



C++ On Sea

July 2022



@ciura_victor

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Senior SW Engineer
Visual C++



Abstract

The C++ community is very large and quite vocal when it comes to controversial issues. We're very fragmented on many topics, based on the breadth of the C++ ecosystem and the background/experience we each bring from our C++ niche.

From CppCoreGuidelines to opinionated best practices to established idioms, there's a lot of good information easily available. Mixed up with all of this there are also plenty of myths. Some myths stem from obsolete information, some from bad teaching materials.

In this presentation, I will dissect a few of the most popular C++ myths to a level of detail not possible on Twitter... and without the stigma of newb/duplicate/eyeroll one might experience when asking these questions on StackOverflow.

Expect the familiar “Busted”, “Plausible”, or “Confirmed” verdicts on each myth and come prepared to chat about these.

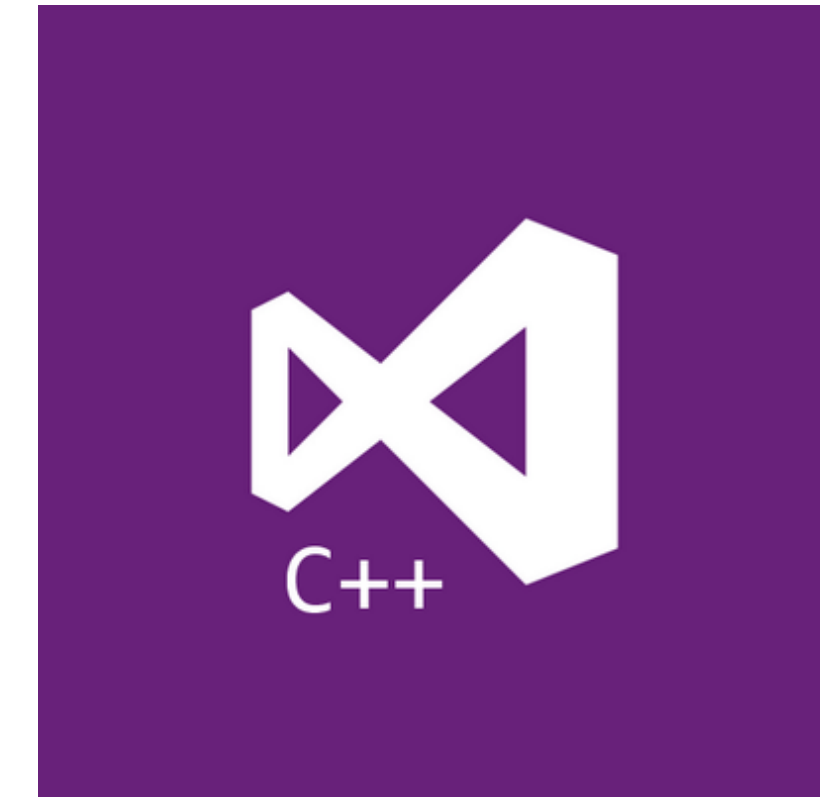
About me



Advanced Installer



Clang Power Tools



Visual C++

 [@ciura_victor](https://twitter.com/ciura_victor)

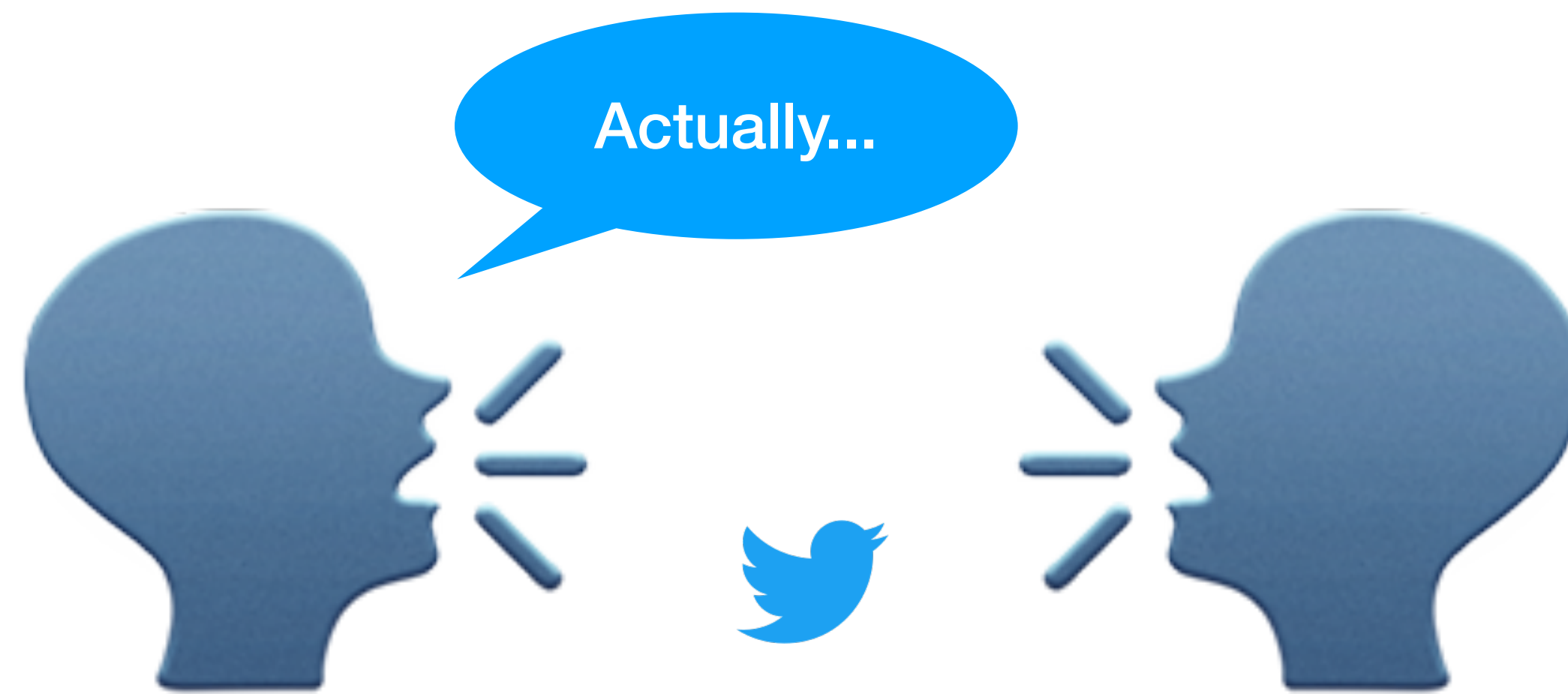


Do ask questions as we go along

Comments are welcome, too

Actually, ...

The C++ community is very large and quite vocal when it comes to controversial issues



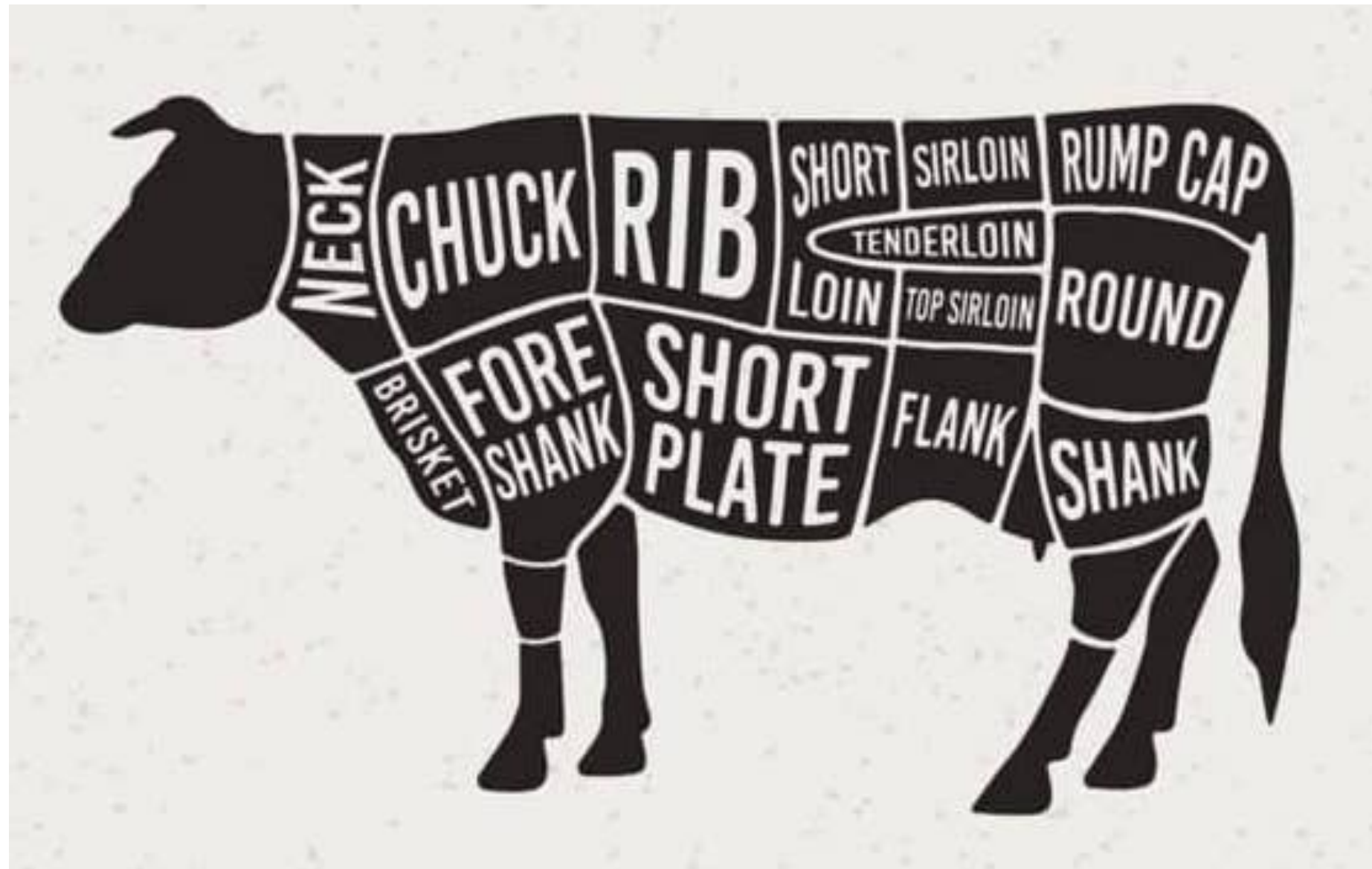
We're Different

We're very **fragmented** on many topics

- based on the **breadth** of the C++ ecosystem
- background/experience we each bring from our C++ **niche**

We're Different

We're very **fragmented** on many topics (Bjarne Stroustrup's 🐘 elephant metaphor)



A lot of good information easily available:

- CppCoreGuidelines
- (opinionated) best practices
- established idioms
- books
- conference presentations
- StackOverflow

🔥 Hot take typing

If it looks like a hot take, if it feels like a hot take... it probably is 😈



Mixed up with all of this, there are also plenty of myths

- some myths stem from obsolete information
- some from bad teaching materials

Let's talk about teaching C++

Not just about code reviews

Let's talk about teaching C++

Note that a few items might seem silly/obvious to you, but I've heard them and had to discuss them with **junior devs** or **interns** we hired fresh out of college.

Or questions I usually get when **lecturing** at my alma mater.

Not just about code reviews

ACCU 2021

C+ UNlverse

ACCU 2021
VIRTUAL EVENT

C++ UNlverse

Victor Ciura

Victor Ciura

0:35 / 26:18

ACCU 2021

#Programming #Cpp #AccuConf

C++ UNlverse - Victor Ciura [ACCU 2021]

youtube.com/watch?v=q0NJDr5hIWA



StackOverflow

Mythbusting with Jason - unscripted improv

youtube.com/watch?v=Bu1AEze14Ns

The screenshot shows a live stream of a C++ mythbusting session. The main window is the Compiler Explorer interface, displaying C++ source code and its assembly output. The source code includes headers for `<fmt/format.h>`, `<array>`, `<cstdint>`, and `<optional>`. It defines a function `get_optional_value` and a function `get_optional_string_size`. The assembly output shows the compiled code for `get_optional_string_size`, including instructions like `lea rdx, [rdi+16]`, `mov BYTE PTR [rdi+26], 100`, and `movabs rcx, 8022916924116329800`.

Two video thumbnails are visible on the left side of the screen. The top thumbnail shows Victor Ciura, and the bottom thumbnail shows Jason Turner. The video player controls at the bottom indicate the video is at 32:48 / 2:03:29.

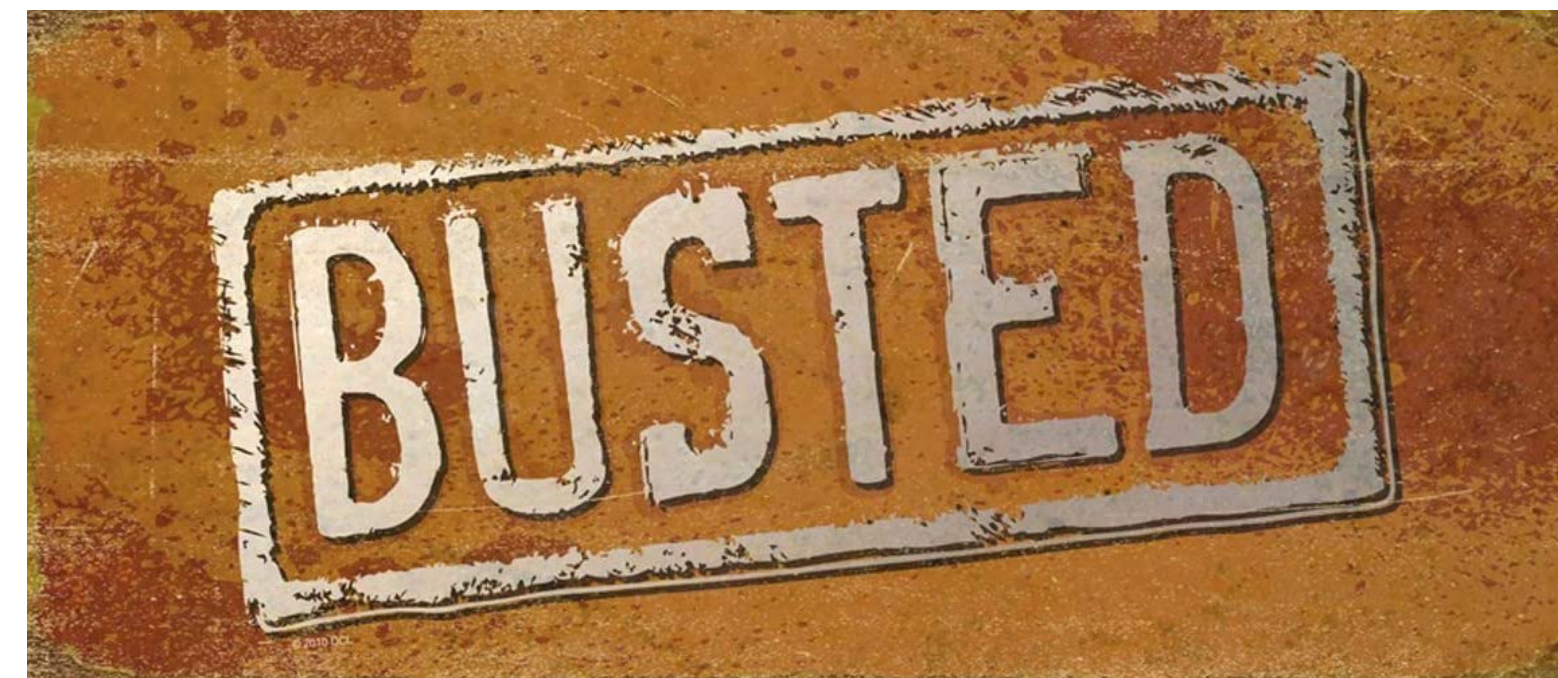
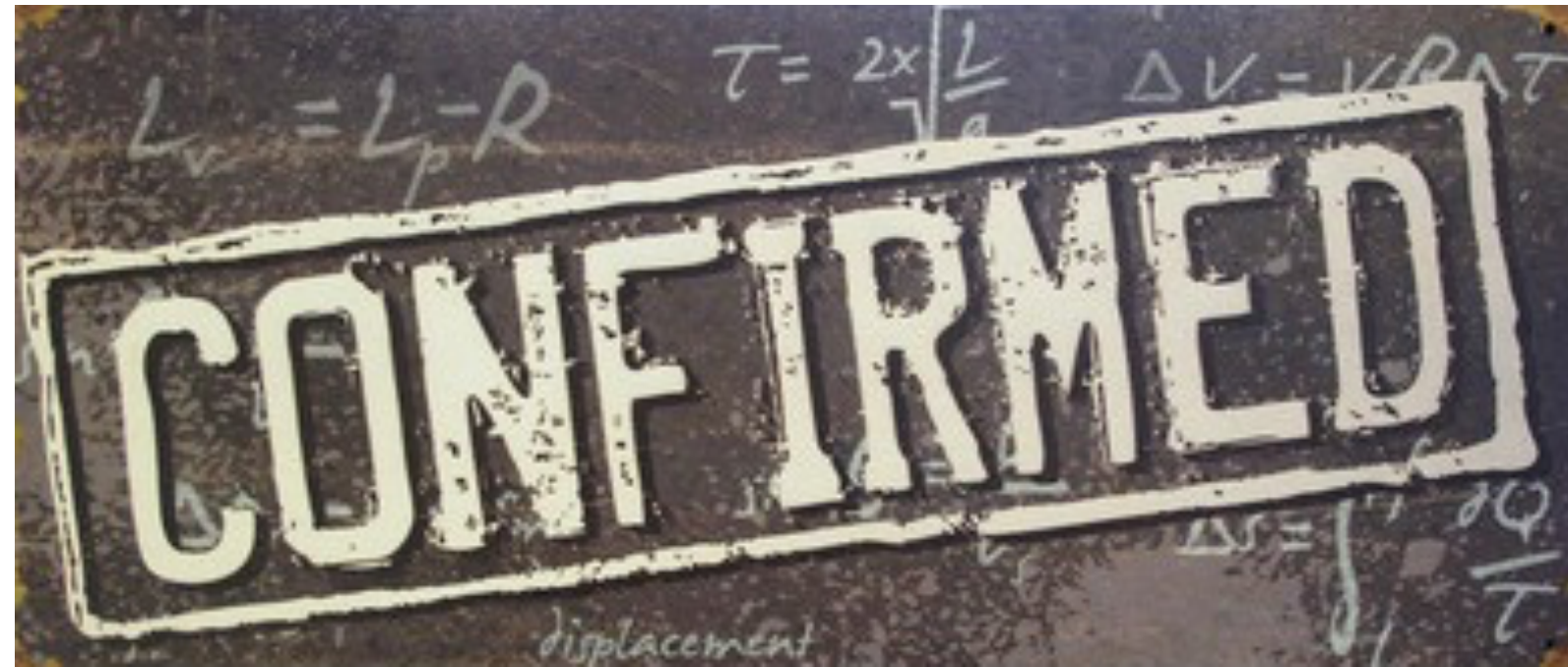
C++ Mythbusting with Victor and Jason

18,218 views • Streamed live on Jan 29, 2021

👍 566 🗨 DISLIKE ➦ SHARE ⬇ DOWNLOAD ✂ CLIP ≡+ SAVE ...

