



# mpideXcode

*Embedded Computing Template on Xcode 4.3*

## Installation Guide

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Documentation <http://embedXcode.weebly.com/>

GitHub repository <https://github.com/rei-vilo/embedXcode>

### How to Help



Contribute to the project on [GitHub](https://github.com/rei-vilo/embedXcode).



Help me buy books on Xcode through my [Amazon Wish List](#).

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# 1. Installation

Before installing the template, here are the pre-requisites:



For all boards:

- Install Arduino 0023 or Arduino 1.0.
- Launch it.
- Define the path of the sketchbook in the menu Arduino > Preferences > Sketchbook location.

Arduino provides the reference for code-sense.

As a matter of fact, Wiring is considered as the reference.

Arduino 0023 should be preferred over Arduino 1.0 because Arduino 0023 is Wiring compliant. So is chipKIT MPIDE 0023.

Arduino 1.0 has introduced many small changes in the syntax which are not compatible with previous release. Energia 1.0 is derived from Arduino 1.0.

So I strongly recommend to pick the release which is compatible with your platforms, either Arduino 0023 or Arduino 1.0.





As an option:

- If chipKIT boards are to be used, install Mptide 0023.
- Launch it.
- Define the path of the sketchbook in the menu Mptide > Preferences > Sketchbook location.



As an option:

- If Wiring boards are to be used, install Wiring 1.0.
- Launch it.
- Define the path of the sketchbook in the menu Wiring > Preferences > Sketchbook location.

The two following files require to be deleted.



Multiplatform Arduino compatible IDE  
Arduino 0023 Compatibility

Modified version of the Arduino IDE created by  
Rick Anderson and Mark Sproul of Fair Use Building  
and Research on May 21, 2011.  
This software is not supported by the Arduino LLC

Version 1.0 Build 100



An open project initiated by Hernando Barragán

The Wiring team is composed of Hernando Barragán, Brett Hagman and Alexander Brevig

Special thanks to contributors: Paul Stoffregen, Michael Margolis, Hans-Christoph Steiner, Annelie Franke, Maarten Lamers, Christoph Waltmann, Etienne Ribeiro, Nicholas Zambetti, Thomas Ouellet Fredericks, Mikal Hart, Pascal Stang, Brian Dean, Carlos Mario Rodriguez, James Partaik, Sawad Brooks, Yaniv Steiner, Tom Igoe, David Cuartielles, David Mellis, Massimo Banzi, Bill Verplank, Gillian Crampton-Smith and many others listed at [wiring.org.co/about.html](http://wiring.org.co/about.html)

© 2004-2010 Hernando Barragán, © 2011 Hernando Barragán, Brett Hagman and Alexander Brevig

Processing is © 2004-2011 Ben Fry and Casey Reas

© 2001-2004 Massachusetts Institute of Technology

/Applications/Wiring.app/Contents/Resources/  
Java/cores/AVR8Bit/program.cpp

/Applications/Wiring.app/Contents/Resources/  
Java/cores/AVR8Bit/makefile



As an option:

- If LaunchPad board is to be used, install Energia 1.0.
- Launch it.
- Define the path of the sketchbook in the menu Energia > Preferences > Sketchbook location.

For other boards with a Processing-based IDE, same procedure:

- Install the corresponding Processing-based IDE.
- Launch it.
- Define the path of the sketchbook.
- Additionally, develop a specific makefile and adapt the Step1 makefile.

Now, the template can be installed:

Check and create ~/Library/Developer/Xcode



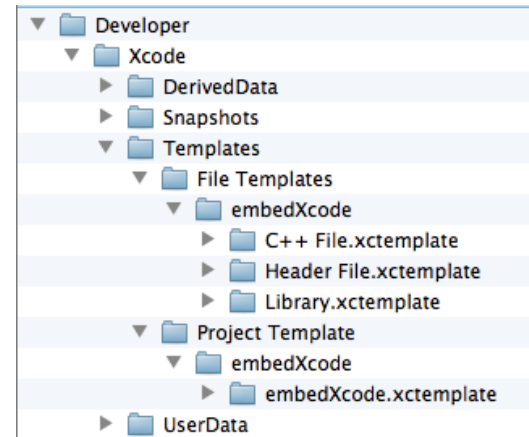
## Energia 1.0

Modified version of the Arduino IDE for the Texas Instrument LaunchPad MSP430 created by Robert Wessels on January 2012.

This software is not supported by the Arduino LLC.



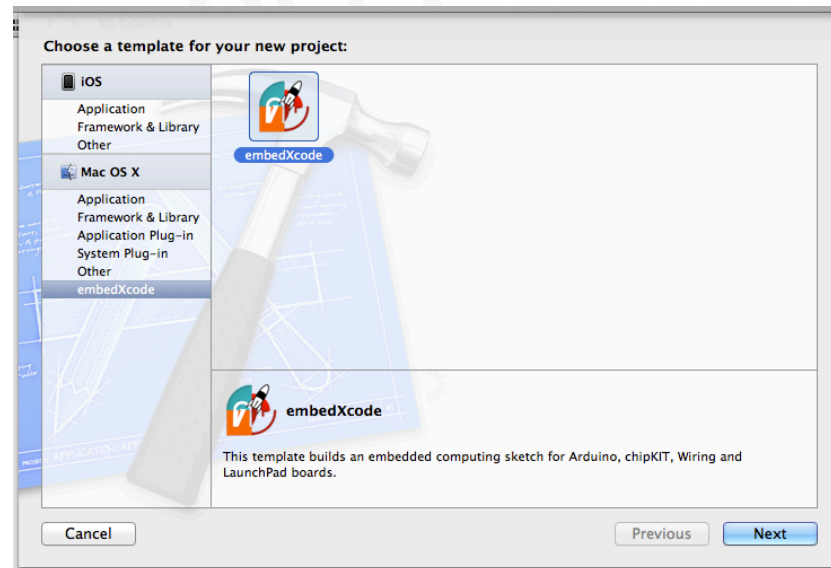
Copy the folder Templates into ~/Library/Developer/Xcode



## 2. Create a New Project

Call the menu File > New > New Project... or press ⌘N.

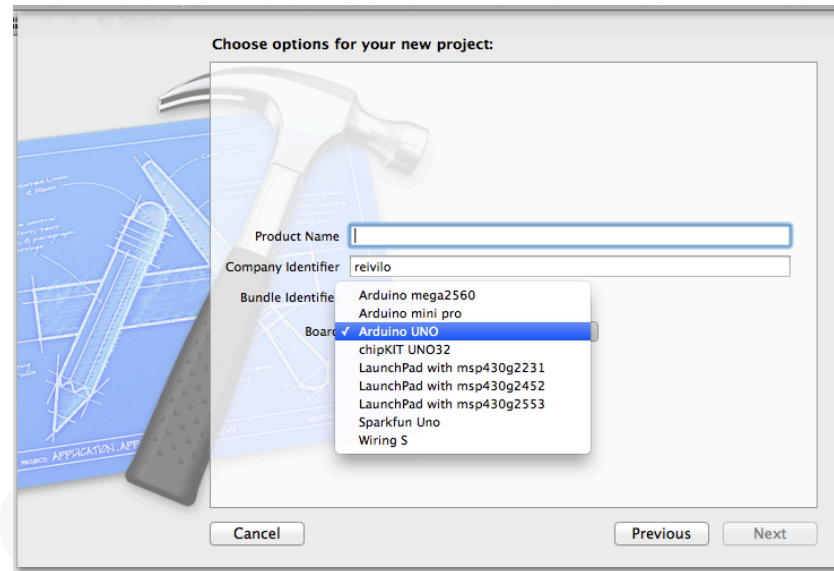
Select embedXcode > embedXcode.



