



Innovations in Clouds,
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Congestion Control Using OpenFlow in Software Defined Data Center Networks

Behzad Akbari

Department of Electrical and Computer Engineering
Tarbiat Modares University



Tarbiat Modares
University

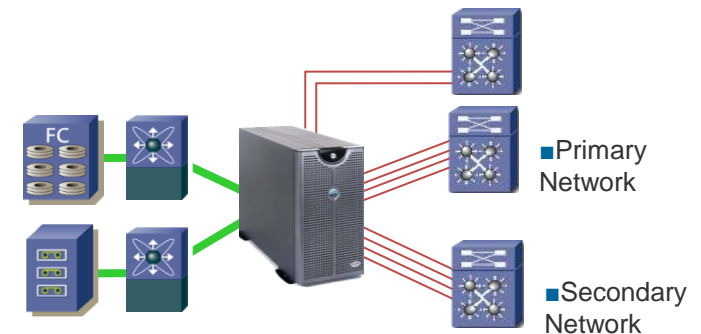
- Background
- Design Rationale
- Method
- Implementation
- Experimental results
- Discussion and conclusion

Objective of multiple networks in data center

- Storage Area Network (SAN)
- High Performance Computing (HPC)
 - high speed lossless packet forwarding
- local area network (LAN)
 - carry best effort traffic

■ Current State of Connectivity...

■ multiple interfaces per Server

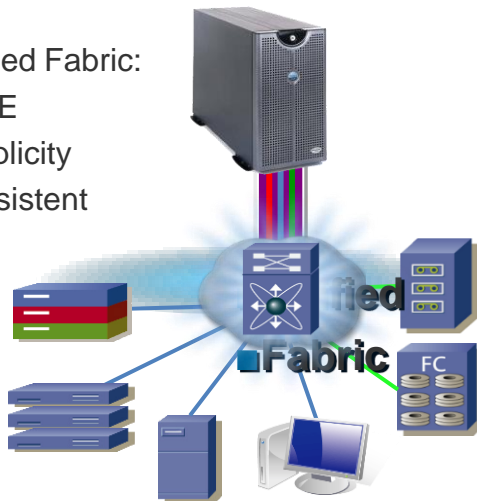


■ Unified Fabric:

■ 10GE

■ Simplicity

■ Consistent



Solution: a single unified network of data centers

Advantage of a single unified network :

- Losslessness
- low transmission delay

Lack of QoS such as:

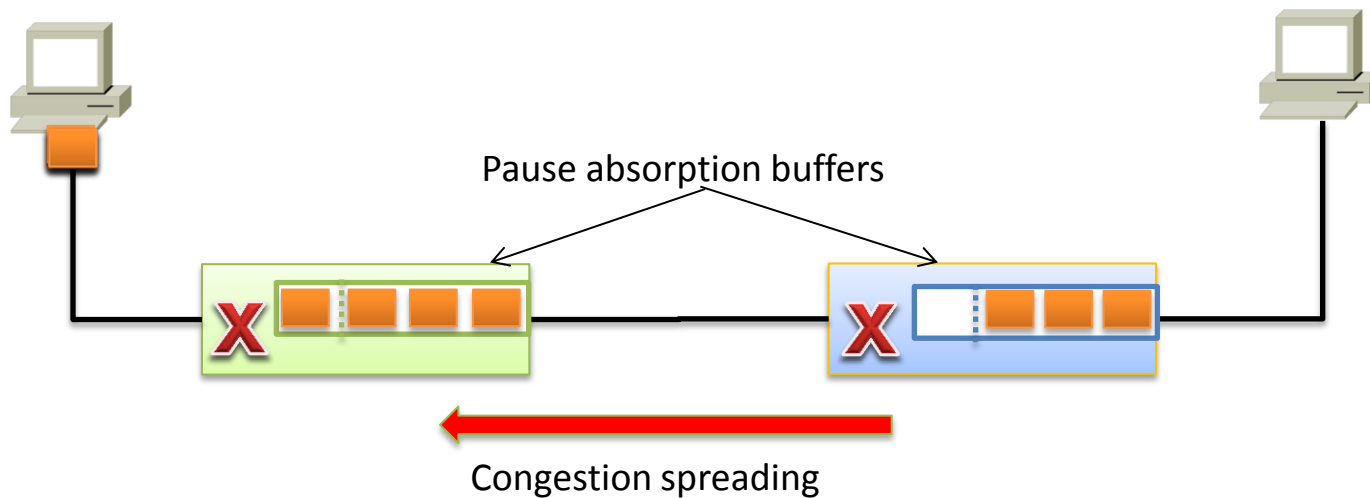
- congestion management

Ethernet congestion management must:

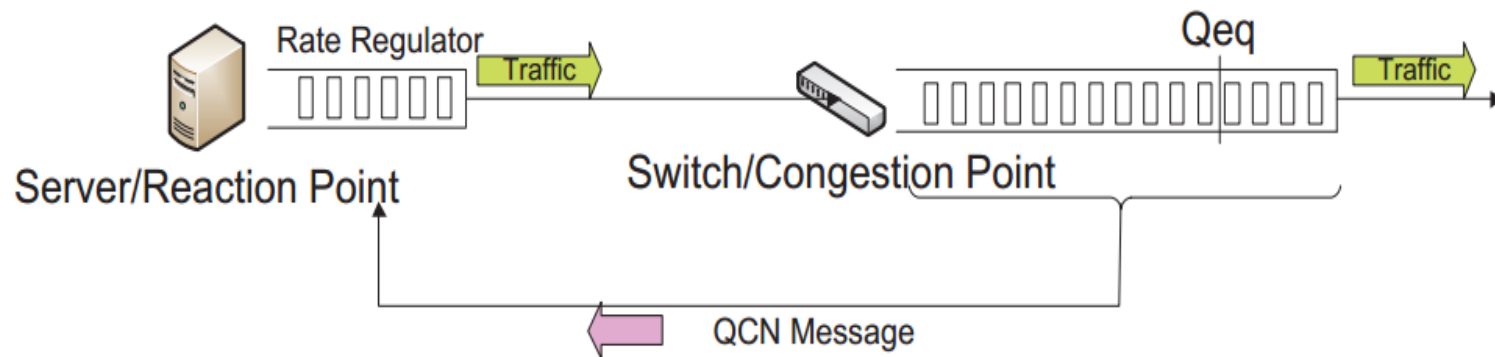
- reduce transmission delay and bandwidth consumption
- optimize application throughput and performance of the network

