CNT2941

# ReDCN: A Dynamic Bandwidth Enabled Optical Reconfigurable Data Center Network

**Xinwei ZHANG , Zuoqing ZHAO, Yisong ZHAO, Yuanzhi GUO, Xuwei XUE, Bingli GUO, and Shanguo HUANG**

**The State Key Laboratory of Information Photonics and Optical Communications, Beijing University of Posts and Telecommunications, Beijing 100876, China**

## Motivation

**Improve the flexibility of the optical data center networks**

***DCN Requirements***

- *Low latency and high throughput*
- *High capacity and scalability*
- *Support reconfiguring*

***Issues for DCNs***

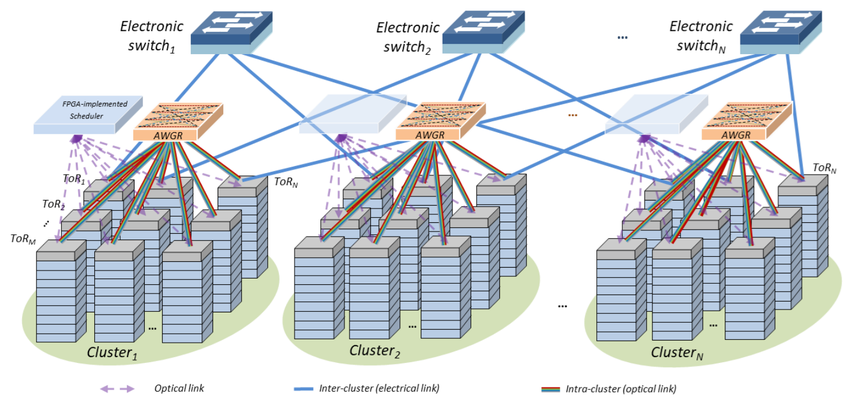
- *Rigid interconnections cannot be reallocated*
- *Uniform bandwidth allocation between ToRs*
- *Cannot handle the dynamic traffic patterns*

***Solutions***

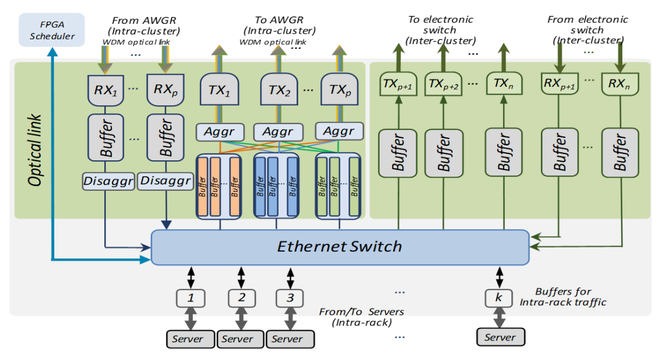
- *Elastically reconfigure the time slots to provide dynamic bandwidth*

## System operation

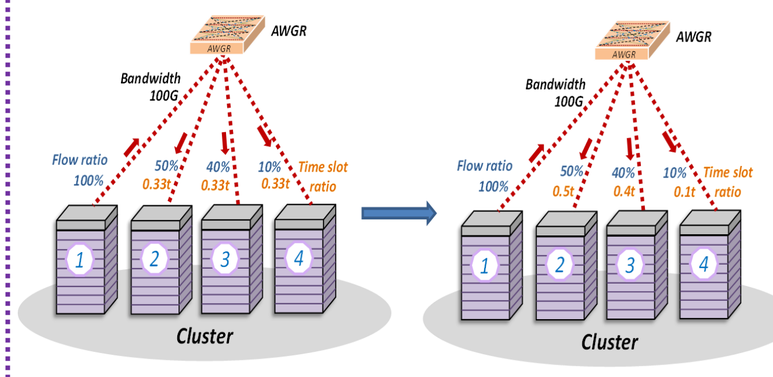
**Reconfigurable DCN with flexible optical bandwidth allocation**