Type in the name of the project.

Select the board on the drop-down list.

Click on Next to save.



### 3. Configure the Project

The template doesn't define all the parameters, so some of them need to be set manually.

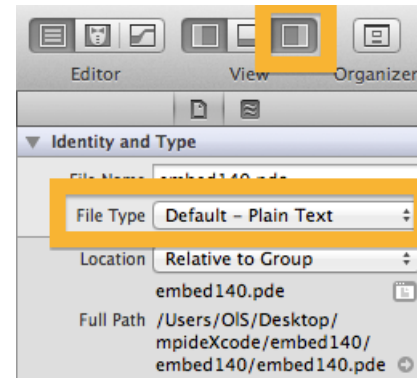
The goal is to have the following work done by the template, provided the right keywords are known.

#### 3.1. *Declare Sketch .pde File as C++ File*

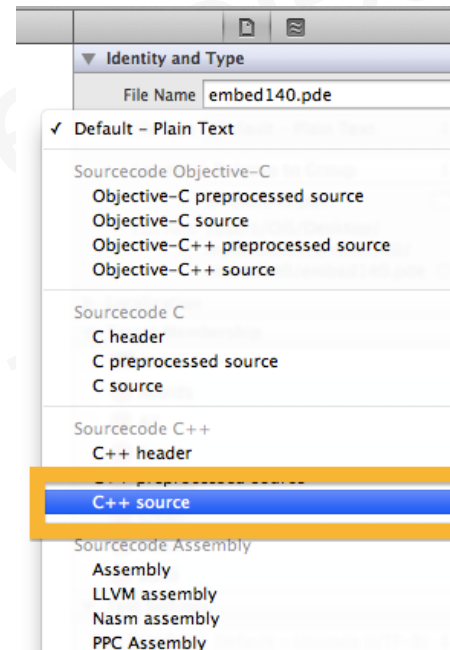
The sketch .pde file is considered as plain text. For code-sense, it should be declared as C++ file.

Select the sketch .pde file.

In the right-most column,

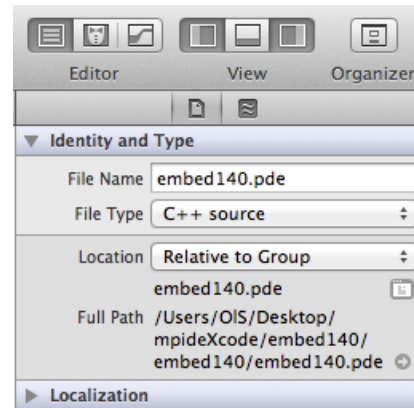


Click on the drop-down list of File Type.  
Select C++ source.





Now, the sketch is considered as C++ code for code-sense.

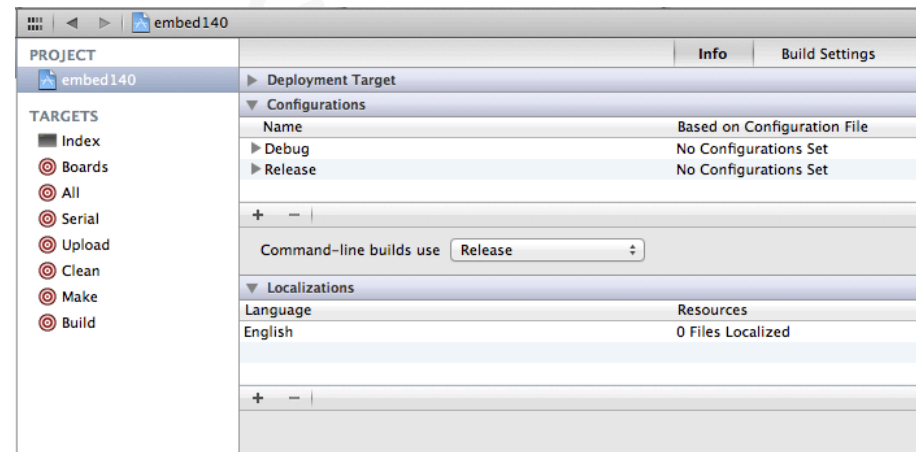


This manual procedure is considered as an issue and reported under [#3 Declare PDE File as C++ Source](#).

### 3.2. Declare User's Sketchbook

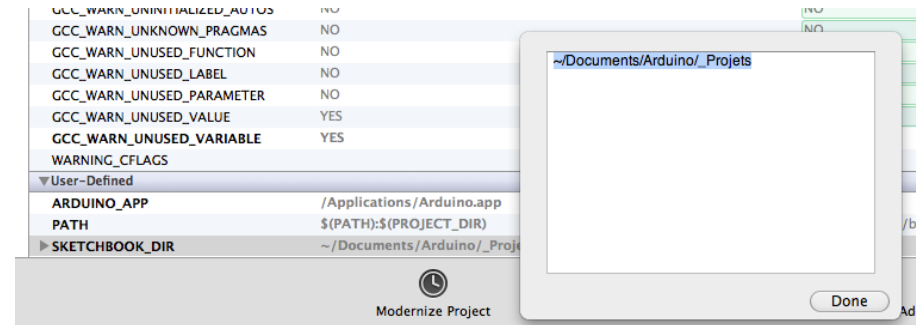
The user's sketchbook is a folder where the user's sketches are saved, among them the libraries in a dedicated sub-folder Libraries.

Select the project and the Build Settings pane.



At the very bottom, double-click on SKETCHBOOK\_DIR and either type in the name of the folder or drag-and-drop it from a Finder window.

The ~ character is accepted.



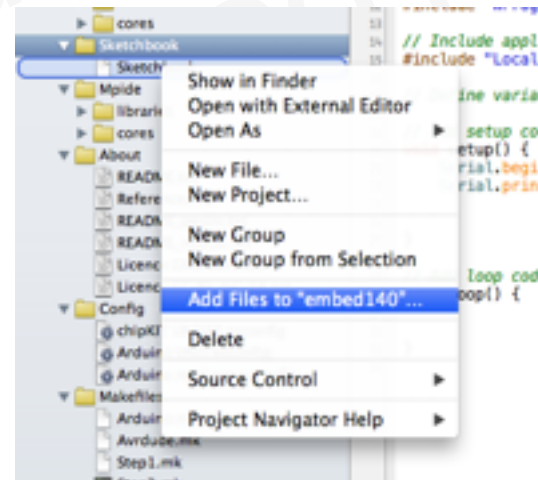
If no sketchbook is defined, SKETCHBOOK\_DIR takes the value defined for Arduino or chipKIT during the installation process.

### 3.3. Add User's Libraries

Open the Sketchbook group on the project hierarchy.

