

White Rabbit Core Hands-on Training

Day 2

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Goals

Previously....

- Introduction to White Rabbit and WR PTP Core (WRPC).
Setting up environment.
- Synthesizing & simulating the WR Core and simulating streamers.

Today:

- Hardware demo of data streaming
- Transmission latency measurement
- Questions & Answers

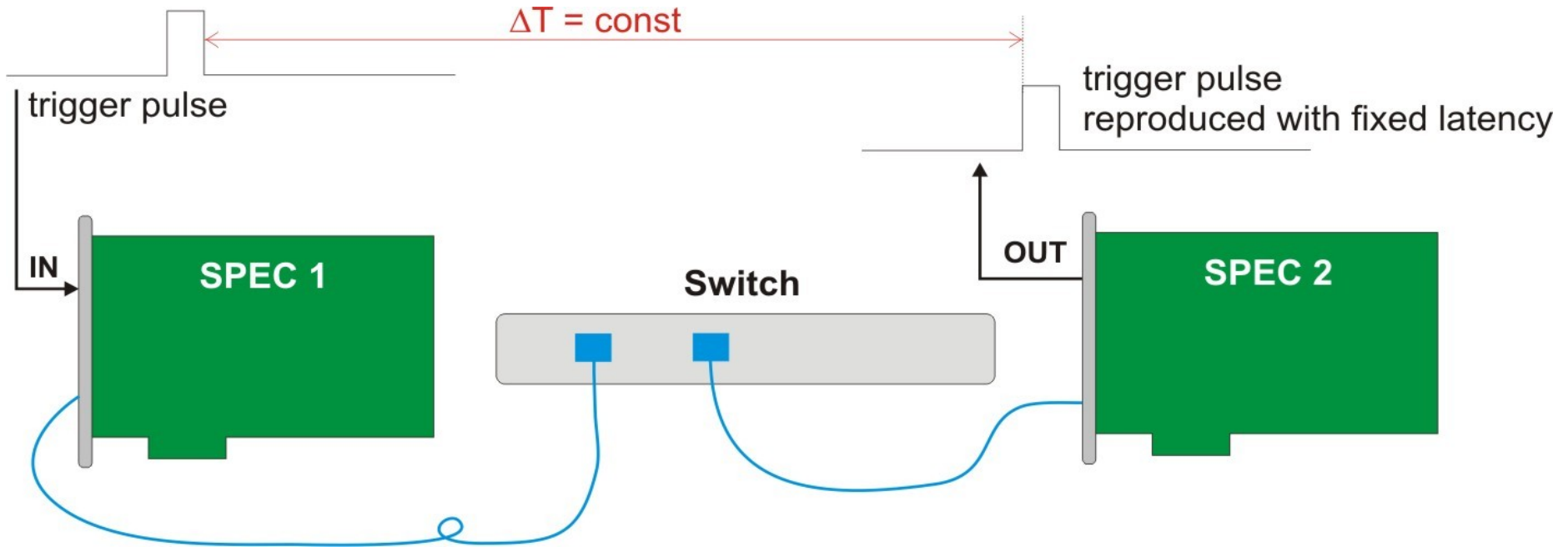
Today's agenda

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- 9:00** More on Streamers. Latency measurement.
- 10:30** Questions & Answers
- 12:00** Lunch break
- 14:00** More Questions & Answers if necessary

