The Emerging Optical Network

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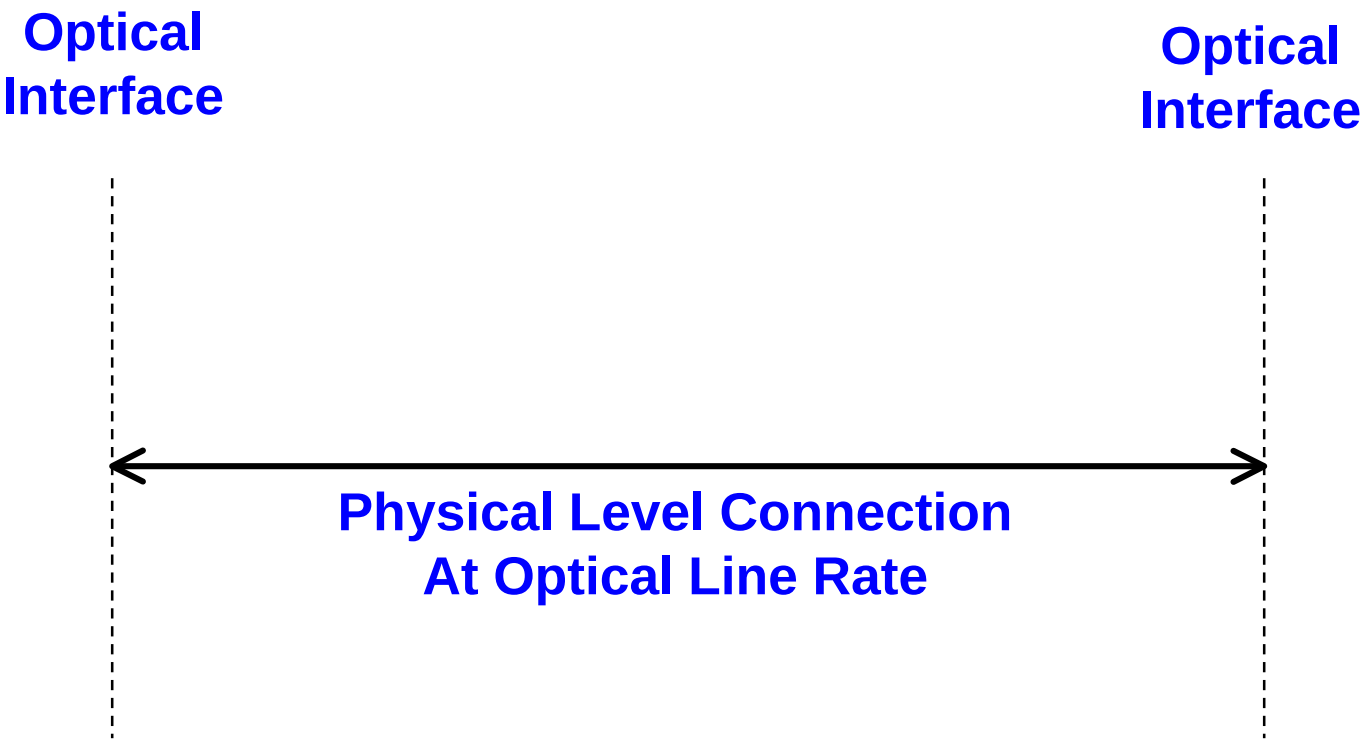
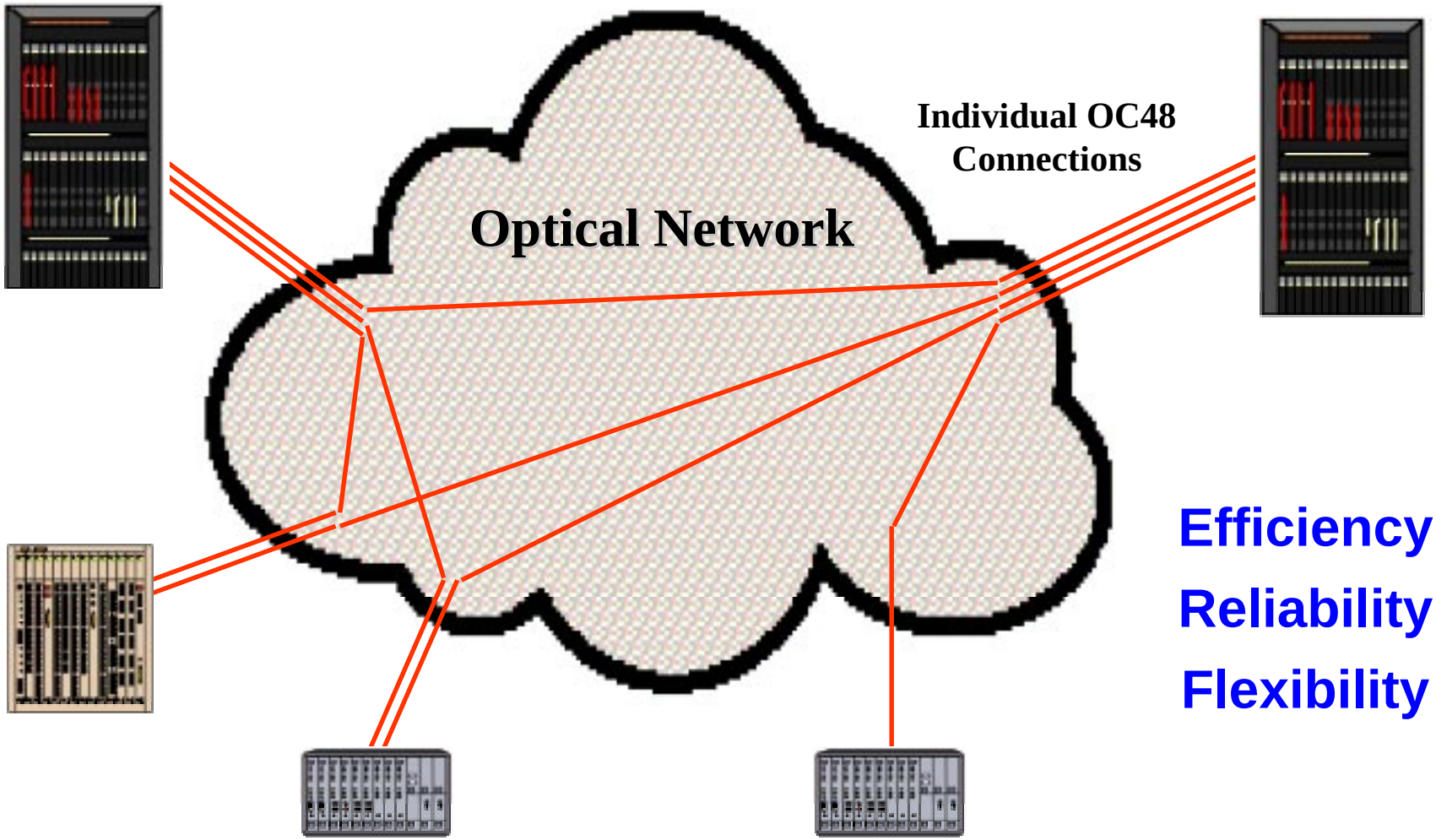
Most Basic Definition



