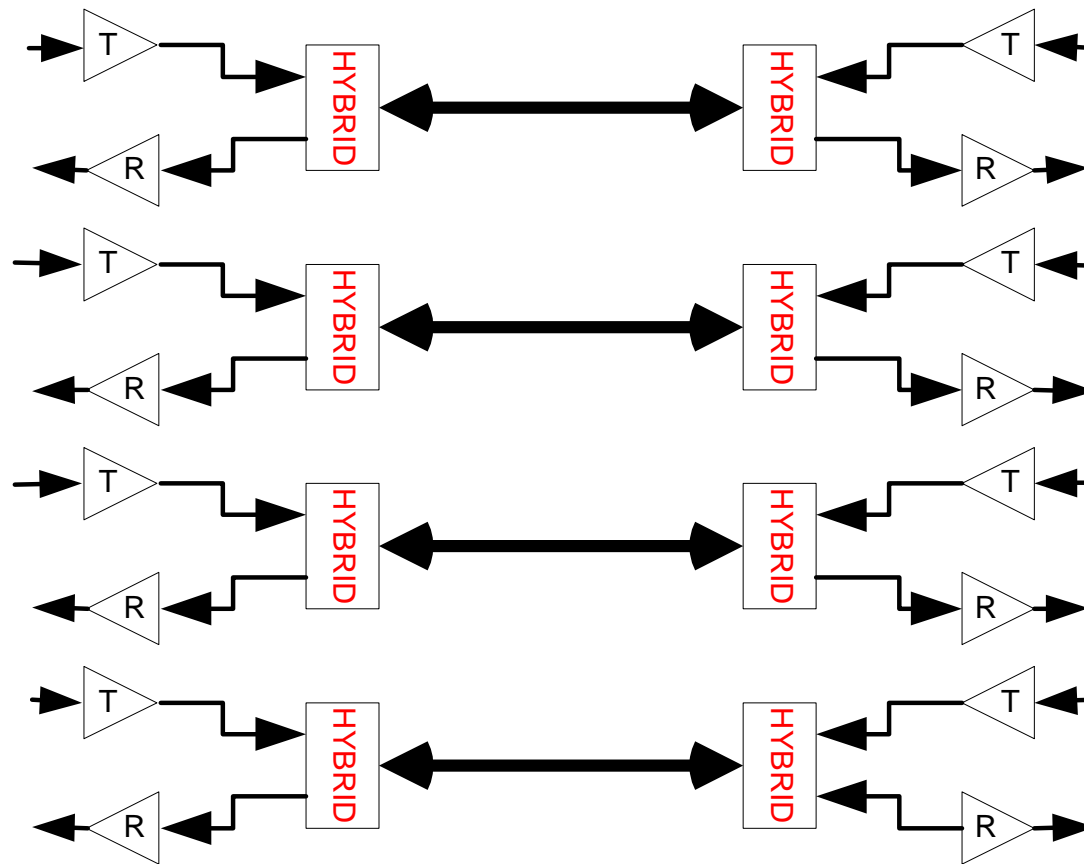