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# Are You Insured Against Your Noisy Neighbor?

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§ Configurations: The testing was done on Based on fourth-generation Intel Xeon E5-2699 v4 @2.20 GHz processor with 22 cores, 55 MB LLC and 62 GB memory 16 1G hugepages. The testing was conducted in OPNFV Pharos testbed on Pod 12 by VSPERF community engineers

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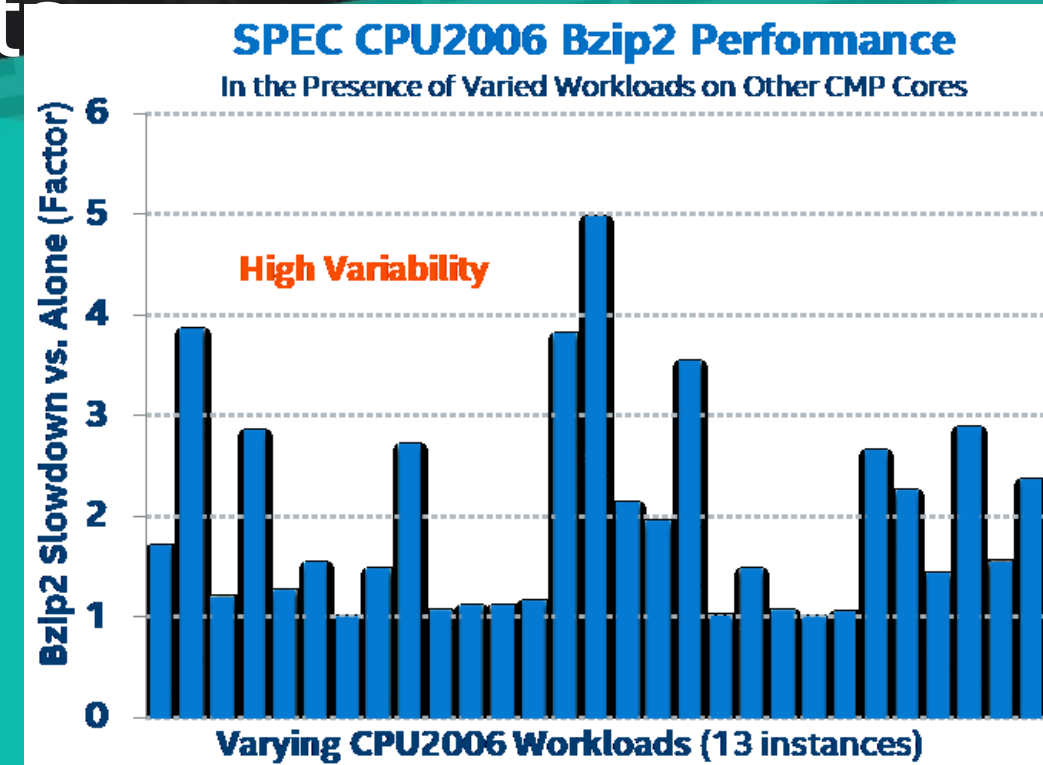
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# Common Contentions in Cloud Deployments

- Minimizing Total Cost of Ownership (TCO) often leads to oversubscription
- Quality of Service (QoS) requirements
- Lack of control of Last Level Cache (LLC) by orchestration layer
- Last-Level Cache Contention Can Lead to 51% Throughput Degradation<sup>1</sup> in Comms Workloads
- Further: Last-Level Cache Contention Can Lead to Almost 5x Performance Variation<sup>1</sup>



