iOS Native Extension Debugging Guide

Step through ActionScript and native code

iOS Native Extension Debugging Guide, second edition
by Radoslava Leseva

Find us on the web at http://easynativeextensions.com/

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Introduction

Being able to step through code is probably the most up-close and personal form of control you can achieve over the quality of your work.

No amount of automated testing, free lunches or health benefits for your testing team would give you the level of confidence that stepping through every line (or even instruction) of code and executing every fork in your logic can. Don't get me wrong: I am very much for testing any way you can. To solely rely on that to catch problems however, you have to anticipate them or apply a big dose of randomness. And when things get hairy, stepping through code provides a quick way to get to the source of pain. Compared to that most other alternatives are… well, like shooting in the dark.

If that was not enough to convince you, take it from **Steve Maguire**: although first published more than twenty years ago, his book Writing Solid Code[1] has not dated one bit.

What you need

- **Mac OS X** with **Xode 6.0** and **iOS SDK 8.0 or newer;**
- **Flash Builder 4.6 or 4.7** with Adobe **AIR SDK 17.0 or newer**;
  For instructions on how to overlay the AIR SDK on the Flex SDK see Adobe's article Overlay AIR SDK on Flex SDK | Flash Builder.
- the build scripts from the example project that comes with this book;
- your iOS device to be connected to your debugging machine via USB;
- for debugging ActionScript and if you are using Flash Builder 4.6: your debugger and your iOS device to be connected to the same network.

Software editions used in the examples

The examples in this book have been tested with:

- Flash Builder 4.6 and 4.7
- AIR SDK 3.4 to 17.0
- Xcode 4.5 to 6.4, running on Mac OS X Lion, Mountain Lion and Yosemite
- iOS SDK 6.0 to 8.3

[1] In the spirit of full disclosure: this is an affiliate link. This means that we may get a commission if you decide to purchase the book through the link above. This will not cost you extra and we only recommend books that we have read and live by, so we know you will be in good hands.

What our readers say

"Well all I can say is that it was easily the best $30 I've spent in a while. I was back up and running in under a day and as an added bonus Radoslava does a brilliant job of detailing how to wrap up the whole build, packaging, and deployment process into a single Ant script. Her build script was much better than the crummy one I remember cobbling together for my original ANE attempts. One of the things I hadn't really tackled previously was learning how to properly debug my ANEs. Thankfully a companion debugging guide came bundled with the package, which takes you through the steps required to write a native iOS project that will wrap around a test AIR app. With that you'll be able to add breakpoints to Xcode and inspect your ANE's native library." Read more…

Christopher Caleb

Author of Flash iOS Apps Cookbook

www.yeahbutisitflash.com

"Your ebook on iOS native extensions (at least the part of it that I've read so far) is the best, clearest communication about software development that I've ever read. It is rare and completely refreshing to find programmers who can speak just as fluently and cleverly in their 'natural' language as in code, and who can also use elegant graphics to clear-up abstractions. Bravo, and thanks!"

Craig Umanoff

Moving Pictures

"@DiaDrawCom The book was great, very good tutorial and was easy to setup my custom ane. Thanks!"

@rudyvdblom

"Your eBook on ANE's is one of the best investments I have made. The excellent explanations and example code have saved me hours of trial-and-error. And I had planned to spend a couple of weeks developing custom email and dropbox extensions. Being able to download well-documented, ready-to-build source code gives me time to add extra features to my app. Very cool. Thanks."

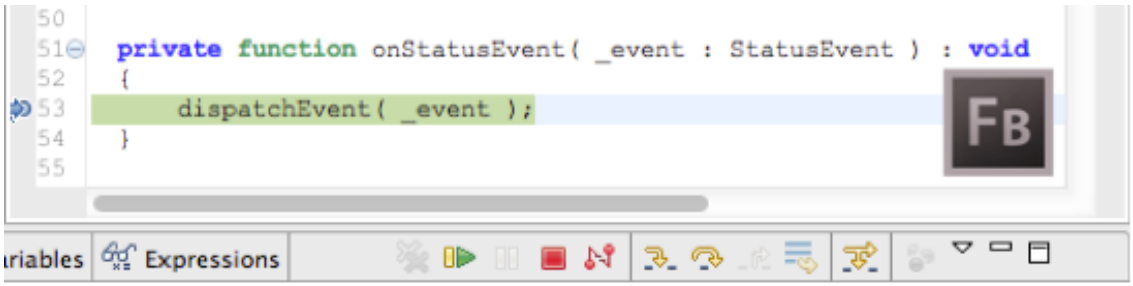
Andrew Rapo

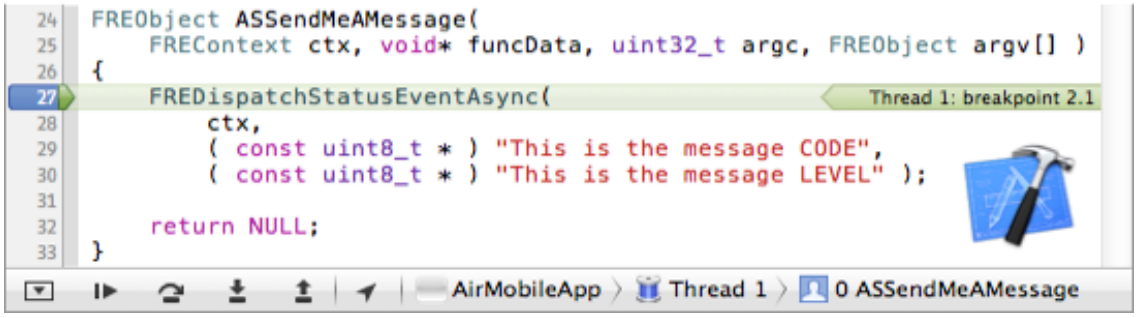
Quahog Entertainment

What to expect

At the end of this guide you will have:

- A set up for debugging your ActionScript native extension code.
- A set up for debugging your Objective-C native extension code.
- Confidence in your code.





Got the code?

You will need the code for the extension

You are probably thinking 'Duh!'

This is just a reminder that if all you have is the extension ANE package that someone else developed, for example, but did not publish the code for, you will not be able to step through the code and debug it. You will need both the ActionScript library project and the Xcode library project and the source files that go with these.

Unless you are a reverse engineering whizz, of course. In this case drop me an email, I would like to buy you a cup of coffee and have a word: radoslava.leseva@diadraw.com.

You will need a test app

An ANE is effectively a library. You can't run a library on its own and in order to be able to step through code, you need something that will run it. ANEs are written to be used by AIR applications and an application is definitely something you can run.

So you will need a test app. Two test apps, to be precise:

- to step through the **ActionScript** side of your ANE you will need to set up a **Flex Mobile Project for iOS** in **Flash Builder**. If you followed the tutorial in our **Easy Native Extensions** book, you will have already done that.

- to step through the **Objective-C** side you will need **Xcode** to be able to execute this test app and for that you have to set up an Xcode mobile app project that wraps around your Flex Mobile Project.

Sound complicated? Don't worry, you will get through it. One bite at a time.

Debugging the ActionScript side

Setting up a test app

If you followed the tutorial in our **Easy Native Extensions** book, you will have already set up a test app for your native extension. If you do not have a test app yet, no worries: **Step 4: Test the extension in an app**, in the Easy Native Extensions book will show you how to do it. It takes all of about 15 minutes.

Using Flash Builder 4.7?

If your answer is 'yes', you can skip the rest of this chapter.

Flash Builder 4.7 provides for **iOS** developers the conveniences that their **Android** brethren are used to and you don't have to do much in the way of gymnastics to start debugging over USB or over a network.

