



1Net
Your Path for
Growth



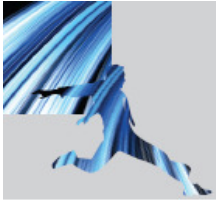
Optimizing Metro Networks

How to further reduce cost-per-bit



Your Partner for Growth

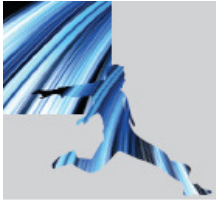
Erwin Filmer
Solutions Director – Asia Pacific



Optimizing Metro Networks



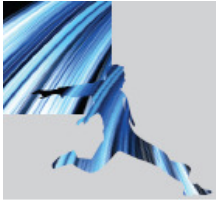
- Cost Reductions
- Why?
- How?
- Example & Case Study
- Key Take-Aways



Cost Reductions – The Usual Ways



- More Ethernet, more IP
- Higher Bit-rates per Port: 1G/10G/40G/100G
- DWDM to Save on Fiber

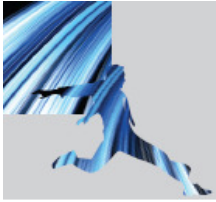


Cost Reductions – The Smart Way



- Holistic Approach to Metro Network Planning

- Work Together
 - Who? → Data & Transport



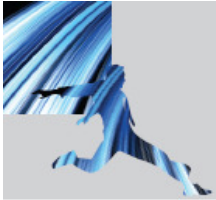
Why?



- Reduce CapEx and Opex at Company Level

- Achieve Lower Cost per Bit

- Do not Sacrifice Network Capabilities
 - Flexibility
 - Scalability
 - Resiliency



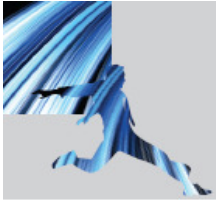
How?



- **Smart Network Planning – Evaluate**
 - Existing traffic
 - Expected growth in traffic
 - Layered traffic protection

- **Joint Planning across Packet & Optical**
 - Select the right technology
 - IP/MPLS (Routers) and ,
 - Flexible/dynamic Optical Networks (ROADM)

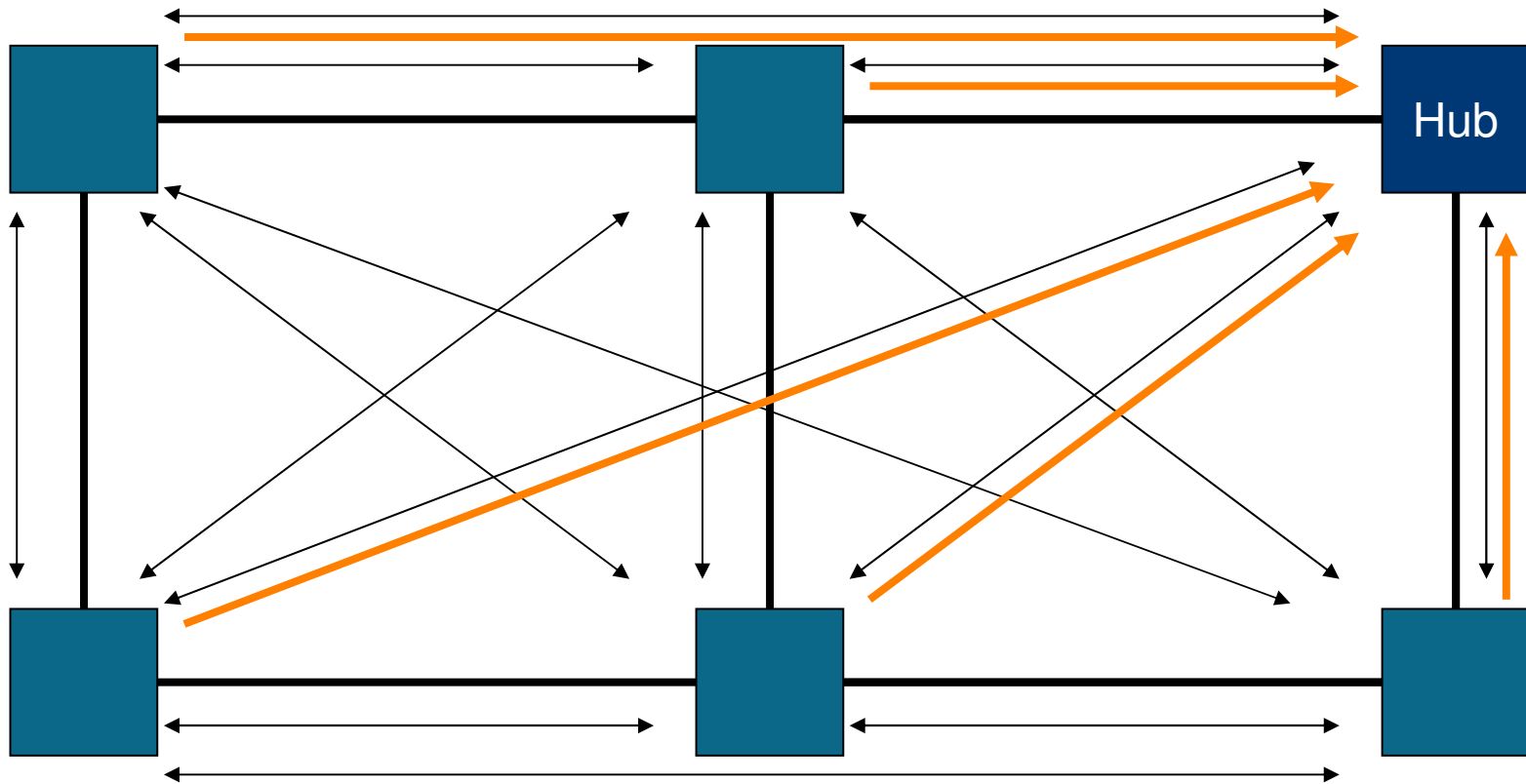
- **Optimize the Metro Network**
 - Avoid OEO conversions for pass-through traffic
 - Reduce ports on Routers (and Cross-Connects)
 - Reduce power consumption

