INVESTORS EXCHANGE DEEP SNAP SPECIFICATION

Version 0.05

Updated: December 23rd, 2020

Table of Contents

OVERVIEW

Participants of Investors Exchange ("IEX" or the "Exchange") may use DEEP to receive real-time depth of book quotations and last sale information direct from IEX. DEEP also supports several security-related administrative messages and provides event controls, such as start of day and end of day, to participants.

The depth of book quotations received via DEEP provide an aggregated size of resting displayed orders at a price and side, and do not indicate the number or size of individual orders at any price level. Non-displayed orders and non-displayed portions of reserve orders are not represented in DEEP. DEEP also provides last trade price and size information. Trades resulting from either displayed or non-displayed orders matching on IEX are reported. Routed executions are not reported.

DEEP provides short sale restriction status, trading status, operational halt status, and security event information via security-related administrative messages. Lastly, DEEP provides event information about the market and data feed via administrative messages.

Please refer to IEX DEEP Specification for more specific DEEP feed information.

The proposed DEEP SNAP service is intended to augment the current DEEP gap-fill retransmission service by adding a separate snapshot protocol to allow consumers to accelerate late-start recovery. It does not modify the existing DEEP feed or retransmission protocols.

TRANSPORT PROTOCOL OPTIONS

DEEP SNAP will use a new request-response TCP/IP unicast protocol.

Note: Snapshot Responses contain data messages detailed in the IEX DEEP Specification and the IEX Transport specification.

ARCHITECTURE

DEEP SNAP is a request-response protocol with no unsolicited messages (i.e. heartbeats). Applications would start to receive and buffer DEEP multicast before connecting to a DEEP SNAP server on a well-known port and would issue a SnapshotRequest Message.

In response the DEEP SNAP server will either provide a Snapshot Response or ErrorResponse Message.

A Snapshot Response provides a point-in-time snapshot of the DEEP Price level data and trading status data for all IEX Symbols along with the associated DEEP feed Sequence number.

On receipt of a Snapshot Response the applications would initialize their internal Price level books for each Symbol using data from the Snapshot Response, then apply any buffered real-time updates with higher sequence numbers.

Applications would then disconnect from the DEEP SNAP server and continue to process the DEEP feed real-time multicast as normal.

Connections may be timed-out and disconnected by either client or server if no data has been transmitted for a significant period (10 seconds).

DATA TYPES

These are identical to the DEEP Specification:

- String: Fixed-length ASCII byte sequence, left justified and space filled on the right
- Long: 8 bytes, signed integer
- Price: 8 bytes, signed integer containing a fixed-point number with 4 digits to the right of an implied decimal point
- Integer: 4 bytes, unsigned integer
- Byte: 1 byte, unsigned integer
- Timestamp: 8 bytes, signed integer containing a counter of nanoseconds since POSIX (Epoch) time UTC
- Event Time: 4 bytes, unsigned integer containing a counter of seconds since POSIX (Epoch) time UTC

All binary fields are in **little endian** format.

Note that each byte is represented by two hexadecimal digits in the examples within this specification.

NETWORK DETAILS

DEEP SNAP TCP/IP

Snapshot Configuration

- Supported Retransmission Protocol(s):   TCP
- Maximum Requests: Quota restricted (1000/day)
- Supported Request Type(s):   SnapshotRequest

DEEP SNAP Server Addresses

SITE	XC Type	Server	Port	Credentials
IEX POP (Equinix NY5)	Primary (A)	TBD	TBD	TBD
	Secondary (B)	TBD	TBD	TBD
Disaster Recovery (Equinix CH4)	Tertiary (C)	TBD	TBD	TBD
IEX Testing Facility (Equinix NY5)	ITF (I)	23.226.155.19	33379	"TEST:password"

Please contact itfsupport@iextrading.com for support help related to the ITF.

MESSAGE FORMATS

SnapshotRequest Message (MessageType 'r')

The SnapshotRequest message is sent from the Client to the DEEP SNAP Server to authenticate and request a Snapshot Response.

Field Name	Offset	Length	Type	Description/Notes
Message Length	0	2	Integer	Length of message in bytes not including this field (41)
Message Type	2	1	Byte	'r' (0x72) – SnapshotRequest
Authentication Token	3	40	Byte	Token supplied by IEX MarketOps. Left justified string *user:password* space padded on right.
ChannelID	43	4	Integer	Channel Identifier.
SessionID	47	4	Integer	Session Identifier.
Minimum Sequence Number	51	8	Long	Minimum Sequence Number useable by client

Total Message Data length is 59 bytes.

