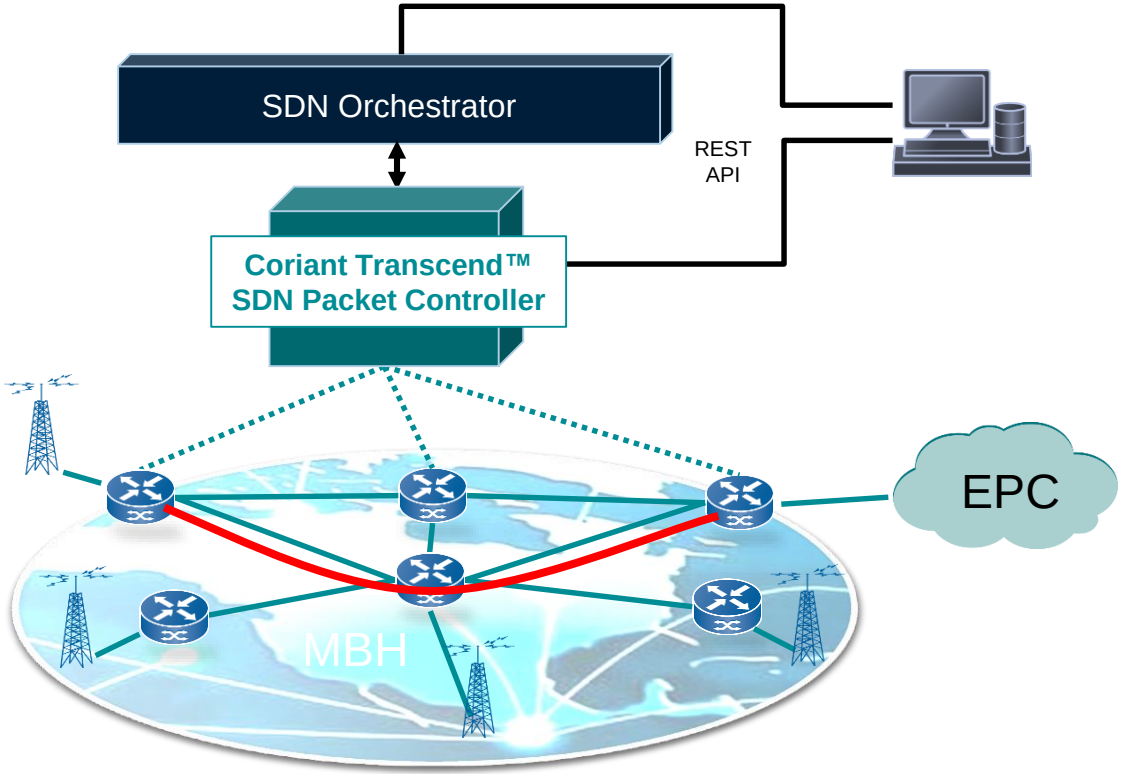
Programmable SDN Controller for 5G Mobile Backhaul Network Optimization

Janne Karvonen

Dec 16, 2016

Reference Architecture



5G Challenges in MBH

- Capacity
- Latency
- Scale & density
- Cloud
- Slicing
- Multi-RAT
- Green
- IP-Optical integration

