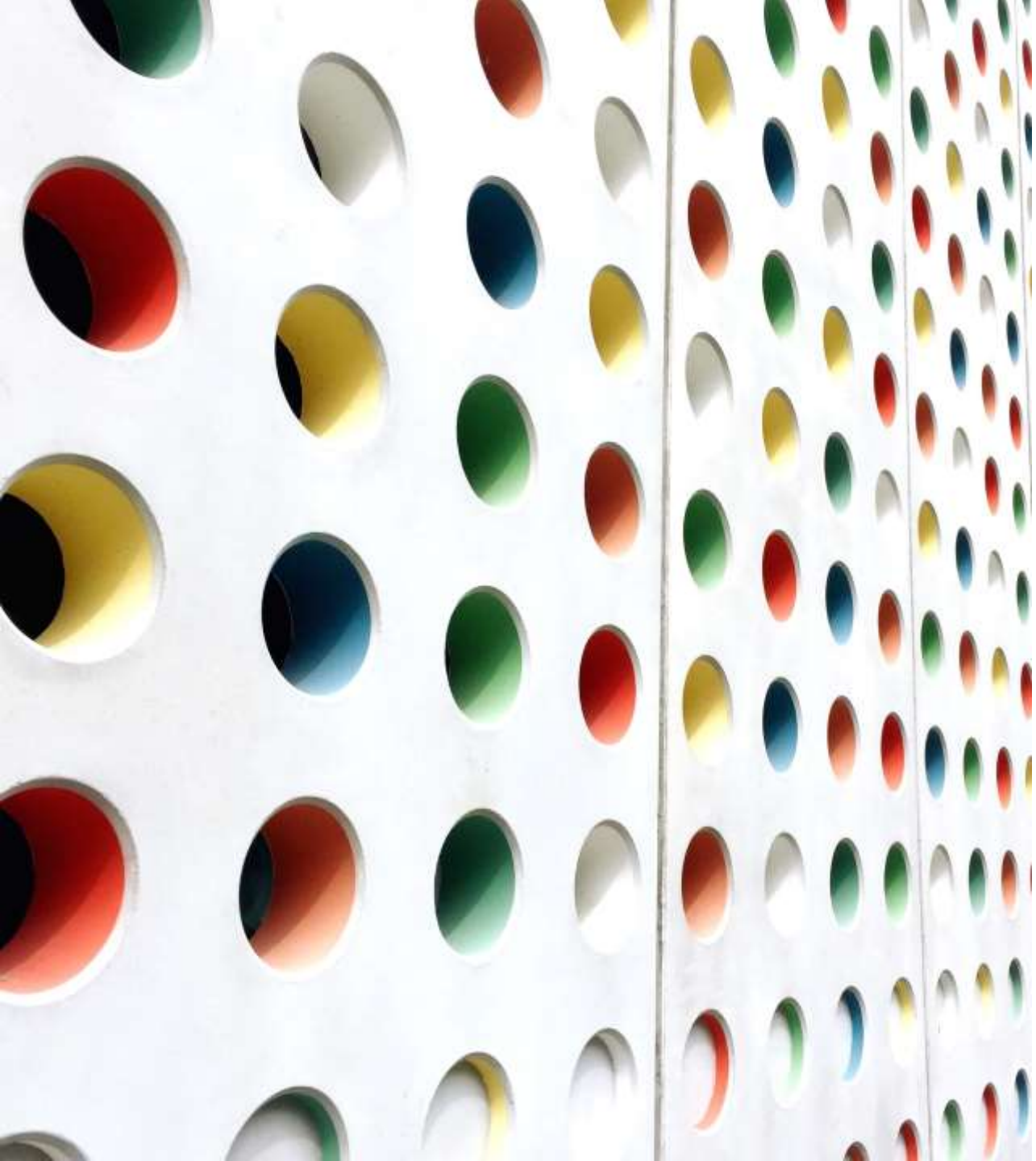