*Architecture of reconfigurable DCN*




*Schematic of the optical ToR with multi TRXs*




*Reconfiguration scheme*

## Validation

### 1 Simulation setup

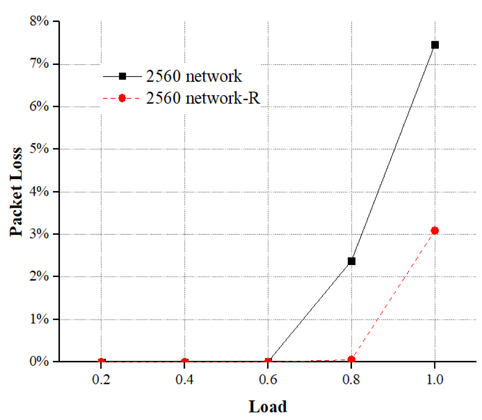
*50% intra-ToR, 37.5% intra-cluster and 12.5% inter-cluster traffics.*

| | ToR$_1$ | ToR$_2$ | ToR$_3$ | ToR$_4$ | ToR$_5$ | ToR$_6$ | ToR$_7$ | ToR$_8$ |
|---|---|---|---|---|---|---|---|---|
| ToR$_1$ | 0 | 0.2 | 0.2 | 0.1 | 0.05 | 0.15 | 0.2 | 0.1 |
| ToR$_2$ | 0.2 | 0 | 0.1 | 0.2 | 0.15 | 0.05 | 0.1 | 0.2 |
| ToR$_3$ | 0.2 | 0.1 | 0 | 0.2 | 0.2 | 0.1 | 0.05 | 0.15 |
| ToR$_4$ | 0.1 | 0.2 | 0.2 | 0 | 0.1 | 0.2 | 0.15 | 0.05 |
| ToR$_5$ | 0.05 | 0.15 | 0.2 | 0.1 | 0 | 0.2 | 0.2 | 0.1 |
| ToR$_6$ | 0.15 | 0.05 | 0.1 | 0.2 | 0.2 | 0 | 0.1 | 0.2 |
| ToR$_7$ | 0.2 | 0.1 | 0.05 | 0.15 | 0.2 | 0.1 | 0 | 0.2 |
| ToR$_8$ | 0.1 | 0.2 | 0.15 | 0.05 | 0.1 | 0.2 | 0.2 | 0 |

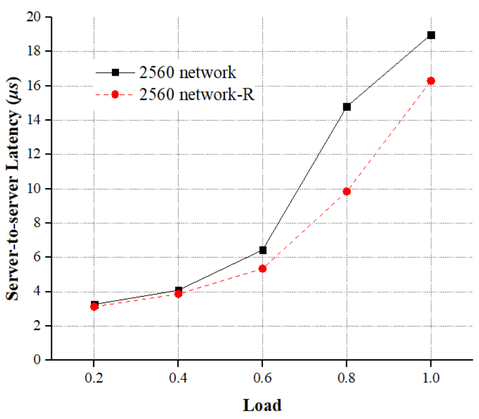
*Traffic distribution between different ToRs.*

- *Figures above show the simulation results in terms of the packet loss, ToR-to-ToR latency, Server-to-Server latency and throughput before (2560 network) and after reconfiguration (2560 network-R).The results prove the proposed ReDCN improves packet loss by 58.5%, end-to-end latency by 63.8% and throughput by 9.4% with compared to the network with rigid interconnections.*

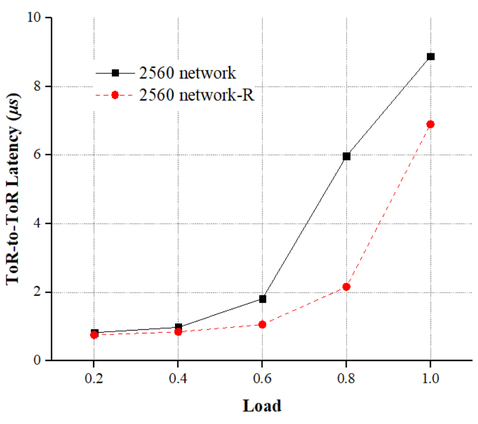
### 2 Packet loss measurements



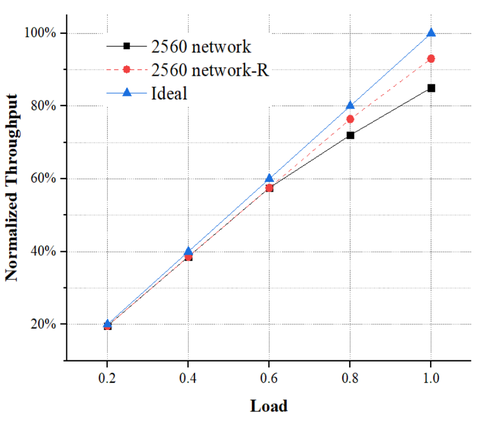

### 3 ToR-to-ToR Latency measurements




### 4 Server-to-Server Latency measurements




### 5 Throughput measurements




## Conclusion

- ✓ Flexible bandwidth allocation can be provided between ToRs
- ✓ Decrease the packet loss by 58.5%, end to end latency by 63.8% and increase throughput by 9.4%