To eliminate the transient congestion:

- IEEE 802.1Qbb (PAUSE mechanism)
 - Advantage:
 - guarantee losslessness
 - Disadvantage:
 - congestion spreading
 - degrade the performance of the network

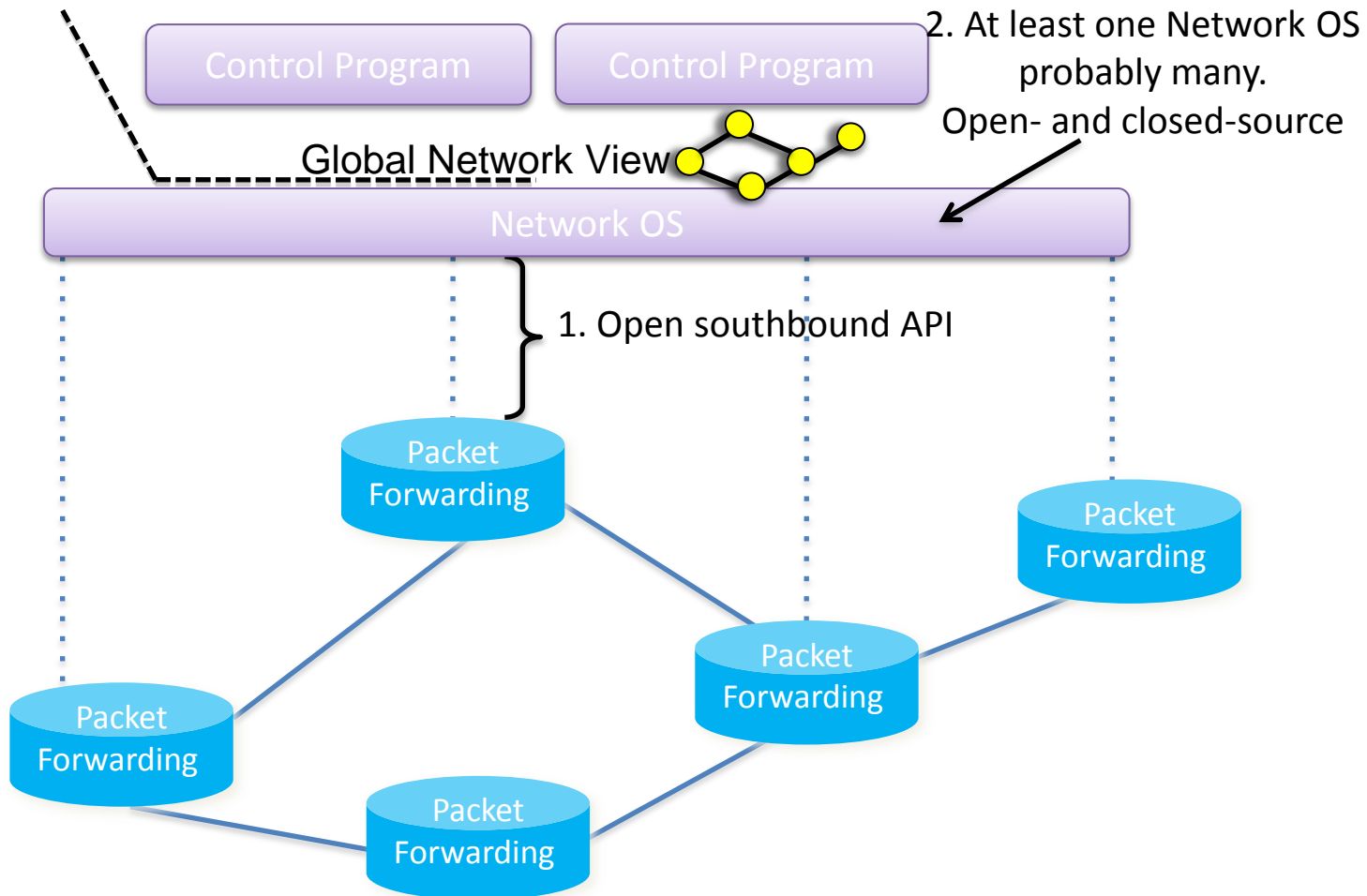


- Quantized Congestion Notification (QCN)
 - Advantage:
 - alleviate congestion without congestion spreading
 - detect congestion using buffer queue length and feedback message
 - Disadvantage:
 - unavoidable for bursty traffic
 - rely on parameters setting and network configuration