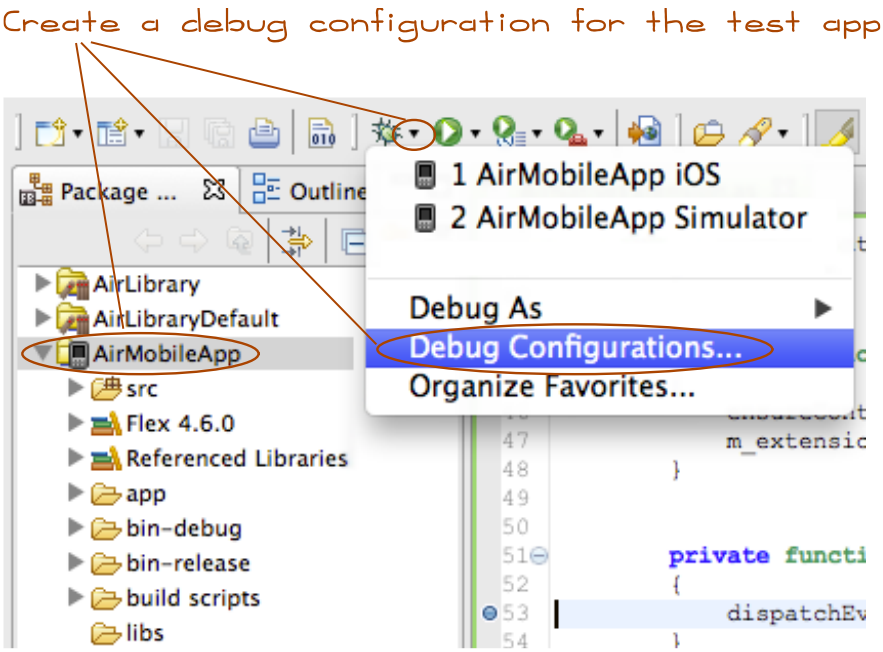
The Adobe Flash Builder 4.7 manual takes you through the process in detail: Debug an application on an Apple iOS device.

Debugging with Flash Builder 4.6: the hard way

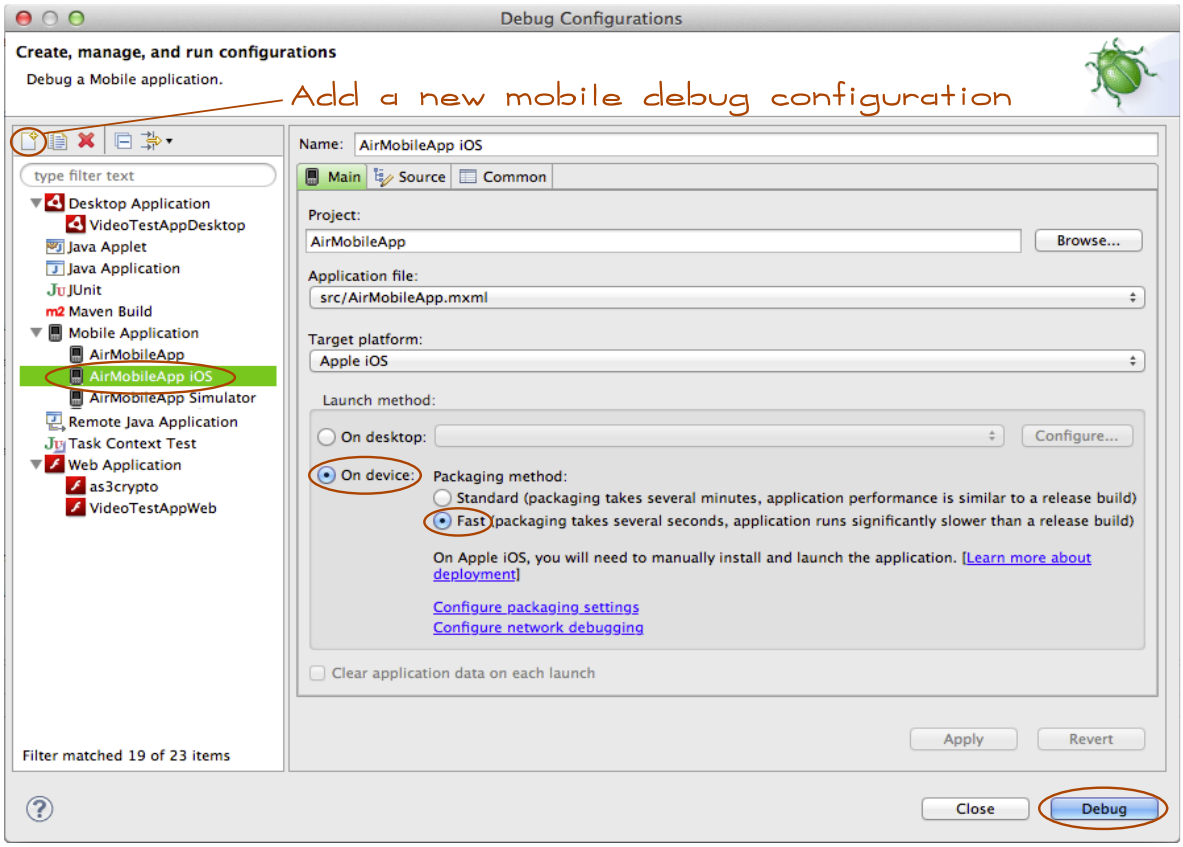
I should probably call this 'the two days of clicking saves two hours of reading' way, because it is not so much hard, as it is boring and prone to causing repetitive strain injuries.

You have probably been through it, experienced it and got sick of it, but here it comes. For completeness, you see...

- With your Flex Mobile app project selected in Flash Builder's Package Explorer, click **Run** > **Debug configurations...** on the main menu or click the drop-down arrow next to the green bug on the tool bar and select **Debug Configurations…**



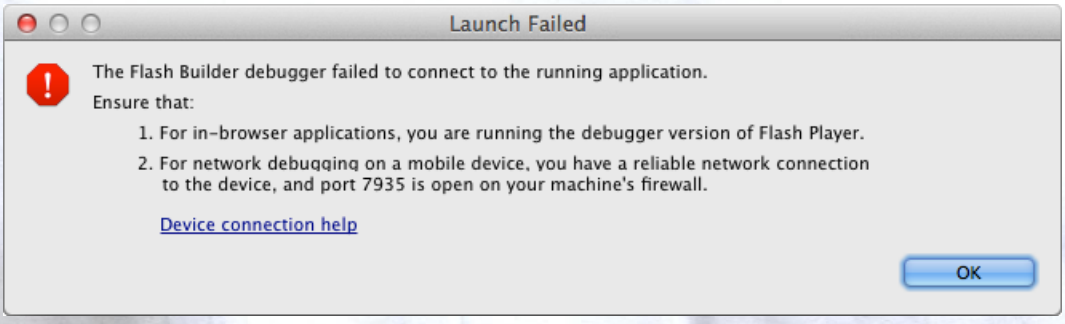
- In the **Debug Configurations** dialog select **Mobile Application** from the list on the right and click the **New** icon to add a new configuration.
- Under **Project** click **Browse** and select your test app project from the work space.
- **Target platform** should already be set to **Apple iOS**.
- Under **Launch method** select **On device**.
- Under **Packaging method** select **Fast**.
- Hit **Debug**.



- You will be prompted to enter your **Certificate Password**:

- When Flash Builder finishes building and packaging your app, you should see this dialog giving you instructions. Follow these to install the app on your device:

- Once the app is installed on your device, tap its icon to launch it.
- You have about **two minutes** to perform the steps above before the debugger loses its patience and shows you a **Launch Failed** alert:



Fear not! **You can start the debugger again** and now that your app has been built and installed on your device, all you have to do is run it. No need to repeat the installation steps again.

- When app and debugger have made contact, you can step through both the application and the ANE ActionScript code - just sprinkle breakpoints to taste.

Debugging with Flash Builder 4.6: the single-click way

The point of debugging your native extension is being able to step through changes you have just made or code you have just added. Being able to zero in on problems in the ANE too, of course.

Waste of time and focus

Every time you make a change either to the ActionScript or to the native side of your extension, you will have to rebuild it, repackage the ANE and then rebuild and repackage the test app, so you can run it through the debugger and see the change in action. Having to do all of this and then follow the steps to install and run your app on a device for every change you made is, frankly, asking too much of a developer's time and concentration. I'm speaking from experience here. I have often found that by the time I had the debugger running I had forgotten what I last changed…

The single-click way

If you could, would you rather click a button that would do all of the above for you? I know I would.

Those of you who followed the tutorial in **Easy Native Extensions** (chapter **Making your life easier**) know where this is going: **Ant scripts**.

In fact, if you have set up your ANE and test app for a single-click build with the build scripts in that chapter, you have already done 99% of the work and you can jump to Set up a builder for the test app, where you will add the last little detail that you need to start debugging.

The rest of you, come with me. All you need is the build scripts in the example project that came with the book - I will show you how to use them for debugging.

