

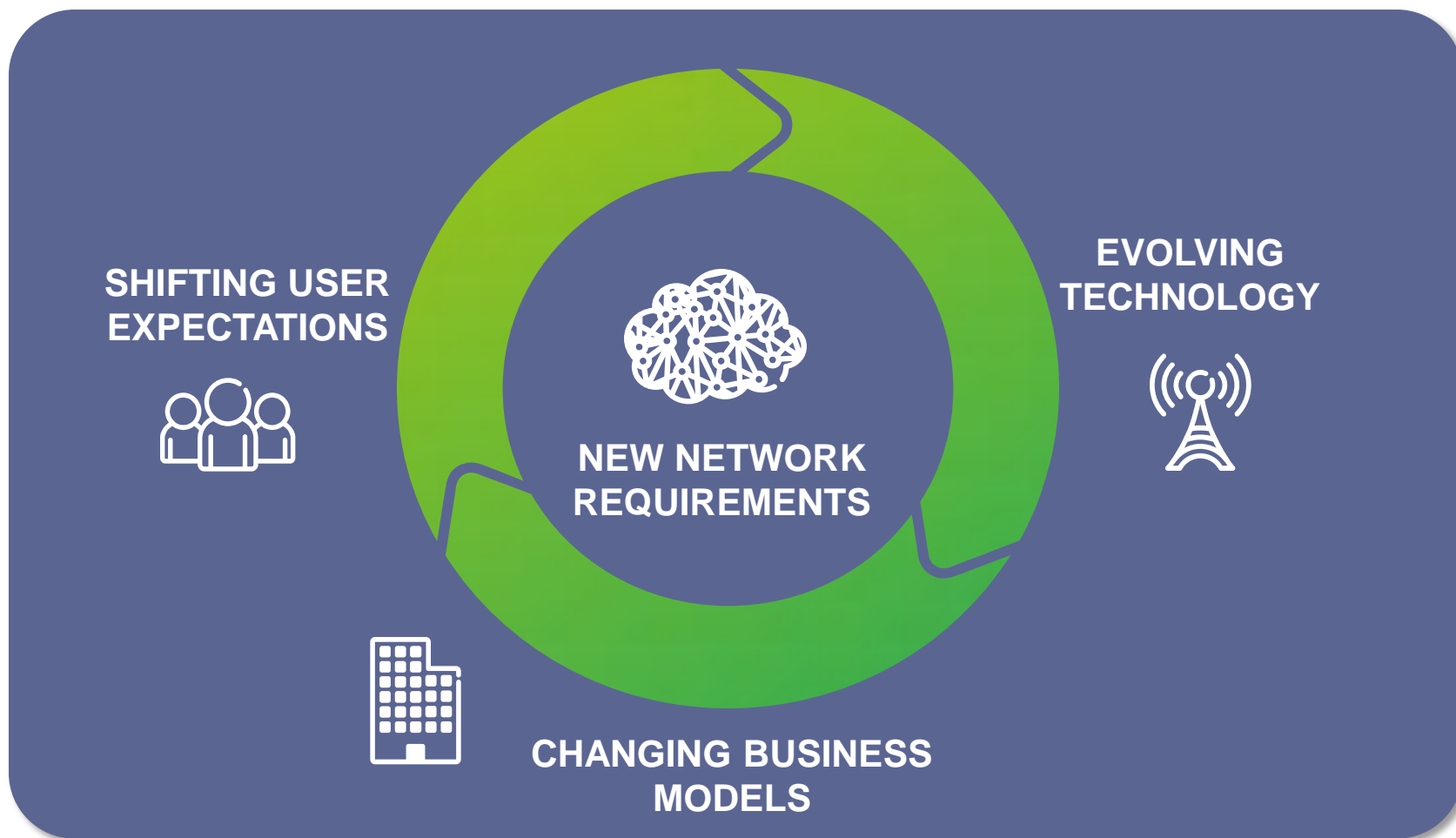
SDN – EVOLUTION OF NETWORKS

Raul Caldeira

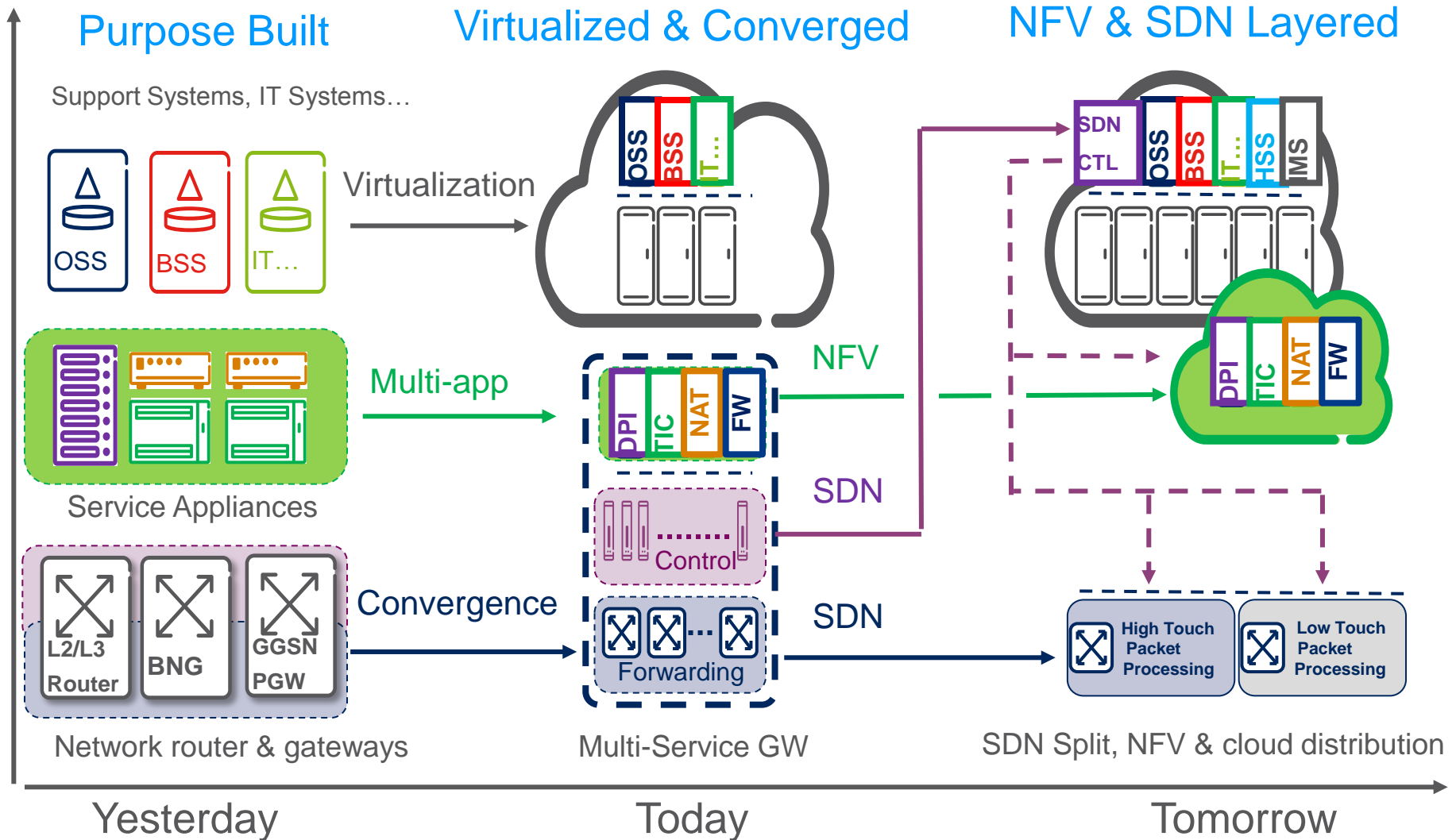
THE NETWORKED SOCIETY



REALIZING THE NETWORKED SOCIETY ...



TELECOM INDUSTRY TRENDS

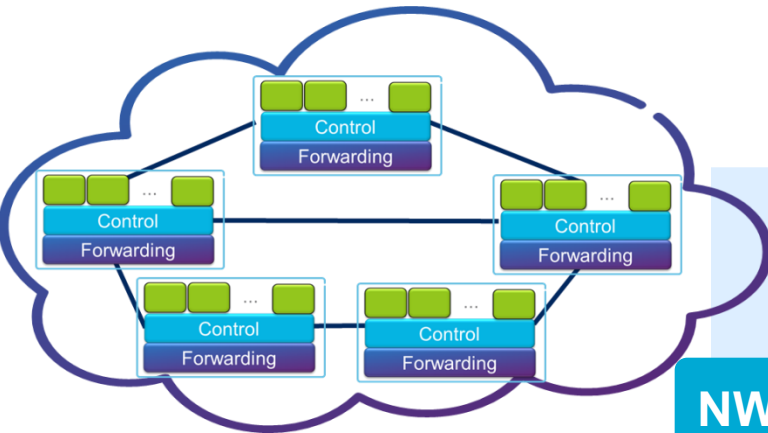


SPLIT ARCHITECTURE

A KEY SDN INNOVATION



Current Networks



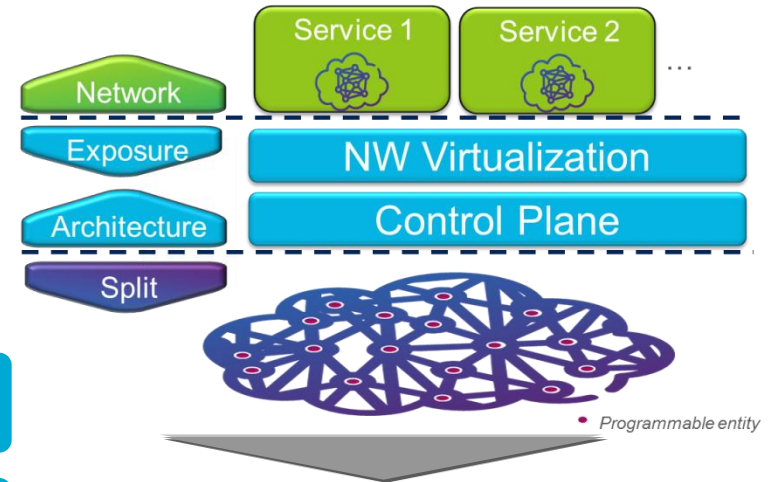
- › Control plane (OS) co-located with FW plane
- › Each vendor OS can only control that vendor's nodes

