What Do We Mean When We Say Nothing At All?

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Who Do We Write For?

- The compiler?
    - A little
    - But compilers don’t care whether things are called Foo or UpdateOrders
- Ourselves right now?
    - Sure
- Ourselves later?
    - Definitely
- Others later?
    - Whether we like it or not

Writing Code is a Form of Communication

Reading Code

- What the heck does this do?
- Why is it doing that?
- Are we sure this actually works?
- What no-talent sad beginner wrote this?
  - Oh, right, me
- I bet that silly goose never considered …

Well Written Code

- Works
- Works in other compilers and on other platforms
- Has considered those questions and pre-answers them

- Expressive
- Transparent
- Communicative

```
/*
orders.cpp
Purpose: Calculates the total of all orders
Author: Jo Programmer
Last Modified: 4/10/06
*/
```

Roger Orr’s Favourite Code Snippet

```
}
```

Introducing

Saying Nothing Sometimes Means Nothing

```
class Holder
{
private:
     int number;
public:
     Holder(int i);
     Holder();
     void inc() { number++; }
     int getNumber() { return number; }
     std::string to_string();
};
```

Saying Nothing Sometimes Speaks Volumes

```
class Holder
{
private:
	int number;
public:
	explicit Holder(int i);
	Holder();
	void inc() { number++; }
	int getNumber() const { return number; }
	virtual std::string to_string() const;
};
```

Some things in C++ are paired with their opposites

- Operators
  - + -
  - * /
  - * &
- Brackets
  - ()
  - {}
  - []
  - <>
- Keywords
  - if else
  - noexcept noexcept(false)

Most things don’t really have opposites

- break
- continue
- return
- foo(x)
- while, for, switch

Let’s talk about these…

- virtual, override
- explicit
- const
    - mutable? Not always
- mutable
    - On a lambda
- public, private
    - In a struct vs in a class
- Ref-qualifiers on a function or on function parameters
- New C++ 17 attributes

Fallthrough

```
switch (i)
{
case 1:
case 2:
   msg += "case 1 or case 2. ";
break;
case 3:
   msg += "case 3 or ";
case 4:
   msg += "case 4.";
default:
   break;
}
```

Fallthrough

```
switch (i)
{
case 1:
case 2:
   msg += "case 1 or case 2. ";
break;
case 3:
   msg += "case 3 or ";
   //fallthrough
case 4:
   msg += "case 4.";
default:
   break;
}
```

Fallthrough

```
switch (i)
{
case 1:
case 2:
   msg += "case 1 or case 2. ";
break;
case 3:
   msg += "case 3 or ";
   [[fallthrough]];
case 4:
   msg += "case 4.";
default:
   break;
}
```

Maybe Unused

```
int j = FunctionWithSideEffects();
assert(j > 0);

[[maybe_unused]] int j = FunctionWithSideEffects();
assert(j > 0);
```

No Discard

```
int getNumber() { return 42; }

auto num = getNumber();
getNumber();

[[nodiscard]] int getNumber() { return 42; }

auto num = getNumber();
getNumber();
```

discarding return value of function with 'nodiscard' attribute

How Can You Be Clearer About Intent?

- Avoid defaults
  - In a class or struct, always include public: and private:
    - Yes, even in a two-element struct like Point
  - Add a return at the end of your void function
- Use those optional things
  - Mark overrides of virtual functions with override
  - Use noexcept(false) if you’ve thought about it
- Sure, they’re not needed, but using them carries meaning
  - Saves others guessing about whether you considered it

How Can You Be Clearer About Intent?

- There is a limit to how verbose you can be
- We do not have these keywords
  - implicit
  - const(false)
  - nonvirtual
  - ByVal
- What should you do?