Set up build scripts for your native extension

- Locate the **build.xml**, **build.properties** and **local.properties** files for the **Air Library** in the example project that came with the book (they should be in **NativeExtensionTutorial/Native Extension/AirLibrary/build scripts**) and copy them near your native extension code. What I have found to work best for me is putting the scripts in a subfolder in the Flash Builder library project of the extension, as that makes it easier to edit the files in Flash Builder.

- Open **local.properties** and set **FLEX_HOME** to the path to where your Flex SDK is installed.

local.properties

```
FLEX_HOME=/Applications/Adobe Flash Builder 4.6/sdks/4.6.0
COMPC=${FLEX_HOME}/bin/compc
ADT=${FLEX_HOME}/bin/adt
```

- Open **build.properties** and set the following:
    - **ane.name** to the name of the ANE file you want to package.
    - **ane.destination** to the folder where you want the ANE file to be put. This folder is relative to the location of the **build.xml** script and doesn't have to exist yet: the build script will create it for you.
    - **iOS.library.name** to the name of your Xcode library and **iOS.library.root** to the path to your Xcode library project, relative to where the **build.xml** script is.
    - **air.library.name** to the name of your Flex Library project.
    - if you have a default implementation for your ANE, set **default.library.name** to the name of the Flex Library project for that and **default.library.root** to the path to that project folder, relative to where **build.xml** is.

Tip: See **Adding support for the AIR Simulator** chapter in the **Easy Native Extensions** book for what a default implementation is.

    - If the file names and paths in your project are different from the defaults used in this tutorial, update these too.

build.properties

```
# Tips:
#
# 1. All paths set in this file, except iOS.library.builddir,
#    are relative to where build.xml is.
#
# 2. You can override any of the values in this file by passing a new value
#    on the command line, prefixed with -D, when you call ant.
#    Example: ant -Dbuild.debug=false


# Set this to true for a Debug build and to false for a Release build
build.debug=true

# File name and folder for the packaged ANE:
ane.name=AirLibrary
ane.destination=../../ane

# XCode project paths:
iOS.library.name=NativeExtensionTemplateiOS
iOS.library.root=../../iOS/${iOS.library.name}
iOS.library=lib${iOS.library.name}.a
#Note that iOS.library.builddir is relative to the Xcode project folder:
iOS.library.builddir=${iOS.library.root}/build

# AIR Library paths:
air.library.name=AirLibrary
air.library.root=../
air.library.sourcedir=${air.library.root}/src
air.extension.descriptor=${air.library.name}-extension.xml
air.platform.descriptor=${air.library.name}-ios-platformoptions.xml

# Default AIR Library paths:
default.library.name=AirLibraryDefault
default.library.root=../../${default.library.name}
default.library.sourcedir=${default.library.root}/src
default.extension.descriptor=${default.library.name}-extension.xml
```

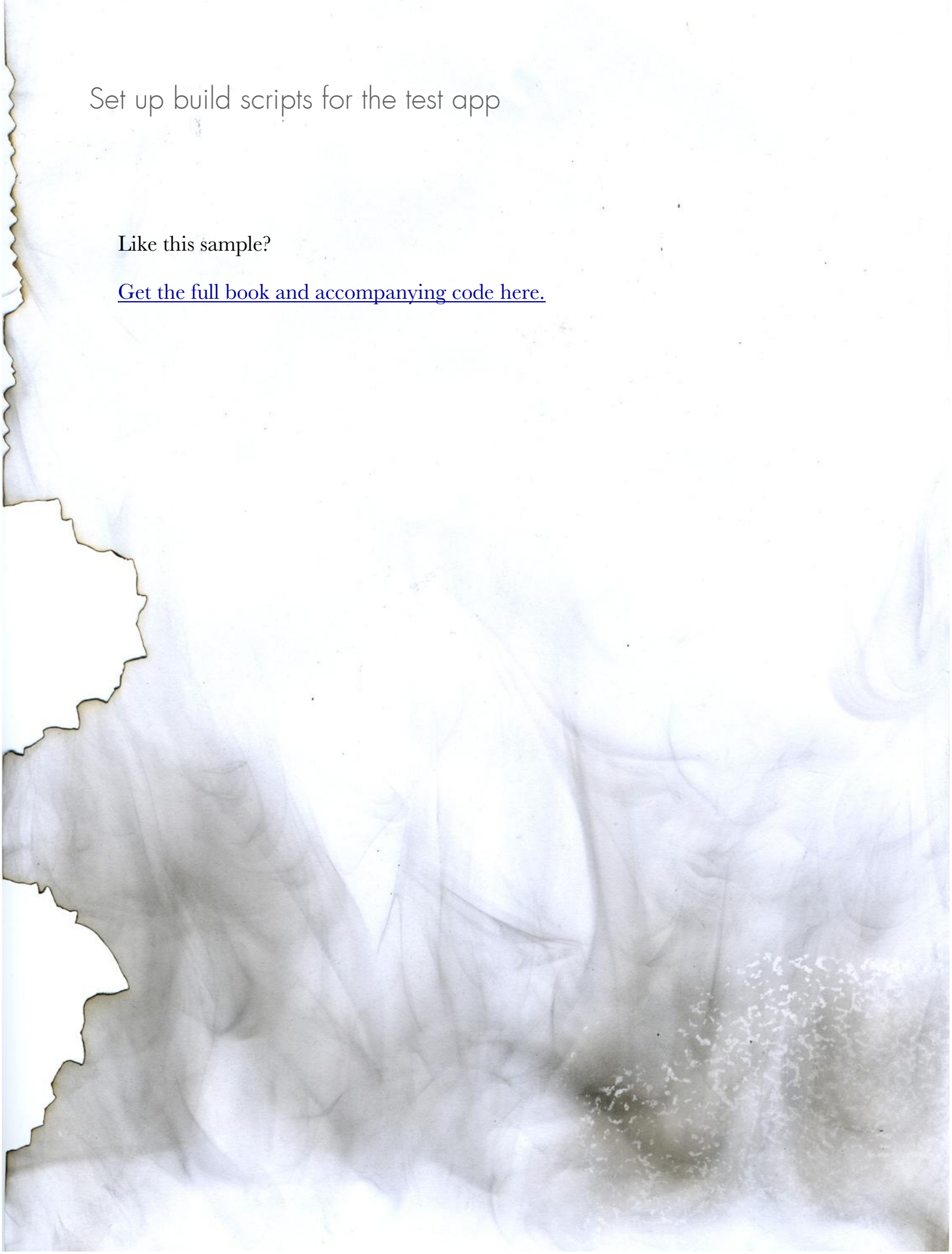
- You shouldn't have to customize anything in the build script, **build.xml**.

Now the good news: you won't have to run this build script yourself. In the next step you will set up a build script for the test app that will do this for you, so you can have the ANE rebuilt and repackaged automatically when you re-run your test app in the debugger.

Tip: If you would like to test this build script setup, which would be a sensible thing to do, see **Test the build script on the command line** in the Easy Native Extensions book.

Like this sample?

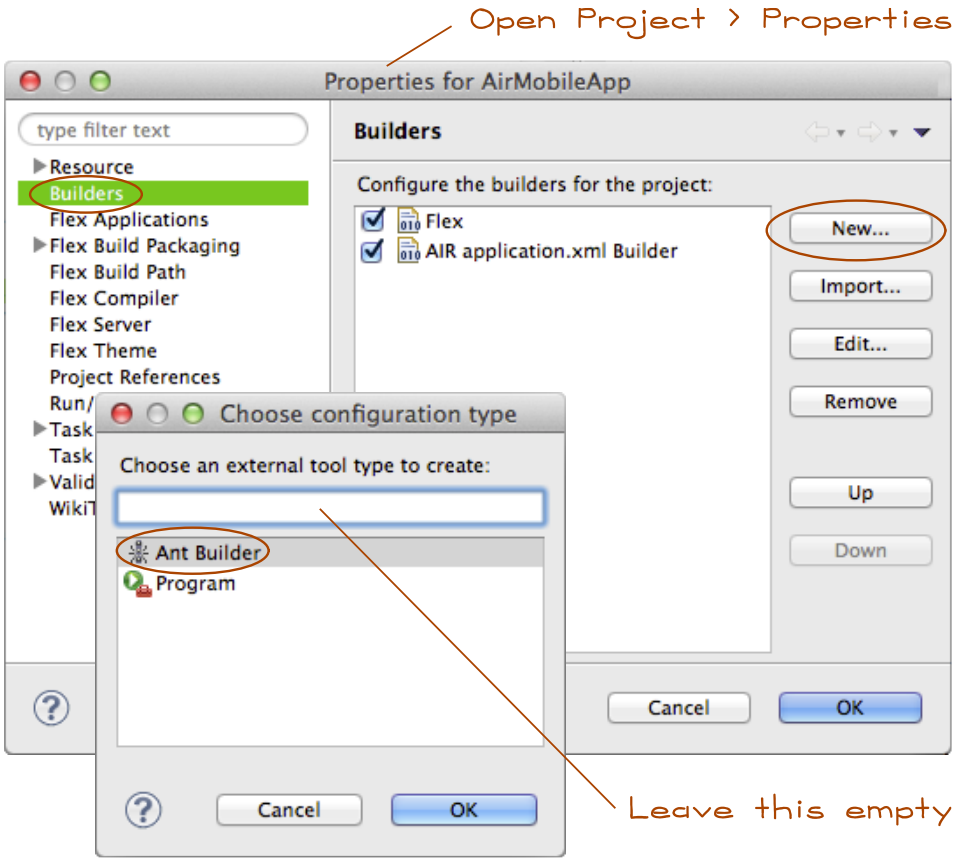
Get the full book and accompanying code here.



