

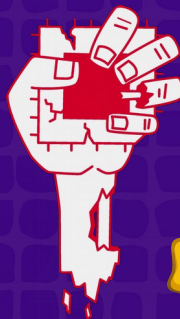
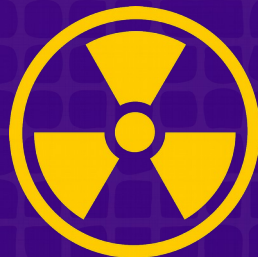
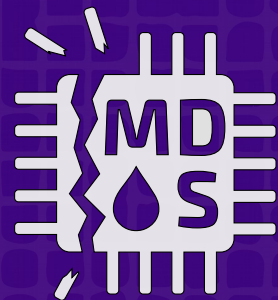
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**Greg Kroah-Hartman**



# Disclaimer

- This talk vastly over-simplifies things.
- See notes for full details and resources.

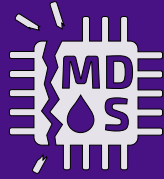
<https://github.com/gregkh/presentation-mds>



- Same “family” of bugs as Spectre/Meltdown
- Hardware bugs
- Exploits the speculative execution model of modern CPUs.
- Many different variants.
- Is going to be with us for a very long time!

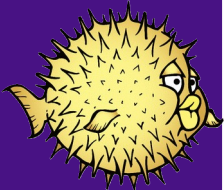


- MDS == “RIDL”, “Fallout”, “Zombieload”, and others
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- Kernel and BIOS fixes required to fully solve



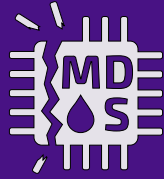
# MDS

- One program can read another program's data
- Can cross the virtual machine boundary
- Exploits “hyper threading” (SMT) issues
- SMT are CPUs that usually share TLBs and L1 cache



# OpenBSD was right

- Guessed more problems would be in this area
- Disabled SMT for Intel chips in June 2018
- Repeated the plea to disable this in August 2018
- Prevented almost all MDS issues automatically
- Security over performance
- Huge respect!



# RIDL

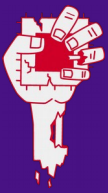
- Rouge-Inflight-Data-Load
- Exploits CPU Line-fill buffers and Load ports
- Steal data across applications, virtual machines, secure enclaves
- Kernel fix by flushing CPU buffers/ports on context switch



# Fallout

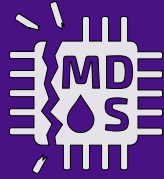
- Exploits CPU Store Buffers
- Read kernel data from userspace
- Breaks ASLR (random kernel addresses)
- “Meltdown” mitigation made this easier to exploit
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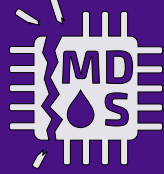
# Zombieland

- Exploits CPU Line-Fill buffers
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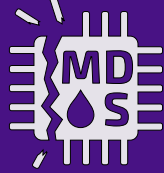
# Other variants

- “Store-to-Leak forwarding”
- “Meltdown UC”
- All allow data to be stolen across security boundaries
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# Flushing CPU buffers is slow

- All of these mitigations slow down the system
- No way yet to schedule different security domains on different physical processors (gang scheduling)
- Disabling SMT mitigates most problems (not ALL!)
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# Flushing CPU buffers is slow

- Performance numbers depend on your workload
- Kernel build
  - -2% smt=on
  - -15% smt=off
  - Heavily multi-threaded, CPU bound
- Kernel creation, no decrease
  - Single threaded, I/O bound
- syscalls are now expensive
- Test your workload!



# Do you feel lucky?

- Users must now choose between performance and security
- What choice did your cloud provider choose?
- <https://make-linux-fast-again.com/>
  - Kernel builds faster by 15%!

# Linux's response

- Kernel fixes available on announcement date
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# Linux security fixes

- Happen at least once a week
- Look like any other bugfix
- Rarely called out as security fix
- Many bugfixes not known to be security related until years later
- No differentiation between bug types
  - A bug is a bug is a bug
- Very few CVEs ever get assigned for kernel security issues

# Linux security fixes != CVEs

- Small fraction of kernel security fixes get CVEs
- If you only cherry-pick CVEs, you have an insecure system
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- [How the Linux Kernel Security team works](#)




