

Measures for Strengthening Algorithmic Trading Framework

1. Objective

- 1.1. This memorandum presents before the Board the various measures that are being proposed to address the concerns relating to market quality, market integrity and fairness on account of usage of Algorithmic Trading & Co-location in Indian securities market.

2. Background

- 2.1. Algorithmic trading (hereinafter referred as 'Algo trading') includes any type of automated rule based trading where decision making is delegated to a computer model. High Frequency Trading (hereinafter referred as 'HFT') is a type of algorithmic trading which is latency sensitive and is characterized by a high daily portfolio turnover and high order-to trade ratio (OTR). As per SEBI Circular No. CIR/MRD/DP/09/2012 dated March 30, 2012, Algo trading has been defined as any order that is generated using automated execution logic.
- 2.2. The facility provided by the Exchanges to trading members and data vendors whereby their trading or data vending systems are allowed to be located within or at the close proximity to the premises of the Stock Exchanges is termed as 'Co-location or Proximity Hosting' facility. The facility enables the co-located trading members or data vendors to access the trade/ order related data before other non-co-located trading members. It also enables the co-located trading members to minimize the time for sending orders to the trading system of the Exchange.
- 2.3. SEBI, in line with the efforts of other global securities market regulators, has taken various steps to frame regulatory guidelines for Algo trading. The following circulars have been issued by SEBI to regulate Algo trading:
 - 2.3.1 Circular No. CIR/MRD/DP/09/2012 dated March 30, 2012, on 'Broad Guidelines on Algorithmic Trading', inter alia, advised Stock Exchanges to ensure that certain checks are in place while permitting Algo trading.
 - 2.3.2 Circular No. CIR/MRD/DP/16/2013 dated May 21, 2013, inter alia, advised Stock Exchanges to ensure that trading members that provide the facility of Algo trading shall subject their system to a system audit every six

months in order to ensure that the requirements prescribed by SEBI/ Stock Exchanges with regard to Algo trading are effectively implemented.

2.3.3 Circular No. CIR/MRD/DP/07/2015 dated May 13, 2015, inter alia, advised Stock Exchanges to ensure fair and equitable access to their co-location facility.

2.3.4 Circular No. CIR/HO/MRD/DP/CIR/P/2016/129 dated December 1, 2016, inter alia, allowed direct connectivity between two colocation facilities of Stock Exchanges.

3. Discussion Paper on Algorithmic Trading and Colocation

3.1. While the abovementioned guidelines provide a broad framework, Algo trading has been continuing to attract the attention of investors and regulators across the world. Some of the issues that have drawn regulatory attention are: unequal access to Algo Traders due to lower latency and availability of Tick-by-Tick (TBT) data; contribution to price volatility; market noise (excessive order entry and cancellation); denial of profit opportunities to other investors; clogging the pipe which carries the orders thus slowing down the order messages of other investors, etc.

3.2. With a view to address these concerns and provide a level playing field between Algo/Co-located trading and manual trading, SEBI issued a discussion paper on August 5, 2016 requesting market participants to provide their views on the efficacy and need to introduce further mechanisms to address the aforementioned concerns.

3.3. Further, in consultation with its Technical Advisory Committee (TAC), SEBI engaged 'X' (this has been excised for reasons of confidentiality) to undertake a simulation exercise, to understand the efficacy and outcome of various mechanisms mentioned in the discussion paper. Additionally, under the aegis of the 'Y'-'Z' (this has been excised for reasons of confidentiality) Research Programme, 'Z' (this has been excised for reasons of confidentiality) undertook a study of Algo trading, including the examination of the pros and cons of the various mechanisms mentioned in the SEBI discussion paper.

3.4. In light of the public comments received, recommendations based on the simulation study conducted by 'X' (this has been excised for reasons of

confidentiality) and the study by 'Z' (this has been excised for reasons of confidentiality) , interactions with market participants and suggestions received from Stock Exchanges, it is proposed that the measures stated in paragraphs 4-9 may be considered to address the concerns relating to Algorithmic/ Co-located trading and to make the market more fair, equitable and transparent. It is further informed that the proposed measures were discussed in the Secondary Market Advisory Committee (SMAC) meeting held on March 07, 2018. Committee, inter alia, agreed with the said measures.

