



Lightspeed Gateway

Overview Document

Version 1.00
September 30, 2009

I. INTRO

Lightspeed's algorithmic-based trading platform, Lightspeed Gateway, provides active traders, proprietary trading groups and hedge funds that employ computer-generated trading strategies with a dynamic, high throughput technology development solution for equities trading. Its unique network-layer messaging protocol specifies ultra low latency market data delivery and order submission to domestic equity exchanges, ECNs and ATSS. Behind these protocols is a powerful and scalable technology infrastructure capable of processing more than 400 million shares in a single trading day. Lightspeed Gateway provides clients with unrivaled speed and performance, measuring in single digit milliseconds per average order entry, combined with zero-effort compliance and regulatory surveillance and protection. All of this is offered in Lightspeed Gateway's ultra-secure Verizon datacenter in Carteret, NJ which also houses NASDAQ's technology infrastructure, thereby giving Lightspeed Gateway customers zero external network hop access to this market center. Lightspeed Gateway is completely platform agnostic and can be used on all major operating systems and programming languages.

II. FEATURES

1. **NASDAQ Co-Located Datacenter:** LIGHTSPEED GATEWAY's infrastructure is located and maintained within Verizon's Carteret, NJ datacenter, a military-grade datacenter with controlled access, backup power and comprehensive support service. Co-location provides LIGHTSPEED GATEWAY clients zero external network "hop" access to NASDAQ, offering a tremendous performance gain in NASDAQ-bound orders.
2. **Anonymity**
 - Market Anonymity--All customer orders are funneled into a common MPID and Ports as they are sent to the markets. So therefore, individual customer order activity cannot be identified by the market
 - Anonymity from other Customers--Your order flow goes through dedicated LS Gateway hardware, thus creating both network and hardware segregation between customers.
 - Anonymity with Lightspeed--Lightspeed does not prop. trade. We are not interested in what you are trading, your strategy, or your data. We are purely a service provider, so there is no conflict of interest.
3. **Multi-Venue Accessibility:** LIGHTSPEED GATEWAY has connections directly to all major U.S. equities markets, ECN's and ATS's. While the physical location of LIGHTSPEED GATEWAY provides industry-leading advantages in equities trading on the NASDAQ, its extensive connectivity with its other market centers delivers comprehensive ultra low latency market data and execution services to its clients.
4. **Risk Management:** All account rules have been uniquely coded to minimize latency. Account rules and limits monitor risk associated with buying power, buying power factor, maximum order size, maximum position size, P&L loss thresholds, short checking odd lot allowances / restrictions and settings to reject all incoming orders.
5. **System Availability, Scalability and Recoverability:** LIGHTSPEED GATEWAY's dynamic architecture has proven its integrity as a highly dependable technology platform in volatile markets, with average uptime / availability of 99.99%. Scalability has been addressed via the distributed system design which allows for additional servers at any level of the system to be added to help handle increased loads from either direction. The ability to resume trading after

any interruption necessitates recoverability as an absolute requirement for LIGHTSPEED GATEWAY. All of the components of LIGHTSPEED GATEWAY's infrastructure are either stateless or can perform a full rewind – a key requirement for recoverability.

6. **Service** : Lightspeed provides the following services to each customer:
 - **Technical Account Management Team:** Devoted exclusively to technical needs of the automated black box trader.
 - **Financial Account Management Team:** A dedicated financial account manager, along with our real time accounting web site, provide easy access to daily, weekly, monthly and year-to-date financial information.
 - **Trade Support:** Trade support specialists are ready to assist traders with trade related questions or problems.
7. **Price:** Active traders, proprietary trading groups and hedge fund customers benefit from Lightspeed's rates that are frequently analyzed to ensure our automated black box traders receive competitive pricing.

III. Lightspeed Gateway's Technology Infrastructure:

LIGHTSPEED GATEWAY's infrastructure is divided into three components that power the Algorithmic Trading division. These components include a Market Data System, an Order Entry System and a Clearing Interface.

