Sujet de thèse

Phd thesis subject title

Optimizing the Linux kernel network stack

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Keywords. System,Linux Kernel, Network stack, Rust, VPN, wireguard

Research axis. Linux kernel programming.

1 Phd thesis proposal

(1233 words)

Context. More and more applications requiring fast packet processing on multicore processors bypass the kernel and use dedicated libraries in user space such as DPDK. This trend is due to the bottlenecks in kernel modules. However, bypassing the kernel does not solve its inherent problems.

Objectives. The first key aim of the Phd is : (i) identifying the bottlenecks in the kernel space (ii) understanding why user based libraries are more efficient that the standard packet processing available in the kernel. As a case study, we are interested in the first instance in the *Wireguard* kernel module that allows to implement a VPN. Wireguard is known for not scaling, which has led to several alternative implementations in the user space only [5, 6, 7]. In a second time, it will be necessary to verify the generalization of bottlenecks for other commonly used kernel modules.

The second aim of the PhD is to provide solutions to the identified bottlenecks. We are particularly interested in leveraging on the Intel's Data Streaming Accelerator instructions (DSA) and Intel's Dynamic Load Balancer (DLB) to promote a hardware-software codesign approach. Accordingly, the objective is to find an adequate solution on the latest Sapphire Rapids (SPR), the next-generation Xeon Processor, that comes to market in 2023, which implements the DSA and DLB instructions.

Expected background : This PhD candidates requires familiarity with the C and Rust languages and operating systems concepts.

References

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