

Evolution to Consolidated Network Layers

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Areas of Network Integration

Data Plane

- Traditionally one technology choice per layer



- Integration of different layers in a single network element
 - Ethernet L2 switching + optical
 - IP/MPLS + optical

Control Plane

- Currently each layer has its own control plane (limited interop)



- SDN Integrates different control plane of different layers into a single unified control plane
 - Centralized instead of distributed

Network Functions

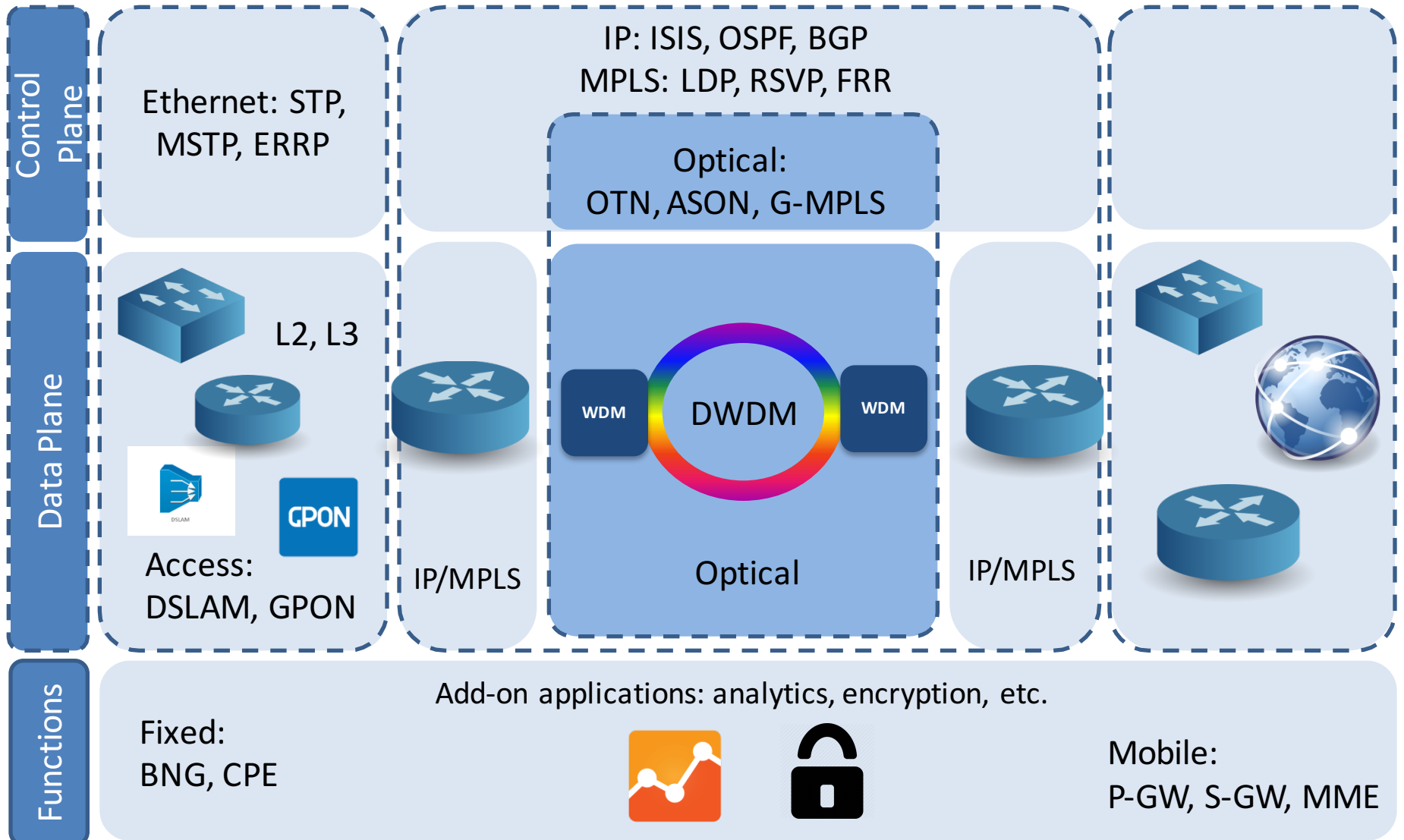
- Dedicated hardware per function



- Virtualization allows network elements to “host” virtualized non-native functions
- Functions can be implemented in the most effective location
 - Distributed vs Centralized
 - Dynamic

