

A photograph of the Aurora Borealis (Northern Lights) over a body of water. The aurora displays vibrant green and blue light curtains against a dark, starry night sky. The lights are reflected in the calm water below. In the foreground, there is a grassy field with small white flowers and a small pond.

Levyx Risk Analytics Acceleration Framework

Making Complex Computation Simple and Affordable

Matt Meinel

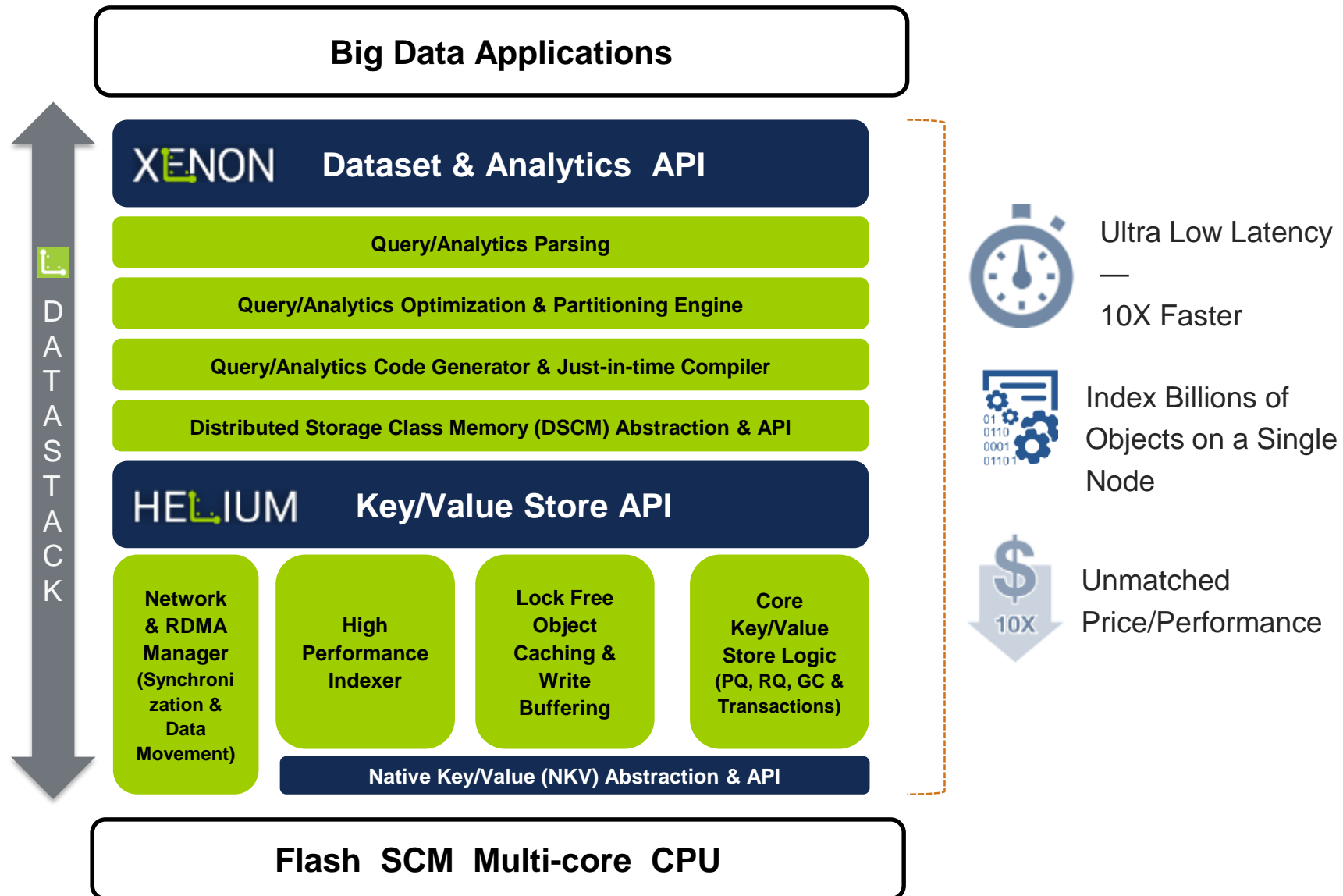
Levyx Inc, SVP Sales and Solutions Architecture

