Required fields are shown with yellow backgrounds and asterisks.

SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549
Form 19b-4

File No. * SR 2023 - * 020

Amendment No. (req. for Amendments *)

Filing by NASDAQ BX, Inc.

Pursuant to Rule 19b-4 under the Securities Exchange Act of 1934

Initial * ✓	Section 19(b)(2) * ☐
Amendment * ☐	Section 19(b)(3)(A) * ✓
Withdrawal ☐	Section 19(b)(3)(B) * ☐

Rule

- ☐ 19b-4(f)(1) ☐ 19b-4(f)(4)
- ✓ 19b-4(f)(2) ☐ 19b-4(f)(5)
- ☐ 19b-4(f)(3) ☐ 19b-4(f)(6)

Pilot ☐

Extension of Time Period for Commission Action * ☐

Date Expires *

Notice of proposed change pursuant to the Payment, Clearing, and Settlement Act of 2010

Section 806(e)(1) * ☐

Section 806(e)(2) * ☐

Security-Based Swap Submission pursuant to the Securities Exchange Act of 1934
Section 3C(b)(2) * ☐

Exhibit 2 Sent As Paper Document ☐

Exhibit 3 Sent As Paper Document ☐

Description

Provide a brief description of the action (limit 250 characters, required when Initial is checked *).

A proposal to set fees for the purchase of field-programmable gate array technology as an optional delivery mechanism for BX TotalView.

Contact Information

Provide the name, telephone number, and e-mail address of the person on the staff of the self-regulatory organization prepared to respond to questions and comments on the action.

First Name * Daniel

Last Name * Cantu

Title * Associate Vice President

E-mail * Daniel.Cantu@nasdaq.com

Telephone * (301) 978-8469

Fax

Signature

Pursuant to the requirements of the Securities Exchange of 1934, NASDAQ BX, Inc.
has duly caused this filing to be signed on its behalf by the undersigned thereunto duly authorized.

Date 08/09/2023

(Title *)

By John Zecca

EVP and Chief Legal Officer

(Name *)

NOTE: Clicking the signature block at right will initiate digitally signing the form. A digital signature is as legally binding as a physical signature, and once signed, this form cannot be changed.

Date: 2023.08.09
15:24:16 -04'00'

SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

For complete Form 19b-4 instructions please refer to the EFFS website.

Form 19b-4 Information *		
Add	Remove	View

SR-BX-2023-020 19b-4.doc

The self-regulatory organization must provide all required information, presented in a clear and comprehensible manner, to enable the public to provide meaningful comment on the proposal and for the Commission to determine whether the proposal is consistent with the Act and applicable rules and regulations under the Act.

Exhibit 1 - Notice of Proposed Rule Change *		
Add	Remove	View

SR-BX-2023-020 Exhibit 1.doc

The Notice section of this Form 19b-4 must comply with the guidelines for publication in the Federal Register as well as any requirements for electronic filing as published by the Commission (if applicable). The Office of the Federal Register (OFR) offers guidance on Federal Register publication requirements in the Federal Register Document Drafting Handbook, October 1998 Revision. For example, all references to the federal securities laws must include the corresponding cite to the United States Code in a footnote. All references to SEC rules must include the corresponding cite to the Code of Federal Regulations in a footnote. All references to Securities Exchange Act Releases must include the release number, release date, Federal Register cite, Federal Register date, and corresponding file number (e.g., SR-[SRO]-xx-xx). A material failure to comply with these guidelines will result in the proposed rule change being deemed not properly filed. See also Rule 0-3 under the Act (17 CFR 240.0-3)

Exhibit 1A - Notice of Proposed Rule Change, Security-Based Swap Submission, or Advanced Notice by Clearing Agencies *		
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The Notice section of this Form 19b-4 must comply with the guidelines for publication in the Federal Register as well as any requirements for electronic filing as published by the Commission (if applicable). The Office of the Federal Register (OFR) offers guidance on Federal Register publication requirements in the Federal Register Document Drafting Handbook, October 1998 Revision. For example, all references to the federal securities laws must include the corresponding cite to the United States Code in a footnote. All references to SEC rules must include the corresponding cite to the Code of Federal Regulations in a footnote. All references to Securities Exchange Act Releases must include the release number, release date, Federal Register cite, Federal Register date, and corresponding file number (e.g., SR-[SRO]-xx-xx). A material failure to comply with these guidelines will result in the proposed rule change being deemed not properly filed. See also Rule 0-3 under the Act (17 CFR 240.0-3)

Exhibit 2- Notices, Written Comments, Transcripts, Other Communications		
Add	Remove	View

Copies of notices, written comments, transcripts, other communications. If such documents cannot be filed electronically in accordance with Instruction F, they shall be filed in accordance with Instruction G.

☐ Exhibit Sent As Paper Document

Exhibit 3 - Form, Report, or Questionnaire		
Add	Remove	View

Copies of any form, report, or questionnaire that the self-regulatory organization proposes to use to help implement or operate the proposed rule change, or that is referred to by the proposed rule change.

☐ Exhibit Sent As Paper Document

Exhibit 4 - Marked Copies		
Add	Remove	View

The full text shall be marked, in any convenient manner, to indicate additions to and deletions from the immediately preceding filing. The purpose of Exhibit 4 is to permit the staff to identify immediately the changes made from the text of the rule with which it has been working.

Exhibit 5 - Proposed Rule Text		
Add	Remove	View

SR-BX-2023-020 Exhibit 5.doc

The self-regulatory organization may choose to attach as Exhibit 5 proposed changes to rule text in place of providing it in Item I and which may otherwise be more easily readable if provided separately from Form 19b-4. Exhibit 5 shall be considered part of the proposed rule change

Partial Amendment		
Add	Remove	View

If the self-regulatory organization is amending only part of the text of a lengthy proposed rule change, it may, with the Commission's permission, file only those portions of the text of the proposed rule change in which changes are being made if the filing (i.e. partial amendment) is clearly understandable on its face. Such partial amendment shall be clearly identified and marked to show deletions and additions.

