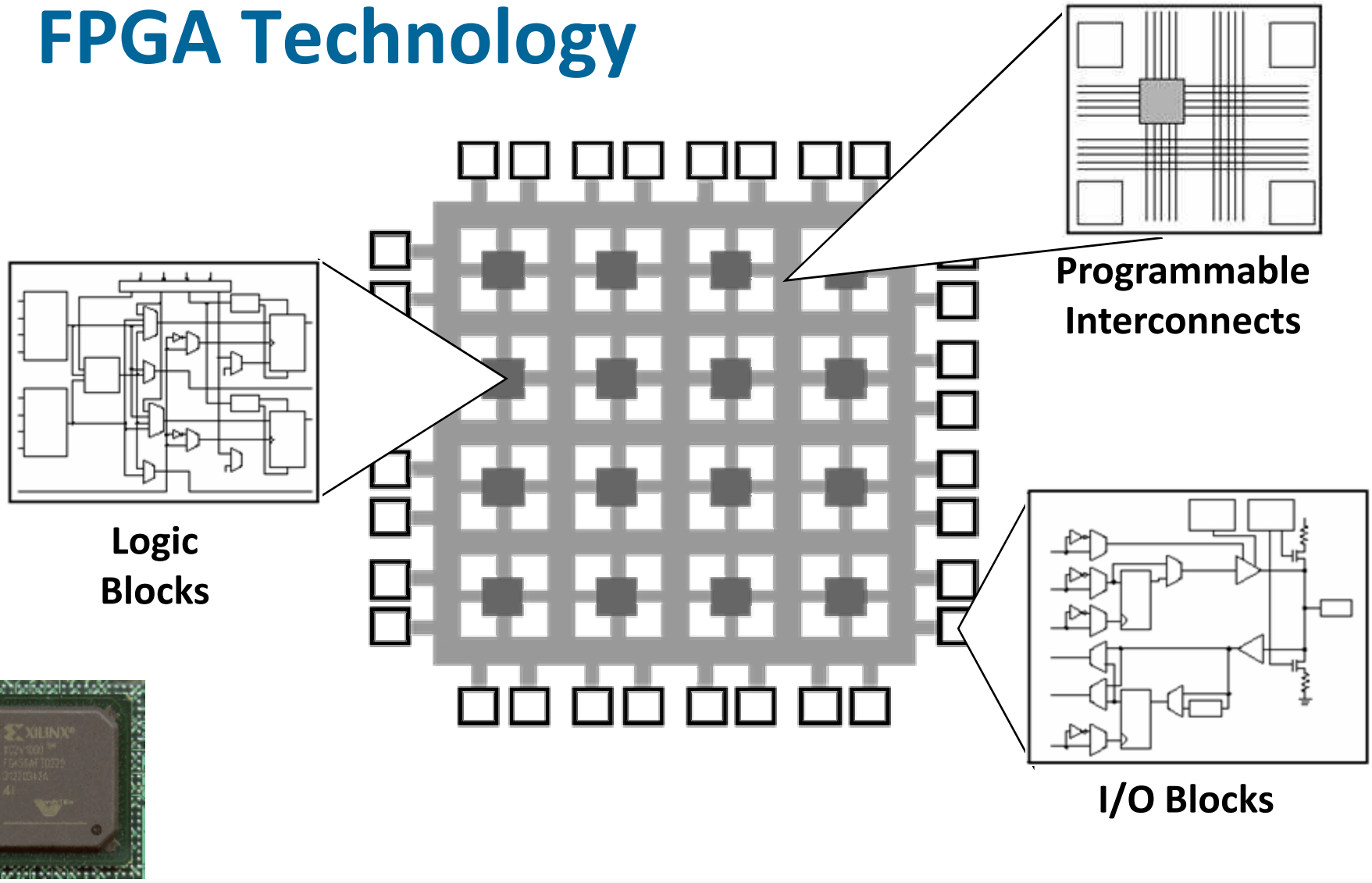

NATIONAL
INSTRUMENTS™

Leveraging the Power of FPGAs for HIL Test Systems

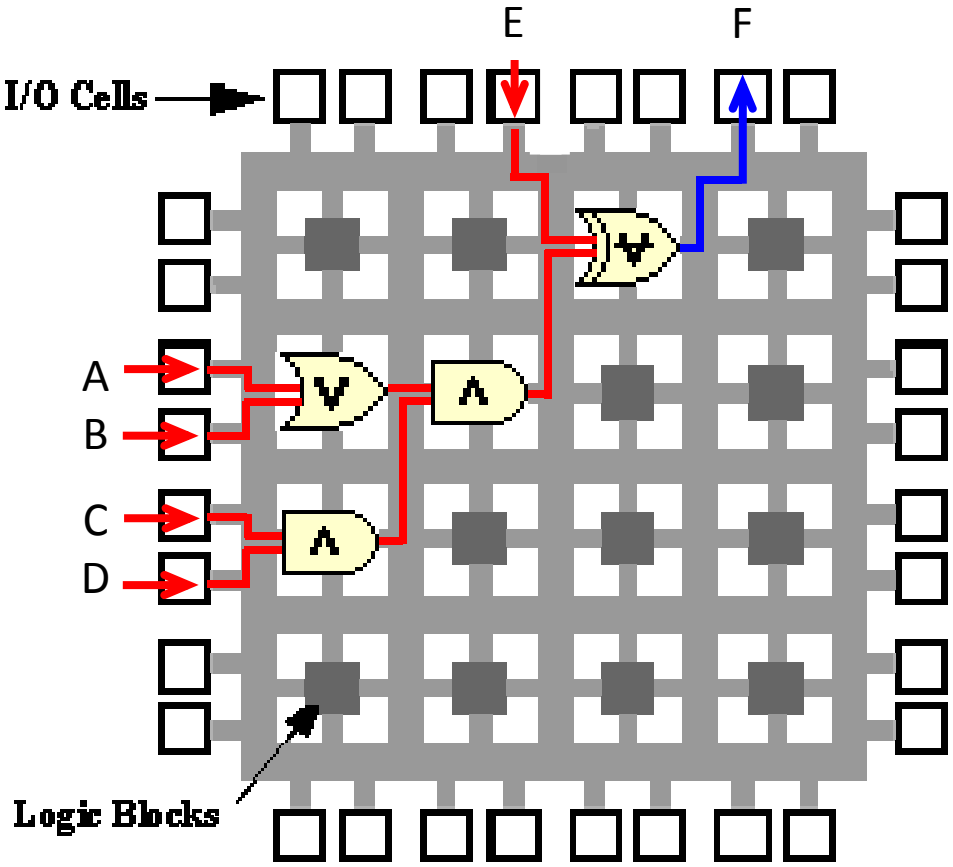
Agenda

