C++ Committee Trip Report

Kona 2022

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The main task of the Kona meeting

NB comment processing

- Comments from *national bodies* after review of the *committee draft* must be answered.
- Basically, this is the bugfix phase of the standard.
- Comments must be processed & answered by the next meeting, where we finalize C++23.

Highlights

- P2644R1 Lifetime of temporaries in range-based `for` extended
- P2589R1 `static operator[]` (for consistency with `static operator()`)
- P2647R1 Permit `static constexpr` variables in `constexpr` functions
- P2564R3 `consteval` needs to propagate up
- P2505R5 “Monadic Functions for std::expected”

P2644R1 Lifetime of temporaries in range-based for extended

```cpp
std::vector<int> f();
for (auto i : range) { /*...*/ } // OK, no temporary
for (auto i : f()) { /*...*/ } // OK, temporary lives long enough
for (auto i : f() | std::views::drop(1)) { /*...*/ } // undefined behavior
```

```
for (for-range-declaration : for-range-initializer ) statement
```

is equivalent to

```
{
  auto &&range = for-range-initializer;
  auto begin = begin-expr;
  auto end = end-expr;
  for ( ; begin != end; ++begin ) {
    for-range-declaration = *begin;
    statement
  }
}
```

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scientific computing related (C++26)

1. linear algebra (free functions on `mdspan`)
   - hard to specify without specifying too much
2. `submdspan`
   - introduces vocabulary for a strided index range
3. `std::matrix<...>`
   - vectors are now simply $N \times 1$ or $1 \times N$ matrices

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further progress

1. ongoing work on improving template metaprogramming, esp. the ergonomics of *packs*
2. `#embed`
3. allowing `static_assert(false)`
4. debugging support
   - `std::breakpoint()`
   - `std::breakpoint_if_debugging()`
   - `std::is_debugger_present()`
5. pattern matching exploration continued
6. plan for new standard: C++ ecosystem
7. aggregates are named tuples

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Aggregates are named tuples (C++26)

```
struct foo {
  int id;
  float x, y, z;
};

static_assert(std::tuple_size_v<foo> == 4);
static_assert(std::same_as<std::tuple_element_t<0, foo>, int>);
static_assert(std::same_as<std::tuple_element_t<1, foo>, float>);
static_assert(std::same_as<std::tuple_element_t<2, foo>, float>);

void f(foo x) {
  assert(std::get<0>(foo) == foo.id);
  assert(std::get<3>(foo) == foo.z);
  assert(&std::get<3>(foo) == &foo.z);
}
```

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```

You will be able to use a `struct` where a `std::tuple` is required now

Pattern matching (C++26?)

P2211R0 syntax:

```
struct FireBlasters {
  int intensity;
  bool operator==(const FireBlasters&) const = default;
};
enum Direction{ Left, Right };
struct Move {
  Direction direction;
  bool operator==(const FireBlasters&) const = default;
};
using Command = std::variant<FireBlasters, Move>;

std::string cmdToStringV2(Command cmd) {
  return inspect(cmd) {
    <FireBlasters> [i] => std::format("Fire Blasters with power {}", i);
    <Move> [case Left] => std::string("Move Left");
    <Move> [case Right] => std::string("Move Right");
  };
}
```

my paper P2600R0 in EWG

EWG	The (language) Evolution Working Group
P2600R0	my paper "A minimal ADL restriction to avoid ill-formed template instantiation"

- related to what I presented on ADL in this group
- prerequisite to further evolution of operator overloading in C++
- which, in turn, is a prerequisite for better integration of `simd`

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SG1	Subgroup on parallelism & concurrency
P1928R1	my paper “Merge data-parallel types from the Parallelism TS 2”

- wants to turn `std::experimental::simd` into `std::simd` for C++26

Three polls were taken and unanimously approved:

1. After significant experience with the TS, we recommend that the next version (the TS version with improvements) of `std::simd` target the IS (C++26)
2. We like all of the recommended changes to `std::simd` proposed in p1928r1 (Includes making all of `std::simd constexpr`, and dropping an ABI stable type)
3. Future papers and future revisions of existing papers that target `std::simd` should go directly to LEWG. (We do not believe there are SG1 issues with `std::simd` today.)

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Intel’s papers P2638R0 and P2663R0

P2638R0 “Intel’s response to P1915R0 for `std::simd` parallelism in TS 2”
P2663R0 “Proposal to support interleaved complex values in `std::simd`”

- P2638R0 propose a few changes to the TS design
- more importantly, both papers propose more features, simplifying the use in more diverse fields

SG1 voted to go ahead with everything proposed, deferring further review to LEWG.

