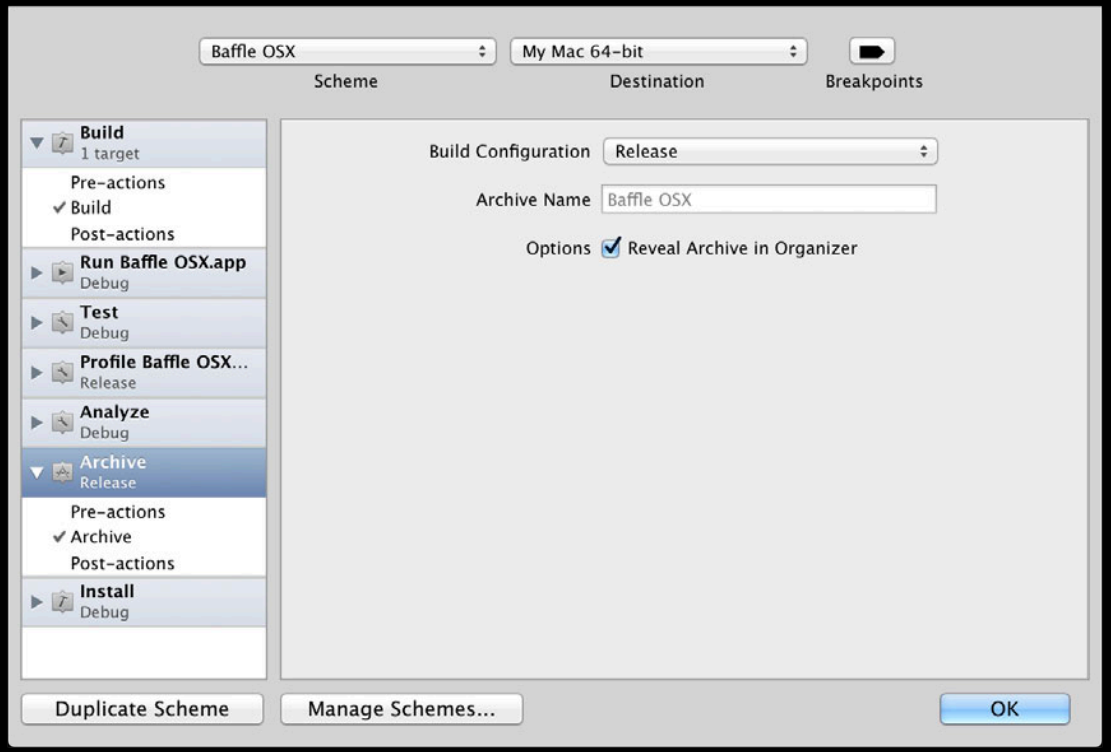

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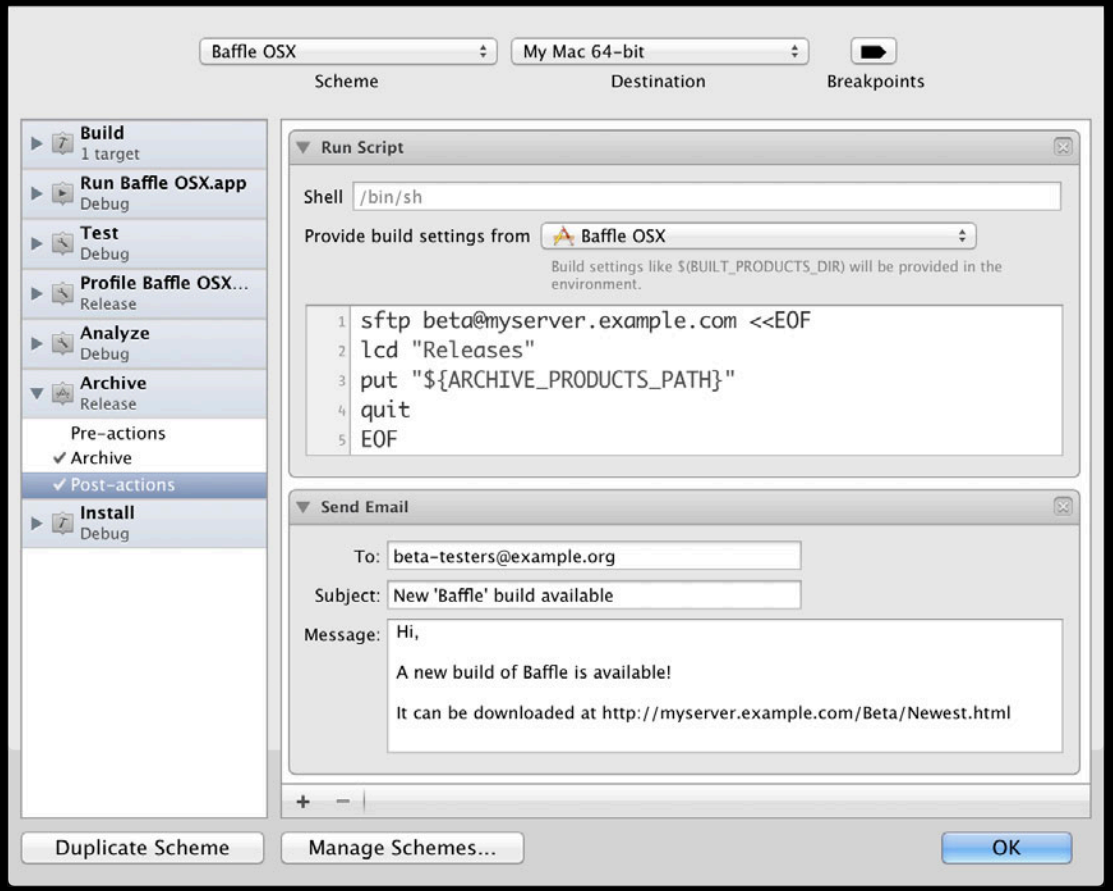
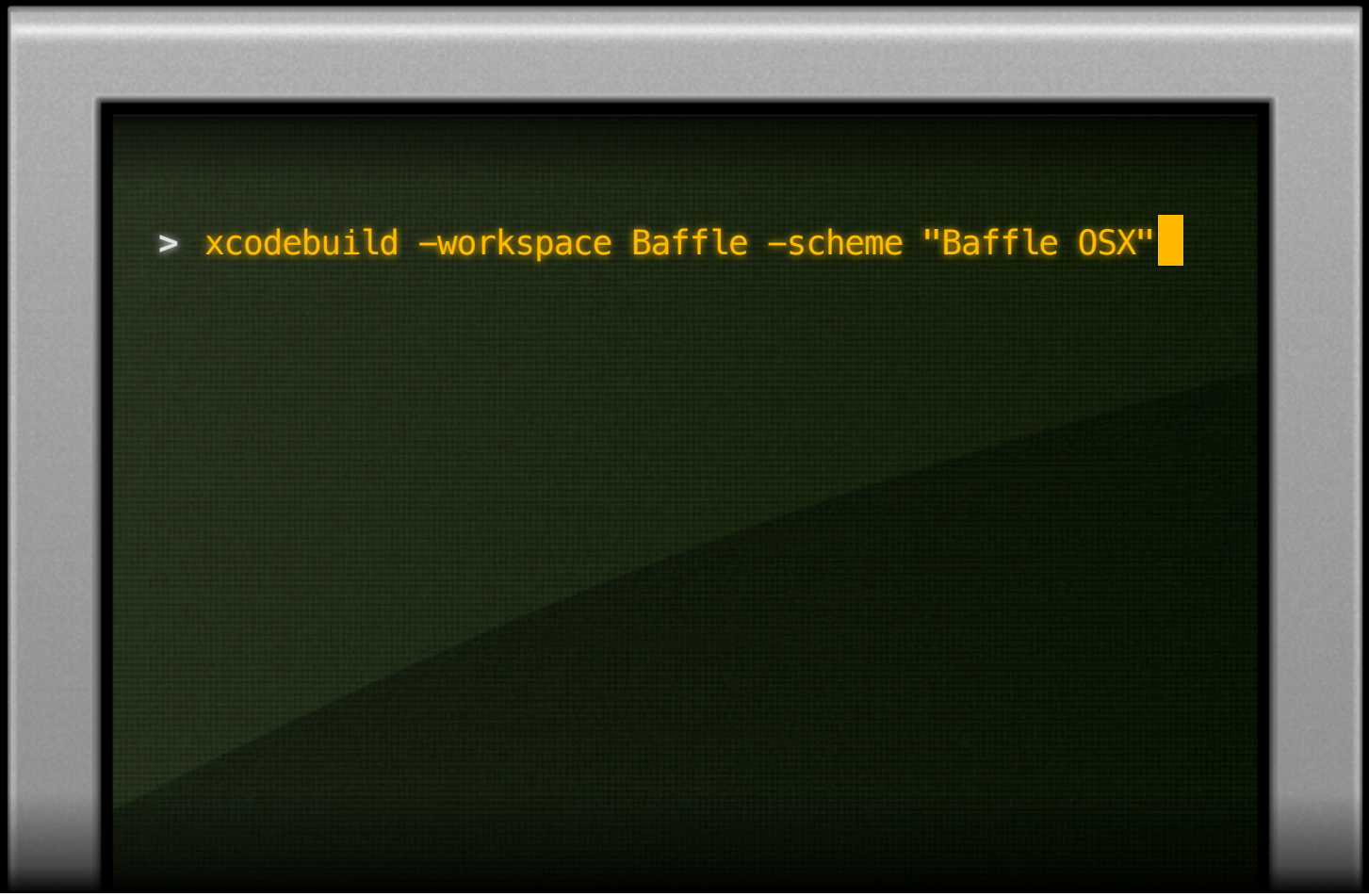


Specifying a Scheme

Specifying a Scheme



Listing the SDKs

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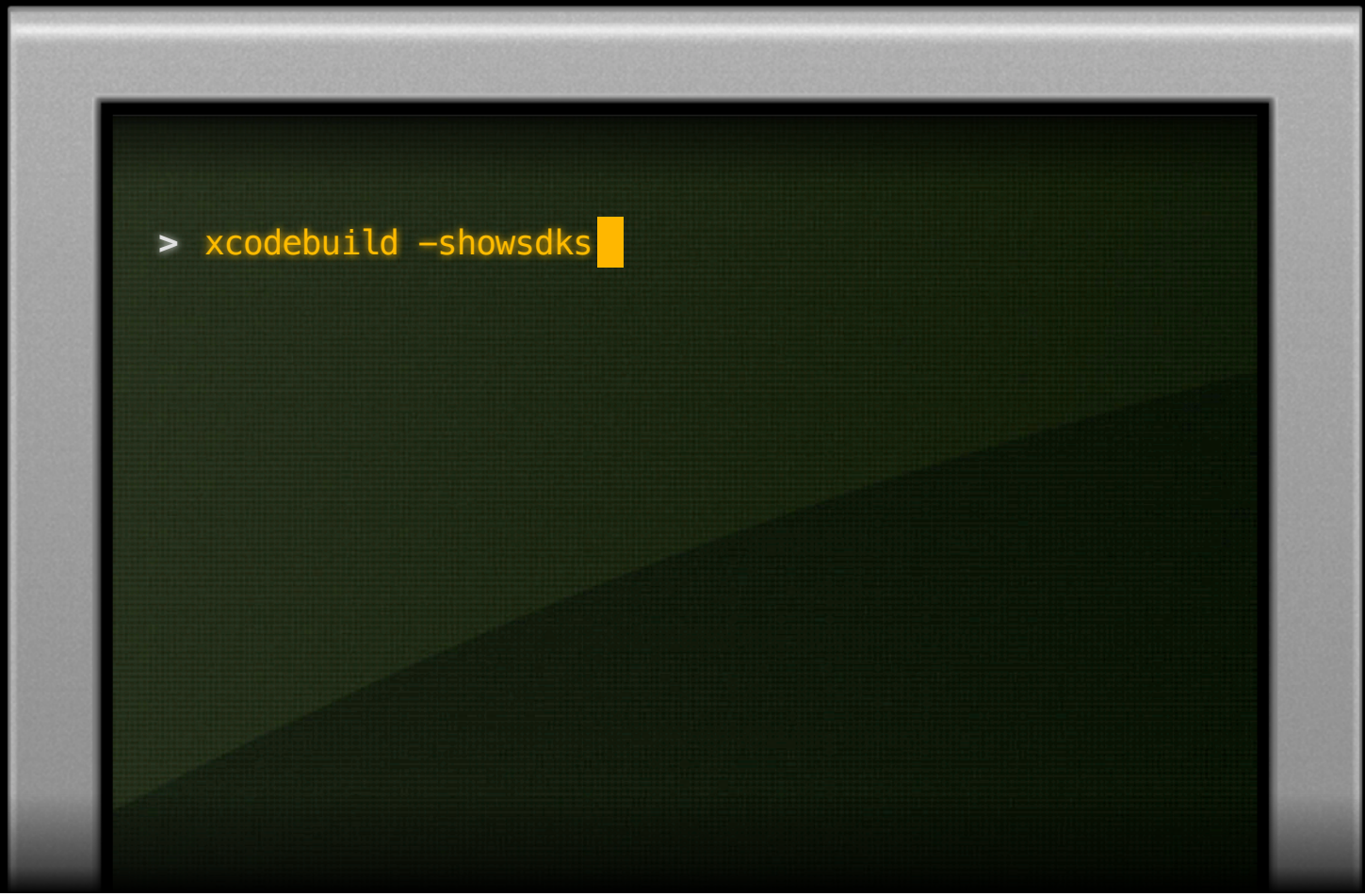


Listing the SDKs

```
> xcodebuild -showsdks

OS X SDKs:
    Mac OS X 10.7               -sdk macosx10.7
    OS X 10.8                   -sdk macosx10.8

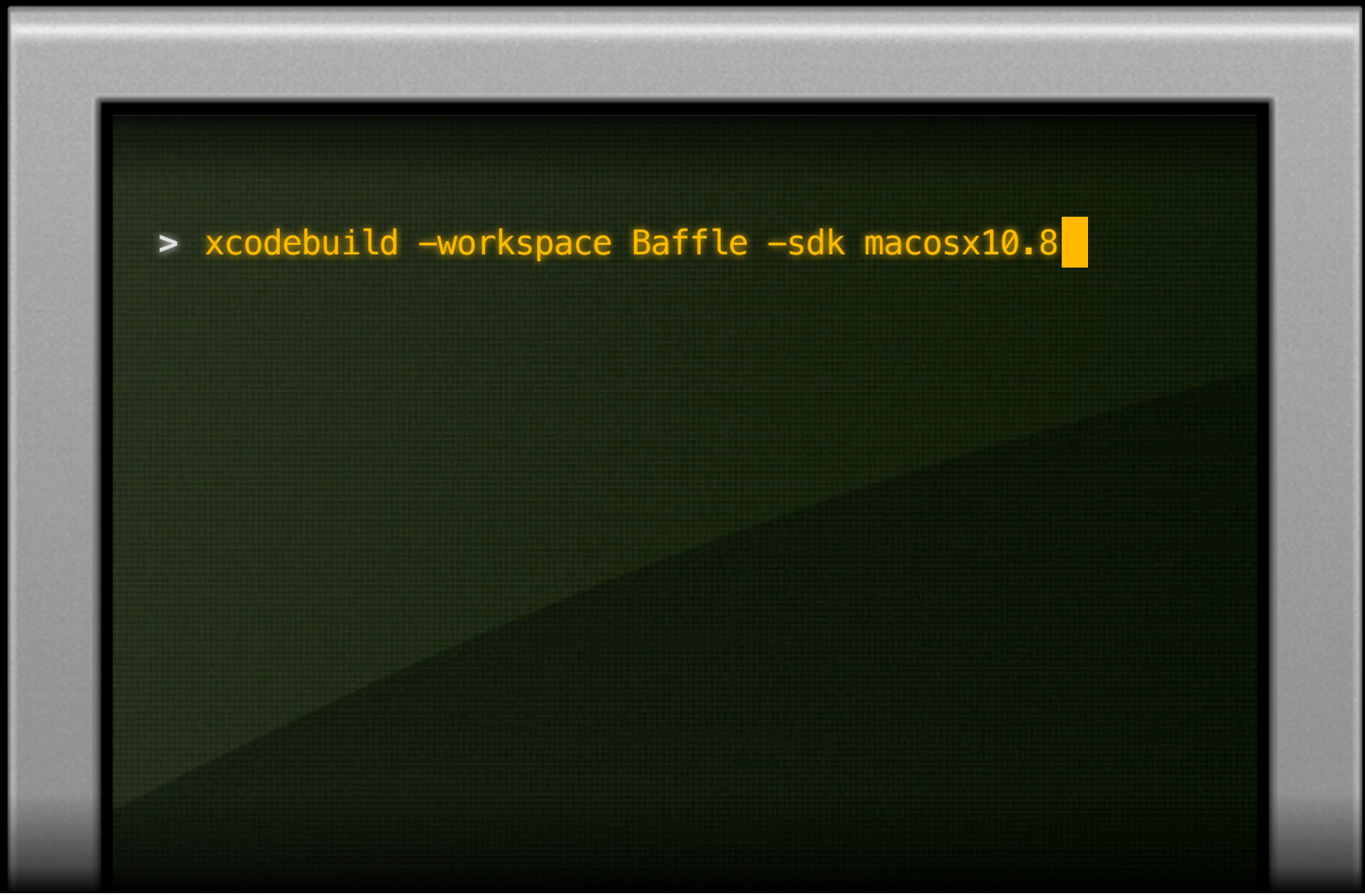
iOS SDKs:
    iOS 6.0                     -sdk iphoneos6.0

iOS Simulator SDKs:
    Simulator - iOS 6.0         -sdk iphonesimulator6.0


>
```

Specifying an SDK

Specifying an SDK



Build Settings

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- “Knobs and switches” of the build system

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- View and edit in Build Settings editor in IDE

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- Set in environment to provide defaults
- Use `-showBuildSettings` option to `xcodebuild`

Seeing Values of Build Settings

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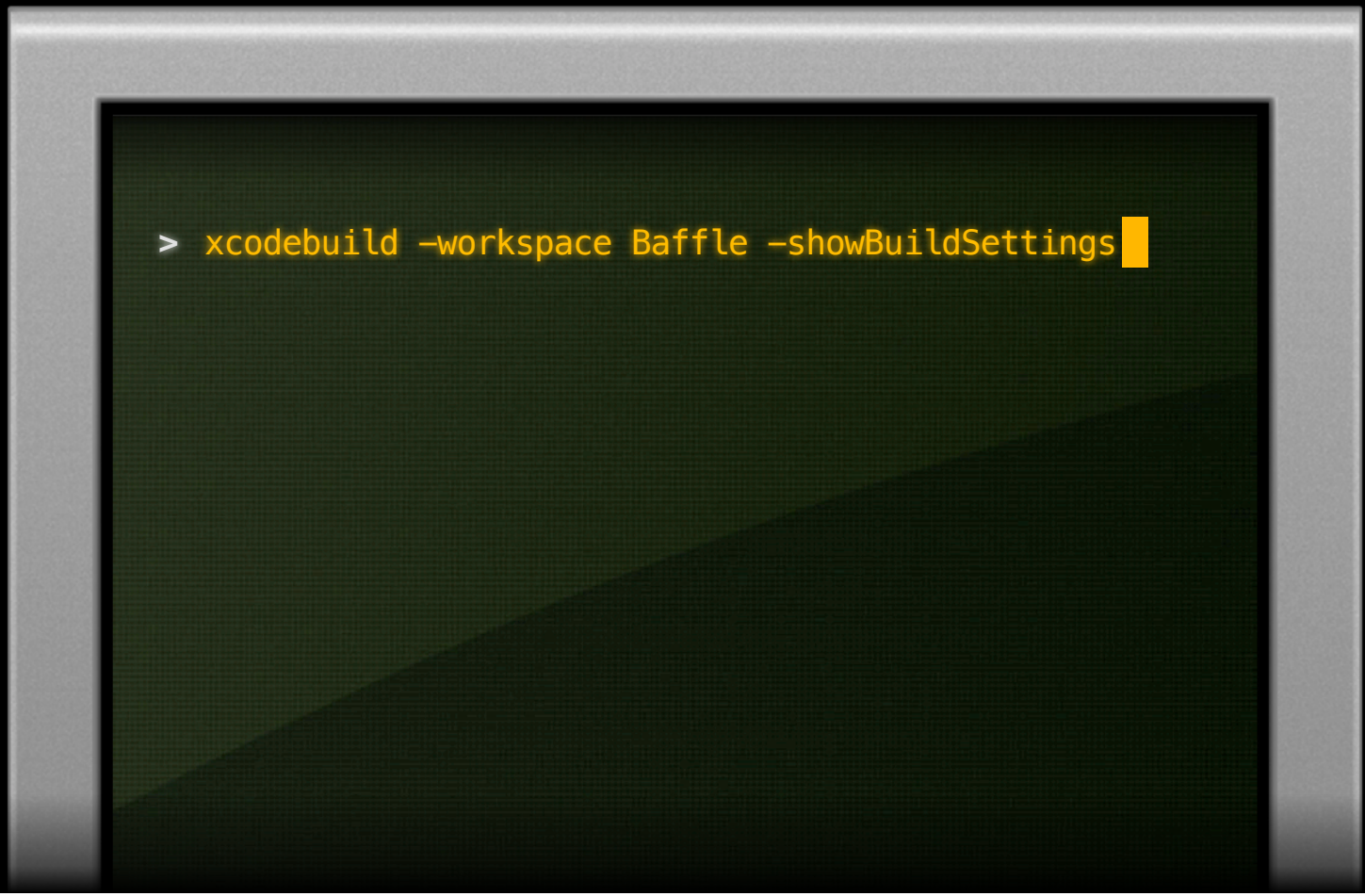


