SONET/SDH

✓ SONET is the TDM optical network standard for North America

✓ SONET is called Synchronous Digital Hierarchy (SDH) in the rest of the world

✓ SONET is the basic physical layer standard

✓ Other data types such as ATM and IP can be transmitted over SONET

✓ OC-1 consists of 810 bytes over 125 us; OC-*n* consists of 810*n* bytes over 125 us

✓ Linear multiplexing and de-multiplexing is possible with Add-Drop-Multiplexers

✓ The SONET/SDH standards enable the interconnection of fiber optic transmission equipment from various vendors through multiple-owner trunk networks.

✓ The basic transmission bit rate of the basic SONET signal is

✓ In SDH the basic rate is 155.52 Mb/s.

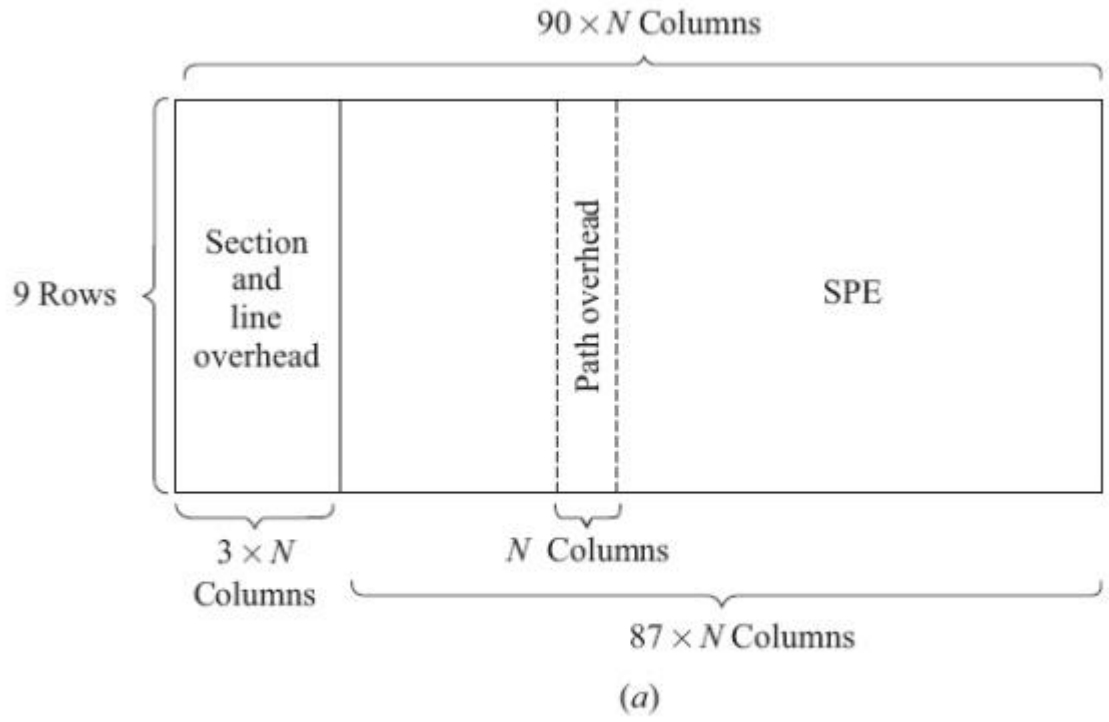


Figure 5.1 Basic formats of an STS-N SONET frame

[Source: htpp://img.brainkart.com]

