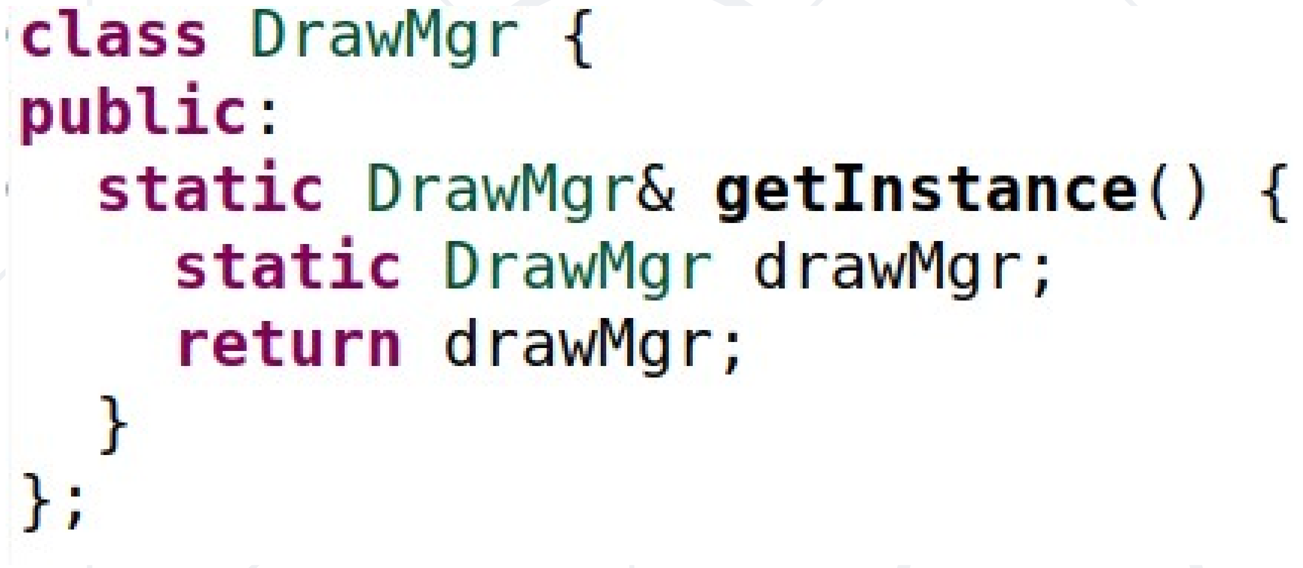
Singleton



```
class DrawMgr {
public:
  static DrawMgr& getInstance() {
    static DrawMgr drawMgr;
    return drawMgr;
  }
};
```

Zhivko Petrov

A guy that knows C++

Software University

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Have a Question?

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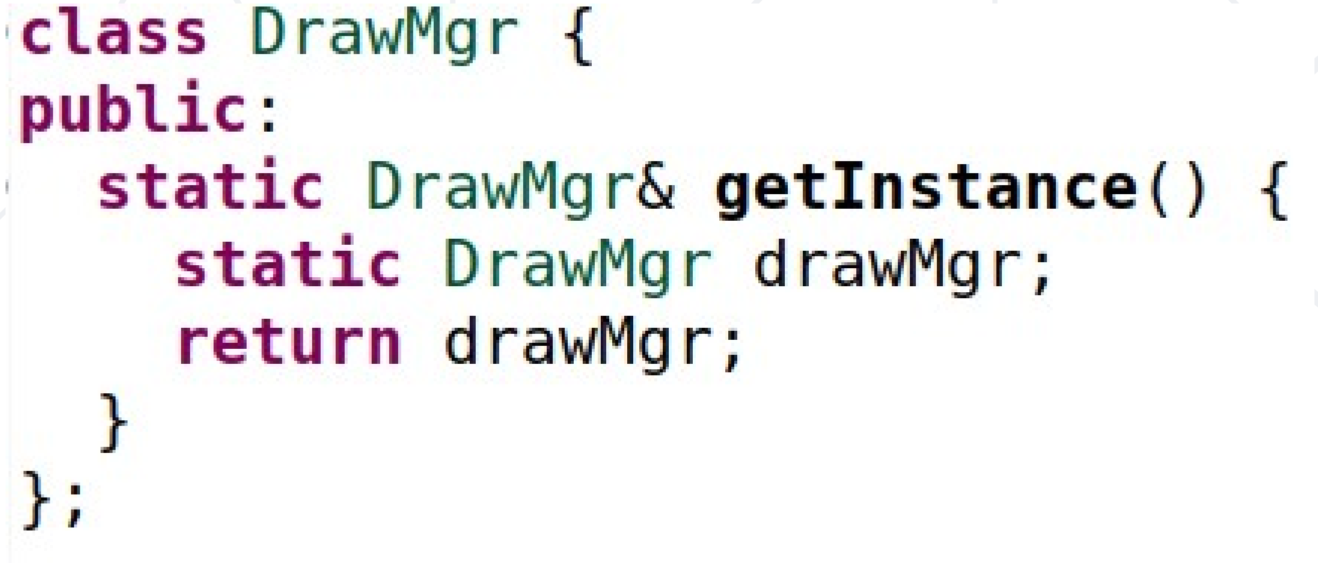
#app-dev-cpp