1.   Text of the Proposed Rule Change

        (a)   Nasdaq BX, Inc. ("BX" or "Exchange"), pursuant to Section 19(b)(1) of

the Securities Exchange Act of 1934 ("Act")[1] and Rule 19b-4 thereunder,[2] is filing with

the Securities and Exchange Commission ("SEC" or "Commission") a proposal to set

fees for the purchase of field-programmable gate array ("FPGA") technology as an

optional delivery mechanism for BX TotalView.

        A notice of the proposed rule change for publication in the Federal Register is

attached as Exhibit 1.

        The text of the proposed rule change is attached as Exhibit 5.

        (b)   Not applicable

        (c)   Not applicable.

2.   Procedures of the Self-Regulatory Organization

        The proposed rule change was approved by senior management of the Exchange

pursuant to authority delegated by the Board of Directors (the "Board"). Exchange staff

will advise the Board of any action taken pursuant to delegated authority. No other

action is necessary for the filing of the rule change.

        Questions and comments on the proposed rule change may be directed to:

                        Daniel A. Cantu
            AVP, Principal Associate General Counsel
                        Nasdaq, Inc.
                        (301) 978-8469

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[1]   15 U.S.C. 78s(b)(1).

[2]   17 CFR 240.19b-4.

3.   Self-Regulatory Organization's Statement of the Purpose of, and Statutory Basis
        for, the Proposed Rule Change

        a.   Purpose

The purpose of the proposed rule change is to establish a fee schedule for the

purchase of field-programmable gate array ("FPGA") technology as an optional delivery

mechanism for BX TotalView ("BX FPGA Service").[3] This follows a recently-filed

proposal to offer FPGA technology as an optional delivery mechanism for BX

TotalView.[4]

   FPGA

FPGA is a hardware-based delivery mechanism that utilizes an integrated circuit

that is programmed to reduce "jitter"—a technical term of art referring to the deviation in

amplitude, phase timing or width of a signal pulse in a digital signal—that will allow data

to be processed in a more predictable, or "deterministic," fashion. Reducing jitter can be

useful for certain customers due to the variability in the timing of market data packets

transmitted by an exchange over the course of the trading day. Orders, and therefore

market data packets, typically accumulate in larger numbers at the beginning and end of

the trading day, as well as during the peaks of activity that occur at random intervals

during the day. These bursts of activity may alter the time interval between the delivery

of data packets because software processes information at variable rates depending on

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[3]   This Proposal was initially filed by the Exchange on May 23, 2023. See Securities Exchange Act
        Release No. 97627 (May 31, 2023), 88 FR 37112 (June 6, 2023) (SR-BX-2023-014). On July 7,
        2023, that filing was withdrawn and replaced to provide supplemental information. See Securities
        Exchange Act Release No. 97946 (July 19, 2023), 88 FR 47937 (July 25, 2023) (SR-BX-2023-
        016). On August 9, 2023, the second filing was withdrawn and replaced with the instant filing,
        which provides additional information without changing the Proposal in substance.

[4]   See SR-BX-2023-011 ("A proposal to offer field-programmable gate array ('FPGA') technology
        as an optional delivery mechanism for BX TotalView."), available at
        https://listingcenter.nasdaq.com/rulebook/BX/rulefilings. A proposal to establish a fee schedule
        for the use of FPGA technology for the Phlx exchange is being filed concurrently with this
        proposal.

load to the system. Processing times may increase at higher loads, and decrease during periods of lesser activity. FPGA technology processes data packets at a constant time interval, without regard to the number of packets processed. Higher levels of determinism mean less variable queuing, which improves the predictability of data transfer, particularly during times of peak market activity.

The benefits of determinism depend on the use case of the customer, as well as the customer's specific system architecture.

Higher determinism does not necessarily mean lower latency. The concepts of determinism and latency are related, but distinct. Determinism refers to predictability in the rate of data transmission; latency refers to the time required to process data or transport it from one location to another. Low latency is not necessarily deterministic, and higher determinism does not necessarily mean low latency. As such, use of FPGA technology will increase determinism, but does not guarantee lower latency at all times.[5]

Among customers that seek a higher degree of determinism, the benefits of FPGA technology vary, as FPGA technology is one possible solution, among a catalog of possible solutions, for increasing the consistency and predictability of message throughput over the course of the trading day. Some customers are able to adequately control jitter without using FPGA technology; other customers address jitter using specialized software, coding or other design solutions in conjunction with FPGA; still others use FPGA alone. The specific choice depends on a complex analysis of the customer's information technology systems in the context of their particular use cases.

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[5]   Because software can be impacted by workload, FPGA technology in general can provide lower latency during periods of peak activity. The same FPGA technology that will support the BX FPGA Service is also broadly commercially available for purchase from third-party sellers unrelated to the Exchange.

FPGA is a broadly-available, commonly-used type of programmable circuit that can be modified to suit different use cases. It is used in a wide spectrum of industries, including the consumer electronics, automotive, and aerospace, as well as in a variety of industrial applications. It is not unique to the financial services industry,[6] or to the Exchange.

FPGA technology has been offered by the Nasdaq Stock Exchange for over a decade, and the Nasdaq Options Market for nearly as long,[7] and has been cited by the SEC as an example of a technology useful in the distribution of market data products.[8]

The Exchange proposes to offer the BX FPGA Service in conjunction with the Exchange's depth of book feed, BX TotalView. BX TotalView is a real-time market data product that provides full order depth using a series of order messages to track the life of customer orders in the BX market, as well as trade data for BX executions and

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[6]   See, e.g., Contrive Datum Insights, "Field-Programmable Gate Array (FPGA) Market is expected to reach around USD 22.10 Billion by 2030, Grow at a CAGR of 15.12% during Forecast Period 2023 to 2030," (February 21, 2023), available at https://www.globenewswire.com/en/news-release/2023/02/21/2612772/0/en/Field-Programmable-Gate-Array-FPGA-Market-Is-Expected-To-Reach-around-USD-22-10-Billion-by-2030-Grow-at-a-CAGR-Of-15-12-during-Forecast-Period-2023-To-2030-Data-By-Contrive-Datum-I.html (describing the general size and state of the FPGA market in 2023).