Top chat replay ▾
for templates. I would like to require

Verdict

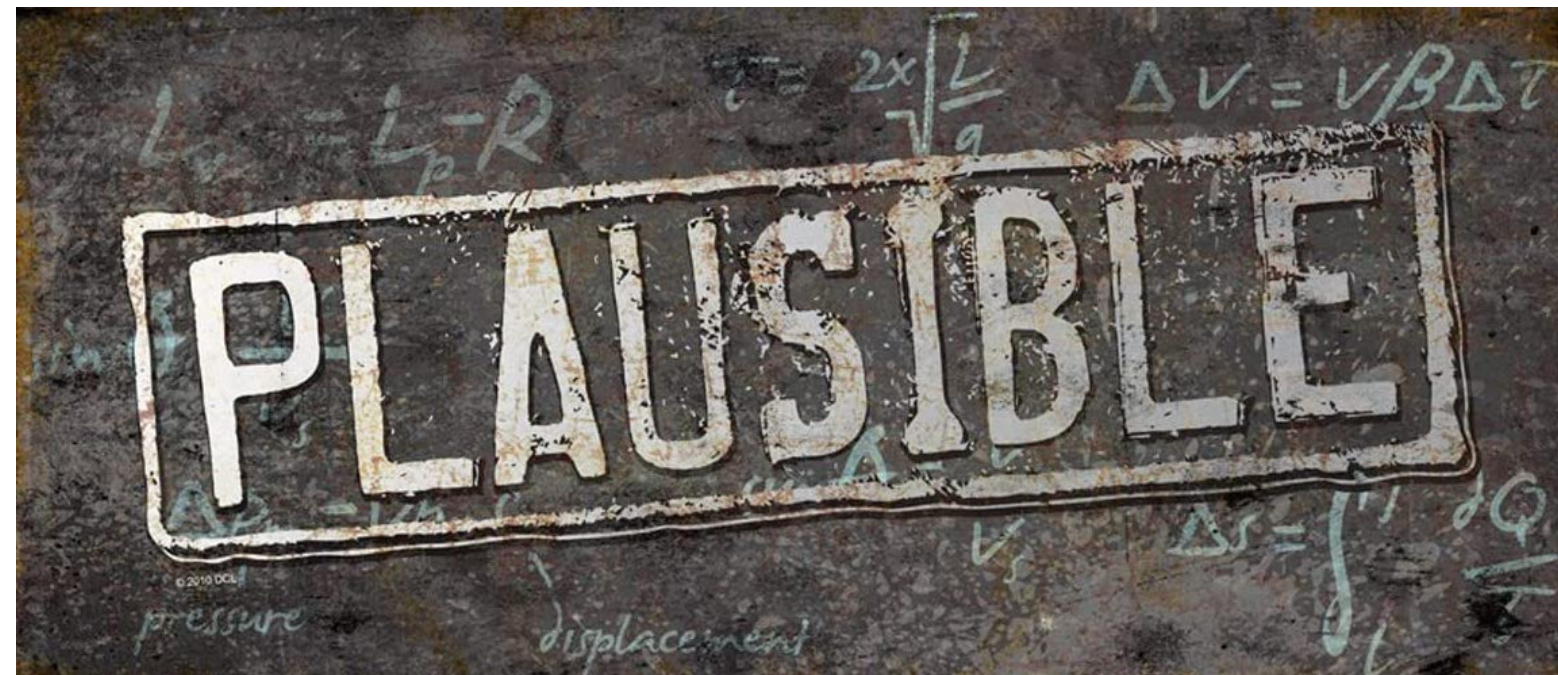


I want to instigate a healthy **dialog**, so speak up

Verdict

A programmer's staple response:

"It depends..." 🧐



Let's test this...



Myth

`iostreams` are slow



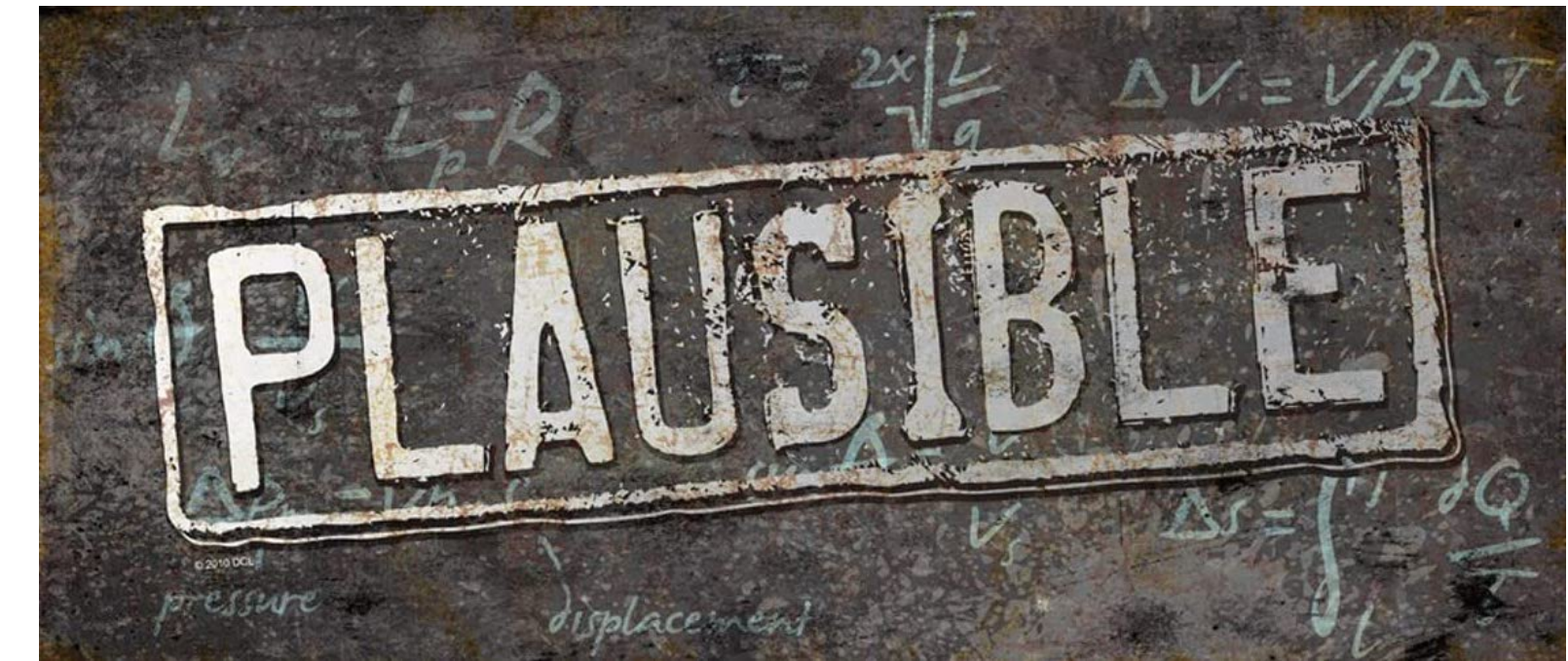
Just kidding 😊

It's not a myth, we've known this for years.

C++20 **modules** will solve all problems



`coroutines` shipped in C++20



No library support 🙄

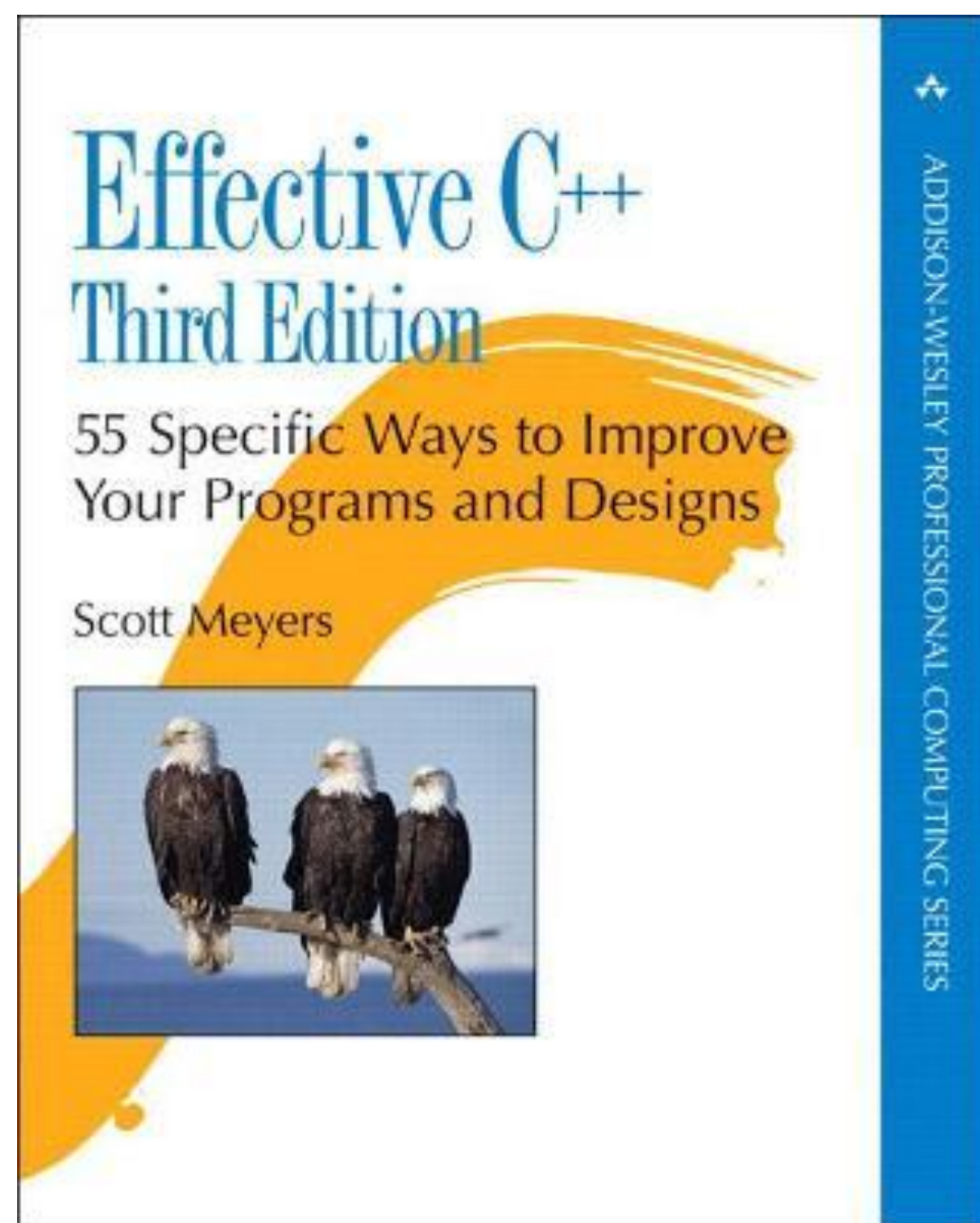
We're going to get a `generators` library in C++23



<Part 1 of N> presentation

<Part 1 of N> presentation

I invite other speakers to **join** this C++ Mythbusting series



66 Item 14

vector and string

The upshot of all this is simple. If you're dynamically allocating arrays, you're probably taking on more work than you need to. To lighten your load, use vectors or strings instead.

Item 14: Use reserve to avoid unnecessary reallocations.

One of the most marvelous things about STL containers is that they automatically grow to accommodate as much data as you put into them, provided only that you don't exceed their maximum size. (To discover this maximum, just call the aptly named `max_size` member function.) For vector and string, growth is handled by doing the moral equivalent of a `realloc` whenever more space is needed. This `realloc`-like

GotW

Myth #11

`printf/sprintf` are very fast

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`sprintf` uses the **global locale**

=> **mutex lock** 😞

Myth #11

`printf/sprintf` are very fast

`sprintf` uses the **global locale**

=> **mutex lock** 😞

On macOS, `sprintf` - that is in system libraries

ends up spending almost all the time inside a locale-related mutex lock 🔥

Myth #11

`printf/sprintf` are very fast

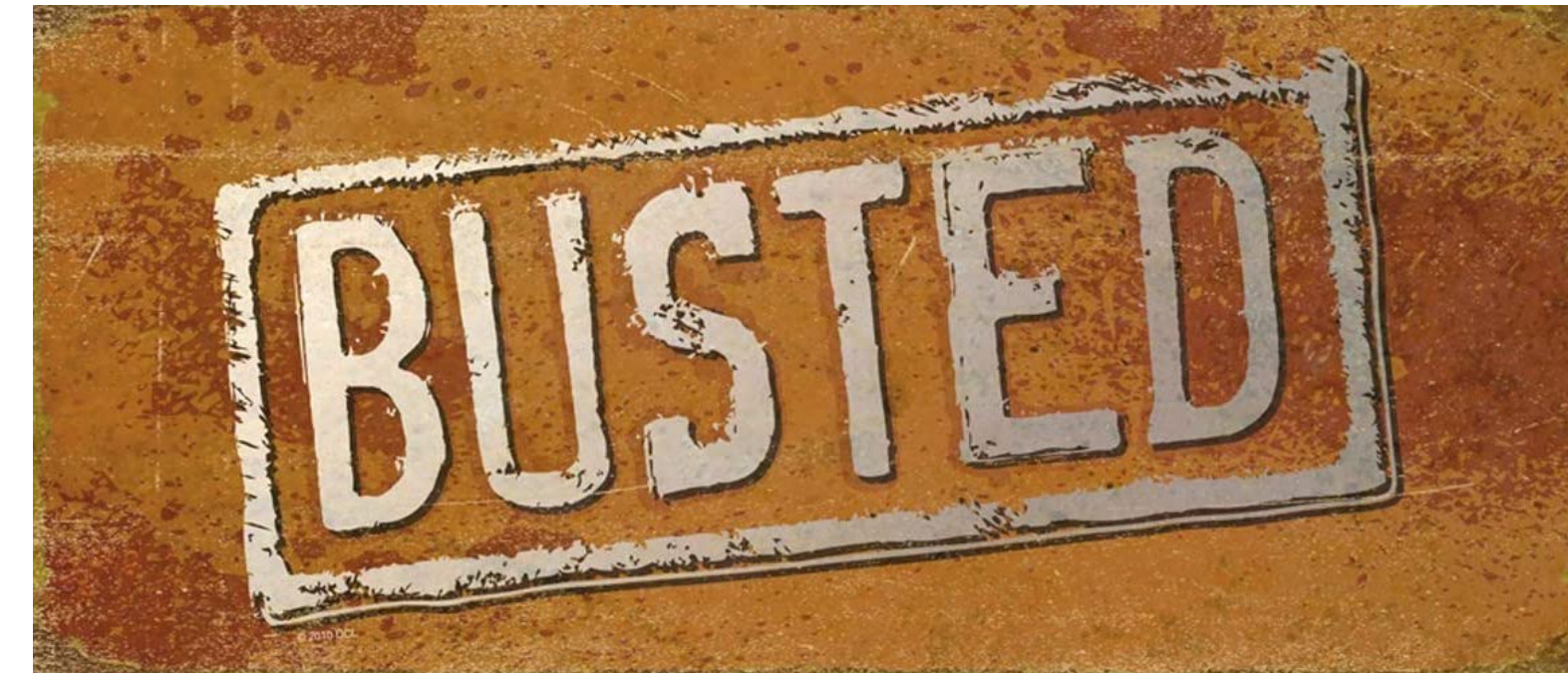
Blender case study: `sprintf` => `{fmt}`

- on macOS: **3-4x** speedup
- on Windows: **20%** speedup (due to a faster float/int formatter)

developer.blender.org/D13998

Myth #11

`printf/sprintf` are very fast



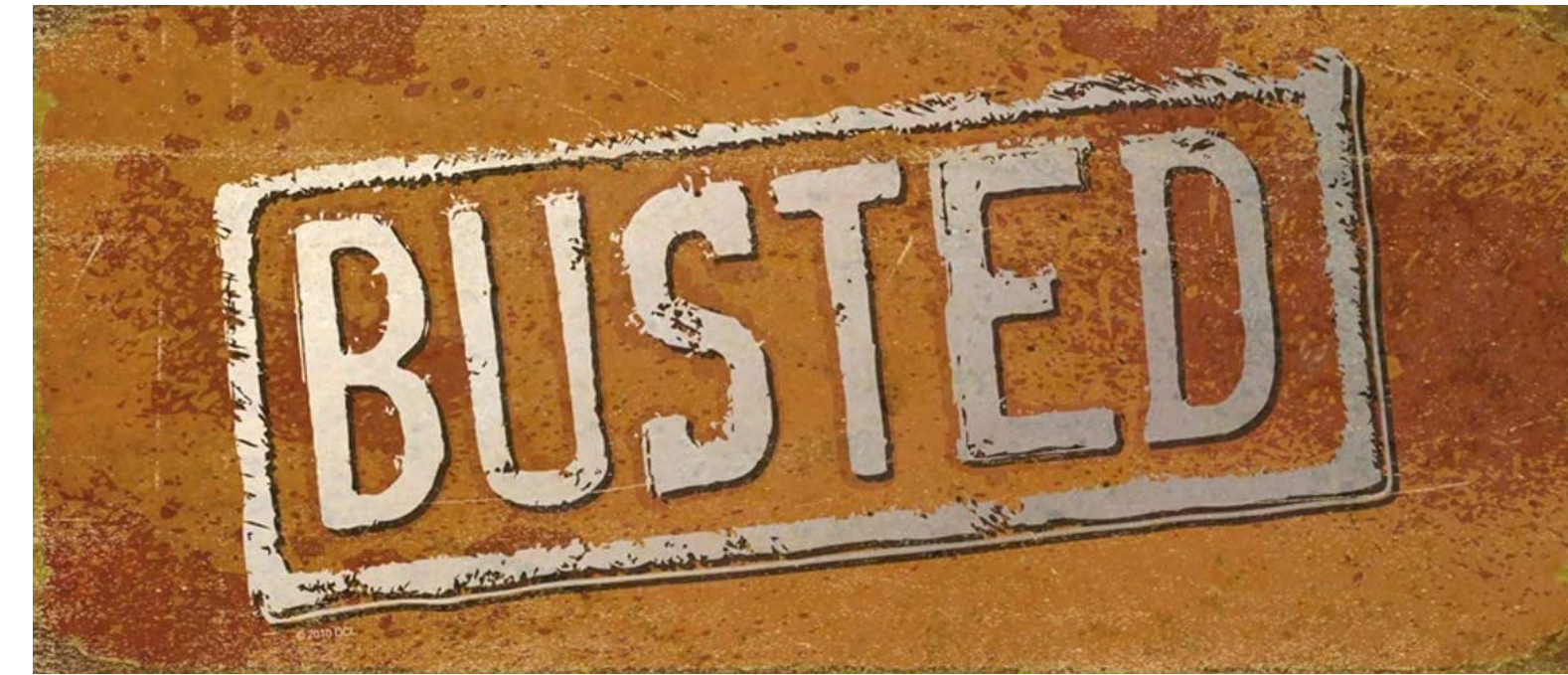
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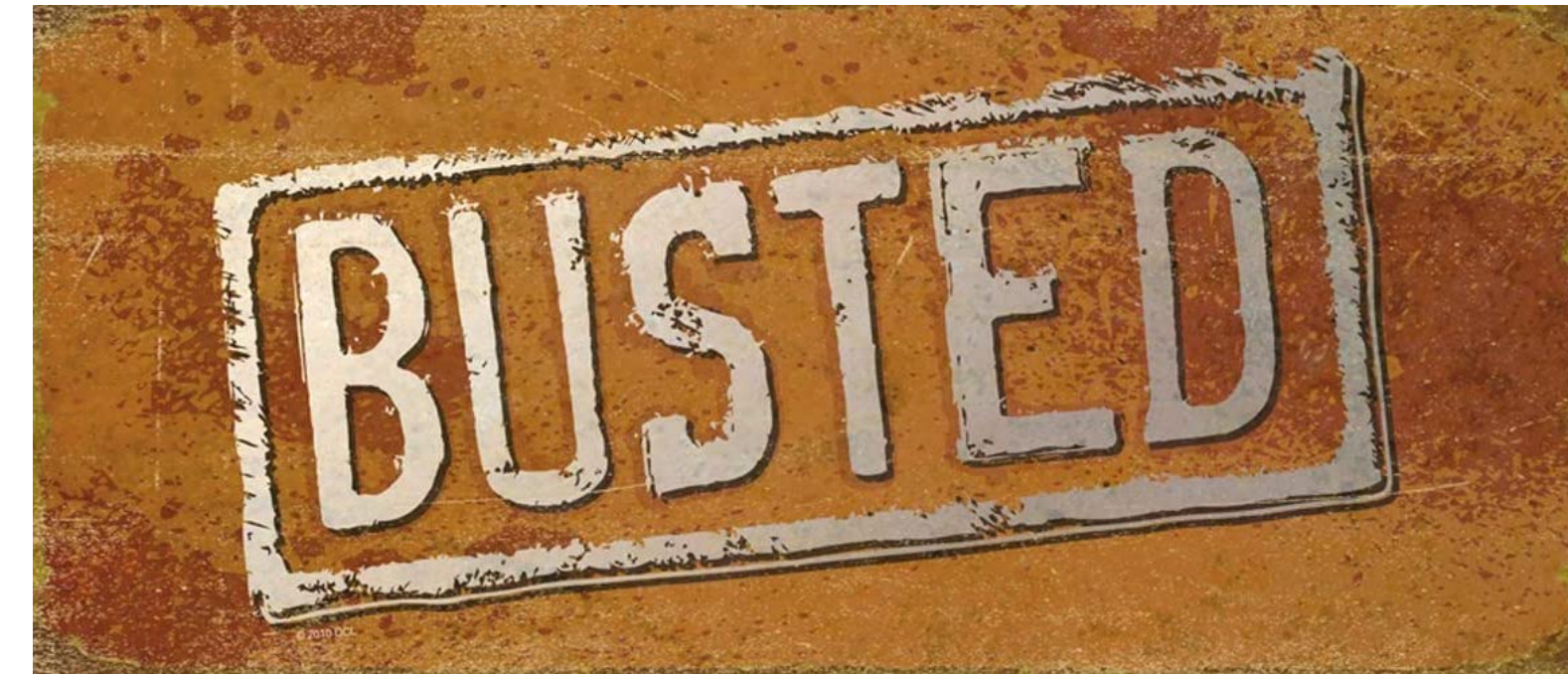
Myth #11

