

# Modern C++ Programming

## 1. INTRODUCTION

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# About Programming

*“And programming computers was so fascinating. You create your own little universe, and then it does what you tell it to do”*

**Vint Cerf**, TCP/IP co-inventor and Turing Award

*“Most good programmers do programming not because they expect to get paid or get adulation by the public, but because it is fun to program”*

**Linus Torvalds**, principal developer of the Linux kernel

*“You might not think that programmers are artists, but programming is an extremely creative profession. It’s logic-based creativity”*

**John Romero**, co-founder of id Software

# A Little History of C and C++ Programming Languages

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# The Assembly Programming Language

A long time ago, in a galaxy far,  
far away...there was **Assembly**

- Extremely simple instructions
- Requires lots of code to do simple tasks
- Can express anything your computer can do
- Hard to read, write
- ...redundant, boring programming, bugs proliferation

```
main:
.Lfunc_begin0:
    push rbp
.Lcfi0:
.Lcfi1:
    mov rbp, rsp
.Lcfi2:
    sub rsp, 16
    movabs rdi, .L.str
.Ltmp0:
    mov al, 0
    call printf
    xor ecx, ecx
    mov dword ptr [rbp - 4], eax
    mov eax, ecx
    add rsp, 16
    pop rbp
    ret
.Ltmp1:
.Lfunc_end0:
.L.str:
.asciz "Hello World\n"
```

In the 1969 **Dennis M. Ritchie** and **Ken Thompson** (AT&T, Bell Labs) worked on developing a operating system for a large computer that could be used by a thousand users. The new operating system was called **UNIX**.

The whole system was still written in assembly code. Besides assembler and Fortran, UNIX also had an interpreter for the **programming language B**. A high-level language like B made it possible to write many pages of code task in just a few lines of code. In this way the code could be produced much faster then in assembly.

A drawback of the B language was that it did not know data-types. (Everything was expressed in machine words). Another functionality that the B language did not provide was the use of “structures”. The lag of these things formed the reason for Dennis M. Ritchie to develop the **programming language C**. In 1988 they delivered the final standard definition ANSI C.



Dennis M. Ritchie, and Ken Thompson

```
#include "stdio.h"  
  
int main() {  
    printf("Hello World\n");  
}
```

## Areas of Application:

- UNIX operating system
- Computer games
- Due to their power and ease of use, C were used in the programming of the special effects for Star Wars



Star Wars - The Empire Strikes Back

The **C++ programming language** (originally named “C with Classes”) was devised by **Bjarne Stroustrup** also an employee from Bell Labs (AT&T). Stroustrup started working on C with Classes in 1979. (The ++ is C language operator).

The first commercial release of the C++ language was in October of 1985.

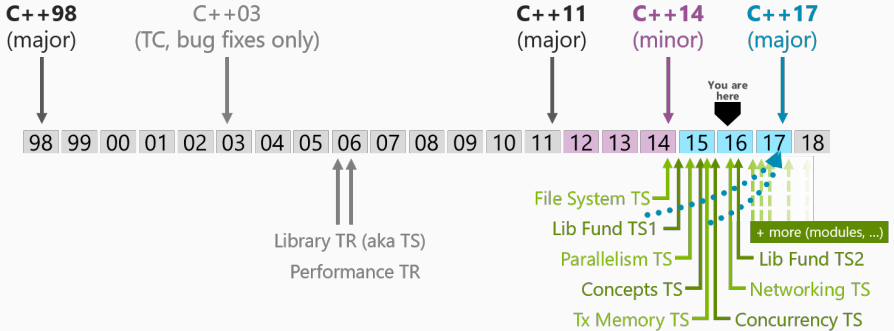


Bjarne Stroustrup



## Areas of Application

- *Operating systems:* Windows, Android, OS X, Linux
- *Image Editing Application:* Adobe Premier, Photoshop and Illustrator
- *Web browser:* Firefox, Chrome, etc.
- High-Performance Computing (HPC)
- Embedded systems
- Multimedia
- *Scientific applications:* Machine Learning, Data analysis at CERN/NASA, SETI@home
- Google also use C++ for Indexing
- *Database:* MySQL
- *Compilers:* LLVM



