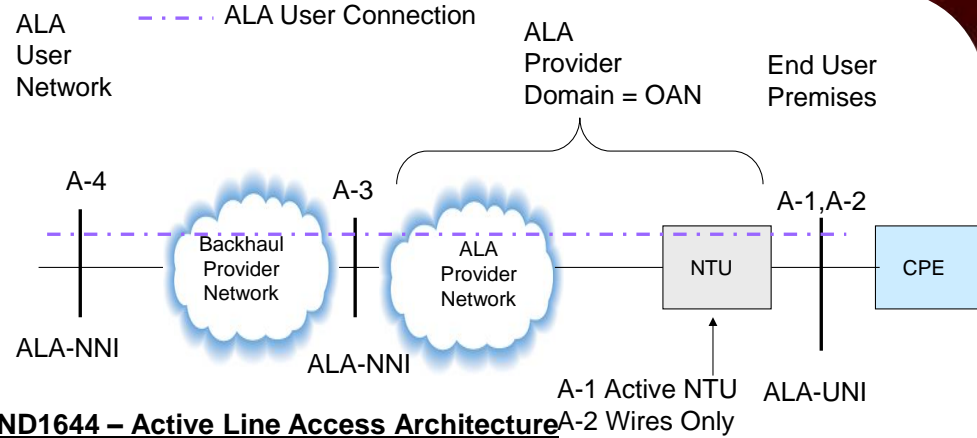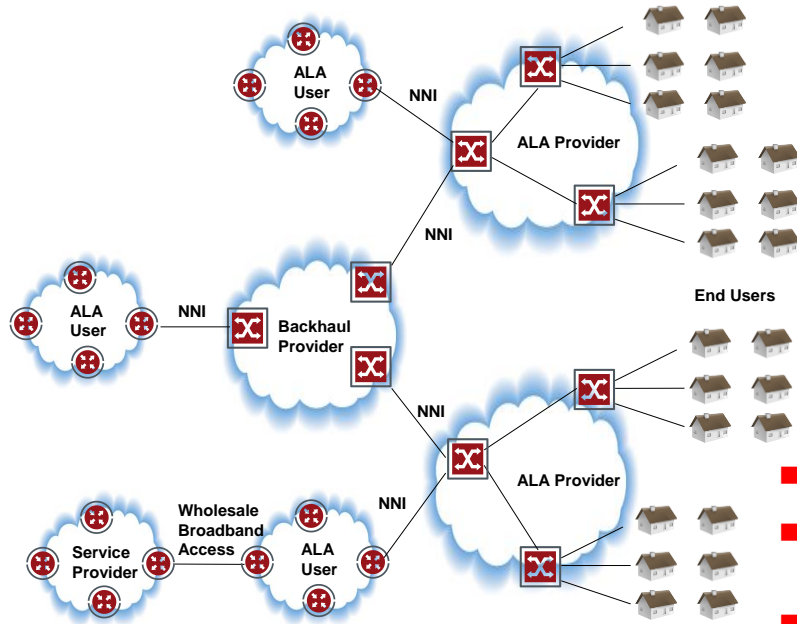FUJITSU

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Regulatory Implications of SDN and NFV in an unbundled network

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UK unbundled architecture for NGA

NICC ND1644 – Active Line Access Architecture

- ■ Architecture used to connect NGA services (VDSL).

- ■ Ofcom VULA, technical standards NICC ALA (ND1644,ND1030 and others), primary implementation in the UK is BT's GEA service.

- ■ ALA Provider handoff is limited to a defined set of local exchanges.

- ■ Backhaul Providers may offer layer 2 transport.