`printf/sprintf` are very fast



Myth #11

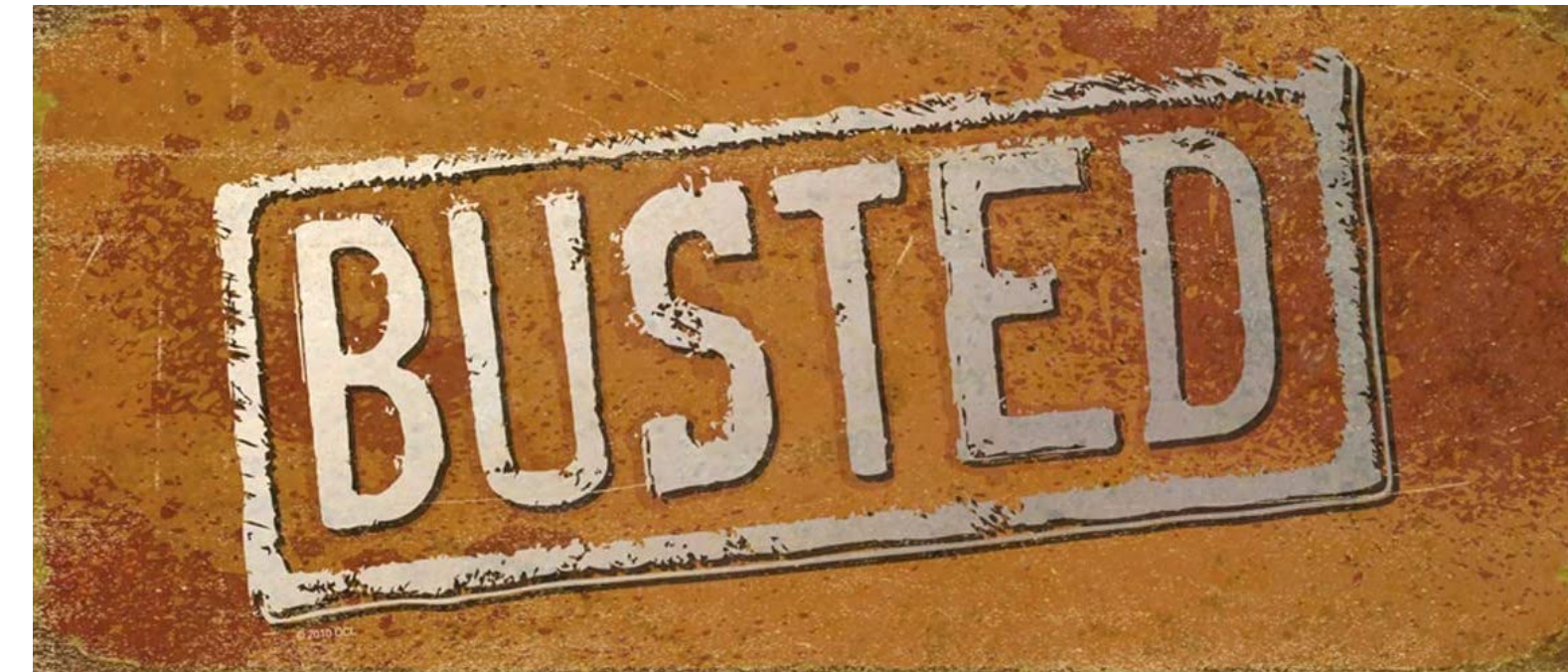
`printf/sprintf` are very fast



Use C++20 `std::format` or `{fmt}` library - `fmt::print()`

Myth #11

`printf/sprintf` are very fast



Use C++20 `std::format` or `{fmt}` library - `fmt::print()`

⚠ Beware of standard functions that use `locale`

Humans Depend on Tools



Myth #14

C++ is not easily toolable 

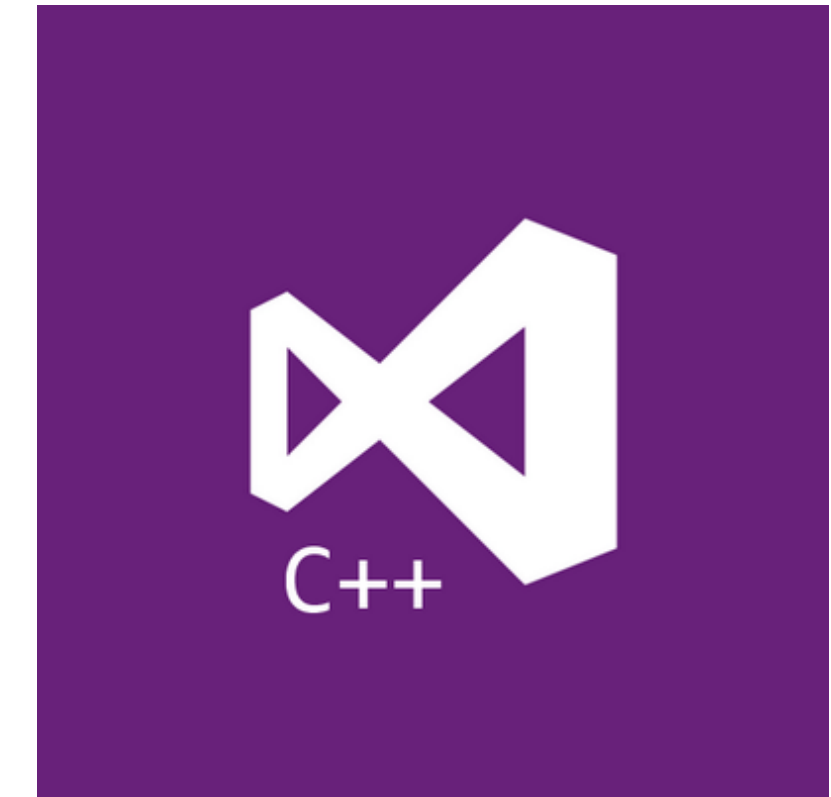
I'm a tool builder



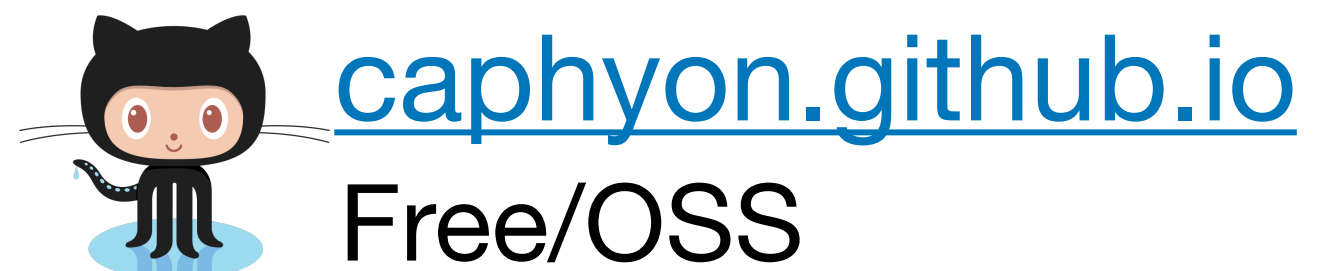
[Advanced Installer](#)



[Clang Power Tools](#)



Visual C++



Programmers Depend on Tools

good code editor
(or IDE)

linter/formatter

powerful (visual) debugger

(automated) refactoring tools

build system

package manager

SCM client

recent compiler(s)
[conformant/strict]

perf profiler

test framework

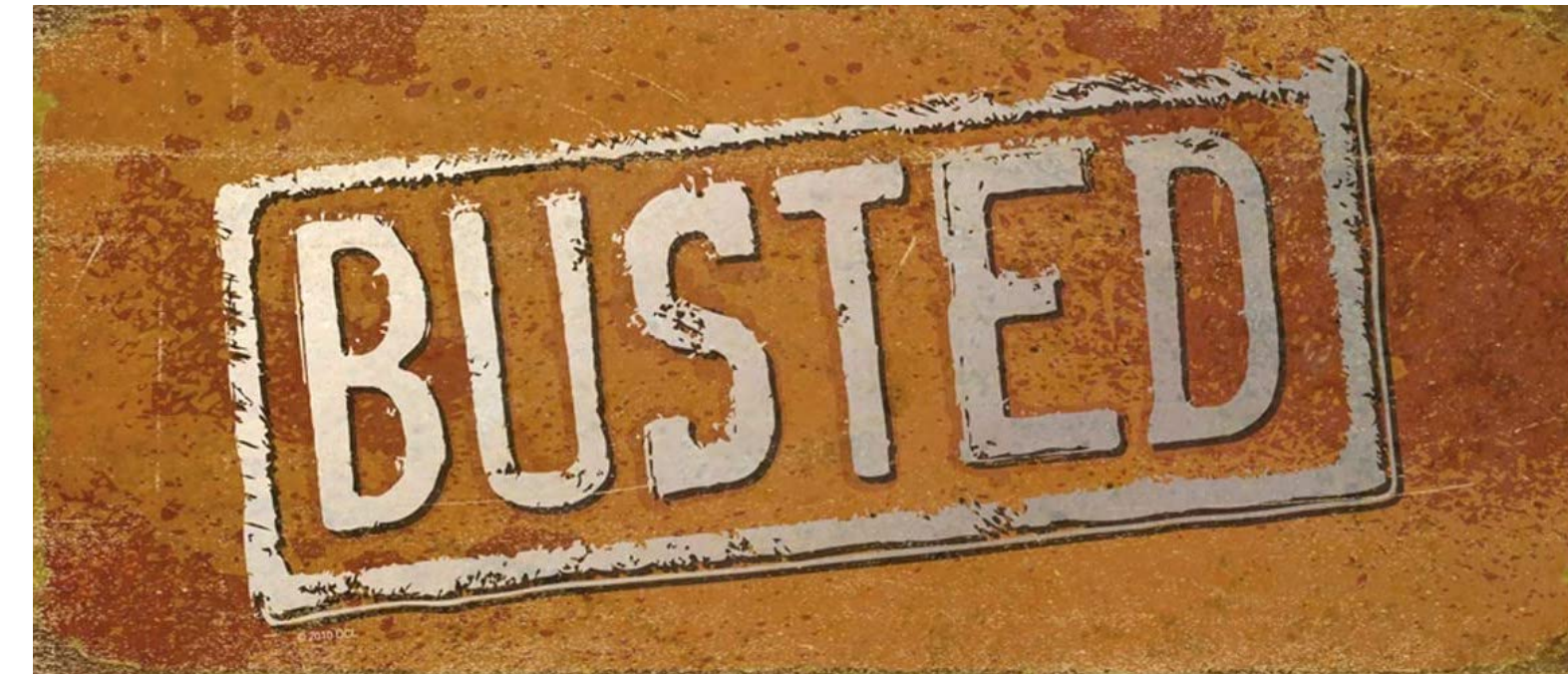
static analyzer

dynamic analyzer
(runtime)

CI/CD service
code reviews platform

+ fuzzing

C++ is not easily toolable 🛠️



Get to know your tools
well

Myth #19

`std::regex` is too slow for
production use

```
const auto r = std::regex(R"((\S+)\s*=\s*(\S+))");  
  
std::cmatch results;  
const auto success = std::regex_match("x = 5", results, r);  
  
fmt::print("Matched: {} '{}='{}'", success,  
           string(results[0].first, results[0].second),  
           string(results[1].first, results[1].second));
```

Myth #19

`std::regex` is too slow for production use

This short snippet is so slow to compile, it will actually timeout in CompilerExplorer 😊

```
const auto r = std::regex(R"((\S+)\s*=\s*(\S+))");  
  
std::cmatch results;  
const auto success = std::regex_match("x = 5", results, r);  
  
fmt::print("Matched: {} '{}='{}'", success,  
           string(results[0].first, results[0].second),  
           string(results[1].first, results[1].second));
```

Myth #19

`std::regex` is too slow for production use

- difficult to use API
- very slow to compile
- very slow at runtime
- perf gotchas: regex c-tor, cmatch expensive



Myth #19

`std::regex` is too slow for production use

Use **CTRE** library instead:

- very fast to compile
- much cleaner API
- supports `string_view`
- builds regular expressions automata at compile time
- github.com/hanickadot/compile-time-regular-expressions



Myth #24

`std::optional` inhibits optimizations
and complicates APIs

Let's see...

Myth #24

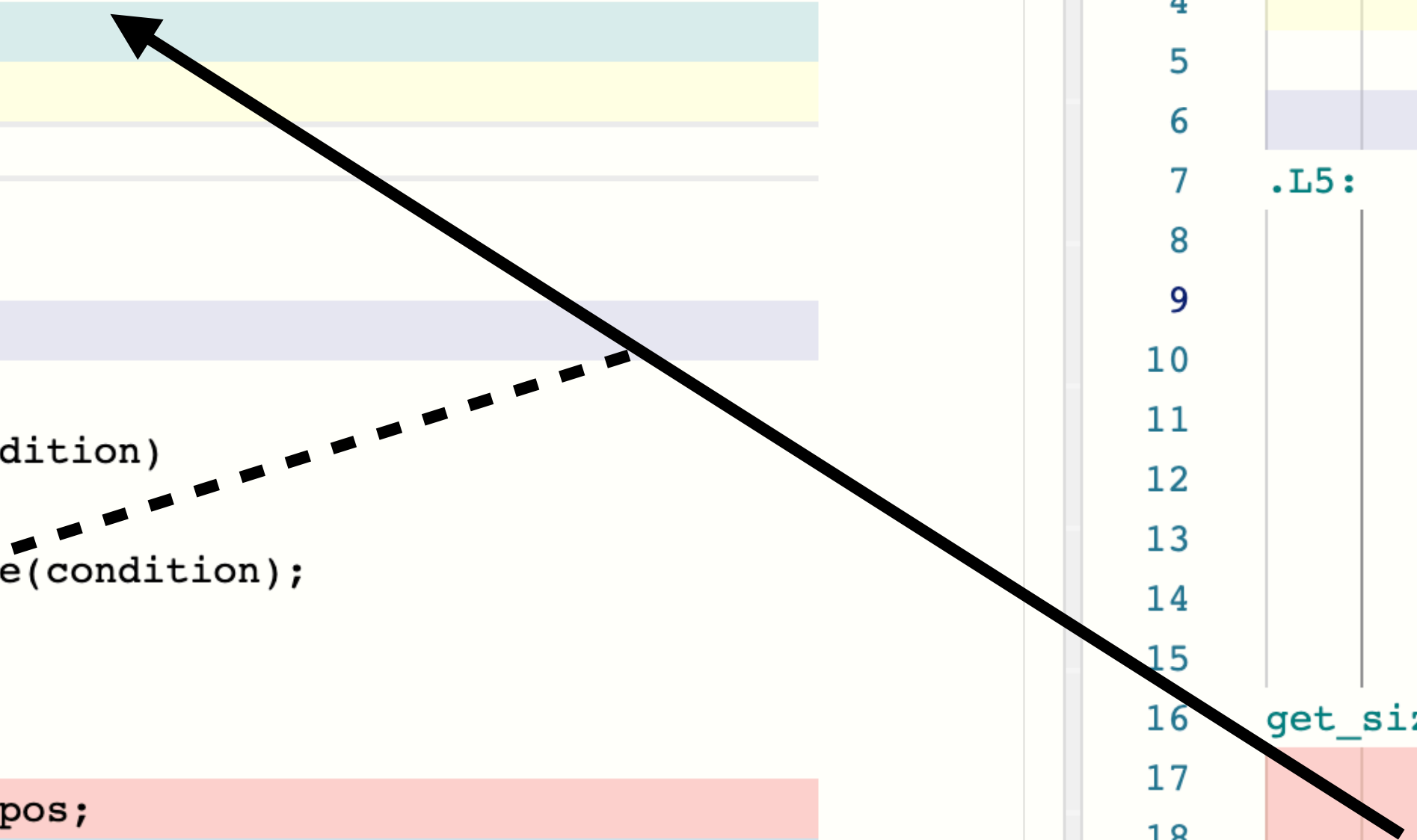
```
C++ source #1 x
A [ ] + v [ ] [ ]
C++
1 #include <optional>
2 #include <cstdint>
3 #include <string>
4
5 std::optional<std::string> get_value(bool condition)
6 {
7     if (condition)
8         return "Hello";
9     else
10        return std::nullopt;
11 }
12
13 std::size_t get_size(bool condition)
14 {
15     const auto str = get_value(condition);
16     if (str)
17         return str->size();
18     else
19         return std::string::npos;
20 }
21
22 int main()
23 {
24     return get_size(true);
25 }
26
```

```
x86-64 gcc 11.2 (C++, Editor #1, Compiler #1) x
x86-64 gcc 11.2 [ ] -O3 -std=c++20 -Wall -Wextra -Wpedanti
A [ ] Output... [ ] Filter... [ ] Libraries [ ] Add new... [ ] Add tool... [ ]
1 get_value[abi:cxx11](bool):
2     mov     rax, rdi
3     test   sil, sil
4     jne    .L5
5     mov    BYTE PTR [rdi+32], 0
6     ret
7 .L5:
8     lea   rdx, [rdi+16]
9     mov  DWORD PTR [rdi+16], 1819043144
10    mov  QWORD PTR [rdi], rdx
11    mov  BYTE PTR [rdi+20], 111
12    mov  QWORD PTR [rdi+8], 5
13    mov  BYTE PTR [rdi+21], 0
14    mov  BYTE PTR [rdi+32], 1
15    ret
16 get_size(bool):
17    cmp   dil, 1
18    sbb  rax, rax
19    or   rax, 5
20    ret
Output (0/0) x86-64 gcc 11.2 [ ] - 3272ms (298483B) ~19264 lines filtered [ ]
Output of x86-64 gcc 11.2 (Compiler #1) [ ] x
A [ ] [ ] Wrap lines
```