Set up a builder for the test app

Setting up Flash Builder to use the build scripts to debug your app is essentially the same as the set up for running the app, described in the Easy Native Extensions book, **Making your life easier, Phase 3**, but with a couple of subtle differences.

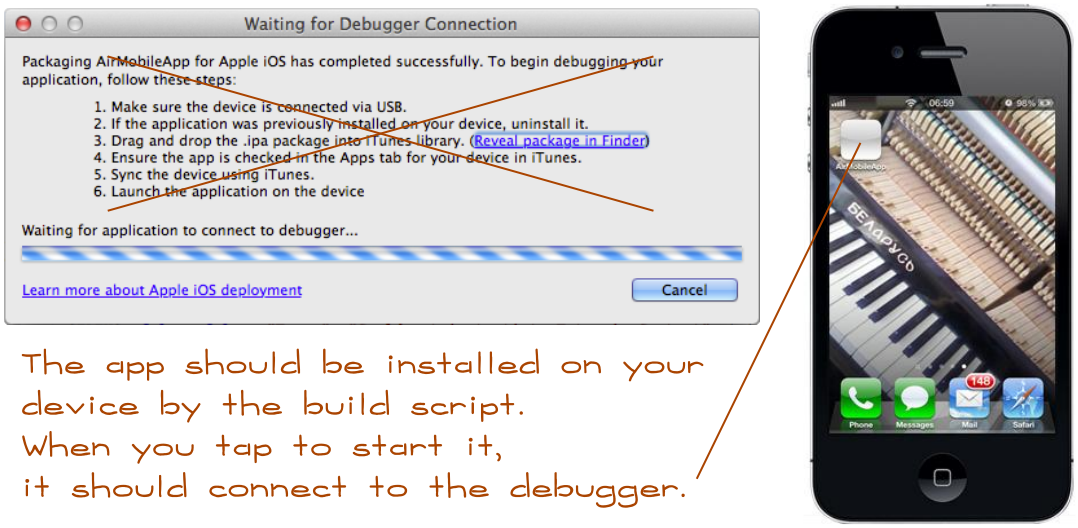
- Select your application project in Flash Builder's Package Explorer and click **Project** > **Properties**.
- From the list on the left select **Builders** and on the right click **New**.
- On the dialog that appears next select **Ant Builder** and leave the text box empty.



Like this sample?

Get the full book and accompanying code here.

You will be asked for your Certificate Password and will again be presented with the **Waiting for Debugger Connection** dialog, but this time you don't have to follow the steps listed on it: the app should already be installed on your device and all you have to do is **tap to run it**.



Debugging the native side

Acknowledgement: The steps in this section are based on the Rajorshi Ghosh's article Debugging Native Extensions for AIR iOS, published on his blog Beautiful Code.

I have tried to simplify it and remove the 'magic' component from the process. To those of you who like a sprinkle of magic in your debugging day I apologize. The rest, I assume that eliminating mysteries is why you picked up this book in the first place.

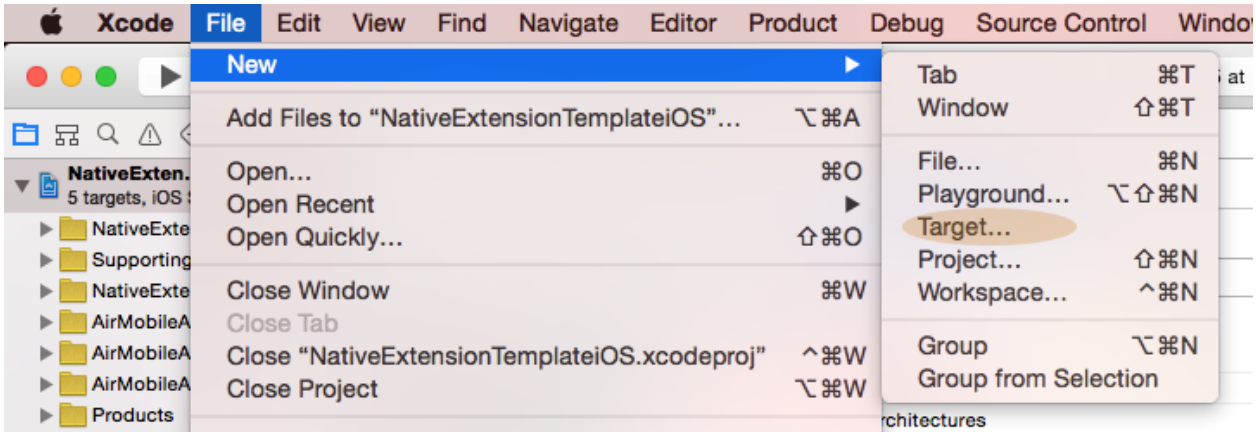
The process explained

The Flex Mobile Project you set up for debugging the ActionScript side of your extension has pretty much everything you need for debugging the native code: a test app and a file with debug symbols (.dSYM).

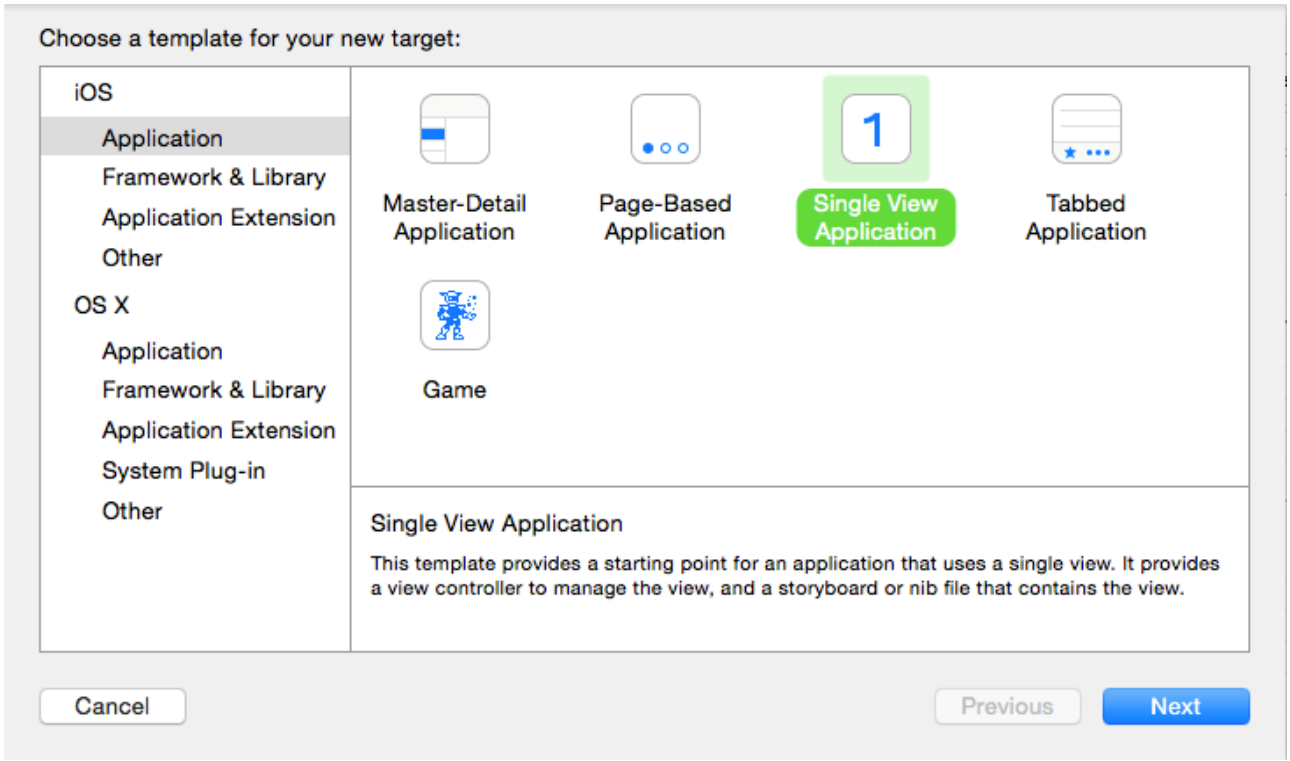
What you will do in this step is help Xcode use these. For this purpose you will add an empty mobile application target to your ANE's Xcode project and set it up to use the IPA and the .dSYM produced by the Flash Builder tools (ADT).

