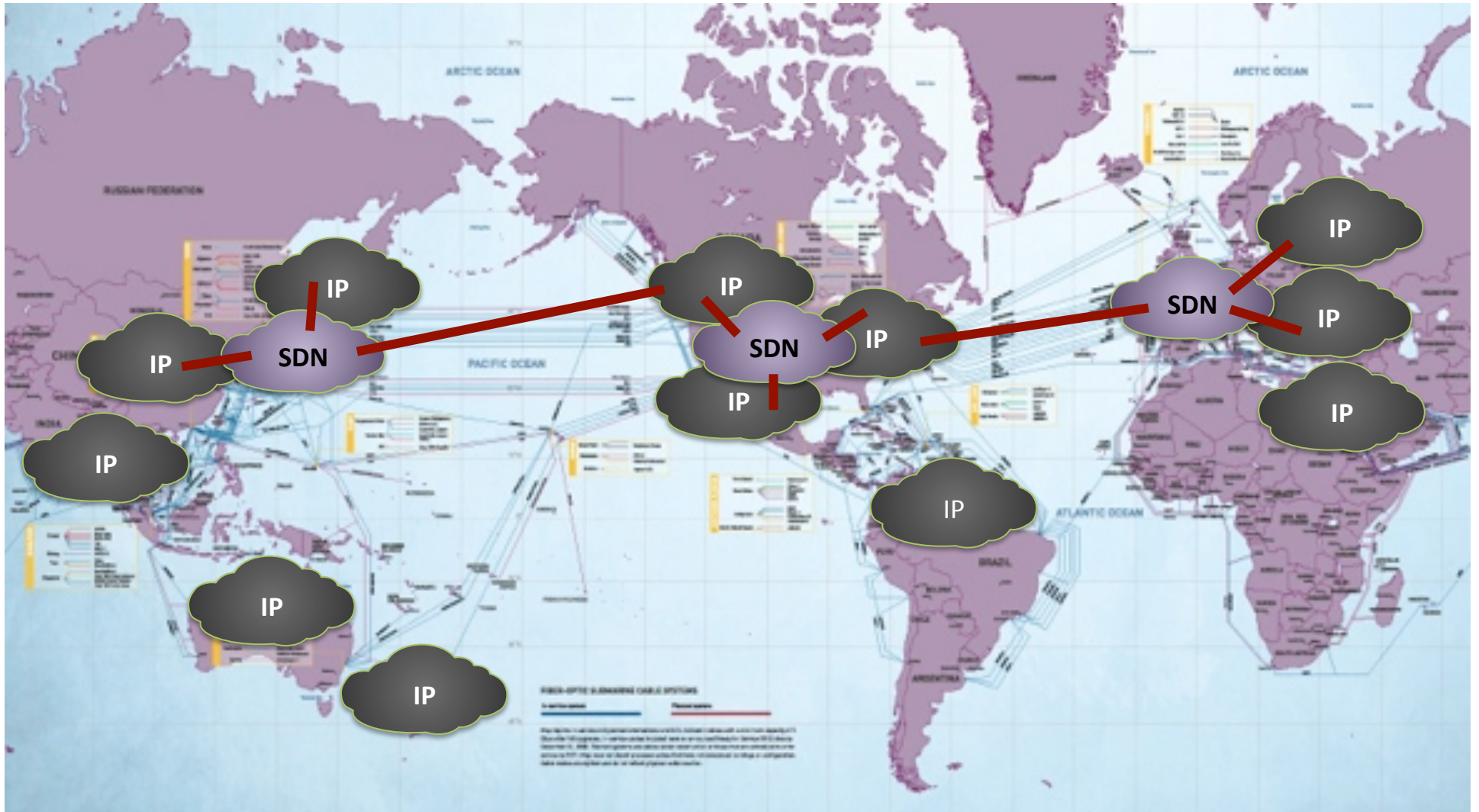


SEAMLESS INTERWORKING OF SDN AND IP

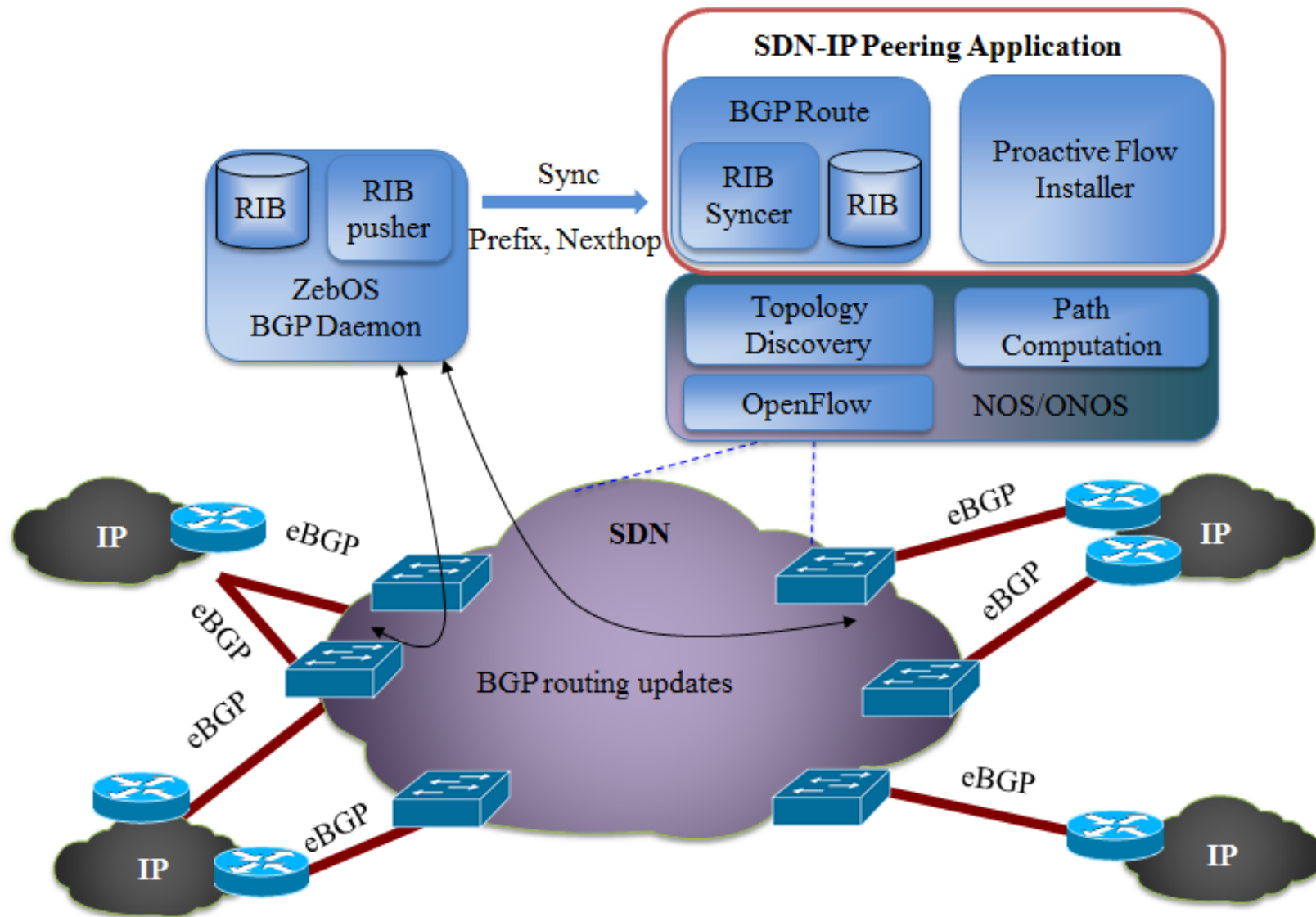