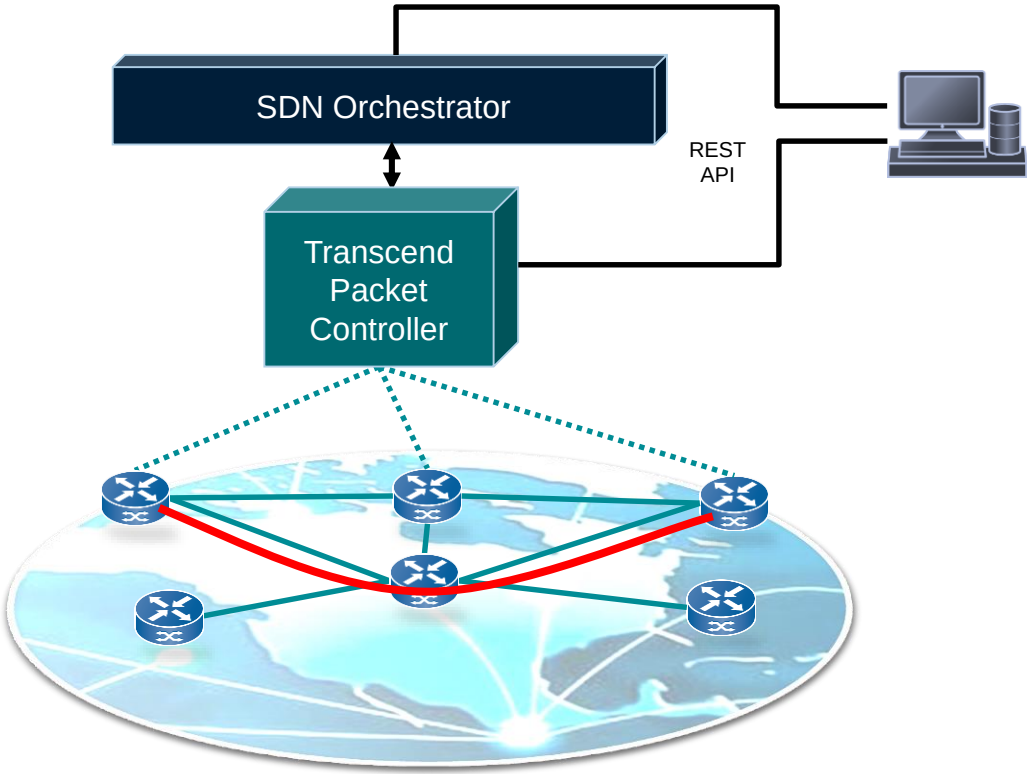
SDN

- Automation
- Programmability
- Centralized intelligence
- Network Virtualization
- Self Optimization
- Self Healing
- Multi-Vendor
- Multi-Layer

Coriant SDN - Target Carrier Applications

Use Cases Enabled with Coriant Packet Controller	Programmable Network Automation	Streamlined automation of common operational actions
	Performance Aware Networks	Configuration/optimization based on real time network performance
	Dynamic Service Assurance	Network events trigger adjustments to improve reliability
Use Cases Requiring Integration with External Controllers	Multi-Layer Network Optimization	Integrate L0/1 transport status into IP/MPLS configuration
	Multi-Vendor Automation	One interface to program multi-vendor network domains
	Application Aware Networks	Configuration/optimization based on application requirements