Right-click to obtain the contextual menu.

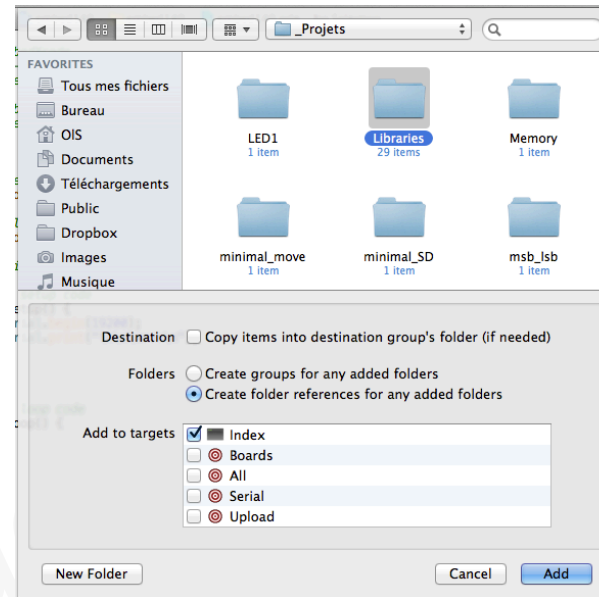
Choose Add file to...



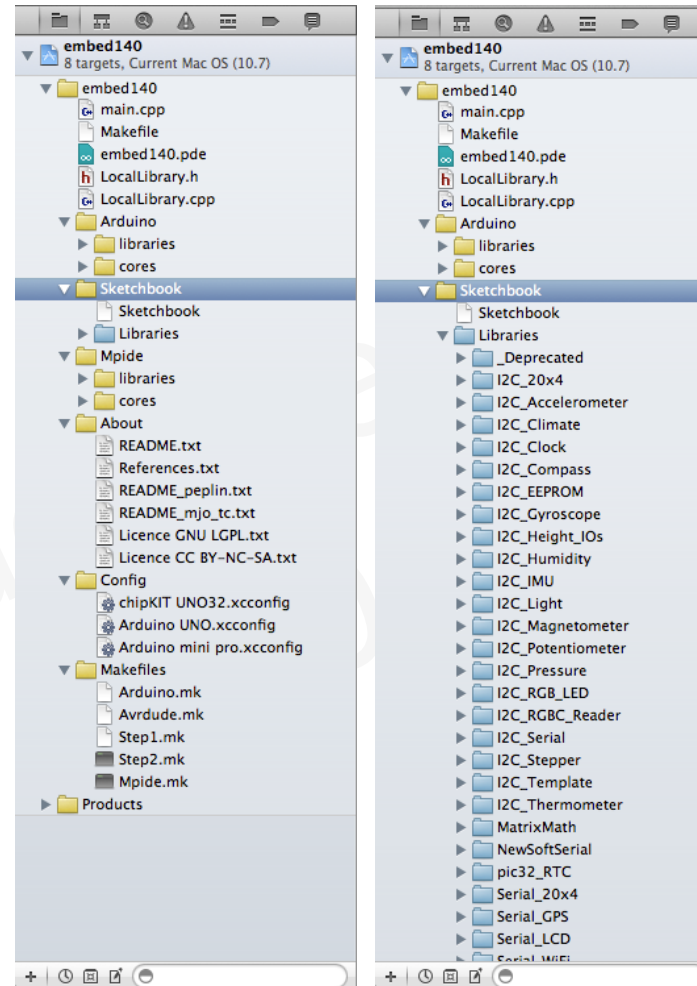
Select the Library sub-folder on the sketchbook folder, tick Add to target > Index and validate with Add.

Both Create group for any added folders and Create folder references for any added folders are relevant.

Don't tick Copy items into destination group's folder (if needed)



The project hierarchy shows all your libraries.



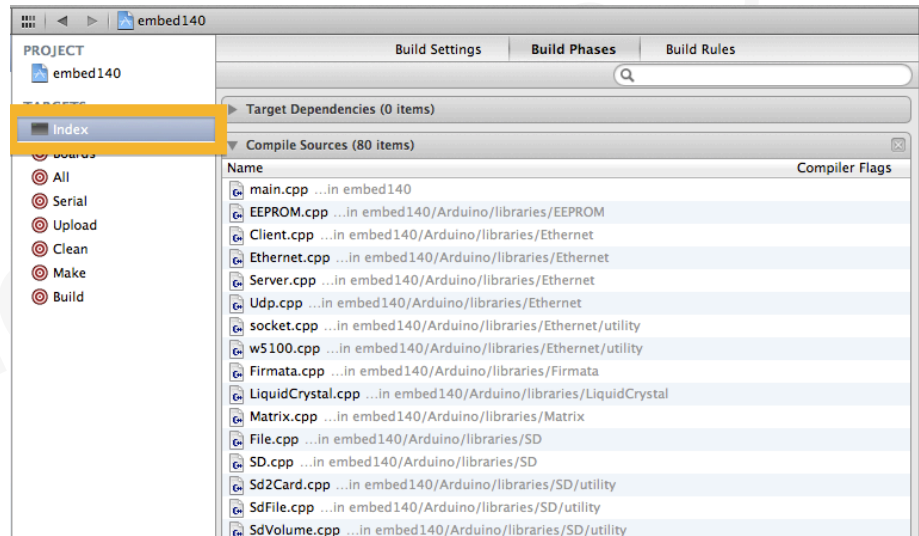
### 3.4. Declare Sources for Code-Sense

Standard C++ keywords are already known, but not some Arduino and user's library keywords.

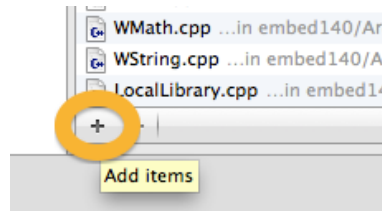
The selection of a board defines the headers for code-sense.

So Xcode needs to be taught where to find them.

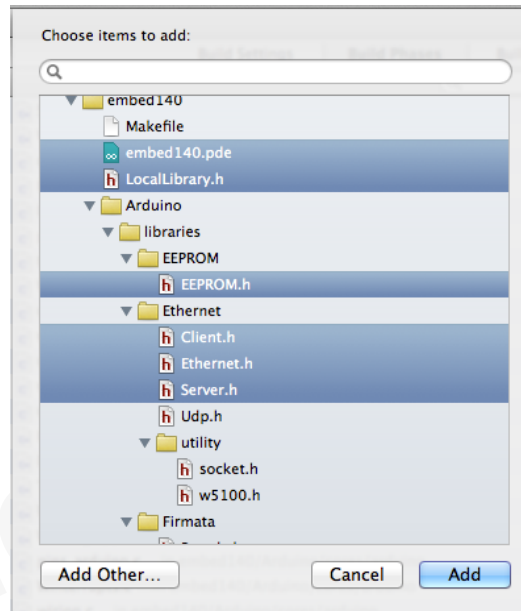
Select the target Index and the Build Phases pane.



