

C++ Club Meeting Notes

Gleb Dolgich

2019-02-14

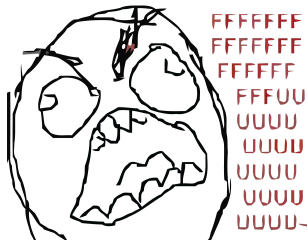
Avoid unsigned

- ▶ [P0330R4](#) Literal Suffixes for ptrdiff_t and size_t
- ▶ [P1227R1](#) Signed ssize() functions, unsigned size() functions
- ▶ [P1428R0](#) Subscripts and sizes should be signed

```
1 template <typename C>
2 constexpr int ssize(const C& c)
3 {
4     const size_t size = c.size();
5     assert(size <= static_cast<size_t>(std::numeric_limits<int>::max()));
6     return static_cast<int>(size);
7 }
```

https://youtu.be/_CaP_xwfAFU

- ▶ Initialisation is broken!
- ▶ Initialiser lists are broken!
- ▶ Auto initialisation is broken!



CppCon 2018 - Geoff Romer - What do you mean "thread-safe"?

https://youtu.be/s5PCh_FaMfM

What are we trying to be "safe" from?


Data races?

"The execution of a program contains a *data race* if it contains two potentially concurrent conflicting actions, at least one of which is not atomic...

Two expression evaluations *conflict* if one of them modifies a memory location (4.4) and the other one reads or modifies the same memory location."

— [The C++ Standard](#)

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What do you mean
"thread-safe"?

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CppCon 2018 - Geoff Romer - What do you mean "thread-safe"?

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What are we trying to be "safe" from?

Data races?

```
std::string s = "";
```

<pre>void thread1() { ... s.append("foo"); ... }</pre>	<pre>void thread2() { ... std::cout << s; ... }</pre>
--	---

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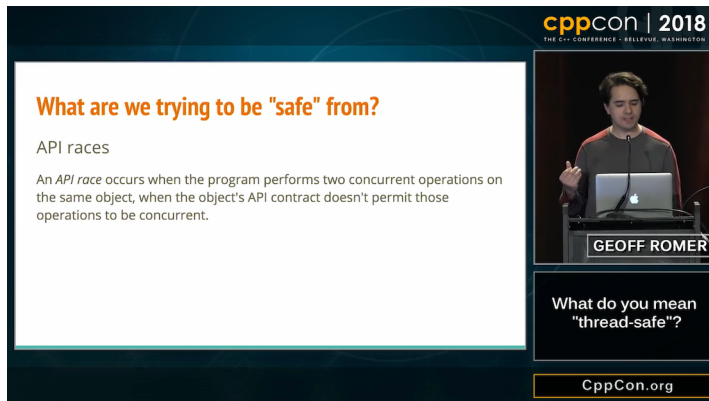
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What do you mean
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The screenshot shows a presentation slide from CppCon 2018. The slide has a dark blue header with the CppCon 2018 logo and the text "THE C++ CONFERENCE • BELLEVUE, WASHINGTON". The main content area is white with a blue border. It features a title "What are we trying to be 'safe' from?" in orange, followed by the text "API races" and a paragraph explaining that an API race occurs when a program performs two concurrent operations on the same object, which is not permitted by the object's API contract. To the right of the slide is a video feed of Geoff Romer, the speaker, standing at a podium with a laptop and a microphone. Below the video feed, the text "What do you mean 'thread-safe'?" is displayed. At the bottom right of the slide, the website "CppCon.org" is listed.

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What are we trying to be "safe" from?

API races

An *API race* occurs when the program performs two concurrent operations on the same object, when the object's API contract doesn't permit those operations to be concurrent.