Pingping Lin, Jonathan Hart
April 2014

ON.LAB

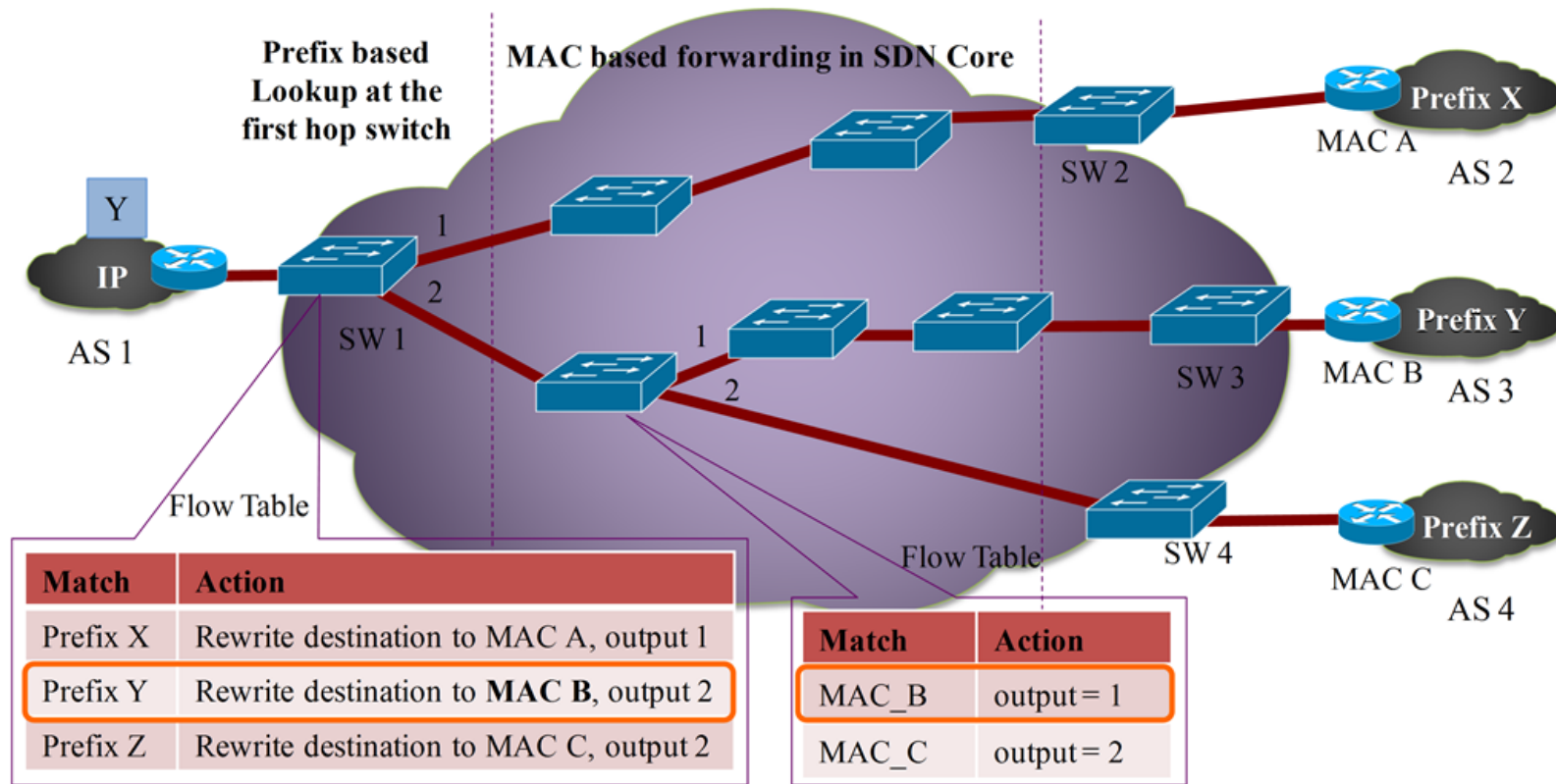
How can we seamlessly peer between SDN and IP networks?