4. Shared Colocation Service

- 4.1. Presently, a trading member who wants to avail co-location services, is allotted space (racks) in the co-location facility of the Exchange. A Member then has to bear one-time setup cost for operationalizing its server in the colocation facility, incur recurring charges for renting out the rack/space facility and charges related to data connectivity, etc. It is estimated that a Member has to pay upwards of Rs.10 lakh per annum for setting up and maintaining a space/full-rack within the co-location facility. Market participants have represented that many small and medium sized Members find it difficult to avail the services of co-location facility due to high cost.
- 4.2. As opposed to each member setting up a server at the co-located facility and individually incurring charges, it is proposed that Exchanges may provide these facilities as a shared service in the co-location facility. Under this arrangement, space/rack shall be allotted to eligible vendors along with provision for receiving the market data broadcast. The vendors shall be responsible for further dissemination of data to their clients i.e. trading members. The vendors shall provide the technical knowhow, hardware, software and expertise, as services, to trading members in the form of Shared Colocation Services and shall be responsible for upkeep and maintenance of all infrastructure in the racks provided to them.
- 4.3. The fee to be charged to a Member would be substantially less than the amount currently being charged for availing space/rack in co-location facility. It is estimated that the aforesaid facility has the potential to reduce the colocation access cost substantially (Exchanges have estimated that the cost would reduce by more than 90%). It would thereby facilitate small and medium sized Members, who otherwise find it difficult to avail colocation facility due to

various reasons including but not limited to high cost, lack of expertise in maintenance and troubleshooting, etc. to avail co-location facility from Exchanges. As co-location facility becomes more affordable, more number of trading members would be in a position to avail the facility, thus enabling Members to reduce the latency for accessing the trading system. This measure, would, therefore address the concern regarding unequal access, in terms of low latency, that co-located Members have over other Members.

- 4.4. **Proposal:** Stock Exchanges may be advised to introduce Shared Colocation Services.

5. Free of Charge Tick-by-Tick Data feed (TBT Feed)

- 5.1. Presently, the Exchanges provide a snapshot of the 5 best bid and ask quotes free of cost to all the trading members. This snapshot is updated almost every second. Trading members and their constituent clients place orders based on the best bid and ask quotes displayed in the snapshot.
- 5.2. Tick- by-Tick (TBT) feed, on the other hand, provides a detailed view of the entire order-book, which includes details relating to addition, modification and cancellation of orders and trades on a real-time basis. This enables the traders to take benefit of the opportunities that may exist between two snapshots. As changes in TBT feed take place very frequently (in microseconds), it is not possible for human beings to observe and analyse such changes and devise appropriate trading strategies. Accordingly, access to TBT Feed is usually not availed by small and medium sized members due to the cost involved in accessing and processing data heavy TBT feed.
- 5.3. TBT feed is mainly subscribed by high frequency traders who, coupled with their access to co-location, use such feeds to recreate the order-book. Analysis of TBT feed enables such trading members to react to every change in the order book. At present, the Exchanges provide TBT data to any market participant upon payment of requisite fee.
- 5.4. A section of market participants is of the view that access of TBT data feed to limited number of resource rich trading members creates disparity and inequality in terms of access to data thereby giving such members unfair market advantage. Market participants have suggested that level playing field

may be created by making the TBT data, available to all the trading members, free of cost.

5.5. It is felt that small and medium sized trading members would be immensely benefitted if TBT data subscription charges are waived off by the Exchanges. This measure would also help in removing disparity and inequality currently observed in the market in terms of access to data.

5.6. **Proposal:** It is proposed that TBT data feed may be provided to all trading members free of cost subject to trading members creating the necessary infrastructure for receiving and processing it. Further, stock exchanges may also be advised to increase the depth of snapshot of 5 best bid and ask quotes, in consultation with trading members.

6. Order to Trade Ratio (OTR)

6.1. Algo Traders tend to place large number of orders, within a small interval of time, to take benefit of the opportunities that may exist for fractions of a second due to small price movements. Algo Trading is, therefore, characterized by high daily portfolio turnover and high order-to trade ratio (OTR). High order to trade ratio naturally raises concerns regarding order flooding, clogging of the pipeline carrying orders to the trading engine, denial of opportunity to other traders to be in front of the order book, etc.

6.2. Currently, a penalty framework for high OTR is applicable in the equity derivatives and currency derivatives segments. Orders placed in the cash segment, orders placed within $\pm 1\%$ of the last traded price (LTP) and orders placed under liquidity enhancement scheme ('LES') are exempted from the framework for imposing penalty for high OTR.

6.3. In spite of the aforesaid framework, it is observed that, over time, the number of algo orders placed have continued to increase. It has been observed that at NSE, the number of average daily algo orders for equity cash segment, equity derivatives segment and currency derivatives segment has increased by approximately 71% between years 2014 to 2017. At BSE, the average daily algo orders for equity cash segment and currency derivatives (as the total number of trades executed in the equity derivatives segment is very negligible, the same has not been taken into account for the aforesaid calculation for BSE) has increased by approximately 11% during the same time period.