Myth #24

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C++ source #1 x
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A [ ] [ ] Wrap lines
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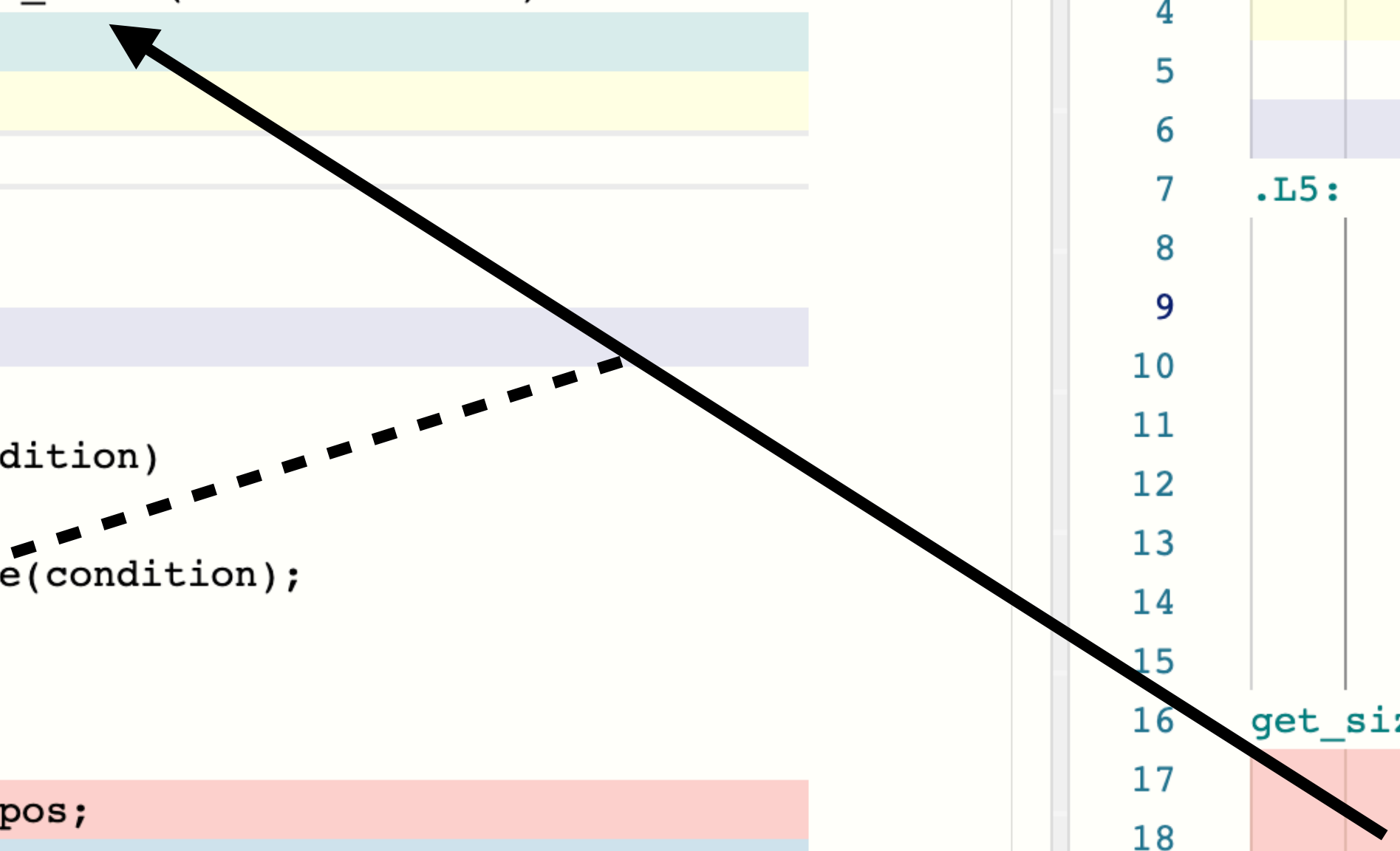


1819043144 = 0x6C6C6548

Myth #24

```
C++ source #1 x
A [ ] + v [ ] [ ]
1 #include <optional>
2 #include <cstdint>
3 #include <string>
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5 std::optional<std::string> get_value(bool condition)
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x86-64 gcc 11.2 [ ] -O3 -std=c++20 -Wall -Wextra -Wpedanti
A [ ] Output... [ ] Filter... [ ] Libraries [ ] Add new... [ ] Add tool... [ ]
1 get_value[abi:cxx11](bool):
2     mov     rax, rdi
3     test   sil, sil
4     jne    .L5
5     mov    BYTE PTR [rdi+32], 0
6     ret
7 .L5:
8     lea   rdx, [rdi+16]
9     mov  DWORD PTR [rdi+16], 1819043144
10    mov  QWORD PTR [rdi], rdx
11    mov  BYTE PTR [rdi+20], 111
12    mov  QWORD PTR [rdi+8], 5
13    mov  BYTE PTR [rdi+21], 0
14    mov  BYTE PTR [rdi+32], 1
15    ret
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```



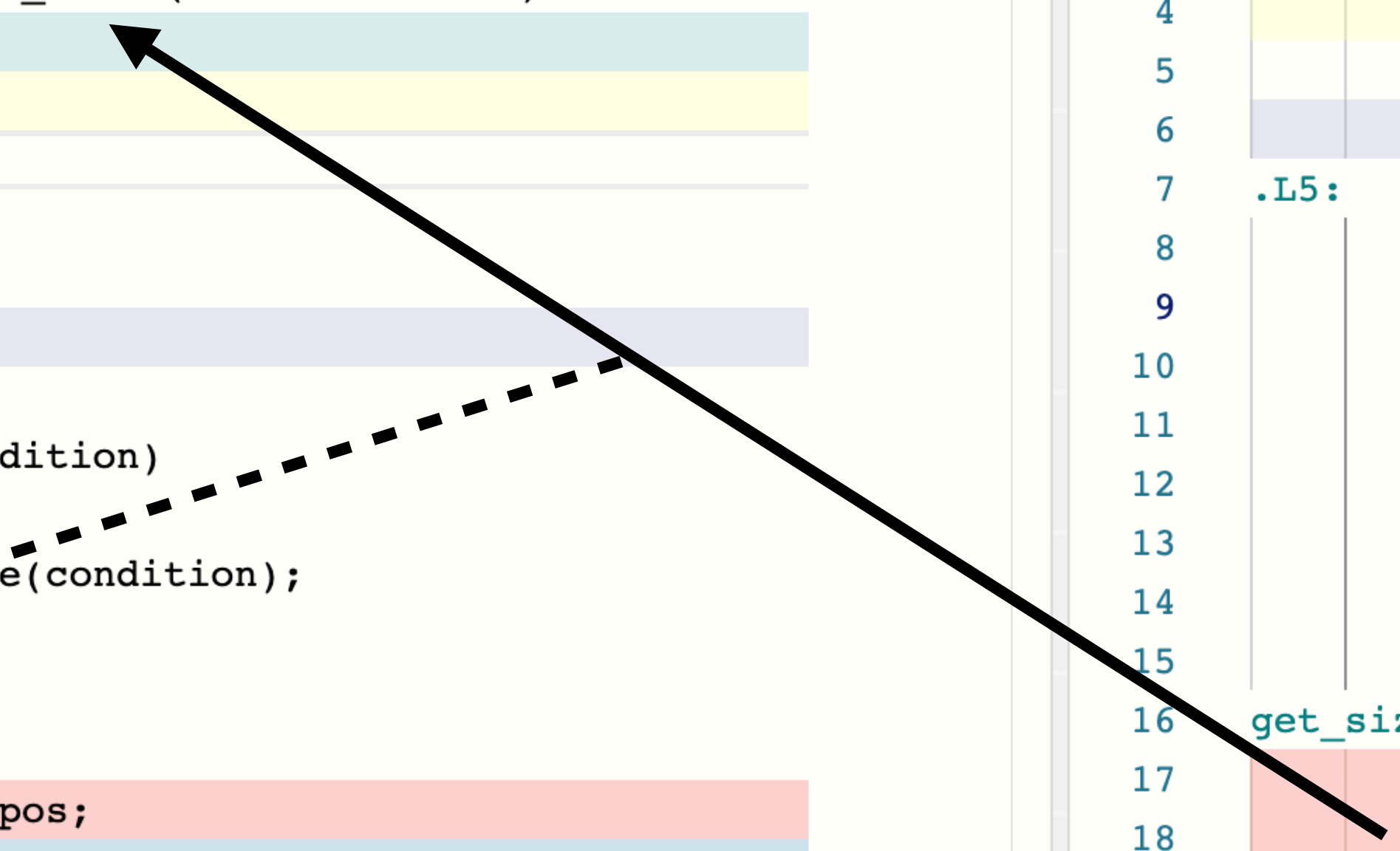
Myth #24

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13 std::size_t get_size(bool condition)
14 {
15     const auto str = get_value(condition);
16     if (str)
17         return str->size();
18     else
19         return std::string::npos;
20 }
21
22 int main()
23 {
24     return get_size(true);
25 }
26
```

```
x86-64 gcc 11.2 (C++, Editor #1, Compiler #1) x
x86-64 gcc 11.2 [ ] -O3 -std=c++20 -Wall -Wextra -Wpedanti
A [ ] Output... [ ] Filter... [ ] Libraries [ ] Add new... [ ] Add tool... [ ]
1 get_value[abi:cxx11](bool):
2     mov     rax, rdi
3     test   sil, sil
4     jne    .L5
5     mov    BYTE PTR [rdi+32], 0
6     ret
7 .L5:
8     lea   rdx, [rdi+16]
9     mov  DWORD PTR [rdi+16], 1819043144
10    mov  QWORD PTR [rdi], rdx
11    mov  BYTE PTR [rdi+20], 111
12    mov  QWORD PTR [rdi+8], 5
13    mov  BYTE PTR [rdi+21], 0
14    mov  BYTE PTR [rdi+32], 1
15    ret
16 get_size(bool):
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19    or   rax, 5
20    ret
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Output of x86-64 gcc 11.2 (Compiler #1) [ ] x
A [ ] [ ] Wrap lines
```

1819043144 = 0x6C6C6548

48 65 6c 6c
"Hell"



Myth #24

```
C++ source #1 X
A [ ] + v [ ] [ ]
C++
1 #include <optional>
2 #include <cstdint>
3 #include <string>
4
5 std::optional<std::string> get_value(bool condition)
6 {
7     if (condition)
8         return "Hello";
9     else
10        return std::nullopt;
11 }
12
13 std::size_t get_size(bool condition)
14 {
15     const auto str = get_value(condition);
16     if (str)
17         return str->size();
18     else
19         return std::string::npos;
20 }
21
22 int main()
23 {
24     return get_size(true);
25 }
26
```

```
x86-64 gcc 11.2 (C++, Editor #1, Compiler #1) X
x86-64 gcc 11.2 [ ] -O3 -std=c++20 -Wall -Wextra -Wpedanti
A [ ] Output... [ ] Filter... [ ] Libraries [ ] Add new... [ ] Add tool...
1 get_value[abi:cxx11](bool):
2     mov     rax, rdi
3     test   sil, sil
4     jne    .L5
5     mov    BYTE PTR [rdi+32], 0
6     ret
7 .L5:
8     lea   rdx, [rdi+16]
9     mov  DWORD PTR [rdi+16], 1819043144
10    mov  QWORD PTR [rdi], rdx
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19    or   rax, 5
20    ret
Output (0/0) x86-64 gcc 11.2 [ ] - 3272ms (298483B) ~19264 lines filtered
Output of x86-64 gcc 11.2 (Compiler #1) X
A [ ] [ ] Wrap lines
```

1819043144 = 0x6C6C6548

48 65 6c 6c
"Hell"

0x6F = 'o'

Myth #24



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Share

C++ source #1



C++

x86-64 gcc 11.2 (C++, Editor #1, Compiler #1)

x86-64 gcc 11.2

-O3 -std=c++20 -Wall -Wextra -Wpeda

Output... Filter... Libraries Add new... Add tool...

```
1 #include <optional>
2 #include <cstdint>
3 #include <string>
4
5 std::optional<std::string> get_value(bool condition)
6 {
7     if (condition)
8         return "This is a longer string";
9     else
10        return std::nullopt;
11 }
12
13 std::size_t get_size(bool condition)
14 {
15     const auto str = get_value(condition);
16     if (str)
17         return str->size();
18     else
19         return std::string::npos;
20 }
21
22 int main()
23 {
24     return get_size(true);
25 }
```

no more SSO

```
35 sub    rsp, 56
36 mov    edi, 24
37 lea   rax, [rsp+16]
38 mov   QWORD PTR [rsp], rax
39 call  operator new(unsigned long)
40 mov   esi, 24
41 mov   BYTE PTR [rsp+32], 0
42 movdq xmm0, XMMWORD PTR .LC0[rip]
43 mov   DWORD PTR [rax+16], 1920234272
44 mov   rdi, rax
45 movups XMMWORD PTR [rax], xmm0
46 mov   QWORD PTR [rsp], rax
47 mov   eax, 28265
48 mov   WORD PTR [rdi+20], ax
49 mov   BYTE PTR [rdi+22], 103
50 mov   BYTE PTR [rdi+23], 0
51 mov   QWORD PTR [rsp+16], 23
52 mov   QWORD PTR [rsp+8], 23
53 call  operator delete(void*, unsigned long)
54 mov   eax, 23
```

Output (0/0) x86-64 gcc 11.2 - 2548ms (341058B) ~22151 lines filtered

Output of x86-64 gcc 11.2 (Compiler #1)

Myth #24



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C++ source #1



C++

x86-64 gcc 11.2 (C++, Editor #1, Compiler #1)

x86-64 gcc 11.2

-O3 -std=c++20 -Wall -Wextra -Wpeda

Output... Filter... Libraries Add new... Add tool...

```
1 #include <optional>
2 #include <cstdint>
3 #include <string>
4
5 std::optional<std::string> get_value(bool condition)
6 {
7     if (condition)
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9     else
10        return std::nullopt;
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16     if (str)
17         return str->size();
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19         return std::string::npos;
20 }
21
22 int main()
23 {
24     return get_size(true);
25 }
```

no more SSO

```
35 sub    rsp, 56
36 mov    edi, 24
37 lea   rax, [rsp+16]
38 mov   QWORD PTR [rsp], rax
39 call  operator new(unsigned long)
40 mov   esi, 24
41 mov   BYTE PTR [rsp+32], 0
42 movdqa xmm0, XMMWORD PTR .LC0[rip]
43 mov   DWORD PTR [rax+16], 1920234272
44 mov   rdi, rax
45 movups XMMWORD PTR [rax], xmm0
46 mov   QWORD PTR [rsp], rax
47 mov   eax, 28265
48 mov   WORD PTR [rdi+20], ax
49 mov   BYTE PTR [rdi+22], 103
50 mov   BYTE PTR [rdi+23], 0
51 mov   QWORD PTR [rsp+16], 23
52 mov   QWORD PTR [rsp+8], 23
53 call  operator delete(void*, unsigned long)
54 mov   eax, 23
```

Output (0/0) x86-64 gcc 11.2 - 2548ms (341058B) ~22151 lines filtered

Output of x86-64 gcc 11.2 (Compiler #1)

Myth #24

C++ source #1



C++

x86-64 gcc 11.2 (C++, Editor #1, Compiler #1)

x86-64 gcc 11.2

-O3 -std=c++20 -Wall -Wextra -Wpeda

Output... Filter... Libraries Add new... Add tool...

```
1 #include <optional>
2 #include <cstdint>
3 #include <string>
4
5 std::optional<std::string> get_value(bool condition)
6 {
7     if (condition)
8         return "This is a longer string";
9     else
10        return std::nullopt;
11 }
12
13 std::size_t get_size(bool condition)
14 {
15     const auto str = get_value(condition);
16     if (str)
17         return str->size();
18     else
19         return std::string::npos;
20 }
21
22 int main()
23 {
24     return get_size(true);
25 }
```

no more SSO

compiler still sees through it and inlines it

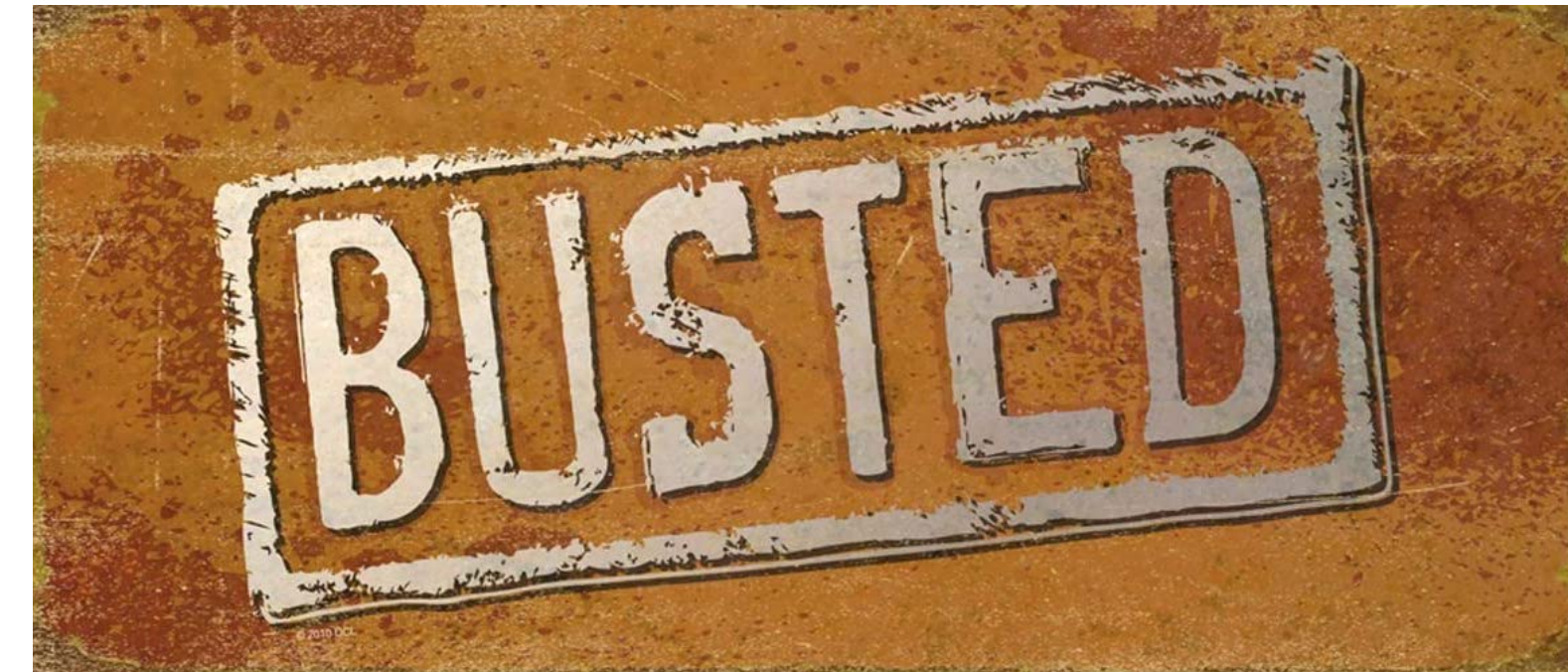
```
35 sub    rsp, 56
36 mov    edi, 24
37 lea   rax, [rsp+16]
38 mov   QWORD PTR [rsp], rax
39 call  operator new(unsigned long)
40 mov   esi, 24
41 mov   BYTE PTR [rsp+32], 0
42 movdqa xmm0, XMMWORD PTR .LC0[rip]
43 mov   DWORD PTR [rax+16], 1920234272
44 mov   rdi, rax
45 movups XMMWORD PTR [rax], xmm0
46 mov   QWORD PTR [rsp], rax
47 mov   eax, 28265
48 mov   WORD PTR [rdi+20], ax
49 mov   BYTE PTR [rdi+22], 103
50 mov   BYTE PTR [rdi+23], 0
51 mov   QWORD PTR [rsp+16], 23
52 mov   QWORD PTR [rsp+8], 23
53 call  operator delete(void*, unsigned long)
54 mov   eax, 23
```