Seeing Values of Build Settings

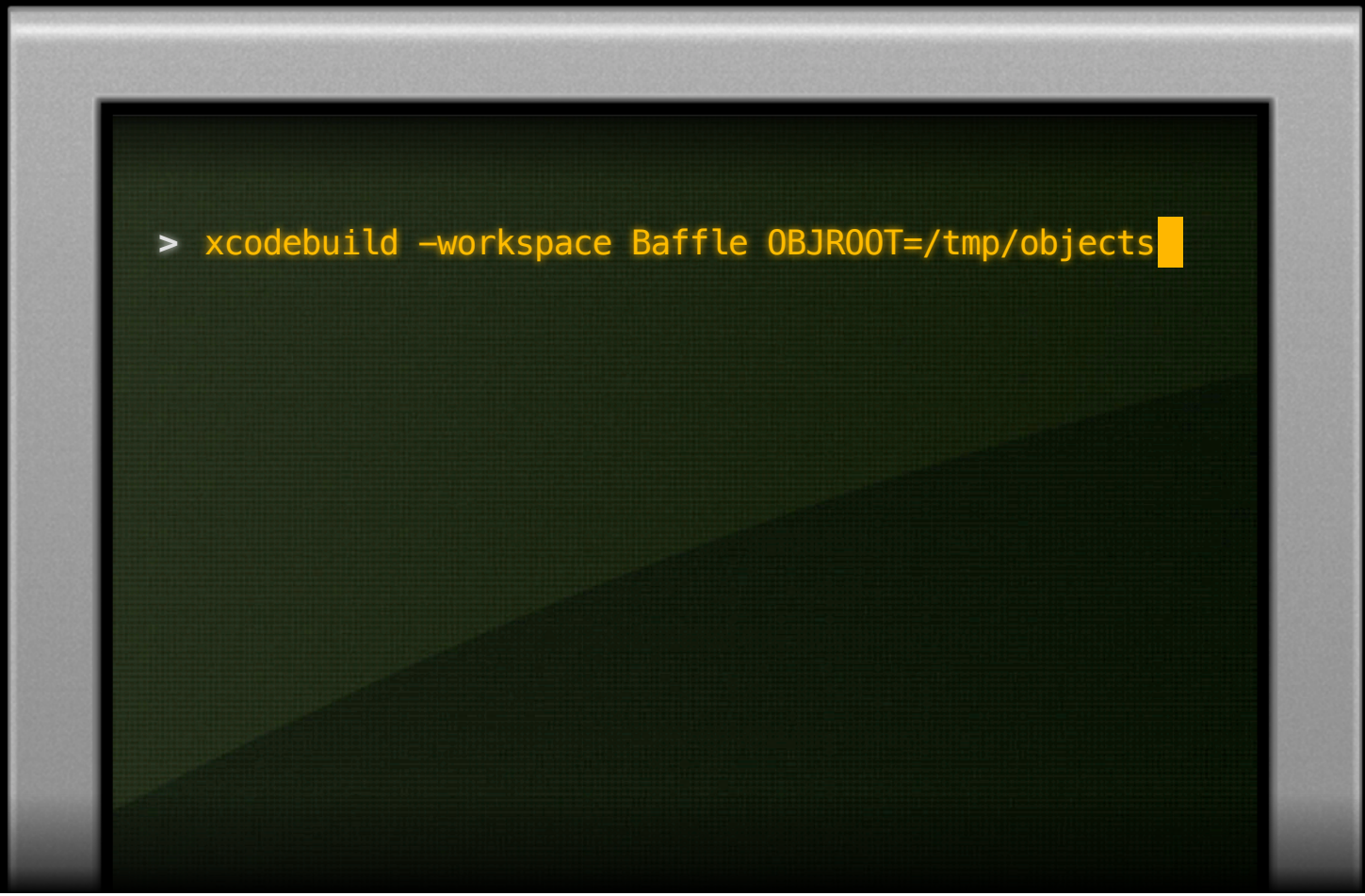
```
> xcodebuild -workspace Baffle -showBuildSettings

Build settings for action build & target "Baffle OSX"
    ACTION = build
    ALWAYS_SEARCH_USER_PATHS = NO
    APPLY_RULES_IN_COPY_FILES = NO
    ARCHS = i386
    ARCHS_STANDARD_32_64_BIT = x86_64 i386
    ARCHS_STANDARD_32_BIT = i386
    ARCHS_STANDARD_64_BIT = x86_64
    AVAILABLE_PLATFORMS = macosx iphoneos
    BUILD_DIR = ./build/Baffle/Build/Products
    CONFIGURATION = Debug
    COPYING_PRESERVES_HFS_DATA = NO

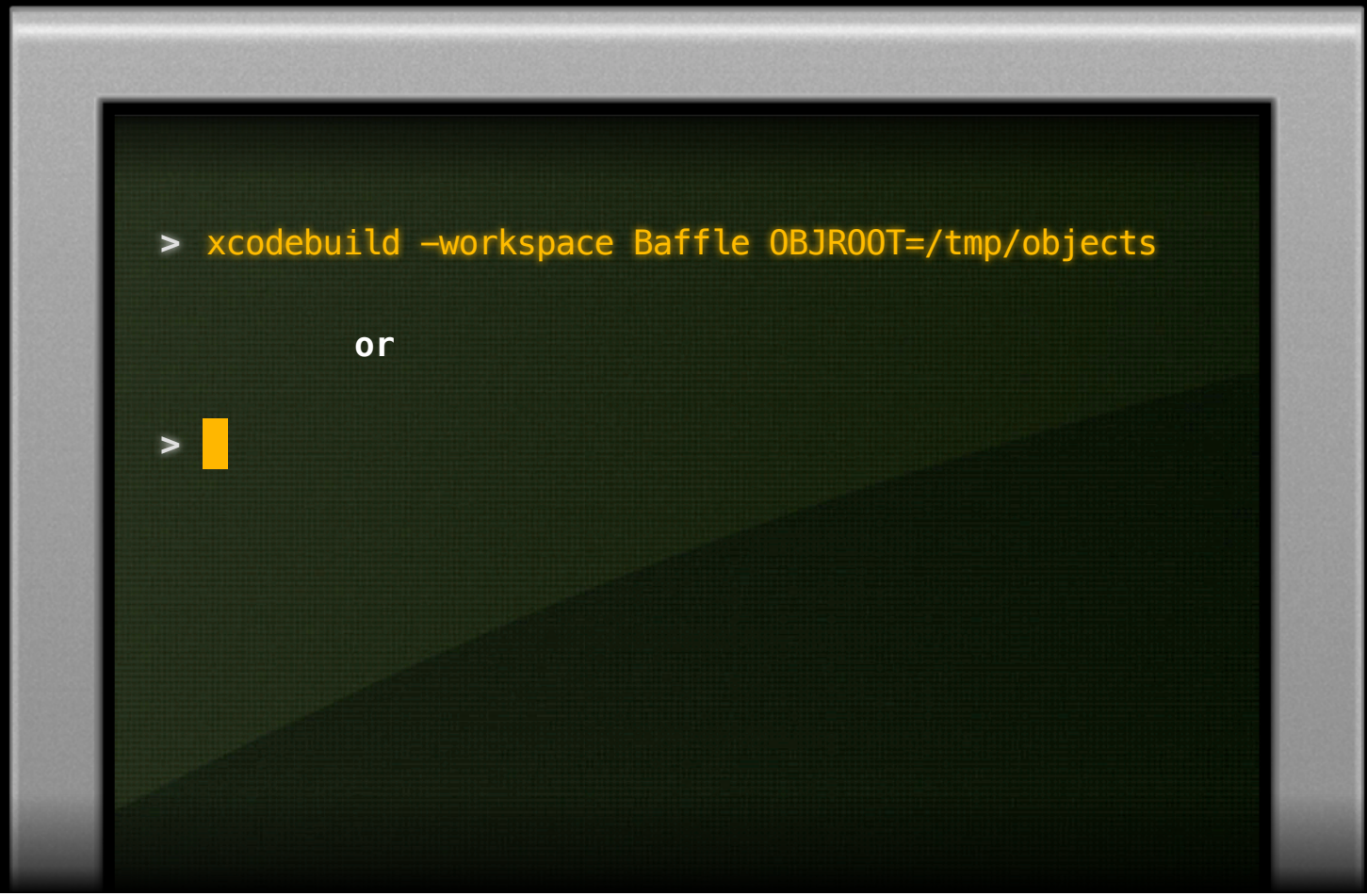
                          :
```

Overriding Build Settings

Overriding Build Settings



Overriding Build Settings



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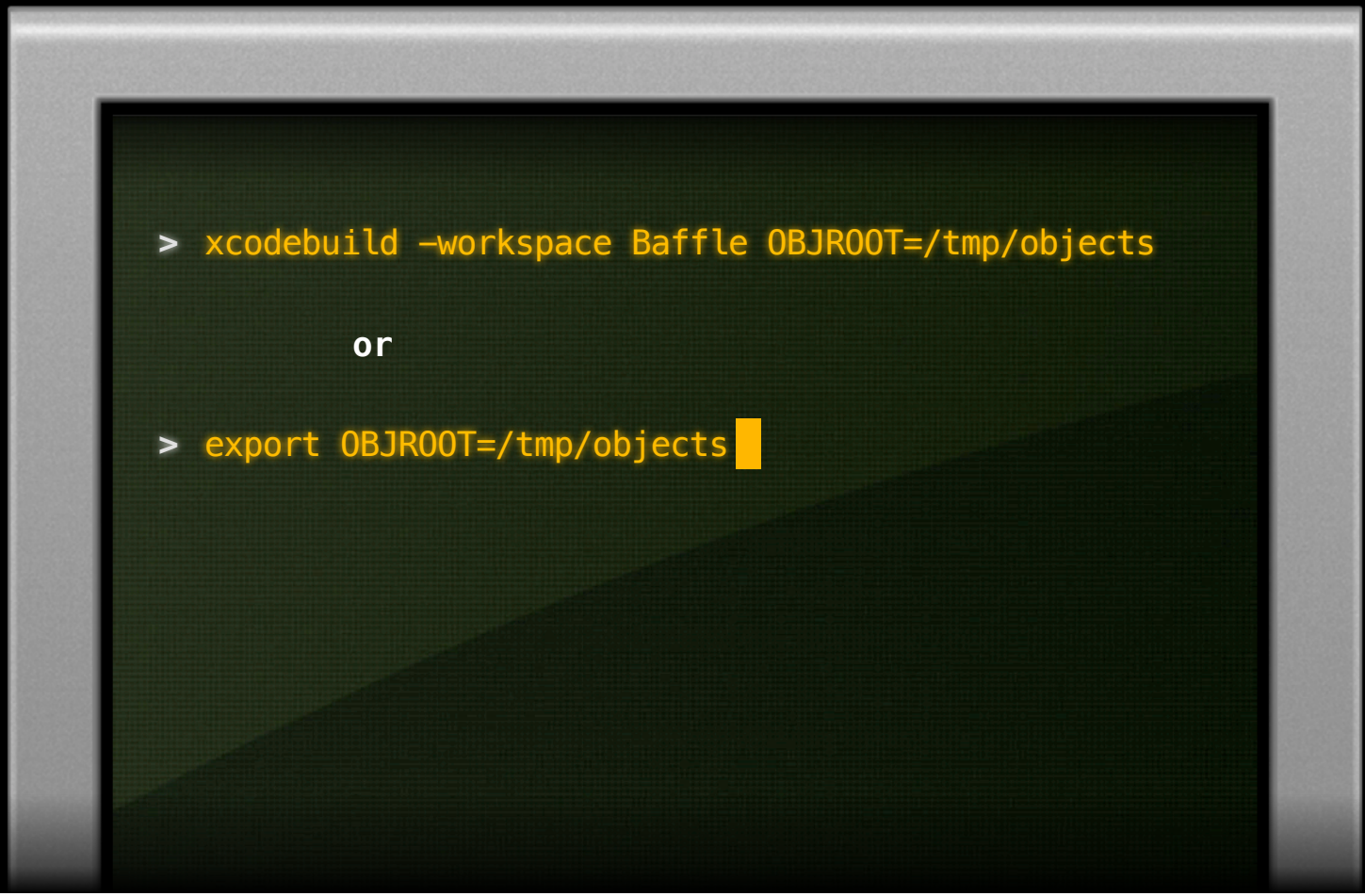

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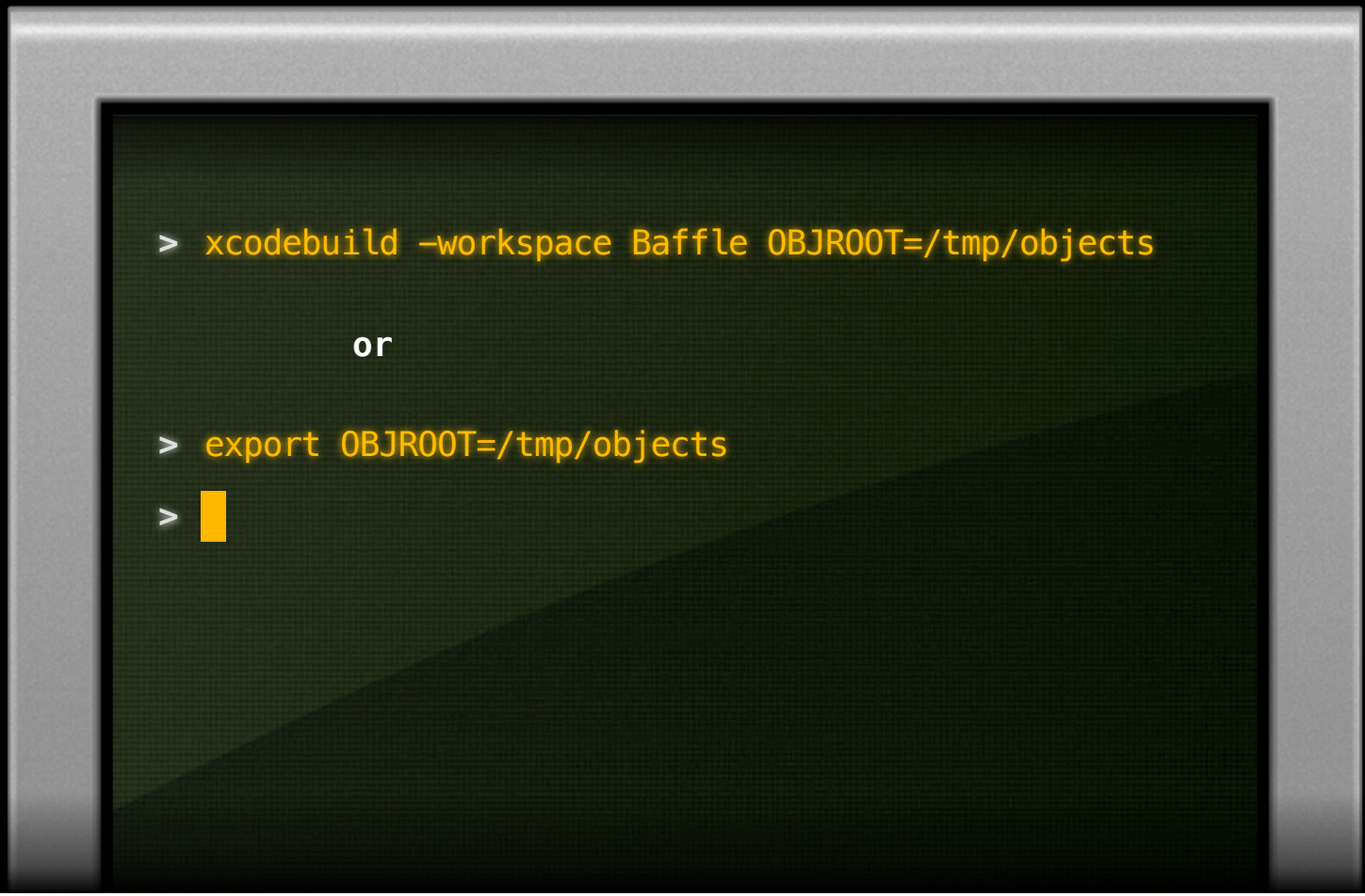


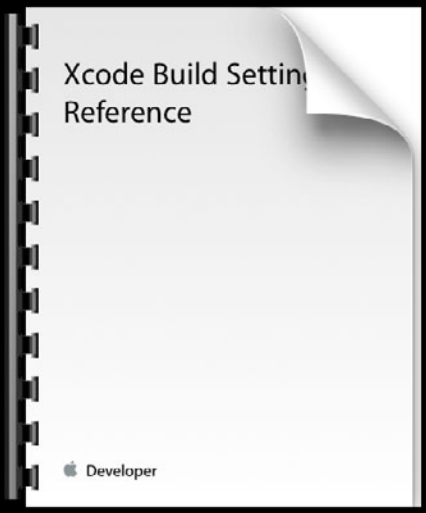
Overriding Build Settings

```
> xcodebuild -workspace Baffle OBJROOT=/tmp/objects

        or

> export OBJROOT=/tmp/objects
> xcodebuild -workspace Baffle
```

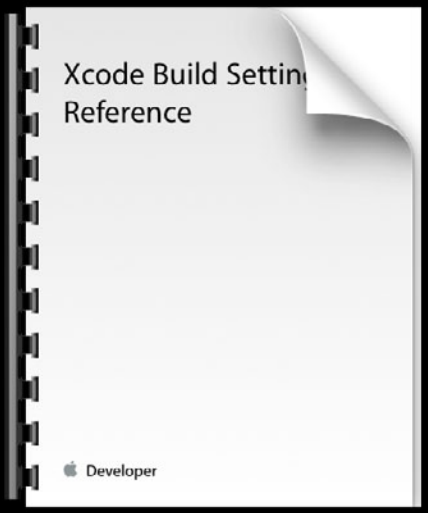
What Build Settings Are Available?



Xcode Build Setting Reference

What Build Settings Are Available?

- Xcode built-in documentation



Xcode Build Setting Reference

What Build Settings Are Available?

- Xcode built-in documentation
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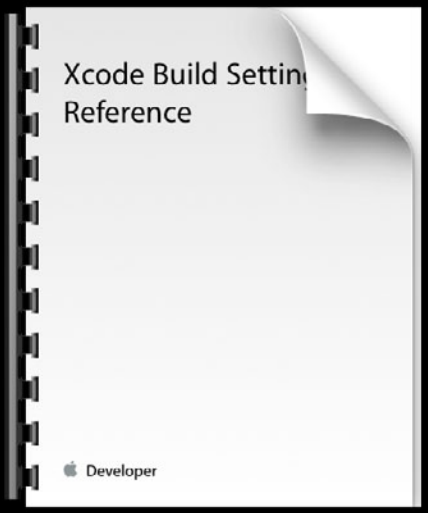

Xcode Build Setting Reference

Putting It All Together

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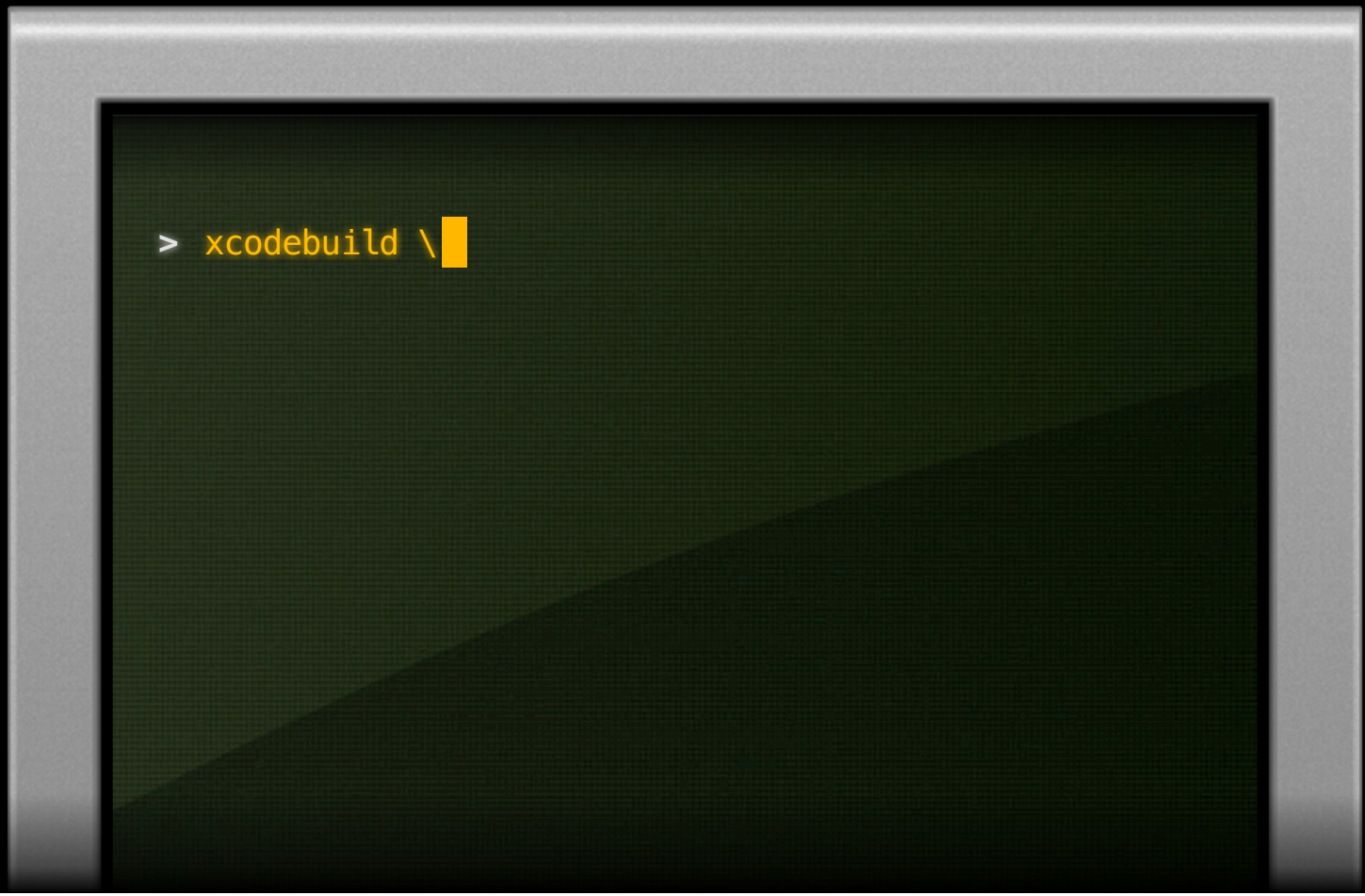

