Boost and C++11

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Administrivia

- Assignment two is out tonight, LaIR times will be posted on the website
- Sunday 8-12 this week
- If you have questions, send me email or come to LaIR hours

Administrivia

Apply to section lead!

Assignment One Feedback

Overall, submissions were very good.

Let's go over some of the common problems though

Assignment One Feedback

There were four main lessons in this assignment

- File I/O
- Basic usage of data structures to transform values
- Reading basic user input
- Looping for a specified amount of time

Assignment One Feedback

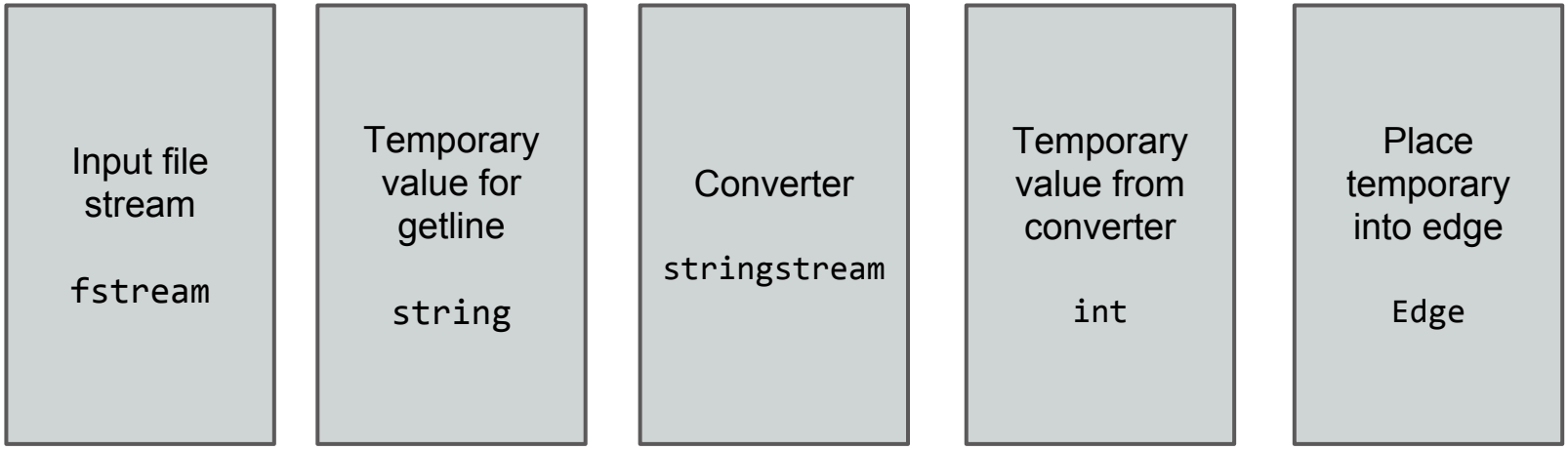
Biggest issue: File I/O
Many used getline and a stringstream to read integers from the file

Assignment One Feedback

Let's look at some correct but overly verbose file reading code.

Assignment One Feedback

Biggest issue: File I/O
Many used getline and a stringstream to read integers from the file



Assignment One Feedback

Biggest issue: File I/O

The following code is the easiest way to read in a graph:

```
size_t numNodes;
input >> numNodes;

Edge e;
while (input >> e.start >> e.end)
  graph.edges.push_back(e);
```

Assignment One Feedback

- Mixing getline and >> will result in bad things!
  - Extraneous data can be left sitting on the stream
  - In general, you should only use one or the other
  - See slides on streams for more details

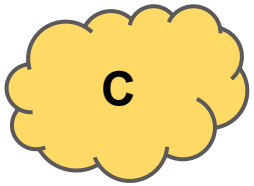
Assignment One Feedback

- Updating nodes as you iterate through them
  - If you apply attractive or repulsive forces before calculating **all** forces, then nodes will have different positions
  - This will affect the computation of later forces!

Changing C++

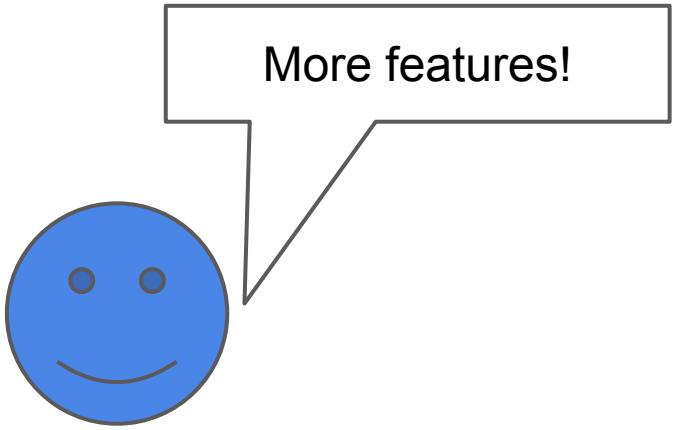
Now let’s take a quick look at the growth of C++ as a language over the years

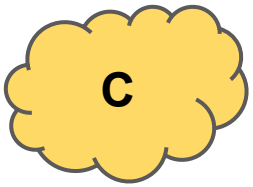
Changing C++



Changing C++

1979: 1 user





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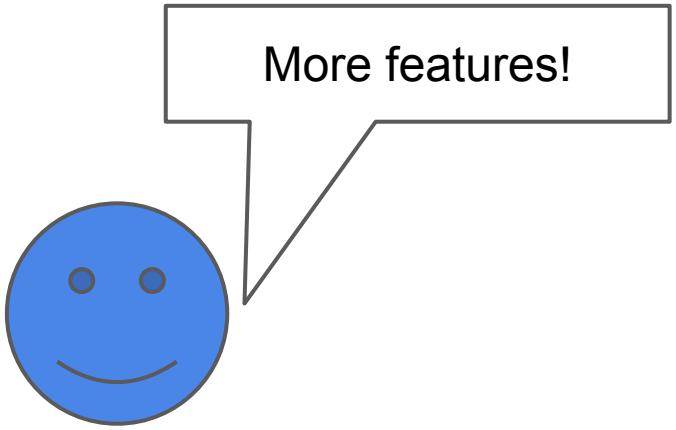