- **What are FPGAs**
- Why are they useful
- FPGAs in HIL Test System

FPGA Technology

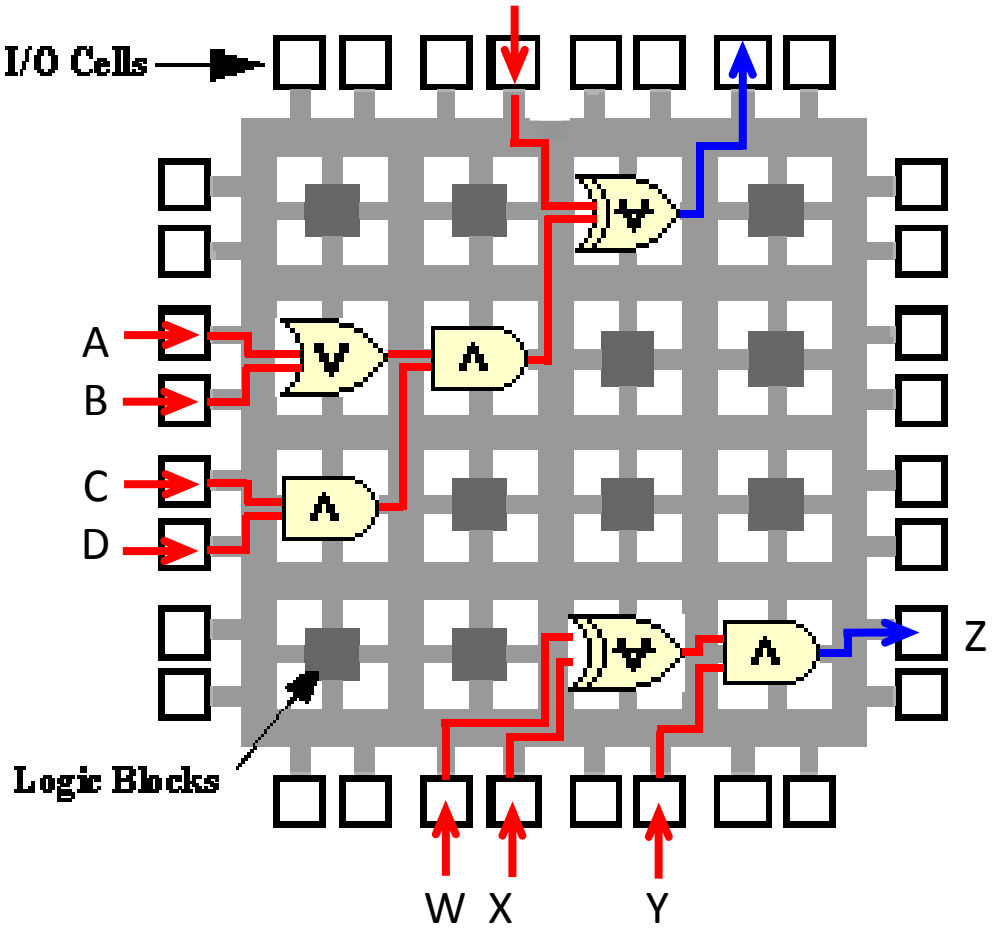


FPGA Logic Implementation



$$F = \{(A+B)CD\} \oplus E$$

True Parallelism



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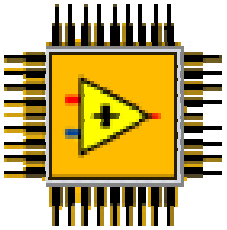
- **Why are they useful**
- FPGAs in HIL Test System

