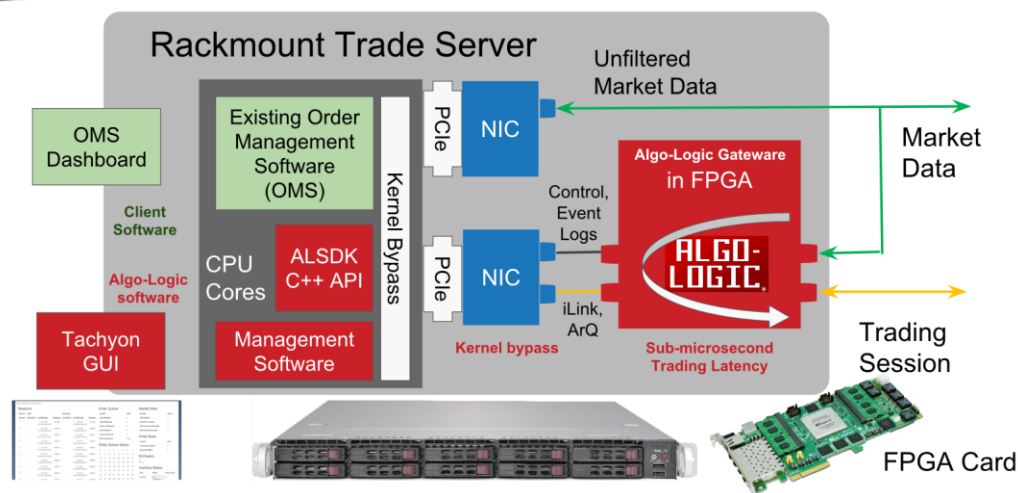


# FPGA Accelerated CME Tick-To-Trade System With Turbo Spreader



## Description

Algo-Logic Systems' 4th generation FPGA accelerated Gateway Defined Networking® (GDN) CME Tick-To-Trade (T2T) System is a sub-microsecond trading solution. It supports all CME Group exchanges including CBOT, COMEX, and NYMEX. The solution is built using Algo-Logic Systems' internally developed, pre-built IP cores that significantly reduce time-to-market and provide flexibility for customizations.

Sub-microsecond wire-to-wire latencies are achieved by receiving CME MDP 3.0 tick data directly into the FPGA on a 10G link, detecting opportunities by building order books, and placing trades in form of FIX messages encapsulated in TCP packets using the ultra-low latency (ULL) 10G TCP Endpoint.

The CME T2T system includes parametrized triggers for mass quote cancel, mass action request and fast arbitrage as well as the ability to modify FIX order fields in FPGA logic. It integrates with existing Order Management Systems (OMS) through C++ Application Programming Interfaces (APIs). A Graphical User Interface (GUI) and RESTful APIs are provided for control and monitoring of the accelerator.

### ArQ C++ Library and API:

- Low latency C++ 98 compatible APIs are used to set up triggers and preload FIX orders to be injected
- Well defined API to pass trigger parameters between hardware and software

### Control Software includes:

- Device parameter configuration (i.e., IP and MAC addresses) and status monitoring
- Logging and event notifications

## FPGA-Accelerated Trading

- **Quote Cancellation**
  - Ultra-low-latency mass quote cancellation by product, instrument group or each instrument
- **On Fill Trigger**
  - Instantly reacts to market data or order fill, whichever comes first, to trigger response order(s)
- **Turbo Spreading**
  - Ultra-low-latency top of book updates
  - Single API call for immediate injection of preloaded quote or hedge order with modified price, quantity, and order IDs
  - Auto-reload enables multiple hedges and quotes to be sent using pre-loaded FIX order
  - Allows trading on multiple instruments with simultaneous multi-leg strategies
  - Supports hardware trading strategies in logic

## Short Time to Market

### Algo-Logic's prebuilt IP cores with sub-microsecond latency

- ULL 10GE PHY+MAC
- CME Feed Handler
- CME Futures & Options Order Book
- 10G TCP Endpoint
- FIX Message Processing

