Centrally Control Dynamic Routing Scenario, Simulation and Suggestion (https://tools.ietf.org/html/draft-wang-teas-ccdr-00)

Aijun Wang (China Telecom)
Xiaohong Huang, Caixia Kou*(BUPT)*
Lu Huang(China Mobile)
Penghui Mi *(Tecent)*
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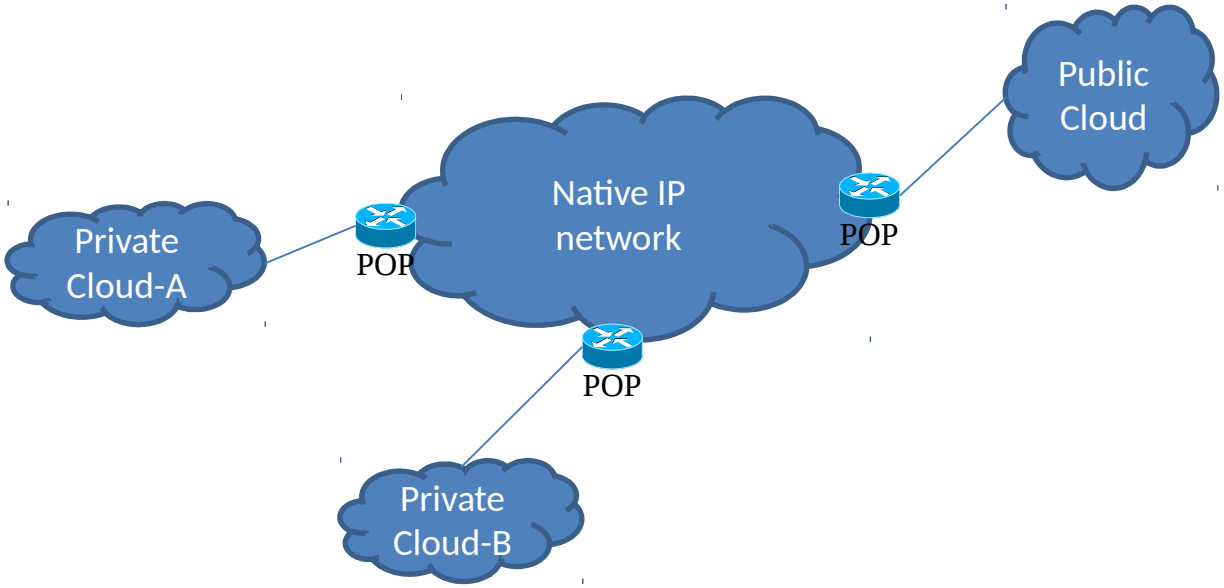
Contents

- CCDR Scenarios(four)
- CCDR Simulation(topology,traffic,results)
- CCDR Suggestions

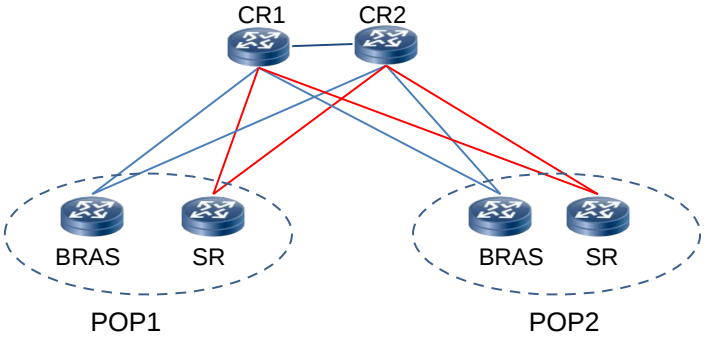
CCDR Scenario-1
QoS Assurance for Hybrid Cloud-based Application