SDN-IP Network Peering Architecture

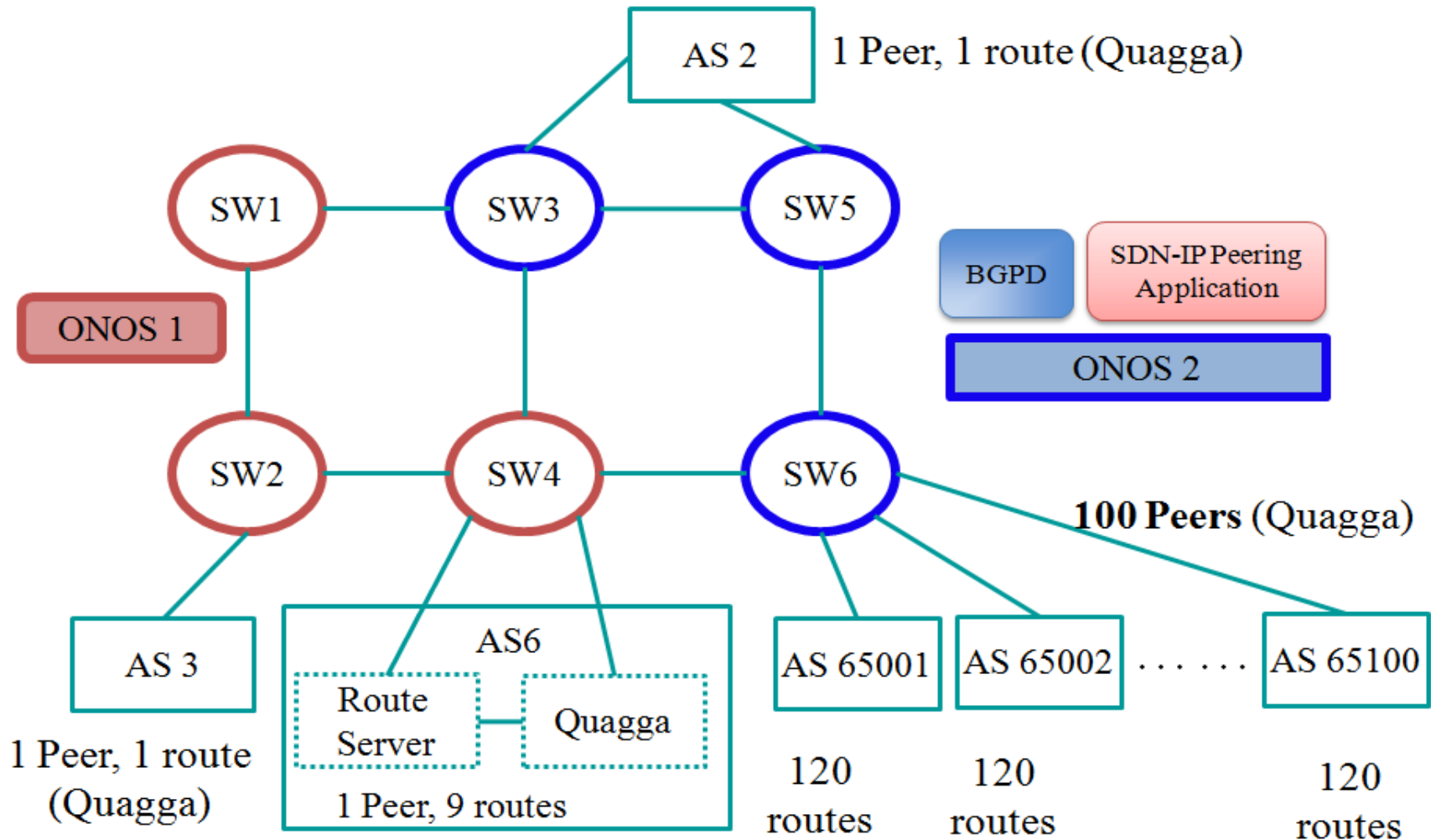


MAC Address Rewriting and Layer 2 Forwarding

