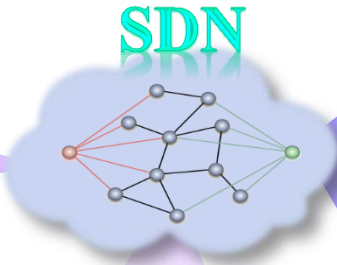

Optical SDN

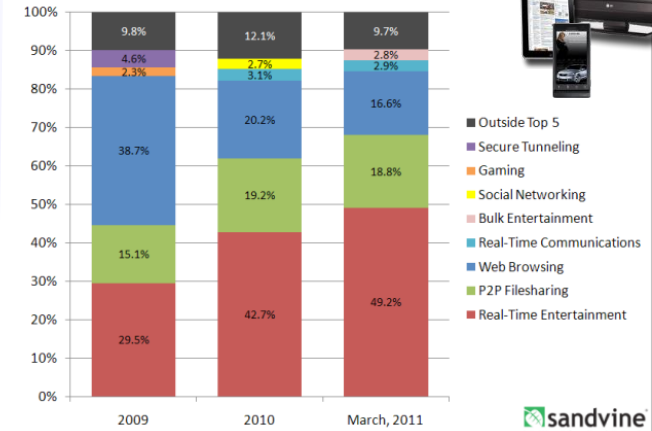
Vishnu Shukla
Verizon, USA

GEC20, UC Davis
June 22, 2014

We're Using the Network in a New Way



Peak Period Aggregate Traffic Composition
(North America, Fixed Access)



<http://techcrunch.com/2011/05/17/netflix-largest-internet-traffic/>

- A new kind of business customer
 - Using both private and public clouds
 - Elastic Compute and storage requires an elastic network with on demand services

- A new kind of service Provider
 - Supplies SaaS, IaaS, PaaS
 - Elastic compute and storage
 - Multi-tenant

- A new network is needed that supports
 - Bandwidth on demand to match compute/storage on demand technology
 - Multi-tenant
 - Higher Utilization and greater efficiency
 - Faster service deployment

- A new kind of Consumer
 - Living in the cloud
 - Applications are hosted in the cloud
 - Shifting from download to streaming
 - News events and new applications load the network in new ways
 - Mobile