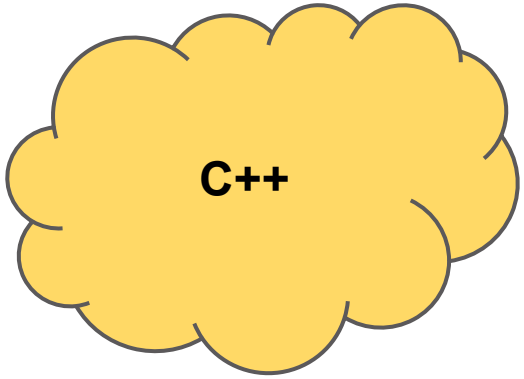

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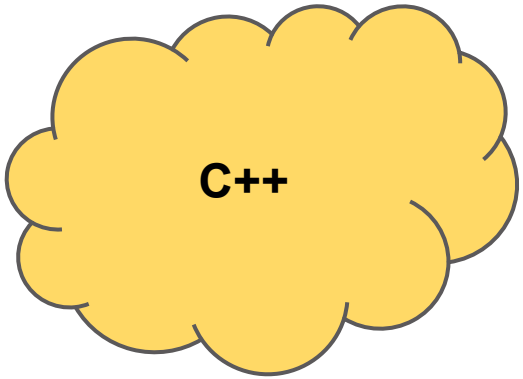
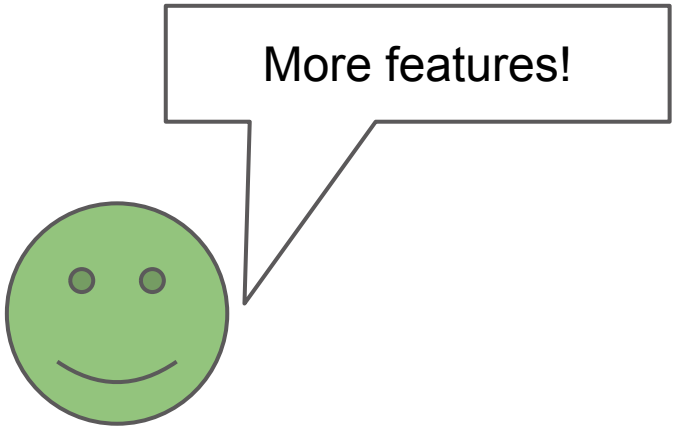
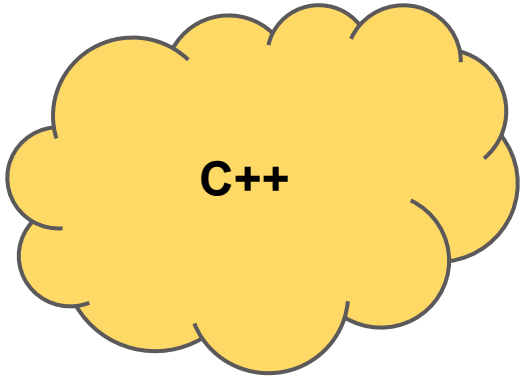


Changing C++

1985: 500 users





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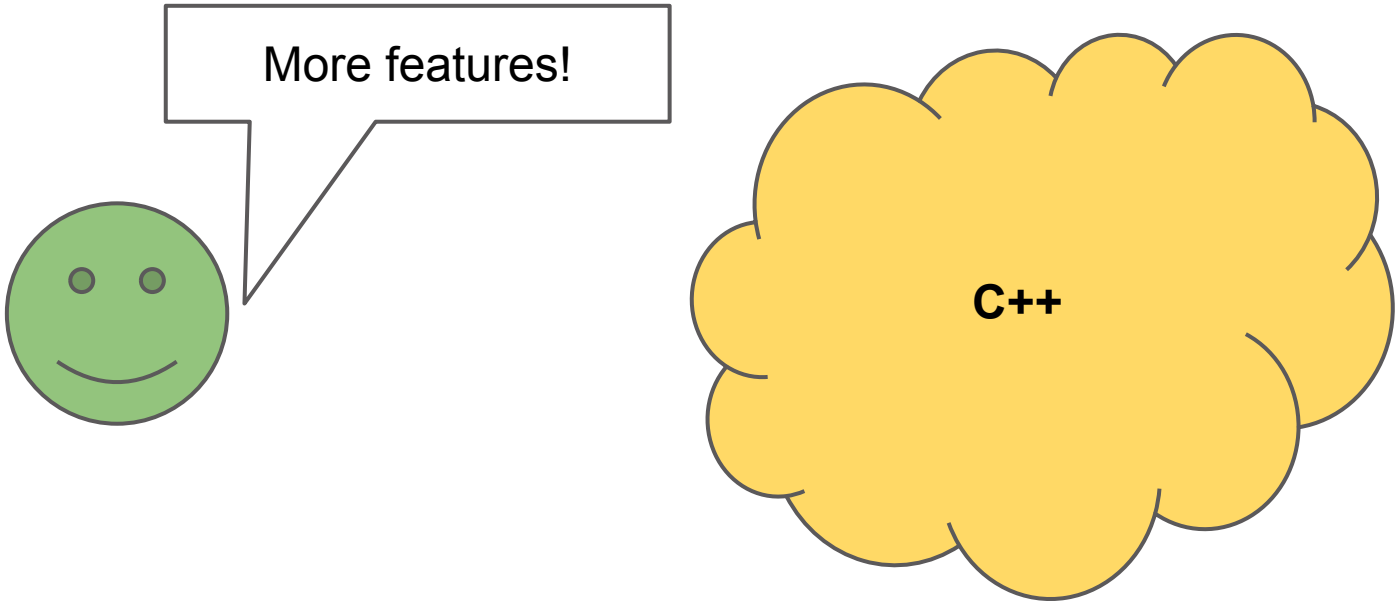

