On Kernel's Safety in the Spectre Era

(And KASLR is Formally Dead)

Davide Davoli[1,2] Martin Avanzini[1,2] Tamara Rezk[1,2]

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Contribution of the talk

There is hope of protecting kernels against speculative attacks.

Memory corruption and layout randomization

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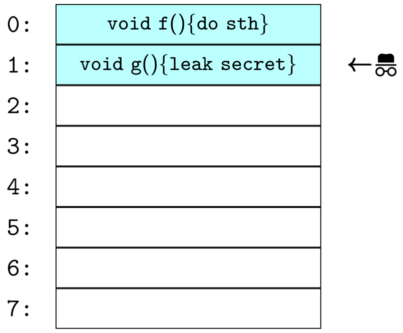

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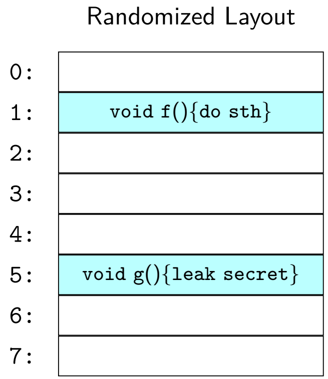

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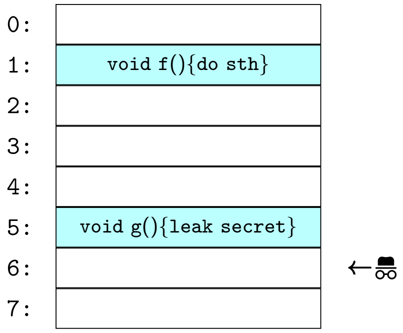

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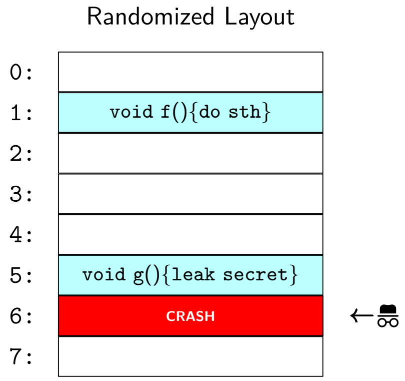

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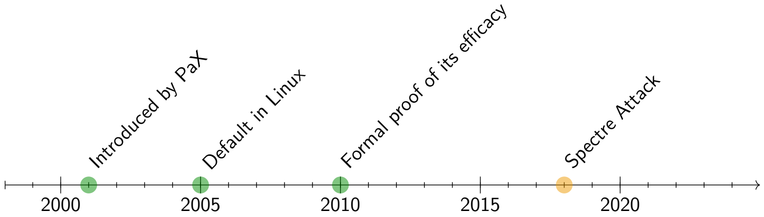

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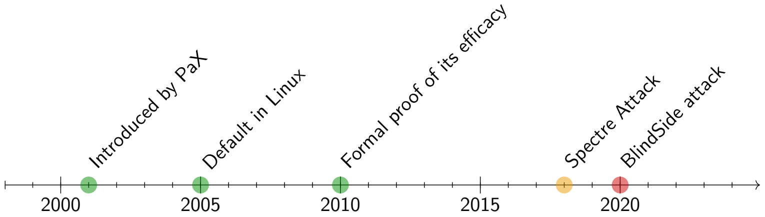

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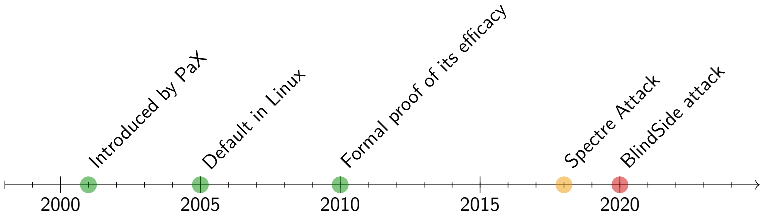

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Can we prevent speculative attacks on kernels?

Main contributions

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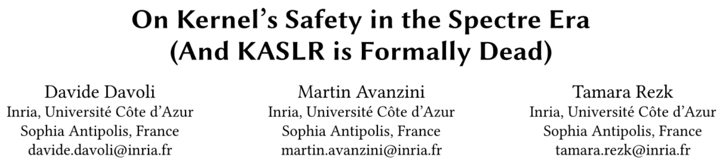

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- We devise a semantics where side-channel and speculative attacks to kernel's layout randomization can be expressed as programs.
- **If a kernel is safe against *ordinary attacks*, it is possible to protect it against *speculative attacks*, systematically.**

Threat model

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Attacker's Goal:

- Trigger a system call to execute code or access data that it is not authorized to access.