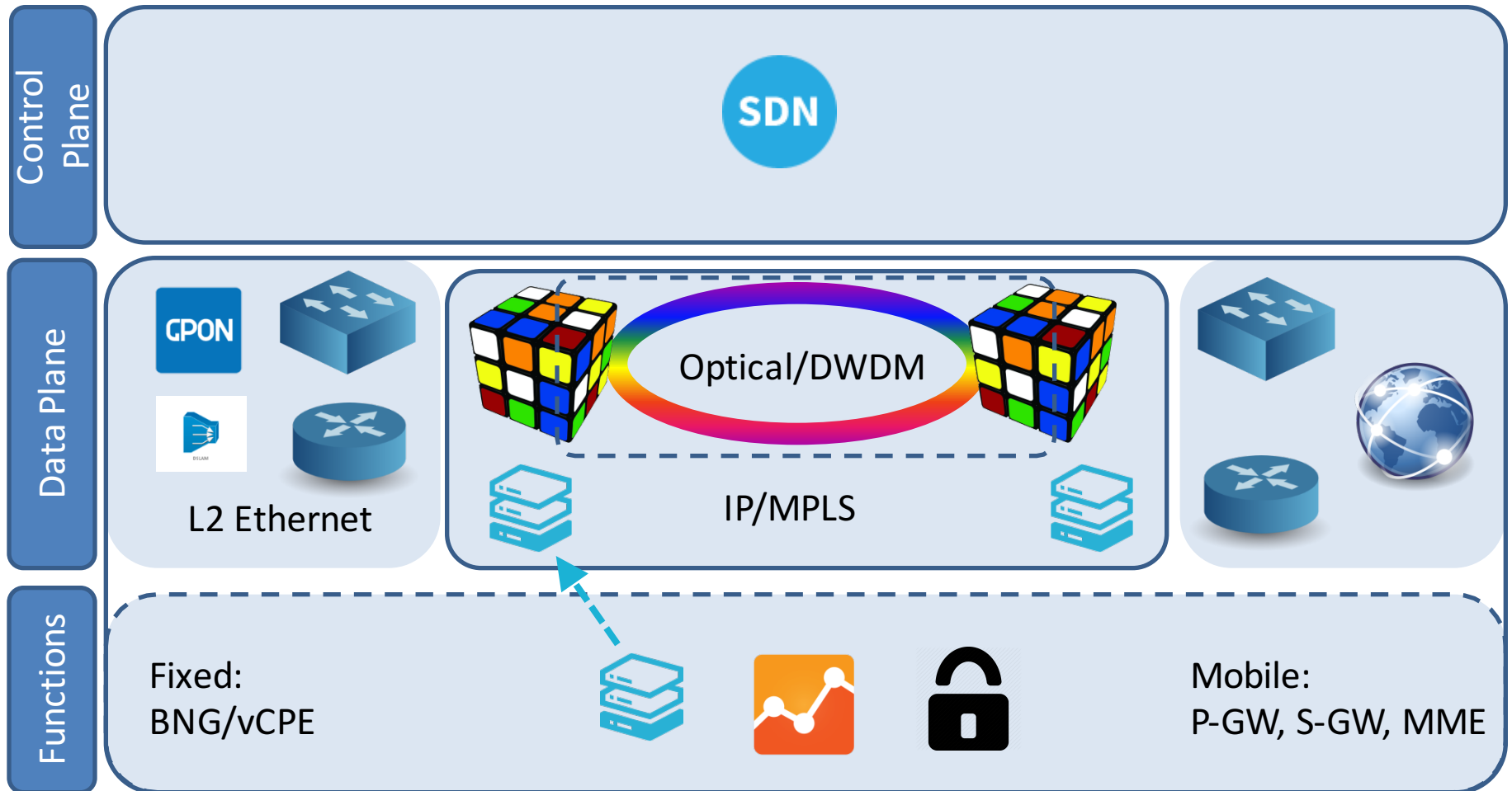
Cost, scalability and flexibility are forcing the integration of Network functions, layers and hardware