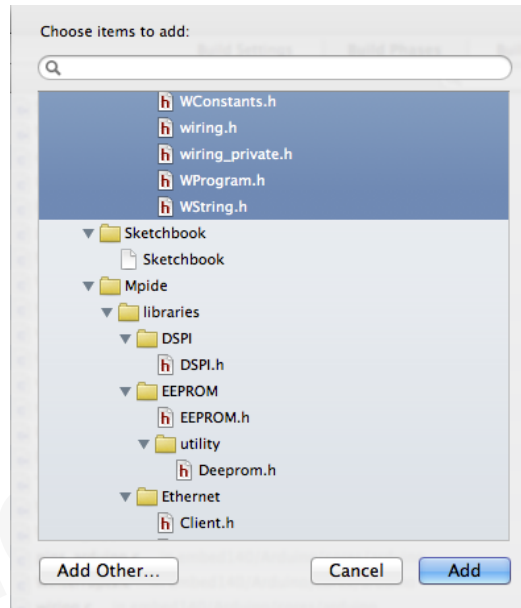
Go to the bottom of the list and click on the + button.



A list shows up.



Select all the .h and .cpp files and click on Add.



This manual procedure is considered as an issue and reported under [#2 Populated Sources List for Code-Sense](#).

### 3.5. Define the Directories for the Target

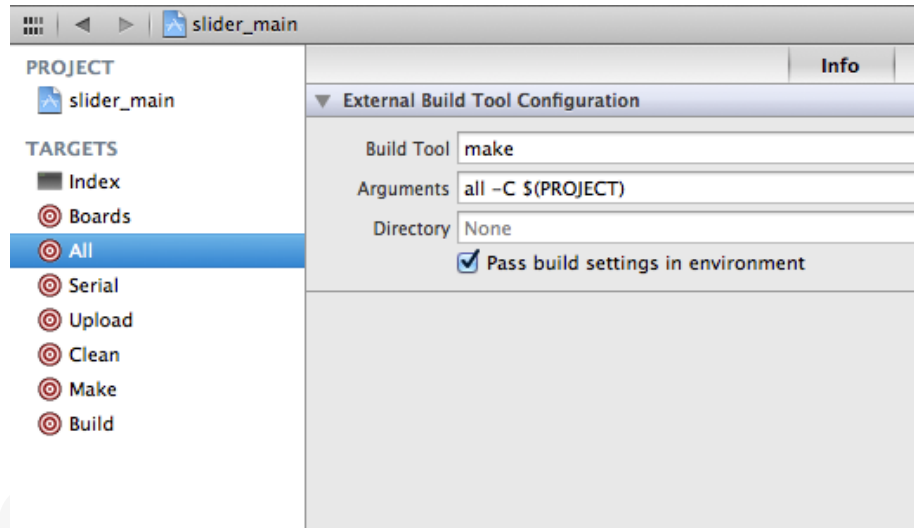
The template doesn't allow to specify the exact directory for the target. In case of an building error, the click-to-error feature may not work properly for the main sketch and the local libraries.

So Xcode needs to be taught where to find them.

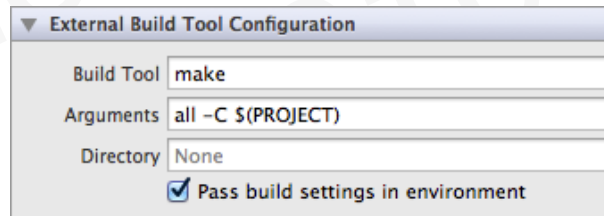
This is an optional procedure.

Select the target All.

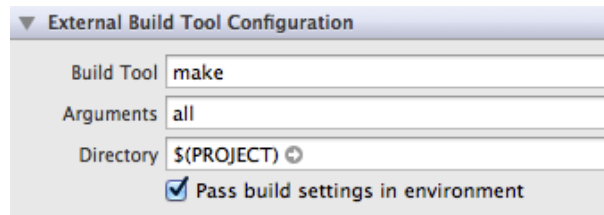
Feel free to update other targets you use often, as Build and Make.



By default, the template mentions `all -C $(PROJECT)` as arguments.



Remove `-C $(PROJECT)` from the arguments and add `$(PROJECT)` into directory.



This manual procedure is considered as an issue and reported under [#12 Define Directory for a Target](#).

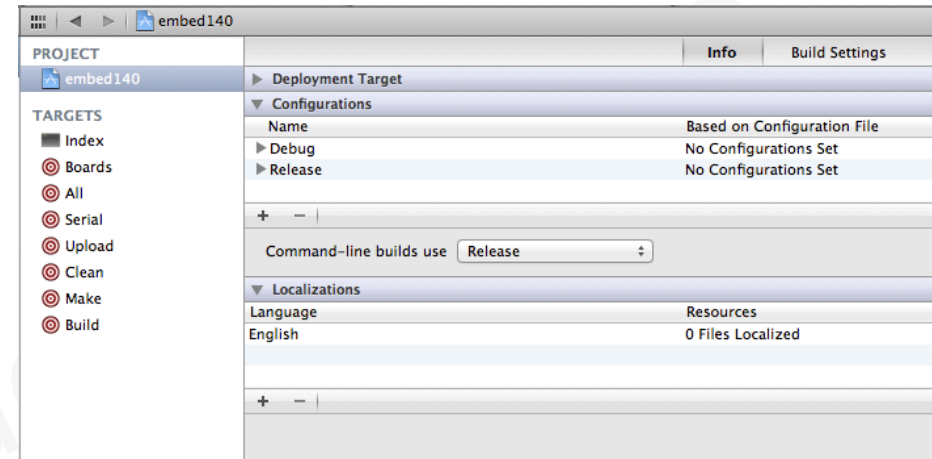
You're ready now!



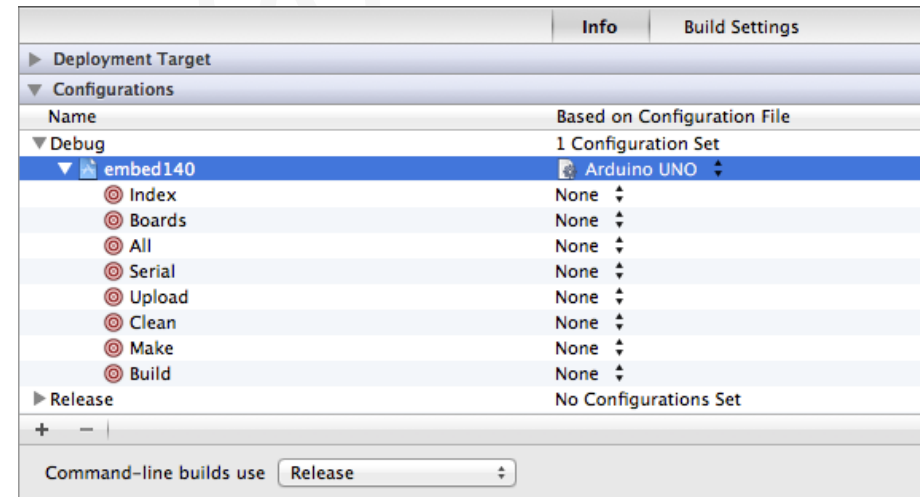
## 4. Use the Project

### 4.1. Change the Board

To change the board, select the project and the Info pane.

