C++ vs. C and Java

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C++ = C + Java + More...	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.

https://yosefk.com/c++fqa/ https://en.cppreference.com/w/

Why use C++?

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

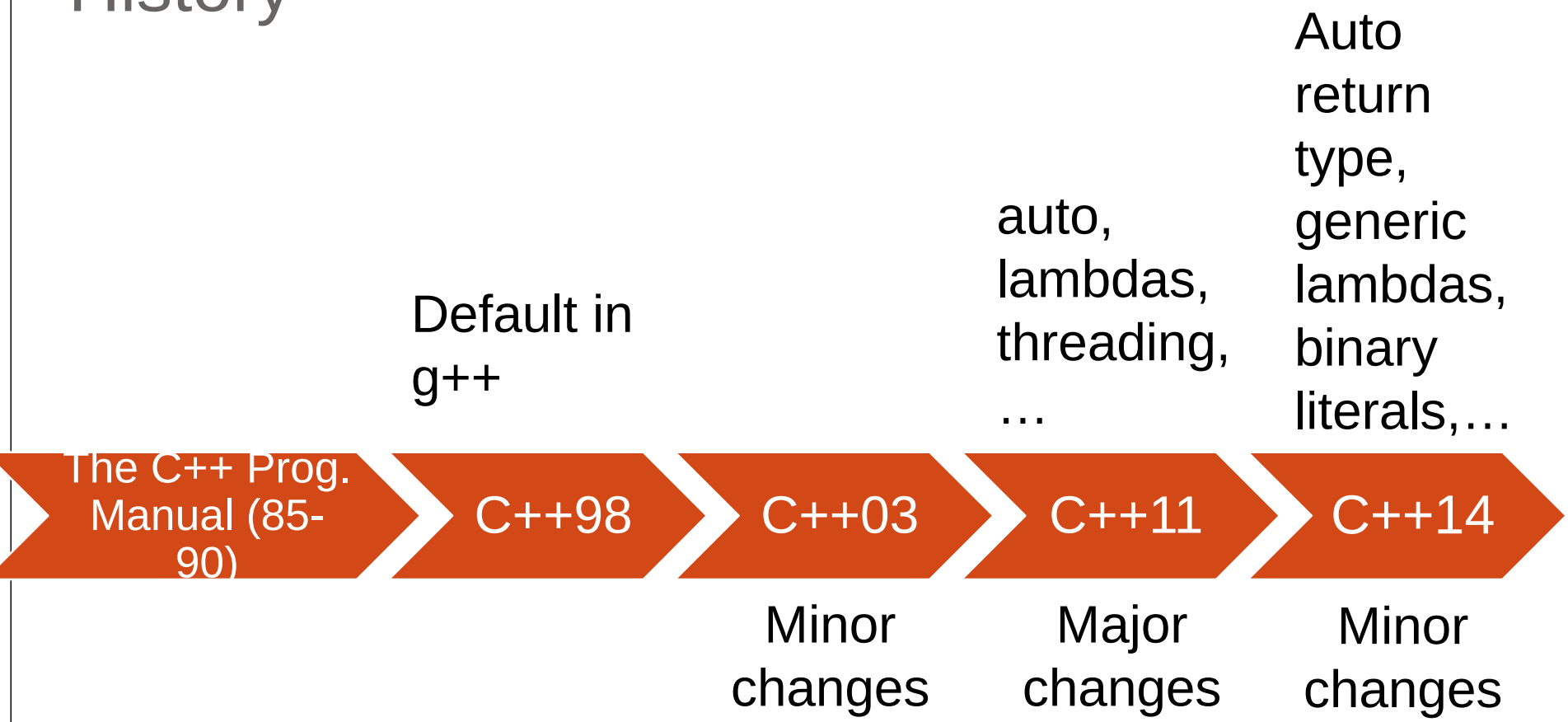
Some software written in C++:

- **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)

C++ vs. Java – memory

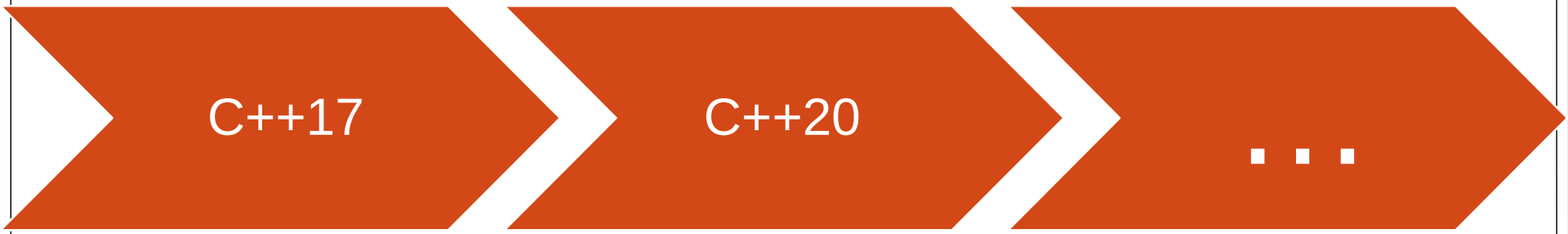
- In C++, the memory consumption of a data structure is tight – you get only what you ask for.
- In Java, your data structures might consume much more memory.
- See example in folder 2.
  - *Why is this?*

History



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

Future



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;

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.