Typical Network Architecture



Direct coupling of control and transport technologies

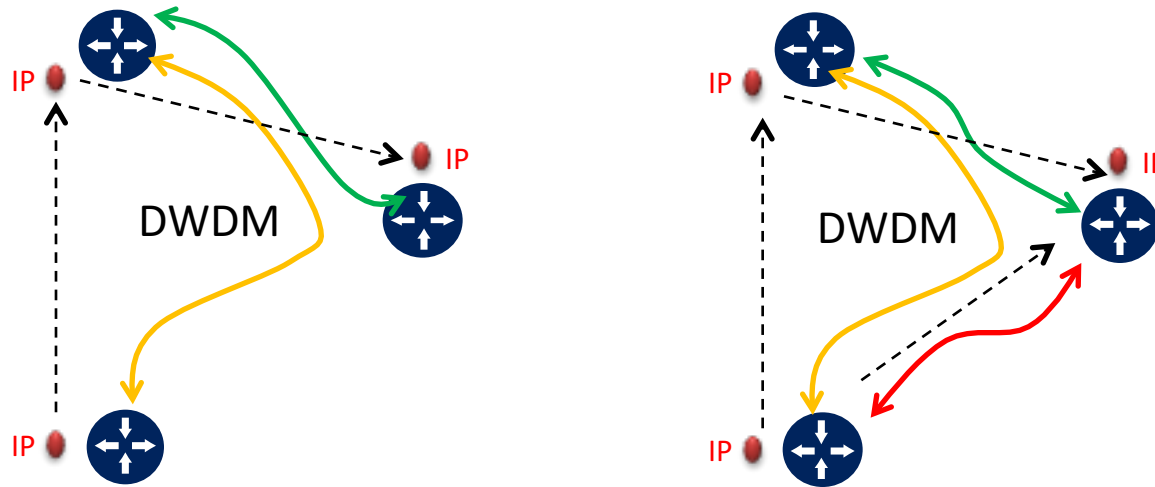
Network Evolution



Unified de-coupled control plane, NEs delivering more than one transport technology, capability to deploy specific functions in existing NEs or servers

DATA PLANE/TRANSPORT

Data Plane: Cost Benefits of Converged Optical/MPLS Interfaces



- Optical and IP network topology are not necessarily the same
- Separate layers create inefficient routing - more difficult to change?
- Fewer transponder interfaces
- IP/MPLS allows for resource sharing and multiple destinations per interface
- Problem grows exponentially with meshes and amplified by protection requirements