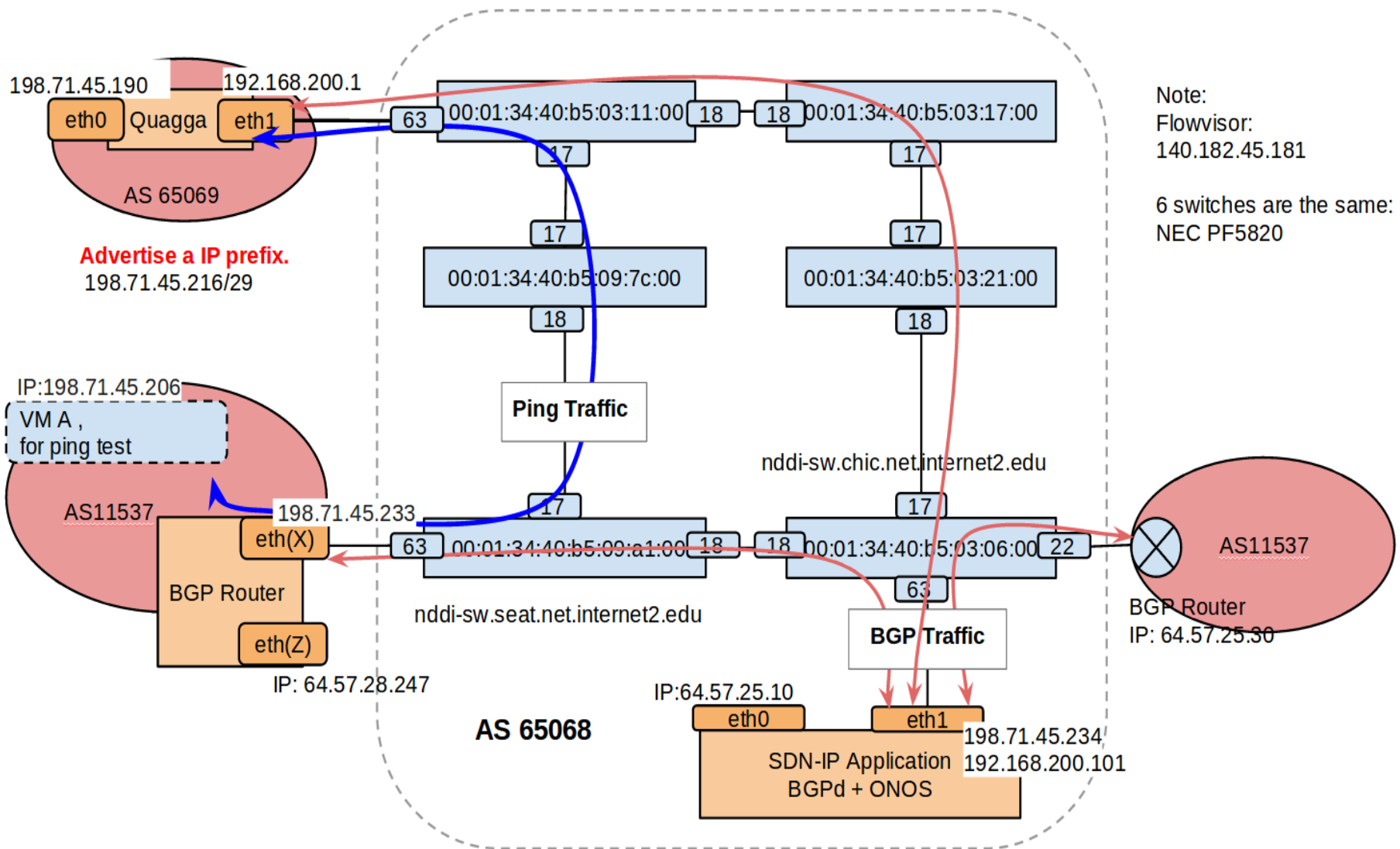


Scalability

- Current version can handle 100 peers and more than 14000 routes.



