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# SDL Game Development

Discover how to leverage the power of SDL 2.0 to create awesome games in C++

Shaun Mitchell

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**Shaun Ross Mitchell**



BIRMINGHAM - MUMBAI

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---

I would like to thank Jason Colman, my university lecturer, whose knowledge and insight into C++ and game programming has been the foundation of my skillset.

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---

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**Luka Horvat** is an enthusiastic software and game developer who got fascinated by computer science in his early years. He chose to study his passion while working on many different projects and technologies. Throughout the years he gained a lot of knowledge and experience, and he wanted to share that with others. He is proficient in many different programming languages, with C++ as his main one; and is passionate about game development. So he started teaching it and currently manages different courses for in this area. He continues to pursue his career in computer science by working on a wide variety of projects and sharing them with others.

---

I would like to thank my friends and family who helped me produce this book.

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I would like to thank my family and friends. All of you are amazing.

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*In memory of my Mum.  
You always believed in me.  
I miss you everyday.*



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# Preface

Creating games in C++ is a complicated process requiring a lot of time and dedication to achieve results. A good foundation of reusable classes can speed up development time and allow focus to be on creating a great game rather than struggling with low-level code. This book aims to show an approach to creating a reusable framework that could be used for any game, whether 2D or 3D.

## What this book covers

*Chapter 1, Getting started with SDL*, covers setting up SDL in Visual C++ 2010 express and then moves onto the basics of SDL including creating a window and listening for quit events.

*Chapter 2, Drawing in SDL*, covers the development of some core drawing classes to help simplify SDL rendering. The `SDL_image` extension is also introduced to allow the loading of a variety of different image file types.

*Chapter 3, Working with Game Objects*, gives a basic introduction to inheritance and polymorphism along with the development of a reusable `GameObject` class that will be used throughout the rest of the book.

*Chapter 4, Exploring Movement and Input Handling*, gives a detailed look at handling events in SDL. Joystick, keyboard, and mouse input are all covered with the development of reusable classes.

*Chapter 5, Handling Game States*, covers the design and implementation of a finite state machine to manage game states. Implementing and moving between different states is covered in detail.

*Chapter 6, Data-driven Design*, covers the use of TinyXML to load states. A class to parse states is developed along with examples for different states.



*Chapter 7, Creating and Displaying Tile Maps*, brings together everything from the previous chapters to allow the creation of levels using the Tiled map editor. A level parsing class is created to load maps from an XML file.

*Chapter 8, Creating Alien Attack*, covers the creation of a 2D side scrolling shooter, utilizing everything learned in the previous chapters.

*Chapter 9, Creating Conan the Caveman*, covers the creation of a second game, altering the code from Alien Attack, showing that the framework is flexible enough to be used for any 2D game genre.

## What you need for this book

To use this book you will need the following software:

- Visual C++ 2010 Express
- Tiled map editor
- TinyXML
- zlib library

## Who this book is for

This book is aimed at beginner/intermediate C++ programmers who want to take their existing skills and apply them to creating games in C++. This is not a beginner's book and you are expected to know the basics of C++, including inheritance, polymorphism, and class design.

## Conventions

In this book, you will find a number of styles of text that distinguish between different kinds of information. Here are some examples of these styles, and an explanation of their meaning.


Code words in text are shown as follows: "We can include other contexts through the use of the `include` directive."


A block of code is set as follows:

```
void Player::update()
{
    m_currentFrame = int(((SDL_GetTicks() / 100) % 6));
```

```
m_acceleration.setX(1);  
  
SDLGameObject::update();  
}
```

New **terms** and **important words** are shown in bold. Words that you see on the screen, in menus or dialog boxes for example, appear in the text like this: "Right-click on the project and choose **Build**".

 Warnings or important notes appear in a box like this.

 Tips and tricks appear like this.

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# 1

## Getting Started with SDL

**Simple DirectMedia Layer (SDL)** is a cross-platform multimedia library created by Sam Oscar Latinga. It provides low-level access to input (via mouse, keyboard, and gamepads/joysticks), 3D hardware, and the 2D video frame buffer. SDL is written in the C programming language, yet has native support for C++. The library also has bindings for several other languages such as Pascal, Objective-C, Python, Ruby, and Java; a full list of supported languages is available at <http://www.libsdl.org/languages.php>.

SDL has been used in many commercial games including World of Goo, Neverwinter Nights, and Second Life. It is also used in emulators such as ZSNES, Mupen64, and VisualBoyAdvance. Some popular games ported to Linux platforms such as Quake 4, Soldier of Fortune, and Civilization: Call to Power utilize SDL in some form.