// I know what I’m doing, don’t change this

// note: passing by value

Context

- Absence of a keyword means one of two things
    - I’ve thought about it and I don’t need *keyword* here
    - I have never heard of *keyword*, or at least haven’t considered whether or not to use it here
- If you use it routinely and consistently throughout the codebase, readers can (possibly? With some certainty?) rule out that second option
- Comments?
    - Only for cases that deceive

```
// I know this looks like it might be an override
// of foo but it’s actually a different signature
```

Optional Return Statements

```
void Thimbule(int robbit)
{
    robbit ++;
    if (robbit)
       return;
    robbit --;
}
```

```
void Sprial(int oob, int boo)
{
    oob ++;
    while (true)
    {
       if (++oob > boo)
          return;
    }
}
```

Ranged For

```
for (auto emp : department)
{
   // ...
}
for (auto& emp : department)
{
   // ...
}
for (auto const & emp : department)
{
   // ...
}
```

Parameter Passing

- `Order createOrder(Customer c, OrderItem oi);`
  - Are you sure?
- `Order createOrder(Customer& c, OrderItem oi);`
  - Pass the order item by value, then move? Copy?
- `Order createOrder(Customer const & c, OrderItem oi);`
  - Oh, Customer objects don’t know their orders?

Omitting Parameter Names

- You can in the declaration
  - Compiler etc don’t care
  - Humans care, so don’t
- You also can in the definition
  - If it’s an unused parameter
  - (virtual function, api drift, whatever)
  - Suppresses compiler warning
  - Big signal to humans
- So, why not follow the same pattern in declaration?

```
int DetermineTotalTaxes(int, int, int);
```

```
int DetermineTotalTaxes(int ProvRate, int FedRate, int)
{
  //whatever
  return 42;
}
```

```
int DetermineTotalTaxes(int ProvRate, int FedRate, int);
```

What Other Choices Can Speak Volumes?

Is A Raw Pointer Always A Non-owning Pointer?

```
bool sendEmails(Employee* pe)
```

```
Message* sendEmails(Employee* pe)
```

- Does this code use smart pointers?
- Is there a lot of new and delete? Rule of 3 or 5?
    - Are there any destructors anywhere?

What Does & Mean? *?

- Is something passed by address or reference as non-const always changed?
- Is there any meta-meaning to passing by address vs by reference?
  - Many style guides suggest pass-by-address to transfer ownership
  - This isn’t about what the compiler thinks
  - You have nothing in the code that mentions owning, yet maybe you’re speaking about owning anyway?

Is A Traditional `for` Loop Always Doing Something Odd?

- Why did I choose that loop?
  - Does it touch every element?
  - Was there a reason not to use a ranged for?
- Isn’t there an algorithm for that?
  - Is this something without a name we all know
    - find, count, all_of, sort, …
  - If you use algorithms when you can, then your choice of a loop gets my attention

