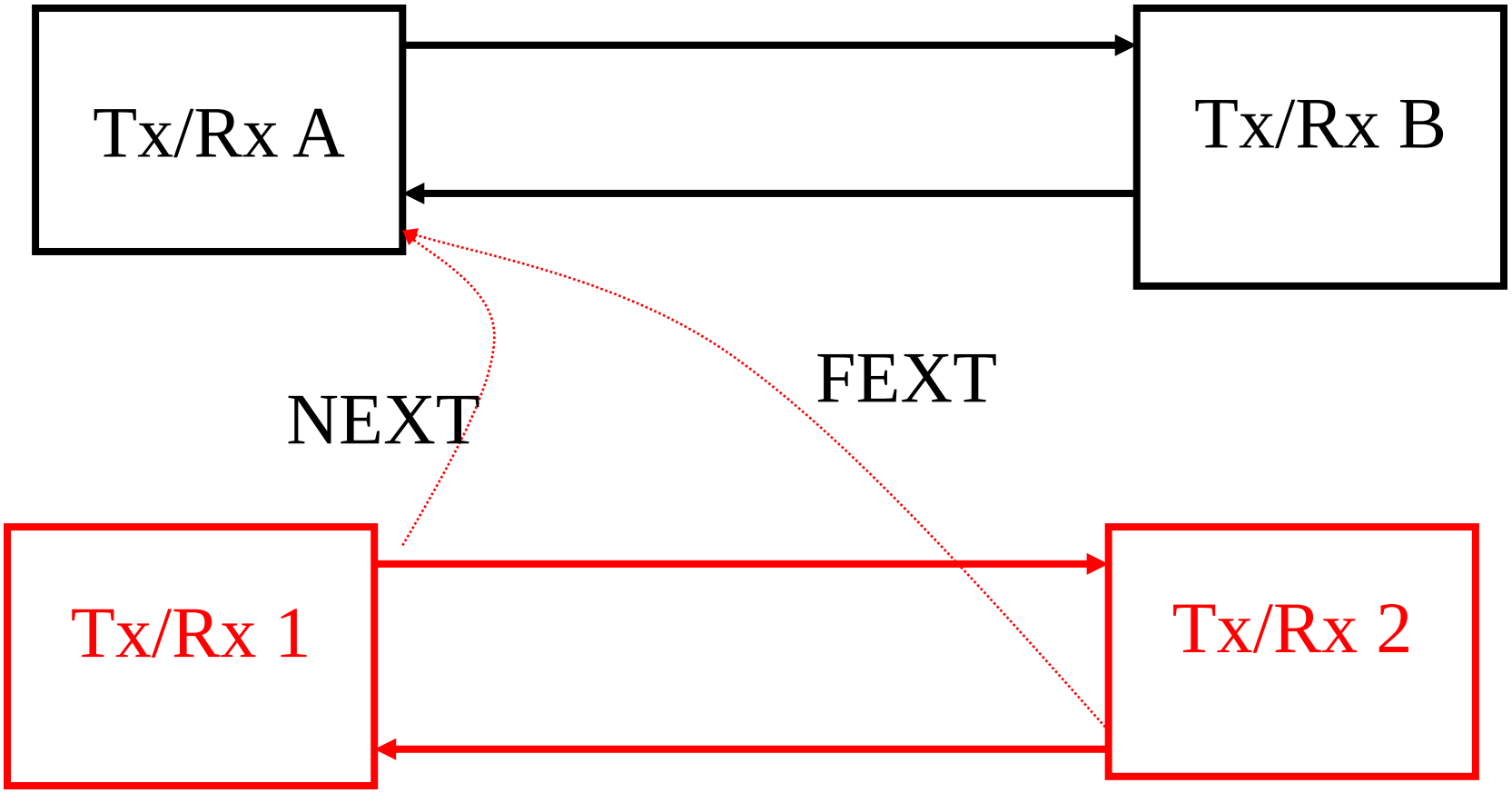
The Wireline Channel

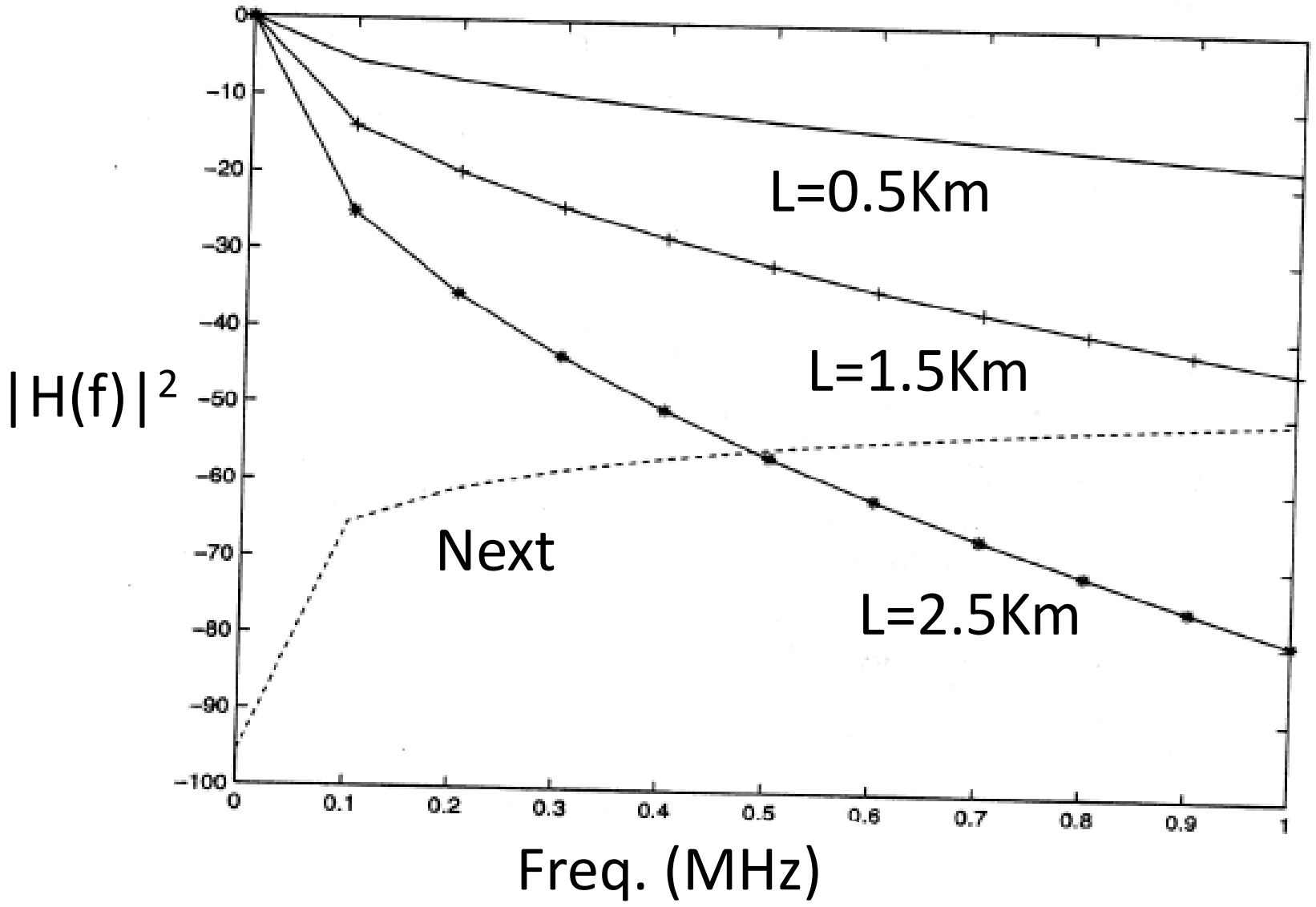
The Wireline Channel

- The channel is limited by a low pass filter at the central office (CO), $BW \approx 3.5KHz$
- The attenuation of the channel is proportional to the length of the subscriber loop (twisted pair)
- Near End Crosstalk (NEXT) and Far End Crosstalk (FEXT).
- Transfer function of wire channel $\left|H_c(f)\right|^2 \propto e^{-kL\sqrt{f}}$
- Transfer function of NEXT $\left|H_N(f)\right|^2 \propto f^{3/2}$
- Transfer function of FEXT $\left|H_F(f)\right|^2 \propto f^2$

