Direct Access to Market Data & Optimized Market Data stream in NFCAST

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Revision History

Version	Modification Date	Modifications
3.0	July 1st 2015	Section 2.1.14: Market Picture message structure changes to remove unused filler fields and data type of certain fields are changed to reduce the size of the message The message type is also changed from 2020 to 2023.
2.0	July 11th , 2013	Decompression logic for auction market picture message section 2.6.4 and 2.8
1.0	June 3rd , 2013	Original Document

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1 Introduction

Currently the market data disseminated by exchange is made available through IML application. The TPS application connects to IML for interactive messages and for broadcast messages.

The IML subscribes to the multicast data sent by the exchange and forwards it to the TPS. The market data sent by BE is in compressed format however the TPS application receives the data in decompressed format. Thus additionally the IML reads the compress data and uncompress the data and sends to the TPS on the configured socket.

It is proposed to provide an option to the users to read the market data directly through the multicast without an IML application. The TPS application can subscribe to the multicast directly and read the market data. In such case the TPS application needs to be aware of the decompression logic required to read the market data. Thus the TPS applications can eliminate the use of IML for the market data.

In this version of document, the market picture structure is further reduced by removal of unwanted filler fields. The data types of certain fields are also changed. The structure optimization is done to reduce the size of each message further. The proprietary decompression should be applied on the new structure. Refer section 2.7 Market Picture Structure [2023] for the revised structure.

2 Features

- The multicast stream for NFCAST can be read directly without IML application.
- Only the market picture message [Message type: 2023] are sent in compressed format on the multicast stream.
- Proprietary compression logic is used for compression.
- Decompression logic needs to be applied on market picture message only and other broadcast messages can be read directly through the multicast stream in the OMB defined message formats.
- While reading the broadcast data through IML, all broadcast message contains header which includes slot number and message length field. However while reading market data directly through multicast stream all the broadcast message does not contain slot number and Message Length fields in the header.
- In case of market picture message the entire market picture message is not sent in compressed format. For each record present in the market picture packet, the compression starts with the open rate field and ends with the last field for that record. All data points from open rates onwards are in compressed format. The decompression logic is detailed with an example in section 2.5
- It is suggested that the user should read 2000 bytes of data by default in a single read call. This single read call will get single packet only. The first 4 bytes will convey the message type and depending upon the message type the user should process the required messages or drop the message if not required.

- Since the size of market picture message cannot be ascertain due to compression logic, the market picture message needs to be read byte by byte. It cannot be mapped to the structure directly as defined in IML OMB.
- Since the size of other broadcast message is certain and thus it can be mapped to the structure as defined in IML OMB.
- Binary values are presented in big-endian byte order so the TPS application needs to convert it to little-endian byte order.
    - Big-Endian means that the most significant byte of any multibyte data field is stored at the lowest memory address, which is also the address of the larger field.
    - Little-Endian means that the least significant byte of any multibyte data field is stored at the lowest memory address, which is also the address of the larger field.

2.1 Compression Principle

The idea used in compression is that rate fields in the structure are defined as long (4 bytes) however since all the rates for a stock usually operates in nearby range thus instead of using 4 bytes for each rate, if differential value with respect to a base rate is sent then the differential value would generally be no exceeding 2 bytes capacity. Thus 2 bytes on each rate filed can be saved. Similar is the idea behind the quantity related filed in the structure.

2.2 Decompression Mechanism

For decompression 2 fields marked as base fields. One base field (LTP) is used for Rate and the other base field (LTQ) is used for Quantity. All the compressed fields contain the difference value with respect to base fields in 2 bytes. The user needs to add this 2 bytes field value with the base field value to arrive the actual value of the next filed.

In case the difference value exceeds 2 bytes then the actual value is sent in next 4 bytes. So for all compressed fields the user needs to read 2 bytes first then depending upon the value in the 2 bytes field the user needs to decide what to do next.
If the 2 bytes field value is 32767 the user needs to read the next 4 bytes to have the actual value as the diff value exceeds 2 bytes. The logic is explained in detail with an example in the example section 2.6

2.3 Decompression Mechanism for Best 5 substructure

In case of best 5 structures, 3 additional aspects are covered in decompression mechanism

2.3.1 Reading Sequence

The best 5 structure needs to be read for buy side and sell side independently i.e. the best 5 Bid structure is read first followed by best 5 offer structure.
Read 5 Best Bid Fields in following order i.e.