**NFV & RT workloads are Time Sensitive**

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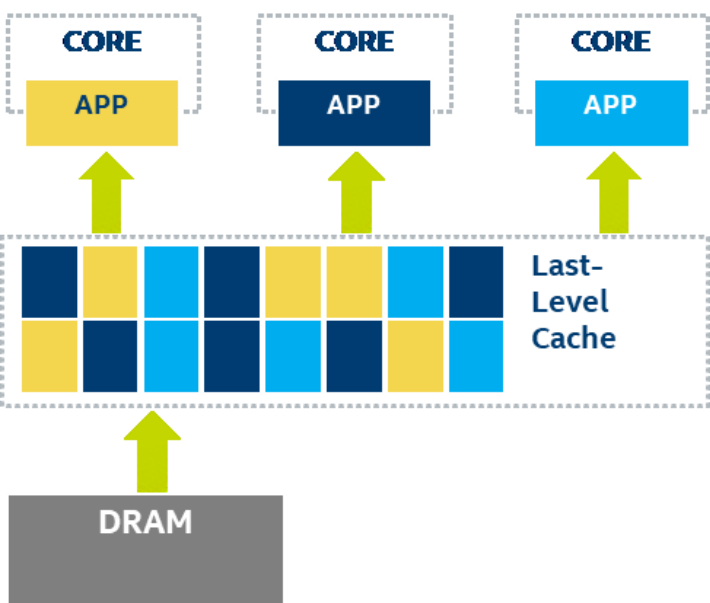
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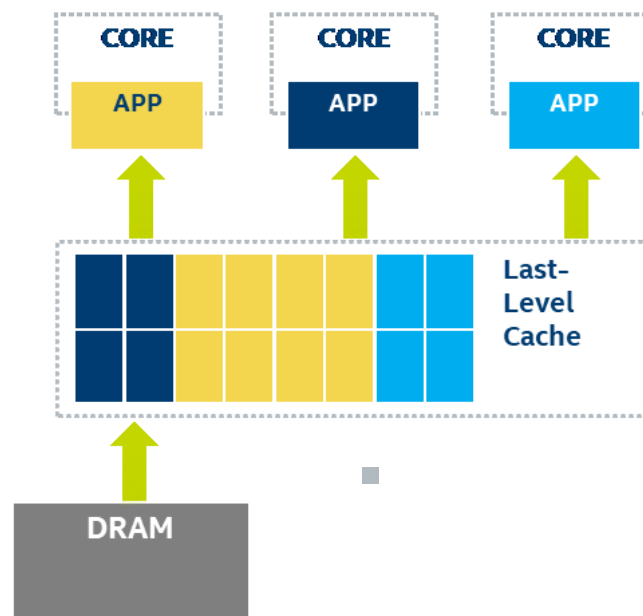
# Intel Resource Director Technology

## Cache Monitoring Technology (CMT)



- Cache Occupancy reported on a per Resource Monitoring ID (RMID) basis—Advanced Telemetry