Source: Coriant

We need a higher capacity, dynamic and flexible Network, an SDN

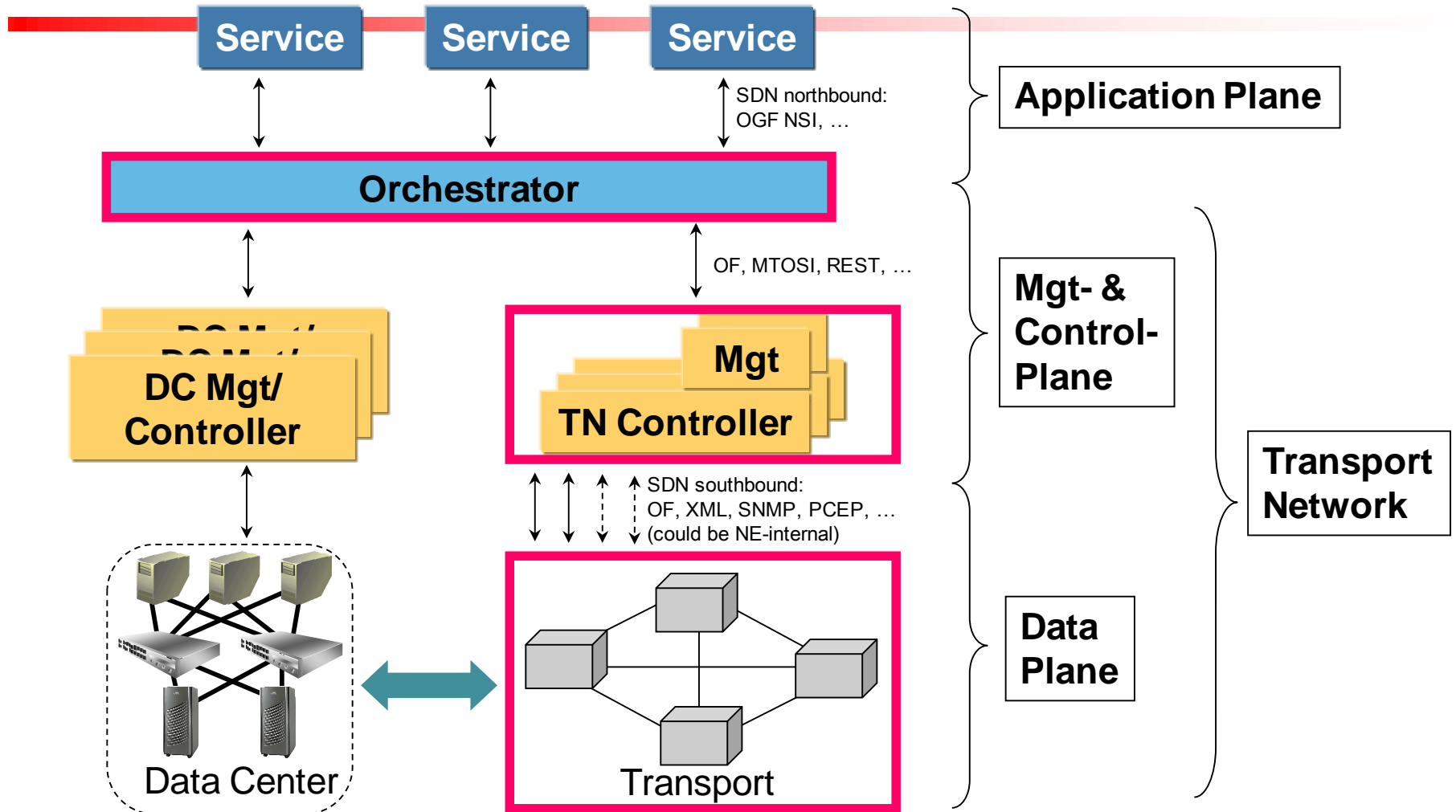


Why Does Transport Need SDN?

- **Optical and transport networks continue to be difficult and expensive to manage, with many manual processes and very long provisioning times**
- **SDN and virtualization have the promise of simplifying optical transport network control, adding management flexibility, and allowing the rapid development of new service offerings by enabling programmatic control of optical transport networks and equipment**
- **Can also reduce the cost of optical switches by moving control and management planes from embedded processors to general-purpose COTS hardware and virtualized software**
- **Utilize centralized network-wide management and control to drive efficiency and speed**

SDN Reference Architecture

Components of Transport SDN



SDN improves transport control

Control Plane = automation

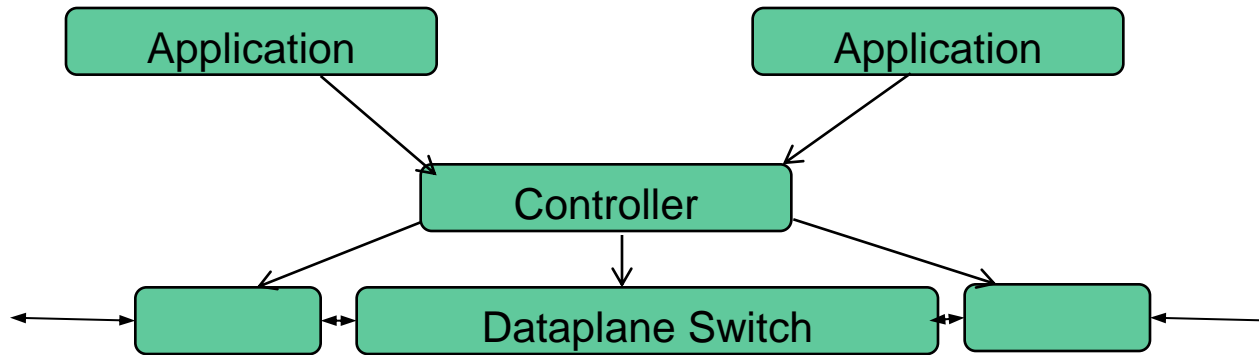
Eliminated Manual Operation
Enable Network Service Mgmt