NW Virtualization

HW Abstraction

Programmability

Split Architectures

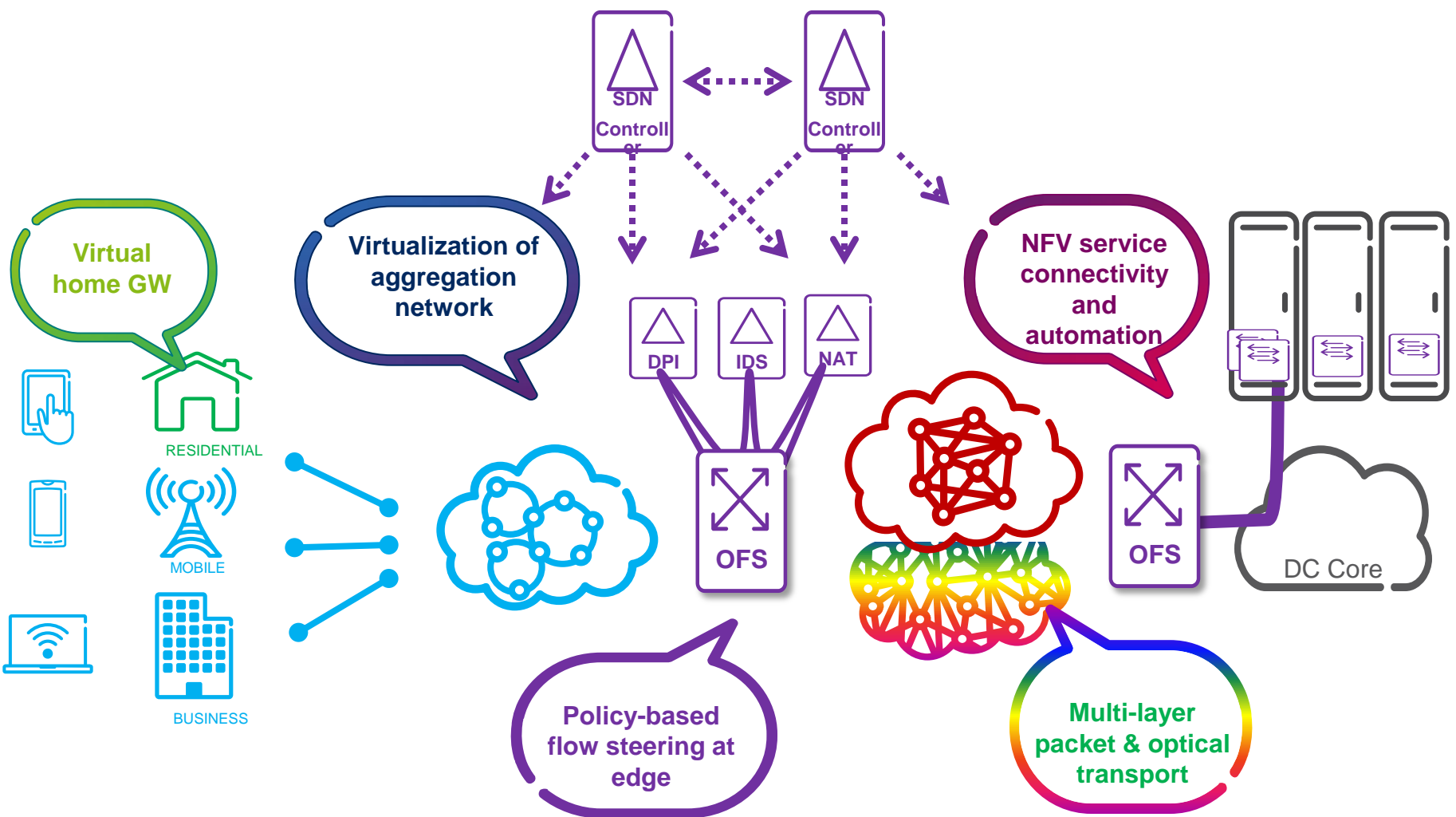


Potential benefits

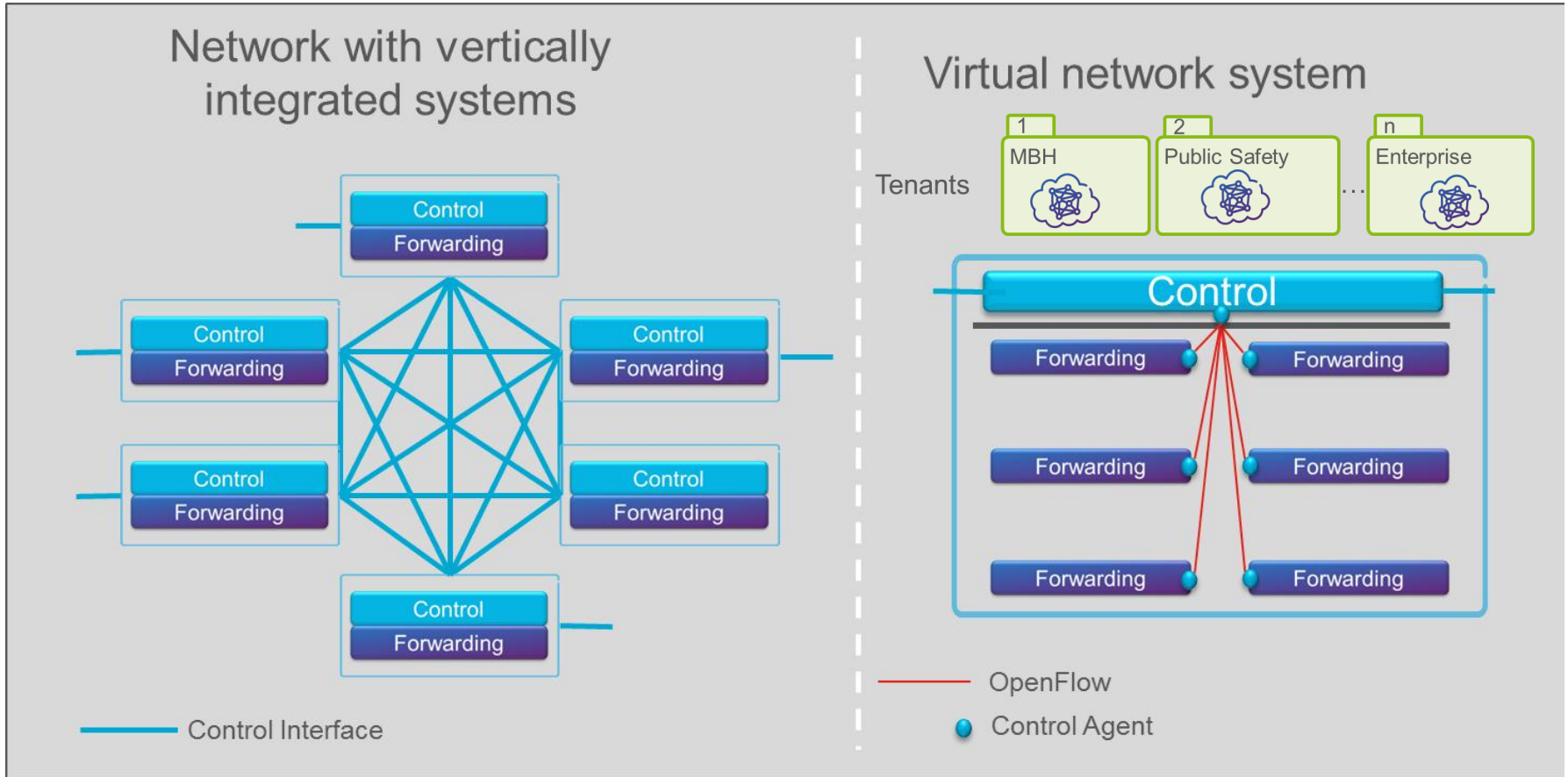
- › Operators:
 - › Service velocity
 - › Lower OPEX due to central provisioning & management
- › Vendors:
 - › Greater feature velocity
 - › Software business opportunities