Changing C++

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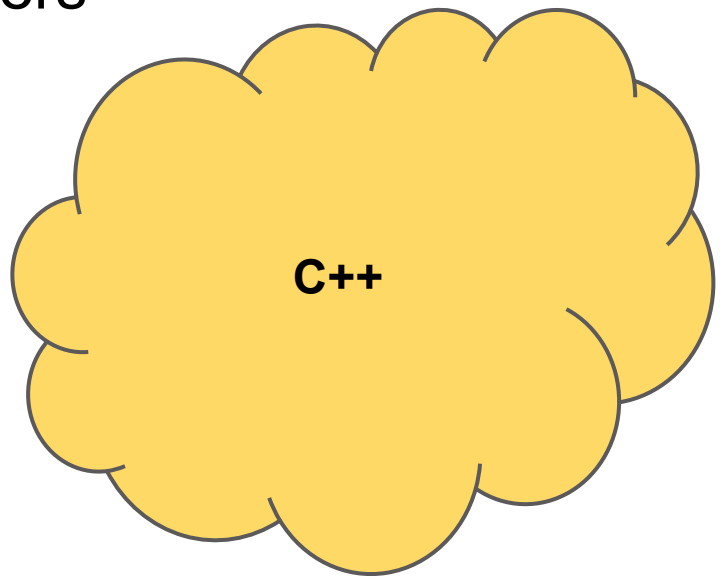
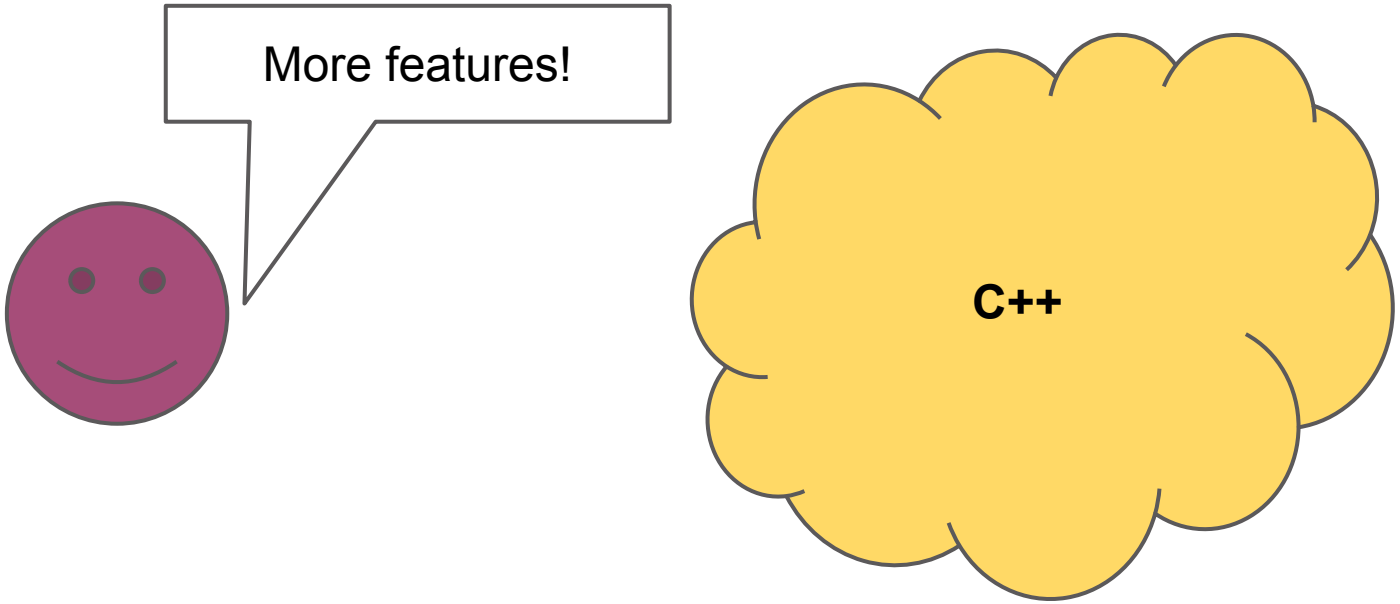


Changing C++

2013: 3.3M users



Changing C++

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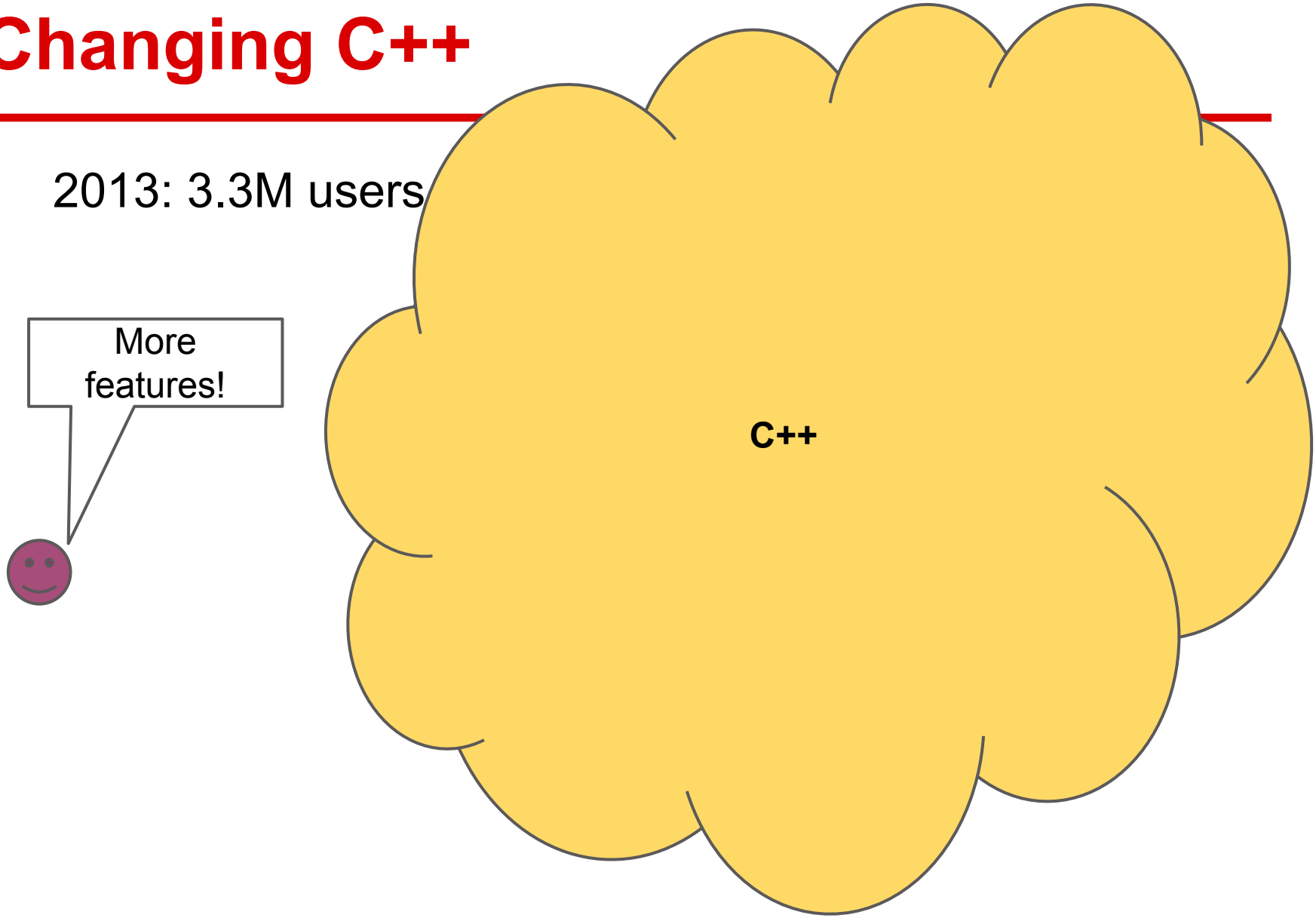

