XRP: In-Kernel Storage Functions with eBPF

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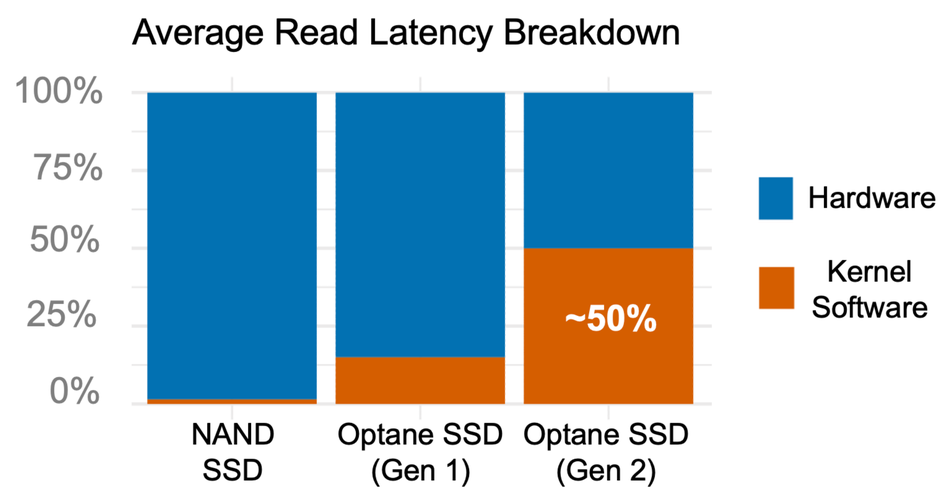
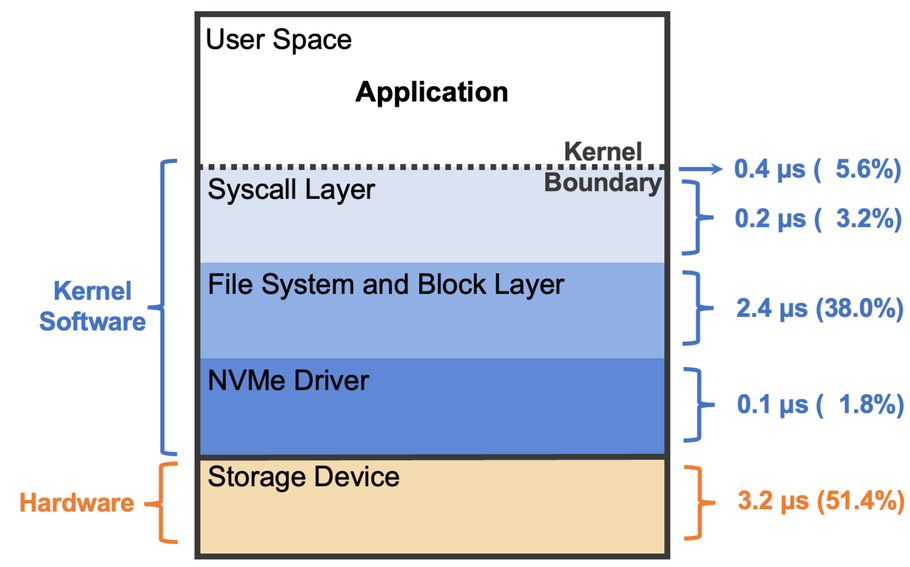
Kernel Software is Becoming the Bottleneck for Storage