April 2018

Levyx at a Glance

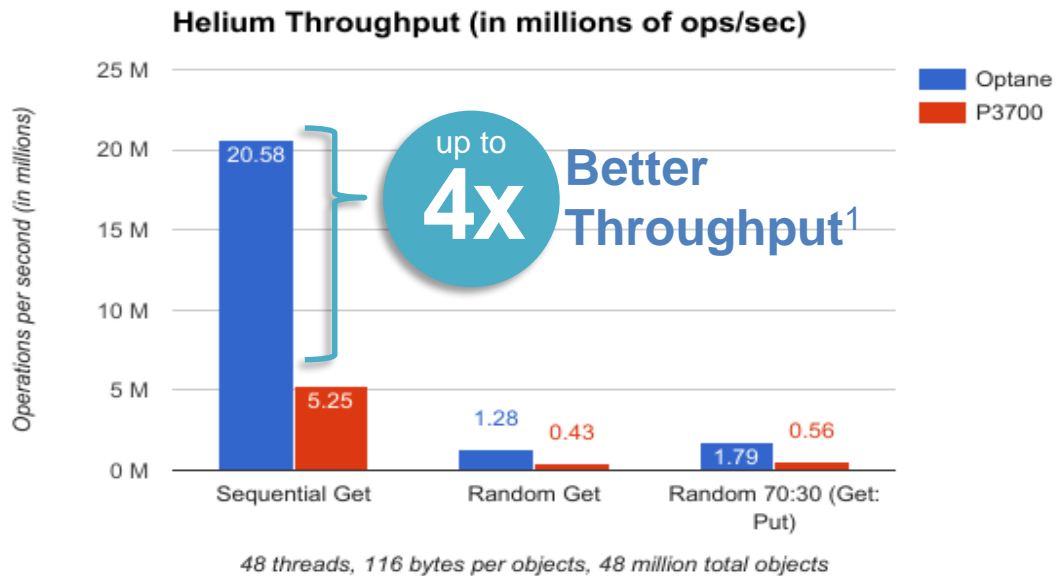
| | |
|----------------|---|
| ORIGIN | <ul style="list-style-type: none">• Year founded: 2013• HQ: Irvine, CA• Founders:<ul style="list-style-type: none">✧ Reza Sadri, CEO - Entrepreneur, PhD C.S. Database specialization✧ Tony Givargis, CTO, UC-Irvine Professor of C.S., PhD C.S.• 24 total headcount: 19 FTEs including 15 engineers (5 PhDs), 5 contract |
| OEM TRACTION | <ul style="list-style-type: none">• Levyx produces ultra high-performance, embeddable software data engines optimized for SSD, storage class memory, and next generation storage.• First major OEM (data grid use case) signed 2015• Currently under evaluation by multiple OEMs |
| FUNDAMENTAL IP | <ul style="list-style-type: none">• ~ 20 Filed/Pending Patents Reza Sadri, CEO - Entrepreneur, PhD C.S. Database specialization<ul style="list-style-type: none">✧ Multiple patents filed for core IP with emphasis on Flash/NVM✧ Essential patents in Big Data analytics, distributed systems, and large-scale data indexing |
| FUNDING | <ul style="list-style-type: none">• ~\$6.5M raised from OCA Ventures, Amino Capital and individual investors |

