How much can we learn in a single execution?

Dynamic reverse-engineering in one shot

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Motivation?

How much can we learn in a single execution?

This much

Function prototypes

This much

Function prototypes

- arity

This much

Function prototypes

- arity
- type of parameters

This much

Function prototypes

- arity
- type of parameters

Function coupling

This much

Function prototypes

- arity
- type of parameters

Function coupling

`malloc` ⟶ `free`

This much

Function prototypes

- arity
- type of parameters

Function coupling

`malloc` ⟶ `free`

`fopen` ⟶ `fclose`

How much can we learn in a single execution?

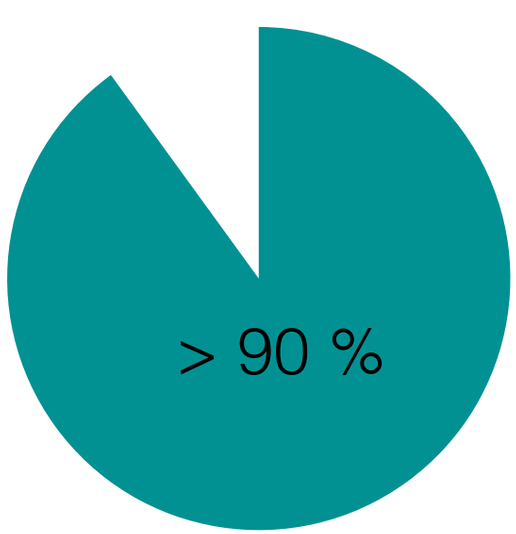
This much

Accuracy:

This much

Accuracy:

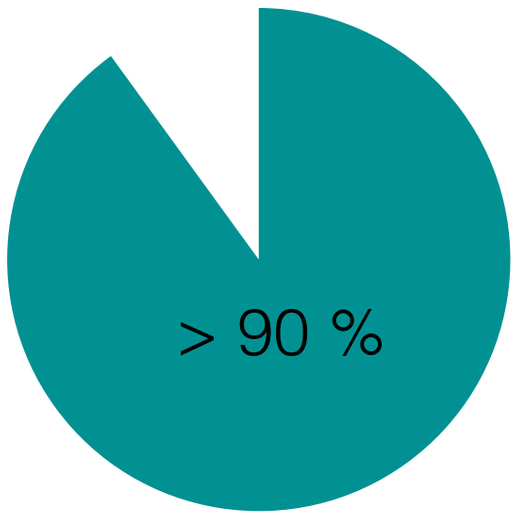
Function arity



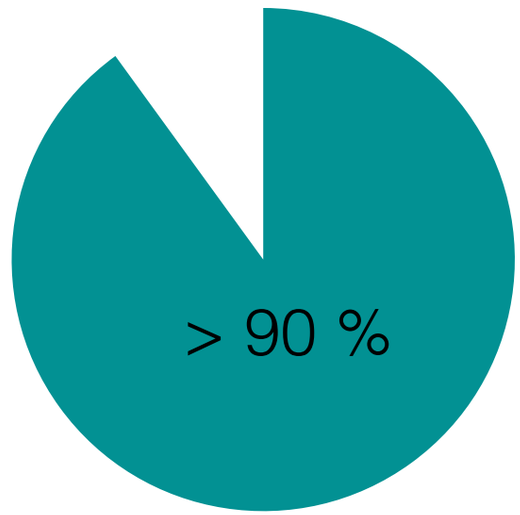
This much

Accuracy:

Function arity



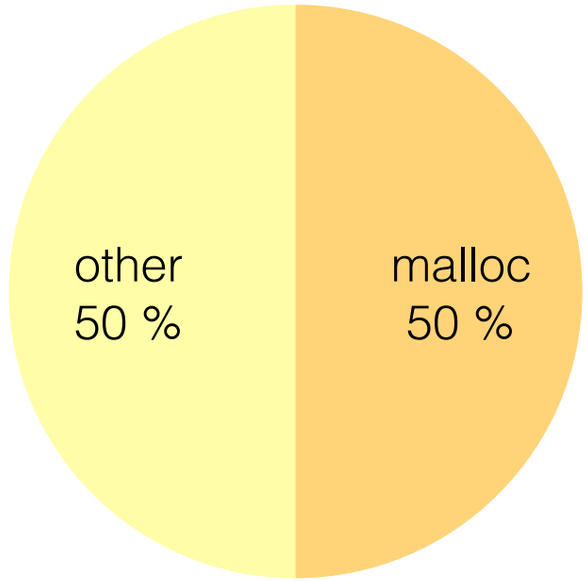
Parameter types



This much

Coupling (on MuPDF):

- 526 functions
- 578 couples
- 42 unique left-side functions



Key Idea

Lightweight

Lightweight dynamic

Key Idea

Lightweight dynamic instrumentation

Key Idea

Lightweight dynamic instrumentation

to recover

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to recover function prototypes

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in

Key Idea

Lightweight dynamic instrumentation to recover function prototypes and coupling from binaries in one execution

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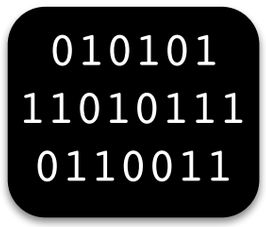
Lightweight dynamic instrumentation to recover function prototypes and coupling from binaries in one execution

Object we study:

Object we study:

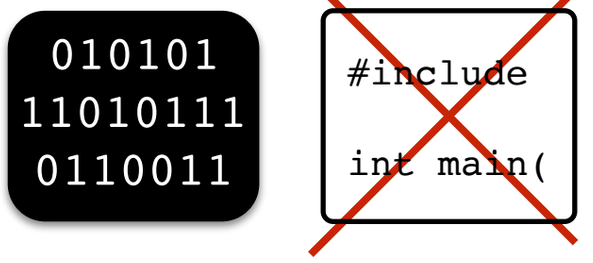
- binary program



binaries

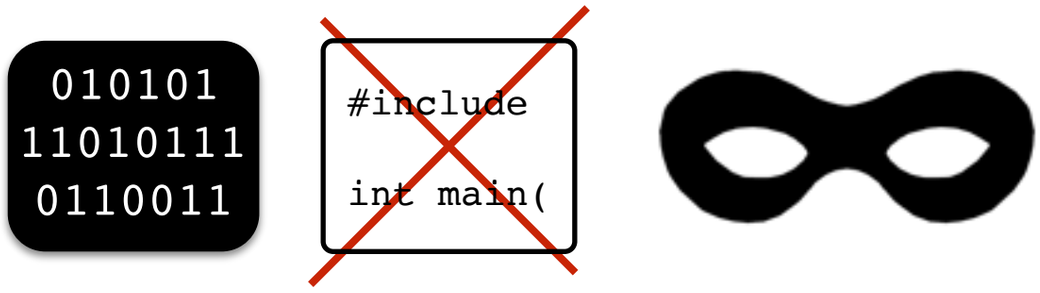
Object we study:

- binary program
- no source code



Object we study:

- binary program
- no source code
- possibly stripped
- possibly obfuscated



Key Idea

Lightweight dynamic instrumentation to recover function prototypes and coupling from binaries in one execution

We want to recover:

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- the number of parameters ⟶ function arity

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- the number of parameters ⟶ function arity
- the type of parameters ⟶ function prototype

Key Idea

Lightweight dynamic instrumentation to recover function prototypes and coupling from binaries in one execution

Intuition:

Functions that are semantically linked

- `malloc` ⟶ `free`
- `fopen` ⟶ `fclose`

Definition. ρ-coupling

Two functions `f` and `g` are ρ-coupled if for any execution `e`, there is a data-flow from the returned value of `f` to a given parameter of `g` in a proportion of calls to `g` greater than ρ.

Key Idea

Lightweight dynamic instrumentation

to recover function prototypes

and coupling from binaries

in one execution

#1 — arity

- Calling convention specifies the way parameters are passed to functions
- For example, `x86-64` calling convention:
  - Parameters passed through registers
  - For integers/addr: `%rdi`, `%rsi`, `%rdx`, `%rcx`, `%r8`, `%r9`
  - For floats: `%xmm0`–`%xmm7`

#1 — arity

Registers read before written are parameters.

to recover

#1 — arity

```
401e55:       75 a9                   jne    401e00
401e57:       90                      nop
401e58:       c9                      leaveq
401e59:       c3                      retq
401e5a:       55                      push   %rbp
401e5b:       48 89 e5                mov    %rsp,%rbp
401e5e:       48 83 ec 30             sub    $0x30,%rsp
401e62:       48 89 7d d8             mov    %rdi,-0x28(%rbp)
401e66:       48 8b 45 d8             mov    -0x28(%rbp),%rax
401e6a:       48 8b 80 b0 27 00 00    mov    0x27b0(%rax),%rax
  …    :      …                       …      …
401e8a:       eb 2e                   jmp    401eba
401e8c:       48 8b 45 f8             mov    -0x8(%rbp),%rax
401e90:       8b 40 20                mov    0x20(%rax),%eax
401e93:       85 c0                   test   %eax,%eax
401e95:       75 17                   jne    401eae
401e97:       48 8b 55 d8             mov    -0x28(%rbp),%rex
401e9b:       48 8d 4d e0             lea    -0x20(%rbp),%rcx
  …    :      …                       …      …
401eb6:       48 89 45 f8             mov    %rax,-0x8(%rbp)
401eba:       48 83 7d f8 00          cmpq   $0x0,-0x8(%rbp)
401ebf:       75 cb                   jne    401e8c
401ec1:       90                      nop
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401fd3:       48 89 c7                mov    %rax,%rdi
401fd6:       e8 7f fe ff ff          callq  401e5a
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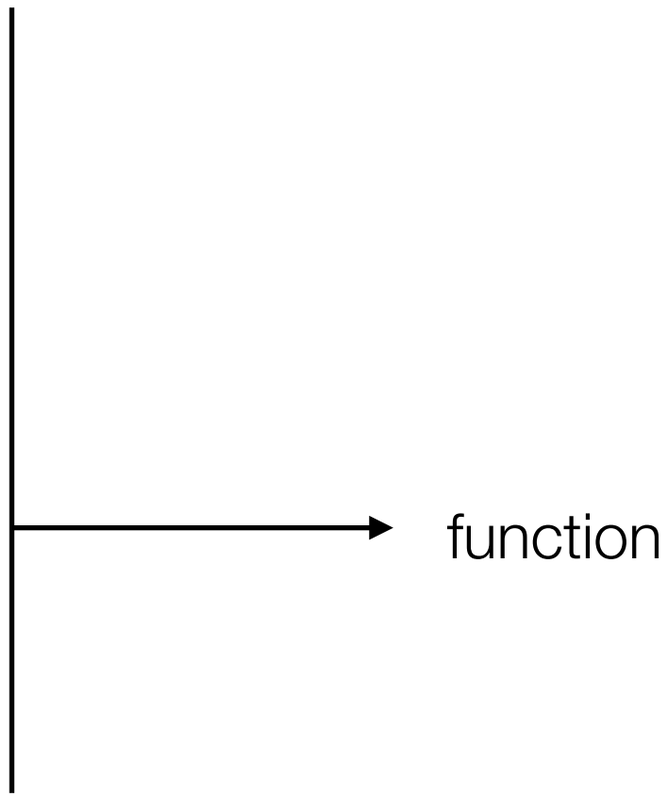

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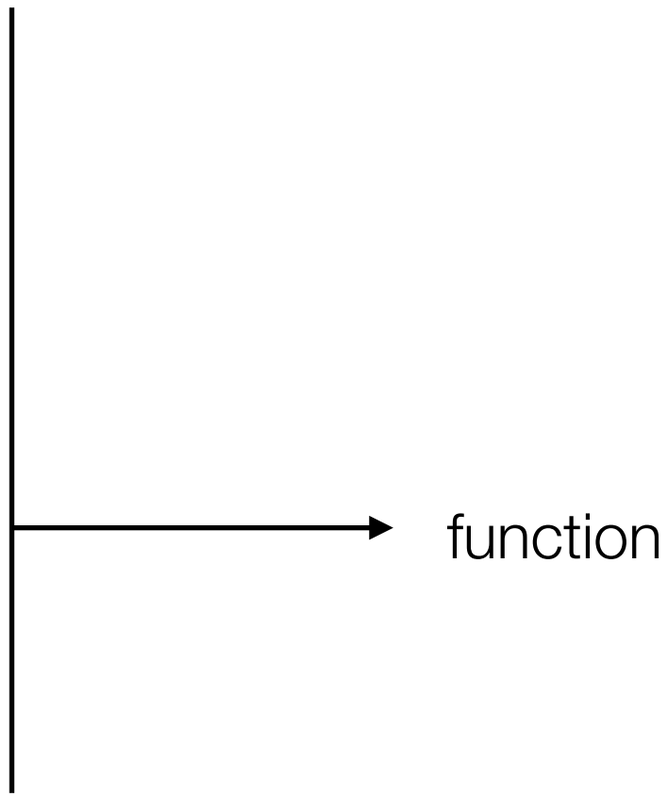

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→ function

- (at least) one parameter

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to recover

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```

→ function

- (at least) one parameter
- returning void

#2 — type

- Three types considered: INT, ADDR, FLOAT
- Distinction INT/ADDR vs. FLOAT given by register
- Main problem: distinction INT vs. ADDR

#2 — type

A location dereferenced (e.g. in `load`/`store`) is an address.

to recover

#2 — type

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401e8c:       48 8b 45 f8             mov    -0x8(%rbp),%rax
```