Singleton concept

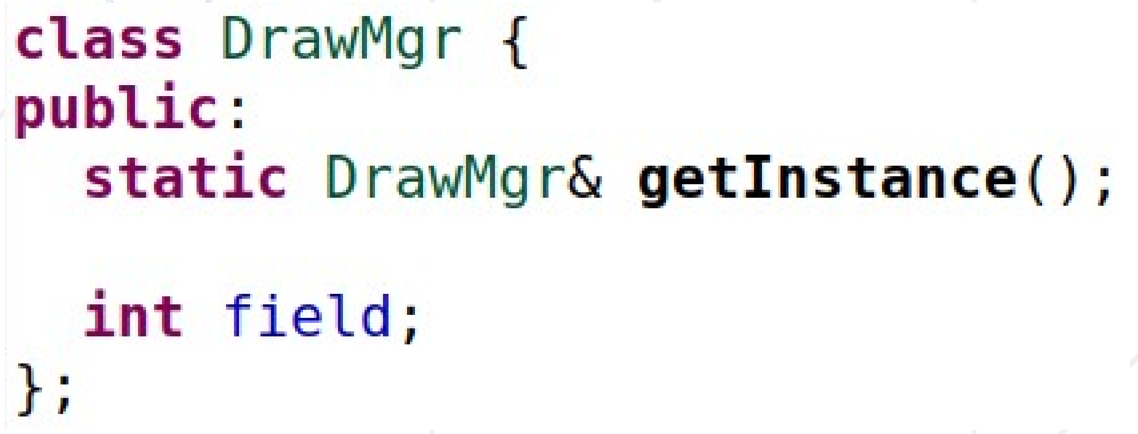
- The Singleton is one of the most famous design pattern
- Singletons control a **unique resource** or have **unique control** over some piece of code
- They **enforce** the creation of only a **single object** for a specific class



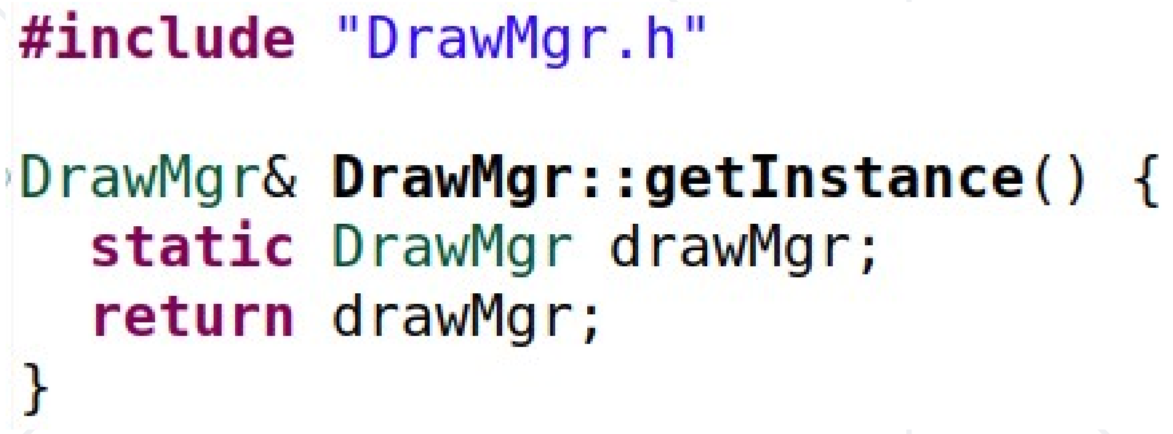
```
class DrawMgr {
public:
  static DrawMgr& getInstance() {
    static DrawMgr drawMgr;
    return drawMgr;
  }
};
```

