Exegy Ticker Plant & Mellanox ConnectX® EN (RDMA over Ethernet) Delivers Breakthrough for Co-located Trading

1.0 Introduction

This paper takes a look at how Exegy's High Frequency Trading technology is taking advantage of the new Mellanox ConnectX-2 EN with RoCE (RDMA over Ethernet) 10GigE NICs that implement the RoCE industry standard for RDMA over Ethernet.

Because High Frequency Trading places a premium on speed, there is a fast adoption rate for computer technologies and innovations that facilitate low latency trading. InfiniBand is just such a technology. However, many financial institutions have invested heavily in Ethernet over many years which has precluded them from taking full advantage of Remote Direct Memory Access (RDMA) as offered in the market-leading Exegy Ticker Plant.

RDMA is direct memory access from the memory of one computer into that of another without involving either one's operating system. This permits high-throughput, low latency networking.

The industry has worked on a new standard for RDMA over Ethernet, known as RoCE (RDMA over Converged Ethernet, pronounced as "Rocky"). Mellanox has recently released its latest NIC cards incorporating this standard and Exegy has successfully tested these Mellanox cards in the Exegy Ticker Plant to deliver market data with Exegy's hallmark low latency performance.

1.1 Business Challenges in High Frequency Trading Sector

High Frequency Trading has evolved very quickly and overcome many technical barriers to enable traders to make use of the best innovations. InfiniBand is a technology that has caused headaches in some trading firms and banks because it is not as standard as Ethernet delivery, but it is widely recognized as an important way to gain access to vast amounts of data at extremely low latencies.

When Exegy went to market in the financial sector in 2006, Exegy discovered many firms interested in Exegy's innovative hardware acceleration technology. Customers were able to easily improve the latency of ingest and processing of extreme loads of market data with the Exegy appliance. But they

were not always able to exploit all the advantages and achieve the lowest latency because their Ethernet infrastructures precluded the use of RDMA.

However, the requirement for banks and financial firms to be able to deal with massive amounts of data at ultra low latencies has become urgent and increasingly important as market data rates have escalated massively over the last four years.
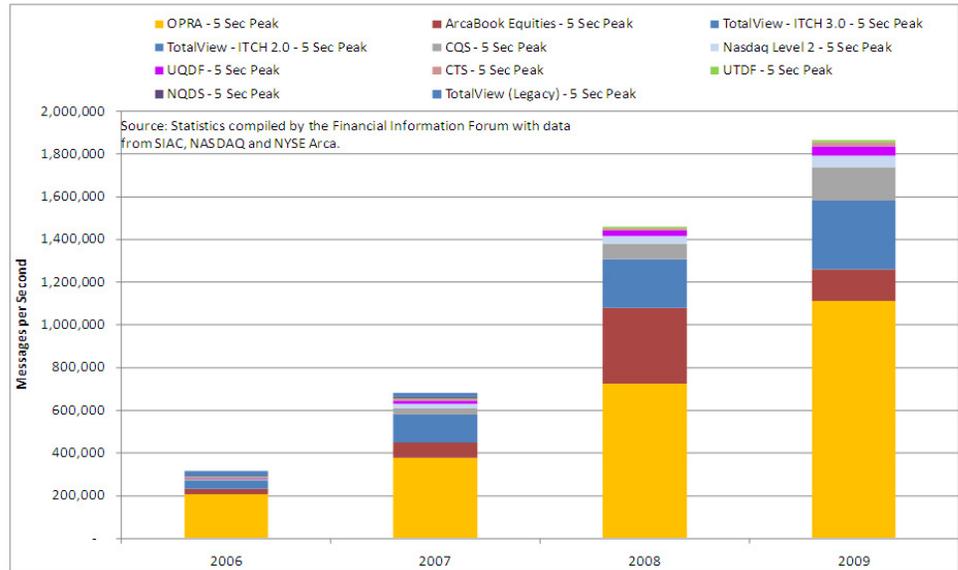
Source: Financial Information Forum

Computers and networks send and receive market data in extremely fast and voluminous bursts of activity. The peaks in the market can be seen on the web site www.marketdatapeaks.com. This web site shows the grand total of messages per second from all the major markets in the United States.

On most active trading days in 2010, the stocks, options and futures markets sent out peaks in excess of 2 million messages per second.