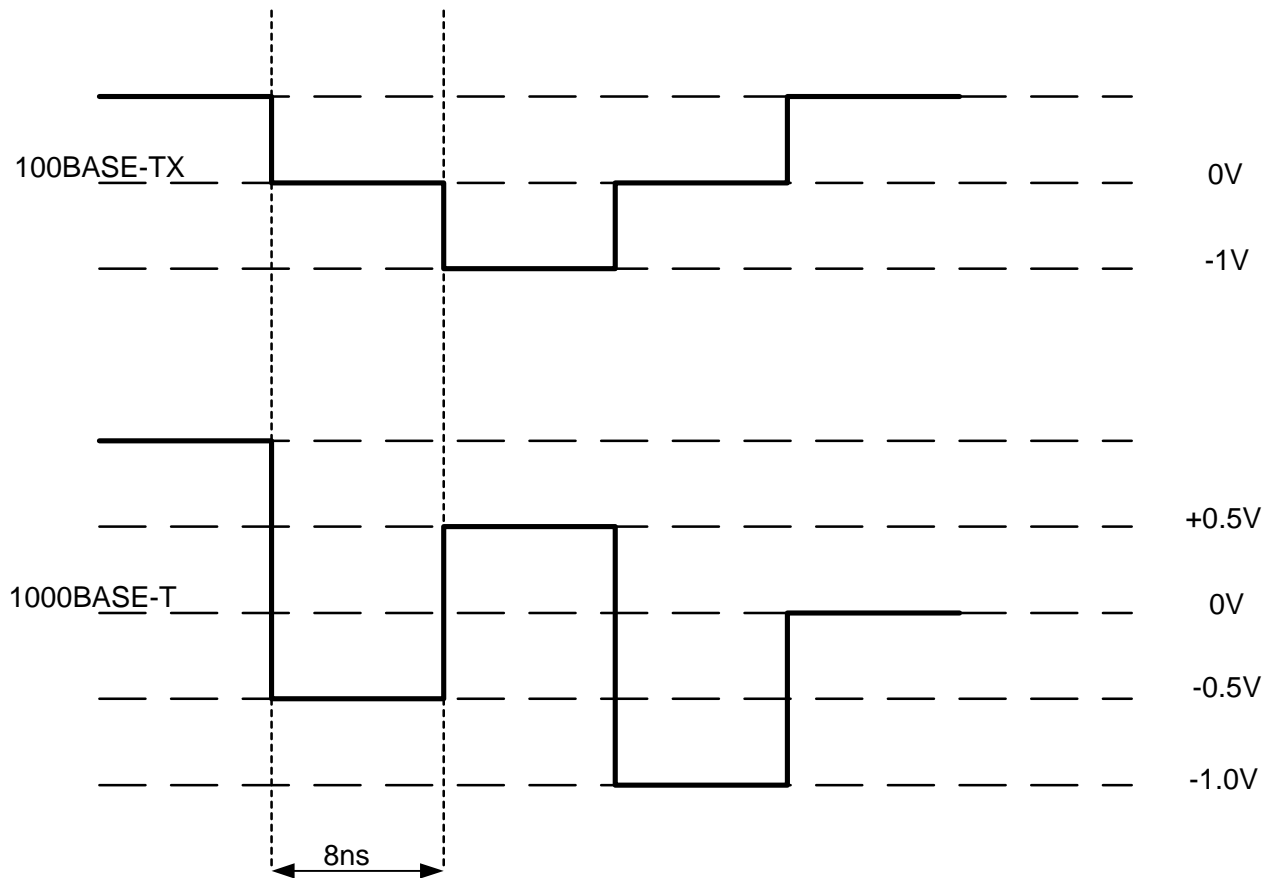# How 1000BASE-T Works