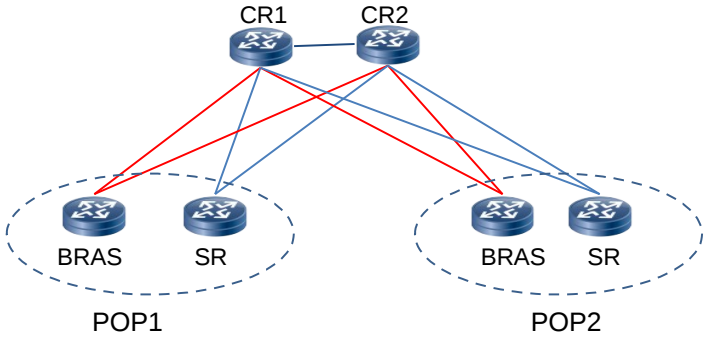
Description:

- Enterprise A and B rent some cloud resources from public cloud, they both have their own privat e cloud that located in different POPs of service provider.
- These enterprises are connected via the exist Internet access line.
- There are other background traffics within the network connected these POPs, the background tr affic is varied from time to time.
- The communication between Private and Public cloud may be burst and require end to end QoS assurance

CCDR Scenario-2
Increased link utilization based on tidal phenomena



Day-Time
SR/CR Link Congestion, BRAS/CR under utilization

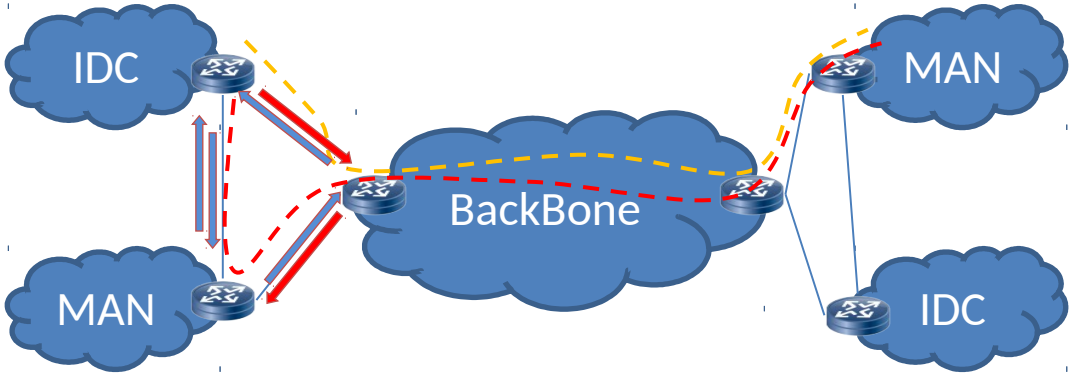


Night-Time
BRAS/CR Link Congestion, SR/CR under utilization

Description:

- Different kind customers are under different network devices.
- The traffic behavior of these customers are periodic, lead to the unbalance of link utilization.
- Service Provider needs to improve the overall link utilization, reduce the cost of long haul links vi a the local loop links under the help of SDN controller.

CCDR Scenario-3
Traffic engineering for IDC/MAN asymmetric link



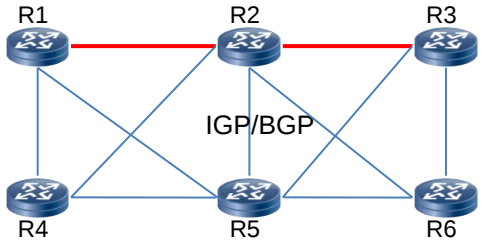
Description:

- Link utilization between IDC/BackBone, MAN/BackBone are asymmetric.
- There are redundant links between MAN and local IDC.
- Some traffic can be diverted from asymmetric link.
- Such traffic engineering should be accomplished under global view of the network.
- Traverse multi-domain

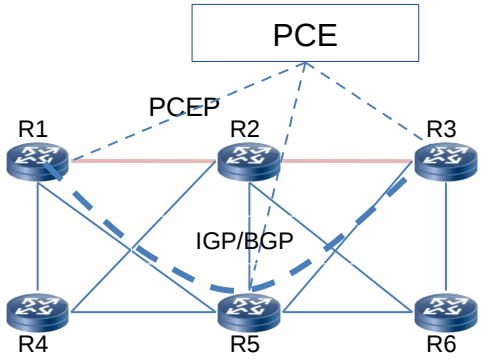
CCDR Scenario-4
Network temporal congestion elimination

Description:

- Within Native IP Network, traffic between two end points always follow the IGP shortest path.
- Traffic varies in real time but has some periodicity.
- Some links will always encounter congestion while others will always under utilization.
- Service provider should find some efficient ways t o schedule part of the traffic out of the congesting link.
- This will certainly increase the average link utilizati on and application's performance.