Set up an application target in Xcode

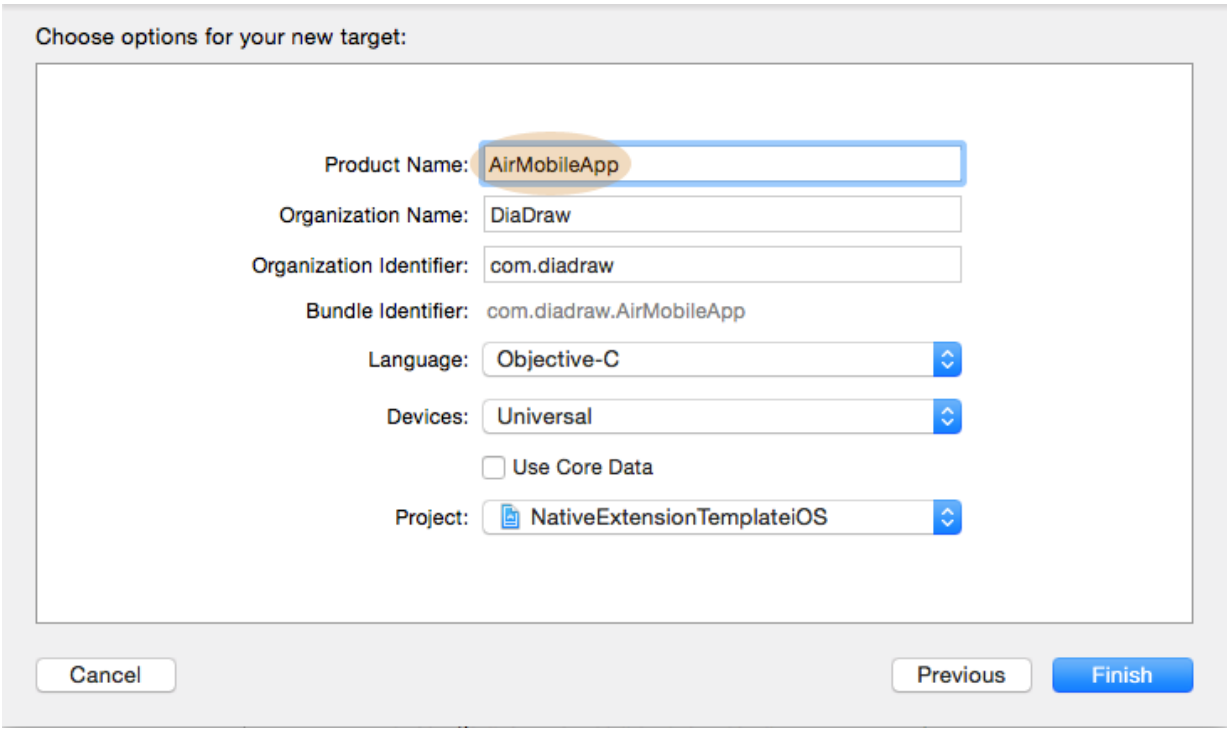
- With your native extension project selected in **Xcode** click **File** > **New** > **Target** on the main menu:



- On the target template dialog select **iOS** > **Application** > **Empty Application**:

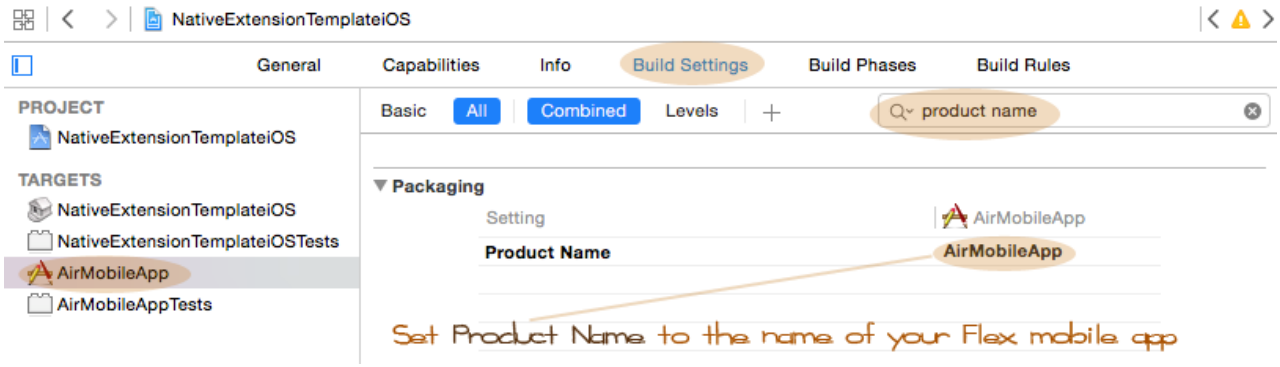


- Set **Product Name** to the name of your Flex Mobile app. This should be the same name that's specified in the **<filename>** tag in your Flex project's app descriptor file: `<filename>AirMobileApp</filename>`

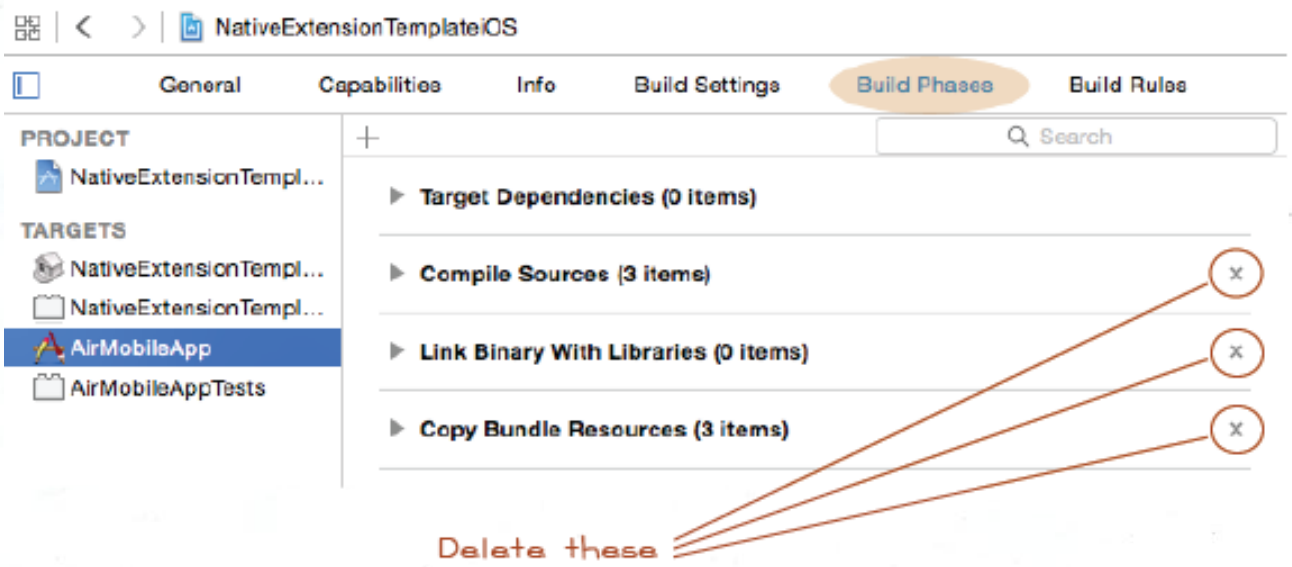


- Click **Finish** to create the target. There should now be two targets in your Xcode project.

