

Leveraging High Performance Market Data at the Enterprise Level

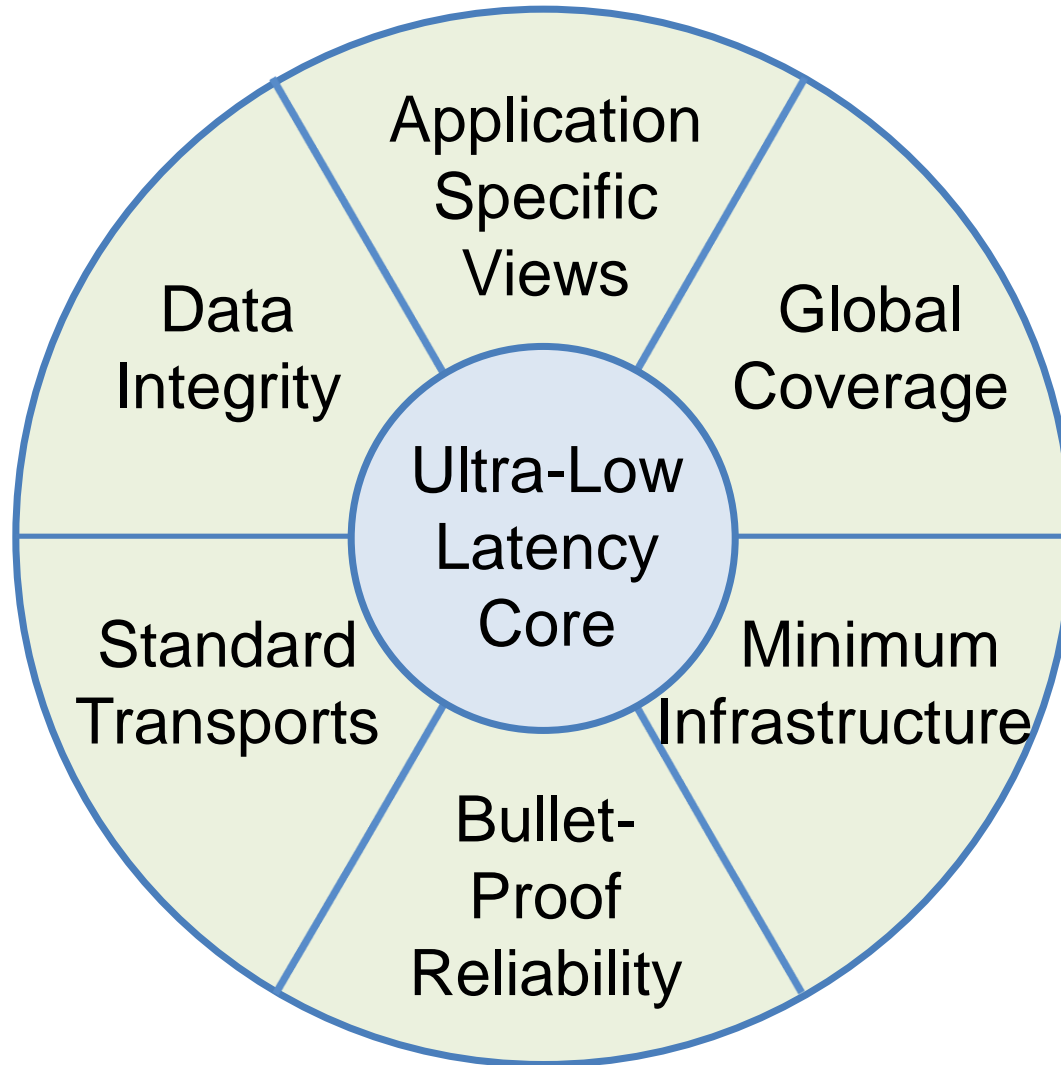
STAC Summits Fall 2015

Mark Skalabrin, CEO

Intelligent Trading. Faster

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Meeting the Needs of Enterprise Market Data





