Network Technologies

MTTF of a fiber link.

Transmission links can be deployed with protection channels, wherein if the primary link is disrupted, the system switches to a protection channel. Fiber cable is typically the transmission medium of choice for these link systems. Figures 1, 2 and 3 show the structure of link systems. Link systems can be generally classified as one of three cases:

- Case A is the single-fiber system with no backup (shown in Fig. 1);
- Case B has redundant fiber media backup. Redundant circuits are supposed to take different physical paths (shown in Fig. 2);
- Case C has fiber media, transceiver, and power backup, with the transceivers being in hot standby (shown in Fig. 3).

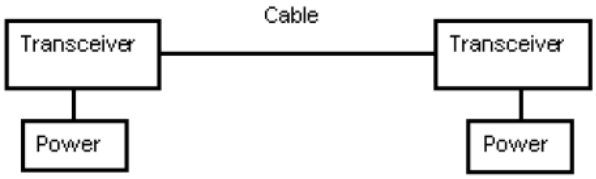

Figure 1. Unprotected link

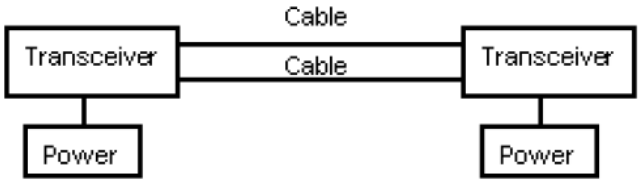

Figure 2. Partially protected link

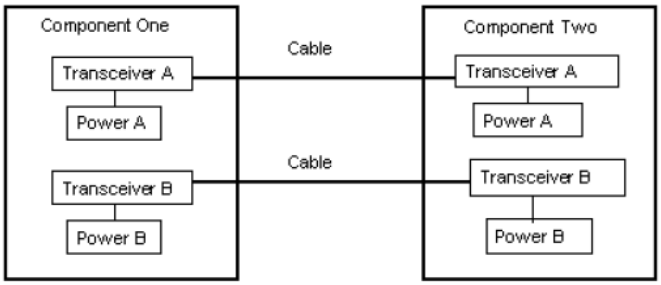

Figure 3. Fully protected link

For long optical fiber links, cable cuts are the dominant failure scenario (table 1 shows the optical fiber MTTF at different distances). Instead, for short fiber links (less than about 5 miles), the optical fiber MTTF is quite high, so that the transceiver and power systems become the dominant contribution to failure, rather than the fibers.
Assuming that the Transceiver MTTF is equal to **8.0 years**, that the Power MTTF is equal to **8.0 years** and that the Times To Failure of a fiber cable, a power supply and a transceiver are independent, exponentially distributed random variables, evaluate a) the MTTF of a 10-mile link without protection, b) the MTTF of a 10-mile, partially protected link, c) the MTTF of a 10-mile link, fully protected link.

Table 1

Link Length (Miles)	Optical Fiber MTTF (Years)
1	222.79
5	45.56
10	22.78
20	11.39