## Modern C++ Evolution

# C++

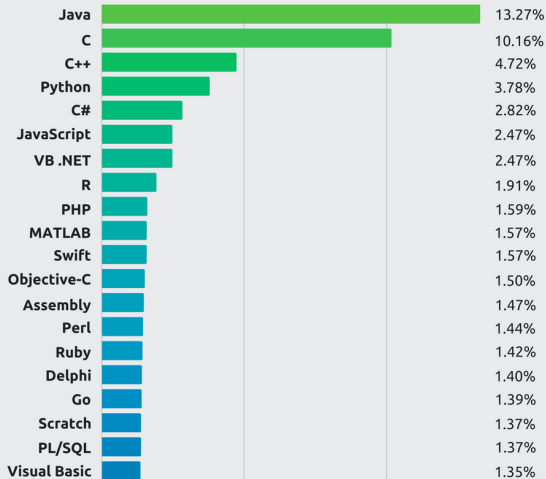
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- Only add features if they solve an actual problem
- Programmers should be free to choose their own style
- **Compartmentalization** is key
- Allow the programmer **full control** if they want it
- Don't sacrifice **performance** except as a last resort
- Enforce **safety at compile time** whenever possible

# Most Popular Programming Languages

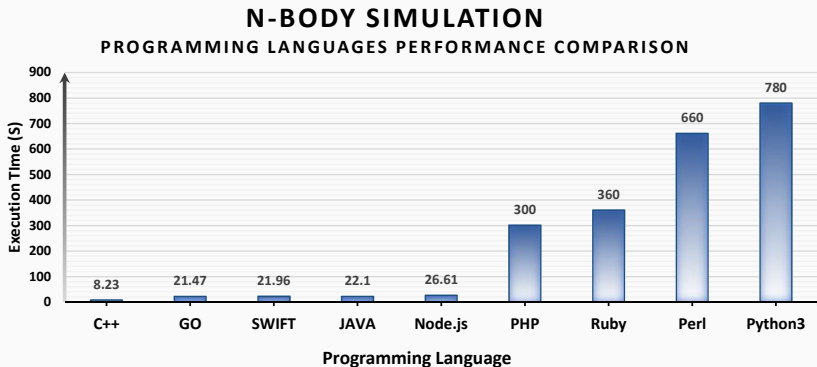
## Top Programming Languages

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# Why C++ is so popular?

- **Extreme performance** (theoretically enables highest performance)
- **Relatively easy to prove and test a C++ program**
- **Many support tools:** coverage, analysis, profiling, etc.
- **Low-level code:** drivers, kernels, etc.



# Why C++ is so difficult?

- C++ is the hardest language for students to master
  - Huge set of features
  - Worry about memory management
  - Learn meta-programming
  - Distinguish compile-time from run-time
  - Low-level implementation details: pointer arithmetics, structure padding, etc.
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*“C makes it easy to shoot yourself in the foot; C++ makes it harder, but when you do it blows your whole leg off”*

**Bjarne Stroustrup**

*“The problem with using C++...is that there’s already a strong tendency in the language to require you to know everything before you can do anything”*

**Larry Wall** (developer of the Perl language)

# References

## Unofficial C++ references:

`en.cppreference.com`

`www.cplusplus.com/reference`

IBM Knowledge Center

## Tutorials:

`www.learncpp.com`

`www.tutorialspoint.com/cplusplus`

`en.wikibooks.org/wiki/C++`

yet another insignificant...programming notes

## Other resources:

`isocpp.org/faq`

`stackoverflow.com`



# The Course

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# What is/What is not

## What the course **is not**:

- A theoretical course on programming
- A high-level concept description

## What the course **is**:

- A quite advanced C++ programming language course
- A very practical course
- Don't focus on the concepts behind something but on what is the best way to use it
- Prefer examples instead long descriptions
- Present many language features

## Prerequisites:

- Knowledges of C programming language
- Knowledges of object-oriented programming

## Federico Busato



- **Research interests:** Parallel/High-Performance Computing and Graph Theory
- **Previous Experience:** Software Engineer at Nvidia (Santa Clara, California, USA)
- **Other Courses:** Advanced Architectures (Master degree), Operating System (Bachelor degree)

## Alessandro Danese



- **Research interests:** Embedded System Verification
- **Previous Experience:** Software Engineer at Intel (Portland, Oregon, USA)
- **Other Courses:** Design Automation of Embedded Systems (Master degree), Operating System (Bachelor degree)

*“The only way to learn a new programming language is by writing programs in it”*

*Dennis Ritchie*