Geoff Thompson

IEEE802.3 Plenary
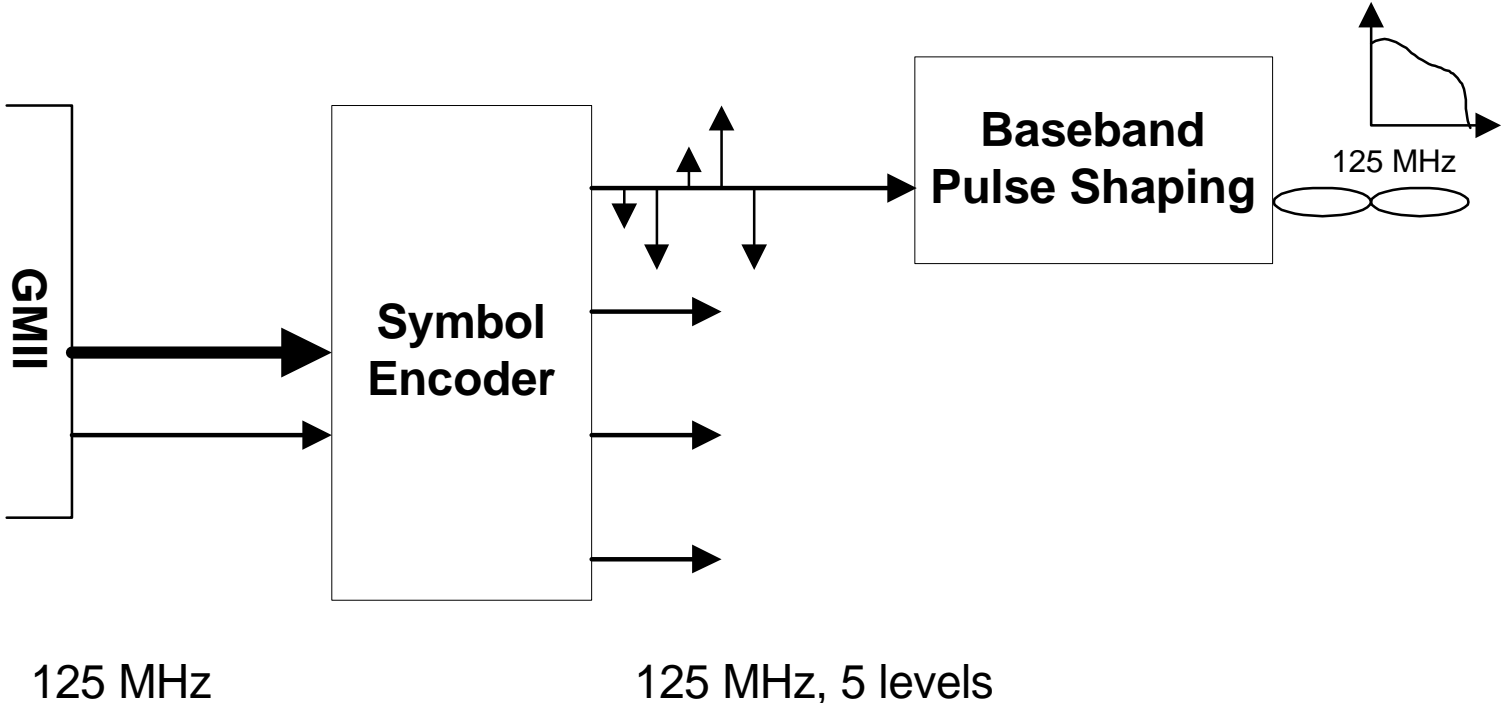
13 Nov 97, Montreal PQ CANADA

Use all four pairs with full-duplex transmission on each pair. (Requires hybrid.)

Use 5-Level Phase Amplitude Modulation (PAM) signaling to increase the amount of information transmitted with each code point.
5 X 5 X 5 X 5 = 625 code points

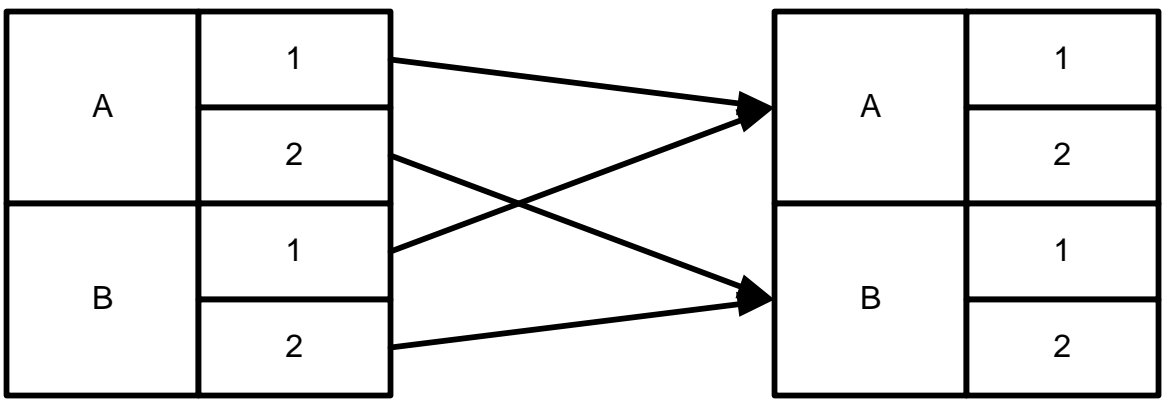# Shape the signal pulse so it conforms to the shape of 100BASE-TX

