CSE 374: Programming Concepts and Tools

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Spring 2017
Lecture 26: Vtable Hijacking

Administrivia

- HW7 due Thurs at Midnight
  - If you have late days you might as well use them (no more than 2 at once though)
- HW5 grades back, we're working madly on HW6b
- Final Review Session 4:30pm-6:30pm on Tues 6/6 (in CSE 403)
- Final Exam 2:30pm on Wed 6/7 in THIS ROOM

Course Evaluations

- Please fill them out!
- Your **honest feedback** helps me learn to teach better
- Things you say about me can and will be used (by me) in job applications next fall
- This is the first class I've taught, I'm sure I have much to learn
- Link is on course website, and here:

  https://uw.iasystem.org/survey/178403

Inheritance

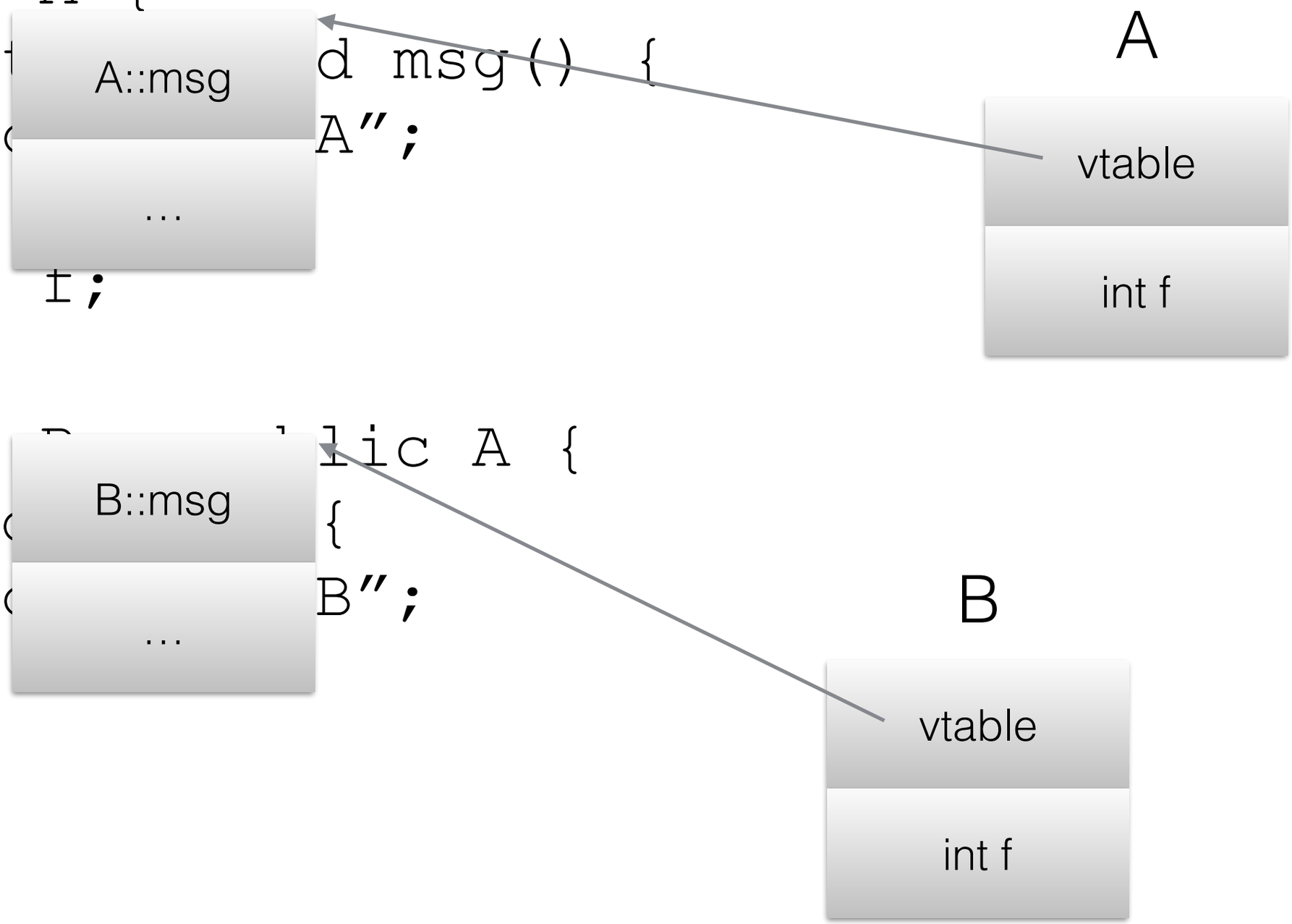
```
class A {
  virtual void msg() {
    cout << "A";
  }
  int f;
};
class B : public A {
  void msg() {
    cout << "B";
  }
};
```

```
A* x;
if (rand()%2) {
  x = new B();
} else {
  x = new A();
}
x->msg();
```