INT or ADDR ?

```
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401e93:       85 c0                   test   %eax,%eax
401e95:       75 17                   jne    401eae
401e97:       48 8b 55 d8             mov    -0x28(%rbp),%rex
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ADDR

```
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401e5b:       48 89 e5                mov    %rsp,%rbp
401e5e:       48 83 ec 30             sub    $0x30,%rsp
401e62:       48 89 7d d8             mov    %rdi,-0x28(%rbp)
401e66:       48 8b 45 d8             mov    -0x28(%rbp),%rax
401e6a:       48 8b 80 b0 27 00 00    mov    0x27b0(%rax),%rax
  …    :      …                       …      …
401e8a:       eb 2e                   jmp    401eba
401e8c:       48 8b 45 f8             mov    -0x8(%rbp),%rax
```

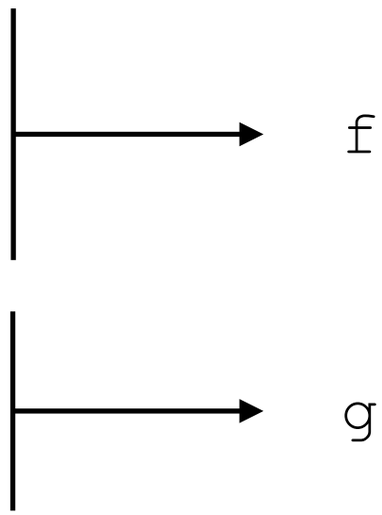
```
401e90:       8b 40 20                mov    0x20(%rax),%eax
401e93:       85 c0                   test   %eax,%eax
401e95:       75 17                   jne    401eae
401e97:       48 8b 55 d8             mov    -0x28(%rbp),%rex
401e9b:       48 8d 4d e0             lea    -0x20(%rbp),%rcx
  …    :      …                       …      …
401eb6:       48 89 45 f8             mov    %rax,-0x8(%rbp)
401eba:       48 83 7d f8 00          cmpq   $0x0,-0x8(%rbp)
401ebf:       75 cb                   jne    401e8c
401ec1:       90                      nop
401ec2:       c9                      leaveq
401ec3:       c3                      retq
401ec4:       55                      push   %rbp
401ec5:       48 89 e5                mov    %rsp,%rbp
  …    :      …                       …      …
401fcb:       48 89 7d f8             mov    %rdi,-0x8(%rbp)
401fcf:       48 8b 45 f8             mov    -0x8(%rbp),%rax
401fd3:       48 89 c7                mov    %rax,%rdi
401fd6:       e8 7f fe ff ff          callq  401e5a
401fdb:       48 8b 45 f8             mov    -0x8(%rbp),%rax
401fdf:       48 8b 80 b0 27 00 00    mov    0x27b0(%rax),%rax
```

#3 — coupling

A shared value between a ret and a param. includes a coupling.

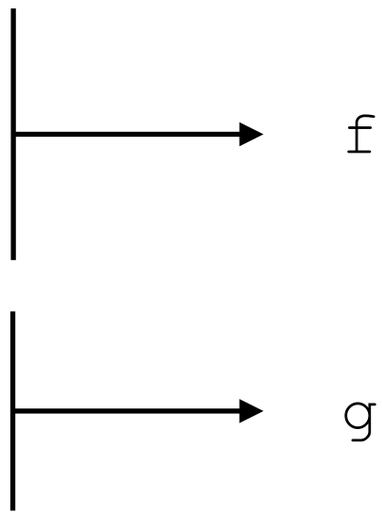
#3 — coupling