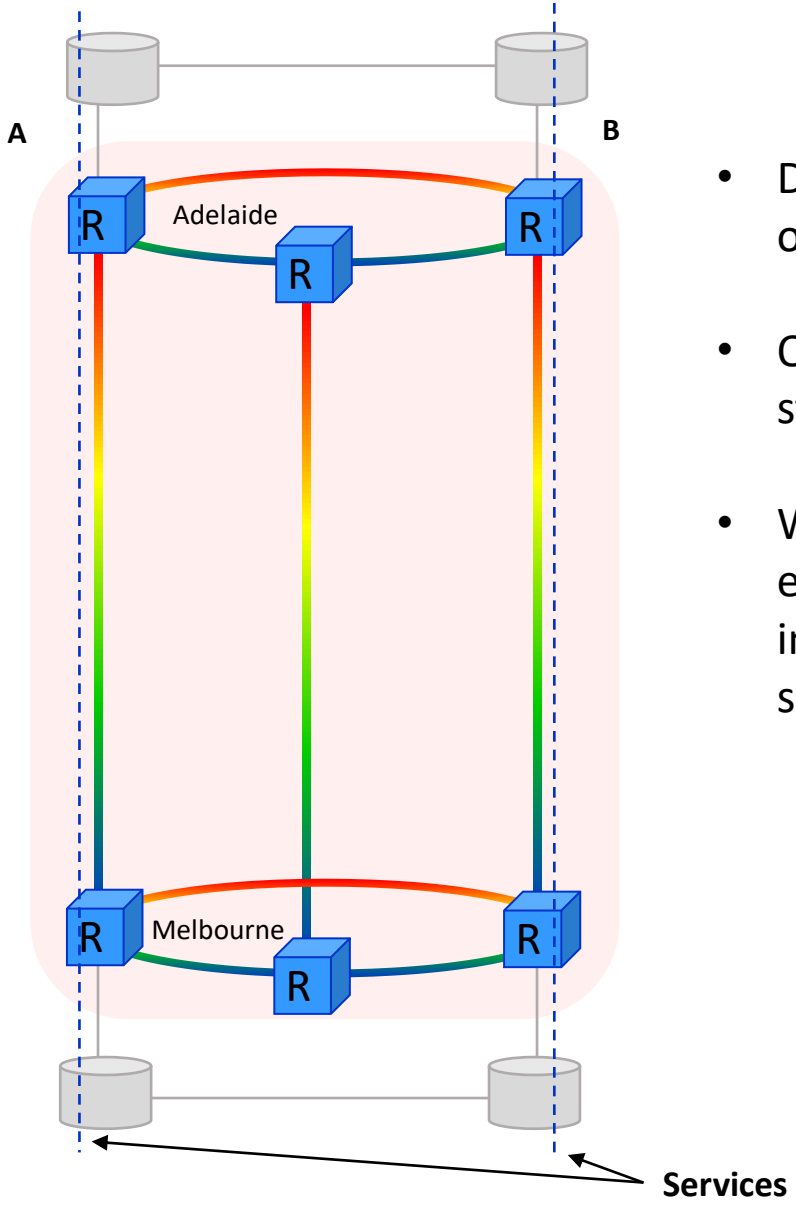