Desired/Required Features



Efficiency

Reliability

Flexibility

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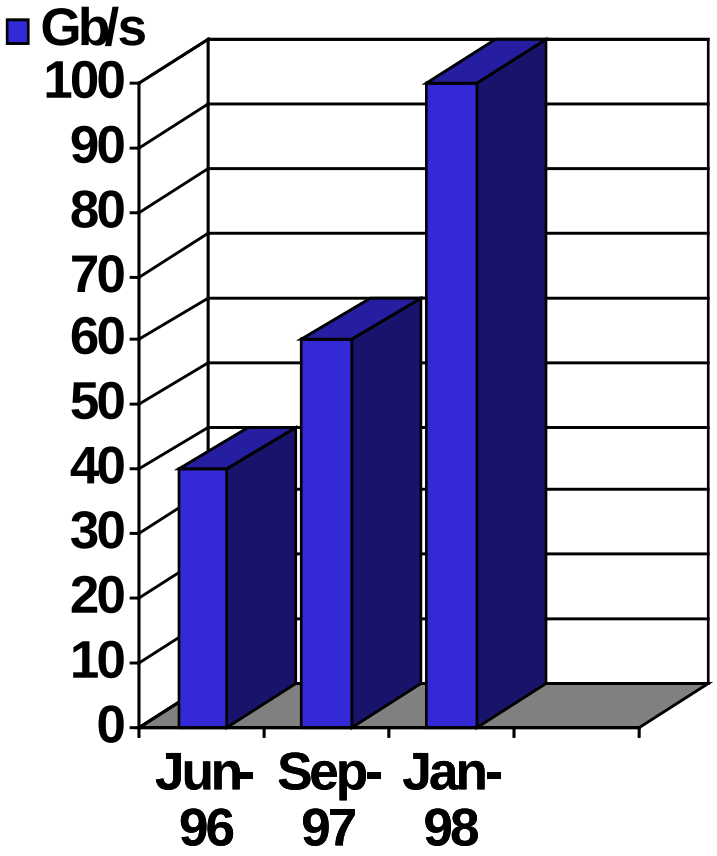
Increasing Efficiency

Dense WDM System - Capacity Growth



Dense WDM System - Evolving Functionality

- Point-to-point
- Optical Add/Drop
- Digital Regeneration

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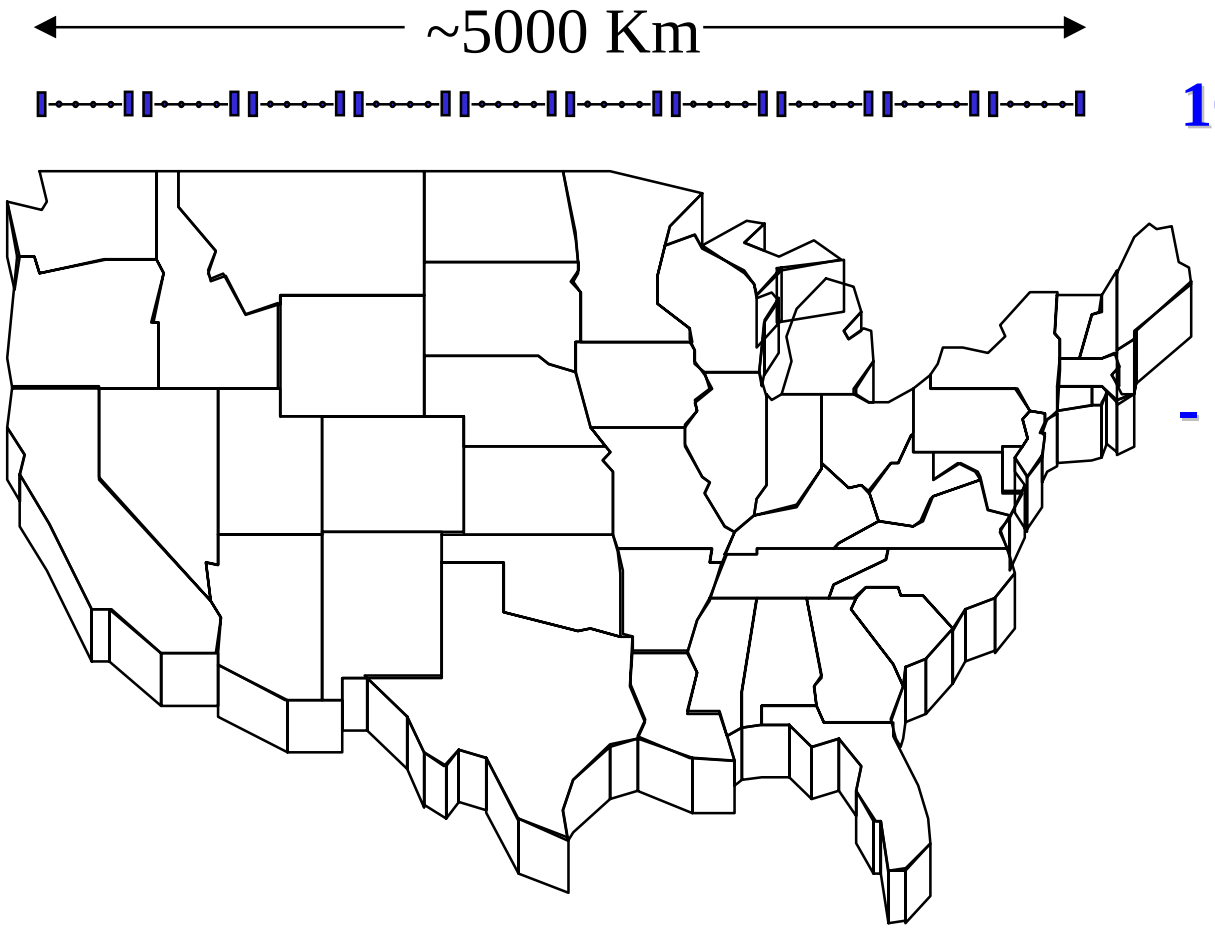
DWDM Long-Haul Systems