Meyer’s Singleton concept

- The lifetime of function static variables begins the **first time** the program flow encounters the declaration and ends at program termination
- If control enters the **declaration concurrently** while the variable is being initialized, the concurrent **execution shall wait** for completion of the initialization



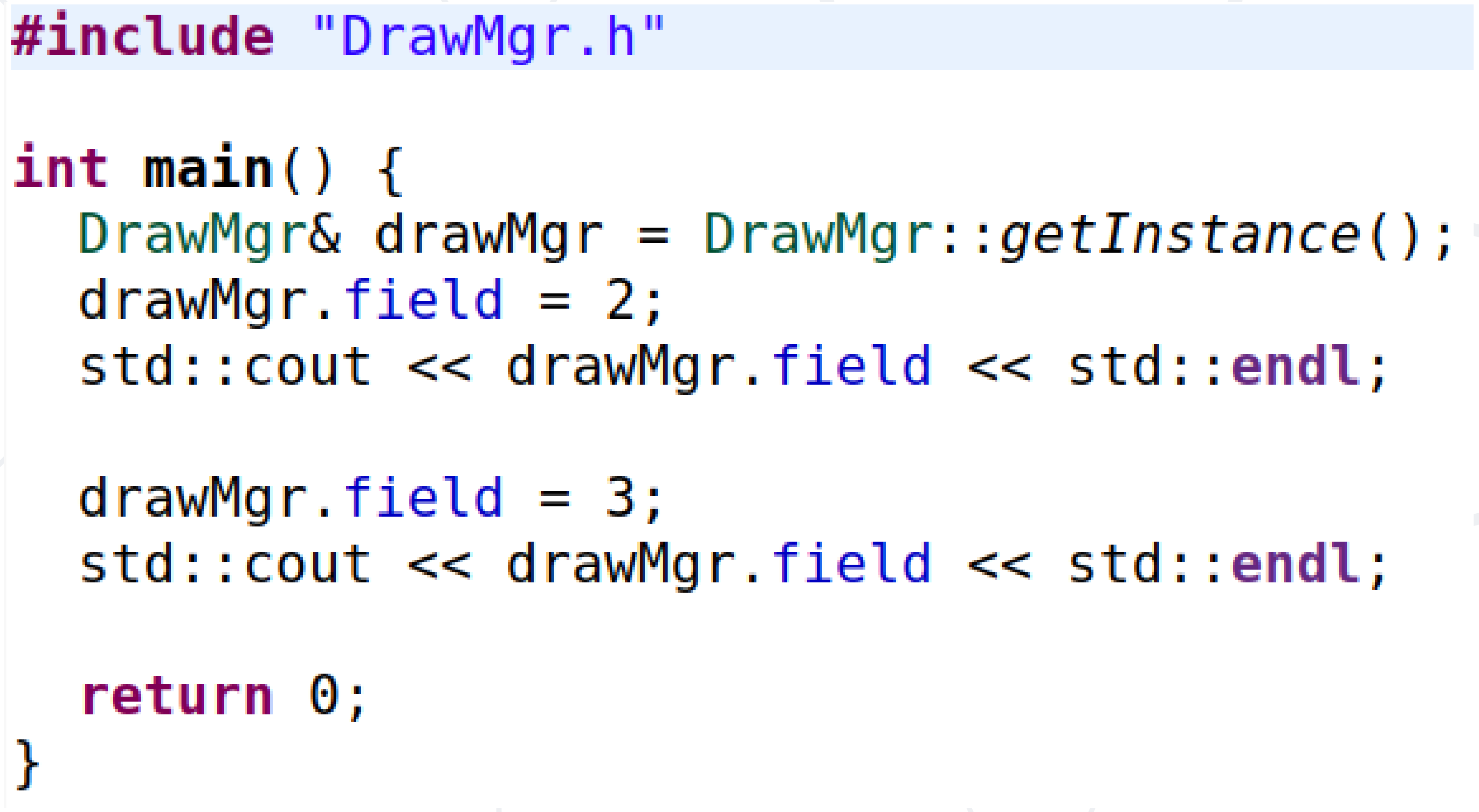
```cpp
class DrawMgr {
public:
  static DrawMgr& getInstance();

  int field;
};
```



```cpp
#include "DrawMgr.h"

DrawMgr& DrawMgr::getInstance() {
  static DrawMgr drawMgr;
  return drawMgr;
}
```