Layer 0 & 1 Control Planes.

SURESH | TELECOMMUNICATION AUSTRALIA | DWDM/OTN |

Current Layer 0 DWDM architecture

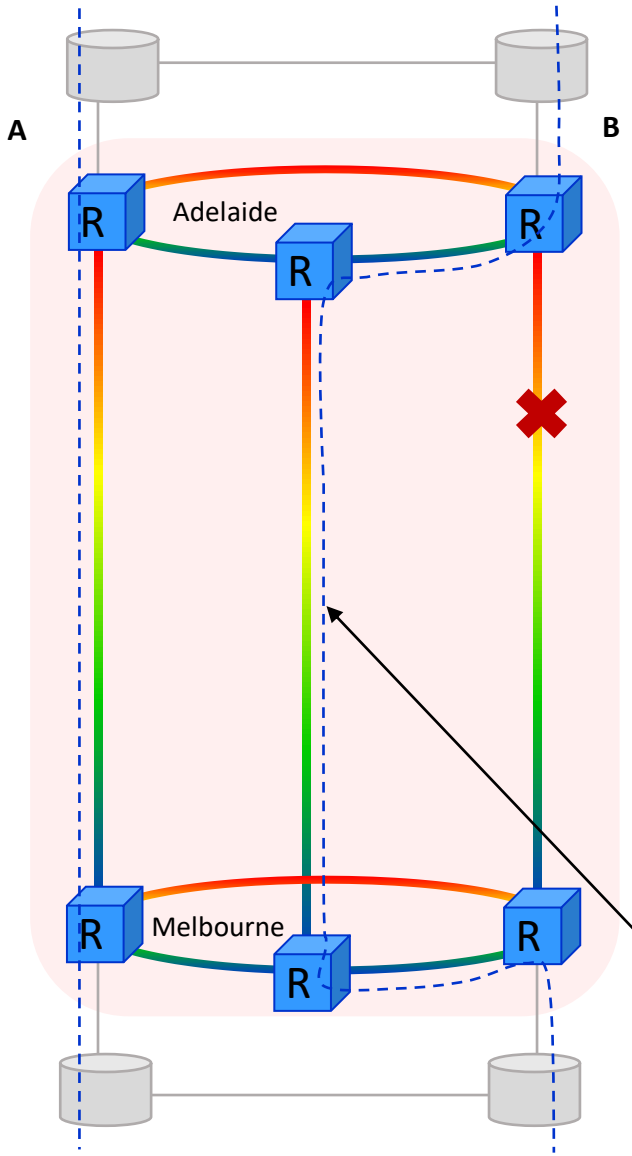


- DWDM network has been deployed with optical switching (ROADM) nodes
- Optical switching is currently only used in a static manner for initial service provisioning
- With Layer 0 Control Plane software, existing hardware can be configured to increase the resiliency of the DWDM service layer.