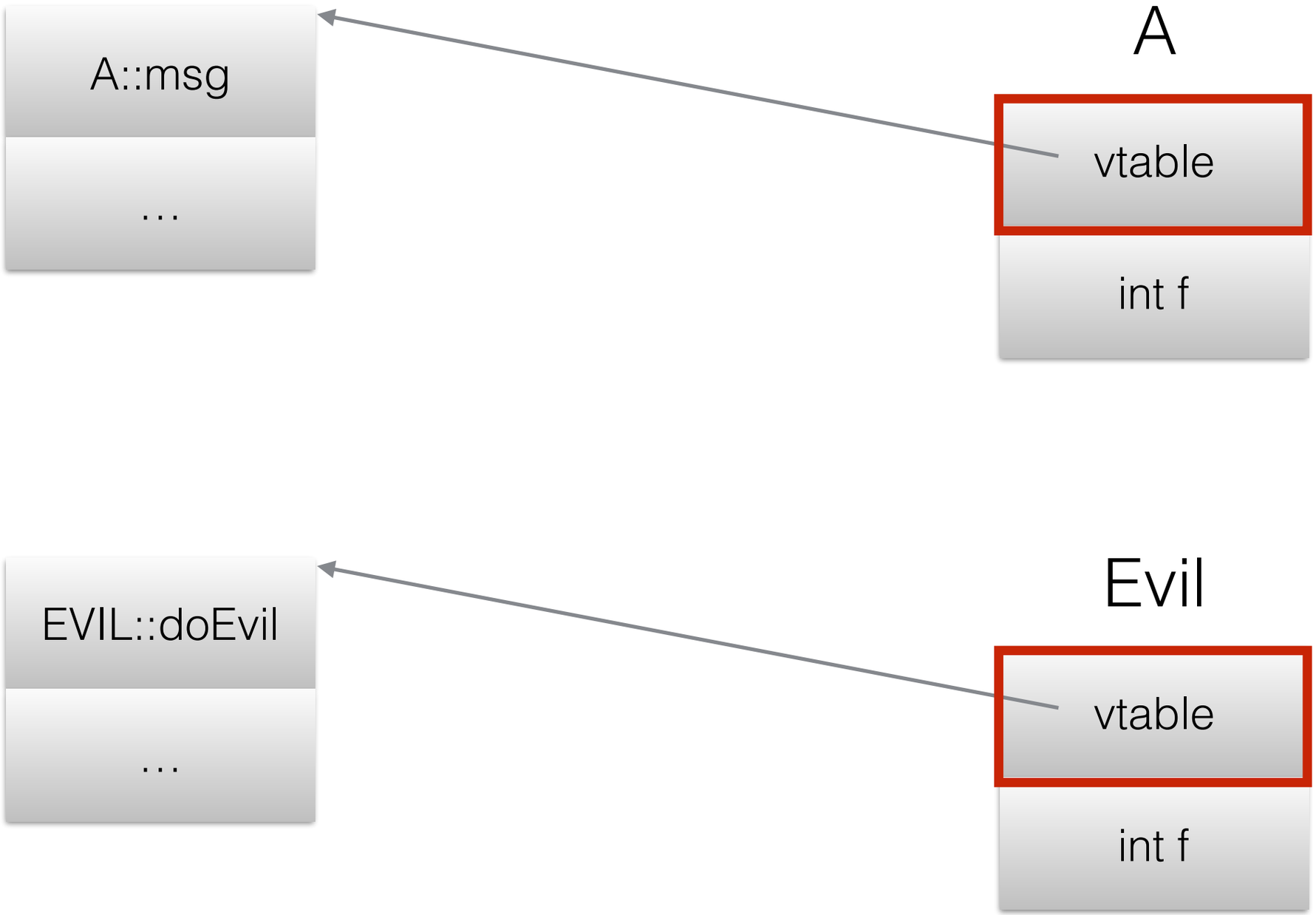
Unknown until runtime

vtables

```
class A {
   virt          d msg() {
      co         A";
   }
   int f;
};
class          lic A {
   voi            {
      co          B";
   }
};
```