SDN INNOVATIVE SOLUTIONS

NETWORK WIDE TRANSFORMATION



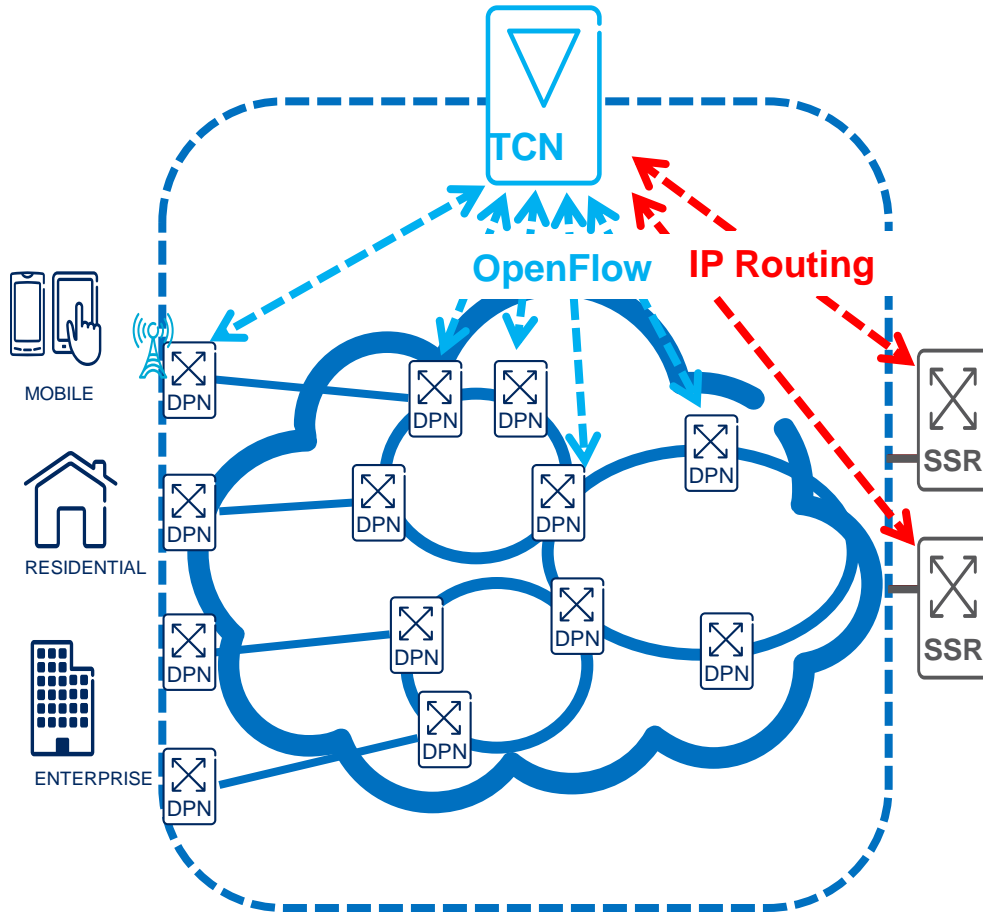
VIRTUAL NETWORK SYSTEM - VNS



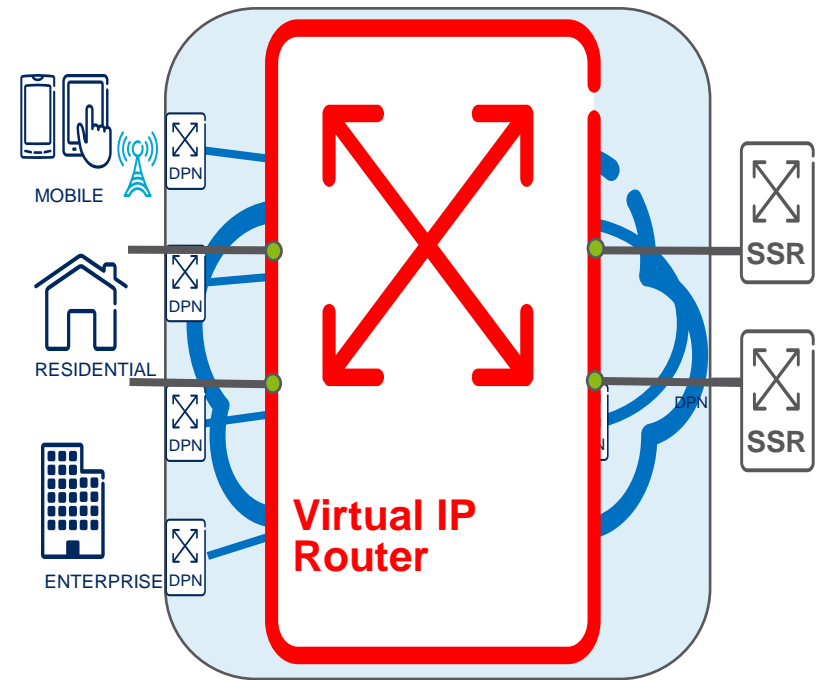
Exploiting SDN virtualization: Multiple tenants on one physical substrate
Exploiting split/centralization: Reducing cost to manage network



