Engineering Code Obfuscation

ISSISP 2017 - Tamperproofing

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What is Tamperproofing?

Bob wants to modify the program binary so that it does something different than we want:

- remove functionality (license check)
- change data (password, cryptographic key)
- add functionality (print, save game)

Tamperproofing the code makes it stop working if Bob changes as little as a byte of the binary!

Tamperproofing has to do two things:

1. detect tampering
2. respond to tampering

Essentially:

```
if (tampering-detected())
    respond-to-tampering()
```

but this is too unstealthy!

```
int foo() {
   … … … …
}
```

Detect tampering

```
int main () {
   if (foo-has-changed-in-any-way())
      foo();
}
```

- ***crash the program***
- ***phone home***
- ***refuse to run***
- ***run slower***
- ***make wrong results***

Respond to tampering

```
int hash (addr_t addr,int words){
   int h = *addr;
   for(int i=1; i<words; i++) {
        addr++;
        h ^= *addr;
    }
    return h;
}
```

```
int foo() {
  … … … …
}
```

Detect tampering

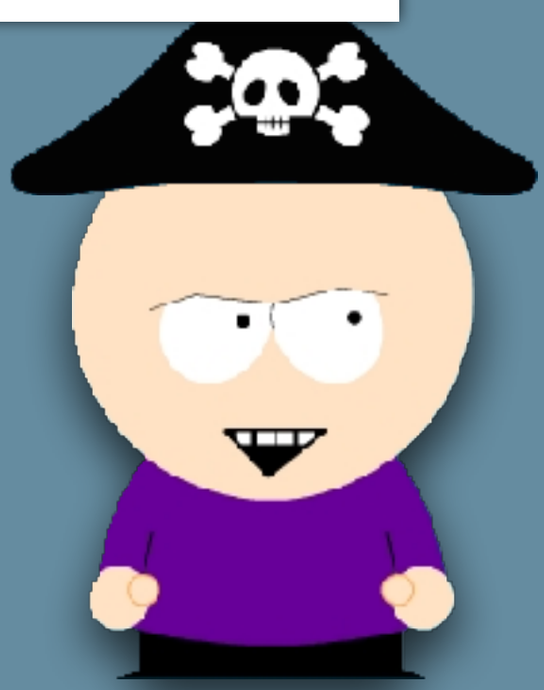
```
int main () {
    if (hash(foo,1000) != 0x4C49F346)
        foo();
}
```

- ***crash the program***
- ***phone home***
- ***refuse to run***
- ***run slower***
- ***make wrong results***

Respond to tampering

```
int foo () {
    if (today > “Aug 17,2016”){
      printf(“License expired!”);
      abort;
    }
}
```

```
check(){
 if (hash(foo)!=42)
   abort()
}
```



```
int foo() {
   … … … …
}
```

```
int foo_copy() {
   … … … …
}
```

Repair foo!!!

Checker 1

```
if (foo-has-changed-in-any-way())
```

copy

```
int foo_copy() {
  … … … …
}
```

```
int foo() {
  … … … …
}
```

Repair Checker 1!