making a call



Use after Free

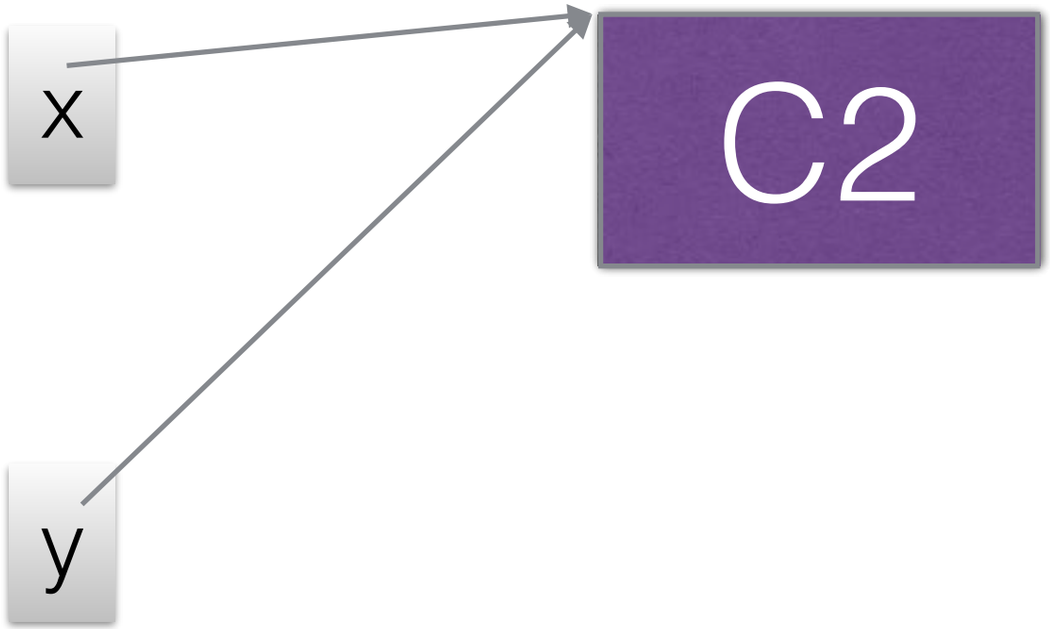
- Memory allocators reuse memory when they can

```
C1* x = new C1();

delete x;

C2* y = new C2();

x->method(); //could call C2 method
```



Not just what if?

- This led to a zero day exploit in Chrome in 2012
- Assuming an already compromised tab process, could execute arbitrary code as the browser kernel
- Used vtable hijacking along with a use-after-free bug

How can we fix it?

- Any ideas?

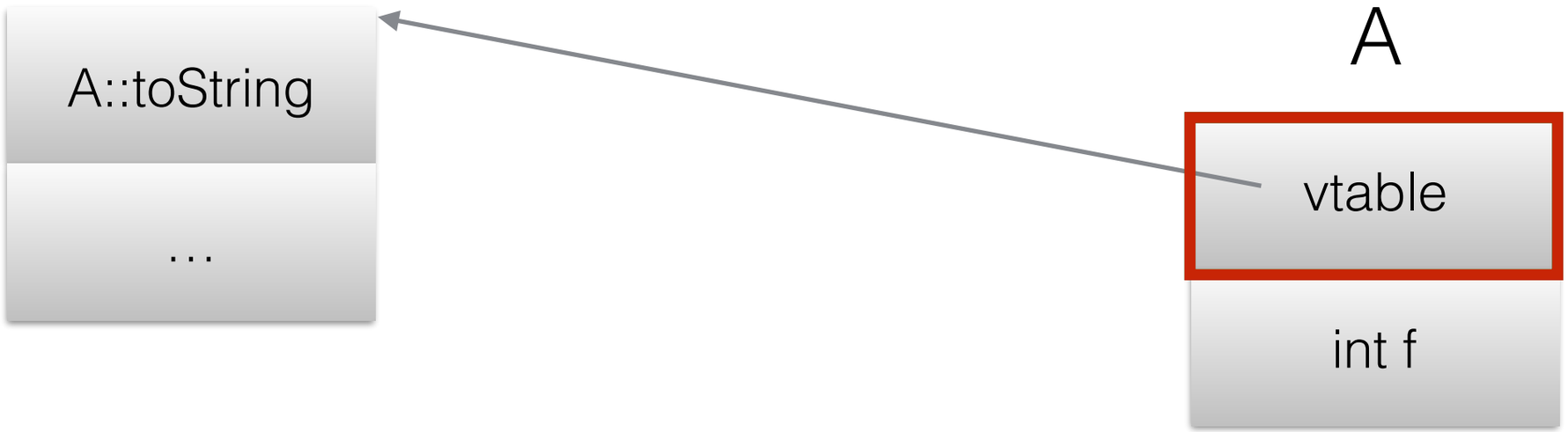
How can we fix it?