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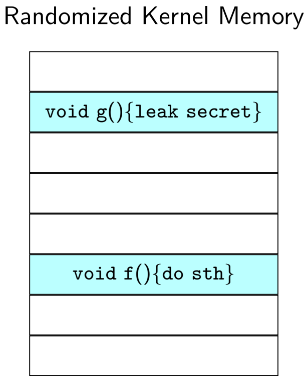

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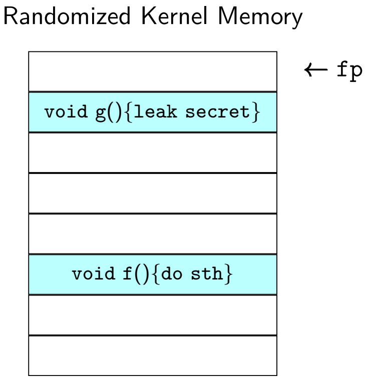

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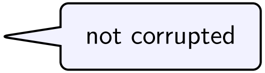

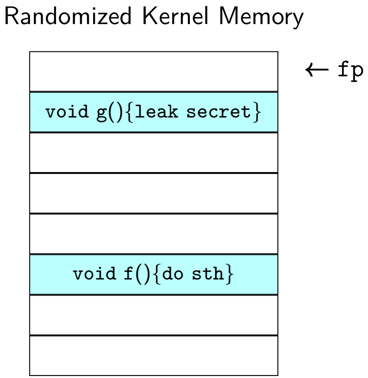

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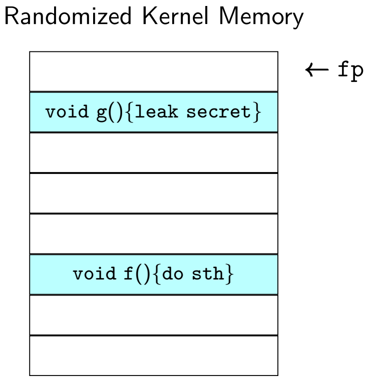

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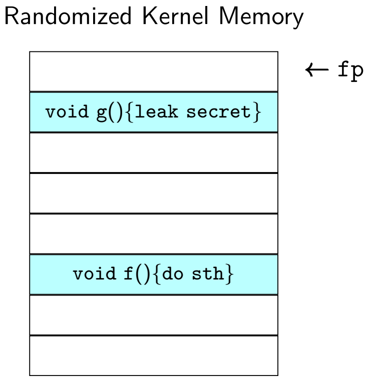

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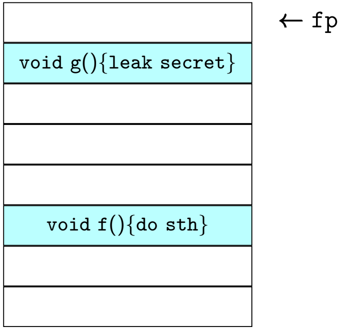

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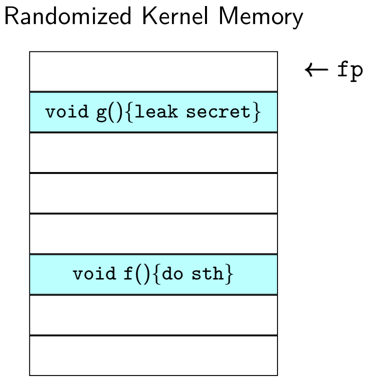

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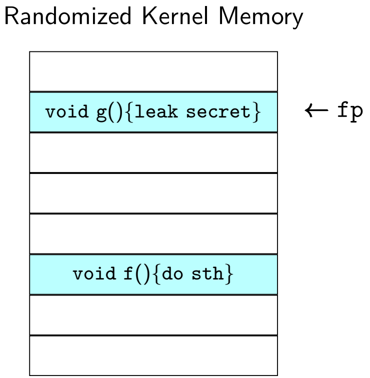

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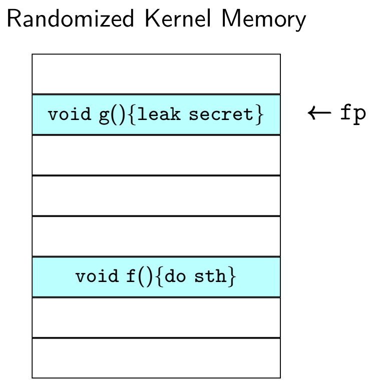