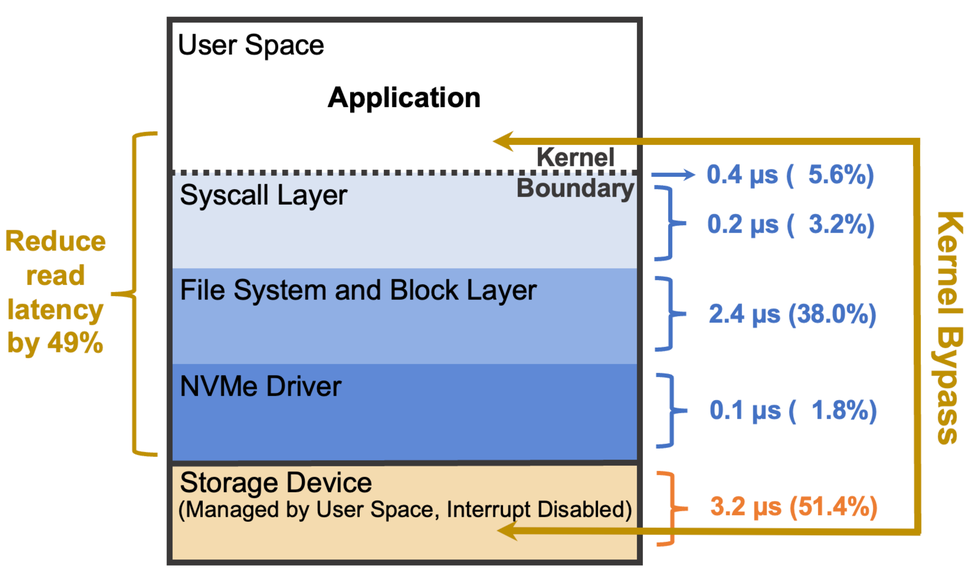
Kernel Software Account for ~50% of the Latency on Fast Storage Devices



Where Does the Latency Come From?