```
...    :        ...                     ...
40059f:         bf 28 00 00 00          mov    $0x28,%edi
4005a4:         e8 40 01 00 00          callq  4006e9
4005a9:         48 89 45 f8             mov    %rax,-0x8(%rbp)
...    :        ...                     ...
4005c3:         48 8b 45 f8             mov    -0x8(%rbp),%rax
4005c7:         be 28 00 00 00          mov    $0x28,%esi
4005cc:         48 89 c7                mov    %rax,%rdi
4005cf:         e8 22 04 00 00          callq  4009f6
...    :        ...                     ...
4006e9:         55                      push   %rbp
4006ea:         48 89 e5                mov    %rsp,%rbp
4006ed:         48 83 ec 28             sub    $0x28,%rsp
4006f1:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
...    :        ...                     ...
4008d9:         c9                      leaveq
4008da:         c3                      retq
...    :        ...                     ...
4009f6:         55                      push   %rbp
4009f7:         48 89 e5                mov    %rsp,%rbp
4009fa:         48 83 ec 30             sub    $0x30,%rsp
4009fe:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
400a02:         48 89 75 d0             mov    %rsi,-0x30(%rbp)
```



#3 — coupling

```
...    :        ...                     ...
40059f:         bf 28 00 00 00          mov    $0x28,%edi
4005a4:         e8 40 01 00 00          callq  4006e9
4005a9:         48 89 45 f8             mov    %rax,-0x8(%rbp)
...    :        ...                     ...
4005c3:         48 8b 45 f8             mov    -0x8(%rbp),%rax
4005c7:         be 28 00 00 00          mov    $0x28,%esi
4005cc:         48 89 c7                mov    %rax,%rdi
4005cf:         e8 22 04 00 00          callq  4009f6
...    :        ...                     ...
4006e9:         55                      push   %rbp
4006ea:         48 89 e5                mov    %rsp,%rbp
4006ed:         48 83 ec 28             sub    $0x28,%rsp
4006f1:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
...    :        ...                     ...
4008d9:         c9                      leaveq
4008da:         c3                      retq
...    :        ...                     ...
4009f6:         55                      push   %rbp
4009f7:         48 89 e5                mov    %rsp,%rbp
4009fa:         48 83 ec 30             sub    $0x30,%rsp
4009fe:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
400a02:         48 89 75 d0             mov    %rsi,-0x30(%rbp)
```



#3 — coupling

```
...    :        ...                     ...
40059f:         bf 28 00 00 00          mov    $0x28,%edi
4005a4:         e8 40 01 00 00          callq  4006e9
4005a9:         48 89 45 f8             mov    %rax,-0x8(%rbp)
...    :        ...                     ...
4005c3:         48 8b 45 f8             mov    -0x8(%rbp),%rax
4005c7:         be 28 00 00 00          mov    $0x28,%esi
4005cc:         48 89 c7                mov    %rax,%rdi
4005cf:         e8 22 04 00 00          callq  4009f6
...    :        ...                     ...
4006e9:         55                      push   %rbp
4006ea:         48 89 e5                mov    %rsp,%rbp
4006ed:         48 83 ec 28             sub    $0x28,%rsp
4006f1:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
...    :        ...                     ...
4008d9:         c9                      leaveq
4008da:         c3                      retq
...    :        ...                     ...
4009f6:         55                      push   %rbp
4009f7:         48 89 e5                mov    %rsp,%rbp
4009fa:         48 83 ec 30             sub    $0x30,%rsp
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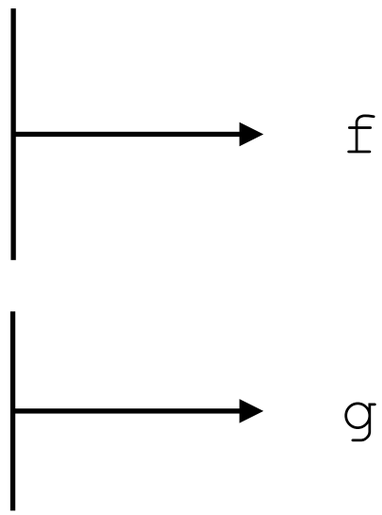
```



#3 — coupling

```
...    :        ...                     ...
40059f:         bf 28 00 00 00          mov    $0x28,%edi
4005a4:         e8 40 01 00 00          callq  4006e9
4005a9:         48 89 45 f8             mov    %rax,-0x8(%rbp)
...    :        ...                     ...
4005c3:         48 8b 45 f8             mov    -0x8(%rbp),%rax
4005c7:         be 28 00 00 00          mov    $0x28,%esi
4005cc:         48 89 c7                mov    %rax,%rdi
4005cf:         e8 22 04 00 00          callq  4009f6
...    :        ...                     ...
4006e9:         55                      push   %rbp
4006ea:         48 89 e5                mov    %rsp,%rbp
4006ed:         48 83 ec 28             sub    $0x28,%rsp
4006f1:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
...    :        ...                     ...
4008d9:         c9                      leaveq
4008da:         c3                      retq
...    :        ...                     ...
4009f6:         55                      push   %rbp
4009f7:         48 89 e5                mov    %rsp,%rbp
4009fa:         48 83 ec 30             sub    $0x30,%rsp
4009fe:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
400a02:         48 89 75 d0             mov    %rsi,-0x30(%rbp)
```

f

g

#3 — coupling

