NOVASPARKS™

High Performance FPGA Market Data Solutions

Can FPGAs Manage US Equity Options Feeds?

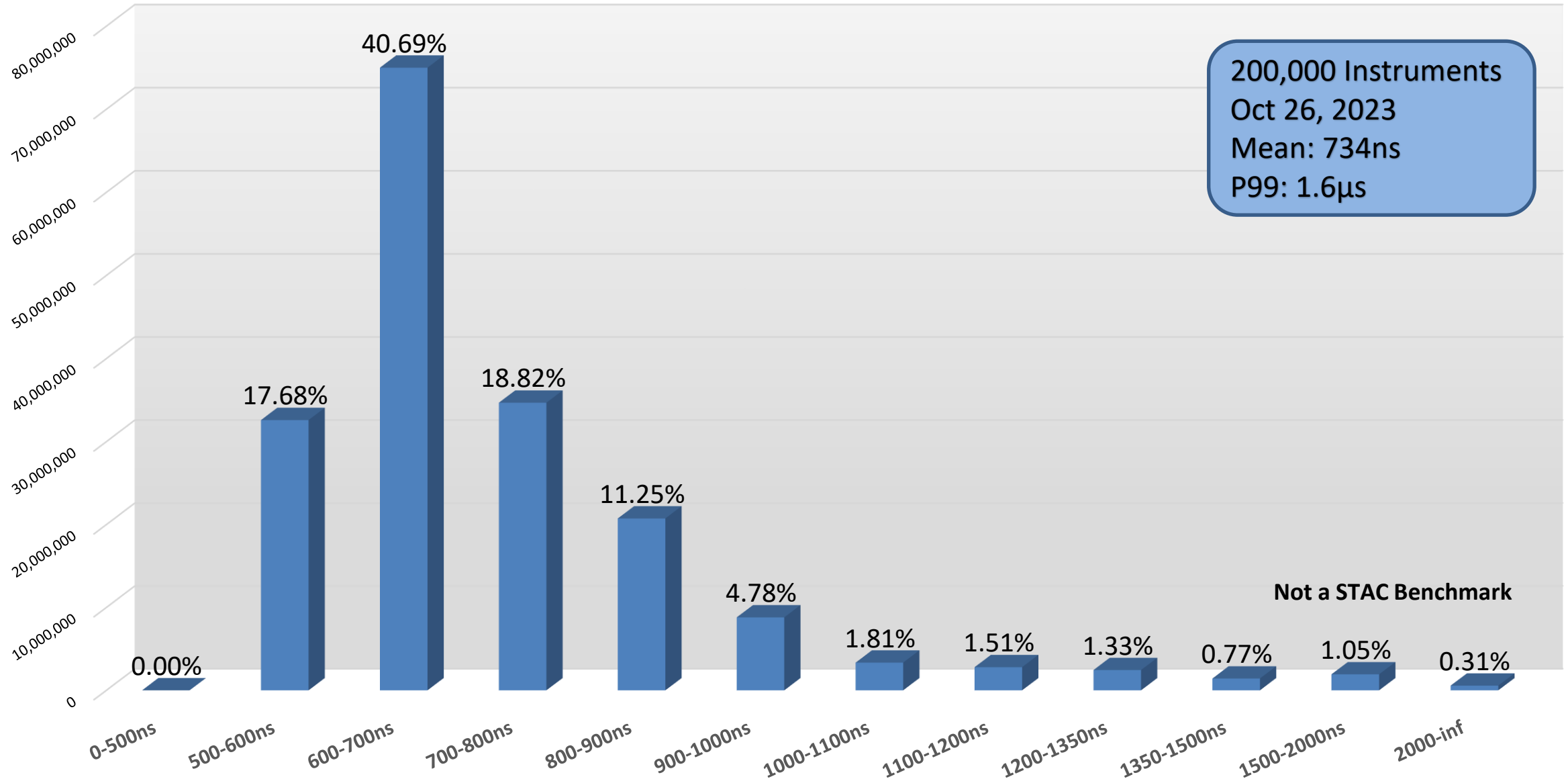**STAC Chicago - May 30, 2024**

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Director of Business Development

Yes, They Can!

- NovaSparks manages full US Equities on single 2U Server:
  - Order Book Building and Normalization FPGA Latency < 500ns
  - 15 Markets x 13,000 Symbols
- Options are much larger both in bandwidth and instrument count
  - NovaSparks custom built QDR memory architecture allows support for 200,000 instruments per FPGA with excellent hardware latency
  - Utilizing available DDR, the solution scales dramatically to manage an additional 300,000 instruments
  - Full markets are supported via a multi-FPGA appliance

Not a STAC Benchmark

CBOE C1 Latency Graph for FPGA (with Book Building)

200,000 Instruments
Oct 26, 2023
Mean: 734ns
P99: 1.6µs

Not a STAC Benchmark

Values by bucket:
- 0-500ns: 0.00%
- 500-600ns: 17.68%
- 600-700ns: 40.69%
- 700-800ns: 18.82%
- 800-900ns: 11.25%
- 900-1000ns: 4.78%
- 1000-1100ns: 1.81%
- 1100-1200ns: 1.51%
- 1200-1350ns: 1.33%
- 1350-1500ns: 0.77%
- 1500-2000ns: 1.05%
- 2000-inf: 0.31%

Support of OPRA by NOV∆TICK

- Support for 96 lines/channels
- Two products:
  - **OPRA Raw Filtering on PCIe Card**
    - Handles full OPRA on a single PCIe Card, 40G input, 100G Q4
    - Filtering on Exchange, Symbol, Exchange, Message type, Quote condition, etc.
    - Output in OPRA Pillar format on PCIe bus or Ethernet 10G
    - Run existing trading applications unaltered
    - Adds 200ns latency in front of NIC card while focusing algo on relevant data content

  - **OPRA Feed Handler on appliance with 4 FPGA boards**
    - Support entire OPRA universe (2.2M symbols x 18 Exchanges)
    - A/B arbitration
    - Output distribution features: NBBO, Exchange, Symbol, Message Type, etc.
    - Average wire to wire FPGA latency at 746ns
    - Books built in appliance, allowing trading server to focus on trading algo

Not a STAC Benchmark

OPRA Bandwidth Management

- OPRA feed publishes only NBBO

- Trades and administrative messages are not conflated

- Size based conflation = Remove only quotes that vary by size > X

- Time based conflation

- Favor critical instruments
  - 78% of volume on instruments with expiration < 30 days
  - 20% of volume on instruments expiring today

- Max bandwidth option – conflate only when queuing occurs

Managed OPRA Service

- OPRA Pillar format

- Hosted in Mahwah with POP in NY4

- Size based conflation for applications

- More aggressive conflation on long expiries and out of the money options

- Conflation only happens during volume peaks

- 10G or 25G Output Max Bandwidth

- In Production Q4 2024

NOVASPARKS™

Pure FPGA Market Data Solutions

Check the NovaSparks box on your card or Email sales@novasparks.com