Thesis B.Sc.

IDP, Guided Research

Impact of Meltdown and Spectre on Networking Performance

Motivation

The recent publication of the Meltdown and Spectre weaknesses of modern processors [1], led to emergency patches for all major operating systems. To harden the Linux kernel against Meltdown susceptible CPUs a new feature called Kernel Page Table Isolation (KPTI) was introduced. However, this new feature is known to have an impact on the overall system performance [2]. We are especially interested in the impact on the networking part of the Linux Kernel.

We operate a testbed at our chair designed for reproducible performance measurements of networking devices. This testbed is used to investigate network devices, especially software packet processing systems. A Meltdown analysis running on our testbed should measure the effects of a new kernel (e.g. with security patches) on networking performance. Further, we want to investigate the impact throughout different kernel versions in this thesis. Based on the Meltdown and Spectre weaknesses and their patches we want to implement a series of regression tests, targeting different aspects related to network processing. In particular, the parts of the networking system influenced by Kernel Page Table Isolation are of interest. This includes the interrupt or poll-driven mode of modern drivers of 10 GbE Network Interface Controllers, the in-kernel network stack, as well as user space applications such as webservers.

Your Task

- Familiarize yourself with details of the weaknesses and patches
- Implement automated framework for regression tests targeting:
  - Linux networking API (NAPI)
  - Network stack of Linux
  - Different userspace applications

You should have experience with Linux. A basic understanding of the Meltdown and Spectre weaknesses are helpful.

Sources

- [1] https://meltdownattack.com/
- [2] https://newsroom.intel.com/editorials/intel-security-issue-update-initial-performance-data-results-client-systems/

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