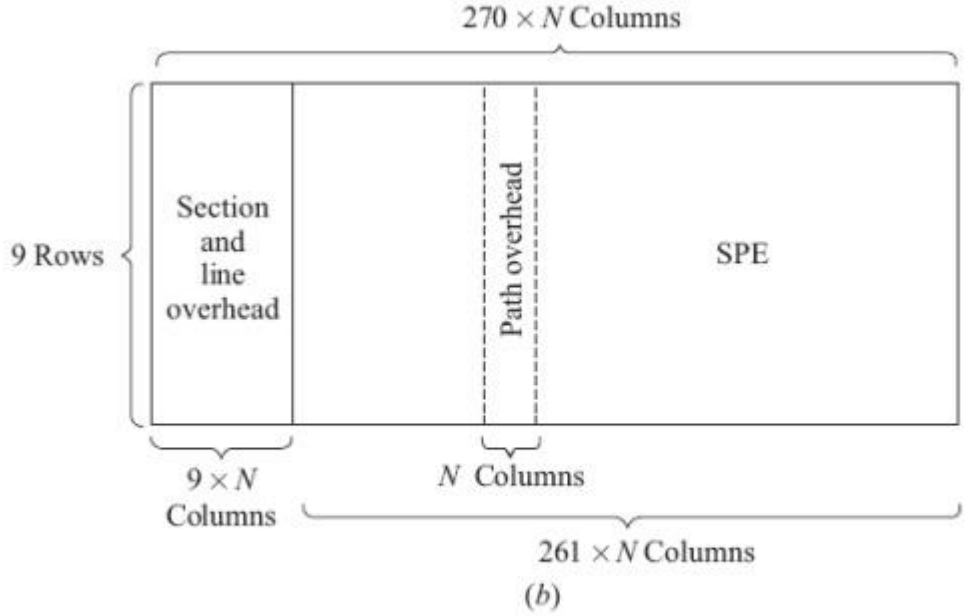


Figure 5.2 Basic formats of an STM-N SDH frame

[Source: htpp://img.brainkart.com]

Common values of OC-N and STM-N:

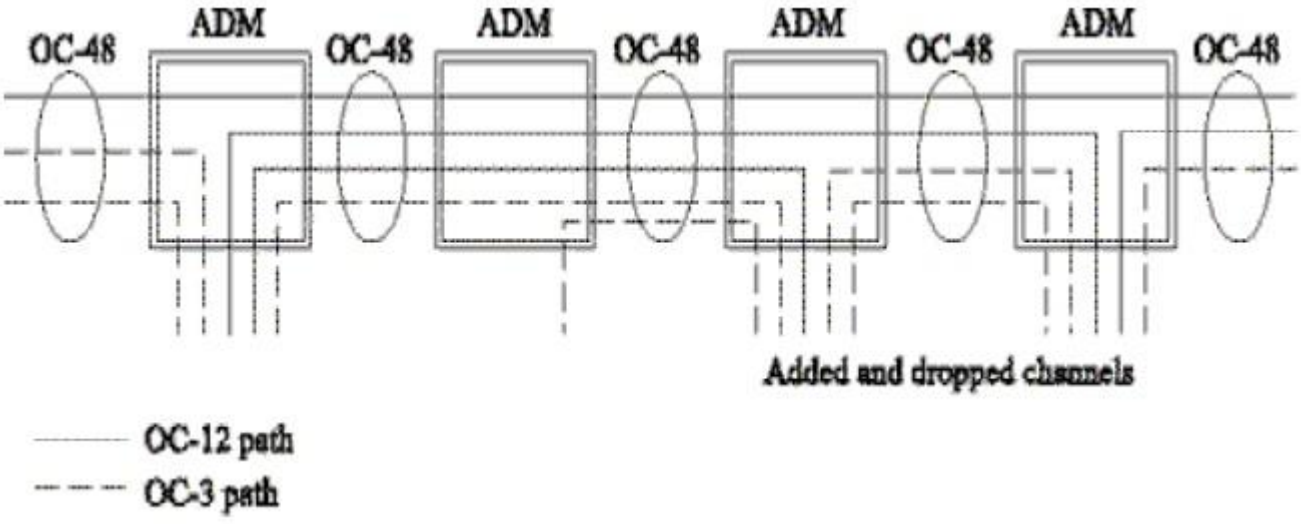
✓ OC stands for optical carrier. It has become common to refer to SONET links as OC-N links.

✓ The basic SDH rate is 155.52 Mb/s and is called the synchronous transport module—level 1 (STM 1).

SONET level	*Electrical level*	*SDH level*	*Line rate (Mb/s)*	*Common rate name*
OC-N	STS-N	—	N × 51.84	—
OC-1	STS-1	—	51.84	—
OC-3	STS-3	STM-1	155.52	155 Mb/s
OC-12	STS-12	STM-4	622.08	622 Mb/s
OC-48	STS-48	STM-16	2488.32	2.5 Gb/s
OC-192	STS-192	STM-64	9953.28	10 Gb/s
OC-768	STS-768	STM-256	39813.12	40 Gb/s

[Source: htpp://img.brainkart.com]

SONET Add Drop Multiplexers:



[Source: htpp://img.brainkart.com]

SONET ADM is a fully synchronous, byte oriented device, that can be used add/drop OC sub-channels within an OC-*N* signal

Ex: OC-3 and OC-12 signals can be individually added/dropped from an OC-48 carrier

SONET/SDH Rings:

✓ SONET and SDH can be configured as either a ring or mesh architecture

✓ SONET/SDH rings are *self-healing rings* because the traffic flowing along a certain path can be switched automatically to an alternate or standby path following failure or degradation of the link segment

✓ Two popular SONET and SDH networks:

– 2-fiber, unidirectional, path-switched ring (2-fiber UPSR)

– 2-fiber or 4-fiber, bidirectional, line-switched ring (2-fiber or 4-fiber BLSR)

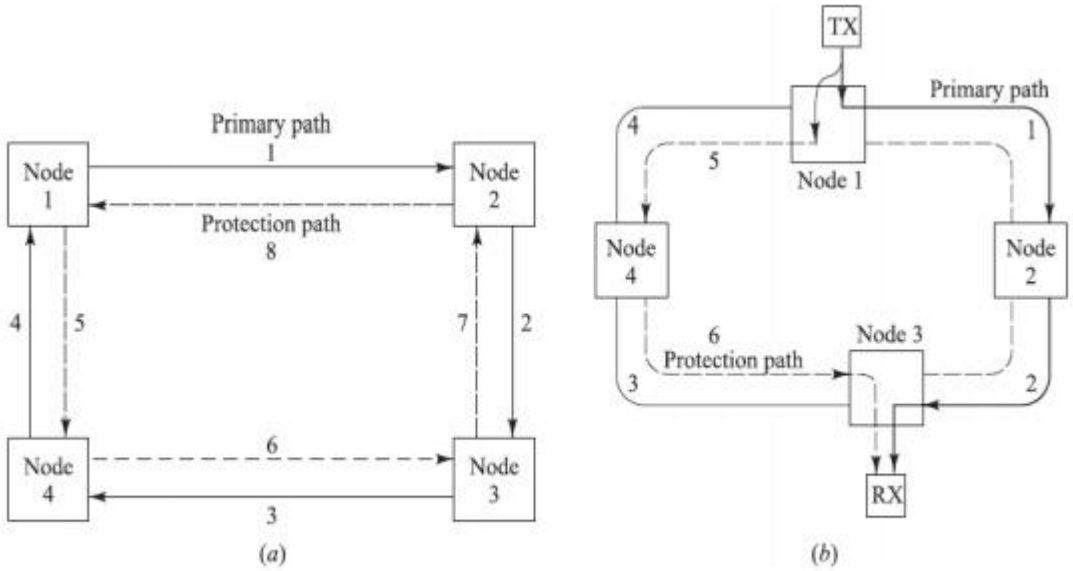
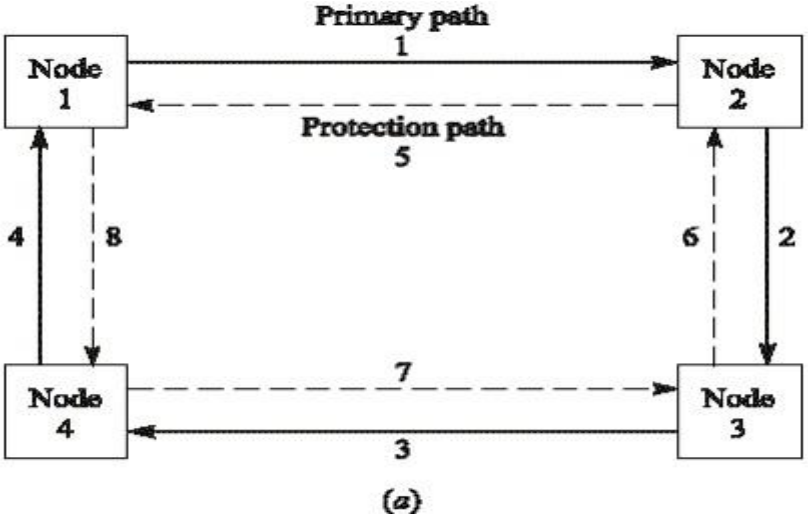