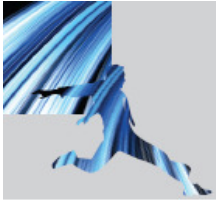


Metro Traffic Patterns – Data Traffic

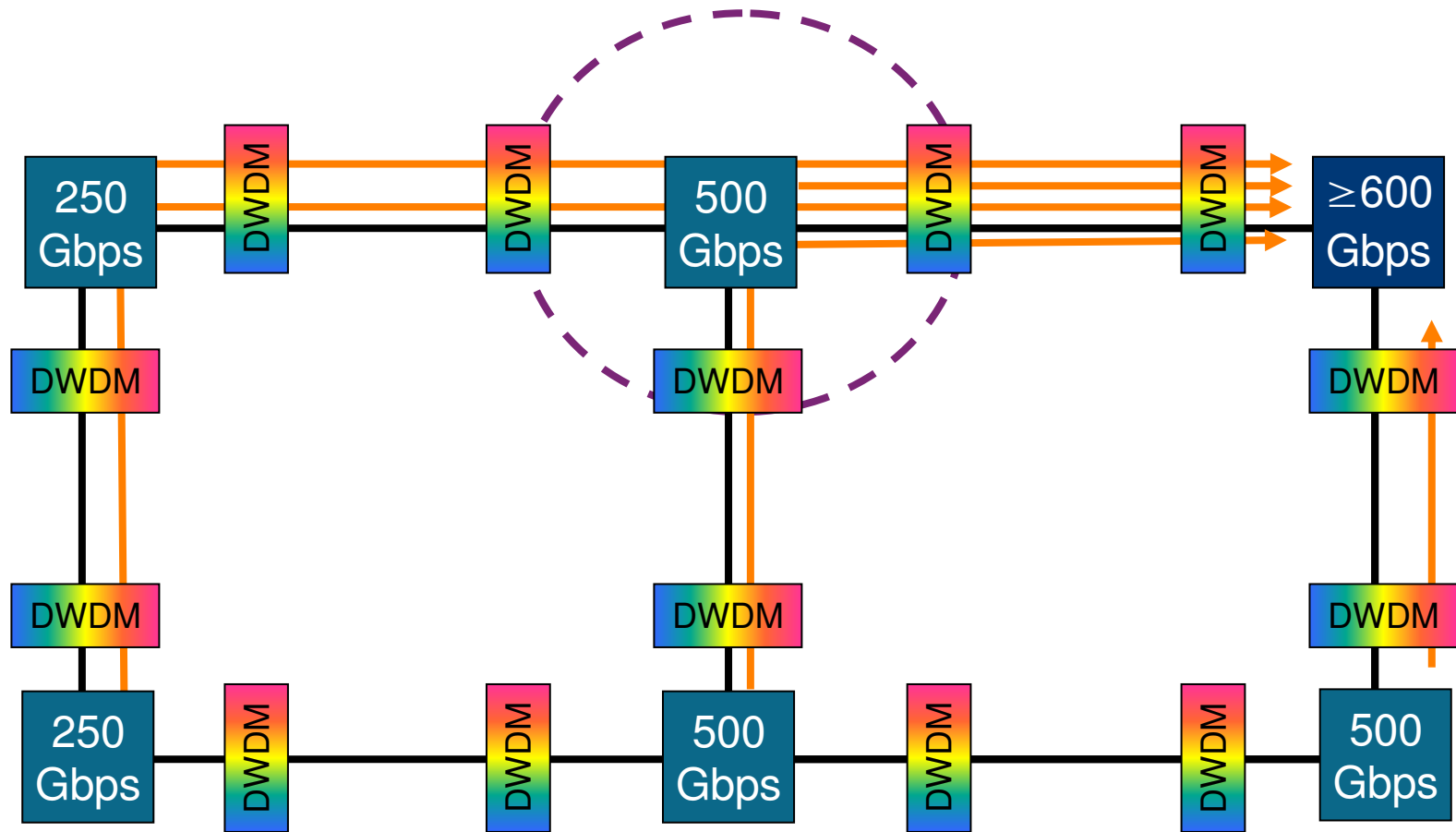


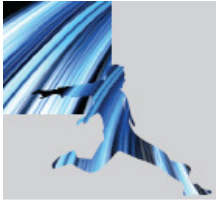
Each node to Hub: 40G
Site-to-site at each Node: 2G