Programmable Network Automation



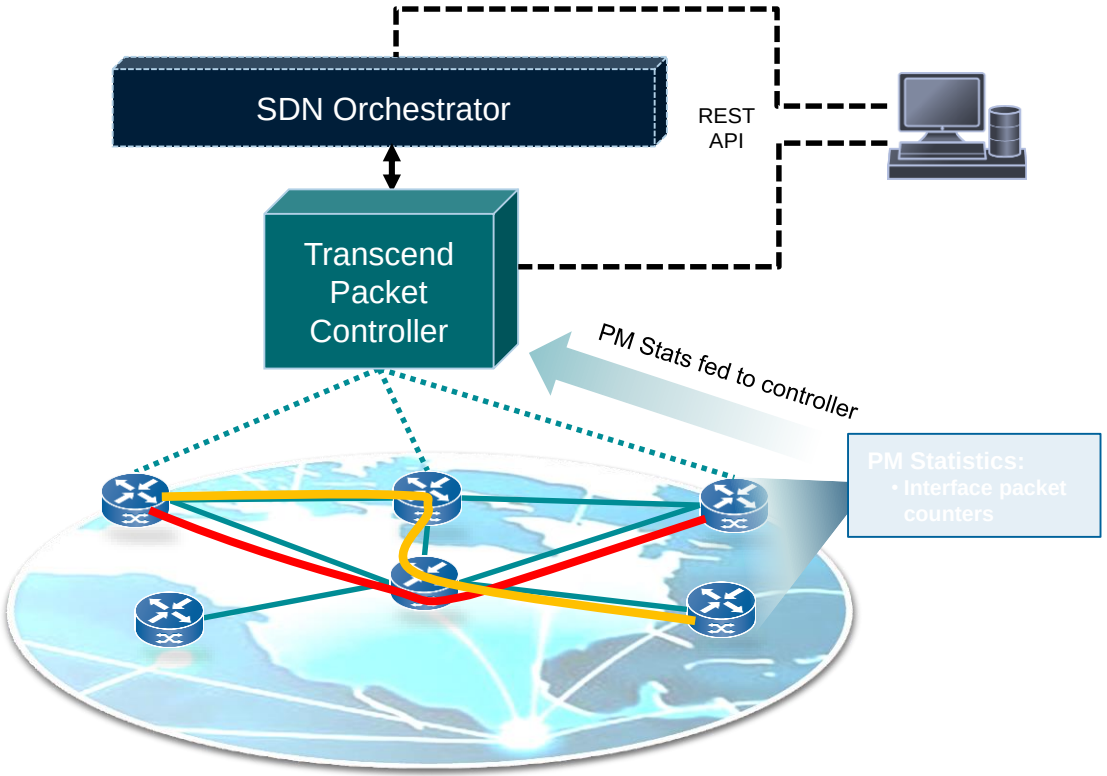
Applications

- Bandwidth on demand
- Dynamic access to cloud services
- Infrastructure activation

Use Case Overview

- REST API provides programmable interface to network
- Service path calculated in controller
- Configurations pushed to network

Performance Aware Services



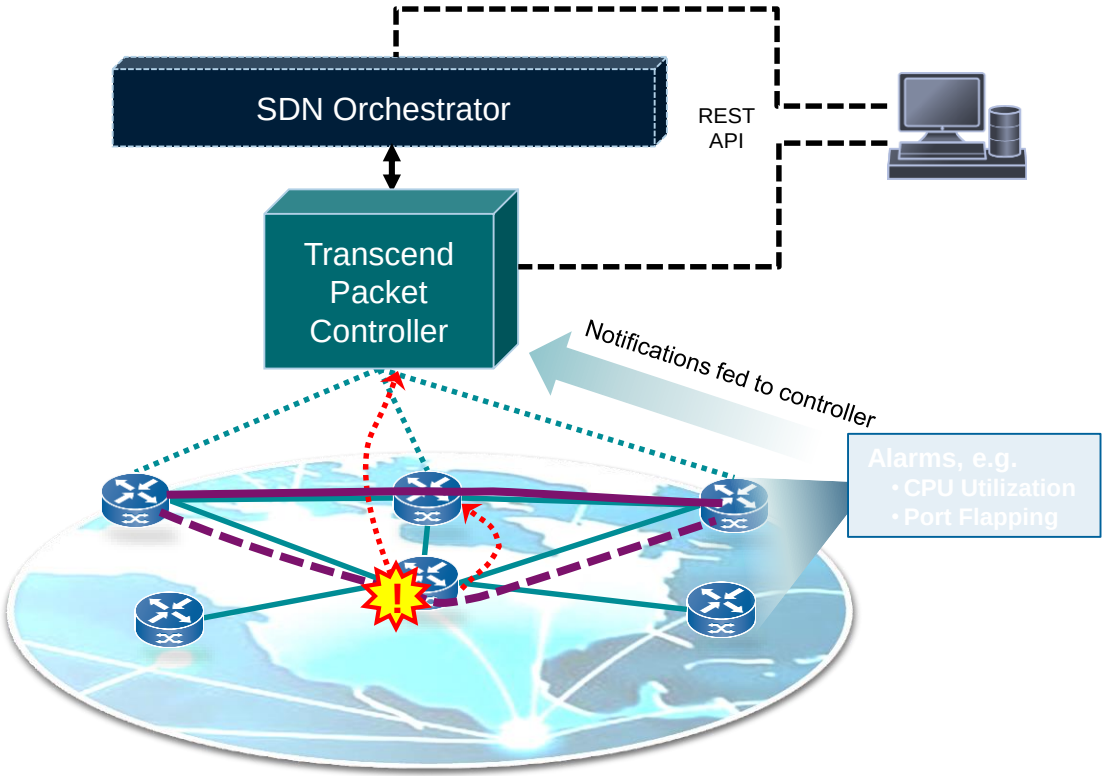
Applications

- Congestion based load-balancing
- Service defragmentation
- Low Latency services
- Performance based optimization