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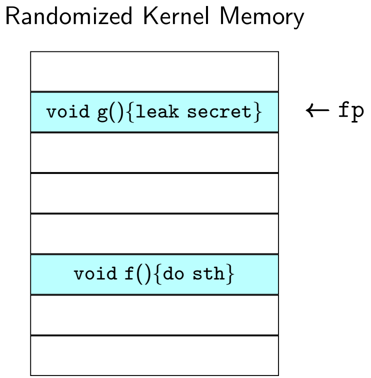

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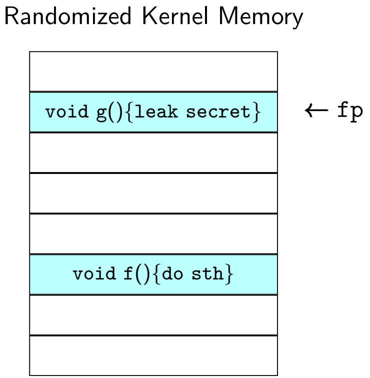

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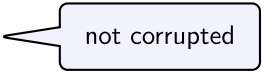

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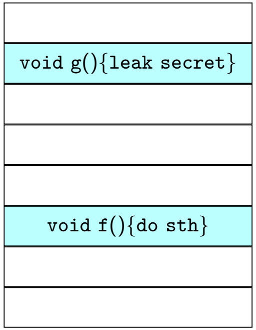

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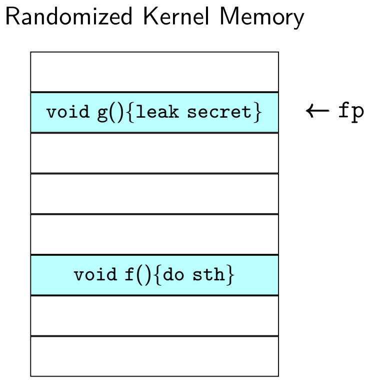

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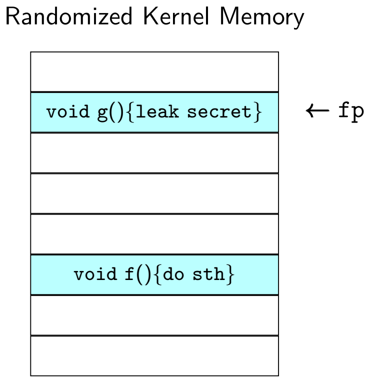

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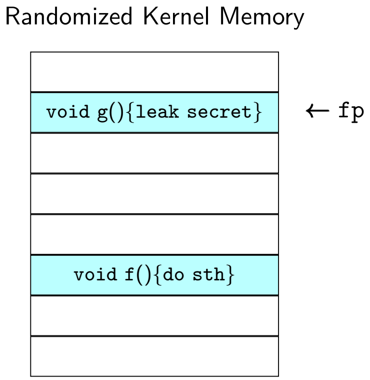

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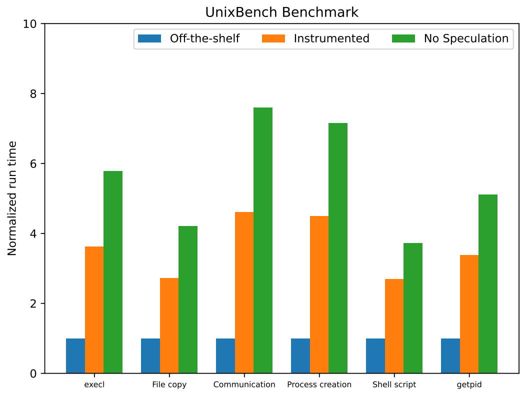
UnixBench Benchmark
Normalized run time
Off-the-shelf
Instrumented
No Speculation
execl
File copy
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Process creation
Shell script
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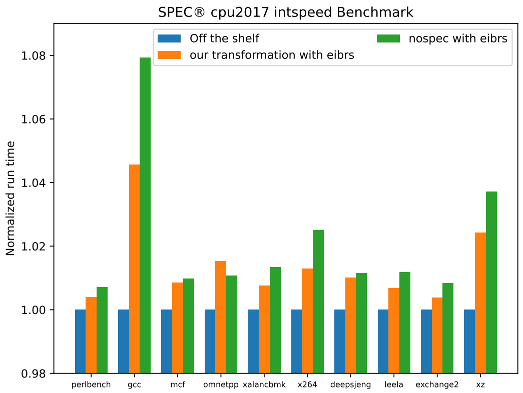
SPEC® cpu2017 intspeed Benchmark
Normalized run time
Off the shelf
our transformation with eibrs
nospec with eibrs
perlbench
gcc
mcf
omnetpp
xalancbmk
x264
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