Internet 2 Deployment



Other Deployments

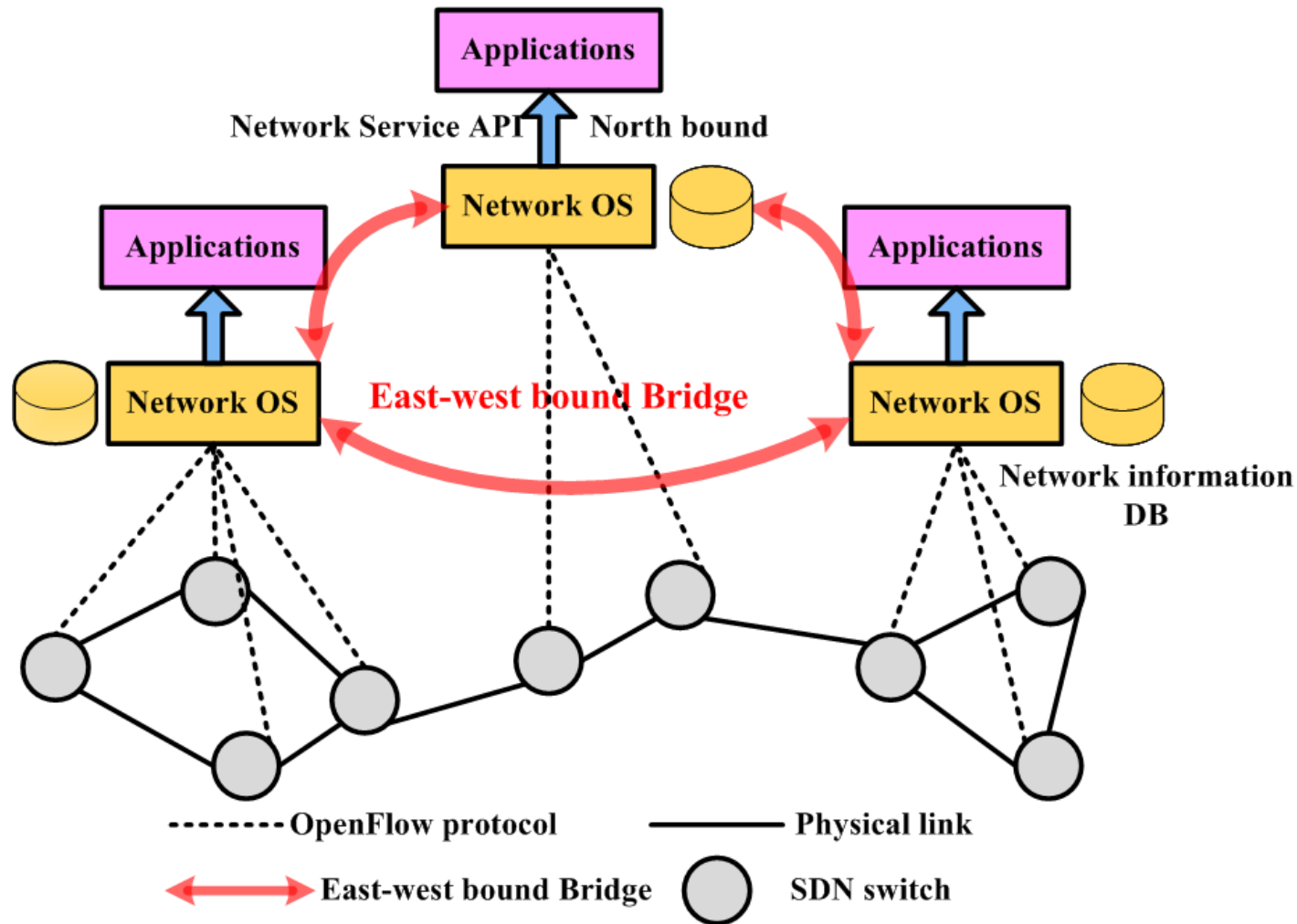
- 1. In collaboration with Google and REANNZ, we preliminary deployed it to an active SDN network in New Zealand.
 - 12,000 routes, 10 peers
 - 10 routes updates/second
- 2. will deploy it to the SDN network of the Tree House project at Stanford University with IP peer ESnet