SDL is not just used for games. It is useful for all manner of applications. If your software needs access to graphics and input, chances are that SDL will be a great help. The SDL official website has a list of applications that have been created using the library (<http://www.libsdl.org/applications.php>).

In this chapter we will cover the following:

- Getting the latest SDL build from the Mercurial repository
- Building and setting up SDL in Visual C++ 2010 Express
- Creating a window with SDL
- Implementing a basic game class

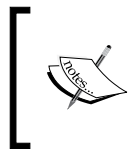
## Why use SDL?

Each platform has its own way of creating and displaying windows and graphics, handling user input, and accessing any low-level hardware; each one with its own intricacies and syntax. SDL provides a uniform way of accessing these platform-specific features. This uniformity leads to more time spent tweaking your game rather than worrying about how a specific platform allows you to render or get user input, and so on. Game programming can be quite difficult, and having a library such as SDL can get your game up and running relatively quickly.

The ability to write a game on Windows and then go on to compile it on OSX or Linux with little to no changes in the code is extremely powerful and perfect for developers who want to target as many platforms as possible; SDL makes this kind of cross-platform development a breeze. While SDL is extremely effective for cross-platform development, it is also an excellent choice for creating a game with just one platform in mind, due to its ease of use and abundance of features.

SDL has a large user base and is being actively updated and maintained. There is also a responsive community along with a helpful mailing list. Documentation for SDL 2.0 is up-to-date and constantly maintained. Visiting the SDL website, [libSDL.org](http://libSDL.org), offers up lots of articles and information with links to the documentation, mailing list, and forums.

Overall, SDL offers a great place to start with game development, allowing you to focus on the game itself and ignore which platform you are developing for, until it is completely necessary. Now, with SDL 2.0 and the new features it brings to the table, SDL has become an even more capable library for game development using C++.



The best way to find out what you can do with SDL and its various functions is to use the documentation found at <http://wiki.libSDL.org/moin.cgi/CategoryAPI>. There you can see a list of all of SDL 2.0's functions along with various code examples.

## What is new in SDL 2.0?

The latest version of SDL and SDL 2.0, which we will be covering in this book, is still in development. It adds many new features to the existing SDL 1.2 framework. The SDL 2.0 Roadmap ([wiki.libSDL.org/moin.cgi/Roadmap](http://wiki.libSDL.org/moin.cgi/Roadmap)) lists these features as:

- A 3D accelerated, texture-based rendering API
- Hardware-accelerated 2D graphics
- Support for render targets

- Multiple window support
- API support for clipboard access
- Multiple input device support
- Support for 7.1 audio
- Multiple audio device support
- Force-feedback API for joysticks
- Horizontal mouse wheel support
- Multitouch input API support
- Audio capture support
- Improvements to multithreading

While not all of these will be used in our game-programming adventures, some of them are invaluable and make SDL an even better framework to use to develop games. We will be taking advantage of the new hardware-accelerated 2D graphics to make sure our games have excellent performance.

## Migrating SDL 1.2 extensions

SDL has separate extensions that can be used to add new capabilities to the library. The reason these extensions are not included in the first place is to keep SDL as lightweight as possible, with the extensions serving to add functionality only when necessary. The next table shows some useful extensions along with their purpose. These extensions have been updated from their SDL1.2/3 Versions to support SDL 2.0, and this book will cover cloning and building them from their respective repositories as and when they are needed.

Name	Description
SDL_image	This is an image file loading library with support for BMP, GIF, PNG, TGA, PCX, and among others.
SDL_net	This is a cross-platform networking library.
SDL_mixer	This is an audio mixer library. It has support for MP3, MIDI, and OGG.
SDL_ttf	This is a library supporting the use of TrueType fonts in SDL applications.
SDL_rtf	This is a library to support the rendering of the <b>Rich Text Format (RTF)</b> .

## Setting up SDL in Visual C++ Express 2010

This book will cover setting up SDL 2.0 in Microsoft's Visual C++ Express 2010 IDE. This IDE was chosen as it is available for free online, and is a widely used development environment within the games industry. The application is available at <https://www.microsoft.com/visualstudio/en-gb/express>. Once the IDE has been installed we can go ahead and download SDL 2.0. If you are not using Windows to develop games, then these instructions can be altered to suit your IDE of choice using its specific steps to link libraries and include files.

SDL 2.0 is still in development so there are no official releases as yet. The library can be retrieved in two different ways:

- One is to download the under-construction snapshot; you can then link against this to build your games (the quickest option)
- The second option is to clone the latest source using mercurial-distributed source control and build it from scratch (a good option to keep up with the latest developments of the library)

Both of these options are available at <http://www.libsdl.org/hg.php>.