Output (0/0) x86-64 gcc 11.2 - 2548ms (341058B) ~22151 lines filtered

Output of x86-64 gcc 11.2 (Compiler #1)

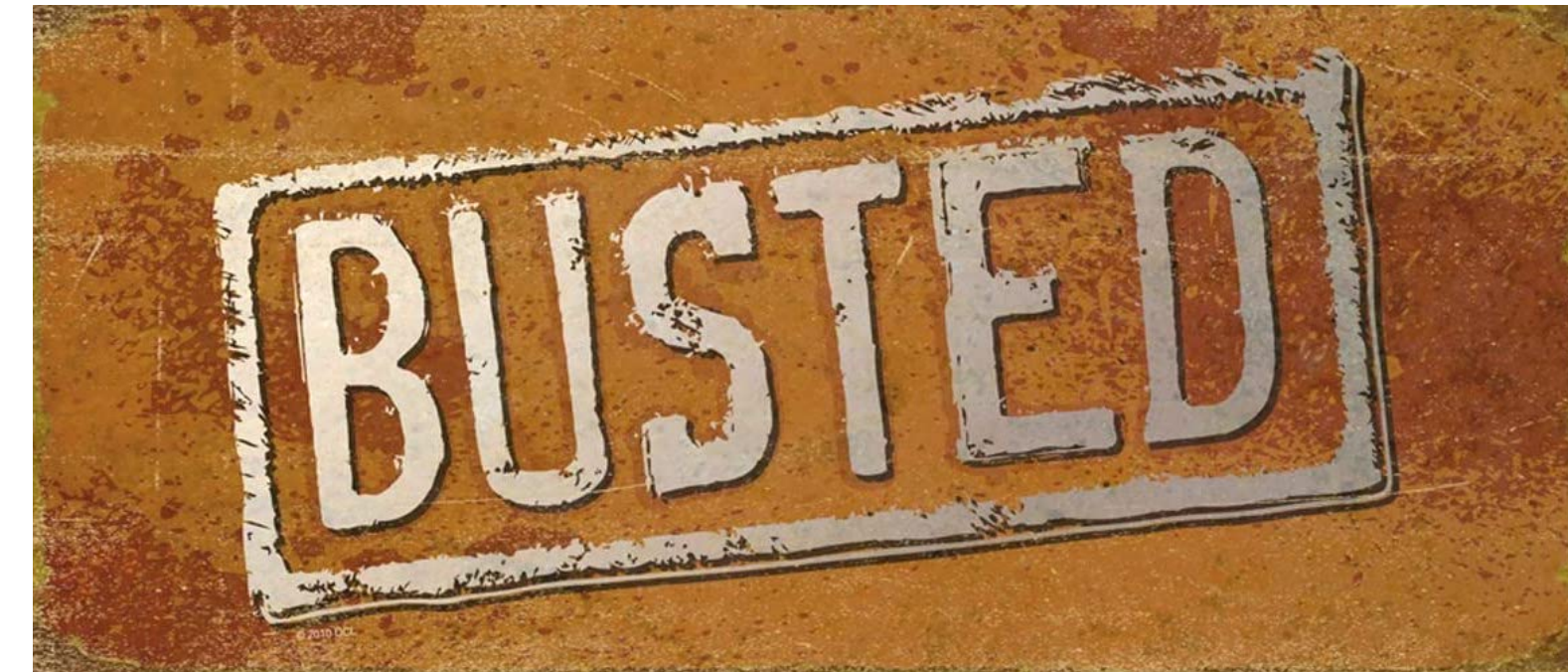
Myth #24

`std::optional` inhibits optimizations



Myth #24

`std::optional` inhibits optimizations



However...

```

C++ source #1 x C++ source #2 x
A [Icons] C++
5 std::optional<std::string> get_value(bool condition)
6 {
7     std::string value = "This is a longer string";
8     if (condition)
9         return value;
10    else
11        return std::nullopt;
12 }
13
14 std::size_t get_size(bool condition)
15 {
16     const auto str = get_value(condition);
17     if (str)
18         return str->size();
19     else
20         return std::string::npos;
21 }
22
23 int main()
24 {
25     return get_size(true);
26 }
  
```

x86-64 gcc 11.2 (C++, Editor #2, Compiler #2)

x86-64 gcc 11.2 -O3 -std=c++20 -Wall -Wextra -Wpedantic

A [Icons] Output... Filter... Libraries Add new... Add tool...

```

1 get_value[abi:cxx11](bool):
2     push    r12
3     mov     r12, rdi
4     test   sil, sil
5     ine    .L6
  
```

```

Diff Viewer x86-64 gcc 11.2 vs x86-64 gcc 11.2
A Left: x86-64 gcc 11.2 -O3 -std=c++20 Assembly
Right: x86-64 gcc 11.2 -O3 -std=c++20 Assembly

50-  mov     BYTE PTR [rdi+23], 0
51-  mov     QWORD PTR [rsp+16], 23
52-  mov     QWORD PTR [rsp+8], 23
53-  call   operator delete(void*, uns
54-  mov     eax, 23
55-  add     rsp, 56

66-  call   operator delete(void*, uns
67+  add     rsp, 88
68+  mov     rax, r12
69+  pop     rbx
70+  pop     r12
71+  ret
72+ .L10:
73+  mov     esi, 24
74+  mov     r12d, 23
75+  call   operator delete(void*, uns
76+  add     rsp, 88
77+  mov     rax, r12
78+  pop     rbx
79+  pop     r12

56-  ret
57 main:
58-  sub     rsp, 8
59-  mov     edi, 1
60-  call   get_size(bool)
61-  add     rsp, 8
62-  ret
63 .LC0:
64-  .quad  2338328219631577172
65-  .quad  8243108416984981601

80-  ret
81 main:
82-  sub     rsp, 8
83-  mov     edi, 1
84-  call   get_size(bool)
85-  add     rsp, 8
86-  ret
87 .LC0:
88+  .quad  23
89+  .quad  23
90+ .LC1:
91-  .quad  2338328219631577172
92-  .quad  8243108416984981601
  
```

```

C++ source #1 x C++ source #2 x
C++
5 std::optional<std::string> get_value(bool condition)
6 {
7     std::string value = "This is a longer string";
8     if (condition)
9         return value;
10    else
11        return std::nullopt;
12 }
13
14 std::size_t get_size(bool condition)
15 {
16     const auto str = get_value(condition);
17     if (str)
18         return str->size();
19     else
20         return std::string::npos;
21 }
22
23 int main()
24 {
25     return get_size(true);
26 }
  
```

x86-64 gcc 11.2 (C++, Editor #2, Compiler #2)

x86-64 gcc 11.2 -O3 -std=c++20 -Wall -Wextra -Wpedantic

Output... Filter... Libraries Add new... Add tool...

```

1 get_value[abi:cxx11](bool):
2     push    r12
3     mov     r12, rdi
4     test   sil, sil
5     ine    .L6
  
```

```

Diff Viewer x86-64 gcc 11.2 vs x86-64 gcc 11.2
Left: x86-64 gcc 11.2 -O3 -std=c++20 Assembly
Right: x86-64 gcc 11.2 -O3 -std=c++20 Assembly

50-  mov     BYTE PTR [rdi+23], 0
51-  mov     QWORD PTR [rsp+16], 23
52-  mov     QWORD PTR [rsp+8], 23
53-  call   operator delete(void*, uns
54-  mov     eax, 23
55-  add     rsp, 56

66-  call   operator delete(void*, uns
67+  add     rsp, 88
68+  mov     rax, r12
69+  pop     rbx
70+  pop     r12
71+  ret
72+ .L10:
73+  mov     esi, 24
74+  mov     r12d, 23
75+  call   operator delete(void*, uns
76+  add     rsp, 88
77+  mov     rax, r12
78+  pop     rbx
79+  pop     r12

56-  ret
57 main:
58-  sub     rsp, 8
59-  mov     edi, 1
60-  call   get_size(bool)
61-  add     rsp, 8
62-  ret
63 .LC0:
64-  .quad  2338328219631577172
65-  .quad  8243108416984981601

80-  ret
81 main:
82-  sub     rsp, 8
83-  mov     edi, 1
84-  call   get_size(bool)
85-  add     rsp, 8
86-  ret
87 .LC0:
88+  .quad  23
89+  .quad  23
90+ .LC1:
91-  .quad  2338328219631577172
92-  .quad  8243108416984981601
  
```

```

C++ source #1 X C++ source #2 X
C++
5 std::optional<std::string> get_value(bool condition)
6 {
7     std::string value = "This is a longer string";
8     if (condition)
9         return value;
10    else
11        return std::nullopt;
12 }
13
14 std::size_t get_size(bool condition)
15 {
16     const auto str = get_value(condition);
17     if (str)
18         return str->size();
19     else
20         return std::string::npos;
21 }
22
23 int main()
24 {
25     return get_size(true);
26 }

```

x86-64 gcc 11.2 (C++, Editor #2, Compiler #2)

x86-64 gcc 11.2 -O3 -std=c++20 -Wall -Wextra -Wper

Output... Filter... Libraries Add new... Add tool...

```

1 get_value[abi:cxx11](bool):
2     push    r12
3     mov     r12, rdi
4     test   sil, sil
5     ine   .L6

```

```

Diff Viewer x86-64 gcc 11.2 vs x86-64 gcc 11.2
Left: x86-64 gcc 11.2 -O3 -std=c+... Assembly
Right: x86-64 gcc 11.2 -O3 -std=c+... Assembly

50-  mov     BYTE PTR [rdi+23], 0
51-  mov     QWORD PTR [rsp+16], 23
52-  mov     QWORD PTR [rsp+8], 23
53-  call   operator delete(void*, uns
54-  mov     eax, 23
55-  add     rsp, 56

66-  call   operator delete(void*, uns
67+  add     rsp, 88
68+  mov     rax, r12
69+  pop     rbx
70+  pop     r12
71+  ret
72+ .L10:
73+  mov     esi, 24
74+  mov     r12d, 23
75+  call   operator delete(void*, uns
76+  add     rsp, 88
77+  mov     rax, r12
78+  pop     rbx
79+  pop     r12

56-  ret
57 main:
58-  sub     rsp, 8
59-  mov     edi, 1
60-  call   get_size(bool)
61-  add     rsp, 8
62-  ret

80-  ret
81 main:
82-  sub     rsp, 8
83-  mov     edi, 1
84-  call   get_size(bool)
85-  add     rsp, 8
86-  ret

```

```

63- .LC0:
64-  .quad  2338328219631577172
65-  .quad  8243108416984981601

87- .LC0:
88+  .quad  23
89+  .quad  23
90+  .quad  23
91-  .quad  2338328219631577172
92-  .quad  8243108416984981601

```

~40% more instructions

```

C++ source #1 x C++ source #2 x
A [Icons] C++
5 std::optional<std::string> get_value(bool condition)
6 {
7     std::string value = "This is a longer string";
8     if (condition)
9         return value;
10    else
11        return std::nullopt;
12 }
13
14 std::size_t get_size(bool condition)
15 {
16     const auto str = get_value(condition);
17     if (str)
18         return str->size();
19     else
20         return std::string::npos;
21 }
22
23 int main()
24 {
25     return get_size(true);
26 }

```

```

Diff Viewer x86-64 gcc 11.2 vs x86-64 gcc 11.2
A Left: x86-64 gcc 11.2 -O3 -std=c++20 Assembly
Right: x86-64 gcc 11.2 -O3 -std=c++17 Assembly
50 mov BYTE PTR [rdi+23], 0
51 mov QWORD PTR [rsp+16], 23
52 mov QWORD PTR [rsp+8], 23
53 call operator delete(void*, unsigned)
54 mov eax, 23
55 add rsp, 56
66 call operator delete(void*, unsigned)
67+ add rsp, 88
68+ mov rax, r12
69+ pop rbx
70+ pop r12
71+ ret
72+.L10:
73+ mov esi, 24
74+ mov r12d, 23
75+ call operator delete(void*, unsigned)
76+ add rsp, 88
77+ mov rax, r12
78+ pop rbx
79+ pop r12
80 ret
81 main:
82 sub rsp, 8
83 mov edi, 1
84 call get_size(bool)
85 add rsp, 8
86 ret
56 ret
57 main:
58 sub rsp, 8
59 mov edi, 1
60 call get_size(bool)
61 add rsp, 8
62 ret
63 .LC0:
64 .quad 2338328219631577172
65 .quad 8243108416984981601
87 .LC0:
88+ .quad 23
89+ .quad 23
90 .LC0:
91 .quad 2338328219631577172
92 .quad 8243108416984981601

```

copy constructing a string

~40% more instructions

```

x86-64 gcc 11.2 (C++, Editor #2, Compiler #2)

```

```

x86-64 gcc 11.2 -O3 -std=c++20 -Wall -Wextra -Wpedantic

```

```

A Output... Filter... Libraries Add new... Add tool...
1 get_value[abi:cxx11](bool):
2     push    r12
3     mov     r12, rdi
4     test   sil, sil
5     ine   .L6

```


Myth #24


```
template <class U = T>  
constexpr optional(U && value);
```

Constructs an optional object that contains a value, initialized **as if** direct-initializing (but not direct-list-initializing) an object of type T with `std::forward<U>(value)`

- this constructor does not participate in overload resolution unless `std::is_constructible_v<T, U&&>` is *true* and `std::remove_cvref_t<U>` is neither `std::in_place_t` nor `std::optional<T>`
- this constructor is `explicit` iff `std::is_convertible_v<U&&, T>` is *false*


`std::optional` complicates APIs

`std::optional` complicates APIs

- don't look inside the  `box`
- don't use optional for error handling
- when in doubt, draw inspiration from other APIs:
Haskell (`Maybe`) or Rust (`Option<T>`)

Myth #24


`std::optional` complicates APIs

- don't look inside the  `box`
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- when in doubt, draw inspiration from other APIs:
Haskell (`Maybe`) or Rust (`Option<T>`)



Myth #24

`std::optional` complicates APIs

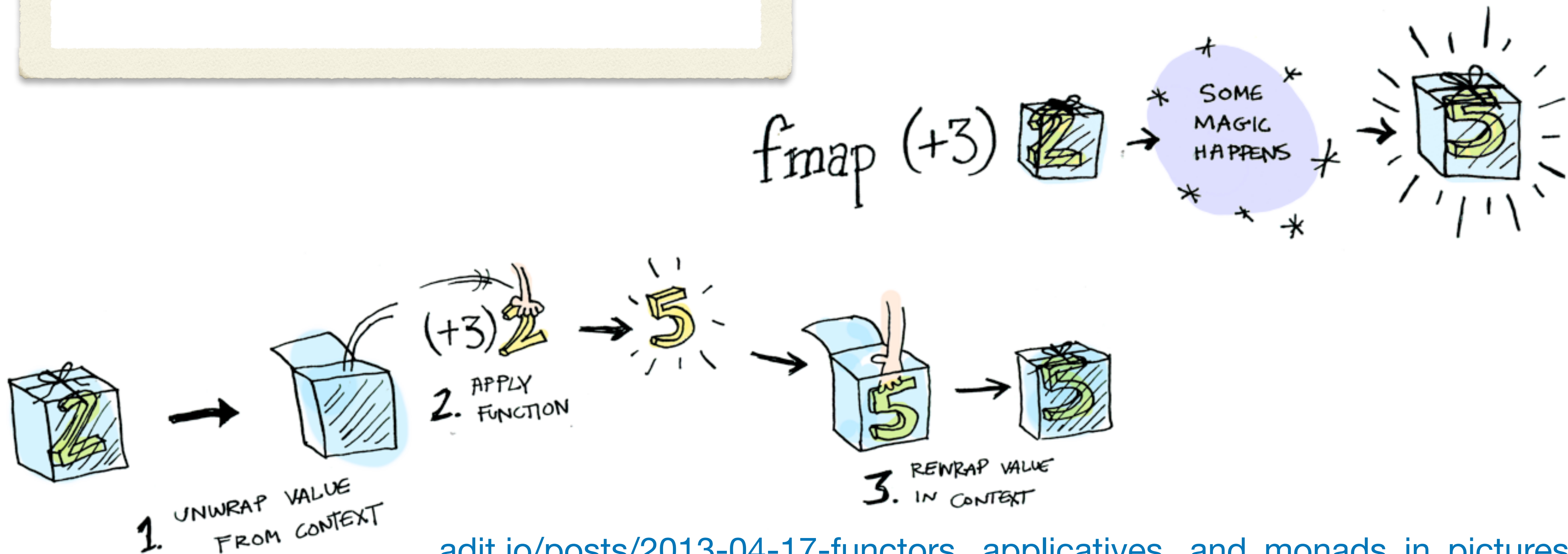
- don't look inside the  `box`
- don't use optional for error handling
- when in doubt, draw inspiration from other APIs:
Haskell (`Maybe`) or Rust (`Option<T>`)



adit.io/posts/2013-04-17-functors, applicatives, and monads in pictures

Myth #24

`std::optional` complicates APIs



[adit.io/posts/2013-04-17-functors, applicatives, and monads in pictures](https://adit.io/posts/2013-04-17-functors,applicatives,andmonadsinpictures)

Myth #24

Monadic `std::optional` (C++23 P0798)

```
optional<T> f()
```

if / else

```
optional<T> g(optional<T> in)
```

if / else

```
optional<T> h(optional<T> in)
```

don't look inside the  box

Myth #24

Monadic `std::optional` (C++23 P0798)

```
optional<int> string_view_to_int(string_view sv)
{
    const auto first = sv.data();
    const auto last  = first + sv.size();

    int val = -1;
    const auto result = std::from_chars(first, last, val);

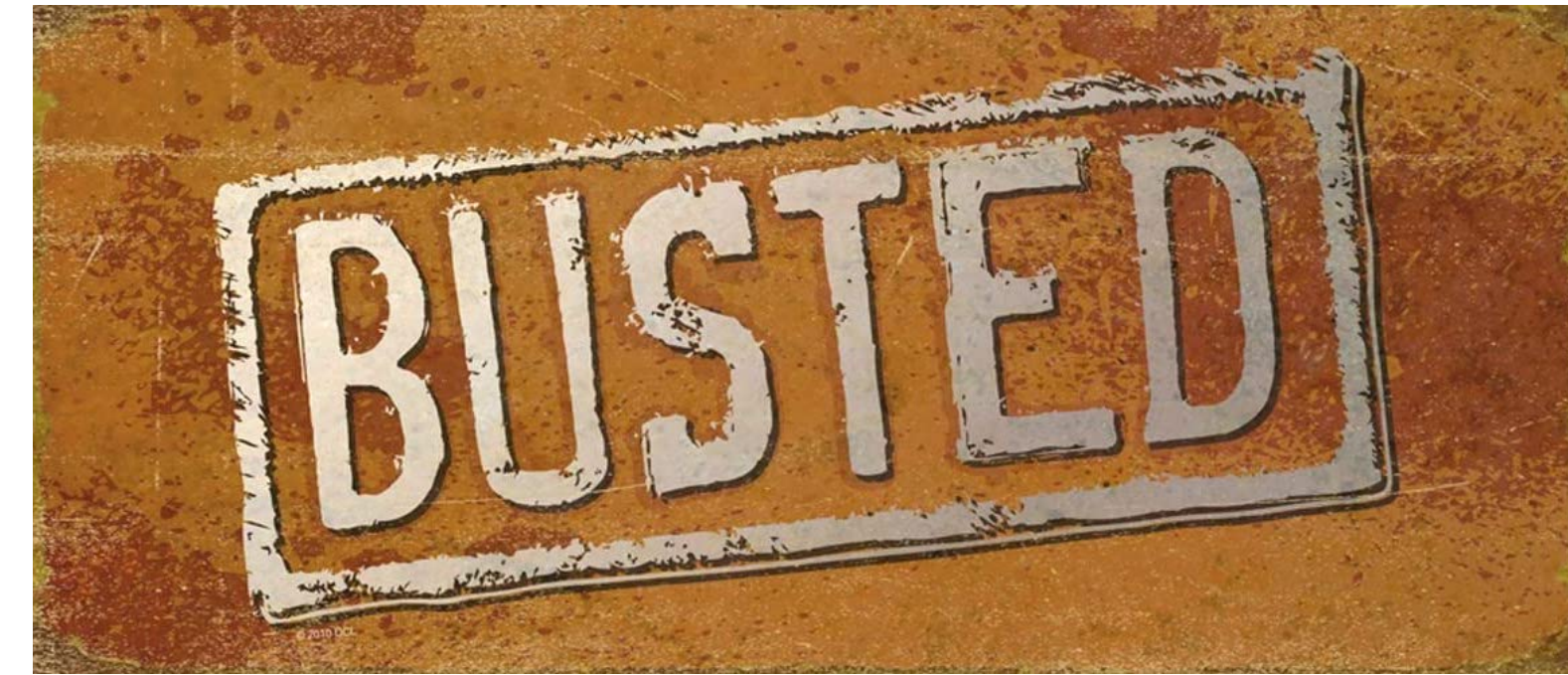
    if (result.ec == errc{} && result.ptr == last)
        return val;
    else
        return nullopt;
}
```


Monadic `std::optional` (C++23 P0798)

```
cout << string_view_to_int(sv)
    .and_then( [=](int val) -> optional<int> {
        const int logs = clamp(val, 0, max_logs);
        if (logs > 0)
            return logs;
        else
            return std::nullopt;
    })
    .transform( [](int val) {
        return std::format("Collecting in {} logs.", val);
    })
    .or_else( [] {
        return optional<string>{"Log error"};
    })
    .value()
```

Myth #24

`std::optional` complicates APIs



Good names

`std::move` doesn't move

`std::forward` doesn't forward

`std::remove` doesn't remove

`std::function` is not a function

...

