



GigaX

Jump

between Ethernet & PL at
200 Mbps

A software API for **Zynq® PS** that Enables
High-speed **GigaE-PL Data Transfer** & Frames Management

Key Features

- Full Duplex GigaE-PL Link
- Data Rate up to 200 Mbps
- Optimised DMA Implementation
- Ethernet Data Caching
- TCP/UDP Headers Management
- IP Address Filtering
- Easy to Install and Use

Applications

- Ethernet Bridge
- Programmable Network Node
- Hardware Acceleration
- Network Offloader
- Ethernet Data Processing
- Software Defined Radio

Overview

Real-time processing of Gigabit Ethernet data in Programmable Logic (PL) is a time-consuming challenge that requires optimised drivers and interface management. System-on-Chip (SoC) devices provide hardware resources that allow this communication, but they lack general purpose software applications to implement it.

GigaX is a lwIP-based API for Xilinx Zynq® SoC that establishes a high-speed communication channel between the GigaE Processing System (PS) port and the PL. Running in one of the Zynq® ARM cores, GigaX processes network and transport headers, and manages SDRAM, Ethernet DMA, and AXI interfaces to setup a robust full duplex data link through the PS at 200Mbps.

The software API also implements IP filtering and TCP/UDP headers management to allow using your device as an Ethernet Bridge, Programmable Network Node, Hardware Accelerator, or Network Offloader.

GigaX is easy to install as a library in your SDK project, being able to control both the GigaE peripheral and the AXI DMA interface to enable a direct communication between Ethernet and your VIVADO IP Cores.

Functionality

Figure 1 shows a high-level diagram of the GigaX functionality and interfaces.

Based on the open source [lwIP stack](#), GigaX controls the Zynq® GigaE peripheral to send/receive Ethernet frames to/from SDRAM via the AMBA Interconnect bus. After performing IP filtering, Ethernet data is sent to PL through a High Performance AXI Port, which is also used to send processed data back to the PS.

PS-PL transfer uses an AXI DMA implemented in the PL and controlled by GigaX through a General Purpose AXI4-Lite Port. Network headers can be kept or removed before reaching the PL. GigaX also allows the generation or modification of IP headers of the data received from PL.

The complete full duplex communication based on DMA and AXI ports allows high-speed data transfer without overloading the ARM processor. AXI4-Stream interfaces shall be used to transfer Ethernet data to/from your IP cores.

The GigaX Data Caching system is capable to manage data peaks over the maximum transfer rate, ensuring stable communications of variable data flows.

The API implements a software watchdog timer to recover from unexpected situations.

System Requirements

Hardware

- Zynq® AP SoC
- DDR2/DDR3 RAM Memory
- Gigabit Ethernet Interface

Software

- VIVADO/SDK Design Suite (v2016.2 or later)
- lwIP library v1.4.1 or later
- Stand-alone Operating System (v5.5 or later)

Configuration Options

In addition to high-speed data transfer, GigaX implements different network functionalities based on a flexible architecture and a wide set of configuration parameters:

- Host and Gateway IP addresses
- Network Mask
- Host MAC address
- TCP Reception Port
- Source and destination IP filtering ranges
- Network headers removal or modification:
 - Source and destination port and IP address
 - Transport protocol (TCP/UDP)
 - Frame length

