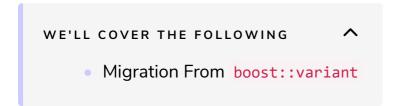
## **Performance & Memory Considerations**

Let's have a quick look at the performance and memory conisderations of std::variant.



std::variant uses the memory in a similar way to union: so it will take the max size of the underlying types. But since we need something that will know what the currently active alternative is, then we need to use some more space. Plus everything needs to honour the alignment rules.

Here are some basic sizes:

```
#include <iostream>
#include <variant>
#include <string>

int main() {
    std::cout << "sizeof string: " << sizeof(std::string) << '\n';
    std::cout << "sizeof variant<int, string>: " << sizeof(std::variant<int, std::string>
    std::cout << "sizeof variant<int, float>: " << sizeof(std::variant<int, float>) << '\
    std::cout << "sizeof variant<int, double>: " << sizeof(std::variant<int, double>) << }
}</pre>
```

## On GCC 8.1, 32 bit:

```
sizeof string: 32
sizeof variant<int, string>: 40
sizeof variant<int, float>: 8
sizeof variant<int, double>: 16
```

What's more interesting is that std::variant won't allocate any extra space!

No dynamic allocation happens to hold variants or the discriminator.

To have a safe sum type, you pay with an increased memory footprint. The additional bits might influence CPU caches. That's why you might want to do some benchmarking for the hot spots in your application that uses variants.

## Migration From boost::variant #

Boost Variant was introduced around the year 2004, so it was 13 years of experience before std::variant was added into the Standard. The STL type draws from the experience of the boost version and improves it.

Here are the main changes:

Feature	Boost.Variant (1.67.0)	std::variant  No	
Extra memory allocation	Possible on assignment, see Design Overview - Never Empty		
visiting	apply_visitor	std::visit	
get by index	no	yes	
recursive variant	yes, see make_recursive_varia nt	no	
duplicated entries	no	yes	
empty alternative	boost::blank	std::monostate	

In the next lesson, we discuss the idea of ErrorCode in std:variant.