Singleton usage

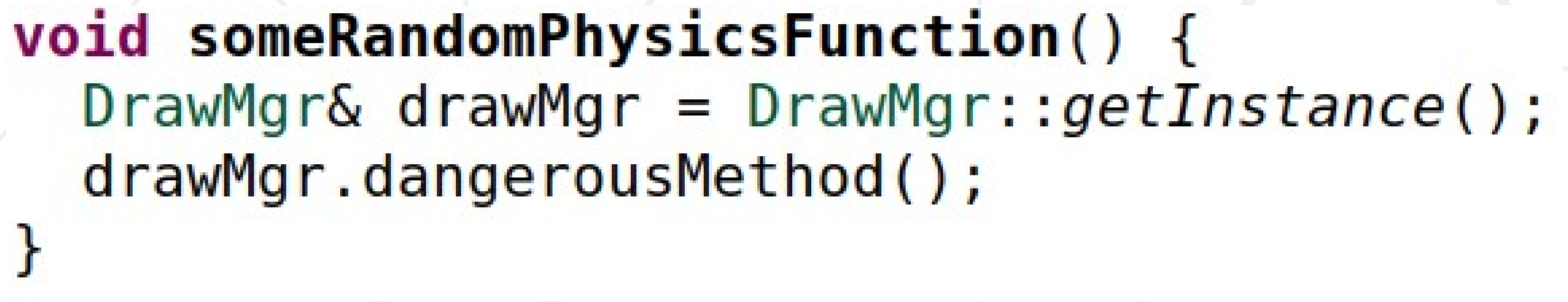
- Singletons are only used through the special **getter fuction**
- Used as normal global variable
- Can be accessed form anywhere



```cpp
#include "DrawMgr.h"

int main() {
  DrawMgr& drawMgr = DrawMgr::getInstance();
  drawMgr.field = 2;
  std::cout << drawMgr.field << std::endl;

  drawMgr.field = 3;
  std::cout << drawMgr.field << std::endl;

  return 0;
}
```

Singleton pitfalls

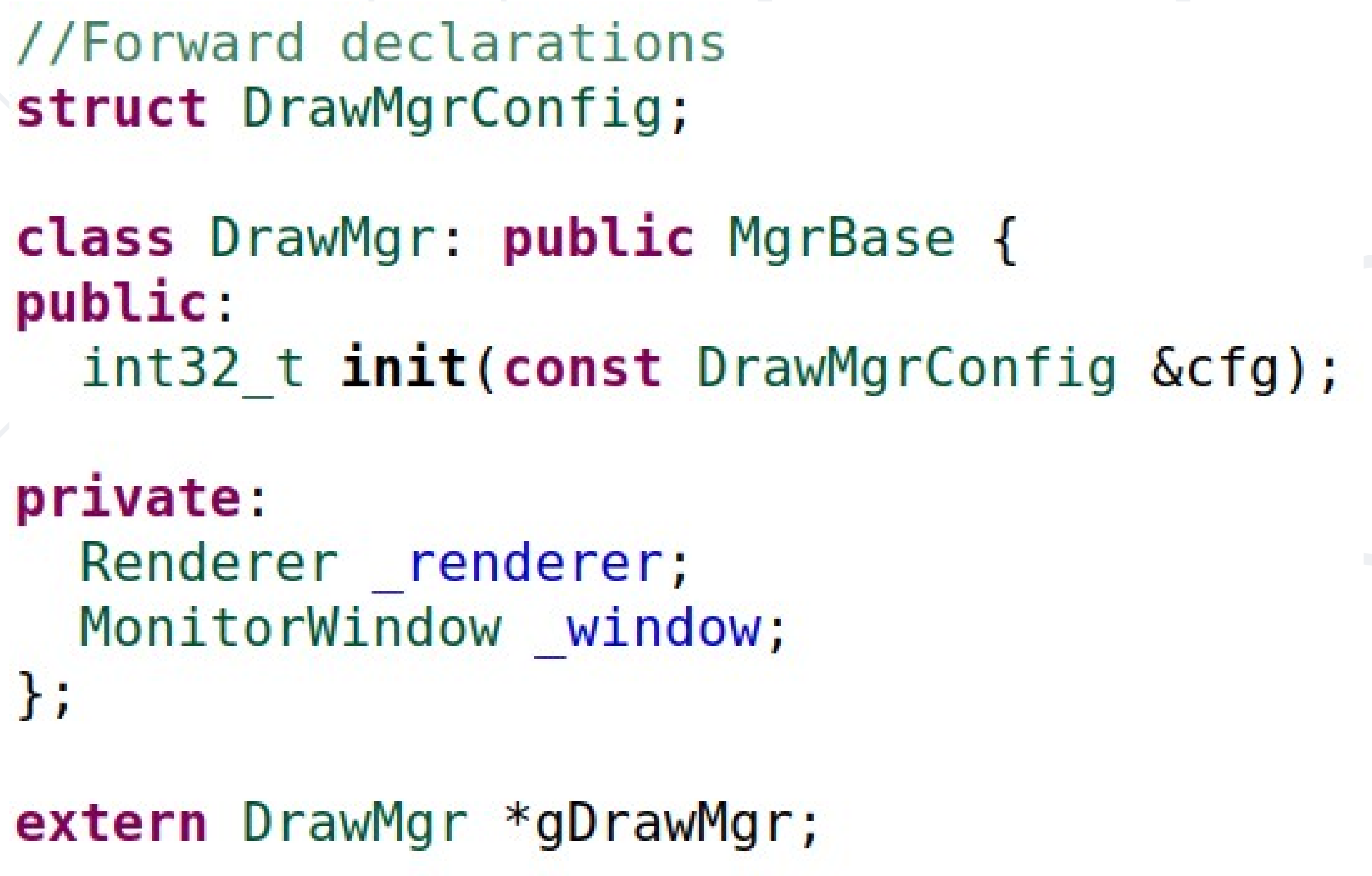
- Although **convenient** to use – Singletons has **one big pitfall**
- They can easily lead to “spaghetti code” **breaking encapsulation**
- Imagine this scenario
- What do Physics has to be with Rendering?
- Why should Physics **access** Rendering sub-system?



```
void someRandomPhysicsFunction() {
  DrawMgr& drawMgr = DrawMgr::getInstance();
  drawMgr.dangerousMethod();
}
```