Checker 2

```
if (foo-checker1-changed())
```

copy

```
Checker1_copy
```

```
Checker1
```

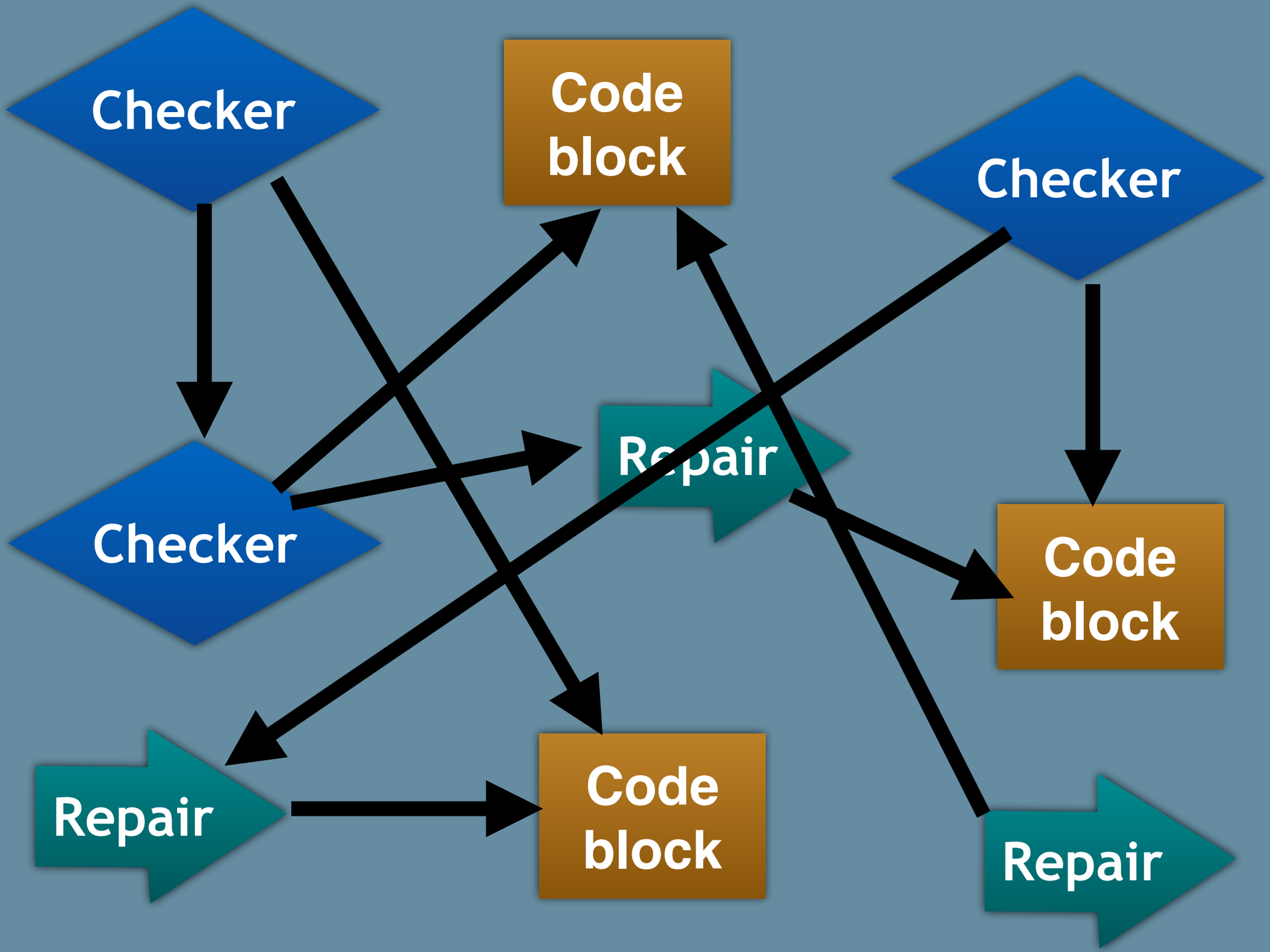
Checker 1

```
if (foo-has-changed-in-any-way())
```

copy

```
int foo_copy() {
  … … … …
}
```

```
int foo() {
  … … … …
}
```


Checker
Code block
Checker
Checker
Repair
Code block
Repair
Code block
Repair

```
uint32 Skypes_hash_function () {
  addr_t addr =(addr_t)((uint32)addr ^(uint32)addr);
  addr = (addr_t)((uint32) addr + 0 x688E5C);
  uint32 hash = 0x320E83 ^ 0x1C4C4 ;
  int bound = hash + 0 xFFCC5AFD ;

  do {
     uint32 data =*((addr_t)((uint32)addr + 0x10));
     goto b1; asm volatile (". byte 0x19"); b1:
     hash = hash ⊕ data ; addr -= 1; bound --;
  } while (bound !=0);

  goto b2;
   asm volatile (".byte 0x73");
  b2:
  goto b3;
   asm volatile (".word 0xC8528417,…”);
  b3:
  hash -= 0x4C49F346; return hash;
}
```

Questions?