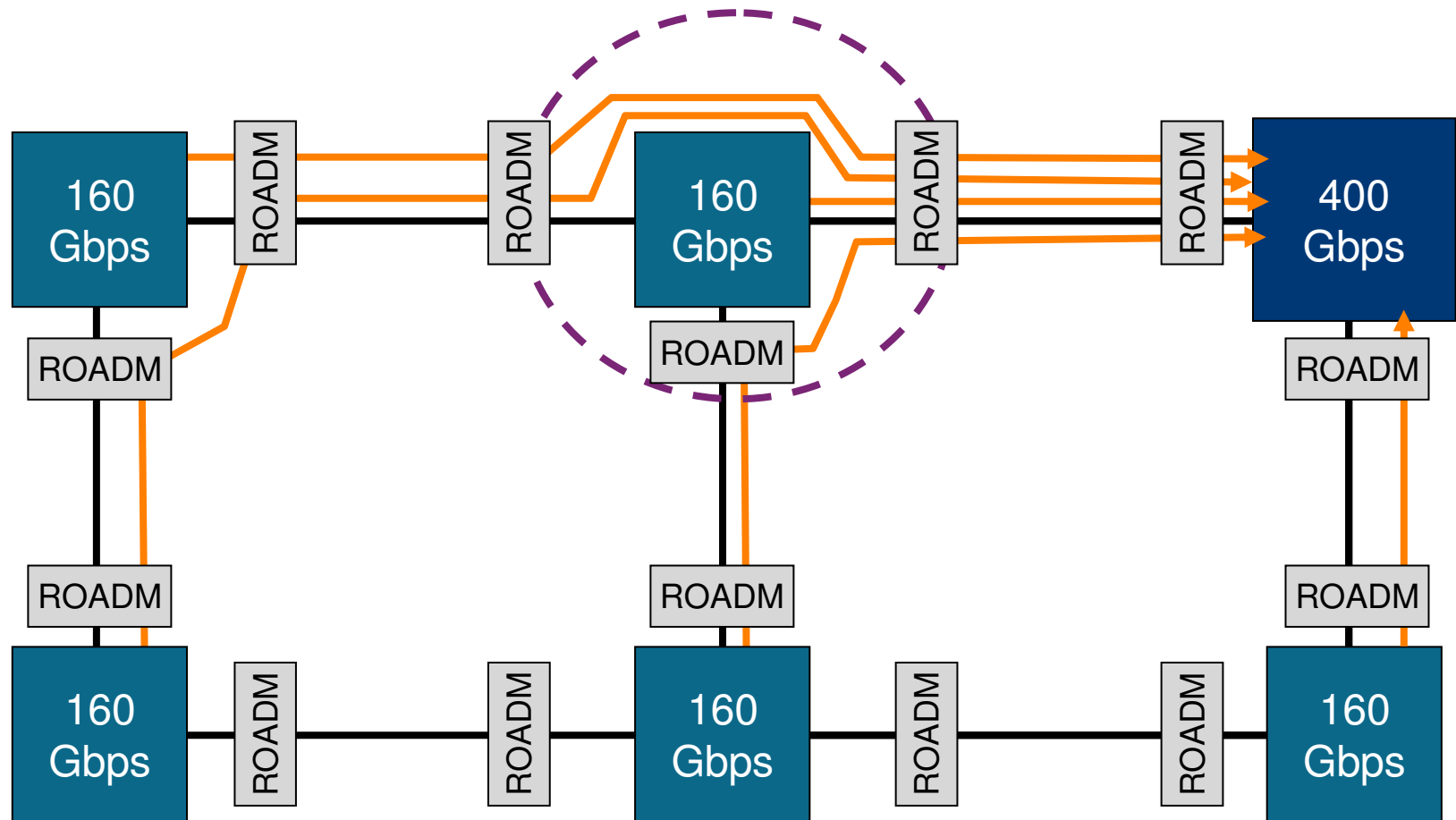


Network Planning – Data Only





Optimized Network Planning

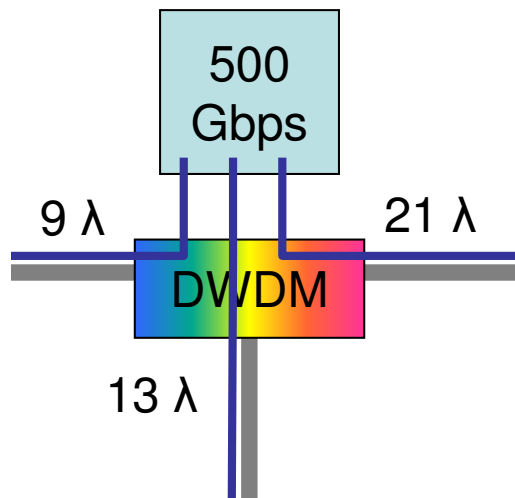


Side-by-Side Comparison



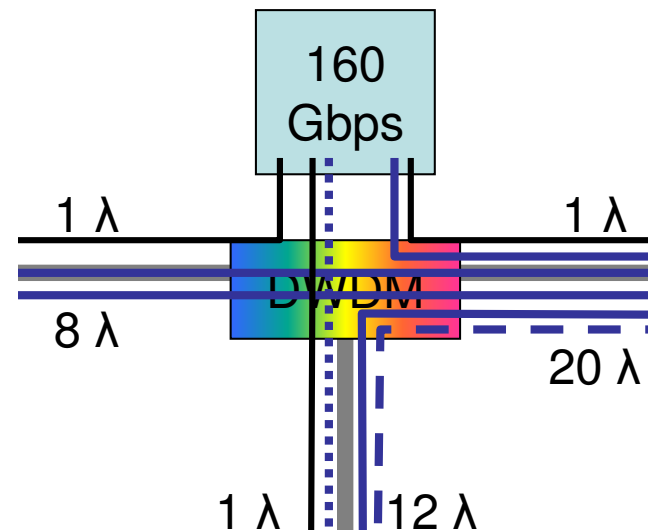
Packet Only Planning

- 43x Optical Ports
- 5kw Power
 - 4000W in Router
 - 1000W in DWDM

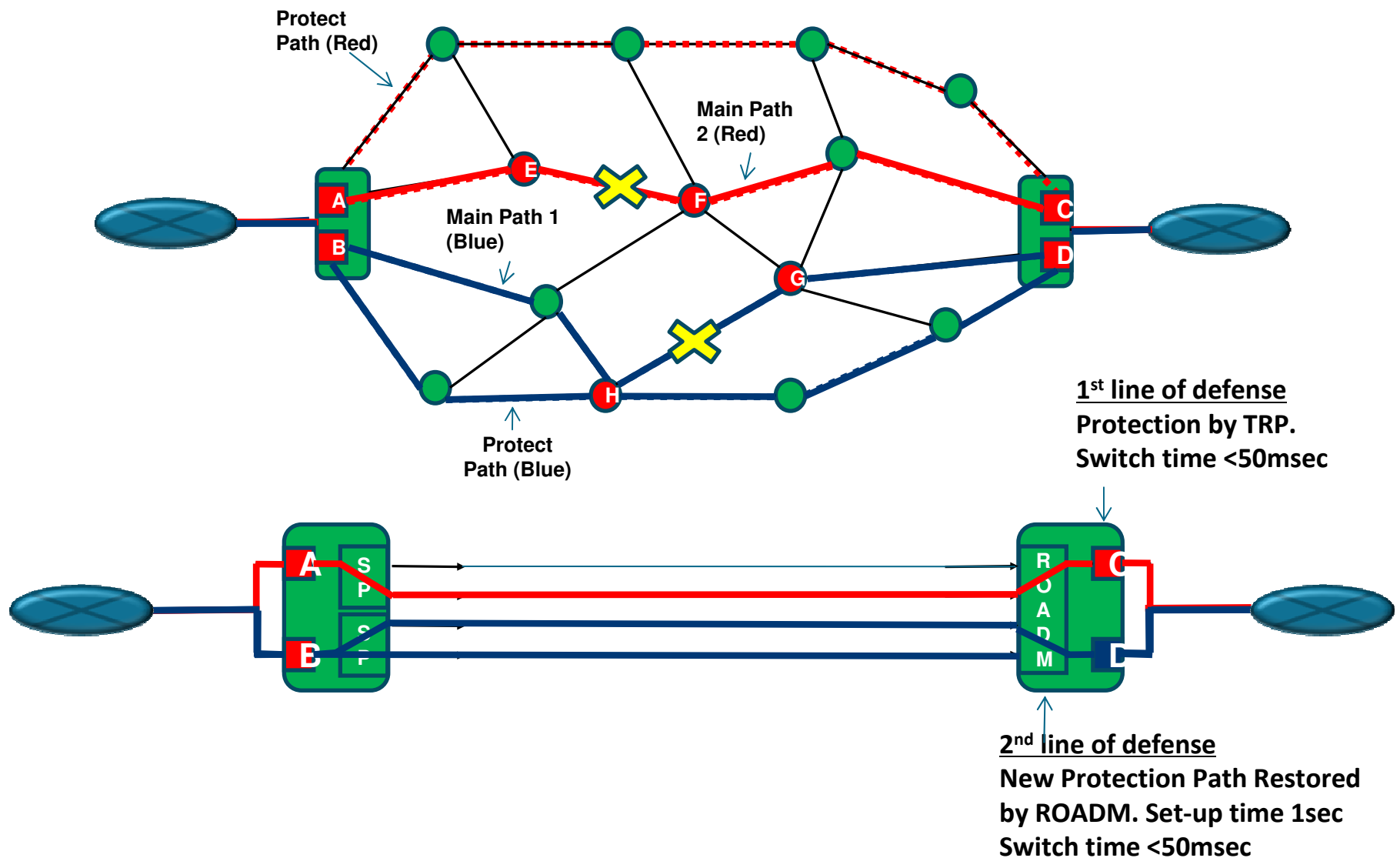


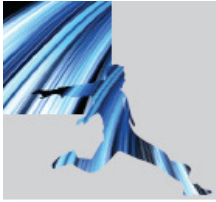
Joint Planning

- 11x Optical Ports
- 2.5kw Power
 - 2000W in Router
 - 500W in ROADM

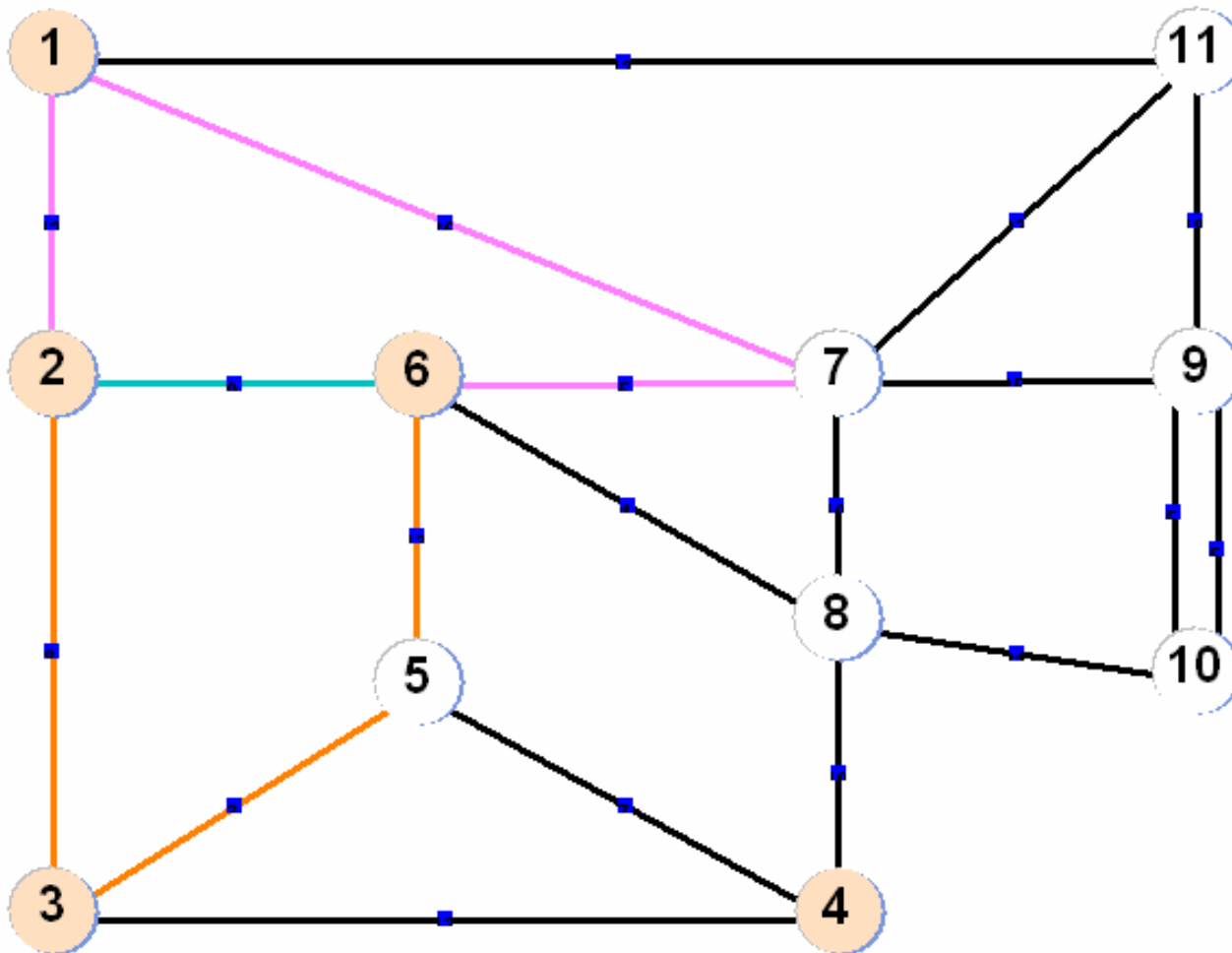


ROADM - Dynamic Optical Protection

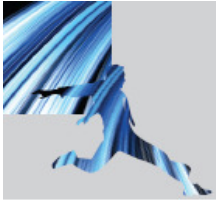




Case Study - India