[7]   See Securities Exchange Act Release No. 67297 (June 28, 2012), 77 FR 39752 (July 5, 2012) (SR-Nasdaq-2012-063) (introducing FPGA technology); see also Nasdaq Data News 2012-13, available at http://www.nasdaqtrader.com/TraderNews.aspx?id=dn2012-13 (introducing TotalView FPGA service as of August 1, 2012); Securities Exchange Act Release No. 74745 (April 16, 2015), 80 FR 22588 (April 22, 2015) (SR-Nasdaq-2015-035) (establishing FPGA for the Nasdaq Options Market); The Nasdaq Stock Market LLC Rules, Equity 7, Section 126(c) (Hardware-Based Delivery of Nasdaq Depth data).

[8]   See Securities Exchange Act Release No. 90610, 86 FR 18596, 18647 (April 9, 2021) (File No. S7-03-20) (listing field programmable gate array services as an example of a technological innovation that could be employed by competing consolidators as part of the Market Data Infrastructure rule).

administrative messages such as Trading Action messages, Symbol Directory, and Event

Control messages.[9]

Customers that choose to purchase BX TotalView without the BX FPGA Service

will receive the same data as customers that elect to purchase BX TotalView with the BX

FPGA Service.

Proposed Fees

BX proposes internal distribution fees of $3,500 per month and external

distribution fees of $350 for the BX FPGA Service; customers that elect to use the BX

FPGA Service for both internal and external distribution will pay both fees.[10] These fees

are in addition to Market Data Distributor Fees,[11] fees for BX TotalView,[12] and other

fees for Distribution Models.[13] Customers that elect to receive BX depth of book data

without using the BX FPGA Service will pay no fee in addition to the underlying fees

listed above.

The proposed fees for the BX FPGA Service are substantially lower than fees for

the Nasdaq FPGA Service, which are set at $25,000 per Distributor for internal only

distribution, $2,500 for external only, and $27,500 for internal and external distribution.[14]

The difference is based, in part, on a comparison of peak activity at the two exchanges.

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[9]   See Nasdaq BX, Inc. Rules, Equity 7, Section 123 (BX TotalView); see also Securities Exchange
       Act Release No. 59307 (January 28, 2009), 74 FR 6069 (February 4, 2009) (establishing fees for
       BX TotalView).

[10]   The difference in amount for external and external distribution reflects Nasdaq's experience that
       the Exchange's FPGA hardware is best employed at the point of ingestion, as the utility of FPGA
       technology falls as the data moves farther from the source.

[11]   See Nasdaq BX, Inc. Rules, Equity 7, Section 119.

[12]   See Id., Section 123.

[13]   See Id., Section 126.

[14]   See The Nasdaq Stock Market LLC Rules, Equity 7 (Pricing Schedule), Section 126(c)
       (Hardware-based delivery of Nasdaq depth data).

As noted above, high levels of determinism are particularly valuable during periods of peak activity.

Although there is considerable variation in the number of messages at various peaks, as well as the duration of peak activity, the proposed fees are roughly comparable to the differences in average peak activity at the BX exchange relative to the Nasdaq exchange. Exchange staff have also discussed the proposed fees with customers, and believe, based on those discussions and their own business judgment, that the proposed fees fairly reflect the value of the BX FPGA Service. A number of customers provisionally agree with this assessment, and have indicated that they are interested in testing it.

No other exchange currently offers FPGA technology as a separate service in conjunction with the delivery of a proprietary data feed, and therefore there are no other fees for comparison.

If BX is incorrect in its determination that the proposed fees reflect the underlying value of the BX FPGA Service, customers will not purchase the product. The BX FPGA Service is not necessary for a customer to ingest and process depth of book information, and those customers that seek a higher degree of determinism have a number of options at their disposal to reduce jitter without using the BX FPGA Service.

b.   Statutory Basis

The Exchange believes that its proposal is consistent with Section 6(b) of the Act,[15] in general, and furthers the objectives of Sections 6(b)(4) and 6(b)(5) of the Act,[16] in particular, in that it provides for the equitable allocation of reasonable dues, fees and

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[15]   15 U.S.C. 78f(b).

[16]   15 U.S.C. 78f(b)(4) and (5).

other charges among members and issuers and other persons using any facility, and is not

designed to permit unfair discrimination between customers, issuers, brokers, or dealers.

The Proposal is reasonable and unlikely to burden the market because the

purchase of the BX FPGA Service is optional for all categories of customers. No

customer and no category of customers (such as, for example, vendors, proprietary

trading firms, banks, hedge funds, market makers, or high frequency trading firms) are

required to purchase the BX FPGA Service for either legal or technological reasons —

even a customer that seeks to reduce jitter.[17]

The Nasdaq exchange has over ten years of experience in selling the Nasdaq

FPGA Service. That experience has shown that the vast majority of Nasdaq depth

customers do not find value in the Nasdaq FPGA Service. The Exchange expects

customers that do not find value in the Nasdaq FPGA Service to make a similar decision

with respect to the BX FPGA Service, and continue to ingest BX TotalView as they do

now.

For those customers that may seek to increase determinism, the purchase of

FPGA technology from the BX exchange will be only one of several options available.

FPGA technology is not unique to the Exchange or even the financial services industry.

Third-party data vendors offer FPGA technology services. Customers may also install

their own FPGA hardware for internal use. All of these are viable options; the benefits of

any particular option will depend on the particular customer's systems and use cases.

Customers may also choose not to address jitter using FPGA technology at all.

As noted above, FPGA technology processes the data at a consistently predictable rate

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[17]   Not all customers of depth of book information process at sufficiently high speeds for jitter to
         become a concern. Neither FPGA hardware nor its substitutes are required to ingest depth of book
         information.

relative to software. This predictability in the rate of processing may not be advantageous or optimal for all systems receiving the exchange data feed.