```
...    :        ...                     ...
40059f:         bf 28 00 00 00          mov    $0x28,%edi
4005a4:         e8 40 01 00 00          callq  4006e9
4005a9:         48 89 45 f8             mov    %rax,-0x8(%rbp)
...    :        ...                     ...
4005c3:         48 8b 45 f8             mov    -0x8(%rbp),%rax
4005c7:         be 28 00 00 00          mov    $0x28,%esi
4005cc:         48 89 c7                mov    %rax,%rdi
4005cf:         e8 22 04 00 00          callq  4009f6
...    :        ...                     ...
4006e9:         55                      push   %rbp
4006ea:         48 89 e5                mov    %rsp,%rbp
4006ed:         48 83 ec 28             sub    $0x28,%rsp
4006f1:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
...    :        ...                     ...
4008d9:         c9                      leaveq
4008da:         c3                      retq
...    :        ...                     ...
4009f6:         55                      push   %rbp
4009f7:         48 89 e5                mov    %rsp,%rbp
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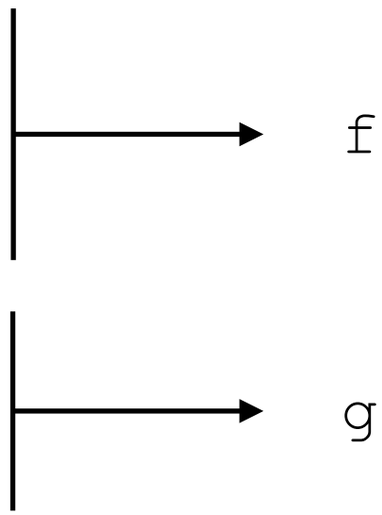
4009fe:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
400a02:         48 89 75 d0             mov    %rsi,-0x30(%rbp)
```



#3 — coupling

```
...    :        ...                     ...
40059f:         bf 28 00 00 00          mov    $0x28,%edi
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4008d9:         c9                      leaveq
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...    :        ...                     ...
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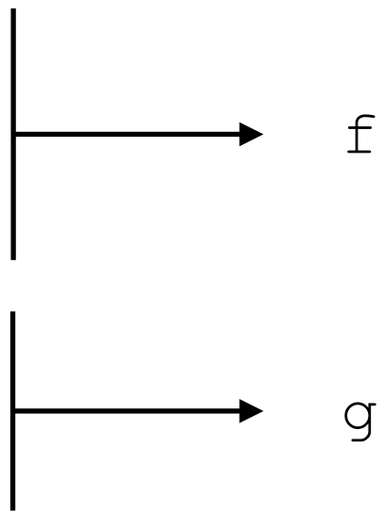
```



#3 — coupling

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4006f1:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
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4008d9:         c9                      leaveq
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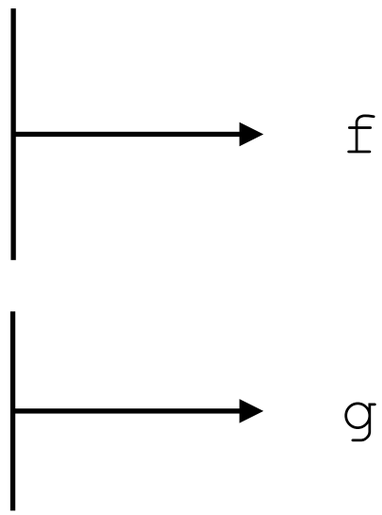
```



#3 — coupling

```
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4005cf:         e8 22 04 00 00          callq  4009f6
...    :        ...                     ...
4006e9:         55                      push   %rbp
4006ea:         48 89 e5                mov    %rsp,%rbp
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4006f1:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
...    :        ...                     ...
4008d9:         c9                      leaveq
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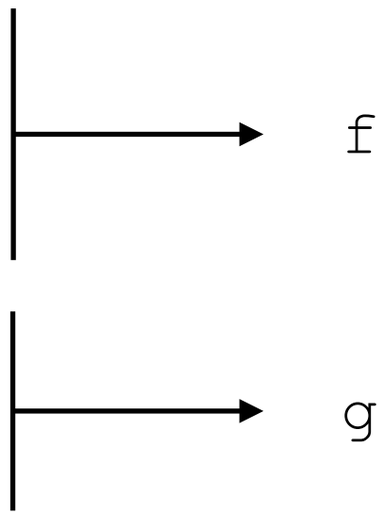
...    :        ...                     ...
4009f6:         55                      push   %rbp
4009f7:         48 89 e5                mov    %rsp,%rbp
4009fa:         48 83 ec 30             sub    $0x30,%rsp
4009fe:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
400a02:         48 89 75 d0             mov    %rsi,-0x30(%rbp)
```



#3 — coupling

```
...    :        ...                     ...
40059f:         bf 28 00 00 00          mov    $0x28,%edi
4005a4:         e8 40 01 00 00          callq  4006e9
4005a9:         48 89 45 f8             mov    %rax,-0x8(%rbp)
...    :        ...                     ...
4005c3:         48 8b 45 f8             mov    -0x8(%rbp),%rax
4005c7:         be 28 00 00 00          mov    $0x28,%esi
4005cc:         48 89 c7                mov    %rax,%rdi
4005cf:         e8 22 04 00 00          callq  4009f6
...    :        ...                     ...
4006e9:         55                      push   %rbp
4006ea:         48 89 e5                mov    %rsp,%rbp
4006ed:         48 83 ec 28             sub    $0x28,%rsp
4006f1:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
...    :        ...                     ...
4008d9:         c9                      leaveq
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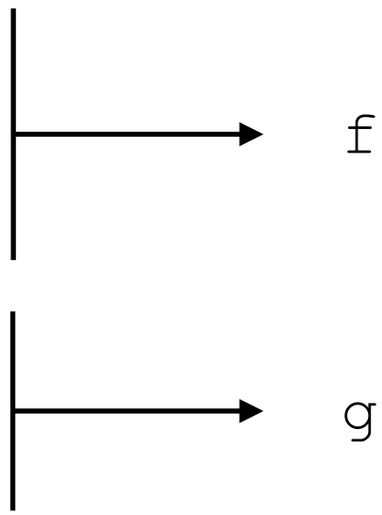
...    :        ...                     ...
4009f6:         55                      push   %rbp
4009f7:         48 89 e5                mov    %rsp,%rbp
4009fa:         48 83 ec 30             sub    $0x30,%rsp
4009fe:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
400a02:         48 89 75 d0             mov    %rsi,-0x30(%rbp)
```



