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ONOS

Towards an Open, Distributed SDN OS

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WAN Networks Today

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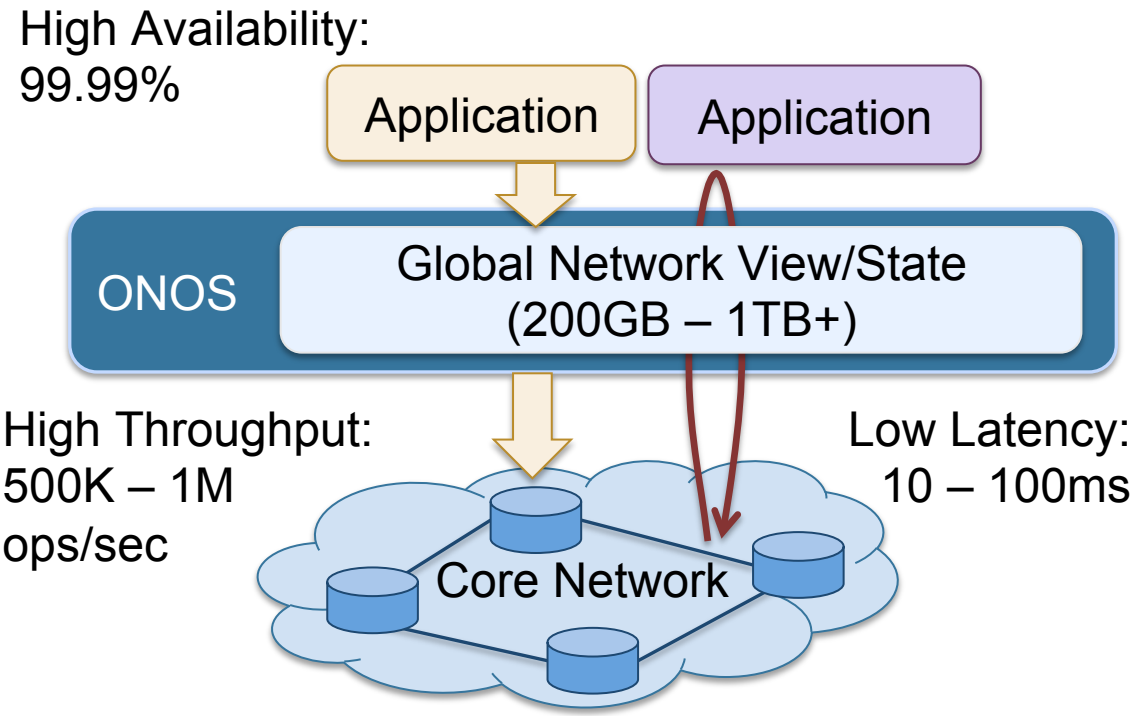
Core
~250 routers
5K - 10K ports

Metro
10K - 50K routers
3M+ ports

Access
~50K devices
1M+ ports



Distributed, SDN OS

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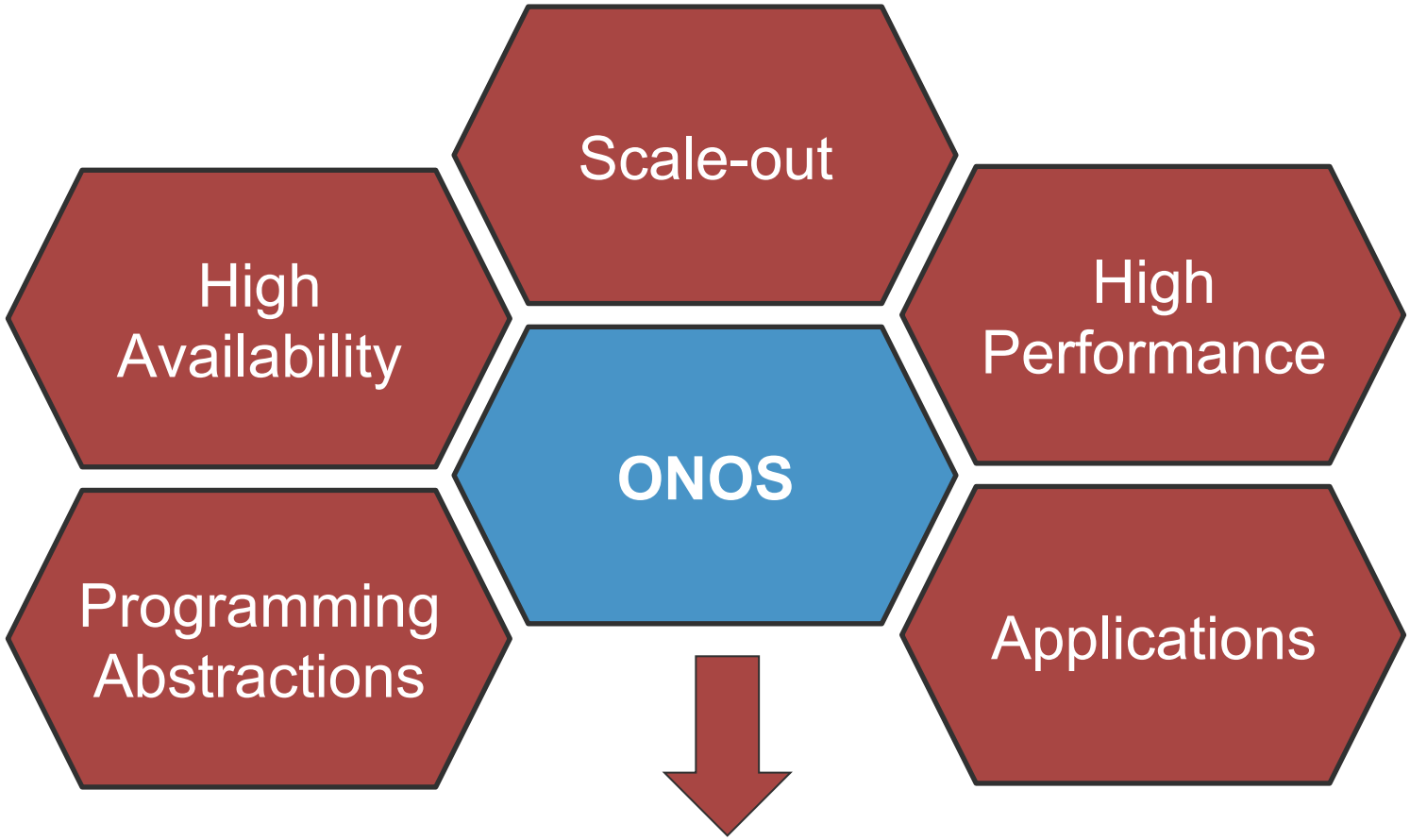

