VELOCIMETRICS

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Rapidly detect performance issues impacting real-time financial systems and networks

With faster trading, surging volumes and evolving regulations continuing to shape the marketplace, the pressure is on to ensure that operational performance is continually optimised.

The ability to rapidly access liquidity at the intended price, without slippage, the emergence of unknown risks or the fear of market data quality issues, is integral to trading success. That's why leading capital market firms and some of the world's largest stock exchanges trust TipOff® to effectively measure and manage the performance of their extremely fast moving and high volume environments.

Capturing, decoding and normalising 100% of data received, TipOff provides real-time and retrospective analysis with access to detailed network, middleware and market data insights.

High-speed network packet capture

TipOff delivers high-speed, passive, network packet capture to disk with sustained data rates in excess of 40Gbps. By capturing everything, TipOff eradicates the risks associated with sampling approaches, guaranteeing that 100% of raw data received will be available for future analysis.

Utilising hardware accelerated compression technology, TipOff can store more than 20 TB of raw capture files on a 2U appliance or 80 TB of raw capture files on a 4U appliance. This approach facilitates high capacity storage with a low footprint, presenting the potential for significant cost savings.

Complete transparency

TipOff's high degree of compatibility, and ease of integration, makes it the perfect partner to Application Tap®, which offers a patented, high precision approach to in-application instrumentation, with minimal performance overhead.

Combining Application Tap's ability to gain a fine-grained view of the individual components operating inside an application with TipOff's extensive level of network visibility, blind spots

The heat map visualises trading performance, highlighting high latency events within a period. These events can then be further investigated via the scatter chart and displayed in various views.

are eliminated. So regardless of where an issue occurs, TipOff can pinpoint its exact source, considerably reducing the problem's time to resolution.

High precision latency measurement

Conducting accurate time stamping to a resolution of 10 nanoseconds on a TipOff Appliance or reading the timestamps generated by the capture layer (for example those created by aggregation switches) extremely precise hop-by-hop performance measurements and analytics can be achieved. These statistics enable TipOff users to very quickly comprehend current performance and identify latency hotspots for focused improvement.
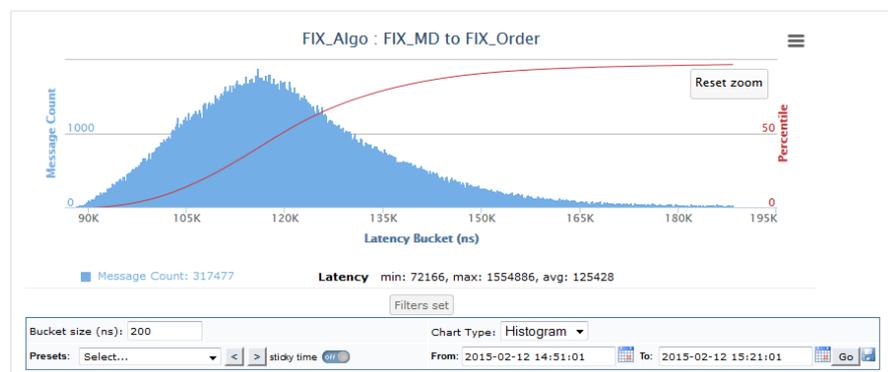
This level of understanding enables users to set benchmarks for future performance and be alerted when thresholds are breached. This insight enables service providers to understand if the latency reported by a client is occurring within their environment or that of the client's. It also enables exchanges to identify if the matching engine is running slower than expected or if public updates are being distributed more quickly than private.

Additionally, by identifying latency hotspots, users can accurately determine how latency reduction budgets should be apportioned to achieve the greatest return on investment (ROI).

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Histogram of trading behaviours

Network analysis

TipOff's precise instrumentation enables performance issues to be forensically analysed, right down to the individual network packet and nanosecond level, supporting:

- 1/10/40 Gigabyte Ethernet interfaces
- Microburst analysis at OSI layers 1 to 4
- TCP re-transmission and transport quality analytics
- TCP latency and packet layer latency analytics

All of these measures are achieved with exact timings to 10 nanosecond resolution, alongside detailed bandwidth analysis.

Middleware analysis

TipOff supports performance root cause analysis by leveraging its thorough examination of the middleware stacks that comprise each hop in a data flow. As the most significant source of latency is often the retransmission latency that results from lost packets, TipOff enables middleware-messaging activities to be independently monitored and analysed.

TipOff monitors the internal operation of reliability layers across an extensive range of middleware messaging protocols. TipOff provides protocol specific statistics, identifying retransmission requests, and generating subscriber, publisher and topic statistics for the messages themselves. In doing so, early warning signs of operational conditions that could result in increased latency can be detected, exposing potential load balancing and capacity challenges.