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(memory-) safety in C++

hot 🔥 topic

P2676R0	“The Val Object Model” by Dave Abrahams, Sean Parent, Dimitri Racordon, David Sankel
P2687R0	“Design Alternatives for Type-and-Resource Safe C++” by Bjarne Stroustrup, Gabriel Dos Reis
evening session	“future of C++”

US companies are breaking away

- Google seems to place all their bets on *Carbon*
- Adobe, Microsoft, Bloomberg, …
  they all need an answer to the executive order calling out “C/C++” as memory unsafe.

(memory-) safety in C++ (2)

- goal: reduce *security* issues in C++ code (CVEs and CWEs)
- goal: make C++ easier to use (i.e. to write *correct* code)
- I believe there is consensus that we cannot only blame user errors

Two road blocks:

1. users must use newer compilers, language standards, and migrate to new facilities
2. making “unsafe” code ill-formed breaks compatibility (which is why C++ is regarded as just as unsafe as C — arguably unfairly so)

Is it still C++ then?

We cannot make C++ safe by default without breaking compatibility.

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personal opinion

- “The Val Object Model” is worth a good look
- Can we integrate new parameter passing so that ...
  - users can pass values, avoiding the pitfalls of references and pointers?
  - local reasoning is maximized (better optimization, less incorrect code)?

- I’d like to focus a lot more of my effort on this topic, but I’m already overworked.
- How can the science C++ userbase take a more active role here? 🤔

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Meeting Rooms

Projecting ephemeral parts | An end to proxy problems

```
type Angle {
  public var radians: Double

  public property degrees: Double {
    inout {
      var d = radians * 180.0 / Double.pi
      yield &d
      radians = d * Double.pi / 180.0
    }
    set(newValue) {
      radians = newValue * Double.pi / 180.0
    }
  }
}
```

Meeting Rooms

Around the Hotel

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Kona Misc.

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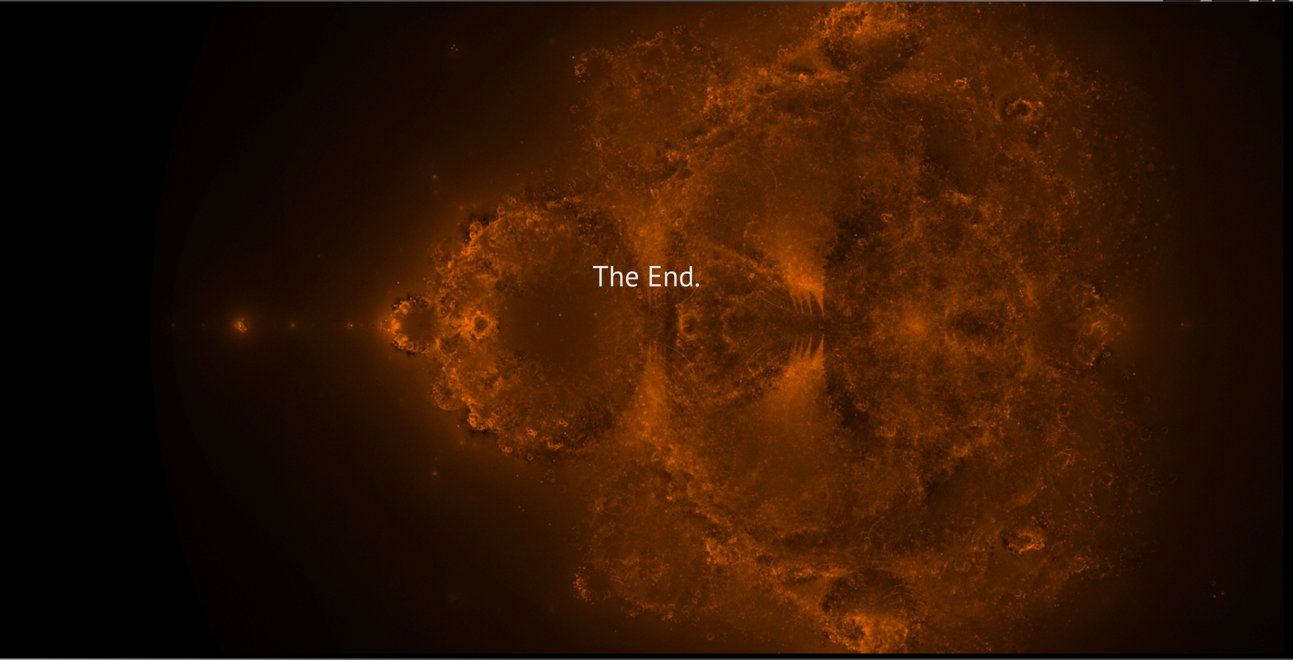
Flying back Home



The End.