Figure 5.3 Generic 2-fiber UPSR with a counter-rotating protection path



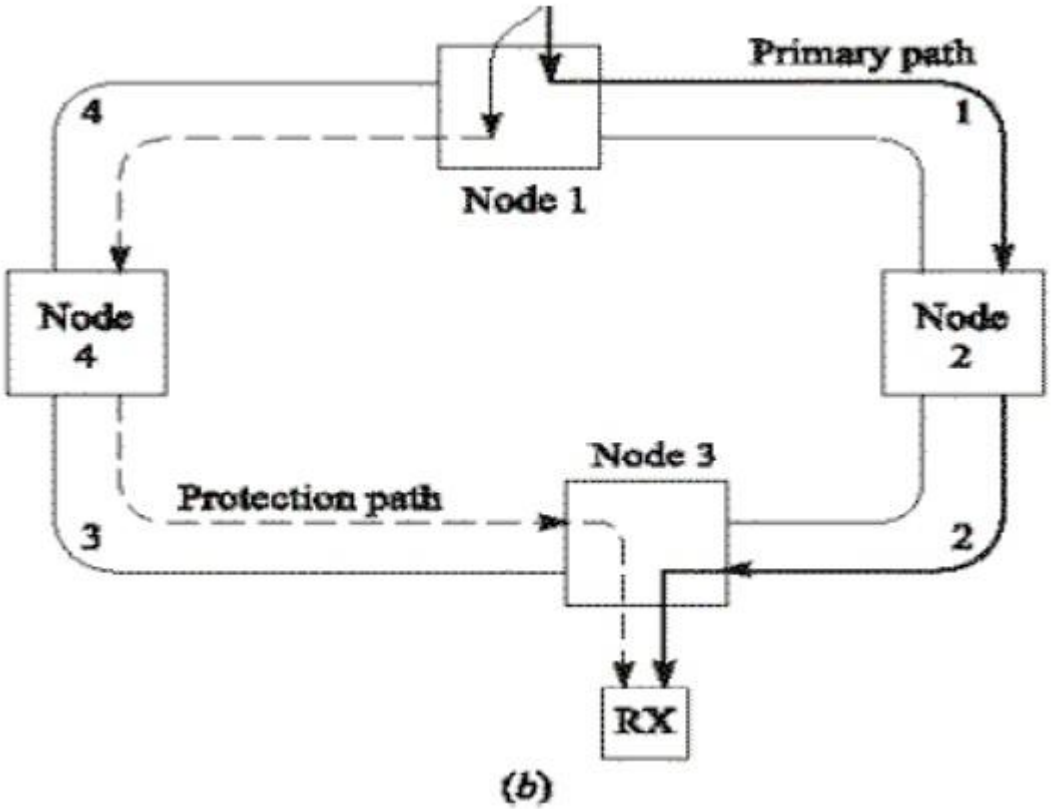
[Source: htpp://img.brainkart.com]

Ex: Total capacity OC-12 may be divided to four OC-3 streams, the OC-3 is called a path here

2-Fiber UPSR Protection:

✓ Rx compares the signals received via the primary and protection paths and picks the best one