Next-generation Data Stack

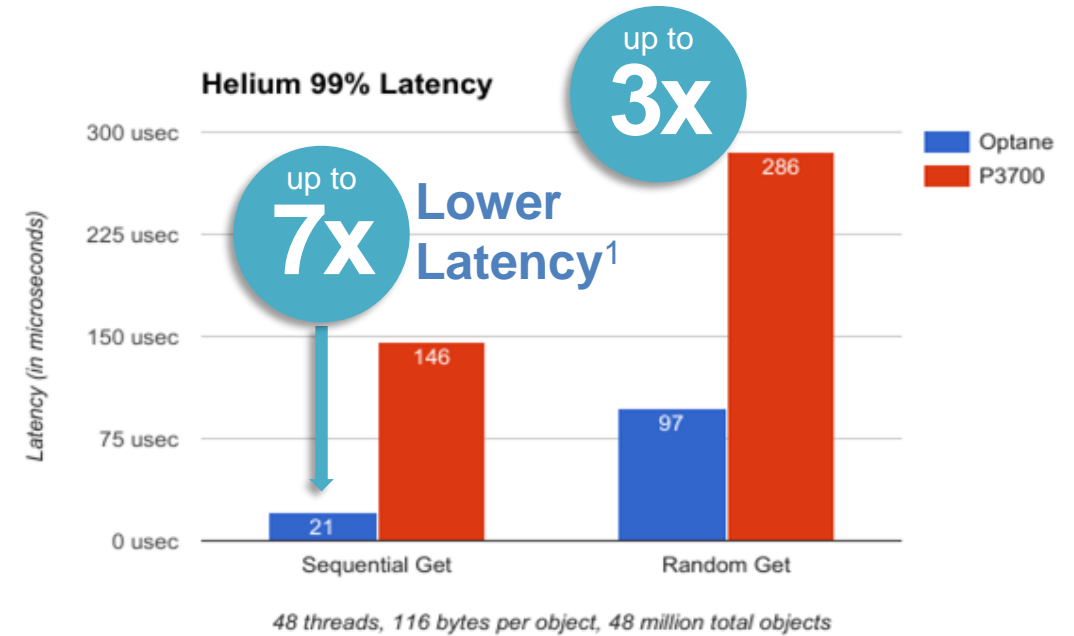


Levyx Helium* Software + Intel® Optane™ SSD DC P4800X

Not STAC Benchmarks



Transactional database service levels >20M TPS



Sub-100 microseconds 99% latency

Major Step-up in Performance and Latency Reduction vs. NAND SSDs

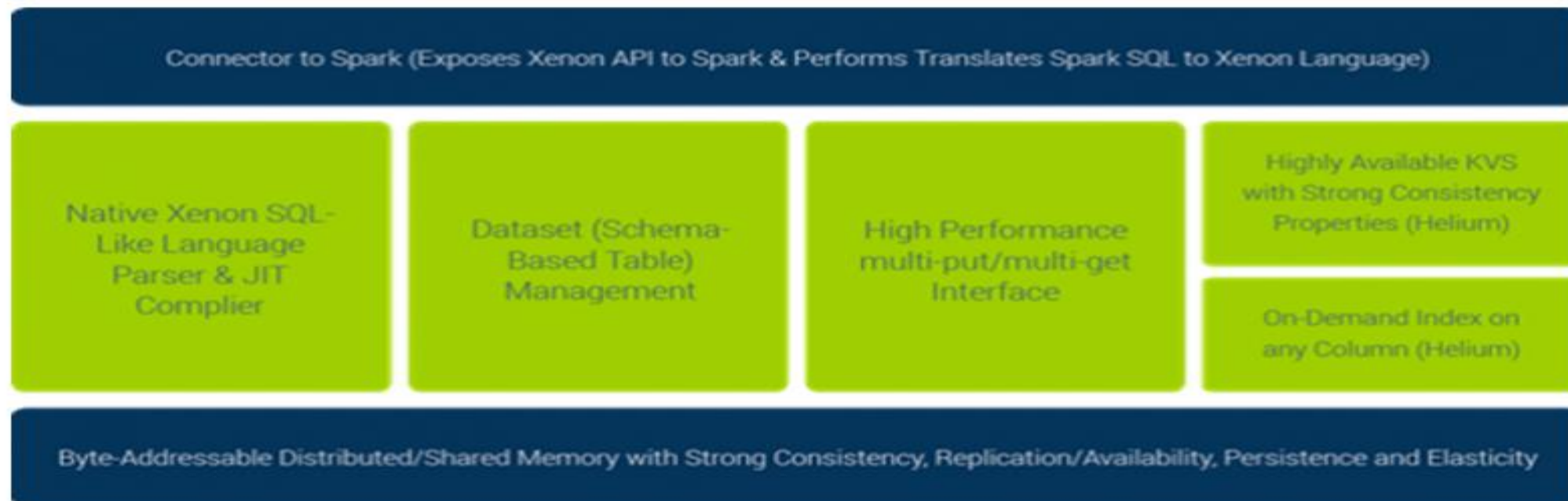
¹Source - Levyx; system configuration: Server model: Lenovo* x3650 CPU 2x Intel® Xeon® E5 2690 v4 @ 2.60 Ghz, 35MB Cache, Ram 128GB DDR4 @ 2133 Mhz, Storage 2TB HDD-Boot Drive, Intel® Optane™ SSD DC P4800X 2x 375 GB; CentOS 7.3.1611 (kernel 3.10.0-514.16.1.el7.x86_64), Network Intel x540-T2 Dual Port 10GBaseT Adapter, Helium* version 2.9.0. Estimated results were obtained prior to implementation of recent software patches and firmware updates intended to address exploits referred to as "Spectre" and "Meltdown". Implementation of these updates may make these results inapplicable to your device or system.