## Cache Allocation Technology (CAT)



- Misbehaving threads can be isolated to increase determinism

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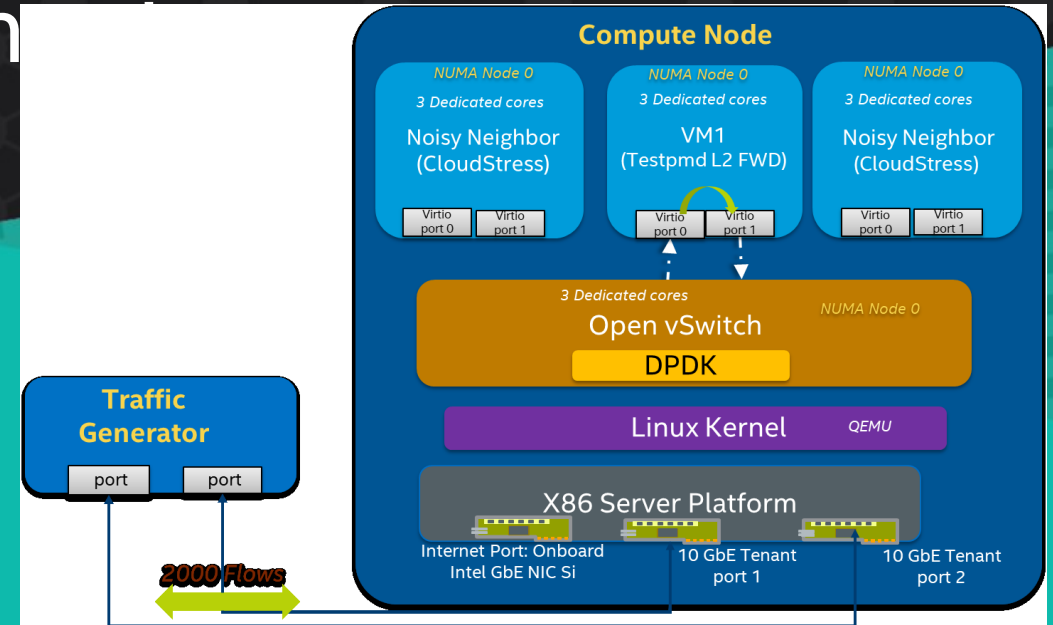
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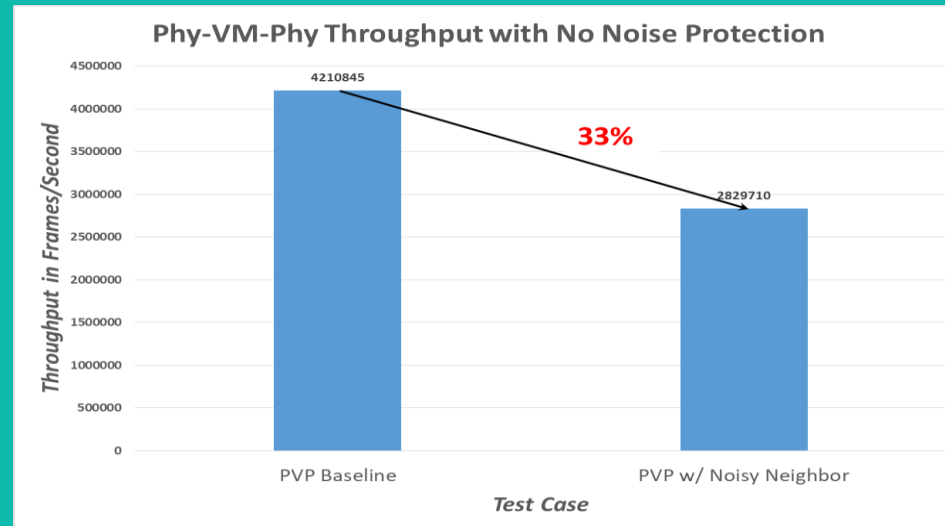
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# Determinism with LLC Management

