

FPGA-based Trading Engine

nxAccess

What is nxAccess?

nxAccess is an execution engine with an FPGA algo sandbox allowing users to preload orders in hardware, receive market data then trigger & update those orders before sending to the trading venue - with the speed and performance of hardware assisted by the flexibility of software.

With constant, deterministic, and jitter-free performance, nxAccess offers the power of FPGA technology with the integration simplicity of a software solution.

Designed for market making, high performance trading and arbitrage strategies, nxAccess accelerates existing trading algorithms without the investment usually required for FPGA-enabled performance.

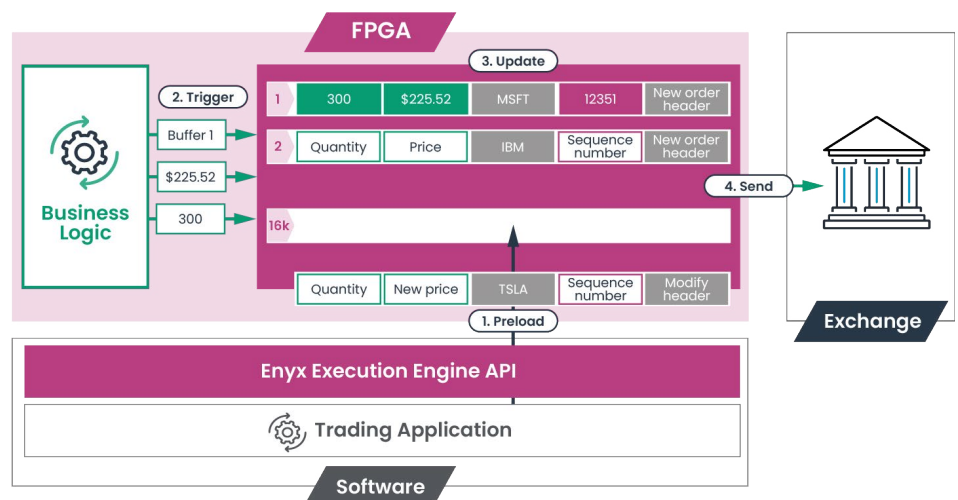
Check out our performance reports for full testing & latency measuring details
www.enyx.com/performance

nxAccess Execution Engine: Preload, Trigger, Update, Send

A unique feature of the nxAccess solution is the ability to leverage hardware for latency critical strategies while maintaining the flexibility of software ensuring a smooth transition to FPGA technology.

The Enyx Execution Engine enables software applications to manage the order execution protocol and FPGA logic to trigger and send orders to the exchange in the following sequence:

- 1 **Preload:** Orders or templates of orders are **preloaded** by software into the execution engine buffers
- 2 **Trigger:** Hardware business logic uses market data or order fill notifications to request the **trigger** of a preloaded buffer & provide fields to update the order
- 3 **Update:** Once triggered, the selected buffer is **updated** with fields from the hardware business logic & any required variables previously initialized by the software
- 4 **Send:** The fully updated order is **sent** to the exchange



Fully integrated FPGA-based market data processing

To accommodate a wide range of trading strategies with varying latency profiles, nxAccess provides two paths to deliver and process incoming market data.

An embedded FPGA-based feedhandler with order book building allows algorithms to make trading decisions based on the most complete view of the market.

Additionally pattern matcher functionality within nxAccess provides a raw market data decoder which quickly extracts key values, such as prices or quantities, allowing users to implement ultra-low latency trading strategies using lightweight market data processing.

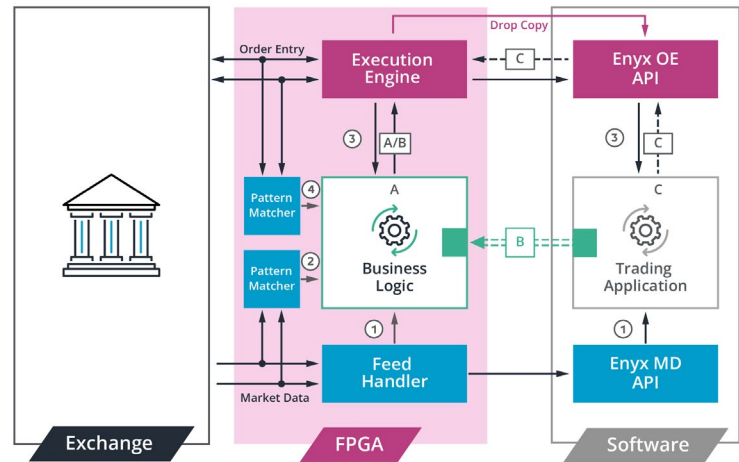
nxAccess: Hardware performance with software flexibility

DATA INPUTS

- 1. Normalized market data** - the FPGA feed handler arbitrates, decodes, normalizes and builds order books for all subscribed symbols. *Delivers normalized data to both hardware & software trading logic.*
- 2. Raw market data** - the pattern matcher (PM) extracts specific signals (i.e. trade summaries) without normalization, bypassing the feed handler, to further reduce latency. *Delivers raw data to hardware trading logic only.*
- 3. Order fill notification** - the execution engine receives incoming order fill notifications from the exchange. *Delivers raw data to both hardware & software trading logic.*

ORDER EXECUTION PATHS

- A. Hardware trigger (HDL or HLS)**
 - Provides easy-to-use, low latency interface to the hardware algorithm
- B. Software trigger (C++)**
 - Uses the same interface as the hardware trigger, allowing for software emulation of hardware business logic (example bus + reference firmware)
 - Hardware trigger can detect duplicate/delayed triggers from software and react accordingly
- C. Direct send via software trading application (C++)**
 - Simple software only path for non-latency sensitive applications



Specifications

- Supports up to 8000 symbols
- Symbols / Message type / Book depth filtering A/B feed arbitration by message
- Book-based and/or order-based market data updates
- Market data & order execution

- exchange resynchronization
- Full Hardware TCP Stacks
- 2 MBytes of in-FPGA order storage
 - Up to 16 000+ order buffers
 - Orders can be stored one-by-one or in bulk
 - Order MTU up to 1504 Bytes

- Kill switch with software heartbeat & bandwidth watchdog Aggregated Rx/Tx audit trail
- Monthly performance & EDC updates