Best Bid Rate1, Total Bid Qty1, No. of Bid at the price points1
Best Bid Rate2, Total Bid Qty2, No. of Bid at the price points2
Best Bid Rate3, Total Bid Qty3, No. of Bid at the price points3
Best Bid Rate4, Total Bid Qty4, No. of Bid at the price points4
Best Bid Rate5, Total Bid Qty5, No. of Bid at the price points5

Once 5 Best Bid Fields completed then start reading the 5 Best Offer Fields in similar order

2.3.2 Decompression logic

The general decompression mechanism mentioned above hold true for best 5 structures also. Additionally the base fields used to decompress best 5 structure changes with each level.

The base field used for different level is different i.e. for e.g. the base fields used in level 1 are different than base fields used in levle2.

For each level the base fields are previous level filed values. The table below provides the base filed used in each level for the buy side best 5 structure

Level 1	**Best Bid 1**	**Best Bid Qty 1**	**No of orders 1**	
Base	LTP	LTQ	LTQ	
Level 2	**Best Bid 2**	**Best Bid Qty 2**	**No of orders 2**	
Base	Best Bid 1	Best Bid Qty 1	No of orders 1	
Level 3	**Best Bid 3**	**Best Bid Qty 3**	**No of orders 3**	
Base	Best Bid 2	Best Bid Qty 2	No of orders 2	
Level 4	**Best Bid 4**	**Best Bid Qty 4**	**No of orders 4**	
Base	Best Bid 3	Best Bid Qty 3	No of orders 3	
Level 5	**Best Bid 5**	**Best Bid Qty 5**	**No of orders 5**	
Base	Best Bid 4	Best Bid Qty 4	No of orders 4	

Similar is the decompression logic for the sell side best 5 structure.

2.3.3 Handling condition when no orders present at a price point

In the best 5 structure, it is possible that the orders may not be present on all 5 price points thus the price points where there are no orders are present are not sent in the structure. Thus during decompression of the best 5 substructure, additionally following logic needs to be also applied

If during reading the 5 Best Bid Fields if any Best Bid Rate is equals to 32766 then the remaining Best Bid Fields will not be present so 32766 indicates there are no more buy price points available in the book.

Similarly during reading the 5 Best Offer Fields if any Best Offer Rate is equals to -32766 then the remaining 5 Best Offer Fields will not be present.

2.4 Repetition of Instruments

1. Once the compression of first instrument is completed the user needs to know the number of bytes he has read. Let's assume after first instrument the number of bytes read as 160.
2. So the user needs to start reading 4 bytes from 160 bytes to get instrument code. Read next 4 bytes for number of trades and continue till compression starts. Store the base values in memory for the second instrument. Then apply the compression logic.

2.5 Summary of decompression mechanism

1. Identify the base values
2. Store the base values in memory
3. Read next 2 bytes and add the value to the base value to get final value
    a. If value is 32767 means diff value is exceeded, thus read next 4 bytes to have the actual value.
4. For Best 5 structure Read 2 bytes
    a. If value is 32767 means diff value is exceeded, thus read next 4 bytes to have the actual value.
    b. If value is 32766 or -32766 means end of best bid or best offer.
    c. The base value for level 1 is LTP and LTQ
    d. The base value for all subsequent level (level n) is its previous level (level n-1

2.6 Example of Decompression Logic

Following are 3 examples explaining the decompression logic for the market picture message.

2.6.1 Example for General Decompression Mechanism

Let's say base field for Rate is Last Traded Rate and its value is 1000. Open Rate as 500 and Previous Close Rate as 40000 and High Rate as 1000.

Field	**Compressed/ Base**	**Value**	**Byte**	**Action**
Last Traded Rate	Base	1000	4	Read 4 bytes to get 1000 and store it in memory
Open Rate	Compressed	-500	2	Read next 2 bytes to get -500 and apply it to LTR to get the final value as 500.
Previous Close Rate	Compressed	32767 40000	2 4	Read 2 bytes to get 32767 and this value is an indicator that diff value exceeds 2 bytes Read next 4 bytes to have the actual value 40000. No need to apply base value.
High Rate	Compressed	0	2	Read next 2 bytes to get 0 and apply it to LTR to get the final value as 1000.

2.6.2 Example for Best 5 structure decompression mechanism.

For example for an instrument only one bid rate and no offer rate is available as below
Best Bid Rate1 as 1000, Total Bid Qty1=25, No. of Bid at the price points1= 5and no Offer Rate
Base LTP is 1000 and Base LTQ is 10