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Identifying API races

```
class LazyStringView {  
    const char* data_;  
    mutable optional<size_t> size_;  
    mutable std::mutex mu_;  
  
public:  
    size_t size() const {  
        std::scoped_lock lock(mu_);  
        if (!size_)  
            size_ = strlen(data_);  
        return *size_;  
    }  
};
```

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Identifying API races

```
struct Counter {  
    int c = 0;  
    void operator()() { ++c; }  
};  
const std::function<void()> f = Counter{};  
  
void thread1() {  
    f();  
}  
  
void thread2() {  
    f();  
}
```

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Identifying API races

If a live object has a **thread-safe type**, it can't be the site of an API race.

If a live object has a **thread-compatible type**, it can't be the site of an API race if it's not being mutated.

If a live object has **any type**, it can't be the site of an API race if it's not being accessed concurrently.

... but beware of **thread-hostile functions**, which can cause API races at sites other than their inputs.

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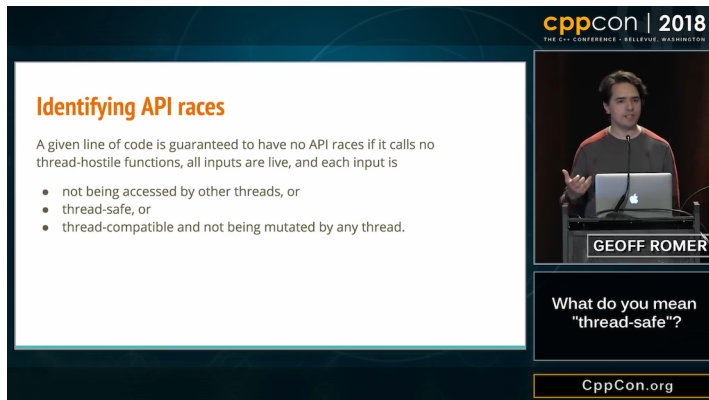
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Identifying API races

A given line of code is guaranteed to have no API races if it calls no thread-hostile functions, all inputs are live, and each input is

- not being accessed by other threads, or
- thread-safe, or
- thread-compatible and not being mutated by any thread.

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Identifying API races

```
vector<int> shared_vec = {0, 0};

void thread1() {
    ...
    ++shared_vec[0];
    ...
}

void thread2() {
    ...
    ++shared_vec[1];
    ...
}
```

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Identifying API races

```
vector<bool> shared_vec = {false, false};

void thread1() {
    ...
    shared_vec[0] = true;
    ...
}

void thread2() {
    ...
    shared_vec[1] = true;
    ...
}
```

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Recommendations

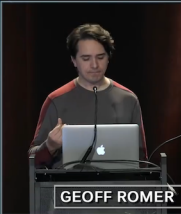
For library code:

- Make your types thread-compatible if possible, thread-safe if necessary.
- Clearly document any types that are thread-safe, or thread-incompatible.
 - Prefer to explicitly document the rest as thread-compatible.
- Be thoughtful about directly exposing sub-objects.
- Never define or use thread-hostile functions.
 - Avoid hidden mutable shared state
 - Be very careful with private pointers to shared data.

For application code:

- Make shared objects thread-safe, or thread-compatible and immutable.

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Proper way to iterate backwards in C++

https://www.reddit.com/r/cpp/comments/947a1z/proper_way_to_do_backward_iteration_in_c/

```
1 for (size_t i = data.size() - 1; i >= 0; --i) { ... } // Nope
2 for (size_t i = data.size(); i--;) { ... } // The C way
3
4 // C++17
5 std::vector<int> vec;
6 for (auto [value, idx] : reverse_index_adapter(vec)) {
7     // idx = n-1, n-2, ... 0
8 }
9
10 std::for_each(vec.rbegin(), vec.rend(), []( ) { ... }); // No index
11
12 for (auto it = data.rbegin(); it != data.rend(); ++it) {
13     auto i = std::distance(it, data.rend()) - 1;
14 }
```