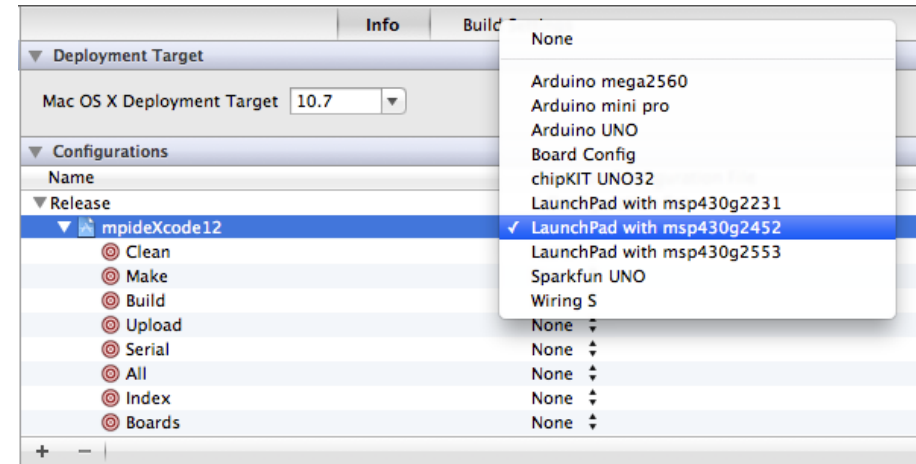


A drop-down list shows the boards available.



Just select one.

If your board isn't listed, you can create a configuration file.  
Please refer to [§6 Add a file](#).



The sketch contains conditional `#include` for the supported IDEs.

They are now based on the micro-controller reference.

In case Arduino version 0023 is used, replace `Arduino.h` by `WProgram.h`.

Those `#include` statements are included on a code snippet for easy use. Refer to [Insert Code Snippet with #include Statements](#).

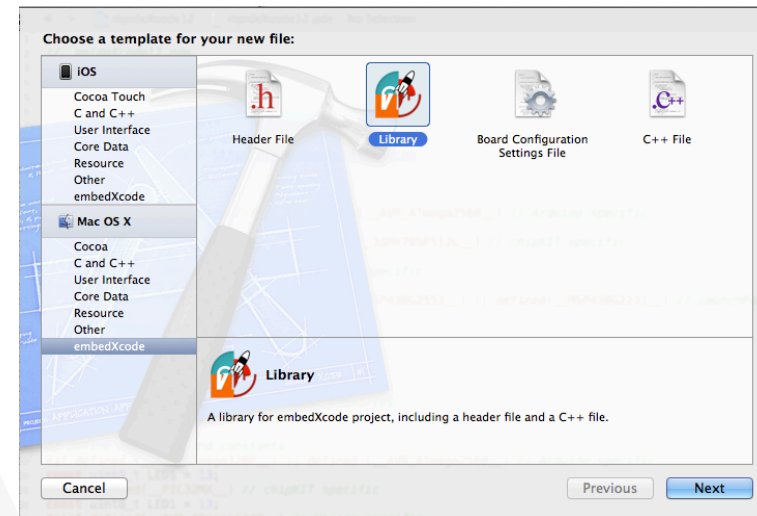
When a board is selected, the configuration file defines parameters for code-sense.

```
// Core library
#if defined(__AVR_ATmega328P__) || defined(
(__AVR_ATmega2560__) // Arduino specific
#include "WProgram.h" // - for Arduino 0023
// #include "Arduino.h" // - for Arduino 1.0
#elif defined(__32MX320F128H__) ||
defined(__32MX795F512L__) // chipKIT specific
#include "WProgram.h"
#elif defined(__AVR_ATmega644P__) // Wiring specific
#include "Wiring.h"
#elif defined(__MSP430G2452__) ||
defined(__MSP430G2553__) || defined(__MSP430G2231__) //
LaunchPad specific
#include "Energia.h"
#endif
```

## 4.2. Add a File

Call the menu File > New > New File... or press ⌘N

Select embedXcode and then Header File, C++ file, Library or Board Configuration Settings File.



Library creates a header file and a C++ code file with the `#include` statement ready!

`#include "LocalLibrary.h"`

Board Configuration Settings File allows to define the settings for a new board.

Specify:

- BOARD\_TAG is the unique identifier of the board, found in the Boards.txt file.
- BOARD\_PORT defines the USB port to be used. This parameter is optional.
- GCC\_PREPROCESSOR\_DEFINITIONS is the name of the micro-controller of the board, found in the Boards.txt file.
- HEADER\_SEARCH\_PATHS needs to be updated with the reference of the IDE, ARDUINO\_APP for Arduino, MPIDE\_APP for Mpide, WIRING\_APP for Wiring, or ENERGIA\_APP for Energia.

The last two parameters improves the selection of the headers for code-sense.



```
1 //
2 // Board Config.xcconfig
3 // Board config file
4 //
5 // Developed with embedXcode
6 //
7 // Project mpideXcode12
8 // Created by Rei VILO on 17/04/12
9 // Copyright (c) 2012 http://sites.google.com/site/vilorei
10 //
11
12 // Board identifier
13 // see Boards.txt for <tag>.name=Arduino Uno (16 MHz)
14 //
15 BOARD_TAG = uno
16
17 // Port (optional)
18 // most common are /dev/tty.usbserial* and /dev/tty.usbmodem*
19 BOARD_PORT = /dev/tty.usbserial*
20
21 // References for Xcode code-sense
22 // see Boards.txt for <tag>.build.mcu=<GCC_PREPROCESSOR_DEFINITIONS>
23 // specify ARDUINO_APP for Arduino, MPIDE_APP for Mpide, WIRING_APP for Wiring, ENERGIA_APP for Energia
24 //
25 GCC_PREPROCESSOR_DEFINITIONS = __AVR_ATmega328P__
26 HEADER_SEARCH_PATHS = $(ARDUINO_APP)/** $(SKETCHBOOK_DIR)/Libraries/**
27
```

### 4.3. Insert #include Statements From Code Snippet

A code snippet includes all the #include statements for selecting the core libraries.