Myth #31

`std::move()` moves ?

Myth #31

`std::move()` moves ?

```
void echo(const std::string & first, const std::string & second)
{
    fmt::print("{} ', '{}", first, second);
}
```

```
int main()
{
    std::string greeting{"Hello from a long string"};
    echo(greeting, greeting);
}
```

Myth #31

`std::move()` moves ?

```
void echo(const std::string & first, const std::string & second)
{
    fmt::print("{} ', '{}'", first, second);
}
```

```
int main()
{
    std::string greeting{"Hello from a long string"};
    echo(greeting, greeting);
}
```

```
'Hello from a long string', 'Hello from a long string'
```

Myth #31

`std::move()` moves ?

```
void echo(const std::string & first, const std::string & second)
{
    fmt::print("{} ', '{}", first, second);
}

int main()
{
    std::string greeting{"Hello from a long string"};
    echo(std::move(greeting), greeting);
}
```

Myth #31

`std::move()` moves ?

```
void echo(const std::string & first, const std::string & second)
{
    fmt::print("{} ', '{}", first, second);
}
```

```
int main()
{
    std::string greeting{"Hello from a long string"};
    echo(std::move(greeting), greeting);
}
```

```
'Hello from a long string', 'Hello from a long string'
```


Myth #31

`std::move()` moves ?

```
void echo(const std::string & first, const std::string & second)
{
    fmt::print("{} ', '{}'", first, second);
}
```

```
int main()
{
    std::string greeting{"Hello from a long string"};
    echo(std::move(greeting), std::move(greeting));
}
```



Myth #31

`std::move()` moves ?

```
void echo(const std::string & first, const std::string & second)
{
    fmt::print("{} ', '{}'", first, second);
}
```

```
int main()
{
    std::string greeting{"Hello from a long string"};
    echo(std::move(greeting), std::move(greeting));
}
```



```
'Hello from a long string', 'Hello from a long string'
```

Myth #31

`std::move()` moves ?

```
void echo(const std::string & first, const std::string & second)
{
    fmt::print("{} ', '{}'", first, second);
}
```

```
int main()
{
    std::string greeting{"Hello from a long string"};
    echo(std::move(greeting), std::move(greeting));
}
```

`string && => const string &`



```
'Hello from a long string', 'Hello from a long string'
```

Myth #31

`std::move()` moves ?

```
void echo(const std::string first, const std::string second)
{
    fmt::print("{} ', '{}", first, second);
}

int main()
{
    std::string greeting{"Hello from a long string"};
    echo(std::move(greeting), std::move(greeting));
}
```

Myth #31

`std::move()` moves ?

```
void echo(const std::string first, const std::string second)
{
    fmt::print("{} ', '{}", first, second);
}
```

```
int main()
{
    std::string greeting{"Hello from a long string"};
    echo(std::move(greeting), std::move(greeting));
}
```

```
'Hello from a long string', ''
```

Myth #31

`std::move()` moves ?

```
void echo(const std::string first, const std::string second)
{
    fmt::print("{} ', '{}", first, second);
}
```

```
int main()
{
    std::string greeting{"Hello from a long string"};
    echo(std::move(greeting), std::move(greeting));
}
```

`string(std::move(greeting))`

`'Hello from a long string', ''`

Myth #31

`std::move()` moves ?

```
void echo(const std::string first, const std::string second)
{
    fmt::print("{} ', '{}", first, second);
}
```

```
int main()
{
    std::string greeting{"Hello from a long string"};
    echo(std::move(greeting), std::move(greeting));
}
```

`string(std::move(greeting))`

clang

```
'Hello from a long string', ''
```

Myth #31

`std::move()` moves ?

```
void echo(const std::string first, const std::string second)
{
    fmt::print("{} ', '{}", first, second);
}

int main()
{
    std::string greeting{"Hello from a long string"};
    echo(std::move(greeting), std::move(greeting));
}
```

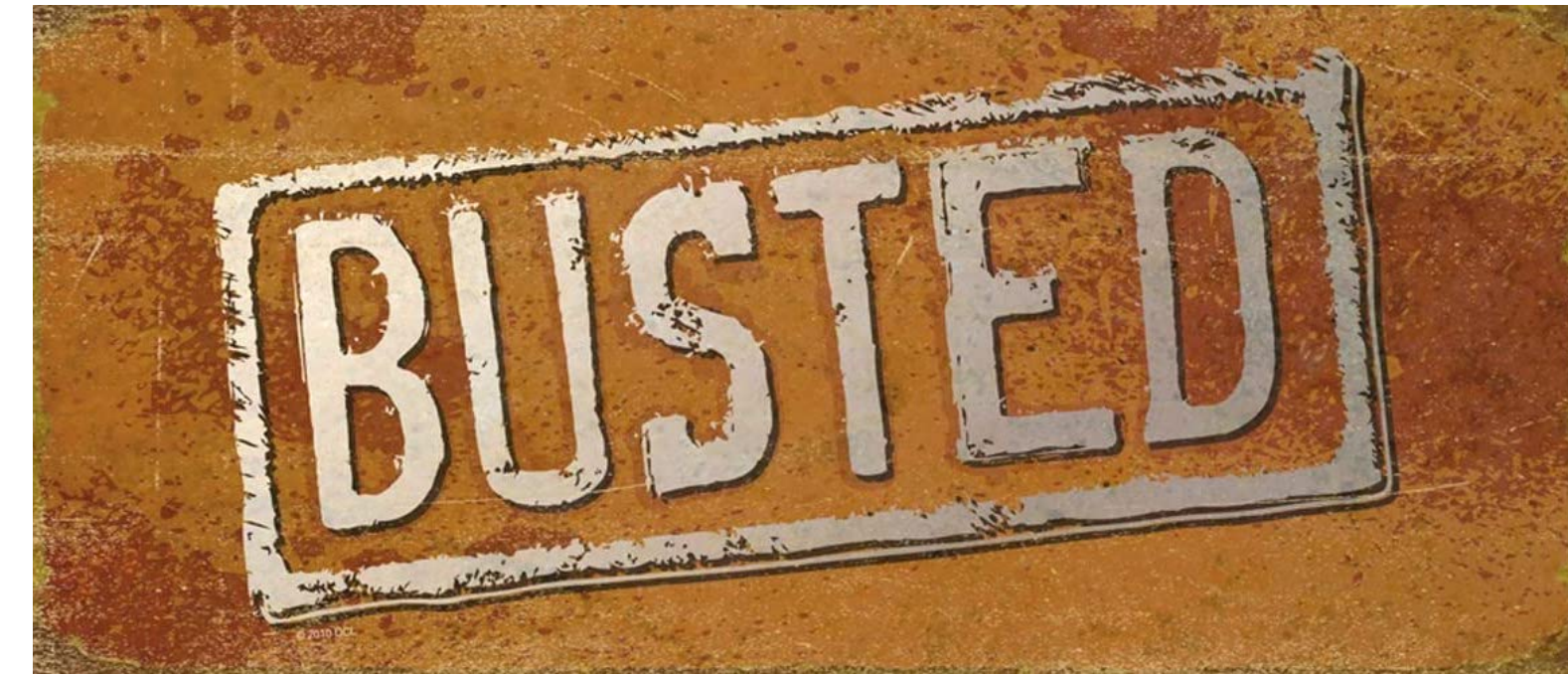
`string(std::move(greeting))`

gcc

```
' ', 'Hello from a long string'
```


Myth #31

`std::move()` moves ?



Myth #36

Always pass input arguments
by const reference

```
void echo(const std::string & first, const std::string & second);
```

Myth #36

```
class Widget
{
    std::string id;

public:
    Widget(const std::string & new_id)
        : id(new_id) {}

    Widget(std::string && new_id)
        : id(std::move(new_id)) {}
};
```

Myth #36

```
class Widget
{
    std::string id;
    std::string name;

public:

    Widget(const std::string & new_id, const std::string & new_name)
        : id(new_id), name(new_name) {}

    Widget(std::string && new_id, std::string && new_name)
        : id(std::move(new_id)), name(std::move(new_name)) {}

    Widget(const std::string & new_id, std::string && new_name)
        : id(new_id), name(std::move(new_name)) {}

    Widget(std::string && new_id, const std::string & new_name)
        : id(std::move(new_id)), name(new_name) {}

};
```



Myth #36

```
class Widget
{
    std::string id;
    std::string name;

public:
    Widget(std::string new_id, std::string new_name)
        : id(std::move(new_id)), name(std::move(new_name)) {}
};
```

when we take ownership (sink)

by value

Myth #36

```
class Widget  
{  
    std::string id;  
    std::string name;
```

```
public:
```

```
void set_name(std::string new_name)  
{  
    name = std::move(new_name);  
}
```

by value

```
};
```

when we take ownership (sink)

Myth #36

```
class Widget
{
    std::string id;
    std::string name;

public:

    void set_name(std::string new_name)
    {
        name = std::move(new_name);
    }
};

Widget w;
w.set_name("Hello from a long string");
```

- create the string with the literal value
- move assignment into data member

Myth #36

```
class Widget
{
    std::string id;
    std::string name;

public:

    void set_name(std::string new_name)
    {
        name = std::move(new_name);
    }
};

Widget w;
std::string name{"Hello from a long string"};
w.set_name(name);
```

- create the string with the literal value
- make a copy of the string
- move assignment into data member

Myth #36

```
class Widget
{
    std::string id;
    std::string name;

public:

    void set_name(std::string new_name)
    {
        name = std::move(new_name);
    }
};

Widget w;
std::string name{"Hello from a long string"};
w.set_name(std::move(name));
```

- create the string with the literal value
- move construct the string
- move assignment into data member

Myth #36

```
class Widget
{
    std::string name;

public:
    void set_name(const std::string & new_name)
    {
        name = new_name;
    }
    void set_name(std::string && new_name)
    {
        name = std::move(new_name);
    }
};
```

```
Widget w;
std::string name{"Hello from a long string"};
w.set_name(name);
```

- create the string with the literal value
- make a copy of the string

Myth #36

```
class Widget
{
    std::string name;

public:

    void set_name(const std::string & new_name)
    {
        name = new_name;
    }
    void set_name(std::string && new_name)
    {
        name = std::move(new_name);
    }
};
```

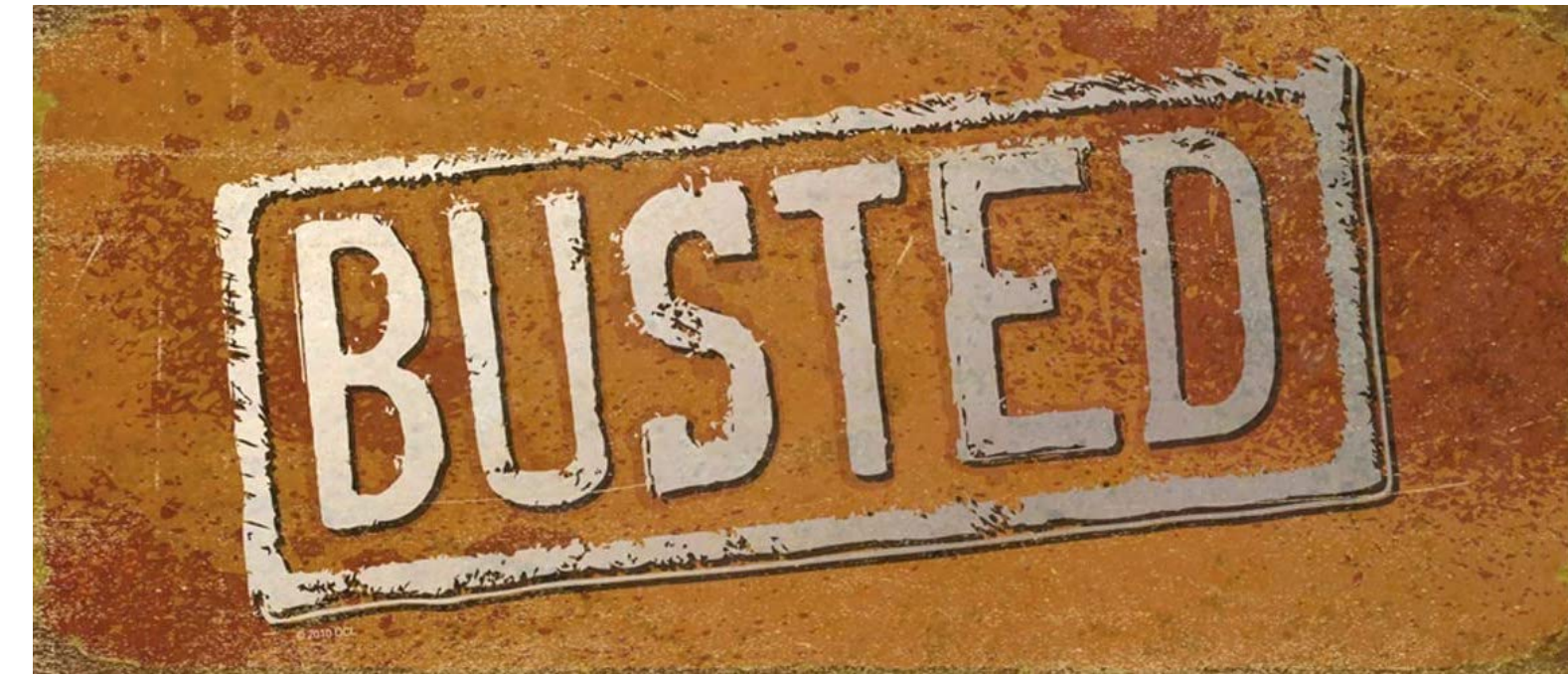
```
Widget w;
std::string name{"Hello from a long string"};
w.set_name(name);
```

Technically, more efficient
(one less move operation)

