



BATS Europe Multicast Latency Feed Specification

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1 Introduction

1.1 Overview

BATS Europe Participants may use the Multicast Latency Feed to monitor various Matching Engine unit performance statistics. Updated Matching Engine level statistics will be distributed via the Latency Feed every 15 seconds during market hours.

Measurements and metrics for each measurement to be distributed are as follows.

1.1.1 Measurements

- **Order to Quote:** The elapsed time from when an order enters the BATS network to the time that order appears on the BATS Europe Multicast PITCH Gig Shaped A feed. Only visible orders have Order to Quote metrics.

1.1.2 Metrics

- **Begin Time:** Number of milliseconds from midnight, London time.
- **End Time:** Number of milliseconds from midnight, London time.
- **Count:** Count of orders used in calculation of all other metrics from Begin Time to End Time.
- **Minimum:** Minimum order processing latency from Begin Time to End Time, in seconds.
- **Maximum:** Maximum order processing latency from Begin Time to End Time, in seconds.
- **Average:** Average order processing latency from Begin Time to End Time, in seconds.
- **Mode:** Mode of the order processing latency from Begin Time to End Time, in seconds.
- **Percentile:** Percentile based metrics of the order processing latency from Begin Time to End Time, in seconds. Initial values to include 99.9%, 99%, 95%, 90%, 75%, 50% (Median) and 25%.
- **Standard Deviation:** Standard deviation of sample.

1.2 Feed Connectivity Requirements

The Multicast Latency Feed is available from the BATS Europe Slough (LD4) facility only. Given the limited amount of messaging required, there is no minimum bandwidth requirement for the Latency Feed. All statistics, at the time of this writing, are available from a single multicast group. There will be no subdivision by market or symbol range. Dropped messages are not recoverable for the Latency Feed.

2 Protocol

The Latency Feed is to be used for monitoring Matching Engine unit performance.

All information presented on the Latency Feed is anonymous and does not contain any Participant identifying information.

2.1 Message Format

The messages that make up the Latency Feed protocol are delivered using the BATS Sequenced Unit Header which handles sequencing and delivery integrity. This unit header mirrors the unit header used in Multicast PITCH. Participants familiar with the Multicast PITCH protocol should find it very easy to reuse code to process the Latency Feed. The “Hdr Unit” field from the sequenced unit header will always be zero filled in the Latency Feed. Within the context of the Latency Feed, a single message can carry multiple statistics from different units. The applicable unit will be identified within each statistic carried in the message.

All UDP delivered events will be self contained. Developers can assume that UDP delivered data will not cross frame boundaries and a single Ethernet frame will contain only one Sequenced Unit Header with associated data.

The Latency Feed is comprised of a series of dynamic length sequenced messages. Each message begins with a length field. **BATS Europe reserves the right to grow the length of messages without notice.** Participants should develop their decoders to deal with unknown messages and messages that grow beyond the expected length. Messages will only be grown to add additional data to the end of a message.

Message sequence numbers are incremented by one for every sequenced message.

2.2 Data Types

The following field types are used within the Sequence Unit Header and the Latency Messages:

- **Binary** fields are unsigned and ordered using Little Endian convention (least significant byte first).
- **Double** fields are 64-bit floating point and are ordered using Little Endian convention (least significant byte first).

2.3 Message Framing

Messages will be combined into a single UDP frame where possible to decrease message overhead and total bandwidth. The count of messages in a UDP frame will be communicated using the BATS Sequence Unit Header. Framing will be determined by the server.

2.4 BATS Sequenced Unit Header

The BATS Sequenced Unit Header is used for all Latency Feed messages.

Sequenced and unsequenced data may be delivered using the Sequenced Unit Header. Unsequenced data will have 0 values for the unit and sequence fields.

Sequenced messages have implied sequences with the first message having the sequence number contained in the header. Each subsequent message has an implied sequence one greater than the previous message up to a maximum of count messages. Multiple messages can follow a Sequenced Unit Header, but a combination of sequenced and unsequenced messages cannot be sent with one header.

The sequence numbers for the first message in the next frame can be calculated by adding the Hdr Count field to the Hdr Sequence. This technique will work for sequenced messages and heartbeats.