Streamer hardware demo

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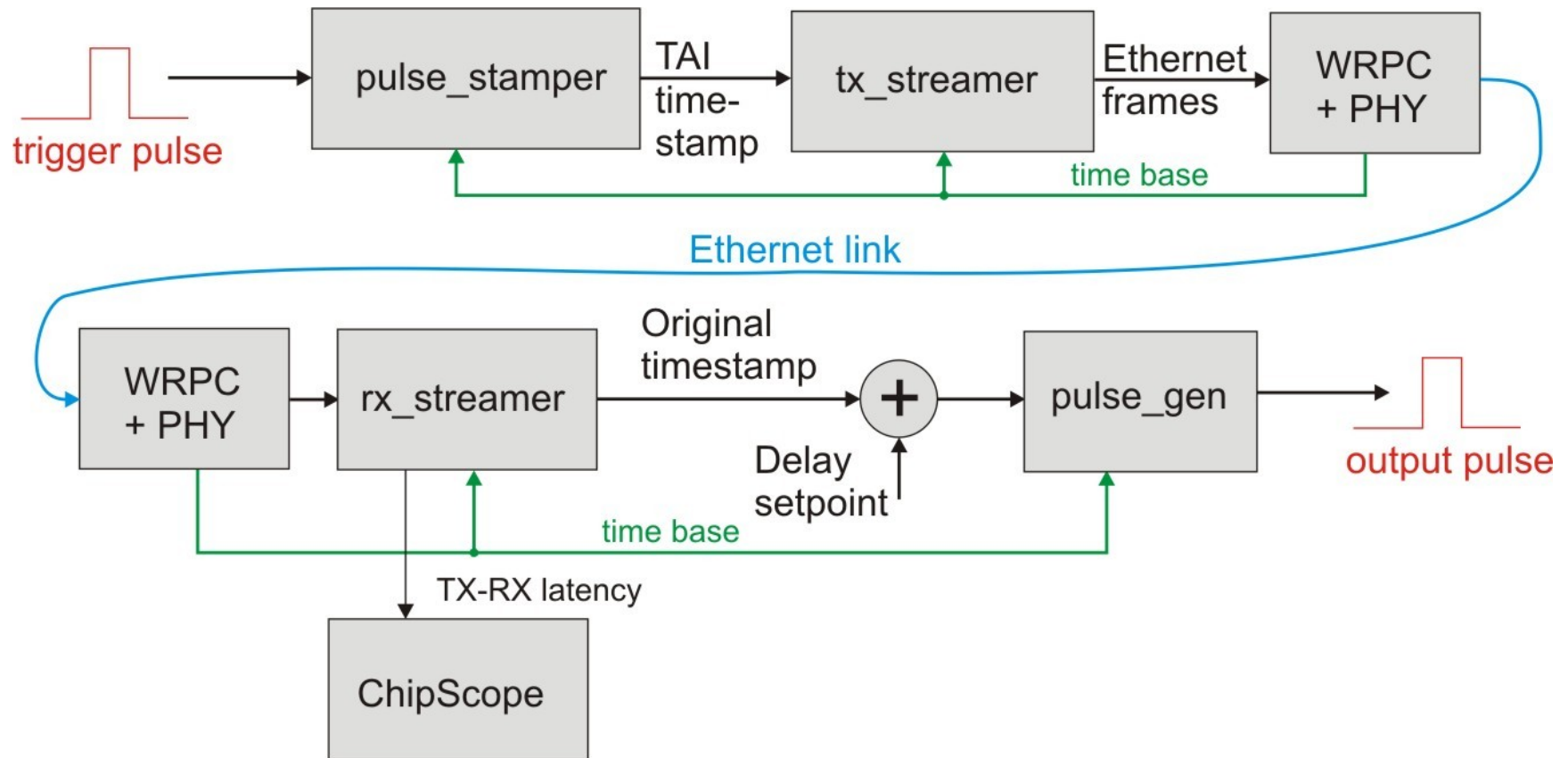


Lesson 04a

- Tag input pulses on one SPEC card, broadcast time tags
- Adjust time tag by fixed delay and reproduce the pulse with fixed latency on another SPEC