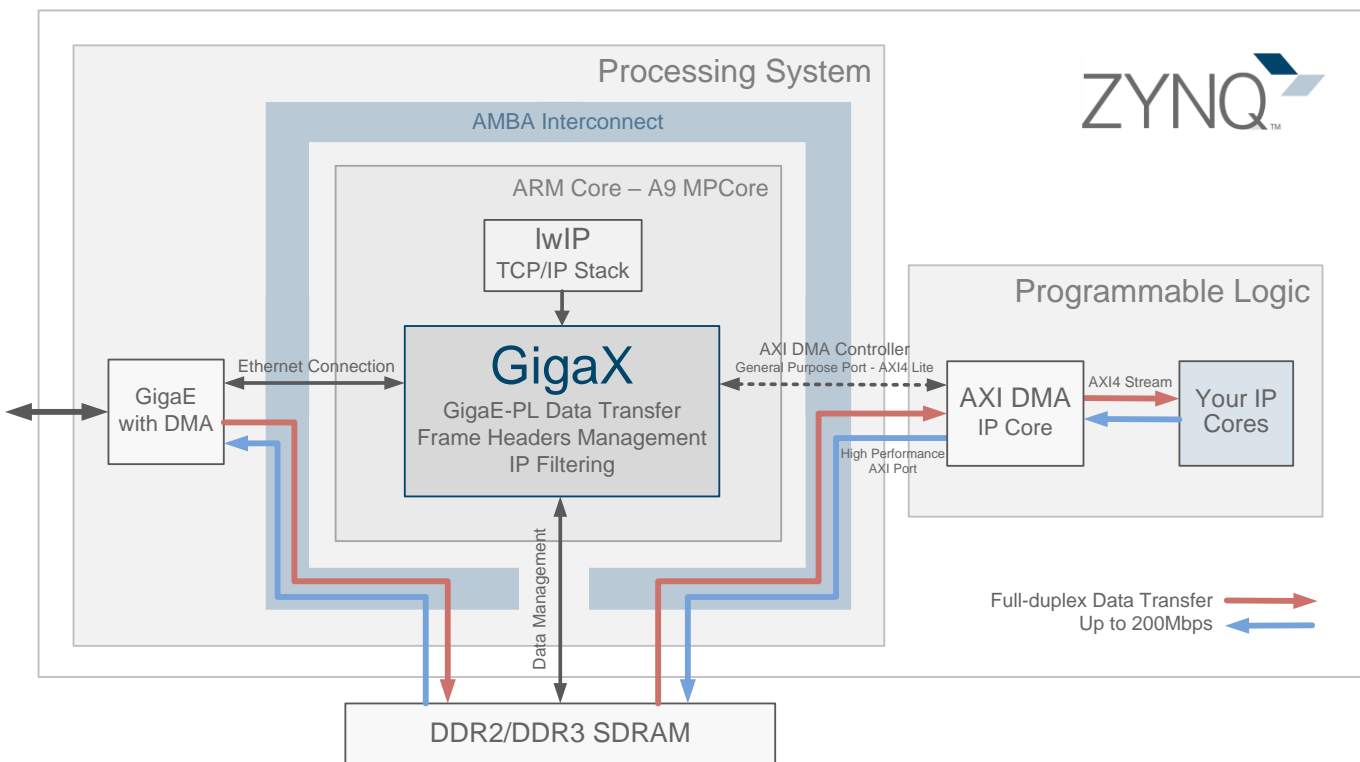


Figure 1. GigaX Functionality and Interfaces

Performance

GigaX features up to 200Mbps full duplex data transfer between Ethernet and PL. Figure 2 shows the frame loss ratio as a function of throughput for UDP traffic. The maximum rate without losing packets depends on the Ethernet frame length (bytes).

TCP connections achieve maximum data rates of 190Mbps.

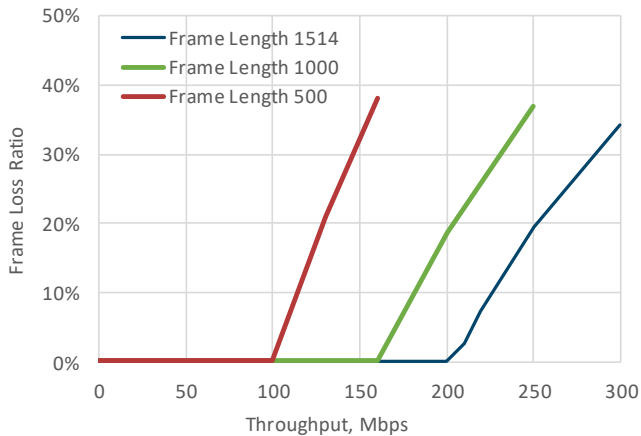


Figure 2. GigaX Frame Loss Ratio, UDP traffic

Typical Applications

Network Offloader

A Zynq® device featuring the GigaX API has the capability to process a huge amount of Ethernet data in programmable logic, working effectively as a network offloader.

The application example in Figure 3 can be used for remote data acquisition and processing, monitoring and control systems or software acceleration.

Connecting the GigaX device outside the LAN allows the implementation of network scanning or high-capacity Network Intrusion and Detection System (NIDS).

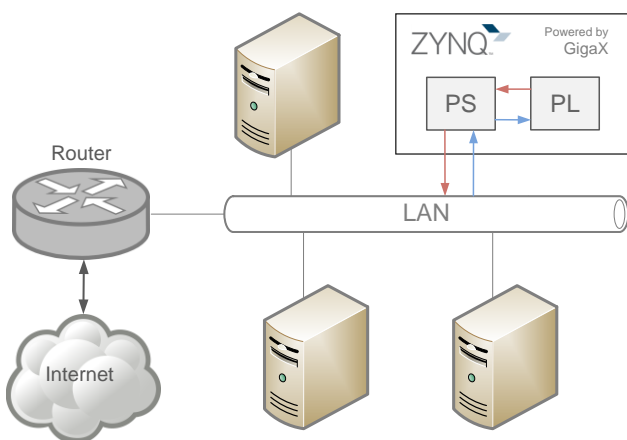


Figure 3. Network Offloader

Ethernet Bridge

GigaX is the perfect solution to implement a Network Bridge through PL using any communication interface. For example, it can be used to setup a wireless connection between two remote Ethernet networks, or to transfer data via any other digital or analogue interface implemented using the programmable logic.

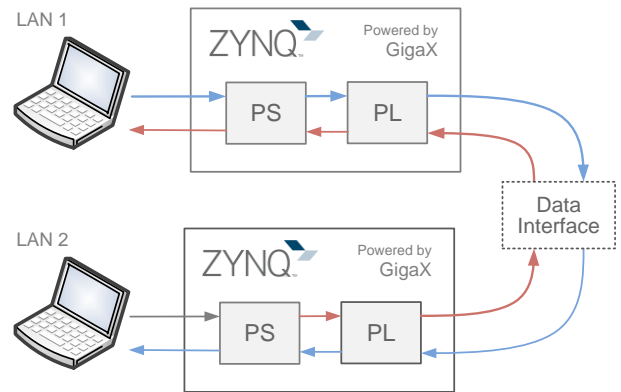


Figure 4. Ethernet Bridge

Other Applications

The characteristics of the GigaX API upgrade your Zynq® device to use it as a Programmable Network Node with the following capabilities:

- IP Filtering
- Ethernet headers management
- TCP/UDP protocol conversion
- Frame length modification
- IP re-routing and port number modification

Package Contents

- GigaX perpetual licence for all your company projects
- Software User Guide
- 2 years of software upgrades
- Unlimited support for bug fixing
- Initial Support for software utilisation

Extended Support

BERTEN provides extended support for a fast and successful integration of the GigaX API in your project, including VIVADO/SDK, AXI interfaces, HDL programming, and FPGA design.

Related Products

GigaExpress SBC

The GigaExpress is the world's smallest Zynq® FMC carrier. This rugged, low power, and small form-factor Single Board Computer (SBC) features Xilinx's Zynq® SoC and DDR3L RAM for both the processing system (PS) and the programmable logic (PL).

The GigaExpress is the perfect piece of hardware to take benefit of the GigaX API and start processing Ethernet packets in the PL right away.