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When Good Kernel Defenses Go Bad:

Reliable and Stable Kernel Exploits via Defense-Amplified TLB Side-Channel Leaks

Lukas Maar Lukas Giner Daniel Gruss Stefan Mangard

August 13-15, 2025

USENIX Security

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Motivation

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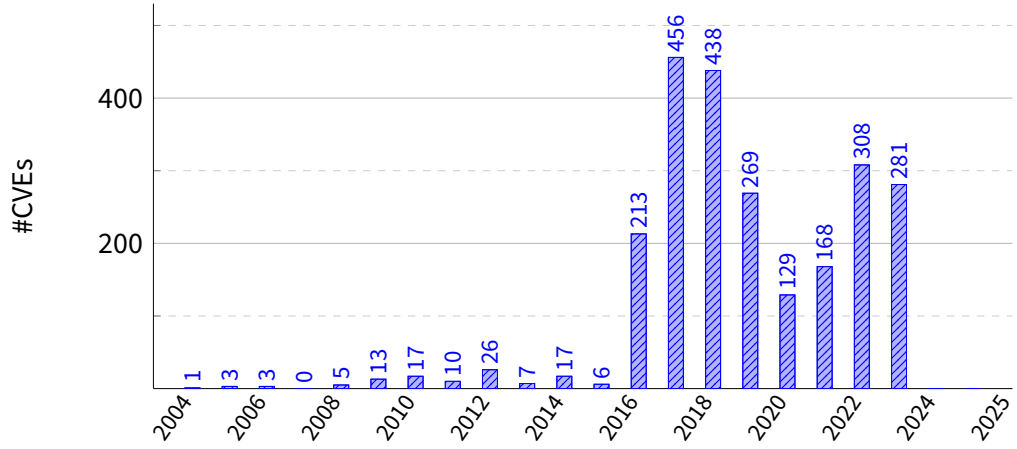
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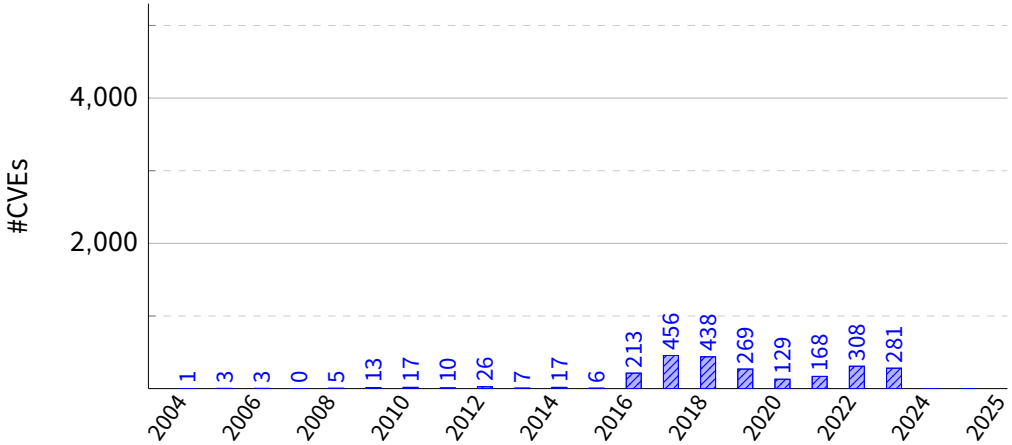
Motivation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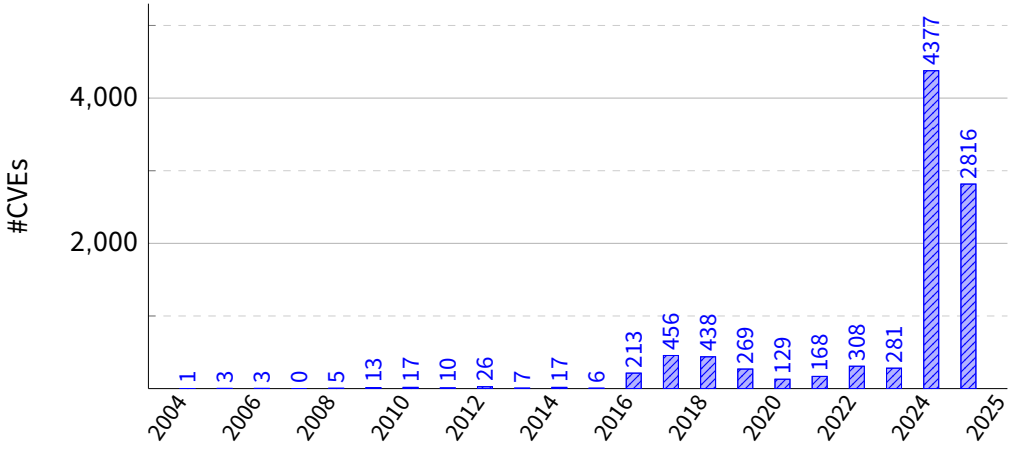
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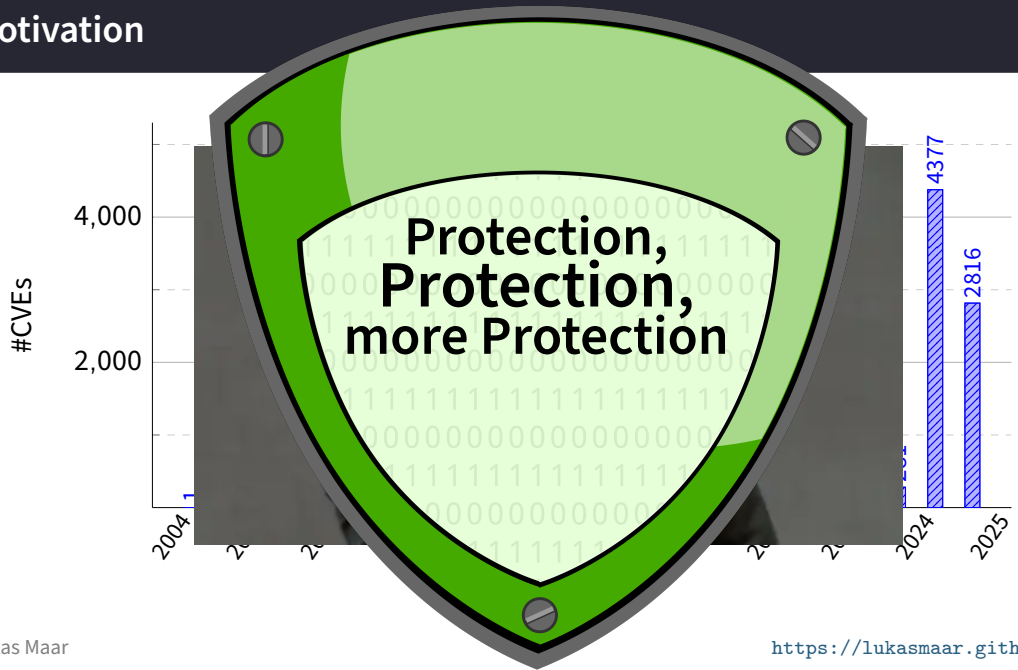
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Protection,
Protection,
more Protection