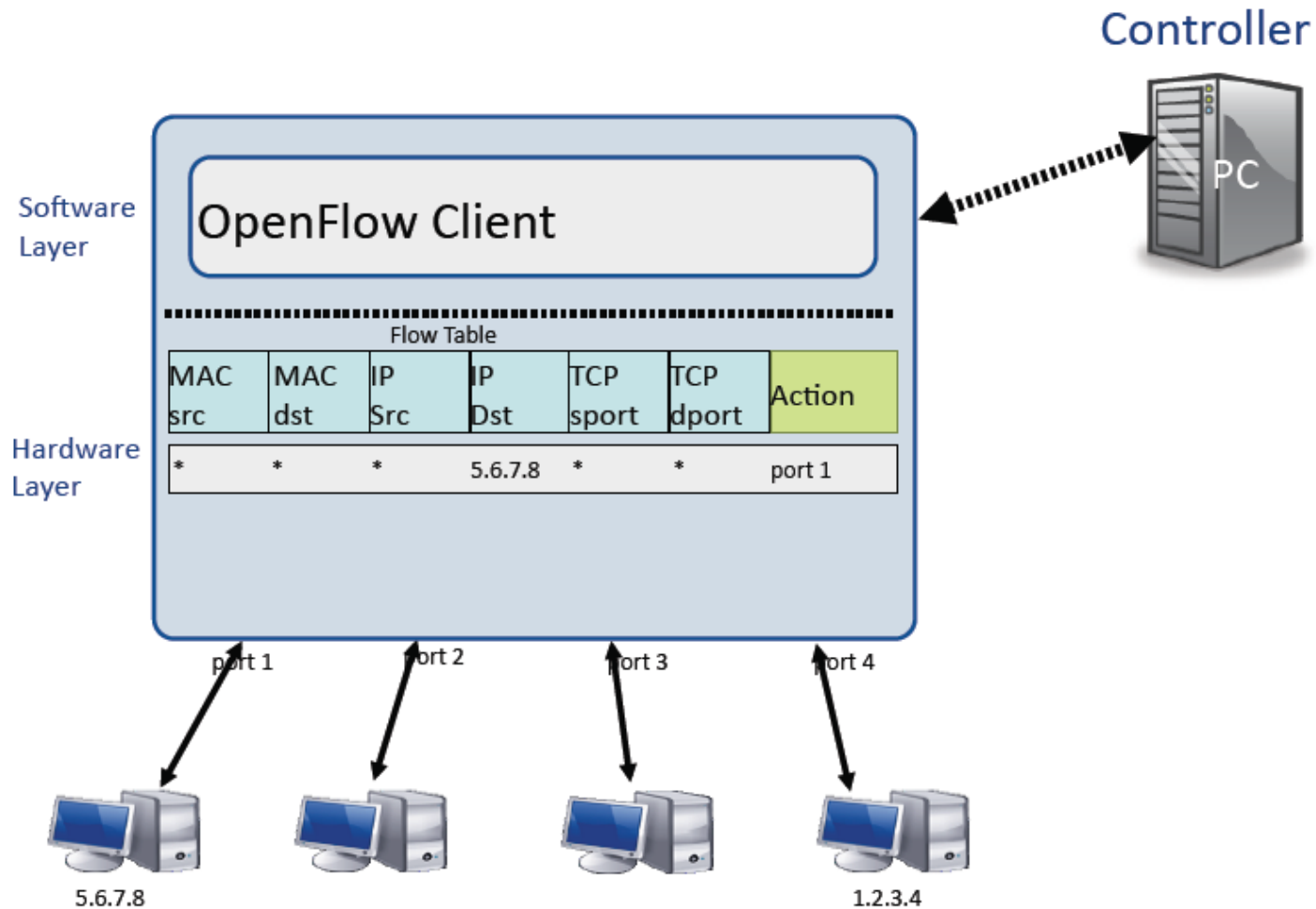


Software Defined Networking (SDN)