Streamer hardware demo

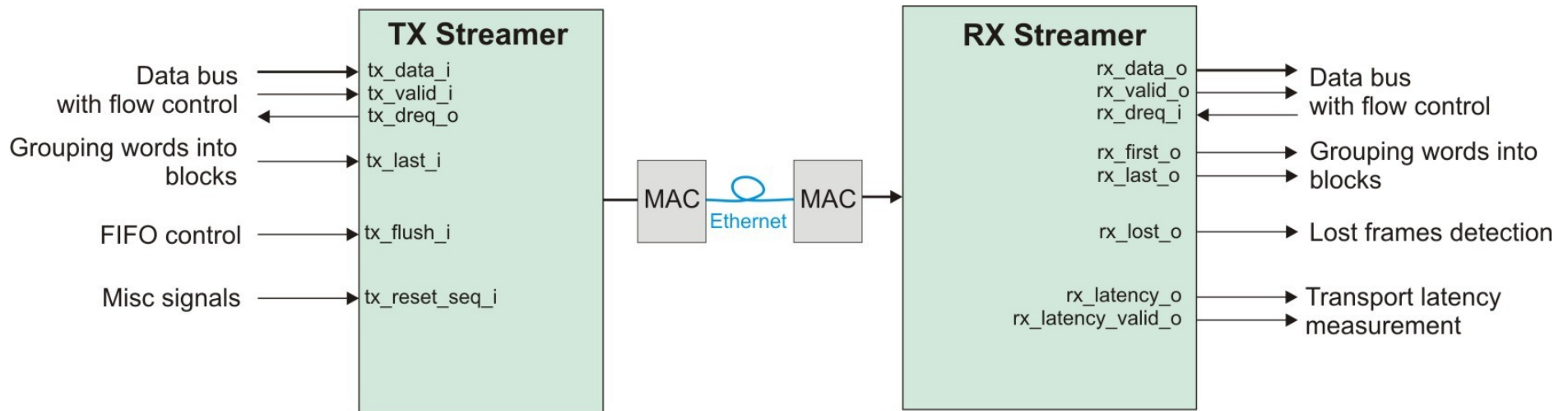
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- Delay fixed to 20 us for simplicity
- ChipScope for latency measurement

Streamers

- **TX streamer** takes a series of data words and encapsulates them into Ethernet frames
- **RX streamer** does the opposite: decodes Ethernet frames into series of data words
- User interface of a TX-RX streamer pair looks like a typical FIFO, with an Ethernet link inside.



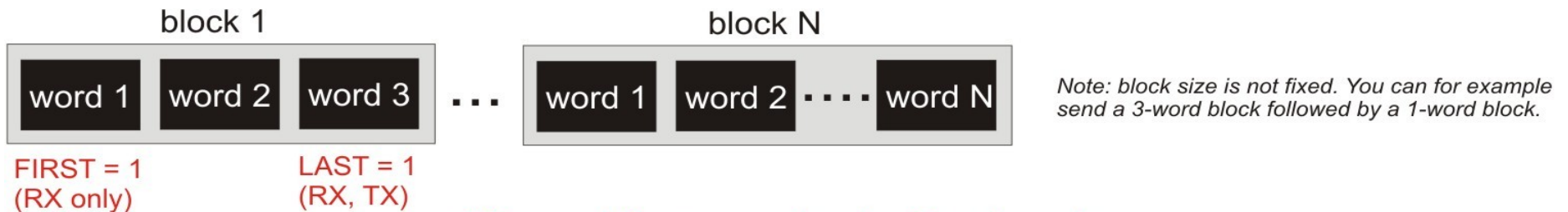
Streamers

- Basic data unit is a **word** of $N * 16$ bits: `g_data_width` parameter
- Data words can be grouped into **blocks** of any reasonable size (not bigger than maximum Ethernet frame length)
- Example: sending 5 channel 24-bit audio data: blocks containing 5 32-bit words.
- Data word width must be identical on both sides

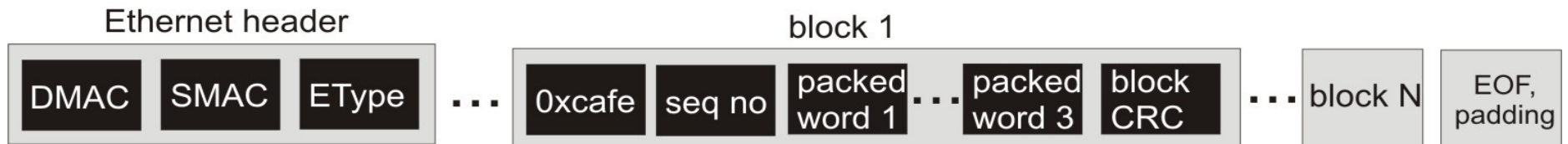
Frame encapsulation

- Each frame contains at least one block (with at least one data word)
- Each block has its own independent CRC. This allows for verifying the contents before end of Ethernet frame, minimizing latency.