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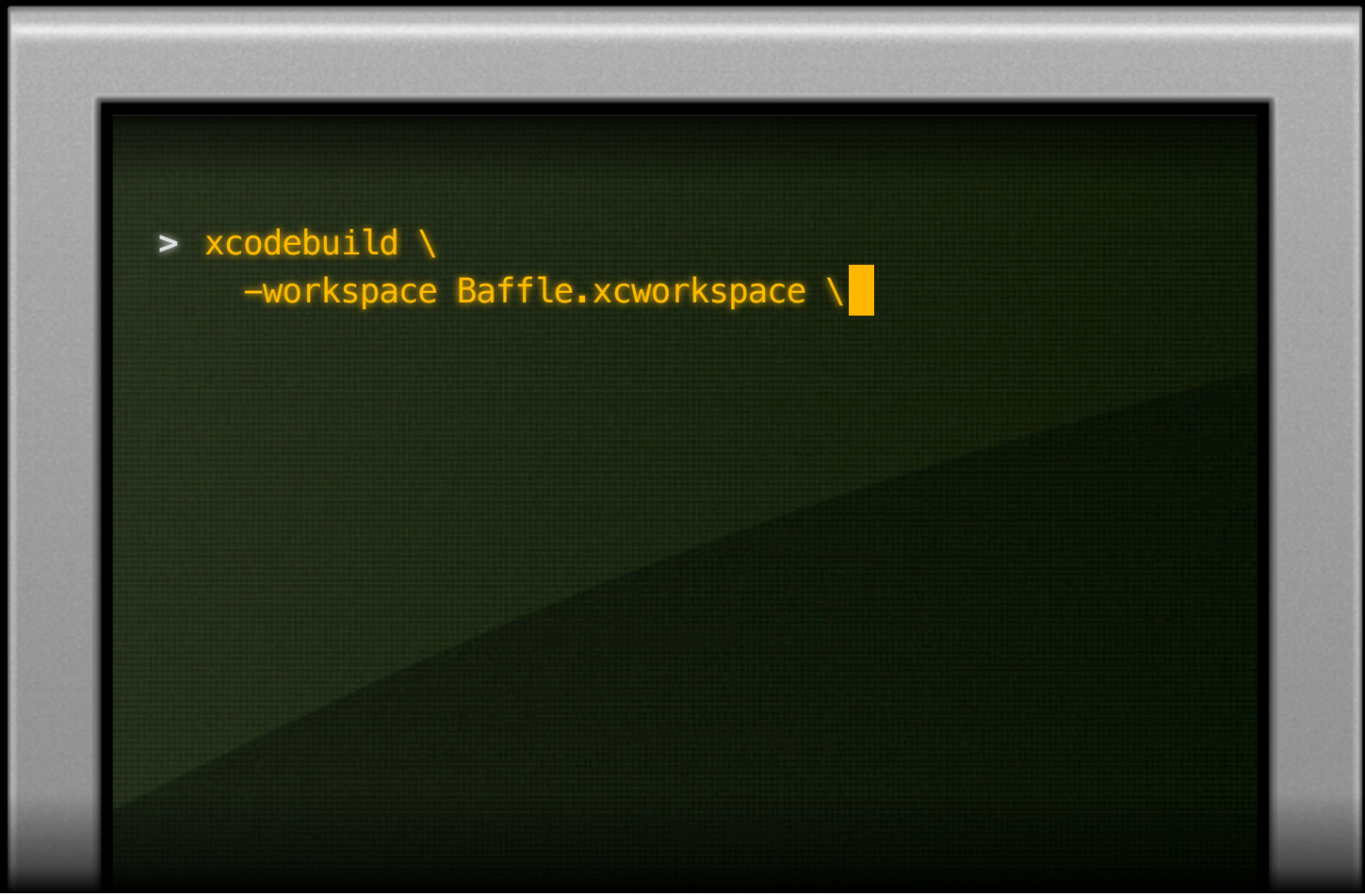

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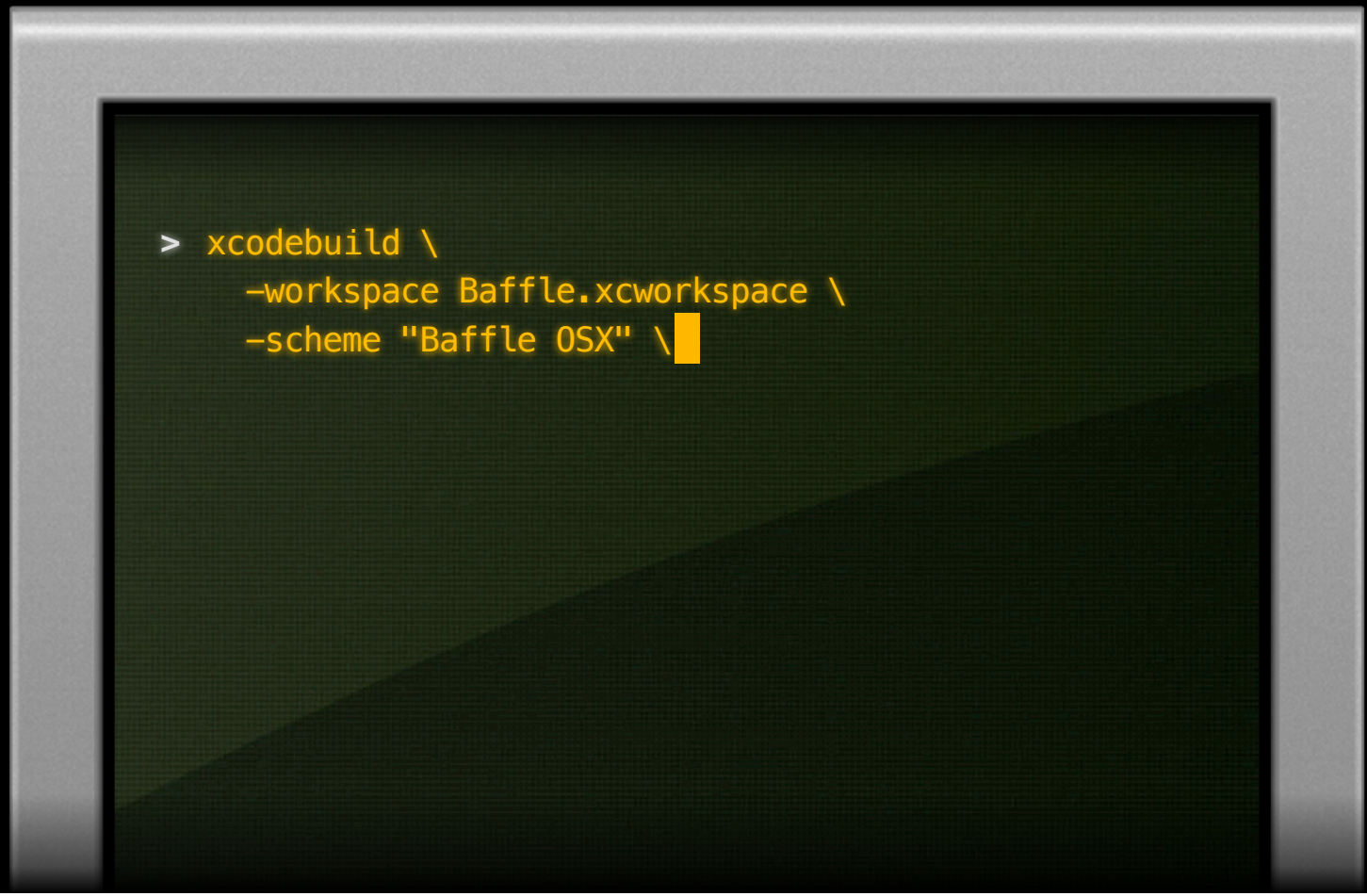
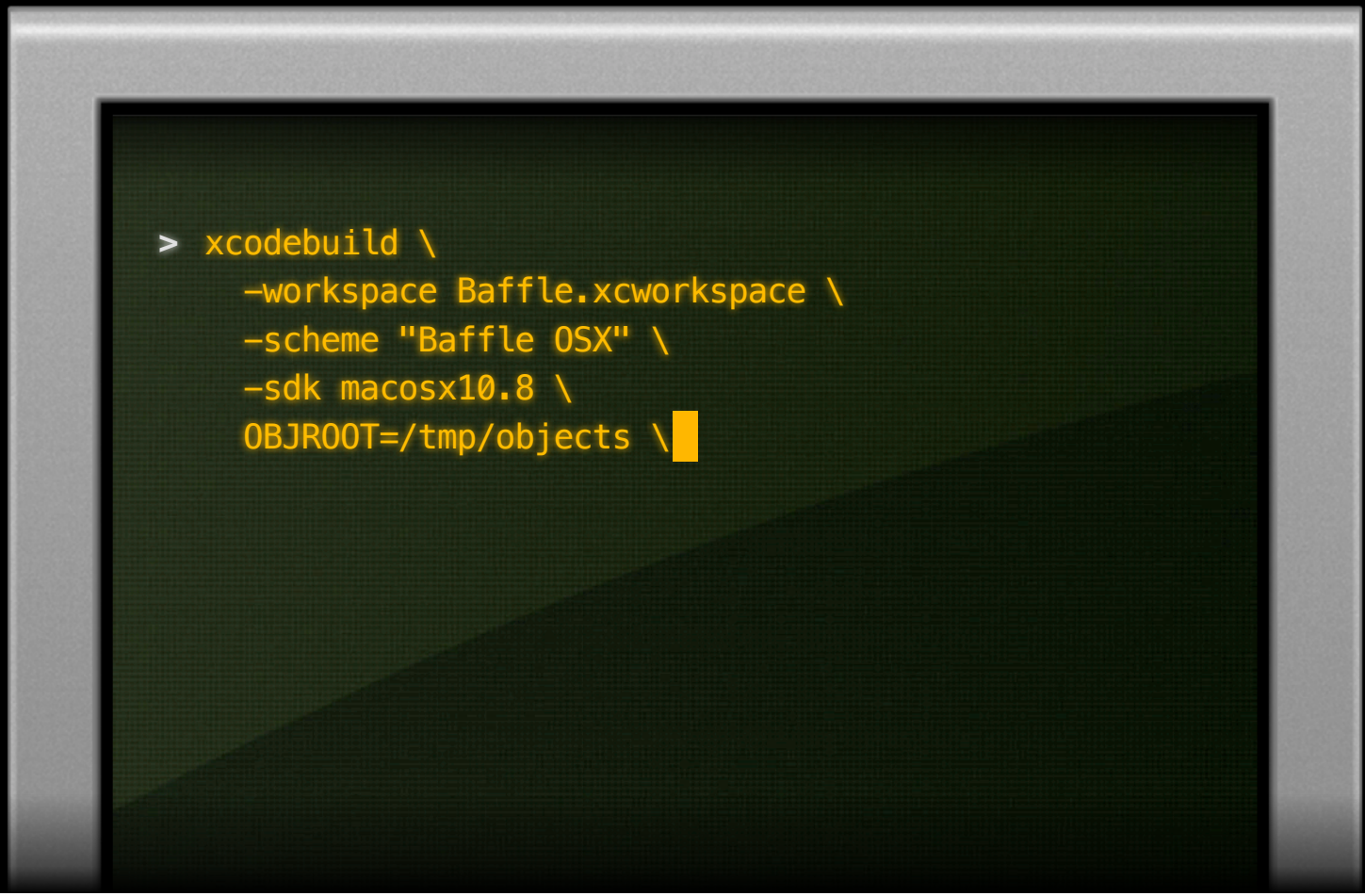


Putting It All Together

```
> xcodebuild \
    -workspace Baffle.xcworkspace \
    -scheme "Baffle OSX" \
    -sdk macosx10.8 \
```

Putting It All Together



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```

Which Xcode.app?

Xcode 4.3

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Xcode 4.5 Preview

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Use `xcode-select`

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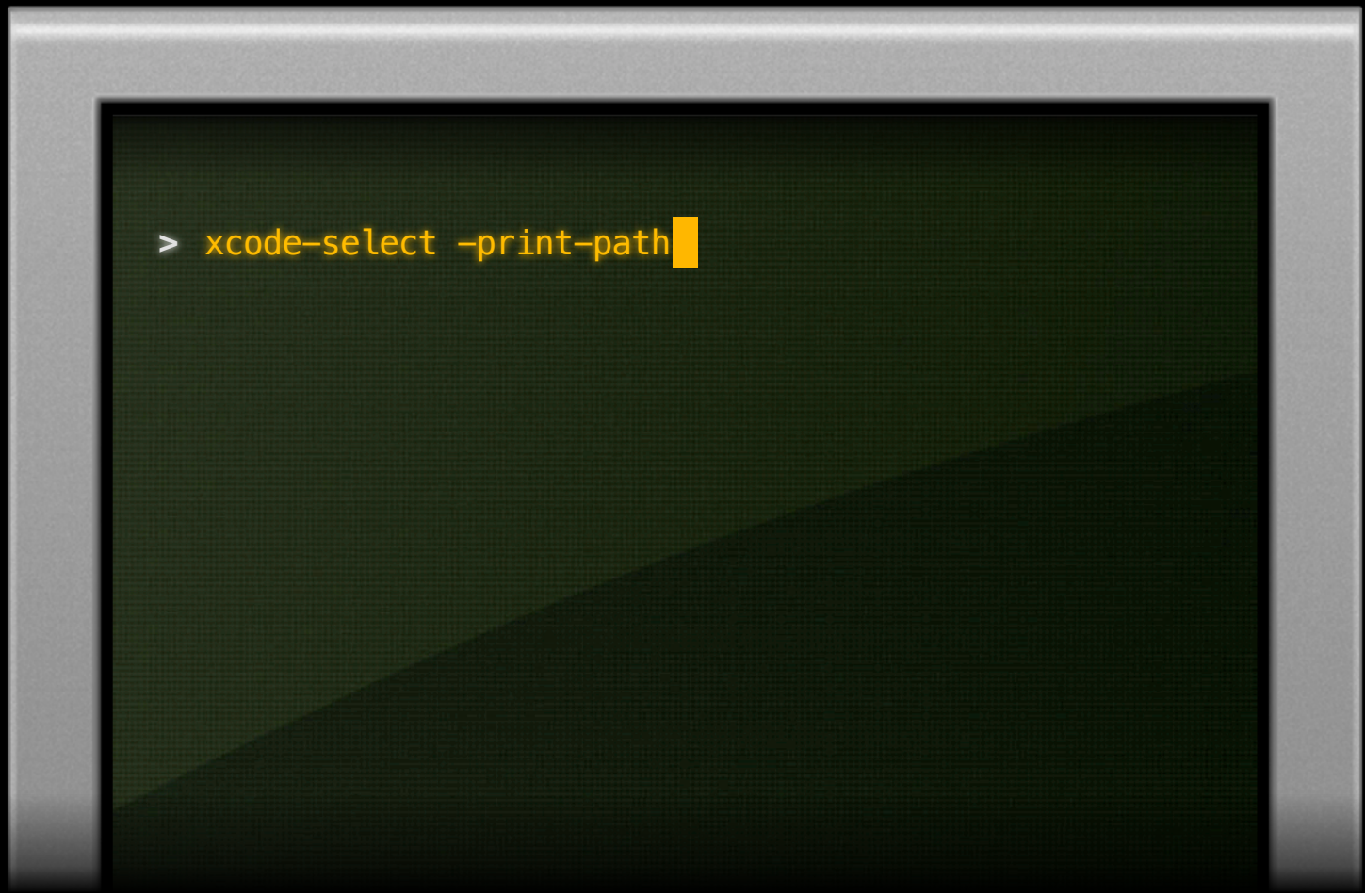

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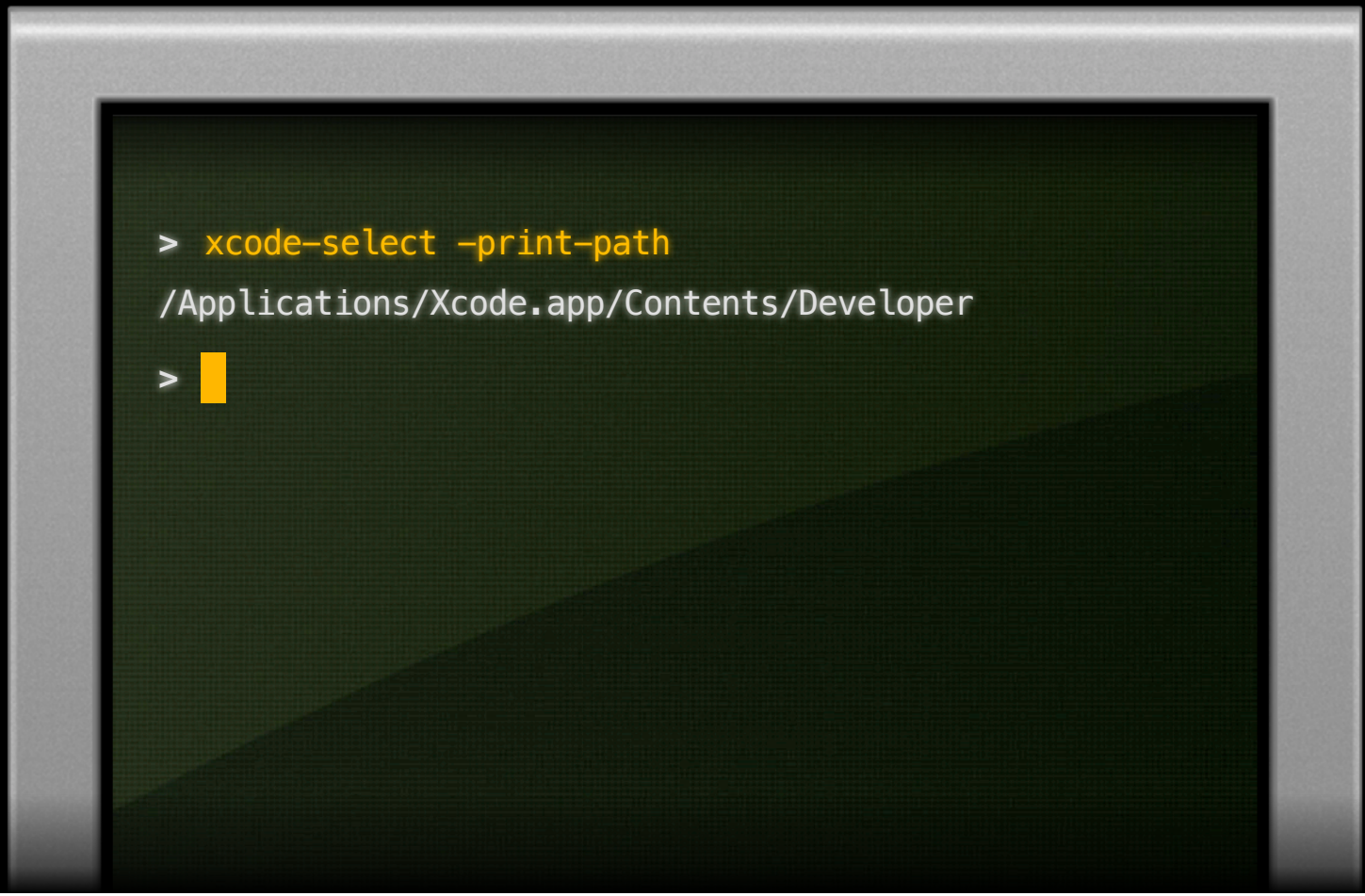

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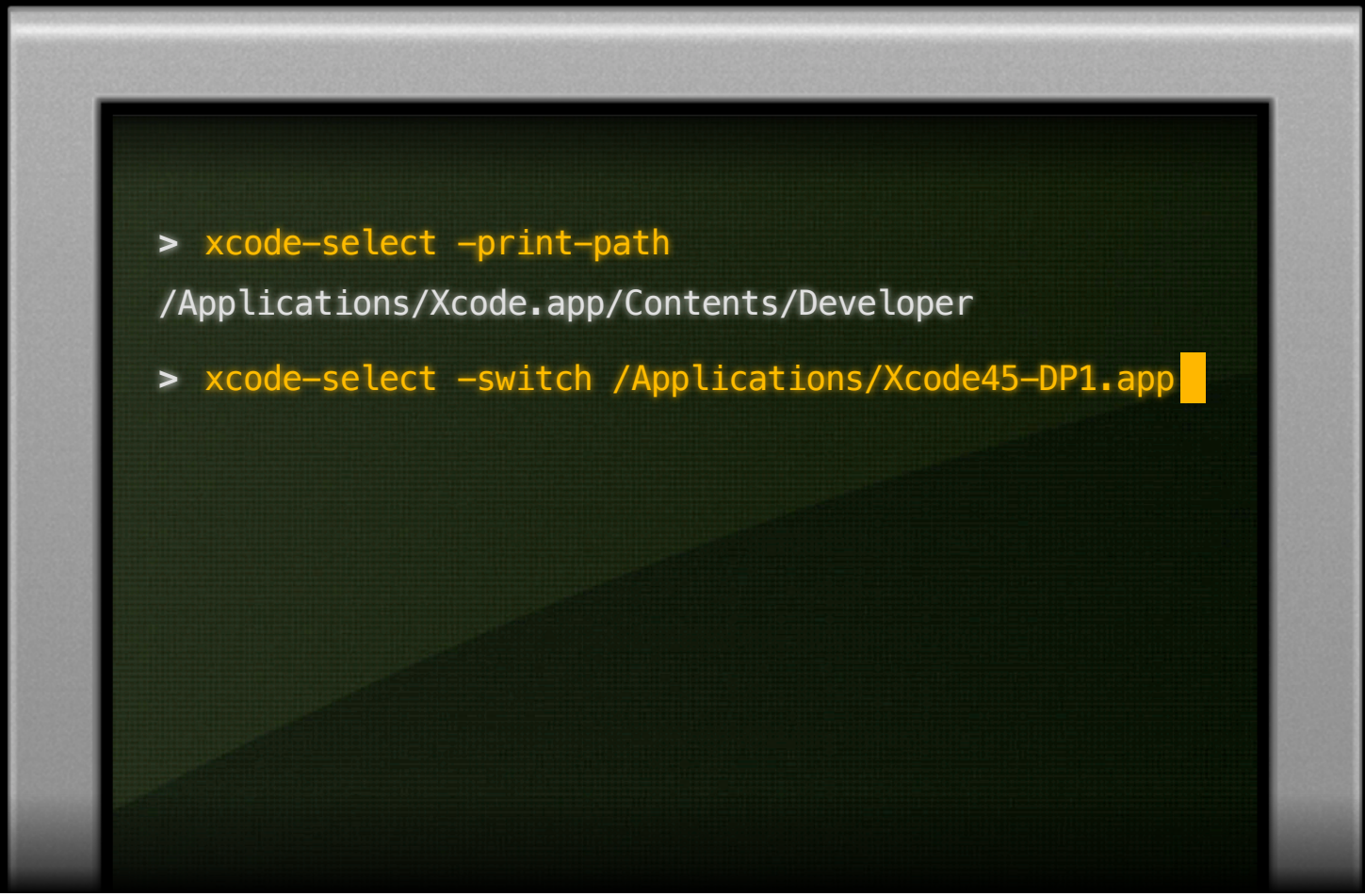