Building SDL 2.0 on Windows also requires the latest DirectX SDK, which is available at <http://www.microsoft.com/en-gb/download/details.aspx?id=6812>, so make sure this is installed first.

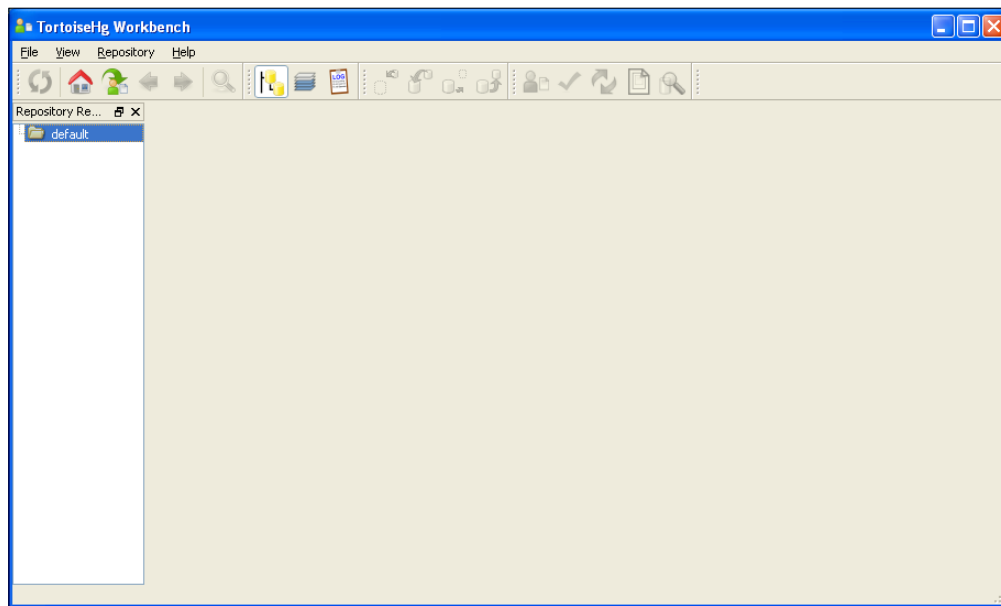
## Using Mercurial to get SDL 2.0 on Windows

Getting SDL 2.0 directly from the constantly updated repository is the best way of making sure you have the latest build of SDL 2.0 and that you are taking advantage of any current bug fixes. To download and build the latest version of SDL 2.0 on Windows, we must first install a mercurial source control client so that we can mirror the latest source code and build from it. There are various command-line tools and GUIs available for use with mercurial. We will use TortoiseHg, a free and user-friendly mercurial application; it is available at [tortoisehg.bitbucket.org](http://tortoisehg.bitbucket.org). Once the application is installed, we can go ahead and grab the latest build.

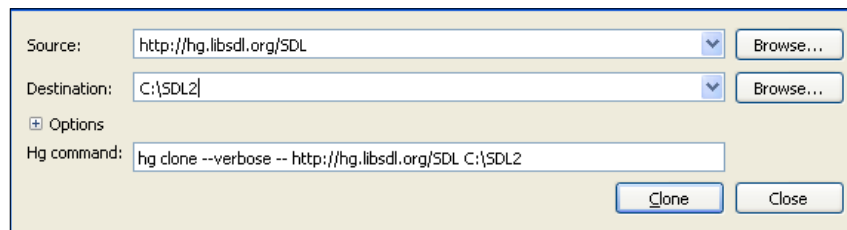
## Cloning and building the latest SDL 2.0 repository

Cloning and building the latest version of SDL directly from the repository is relatively straightforward when following these steps:

1. Open up the **TortoiseHg Workbench** window.



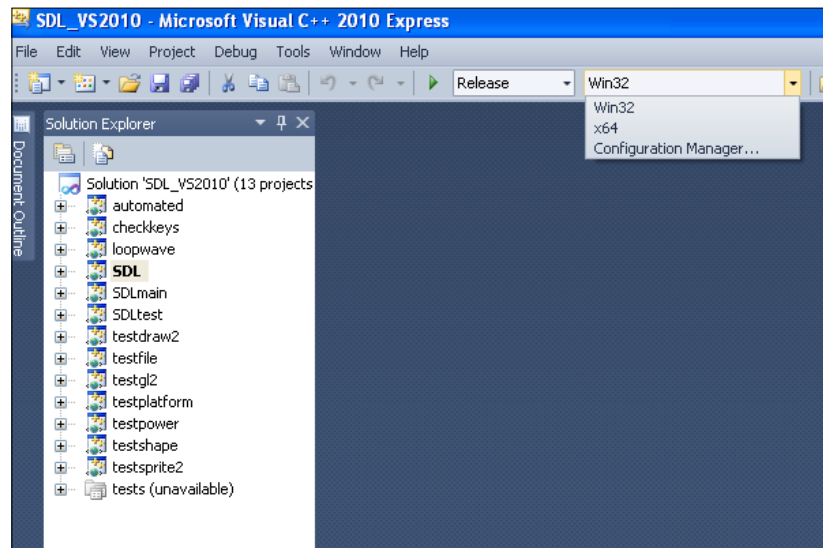
2. Pressing *Ctrl + Shift + N* will open the clone dialog box.
3. Input the source of the repository; in this case it is listed on the SDL 2.0 website as <http://hg.libsdl.org/SDL>.
4. Input or browse to choose a destination for the cloned repository – this book will assume that `C:\SDL2` is set as the location.
5. Click on **Clone** and allow the repository to copy to the chosen destination.



