



Compiler && Compiled Languages

Week 0

```
C:\Users\brend\source\repos\VGATestProject\x64\Release\VGATestProject.exe (process 70484) exited with code 0.  
Press any key to close this window . . .
```



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Compi Ler



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No Hablo Inglés

Human Legible



Computer Legible



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Compiler

```
#include <iostream>
```

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

```
0000000000001169 <main>:  
1169: f3 0f 1e fa      endbr64  
116d: 55              push    %rbp  
116e: 48 89 e5        mov     %rsp,%rbp  
1171: ba 0c 00 00 00  mov     $0xc,%edx  
1176: 48 8d 35 87 0e 00 lea     0xe87(%rip),%rsi    # 2004 <_IO_stdin_used+0x4>  
117d: bf 01 00 00 00  mov     $0x1,%edi  
1182: e8 09 fe ff ff  callq   1060 <write@plt>  
1187: bf 00 00 00 00  mov     $0x0,%edi  
118c: e8 df fe ff ff  callq   1070 <exit@plt>  
1191: 66 2e 0f 1f 84 00 nopw    %cs:0x0(%rax,%rax,1)  
1198: 00 00 00  
119b: 0f 1f 44 00 00  nopl    0x0(%rax,%rax,1)  
  
00000000000011a0 <_libc_csu_init>:  
11a0: f3 0f 1e fa      endbr64  
11a4: 41 57           push    %r15  
11a6: 4c 8d 3d 03 2c 00 00 lea     0x2c03(%rip),%r15    # 3db0 <__frame_dummy_init_array_entry>  
11ad: 41 56           push    %r14  
11af: 49 89 d6        mov     %rdx,%r14  
11b2: 41 55           push    %r13  
11b4: 49 89 f5        mov     %rsi,%r13  
11b7: 41 54           push    %r12  
11b9: 41 89 fc        mov     %edi,%r12d  
11bc: 55             push    %rbp  
11bd: 48 8d 2d f4 2b 00 00 lea     0x2bf4(%rip),%rbp    # 3db8 <__do_global_ctors_aux_fini_array_entry>  
11c4: 53             push    %rbx  
11c5: 4c 29 fd        sub     %r15,%rbp  
11c8: 48 03 ec 08     sub     $0x8,%rsp  
11cc: e8 2f fe ff ff  callq   1000 <_init>  
11d1: 48 c1 fd 03     sar     $0x3,%rbp  
11d5: 74 1f           je      11f6 <_libc_csu_init+0x56>  
11d7: 31 db          xor     %ebx,%ebx  
11d9: 0f 1f 80 00 00 00 00 nopl    0x0(%rax)  
11e0: 4c 89 f2        mov     %r14,%rdx  
11e3: 4c 89 ee        mov     %r13,%rsi  
11e6: 44 89 e7        mov     %r12d,%edi  
11e9: 41 ff 14 df     callq   *(%r15,%rbx,8)  
11ed: 48 83 c3 01     add     $0x1,%rbx  
11f1: 48 39 dd        cmp     %rbx,%rbp  
11f4: 75 ea           jne     11e0 <_libc_csu_init+0x40>  
11f6: 48 83 c4 08     add     $0x8,%rsp  
11fa: 5b             pop     %rbx  
11fb: 5d             pop     %rbp  
11fc: 41 5c           pop     %r12  
11fe: 41 5d           pop     %r13  
1200: 41 5e           pop     %r14  
1202: 41 5f           pop     %r15  
1204: c3             retq  
1205: 66 66 2e 0f 1f 84 00 data16  %cs:0x0(%rax,%rax,1)
```

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Compiled Languages



What is a Compiled Language

Compiled Languages

- Code converted to assembly at build time
- Runs directly on the machine

Interpreted Languages

- Has a VM that reads the code and runs it
- Essentially a real time translation layer between code and machine at runtime
- Some languages have an intermediary step like ByteCode in Java



Pros and Cons

Compiled Languages

- Low-Level Access
- Minimal Overhead
- Control Implementation Details

- Only compiles for one type of Assembly (Hardware Dependent)
- Fussy on Implementation Details
- Less Safe (Memory Overflow, Pointer overriding, etc)

Interpreted Languages

- Code Compatible with any OS
- Forgiving with errors
- Programs isolated, thus safe
- Smooths Implementation Details

- Restrictive System Access
- High Overhead for VM

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C++



C Language

```
int main()
{
    char aa[] = "Studytonight ";
    char bb[] = "- Best place to learn";

    char *a = aa;
    char *b = bb;

    while (*a)
    {
        a++;
    }
    while (*b)
    {
        *a = *b;
        b++;
        a++;
    }
    *a = '\0';

    printf("The string after concatenation is: %s ", aa);

    return (0);
}
```

Evolution of Windows Logos



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C++

```
#include <iostream>
#include <string>
using namespace std;

int main() {
    string name = "Jimmy";
    string title = "Dr.";
    string fullName = title + " " + name;
    cout << fullName;

    return 0;
}
```



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Installing C++



Some Helpful Resources

- <https://visualstudio.microsoft.com/downloads/>
- https://clang.llvm.org/get_started.html **
- <https://code.visualstudio.com/docs/languages/cpp> *

* Always remember to restart the computer after adjusting environment variables

** Linux and Mac should already have working versions of the C++ compiler: g++