

## At-A-Glance

### Introduction

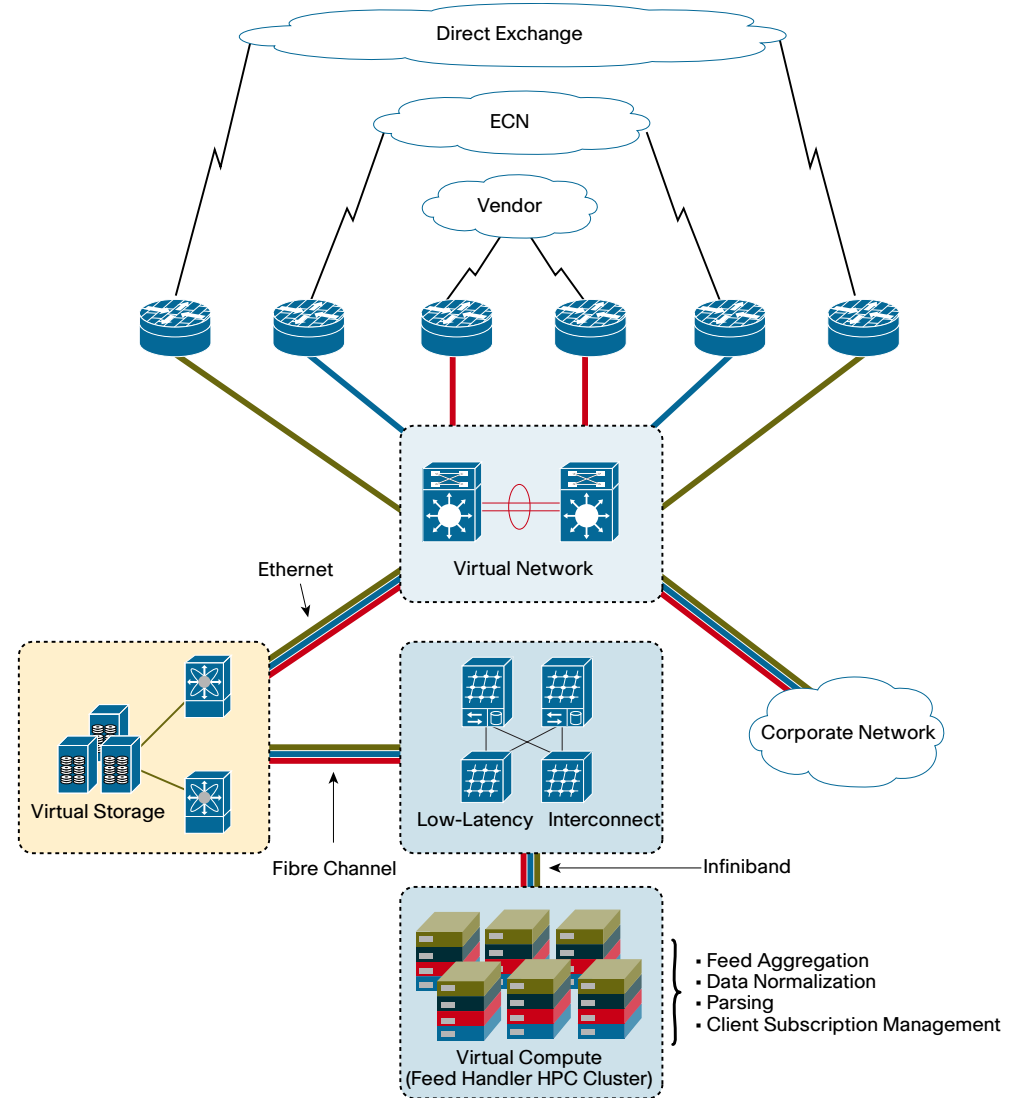
The explosion of electronic trading has created the need for high-performance computing (HPC) environments. To gain a competitive edge in the marketplace, portfolio and risk managers must be able to access real-time financial information and utilize technical indicators to buy and sell equities and exotic investments. As new investment products are introduced, the need to obtain an accurate view of a fund's value and its related risk is significantly increased. These growing business necessities are creating enormous stress on the current compute infrastructures, where highly computational algorithms in mission-critical applications are unable to scale effectively.

Cisco Systems® is uniquely positioned to address this problem with its high-performance computing solutions, which include both Ethernet and InfiniBand technologies. Cisco's broad solution portfolio delivers high speeds, low latencies, open standards, and high system availability-and allows financial customers to deploy the right infrastructure for their application.

To solve many of the emerging application requirements, Cisco offers InfiniBand and high-density 10 Gigabit Ethernet solutions, which are optimized for the most-demanding financial applications. The InfiniBand 4X DDR (double data rate) technology in the Server Fabric Switching (SFS) family can provide throughput rates of up to 20 Gbps. This ultra-low-latency computing fabric provides native remote direct memory access (RDMA) capabilities, to share computational power across multiple CPUs and ensure maximum cluster performance. RDMA has the additional benefit of allowing inter-CPU and memory read/writes, as well as kernel bypass. Applications that specifically support Message Passing Interface (MPI) or Open Fabrics messaging transports can effectively achieve latencies of less than 10 microseconds.

The InfiniBand fabric can also be seamlessly integrated with existing Ethernet networks by using SFS 3000 Series switches-this eliminates any interoperability concerns. The Cisco Catalyst® 6500 Series switches offer a high-density 10 Gigabit Ethernet solution with low latency that is ideal for large Ethernet clusters. The flexibility of multiple-grid computing designs that can adapt to any grid environment allows an organization to scale quickly with growing business demands.