Applications will normally wait until they receive and start buffering DEEP Feed Multicast messages before connecting and sending a SnapshotRequest to the DEEP SNAP Server. The SnapshotRequest's ChannelID, SessionID and Minimum Sequence Number fields should be populated with values from the DEEP FEED IEX TP-Header in the Multicast packet.

ErrorResponse Message (MessageType 'e')

Sent by the DEEP SNAP server to the client when a SnapshotRequest is rejected.

Field Name	Offset	Length	Type	Description/Notes
Message Length	0	2	Integer	Length of message in bytes not including this field (2)
Message Type	2	1	Byte	'e' (0x65) – ErrorResponse
Reject Reason Code	3	1	Byte	Reason the SnapshotRequest was rejected

Total Message Data length is 4 bytes.

Reject Reason Code

'A' (0x41) – Authentication Failure
'C' (0x43) – Incorrect ChannelID in SnapshotRequest
'E' (0x45) – Snapshot Request already active
'Q' (0x51) – Quota Exceeded
'R' (0x52) – Snapshot Not Yet Available (no snapshot >= requested Minimum Sequence Number is available)
'S' (0x53) – Incorrect SessionID in SnapshotRequest
'U' (0x55) – Snapshot Service Temporarily Unavailable

Snapshot Response

A Snapshot Response is sent from the DEEP SNAP server to the client when a client SnapshortRequest is successful. A Snapshot Response consists of a SnapshotStart message, followed by SnapshotData messages, and concluded by a SnapshotEnd message.

SnapshotStart Message (MessageType 's')

Field Name	Offset	Length	Type	Description/Notes
Message Length	0	2	Integer	Length of message in bytes not including this field (9)
Message Type	2	1	Byte	's' (0x73) –SnapshotStart
SnapshotLength	3	8	Long	Length in bytes of the complete Snapshot Response. Includes this SnapshotStart message, all SnapshotData messages and the SnapshotEnd message

SnapshotData Message (MessageType 'd')

Field Name	Offset	Length	Type	Description/Notes
Message Length	0	2	Integer	Length of message in bytes not including this field (variable)
Message Type	2	1	Byte	'd' (0x64) – SnapshotData
IEX-TP Header	3	40	Byte	see IEX Transport specification
IEX-TP MessageBlock Length	43	2	Integer	see IEX Transport specification
IEX-TP Message Data	45		Variable	see IEX Transport specification and IEX DEEP Specification

The IEX-TP Message Data will contain messages in IEX DEEP format and may include any DEEP message types.

SnapshotEnd Message (MessageType 'x')

Field Name	Offset	Length	Type	Description/Notes
Message Length	0	2	Integer	Length of message in bytes not including this field (9)
Message Type	2	1	Byte	'x' (0x78) –SnapshotEnd
Snapshot Sequence Number	3	8	Long	Sequence at which the Snapshot was created

DEEP Feed messages in Snapshot Response

The IEX-TP Message Data returned in the SnapshotData messages will contain DEEP Feed messages required to rebuild the current state of the DEEP Feed books for each symbol at the SequenceNumber the Snapshot was created.

Snapshot Content:

1. *SnapshotStart* message

2. For each IEX Listed symbol (at time of snapshot)

      a) Latest SecurityDirectory Message

3. Latest SystemEvent message (if exists at time of snapshot)

4. For each symbol (at time of snapshot)

      a) Latest TradingStatus Message (if exists at time of snapshot)

      b) Latest SecurityEvent Message (if exists at time of snapshot)

      c) Latest OperationalHaltStatus Message (if exists at time of snapshot)

      d) Latest ShortSalePriceTestStatus Message (if exists at time of snapshot)

      e) Latest OfficialPrice Message (if exists at time of snapshot)

      f) All PriceLevelUpdate Messages (that are active at time of snapshot)

5. *SnapshotEnd* Message (includes SnapshotSequenceNumber)

Note: All DEEP Feed messages (shown in bold) are wrapped within a DEEP SNAP *SnapshotData* Message that includes an IEX-TP Header providing DEEP Feed sequencing and timing information.

Note: All PriceLevelUpdate Messages will have EventFlags=1 regardless of the original value sent on the DEEP Feed. All messages will add a new level to the symbol's orderbook. No messages will delete or modify levels.

Note: PriceLevelUpdate Messages will not be in the original DEEP Feed Sequence or SendTime order.