Network OS for WAN and Service Provider networks

Clean separation of Control Plane from Data Plane

Distributed, SDN OS

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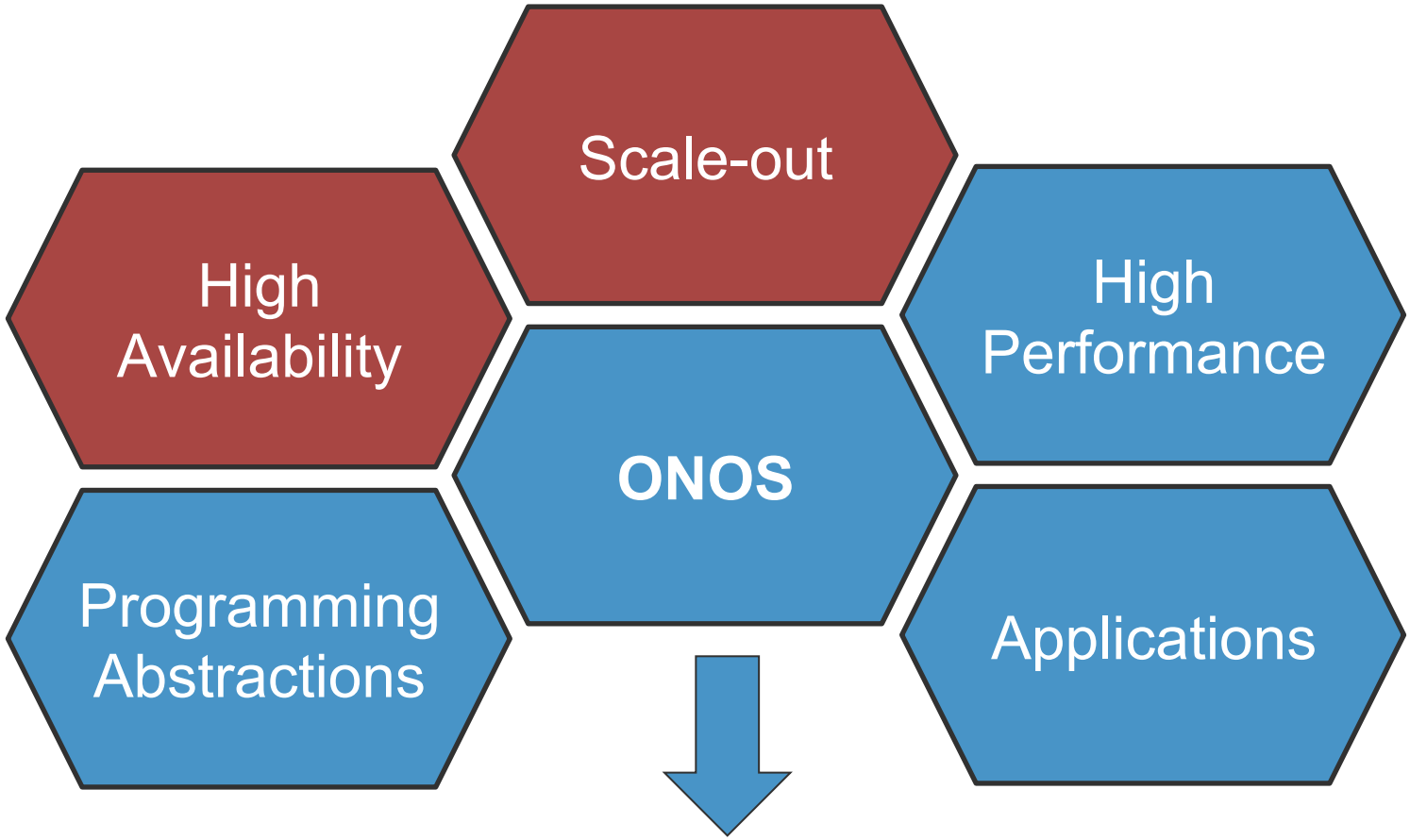