R Directionless ROADM, CD(C) ROADM future

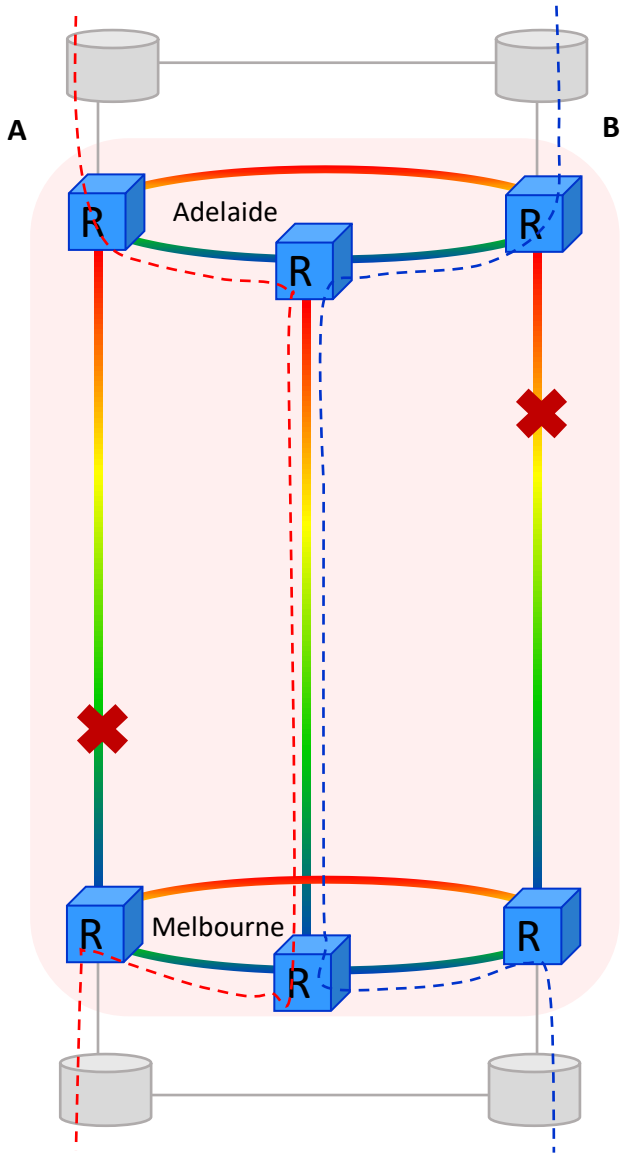
Router / Switch

Layer 0 Control Plane – Path failure



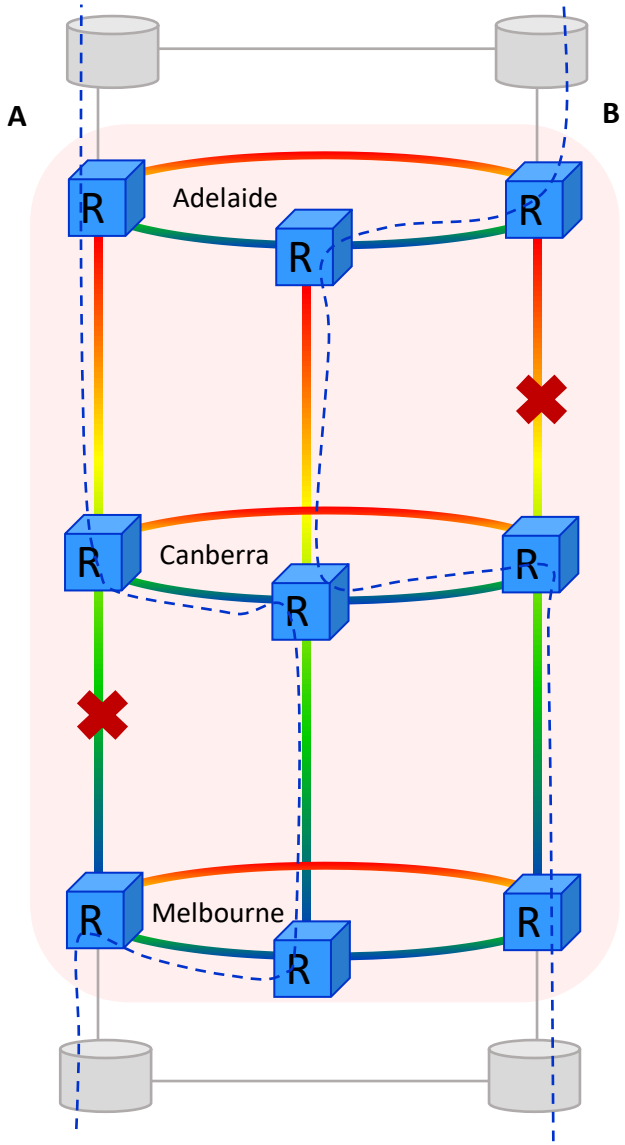
- Layer 0 Control Plane re-routes wavelengths onto restoration path in the event of line failures.
  Note, restoration of the wavelength will take tens of minutes.
- Reduces Network at Risk for protected services and reduces MTTR for non-protected services.
- No change to client (1 – 100GE) signalling / payload options.

Layer 0 Control Plane – Second failure



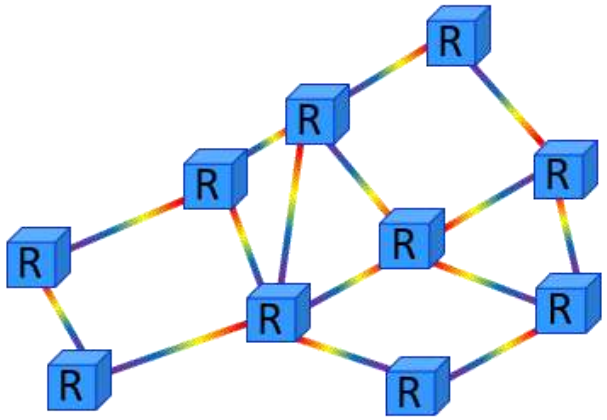
- Can't restore where both A and B paths use the same wavelength under initial scope
- A goes to 3rd path or B goes to 3rd path but not both.
- Option to restore a second fibre cut on second service will require a <u>second wavelength</u>
  ie inefficient use of wavelengths = $$$