Packet Capture

- 100% network packet capture to disk at 40Gbps
- High capacity, low footprint storage

Complete Transparency

- Application and network monitoring
- Blind spot elimination

Precise Latency Measurement

- Non-invasive latency monitoring
- Accurate time stamping to 10 nanoseconds using the TipOff Appliance
- Ability to read time stamps generated at the capture layer
- Multi-hop and multi-protocol
- Tick-to-trade and trade-to-tick
- Execution venue latency analysis

Network Analysis

- Drill down to the individual packet and nanoseond level for detailed forensic analysis
- Microburst analysis and alerting
- Bandwidth analysis
- TCP troubleshooting

Precise Time Retransmission

- Re-experience market data idiosyncrasies
- Retransmit market data at the original speed, slower or faster
- Generate a robust, real-world testing environment

Market Data Analysis

- High volume sequence gap analysis
- Capacity planning

Real-time Protocol Decodes

- Extensive library of high speed middleware and exchange protocol decoders
- Decode up to 4 million+ messages per second
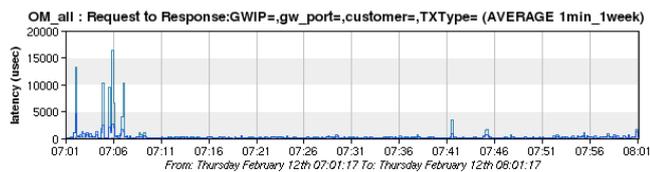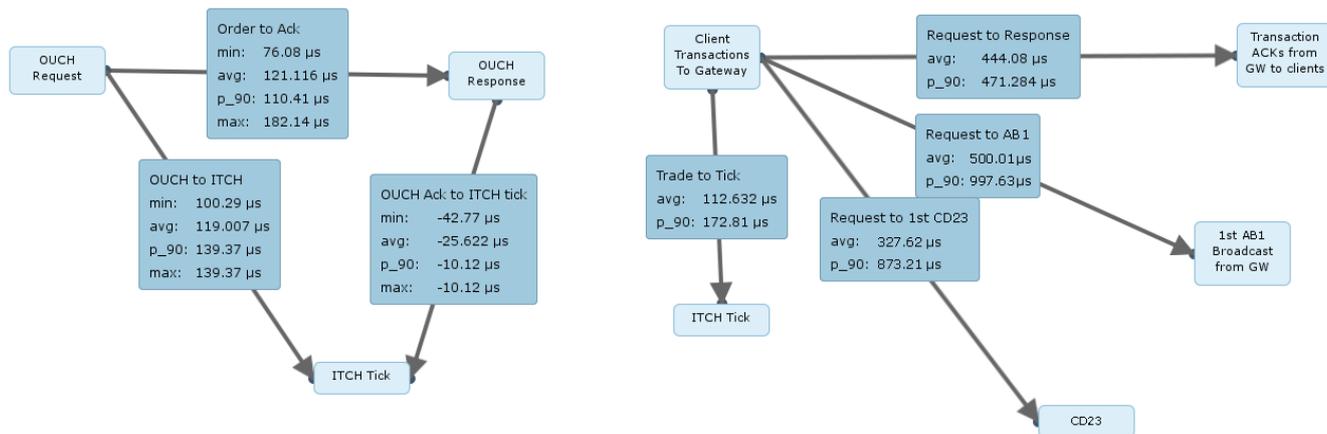- Decoder SDK

Middleware Analysis

- Independently monitor and analyse middleware messaging activities
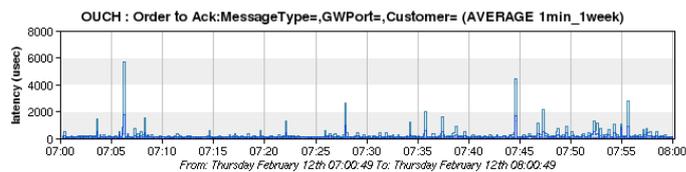
Flexibility

- Seamlessly integrate normalised data with the users own in-house or third party analysis tools
- Asset class and business use agnostic
- Multiple deployment and accelerated implementation options

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OUCH Request

Order to Ack
min: 76.08 µs
avg: 121.116 µs
p_90: 110.41 µs
max: 182.14 µs

OUCH Response

OUCH to ITCH
min: 100.29 µs
avg: 119.007 µs
p_90: 139.37 µs
max: 139.37 µs

OUCH Ack to ITCH tick
min: -42.77 µs
avg: -25.622 µs
p_90: -10.12 µs
max: -10.12 µs