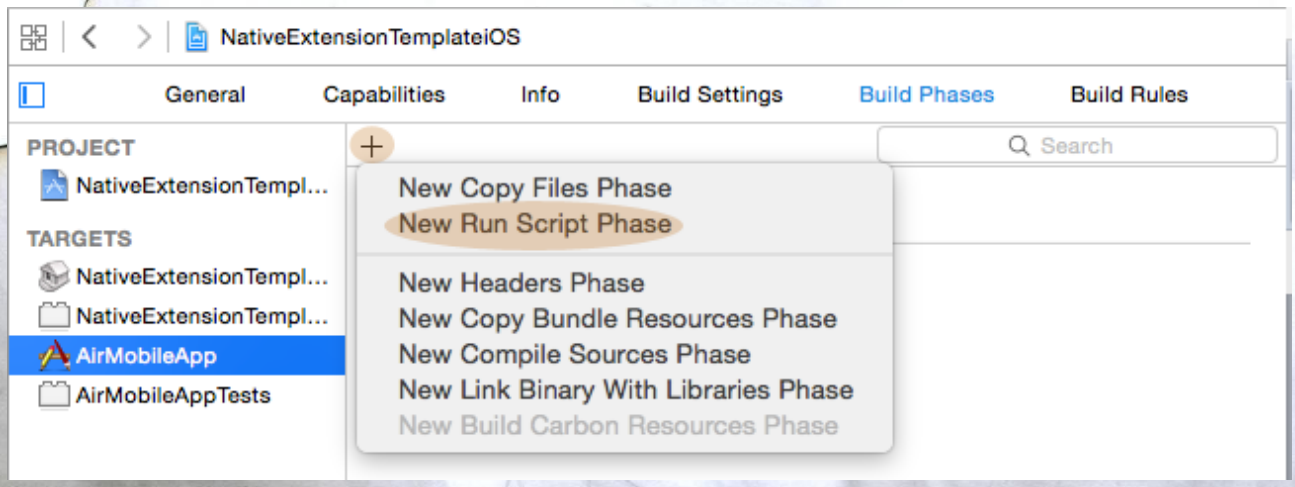
- Select the target you just created, go to the **Build Settings** tab and make sure that **Product Name** is set to your Flex mobile app's name:



- Next, go to **Build Phases** and delete all phases except **Target Dependencies**:



- Then add a **Run Script** build phase:

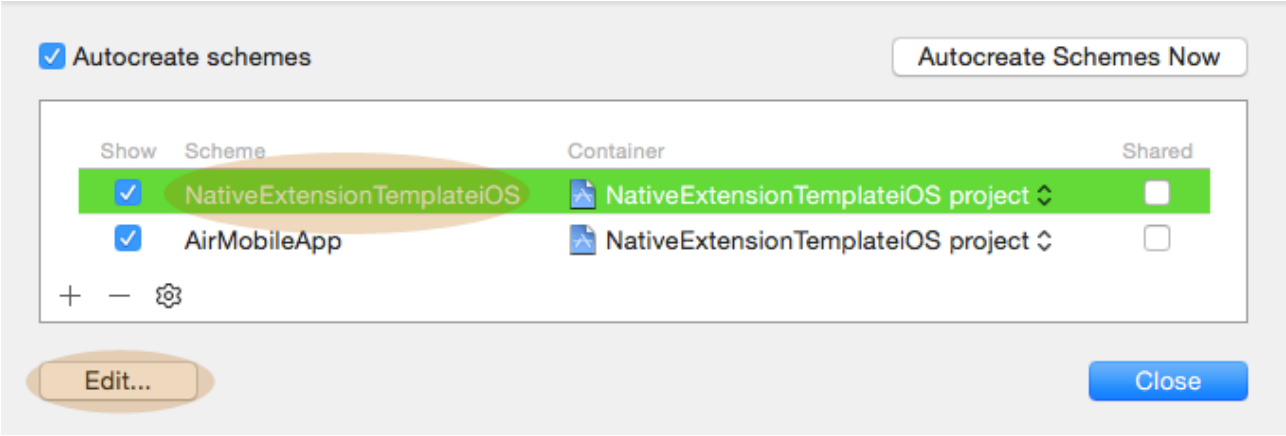


Like this sample?

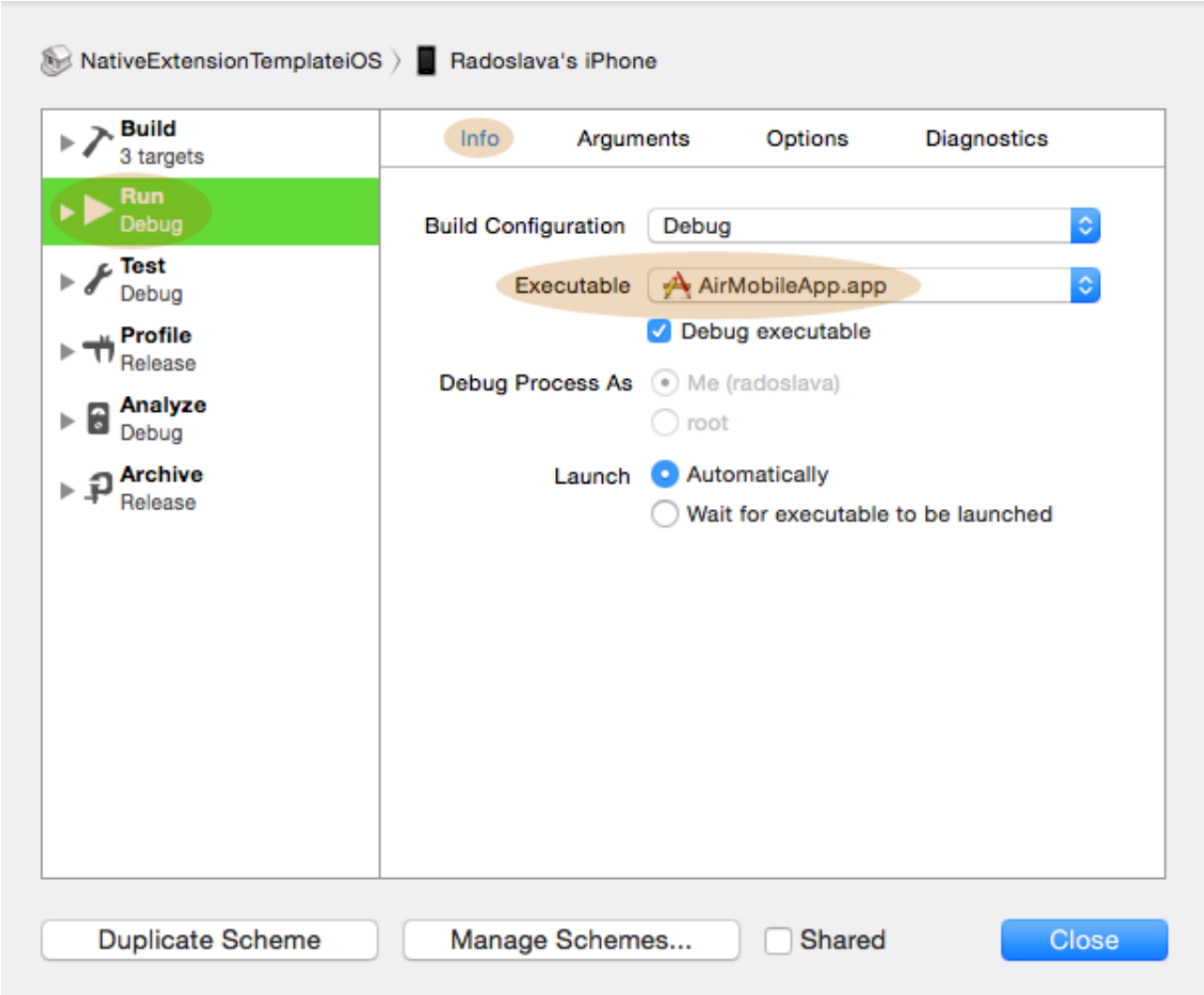
Get the full book and accompanying code here.