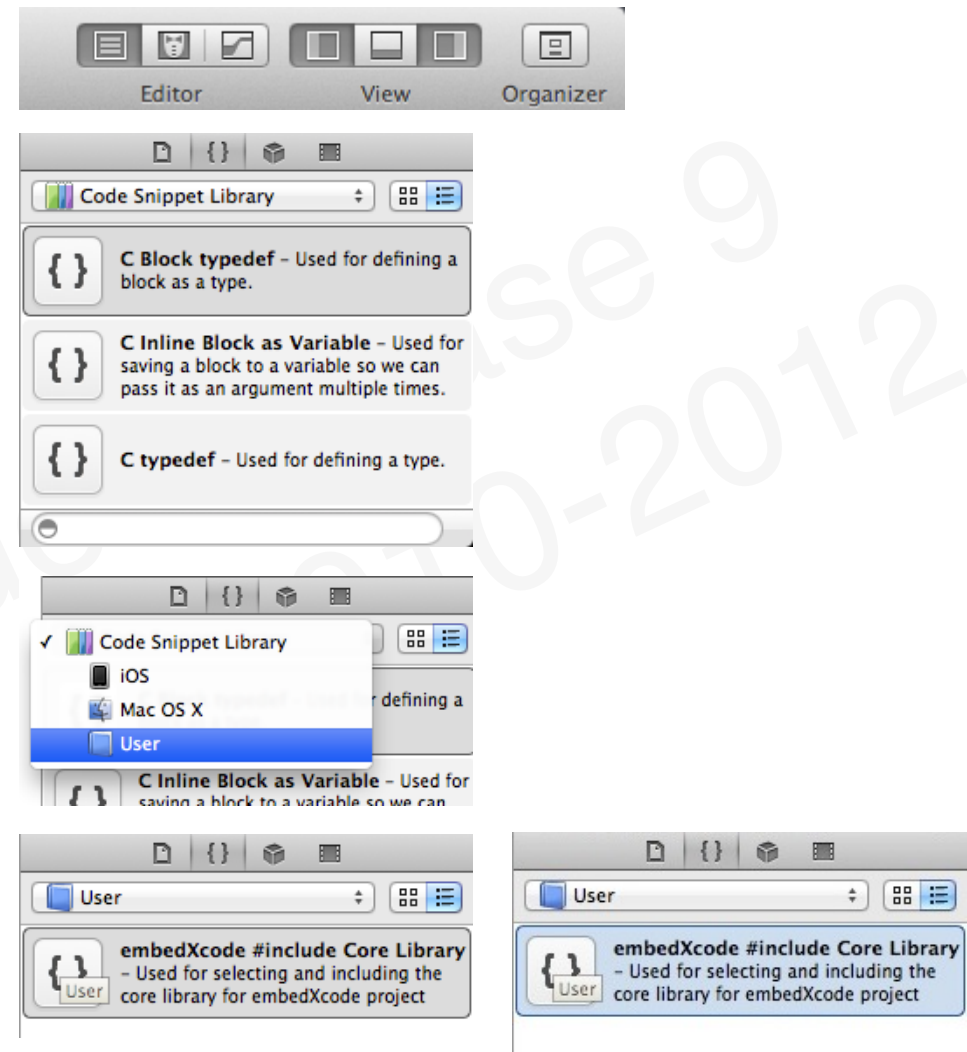
```
// Core library
#if defined (__AVR_ATmega328P__) || defined
(__AVR_ATmega2560__) // Arduino specific
#include "WProgram.h" // - for Arduino 0023
// #include "Arduino.h" // - for Arduino 1.0
#elif defined(__32MX320F128H__) ||
defined(__32MX795F512L__) // chipKIT specific
#include "WProgram.h"
#elif defined(__AVR_ATmega644P__) // Wiring specific
#include "Wiring.h"
#elif defined(__MSP430G2452__) || defined(__MSP430G2553__)
|| defined(__MSP430G2231__) // LaunchPad specific
#include "Energia.h"
#endif
```

To display the code snippets, click on the right button of the View selector.

The library of code snippets is at the bottom of the right-most pane.

Select User on the drop-down list.

Select the embedXcode #include Core Library snippet.



Click and drop to the destination.



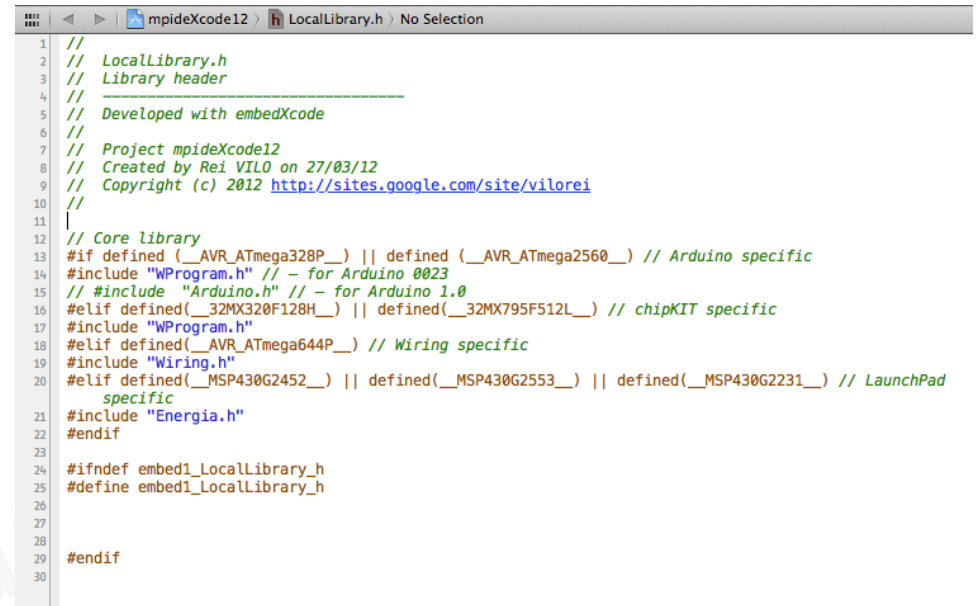
The pointer changes for

The cursor appears on the code.



```
1 //  
2 // LocalLibrary.h  
3 // Library header  
4 //  
5 // -----  
6 // Developed with embedXcode  
7 //  
8 // Project mpideXcode12  
9 // Created by Rei VILO on 27/03/12  
10 // Copyright (c) 2012 http://sites.google.com/site/vilorei  
11 //  
12 |  
13  
14 #ifndef embed1_LocalLibrary_h  
15 #define embed1_LocalLibrary_h  
16  
17  
18  
19 #endif  
20
```

The code is inserted.



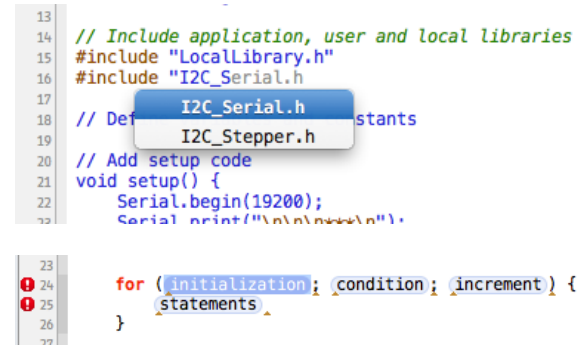
```
1 //
2 // LocalLibrary.h
3 // Library header
4 //
5 // Developed with embedXcode
6 //
7 // Project mpideXcode12
8 // Created by Rei VILO on 27/03/12
9 // Copyright (c) 2012 http://sites.google.com/site/vilorei
10 //
11 |
12 // Core library
13 #if defined (__AVR_ATmega328P__) || defined (__AVR_ATmega2560__) // Arduino specific
14 #include "WProgram.h" // - for Arduino 0023
15 // #include "Arduino.h" // - for Arduino 1.0
16 #elif defined (__32MX320F128H__) || defined (__32MX795F512L__) // chipKIT specific
17 #include "WProgram.h"
18 #elif defined (__AVR_ATmega644P__) // Wiring specific
19 #include "Wiring.h"
20 #elif defined (__MSP430G2452__) || defined (__MSP430G2553__) || defined (__MSP430G2231__) // LaunchPad
    specific
21 #include "Energia.h"
22 #endif
23
24 #ifndef embed1_LocalLibrary_h
25 #define embed1_LocalLibrary_h
26
27
28
29
30 #endif
```

#### 4.4. Re-Index the Keywords for Code-Sense

Code-sense is a major feature of Xcode.