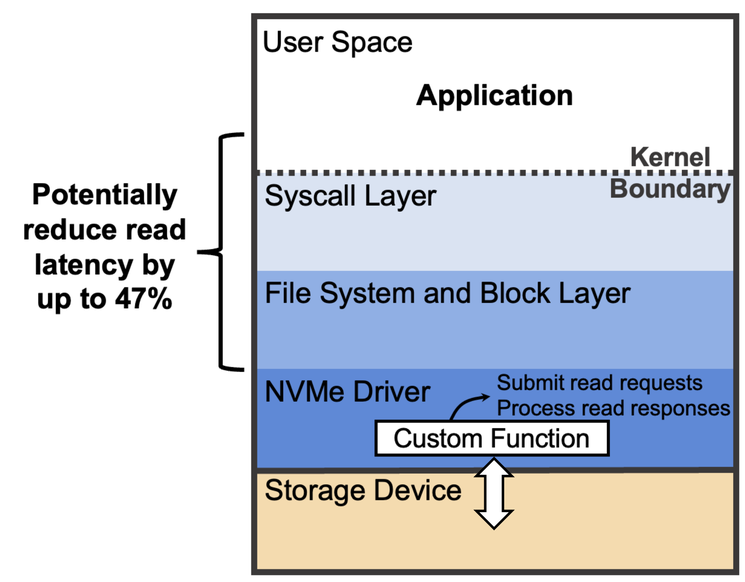


Kernel Bypass is Not a Panacea



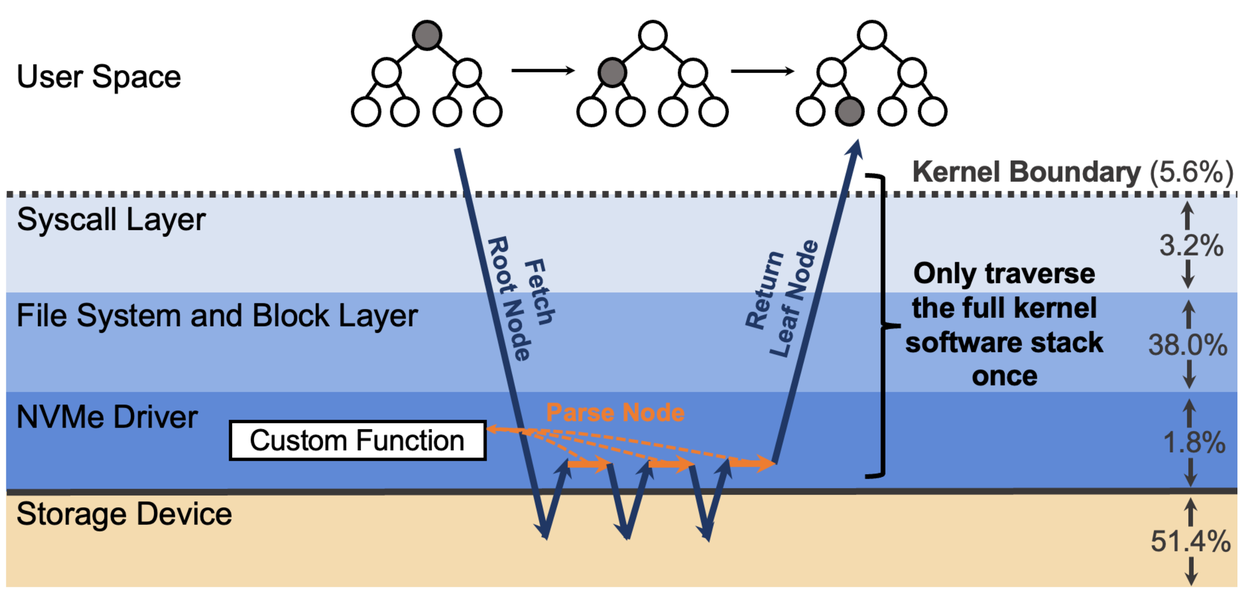
- ✅ Does not incur the overhead of the kernel storage stack
- ❌ No fine-grained access control
- ❌ Requires busy polling for completion
  - ❌ Processes cannot yield CPU when waiting for I/O
    - ❌ CPU cycles are wasted when I/O utilization is low
    - ❌ CPU cannot be shared efficiently among multiple processes