- create the string with the literal value
- make a copy of the string

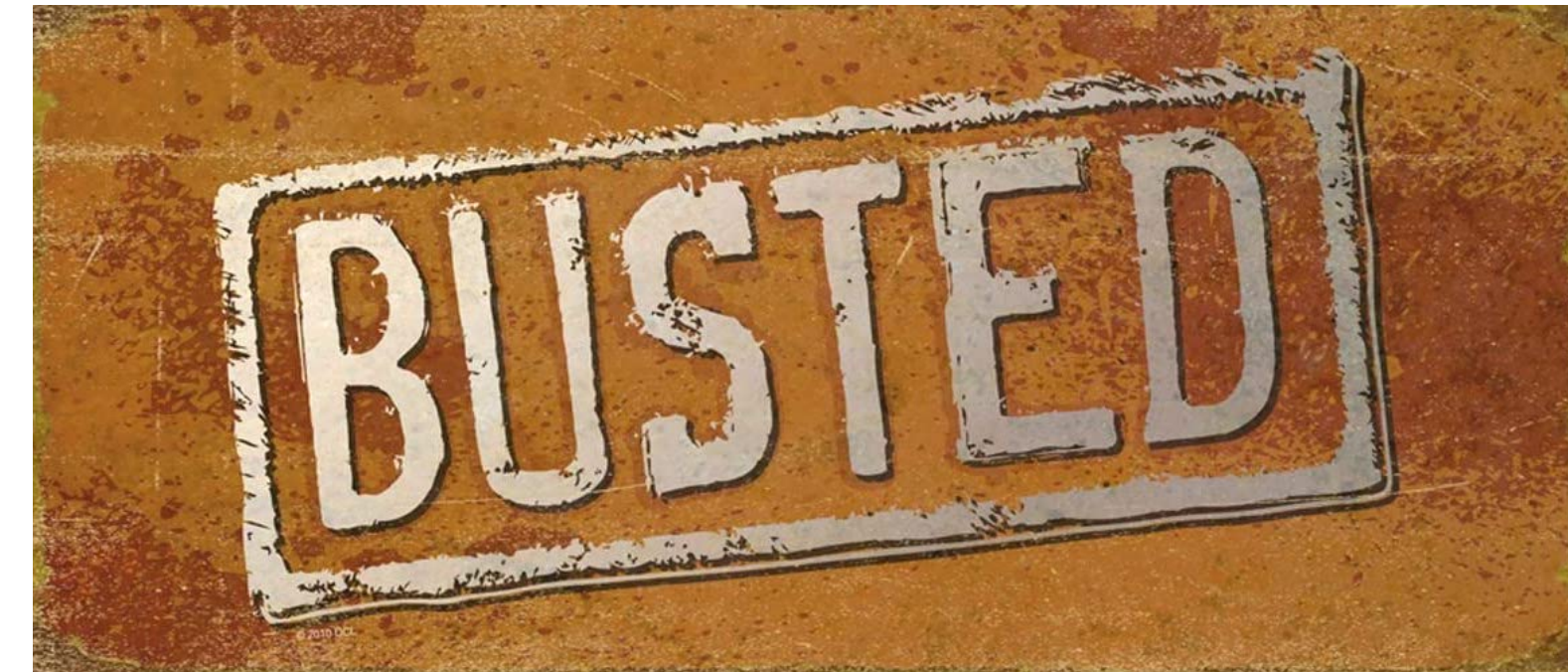
Myth #36

Always pass input arguments
by const reference



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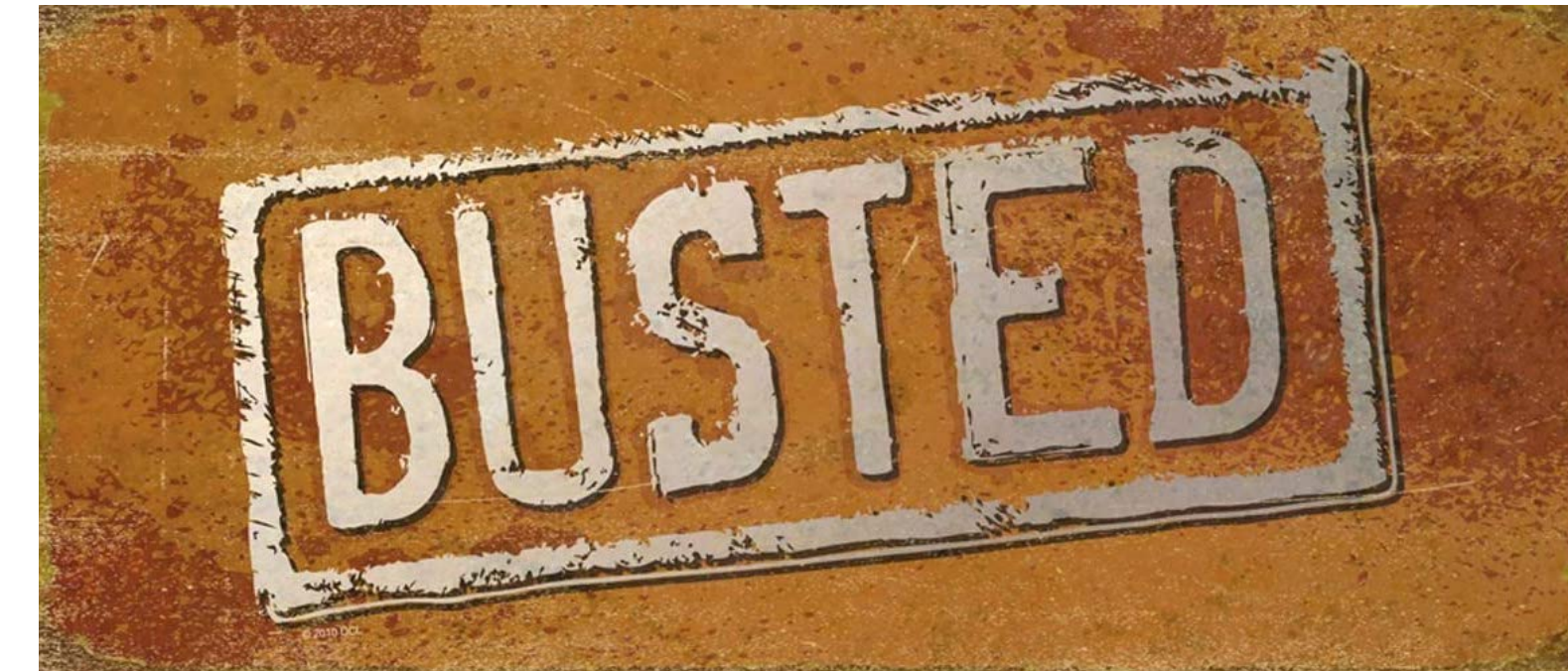


There's even a [clang-tidy modernizer](https://clang.llvm.org/extra/clang-tidy/checks/modernize-pass-by-value) check to perform this transformation at scale

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Myth #5

Adding **const** always helps

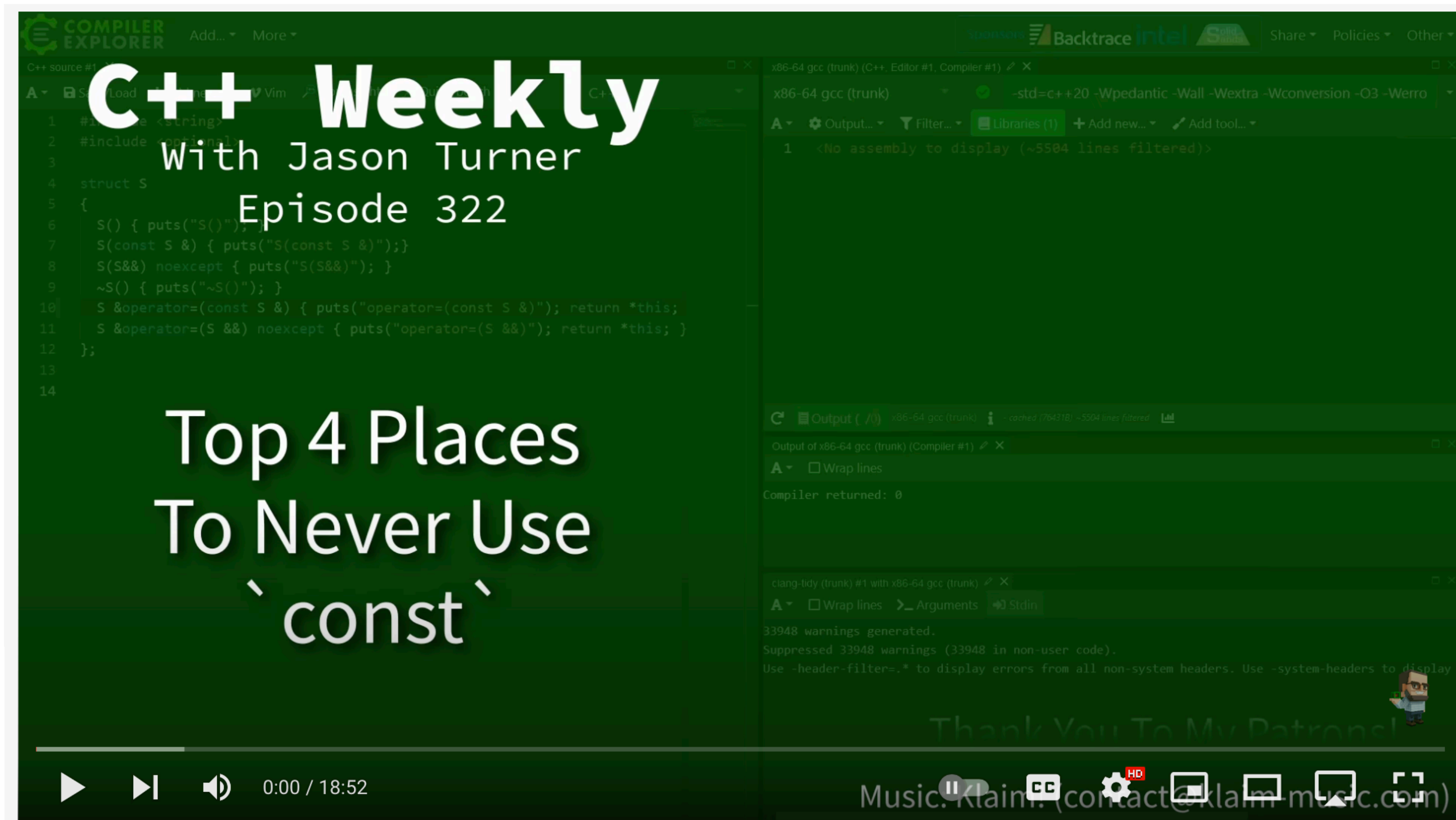
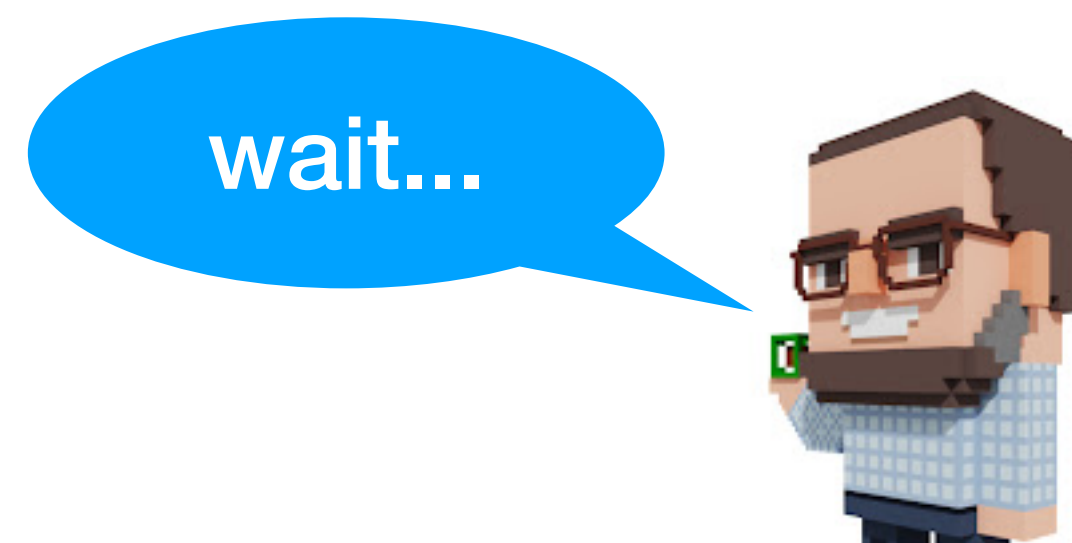
const all the things!



Myth #5

Adding **const** always helps

<https://www.youtube.com/watch?v=dGCxMmGvocE>



C++ Weekly - Ep 322 - Top 4 Places To Never Use `const`

Myth #5



compiler-explorer.com/z/9Wcc54r9x

Myth #5



Top 4 places to **never use const**:

compiler-explorer.com/z/9Wcc54r9x

Myth #5



Top 4 places to **never use const**:

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Myth #5



Top 4 places to **never use const**:

- don't `const` non-reference return types

compiler-explorer.com/z/9Wcc54r9x

Myth #5



Top 4 places to **never use const**:

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- don't `const` **local values** that need take advantage of implicit **move-on-return** operations (even if you have multiple different objects that might be returned)

compiler-explorer.com/z/9Wcc54r9x

Myth #5



Top 4 places to **never use const**:

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compiler-explorer.com/z/9Wcc54r9x

Myth #5



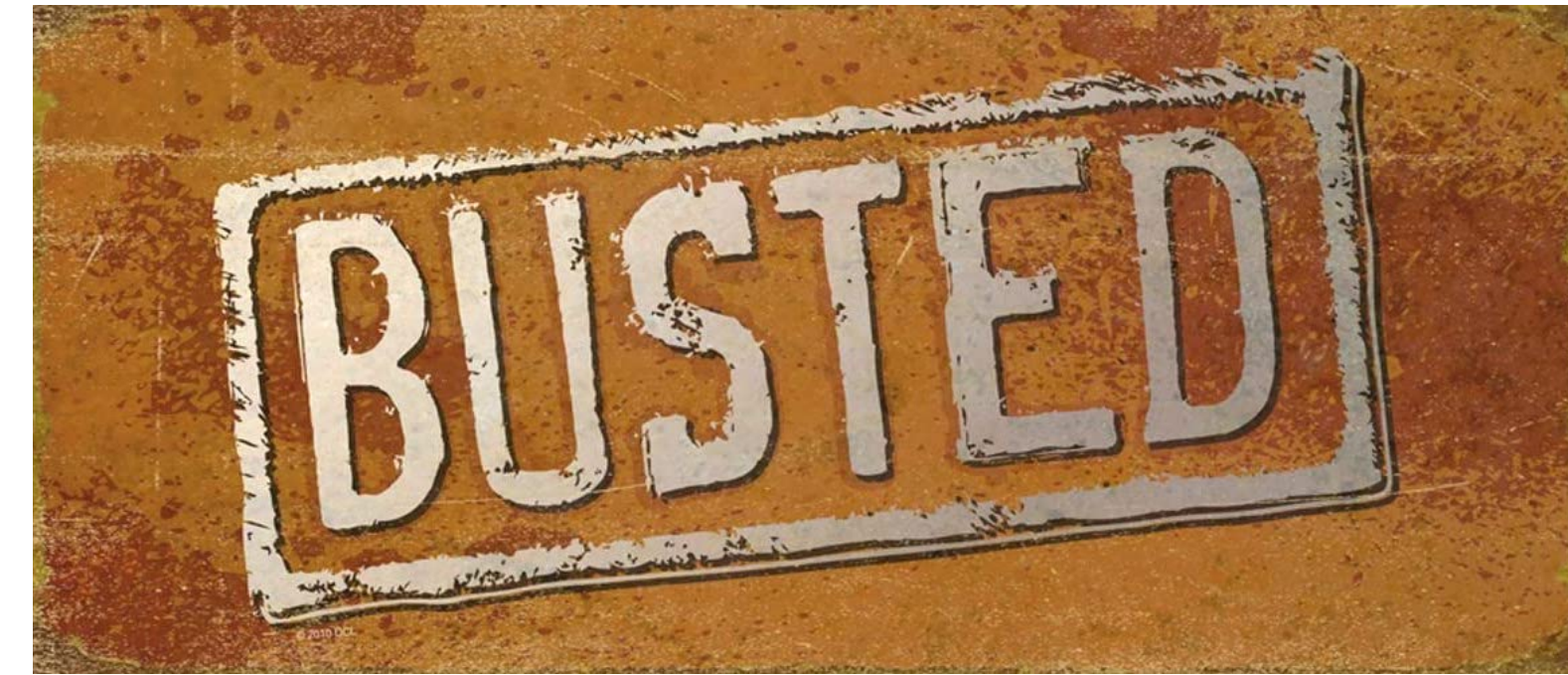
Top 4 places to **never use const**:

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- don't `const` non-trivial **value parameters** that you might need to **return directly** from the function
- don't `const` **any member data**
 - it breaks implicit and explicit moves
 - it breaks common use cases of assignment

compiler-explorer.com/z/9Wcc54r9x

Myth #5

Adding **const** always helps



Make All Data Members Private ?

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- maybe you don't need **constructors** either { }
- **refactoring** concerns

Myth #37

Make All Data Members Private ?

Sometimes `structs` just wanna be `structs` 😊

CCU
2022

[video to be published soon](#)

ABSTRACTION PATTERNS:

*MAKING CODE RELIABLY BETTER
WITHOUT DEEP UNDERSTANDING*

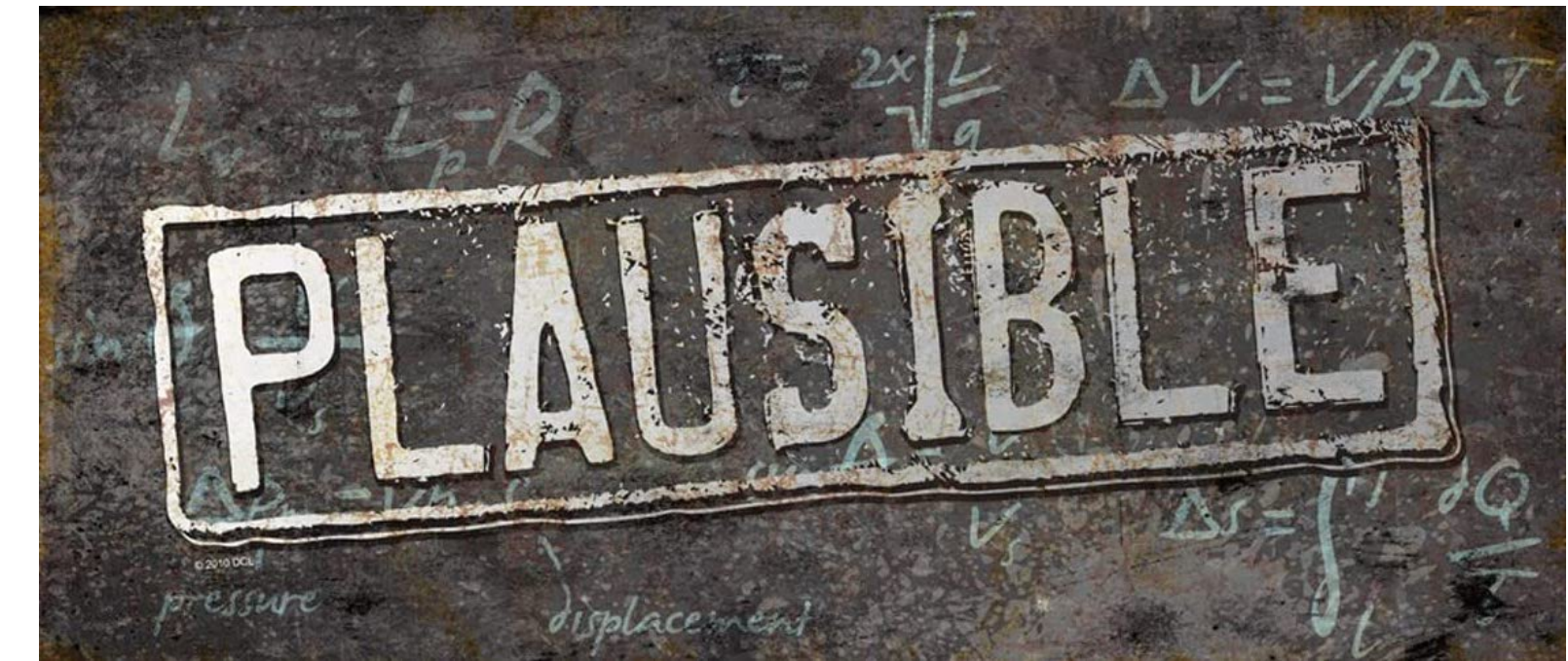
KATE GREGORY

00:02:39 / 01:24:13

Speed  

Myth #37

Make All Data Members Private ?



Sometimes `structs` just wanna be `structs` 😊

Recommended

Sometimes `structs` just wanna be `structs` 😊

While we're on the subject of `structs` ...

Recommended

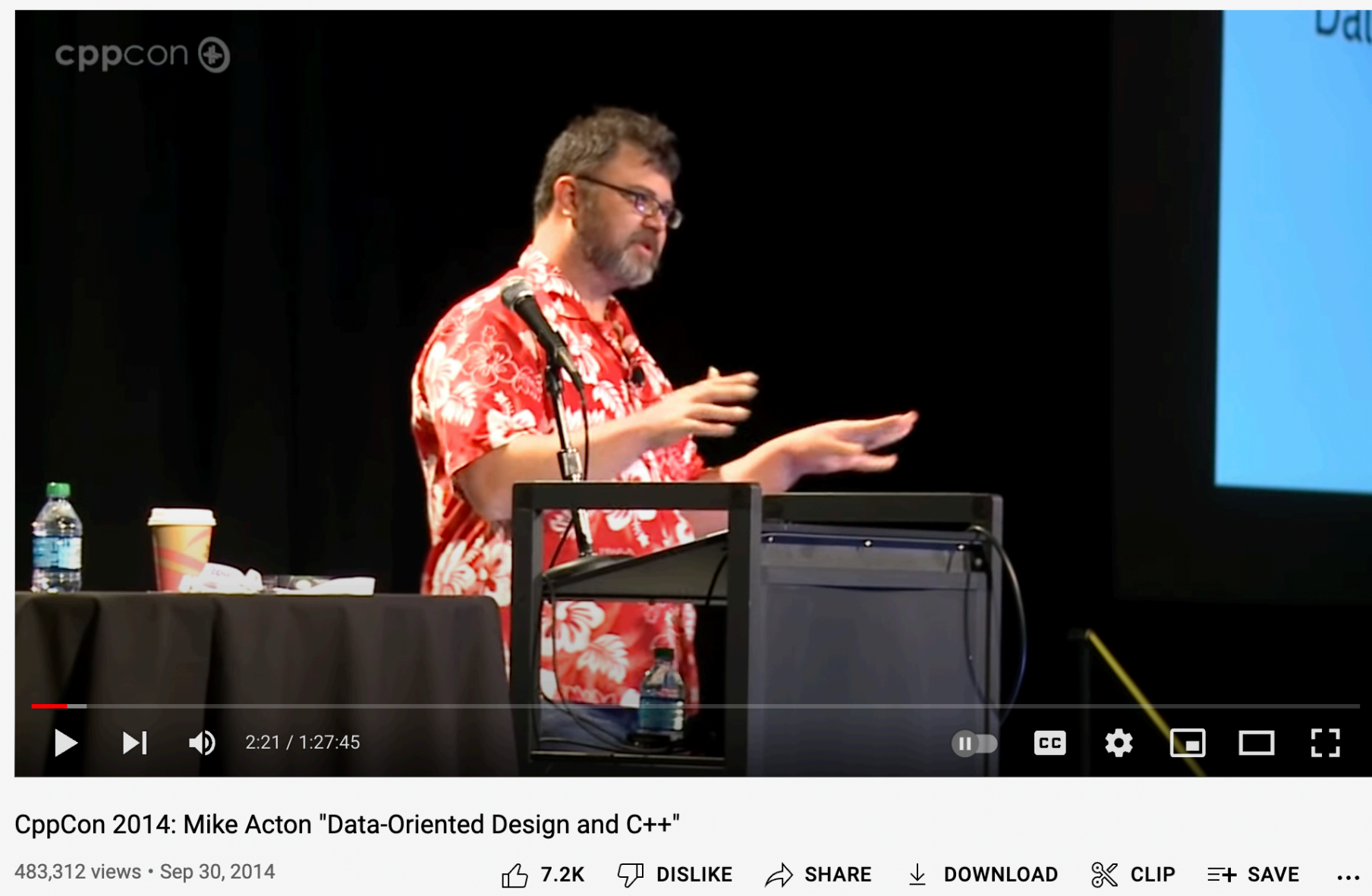


CppCon 2014: Mike Acton "Data-Oriented Design and C++"

483,312 views • Sep 30, 2014

👍 7.2K 👎 DISLIKE ➦ SHARE ⬇️ DOWNLOAD ✂️ CLIP ≡+ SAVE ...