- ■ Wholesale Providers may terminate the layer 2 and offer wholesale broadband access products
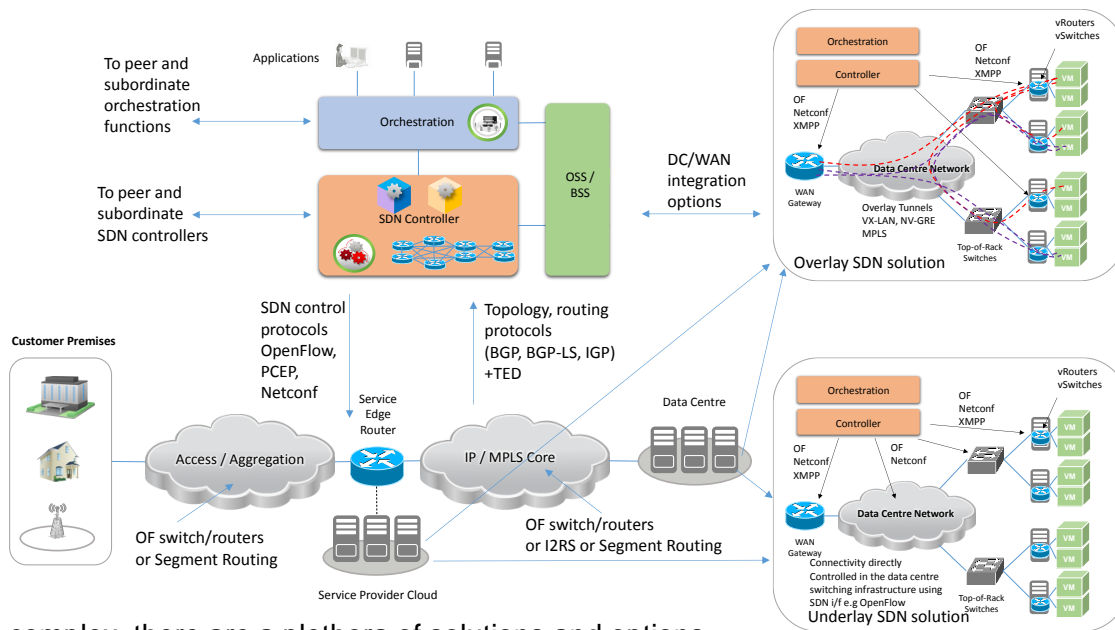
- The landscape is complex, there are a plethora of solutions and options.

- Network operators will choose the ones that meet specific business needs.

- Some things that are thought of as SDN capabilities, e.g. exposing network routing capabilities to OTT providers, can be done today using non SDN solutions. Network Providers can expose a VRF on a PE router within an IP MPLS BGP VPN.
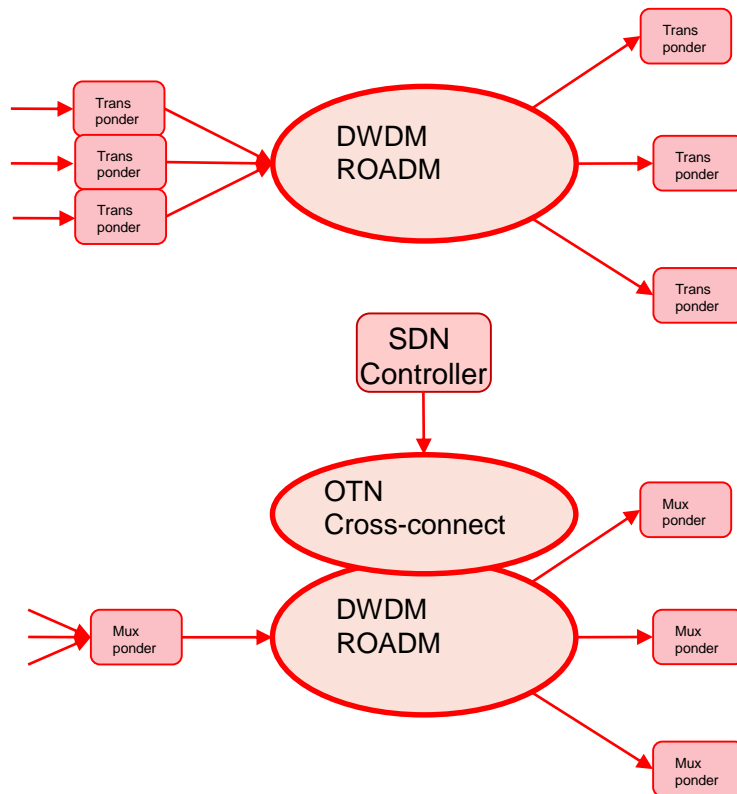
ROADM with OTN transport layer
- OTN provides multiplexing over λ
- But, separate λ required for each destination
- Network capacity will be limited by availability of wavelengths before fibre capacity is starved