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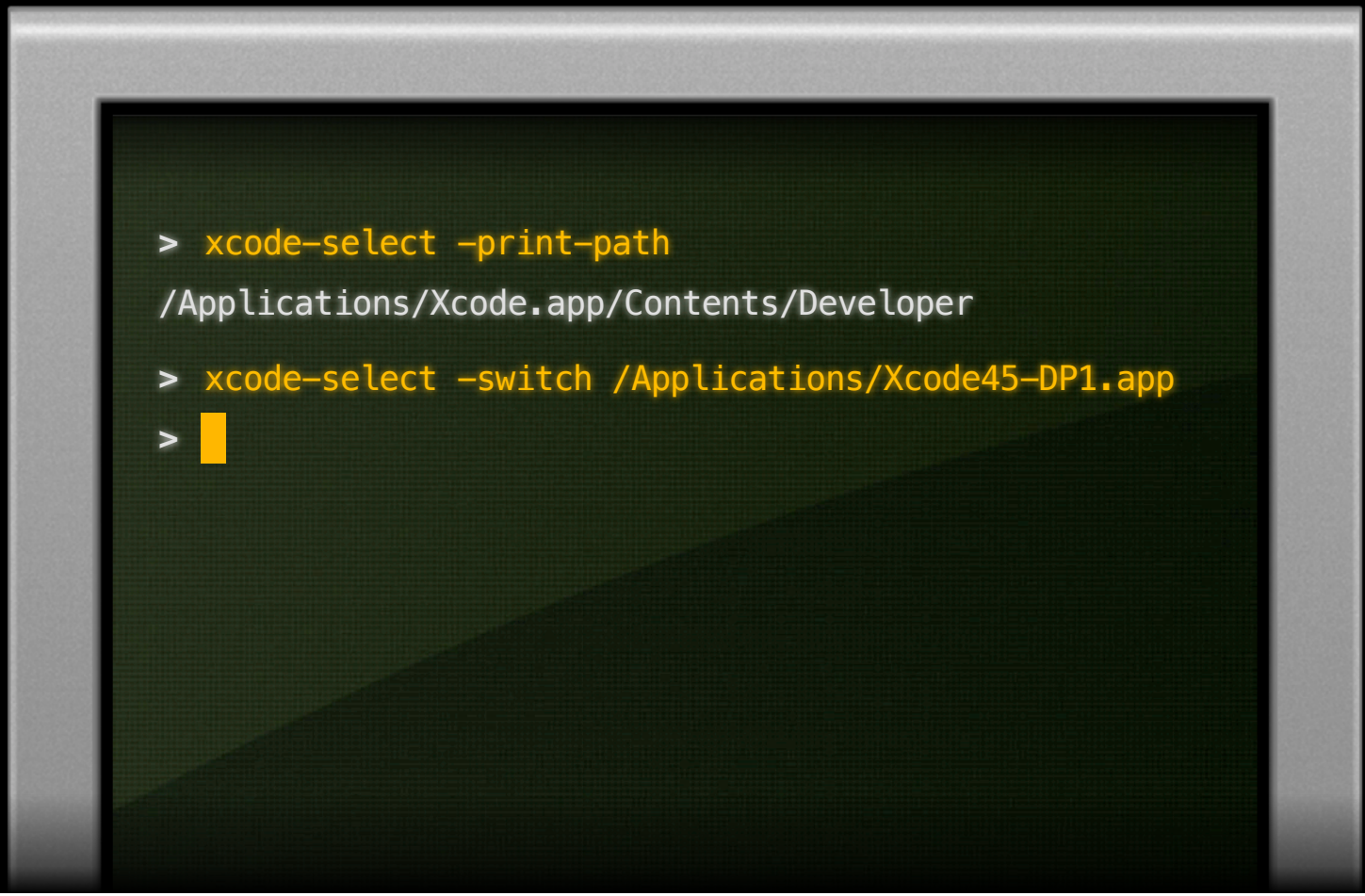

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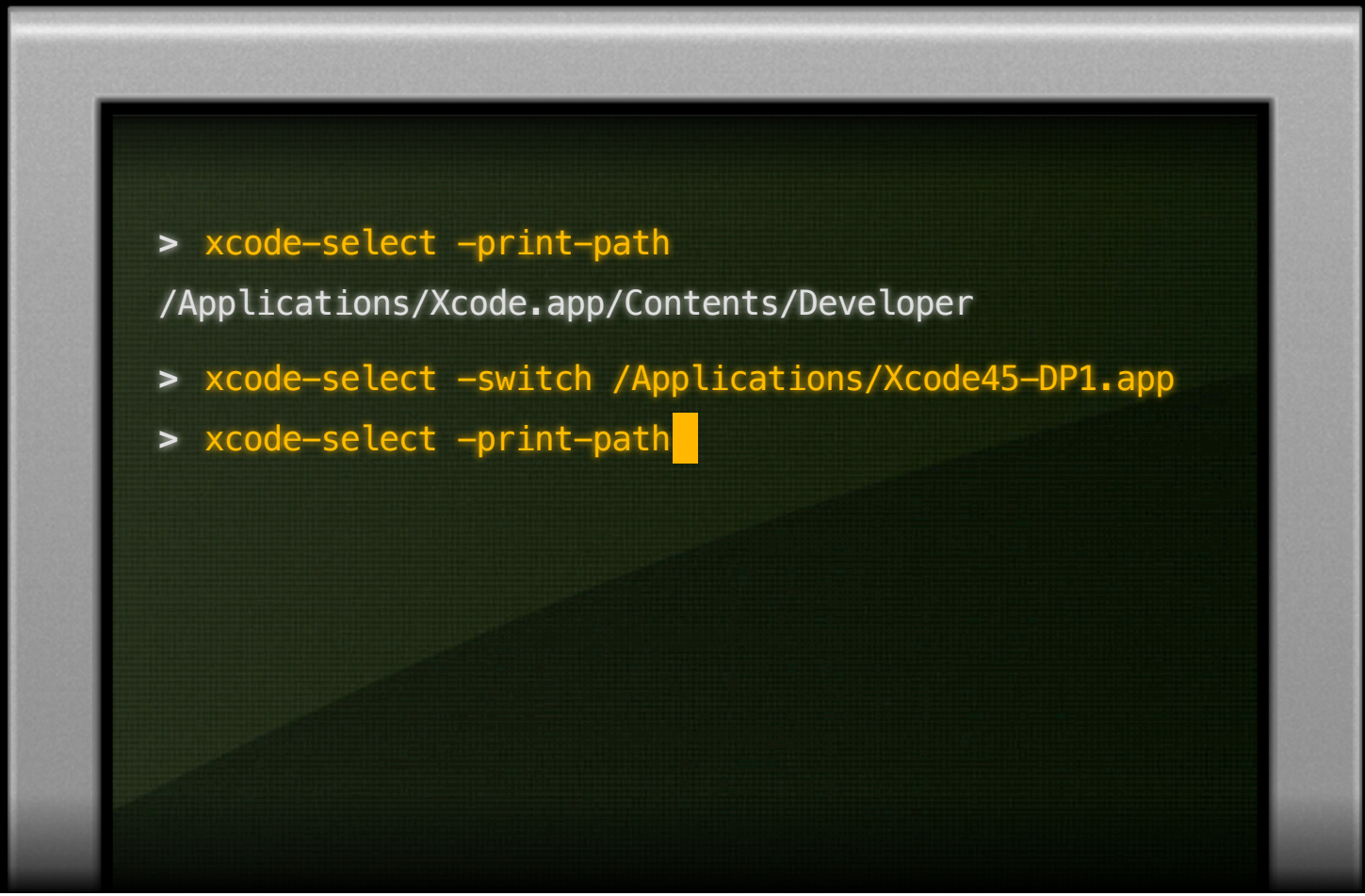

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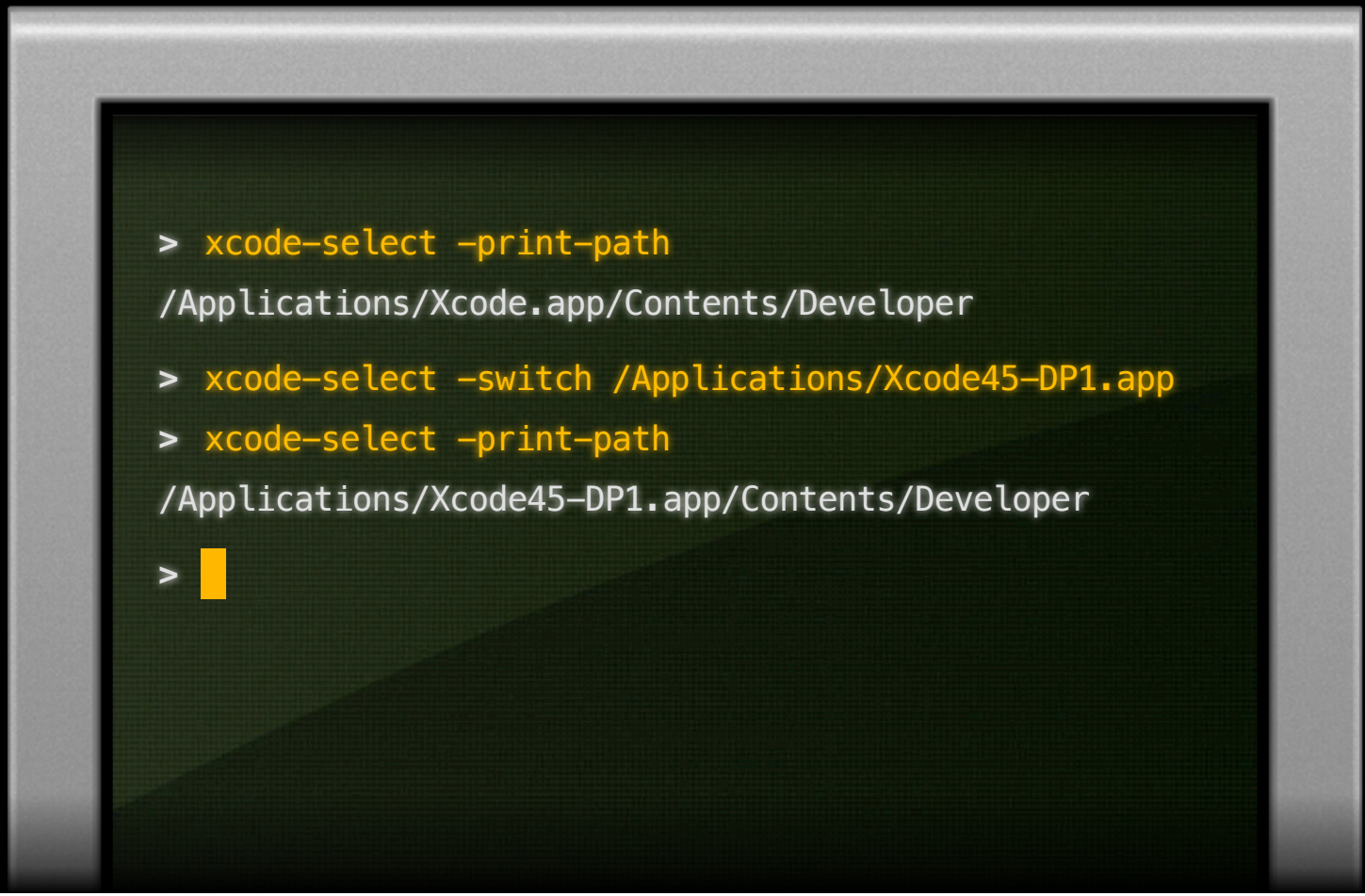

Use xcode-select

```
> xcode-select -print-path
/Applications/Xcode.app/Contents/Developer
> xcode-select -switch /Applications/Xcode45-DP1.app
> xcode-select -print-path
/Applications/Xcode45-DP1.app/Contents/Developer
> xcodebuild -version
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Xcode 4.5
Build version 4G78z
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```

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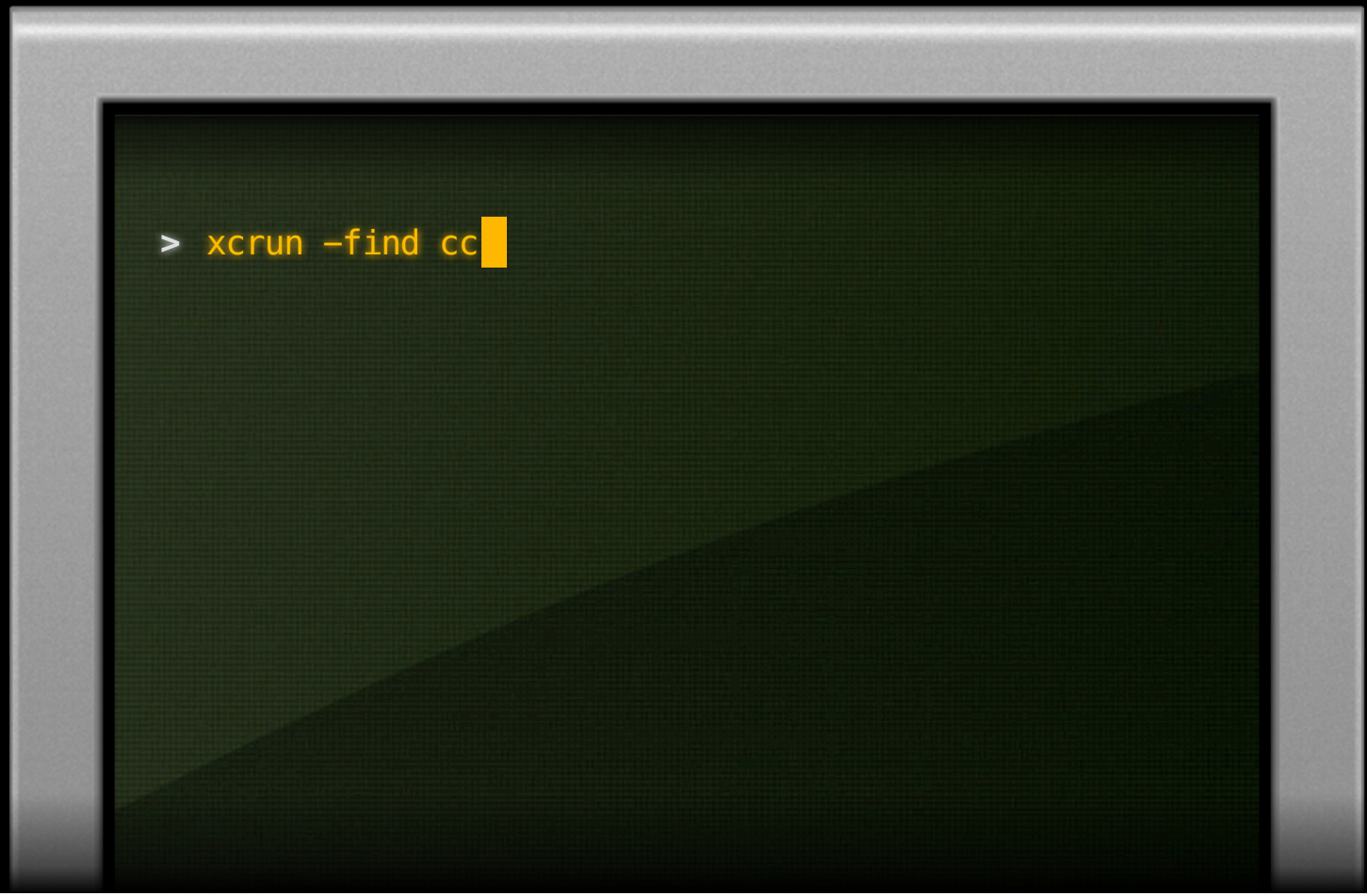
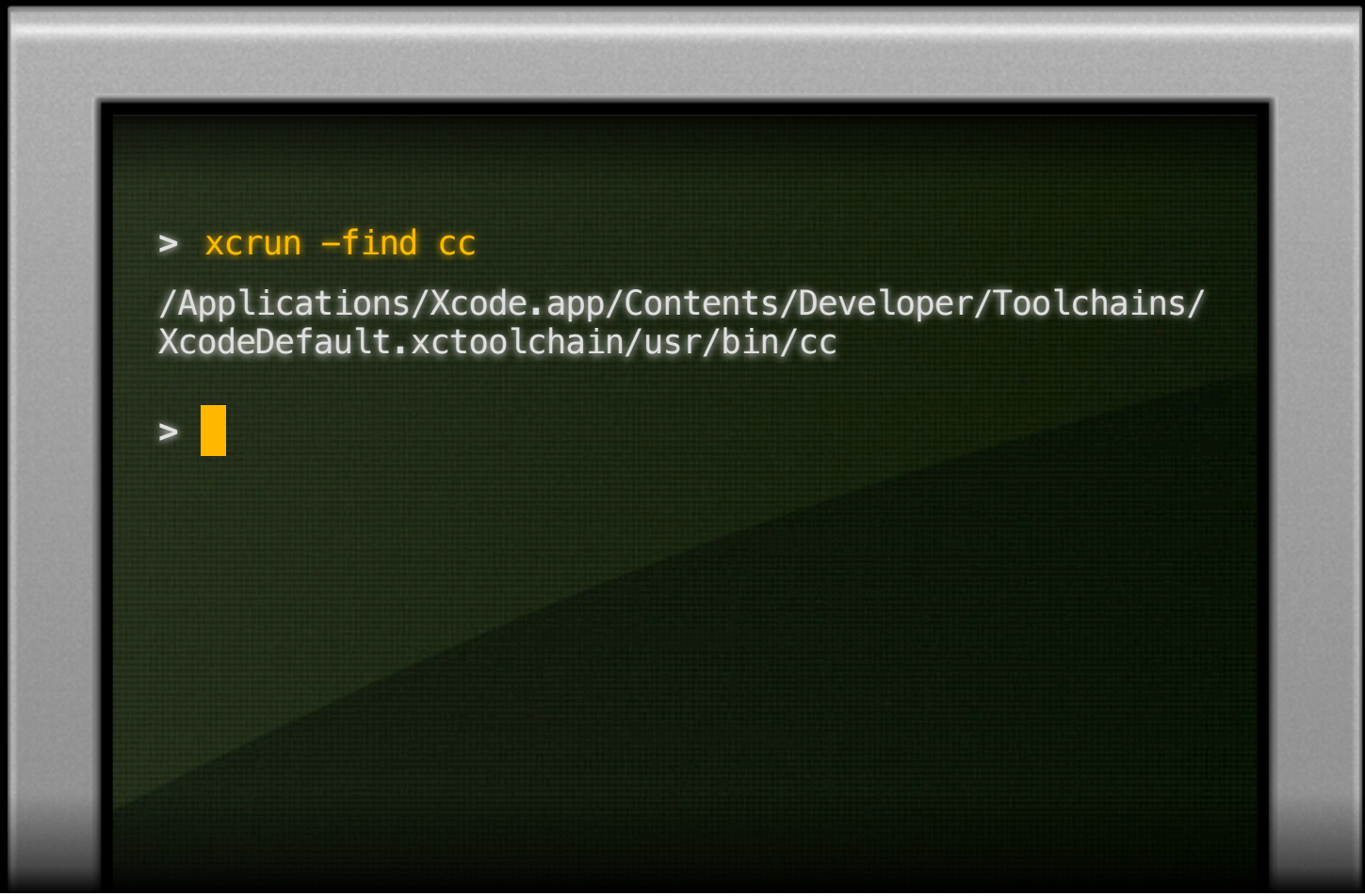
  - Also searches standard `$PATH` as a fallback
- Mode 1: Print the path of the tool
  - Usage: `xcrun -find tool`
- Mode 2: Run the tool with a full command line
  - Usage: `xcrun tool arg1 arg2 ...`

Using `xcrun`

Using `xcrun`



Using `xcrun`


> xcrun -find cc
/Applications/Xcode.app/Contents/Developer/Toolchains/
XcodeDefault.xctoolchain/usr/bin/cc
>

Using `xcrun`

