

C++ vs. C and Java

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<i>C++ = C + Java + More...</i>	C	C++	Java
Low-level machine programming	Yes	Yes	No
High-level OO programming	No	Yes	Yes
Generic template programming	No	Yes	Limit-ed
Complexity	Low	High	Med.

Why use C++?

- Combine high-level abstractions with low-level time and memory control.
- Understand the machine.
- Practice learning a complex language.

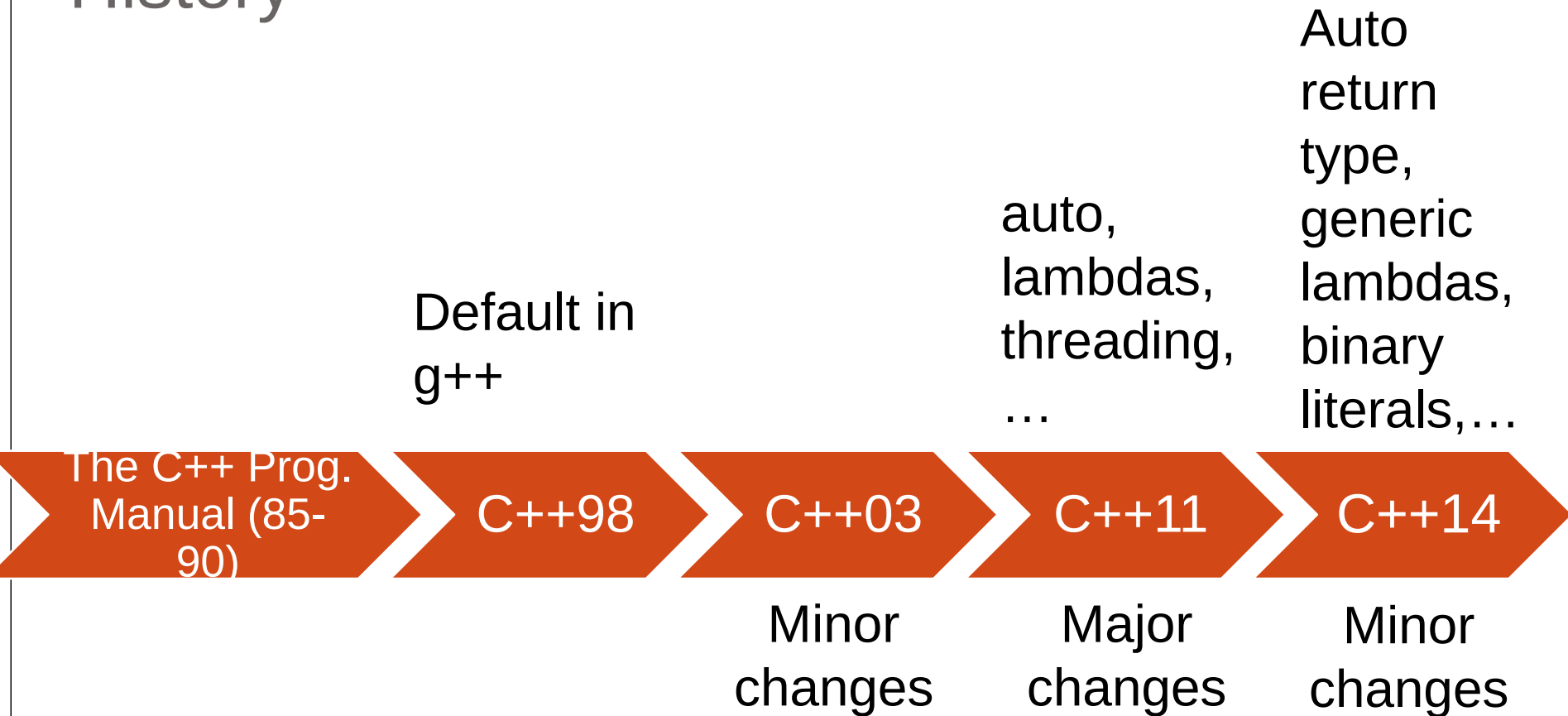
Some software written in C++:

- **Facebook:** <https://github.com/facebook/folly>
- **Bitcoin:** <https://github.com/bitcoin/bitcoin>
- **LibreOffice:** <https://github.com/LibreOffice/core>
- **Unreal:** <https://github.com/EpicGames/UnrealEngine>
- **TensorFlow:** [https://github.com/tensorflow/tensorflow\(+python\)](https://github.com/tensorflow/tensorflow(+python))

C++ vs. Java – memory

- In C++, the memory consumption of a data structure is tight – you get only what you ask for.
- In Java, your data structures might consume much more memory.
- See example in folder 2.
 - *Why is this?*

History



**We'll learn parts of C++-11, 14, 17,
Mostly parts that makes C++ more “pythonic” while keeping it
efficient**

Future



C++17

C++20

...

The missing types

strings in C++

```
#include <iostream>
#include <string>
```

```
int main()
```

```
{
```

```
    std::string str;
```

```
    int a;
```

```
    double b;
```

```
    std::cin >> str >> a >> b;
```

```
    if(std::cin.fail())
```

```
    {
```

```
        std::cerr << "input problem\n";
```

```
        return 1;
```

```
    }
```

```
    std::cout << "I got: " << str << ' ' <<
```

```
    << a << ' ' << b << std::endl;
```

```
}
```

:More about string functions

<http://www.cppreference.com/cppstring>

Boolean variables

```
#include <iostream>
```

```
int main()
```

```
{
```

```
    int a = 5;
```

```
    bool isZero = (a == 0);
```

```
    // same conditions
```

```
    if(!isZero && isZero==false &&  
isZero!=true && !!! isZero && a )
```

```
{
```

```
    std::cout << "a is not zero\n";
```

```
}
```

```
}
```

Good
style



C++-11 namespace (folder 3)

- Groups different variables and functions together;
- Reduces danger of name-collision when including different libraries;
- Can span multiple files.
- Standard library namespace: `std`;
- Another example: `folly`
https://github.com/facebook/folly/blob/master/folly/stop_watch.h
- Standard library namespace: `std`;

C++-11 enum class (folder 4)

```
enum class Season : char {  
    WINTER, // = 0 by default  
    SPRING, // = WINTER + 1  
    SUMMER, // = WINTER + 2  
    AUTUMN  // = WINTER + 3  
};  
  
Season curr_season;  
curr_season= Season::AUTUMN;  
curr_season= SUMMER; // won't compile! (good)  
curr_season= 19; // won't compile! (good)  
int prev_season= (int)Season::SUMMER; // won't  
compile! (good)
```

Error Handling in C++ *(folders 5-6)*

	Exception	Assert
Used during:	Normal run	Development
Used for:	Handling exceptional conditions.	Spotting internal errors and bugs.
Disabling:	No	With compiler flag

Unit-testing in C++

- You learned to do it in Java (JUnit).
- It is at least as important in C++.
- There are many frameworks for automated unit-testing in C++.
- We will use **doctest** – an open-source framework:
<https://github.com/onqtam/doctest>
- See folder 8 for an example.