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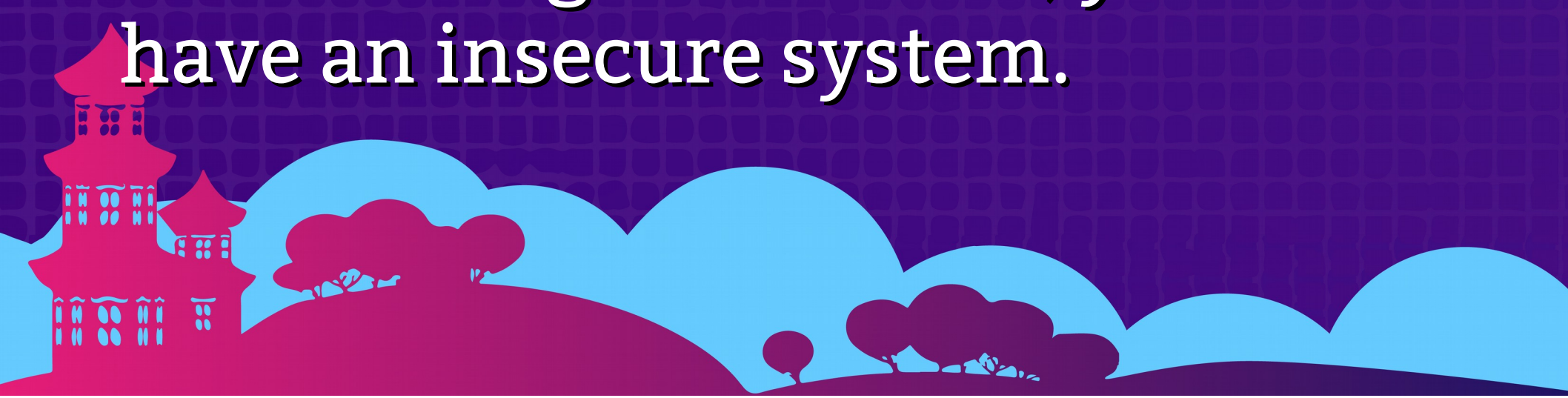
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# Linux Longterm Kernels Fix Problems

- Bugs are fixed before you realize it is a issue.
- Google security team requests for Pixel phones in 2018:
  - 92% (201/218) problems were already fixed in LTS kernel
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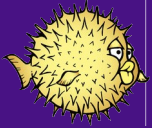
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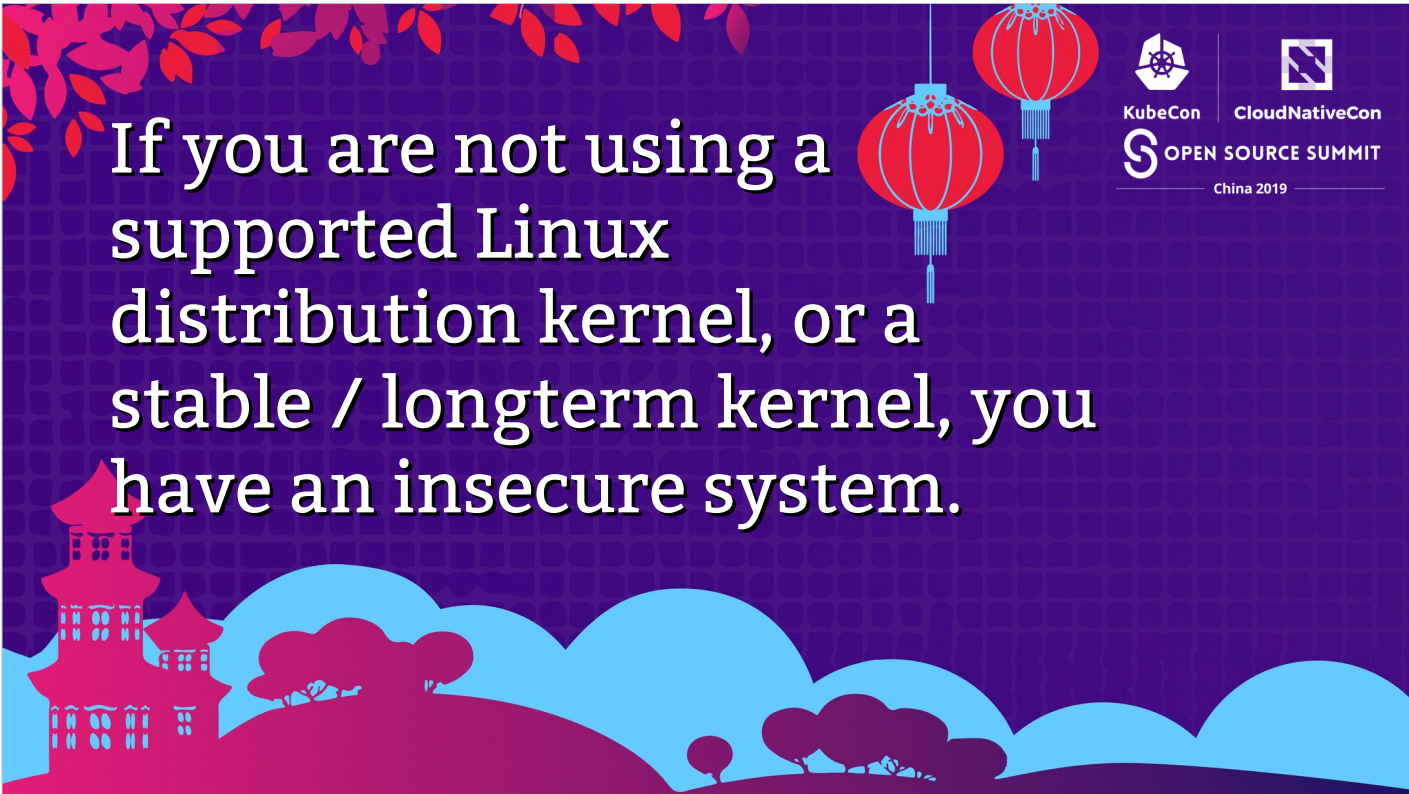
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