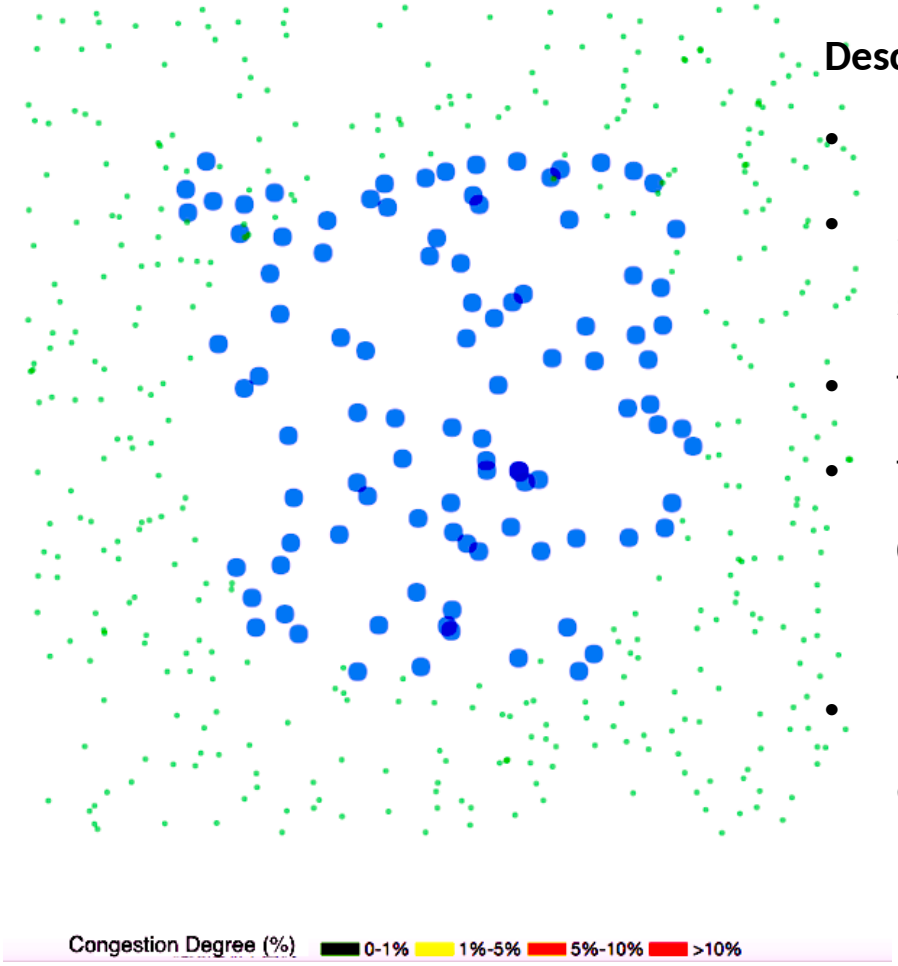


Native IP Network



PCE in Native IP Network

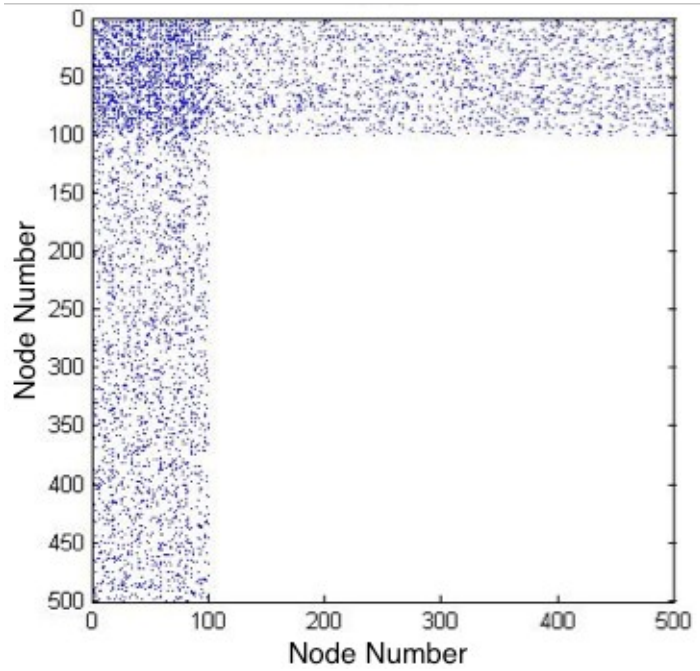
CCDR Simulation
Topology Simulation

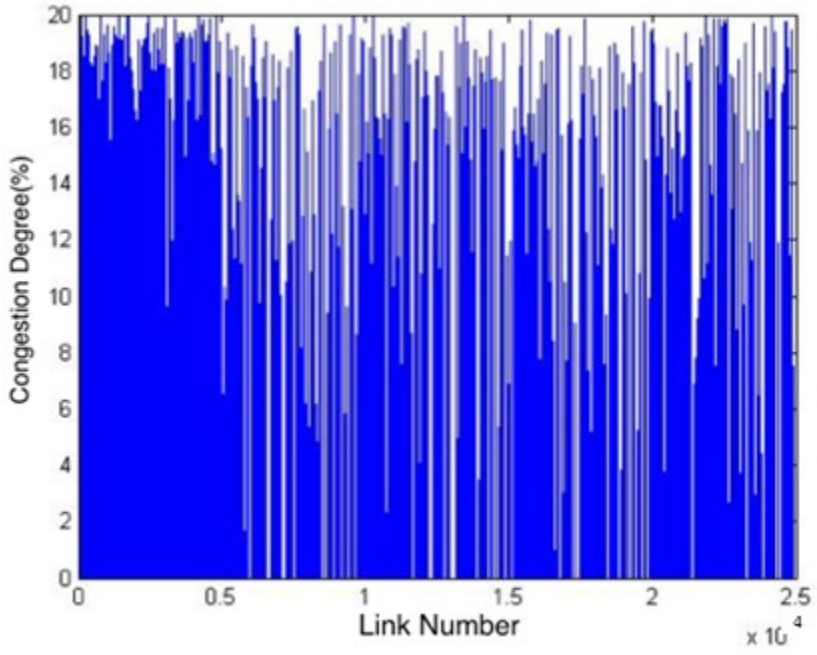


Description:

- 100 core nodes (Blue) and 400 edge nodes (Green).
- 20000 links: Core nodes are full mesh. Edge nodes ha s 2 to 30 up-links.
- The bandwidth of all links is set to be 100Gbps.
- The link metric between core nodes is from 60 to 10 0. The link metric between core and edge nodes is fro m 1000 to 1060.
- Link congestion threshold is set to be 0.8 for core nod es, to be 0.9 for core/edge nodes.