WE-Bridge: West-East Bridge for SDN-SDN Network Peering

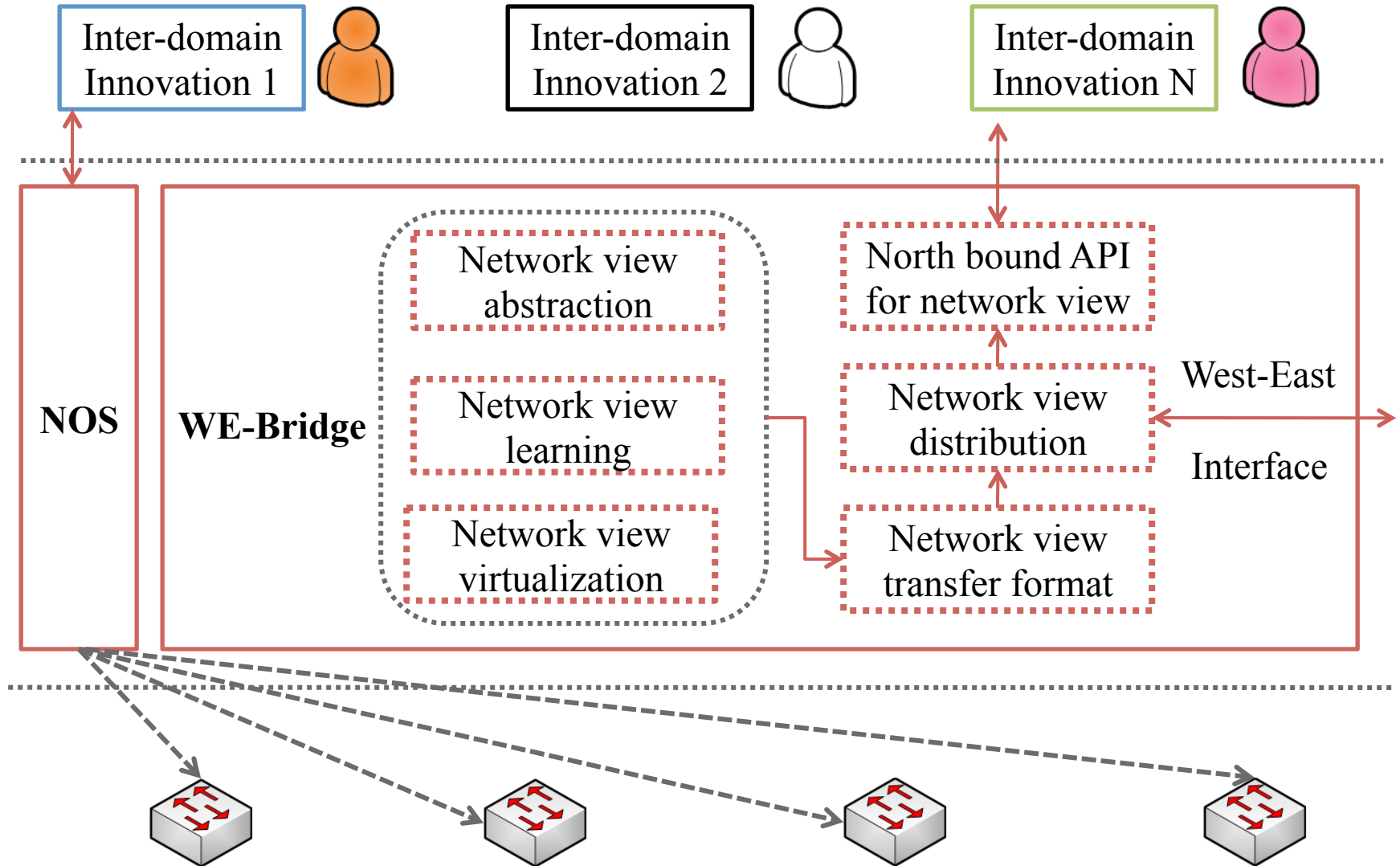
Pingping Lin, Jun Bi, Steve Wolff
April 2014