```
> xcrun -find cc
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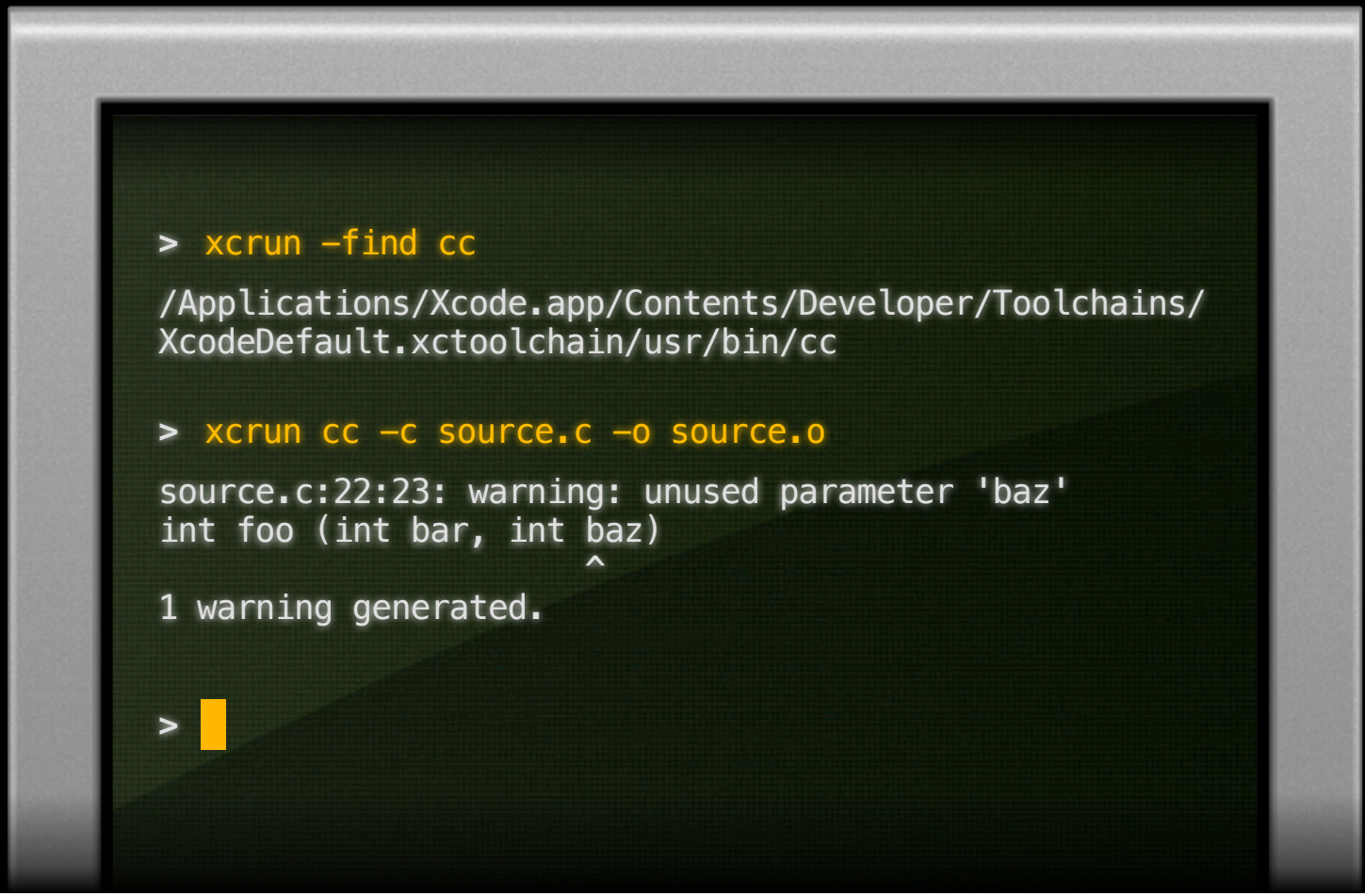
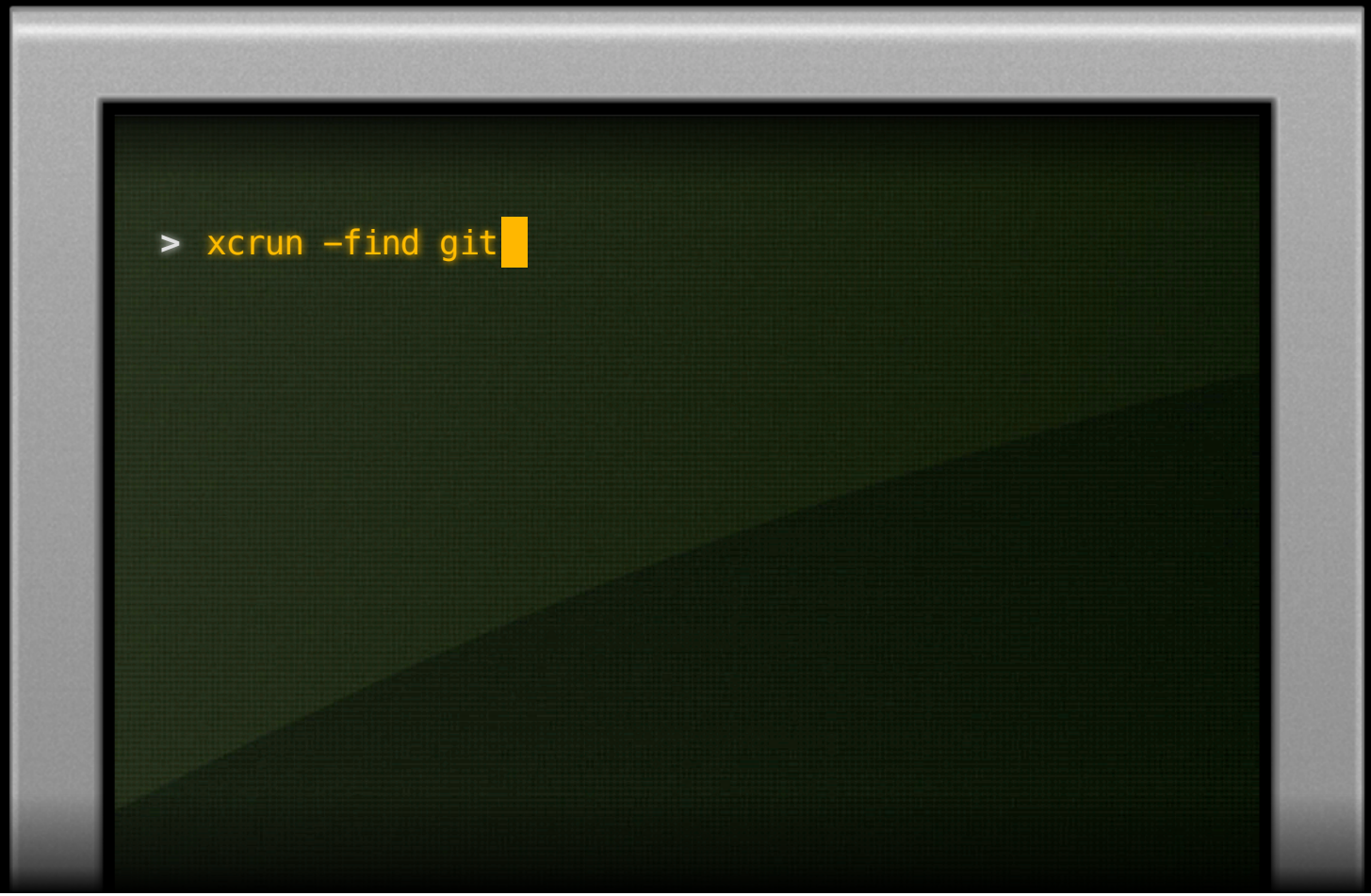
> xcrun cc -c source.c -o source.o
```

Using `xcrun`


> xcrun -find cc
/Applications/Xcode.app/Contents/Developer/Toolchains/
XcodeDefault.xctoolchain/usr/bin/cc
> xcrun cc -c source.c -o source.o
source.c:22:23: warning: unused parameter 'baz'
int foo (int bar, int baz)
^
1 warning generated.
>

Using `xcrun`

Using `xcrun`



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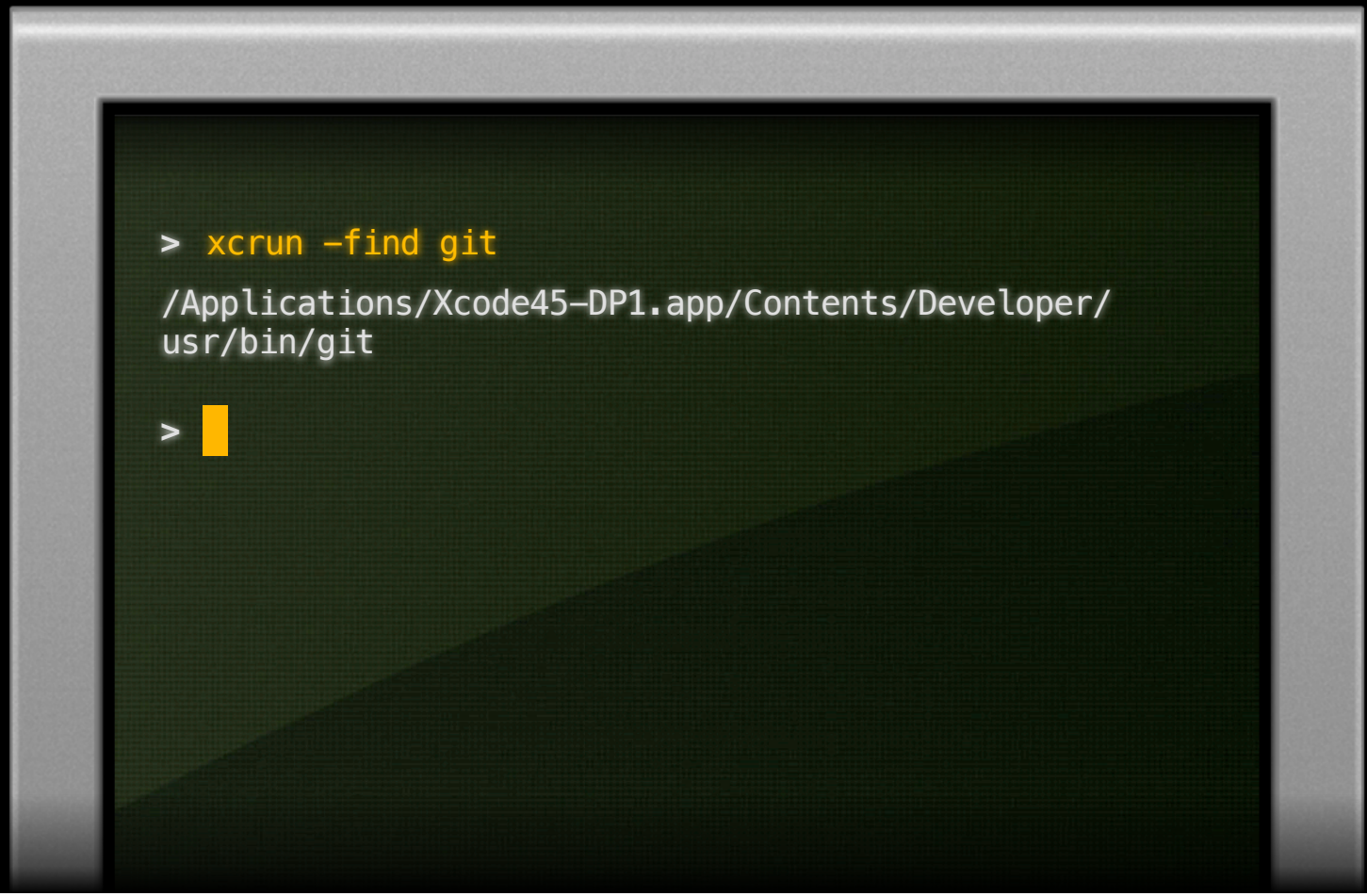
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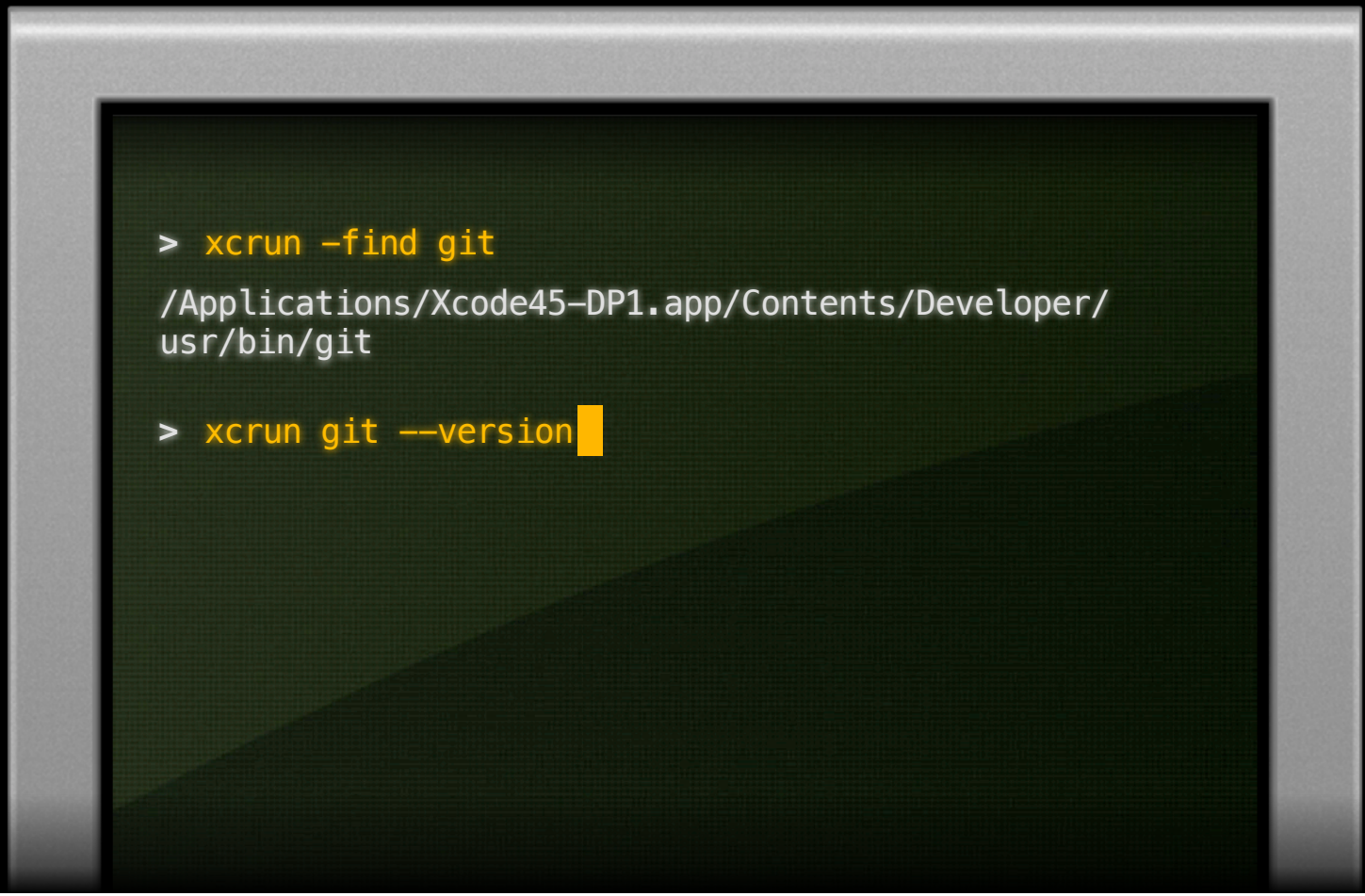
Using `xcrun`


> xcrun -find git
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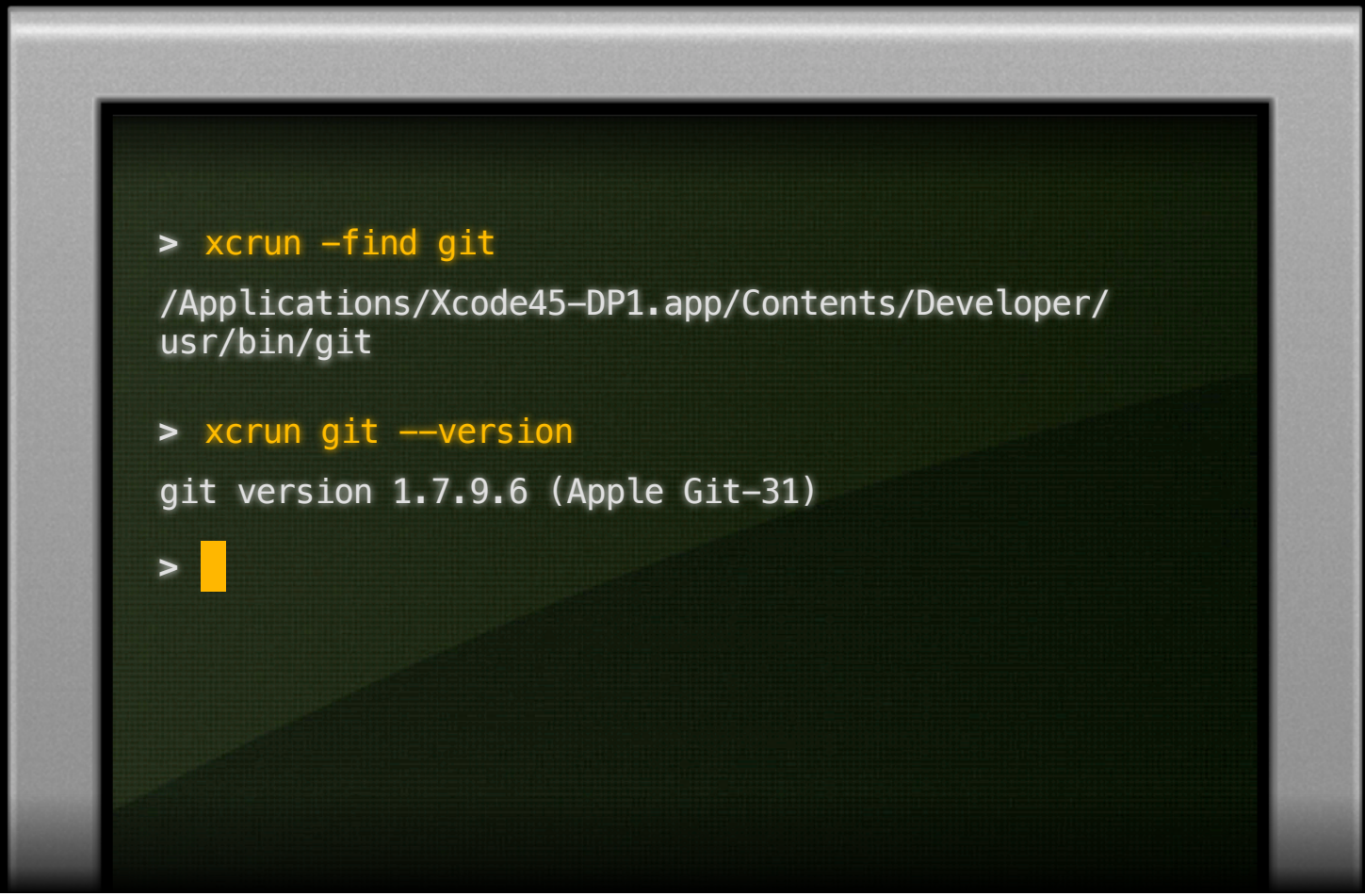
> xcrun git --version