Tell Xcode to run your app

- From the main menu in Xcode select **Product** > **Scheme** > **Manage Schemes** and from the list select the scheme for your **native extension library target** (not for the app target), then click **Edit**:



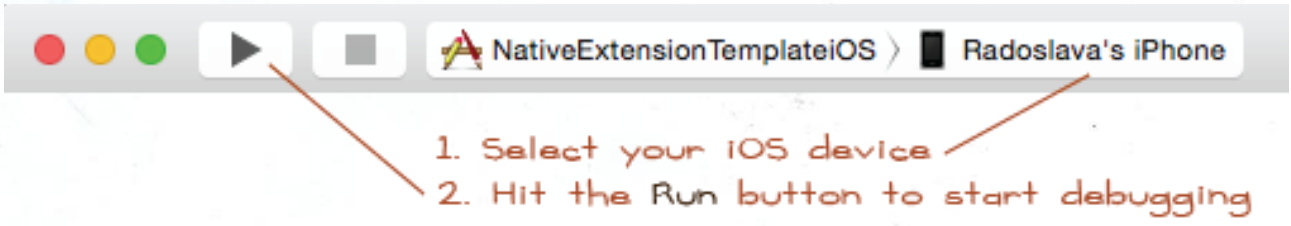
- Select the **Run** scheme on the left and on the right make sure that the app target is selected as the **Executable** on the **Info** tab:



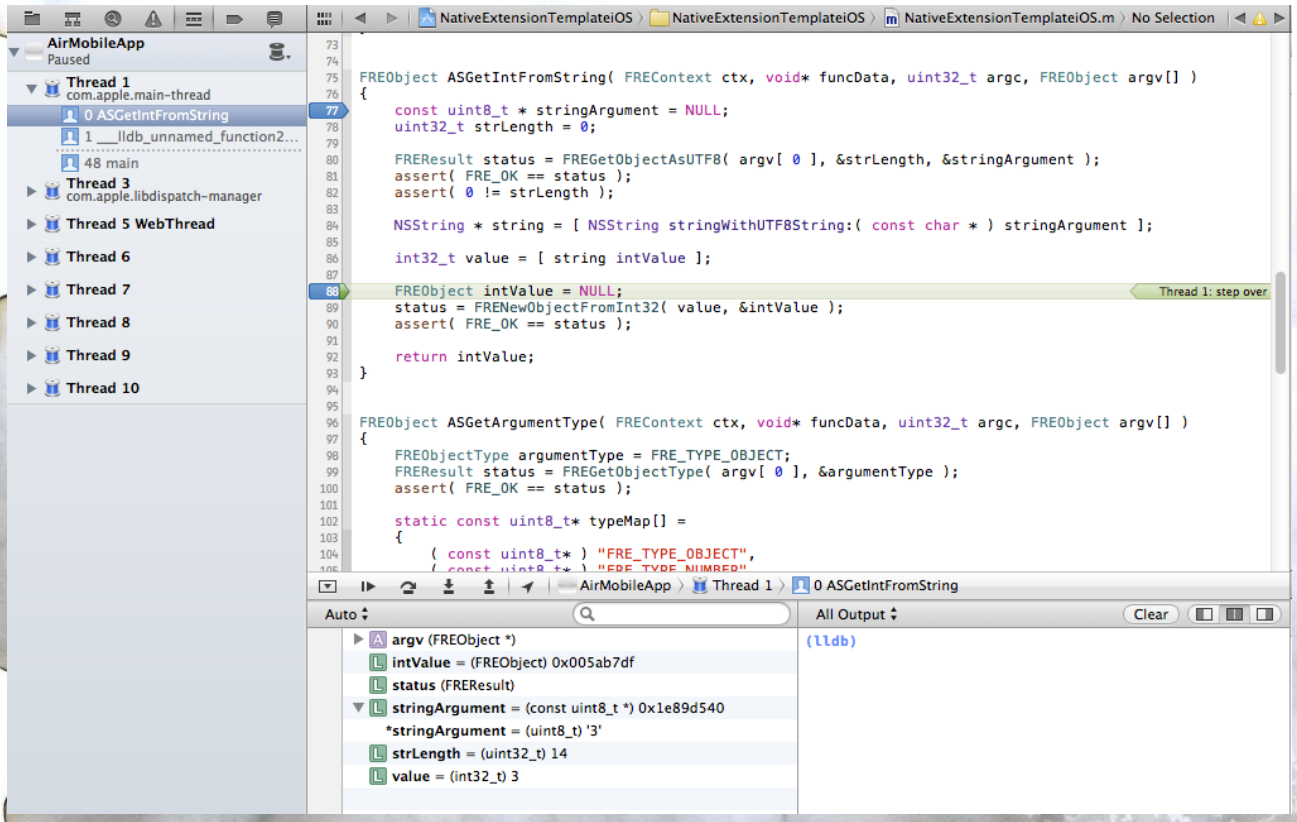
Start debugging in Xcode

Finally!

- Make sure your iOS device is connected to your machine via USB.
- In Xcode's main window select your device in the **Scheme** drop-down on the top left and then hit the **Run** button:



- Did you put any breakpoints in your code?



Like this sample?

[Get the full book and accompanying code here.]

Bonus chapter:

Diagnosing build problems

All of this single-click build, package and run business is really good at providing convenience and saving you time. One downside of it however is that when things go wrong, you are slapped with a huge build log. In it, it seems, each of the tools in the chain couldn't wait to tell you what it's doing, done or got stuck on.

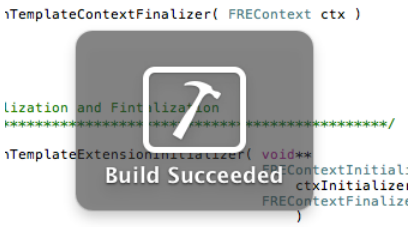
In this chapter we will go through some ways in which Xcode can be of help with narrowing down compiler, linker and packaging problems and diagnosing them quickly.

First, you will need to have set up your ANE and test app for building and debugging through Xcode, as shown in the previous chapter.

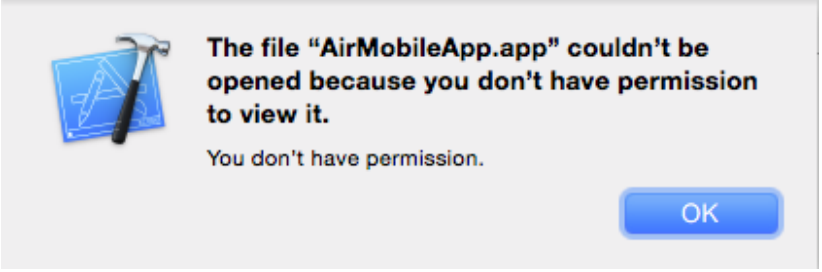
Misleading symptoms

When Xcode finishes running your script, you will usually see a pop-up or a dialog of some sort that tells you if the build succeeded or failed. These can often be misleading in several ways, just to make your life more interesting.

For example, you might see "Build Succeeded" even if there were build problems, but Xcode managed to get hold of an old .ipa or .app to run:



Or you might see this error message, telling you "The file X couldn't be opened because you don't have permission to view it". 99% of the time this has nothing to do with permissions and could be an indication of an error in your ActionScript code, password mismatch in your provisioning, packaging issues or bad lunch.



Where to look instead

Issues on the native side

Compiler problems

Provisioning problems

Like this sample?

Get the full book and accompanying code here.