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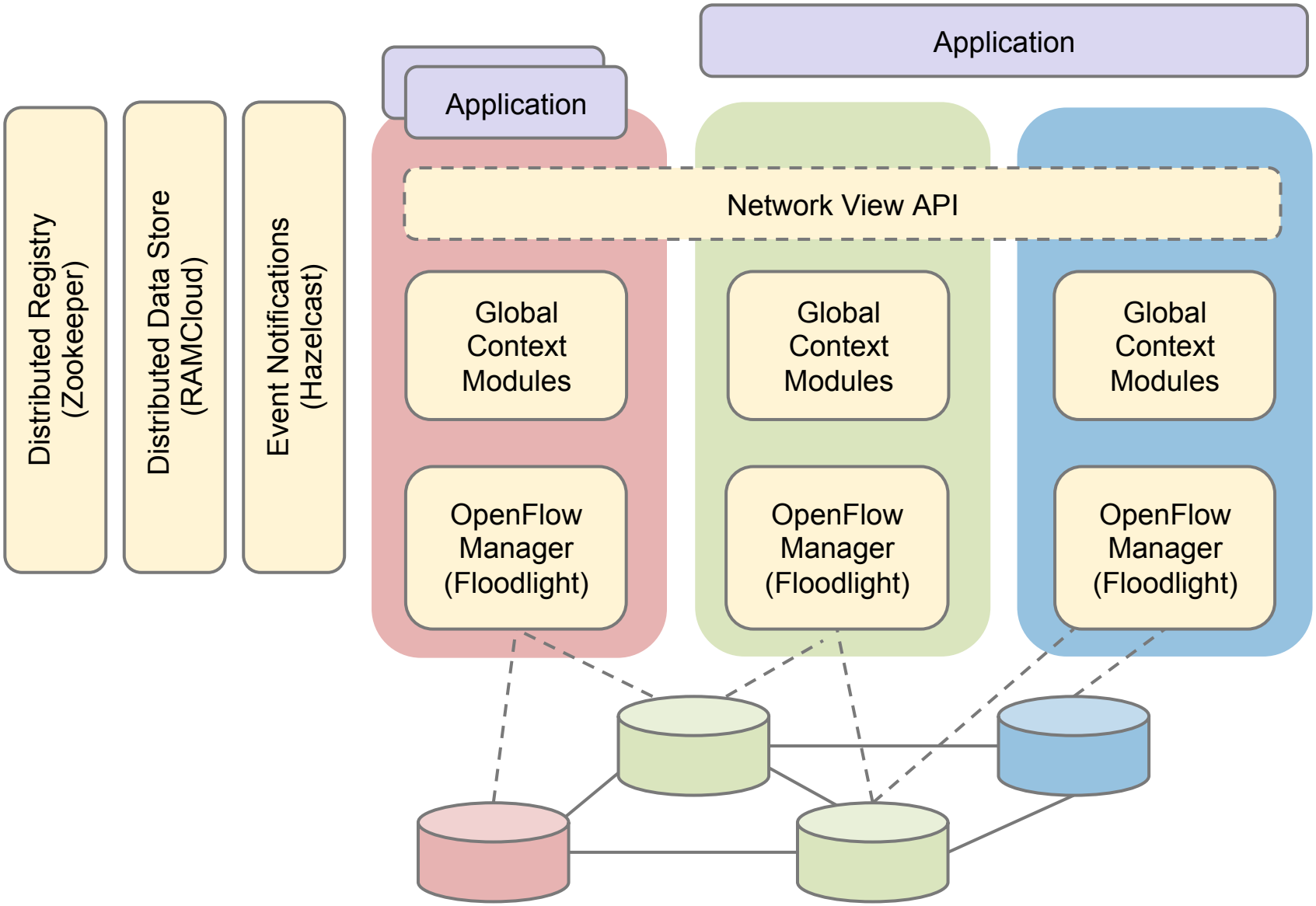
Distributed Architecture