Data Plane: Benefits of Combining Optical and LSR

Common control plane

- IP adjacencies
- Path Computation, measurements and reporting

Common protection mechanism

- Fast Re-Route

Virtual Interfaces

- Effective Capacity Planning

Efficient architectures

- Place routers where they need to be
- Match optical circuits to LSPs

Costs and Environmental savings

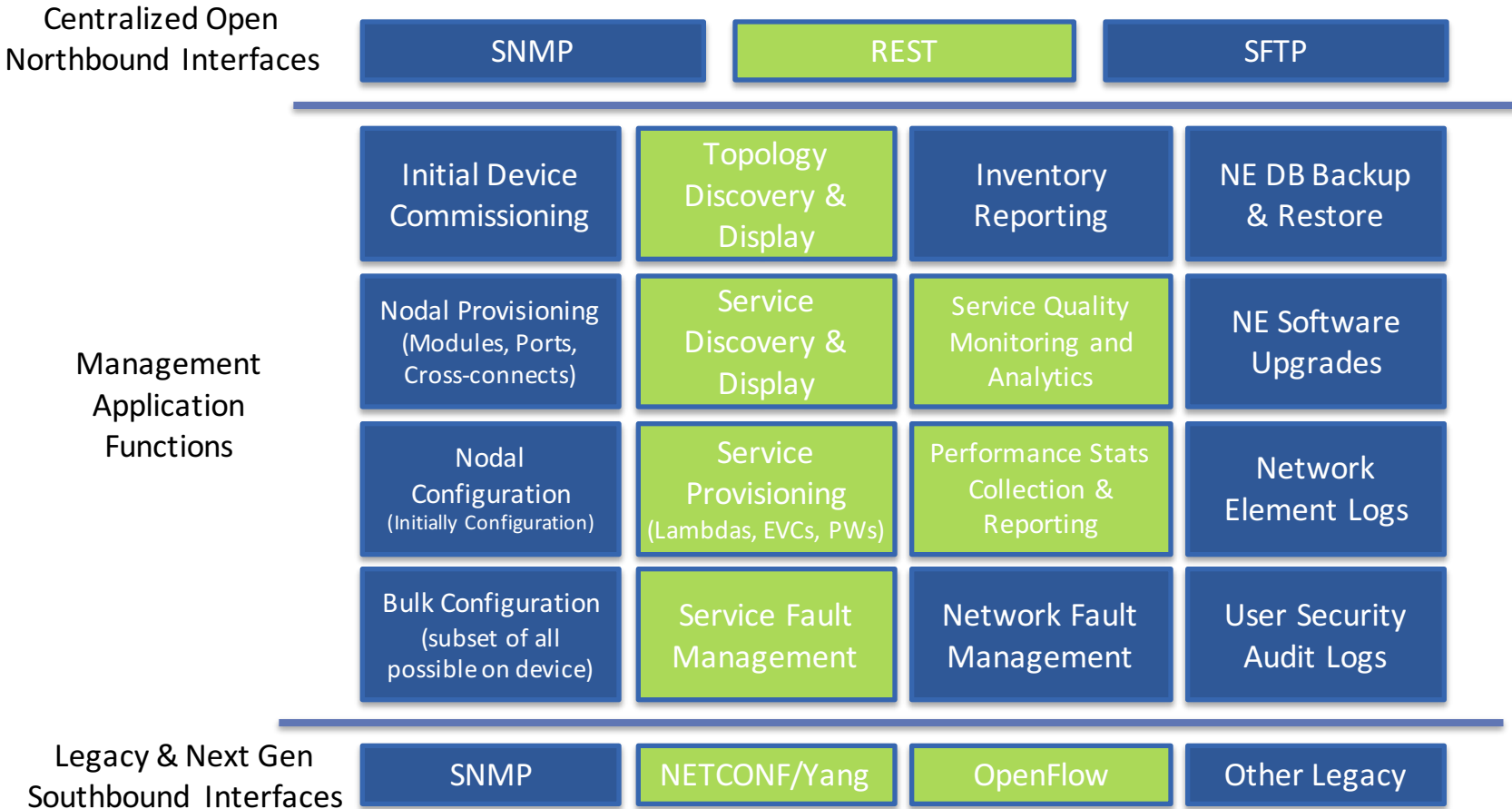
- Cost savings from collapsing layers
- Single platform

Future focused

- Enables innovation
- MPLS is well understood
- Aligns well with SDN vision

CONTROL PLANE

SDN functions



Open interfaces are required

A Network Management System is still used for the other functions

NETWORK FUNCTIONS

Network Functions Integration

- Virtualization architectures decouple functions from proprietary hardware appliances
 - Functions can run software on commercial hardware platforms.
 - Dedicated platforms still needed to offer scalability, mainly in centralized functions
- Other functions could be virtualized when
 - Distributed
 - Requirements that do not justify a complete dedicated HW solution (smaller applications)
 - Dynamic functions

NFV allows functions to be deployed in the most efficient location and platform

Possible Virtualization Use Cases

Function	Distributed	Dynamic	Size
Analytics	✓		
DPI	✓		
Mobile EPC (P-GW, MME)			✓
vCPE	✓		
Gaming Compute Engine	✓	✓	
Troubleshooting		✓	
Security (D-DOS)	✓	✓	
BNG	✓		✓

Summary

Data Plane

- Hardware vendors announcing converged MPLS and optical functions.



Control Plane

- SDN control plane in live production networks today



Network Functions

- Virtualised functions in deployment for some years, more emerging



Thank you
questions welcome ccousins@btisystems.com