- Cache Quality of Service (QoS) adjustments with multiple workloads
- Consistency in Throughput & Latency w/ Noisy Neighbor avoidance
- Test setup with OPNFV VSPERF
- Leverage Spirent CloudStress as Noisy Neighbor
- Utilize Collectd for Metrics



**Fig: VSPERF Test Setup**



**Fig: Throughput of 64B Packets**



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# Policy Driven LLC Allocation - Resource Management Daemon

- Associate workload with dedicated LLC
- Construct LLC policy to protect workload from contention

Resource Management Daemon  
(RMD) - A Linux daemon that:

- Runs on individual hosts
- REST API, accessible to orchestrator
- Accepts & enforces policy
- Platform Aware

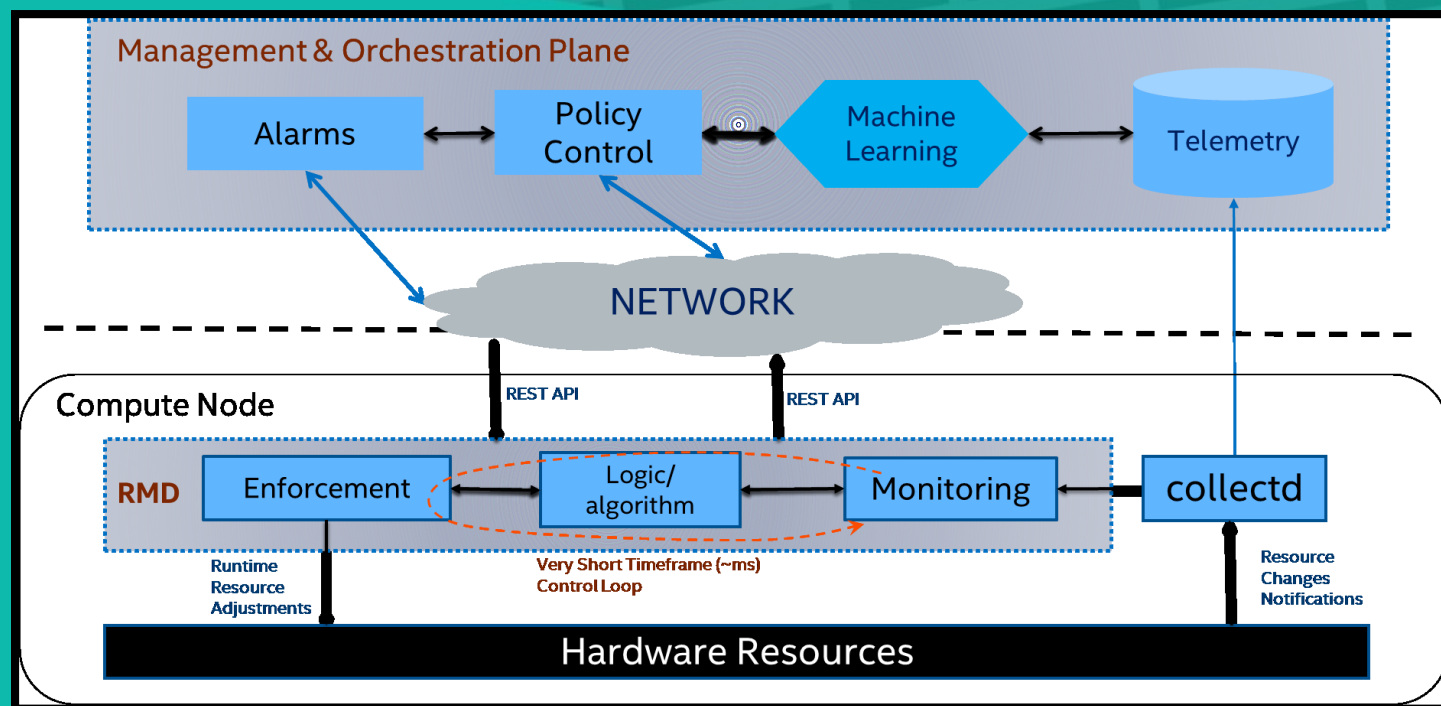


Fig: RMD interactions with Platform & MANO Layer

Open Source: <https://github.com/intel/rmd>

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# Workload Sensitivity & Policy Mapping

- Apply LLC policy at run time using RMD
  - LLC for VM under test – “Guaranteed” -2.5 MB
  - LLC for CloudStress VMs – “Best-effort” - 2.5 MB/VM
- Re-run the performance tests