Use Case Overview

- Performance metrics collected by controller
- Application requests service
- Controller runs context aware path computation algorithm
- Service activated

Dynamic Service Assurance



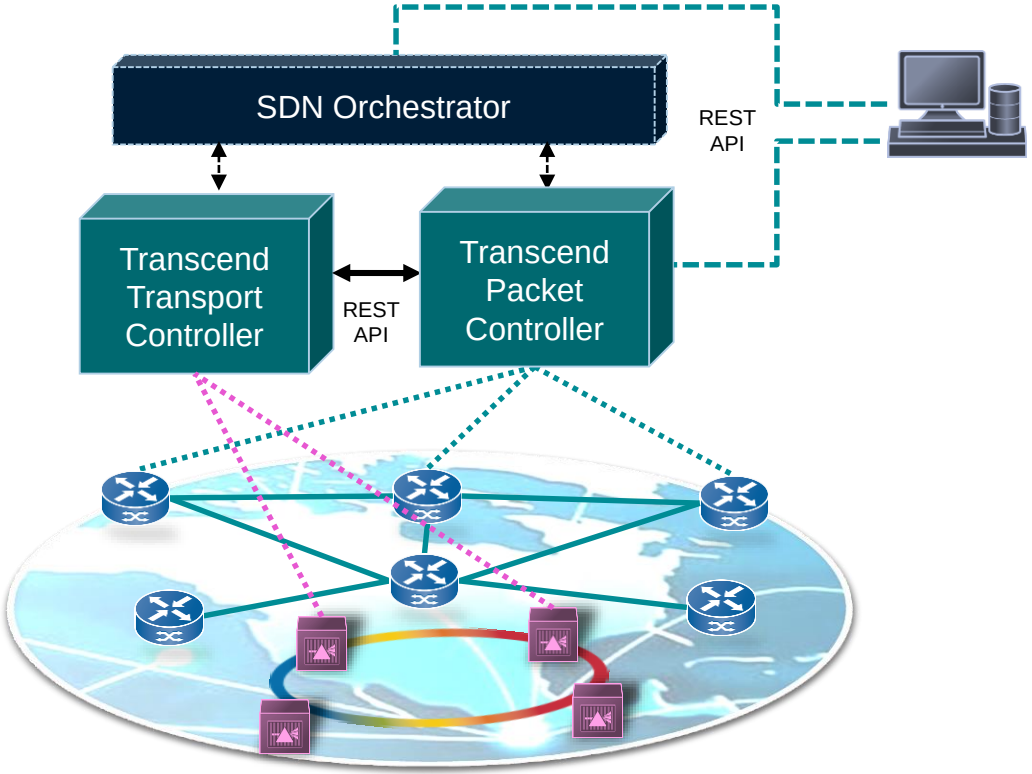
Applications

- Alarm based service re-route
- Route around potentially unstable network elements
- Policy based service assurance

Use Case Overview

- Controller receives notifications
- PCE calculates alternate path to assure service uptime
- Network re-route
- Notification to Orchestrator