The best foundation for Enterprise Market Data

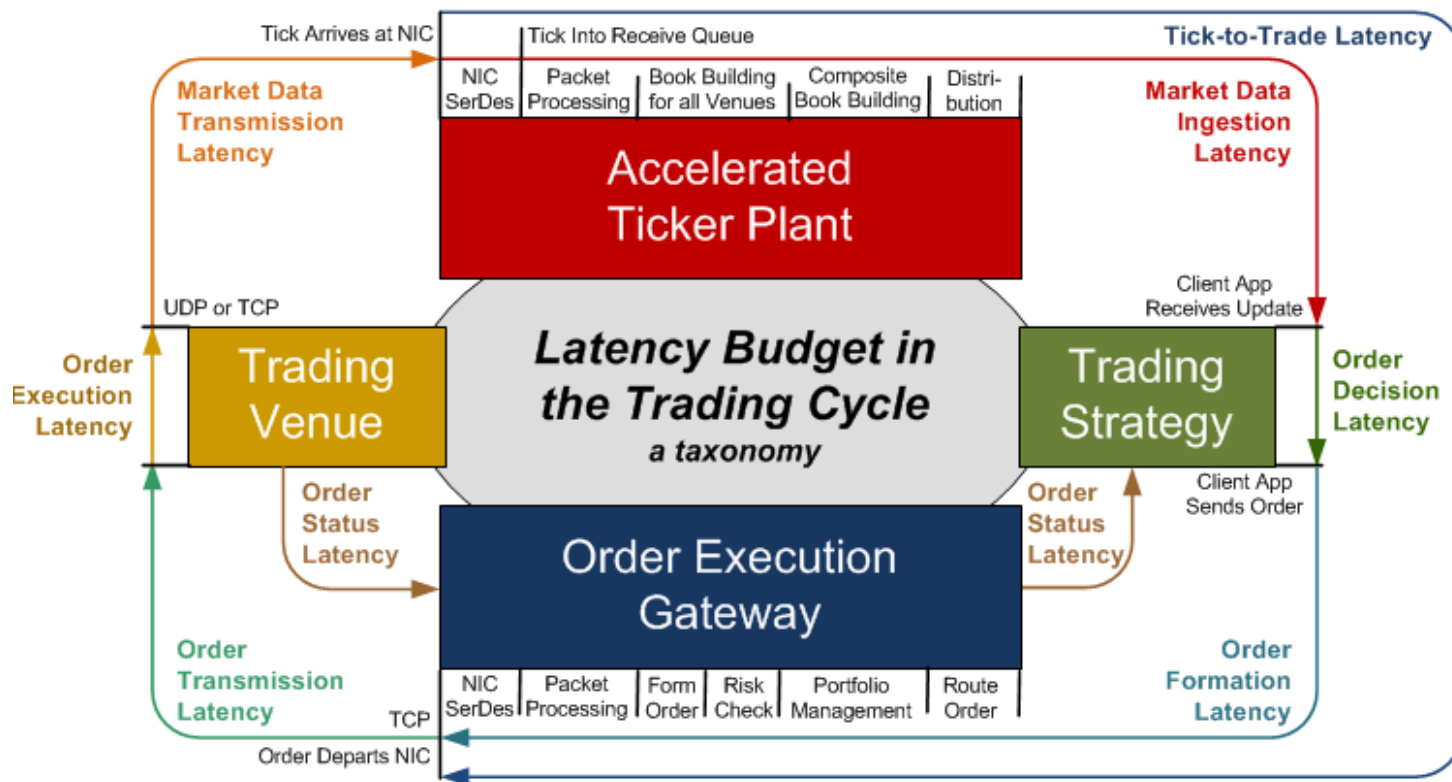
What are the benefits of using a high performance market data core for enterprise market data?

- Shrinking Costs
- Shrinking Complexity
- Shrinking Complaints

Design Drivers for an Ultra-Low Latency Core

Technology choices

- Processing elements
- Network Adapters
- Programming Environment
- Scalability Model





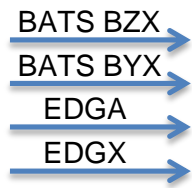
Decision Criteria for Selecting Processing Element

- Latency – wire to decision, decision to wire
- Determinism in the face of market data bursts
- Programming flexibility matched to algorithm complexity
- Rate of change matched to development and qualification cycle
- Impact on operational costs
- Problem resolution cycle matched to business needs
 - identify, fix, qualify, and deploy –



Scalability Model Example

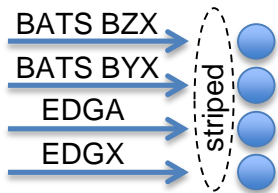
4 Exchanges x 1 Thread



Percentile	Thread 1
50%	0.8 μ s
90%	39.2
99%	1400.0
Pkt. Wait	7%

Single Thread processing 4 Exchanges
P99 latency is high due to packet queuing
despite 93% backup free

4 Exchanges x 4 Thread



Percentile	Thread 1	Thread 2	Thread 3	Thread 4
50%	0.9 μ s	0.9 μ s	0.9 μ s	0.9 μ s
90%	1.4	1.9	1.4	1.9
99%	3.0	3.7	3.0	3.9
Pkt. Wait	<1%	<1%	<1%	<1%

With a well
designed scalability
model adding
threads linearly
scales throughput
eliminating latency
from queuing