✓ Constant protection and automatic switching

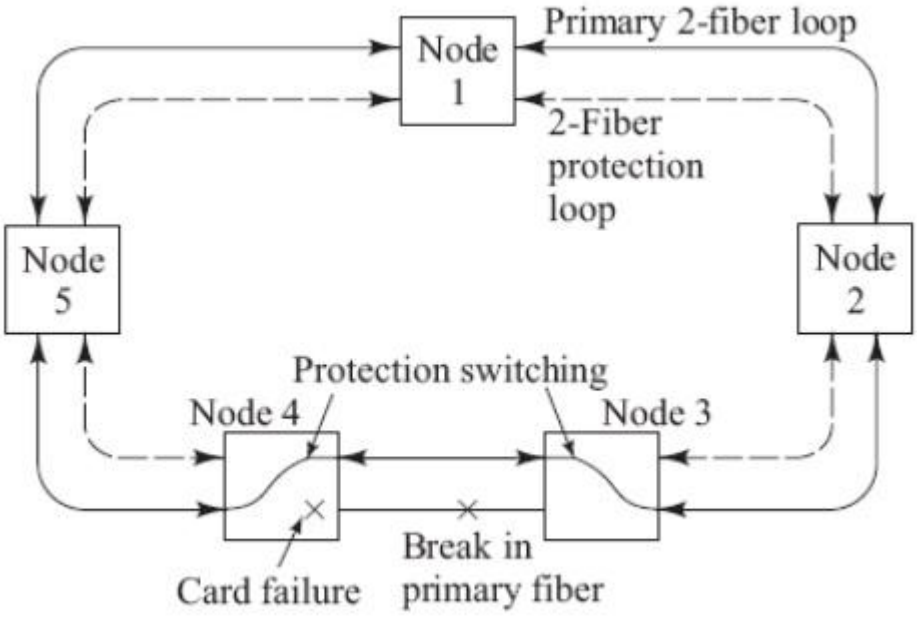


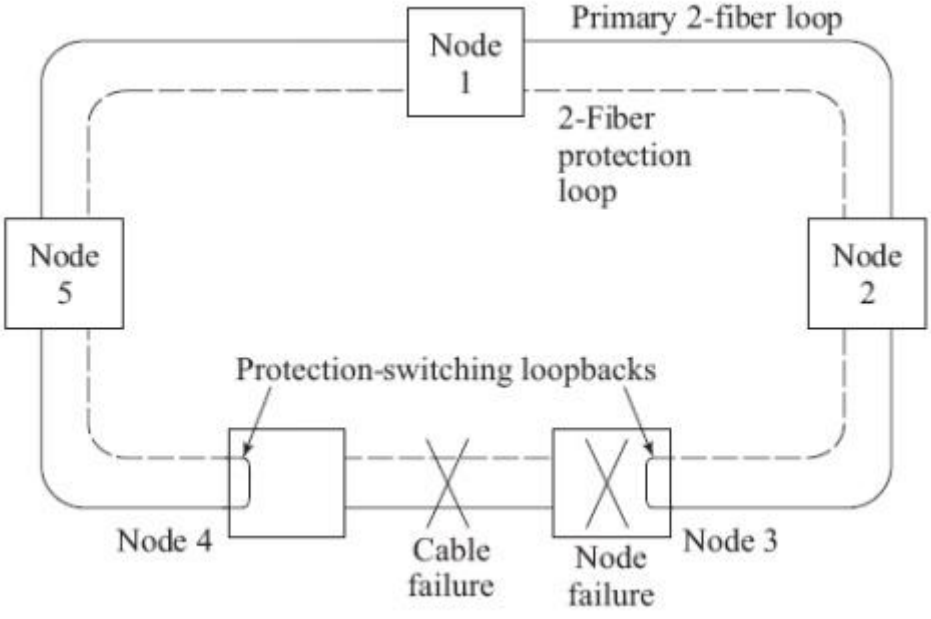
[Source: htpp://img.brainkart.com]

BLSR Recovery from Failure Modes:

✓ If a primary-ring device fails in either node 3 or 4, the affected nodes detect a loss-of-signal condition and switch both primary fibers connecting these nodes to the secondary protection pair

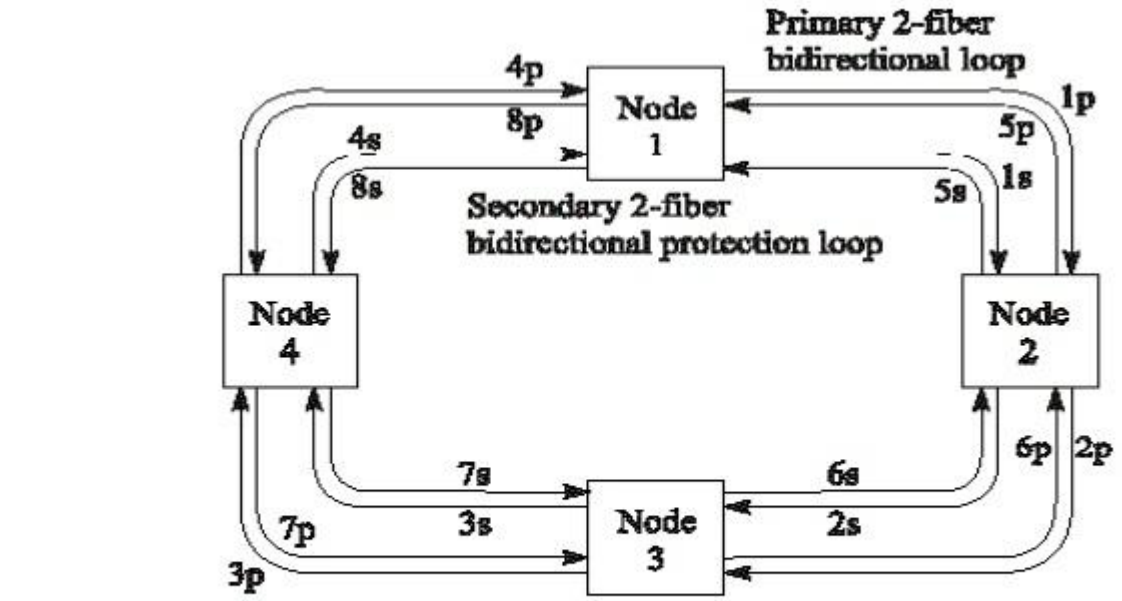
✓ If an entire node fails or both the primary and protection fibers in a given span are severed, the adjacent nodes switch the primary-path connections to the protection fibers, in order to loop traffic back to the previous node.