#3 — coupling

1) `f` returns `0x7fe047419010`

```
...    :        ...                     ...
40059f:         bf 28 00 00 00          mov    $0x28,%edi
4005a4:         e8 40 01 00 00          callq  4006e9
4005a9:         48 89 45 f8             mov    %rax,-0x8(%rbp)
...    :        ...                     ...
4005c3:         48 8b 45 f8             mov    -0x8(%rbp),%rax
4005c7:         be 28 00 00 00          mov    $0x28,%esi
4005cc:         48 89 c7                mov    %rax,%rdi
4005cf:         e8 22 04 00 00          callq  4009f6
...    :        ...                     ...
4006e9:         55                      push   %rbp
4006ea:         48 89 e5                mov    %rsp,%rbp
4006ed:         48 83 ec 28             sub    $0x28,%rsp
4006f1:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
...    :        ...                     ...
4008d9:         c9                      leaveq
4008da:         c3                      retq
...    :        ...                     ...
4009f6:         55                      push   %rbp
4009f7:         48 89 e5                mov    %rsp,%rbp
4009fa:         48 83 ec 30             sub    $0x30,%rsp
4009fe:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
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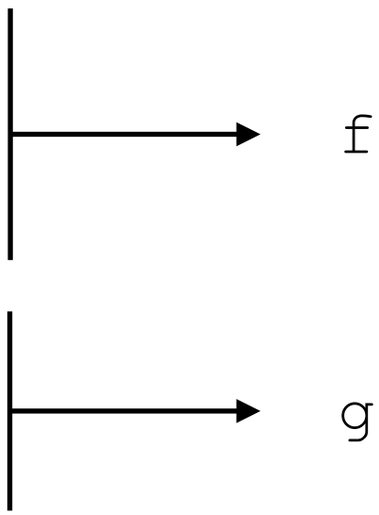
```



#3 — coupling

1) `f` returns `0x7fe047419010`

```
...    :        ...                     ...
40059f:         bf 28 00 00 00          mov    $0x28,%edi
4005a4:         e8 40 01 00 00          callq  4006e9
4005a9:         48 89 45 f8             mov    %rax,-0x8(%rbp)
...    :        ...                     ...
4005c3:         48 8b 45 f8             mov    -0x8(%rbp),%rax
4005c7:         be 28 00 00 00          mov    $0x28,%esi
4005cc:         48 89 c7                mov    %rax,%rdi
4005cf:         e8 22 04 00 00          callq  4009f6
...    :        ...                     ...
4006e9:         55                      push   %rbp
4006ea:         48 89 e5                mov    %rsp,%rbp
4006ed:         48 83 ec 28             sub    $0x28,%rsp
4006f1:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
...    :        ...                     ...
4008d9:         c9                      leaveq
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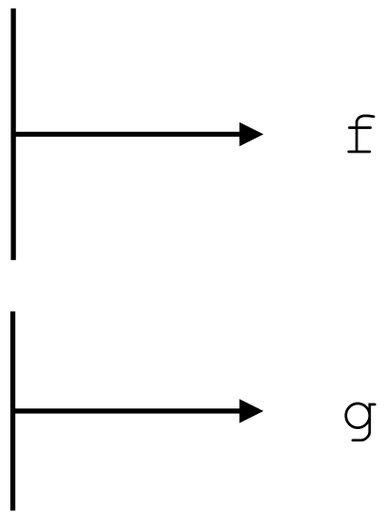
4009fa:         48 83 ec 30             sub    $0x30,%rsp
4009fe:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
400a02:         48 89 75 d0             mov    %rsi,-0x30(%rbp)
```



#3 — coupling

1) `f` returns `0x7fe047419010`

```
...    :        ...                     ...
40059f:         bf 28 00 00 00          mov    $0x28,%edi
4005a4:         e8 40 01 00 00          callq  4006e9
4005a9:         48 89 45 f8             mov    %rax,-0x8(%rbp)
...    :        ...                     ...
4005c3:         48 8b 45 f8             mov    -0x8(%rbp),%rax
4005c7:         be 28 00 00 00          mov    $0x28,%esi
4005cc:         48 89 c7                mov    %rax,%rdi
4005cf:         e8 22 04 00 00          callq  4009f6
...    :        ...                     ...
4006e9:         55                      push   %rbp
4006ea:         48 89 e5                mov    %rsp,%rbp
4006ed:         48 83 ec 28             sub    $0x28,%rsp
4006f1:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
...    :        ...                     ...
4008d9:         c9                      leaveq
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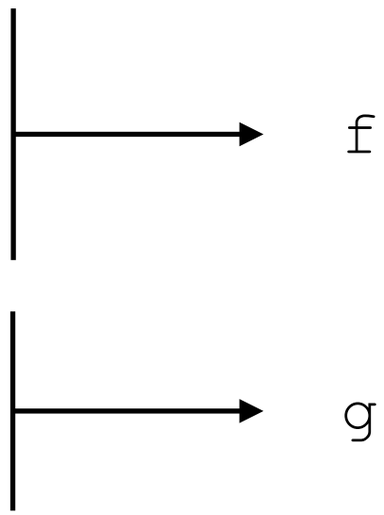
...    :        ...                     ...
4009f6:         55                      push   %rbp
4009f7:         48 89 e5                mov    %rsp,%rbp
4009fa:         48 83 ec 30             sub    $0x30,%rsp
4009fe:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
400a02:         48 89 75 d0             mov    %rsi,-0x30(%rbp)
```