Layer 0 Control Plane – Future enhancements



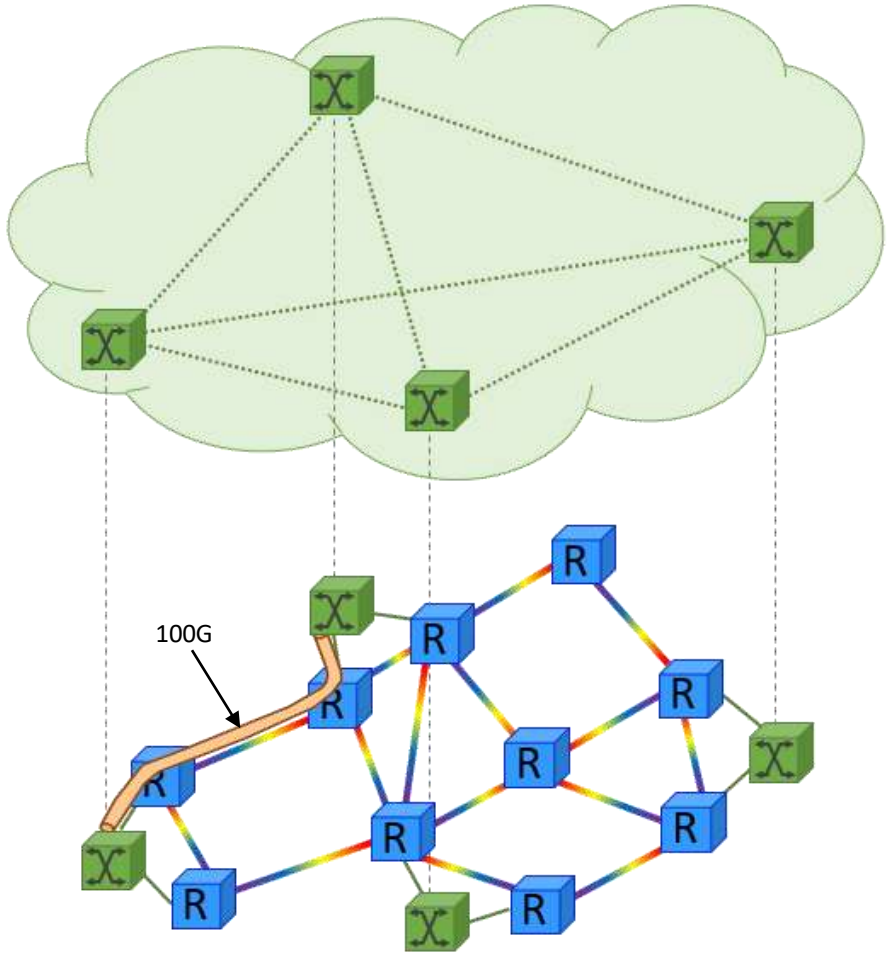
- More path options will be made available in the future using a higher degree of optical meshing.
- More paths allows 2+ failure survivability by re-routing via optical interconnection points
- NMS for this functionality will be “BluePlanet”, Ciena’s more capable NMS, SDN Manager, Domain Controller.
- Open API’s available to Southbound systems

Current Layer 1 OTN architecture



- Current OTN network is based on static mapped connections between DWDM Transponders / Muxponders
  - Intercapital
  - Regional
  - Metro
  - Passive
  - etc
- Service deployment requires manual provisioning at multiple points and physical adjustments
- Maximum transport efficiency is a manual process
  - eg GE handoff between Wholesale / Core