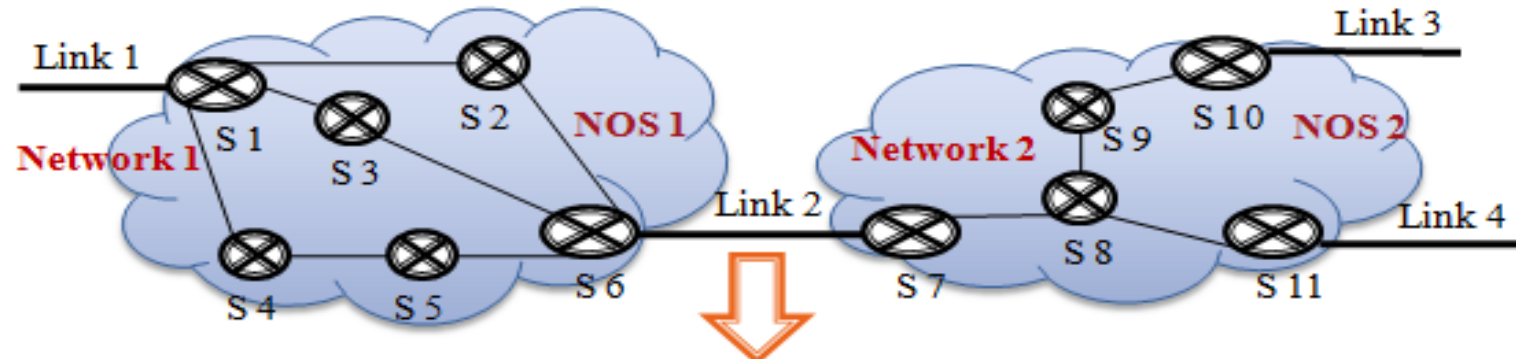
West-East Bound Bridge



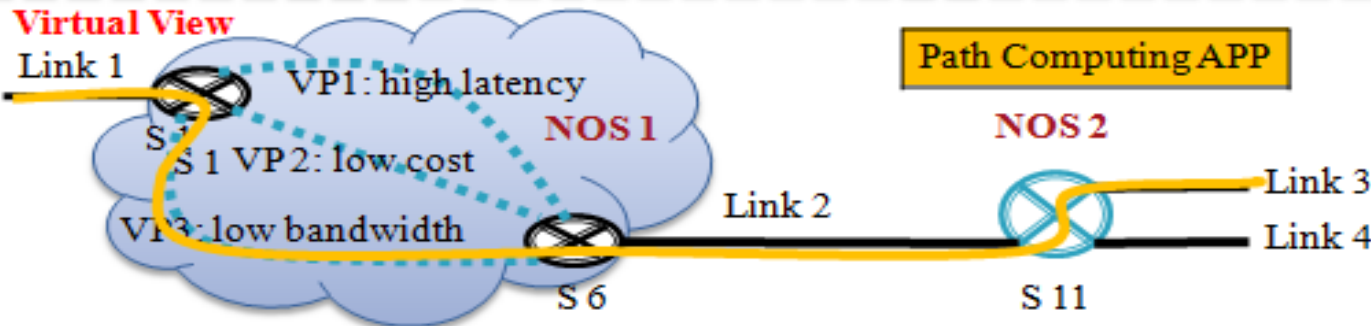
WE-Bridge Model



Virtual Network View



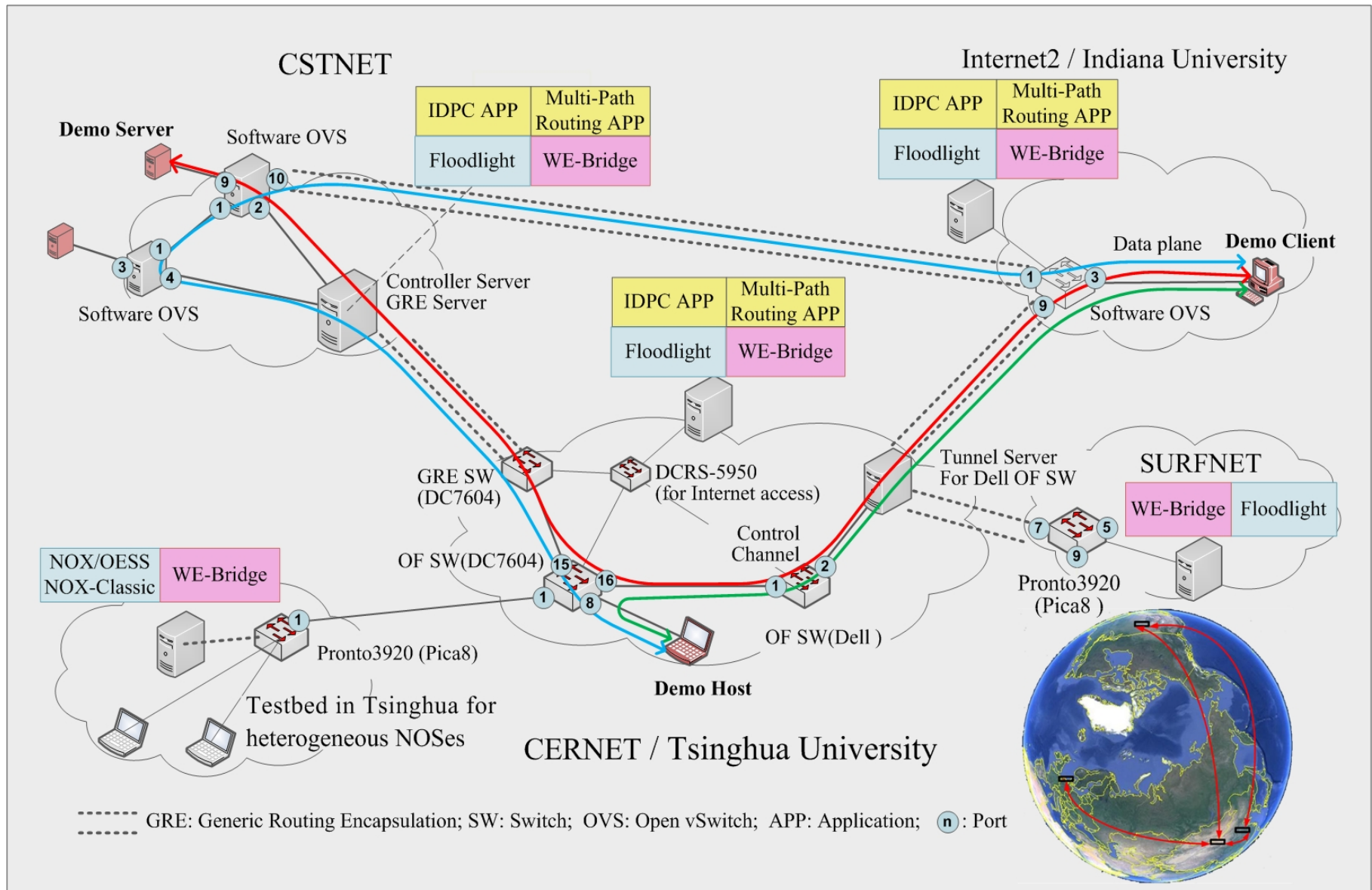
Physical View Abstract a sub network to a virtual Link and virtual Node



PP	VP	SLA
(S1, S2, S6)	(S1, S6)	latency = t(x1)
(S1, S3, S6)	(S1, S6)	cost = money (y1)
(S1, S4, S5, S6)	(S1, S6)	bd = bps (1G)