VIRTUAL NETWORK SYSTEM ACCESS & BACKHAUL TRANSPORT



VNS Domain: Internal view

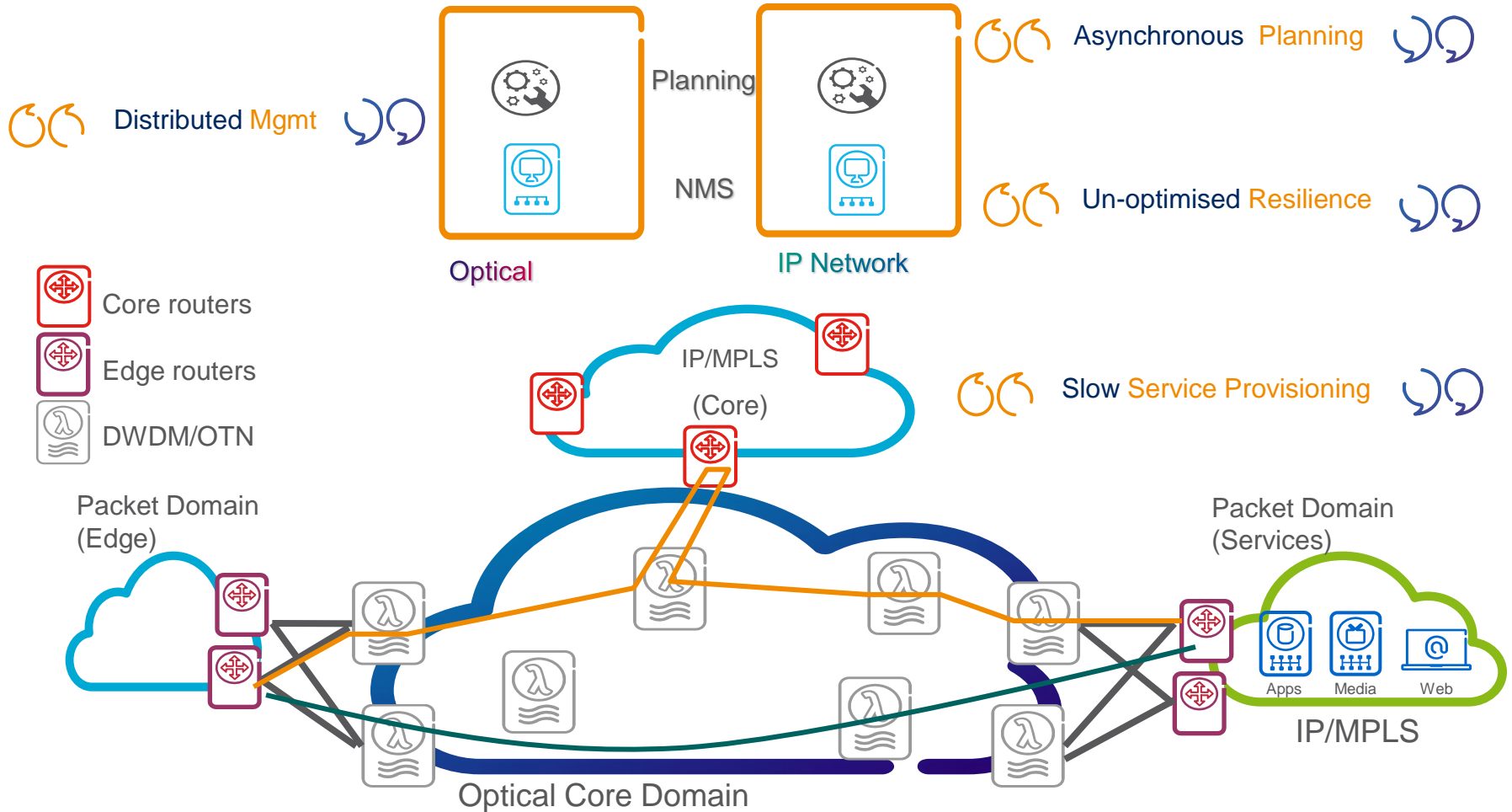


VNS Domain: External view



SO WHAT ABOUT (...) AND IT'S FIBER IMPACTS

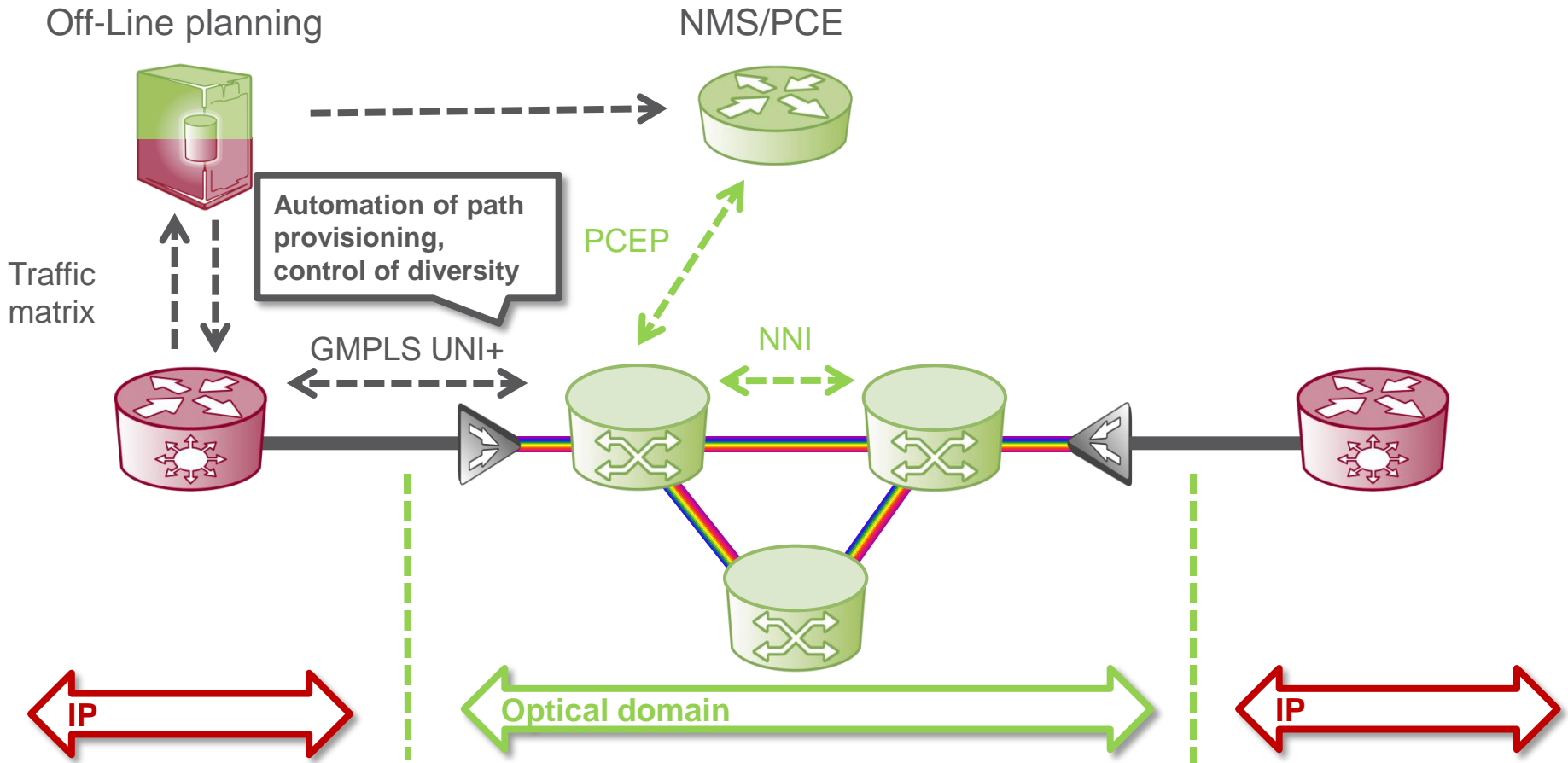