Streamer user interface (data, valid, first, last)

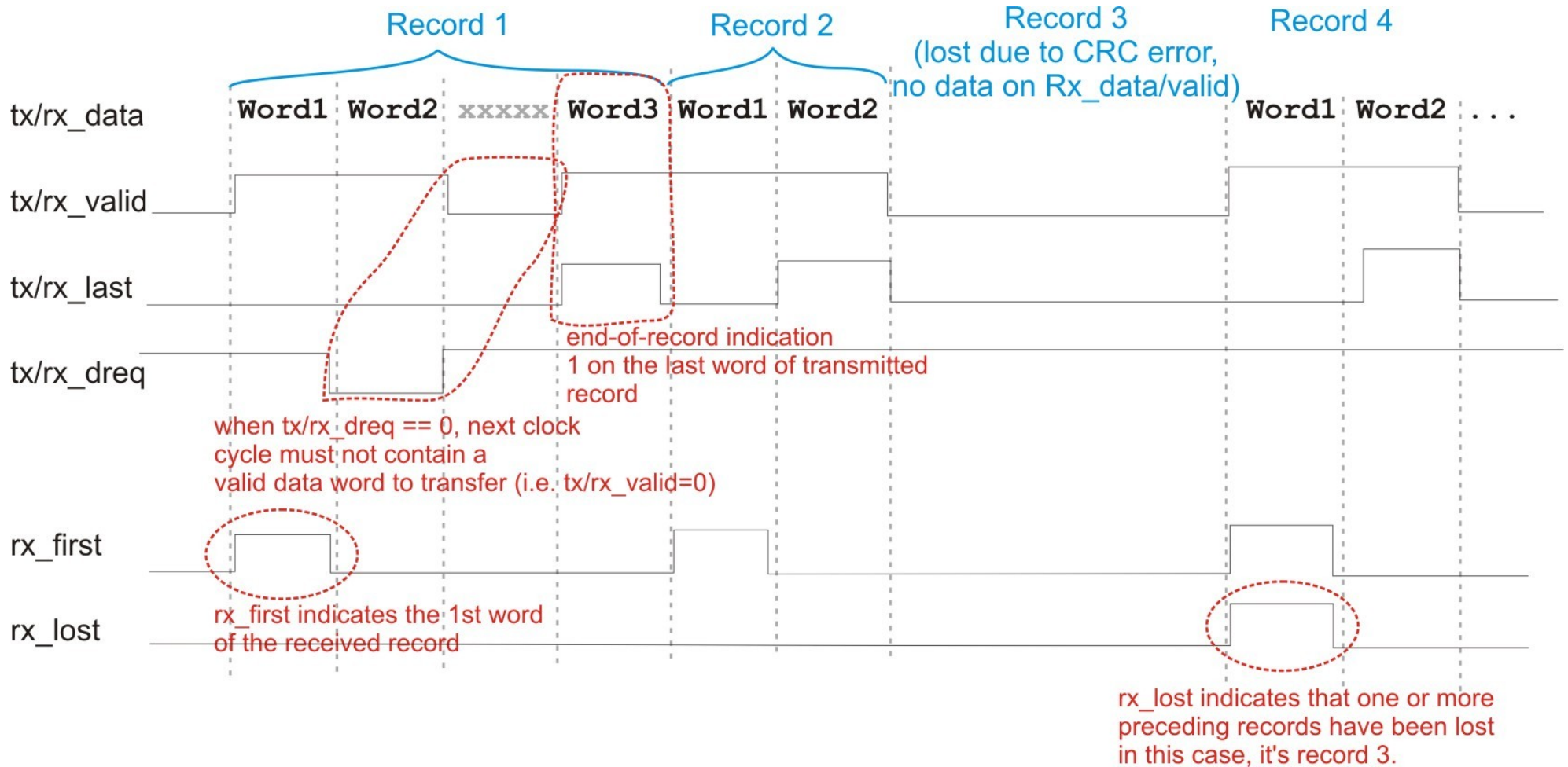


Ethernet frames outputted by the streamer



Note: Destination MAC and Ethertype come from `cfg_xxx` inputs. Source MAC field is automatically embedded by the WR Core.

Streamer interface



Latency measurement

- Simply use ChipScope to log `rx_latency_o` of the `xrx_streamer`
- Plot the results using Gnuplot/Excel/Matlab. 1 unit = 8 nanoseconds.
- Note: timing interface of both TX and RX streamers must be connected to the WR Core.