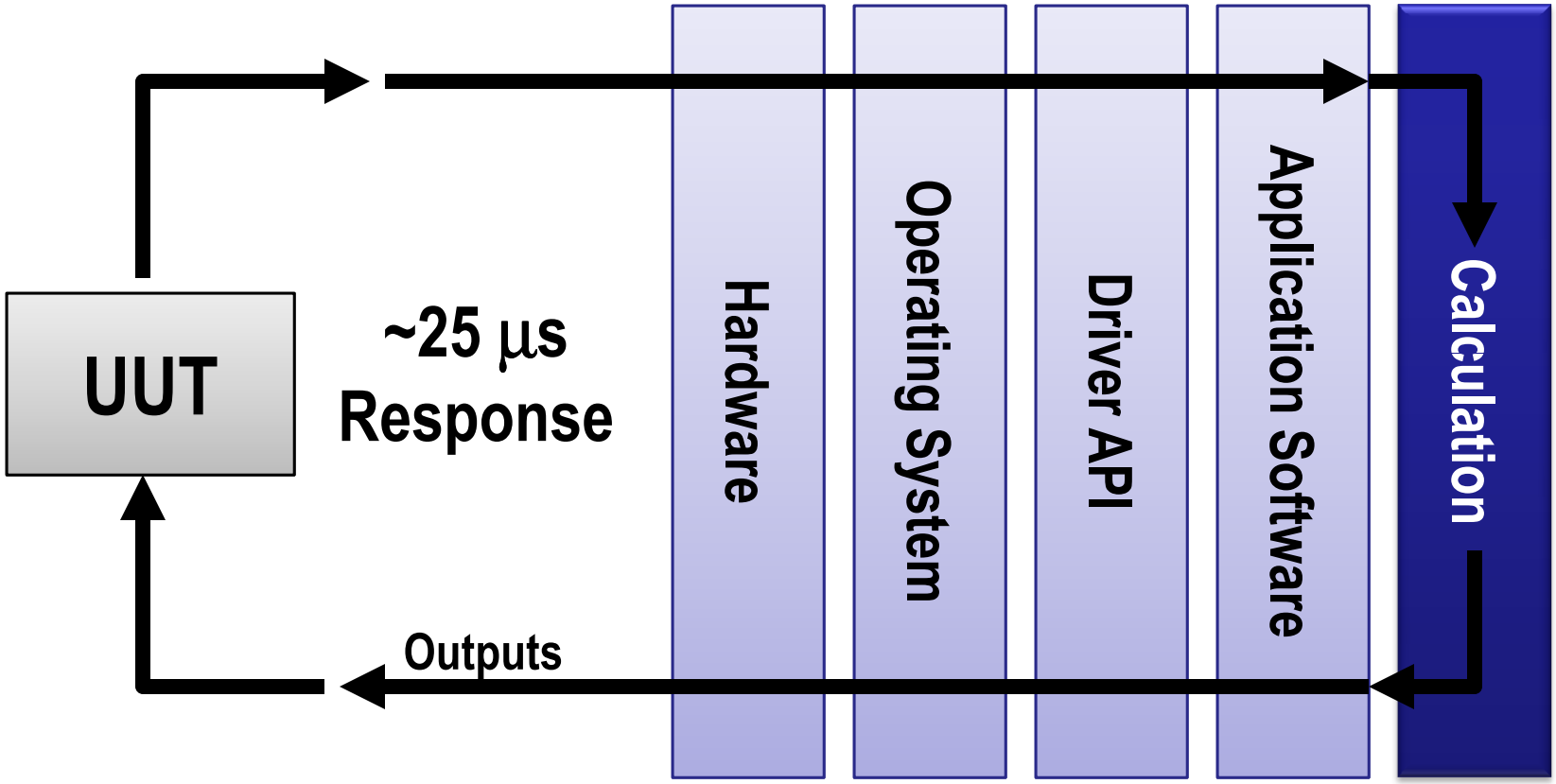
Why are they useful?



- ***Off-load Processing –*** *achieve real-time performance with more complex simulations*
- ***Hard Determinism –*** *realistic simulation timing, local intelligence*
- ***Reconfigurable Hardware Personalities –*** *flexibility to test multiple ECU types*

