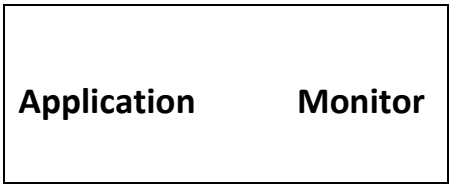
Inline Reference Monitor



-Move monitor into app

-share address space

-must protect integrity of monitor

-advantages

-lower overhead

-can monitor more internal state & actions of application

-strictly more powerful than external monitor

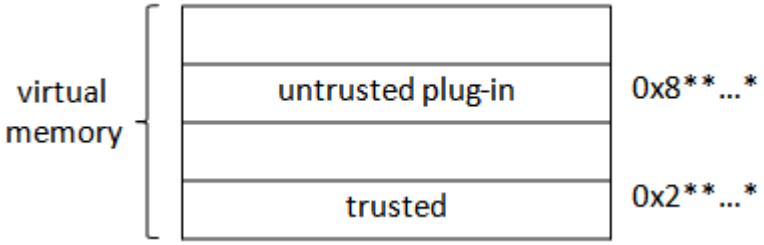
-challenges

-monitor integrity

-how to do it

-complete mediation

SFI (later CFI)



Scenario:

-untrusted plug-in to trusted code

-lots of RPC calls

-GOAL: restrict untrusted code to its own memory + RPC

Rewrite memory references

Original

ld %r0, %r5

Attack: jump straight to ld

Rewrite

mov %r30, %r5

mov %r31, %r30

and %r31, %31, mask

cmp %31, segid

jne ABORT

ld %r0, %r30

-dedicate register %r30 (%r28 %29)

-all loads/stores use %r30

-all moves to %r30 followed by check

-no signals

Enforcing

mov %r30, %r5

and %r30, %30, Nsegmask

or %r30, %r30, segid

ld %r0, %r30

jmp %r5

mov %r30, %r5

and %r30, %r30, mask

or %r30, %r30, segid

jmp %r30

SFI RPC

-untrusted module can only jump into its own segment

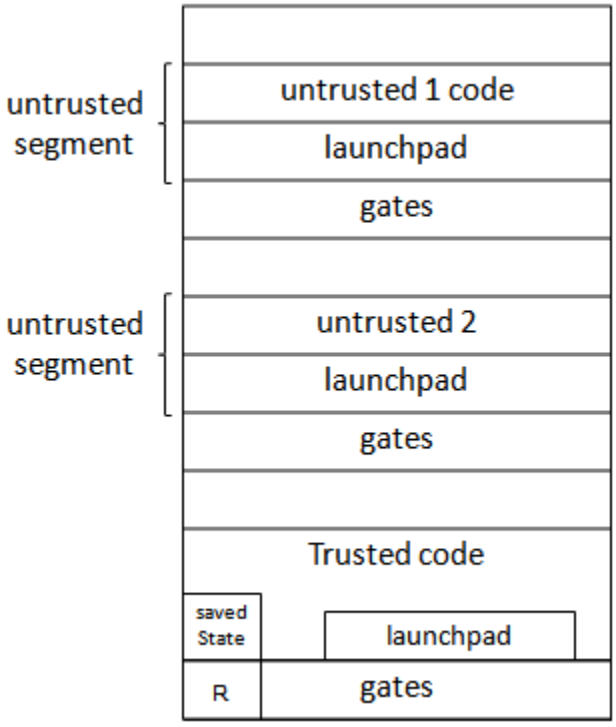
-only escape is via launchpad

-code in launchpad jumps to trusted code

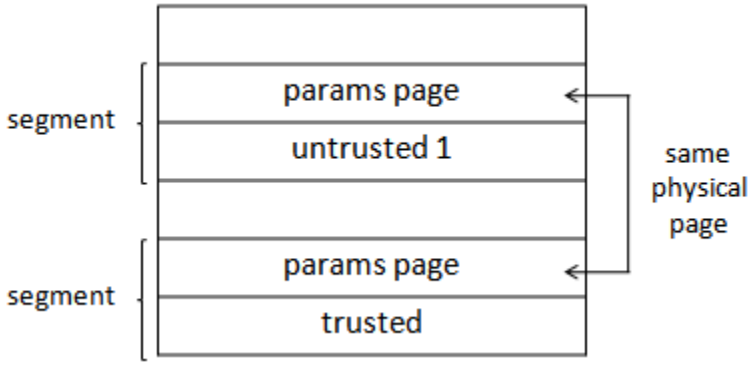
-untrusted code can only jump to specified locations

Attacks

could jumps into middle of trusted function



jmp F1
jmp F2
jmp F3
.
.
.



untrusted code can safely

jump anywhere in launchpad

SFI RPC

-copy args

-2 extra jumps

-dedicated regs

OS RPC

-copy args

-caller to kernel

-kernel to callee

-save caller state

-load callee state

-OS overhead

OS RPC: 200 µs

SFI RPC: ~1 µs

Funcall: .1µs