- Solution for Metro Mesh
- Protected against 2 failures
- Optical and/or ASON protection
- Total 25x10G services



Comparison of Three Solutions



- ASON solution (electrical XC) – no ROADM
 - Full OEO for all traffic

- Combined ROADM and ASON (electrical XC)
 - Mostly OEO, ROADM for some pass-through

- Full Dynamic ROADM protection
 - No ASON, all protection done by the ROADM

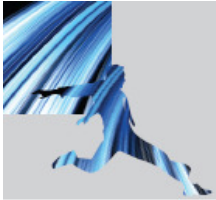
Comparison performed using ECI Network Design Platform (NDP)



Results



| | ASON | Converged ASON+ROADM | ROADM |
|--|------------------------|-------------------------|-------------------------|
| Average Lambda usage per span | 16.5 | 16 | 16.7 |
| Number of colored line interfaces | 266 | 228 | 50 |
| Average XC size | 640G | 560G | NA |
| Number of ROADMs | 10 | 17 | 31 |
| Selling Price | 100% | -5% | -43% |
| Expansion lambda price (incl. Protection) | \$ X | -20% | -65% |
| Power consumption | 4KW per XC Node | 4KW per Node | <1KW per Node |
| Protection quality | PM based, <50msec | PM based, <50msec | 1+1 forever <50msec |
| 40G/100G upgradability | Requires XC upgrade | Requires XC upgrade | No change in ROADM |



Key Take-Aways



- **LOWER CAPEX:** Optical protection can save up to 50% of network cost vs. traditional OEO (ASON or Router) restoration.
- **GREEN:** Power consumption is minimal as optical switching consumes lower power than electrical switching
- **40G/100G Readiness:** Upgrade to 40/100G wavelengths does not require change in optical infrastructure, while in ASON or Routers, all line Interfaces need to be replaced!
- **SIMPLE:** Preplanned dedicated optical protection management and operation is simple and straight forward with no complex signaling and maintenance as in ASON or Router networks



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THANK YOU



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