Solution Brief

AXI Streaming Crossbar

Design Example

Description

The Agilex® 9 SoC FPGA Direct RF-Series provides unprecedented analog FPGA-based technological capabilities that enable wideband and SWAP-sensitive systems, for applications such as Radar, EW, and quantum computing. Its analog/digital sampling capabilities can be a key enabler in many applications.

The integration of A-Tile with high sample rate data converters, F-tile transceivers, and EMIF with substantial external memory bandwidth allows various data sources/sinks, highlighting a key advantage of FPGA in supporting IO flexibility. For optimal performance, this requires efficient and reliable data transfer between modules within the FPGA. This platform allows a high-throughput, low-latency, end-to-end system implementation, which is critical for applications that require a fast response time.

AXI4-Stream protocol defines a very useful module-to-module interconnect within an FPGA. Unlike the chip-to-chip interface that manages the physical layer, the on-chip AXI interface specification at the module level focuses on the reliable data transmission between internal IP blocks.

This design example showcases the use of an AXI Streaming crossbar to support a high-throughput, low-latency, efficient data transfer between modules in the FPGA design. This is an important system requirement for reducing overall system latency to achieve fast real-time decision-making.

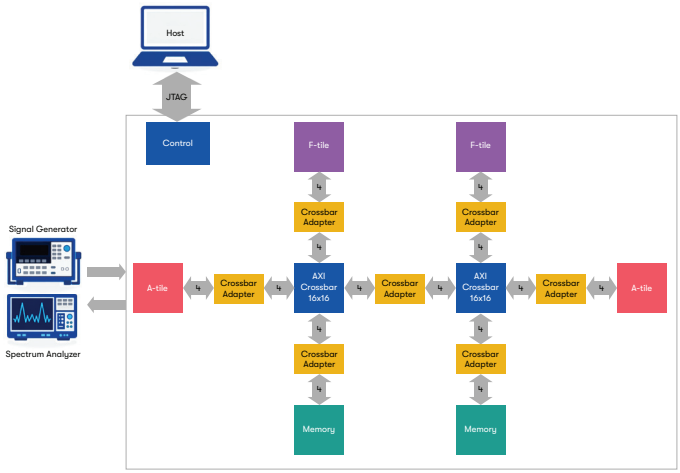
Features

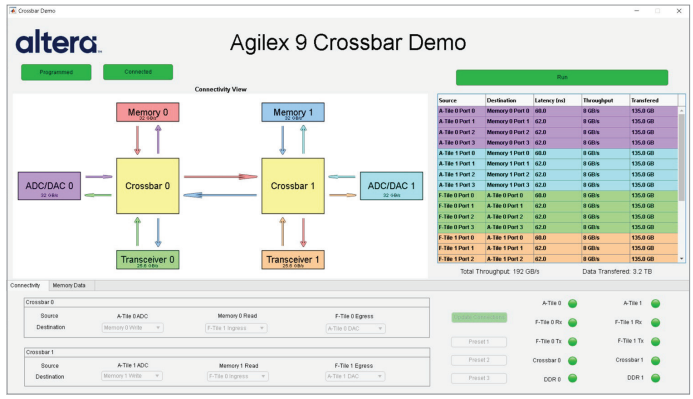
- Supports 24 TX/RX AXI-Streaming channels on Agilex® 9 Direct RF SoC FPGA
  - 2 x A-tile (4 ports) data source and sink
  - 2 x F-tile (4 channels) data source and sink
  - 2 x Memory (4 ports) data source and sink
- Real-time control of dataflow through the AXI Streaming Crossbar
- AXI Crossbar adapter module supports bi-directional data converting AVST to AXI-ST and routing metadata for arbitrary data source/sink routing
- MATLAB host GUI interfaces with the hardware to provide dataflow control
- Performance metrics
  - Average Latency: 134 ns
  - Throughput: 192 GB/s
- Agilex® 9 Direct-RF Series AGRW027 FPGA Development kit

Applications

- Radar and electronic countermeasures
- Communication systems
- Quantum computing

For more information about Altera® FPGA design examples, contact Altera.





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