IP & OPTICAL CHALLENGES TODAY



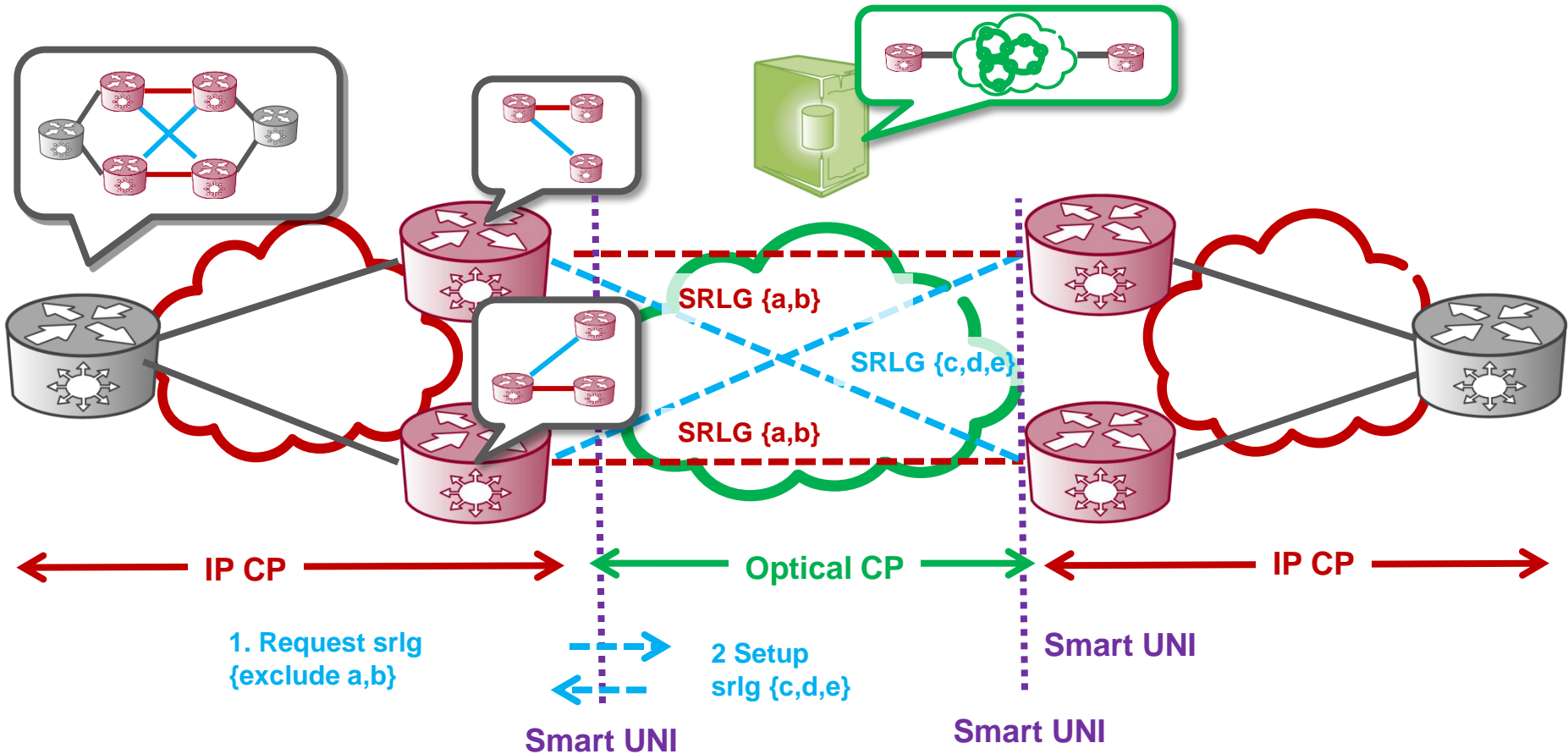
Optical and IP networks work in different and separated planes requiring dedicated Planning, Management and Optimization activities