GMII

Symbol Encoder
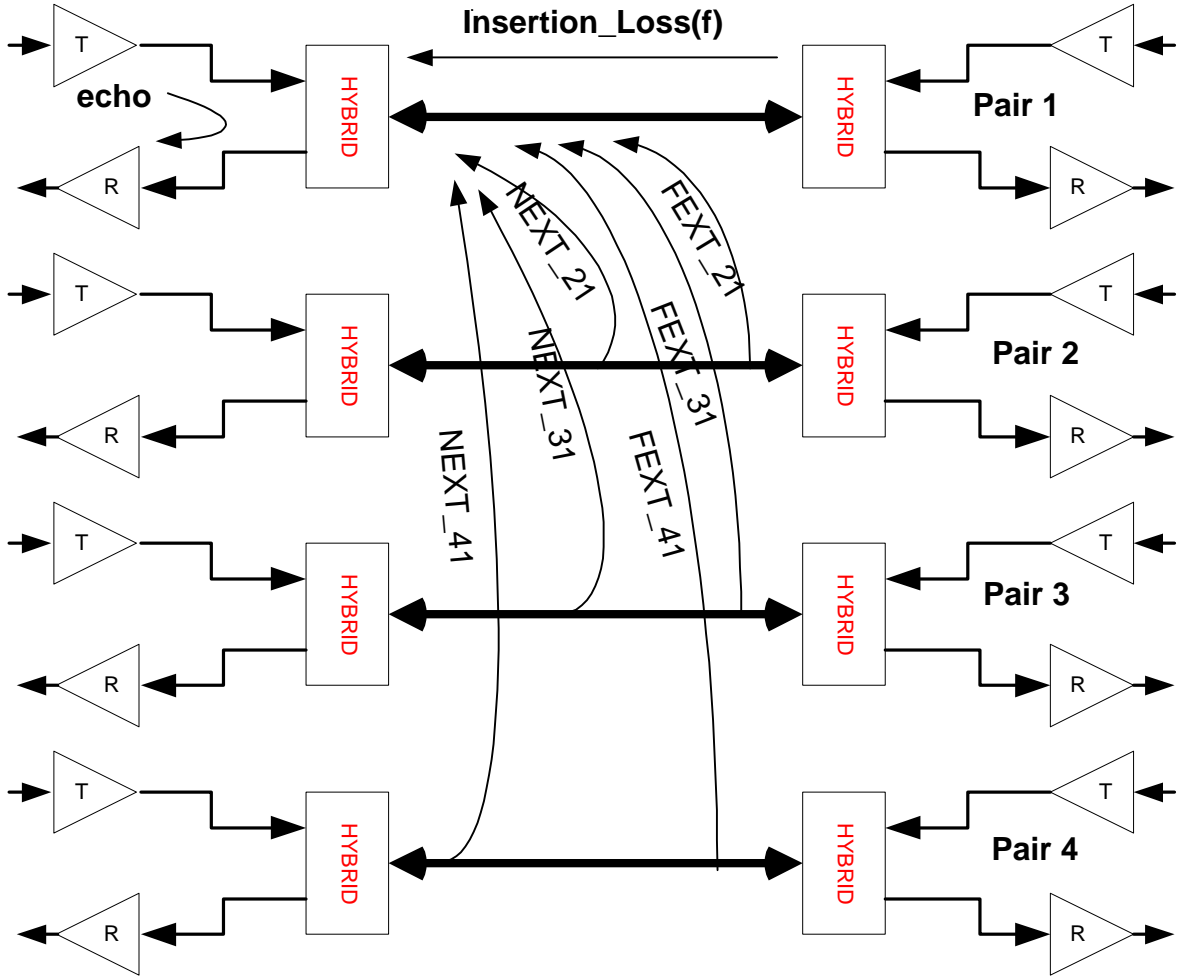
Baseband Pulse Shaping

125 MHz

125 MHz

125 MHz, 5 levels

5-level signaling reduces noise immunity. Use Forward Error Correction to increase noise immunity.
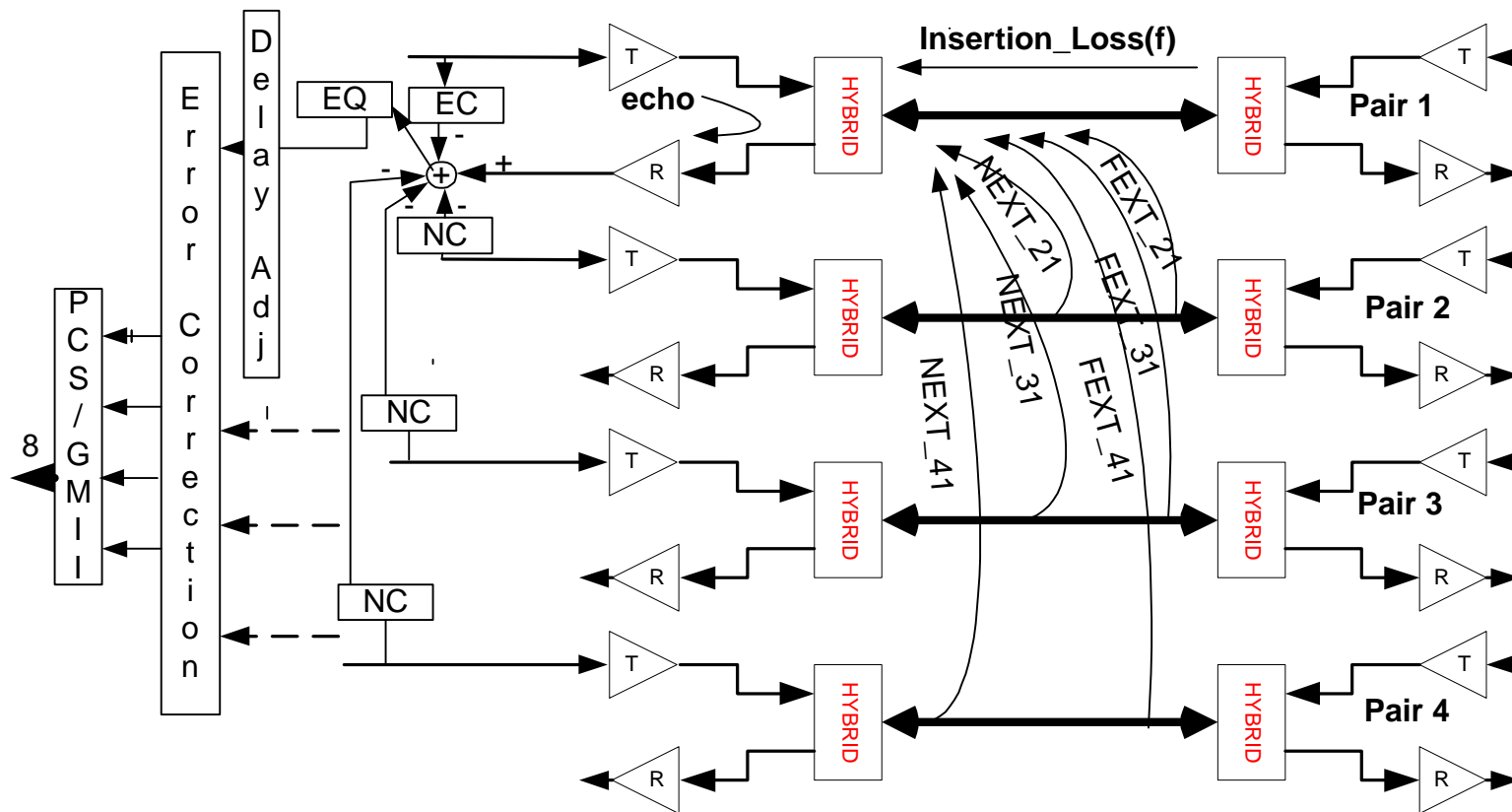625 code points allow 2X redundancy (256 X 2 = 512) with additional code points for control.
Organize code points in subsets so that each arriving code point defines the subset membership of the next code point.

Using four pair and full-duplex on each pair introduces echo and crosstalk

1000BASE-T uses DSP-based adaptive filtering to cancel the effects of echo, crosstalk and noise

1000BASE-T

- 125 MHz clock
- Four pair
- PAM 5 coding on each pair
- One byte per BAUD over four pair
- Full-duplex on each pair