Dynamic Hooks

Hiding Control Flow Changes within Non-Control Data

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- Event interception requires us to divert the control flow at runtime
- This is accomplished by installing **hooks** into the control flow

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$\Rightarrow$ **How can we evade existing detection mechanisms?**

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- Hooks must target **persistent** control data

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Dynamic Hooks: Evade existing mechanisms by targeting transient control data

Outline

Dynamic Hooks

▸ Idea

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- Modify non-control data to trigger **vulnerabilities**
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⇒ **Target transient control data**
⇒ **No evident connection between hook and control flow change**

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$\Rightarrow$ **Much stronger attacker model**

```c
struct list_head
{
        struct list_head *next;
        struct list_head *prev;
};

static void list_del(struct list_head *entry)
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        entry->next->prev = entry->prev;
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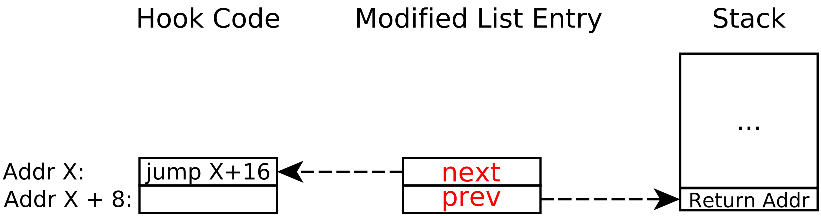
- $[prev] = next$



Hook Code
Modified List Entry
Stack
Addr X:
Addr X + 8:
jump X+16
next
prev
...
Return Addr

Dynamic Hooks

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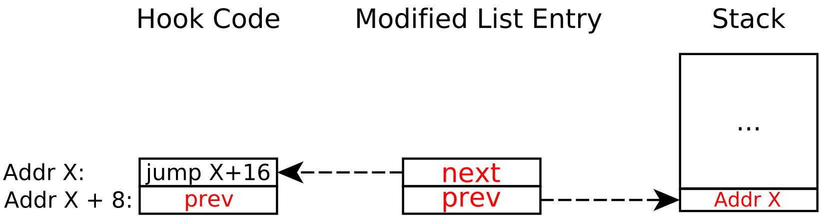

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▸ Suited Vulnerabilities

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```
mov [rax], rbx
```

- Dynamic **control** hooks

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Types

- Dynamic **control** hooks
- Dynamic **data** hooks

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- Symbolic Execution

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  - Implementation: Based on IDA Pro
- Symbolic Execution

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  - check satisfiability of conditional branches
  - generate detailed information about controlled registers

Outline

OS	*Instructions*	*8-byte moves*	*Slices*	*Paths*
Linux	1,976,441	42,130	1753	**566**
Windows	1,330,791	26,694	5450	**379**

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- Program Slicing: no memory model
  $\Rightarrow$ **79,853** paths ignored

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Prototype Limitations

- Program Slicing: no memory model
  $\Rightarrow$ **79,853** paths ignored
- Symbol Execution: supports only a subset of x86 instruction set
  $\Rightarrow$ **5857** slices ignored

Implemented three prototypes of dynamic hooks

1. Control Hook: Interception of system calls (Linux)
2. Data Hook: Backdoor (Linux)
3. Control Hook: Interception of process termination (Windows)

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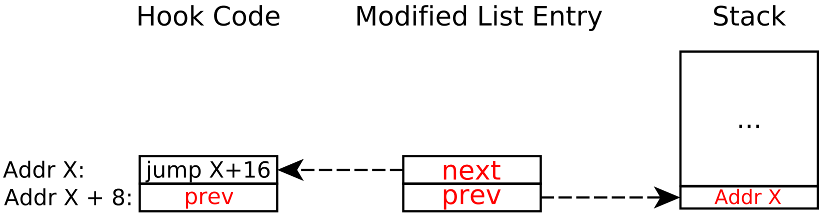

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- Side effects?

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- are more fragile than traditional hooks