Singleton correct usage

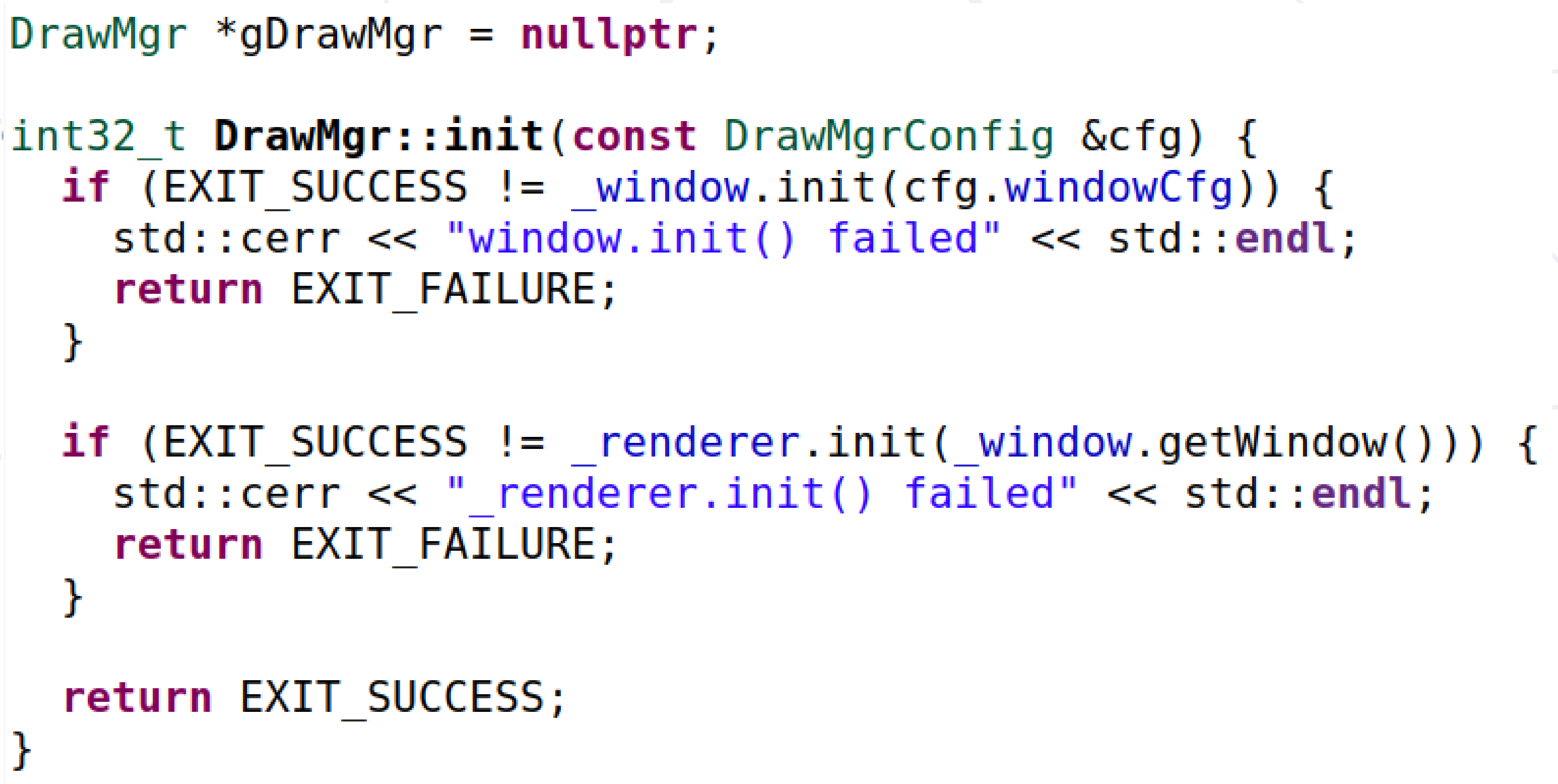
- To avoid the Singletons pitfalls some certain rules must be followed
- **Remove** the static function – it is both verbose and expensive
- Use **Abstraction** and **Encapsulation** as much as possible



```
//Forward declarations
struct DrawMgrConfig;

class DrawMgr: public MgrBase {
public:
  int32_t init(const DrawMgrConfig &cfg);

private:
  Renderer _renderer;
  MonitorWindow _window;
};

extern DrawMgr *gDrawMgr;
```