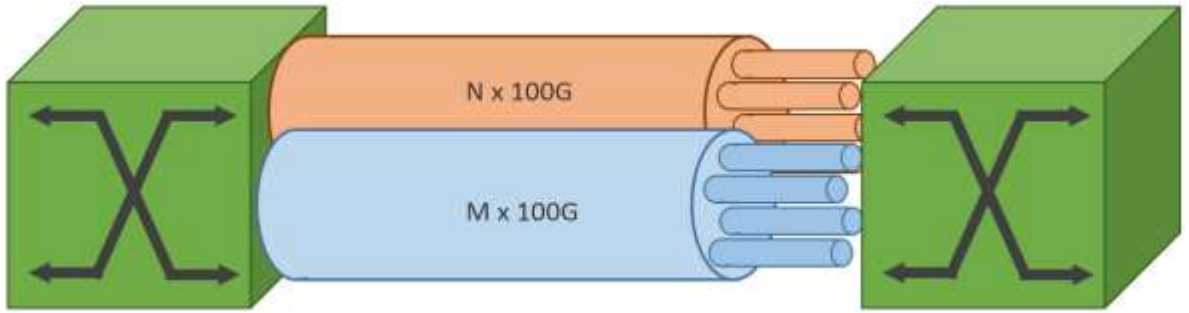
Layer 1 Control Plane OTN overlay



- L1 OTN Control Plane overlays existing DWDM / OTN transport network
  - Can utilise underlying DWDM network for physical transport
- Logical Control Plane functions as full connectivity OTN mesh
  - Any-to-any service routing (pre-provisioned 100G connectivity)
  - Service activation does not require intermediate site visits or physical connections
  - Automatic grooming for efficient wavelength fill

Layer 1 Control Plane OTN

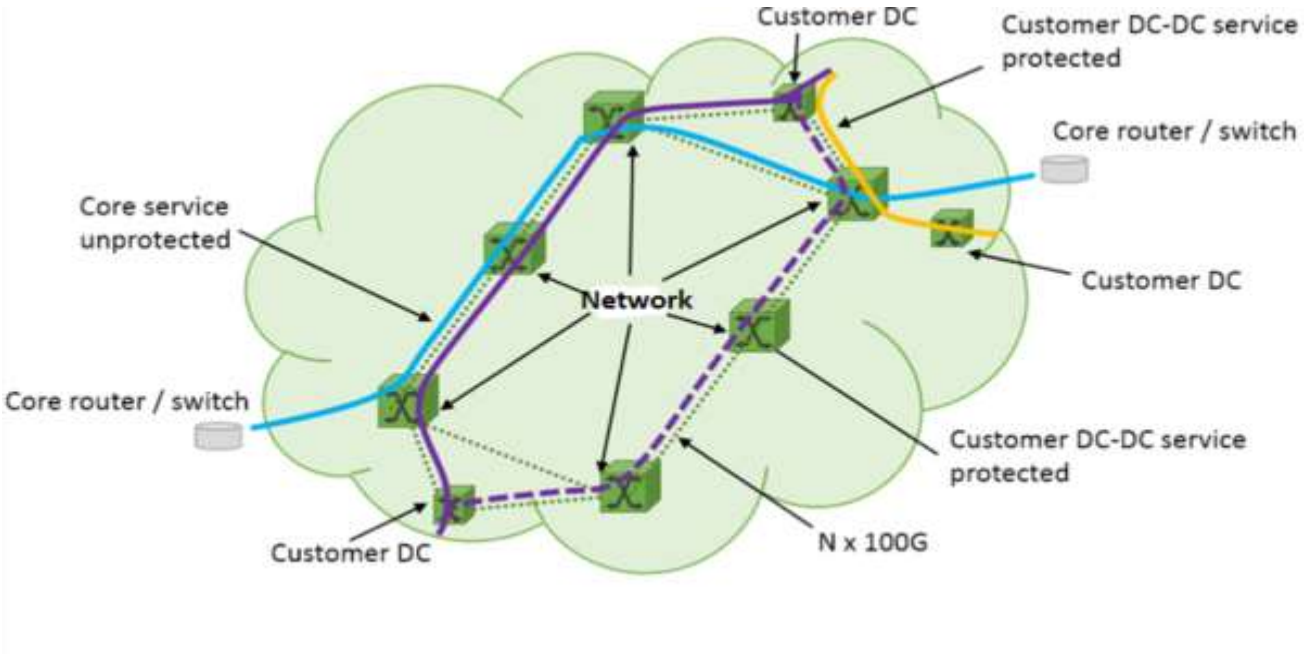
- Abstraction of physical ports into logical OTN connectivity
- Automatic bandwidth grooming for efficient transport / wavelength utilisation
  - No manual demuxing
  - Same infrastructure for multiple services / service types
  - Easier wavelength management
- Can partition bandwidth for application / business-specific requirements
  - eg separate wavelength for Wholesale / Core



Layer 1 Control Plane OTN services

- Unprotected and protected (1+1 <50ms) services available
  - <50ms switch time for protected services

- Can run over the DWDM Layer 0 Control Plane
  - Improved network resiliency



Thank You