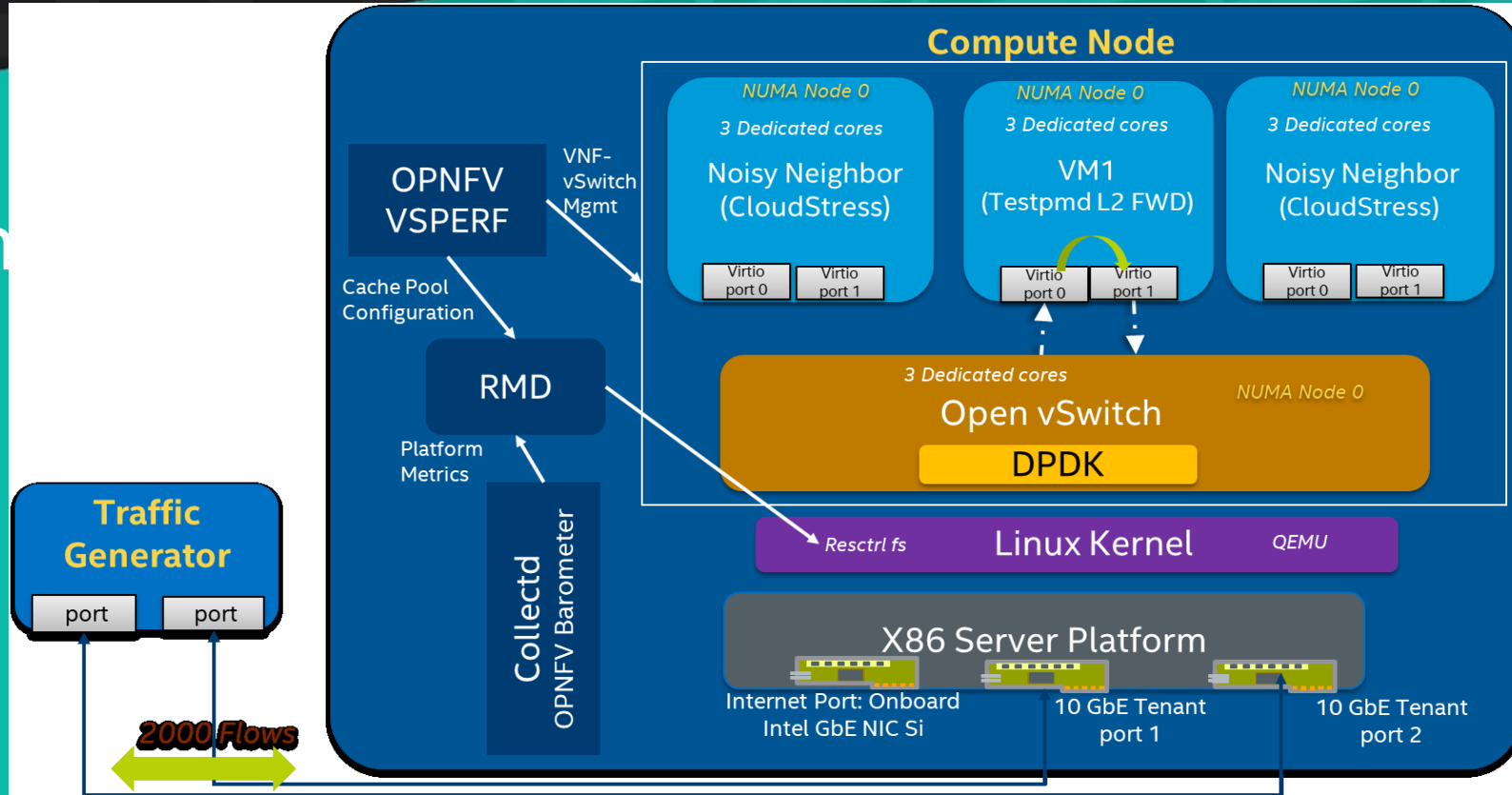


Fig: VSPERF Test setup with RMD & Collectd

Run Time LLC Control via RMD Policy Mapping

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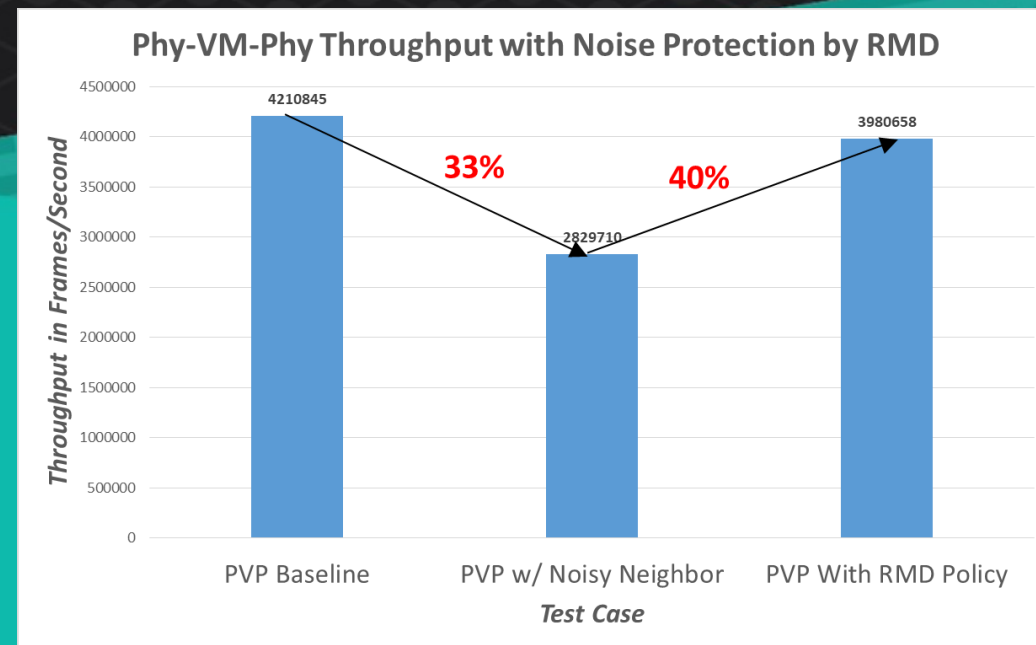
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# Noisy Neighbor Protection & Takeaways

- Guaranteed LLC policy helped preserve VM performance
- Throughput improvement of ~40% with noise protection
- Integrating into OpenStack & Kubernetes

## Takeaways

- Noisy Neighbor affects are real and here to persist
- Intel RDT & RMD enables hardware infrastructure for LLC QoS control
- OPNFV VSPERF with RMD enables LLC QoS analysis for NFVi



**Fig: Throughput of 64B Packets**

**Optimal Cache Policy Ensures Deterministic Performance**

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