Field	Compressed/ Base	Value	Byte	Action
Last Traded Rate(LTR)	Base	1000	4	Assume already available in memory
Last Traded Quantity(LTQ)	Base	10	4	Assume already available in memory
Best Bid Rate1	Compressed	0	2	Read next 2 bytes to get 0 and apply it to LTR to get the final value as 1000.
Total Bid Qty1	Compressed	15	2	Read next 2 bytes to get 15 and apply it to LTQ to get the final value as 25.
Bid at the price points1	Compressed	-5	2	Read next 2 bytes to get -5 and apply it to LTQ to get the final value as 5.
Best Bid Rate2	Compressed	32766	2	Read next 2 bytes to get 32766 indicates end of Best bid [Not available]
Total Bid Qty2	Compressed	NA	0	Not Available
Bid at the price points2	Compressed	NA	0	Not Available
Best Bid Rate3	Compressed	NA	0	Not Available
Total Bid Qty3	Compressed	NA	0	Not Available
Bid at the price points3	Compressed	NA	0	Not Available
Best Bid Rate4	Compressed	NA	0	Not Available
Total Bid Qty4	Compressed	NA	0	Not Available
Bid at the price points4	Compressed	NA	0	Not Available
Best Bid Rate5	Compressed	NA	0	Not Available
Total Bid Qty5	Compressed	NA	0	Not Available
Bid at the price points5	Compressed	NA	0	Not Available
Best Offer Rate1	Compressed	-32766	2	Read next 2 bytes to get -32766 indicates end of Best offer [Not available]
Total Offer Qty1	Compressed	NA	0	Not Available
Offer at the price points1	Compressed	NA	0	Not Available

2.6.3 Example for full market picture packet reading [Message Type 2023]

Field Name	Type	Action
Message Type	Long	Read 4 bytes
Hour	Short	Read next 2 bytes
Minute	Short	Read next 2 bytes
Second	Short	Read next 2 bytes

Filler	Char	Read next 1 byte
Millisecond	Short	Read next 2 bytes
No of Records	Char	Read next 1 byte
Filler	Char	Read next 1 byte
Following is a market picture structure appearing repeatedly (Max 6 times)		
Instrument Code	Long Long	Read next 8 bytes
No of Trades	Long	Read next 4 bytes
Volume	Long	Read next 4 bytes
Value	Long	Read next 4 bytes
Trade Value Flag	Char	Read next 1 byte
Trend	Char	Read next 1 byte
Six Lakh Flag	Char	Read next 1 byte
Market Type	Char	Read next 1 byte
Session Number	Char	Read next 1 byte
LTP Hour	Char	Read next 1 byte
LTP Minute	Char	Read next 1 byte
LTP Second	Char	Read next 1 byte
LTP Millisecond	Short	Read next 2 bytes
No of Price points	Char	Read next 1 bytes
Close Rate	Long	Read next 4 bytes
Last Trade Qty	Long	Read next 4 bytes and save as Qty base
LTP	Long	Read next 4 bytes and save as Rate base
Open Rate	Long	Read next 2 bytes and apply compression logic with base as LTP
Previous Close Rate	Long	Read next 2 bytes and apply compression logic with base as LTP
High Rate	Long	Read next 2 bytes and apply compression logic with base as LTP
Low Rate	Long	Read next 2 bytes and apply compression logic with base as LTP
Indicative Equilibrium Price	Long	Read next 2 bytes and apply compression logic with base as LTP
Indicative Equilibrium Qty	Long	Read next 2 bytes and apply compression logic with base as LTQ
Buy Implied Qty	Long	Read next 2 bytes and apply compression logic with base as LTQ
Sell Implied Qty	Long	Read next 2 bytes and apply compression logic with base as LTQ
Total Bid Qty	Long	Read next 2 bytes and apply compression logic with base as LTQ

Total Offer Qty	Long	Read next 2 bytes and apply compression logic with base as LTQ
Lower Circuit Limit	Long	Read next 2 bytes and apply compression logic with base as LTP
Upper Circuit Limit	Long	Read next 2 bytes and apply compression logic with base as LTP
Weighted Average	Long	Read next 2 bytes and apply compression logic with base as LTP
Following buy sub-structure will repeat number of times as specified in the "No. of Price points" field above or the buy sub structure will terminate if the value 32766 encountered.		
Best Bid Rate	Long	Read next 2 bytes and apply compression logic with base as LTP. For level 2 base is 1st level and so on
Total Bid Qty	Long	Read next 2 bytes and apply compression logic with base as LTQ. For level 2 base is 1st level and so on
No. of Bid at the price points	Long	Read next 2 bytes and apply compression logic with base as LTQ. For level 2 base is 1st level and so on
Following sell sub-structure will repeat number of times as specified in the "No. of Price points" field above or the sell sub structure will terminate if the value -32766 encountered.		
Best Offer Rate	Long	Read next 2 bytes and apply compression logic with base as LTP. For level 2 base is 1st level and so on
Total Offer Qty	Long	Read next 2 bytes and apply compression logic with base as LTQ. For level 2 base is 1st level and so on
No. of Ask at the price point	Long	Read next 2 bytes and apply compression logic with base as LTQ. For level 2 base is 1st level and so on