Using `xcrun`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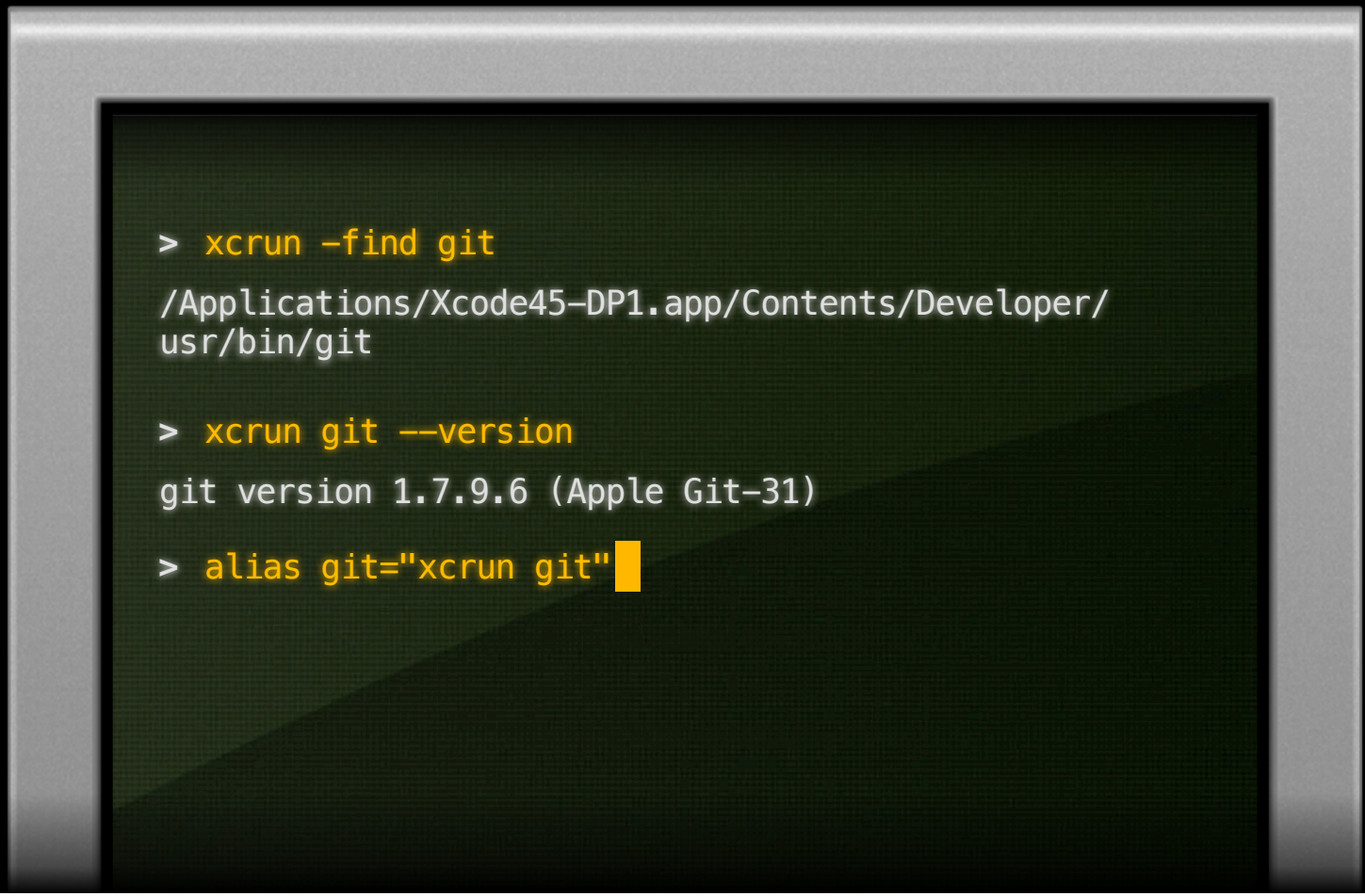
git version 1.7.9.6 (Apple Git-31)
>

Using `xcrun`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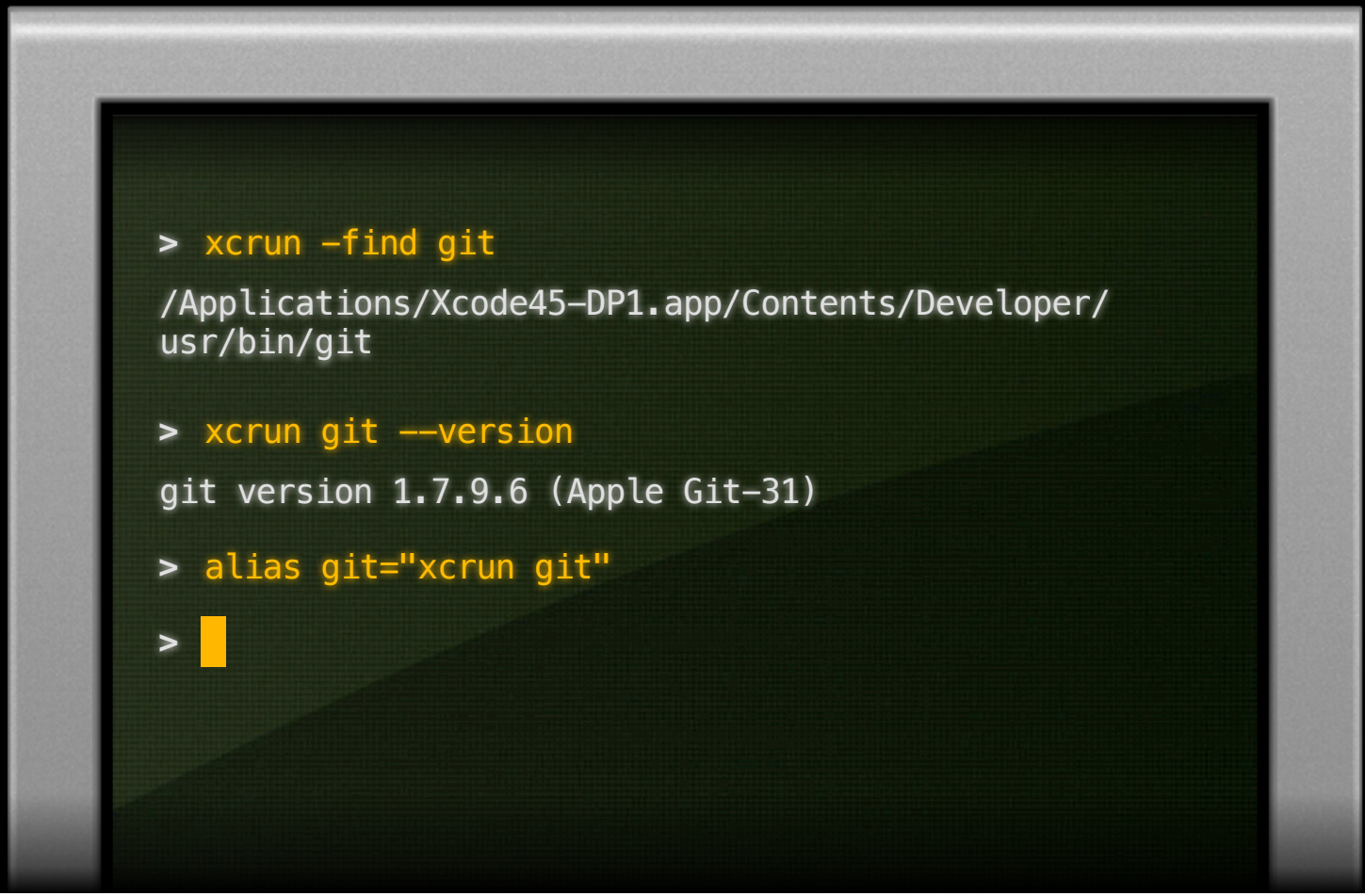
> alias git="xcrun git"

Using `xcrun`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Directly Invoking a Specific `xcodebuild`

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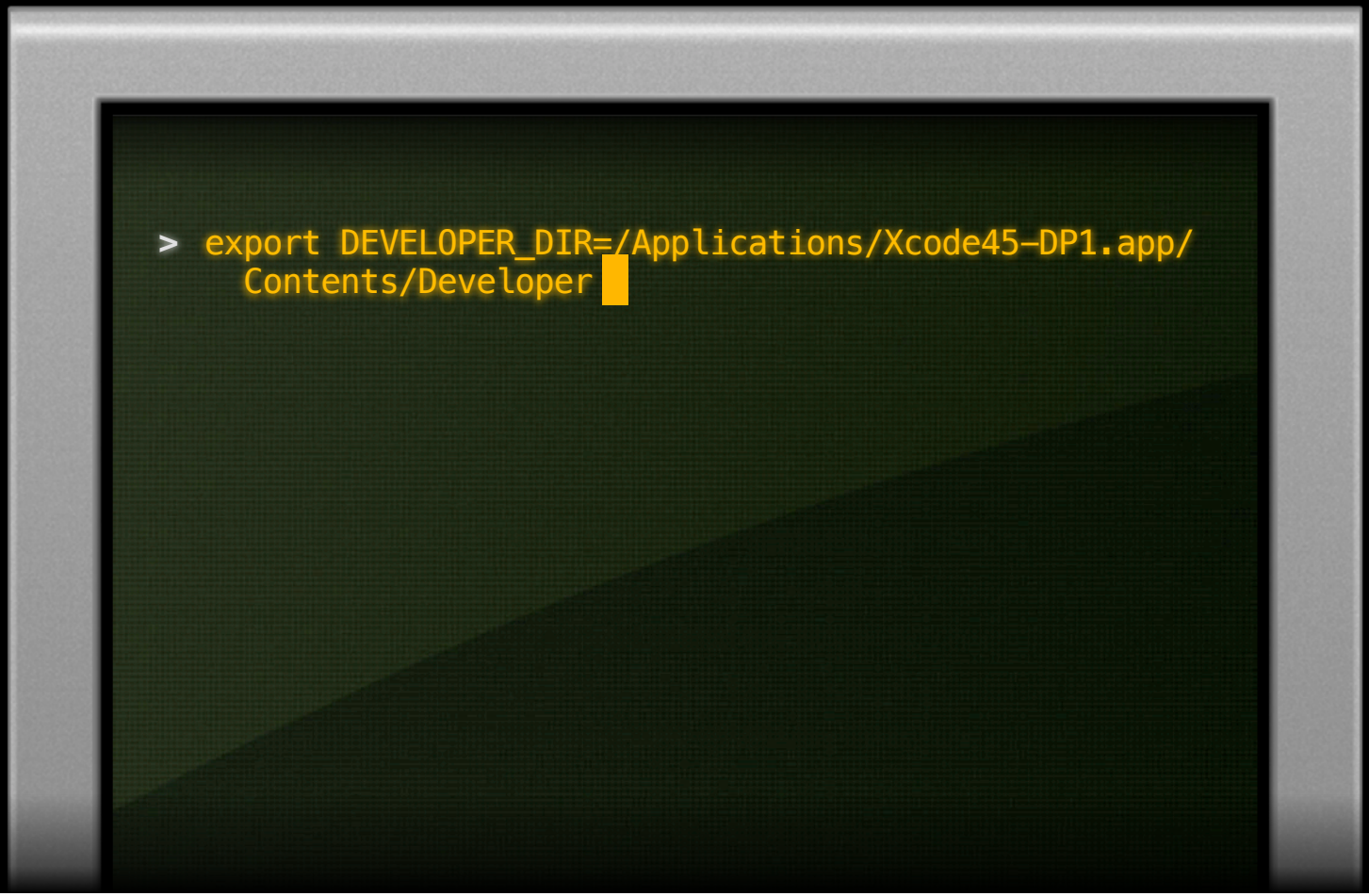

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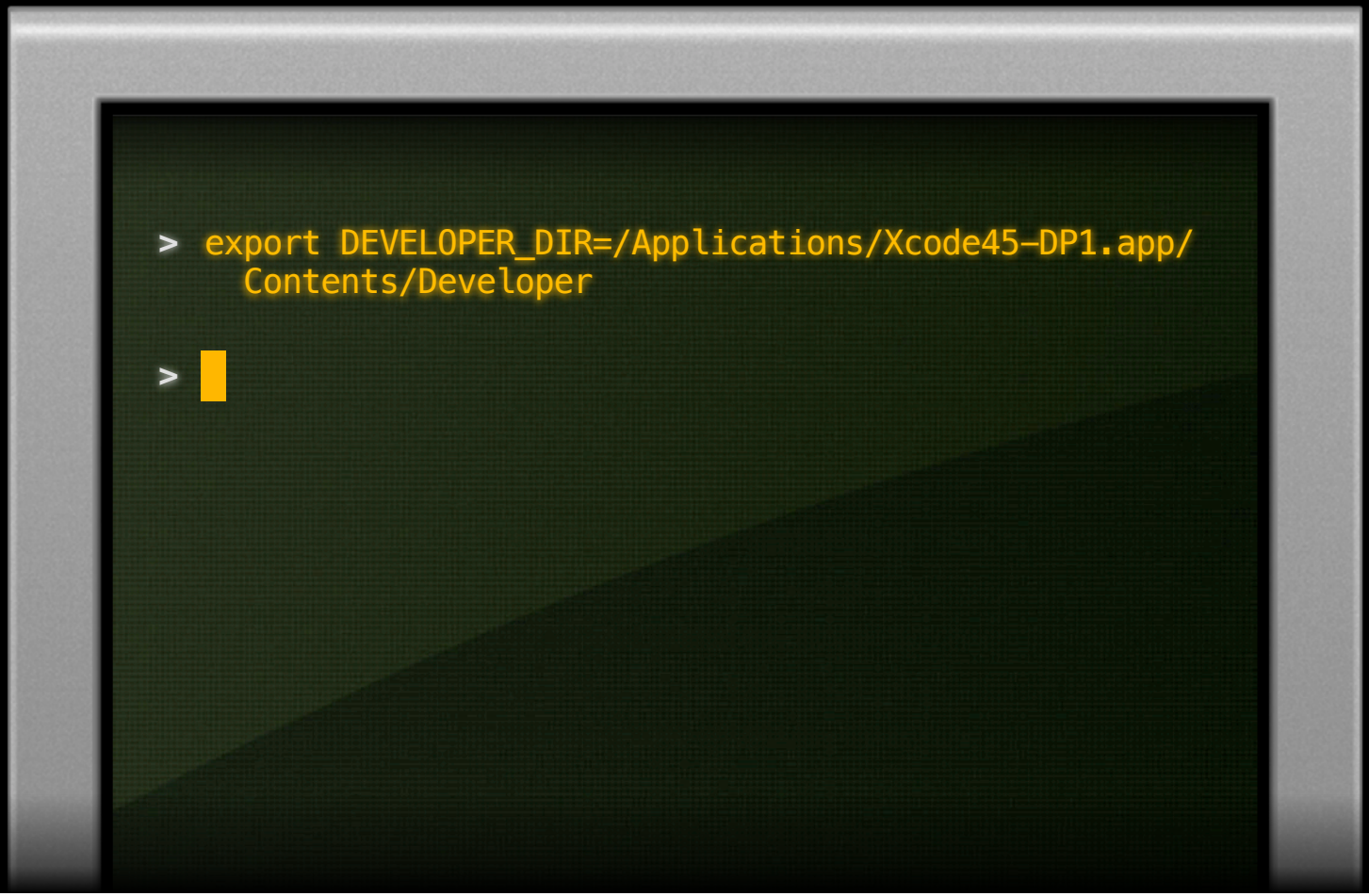

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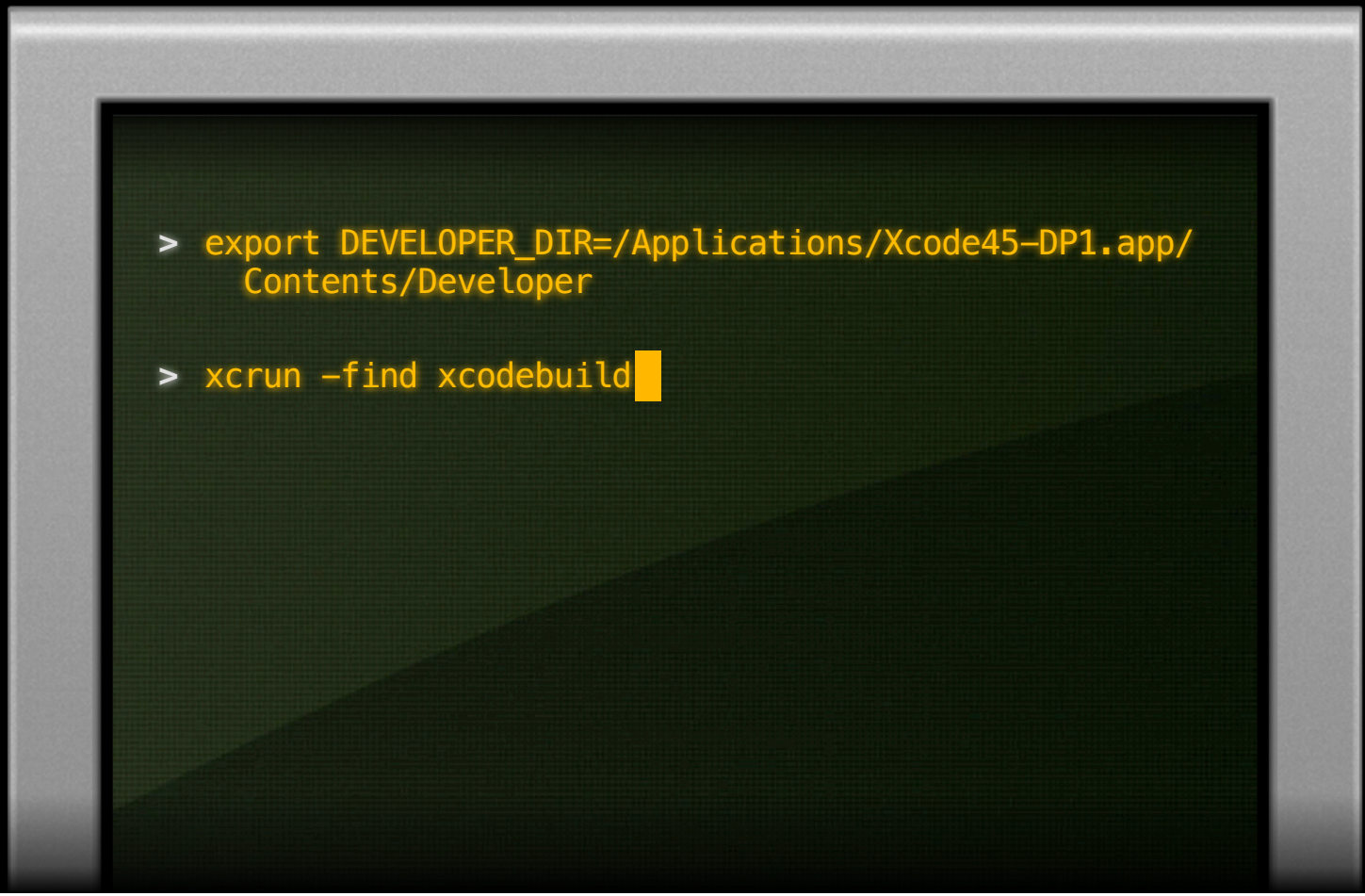
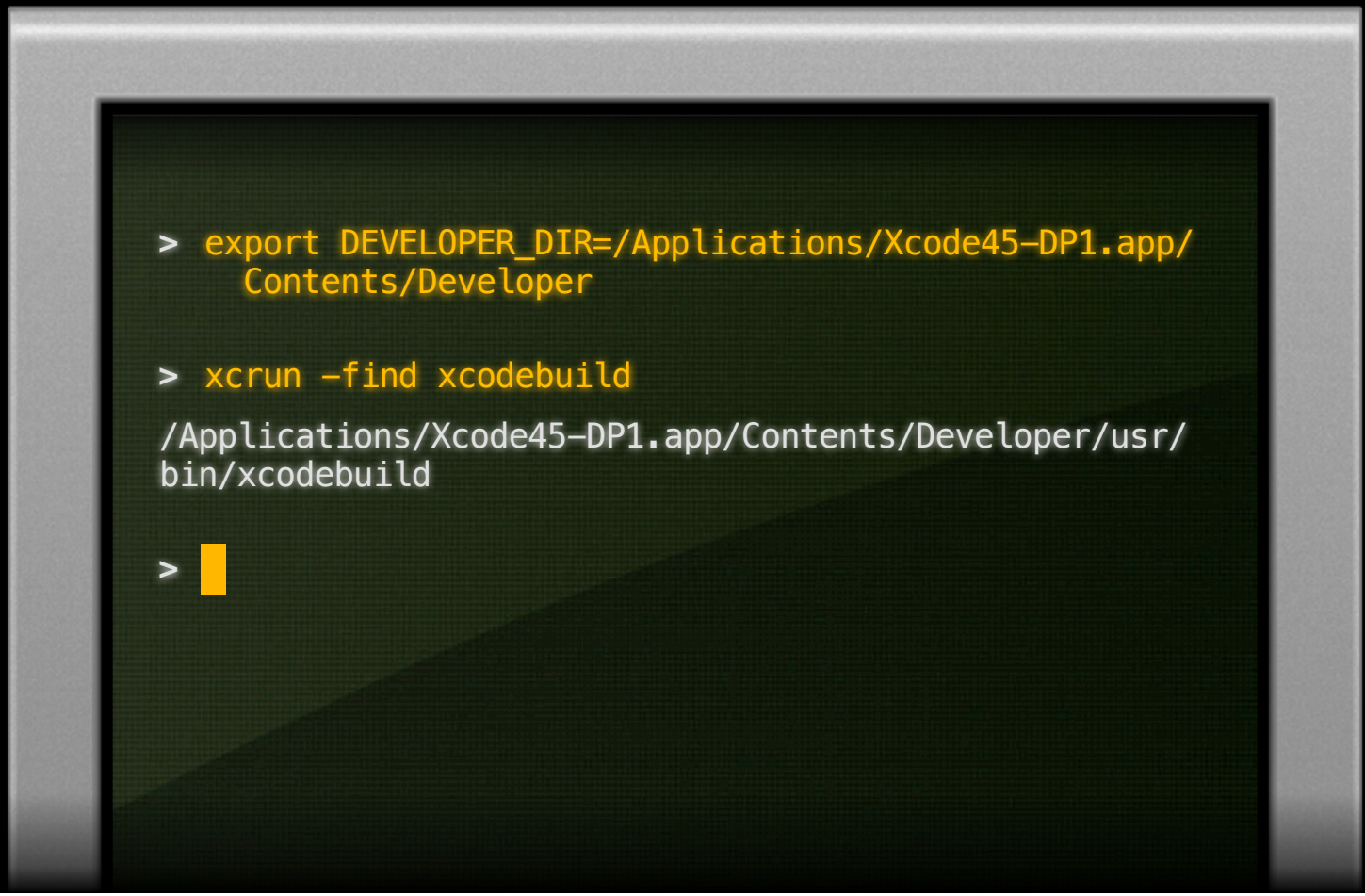


Directly Invoking a Specific `xcodebuild`



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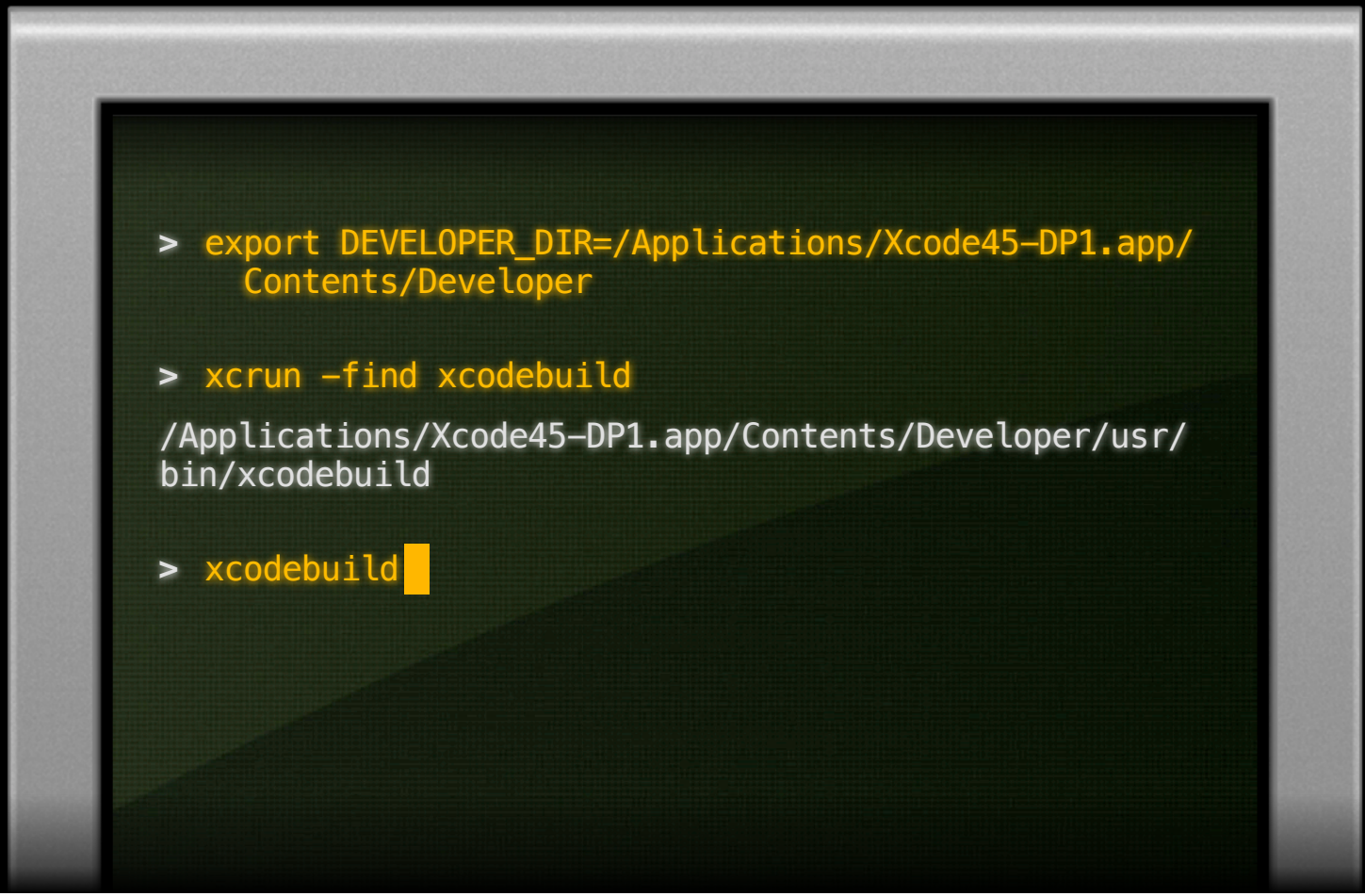

Directly Invoking a Specific xcodebuild