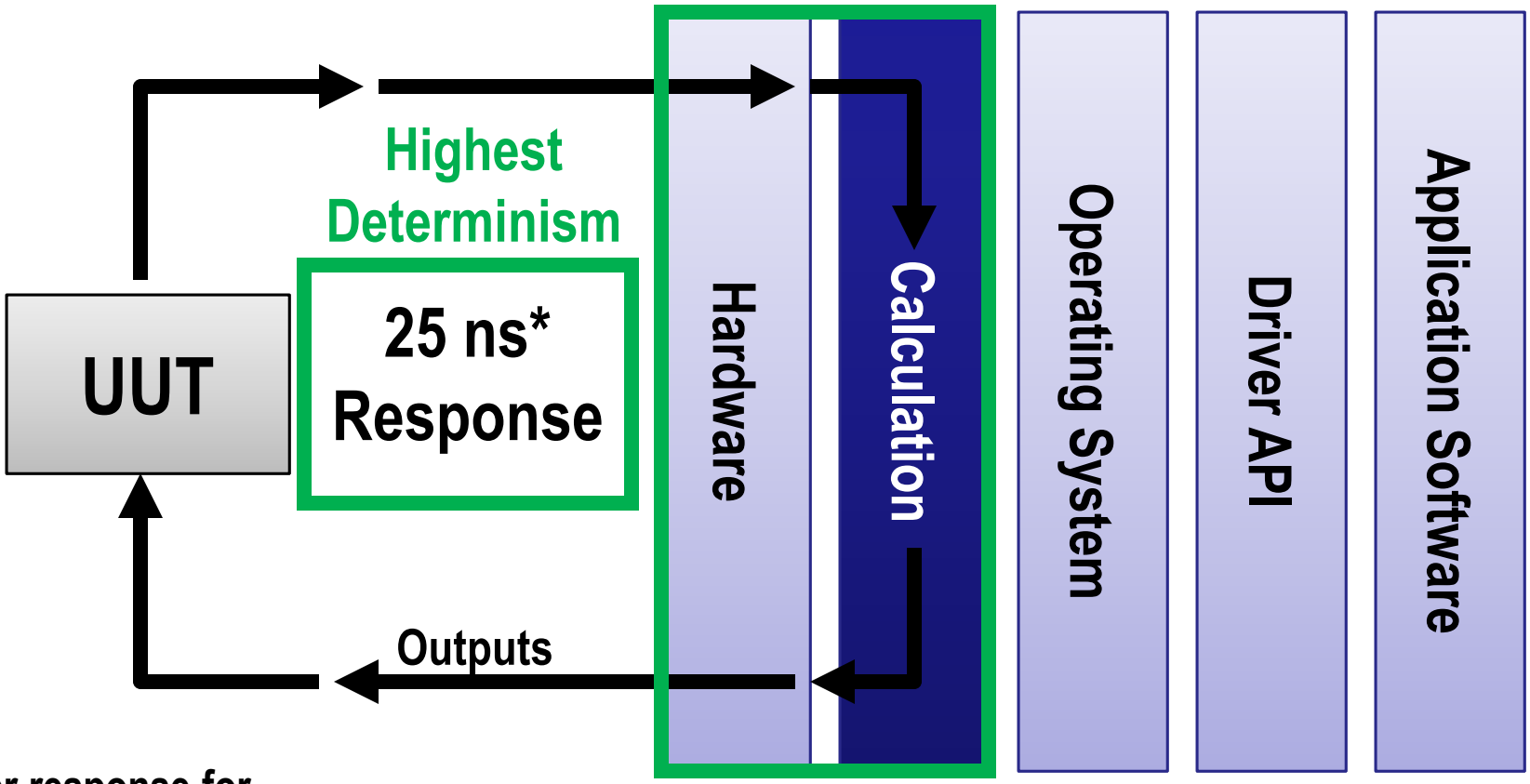
Off-Load Processor & Determinism

Calculation in Software



Off-Load Processor & Determinism

Calculation in Hardware



* Faster response for
80 and 120 MHz clocks

Agenda

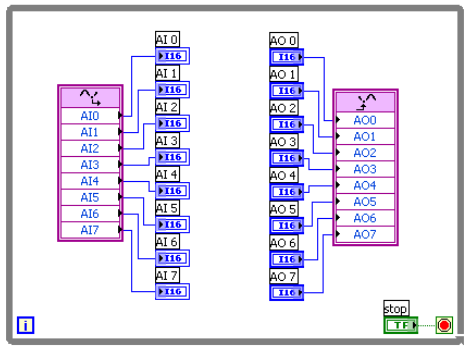
- What are FPGAs
- Why are they useful
- **FPGAs in HIL Test System**

FPGAs in HIL Test Systems

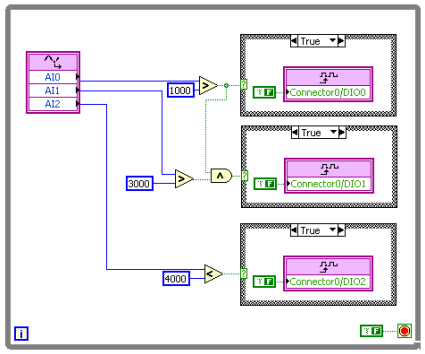
- Intelligent DAQ
- Digital Protocols
- Sensor Simulation
- Actuator Processing
- Model execution