Singleton correct usage

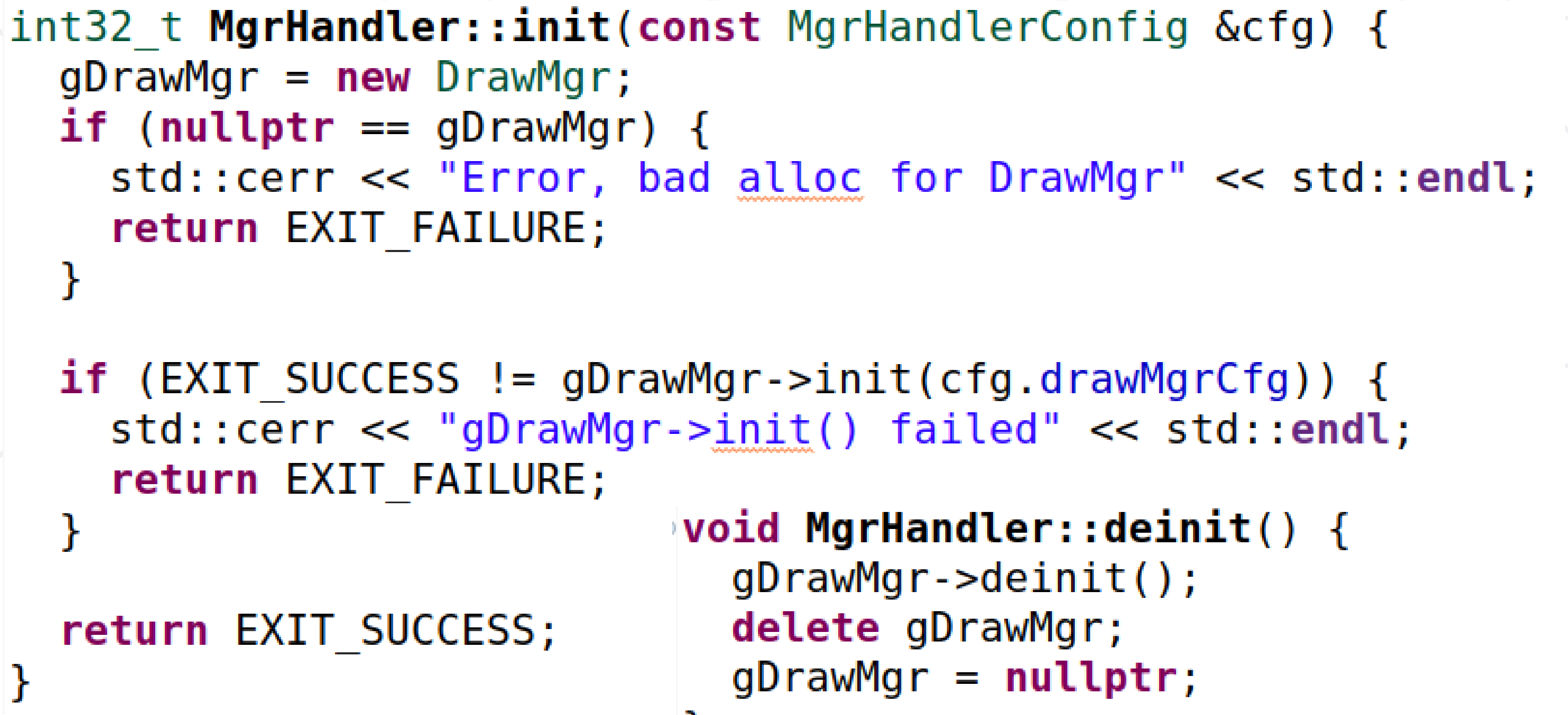
- Implement your class functionalities as normal
- Have a **single** global object