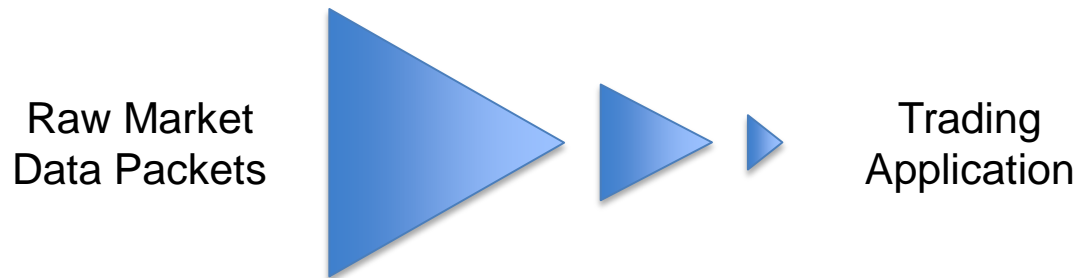
Market Data Dispatch Time: Run on DL380p Gen8 24-core 2.7GHz "Ivy Bridge" Intel Xeon Server (E5-2697 v2)

Measures from the moment the packet arrives at our NIC to the moment the tick is put into shared memory in a queue for the client process to consume. It includes the time to decode the messages (from both the primary and secondary feed of each exchange, though only the primary is used unless a gap has occurred), normalize the data, and build the full-depth book for every symbol and passing price aggregated top of book updates to the memory of subscribed clients.



Design Criteria for Application Specific Data Views

Challenge: Retain relevance without information overload

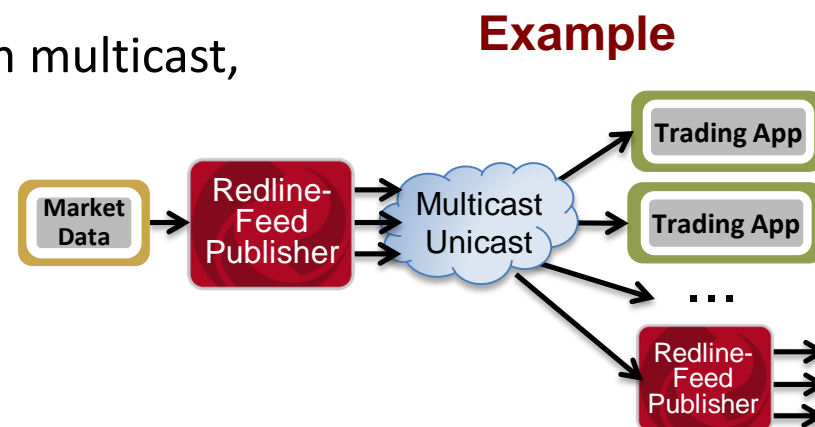


- The goal is to reduce distractions
 - Receive only the most relevant data, at the rate you need it
- Minimized overhead to only what is necessary
- Combine and normalize information to the highest level that retains relevance
 - Providing order level trigger event typically sufficient to provide context

Design Criteria for Enterprise Distribution

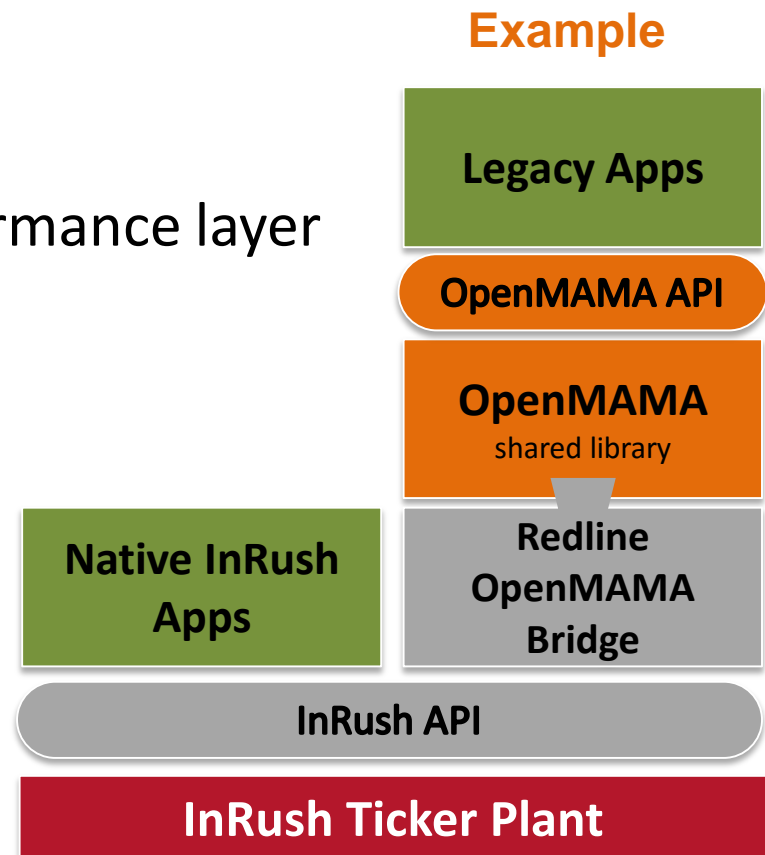
Challenge: distributing data to a wide range of apps