### Augments existing Order Management Systems

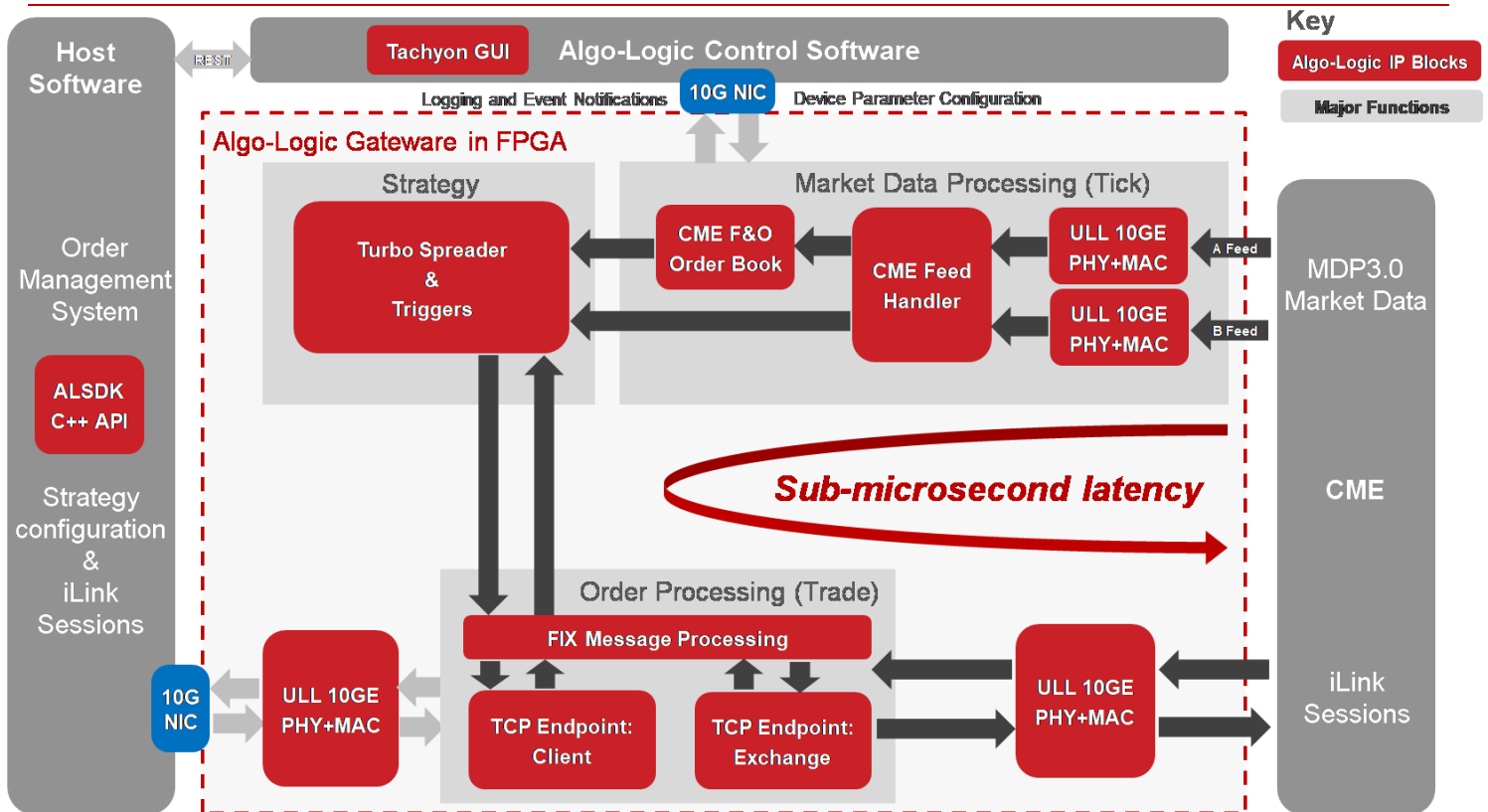
- Minimal changes to software through well-defined APIs
- No FPGA programming skills required

# FPGA Accelerated CME Tick-To-Trade System With Turbo Spreader

## CME Tick-To-Trade System Features and Base Specifications

<b>FPGA Accelerated Trading</b>	Multi-leg turbo spreading, quote cancel, and on fill triggers
<b>Pre-Built IP Cores</b>	CME Feed Handler, CME Futures & Options Order Book, 10G TCP Endpoint, ULL 10GE PHY+MAC
<b>Multicast Channels for Market Data</b>	Up to 16
<b>Order Book Configuration</b>	20 security IDs with L2 snapshots containing BBO, all 10 book levels
<b>FIX Sessions and Order Queues</b>	32 and 64 respectively, with 2 Kbyte per queue message size limit
<b>Turbo Spreading in Logic</b>	Fast arbitrage across multiple legs
<b>Configurable Number of lean Legs</b>	2 with full support for quoting one or two legs of a spread or strategy
<b>Multiple Quoting Configurations</b>	4 instances allowing independent and simultaneous quoting instances
<b>CME Price Precision</b>	Support for CME products with up to 9 decimals
<b>Logging and Event Notifications</b>	FIX logs, Raw Market Data logs, CME Order Book BBO, Trigger events
<b>FPGA Device and Platform</b>	Intel Stratix V with 10 Gbps Ethernet on Terasic DE5-Net

## CME Tick-To-Trade System Diagram



Algo-Logic Systems builds FPGA accelerated Gateway Defined Networking® (GDN) latency.