TRENDS IN TRADING TECHNOLOGY

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During the last 10 years the financial trading industry has had to evolve due to the following systemic changes:

- Increased competition between exchanges due to market fragmentation
- Regulatory pressure to decrease risk and prevent trading accidents
- Move of exchanges to colocation centers requiring fair and consistent access to all members
- Increase of technical volumes due to automated trading
- Increased competition amongst the Sell-Side due to pressure from the Buy-Side to decrease total cost of trading
- Increased demand for fairer and more predictable trading conditions from the exchanges
- Increased complexity and diversity of the traditional market data universe to include cloud-based information

This has created an evolving landscape with the following lasting consequences:

- Decrease of the traditional manual trading and allocation of Buy-Side orders and screen based trading
- Concentration of exchange connectivity platforms into exchange or proximity hosted colocation centers
- Development of a low latency, low jitter industry through the mobilization of technologies never before used in the financial industry such as microwave links and FPGAs (Field Programmable Gate Arrays) for market data, connectivity and algos
- Development of a seamless low-latency pre-trade check capacity, also through the mobilization of FPGA technology provided by specialized vendors or the exchanges themselves
- Mobilization of Big Data technologies that are now incorporated into an increasing number of automated trading platforms

Meeting these new challenges is a work in progress for the industry.

EXCHANGE CONNECTIVITY AND RISK

The move towards the commoditization of extreme low latency in trading is already well under way. This will be compounded by the need to include fail-safe risk checks, which will be provided by both exchanges

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and specialized vendors. The volumes and sheer amounts of testing cases and computational power that are needed for these services mean that systems that can fully incorporate parallel processing such as FPGAs and maybe ASICs at some point in the future will be more and more widely used. Low latency risk assessment across multiple asset classes traded on multiple locations will allow allocating trading capital to be more efficiently utilized.

THE MARKET DATA UNIVERSE

The move beyond traditional exchange provided market data is already well under way. Integration of feeds from Social Media platforms such as Twitter will continue and as a result, big data technologies will become increasingly mainstream in more and more algorithmic trading platforms. Due to the inherent volatility of such data sources, this will also compound the need for fail-safe and robust risk checking.

Techniques that will allow vast amounts of data to be processed in parallel, such as consolidation of traditional exchange order books as well as consolidation of heterogeneous non structured data, will also become mainstream.

HFTS AND THE NEED FOR SPEED

The race to low latency has been pushed close to the limits of the speed of light. We now have layer 1 switches that can process a network packet in less than 5 nanoseconds and full trading platforms in FPGAs that can process the incoming data and trigger an order in less than 1 microsecond. To put this into context, we have to remember that in a vacuum an electron travelling at the speed of light needs more than 3 ns to travel one meter.

Given that most legacy automated trading platforms are not well suited to fully take advantage of these speeds, it is clear that a consolidation or Darwinian phase of the algo industry is under way. The emphasis will be on benefitting from consistent and reliable low latency market connectivity, bringing it to single digit microseconds for simple strategies such as arbitrage, while improving the algorithmic decision-making process, allowing firms to perform more complex algorithms at high speed.

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For this shift to happen smoothly a specialization of tasks and service provision is under way:

- **Exchanges will continue their move towards fair colocation with limited technical noise. This will provide a consistent advantage to those customers with the more competitive trading systems. Exchanges will also continue to move towards a more systemic offer of comprehensive risk checking as the business and legal risk of providing such services is balanced by the competitive advantage of being seen as both innovative and safe.**
- **Specialized vendors will make extreme low latency offers (once the privilege of large Buy-Sides with multi-million dollar IT budgets) a commodity. Low latency hosting offers will be "democratized" in the same manner.**
- **Expertise in low-level programming will no longer be a pre-requisite, as this will be supplied by solution providers. As a result, Buy-Sides and HFTs who used to need network system experts, connectivity protocol experts and expertise in low level machine language programming will be able to focus on their key differentiating factor: the quality and innovation of their own algos. They will be provided over time with a more and more efficient set of tools to allow them flexibility and time to market. Firms that currently program their algos with evolved languages such as C++ will see offers evolve until they can build their algo into a variation of "Excel in Hardware".**