Flow Engine
A Programmable SDN Platform
Carrier/WAN SDN
SDN facilitates better network control

Distributed Network Control

- Service A: R1 -> R4 20G
- Service B: R5 -> R4 20G

Low Efficiency
- Complex routing setup & mainly based on shortest path
- Low throughput & low link utilization
- Difficult deployment of new services & business applications

High Efficiency
- Simplified routing setup & advanced global routing decisions
- Near optimal throughput & link utilization
- Flexible APP deployment

Centralized Network Control

Flow Engine: an advanced routing platform for SDN Networks
Carrier/WAN SDN

Real Use Case: Tencent

- Flow Engine is used in Tencent’s network in China
- Network optimization process is called every five minutes by Tencent App Server
- Flow Engine calculates the nearly optimum result in seconds

SDN in DCI | 63% Throughput Increase | Minimum Cost Routing
Carrier/WAN SDN

Flow Engine: A Programmable SDN Platform

Powerful and Open Programmable Interfaces
1) C/C++/Java Interfaces, RPC / Messages
2) Easy integration with third party APPs

Platform Independent
1) Seamless integration with different SDN controllers: SNC, ONOS, ODL
2) Deployment is independent of the SDN controller platform

Network Performance in Real Deployments
1) 63% throughput increase
2) Global optimization in seconds
Carrier/WAN SDN
Flow Engine Architecture & Demo

Dynamic Services Scheduling
1) Optimal resource allocation for current/future services
2) Support time varying service requirements

Fast Network Recovery
1) Recovery based on global network view
2) Online fault analysis

Super Bandwidth on Demand (BoD)
1) BoD Algorithm in IP & Optical
2) Load balancing policy

Third Party APP
1) GUI is designed using ONOS
2) Initial services deployment using ONOS
3) Re-optimization by Flow Engine
Thank You!
Carrier/WAN SDN

APP1: Dynamic Services Scheduling

**Future Service Provisioning**
- Short-term & long-term traffic prediction
- Network resources & time allocation
- Optimal sequence of resource provisioning
- Efficient scheduling & routing for all requests

**Business Paradigms & Product Features**
- BandWidth on Demand (BWoD)
- Better network admission & congestion control
- Improved resiliency/robustness
- Fine-grained resource allocation
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APP2: Fast Network Recovery

**Fast Network Recovery**
- Real-time fault recovery using global information
- Online fault analysis for failure prediction
- Optimal set of restored services
- Minimum cost of system restoration

**Business Paradigms & Product Features**
- Lower CapEx & OpEx for network resilience
- Faster network recovery
- Earlier discovery of failures and side effects
- Higher resource utilization
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APP3: Super Bandwidth On Demand

Super BoD
- Cross-layer (IP & optical) optimization
- Improved network efficiency
- Fair resource utilization over time
- Real-time routing computation

Business Paradigms & Product Features
- TCO savings
- Rich set of routing policies
- New pricing models (pay-as-you-go)
- Early routing

Cross-layer topology

Link Information: SRLG, wavelength, distance

Network
APP4: Adaptive Routing Re-optimization (3rd party)

**Adaptive Routing Re-optimization**
- LP solver & heuristics for ILP
- Higher accepted traffic
- Optimal sequence of flow reconfigurations
- ONOS integration by programmable interface

**Network Performance & Use Cases**
- Up to 63% of throughput increase
- Real-time routing computation (thousand demands in less than 1s)
- Periodic network reconfiguration

Carrier/WAN SDN

ONOS Controller with Flow Engine

Open Flow

IP Network

ONOS Controller with Flow Engine

Open Flow

IP Network