#3 — coupling

1) `f` returns `0x7fe047419010`

```
...    :        ...                     ...
40059f:         bf 28 00 00 00          mov    $0x28,%edi
4005a4:         e8 40 01 00 00          callq  4006e9
4005a9:         48 89 45 f8             mov    %rax,-0x8(%rbp)
...    :        ...                     ...
4005c3:         48 8b 45 f8             mov    -0x8(%rbp),%rax
4005c7:         be 28 00 00 00          mov    $0x28,%esi
4005cc:         48 89 c7                mov    %rax,%rdi
4005cf:         e8 22 04 00 00          callq  4009f6
...    :        ...                     ...
4006e9:         55                      push   %rbp
4006ea:         48 89 e5                mov    %rsp,%rbp
4006ed:         48 83 ec 28             sub    $0x28,%rsp
4006f1:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
...    :        ...                     ...
4008d9:         c9                      leaveq
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...    :        ...                     ...
4009f6:         55                      push   %rbp
4009f7:         48 89 e5                mov    %rsp,%rbp
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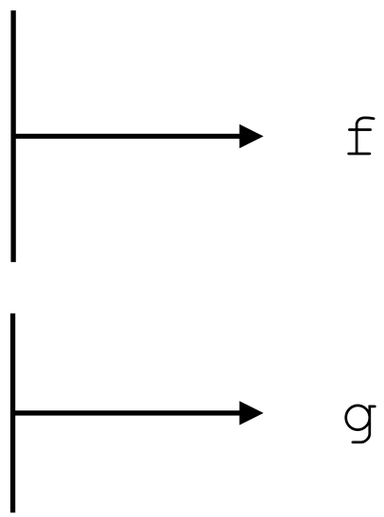
4009fe:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
400a02:         48 89 75 d0             mov    %rsi,-0x30(%rbp)
```

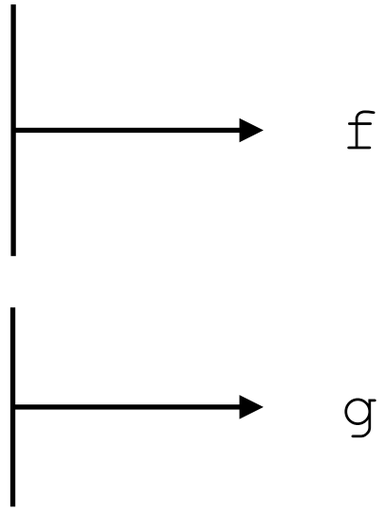


to recover

#3 — coupling

1) `f` returns `0x7fe047419010`

```
...    :        ...                     ...
40059f:         bf 28 00 00 00          mov    $0x28,%edi
4005a4:         e8 40 01 00 00          callq  4006e9
4005a9:         48 89 45 f8             mov    %rax,-0x8(%rbp)
...    :        ...                     ...
4005c3:         48 8b 45 f8             mov    -0x8(%rbp),%rax
4005c7:         be 28 00 00 00          mov    $0x28,%esi
4005cc:         48 89 c7                mov    %rax,%rdi
4005cf:         e8 22 04 00 00          callq  4009f6
...    :        ...                     ...
4006e9:         55                      push   %rbp
4006ea:         48 89 e5                mov    %rsp,%rbp
4006ed:         48 83 ec 28             sub    $0x28,%rsp
4006f1:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
...    :        ...                     ...
4008d9:         c9                      leaveq
4008da:         c3                      retq
...    :        ...                     ...
4009f6:         55                      push   %rbp
4009f7:         48 89 e5                mov    %rsp,%rbp
4009fa:         48 83 ec 30             sub    $0x30,%rsp
4009fe:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
400a02:         48 89 75 d0             mov    %rsi,-0x30(%rbp)
```



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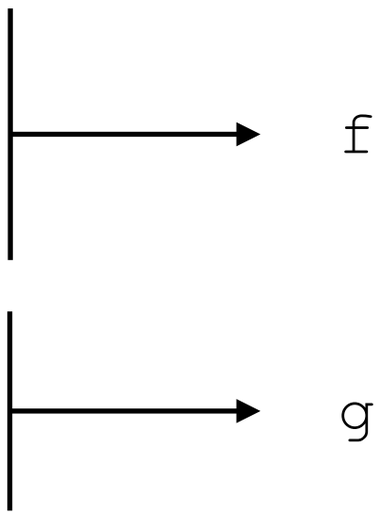

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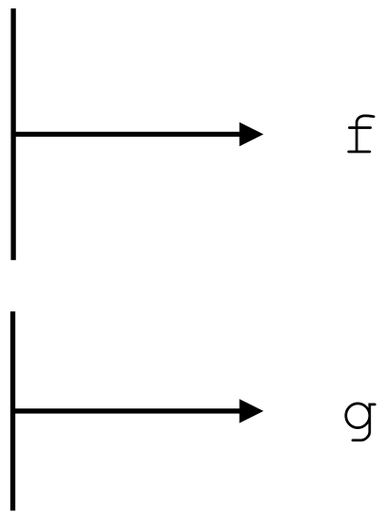

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4009fe:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
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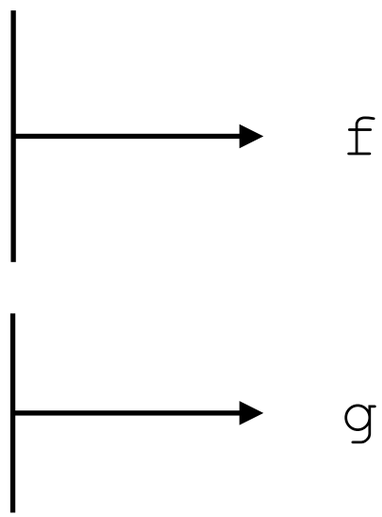

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4006ed:         48 83 ec 28             sub    $0x28,%rsp
4006f1:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
...    :        ...                     ...
4008d9:         c9                      leaveq
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4009fe:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
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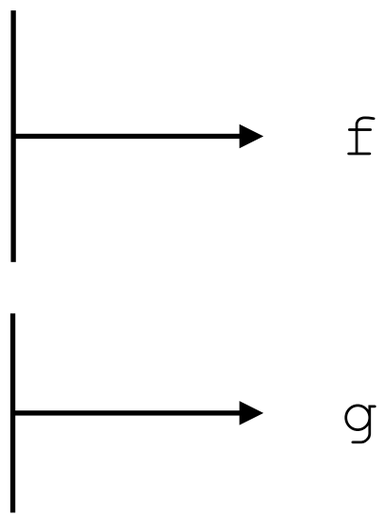

