Overview

Introduction Continued
Protection in Ring Networks
Protection in Mesh Networks

Introduction - Protection and Restoration in Optical Network

Protection/Restoration Schemes

- Preconfigured Backup Route and Wavelength
  - Dedicated Backup
    - Link Protection
    - Path Protection
  - Shared Backup
    - Link Protection
    - Path Protection
- Dynamic Discovery of Backup Route and Wavelength
  - Link Restoration
  - Path Restoration
**Introduction - Span Protection**

Multiple fibers between nodes
Switch from one fiber to another
1+1, 1:1, N:1

**Introduction - Dynamic Path Restoration and Line Restoration**

Restoration - When a failure occurs, another route and free resources have to be discovered dynamically.
More resource efficient.
Require signaling.
Longer recover time.
Path restoration and link restoration
Distributed preplanning approach:
   Probability based selection scheme
Introduction - Revertive and Nonrevertive Recovery

Revertive – When fault is repaired, switch traffic back to primary.
When fault is repaired, primary becomes backup

Overview

Introduction Continued
Protection in Ring Networks
Protection in Mesh Networks
SONET

UPSR
BLSR/4
BLSR/2

SONET Layers

Path – End-to-end transmission.
Line – Multiplexing and synchronization.
Section – Regenerator, error monitoring, framing, etc.
Photonic – Lasers, LEDs, etc
SONET Layers

SONET - UPSR

Two Fibers. One clockwise - working, one other counterclockwise - protection.
Path level layer. Done by the end nodes.
1+1. Dedicated protection. 50% capacity required.
Popular for low speed local exchange and access network (OC-3 and OC-12)
Simple
SONET - UPSR

SONET BLSR

Working traffic on both directions.
At line or section layer. Done by the nodes adjacent to the failure.
4 bit address. At most 16 nodes.
Protection capacities can be shared.
Protection capacities can carry low priority traffic.
Widely deployed in long-haul and inter-office network.
SONET BLSR/4

4 fibers. Two working, two protection.
Shortest path routing.
Span switching on transmitter or receiver failure. Activate the protection fiber on the same link.
Ring switching on node failure or fiber cut. Activate the protection fiber around the ring.
Most complex signaling.

BLSR/4 Span Switching
**BLSR/4 Ring Switching**

![Diagram of BLSR/4 Ring Switching](image)

**SONET BLSR/2**

2 fibers. Half the capacity of each fiber is reserved for protection.
Shortest path routing.
Ring switching only. Less capable than BLSR/4.
Complex signaling.
BLSR/2

Optical Layer Protection

Optical Multiplex Section (OMS) Protection
  Operate on all wavelengths in a fiber link
  OMS-DPRing, OMS-SPRing

Optical Channel (OCh) Protection
  Operate on individual light path
  Cost may be higher than OMS protection
  OCh-SPRing
OMS-DPRing

Similar to SONET UPSR.
One possible configuration on page 572 in textbook.

OMS-SPRing

Similar to SONET BLSR.
On 4 fiber configuration, both span switching and ring switching are supported.
**OMS-SPRing**

**OCh-SPRing**

Similar to SONET BLSR
Operate on wavelengths instead of SONET OCs and STS’s