Changing C++

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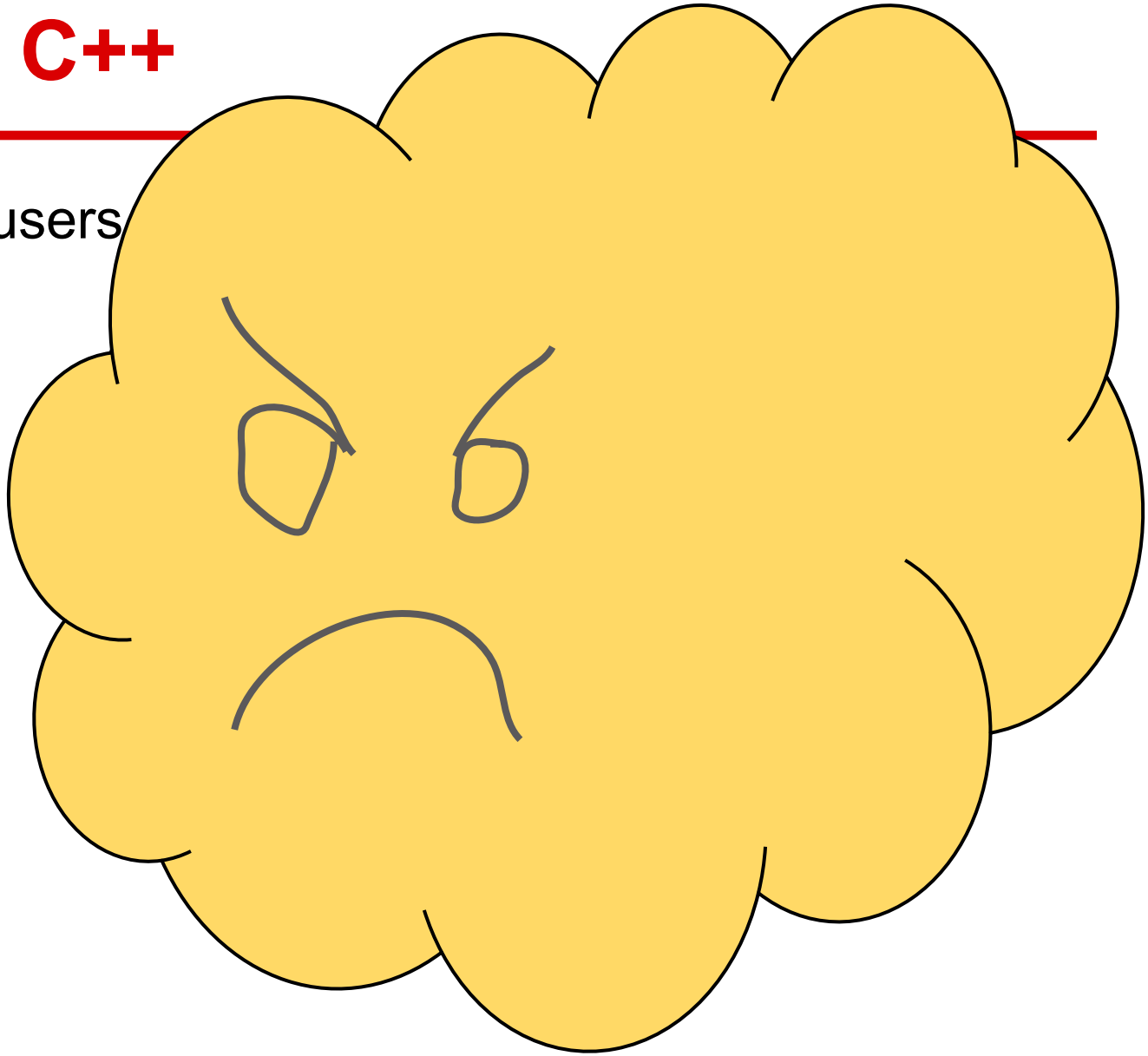


Solution: Extensible Language

Extensibility

Let C++ users add features to the language without changing the definition of the language

Boost

- Huge (19 million lines of code) collection of third party C++ code
- High quality
- Many libraries incorporated into C++11

Boost

How much C++ you need to know to understand...