The design of data processing architecture is complex. The ingestion of data from an exchange is just one step in the life-cycle of trading. Customers must also generate and submit orders, evaluate trades, and then generate new orders while interacting with multiple exchanges. All of these steps are part of a single trading system. Changing any one step in the process — by, for example, purchasing the BX FPGA Service when other exchanges may not offer FPGA—often results in the need for changes to other aspects of the process. As such, the decision to buy the BX FPGA Service will be based on whether the service is compatible with the customer's trading system as a whole, not just on whether it may facilitate the processing of data from a single exchange. The appropriateness of any particular solution will depend on the customer's system architecture, and the specific use cases for the market data consumed.

To illustrate the choice faced by exchange customers, consider the decisions made by the two consolidated data processors, the UTP and CTA Plans, two different systems that use dissimilar means to achieve an optimal solution. Both perform the same task — combining quotes and trades from all US exchanges into a consolidated data feed with relatively low jitter. Yet only one processor — the CTA Plan—uses FPGA hardware, while the other—the UTP Plan—does not.

This is because the UTP Plan's design, coding and hardware achieve the desired level of determinism without FPGA technology. The CTA Plan, by contrast, elected to incorporate FPGA technology into its system design. Notwithstanding these different design decisions, both plans achieve broadly similar levels of performance. FPGA

technology is therefore not essential to addressing jitter, but rather is one option among many to address the issue.

Market data customers face an array of choices to optimize determinism, much like the UTP and CTA Plans. For example, a customer may purchase and deploy its own FPGA hardware, without purchasing the proposed FPGA technology service from the Exchange, *after* receiving data from the Exchange. Another customer may find use of the BX FPGA Service, which lowers the level of jitter prior to the customer's receipt of the data, to be a better fit for its system architecture. The solution chosen will vary based on the needs and design choices of the customer.

The experience of the Nasdaq exchange in offering the Nasdaq FPGA Service shows that customers sensitive to jitter often avail themselves of substitutes for FPGA technology, a decision that can change over time. Over the past decade, a total of 21 current or potential users of the Nasdaq FPGA Service — all of which sought a higher degree of determinism — substituted the Nasdaq FPGA Service with an alternative solution. Six of these customers were in the process of developing and testing the Nasdaq FPGA Service, but ultimately decided not to purchase it before completing this process. The remaining 15 customers purchased the Nasdaq FPGA Service, only to cancel it after using it. Because all of these customers continued to utilize the underlying data, these cancelations demonstrate that the BX FPGA Service, like the Nasdaq FPGA Service, will be an optional service, even for those customers that seek to reduce jitter.

Moreover, as noted above, no other exchange currently offers FPGA technology in conjunction with their proprietary data feeds as a separate service, notwithstanding the fact that it is a widely available technology, providing further evidence that customers

have multiple options at their disposal to address jitter.

In the experience of the Nasdaq exchange, the Nasdaq FPGA Service is purchased by vendors, proprietary trading firms, banks, high-frequency trading firms, hedge funds, and market makers. The Nasdaq exchange is aware of no systematic differences within any of these categories among market participants that choose to use or not to use the Nasdaq FPGA Service.

Few customers of Nasdaq TotalView purchase the Nasdaq FPGA Service. This is because the bulk of customers consume Nasdaq TotalView for display (i.e., human) usage. FPGA technology impacts performance at a speed that a human cannot process, and there is no need for FPGA technology for such usage.

Of the customers that receive Nasdaq TotalView from Nasdaq (either through a direct feed or an extranet connection), and are in a position to utilize the Nasdaq FPGA Service, only about 15 percent purchase it.

Most strikingly, only approximately 3% of market makers at Nasdaq purchase the Nasdaq FPGA Service.[18] This may seem a surprising result, given that market makers, by definition, trade throughout the day and during periods of peak activity, but, as noted above, customers have several options: purchase FPGA services from a third-party vendor, implement FPGA technology on their own, or configure their systems to process data during peaks without the use of FPGA. The fact that only about 3% of market makers at the Nasdaq exchange purchase the Nasdaq FPGA Service demonstrates that most customers make use of alternative solutions. As such, the determining factor in

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[18]   The 3% figure represents the percentage of designated market makers by market participant identifier ("MPID") that currently purchase the Nasdaq FPGA Service relative to all MPIDs on the Nasdaq Market Center. The MPID is a unique four-letter mnemonic assigned to each Participant in the Nasdaq Market Center. A Participant may have one or more than one MPID. See The Nasdaq Stock Market LLC Rules, Equity 1, Section 1(a)(11).

whether to purchase the Nasdaq FPGA Service is not the category of customer, but rather the compatibility of that service with the customer's specific systems architecture and technical requirements, which can and do change over time as systems are modified, replaced or updated.

For all of these reasons, customers can discontinue the use of the BX FPGA Service at any time, or decide not to purchase it, for any reason, including the level of fees.

Customers that choose not to purchase the BX FPGA Service are not impacted by the proposal.

The BX FPGA Service will be available to all customers on a non-discriminatory basis, and therefore the proposed fees are not designed to permit unfair discrimination between customers, issuers, brokers, or dealers.

4.   Self-Regulatory Organization's Statement on Burden on Competition

The Exchange does not believe that the proposed rule change will impose any burden on competition not necessary or appropriate in furtherance of the purposes of the Act.

This Proposal, a response to customer demand, is a product of a competitive marketplace. To date, lower levels of peak activity at the BX Exchange relative to the Nasdaq exchange have been associated with low levels of customer interest in this product. Recently, however, BX has heard from customers interested in using FPGA technology for BX TotalView. To address this customer demand, and to drive liquidity to the BX Exchange by making it a more attractive trading venue, BX has decided to offer this product.

Approval of this Proposal will further promote competition by providing market participants additional choices in the transmission of depth of book data.