100 Gb/s Across the US!

Ten forty channel DWDM systems
- 20 DWDM Terminals
- 40 Line Amplifiers
- 1 fiber pair
Regeneration in DWDM Terminal

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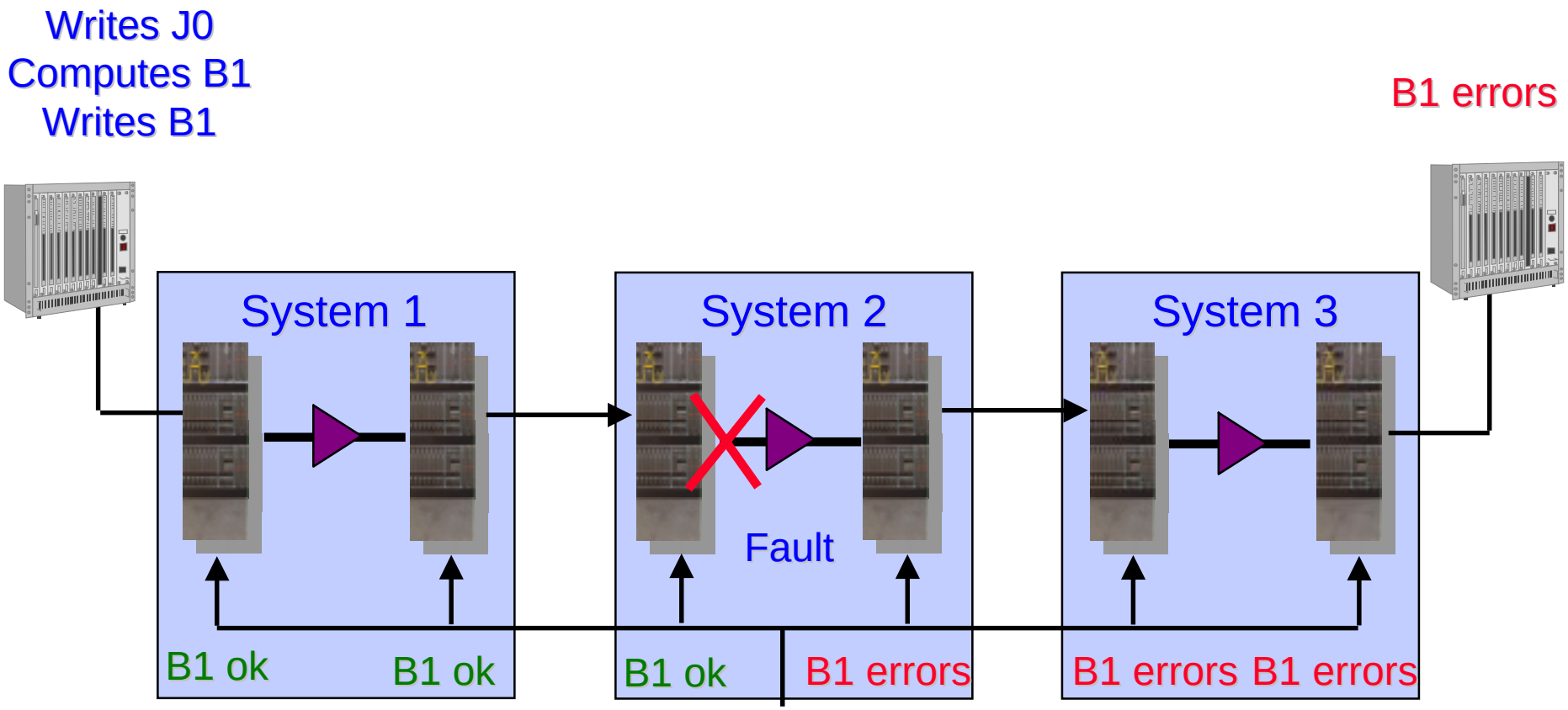
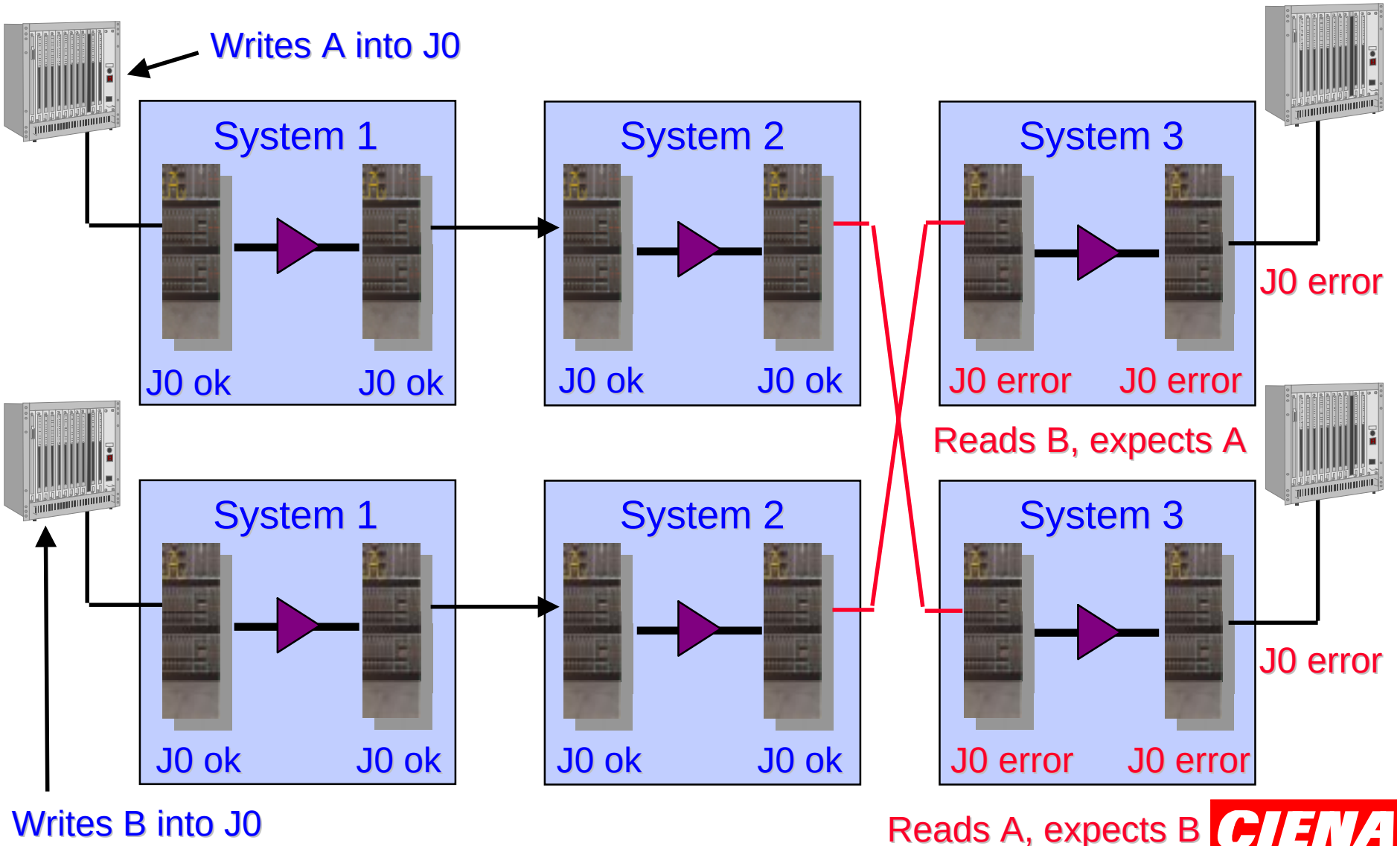
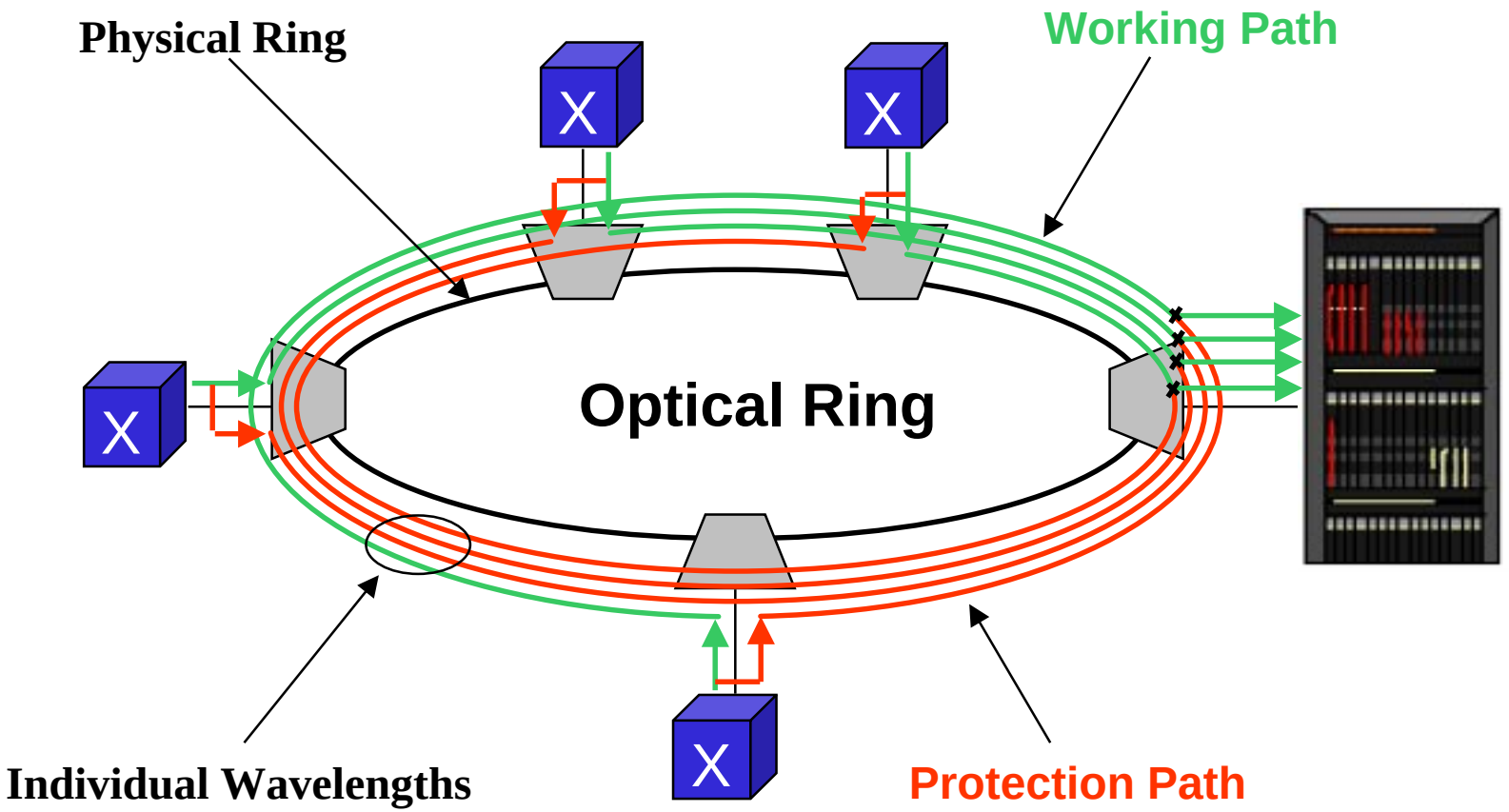
Increasing Reliability - Performance Monitor