Distributed, SDN OS

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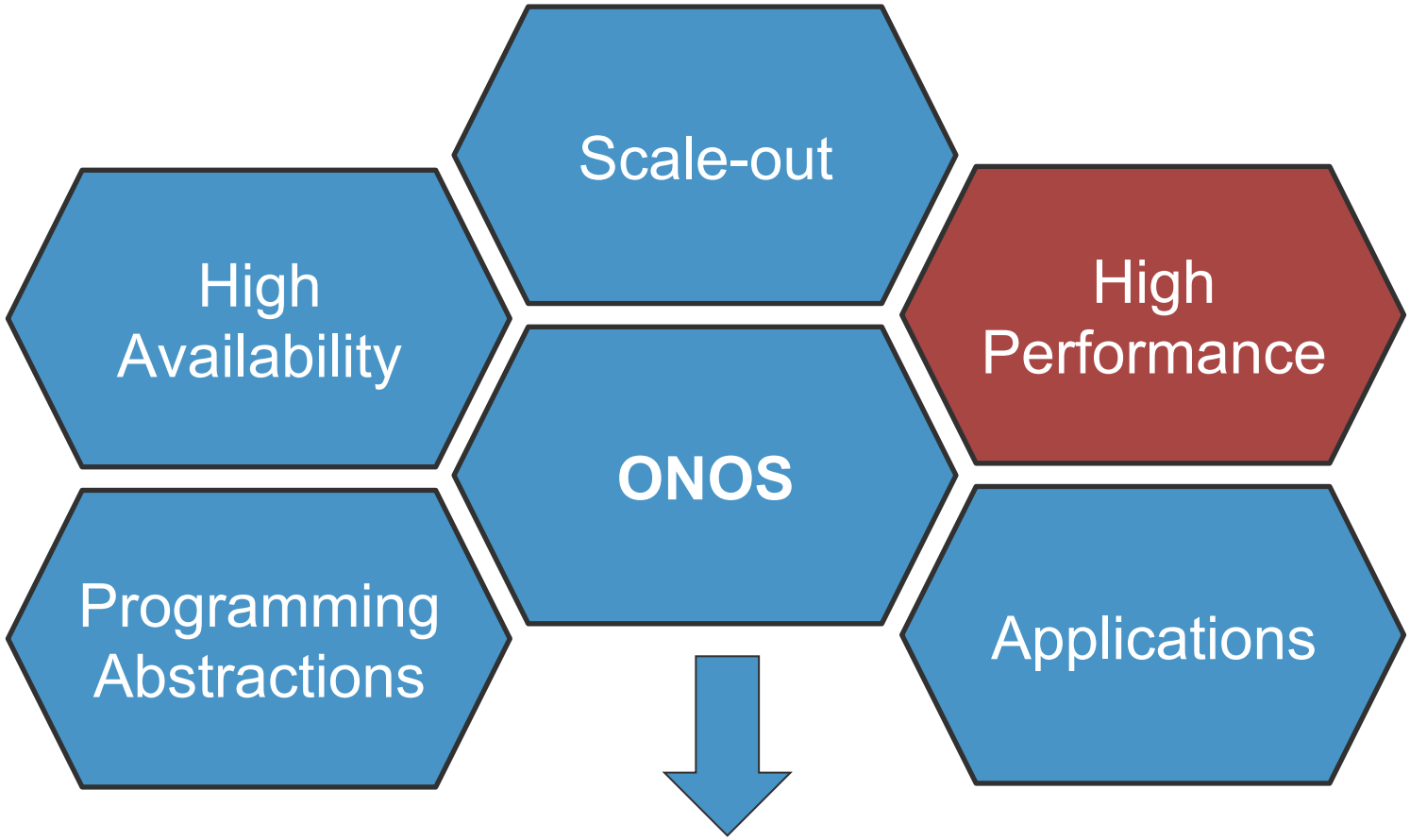