#3 — coupling

1) `f` returns `0x7fe047419010`

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...    :        ...                     ...
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4006e9:         55                      push   %rbp
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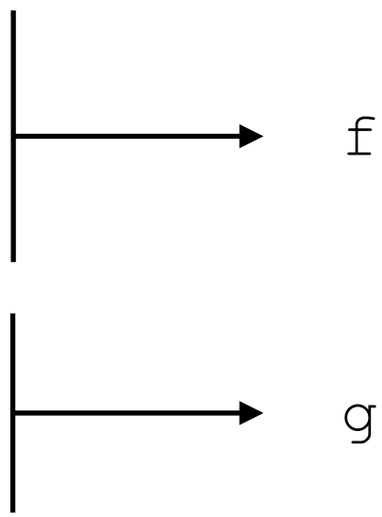
```



to recover

#3 — coupling

```
...    :        ...                     ...
40059f:         bf 28 00 00 00          mov    $0x28,%edi
4005a4:         e8 40 01 00 00          callq  4006e9
4005a9:         48 89 45 f8             mov    %rax,-0x8(%rbp)
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4006f1:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
...    :        ...                     ...
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4009fa:         48 83 ec 30             sub    $0x30,%rsp
4009fe:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
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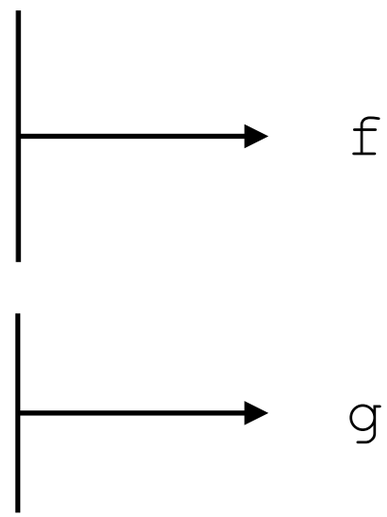
```



1) `f` returns `0x7fe047419010`
2) `g` takes `0x7fe047419010`

#3 — coupling

```
...    :        ...                     ...
40059f:         bf 28 00 00 00          mov    $0x28,%edi
4005a4:         e8 40 01 00 00          callq  4006e9
4005a9:         48 89 45 f8             mov    %rax,-0x8(%rbp)
...    :        ...                     ...
4005c3:         48 8b 45 f8             mov    -0x8(%rbp),%rax
4005c7:         be 28 00 00 00          mov    $0x28,%esi
4005cc:         48 89 c7                mov    %rax,%rdi
4005cf:         e8 22 04 00 00          callq  4009f6
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4006e9:         55                      push   %rbp
4006ea:         48 89 e5                mov    %rsp,%rbp
4006ed:         48 83 ec 28             sub    $0x28,%rsp
4006f1:         48 89 7d d8             mov    %rdi,-0x28(%rbp)
...    :        ...                     ...
4008d9:         c9                      leaveq
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4009fa:         48 83 ec 30             sub    $0x30,%rsp
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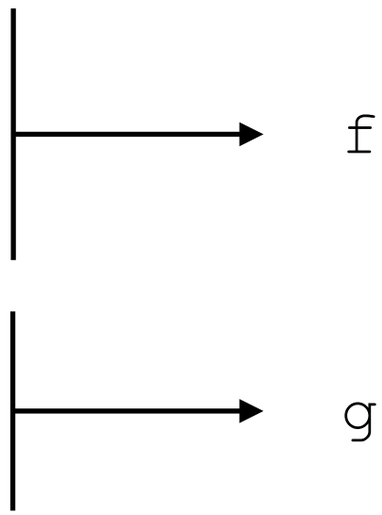

1) `f` returns `0x7fe047419010`
2) `g` takes `0x7fe047419010`

⇒ `f` and `g` are coupled

Key Idea

Lightweight dynamic instrumentation to recover function prototypes and coupling from binaries in one execution

- Using PIN
- Three pintools: `arity.cpp`, `type.cpp`, `couple.cpp`
- Instrumentation example:

```
if (INS_RegRContain(ins, REG_RDI) && !INS_RegWContain(ins, REG_RDI)) {
            INS_InsertCall(ins, IPOINT_BEFORE, (AFUNPTR) reg_access,
                        IARG_UINT32, REG_RDI,
                        IARG_ADDRINT, INS_Address(ins),
                        IARG_END);
```

Key Idea

Lightweight dynamic instrumentation to recover function prototypes and coupling from binaries in one execution

one execution

- `pin -t arity.so — mupdf ./pprew_slides.pdf`

- `pin -t type.so — emacs ./type.so`

- `pin -t couple.so — midori`

Key Idea

Lightweight dynamic instrumentation to recover function prototypes and coupling from binaries in one execution

Overhead of instrumentation

	grep	tar	a2ps
#function	46	101	127
T1 (in s.)	0,80	0,99	0,80
T2 (in s.)	1,70	2,64	31,6
T3 (in s.)	1,06	1,79	13,2

Time execution depending on the instrumentation

- T1: no instrumentation
- T2: arity inference
- T3: type inference

Final words

Accuracy of arity inference

	midori	grep	mupdf	emacs
#function	4094	51	526	591
accuracy (%)	95,8	95,6	98,7	92,4

Accuracy of type inference

	midori	grep	mupdf	emacs
#function	4094	51	526	591
accuracy (%)	96,2	100	92,5	90,4

Additional materials

- Paper: `Lightweight heuristics to retrieve parameter associations from binaries`

- Scat implementation: https://github.com/Frky/scat

- Documentation to come

Do you have

questions ?