Sequenced Unit Header				
Field	Offset	Length	Data Type	Description
Hdr Length	0	2	Binary	Length of entire block of messages. Includes this header and “Hdr Count” messages to follow.
Hdr Count	2	1	Binary	Number of messages to follow this header.
Reserved	3	1	Binary	This byte will be zero filled and reserved for future use.
Hdr Sequence	4	4	Binary	Sequence of first message to follow this header.
Total Length = 8 bytes				

2.5 Heartbeat Messages

The BATS Sequenced Unit Header with a count field set to “0” is used for heartbeat messages. During trading hours, heartbeat messages will be sent from all multicast addresses if no data has been delivered within 1 second. Heartbeat messages never increment the sequence number for a unit, but can be used to detect gaps on the real-time multicast channels during low update rate periods.

Heartbeats on the real-time multicast addresses during trading hours will have a Hdr Sequence value equal to the sequence of the next sequenced message to be sent for the unit.

Outside of trading hours, BATS sends heartbeat messages on all real-time and gap channels with a sequence of “0” to help users validate multicast connectivity. Heartbeat messages may not be sent from 12:00am – 1:00am London time or during maintenance windows.

3 Latency Feed Message

The Latency Feed supports a single message type that is used to present a variety of metrics for noted key measurements.

3.1 Latency Stat Message

A Latency Stat Message demonstrates performance for a specific Matching Engine unit for a specific time-frame. The unit and metric are defined in the body of the message as described in the table below.

Sequenced Unit Header				
Field	Offset	Length	Data Type	Description
Length	0	1	Binary	Length of this message including this field.
Message Type	1	1	Binary	0x90
Measurement Type	2	1	Binary	0 (zero) = Order to Quote
Matching Unit	3	1	Binary	Refer to the Multicast PITCH specification for Matching Unit mappings.
Begin Time	4	4	Binary	Number of milliseconds from midnight (London time).
End Time	8	4	Binary	Number of milliseconds from midnight (London time).
Count	12	4	Binary	Count of orders used in calculation of all other metrics from Begin Time to End Time.
Minimum	16	8	Double	Minimum order processing latency (seconds) from Begin Time to End Time.
Maximum	24	8	Double	Maximum order processing latency (seconds) from Begin Time to End Time.
Average	32	8	Double	Average order processing latency (seconds) from Begin Time to End Time.
Standard Deviation	40	8	Double	Standard deviation.
Mode	48	8	Double	Mode of order processing latency (seconds) from Begin Time to End Time.
99.9 Percentile	56	8	Double	99.9 percentile of order processing latency (seconds) from Begin Time to End Time.
99 Percentile	64	8	Double	99 percentile of order processing latency (seconds) from Begin Time to End Time.
95 Percentile	72	8	Double	95 percentile of order processing latency (seconds) from Begin Time to End Time.
90 Percentile	80	8	Double	90 percentile of order processing latency (seconds) from Begin Time to End Time.
75 Percentile	88	8	Double	75 percentile of order processing latency (seconds) from Begin Time to End Time.
50 Percentile (Median)	96	8	Double	50 percentile of order processing latency (seconds) from Begin Time to End Time.
25 Percentile	104	8	Double	25 percentile of order processing latency (seconds) from Begin Time to End Time.
Total Length = 112 bytes				

4 Multicast Configuration

4.1 Limitations/Configurations

Period/Type	Limit/Setting	Notes
MTU	1,500 bytes	BATS will send UDP messages up to 1,500 bytes. Participants should ensure that their infrastructure is configured accordingly.

4.2 Rendezvous Points

Data Centre/Environment	Rendezvous Point
BATS Europe LD4 Production	95.130.109.254
BATS Europe LD4 Certification	TBD

4.3 Latency Feed Distribution Addressing

Data Centre/Environment	IP Port	Multicast (and Source) IP Addresses
BATS Europe LD4 Production	31201	224.0.83.255 (95.130.109.177)
BATS Europe LD4 Certification	TBD	TBD

5 Support

Please email support questions or comments regarding this specification to:

`tradedeskeurope@batstrading.com`

Revision History

11 November 2011	Initial version.
7 February 2012	Messages now include percentiles.
