



Dedicated FPGA-Accelerated Time-Series Database for IIoT



Overview

The recent phenomenon of IIoT and Big Data has had irreversible effects on how industrial devices should evolve. Obviously, for each subset of common operations will be created dedicated hardware with enhanced connectivity for better performance and lower cost.

The FPGA-Accelerated Time-Series (Key-Value) Database is a dedicated hardware for storing IIoT sensors generated metrics. Sensors data pass directly into FPGA from Ethernet bypassing any type of operating systems and software layers. All Time-Series database operations take place under FPGA on fly. Direct connection with storage device from FPGA is used to stream data to memory for storage.

Advantages

- One unit replaces up to 10 data centers
- Requests per second (RPS): **12.8M (10X)**
- Latency: **4.9-6 us (100X)**
- Power consumption (RPS/W): **220K (31X)**
- 1 / 10 Gb Ethernet connection
- Cost of software purchase: **\$0**
- Cost of software support: **\$0**
- Integration with existing systems
- Increased reliability due to software-less approach

Features

- Full support of TCP stack on FPGA
- IIoT generated Time-Series data preliminary storage using Hash tables and DRAM memory
- Data interpolation / extrapolation based on regression algorithms which guarantees best fit
- Predicted data query
- Channels interconnection evaluation
- Aggregators
- Connectivity APIs for C/C++, Python, LabVIEW
- Web user interface for configuration and data viewing

Applications

- IIoT Database
- Big data
- Cloud Data Center
- OPC historian
- SCADA database
- Web server caching device (memcached)

**Comparison was done with Intel Xeon (8 cores) processor based systems*