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Improving Latency

- Initial system performance was terrible
- Reduce number of remote operations

Adding a Switch	Reads	Writes
Generic Graph Data Model	8	9
Custom Data Model	1	1

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Topology State

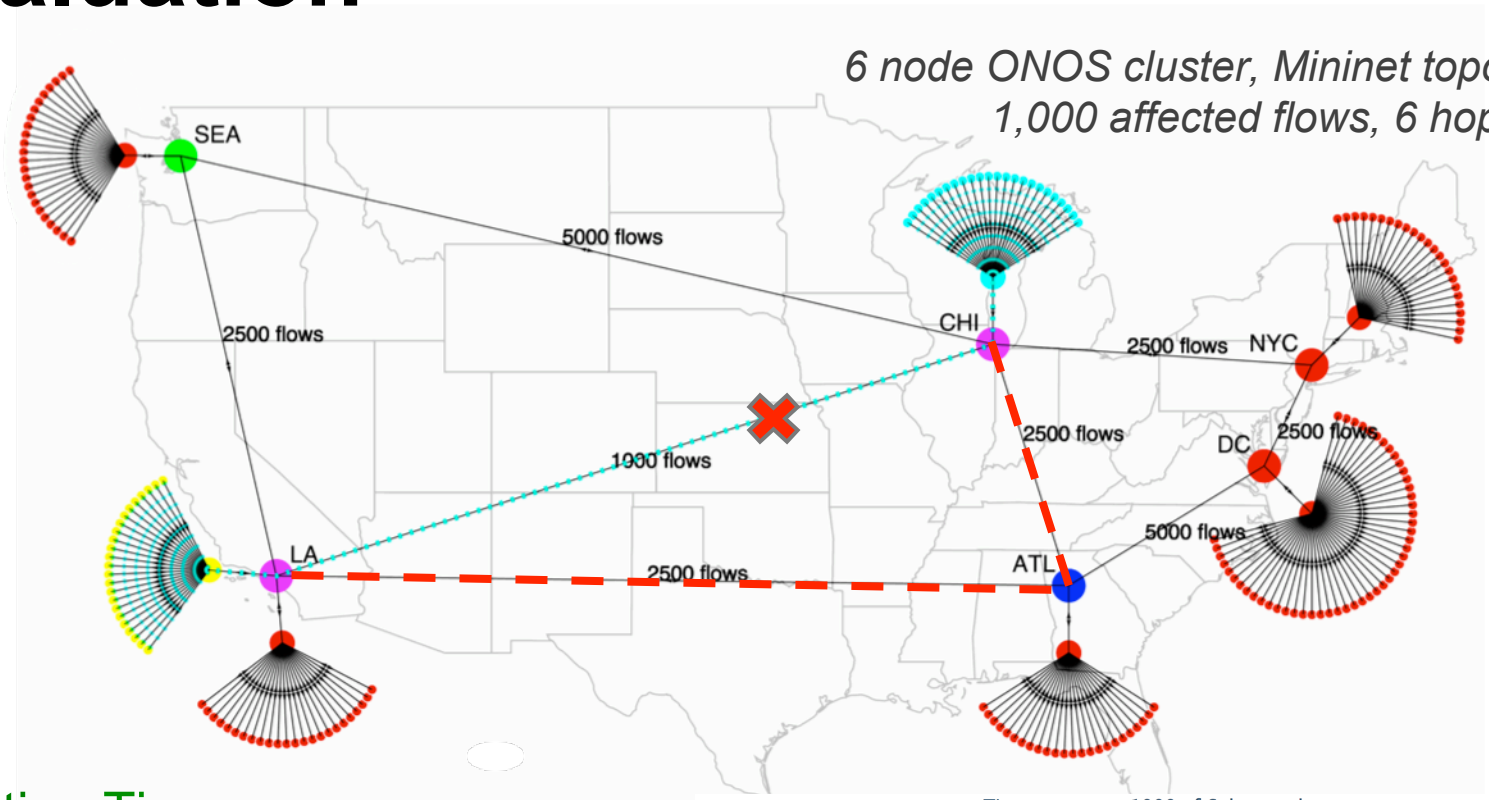
- Sometimes remote reads/writes are too slow

Topology Replicas

- Exploit read-heavy access pattern by storing a copy on each instance
- Build indices in-memory to improve lookup time
- Apply updates atomically to maintain integrity

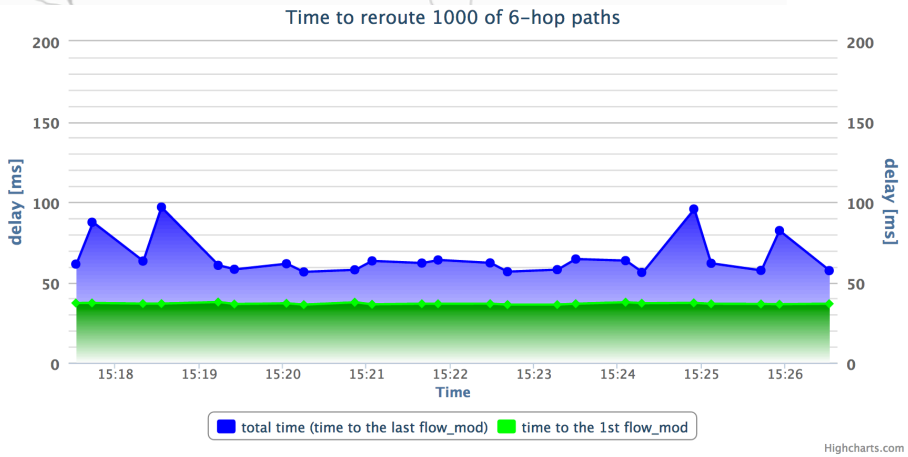
Evaluation

6 node ONOS cluster, Mininet topology,
1,000 affected flows, 6 hop path



Reaction Time:
45.2 ms (median)
75.8 ms (99th percentile)

Total Time to Reroute:
71.2 ms (median)
116 ms (99th percentile)



