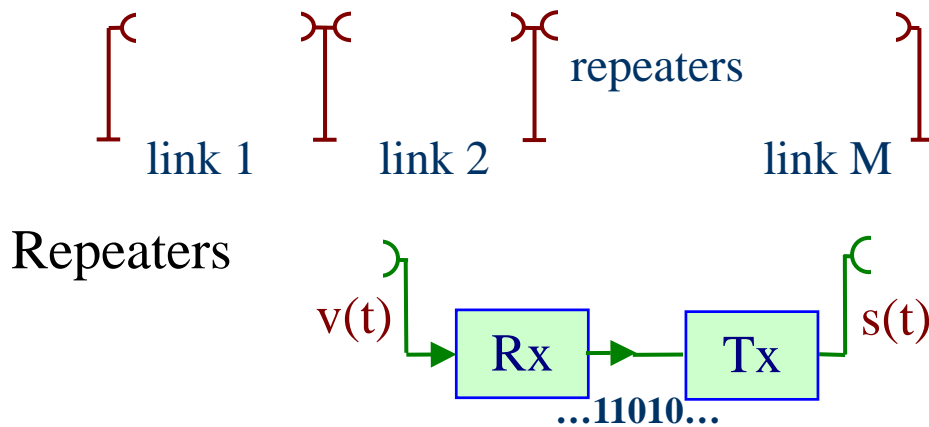


3.2 Regeneration Effect for Repeaters



- noise-free signal is regenerated for transmission, but with possible errors
- P : bit error probability for a signal link
- P_e : bit error probability for a total of M links

$$P_e = \sum_{n=1}^M \binom{M}{n} P^n (1-P)^{M-n}$$

n: odd

$$\text{let } P_e' = \sum_{n=1}^M \binom{M}{n} P^n (1-P)^{M-n}$$

n: even

$$P_e + P_e' = [P + (1-P)]^M = 1$$

$$P_e' - P_e = [(1-P) - P]^M = (1-2P)^M$$

$$\therefore P_e = \frac{1}{2} [1 - (1-2P)^M] \approx MP \quad \text{if } P \text{ small}$$

$$\text{example : } M = 20, P_e = 10^{-6}, P = 5 \times 10^{-8}$$

- Data can be transmitted very far with desired quality at reasonable price (limited incremental E_b / N_0)
- errors can be very limited in each link