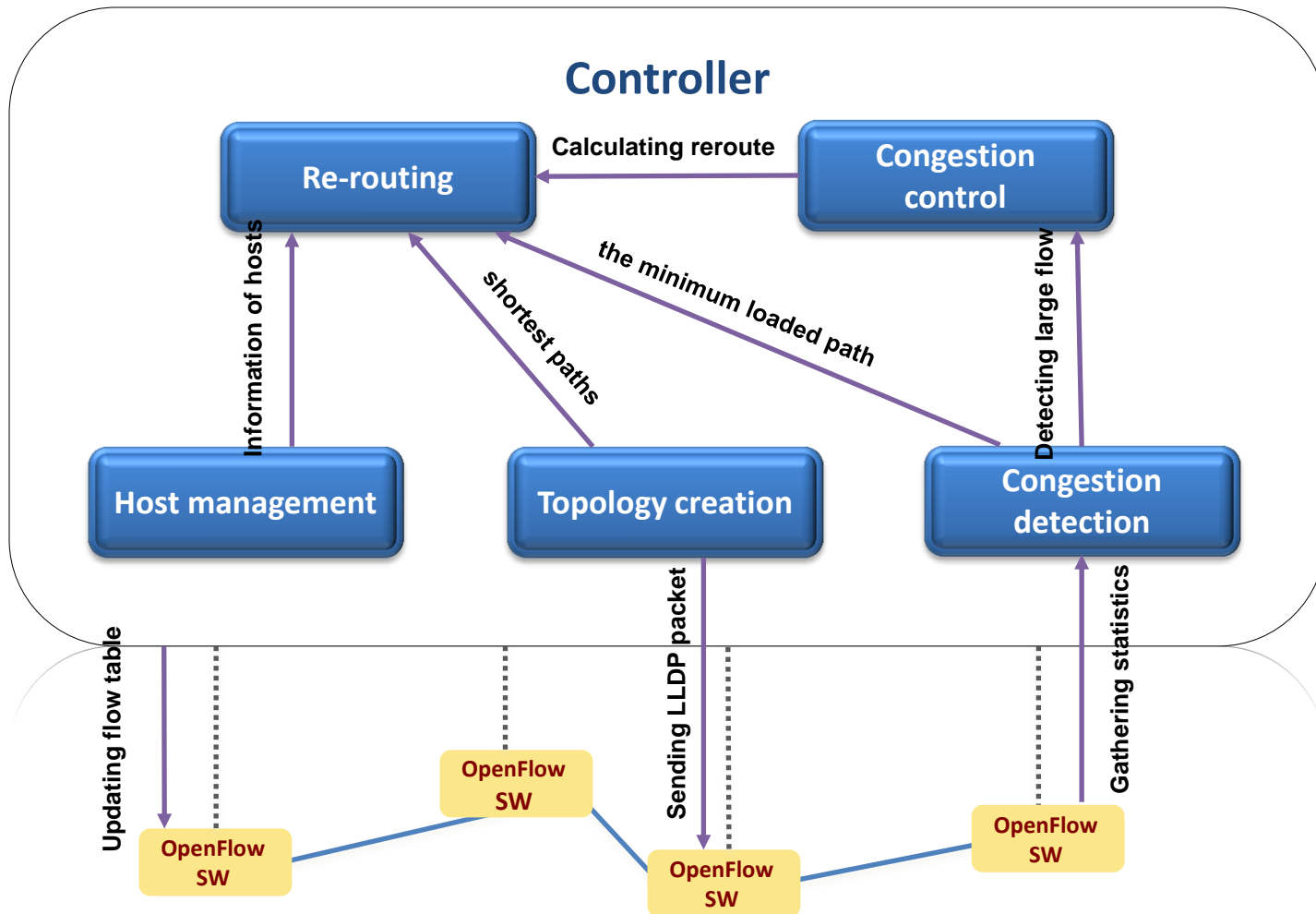
3. Open northbound API



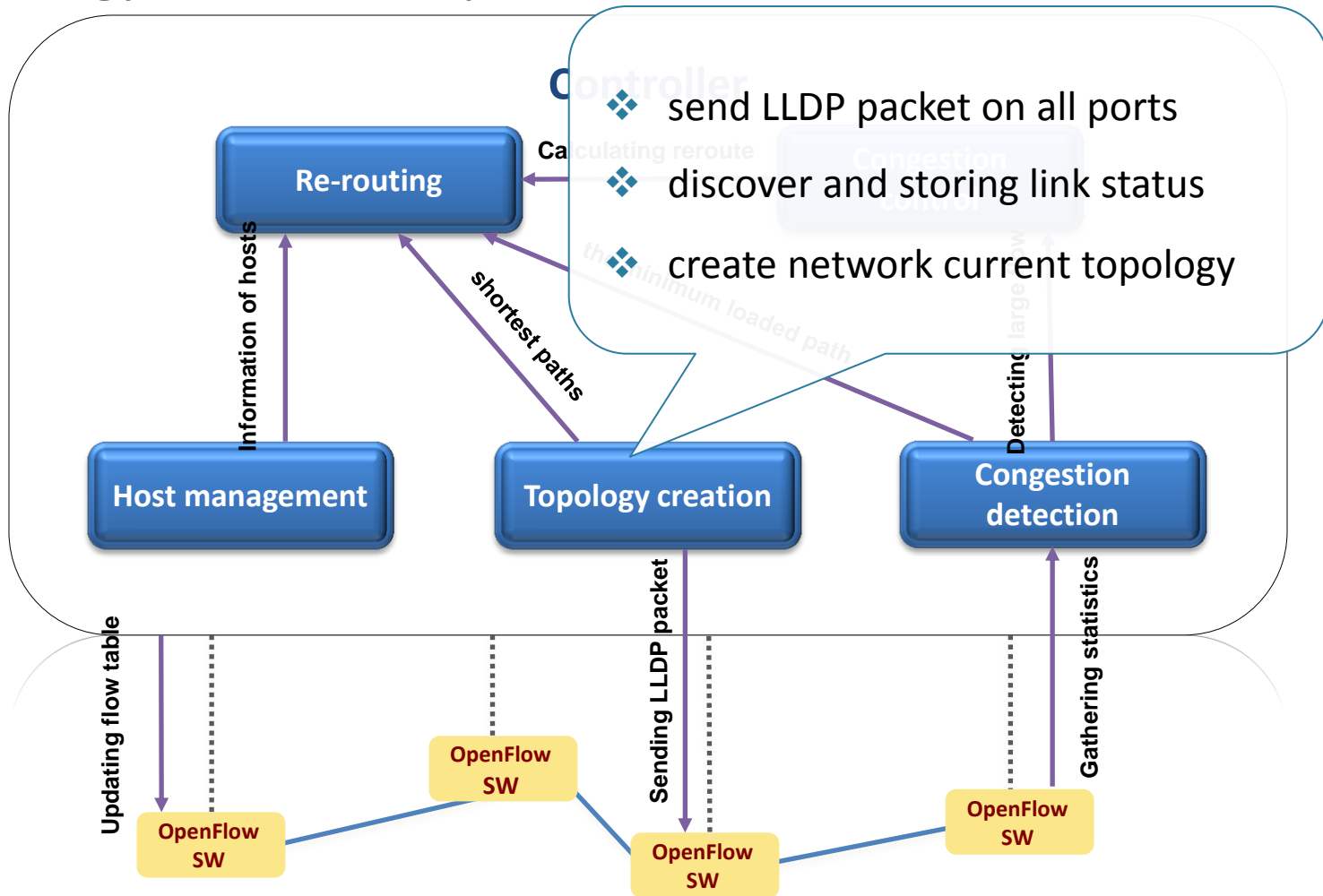
OpenFlow network



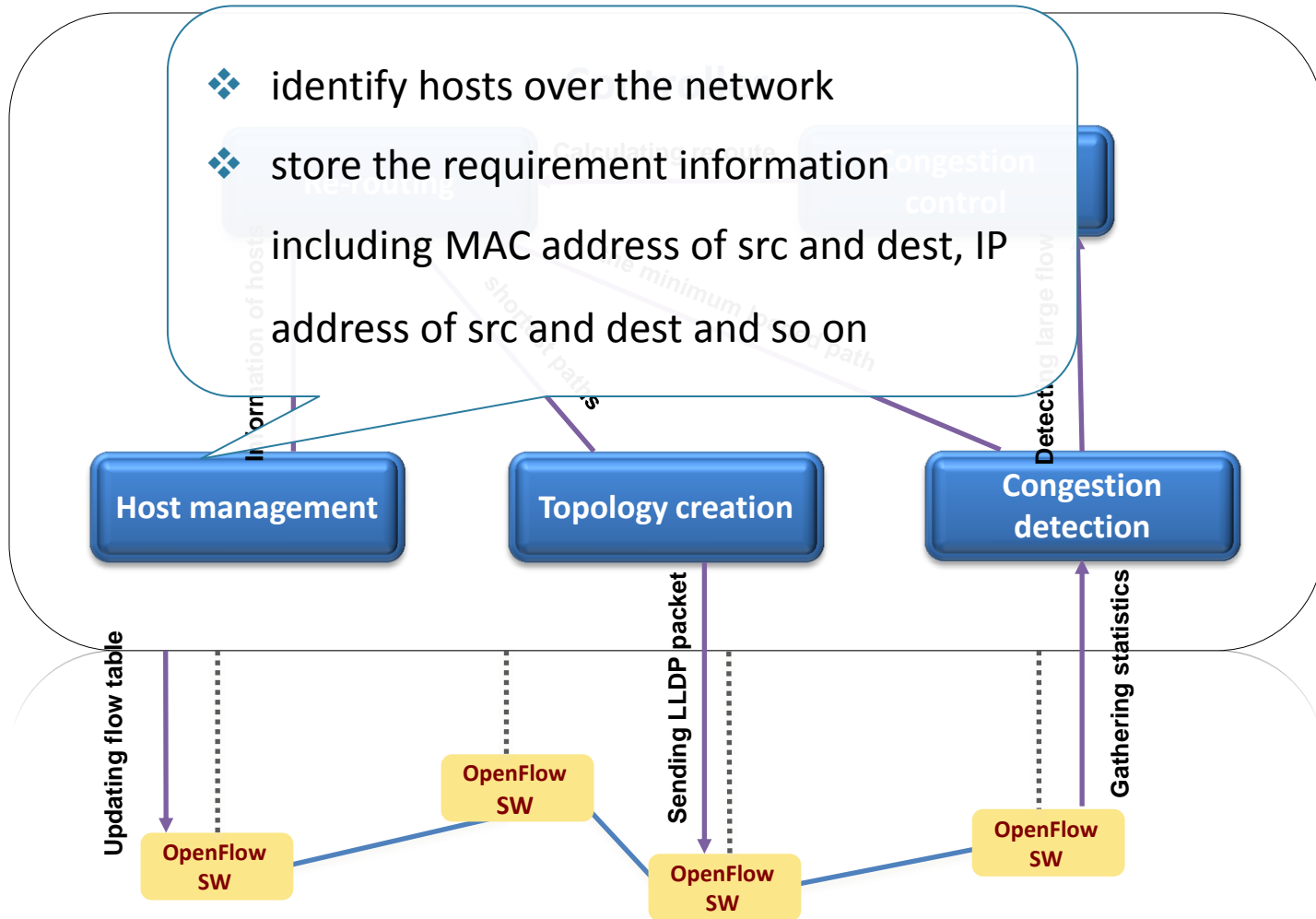
- Framework of method



- Topology creation component