ROADM with OTN transport layer and OTN switching
- OTN provides multiplexing over λ
- λ required to connect site to OTN switching core
- Separate OTN path required for each destination
- Improved utilisation of fibre resources
- Ability to upgrade network capacity with addition of Muxponders in OTU2/3/4 hierarchy
- SDN adds orchestration capability and on-demand configuration
- **As edge to edge flows reach 10Gbps and above provides costs savings and**

Carriers offering NFV as a Service

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Customer Premises

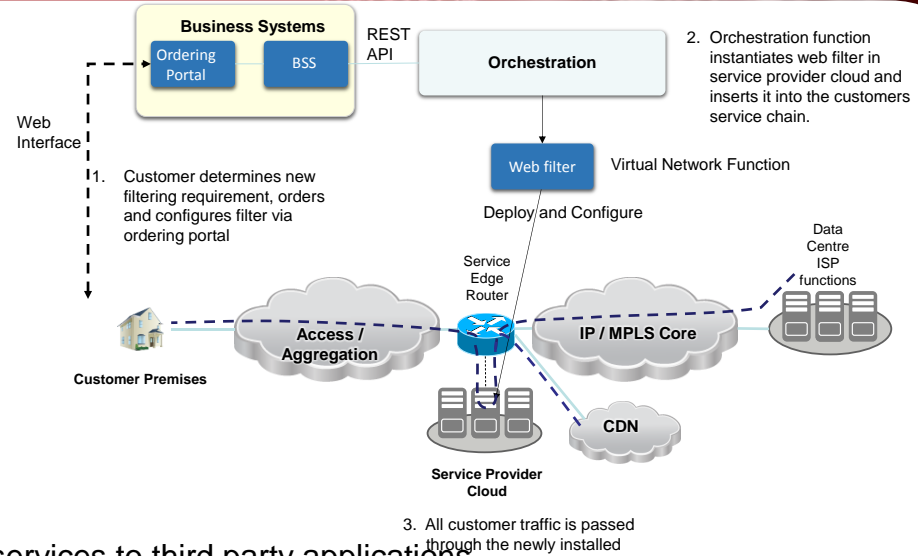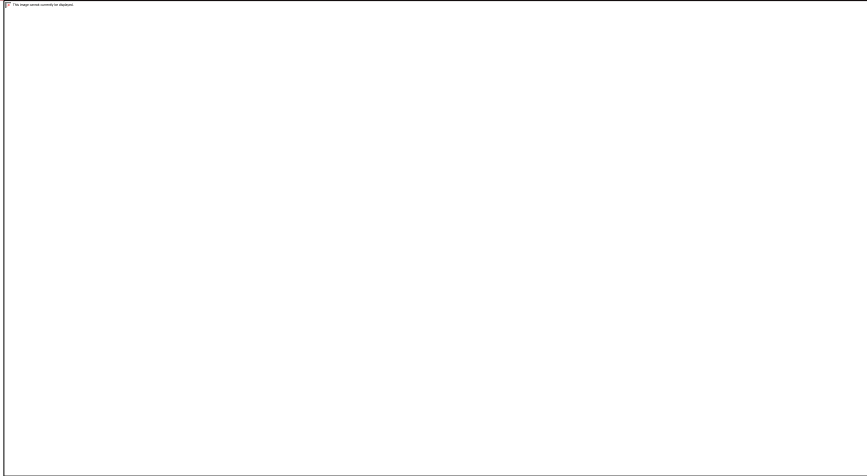Service Edge Router

Access / Aggregation

IP / MPLS Core

Data Centre

Carrier Cloud Services
Cloud Infrastructure AAS
Cloud Platform AAS,
Software AAS

Service Provider Cloud

Customer Virtual Network
Any Network Function
Compute + Storage +
Network

Customer Network Function
Carrier Defined Menu
Function + Network

Customer Network Platform
Carrier Defined Bundles
Functions + Network

NFV IAAS

VNFAAS

VNPAAS

Carrier NFV Infrastructure
BNG, Radius, DNS, vEPC
Firewalls, vCPE, IDPS, CGNAT,
Filtering, Transcoding.