https://youtu.be/S7l66lZX_zM

Inverse two-phase initialisation

```
1 class Foo
2 {
3     static expected<construction_token>
4     preconstruct(Arg n_arg) noexcept
5     {
6         construction_token t;
7         t.state = make_unique_nothrow(n_arg);
8         if (!t.state) return unexpected(my_errc::error);
9         return t;
10    }
11
12    Foo(construction_token&& t) noexcept
13    : m_state(std::move(t.state)) {}
14 };
```

https://youtu.be/S7l66lZX_zM

Inverse two-phase initialisation: usage

```
1 // 1
2 expected<Foo::construction_token> t1 = Foo::preconstruct(args);
3 if (!t1.has_value()) { /* get out */ }
4 Foo obj(std::move(*t1));
5
6 // 2
7 auto t2 = Foo::preconstruct(args);
8 auto obj_ptr = std::make_shared<Foo>(std::move(*t2));
9
10 // 3
11 auto t3 = Foo::preconstruct(args);
12 std::vector<Foo> objects;
13 objects.emplace_back(std::move(*t3));
```


<https://youtu.be/tsG95Y-C14k>

```
1 // MSVC rejects, GCC accepts, Clang accepts
2 extern extern "C++" extern "C" extern "C++" int x;
3
4 // MSVC accepts, GCC rejects, Clang accepts
5 extern "C++" extern "C" extern "C++" extern int x;
```

<https://youtu.be/tsG95Y-C14k>

selection-statement:

`if constexpropt (init-statementopt condition) statement`

```
1 if (class foo; !ret.second) /* ... */;  
2  
3 if (false; true) /* ... */;  
4  
5 if (; true) /* ... */;
```

<https://youtu.be/tsG95Y-C14k>

Declare and initialise a variable of type "function pointer":

```
1 | auto (*fp)() -> int(&f);
```

<https://youtu.be/tsG95Y-C14k>

```
1 struct foo;  
2 void bar(foo foo);  
3 void bar(foo(foo)); // vexing parse  
4 void bar(foo((foo))); // more vexing parse
```

<https://youtu.be/tsG95Y-C14k>

```
1 class bar {};  
2 int bar;      // OK  
3 bar b;        // error  
4 class bar b;   // OK  
5 class std::vector<class bar> bars; // OK  
6  
7 // also acts as a forward declaration  
8 void foo(struct S* x);  
9  
10 // weird scoping rules  
11 class C { void foo(struct S* x); };  
12 S* s;
```

<https://youtu.be/tsG95Y-C14k>

pseudo-destructor-name

```
1 int i;  
2 i.~int(); // error: int is not type-name but type-specifier  
3 using foo = int;  
4 i.~foo(); // OK  
5 ~int(); // OK (not a destructor!)
```

<https://youtu.be/tsG95Y-C14k>

Alternative tokens

```
1 struct Foo
2 {
3     Foo();
4     compl Foo();
5     Foo(const Foo bitand);
6     Foo(Foo and);
7 };
```

CppCon 2018: Matt Godbolt “The Bits Between the Bits: How We Get to main()”


<https://youtu.be/dOfucXtyEsU>

Daniele Pallastrelli - Reduce Compilation Times With **extern template**

<https://arne-mertz.de/2019/02/extern-template-reduce-compile-times/>

Move smart pointers in and out functions in modern C++

- ▶ Move smart pointers in and out functions in modern C++
 - ▶ **Reddit:** https://www.reddit.com/r/cpp/comments/aaux96/move_smart_pointers_in_and_out_functions_in/



Lynn
@chordbug

🌶️ HOT JAVASCRIPT TIP: 🌶️

to increment some counter on the page,

```
node.innerText += 1
```

doesn't work ($0 \rightarrow 01 \rightarrow 011 \rightarrow \dots$), but

```
node.innerText -= -1
```

works fine ($0 \rightarrow 1 \rightarrow 2 \rightarrow \dots$)

4,127 Likes	1,490 Retweets
5 Feb 2019 at 16:36	via Twitter Web Client