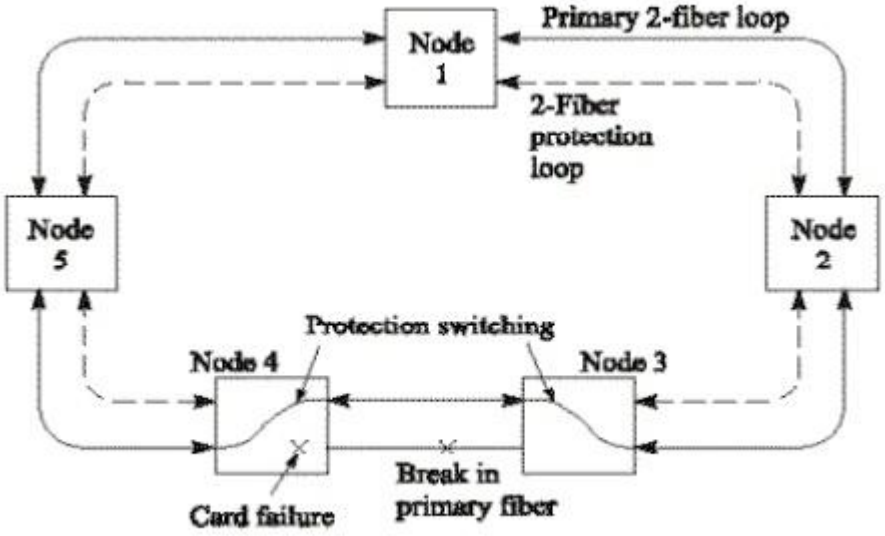
[Source: htpp://img.brainkart.com]

4-Fiber BLSR Basics:



[Source:htpp://img.brainkart.com]

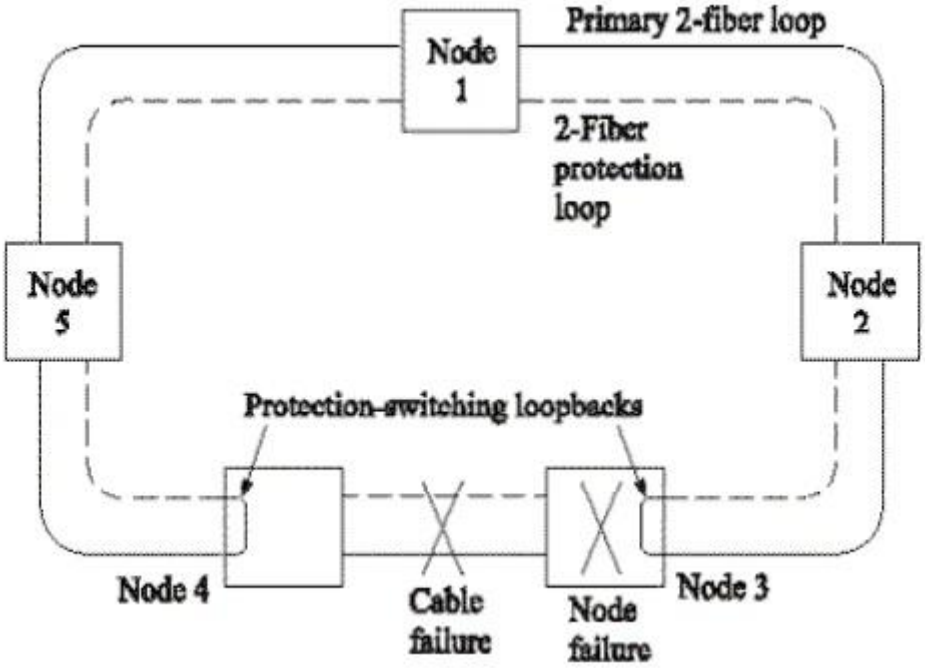
BLSR Fiber-Fault Reconfiguration:



[Source: htpp://img.brainkart.com]

In case of failure, the secondary fibers between only the affected nodes (3 & 4) are used, the other links remain unaffected

BLSR Node-Fault Reconfiguration:



[Source: htpp://img.brainkart.com]

If both primary and secondary are cut, still the connection is not lost, but both the primary and secondary fibers of the entire ring is occupied.