Apart from pretty colours on the code and enhanced visibility, code-sense brings:

- auto-completion,
- code-snippets and check-as-you-type code monitoring,



```
13
14 // Include application, user and local libraries
15 #include "LocalLibrary.h"
16 #include "I2C_Serial.h"
17 // Def I2C_Serial.h constants
18 // Def I2C_Stepper.h
19 // Add setup code
20 void setup() {
21     Serial.begin(19200);
22     Serial.print("\n\n\n\n\n");
23
24     for (initialization; condition; increment) {
25         statements
26     }
27 }
```

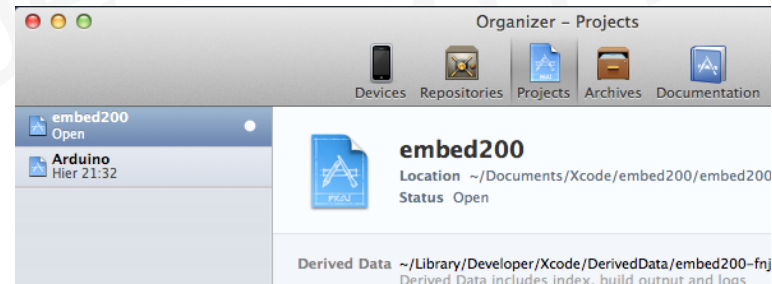
- click-to-definition



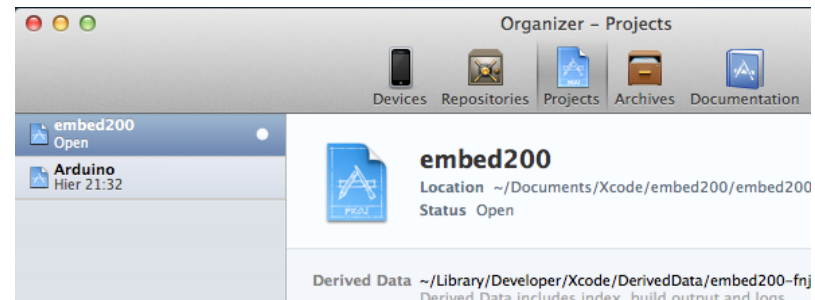
If code-sense doesn't work, we need to force a re-indexing of the key words.

To do so, first close the project.

Call the menu Window > Organiser and select the Projects pane.

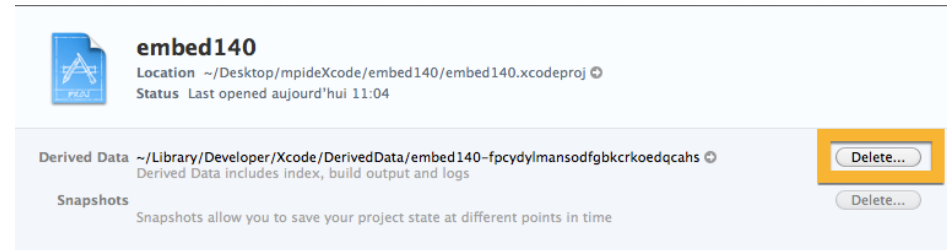


Select then the project.

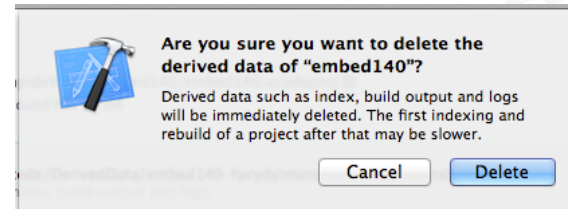




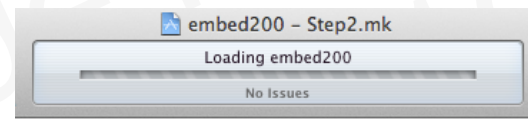
The index is saved within the Derived Data folder.  
Click on the Delete button to delete them.



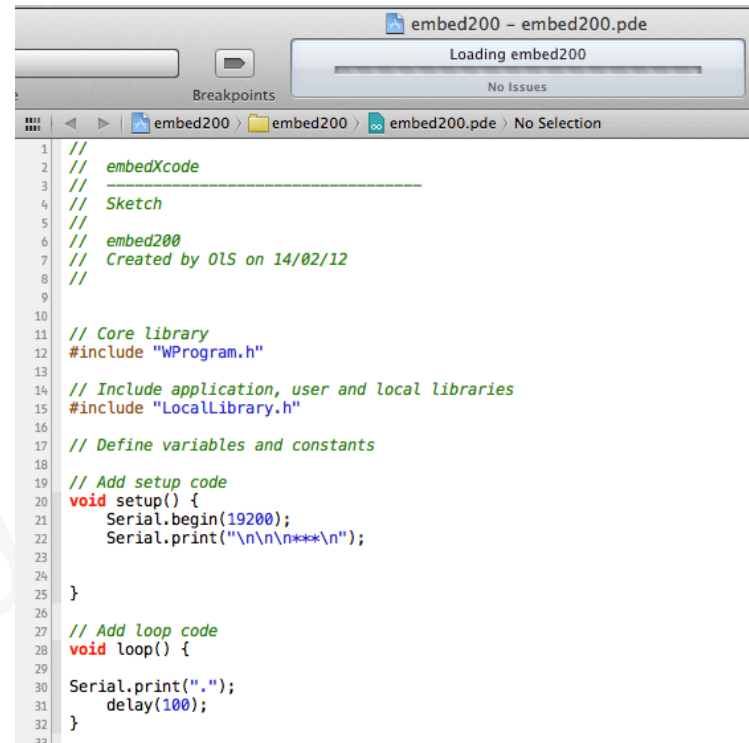
Confirm the deletion.



Load the project.



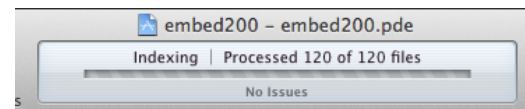
There's no code-sense yet: everything is in black-and-white, except standard C++ keywords.