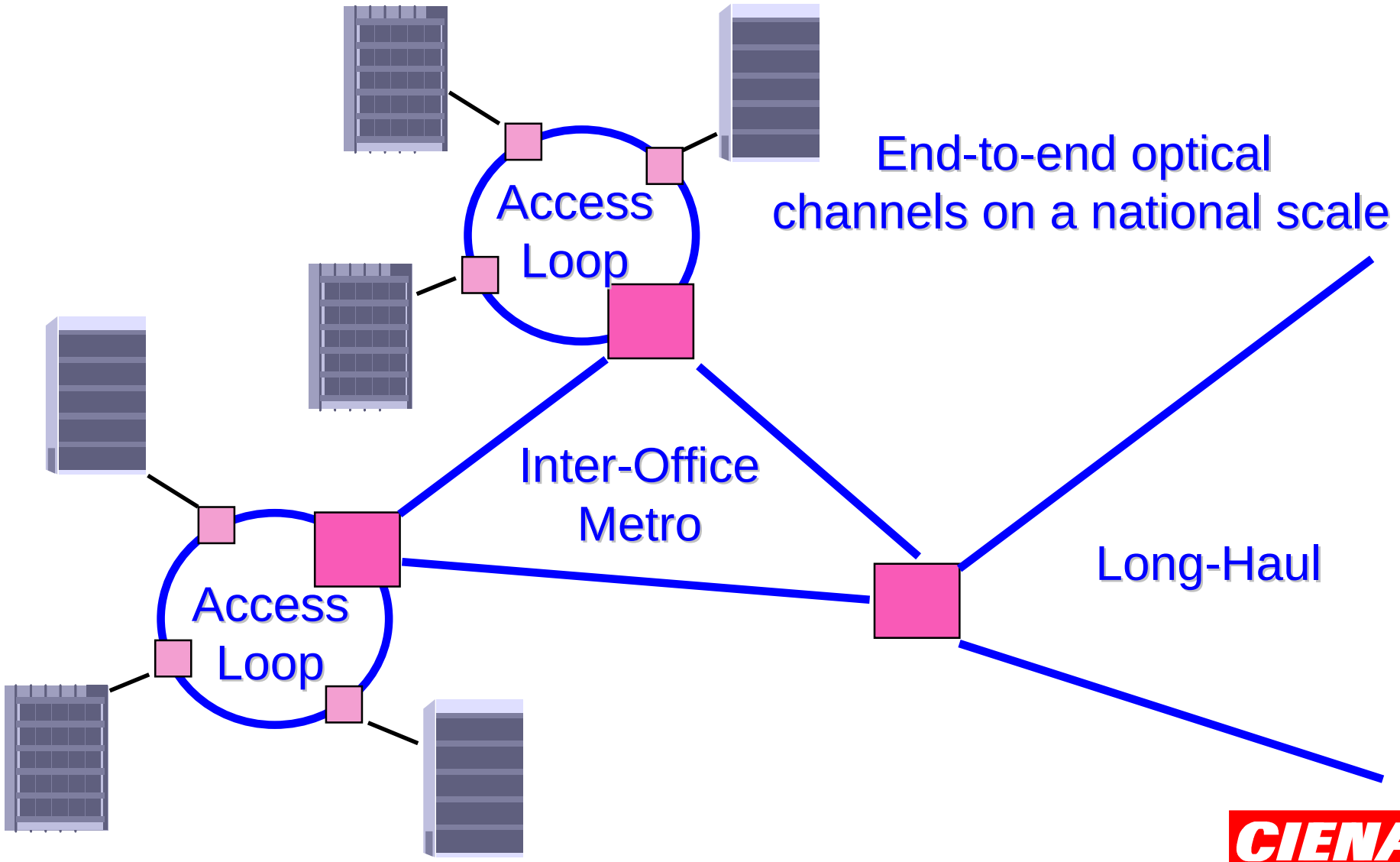
Increasing Reliability - Path Trace



Increasing Reliability - Local UPSR



Increasing Flexibility - Application-Specific Architectures



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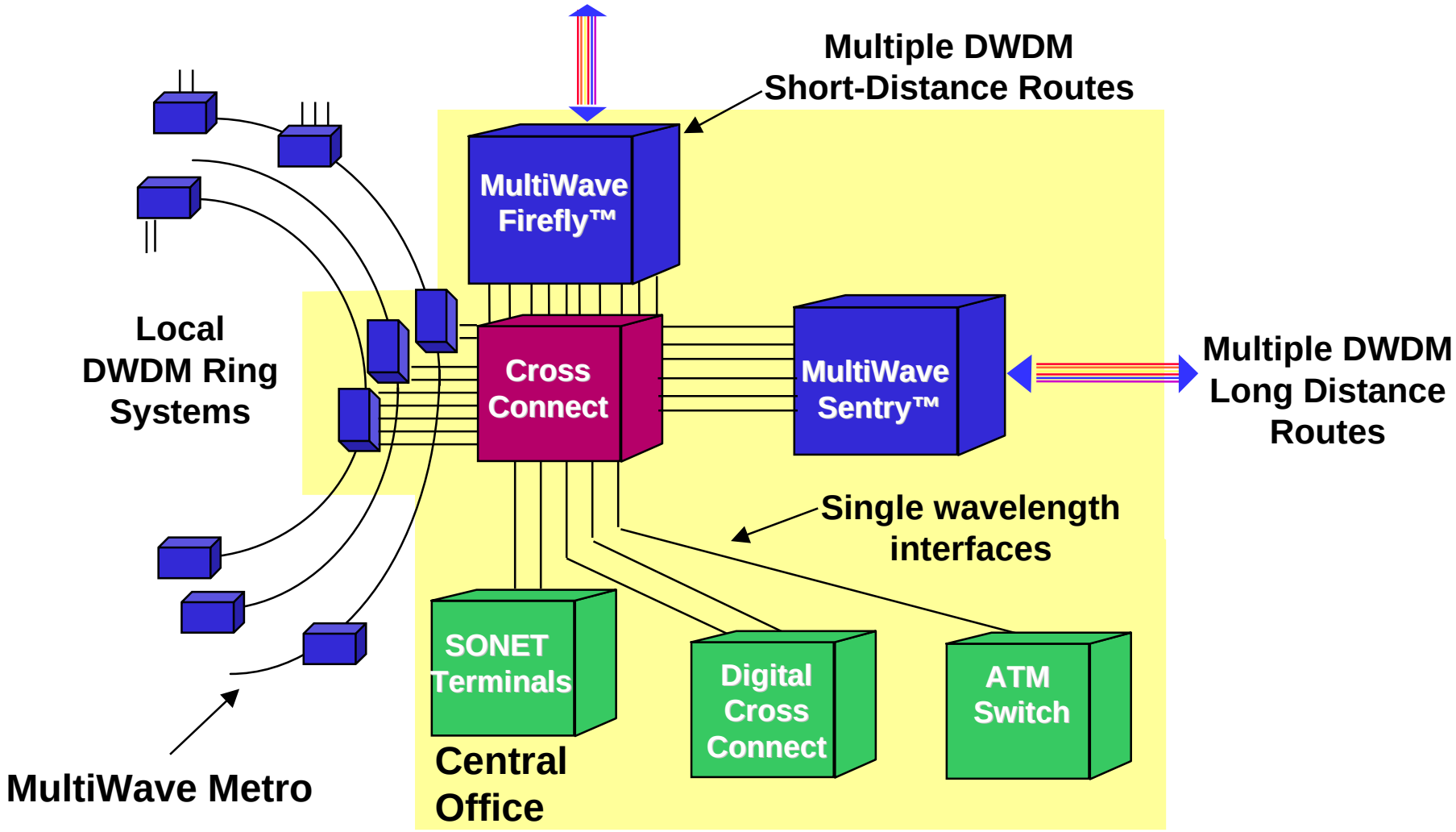
Optical Interconnection via Short-Reach Interfaces



Additional Features Required

- Efficiency
  - Very low cost ring access systems
  - Regional (state-sized) architecture
  - Always…more capacity / less cost
- Reliability
  - Transport protection
  - Service switch port protection
- Flexibility
  - Software provisioning

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ATTENTION: Late Breaking News

Core Network Routers/Switches receive OC48c ports by year-end.

- Carriers will need to provide end-to-end optical channels to meet this need economically.
- Multimedia applications will require rapid connection recovery.
- No system is yet deployed to protect OC48c connection.

