*What exactly is OpenGL?*

It's a way to draw stuff in 3D. It can also be used for 2D drawing, but there are better tools for straight 2D drawing, such as SDL and Allegro.

The graphics card is where the 3D computation happens. The purpose of OpenGL is to communicate with the graphics card about your 3D scene.

*So why not talk to the graphics card directly?*

Each graphics card is a little different. In a sense, they all speak different "languages". To talk to them all, you can either learn all of their languages, or find a "translator" that knows all of their languages and talk to the translator, so that you only have to know one language.

OpenGL serves as a "translator" for graphics cards

Programming OpenGL in C/C++

To program we need a C/C++ compiler, either GCC (GNU Compiler Collection) from MinGW or Cygwin (for Windows), or Visual C/C++ Compiler, or others.

*The following sets of libraries are needed in programming OpenGL:*

1. **Core OpenGL (GL)**: consists of hundreds of functions, which begin with a prefix "gl" (e.g., glColor, glVertex, glTranslate, glRotate)

The Core OpenGL models an object via a set of geometric primitives, such as point, line, and polygon.

1. **OpenGL Utility Library (GLU)**: built on-top of the core OpenGL to provide important utilities and more building models (such as quadric surfaces).

GLU functions start with a prefix "glu" (e.g., gluLookAt, gluPerspective)

1. **OpenGL Utilities Toolkit (GLUT)**: provides support to interact with the Operating System (such as creating a window, handling key and mouse inputs); and more building models (such as sphere and torus).

GLUT functions start with a prefix of "glut" (e.g., glutCreatewindow, glutMouseFunc). 

[opengl.org](http://www.opengl.org/resources/libraries/glut/): "GLUT is designed for constructing small to medium sized OpenGL programs. While GLUT is well-suited to learning OpenGL and developing simple OpenGL applications, GLUT is not a full-featured toolkit so large applications requiring sophisticated user interfaces are better off using native window system toolkits.

GLUT is simple, easy, and small."

1. **OpenGL Extension Wrangler Library (GLEW)**: "GLEW is a cross-platform open-source C/C++ extension loading library. GLEW provides efficient run-time mechanisms for determining which OpenGL extensions are supported on the target platform." Source and pre-build binary available at <http://glew.sourceforge.net/>.

Each of the software package consists of:

1. A *header* file: "gl.h" for core OpenGL, "glu.h" for GLU, and "glut.h" (or "freeglut.h") for GLUT, typically kept under "include\GL" directory
2. A *static library*: for example, in Win32, "libopengl32.a" for core OpenGL, "libglu32.a" for GLU, "libglut32.a" (or "libfreeglut.a" or "glut32.lib") for GLUT, typically kept under "lib" directory
3. An optional *shared library*: for example, "glut32.dll" (for "freeglut.dll") for GLUT under Win32, typically kept under "bin" or "c:\windows\system32"

It is important to locate the directory path and the actual filename of these header files and libraries in your operating platform in order to properly setup the OpenGL programming environment.

Installing VC++, OpenGL, GLU and GLUT

You need to install:

1. **Visual C++ Express 2010**:

VC++ would be installed in "C:\Program Files\Microsoft Visual Studio 10.0\VC", with headers in sub-directory "include" and libraries in "lib".

1. **Windows SDK which includes OpenGL and GLU (OpenGL Utility)**.

Visual C++ 2010 Express bundles the Microsoft Windows SDK, which would be installed in: "C:\Program Files\Microsoft SDKs\Windows\v7.0A".

The followings are used from Windows SDK:

* + gl.h, glu.h: header for OpenGL and GLU in directory "C:\ProgramFiles\MicrosoftSDKs\Windows\v7.0A\include\gl".
  + opengl32.lib, glu32.lib: libraries for OpenGL and GLU in directory

"C:\Program Files\Microsoft SDKs\Windows\v7.0A\lib".

* + opengl32.dll, glu32.dll: dynamic link libraries for OpenGL and GLU in directory "C:\Windows\System32".

This directory is to be included in PATH environment variable.

If you use the VC++ IDE, the include-path and lib-path would have been set correctly. If you use the CMD shell, you need to run the batch file "vcvarsall.bat" (in "C:\Program Files\Microsoft Visual Studio 10.0\VC\bin"), or "vcvars32.bat" in the earlier version, to set the environment variables.

1. **GLUT (OpenGL Utility Toolkit)**: Download Nate Robin's original Win32 port of GLUT from @ <http://www.xmission.com/~nate/glut.html> (or freeglut @ [http://freeglut.sourceforge.net](http://freeglut.sourceforge.net/)).

Unzip and copy "glut.h" to "C:\Program Files\Microsoft SDKs\Windows\v7.0A\include\gl",

 "glut32.lib" to

"C:\Program Files\Microsoft SDKs\Windows\v7.0A\lib", and "glut32.dll" to

"C:\Windows\System32" (that is, the same locations as OpenGL and GLU).

Writing Basic OpenGL Program

1. Launch Visual C++ 2010 Express
2. Create a new "Win32 Console Application" project: Select "File" menu ⇒ New ⇒ Project... ⇒ In "Project Types", select "Visual C++", "Win32".

In "Templates", select "Win32 Console Application". In "Location", set your working directory.

In "Name", enter "hello" ⇒ Next ⇒ Check "Empty Project" ⇒ Finish.

1. Create a new Source file: Right-click on the "Source Files" of the project name ⇒ Add ⇒ New Item... ⇒

In "Categories", select "Visual C++", "Code".

In "Templates", select "C++ File (.cpp)".

In "Name", type "GL01Hello.cpp" ⇒ Add.

1. In the editor panel for "GL01Hello.cpp", add the below code .
2. Build the solution ("Build" menu ⇒ Build Solution) and run the program ("Debug" menu ⇒ "Start Without Debugging").