- 6.4. In order to encourage algo traders to place more orders closer to the LTP, thus, bringing meaningful liquidity to the market, it is proposed that, instead of orders placed within $\pm 1\%$, orders placed within $\pm 0.75\%$ of the LTP may be exempted from the framework for imposing penalty for high OTR. Further, orders placed in the equity cash segment and orders placed under LES, currently being exempted, may also be brought under the OTR framework.
- 6.5. The above measure would encourage Algo traders to place orders close to the prevailing market price. It is also felt that reduction of the current exemption to Algo orders from $\pm 1\%$ of LTP to $\pm 0.75\%$ of LTP may lead to reduction in order to trade ratio, thus, addressing the concerns of excessive order flooding, denial of trade opportunity to non- algo orders, etc.
- 6.6. **Proposal:** It is proposed that algo orders placed within $\pm 0.75\%$ of the LTP may be exempted from the framework for imposing penalty for high OTR. Further, the OTR framework may also be extended to orders placed in the equity cash segment and orders placed under LES.

7. Tagging of Algos

- 7.1. Presently, a specific code is attached to all algo orders to distinguish it from non-algo orders. Each algo, however, is designed for a specific trading strategy and a code generic to all algo orders fails to distinguish the varied strategies underpinning different algos.
- 7.2. As algos are increasingly being employed for activities such as spoofing, layering, etc., which may be construed to be manipulative, it is important, from a surveillance perspective that a unique identifier be allotted to each algo. This would not only help in establishing an audit trail but would also facilitate in enhancing surveillance of the market.
- 7.3. **Proposal:** It is proposed that the Stock Exchanges may be advised to allot a unique identifier for each algo.

8. Measurement of Latency for Co-location and Proximity Hosting

- 8.1. Latency generally refers to the time taken for an order message to complete the round trip from the trading member's terminal to the matching engine of the Exchange and back.
- 8.2. As latency is a function of distance, a co-located trading member (as these trading members are located within or at close proximity to the premises of the Stock Exchanges) would have a lower latency in comparison to a non-co-located trading member.
- 8.3. Low latency enables a co-located Algo trader to react to trading opportunities faster than a non-co-located trading member and therefore, plays an important role in efficient deployment of algo based trading strategies.
- 8.4. Currently, Exchanges are disclosing latency observed on their matching platform as the time taken to complete the round trip from the Core Router (Core Router is the place where both Colo- orders and Non-colo orders meet) to the matching engine and back. This latency is being measured in microseconds at 90th percentile of the time taken for the round trip. For a trading member to assess the efficiency of a trading architecture, it is important that more granular level data with respect to latency are disclosed. Accordingly, it is proposed that Exchanges may additionally publish minimum, maximum and mean latencies and latencies at 50th and 99th percentile.
- 8.5. In addition to the above, disclosure of the latency observed between a co-located rack and core router of an Exchange is equally important in evaluating the efficiency of the co-location facility of an Exchange. Accordingly, it is also proposed that Exchanges may publish a reference latency, which is the time taken for an order message to travel between a reference rack in the Colocation facility and the Core Router.
- 8.6. The above proposal would enable trading members to compare the actual latencies experienced by them at their respective racks in the co-location facility vis-à-vis the reference latency published by the Exchange.
- 8.7. **Proposal:** It is proposed that the Stock Exchanges may be advised to publish additional details regarding the latency observed within Exchange trading infrastructure. Further, Exchanges may also be advised to publish a reference latency between a reference rack in the co-located facility and the core router of the Exchange.

9. Review of Testing Requirement for Software and Algos

- 9.1. Currently, Exchanges are required to organize mock trading sessions at least once in a calendar month, to facilitate testing of new software, existing software that has undergone any change of functionality, including algos. Such mock trading sessions are currently organized on the first Saturday of the month.
- 9.2. Market participants have highlighted that they face delay in deployment of new algos as they have to wait for a month to test the algos. It has also been informed that the mock trading sessions may not be effective as orders placed by members are spread unevenly throughout the day (as Saturday is a trading holiday), thus failing to identify potential issues that may occur in a normal trading environment.
- 9.3. With a view to address aforementioned concerns of market participants, Exchanges have suggested that the monthly mock trading sessions may be supplanted by a daily simulated market environment for testing of softwares. The above proposal would be available to a trading member on all trading days, thus, providing flexibility to the trading member in terms of participation as also on testing of software including algos. Further, simulated market environment would also help in reducing operational and man-power logistics/costs, as trading members would not be required to operate on a holiday.
- 9.4. **Proposal:** In view of the above, it is proposed that Exchanges may be allowed to provide a simulated market environment for testing of software including algos. Such a facility may be made available over and beyond the current framework of mock trading. After assessing the robustness of the facility, the decision to phase out with monthly mock trading may be taken in consultation with the appropriate technical committees of SEBI.
- 9.5. The Board is requested to consider and approve the proposals under paragraphs 4.4, 5.6, 6.6, 7.3, 8.7 and 9.4 and authorize the Chairman to take consequential and incidental steps to give effect to the decisions of the Board.