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Protection/Recovery Choices

- Span Switched - Simple, fast, bandwidth inefficient, multiple failure risk
- Ring protection - Established, fast, application-specific efficiency
- Mesh protection - Extremely complex, probably slower, most efficient

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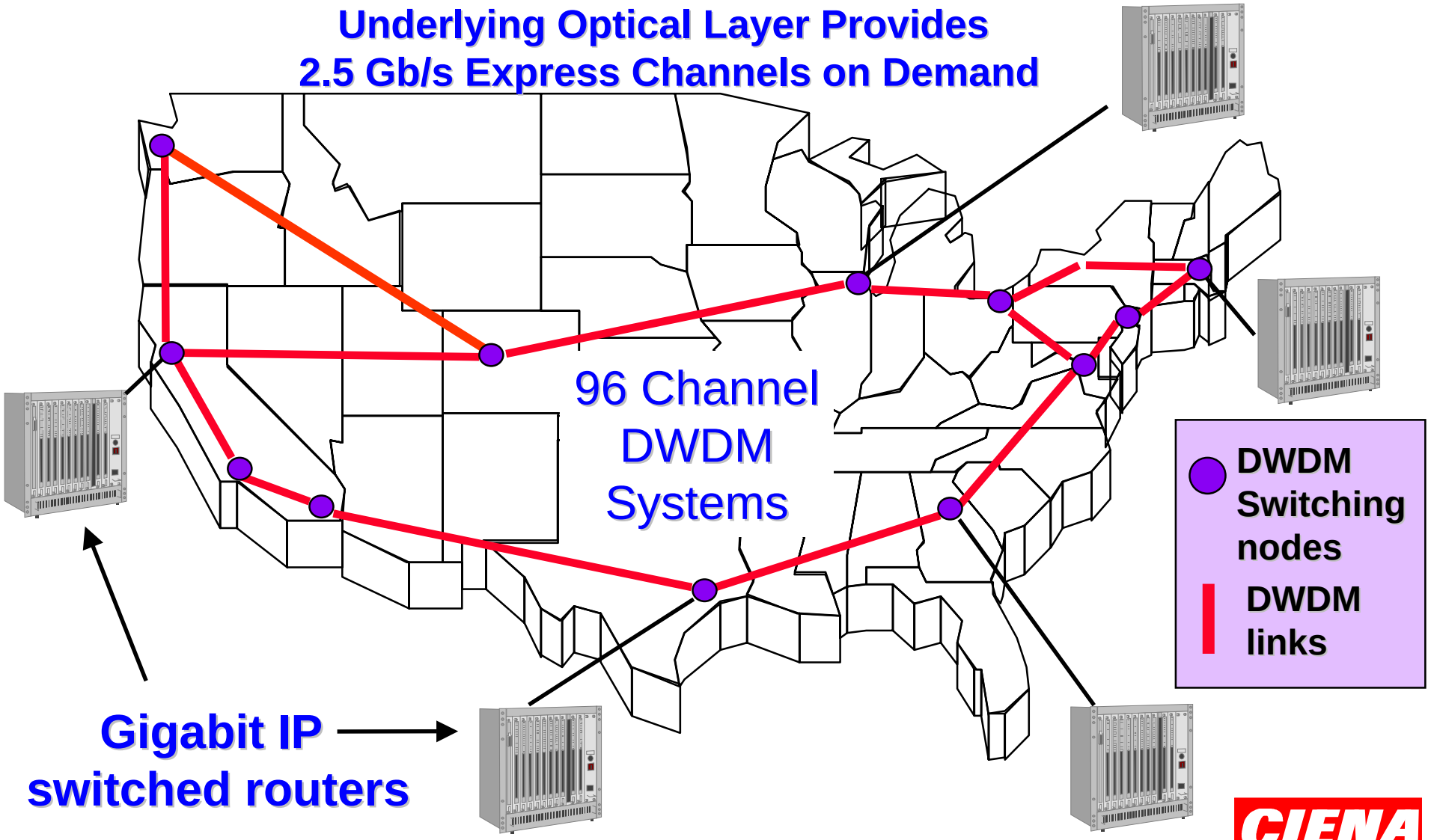
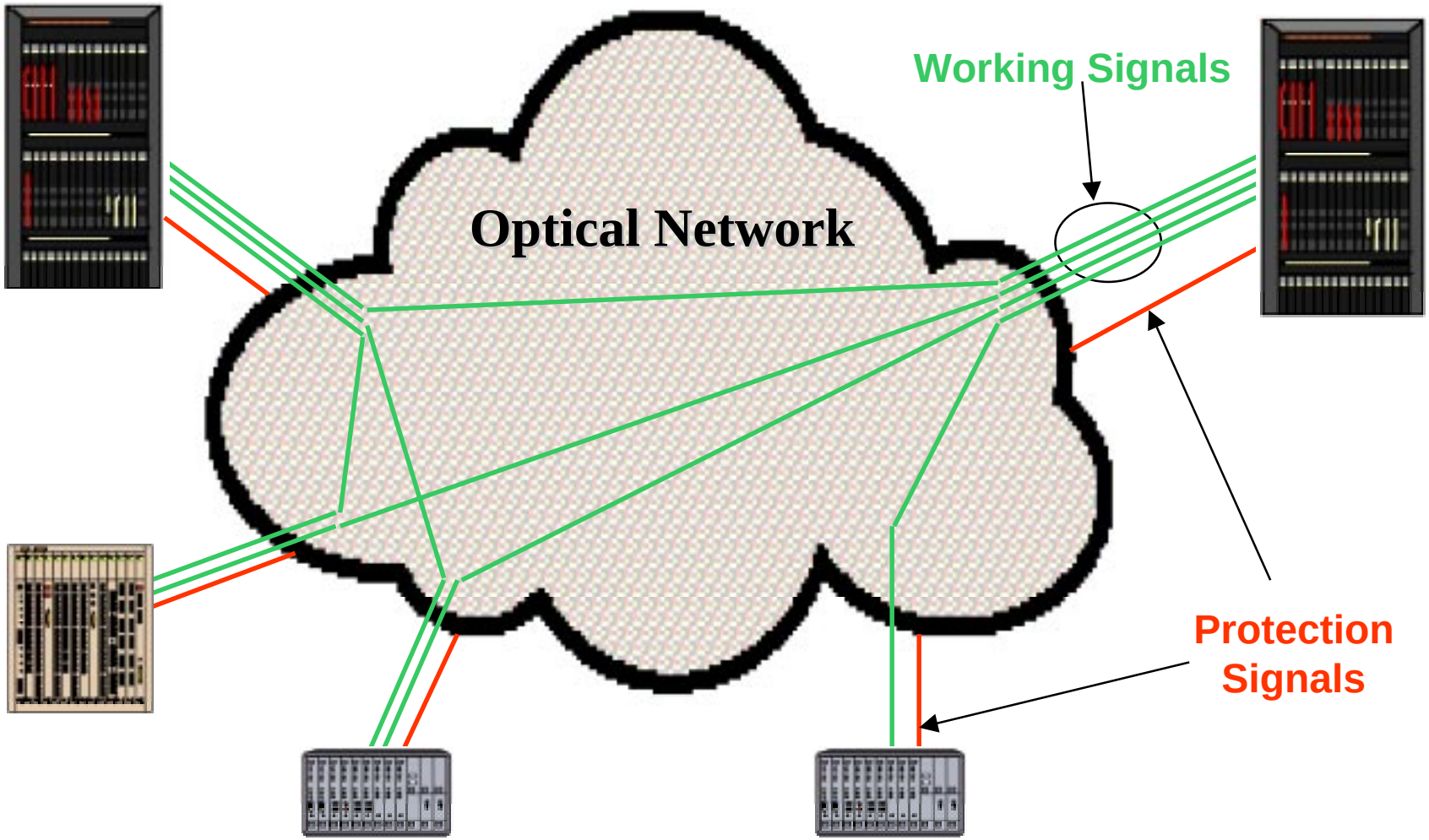
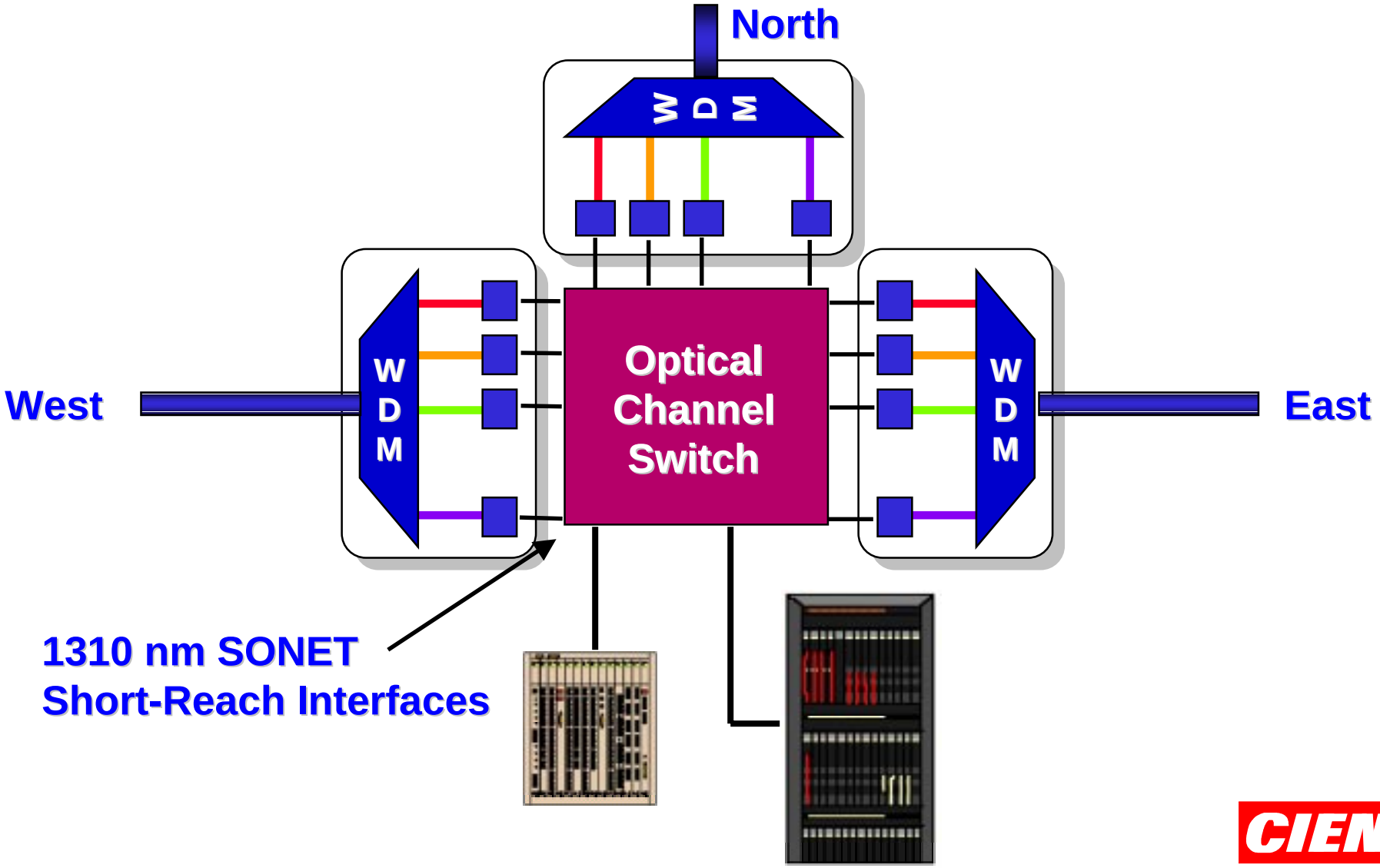
Ring-Protected National Network