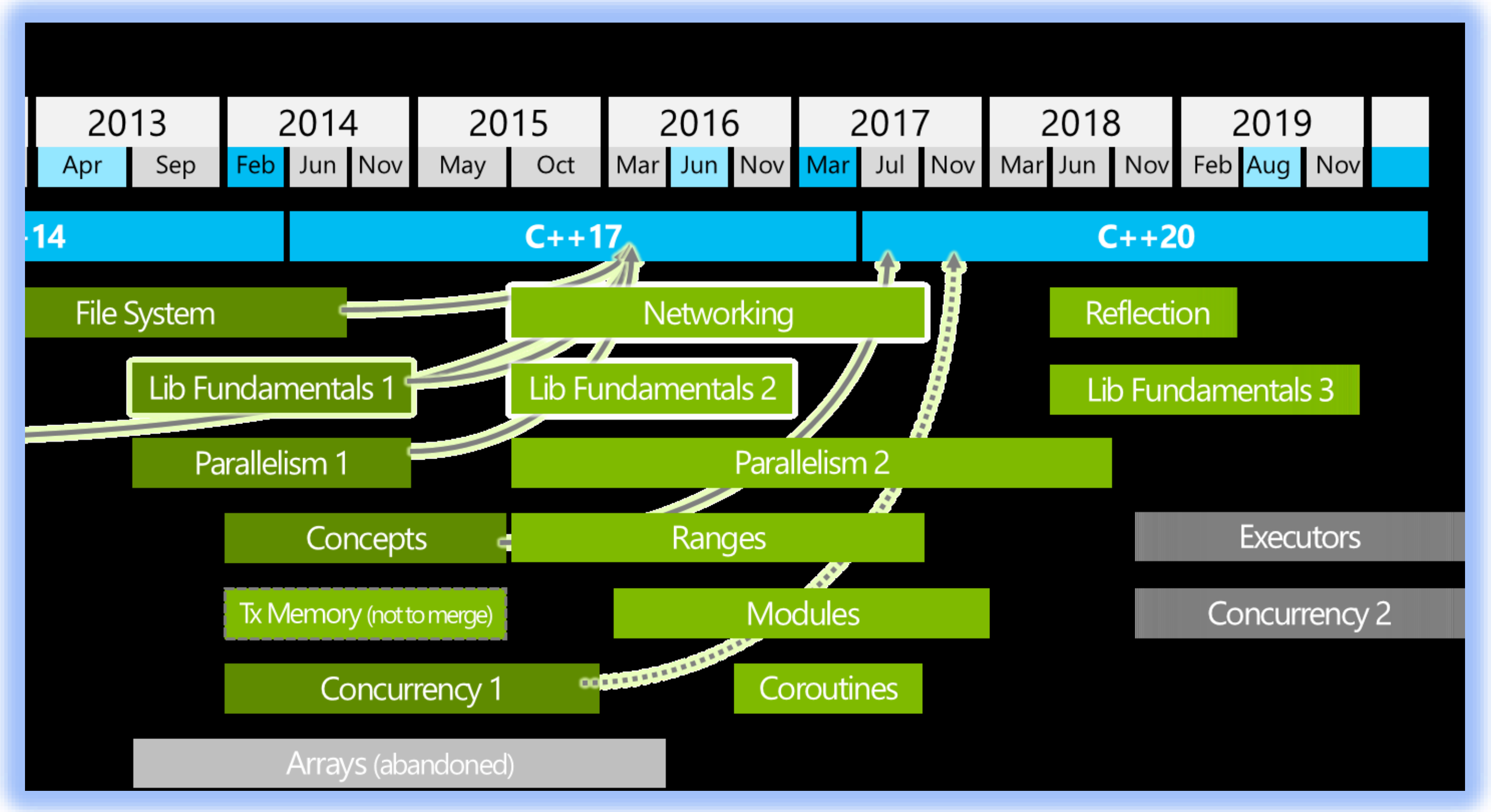
Initializing

- If a constructor doesn't set a member variable after `:`, perhaps:
  - There's a nonstatic member initializer that does
  - It gets set in the body
    - Why?
  - It was forgotten when the member was added to the class
    - Bonus points: forgotten in only one of the 5 constructors

- What does it mean when I initialize something to its default value?
  - `string s = "";`
  - `vector<Employee> department(0);`

Could The Language Help Us?

- Should we add keywords or attributes? Would you use them?
  - implicit
  - const(false)
  - nonvirtual
  - ByVal
- Are you using fallthrough and maybe_unused?
  - Why not?



Call To Action

Communicate

- Clear code involves thinking about what you are telling the future reader
- Show them why you did this
- No puzzles or mysteries
- No chance to think you were foolish or ill-informed

What is Not in Your Code?

- Think about what you’re not including or doing
- The other ways you could have done this
- The other choices you could have made
- Can people learn from a seemingly arbitrary choice?

Nothingness

- Can you express your choice without nothingness?
  - A little verbosity goes a long way
- If the only way to express yourself is with nothingness, then fine, but make that nothingness speak
  - Context
  - Show your colours

Use Nothing In a Generous Way

- Give that future reader all they need
- Make sure your nothing speaks volumes
- Ensure that they will understand