- Allow for flexible definition of published content on a per publisher basis
 - Depth, Price Aggregation, Conflation Policy, Maximum Bandwidth
- Allow for both unicast and multicast from the same source
- Support cascading publishers
 - Allows transformation at each hop
 - Example: unicast site to site, republish multicast, republish time conflated
- Support Entitlement permissioning



Challenge: bridging to deployed applications

- When adopting a high performance API, there may remain some applications you don't want to change
- Solution: bridging
- Method: maintain the high performance layer as long as possible





Challenge: decoding the market data Tower of Babel

- Varying Symbology in use
 - exchange native
 - in-house
 - independent software vendor's
- Currency further complicates matters
- Solution:
 - Flexible translation layer



Challenge: Raising the bar on resilience

Most important thing is to know when something is wrong!

- *and know what to do about it...*
- Example: network disruption affecting an order level direct feed
 - Prevention
 - Situational Awareness
 - Substitution
 - Recovery

The faster you know that something is wrong

- *the lower the impact...*
- Example: real-time monitoring



Challenge: leverage the Cloud where it fits best

- Historical Market Data
- Simulation Environment
- Analytics
- Continuous software integration and testing



Unified Architecture with High Performance Core

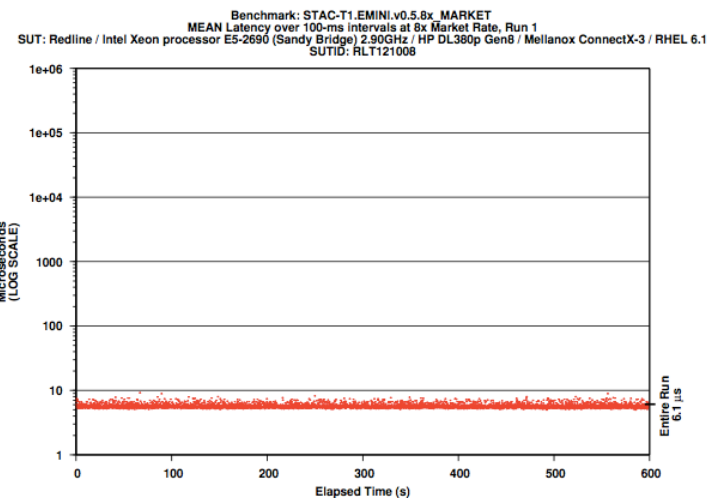
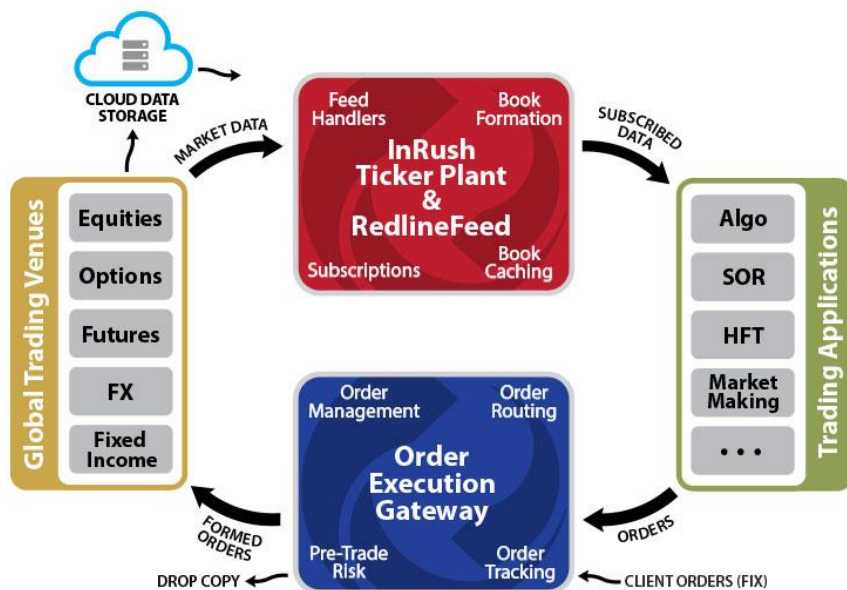
- Significant Financial Saving
- Reduced Complexity
- Improved Performance
- Happier Clients



Who is Redline Trading Solutions?

The leader in high performance trading solutions since 2008

- Ultra-low latency ticker plant and order execution gateway solutions
- Deployed at leading banks, prop trading firms, market makers and dark pools
- Headquarters near Boston with offices in NYC, London, Chicago, and Hong Kong



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