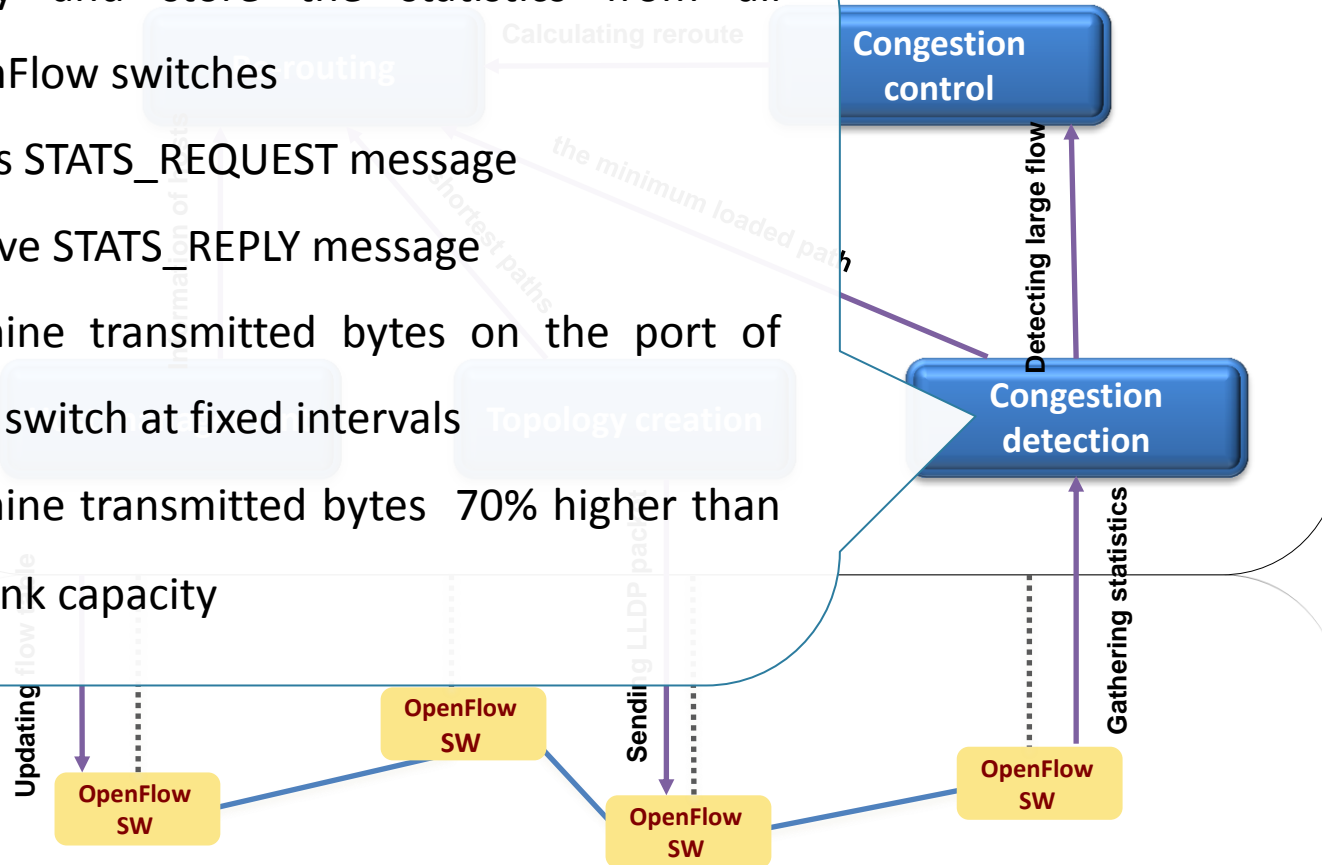


- Host management component

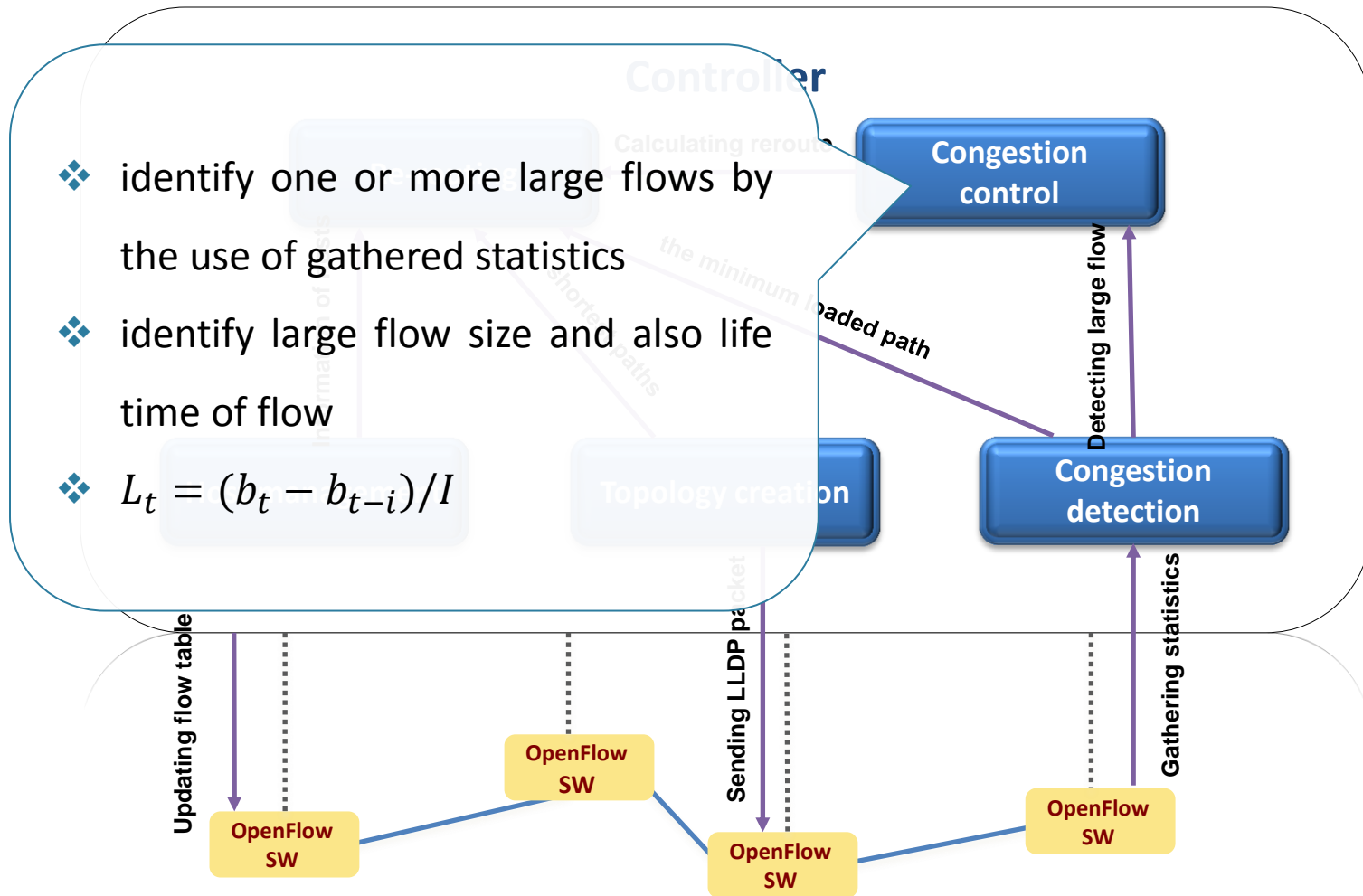


- Congestion detection component

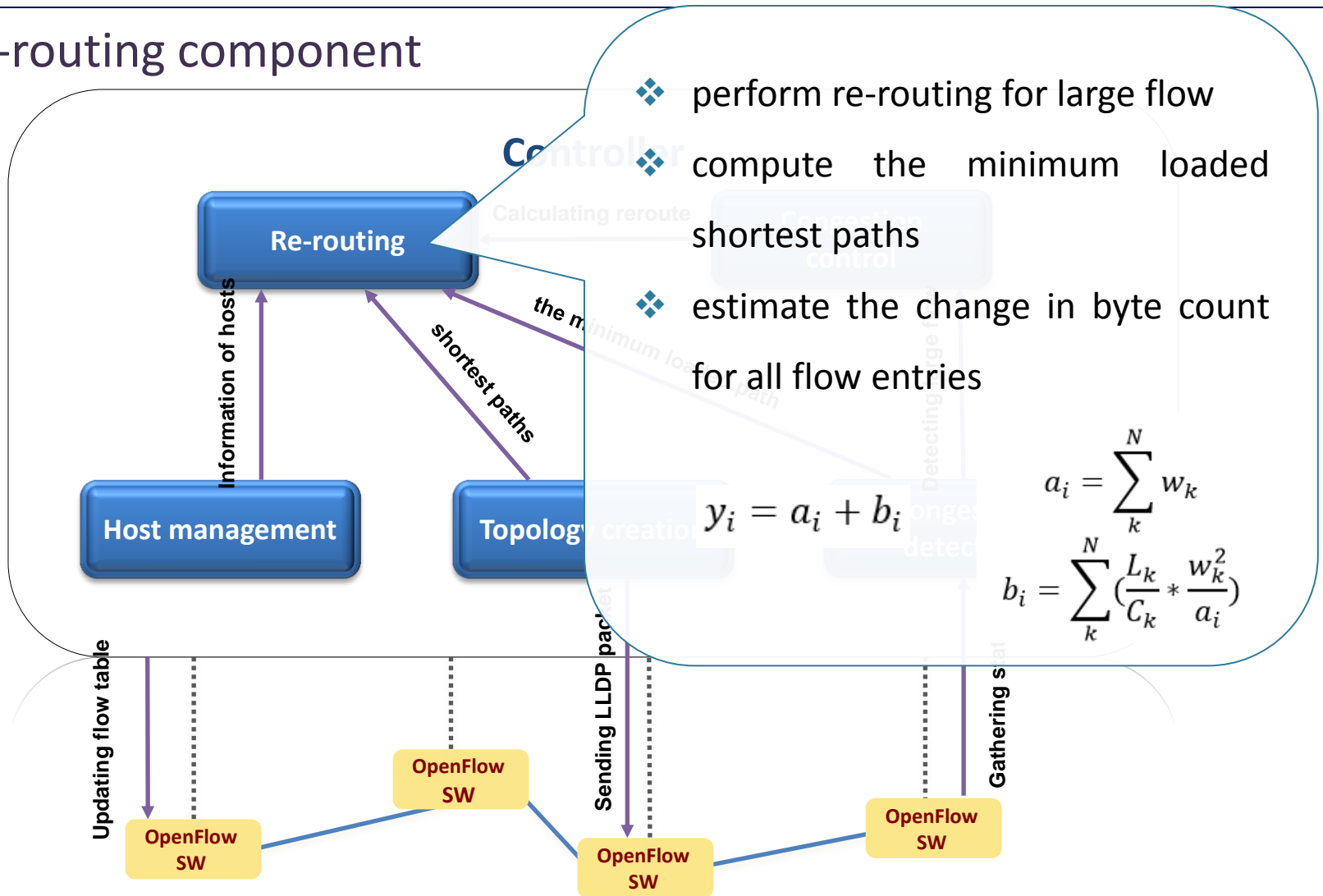
- ❖ query and store the statistics from all OpenFlow switches
- ❖ sends STATS_REQUEST message
- ❖ receive STATS_REPLY message
- ❖ examine transmitted bytes on the port of each switch at fixed intervals
- ❖ examine transmitted bytes 70% higher than the link capacity