Intelligent DAQ

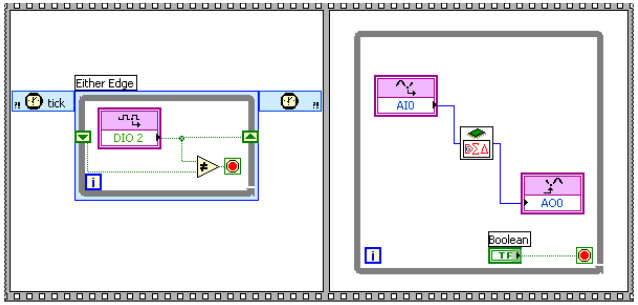
Analog IO



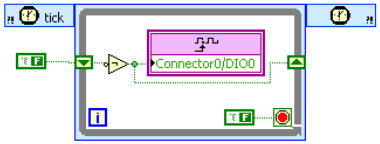
Custom Triggering



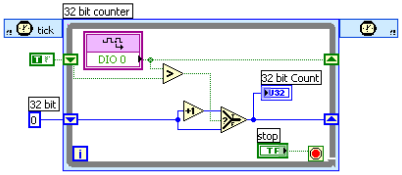
Custom timing and synchronization

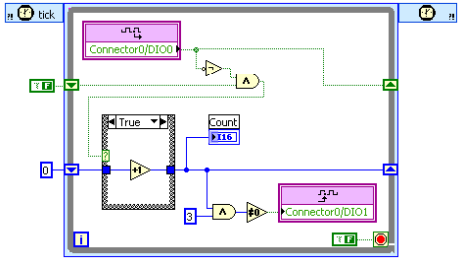


Clocks

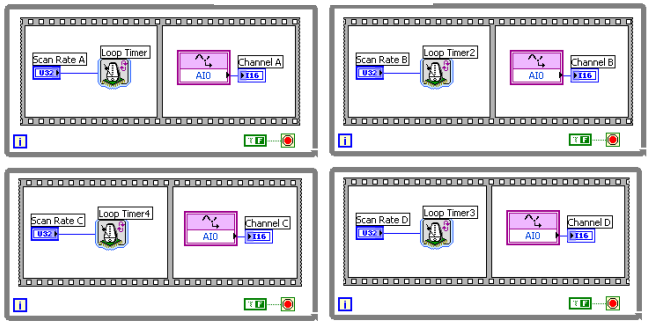


Custom Counters

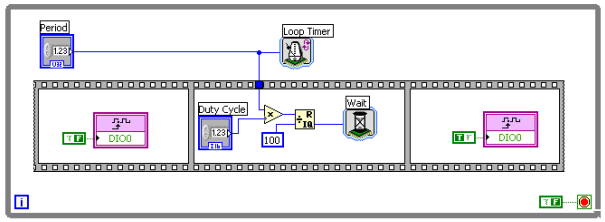


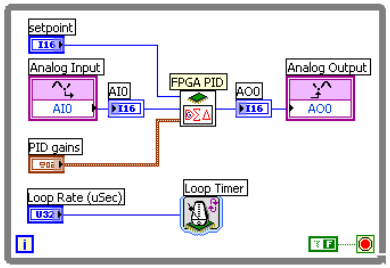


Multi-rate



PWM





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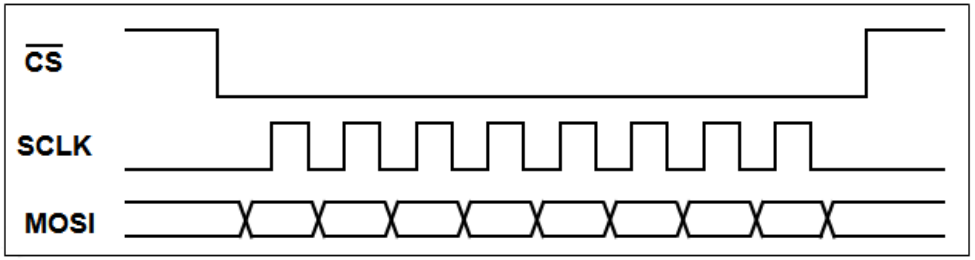
