## **Object Creation**

The different methods of in-place object creation are discussed briefly in this lesson.

#### WE'LL COVER THE FOLLOWING ^

- In Place Construction
  - Complex Types
    - std::make\_any
- Changing the Value
- Object Lifetime

There are several ways you can create std::any object:

- a default initialisation then the object is empty
- a direct initialisation with a value/object
- in place std::in\_place\_type
- via std::make\_any

You can see it in the following example:

```
#include <string>
#include <iostream>
#include <any>
#include <cassert>
using namespace std;

class MyType
{
   int a, b;

   public:
      MyType(int x, int y) : a(x), b(y) { }
};

int main()
{
   // default initialization:
   std::any a;
   present/la bas yelve());
}
```

```
// initialization with an object:
std::any a2{10}; // int
std::cout << "a2 is: " << std::any_cast<int>(a2) << '\n';
std::any a3{MyType{10, 11}};

// in_place:
std::any a4{std::in_place_type<MyType>, 10, 11};
std::any a5{std::in_place_type<std::string>, "Hello World"};
std::cout << "a5 is: " << std::any_cast<std::string>(a5) << '\n';

// make_any
std::any a6 = std::make_any<std::string>("Hello World");
std::cout << "a6 is: " << std::any_cast<std::string>(a6) << '\n';
}</pre>
```





# In Place Construction #

Following the style of std::optional and std::variant, std::in\_place\_- to efficiently create objects in place.

### Complex Types #

In the below example a temporary object will be needed:

```
std::any a{UserName{"hello"}};
```

but with:

```
std::any a{std::in_place_type<UserName>, "hello"};
```

The object is created in place with the given set of arguments.

std::make\_any#

For convenience std::any has a factory function called std::make\_any that returns

```
return std::any(std::in_place_type<T>, std::forward<Args>(args)...);
```

So in the previous example we could also write:

```
auto a = std::make_any<UserName>{"hello"};
```

make any is probably more straightforward to use.

# Changing the Value #

When you want to change the currently stored value in std::any then you
have two options: use emplace or the assignment:

```
class MyType {
                                                                                        int a, b;
public:
   MyType(int x, int y) : a(x), b(y) { }
};
int main() {
   // default initialization:
   std::any a;
   assert(!a.has_value());
   a = MyType(10, 11);
    a = std::string("Hello");
   a.emplace<float>(100.5f);
    a.emplace<std::vector<int>>({10, 11, 12, 13});
    a.emplace<MyType>(10, 11);
    return 0;
}
```

# Object Lifetime #

The crucial part of being safe for std::any is not to leak any resources. To
achieve this behaviour std::any will destroy any active object before
assigning a new value.

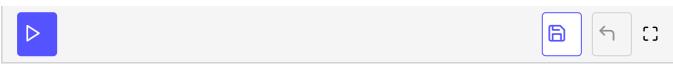
```
void* operator new(std::size_t count) {
    std::cout << "allocating: " << count << " bytes" << std::endl;
    return malloc(count);
}

void operator delete(void* ptr) noexcept {
    std::puts("global op delete called");
    std::free(ptr);
}

class MyType {</pre>
```

```
public:
    MyType() { std::cout << "MyType::MyType\n"; }
    ~MyType() { std::cout << "MyType::~MyType\n"; }
};

int main() {
    {
        std::any var = std::make_any<MyType>();
        var = 100.0f;
        std::cout << std::any_cast<float>(var) << '\n';
    }
}</pre>
```



If the constructors and destructors were instrumented with prints, we would get the following output:

```
MyType::MyType
MyType::~MyType
100
```

The any object is initialised with MyType, but before it gets a new value (of 100.0f) it calls the destructor of MyType.

That's all for the object creation. We'll look into different ways of accessing the stored values in the next lesson.