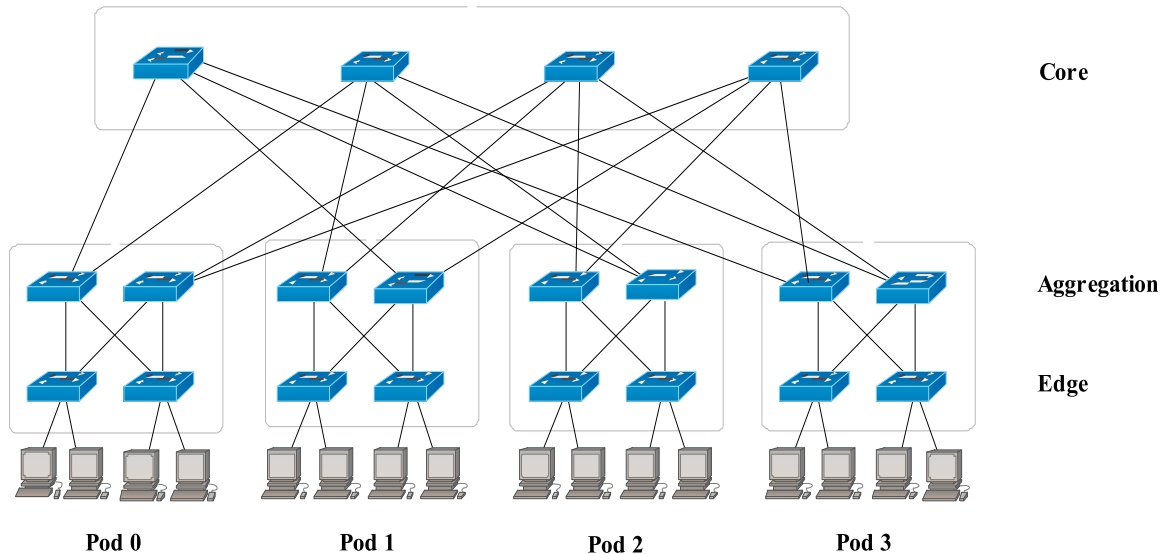
- Congestion control component



- Re-routing component

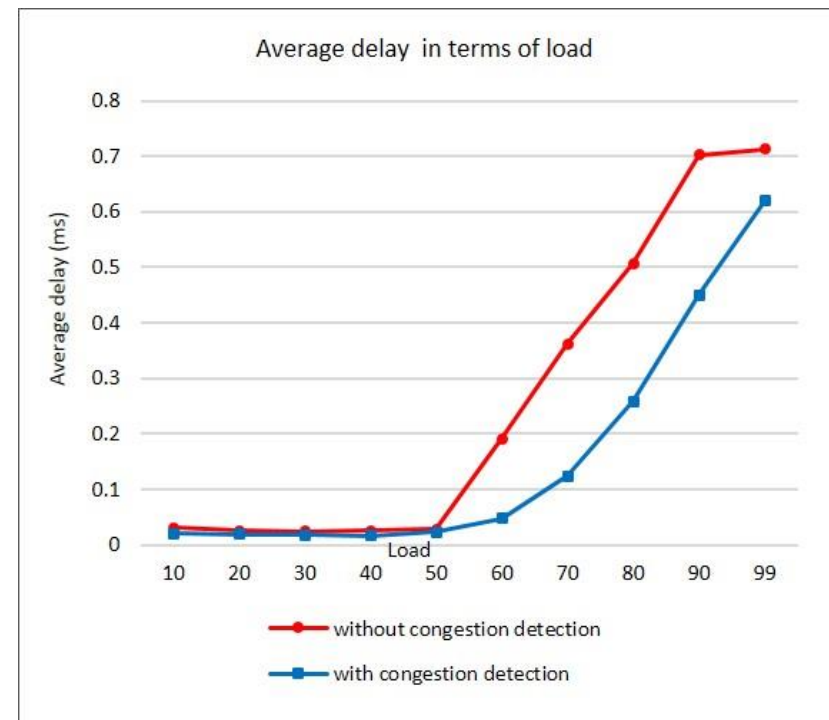
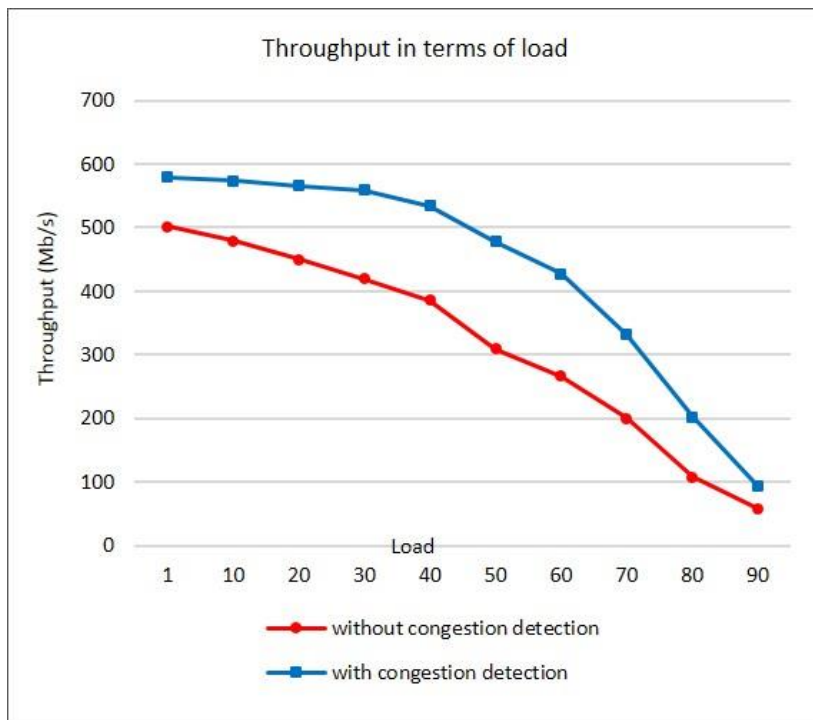


- Emulator: Mininet
- Controller: Floodlight
- Topology: fat-tree network with $k=4$ namely 20 OpenFlow switches, 16 hosts