Multi-Layer Network Control



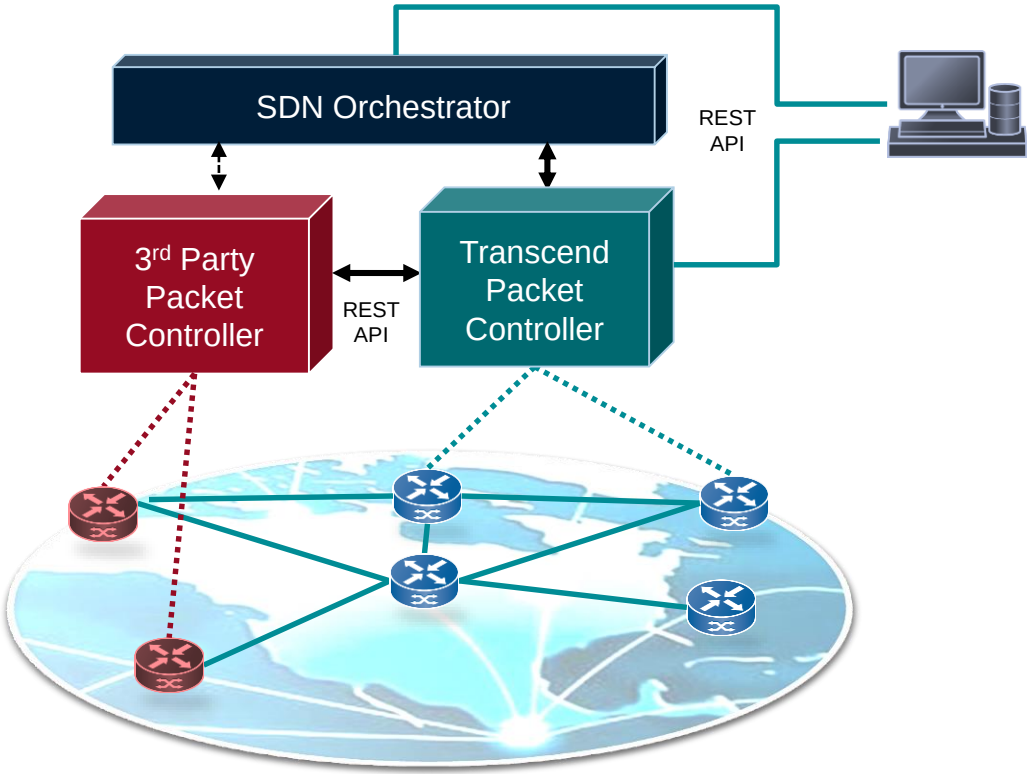
Applications

- IP/MPLS path computation based on optical path diversity
- Port shaping based on real time microwave throughput

Use Case Overview

- API between IP & Transport
- SRLG on PCE
- Controller PCE integrates transport layer state into network model
- MPLS Protection routes based on state of physical network

Multi-Vendor Network Control



Applications

- Automated provisioning across vendor domains
- Globally optimized path computation

Use Case Overview

- Coriant controller supports multi-domain network model
- API to 3rd party controllers
- Multi-domain services (Ex. S-MPLS) supported

Research Issues & Challenges

- Programmable Network Automation
  - API development for network automation workflows
  - Routing algorithms for SDN controller based routing (Multi-Domain, Multi-Layer & Multi-Dimensional routing)
- Performance Aware Services
  - Route calculation based on measured NW performance (congestion, latency)
  - Mechanisms for measuring network performance (packet counters, TWAMP, Y.1731, PING etc.)
  - End-to-end constraints (latency, max. congestion) in routing algorithms
  - Maintaining and optimizing the end-to-end performance
  - QoS handling
- Dynamic Service Assurance
  - Mechanisms for monitoring network events
  - Event-triggered connection optimization and restoration
  - Combination and interworking of NE-based fast protection and SDN controller based restoration/optimization
- Multi-Layer Network Control
  - Multi-layer aware/capable routing algorithms
  - Co-operative multi-layer routing
  - Dynamic SRG awareness & Physical Disjoint Routing
  - Dynamic NW optimization in multi-layer networks
- Multi-Vendor / Multi-Domain / Hierarchical Network Control
  - (Standardized) APIs for plug'n'play vendor interoperability
  - Multi-domain routing algorithms
  - Co-operative multi-domain routing
  - Modeling of network sub-domains
  - Modeling of foreign network domains
- General
  - Scalability

Thank You.

Coriant