*Other names and brands names may be claimed as the property of others

Recent Backtesting Results on AWS available ...

Posted February 12, 2018

Vault Reports: STAC-A3 and Spark on AWS, with and without Levyx Xenon



Backtesting price-performance of Spark/AWS with and without data acceleration

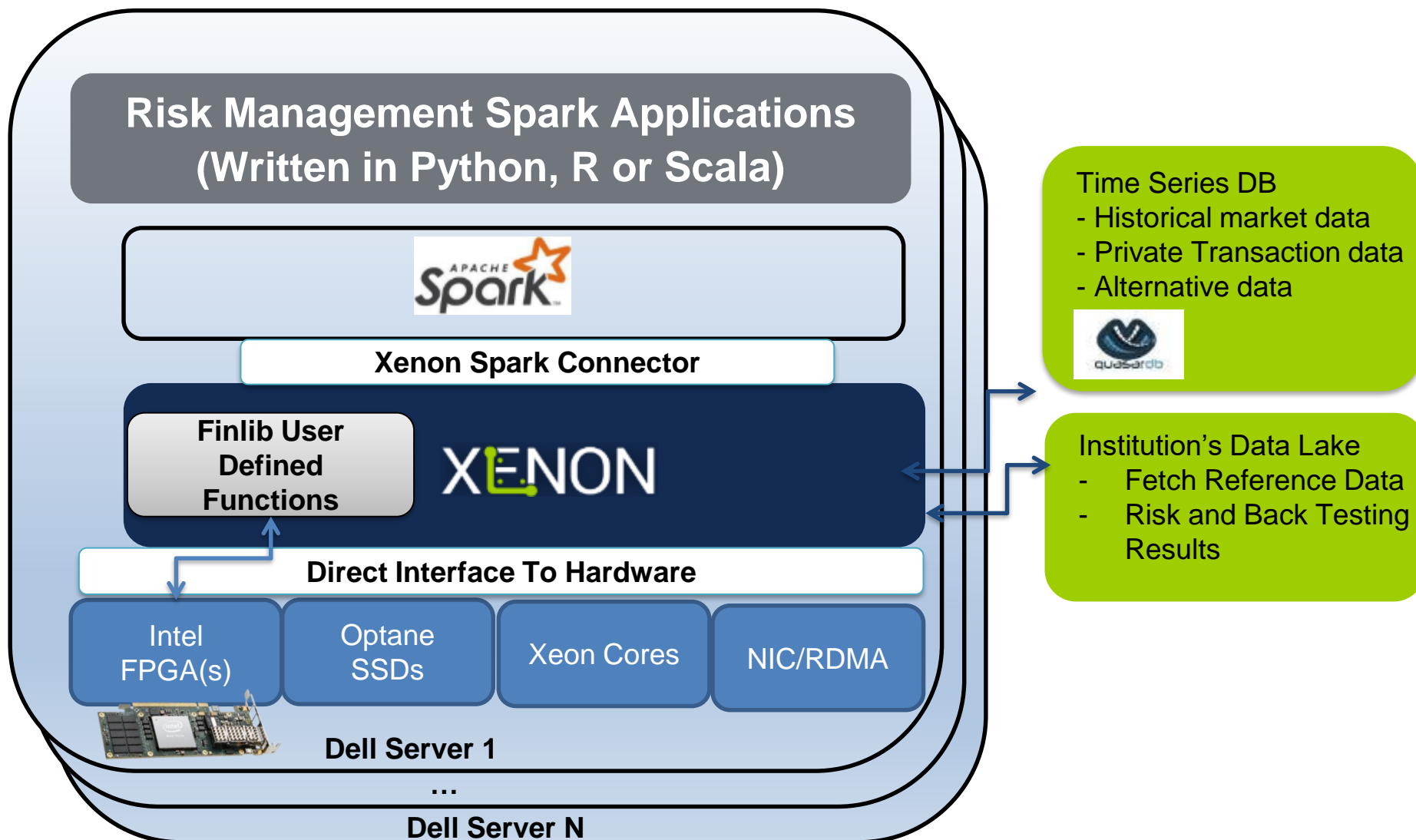
Next-Generation Risk Analytics Solutions Must Seamlessly Integrate All of the Tools