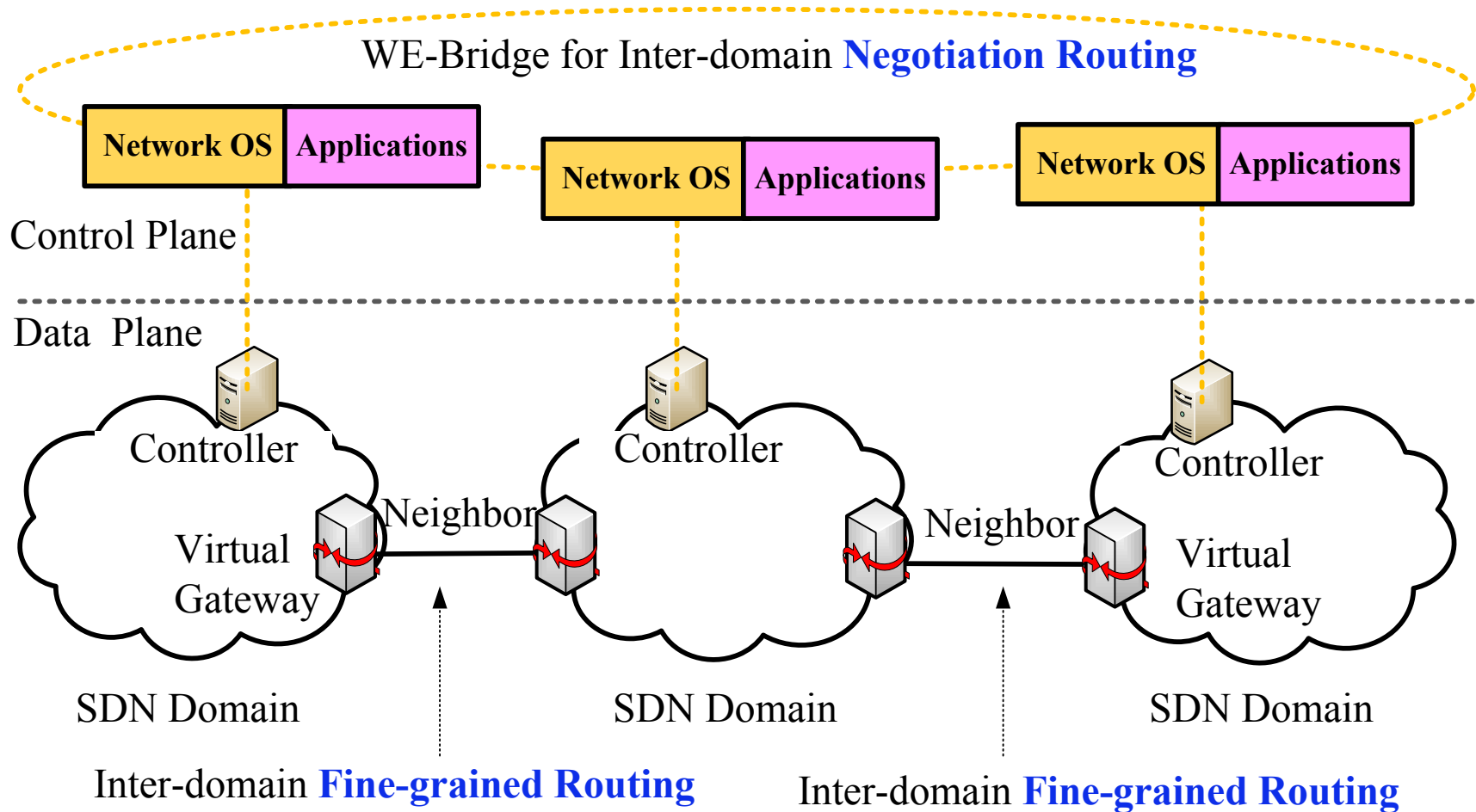
PP	VP	SLA
(S7, S8, S11)	S11	bd(x2)
(S7, S8, S9, S10)	S11	bd(y2)

..... Virtual link Physical OF switch Virtual OF switch



Global SDN Federal Testbed: Internet2, CERNET (China education and research network), CSTNET (China science and technology network), and SURFNET (the national research and education network of Netherlands)

Two Inter-domain Routing Innovations



Contributors

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- Prof. Jun Bi (architect & design)
- Pingping Lin (design & coding)
- Ze Chen (coding)
- Anmin Xu (coding)
- Dr. Hongyu Hu (testing)
- Yayuan Sun (configuration)
- Yang Yu (testing)
- Prof. Jilong Wang's operation team

▶ CSTNET

- Dr. Yulei Wu (testing)
- Dr. Yuepeng E (configuration)
- Jianning Chen (application)

▶ BIG at CAS

- Shaoping Ling (application)

▶ SURFnet

- Ronald van der Pol (infrastructure)

▶ Interent2

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- Mike Sullivan
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- Edward Moynihan
- Di Lu
- Wendy Huntoon

▶ Indiana University

- John Hicks
- Brent Sweeny

▶ NCBI

- Frank Gao
- Tony Zhang

Conclusion

- SDN-IP Peering was demoed in SIGCOMM 2013
- SDN-SDN Peering was demoed in Chinese-American Networking Symposium 2013, Super Computing 2013, and will be demoed in INFOCOM 2014

Thank you!