Carrier NFV Services
NFV Infrastructure AAS
Virtual Network Function AAS
Virtual Network Platform AAS

- Some carriers are looking to move Service Provider cloud to the edge.

- But carrier PoPs are not necessarily Xeon server friendly. Significant investment likely to be required, less so in the carrier data centre.

- From an OTT, or an alternative carrier perspective the most attractive option is bit stream transport for connectivity and NFV IAAS. Otherwise the carrier constrains the options by limiting available VNFs.

- Carriers may also offer NFV IAAS on CPE equipment such as Ethernet NIDs.

- Issues such as "equivalence of input" for unbundled exchanges are likely to be raised, but in an unbundled environment does a carrier benefit from opening up the infrastructure to innovation in this way?

- OTT providers and alternative carriers already using NFV for services such as virtual CPE, one issue here is the lack of suitable low cost transport products from carriers.

Application Centric Networking and SDN/NFV

Business Systems

Ordering Portal

BSS

REST API

Orchestration

2. Orchestration function instantiates web filter in service provider cloud and inserts it into the customers service chain.

Web Interface

1. Customer determines new filtering requirement, orders and configures filter via ordering portal

Web filter

Virtual Network Function

Deploy and Configure

Service Edge Router

Data Centre ISP functions

Access / Aggregation

IP / MPLS Core

Customer Premises

CDN

Service Provider Cloud

3. All customer traffic is passed through the newly installed filter

- A key benefit of SDN and NFV is the ability to offer network services to third party applications.

- However this requires the SDN "North Bound Interface" which has to date been problematic. Recent work looked at intent based interfaces, projects such as Boulder and Aspen. Some similar functionality exists today built into OSS interfaces.

- Has the potential to allow OTT providers to exploit network capabilities more fully when delivering service. But issues around which APIs are exposed, integration costs, ease of consumption, equivalence of APIs. Carriers likely to expose only those capabilities that benefit them as opposed to handing more revenue and flexibility to OTT providers.

Technology Conclusions

- **SDN and NFV are important technologies moving forward.**

  - Carriers will adopt them based on business need.

  - In some parts of the network, e.g. the data centre, SDN is already embedded (NSX, ACI, MidoNet and others to support cloud networking and virtualisation).

  - Typically use cases that are constrained and single operator in scope will be implemented first.

  - There are significant Systems Integration costs in deploying both technologies, including OSS/BSS integration.

  - A key challenge is making these solutions easy to deploy and operate.

  - Operational complexity means that network slicing, as seen in academic networks, won't become a reality in carrier networks.

- **Fundamental networking requirements remain**

  - Low cost ubiquitous connectivity for business and residential services with regulation as necessary.

    - For example a key technology for 4G mobile should be C-RAN but lack of fibre infrastructure is a blocker in Europe.

  - Potential for service innovation where Ethernet bit stream services are available without cost premium, but some operators charge a premium for layer 2 transport even for layer 2 services (UK NGA).

Regulatory Considerations

- **SDN and NFV offer significant benefits.**
  - Service Innovation with fail fast methodologies and increased automation.
  - Eventually application awareness in the network and network awareness in the application.
  - Service Chaining and portals will provide greater customer control.
  - Easier support of traffic management, QoS and high bandwidth connectivity.
  - The slowly emerging North Bound Interface is critical to allow OTT providers to exploit the power of the network.
- **But there are risks, and regulation may be required to mitigate these.**
  - Complicates net neutrality auditing, since service chains and traffic management are now deployed on virtual infrastructure.
  - The carrier controls what aspects of SDN and NFV are exposed to OTT providers and where that capability exists.
  - In unbundled markets need to ensure in-house carrier services use the same capabilities they expose to third party providers and no more.
  - It may eventually become necessary to regulate some network APIs to meet the ambitions of the Digital Single Market.
  - Security of both SDN and NFV solutions is a concern, likely to require greater oversight.