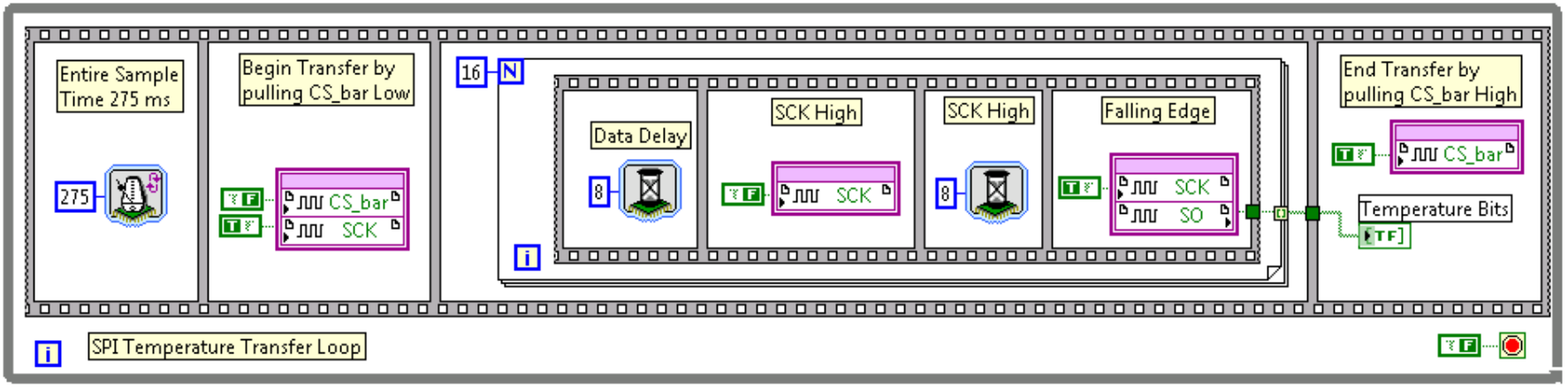
Communication Protocols





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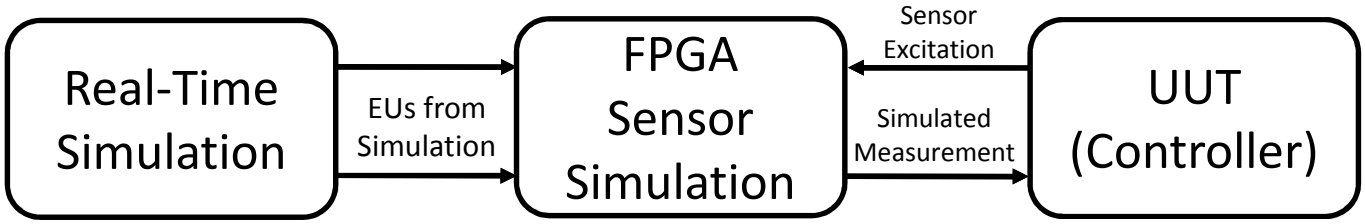
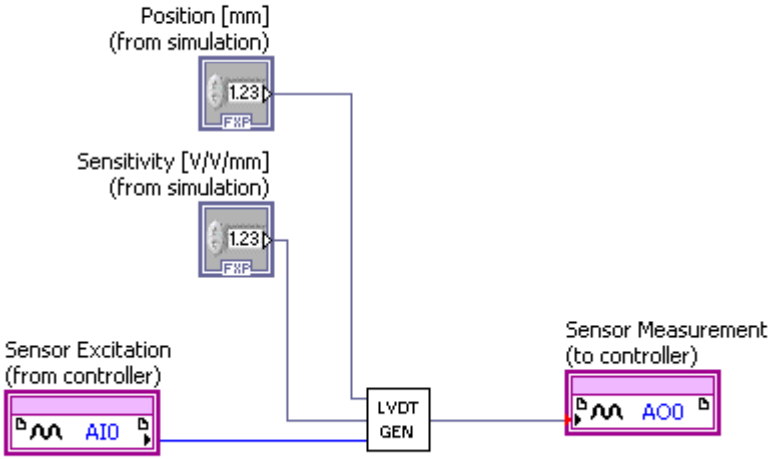
Sensor Simulation - LVDT





Summary

FPGA-based IO interfaces are being used to expand the capabilities and performance of these HIL test systems through:

- Intelligent DAQ
- Digital Protocols
- Sensor Simulation
- Actuator Processing
- Model execution