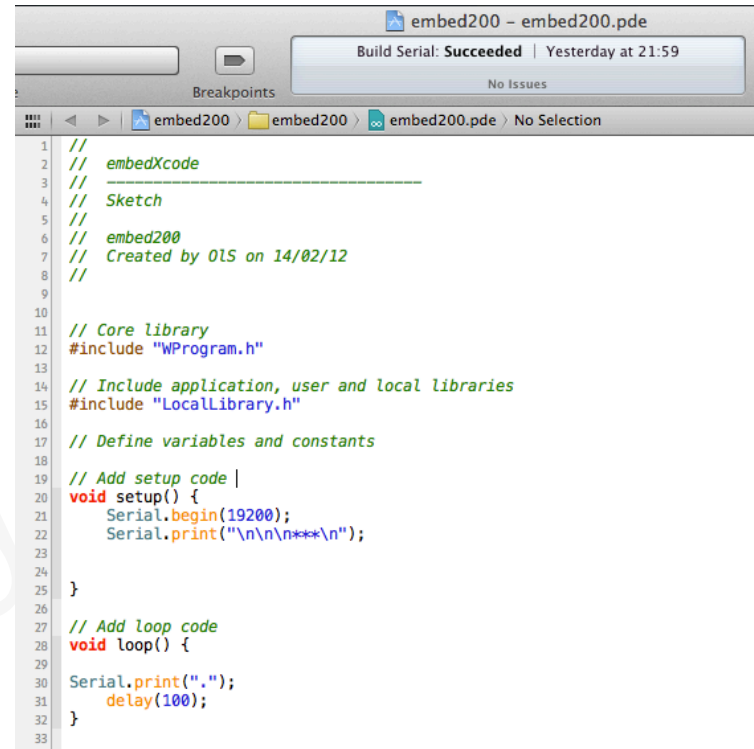
The screenshot shows the Arduino IDE interface. At the top, a progress bar indicates 'Loading embed200' with 'No Issues'. Below this, the breadcrumb trail shows 'embed200 > embed200 > embed200.pde > No Selection'. The main editor displays the source code for 'embed200.pde' with line numbers 1 through 33. The code is mostly in black and white, with standard C++ keywords like 'void', 'include', 'Serial', and 'delay' highlighted in red. Comments are in green. The code includes a core library, application and local libraries, and defines variables and constants. It also contains setup and loop functions.

```
1 //  
2 // embedXcode  
3 // -----  
4 // Sketch  
5 //  
6 // embed200  
7 // Created by OLS on 14/02/12  
8 //  
9 //  
10 //  
11 // Core library  
12 #include "WProgram.h"  
13 //  
14 // Include application, user and local libraries  
15 #include "LocalLibrary.h"  
16 //  
17 // Define variables and constants  
18 //  
19 // Add setup code  
20 void setup() {  
21   Serial.begin(19200);  
22   Serial.print("\n\n\n**\n");  
23 }  
24 }  
25 }  
26 }  
27 // Add loop code  
28 void loop() {  
29   Serial.print(".");  
30   delay(100);  
31 }  
32 }  
33 }
```

The index is being built.



When the index is built, code-sense shows pretty colours.



The screenshot shows the embedXcode IDE interface. At the top, a status bar indicates 'Build Serial: Succeeded' and 'Yesterday at 21:59'. Below this, a breadcrumb trail shows the file path: 'embed200 > embed200.pde'. The main editor area displays a C++ sketch with syntax highlighting. The code includes comments, preprocessor directives, and function definitions. A large, faint watermark 'embedXcode © Rei VILO' is visible across the background of the code editor.

```
1 //  
2 // embedXcode  
3 // -----  
4 // Sketch  
5 //  
6 // embed200  
7 // Created by OLS on 14/02/12  
8 //  
9  
10  
11 // Core library  
12 #include "WProgram.h"  
13  
14 // Include application, user and local libraries  
15 #include "LocalLibrary.h"  
16  
17 // Define variables and constants  
18  
19 // Add setup code |  
20 void setup() {  
21     Serial.begin(19200);  
22     Serial.print("\n\n\n***\n");  
23  
24 }  
25  
26 // Add loop code  
27 void loop() {  
28     Serial.print(".");  
29     delay(100);  
30 }  
31  
32  
33
```

## 5. Appendixes

### 5.1. What Has Been Tested

Platform	What Has Been Tested	What Has Not Been Tested	Reference Boards
Arduino	Sketch compilation and upload		Arduino Uno, Arduino mega2560 and Arduino mini pro
chipKIT	Sketch compilation and upload		chipKIT UNO32
Wiring	Sketch compilation and upload		Wiring S
LaunchPad	Sketch compilation and upload		LaunchPad with MSP430G2542, MSP430G2331 and MSP430G2553

### 5.2. Known Issues

Most of the issues are related to unknown keywords for the Xcode 4.3 template.

Most critical issues are:

[#2 Populated Sources List for Code-Sense](#)

[#3 Declare PDE File as C++ Source](#)

[#12 Define Directory for a Target](#)

### 5.3. Contributions and References

See documents on the About folder for additional contributions and detailed references.

### 5.4. Referenced Boards

According to the Boards.txt files:

Arduino	chipKIT	Wiring	LaunchPad
Arduino Uno	chipKIT UNO32	Wiring S @ 16 MHz	LaunchPad with mps430g2452
Arduino Duemilanove or Nano w/ ATmega328	chipKIT MAX32	Wiring S with Play Shield @ 16 MHz	LaunchPad with mps430g2231
Arduino Diecimila, Duemilanove, or Nano w/ ATmega168	chipKIT MAX32-USB for Serial	Wiring V1.0/Wiring Mini V1.0 @ 16 MHz	LaunchPad with mps430g2553
Arduino Mega 2560	Cerebot MX3cK	Wiring V1.1 ATmega1281 @ 16 MHz	
Arduino Mega (ATmega1280)	Cerebot MX4cK	Wiring V1.1 ATmega2561 @ 16 MHz	
Arduino Mini	Cerebot MX7cK		
Arduino Fio	Cerebot 32MX4		
Arduino BT w/ ATmega328	Cerebot 32MX7		
Arduino BT w/ ATmega168	Microchip PIC32 Starter kit		
LilyPad Arduino w/ ATmega328	Microchip PIC32 Ethernet Starter kit		
LilyPad Arduino w/ ATmega168	Microchip PIC32 USB Starter kit II		
Arduino Pro or Pro Mini (5V, 16 MHz) w/ ATmega328	Microchip PIC32 Explorer 16		
Arduino Pro or Pro Mini (5V, 16 MHz) w/ ATmega168	MirkoElektronika PIC32 Multimedia Board		
Arduino Pro or Pro Mini (3.3V, 8 MHz) w/ ATmega328	MirkoElektronika PIC32 mikroMedia Board		
Arduino Pro or Pro Mini (3.3V, 8 MHz) w/ ATmega168	Pic32 UBW32-MX460		
Arduino NG or older w/ ATmega168	Pic32 UBW32-MX795		
Arduino NG or older w/ ATmega8	Pic32 CUI32-Development Stick		

## 5.5. Version History

Date	mpideXcode	embedXcode	Installation Guide	Comment
Jan 22, 2012	a			Initial release
Feb 02, 2012	b			chipKIT operational
Feb 04, 2012	c			Code-sense operational
Feb 06, 2012	d			User libraries
Feb 06, 2012	e			Code checking while typing with Index as target
Feb 08, 2012	f			Code-sense, click-to-error with standard targets
Feb 14, 2012	g	1	1	Multi-application, check-as-you-type, template
Feb 18, 2012	6	2	2	Improvements
Feb 26, 2012		3		Modular makefiles
Mar 06, 2012	7	4	3	Arduino 1.0 implementation
Mar 12, 2012	8	5		Bugs fixed
Mar 15, 2012	9	6	4	All Arduino/chipKIT/Wiring/Energia and user libraries included by default
Apr 05, 2012	10	7	5	Wiring 1.0 and Energia 1.0 implementations
Apr 08, 2012	11	8	5	Bugs fixed
Apr 16, 2012	12	9	6	Code-sense reference defined by selected board

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