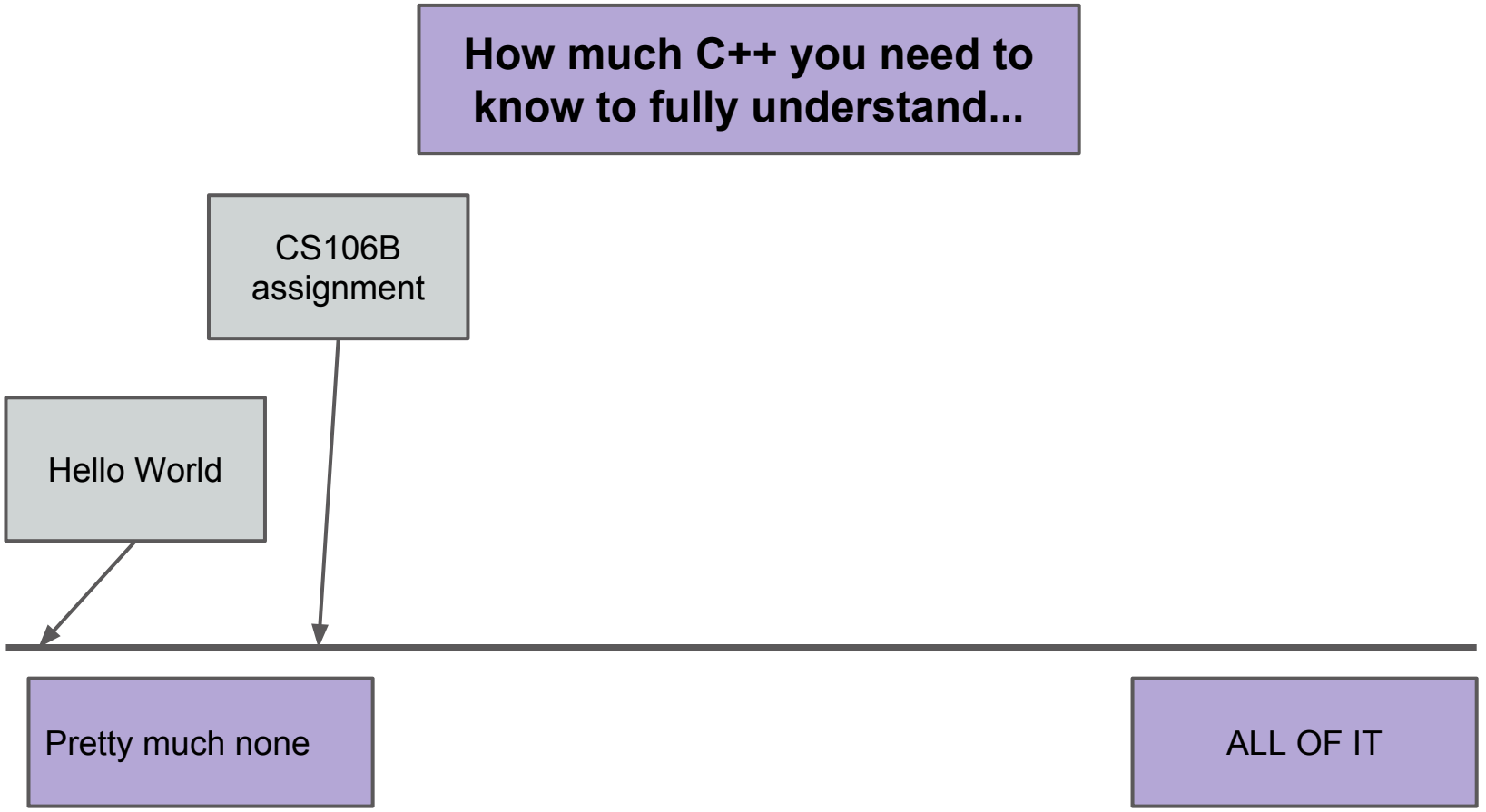
Pretty much none

ALL OF IT

Boost

How much C++ you need to know to fully understand...