Nothing in the Proposal burdens inter-market competition (the competition among self-regulatory organizations) because approval of the Proposal does not impose any burden on the ability of other exchanges to compete. As noted above, FPGA technology is generally available and any exchange has the ability to offer it if it so chooses.

Nothing in the Proposal burdens intra-market competition (the competition among consumers of exchange data) because the BX FPGA Service will be available to any customer under the same fee schedule as any other customer, and any market participant that wishes to purchase the BX FPGA Service can do so on a non-discriminatory basis.

5.   <u>Self-Regulatory Organization's Statement on Comments on the Proposed Rule Change Received from Members, Participants, or Others</u>

No written comments were either solicited or received.

6.   <u>Extension of Time Period for Commission Action</u>

Not applicable.

7.   <u>Basis for Summary Effectiveness Pursuant to Section 19(b)(3) or for Accelerated Effectiveness Pursuant to Section 19(b)(2)</u>

Pursuant to Section 19(b)(3)(A)(ii) of the Act,[19] the Exchange has designated this proposal as establishing or changing a due, fee, or other charge imposed by the self-regulatory organization on any person, whether or not the person is a member of the self-regulatory organization, which renders the proposed rule change effective upon filing.

At any time within 60 days of the filing of the proposed rule change, the Commission summarily may temporarily suspend such rule change if it appears to the Commission that such action is: (i) necessary or appropriate in the public interest; (ii) for

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[19]   15 U.S.C. 78s(b)(3)(A)(ii).

the protection of investors; or (iii) otherwise in furtherance of the purposes of the Act. If

the Commission takes such action, the Commission shall institute proceedings to

determine whether the proposed rule should be approved or disapproved.

8.   Proposed Rule Change Based on Rules of Another Self-Regulatory Organization
        or of the Commission

        Not applicable.

9.   Security-Based Swap Submissions Filed Pursuant to Section 3C of the Act

        Not applicable.

10.   Advance Notices Filed Pursuant to Section 806(e) of the Payment, Clearing and
        Settlement Supervision Act

        Not applicable.

11.   Exhibits

        1.   Notice of Proposed Rule Change for publication in the Federal Register.

        5.   Text of the proposed rule change.

EXHIBIT 1

SECURITIES AND EXCHANGE COMMISSION
(Release No.   ; File No. SR-BX-2023-020)

August __, 2023

Self-Regulatory Organizations; Nasdaq BX, Inc.; Notice of Filing and Immediate Effectiveness of Proposed Rule Change to Set Fees for the Purchase of Field-Programmable Gate Array ("FPGA") Technology as an Optional Delivery Mechanism for BX Totalview.

Pursuant to Section 19(b)(1) of the Securities Exchange Act of 1934 ("Act")[1], and

Rule 19b-4 thereunder,[2] notice is hereby given that on August 9, 2023, Nasdaq BX, Inc.

("BX" or "Exchange") filed with the Securities and Exchange Commission ("SEC" or

"Commission") the proposed rule change as described in Items I, II, and III, below,

which Items have been prepared by the Exchange. The Commission is publishing this

notice to solicit comments on the proposed rule change from interested persons.

I.   Self-Regulatory Organization's Statement of the Terms of Substance of the
        Proposed Rule Change

The Exchange proposes to set fees for the purchase of field-programmable gate

array ("FPGA") technology as an optional delivery mechanism for BX TotalView.

The text of the proposed rule change is available on the Exchange's Website at

https://listingcenter.nasdaq.com/rulebook/bx/rules, at the principal office of the

Exchange, and at the Commission's Public Reference Room.

II.   Self-Regulatory Organization's Statement of the Purpose of, and Statutory Basis
        for, the Proposed Rule Change

In its filing with the Commission, the Exchange included statements concerning

the purpose of and basis for the proposed rule change and discussed any comments it

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[1]   15 U.S.C. 78s(b)(1).

[2]   17 CFR 240.19b-4.

received on the proposed rule change. The text of these statements may be examined at

the places specified in Item IV below. The Exchange has prepared summaries, set forth

in sections A, B, and C below, of the most significant aspects of such statements.

A.   Self-Regulatory Organization's Statement of the Purpose of, and Statutory
        Basis for, the Proposed Rule Change

1.   Purpose

The purpose of the proposed rule change is to establish a fee schedule for the

purchase of field-programmable gate array ("FPGA") technology as an optional delivery

mechanism for BX TotalView ("BX FPGA Service").[3] This follows a recently-filed

proposal to offer FPGA technology as an optional delivery mechanism for BX

TotalView.[4]

FPGA

FPGA is a hardware-based delivery mechanism that utilizes an integrated circuit

that is programmed to reduce "jitter"—a technical term of art referring to the deviation in

amplitude, phase timing or width of a signal pulse in a digital signal—that will allow data

to be processed in a more predictable, or "deterministic," fashion. Reducing jitter can be

useful for certain customers due to the variability in the timing of market data packets

transmitted by an exchange over the course of the trading day. Orders, and therefore

market data packets, typically accumulate in larger numbers at the beginning and end of

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[3]   This Proposal was initially filed by the Exchange on May 23, 2023. See Securities Exchange Act
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        2023, that filing was withdrawn and replaced to provide supplemental information. See Securities
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        016). On August 9, 2023, the second filing was withdrawn and replaced with the instant filing,
        which provides additional information without changing the Proposal in substance.

[4]   See SR-BX-2023-011 ("A proposal to offer field-programmable gate array ('FPGA') technology
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        https://listingcenter.nasdaq.com/rulebook/BX/rulefilings. A proposal to establish a fee schedule
        for the use of FPGA technology for the Phlx exchange is being filed concurrently with this
        proposal.

the trading day, as well as during the peaks of activity that occur at random intervals during the day. These bursts of activity may alter the time interval between the delivery of data packets because software processes information at variable rates depending on load to the system. Processing times may increase at higher loads, and decrease during periods of lesser activity. FPGA technology processes data packets at a constant time interval, without regard to the number of packets processed. Higher levels of determinism mean less variable queuing, which improves the predictability of data transfer, particularly during times of peak market activity.

