Architecting to Achieve a Billion Requests Per Second Throughput on a Single Key-Value Store Server Platform

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Important and challenging In-memory Key-value Stores

In-memory distributed key-value store
• Critical data caching/serving layer in cloud/datacenter infrastructure
• Low-latency, high-throughput, simple hash-table-like interface, at scale

Red hot research in two directions
• Hardware/FPGA acceleration, w/ stock software
• Software centric research, w/ stock hardware
Understanding the essence of key-value stores

Achieving 120 Million requests/second (RPS) on commodity hardware

Architecting a near future KVS platform achieving 1 Billion RPS and beyond

Great collaboration between Intel Labs/ISTC-CC/SNU
- Published in ISCA’ 2015
- Honored by being fast-tracked to ACM TOCS
- Strong interests from IL, DCG, and SSG to push forward
Record-setting Performance & Energy Efficiency

- Best energy efficiency among all systems (FPGA, ARM, and GPU)

- Full stack optimization to get the last nano-second/Joule

- User-level networking

- Better KVS backend

- Holistic software design

95th Latency for all: 100us

- Uniform 50% GET
- Uniform 95% GET
- Skewed 50% GET
- Skewed 95% GET
We are No.1
We are not done
The pursuit of another 10X speedup
Future Platforms: to Billion RPS and Beyond

Quad-socket with 60 3-issue cores, 750KB L2 cache/core, 300GbE per socket, with flow-director and DDIO

Full-stack architecting as the key enabler
• Optimized MICA
• Manycore based, whole system optimized, balanced platform
Conclusions

- Understanding the essence of key-value stores
- Achieving 120 Million requests/second (RPS) on commodity hardware
- Architecting a near future KVS platform achieving 1 Billion RPS and beyond

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