

SDN Controller Performance Evaluation

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Challenges

- Fast evolving speed of SDN
- Growing requirements for various scenarios
- Lack of benchmark tools
- Distributed system

Centralized Controller

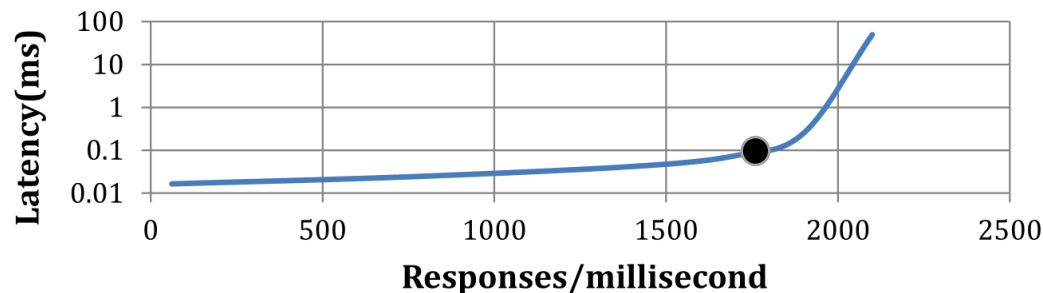
- Baseline (Single CPU, single switch)

Controller	Throughput (rps/ms)	Latency (ms)
Pox (Python)	105	0.0416
Ryu (Python)	106	0.037
Nox (C++)	687	0.0179
FloodLight (Java)	670	0.0222
Beacon (Java)	2302	0.0164

- Various factors investigated
 - Number of switches and threads
 - System-wide settings
 - Specifically crafted scenarios

Evaluation Result

- Performance degradation with more than 200 switches
- Python interpreter: PyPy outperforms CPython over 4 times.
- Hyper-Threading is useful for Java-based controllers.
- Correlation between throughput and latency

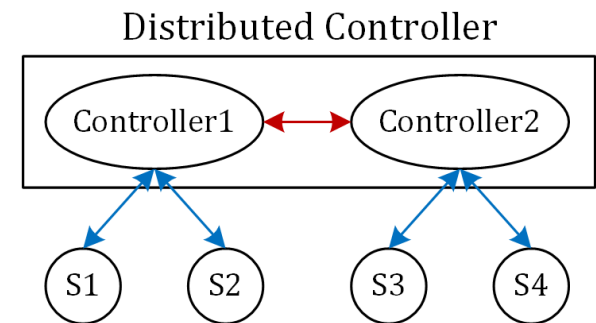


Distributed Controller

- Baseline (Single CPU, single switch)

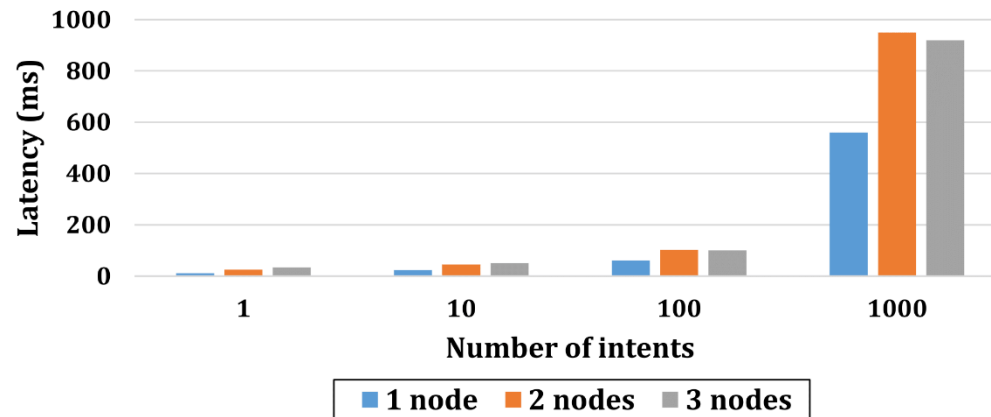
Controller	Throughput (rps/ms)	Latency (ms)
ODL (Java)	9	0.111
ONOS (Java)	49	0.026

- Two types of control traffic
 - Controller-Switch
 - Controller-Controller (Synchronization)
- Control latency due to synchronization



Controller Synchronization

- Evaluation on ONOS v1.1.0 (Hazelcast-based)
 - Peak synchronization traffic rate less than 150Mbps (5 nodes)
 - The flow installation latency could be enlarged by 2~3 times.



- Control message priority
 - Various types of control message: Flow_Add vs Packet_Out
 - Impact on distributed controller with two-layer synchronization

Summary

- The usability, reliability and security are equally important as the performance in choosing the controller.
- Centralized controllers show clear limitations on large scale deployment, and distributed controllers are required.
- The efficient synchronization system is critical to the success of distributed controller, and various modifications are required.
- Related IETF Drafts
 - Benchmarking Methodology for SDN Controller Performance
 - Priority based Flow Rule Request Message Processing Mechanism in the OpenFlow Switch
- Benchmark tools

Thanks for your attention !



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