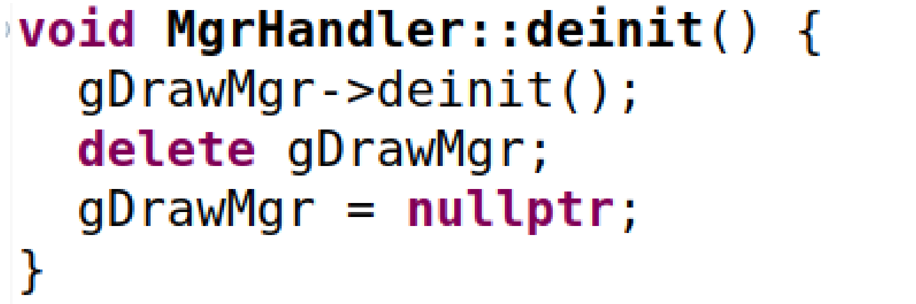
```
DrawMgr *gDrawMgr = nullptr;

int32_t DrawMgr::init(const DrawMgrConfig &cfg) {
  if (EXIT_SUCCESS != _window.init(cfg.windowCfg)) {
    std::cerr << "window.init() failed" << std::endl;
    return EXIT_FAILURE;
  }

  if (EXIT_SUCCESS != _renderer.init(_window.getWindow())) {
    std::cerr << "_renderer.init() failed" << std::endl;
    return EXIT_FAILURE;
  }

  return EXIT_SUCCESS;
}
```

Singleton creation/destruction

- Ensure your objects gets created and initialized/deinitilized only on a **single place** in the code
- Usually this is done in the **core** system init/deinit methods