Offload Functions to the Kernel

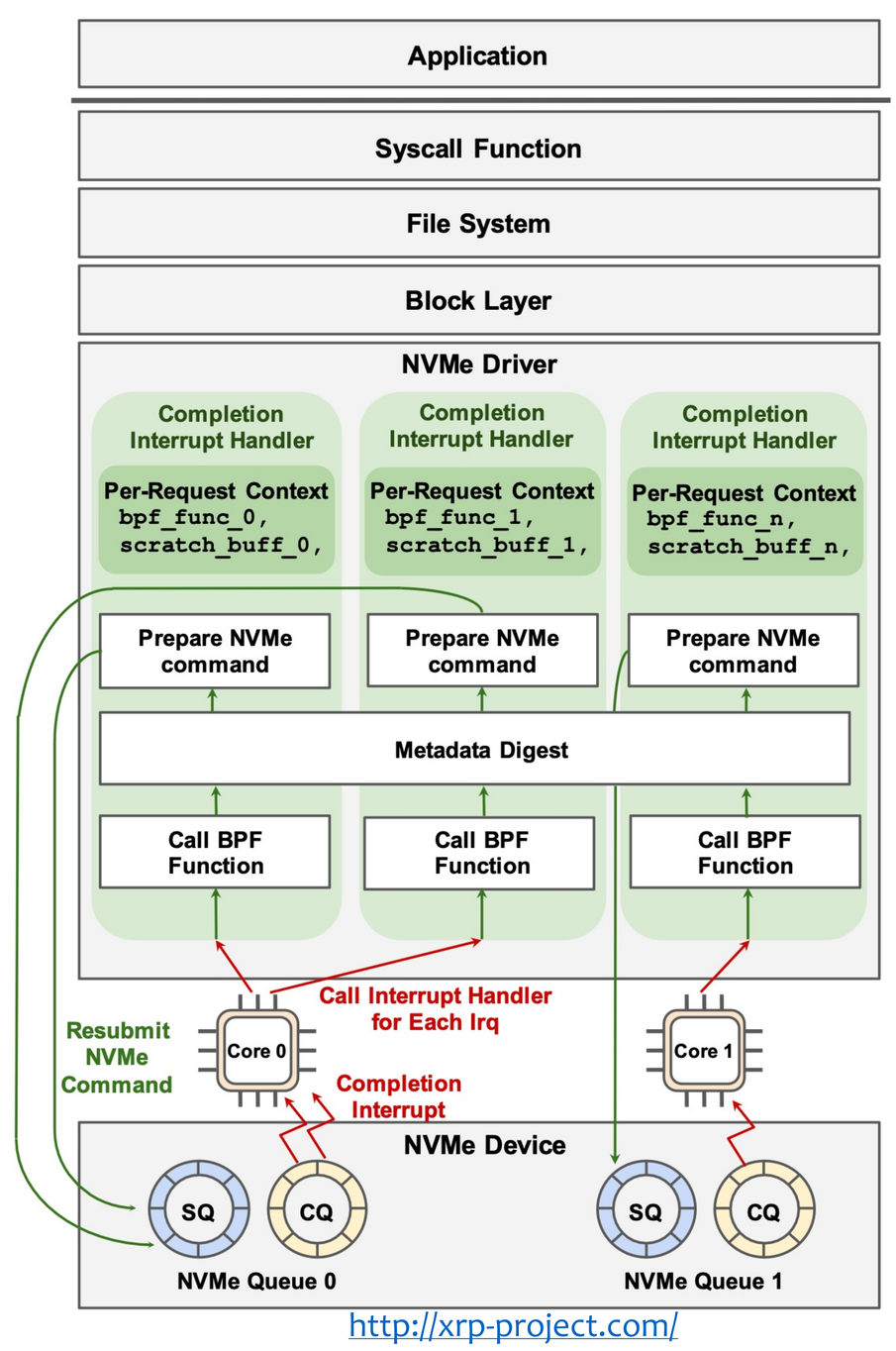


Using In-Kernel Functions to Accelerate Storage Engines

In-Kernel Functions Can Accelerate B+ Tree Index Lookup

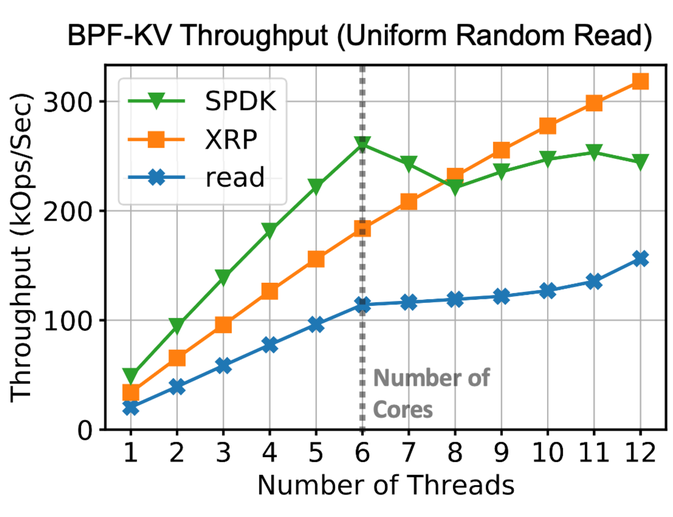


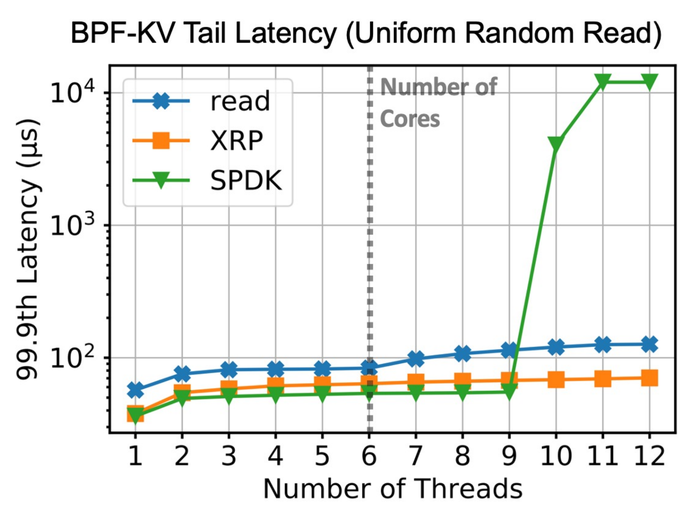
XRP Architecture



http://xrp-project.com/

Results





We integrate XRP with BPF-KV and WiredTiger