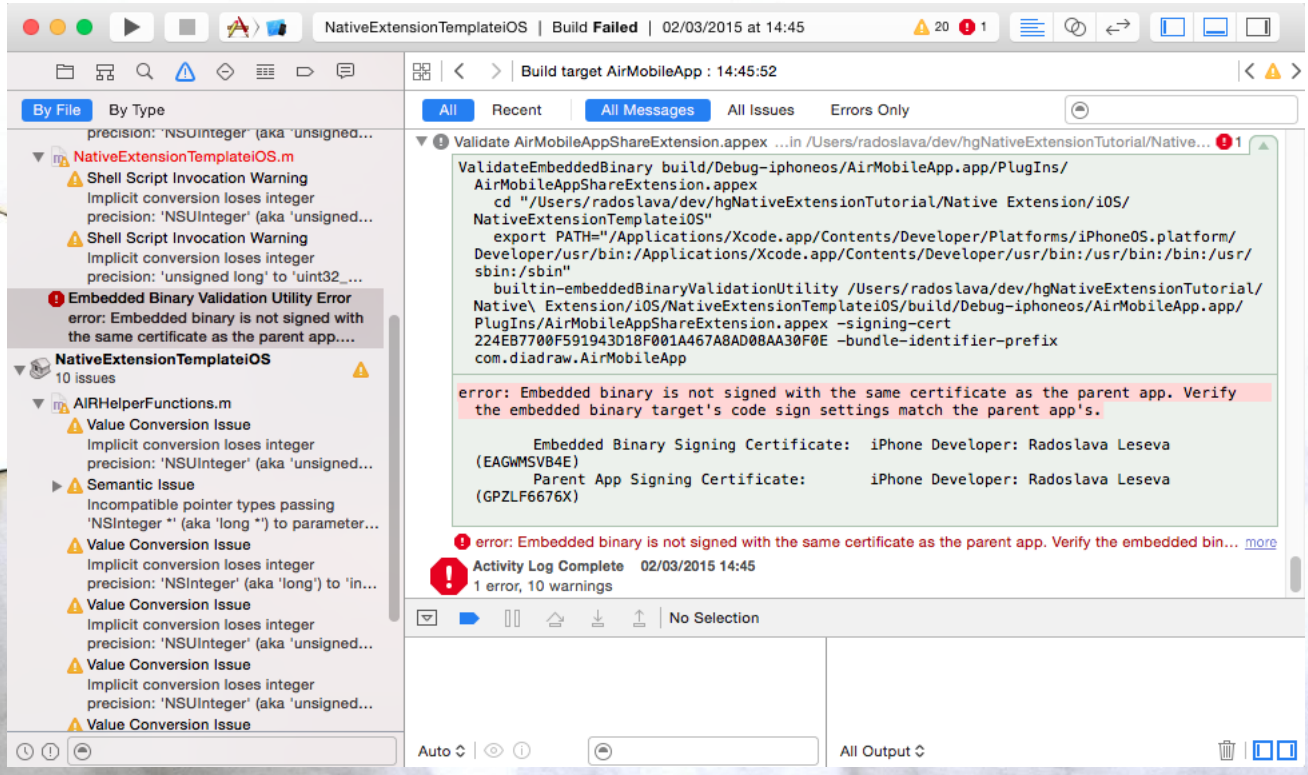
Errors on the AIR side

Diagnosing problems that happened on the AIR side requires more digging in Xcode, but is rewarding in terms of finding out what the issues are without having to switch back and forth between IDEs.

Anything that happens on the AIR side up to installation will be reported in Xcode's build log. Issues that happen during installation however you will find in your device's console. Let us take a look at these in turn.

Xcode's build log

You saw a screenshot of the build log above, but here it is again in its entire beauty:



Like this sample?

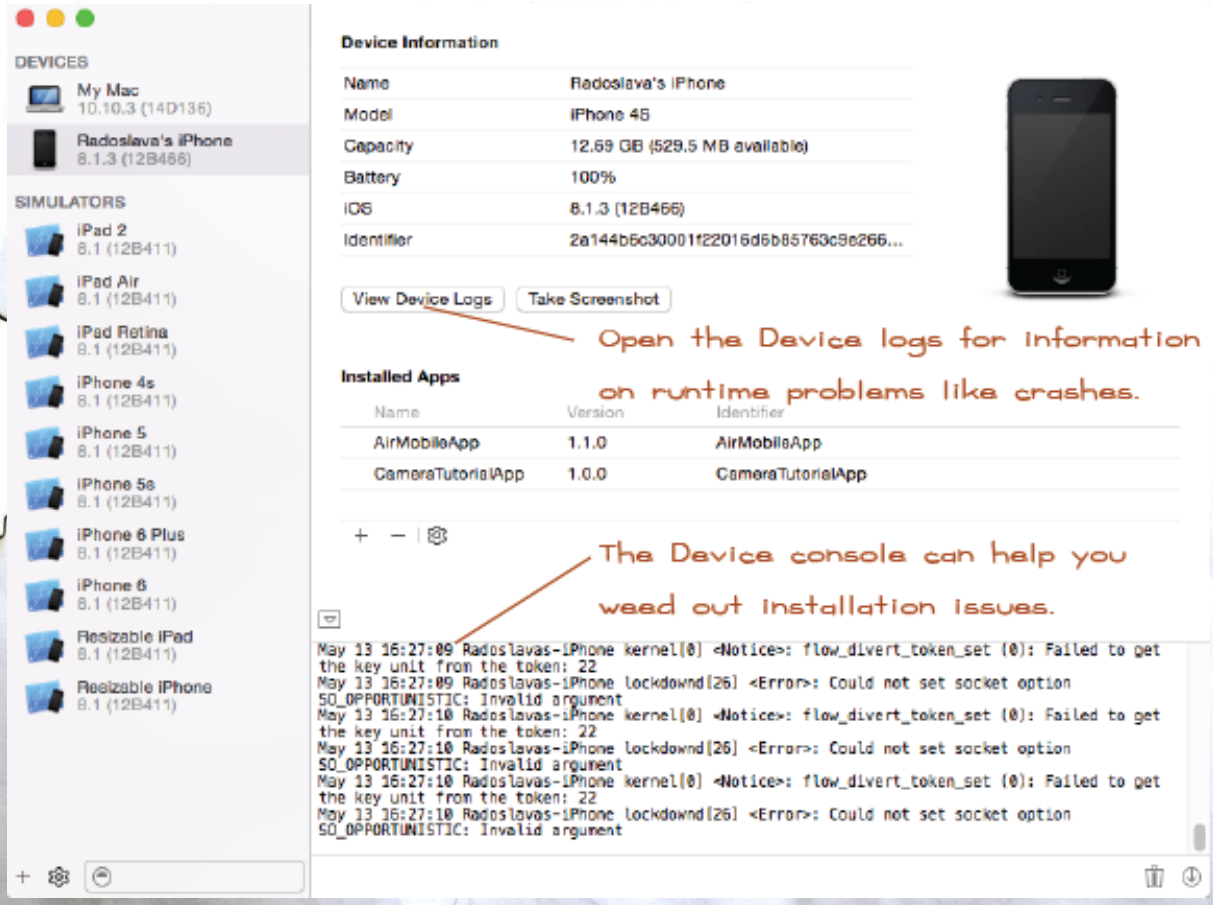
[Get the full book and accompanying code here.]

Xcode's device console

Sometimes you only get to hear about a problem with your app package when you try to install it on a device. And you are often notified by a terse error message like this:

```
Application verification failed.
```

It is another one of those that can mean a range of things. This is where Xcode's device console comes in handy. To open it, plug your iOS device into your computer via USB, then go to **Window > Devices** and if you don't see a console at the bottom of the screen, click the little arrow button to expand it.



Like this sample?

Get the full book and accompanying code here.

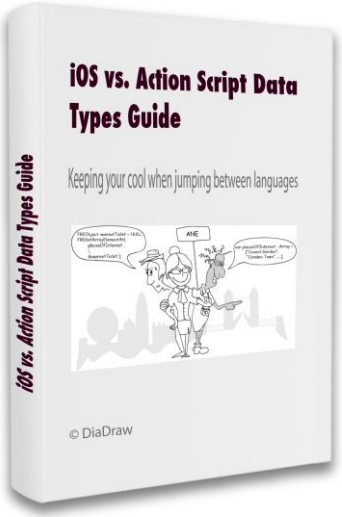
Acknowledgements and where to go from here

As much as I would have loved to claim that I worked out how to debug an ANE in Xcode all by myself, I can't. I must give credit to **Rajorshi Gosh** and his spot-on blog post Debugging Native Extensions for AIR iOS.

Useful online materials

- Free online tutorials on EasyNativeExtensions.com
- Debug an application on an Apple iOS device from the **Flash Builder 4.6** Adobe Online Manual
- Debug an application on an apple iOS device from the **Flash Builder 4.7** Adobe Online Manual
- Debug and Tune Your App from the **Xcode** User Guide
- Understanding and Analyzing iOS Application Crash Reports, Technical Note TN2141 by Apple for the times you get caught by surprise

Want more?



- For a library of conversion functions that will save you time passing data between Objective-C and ActionScript download our iOS Data Types Guide: keeping your cool when jumping between languages.

Thank you!

Thank you for picking this Debugging Guide and investing the time and money in it! We hope it saved you hours and got you closer to the top-notch quality we know you always strive for.

If you have a few minutes, we would love to hear what you thoughts about it.

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Thanks again and may the source be with you!