Is it a SmartNIC or a Key-Value Store? Both!
G. Siracusano*, R. Bifulco†
University of Rome Tor Vergata*, NEC Laboratories Europe†

Motivation
- In-memory Key-Value stores (KVS) are critical components of modern web services.
- Given their key role in website performance, KVS are carefully tuned to maximize throughput and minimize response time.

Related work
- KVSs have been optimized to take advantage of modern server's hardware [1].
- Purpose-built accelerators have been proposed to improve performance [2].

PoC Implementation
- NICached implemented using the OpenState abstraction could be deployed to several targets.
  - NetFPGA.
  - P4 based NICs.
  - eBPF for Linux or for NPU-based SmartNIC.

NICached PoC deployed using the eBPF target.
- eXpress Data Path (XDP) hook is used.
- XDP_TX action to transmit packets.

Testbed:
- Two machine with Intel Xeon E5-1630 CPUs (4 cores @3.70GHz).
- Two Mellanox ConnectX-3 (40Gbps) Ethernet cards.
- XDP_TX baseline 6.9 million packets per second (Mpps).

Software micro-benchmarks:
- Cache composed by 3.2 million of entries, Key/Value size 8 bytes.
- Small entries represent the critical workload for KVS[1,5].
- memcached throughput ~ 0.9 million of request per second.
- NICached throughput ~ 5.4 million of request per second, using a single core.

Design
- Several proposals in programmable network data planes suggest FSM abstraction as programming model [3,4].
- NICached algorithm can be easily expressed using a Finite State Machine (FSM).

ACKNOWLEDGMENTS
This work has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No. 671648 (“VirtuWind”). This paper reflects only the authors’ views and the European Commission is not responsible for any use that may be made of the information it contains.

© NEC Corporation 2017