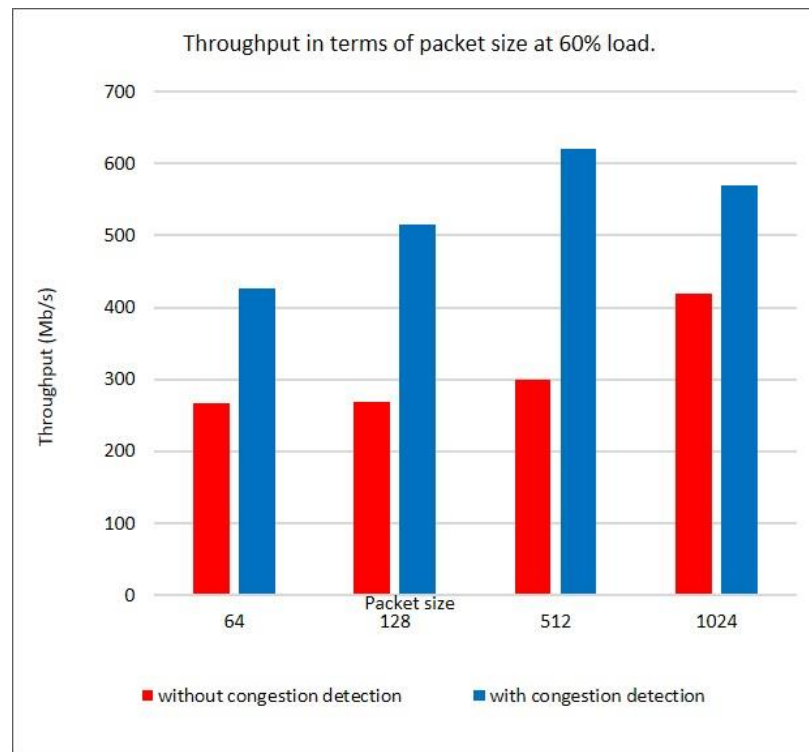
Experiment 1:

- packet size 64 byte
- load amount: 10% to 99%
- time: 1 minute



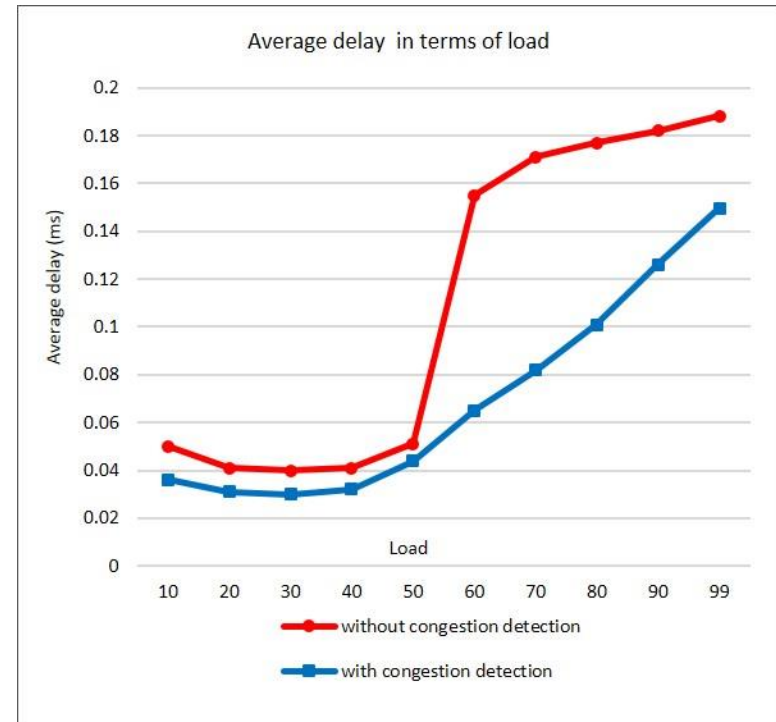
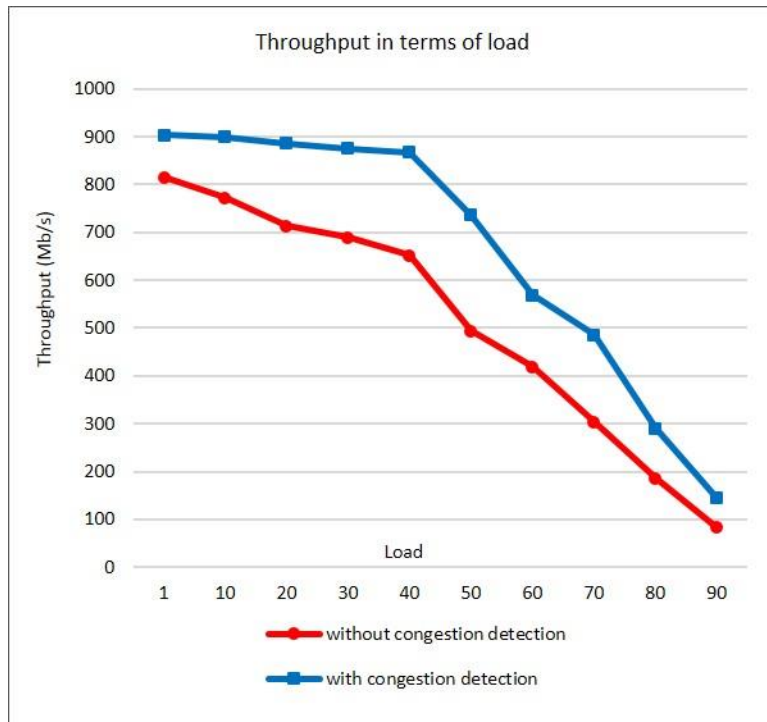
Experiment 1:

- packet size : in the range of 64 to 1024 byte
- load amount: 60%
- time: 1 minute



Experiment 2:

- packet size 1024 byte
- load amount: 10% to 99%
- time: 1 minute



Discussion and conclusion

- congestion delay whereby the packet size increases
- enhanced efficiency of the network
- throughput enhancement
- average packet delay reduction.

In the view of qualitative data compare with QCN

- Overhead:
 - QCN is low and unpredictable.
 - proposed method is low and predictable
- Rate of convergence to fair state:
 - QCN is slow in convergence to fair state due to AIMD- like algorithms
 - proposed method can reach the perfect fair state owing to centralization.

- Using significant features of SDN in order to optimize performance of the network

Further research

- exploit machine learning methods for improvement of the detection and management components
- examine in the large scale of the network using distributed controller due to overhead on the single controller.



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Thank you!



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