Our Contributions

Reliable and stable side-channel-assisted kernel exploitation

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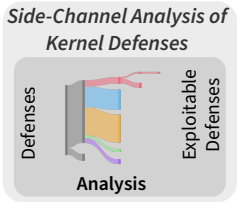
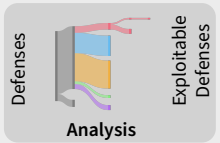
Reliable and stable side-channel-assisted kernel exploitation



Our Contributions

Reliable and stable side-channel-assisted kernel exploitation

Side-Channel Analysis of Kernel Defenses



Location Disclosure Attacks

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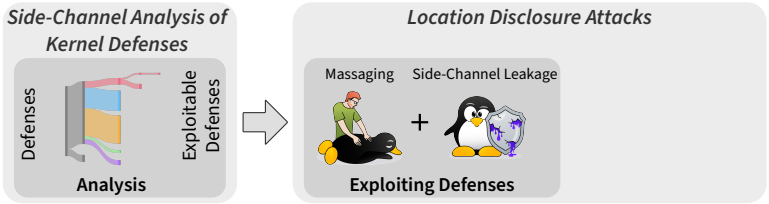
Reliable and stable side-channel-assisted kernel exploitation



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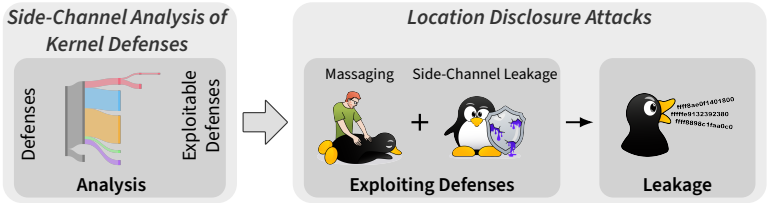
Reliable and stable side-channel-assisted kernel exploitation



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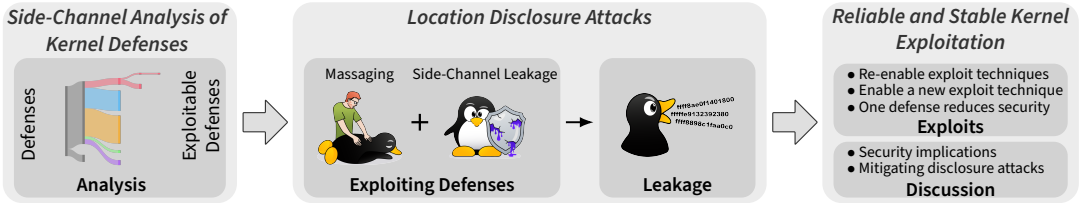

Our Contributions contd

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- **Analysis:**
  - Virtualization of the kstack
  - Virtualization of the kheap
  - Strict memory permission enforcement

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- **Evaluation:**
  - Intel CPUs from 8th to 14th gen
  - Generic Ubuntu kernels from v5.15 to 6.8

Our Contributions contd

- **Analysis:**
  - Virtualization of the kstack
  - Virtualization of the kheap
  - Strict memory permission enforcement
  - Additional allocator design decisions
- **Evaluation:**
  - Intel CPUs from 8th to 14th gen
  - Generic Ubuntu kernels from v5.15 to 6.8
- **Results:**
  - Three side-channel-assisted exploit techniques
  - Near 100 % reliability
  - No system crashes

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