Mesh-Protected Optical Network



Mesh Network Node



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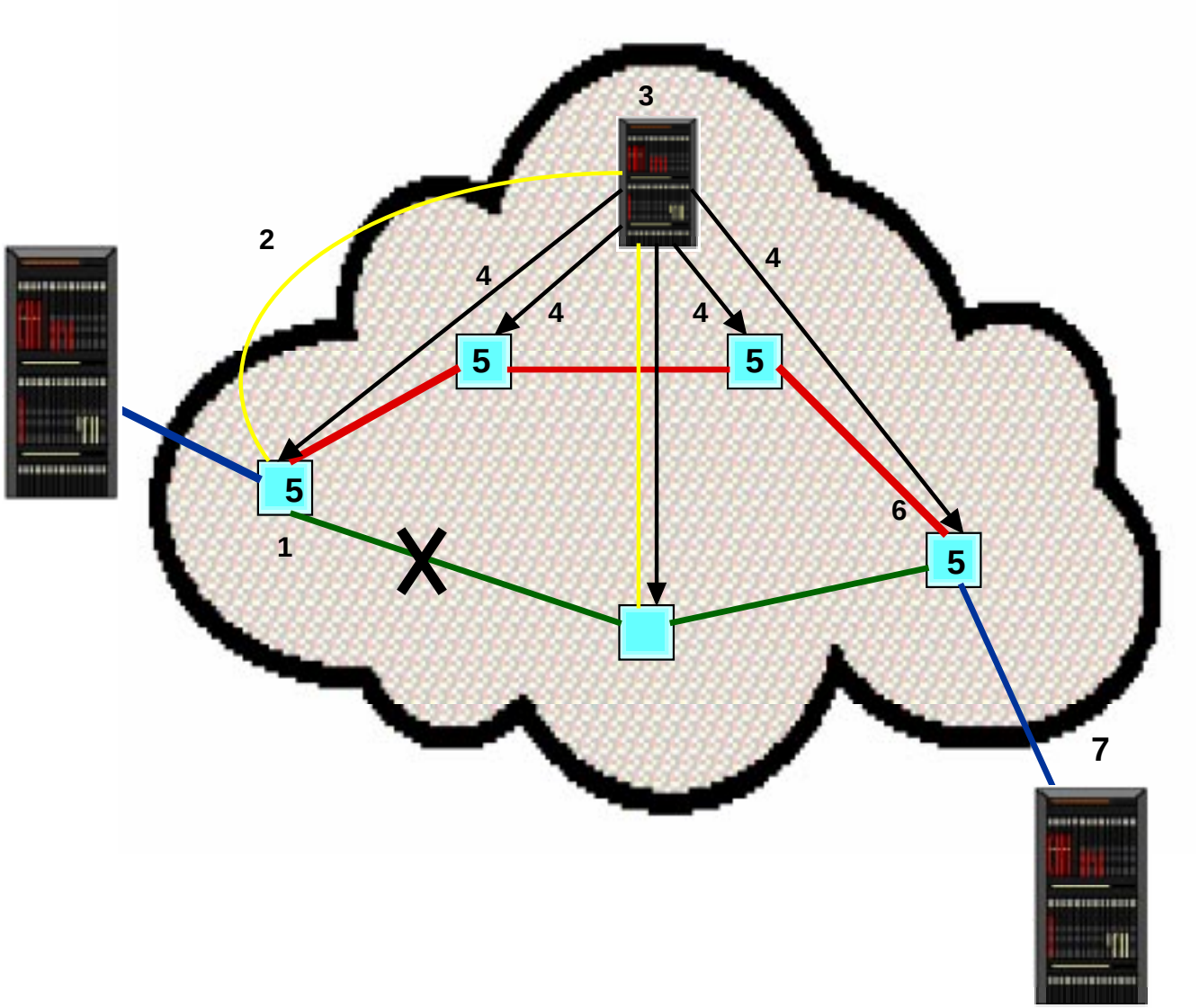
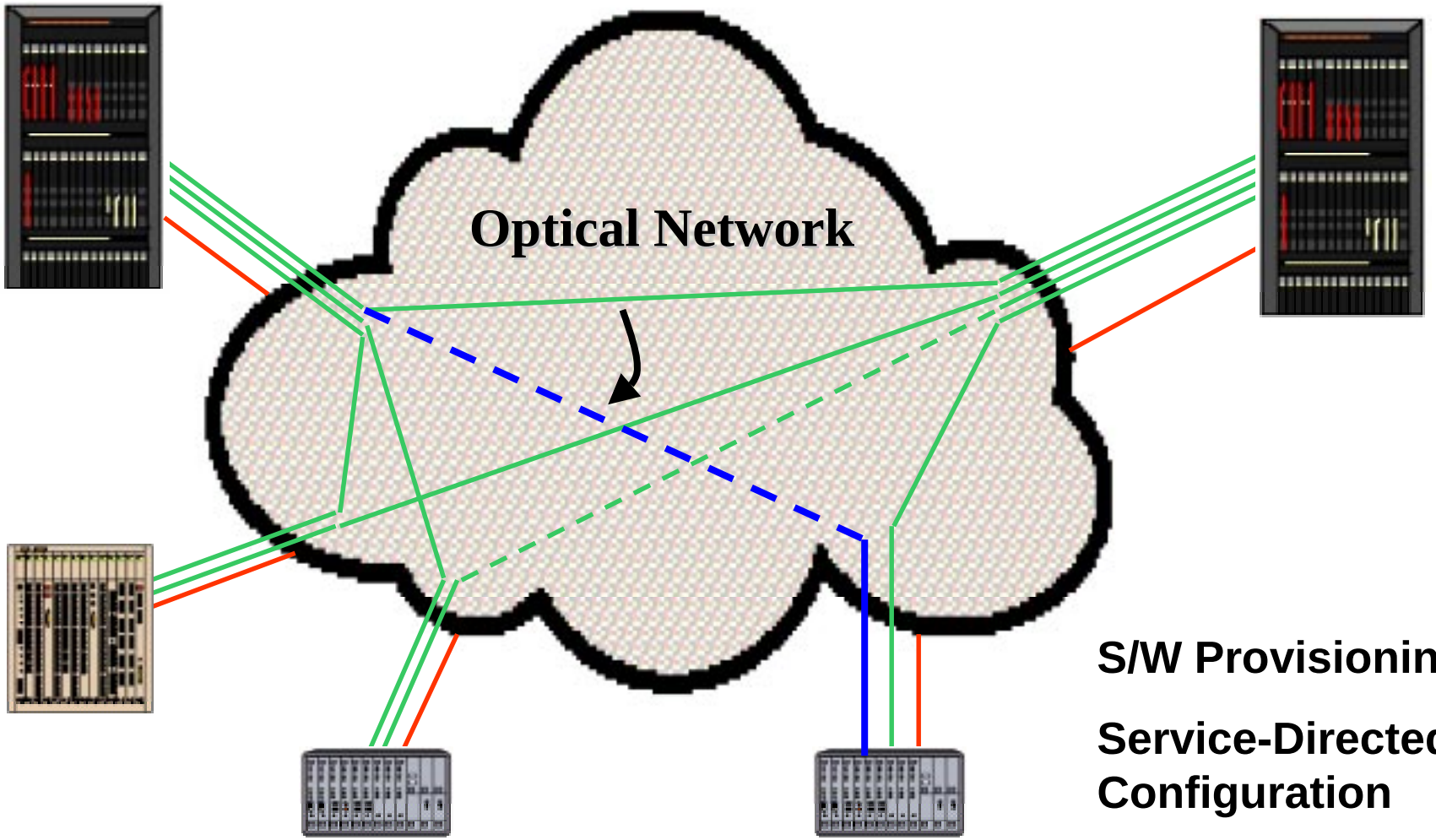
Mesh Protection Options

- Central Control
  - Real-Time
  - Pre-Planned
- Distributed Control
  - Real-Time
  - Pre-Planned

APS Control in Mesh Network



Ultimate Optical Network Flexibility



S/W Provisioning

Service-Directed Configuration

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