FPGA Solutions for Accelerated Compute and Backtesting are the future:

- 1 FPGAs must be tightly integrated and seamlessly integrated with software systems and applications.
- 2 Application data must be represented in a dataframe format that is flexible enough to be routable through heterogenous processing elements (e.g., cores and FPGAs) in parallel.
- 3 Underlying compute platform must be scalable and distributed to correctly partition to workload between nodes within a cluster, cores within each node, and FPGA accelerators on each node.

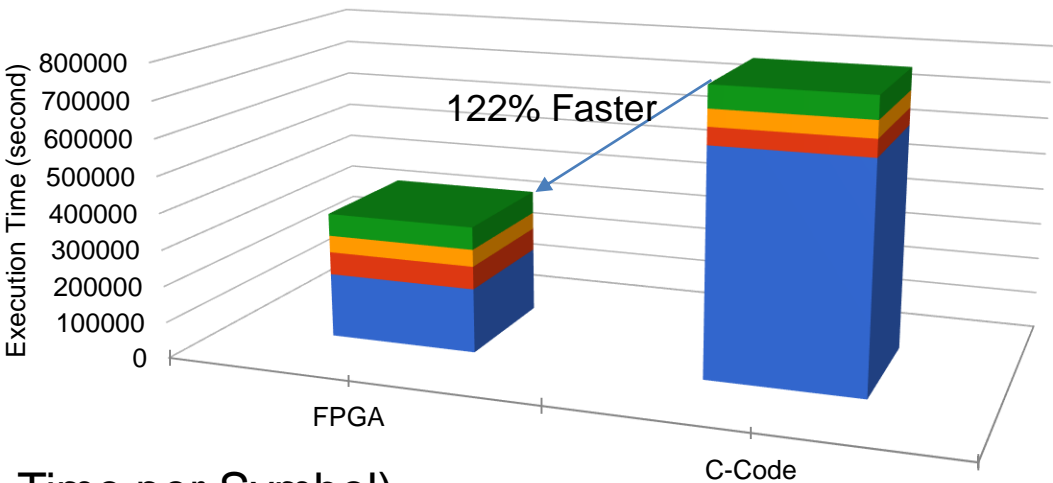
The Levyx / Intel Risk Analytics Acceleration Framework does all of these.

Integrated Intel's FPGA FinLib Option Calcs in a few weeks ...