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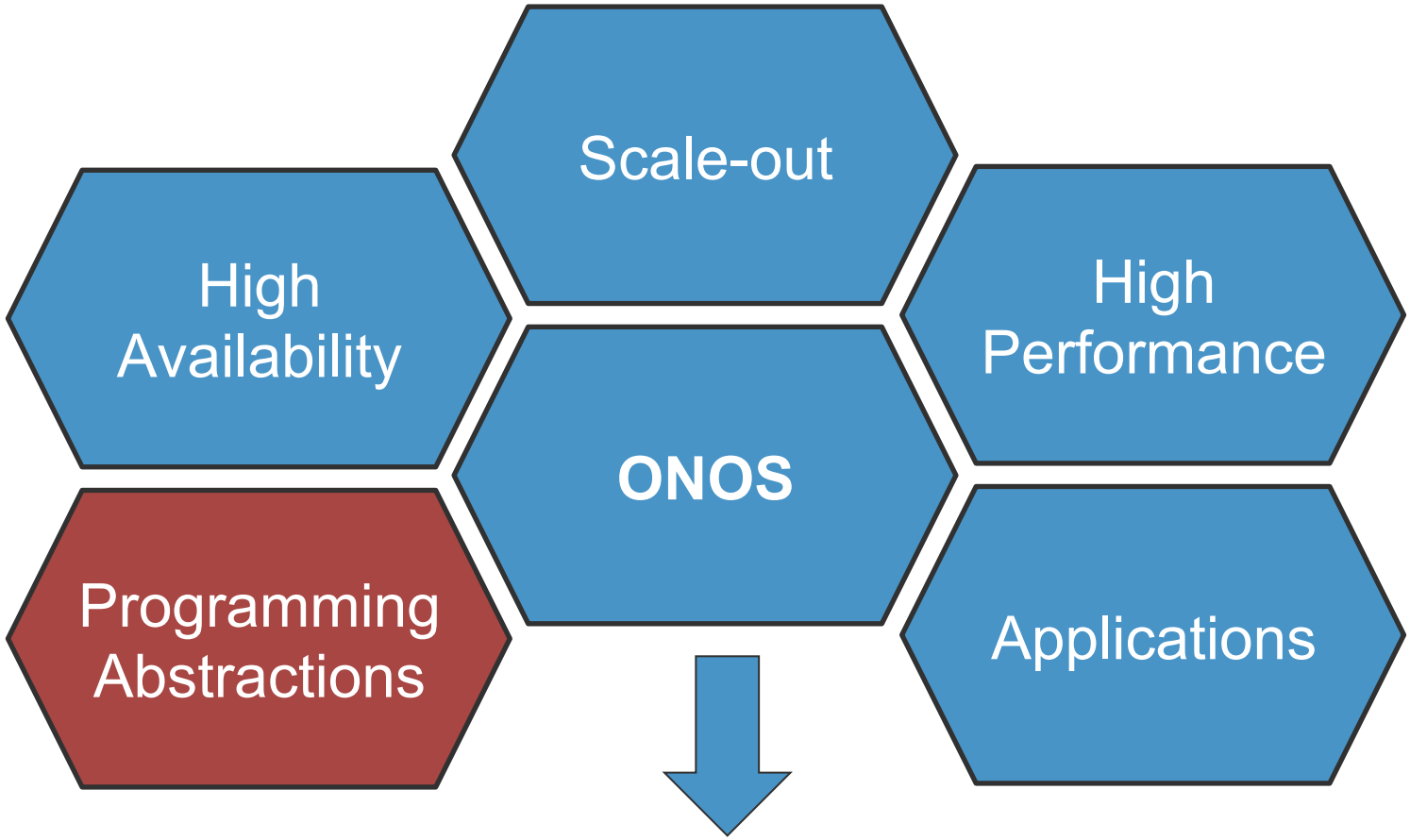