Boost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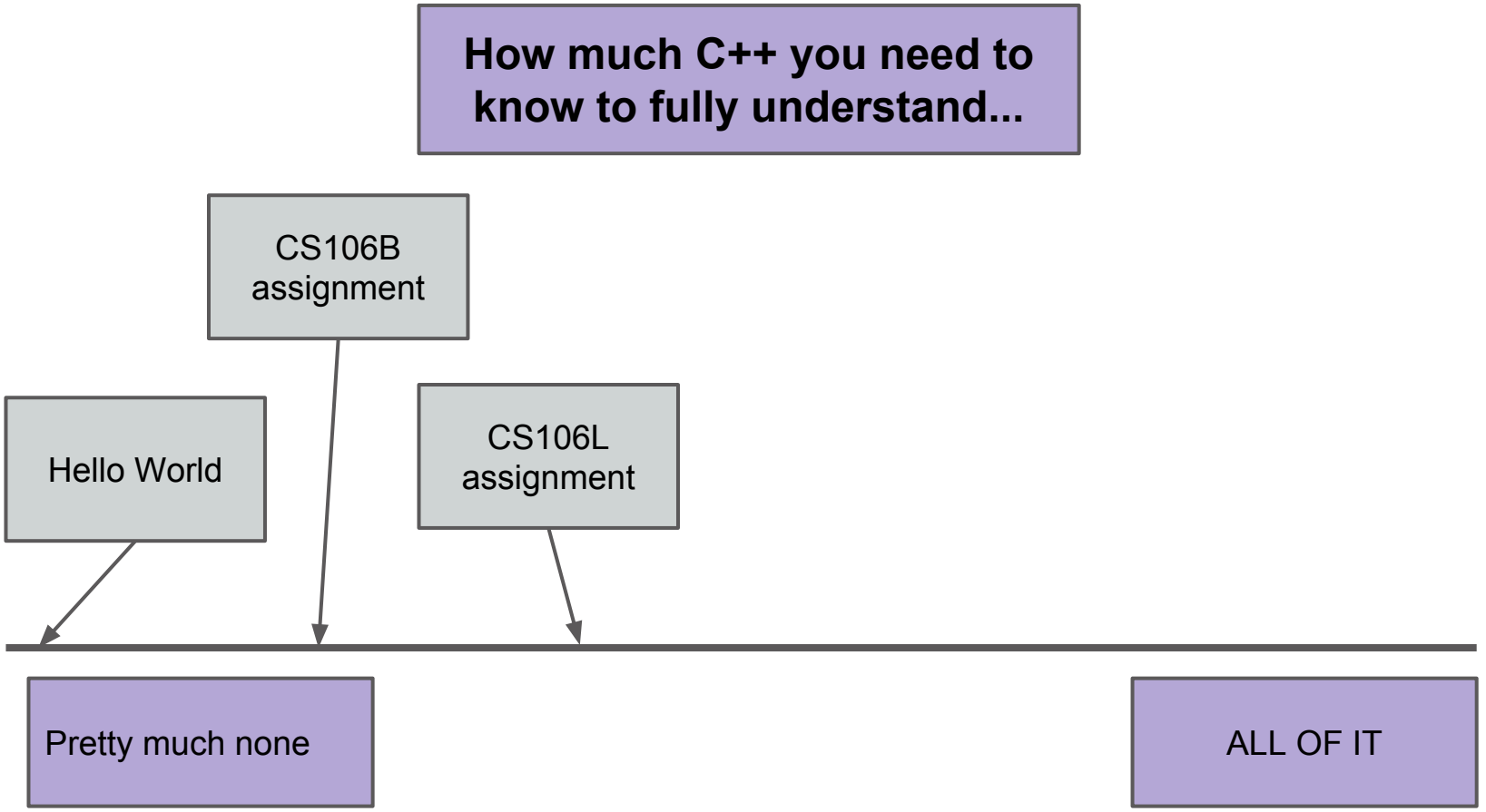
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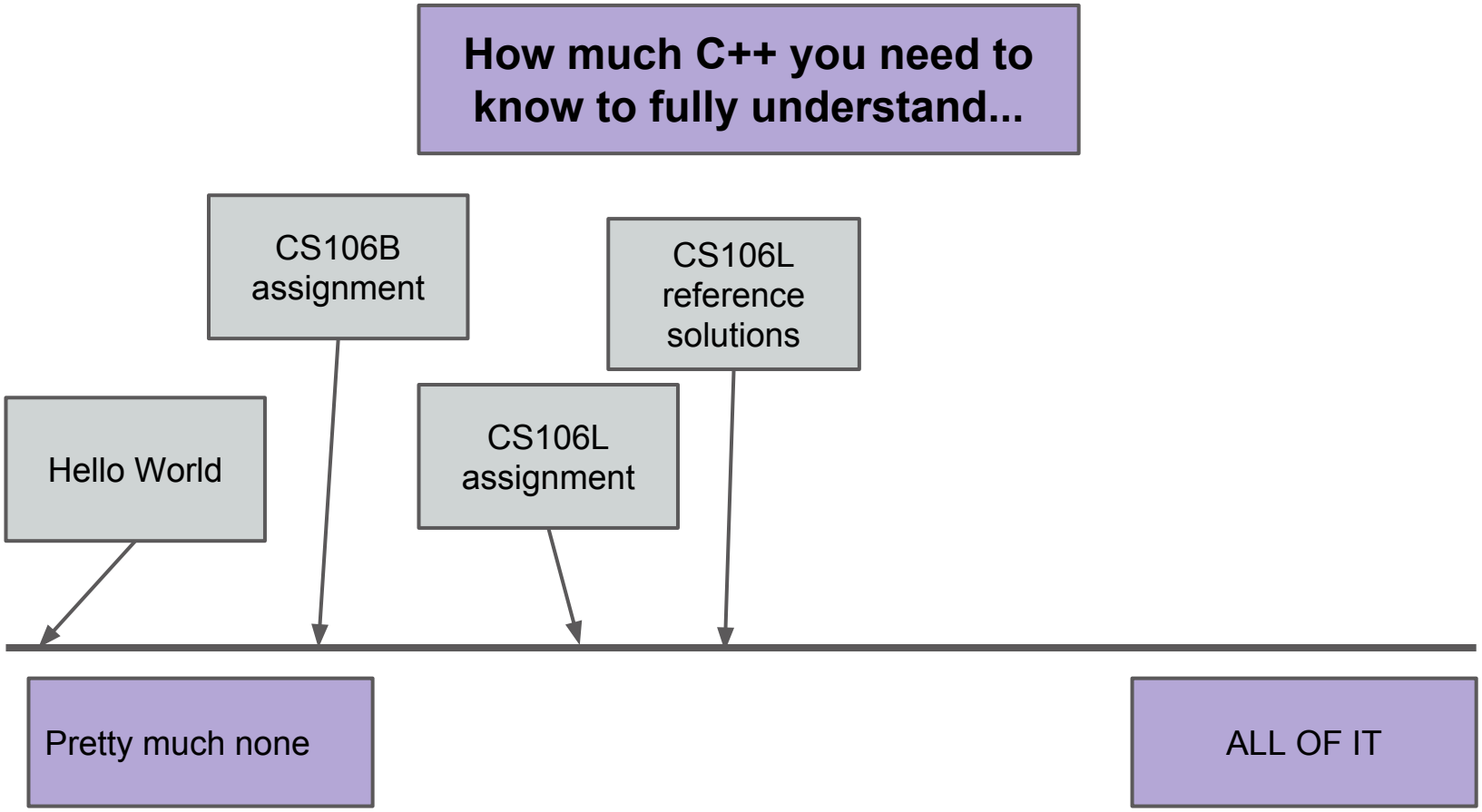
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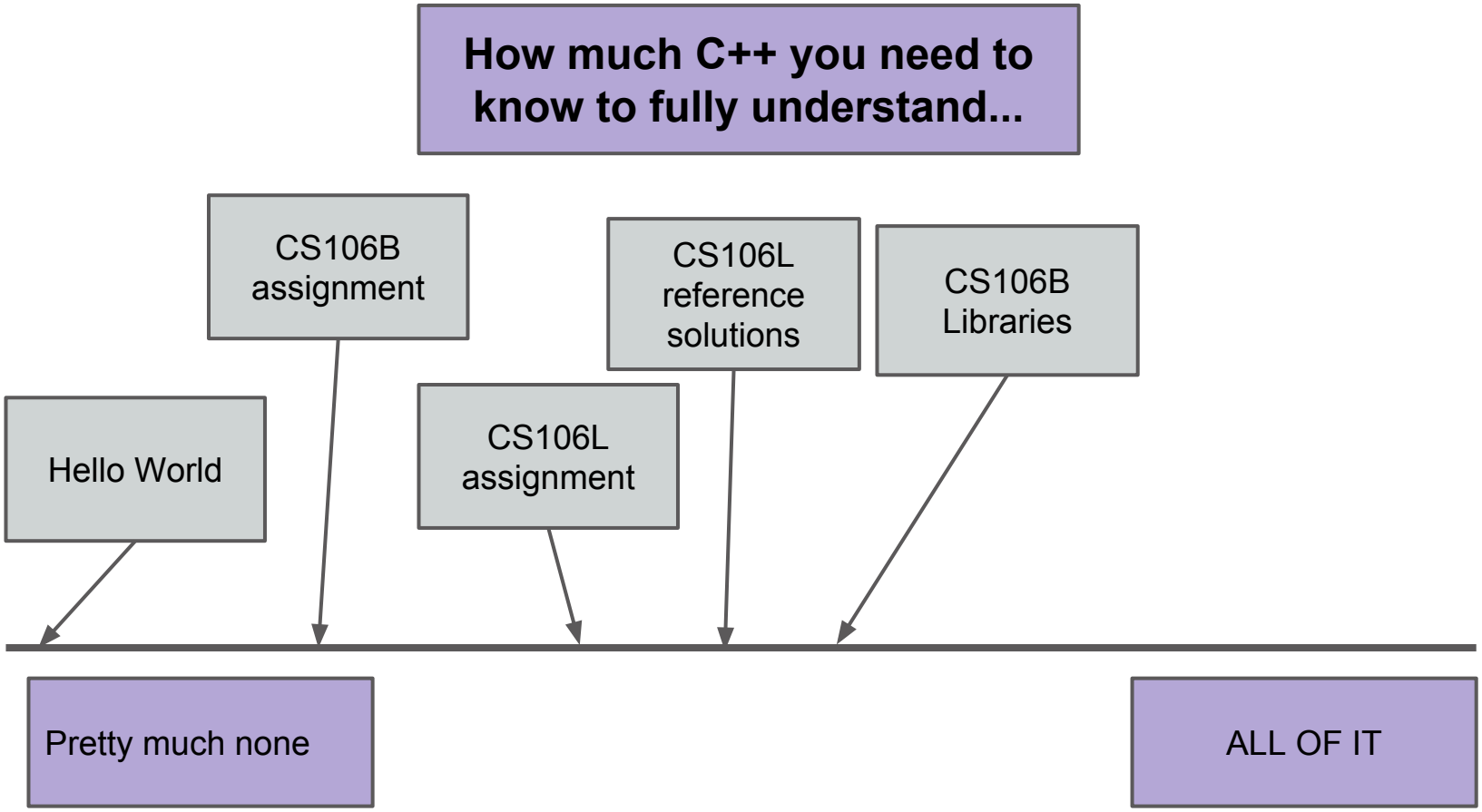
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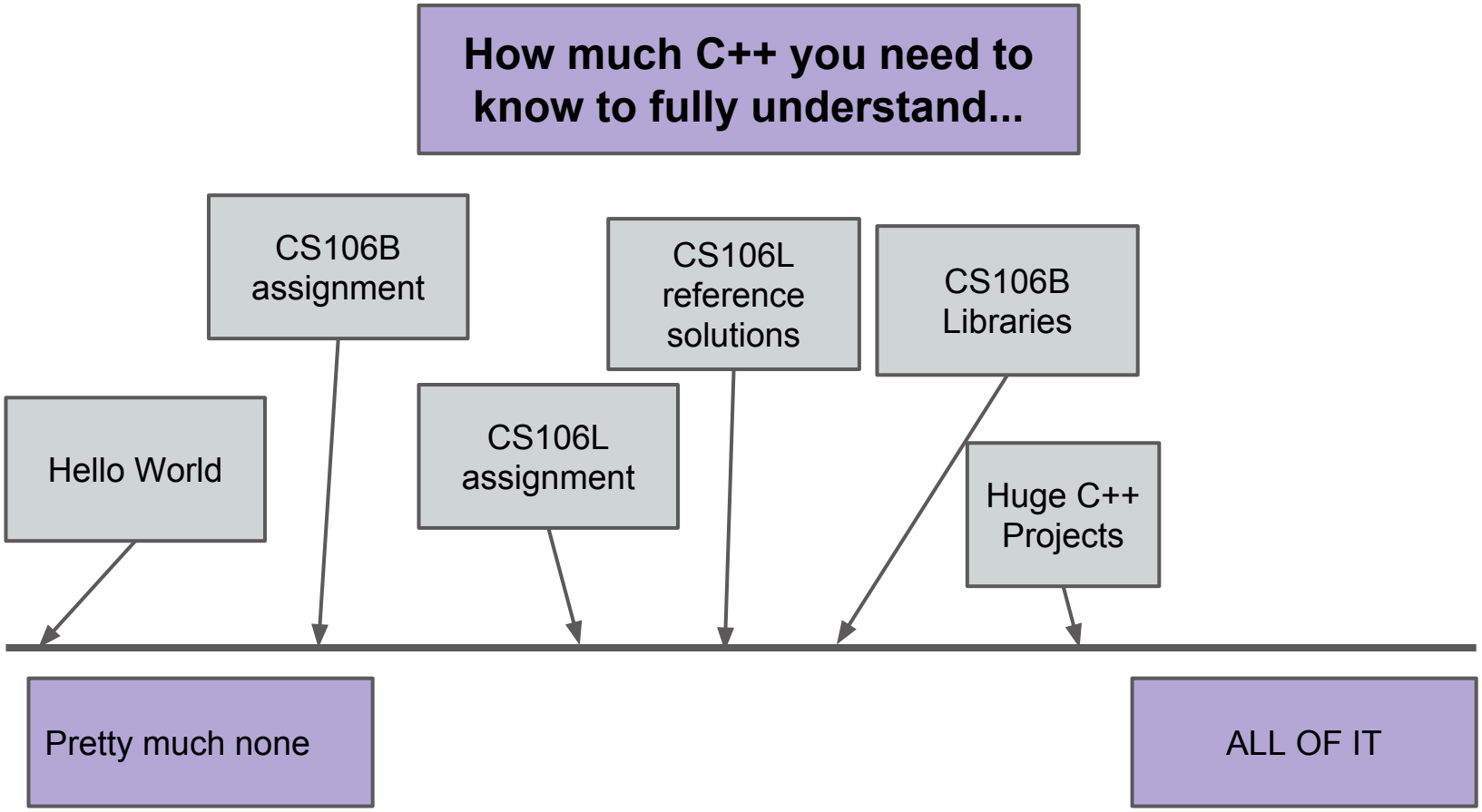
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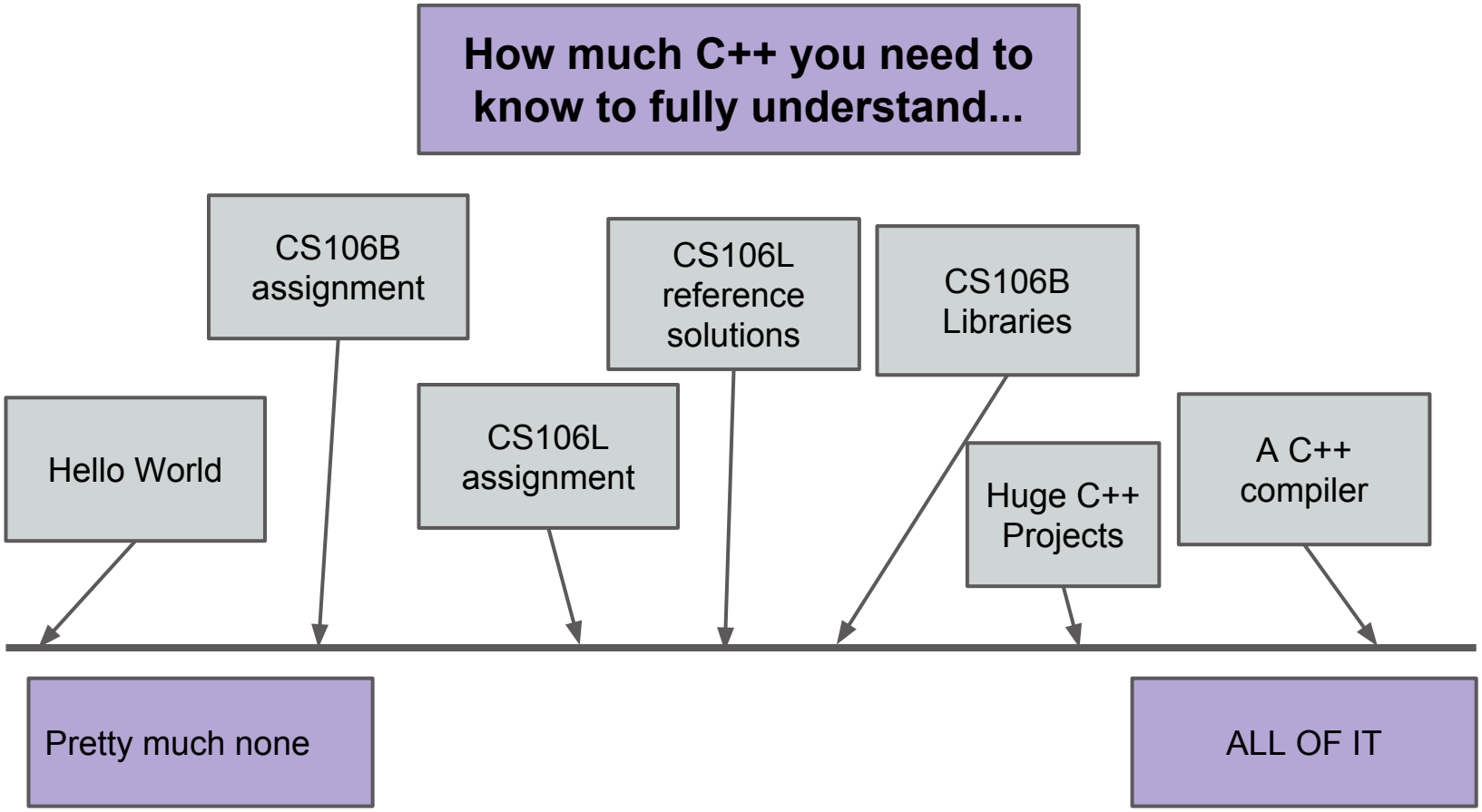
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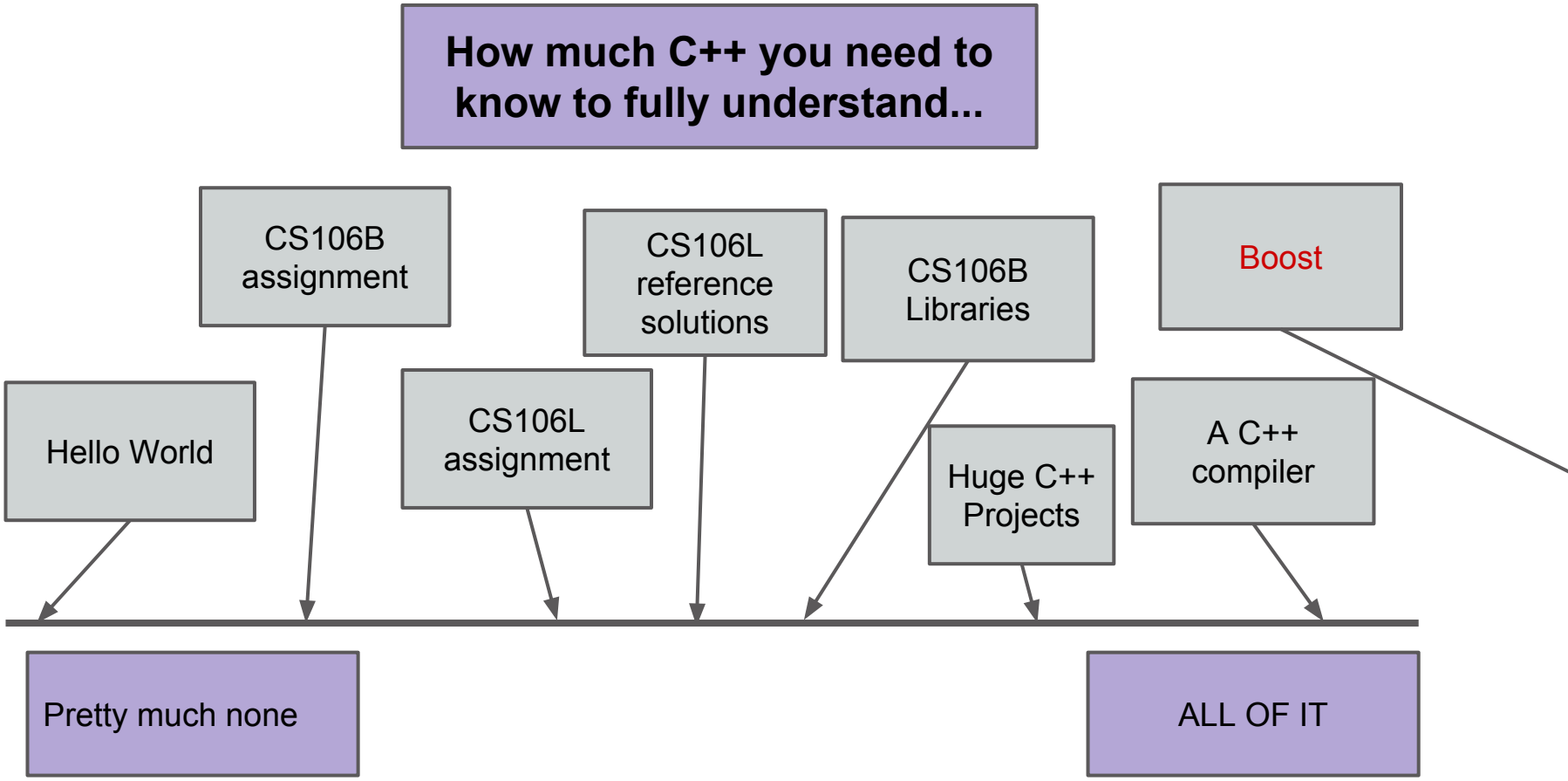
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Boost and C++11

- Boost uses the extensibility of C++ to add features to the language without requiring a new version of the language itself
- Sometimes, Boost's changes will be incorporated into C++ itself
- Let's take a look at some examples.

Boost

- We often talk about converting between integers and strings
- What if there was an easier way?
- Like, **much** easier

Boost

See code in LexicalCast.pro

Boost

- Let's take a look at how foreach came to be included in the language
- `BOOST_FOREACH` first introduced in 2004
- Stanford's foreach loop does similar stuff
- This was standardized to the "range-based for" loop we know and love in C++11

```
set<int> s;
for (int x : s)
   cout << x << endl;
```

Boost

See code in ForEach.pro

Boost

- Now let's look at a C++11 feature, `auto`
- The new keyword `auto` allows a programmer to simplify the declaration of a variable
- Variables declared `auto` have their type inferred from the right of the = sign

```
auto x = 0;
auto y = 0.0;
```

Boost

See code in Auto.pro

Boost

- Let’s look at one last cool feature: lambdas
- Lambdas allow us to define a function just like we define a variable
- It’s tricky to explain why this is useful, but let’s take a look at a few examples to understand why

Boost

See code in BasicLambda.pro and Lambda.pro