GMPLS UNI+

DYNAMIC CONTROL

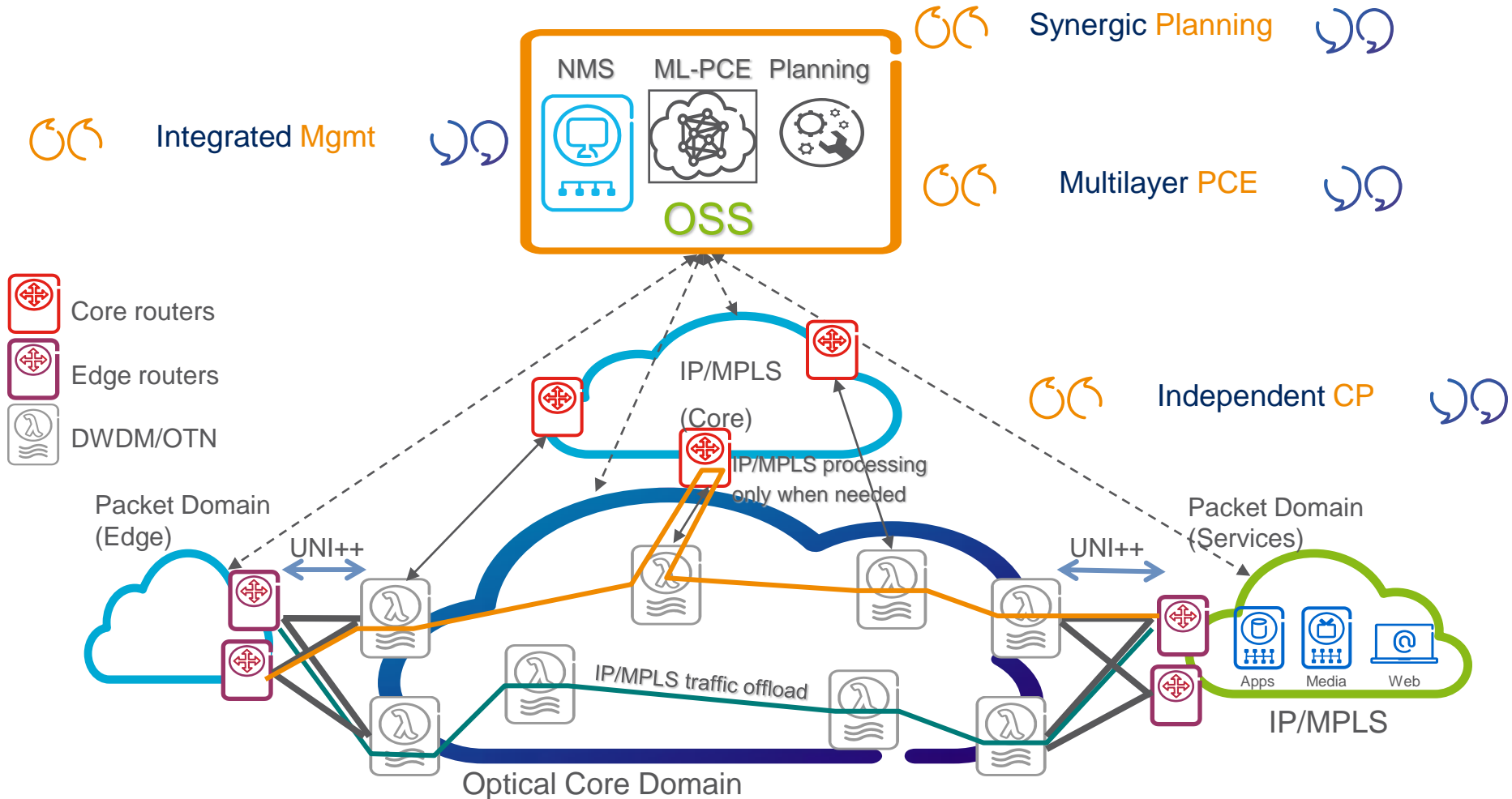


GMPLS UNI+ AUTOMATED CONSTRAINTS EXCHANGE



- › Smart UNI extends GMPLS to provide additional visibility to the traffic layer
 - Exchange of SRLG control information and constraints
 - Additional path characteristics such as end to end delay

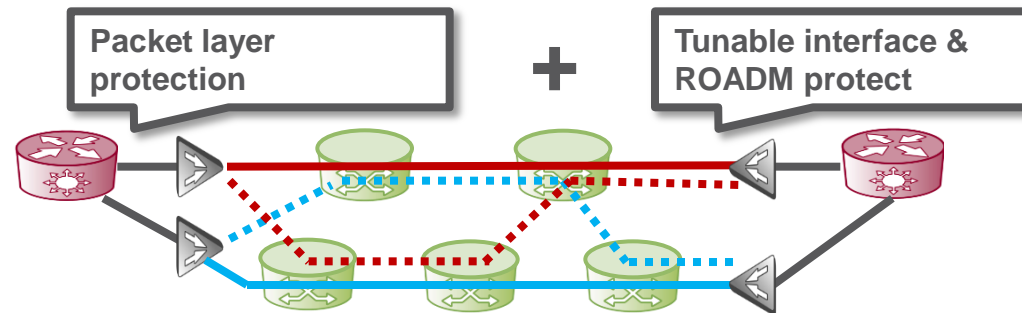
IP AND OPTICAL REFERENCE NETWORK



A single converged transport network with seamless planning interworking signaling and recovery capabilities enabling e2e services

PACKET + OPTICAL PROTECTION

PACKET PROTECTION COMPLEMENT



- › Coordinating protection layers is complex
 - Upper layer protection must be aware of underlying protection scheme and speed
 - But relax timing causes unnecessary delays should under-layer fail to protect
 - Integration of dynamic signaling / coordination complex across multi-layer
- › Packet level protection + Optical restoration offers ideal mix
 - Packet layer provides rapid and flexible protection schemes
 - Optical layer can work uncoordinated to provide restoration of the primary path
 - **Does require strict diversity of the optical path to guarantee success**

ANALYST VIEW

INFONETICS CONTINUOUS RESEARCH



› WHAT ABOUT PACKET-OPTICAL?