2.7 Market Picture [2023] Structure

Field Name	Type	Description	Values, meanings, Validations
Message Type	Long	Type of message	2023-Market picture Broadcast
~~Reserved Field~~	~~Long~~		Removed
~~Reserved Field~~	~~Long~~	~~For Internal Use~~	Removed
~~Reserved Field~~	~~unsigned short~~	~~For Internal Use~~	Removed
Hour	Char	Time : HH	
Minute	Char	Time : MM	

Second	Char	Time : SS	
Filler1	Char	For Future Use	Added
Millisecond	Short	Time : sss	
~~Reserved Field~~	~~Short~~		Removed
~~Reserved Field~~	~~Short~~	~~Reserved Field~~	Removed
No of Records	Char	No. of market picture records sent	This can have a maximum of 6 records
Filler2	Char	For Future Use	Added
Following is a market picture structure appearing repeatedly (Max 6 times)			
Instrument Code	Long Long	Instrument code of the Instrument for which Touchline details are being sent.	
No of Trades	Long	Number of trades took place during the day for the Instrument	The cumulative no. of trades for in PCAS sessions during the day
Volume	Long	Total Traded qty during the day for the Instrument	The cumulative no. of shares traded in all PCAS sessions during the day
Value	Long	Total Traded value during the day for the instrument	The cumulative value traded in all PCAS sessions during the day
Trade Value Flag	Char	Unit for value	'l' for lacs, 'c' for crores
Trend	Char	Up/down trend	'+' for up, '-' for down
Six Lakh Flag	Char	Indicates that Six Lakh Instrument code is active for this Instrument code	Values: 'Y' for active 'N' for not active
~~Reserved Field~~	~~Char~~		Removed
Market Type	Char	The type of market	20-PCAS
Session Number	Char		Refer session table, section 8.7
LTP Hour	Char	Hour at which Last trade took place	
LTP Minute	Char	Minute at which Last trade took place	

LTP Second	Char	Second at which Last trade took place	
LTP Millisecond	Short	Millisecond at which Last trade took place	
~~Reserved Field~~	~~Char[2]~~		Removed
~~Reserved Field~~	~~Short~~		Removed
No of Price points	Char	"n" Number of Price points	Currently "n" = 5
~~Timestamp~~	~~Long Long~~	~~Time at which the market data was generated at Exchange~~	Removed
Close Rate	Long	Close price for the current day once close price for the day is determined in closing session	The field will be populated once close price for the day is determined else it would be 0
Last Trade Qty	Long	Quantity which got executed in the Last trade	The total quantity traded in the last PCAS session where EP was discovered
LTP	Long	Price at which last trade took place.	In paise. The traded rate in the last PCAS session where EP was discovered
Open Rate	Long	Opening rate of the Instrument.	In paise. The first discovered EP during the day
Previous Close Rate	Long	Previous Closing rate of the Instrument	In paise. Previous day's close price in all sessions
High Rate	Long	Highest traded rate of the Instrument	In paise. The highest EP discovered among any PCAS sessions conducted during the day
Low Rate	Long	Lowest traded rate of the Instrument	In paise. The Lowest EP discovered among any PCAS sessions conducted during the day
~~Reserved Field~~	~~Long~~	~~For Future Use~~	Removed

Indicative Equilibrium Price	Long	Indicative EP price if determined in PCAS order entry session	Indicative EP price if determined in PCAS order entry session
Indicative Equilibrium Qty	Long	Indicative EP Quantity if determined in PCAS order entry session	Indicative EP quantity if determined in PCAS order entry session
Buy Implied Qty	Long	Buy implied quantity if implied order is present	Applicable for Derivatives segment
Sell Implied Qty	Long	Sell implied quantity if implied order is present	Applicable for Derivatives segment
Total Bid Qty	Long	Total Bid Qty	
Total Offer Qty	Long	Total Offer Qty	
Lower Circuit Limit	Long	Lower Circuit limit for Instrument	The lowest rate at which order can be placed during the day
Upper Circuit Limit	Long	Upper Circuit limit for Instrument	The highest rate at which order can be placed during the day
Weighted Average	Long	Weighted Average for Instrument	
Following sub-structure will repeat number of times as specified in the "No. of Price points" field above.			
Best Bid Rate	Long	Best bid rate in paise	
Total Bid Qty	Long	Total quantity available at best bid rate	
No. of Bid at the price points	Long	No. of Orders at the Buy Price point	
~~Filler~~	~~Long~~	~~For Future Use~~	Removed
Best Offer Rate	Long	Best offer rate in paise	
Total Offer Qty	Long	Total quantity available at best offer rate	
No. of Ask at the price point	Long	No. of Orders at the Sell Price point	
~~Filler~~	~~Long~~	~~For Future Use~~	Removed