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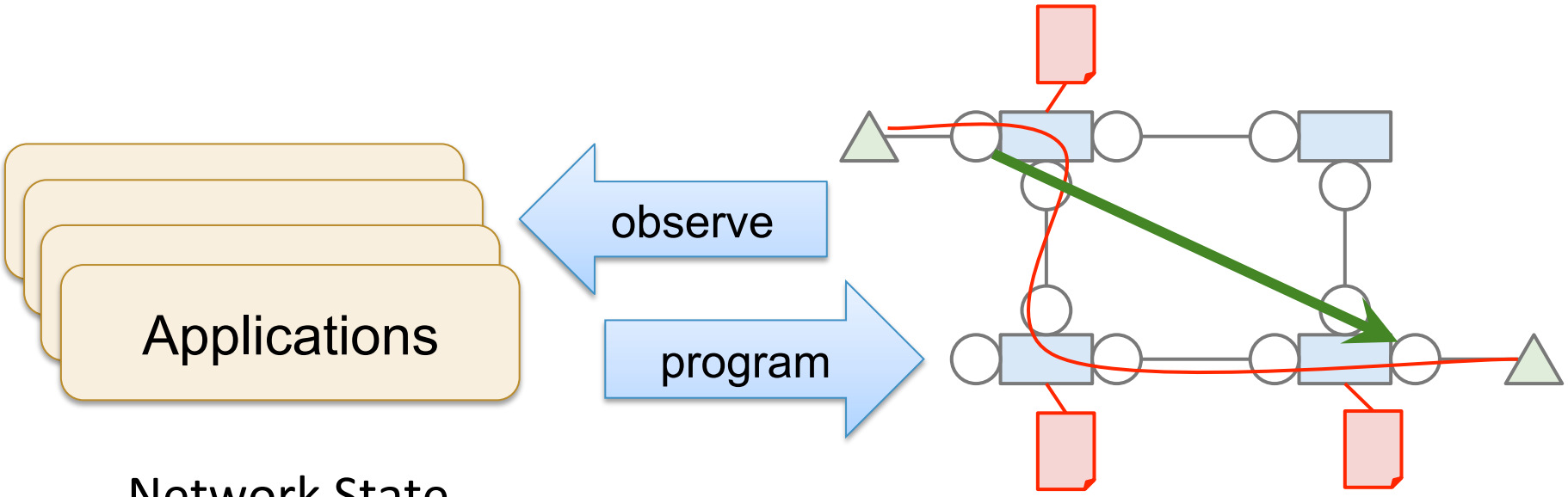
Global Network View



Network State

- Topology
  (Switch, Port, Link, …)
- Network Events
  (Link down, Packet-In, …)
- Flow state
  (Flow-tables, connectivity paths, …)

	Switch
	Port
	Link
	Host
	Intent
	FlowPath
	FlowEntry

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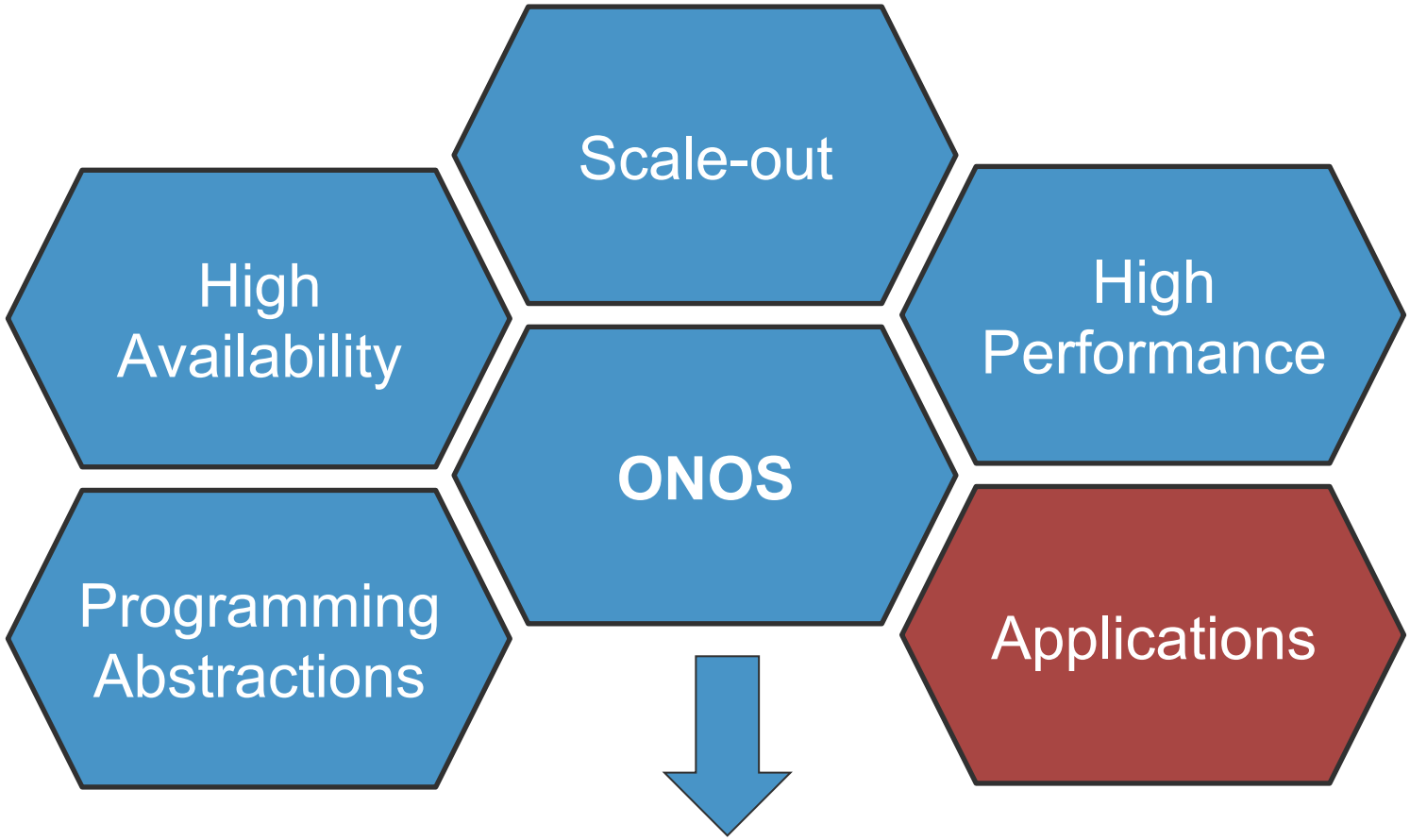