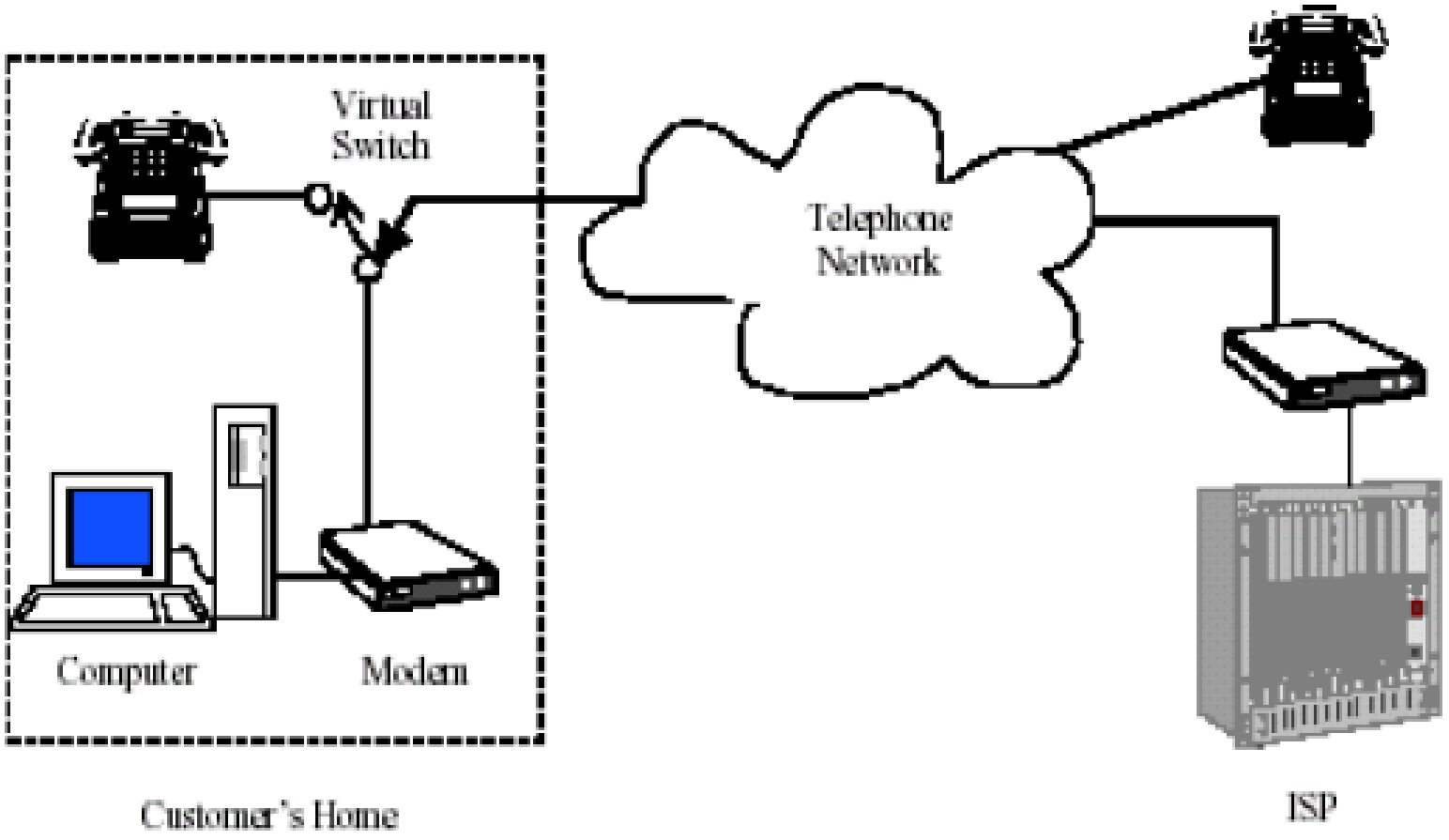
NEXT and FEXT



PSD of Channels and NEXT



Voiceband Modems (VBM)



Evolution of VBM

Low-speed Modems

Standard	modulation	bps	Date	Notes
V.21	FSK	300	Early 70s	Ch 1: 1270Hz,1070Hz Ch 2: 2225Hz,2025Hz
V.22	4DPSK	1200	Late 70s	Channels: 1200Hz, and 2400Hz
V.22bis	16QAM	2400	1984	600 baud

VBM

Medium speed Modems

Standard	modulation	bps	Date	Notes
v.32	16 or 32 (TCM) QAM	9600	1984	Band=600-3000Hz

VBM

High speed modems

Standard	modulation	bps	Date	Note
V.32bis	128QAM	14400	1991	Trellis coded
V.34	Up to 1664QAM	33600	1994	1200Hz, and 2400Hz
V.90	PAM	56000 downstream, 33600 upstream	1998	Digital modem