1.2 Exegy Ticker Plant 3.0

The Exegy Ticker Plant is entirely focused on leveraging the very best technology to constantly ascertain the best prices in the market, however busy or however fast the marketplace. Exegy promises an edge previously available only to an elite minority of firms.

The next generation hardware-accelerated appliance is specifically designed from the ground up for market data . The latest Exegy Ticker Plant is significantly faster than previous versions, is smaller, has more functionality and offers more connections. Key features include:

- User-defined BBO
- Virtual Order Book
- Top-of-Book Quotes
- Basket and Index Calculation Engine
- US, Canada and Europe; equity, options, and futures

Inside the Box

The Exegy Ticker Plant includes a Basket and Index Calculation Engine that monitors up to a thousand portfolios simultaneously and facilitates extremely fast list trading, such as found with ETF and index arbitrage strategies.

Also inside is the Virtual Order Book Engine, that incorporates all order book prices from all venues into multiple, selectable views. Its extreme capacity and speed constantly assures the best view of the electronic market.

Integrated Top-of-Book processing allows clients to construct the very best prices derived from multiple level 2 feeds into one coherent low latency stream.

User-defined BBO composites give traders the opportunity to easily create and modify meaningful Best Bid and Offer prices.

The Exegy Ticker Plant now has over sixty feed handlers built-in to the system and the list of exchanges is constantly expanding. Every feed handler is available to every customer without further charge. Every feed handler is kept up to date by the Exegy data team.

Outside the Box

For the first time, The Exegy Ticker Plant is available in a 2U appliance. The 2U appliance is especially useful when space is limited but speed is still of the essence.
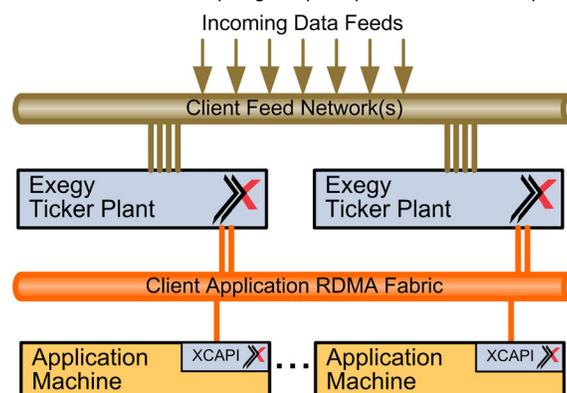
Exegy Ticker Plant 3.0 uses RDMA to deliver data to customer applications. Customers can choose InfiniBand or 10 Gigabit Ethernet to match their network infrastructure.

1.3 Mellanox ConnectX-2 EN with RoCE

Mellanox ConnectX-2 EN NICs support 10GigE and 40GigE data rates. The recently released ConnectX-2 EN with RoCE NICs deliver the lowest application-to-application level latency utilizing industry standard specifications and supports the entire breadth of the OpenFabrics Enterprise Distribution (OFED) API.   ConnectX-2 EN with RoCE incorporates a purpose-built, most deployed, field proven and scalable RDMA transport technology to deliver 1.3 microseconds application level latency, bringing InfiniBand-like performance and clustering efficiency to the Ethernet world. ConnectX-2 EN with RoCE uses a loss less Ethernet fabric to deliver such low latencies in a reliable and deterministic way to ensure demanding data center applications are able to scale and perform consistently in the face to massive growth in data and fabric usage spikes. Because it supports the standard OFED API, applications that utilize that API today can now seamlessly run over ConnectX-2 EN with RoCE, making the benefits of this product readily available to end users, independent software vendors, appliance vendors and original equipment manufacturers.

1.4 Mellanox ConnectX-2 EN with RoCE inside Exegy

The Exegy Ticker Plant 3.0 is an appliance that incorporates a wide range of interesting technology, from standard microprocessors such as AMD's Opteron and Intel's Nehalem processors to more exotic reconfigurable hardware using Field Programmable Gate Arrays (FPGA). The FPGA chips host digital logic that has been designed by Exegy specifically for processing market data in a highly performant and parallel manner. This reconfigurable hardware is then combined with highly optimized real-time, multi-threaded software and other advanced technology to achieve just the right blend of computational resources needed to meet the low latency, high capacity demands of today's High Frequency Trader.