Defined by NE Vendors

SDN= New Behaviors

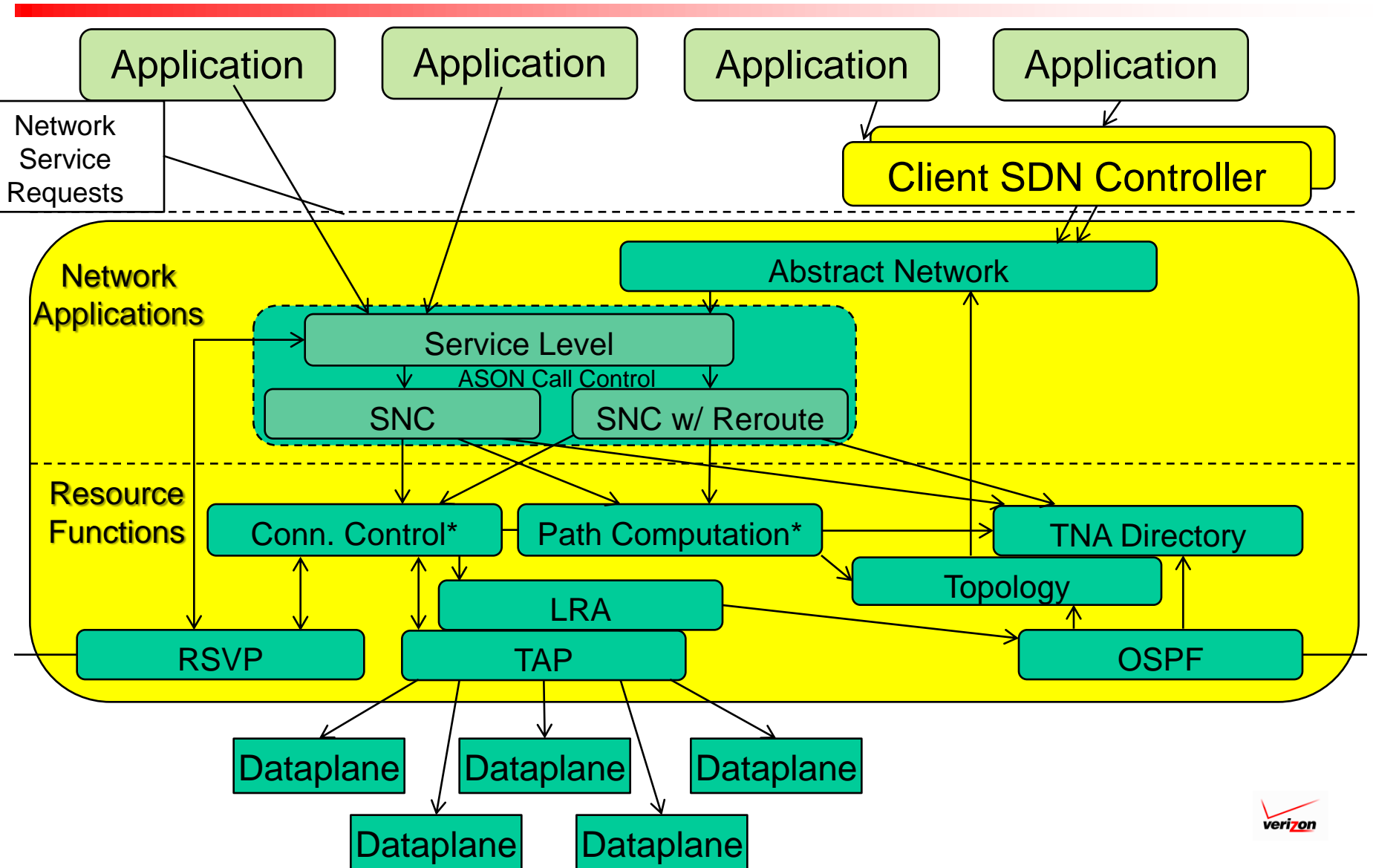
Enables Carrier differentiation
Removes hurdles to development

Delivered through Programmability



- **Three levels of Programmability**
 - **Dataplane**
 - **Transport Control Behaviors**
 - **Application Awareness**

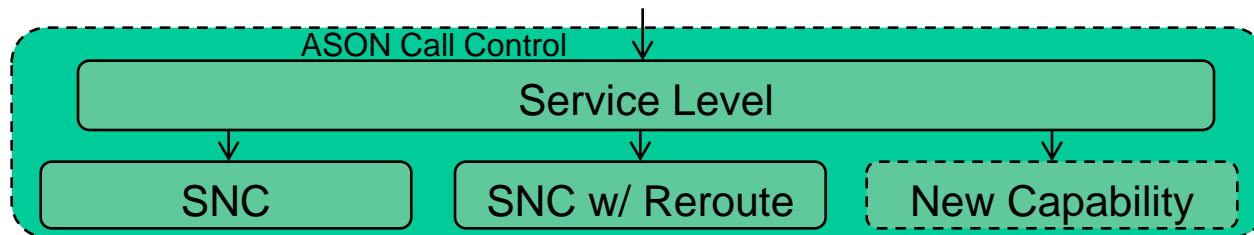
Place in Framework



Use Case

◆ Service Level

- Select between different Call “programs”
 - Different binding to API events
 - e.g. Link/Connection failure notifications
 - Different algorithms



- Enables addition of new behaviors

SDN Promise

- ◆ **SDN advocates for greater programmability**
 - Provide new behaviors not considered by Standards, Vendor implementations

- ◆ **Facilitates Network application eco-system**
 - Seamless/Rapid relocation of endpoints
 - Abstracted NEs
 - Virtual Networks

SDN Promise

- ◆ **Service Level conveyed in G-UNI**
 - Not standardized
 - Enables carrier differentiation
 - Used as an input to call policy management to controls call behaviors e.g.
 - Restoration style (Protection/Reroute, reversion)
 - Diversity level

Challenges

- **Operational simplicity**
 - On-board new clients rapidly
- **Differentiated service delivery**
 - Automate resource allocation on the fly
- **Scalability**
 - Support X transactions per hour
- **Security**
 - Service isolation and authentication per client
- **Continuous Availability**
 - Disaster avoidance / recovery
- **Current transport business model**

Programmability and Application Awareness



SDN Architecture Issues

- **How will Multi-Domain be handled?**
 - What is the relationship between controllers?
 - Peer or overlay
- **How will Multi-Layer be handled?**
 - E.g., location and triggering of adaptation
- **What is the relationship to Network Management?**
 - OF control vs. EMS/NMS control (mediation device)

Summary

- **SDN has great promise to improve transport control**
 - Programmability
 - Ability to deliver new behaviors not (yet) considered by standards, vendors, ...
 - Simplified multi-layer control
 - Common behaviors in heterogeneous NE deployments
 - Application awareness
- **OIF is providing guidance to accelerate deployment**
 - Use cases and architecture
 - Carrier requirements
 - Framework document
 - Demonstrations