The benefits of determinism depend on the use case of the customer, as well as the customer's specific system architecture.

Higher determinism does not necessarily mean lower latency. The concepts of determinism and latency are related, but distinct. Determinism refers to predictability in the rate of data transmission; latency refers to the time required to process data or transport it from one location to another. Low latency is not necessarily deterministic, and higher determinism does not necessarily mean low latency. As such, use of FPGA technology will increase determinism, but does not guarantee lower latency at all times.[5]

Among customers that seek a higher degree of determinism, the benefits of FPGA technology vary, as FPGA technology is one possible solution, among a catalog of possible solutions, for increasing the consistency and predictability of message throughput over the course of the trading day. Some customers are able to adequately control jitter without using FPGA technology; other customers address jitter using

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[5]   Because software can be impacted by workload, FPGA technology in general can provide lower latency during periods of peak activity. The same FPGA technology that will support the BX FPGA Service is also broadly commercially available for purchase from third-party sellers unrelated to the Exchange.

specialized software, coding or other design solutions in conjunction with FPGA; still

others use FPGA alone. The specific choice depends on a complex analysis of the

customer's information technology systems in the context of their particular use cases.

FPGA is a broadly-available, commonly-used type of programmable circuit that

can be modified to suit different use cases. It is used in a wide spectrum of industries,

including the consumer electronics, automotive, and aerospace, as well as in a variety of

industrial applications. It is not unique to the financial services industry,[6] or to the

Exchange.

FPGA technology has been offered by the Nasdaq Stock Exchange for over a

decade, and the Nasdaq Options Market for nearly as long,[7] and has been cited by the

SEC as an example of a technology useful in the distribution of market data products.[8]

The Exchange proposes to offer the BX FPGA Service in conjunction with the

Exchange's depth of book feed, BX TotalView. BX TotalView is a real-time market data

product that provides full order depth using a series of order messages to track the life of

customer orders in the BX market, as well as trade data for BX executions and

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[6]   See, e.g., Contrive Datum Insights, "Field-Programmable Gate Array (FPGA) Market is expected
        to reach around USD 22.10 Billion by 2030, Grow at a CAGR of 15.12% during Forecast Period
        2023 to 2030," (February 21, 2023), available at https://www.globenewswire.com/en/news-
        release/2023/02/21/2612772/0/en/Field-Programmable-Gate-Array-FPGA-Market-Is-Expected-
        To-Reach-around-USD-22-10-Billion-by-2030-Grow-at-a-CAGR-Of-15-12-during-Forecast-
        Period-2023-To-2030-Data-By-Contrive-Datum-I.html (describing the general size and state of
        the FPGA market in 2023).

[7]   See Securities Exchange Act Release No. 67297 (June 28, 2012), 77 FR 39752 (July 5, 2012) (SR-
        Nasdaq-2012-063) (introducing FPGA technology); see also Nasdaq Data News 2012-13,
        available at http://www.nasdaqtrader.com/TraderNews.aspx?id=dn2012-13 (introducing
        TotalView FPGA service as of August 1, 2012); Securities Exchange Act Release No. 74745
        (April 16, 2015), 80 FR 22588 (April 22, 2015) (SR-Nasdaq-2015-035) (establishing FPGA for
        the Nasdaq Options Market); The Nasdaq Stock Market LLC Rules, Equity 7, Section 126(c)
        (Hardware-Based Delivery of Nasdaq Depth data).

[8]   See Securities Exchange Act Release No. 90610, 86 FR 18596, 18647 (April 9, 2021) (File No.
        S7-03-20) (listing field programmable gate array services as an example of a technological
        innovation that could be employed by competing consolidators as part of the Market Data
        Infrastructure rule).

administrative messages such as Trading Action messages, Symbol Directory, and Event

Control messages.[9]

Customers that choose to purchase BX TotalView without the BX FPGA Service

will receive the same data as customers that elect to purchase BX TotalView with the BX

FPGA Service.

Proposed Fees

BX proposes internal distribution fees of $3,500 per month and external

distribution fees of $350 for the BX FPGA Service; customers that elect to use the BX

FPGA Service for both internal and external distribution will pay both fees.[10] These fees

are in addition to Market Data Distributor Fees,[11] fees for BX TotalView,[12] and other

fees for Distribution Models.[13] Customers that elect to receive BX depth of book data

without using the BX FPGA Service will pay no fee in addition to the underlying fees

listed above.

The proposed fees for the BX FPGA Service are substantially lower than fees for

the Nasdaq FPGA Service, which are set at $25,000 per Distributor for internal only

distribution, $2,500 for external only, and $27,500 for internal and external distribution.[14]

The difference is based, in part, on a comparison of peak activity at the two exchanges.

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[9]   See Nasdaq BX, Inc. Rules, Equity 7, Section 123 (BX TotalView); see also Securities Exchange
        Act Release No. 59307 (January 28, 2009), 74 FR 6069 (February 4, 2009) (establishing fees for
        BX TotalView).

[10]   The difference in amount for external and external distribution reflects Nasdaq's experience that
        the Exchange's FPGA hardware is best employed at the point of ingestion, as the utility of FPGA
        technology falls as the data moves farther from the source.

[11]   See Nasdaq BX, Inc. Rules, Equity 7, Section 119.

[12]   See Id., Section 123.

[13]   See Id., Section 126.

[14]   See The Nasdaq Stock Market LLC Rules, Equity 7 (Pricing Schedule), Section 126(c)
        (Hardware-based delivery of Nasdaq depth data).

As noted above, high levels of determinism are particularly valuable during periods of peak activity.

Although there is considerable variation in the number of messages at various peaks, as well as the duration of peak activity, the proposed fees are roughly comparable to the differences in average peak activity at the BX exchange relative to the Nasdaq exchange. Exchange staff have also discussed the proposed fees with customers, and believe, based on those discussions and their own business judgment, that the proposed fees fairly reflect the value of the BX FPGA Service. A number of customers provisionally agree with this assessment, and have indicated that they are interested in testing it.