ITCH Tick

Client Transactions To Gateway

Request to Response
avg: 444.08 µs
p_90: 471.284 µs

Transaction ACKs from GW to clients

Request to AB1
avg: 500.01µs
p_90: 997.63µs

Trade to Tick
avg: 112.632 µs
p_90: 172.81 µs

Request to 1st CD23
avg: 327.62 µs
p_90: 873.21 µs

1st AB1 Broadcast from GW

ITCH Tick

CD23

OM_all : Request to Response:GWIP=,gw_port=,customer=,TXType= (AVERAGE 1min_1week)

From: Thursday February 12th 07:01:17 To: Thursday February 12th 08:01:17

	min	max	avg	total
today	74.72	36749.20	491.72	451847
yesterday	71.89	28420.60	384.62	1077552
min	76.17	168.02	86.96	
weighted avg	117.35	4639.35	334.56	
50th percentile	106.62	317.94	145.78	
90th percentile	123.95	16540.8	475.37	
std deviation	21.85	8867.69	1184.83	

OUCH : Order to Ack:MessageType=,GWPort=,Customer= (AVERAGE 1min_1week)

From: Thursday February 12th 07:00:49 To: Thursday February 12th 08:00:49

	min	max	avg	total
today	50.18	19178.40	185.26	367184
yesterday	50.06	29391.40	319.24	1096366
min	56.08	152.08	64.07	
weighted avg	96.03	1780.26	259.95	
50th percentile	80.98	1355.52	140.97	
90th percentile	100.13	5749.16	599.30	
std deviation	22.02	2459.19	290.63	

Typical trading desk dashboard

Market data analysis

TipOff supports high volume, market data sequence gap detection. By instantly identifying and alerting the business to missing sequences, and recognising the feeds impacted, damage limitation methods can be implemented to avoid inaccurate trading decisions based on unknowingly partial data streams.

TipOff also enables the real-time and historical analysis of market data message volumes, which can then be used to facilitate more effective capacity planning.

Event syndication into client specific analysis systems

TipOff guarantees 100% capture and enables data to be decoded through its extensive library of high performance protocol decoders. In addition to offering an extensive range of performance analytics of its own, TipOff is also able to stream normalised data into a client's own choice of either in-house or third party analysis tools. In doing so, the syndicated events are then able to feed client specific systems, databases and messaging tools providing vital risk and regulatory insight.

In response to client demand, TipOff has developed a range of event syndication adapters facilitating seamless integration with many of the most widely adopted third-party analysis tools.

Precise Timed Retransmission

TipOff's Precise Timed Retransmission capability enables TipOff to retransmit previously captured data onto the network, reproducing the original packet timings with high precision, including every microburst with nanosecond accuracy. Enabling the idiosyncrasies of real-world market data, for example, to be accurately re-experienced at the original recorded rate or a multiple or fraction of the original rate.

This unique functionality enables real-world environments to be re-created, so new algorithms and system enhancements can be more robustly tested and users gain a stronger understanding of how their algos and systems are likely to perform under varying conditions.

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Deployment Options
TipOff can be rapidly deployed as both an Appliance and software only solution on physical and virtual machines:

TipOff G6 Hardware
The latest TipOff G6 hardware offers unrivalled performance, leveraging the very latest Intel CPUs coupled with both FPGA and ASIC based hardware acceleration.

TipOff G6 Turbo
TipOff G6 is available with the Turbo software option – a high performance database that enables TipOff to correlate and store an extremely high traffic rate on a single appliance. TipOff G6 Turbo achieves a 20 fold performance gain over TipOff G6 for typical transaction latency monitoring use cases.

TipOff Software
TipOff is also available as software only, enabling users to deploy this powerful solution on their choice of hardware, in a virtual machine or blade server environment.

Decoder Coverage
TipOff offers Equities, FX, Fixed Income and Derivatives market data and transaction decoders for an extensive range of regional and globally adopted protocols.

About Velocimetrics
Velocimetrics sets a new benchmark for business monitoring and operational oversight by delivering uncompromised end-to-end visibility across complex environments, accompanied by performance improving analytics.

Its full-spectrum product suite, comprising of TipOff, Velocimetrics and Application Tap enables emerging problems to be instantly detected and their root cause rapidly understood from both a business and technical perspective. This significantly reduces an issue's potential impact, whilst also identifying opportunities for on-going performance improvements.

Providing asset class agnostic, highly customisable, agile, open and globally scalable solutions, Velocimetrics prioritises flexibility so it can build the solution that will effectively meet your firm's specific requirements.

Formed in 2009, Velocimetrics' world-class financial services expertise continues to attract a growing global client base. Its sophisticated solutions deliver the level of transparency required to instil confidence and its innovative approach demonstrates the future potential for business flow monitoring and performance analysis tools.

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