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Outline

- Source Code
- IDE and compiler interaction
- Compiling and Running (no IDE)
- Debugging (no IDE)
- Compiling, Running and Debugging with IDE

C++: A simple program

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Source Code – hello.cpp

```
// a small C++ program
#include <iostream>

int main()
{
    std::cout << "Hello, world!" << std::endl;
    return 0;
}
```

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Something Different– header files

- Java
 - classes are all in 1 file
 - import statements used to include references to classes from libraries
- C++
 - classes are in 2 files (.cpp and .h)
 - Include files reference a library (or object file)- linker includes it in executable
 - C++ is more difficult to use in this respect

```
import java.lang.String;
```

```
#include <string>
```

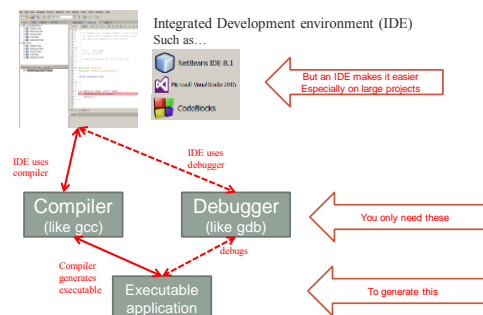
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IDE and compiler interaction



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- **Compiling and Running (no IDE)**
- Debugging (no IDE)
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Getting a compiler

- Visual C++ - comes with MS compiler, see Readings

- GCC – depends on OS
 - Linux install build essentials to get GCC

```
$ sudo apt-get update
$ sudo apt-get upgrade
$ sudo apt-get install build-essential
$ gcc -v
$ make -v
```

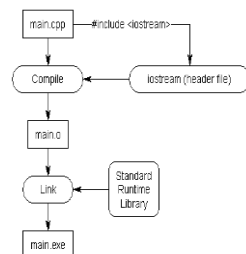
- Windows – minGW or Cygwin for GCC
 - http://www.mingw.org/wiki/HOWTO_Install_the_MinGW_GCC_Compiler_Suite
 - <https://www.cygwin.com/>

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Compiling/Linking

```
// a small C++ program
#include <iostream>
```

```
int main()
{
    std::cout << "Hello, world!" << std::endl;
    return 0;
}
```



See http://www.rtu.edu.sg/home/ehchua/programming/cpp/gcc_make.html for more information
Diagram from <http://www.learncpp.com/cpp-tutorial/19-header-files/>

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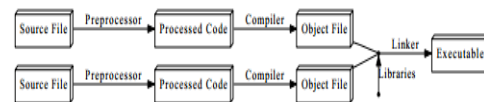
Compilers

- see https://en.wikipedia.org/wiki/List_of_compilers#C.2B.2B_compilers

Compiler	Author	Windows	Linux	Other OS	License type	IDE?	Standard conformance
C++Builder	Embarcadero (CodeGear)	Yes	Yes, 64-bit	No	Proprietary	Yes	Yes, Yes, Yes
Tello C++ Engine	Embarcadero (CodeGear)	Yes	No	No	Freeware	No	Yes, Yes, Yes
C++-Compiler	Embarcadero (CodeGear)	Yes	No	No	Freeware	No	Yes, Yes, Yes
Clang	LLVM	Yes	Yes	Yes, iOS, Android, etc.	Proprietary	Yes	Yes, Yes, Yes
Microsoft C++	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 6.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 7.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 8.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 9.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 10.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 11.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 12.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 13.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 14.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 15.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 16.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 17.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 18.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 19.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 20.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 21.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 22.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 23.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 24.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 25.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 26.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 27.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 28.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 29.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 30.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 31.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 32.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 33.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 34.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 35.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 36.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 37.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 38.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 39.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 40.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 41.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 42.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 43.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 44.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 45.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 46.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
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Visual C++ 48.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
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Visual C++ 50.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 51.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 52.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 53.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 54.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 55.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 56.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 57.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 58.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 59.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 60.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 61.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 62.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 63.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 64.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 65.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 66.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 67.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 68.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 69.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 70.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 71.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 72.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 73.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 74.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 75.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 76.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 77.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 78.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 79.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 80.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 81.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 82.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 83.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 84.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 85.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 86.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 87.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 88.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 89.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 90.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 91.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 92.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 93.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 94.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 95.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 96.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 97.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 98.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 99.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes
Visual C++ 100.0	Microsoft	Yes	No	No	Proprietary	Yes	Yes, Yes, Yes

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Compiling/Linking - overview



Source File – .cpp .hpp .h files files

Preprocessor – program that performs text substitution

Compiler – converts preprocessed source code to object code for a particular processor

Linker – Links object files and external libraries to form exe (or library)
Will always link the C runtime and StandardLibrary

See http://www.rtu.edu.sg/home/ehchua/programming/cpp/gcc_make.html for more information

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Compiling/Linking – Example 1

- As simple as `g++ -o hello.exe hello.cpp`
- Can become very complex
- Commands reside in make file

```

Administrator: C:\Windows\system32\cmd.exe
C:\Users\Lynn\Dropbox\Classes\GPSC427\Week 1\Demo>g++ -o hello.exe hello.cpp
C:\Users\Lynn\Dropbox\Classes\GPSC427\Week 1\Demo>dir
Volume in drive C has no label.
Volume Serial Number is C085-3F4B

Directory of C:\Users\Lynn\Dropbox\Classes\GPSC427\Week 1\Demo

08/10/2013 11:50 PM <DIR>
08/10/2013 11:50 PM <DIR>
08/10/2013 11:15 PM 124 hello.cpp
08/10/2013 11:50 PM 74,957 hello.exe
2 File(s) 75,081 bytes
2 Dir(s) 68,860,615,704 bytes free

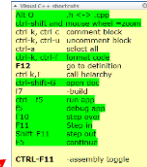
C:\Users\Lynn\Dropbox\Classes\GPSC427\Week 1\Demo>hello
Hello, world!
  
```

See http://www.rtu.edu.sg/home/ehchua/programming/cpp/gcc_make.html for more information
Diagram from <http://www.learncpp.com/cpp-tutorial/19-header-files/>

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Compiling/Linking – Using an IDE

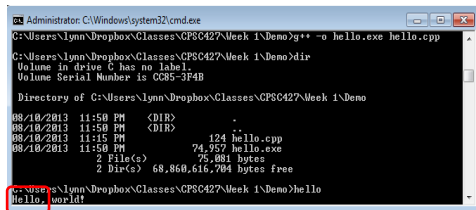
- **Let Integrated Development Environment (IDE) handle all details**
- **(build settings still there just using default project settings)**
- **Create C++ project**
- **Copy 3 files from example 2 to it**
- **Build it**
- **Here are some key shortcuts**



Key bindings I use

Running

- Its an Executable! (no virtual machine)
- Can run from command line or IDE
- Fast Demo Various bits of IDE



What have we learned

- C++ has lots of similarities to Java (more as we go)
- How to write a simple C++ program
- How to compile using command line
- How to use an IDE to create a program
- **For this class and most likely professionally, let the IDE manage your builds.**
- Basic IDE usage (Debug/release build, variables, breakpoints etc)
- How to run a program
- **PRACTICE PLEASE**