An integral part of the Exegy appliance is the interconnect mechanism used between it and a customer's server. A popular choice has the use of InfiniBand because of its performance characteristics and the availability of software interfaces that allow applications to use RDMA techniques without a lot of software processing overhead.

With the introduction of the RoCE standard and Mellanox ConnectX-2 EN with RoCE, Exegy is able to offer the same low latency, high capacity experience with a 10G Ethernet interconnect in addition to an InfiniBand fabric, thereby enabling more choice for customers.

1.5 How Mellanox ConnectX-2 EN with RoCE Shines

Exegy has tested other technologies that offer RDMA over Ethernet. The Internet Engineering Task Force (IETF) protocol iWARP allows memory-to-memory transport over Ethernet. However, Exegy discovered that the efficiencies of RDMA were essentially compromised as the memory-to-memory constructs were not conducive to being handled in artificial TCP tunnels. Exegy therefore concluded that iWarp was not a viable option for Exegy customers who desired RDMA performance but preferred Ethernet.

In testing Mellanox ConnectX-2 EN with RoCE, Exegy found the system easy to use and implement. It was straightforward to demonstrate that the technology was working with full functionality for RDMA as promised. ConnectX-2 EN with RoCE performance proved to be significantly better than using other protocols over Ethernet.

As a result of our testing, Mellanox is our vendor of choice for all of our network adapters supporting RDMA over Ethernet or InfiniBand.

1.6 Exegy – Case Study

Hardware Acceleration

Advanced technology has allowed firms beyond the traditional financial giants to trade using High Frequency techniques. As a by-product of the competition, exchanges and alternative trading systems have progressively produced more and more data. Direct feed subscribers need to consume all of the data and have used technological innovation to do so and take advantage of new market conditions.

An added benefit to hardware acceleration is the ability to bring in and process more data on a single computer. This is particularly important to traders who need to view more than one market at once to profit from temporary anomalies.

Exegy has cultivated the ability for its Exegy Ticker Plant to be able to ingest millions of messages per second at the lowest possible latency. Exegy's first customers were able to consume vast quantities of normalized data and calculations from the Exegy Ticker Plant using RDMA over standard InfiniBand. However, not all banks and financial institutions have become familiar with InfiniBand and have preferred to receive data over their Ethernet networks.

Every trading firm has proprietary trading strategies that are highly confidential but the general trading strategies are understood. Exegy specializes in the pre-processing of data wherever possible so that Exegy customers can trade faster and more efficiently. Through the adoption of the RoCE standard, Exegy customers can improve their consumption rates and decrease the latencies by using RDMA over Ethernet without the need for implementing unfamiliar InfiniBand networks.

1.7 Summary

Exegy's Ticker Plant and its clients can ingest millions of messages per second from today's extremely busy stock, option and futures markets. With the incorporation of the latest Mellanox ConnectX-2 EN with RoCE adapters, customers need not hesitate to adopt this ground breaking technology since they can easily accommodate it over their familiar Ethernet networks.

1.8 Exegy - The Company

Exegy offers hardware-accelerated appliances for the Financial Services community, facilitating the delivery and normalization of market data at very high data rates, without sacrificing latency or useful functionality. Because Exegy appliances are based on non-traditional hardware-acceleration technologies, more market data can be delivered faster without increasing operating costs, space or management time.

Exegy is a privately-held corporation headquartered in St. Louis, Missouri.

Exegy has considerable experience servicing high frequency traders and trading venues. In serving this market, Exegy has enabled more traders to take advantage of the latest advances in parallel high-performance computing by including cutting edge technology into a single box solution. Previously traders taking direct feeds from exchanges would need to engage considerable staff with advanced programming knowledge and employ large arrays of customized computers to be able to read the data feeds from the exchanges. But today, all of this specialized knowledge is included in a 3 ½ inch tall appliance. In other words Exegy has built a specialized high capacity high speed server that excels at reading price feeds emanating from the world's leading stock markets and exchanges. This is known as the Exegy Ticker Plant. It is also worth pointing out that Exegy has an operations group that constantly monitors the Exegy Ticker Plant. This part of the service reduces the requirement for dedicated operations staff in high frequency trading firms.

Mellanox
TECHNOLOGIES

350 Oakmead Parkway
Sunnyvale, CA 94085
Tel: 408-970-3400 • Fax: 408-970-3403
www.mellanox.com