CCDR Simulation
Traffic Matrix Simulation

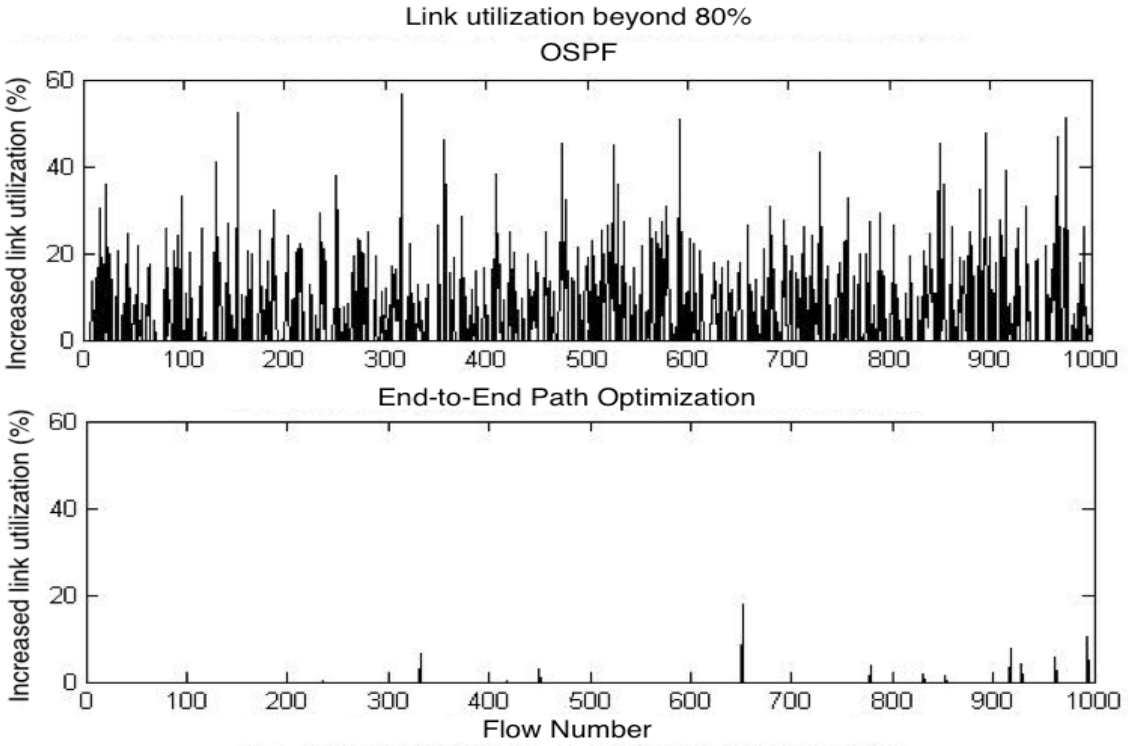




Description:

- The end-to-end network traffic is a 500*500.
- The components of traffic matrix are generated from 10Mbps to 7Gbps randomly.
- About 20% links are overloaded when the Open Shortest Path First (OSPF) protocol is used in th e network. And the average congestion degree of all overloaded links is about 10%.