```
> export DEVELOPER_DIR=/Applications/Xcode45-DP1.app/
    Contents/Developer

> xcrun -find xcodebuild

/Applications/Xcode45-DP1.app/Contents/Developer/usr/
bin/xcodebuild

> xcodebuild

=== BUILD NATIVE TARGET Baffle OSX OF PROJECT Baffle
OSX WITH CONFIGURATION Debug ===

ProcessPCH build/Intermediates/PrecompiledHeaders/Baff
leCocoa_Prefix-dkhujustkymhfqbdihrzilncxtxa/BaffleCoco
a_Prefix.pch.pth OtherSources/BaffleCocoa_Prefix.pch n
ormal x86_64 objective-c com.apple.compilers.llvm.clan
```

Automating `xcodebuild`

Using Xcode with Continuous Integration

Daniel Dunbar
System Tools Engineer

What Is Continuous Integration?

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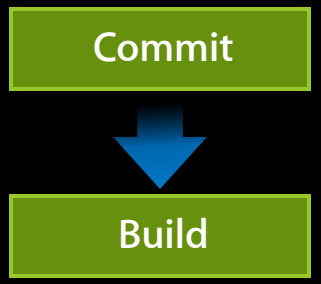

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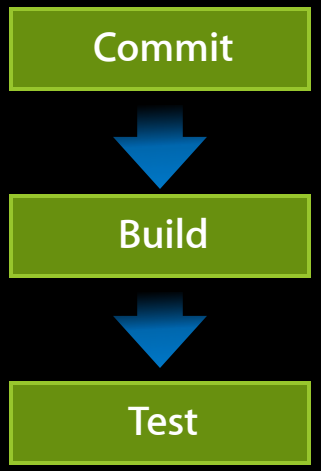

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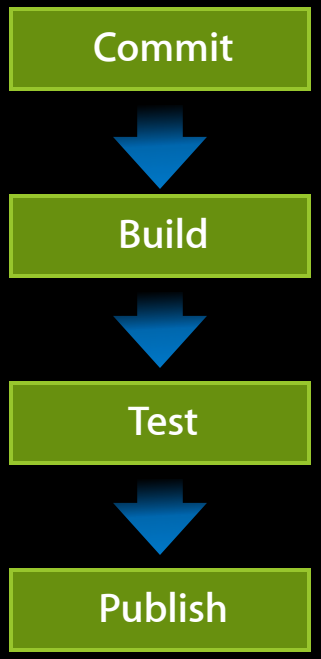

Continuous Integration Example

Continuous Integration Example

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- Solution
  - Use `xcodebuild` and Continuous Integration

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`DSTROOT, OBJROOT, SYMROOT, SHARED_PRECOMPS_DIR`

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sudo xcodebuild -license
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- Ensure access to appropriate development certificates

Demo

Automating project builds

Working Outside Xcode

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- Many projects may not supply native Xcode projects

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- Many projects may not supply native Xcode projects
  - Legacy code base

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  - Understanding the command line tools package

The Command Line Tools Package

The Command Line Tools Package

- What is the command line tools package?

The Command Line Tools Package

- What is the command line tools package?
- How to install the command line tools package?

The Command Line Tools Package

- What is the command line tools package?
- How to install the command line tools package?
- When should it be installed?

What Is the Package?

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- Separate package for doing extensive command line development

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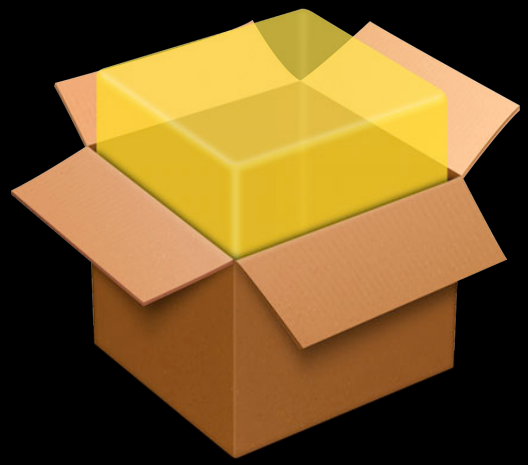
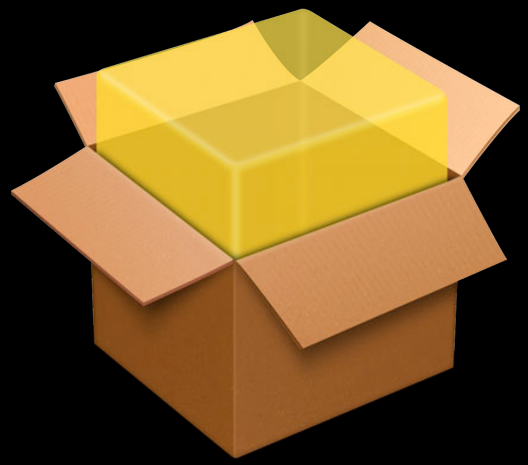
- New in Xcode 4.3
- Separate package for doing extensive command line development
- Supported mechanism for UNIX-style development

What Does It Contain?



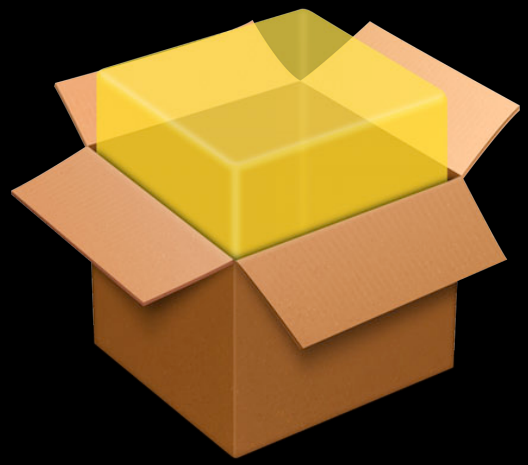
What Does It Contain?

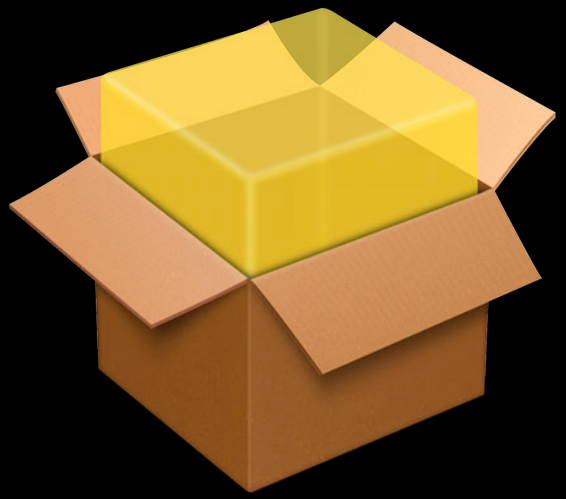
- Contains everything for command line development

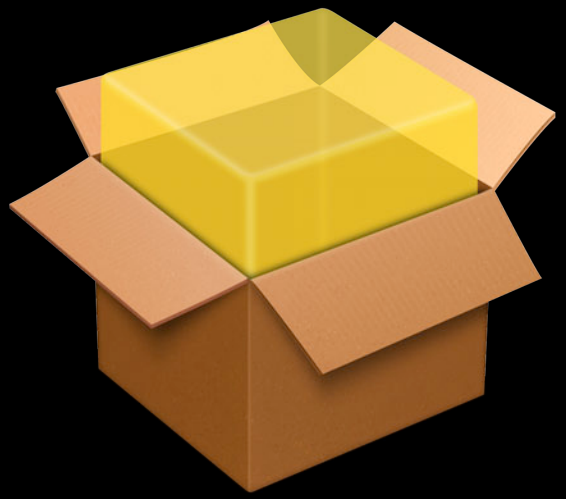


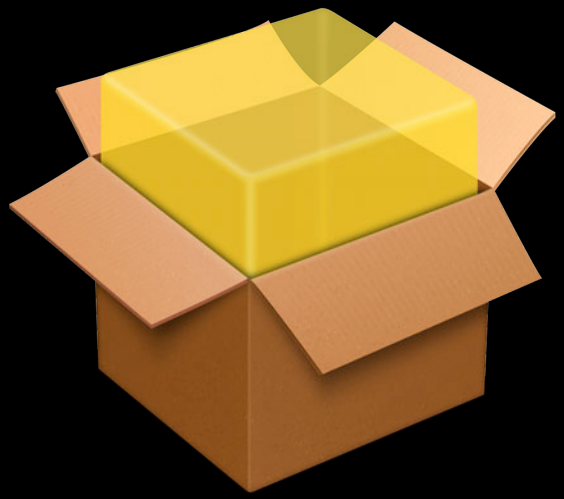
What Does It Contain?

- Contains everything for command line development
- Bundled at the standard UNIX location (/usr)





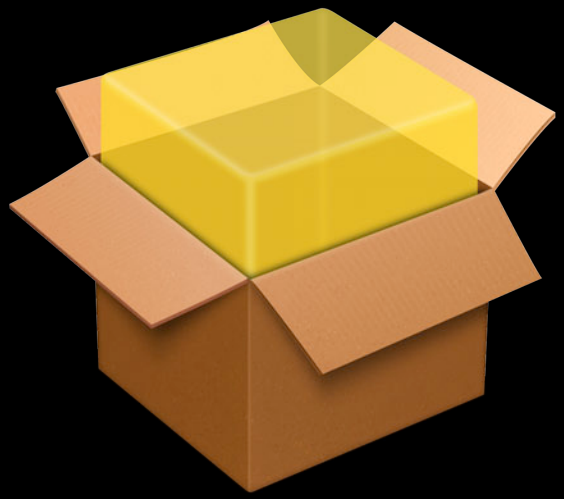




Tools

OSX / SDK

Documentation
(man Pages)



Tools

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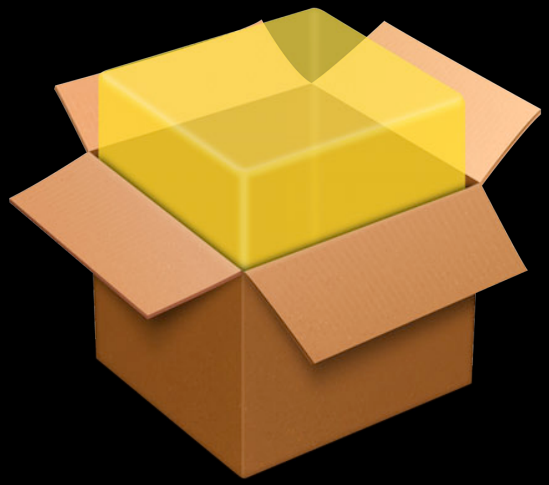
Development Tools

Debugging Tools

Source Control

Obtaining the Command Line Tools



Download from
Developer Resources

Install from Xcode

Obtaining the Command Line Tools

As a standalone download

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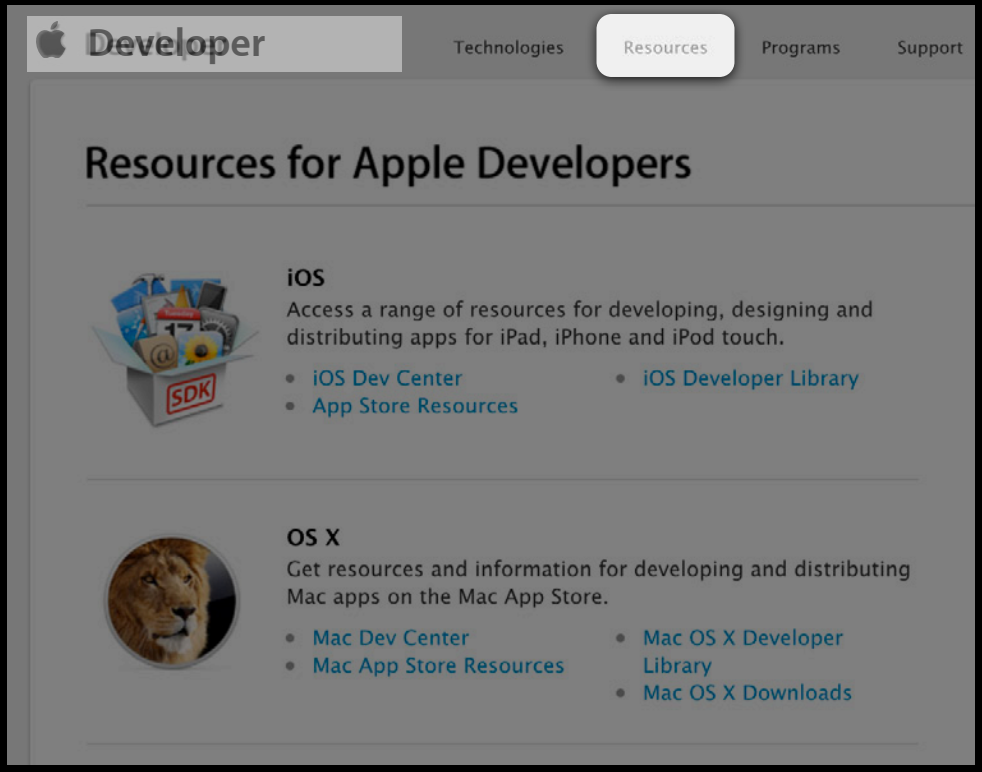

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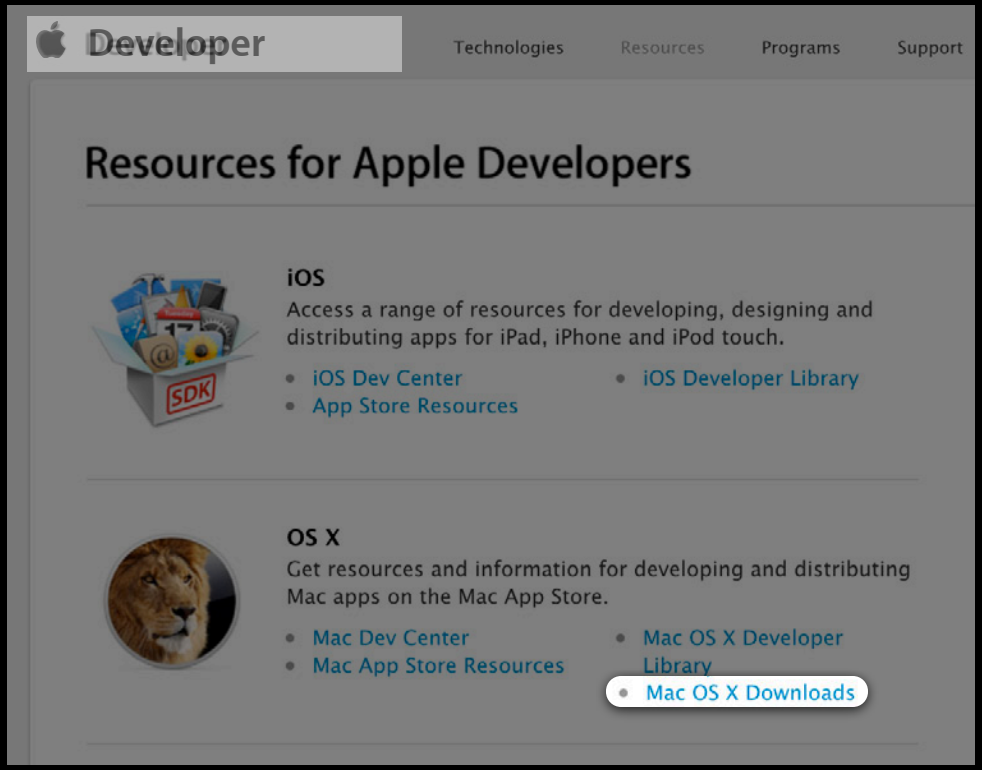

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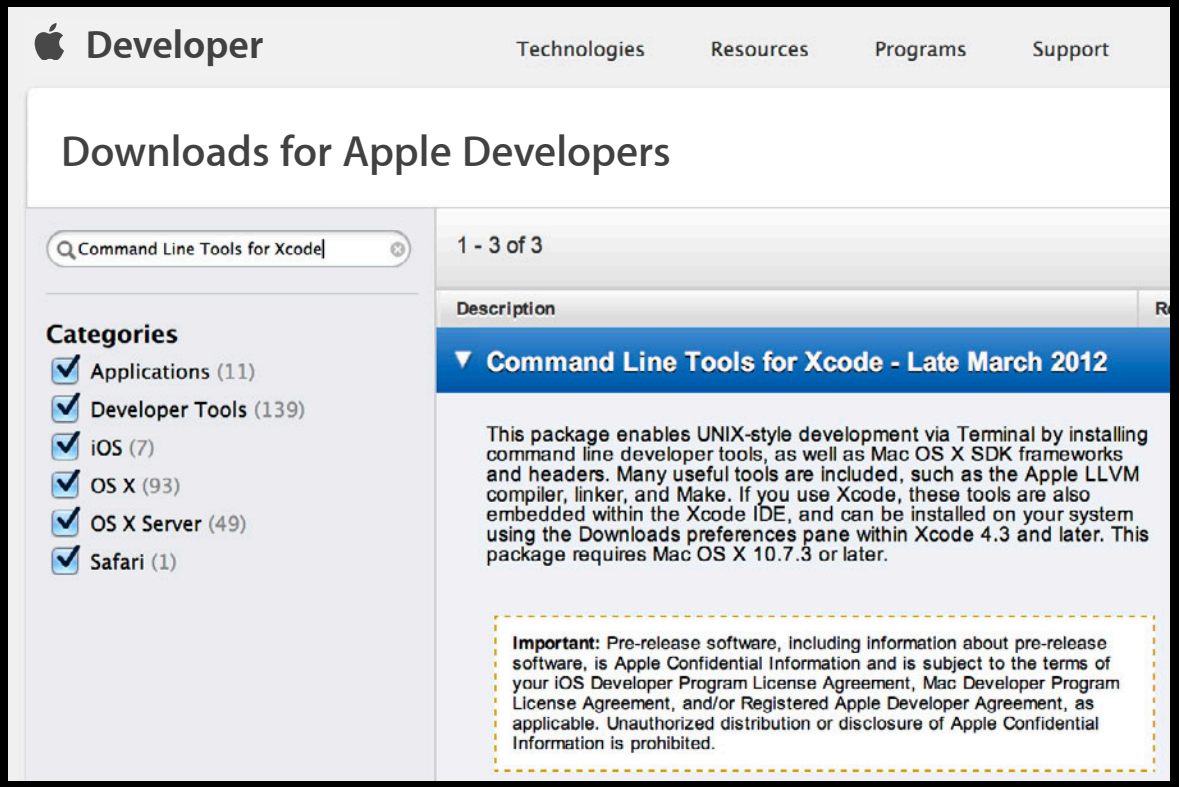

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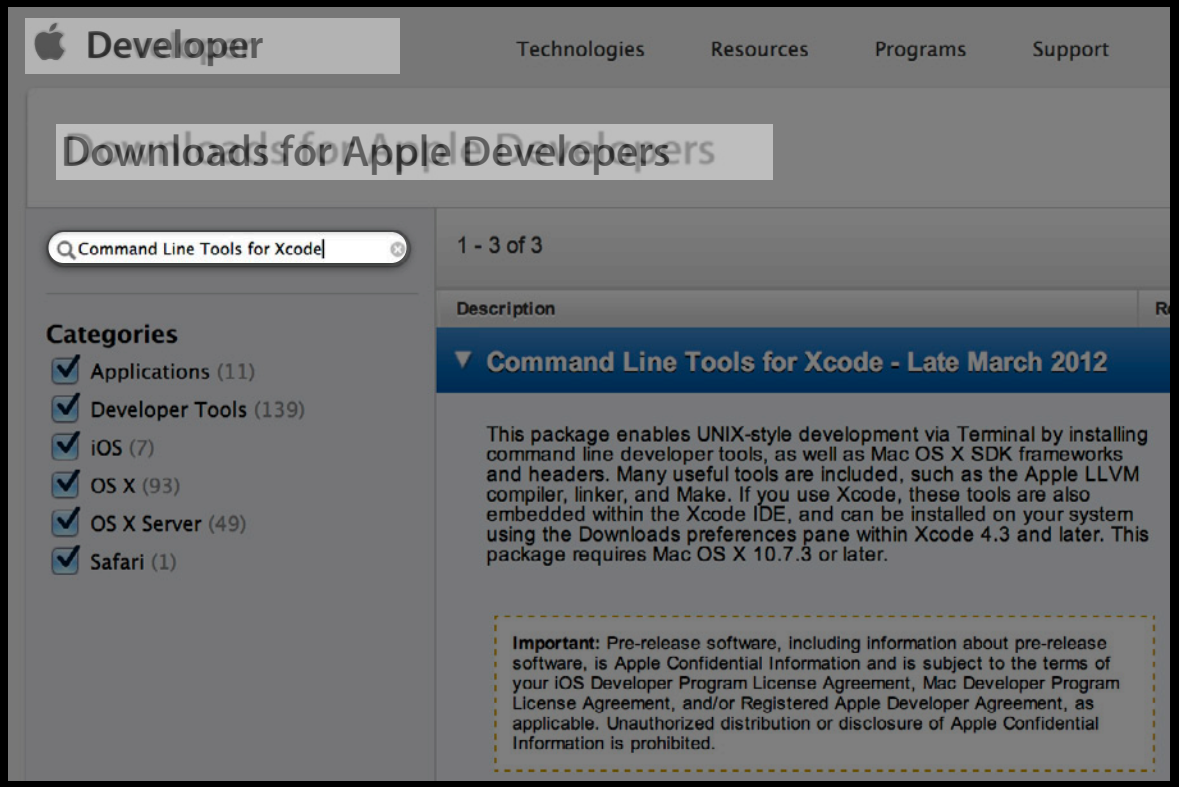

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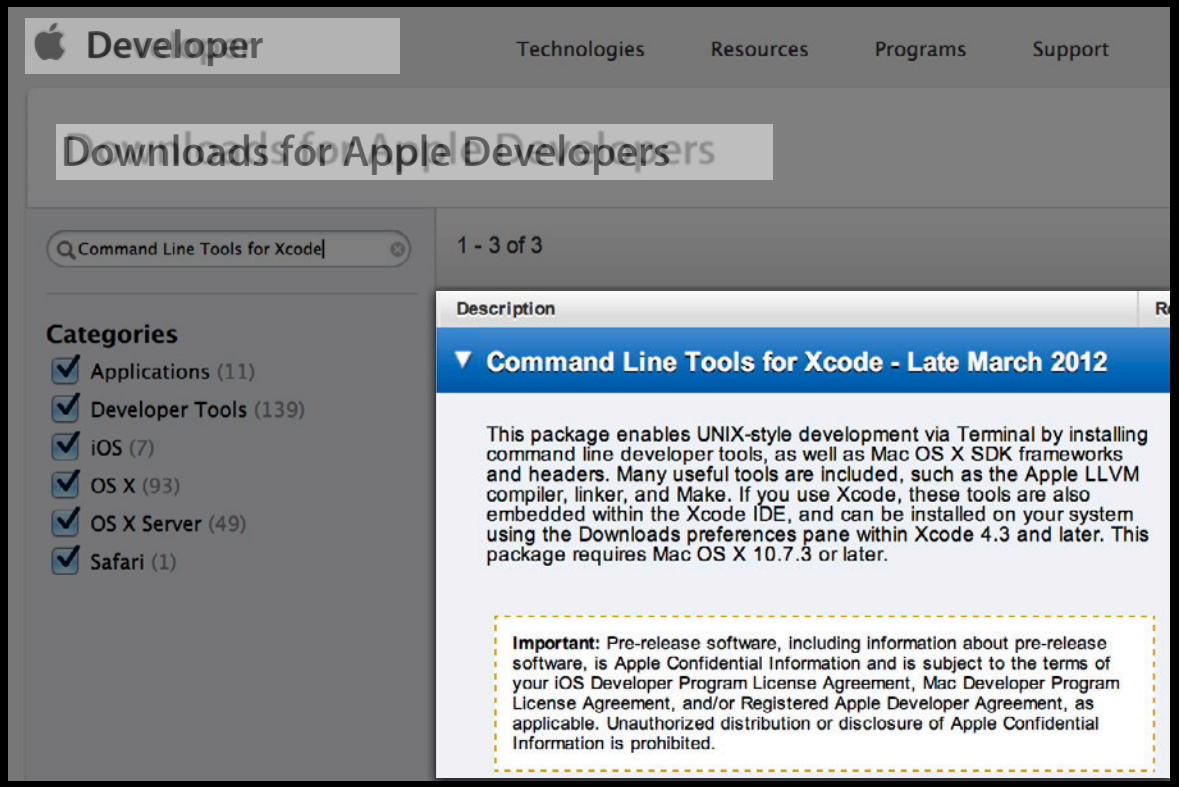

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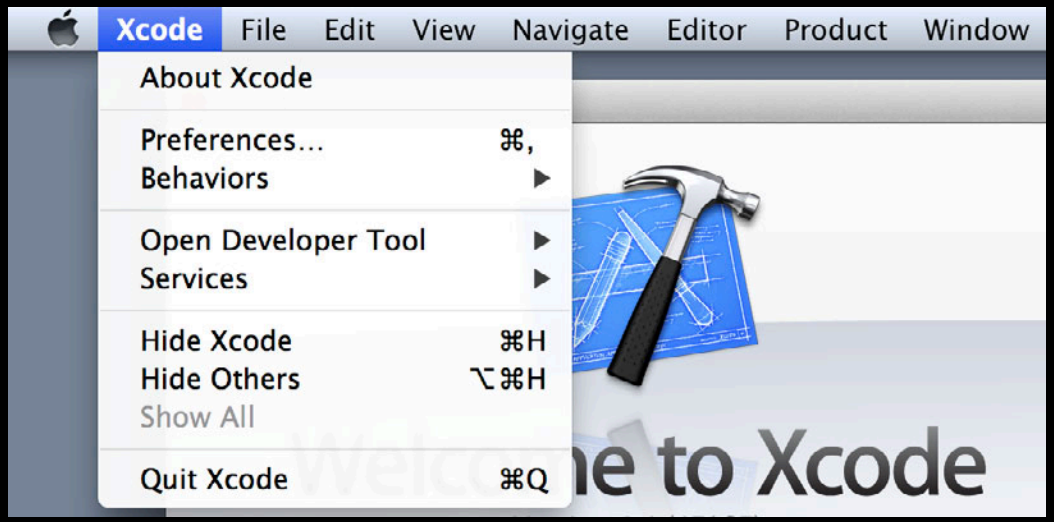

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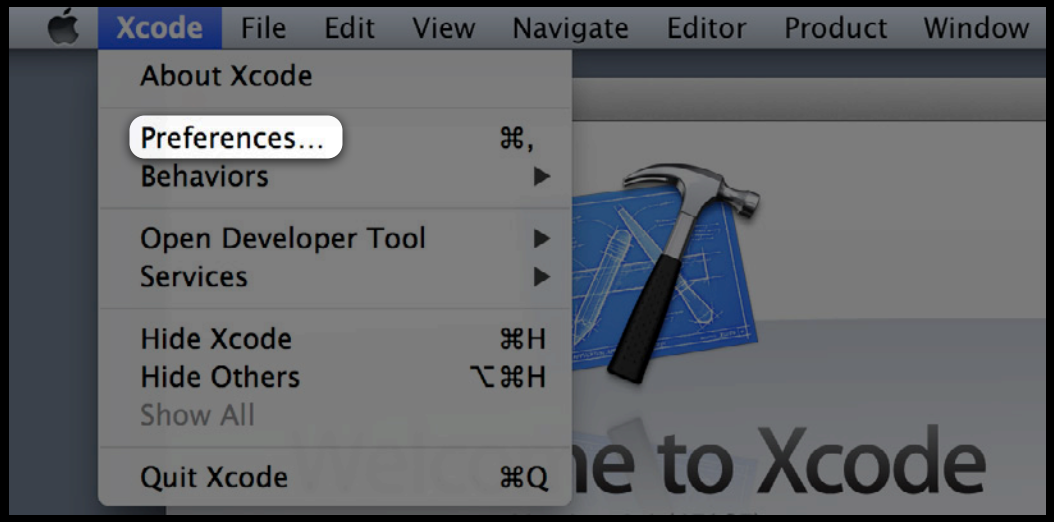

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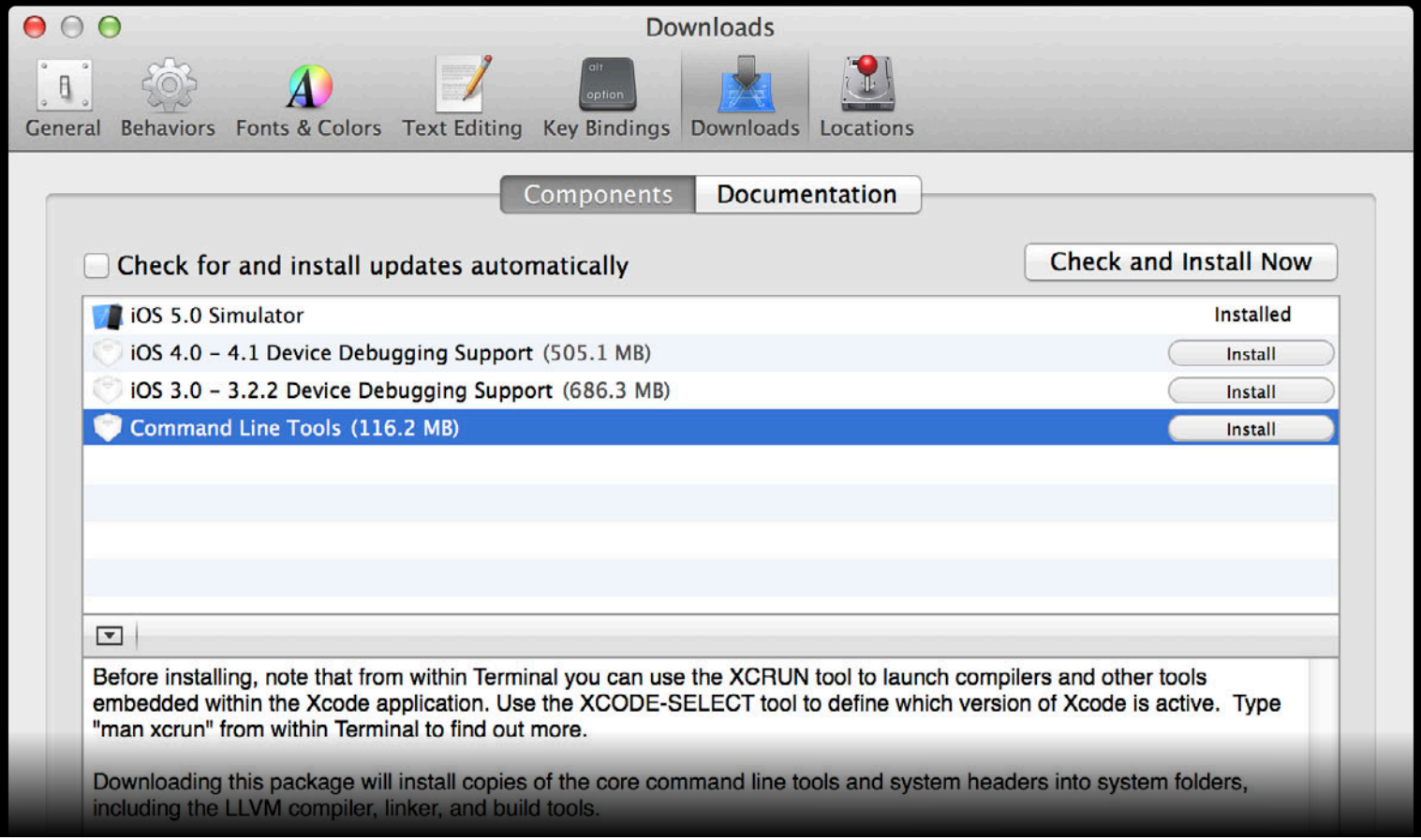

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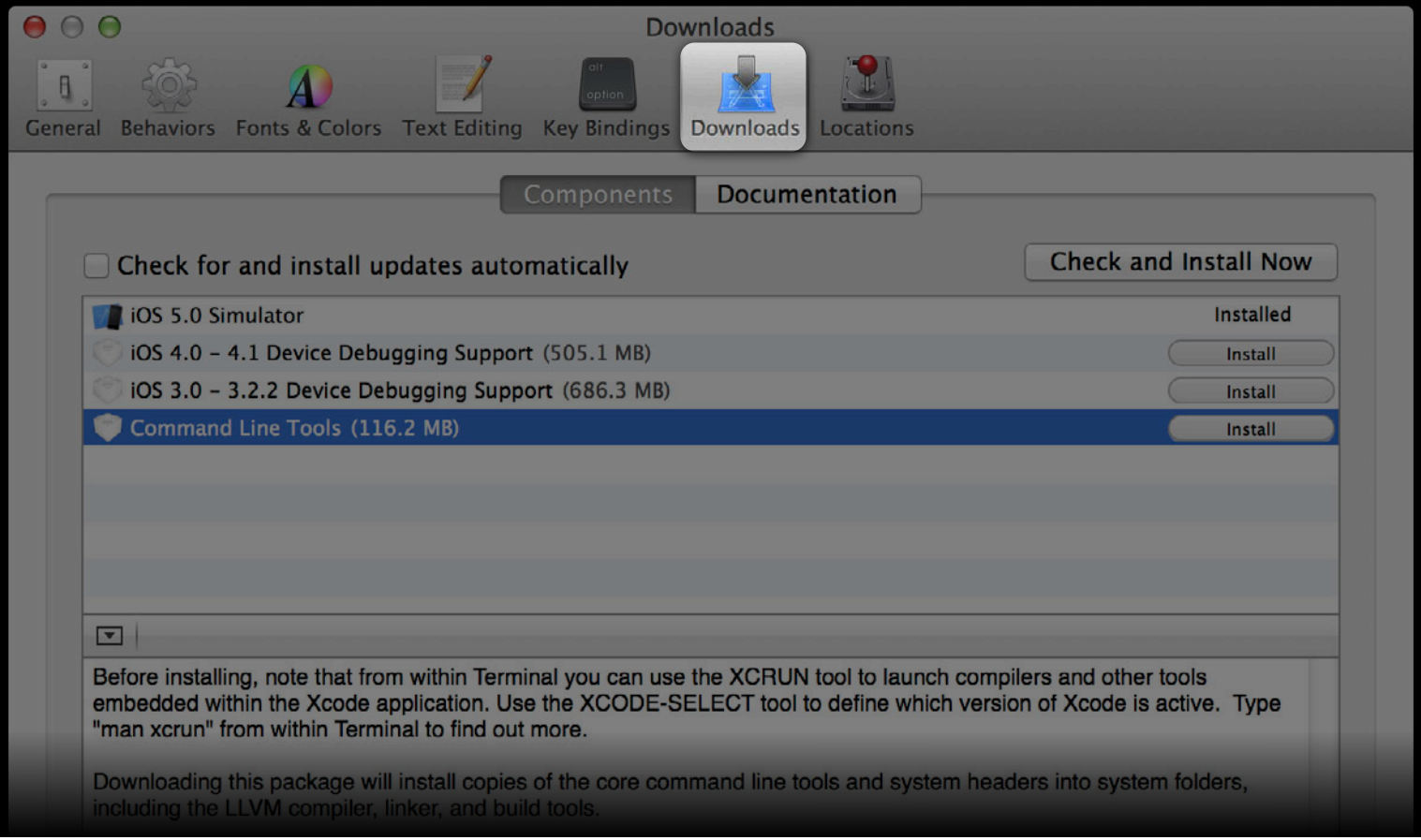

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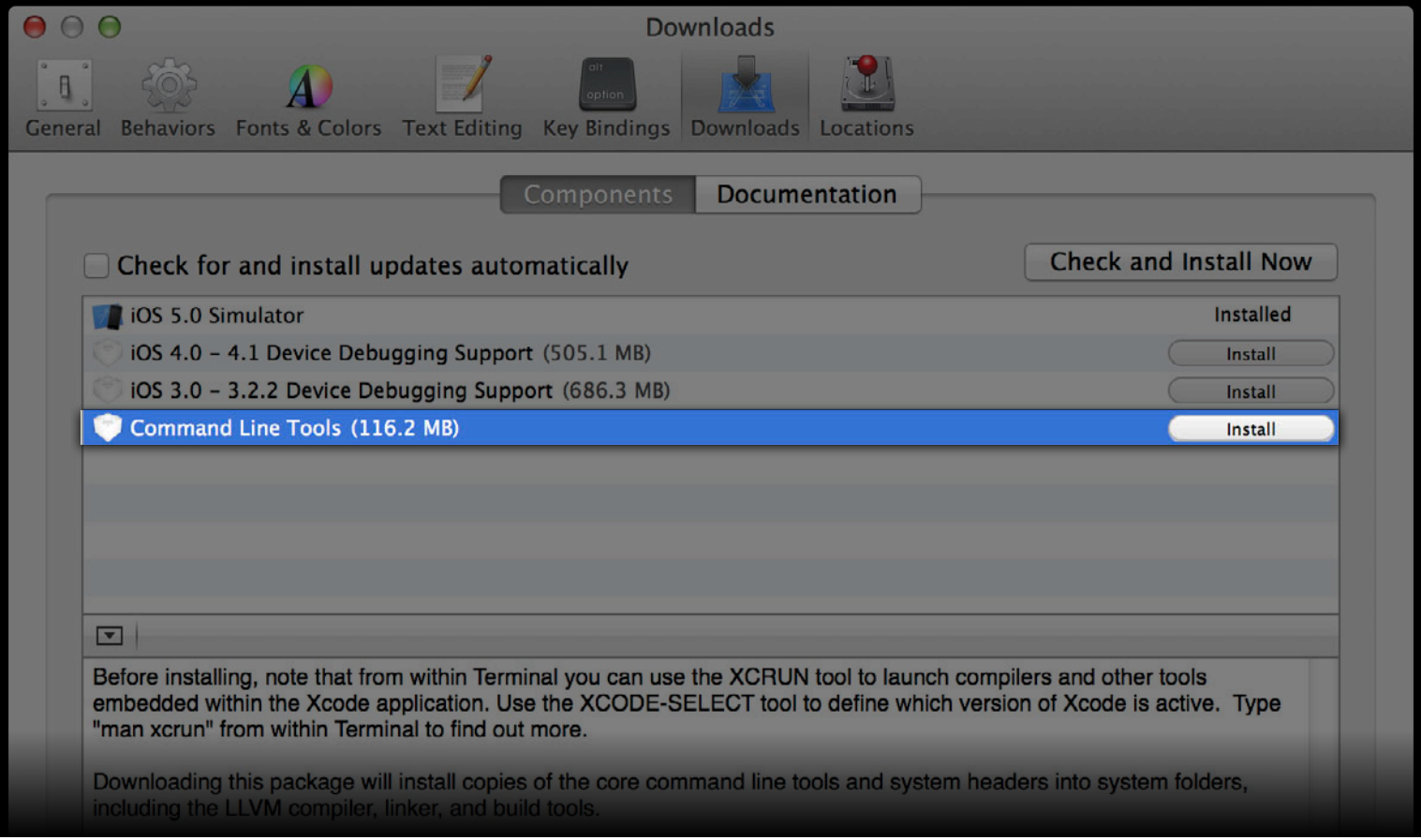

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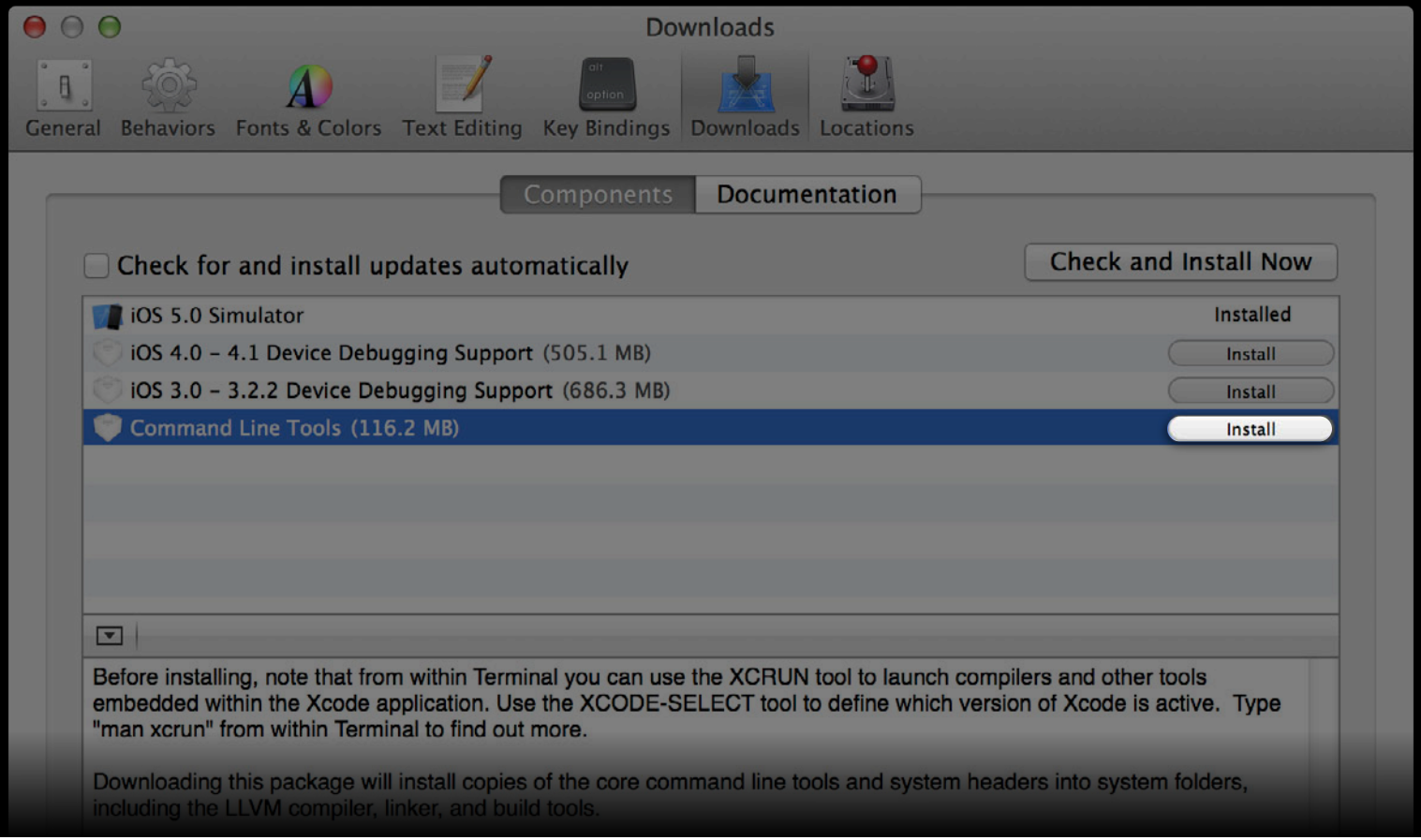

When to Install the Package

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  - Recommended practice for working with Fink, MacPorts, Homebrew

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```
$ fink
$ port
$ brew install wget
```

