RX Decision Feedback Equalization (DFE)

- DFE is a **non-linear** equalizer
- Slicer makes a **symbol decision**, i.e. quantizes input
- ISI is then directly subtracted from the incoming signal via a feedback FIR filter

\[ z_k = y_k - w_1 \tilde{d}_{k-1} - \cdots - w_{n-1} \tilde{d}_{k-(n-1)} - w_n \tilde{d}_{k-n} \]
RX Decision Feedback Equalization (DFE)

- **Pros**
  - Can boost high frequency content without noise and crosstalk amplification
  - Filter tap coefficients can be adaptively tuned without any back-channel

- **Cons**
  - Cannot cancel pre-cursor ISI
  - Chance for error propagation
    - Low in practical links (BER=10^{-12})
  - Critical feedback timing path
  - Timing of ISI subtraction complicates CDR phase detection

\[ z_k = y_k - w_1 \hat{d}_{k-1} - \cdots - w_{n-1} \hat{d}_{k-(n-1)} - w_n \hat{d}_{k-n} \]
DFE Example

- If only DFE equalization, DFE tap coefficients should equal the unequalized channel pulse response values \([a_1 \ a_2 \ldots \ a_n]\).

- With other equalization, DFE tap coefficients should equal the pre-DFE pulse response values.

\[
[w_1 \ w_2] = [a_1 \ a_2]
\]