1. **Market Data System.** LIGHTSPEED GATEWAY's Market Data System is comprised of three distinct subcomponents.
 - **Multicast feeds.** Connect to venues and directly receive the full raw data from a dedicated port on your server.
 - **Lightspeed Books.** Connects to various splitters and feeds out a normalized market data feed for individual markets and ECN's, thus insulating LIGHTSPEED GATEWAY users from the constantly changing landscape of market data messages.
 - **Prints and Quotes.** Provides a normalized, aggregated Level I and II market data feeds as well as various stock-level statistics such as high, low, open and close.
2. **Order Entry System.** LIGHTSPEED GATEWAY's Order Entry System is built specifically for speed and stability. It is comprised of various specialized subcomponents performing the following functions:
 - Short locate and short management
 - buying power, buying power factor, maximum order size, maximum position size, P&L loss thresholds
 - Connectivity to market centers to deliver orders.
 - Connectivity to Lightspeed Clearing and Databasing systems
 - Load-balancing and fail-over (fully distributed, horizontally scalable architecture)
3. **Clearing Interface.** LIGHTSPEED GATEWAY's Clearing Interface is an internally managed relational database that is used in conjunction with the clearing firm to both perform trade-level book keeping and to generate all regulatory (i.e., OATS) reporting.



IV. PERFORMANCE

The performance of a direct market access system is evaluated on four criteria: speed, reliability, consistency and functionality. Some of these attributes are inversely related to each other. For example, the redundancies necessary to increase system reliability also reduce the speed of each transaction. We continuously evaluate the balance of these attributes in order to maximize our client's profits and enable trading strategies that would otherwise be impossible.

We created Lightspeed Gateway to minimize the time it takes to view updated market-data and receive confirmation of an order's acceptance. From structural advantages of Lightspeed Gateway's proprietary protocol, to reducing fiber-optic travel time by co-locating our servers in the market data centers, we are committed to finding new ways to reduce latency and ensure that our client's orders are the first byte on the wire.

1. SPEED

- **Lightspeed Gateway :: Protocol**

In its most basic form, Lightspeed Gateway is a proprietary protocol that allows markets and trading algorithms to communicate. While some protocols are built to satisfy the needs of many, Lightspeed Gateway is built for those who need speed. That's why competitors like FIX will have a hard time being as fast as we are. They require integration of open-source libraries that must be optimized to break their forward's compatibility and upgradeability. Lightspeed Gateway is optimized internally so that details are hidden from the end user, making the code simple, fast and stable.

- **Lightspeed Gateway :: Co-Lo**

Active trading is a race where milliseconds make all the difference. Lightspeed Gateway co-locates its servers in the same data-centers as NASDAQ so that data only needs to travel through a few feet of fiber optic cable.

- **Lightspeed Gateway :: Efficiency**

Lightspeed Gateway prides itself on being brutally efficient. All risk and compliance checks are made prior to sending data to market without incurring any measurable latency. It is Lightspeed Gateway's efficiency that allows these services to be provided with no significant impact on performance. The pursuit of pure speed does not undermine Lightspeed Gateway's system stability. Lightspeed Gateway has worked to reduce downtime to an unprecedented 0.03%. Our system's reliability consists of two core attributes:

2. STABILITY

- **PROTOCOL-BASED STABILITY**

A simple protocol implies simple code, and simple code is always more stable. That's one of the strongest motivations behind the Lightspeed Gateway protocol specification.

- **Lightspeed Gateway :: HARDWARE-BASED STABILITY**

Single-tasking computers that can be horizontally scaled from the technology powering Lightspeed Gateway. Single component failure should not affect the system as a whole.

Successful algorithmic trading depends on honing the logic that executes orders. This is impossible to achieve without consistent, quality data. Lightspeed Gateway is designed to minimize speed deviations by carefully considering the two aspects of automated trading: order entry and delivery of market data.

3. CONSISTENCY

- **Lightspeed Gateway :: Order Entry**

There are countless opportunities in the market, but many are short-lived. This results in large numbers of orders being placed in short periods of time. Lightspeed Gateway's order entry system is specifically designed to avoid this problem – it handles 15 million orders every day and provides customers with a service they can count on.

- **Lightspeed Gateway :: Market Data**

Nowhere else is the adage "garbage in, garbage out" truer than in automated trading. Consistent and dependable delivery of market data to a black box is an absolute necessity. Lightspeed Gateway excels in this area too. Offering a multitude of delivery options and historical data for end-user back testing, Lightspeed Gateway gives your black box the market data it needs to be effective.

As a protocol, Lightspeed Gateway was built for pure speed. But as a system, Lightspeed Gateway offers a comprehensive package for connectivity, control and additional tools.

4. FUNCTIONALITY

- **Lightspeed Gateway :: CONNECTIVITY**

Lightspeed Gateway, a Division of a FINRA Broker Dealer, connects to all the major markets, NYSE, NASDAQ, AMEX, and is co-located with NASDAQ at their military grade hosting facility. Also, order type such as RASH are supported by Lightspeed Gateway's order entry system.

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