- There's an invariant being violated here: when making a virtual call, the vtable pointer is one of the allowed vtable pointers

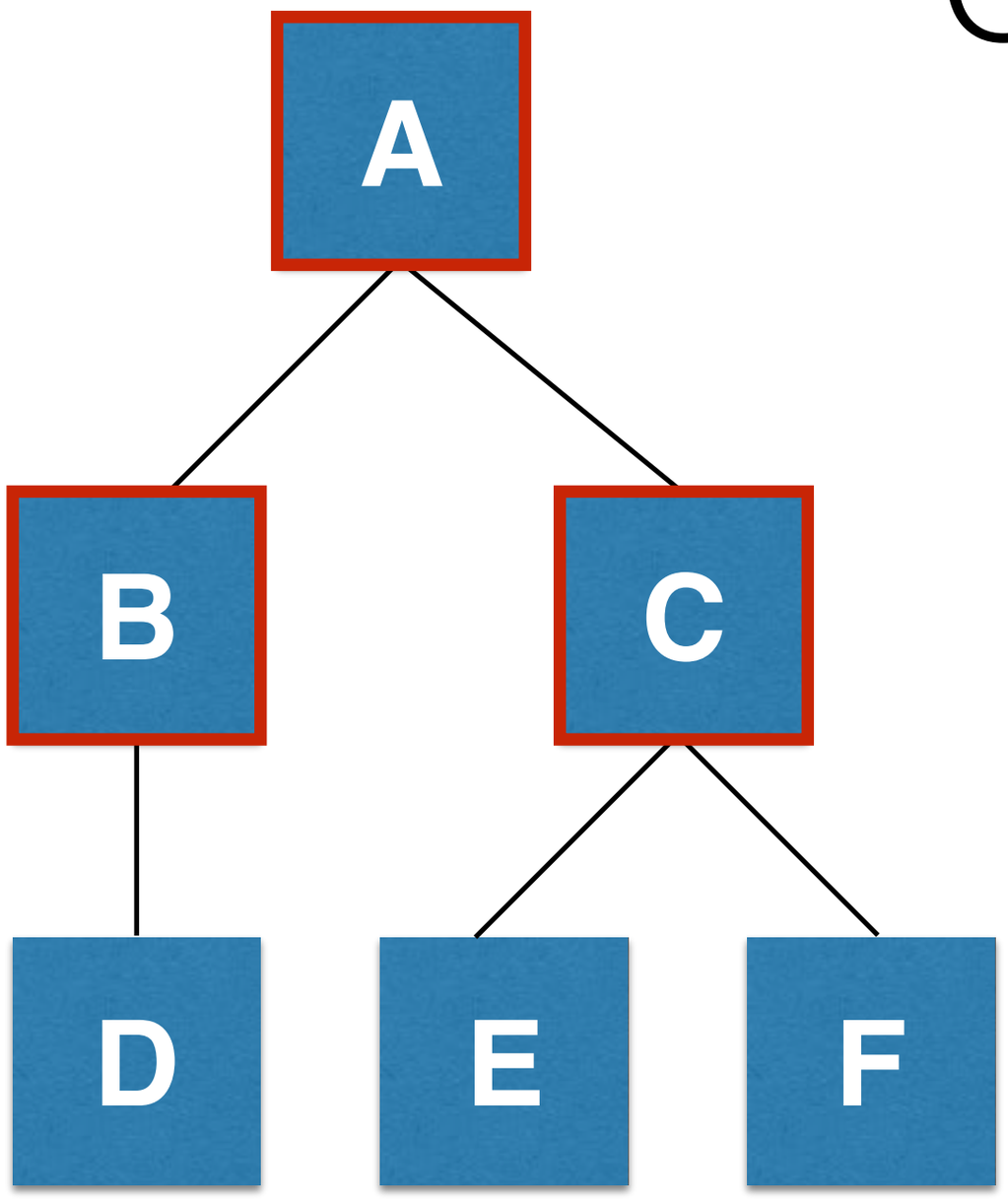
- Just check that it's the one of the correct pointers right before making the call

- *SafeDispatch: Securing C++ Virtual Calls from Memory Corruption Attacks. D. Jang, Z. Tatlock, S. Lerner, NDSS '14.*

How can we fix it?



Which vtable pointers are OK?



Static Type Classes

Performance

- Evaluated on the open source part of Chrome, called Chromium
- 2.1% performance overhead overall
- 7.5% memory overhead overall

Downsides

- Can you think of any downsides to this approach?