[...]

This could be the year packet-optical, specifically combined layer 0-2 equipment, re-enters the network debate in force, this time riding the coat tails of SDN. **Coupling P-OTS with a SDN allows the hardware to essentially become less intelligent as the complex control plane is decoupled from the optical hardware.** In essence, this lowers the barriers to entry for this technology, provided the operator is moving to a more SDN-like control plane.

[...]



INFONETICS
RESEARCH

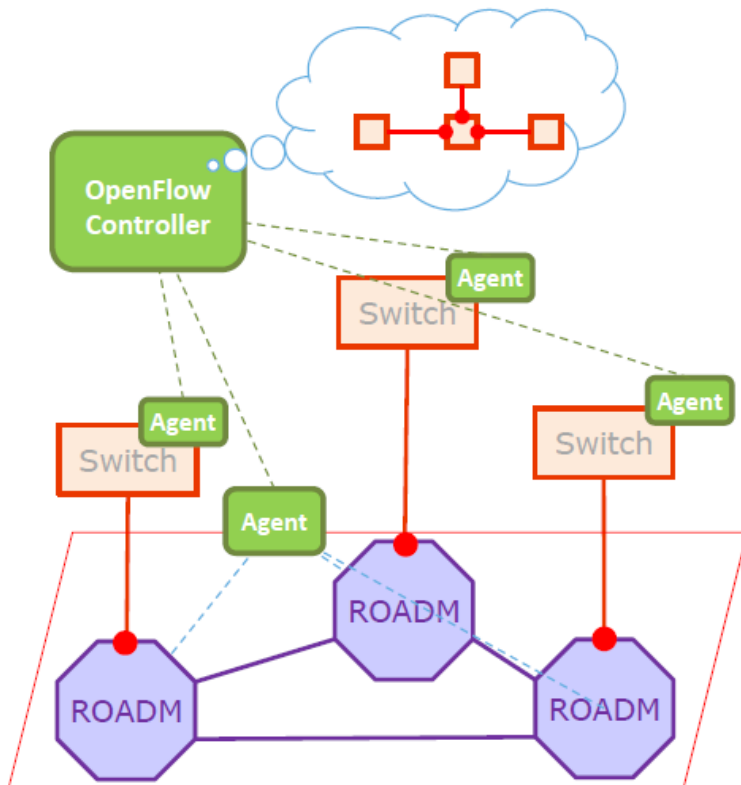
SDN AND OPTO

POSSIBLE MODELS



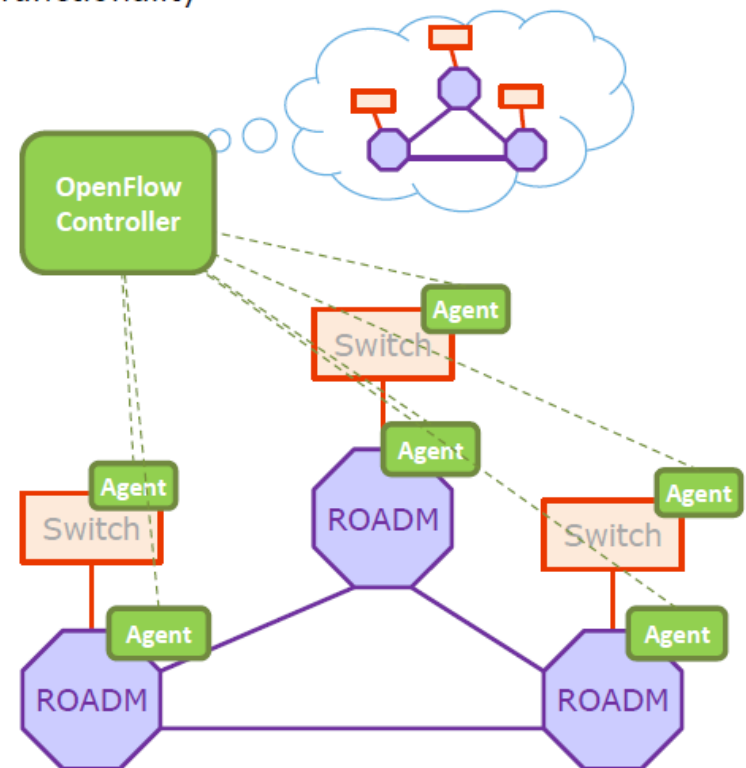
Overlay Model / UNI Model

- Optical Network is modeled as an Abstract Switch
- No OpenFlow Circuit Switching or Optical Layer extensions (optical layer complexity is hidden)
- Internally, GMPLS can be used to setup Lightpaths