6. Within the `C:\SDL2` directory there will be a `visualC` folder; inside the folder there is a Visual C++ 2010 solution, which we have to open with Visual C++ Express 2010.
7. Visual C++ Express will throw up a few errors about solution folders not being supported in the express version, but they can be safely ignored without affecting our ability to build the library.



8. Change the current build configuration to release and also choose 32 or 64 bit depending on your operating system.



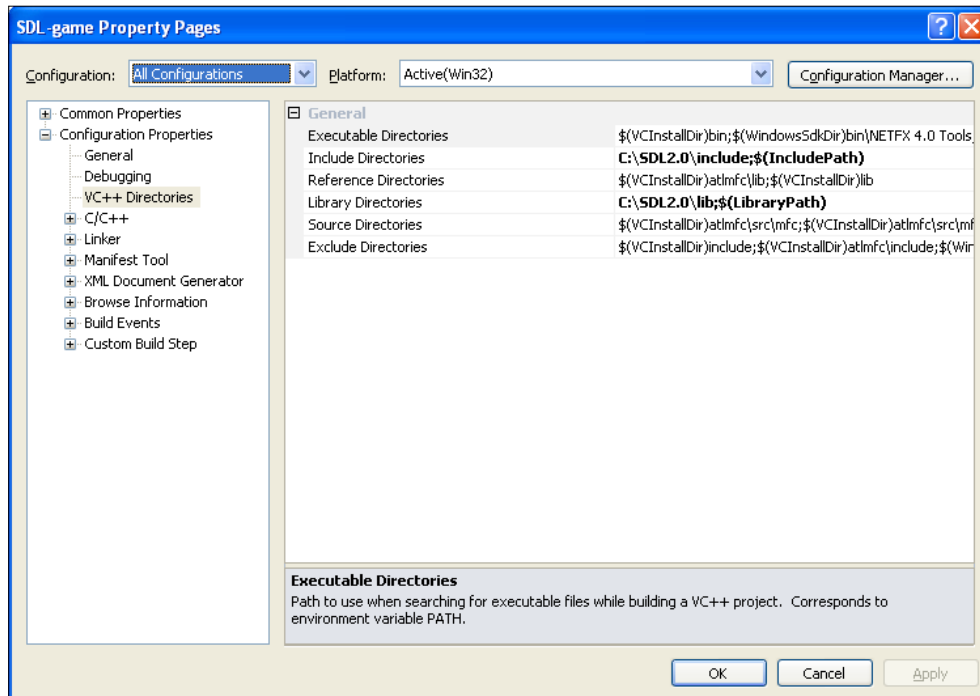
9. Right-click on the project named **SDL** listed in the **Solution Explorer** list and choose **Build**.
10. We now have a build of the SDL 2.0 library to use. It will be located at C:\SDL2\VisualC\SDL\Win32 (or x64) \Release\SDL.lib.
11. We also need to build the SDL main library file, so choose it within the **Solution Explorer** list and build it. This file will build to C:\SDL2\VisualC\SDLmain\Win32 (or x64) \Release\SDLmain.lib.
12. Create a folder named `lib` in C:\SDL2 and copy `SDL.lib` and `SDLmain.lib` into this newly created folder.

## I have the library; now what?

Now a Visual C++ 2010 project can be created and linked with the SDL library. Here are the steps involved:

1. Create a new empty project in Visual C++ express and give it a name, such as `SDL-game`.
2. Once created, right-click on the project in the **Solution Explorer** list and choose **Properties**.

3. Change the configuration drop-down list to **All Configurations**.
4. Under **VC++ Directories**, click on **Include Directories**. A small arrow will allow a drop-down menu; click on **<Edit...>**.



5. Double-click inside the box to create a new location. You can type or browse to C:\SDL2.0\include and click on **OK**.
6. Next, do the same thing under library directories, this time passing in your created lib folder (C:\SDL2\lib).