No other exchange currently offers FPGA technology as a separate service in conjunction with the delivery of a proprietary data feed, and therefore there are no other fees for comparison.

If BX is incorrect in its determination that the proposed fees reflect the underlying value of the BX FPGA Service, customers will not purchase the product. The BX FPGA Service is not necessary for a customer to ingest and process depth of book information, and those customers that seek a higher degree of determinism have a number of options at their disposal to reduce jitter without using the BX FPGA Service.

2.   Statutory Basis

The Exchange believes that its proposal is consistent with Section 6(b) of the Act,[15] in general, and furthers the objectives of Sections 6(b)(4) and 6(b)(5) of the Act,[16] in particular, in that it provides for the equitable allocation of reasonable dues, fees and

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[15]   15 U.S.C. 78f(b).

[16]   15 U.S.C. 78f(b)(4) and (5).

other charges among members and issuers and other persons using any facility, and is not

designed to permit unfair discrimination between customers, issuers, brokers, or dealers.

The Proposal is reasonable and unlikely to burden the market because the

purchase of the BX FPGA Service is optional for all categories of customers. No

customer and no category of customers (such as, for example, vendors, proprietary

trading firms, banks, hedge funds, market makers, or high frequency trading firms) are

required to purchase the BX FPGA Service for either legal or technological reasons —

even a customer that seeks to reduce jitter.[17]

The Nasdaq exchange has over ten years of experience in selling the Nasdaq

FPGA Service. That experience has shown that the vast majority of Nasdaq depth

customers do not find value in the Nasdaq FPGA Service. The Exchange expects

customers that do not find value in the Nasdaq FPGA Service to make a similar decision

with respect to the BX FPGA Service, and continue to ingest BX TotalView as they do

now.

For those customers that may seek to increase determinism, the purchase of

FPGA technology from the BX exchange will be only one of several options available.

FPGA technology is not unique to the Exchange or even the financial services industry.

Third-party data vendors offer FPGA technology services. Customers may also install

their own FPGA hardware for internal use. All of these are viable options; the benefits of

any particular option will depend on the particular customer's systems and use cases.

Customers may also choose not to address jitter using FPGA technology at all.

As noted above, FPGA technology processes the data at a consistently predictable rate

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[17]   Not all customers of depth of book information process at sufficiently high speeds for jitter to
         become a concern. Neither FPGA hardware nor its substitutes are required to ingest depth of book
         information.

relative to software. This predictability in the rate of processing may not be advantageous or optimal for all systems receiving the exchange data feed.

The design of data processing architecture is complex. The ingestion of data from an exchange is just one step in the life-cycle of trading. Customers must also generate and submit orders, evaluate trades, and then generate new orders while interacting with multiple exchanges. All of these steps are part of a single trading system. Changing any one step in the process — by, for example, purchasing the BX FPGA Service when other exchanges may not offer FPGA—often results in the need for changes to other aspects of the process. As such, the decision to buy the BX FPGA Service will be based on whether the service is compatible with the customer's trading system as a whole, not just on whether it may facilitate the processing of data from a single exchange. The appropriateness of any particular solution will depend on the customer's system architecture, and the specific use cases for the market data consumed.

To illustrate the choice faced by exchange customers, consider the decisions made by the two consolidated data processors, the UTP and CTA Plans, two different systems that use dissimilar means to achieve an optimal solution. Both perform the same task — combining quotes and trades from all US exchanges into a consolidated data feed with relatively low jitter. Yet only one processor — the CTA Plan—uses FPGA hardware, while the other—the UTP Plan—does not.

This is because the UTP Plan's design, coding and hardware achieve the desired level of determinism without FPGA technology. The CTA Plan, by contrast, elected to incorporate FPGA technology into its system design. Notwithstanding these different design decisions, both plans achieve broadly similar levels of performance. FPGA

technology is therefore not essential to addressing jitter, but rather is one option among many to address the issue.

Market data customers face an array of choices to optimize determinism, much like the UTP and CTA Plans. For example, a customer may purchase and deploy its own FPGA hardware, without purchasing the proposed FPGA technology service from the Exchange, *after* receiving data from the Exchange. Another customer may find use of the BX FPGA Service, which lowers the level of jitter prior to the customer's receipt of the data, to be a better fit for its system architecture. The solution chosen will vary based on the needs and design choices of the customer.

The experience of the Nasdaq exchange in offering the Nasdaq FPGA Service shows that customers sensitive to jitter often avail themselves of substitutes for FPGA technology, a decision that can change over time. Over the past decade, a total of 21 current or potential users of the Nasdaq FPGA Service — all of which sought a higher degree of determinism — substituted the Nasdaq FPGA Service with an alternative solution. Six of these customers were in the process of developing and testing the Nasdaq FPGA Service, but ultimately decided not to purchase it before completing this process. The remaining 15 customers purchased the Nasdaq FPGA Service, only to cancel it after using it. Because all of these customers continued to utilize the underlying data, these cancelations demonstrate that the BX FPGA Service, like the Nasdaq FPGA Service, will be an optional service, even for those customers that seek to reduce jitter.

Moreover, as noted above, no other exchange currently offers FPGA technology in conjunction with their proprietary data feeds as a separate service, notwithstanding the fact that it is a widely available technology, providing further evidence that customers

have multiple options at their disposal to address jitter.

In the experience of the Nasdaq exchange, the Nasdaq FPGA Service is purchased by vendors, proprietary trading firms, banks, high-frequency trading firms, hedge funds, and market makers. The Nasdaq exchange is aware of no systematic differences within any of these categories among market participants that choose to use or not to use the Nasdaq FPGA Service.

Few customers of Nasdaq TotalView purchase the Nasdaq FPGA Service. This is because the bulk of customers consume Nasdaq TotalView for display (i.e., human) usage. FPGA technology impacts performance at a speed that a human cannot process, and there is no need for FPGA technology for such usage.