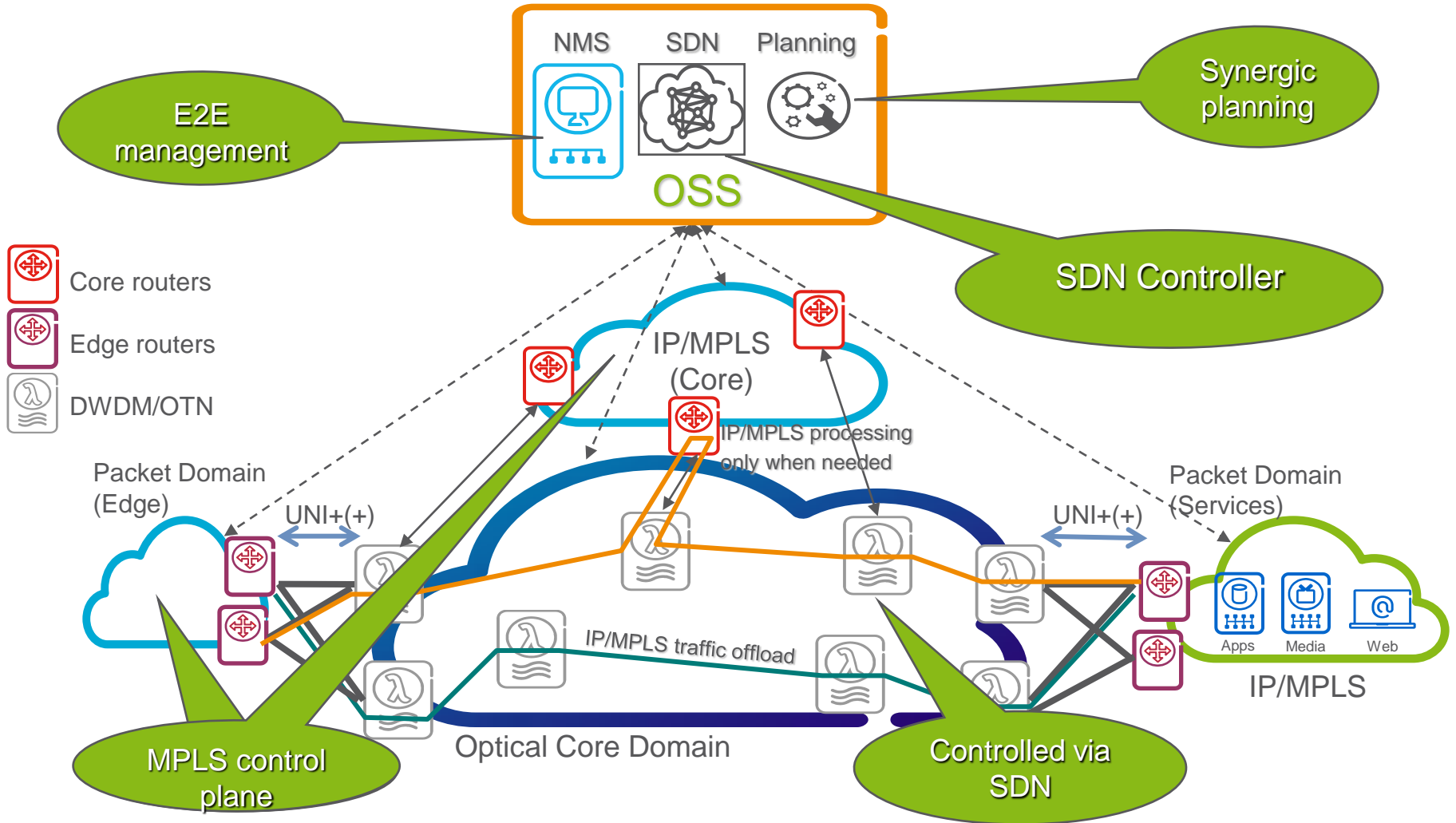
Integrated Model

- Optical Network is fully modeled by OpenFlow
- Optical layer complexity must be supported by OpenFlow
- GMPLS currently used to substitute missing functionality

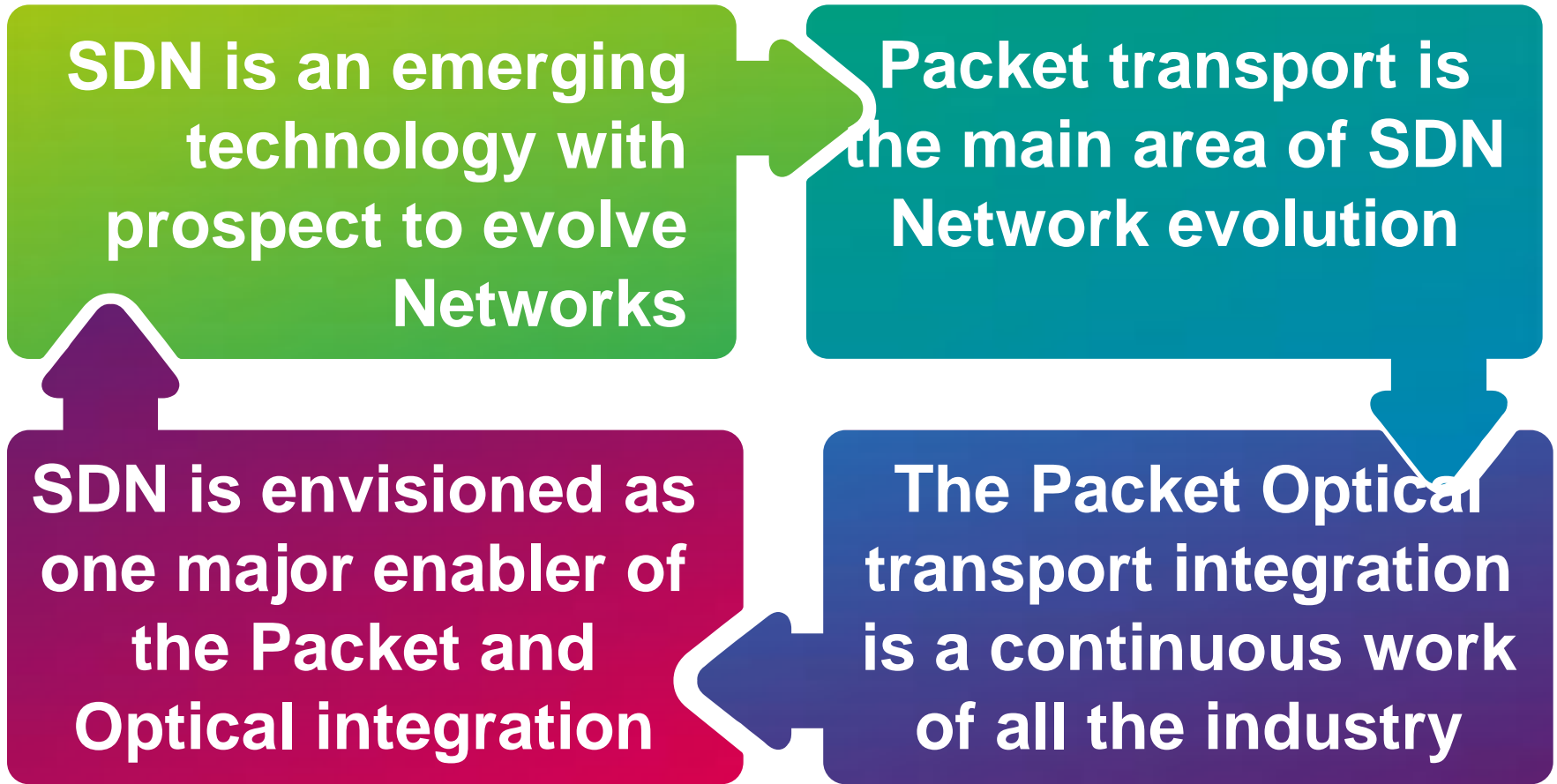


IP AND OPTO SDN

INTERWORKING VIA UNI+(+)



SUMMARY





ERICSSON