Recommended



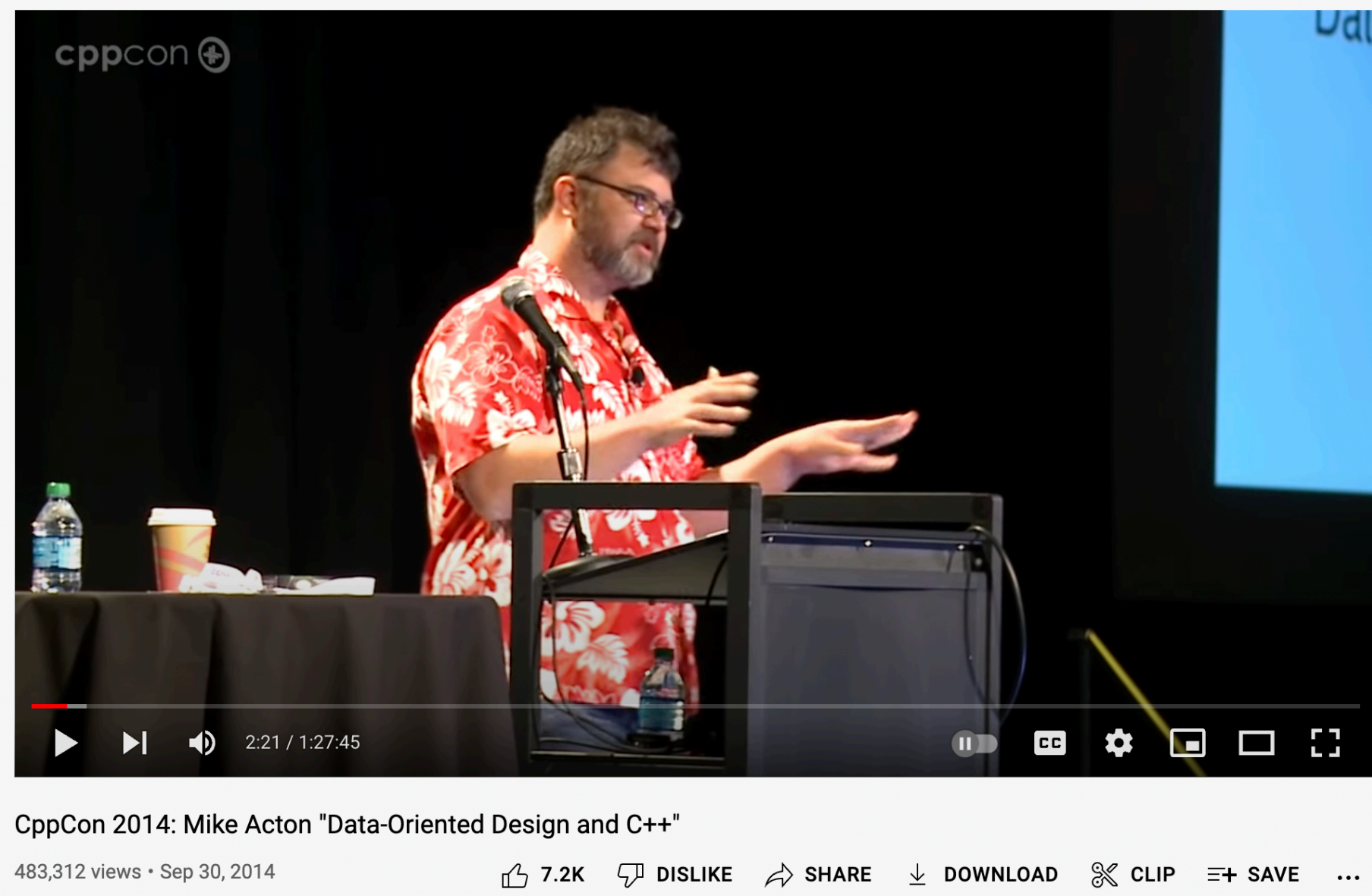
Unpopular opinion (in the C++ community):

But I still think [Mike Acton](#)'s keynote at CppCon 2014 is one of the best CppCon keynotes ever.

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Software = **Data** ➡ xForm ➡ **Data**

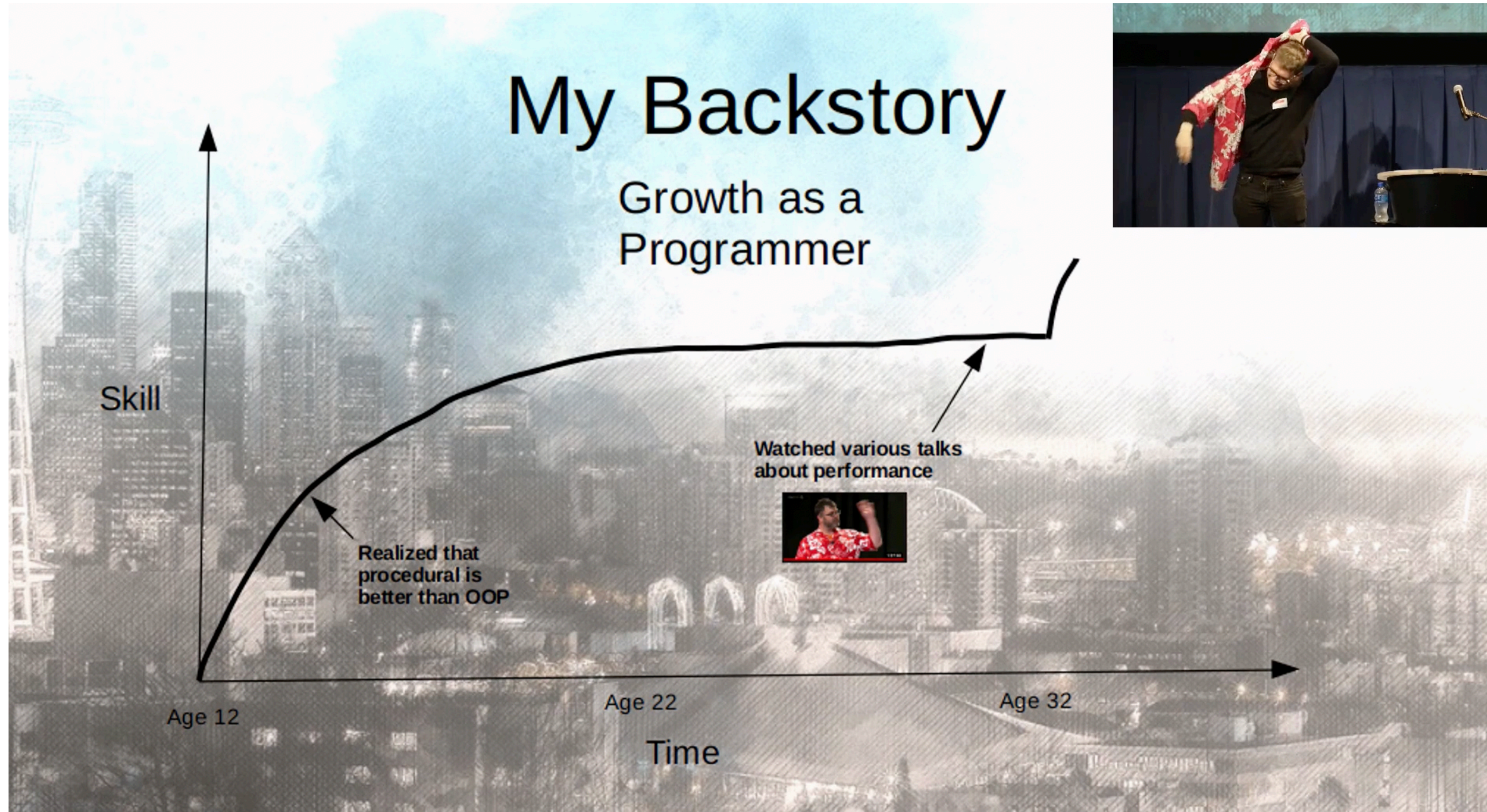
Performance = smart data layout

Memory access patterns

Recommended

A Practical Guide to Applying **Data-Oriented Design**

vimeo.com/649009599



Andrew Kelley



Myth #40

Iterators must go!

BoostCon 2009



"What's up with that?"

"Destroy!" 😊

I finally found a recording of this:

archive.org/details/AndreiAlexandrescuKeynoteBoostcon2009

Iterators must go!

BoostCon 2009



A. Stepanov: *"Alexandrescu is on a crusade to eliminate iterators [...]"*

Programming Conversations Lecture - A9

youtube.com/playlist?list=PLHxtyCq_WDLXFAEA-IYoRNQIezL_vaSX-

Myth #40

Iterators must go!

BoostCon 2009



Someone did properly "*Destroy*", but after ~12 years...

Iterators and Ranges

youtube.com/watch?v=95uT0RhMGwA



Iterators and Ranges: Comparing C++ to D, Rust, and Others

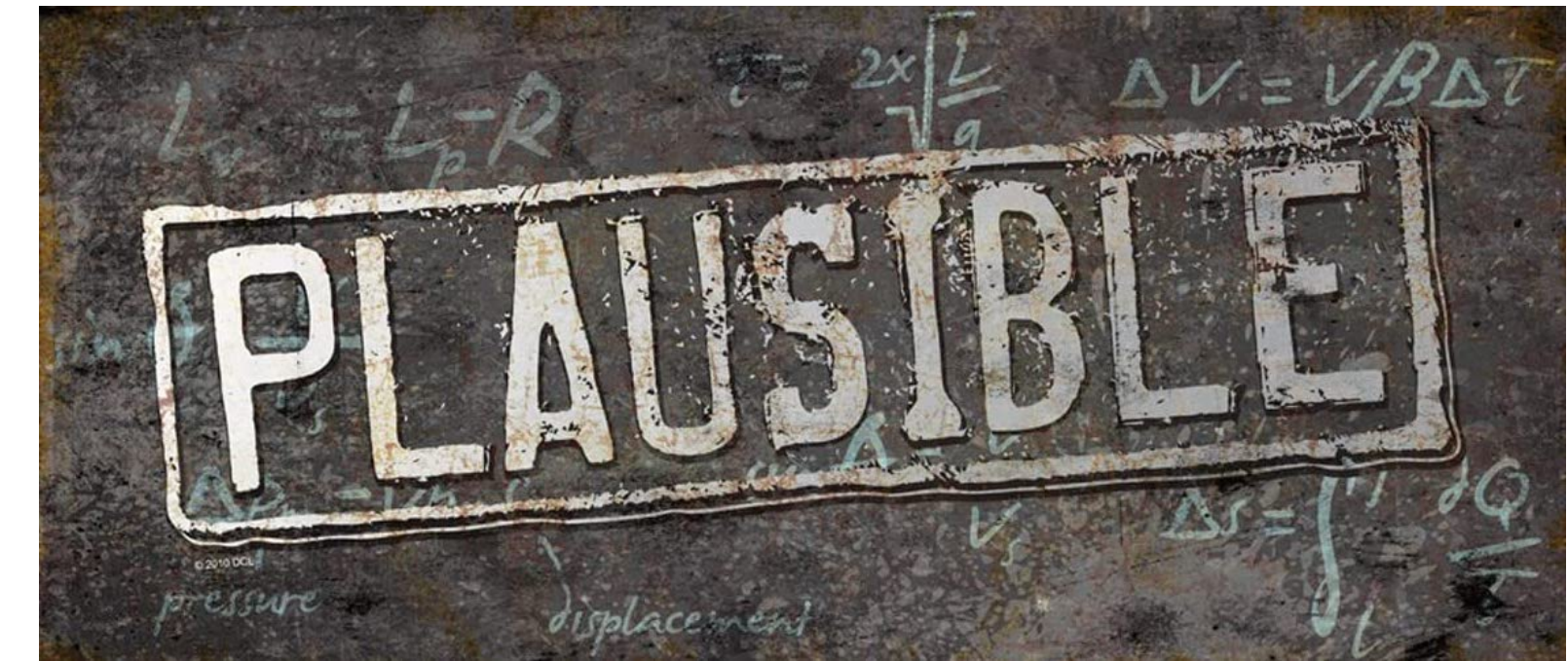
Barry Revzin



Keynote: Iterators and Ranges: Comparing C++ to D, Rust, and Others - Barry Revzin - CPPP 2021

Myth #40

Iterators must go!



New (C++) is the enemy of the old

"Before we had [\[feature\]](#), we were nonetheless able to program in C++"

- *Pablo Halpern, ACCU Conf 2022 (via Kate Gregory)*

The image shows a video player interface. The main content area displays a presentation slide with the following text:

Some Programming Myths Revisited

Patrice Roy
Patrice.Roy@USherbrooke.ca
CeFTI, Université de Sherbrooke
Patrice.Roy@clg.qc.ca
Collège Lionel-Groulx

The video player includes a progress bar at the bottom showing 0:25 / 1:00:50, and a control bar with icons for play, volume, and full screen. The video thumbnail on the right shows Patrice Roy at a podium, with the text "Patrice Roy" overlaid. The video title "Some Programming Myths Revisited" is also visible in the thumbnail area. The video player interface includes the Cppcon 2019 logo and the text "The C++ Conference" and "cppcon.org".

📍 AURORA

Some Programming Myths Revisited - Patrice Roy - CppCon 2019

youtube.com/watch?v=KNqRjzSIUVo



<Part 1 of **N**> presentation

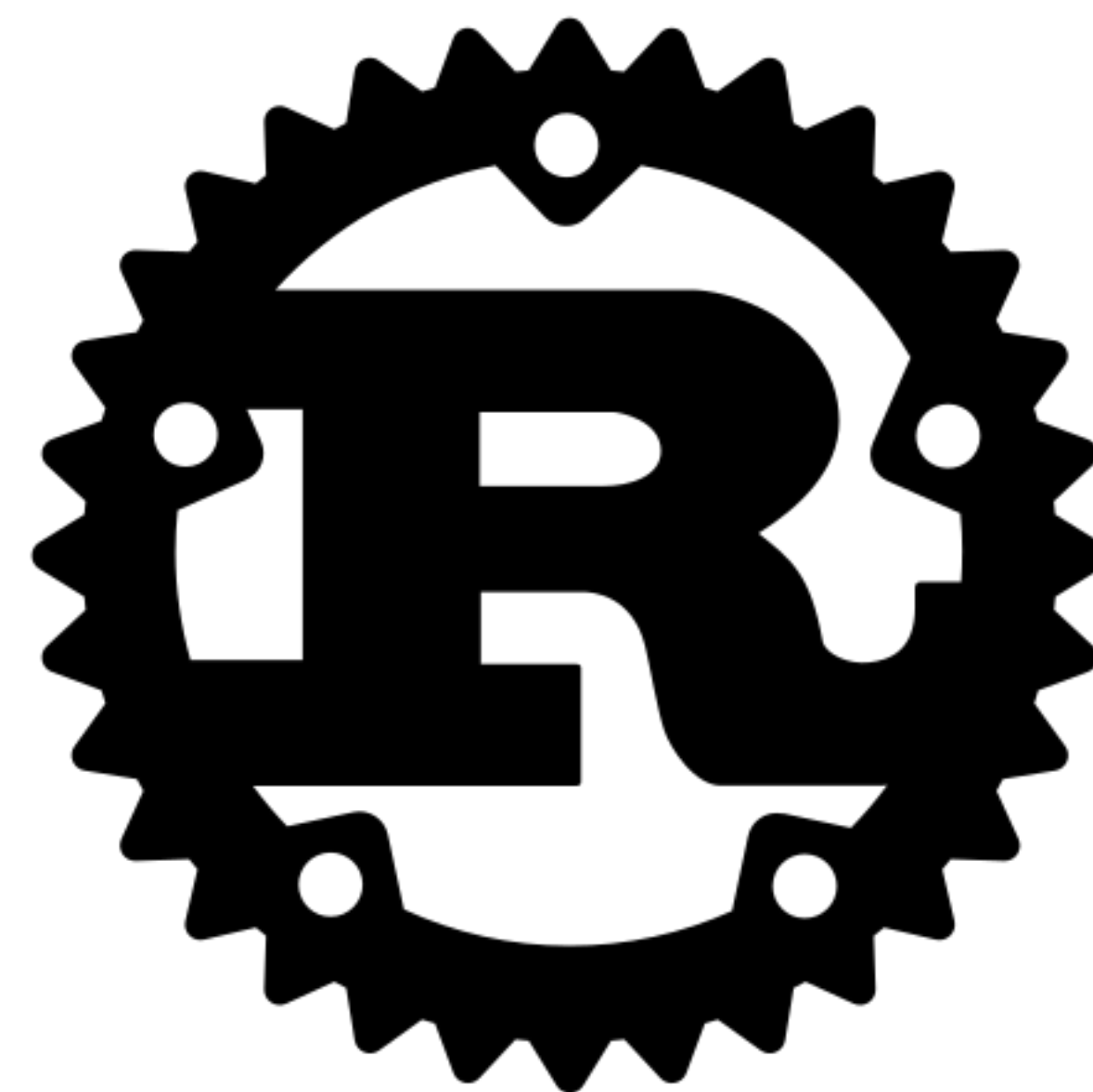
I invite other speakers to **join** this C++ Mythbusting series

Myths, in future episodes:

- strength reduction is so '90s, compilers are much smarter today
- `shared_ptr` is cheap (to copy)
- C++ templates produce code bloat
- C++ uniform initialization `{}` is to be preferred, always
- always capture `[=]` by value to avoid dangling
- `std::string` generates a lot of waste because of SSO (COW could be better)
- (N)RVO is always guaranteed
- concept checking increases build times
- function default argument values are evil
- ...

Myths, in future episodes:

- Featuring guest appearances by **Rust**
- Borrowing Trouble: the difficulties of a C++ borrow checker
- Rust and C++ interoperability
- Memory safety in Chromium
- Lifetime annotations for C++ (LLVM RFC)
- ...





C++ On Sea

July 2022



@ciura_victor

Victor Ciura
Senior SW Engineer
Visual C++