CCDR Simulation
End-to-End Path Optimization Result

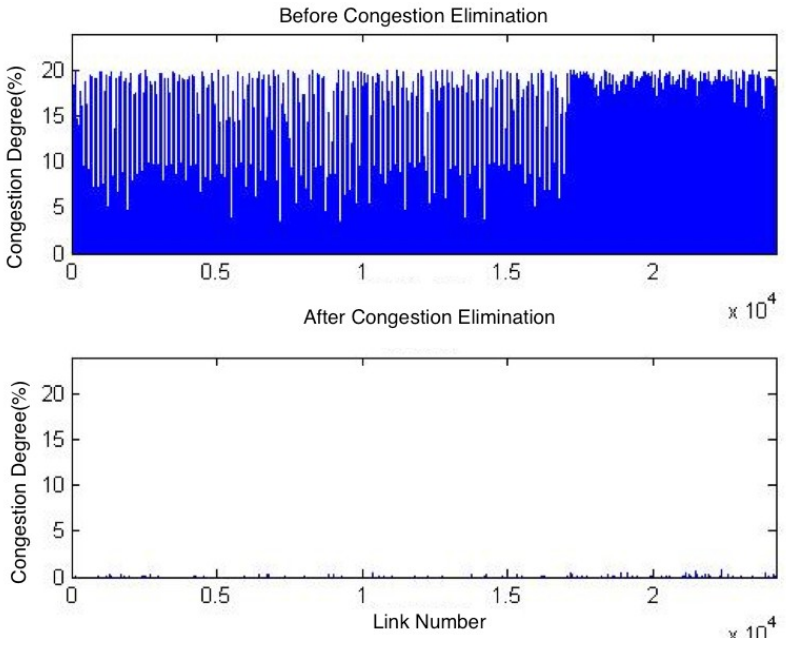


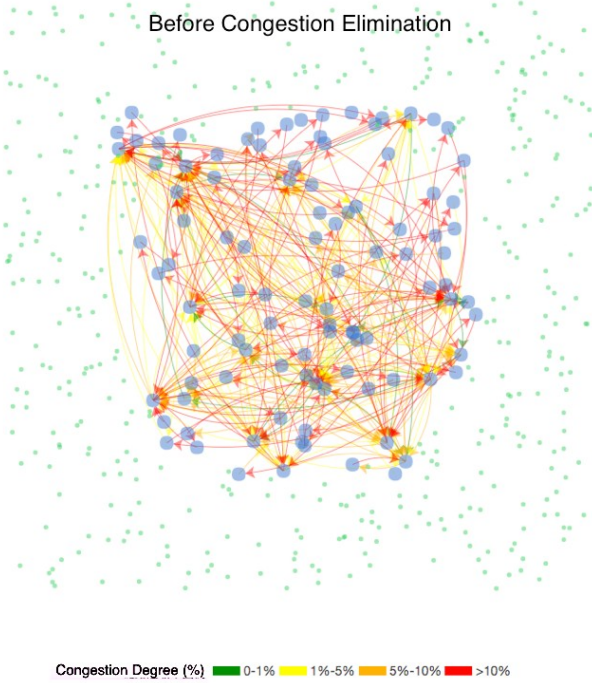
Note:
"Increased link utilization" is equal to the sum of the congestion degree of the links that the flow passes.

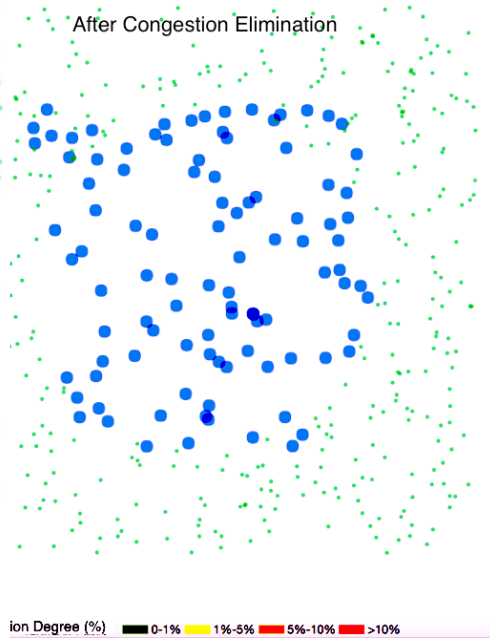
Description:

- 1000 flows arrived in 6 periods : 100, 200, 100, 250, 150 and 200 flows In each period. The size of flows is from 10Mbps to 10Gbps.
- The end-to-end path optimization has an eye-catching decreasing in link utilization relative to th e path chosen based on OSPF.

CCDR Simulation
Network Temporal Congestion Elimination Result







Description:

- Before optimization, the average congestion degree of all congested links is more than 10%.
- After optimization , the average congestion degree of all congested links is less than 2%.
- The degree of network congestion is greatly eliminated.

Solution Consideration

- ✓ It is feasible to apply PCE within native IP network.
- ✓ The solution should be easy to deploy within one domain or span multi-domains.
- ✓ The solution should decrease the complexity of distributed network protocol.
- ✓ The solution should lower the burden on network devices.
- ✓ Draft PCE in Native IP network and BGP Community PCE begins the solution exploration.

Further Action

- Are these enough to start CCDR related standardization activities?
- Adopt solution draft PCE in Native IP network as WG draft?
- Further exploring the related scenarios?
- Comments?

Wangaj.bri@chinatelecom.cn

huangxh@bupt.edu.cn

koucx@lsec.cc.ac.cn

kevinmi@tencent.com

hlisname@yahoo.com

IETF99@Prague