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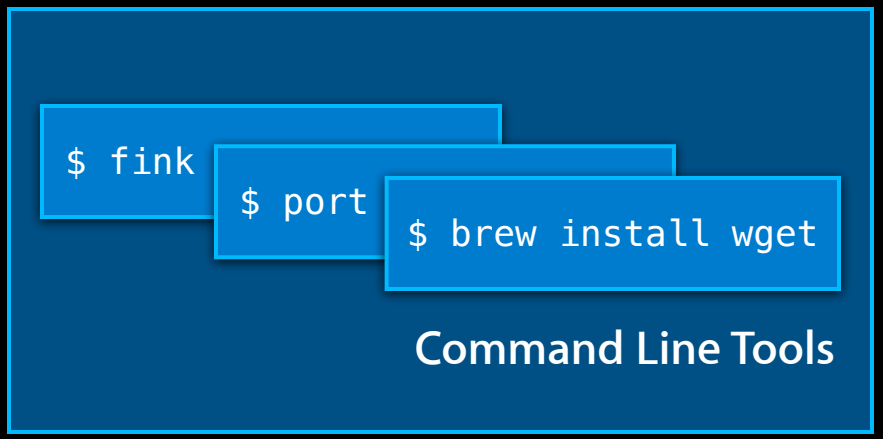

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  - Legacy projects

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  - Legacy projects
  - Non-Xcode IDE based development (e.g., Makefiles)

When to Install the Package

- Limited development, small download size

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- Limited development, small download size
  - Command line tools package is self-contained

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  - Requires manual effort to keep up-to-date with new releases

Review

Primary Xcode Command Line Tools

Tool	Summary
`xcode-select`	Choose the default Xcode.app to use
`xcodebuild`	Build, archive, and query Xcode projects and workspaces
`xcrun`	Find and execute command line tools that are inside Xcode
`man`	Access to command line documentation

Common `xcode-select` Options

Option	Usage
`-print-path`	Show the currently selected Xcode Developer directory
`-switch <path>`	Switch to the given Xcode (or Developer directory)

Common `xcodebuild` Options

Option	Usage
`-workspace <name>` `-project <name>`	Select a project or workspace to operate on
`-scheme <name>`	Select a scheme to use
`-sdk <name>`	Select an SDK to use
`-showsdks`	List available SDKs
`-list`	List schemes or targets for active project or workspace
`-showBuildSettings`	List active build settings and their values
`NAME=VALUE`	Override a build setting with a particular value

Common xcrun Options

Option	Usage
`-find <name>`	Find a tool in the active Xcode
`-sdk <name>`	Select an SDK to perform lookups in
`<tool> ... args ...`	Find and execute the tool with the provided arguments

More Information

Michael Jurewitz
Developer Tools Evangelist
jury@apple.com

Documentation
Xcode Build Setting Reference
http://developer.apple.com

man Pages
http://developer.apple.com
(or `man <toolname>` on the command line)

Apple Developer Forums
http://devforums.apple.com

Related Sessions

Working with Schemes and Projects in Xcode	Marina Wednesday 4:30PM
Building, Archiving, and Submitting Your App	Pacific Heights Thursday 4:30PM

Labs

Xcode Lab	Developer Tools Lab B Daily 9:00AM
Xcode Lab	Developer Tools Lab B Daily 2:00PM

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- Use `xcodebuild` to script and automate builds
  - Use build settings and schemes to customize to your project
- Consider using continuous integration to improve development
- Use the Command Line Tools package when working outside Xcode


WWDC2012