

Your name:

Suppose Bernard and Bernice are 3000 km apart. Bernice sends Bernard an image of size 4×10^7 B. The communications link runs at 320,000 b/s. The signal is passing through a vacuum at 3×10^8 m/s. How soon after Bernice starts sending the image can Bernard see the whole thing? Show both the transmit time and the propagation delay. Reminder: transmit time is the time it takes to place the signal on the link, and propagation delay is the time it takes a signal to traverse the link.

First, the transmit time:

$$\begin{aligned}t_{\text{emit}} &= \frac{\text{msg size}}{\text{throughput}} \\&= \frac{4 \times 10^7 B}{320000 b/s} \\&= \frac{32 \times 10^7 b}{32 \times 10^4 b/s} \\&= 1 \times 10^3 s \\&= 1000 s\end{aligned}$$

Second, the propagation delay:

$$\begin{aligned}t_{\text{prop}} &= \frac{\text{distance}}{\text{speed}} \\&= \frac{3000 km}{3 \times 10^8 m/s} \\&= \frac{10^6}{10^8} s \\&= 10^{-2} s\end{aligned}$$

So the total time is 1000.01s.