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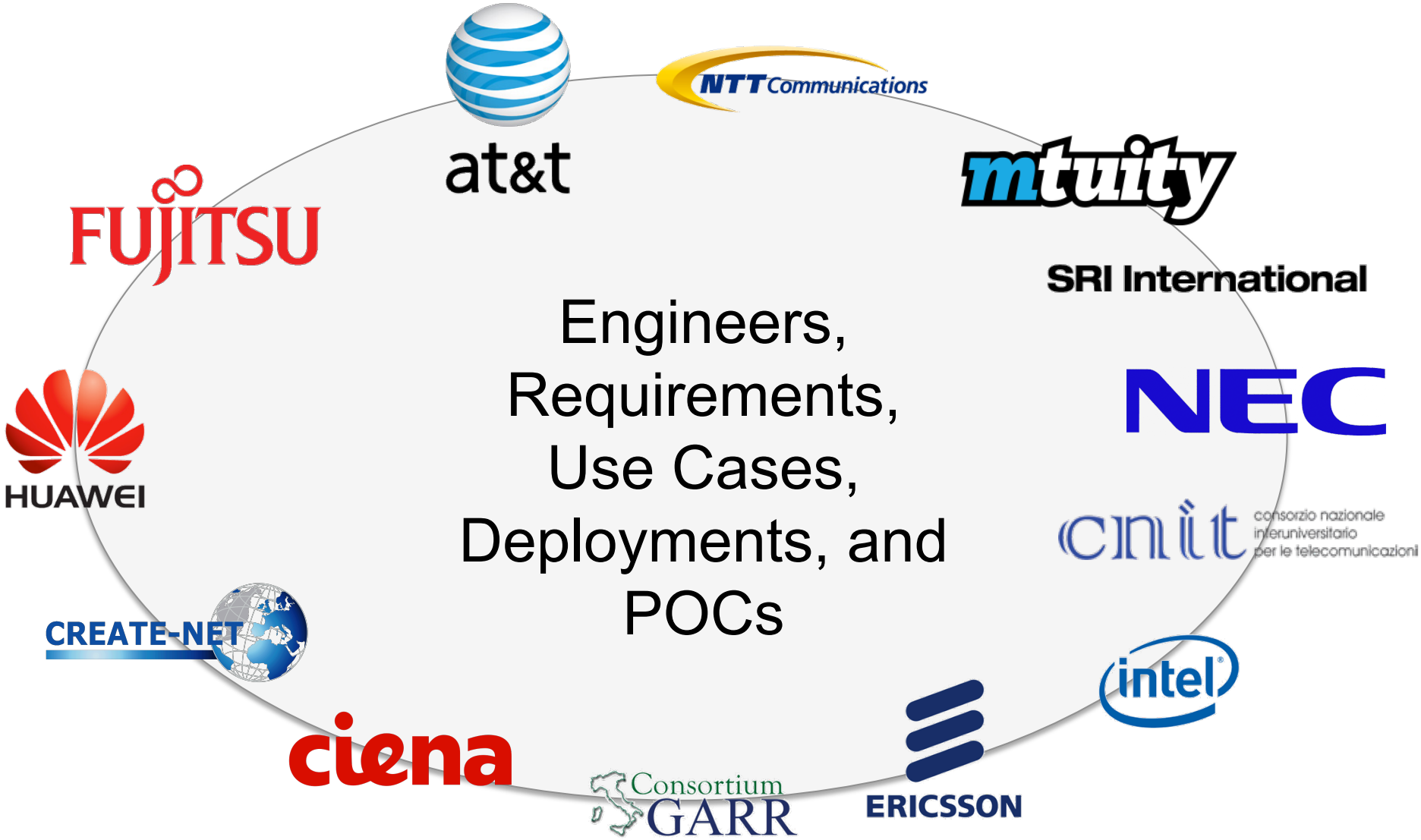
Community



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Use Cases

- SDN-IP: BGP peering and prefix routing
  (deployment with INTERNET 2)
- Traffic Engineering on converged Packet/Optical core network
- Segment Routing using MPLS labels
  (in collaboration with ONF OPEN NETWORKING FOUNDATION)
- Virtual Central Offices (SDN + NFV)

Looking Ahead

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- **Open Source by the end 2014**

- Improvements to HA and performance
- Better and more general abstractions
- Isolation and Security
- Resource Scheduling
- Hierarchical or Peer-to-Peer coordination
- More use cases and deployments

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Learn more at:
http://onlab.us

Thanks!