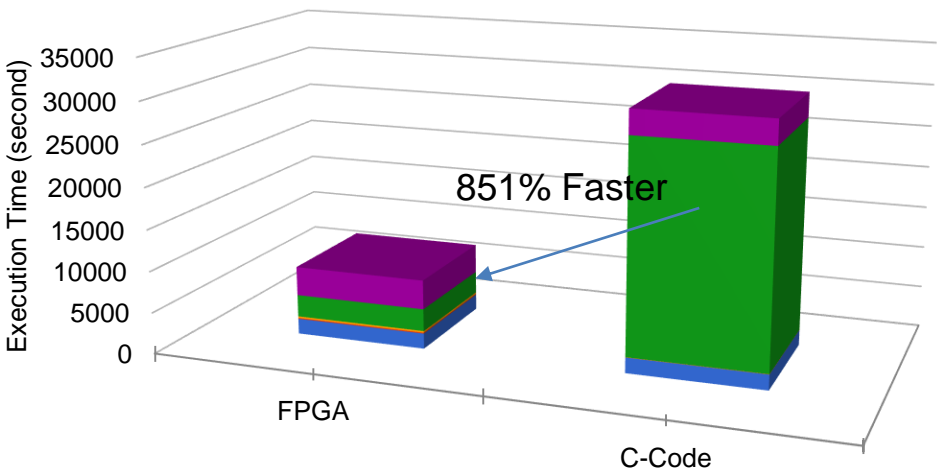


Result: Options Calculation Compute Times Significantly Reduced by Single FPGA

20 Symbols, 50 Simulations (Total Time - All Symbols)



20 Symbols, 50 Simulations (Options Calc Time per Symbol)



- Read From FPGA, Write To SSD
- Run Algorithm
- Write To FPGA Memory
- Setup FPGA
- Write To Xenon Memory

* Not STAC BENCHMARKS

Dual FPGA Results Show Near Linear Scaling

Single FPGA Evaluation – Jan 2018

| Symbols | Total Number of Options | Spark Calculation (options/sec*) | Xenon / FPGA Calculation (options/sec*) |
|---------|-------------------------|----------------------------------|---|
| 4 | 584,396,032 | 18,435,072 | 62,692,782 |
| 20 | 2,921,980,160 | 16,432,423 | 54,220,561 |
| 80 | 11,687,920,640 | 15,138,569 | 47,866,869 |

Dual FPGA Evaluation – Feb 2018

| Symbols | Total Number of Options | Spark Calculation (options/sec*) | Xenon / FPGA Calculation (options/sec*) |
|---------|-------------------------|----------------------------------|---|
| 4 | 1,168,792,064 | 26,386,667 | 90,744,070 |
| 20 | 5,843,960,320 | 30,847,936 | 97,958,254 |
| 80 | 23,375,841,280 | 31,231,301 | 94,990,986 |

* Not STAC BENCHMARKS


Symbols: The number of stock symbols used ie IBM, APPL, MSFT, etc

Options: An individual “Black-Scholes Function” call to value a specific Call or Put option with a specific set of parameters as might be traded on the CBOE (Chicago Board of Options Exchange)

*Number of Option Calculations per Second Including Greeks (Risk Metrics)

More Info: STAC Vault, Solution Brief and Podcast, More STAC results coming ...

SOLUTION BRIEF
Financial Services
Risk and Trading Model Analytics



Why FPGA actually stands for “financial programming greatly accelerated”

Authors:

Matt Meinel
SVP Sales, Business Development,
and Solutions Architecture
Levyx Incorporated

Luis Morales
Chief Operating Officer
Levyx Incorporated



If you are responsible for building, testing, maintaining, or deploying trading/risk models utilizing financial algorithms:

- **As a business strategist or trader:**
You will better understand how to best apply the latest technologies for financial backtesting to successfully generate more

Achieving peak performance in financial capital market risk analytics using the Levyx Risk Analytic Framework with Intel® FPGAs and Intel® Optane™ SSDs

Executive Summary

Alpha or excess profits—that’s what any trading firm continuously strives for. Here you will see how backtesting trading models—the use of historical data to forecast the profitability and risks of new algorithmic high-frequency trading (HFT) strategies—using the Levyx Risk Analytic Framework is more efficient and less time-consuming than conventional approaches.¹ The framework brings together some Intel’s latest innovations with Levyx software to drive significant hardware acceleration that results in 2x to 8x performance gains in this type of application.² These efficiencies result in brokerages, investment banks, and hedge funds “learning fast” by deploying more robust and profitable trading models across their electronic trading and risk management systems, which in turn reduces risk and increases profitability.



Levyx on Intel's Conversations in the Cloud (Feb 2018)

40 views

Levyx Inc
Published on Mar 5, 2018

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Matt Meinel, Senior Vice President - Sales, Business Development and Solutions Architecture at Levyx joins this episode of Intel's Conversations in the Cloud to discuss leading-edge financial services solutions that leverage high-performance data store technology. Levyx's

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A photograph of the Aurora Borealis (Northern Lights) in a snowy mountain landscape. The aurora is a vibrant green, appearing as several bright, vertical streaks of light against a dark, starry night sky. The landscape below is covered in snow, with dark, jagged mountain peaks and rocky outcrops visible. The water in the foreground is calm, reflecting the green light of the aurora.

Thanks!

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