Financial market data providers and consumers are aggressively preparing for upcoming changes in the industry driven by the Regulation National Market System (Reg NMS), the Markets in Financial Instruments Directive (MiFID), and FIX Adapted for Streaming (FAST). A utility computing model is necessary to help organizations respond to these changing market conditions and skyrocketing data rates. A utility computing model constructed with Cisco InfiniBand fabric and the VFrame management platform can help manage virtualized computing and network resources. Capacity can be added on demand or as required by business policies. As clusters become grids, Cisco can quickly make use of servers that allow an organization to scale up its computing resources faster and more cost-effectively. New services and extra compute power can be added automatically, on the fly, to maximize utilization of servers that typically operate below optimum capacity. This intelligent HPC network fabric helps reduce the total cost of ownership because resources are utilized more efficiently. Further, it provides the architecture for consolidating and virtualizing resources, enabling the evolution to an automated system that is able to dynamically respond to changing business needs.





# High-Performance Computing for Financial Institutions

## At-A-Glance

### Cisco HPC Solutions' Benefits to Financial Institutions

#### **Delivers low-latency and high speed Ethernet and InfiniBand interconnects for financial applications such as trading floors and market data feed**

Automated trading makes reducing latency and increasing performance essential in a market data environment. Feed handlers receive real-time market data feeds from sources such as OPRA (Options Price Reporting Authority), NASDAQ, and electronic communications networks (ECNs), and these feeds need to be "normalized" before being distributed to users. Data normalization allows feeds to be standardized through dedicated feed processors and entered into a uniform database model. The uniform access to multiple normalized market data feeds facilitates data distribution to end-users and ensures data consistency throughout the organization. The high server-to-server traffic that occurs as these computations are performed means that a cluster of servers with the lowest possible latency interconnect is needed to reduce delay in delivering the market data.

Through the use of RDMA technology, an application can offload all communications management to the InfiniBand host channel adapter, which allows more CPU cycles to be spent on processing, rather than communications. Cisco's innovative HPC solution creates a high-performance server I/O fabric, achieving ultra-low-latency performance to support the growing computing needs of market data feed handlers and other trading floor applications.

#### **Minimizes latency in each component of delivery platform**

It is imperative that latency be minimized when delivering time-sensitive data. As the data traverses the different components of a trading platform-including market data delivery, order routing, and execution-an HPC environment addresses the speed-sensitivity requirements by providing a lowest-latency interconnect, so that raw computational power can be utilized in clusters to deliver the fastest response possible.

#### **Helps prepare for new regulations that will drive high market-data volumes**

Regulatory changes such as Reg NMS will generate more quote, order, and cancel/replace messages as equity firms adapt to more-electronic business processes. The subpenny pricing rule will also increase demands on the supporting infrastructure. MiFID, which goes into effect in Europe next year, is expected to lead to higher data volumes as well, since investment banks that internalize trades will be required to publish their pretrade quotes electronically. An InfiniBand HPC environment provides a secure, scalable solution to meet the growing needs of the financial services industry.

#### **Increases competitive edge by incorporating FAST protocol for lowest-latency connections**

As financial industry experts predict relentless growth in market-data volumes, organizations are preparing for implementation of the FAST Protocol. FAST offers a lower-latency feed that uses a data-compression technology. Exchanges are planning to use FAST to deliver new products in areas such as derivatives and equities. However, to support the new, rapid market data message rates and deliver the quickest-possible trade execution, a grid computing model is needed to parse the data from the feeds and then deliver it to consumers. The InfiniBand HPC solution can provide the lowest latency transport while providing the bandwidth to sustain increased market volumes.

#### **Provides flexibility to support a service-oriented architecture based on industry-standard protocols**

The Cisco HPC solution adheres to industry standard protocols such as Open MPI and Open Fabrics. This allows customers to leverage the true high-performance, ultralow-latency characteristics of the InfiniBand fabric. An application environment that supports these industry protocols will truly benefit from the open architecture, as it becomes part of a service-oriented architecture strategy for the adaptive enterprise. This shortens the time to market for new financial products, providing a competitive edge.

#### **Allows the use of common tools to manage Ethernet and InfiniBand networks**

The VFrame management platform enables the delivery of utility computing into the data center environment. This increases the ability to rapidly provision shared-server and I/O resources on demand. By managing and orchestrating diverse Ethernet and InfiniBand resources, a financial organization can become more agile-adapting easily to rapidly changing market conditions. In addition, just-in-time provisioning reduces operational costs by automating regular tasks. Since InfiniBand creates a high-speed fabric that is shared by all the nodes participating in it, downtime can be quickly averted by reallocating resources to different resource pools.

#### **Supports the increasing trend toward a utility computing model to support heavy computations**

As market-data levels continue to rise and financial organizations look to expand their product portfolios, increasing raw computational power is required to support the algorithms needed for portfolio performance analytics, Monte Carlo simulations, value calculations, and risk profiling of trades. Grid services virtualize computing silos that underperform or are underutilized and makes them well-balanced, fully optimized enterprise backbones. The Server Fabric HPC infrastructure can be scaled quickly, because additional computing power can be added to the grid dynamically to support business processes with increasing demands. The combination of Server Fabric Switching and VFrame allows for effective consolidation, virtualization, and automation of resources that deliver instantaneous return on investment