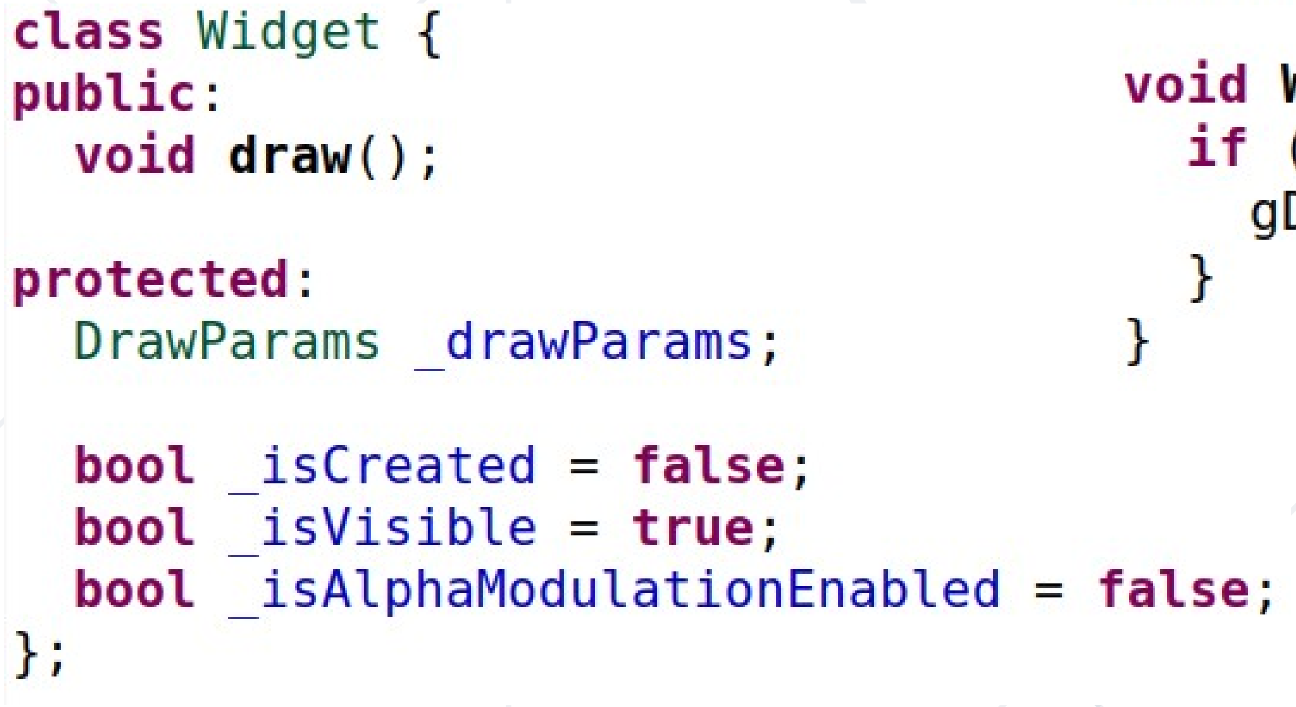
```cpp
int32_t MgrHandler::init(const MgrHandlerConfig &cfg) {
  gDrawMgr = new DrawMgr;
  if (nullptr == gDrawMgr) {
    std::cerr << "Error, bad alloc for DrawMgr" << std::endl;
    return EXIT_FAILURE;
  }

  if (EXIT_SUCCESS != gDrawMgr->init(cfg.drawMgrCfg)) {
    std::cerr << "gDrawMgr->init() failed" << std::endl;
    return EXIT_FAILURE;
  }

  return EXIT_SUCCESS;
}
```



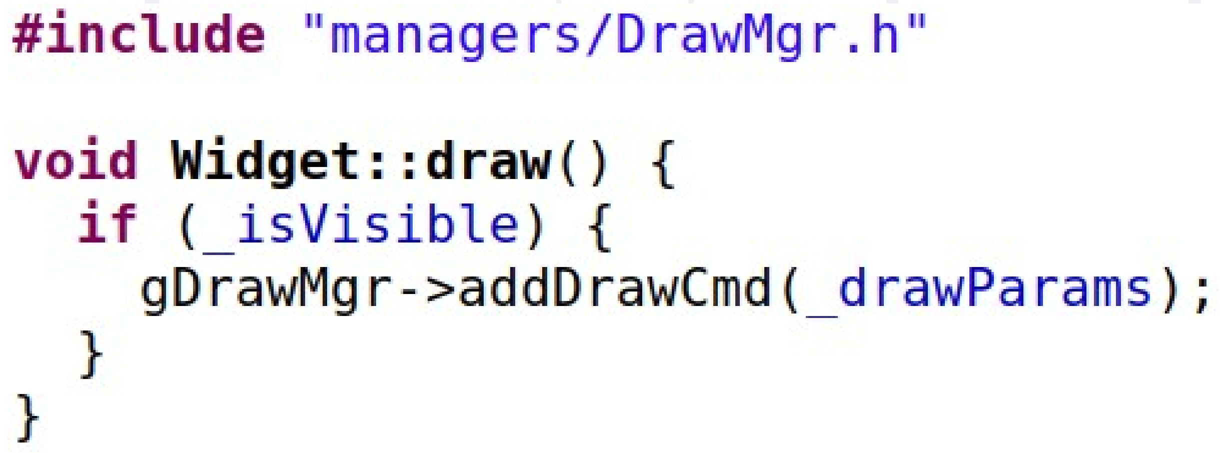
```cpp
void MgrHandler::deinit() {
  gDrawMgr->deinit();
  delete gDrawMgr;
  gDrawMgr = nullptr;
}
```

Singleton – restriction

- It is important to **restrict** the developer in “blindly” using the Singleton
- Achieved by **hiding** the usage of the Singleton in other API calls



```
class Widget {
public:
  void draw();

protected:
  DrawParams _drawParams;

  bool _isCreated = false;
  bool _isVisible = true;
  bool _isAlphaModulationEnabled = false;
};
```



```
#include "managers/DrawMgr.h"

void Widget::draw() {
  if (_isVisible) {
    gDrawMgr->addDrawCmd(_drawParams);
  }
}
```

Questions?

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