Of the customers that receive Nasdaq TotalView from Nasdaq (either through a direct feed or an extranet connection), and are in a position to utilize the Nasdaq FPGA Service, only about 15 percent purchase it.

Most strikingly, only approximately 3% of market makers at Nasdaq purchase the Nasdaq FPGA Service.[18] This may seem a surprising result, given that market makers, by definition, trade throughout the day and during periods of peak activity, but, as noted above, customers have several options: purchase FPGA services from a third-party vendor, implement FPGA technology on their own, or configure their systems to process data during peaks without the use of FPGA. The fact that only about 3% of market makers at the Nasdaq exchange purchase the Nasdaq FPGA Service demonstrates that most customers make use of alternative solutions. As such, the determining factor in

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[18]   The 3% figure represents the percentage of designated market makers by market participant identifier ("MPID") that currently purchase the Nasdaq FPGA Service relative to all MPIDs on the Nasdaq Market Center. The MPID is a unique four-letter mnemonic assigned to each Participant in the Nasdaq Market Center. A Participant may have one or more than one MPID. See The Nasdaq Stock Market LLC Rules, Equity 1, Section 1(a)(11).

whether to purchase the Nasdaq FPGA Service is not the category of customer, but rather the compatibility of that service with the customer's specific systems architecture and technical requirements, which can and do change over time as systems are modified, replaced or updated.

For all of these reasons, customers can discontinue the use of the BX FPGA Service at any time, or decide not to purchase it, for any reason, including the level of fees.

Customers that choose not to purchase the BX FPGA Service are not impacted by the proposal.

The BX FPGA Service will be available to all customers on a non-discriminatory basis, and therefore the proposed fees are not designed to permit unfair discrimination between customers, issuers, brokers, or dealers.

B.   Self-Regulatory Organization's Statement on Burden on Competition

The Exchange does not believe that the proposed rule change will impose any burden on competition not necessary or appropriate in furtherance of the purposes of the Act.

This Proposal, a response to customer demand, is a product of a competitive marketplace. To date, lower levels of peak activity at the BX Exchange relative to the Nasdaq exchange have been associated with low levels of customer interest in this product. Recently, however, BX has heard from customers interested in using FPGA technology for BX TotalView. To address this customer demand, and to drive liquidity to the BX Exchange by making it a more attractive trading venue, BX has decided to offer this product.

Approval of this Proposal will further promote competition by providing market participants additional choices in the transmission of depth of book data.

Nothing in the Proposal burdens inter-market competition (the competition among self-regulatory organizations) because approval of the Proposal does not impose any burden on the ability of other exchanges to compete. As noted above, FPGA technology is generally available and any exchange has the ability to offer it if it so chooses.

Nothing in the Proposal burdens intra-market competition (the competition among consumers of exchange data) because the BX FPGA Service will be available to any customer under the same fee schedule as any other customer, and any market participant that wishes to purchase the BX FPGA Service can do so on a non-discriminatory basis.

      C.   Self-Regulatory Organization's Statement on Comments on the Proposed Rule Change Received from Members, Participants, or Others

No written comments were either solicited or received.

III.   Date of Effectiveness of the Proposed Rule Change and Timing for Commission Action

The foregoing rule change has become effective pursuant to Section 19(b)(3)(A)(ii) of the Act.[19]

At any time within 60 days of the filing of the proposed rule change, the Commission summarily may temporarily suspend such rule change if it appears to the Commission that such action is: (i) necessary or appropriate in the public interest; (ii) for the protection of investors; or (iii) otherwise in furtherance of the purposes of the Act. If the Commission takes such action, the Commission shall institute proceedings to determine whether the proposed rule should be approved or disapproved.

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[19]   15 U.S.C. 78s(b)(3)(A)(ii).

IV.   Solicitation of Comments

Interested persons are invited to submit written data, views and arguments concerning the foregoing, including whether the proposed rule change is consistent with the Act. Comments may be submitted by any of the following methods:

Electronic Comments:

- Use the Commission's internet comment form (https://www.sec.gov/rules/sro.shtml); or

- Send an email to rule-comments@sec.gov. Please include file number SR-BX-2023-020 on the subject line.

Paper Comments:

- Send paper comments in triplicate to Secretary, Securities and Exchange Commission, 100 F Street NE, Washington, DC 20549-1090.

All submissions should refer to file number SR-BX-2023-020. This file number should be included on the subject line if email is used. To help the Commission process and review your comments more efficiently, please use only one method. The Commission will post all comments on the Commission's internet website (https://www.sec.gov/rules/sro.shtml). Copies of the submission, all subsequent amendments, all written statements with respect to the proposed rule change that are filed with the Commission, and all written communications relating to the proposed rule change between the Commission and any person, other than those that may be withheld from the public in accordance with the provisions of 5 U.S.C. 552, will be available for website viewing and printing in the Commission's Public Reference Room, 100 F Street NE, Washington, DC 20549, on official business days between the hours of 10 a.m. and 3

p.m. Copies of the filing also will be available for inspection and copying at the principal

office of the Exchange. Do not include personal identifiable information in submissions;

you should submit only information that you wish to make available publicly. We may

redact in part or withhold entirely from publication submitted material that is obscene or

subject to copyright protection. All submissions should refer to file number SR-BX-

2023-020 and should be submitted on or before [INSERT DATE 21 DAYS AFTER

DATE OF PUBLICATION IN THE *FEDERAL REGISTER*].

For the Commission, by the Division of Trading and Markets, pursuant to

delegated authority.[20]

Sherry R. Haywood,

Assistant Secretary.

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[20]   17 CFR 200.30-3(a)(12).

EXHIBIT 5

Deleted text is [bracketed]. New text is underlined.

NASDAQ BX, INC. RULES

Equity Rules

Equity 7 Pricing Schedule

* * * * *

Section 126. Distribution Models

(a) No change.

(b) Hardware-Based Delivery of BX Depth data

The charges to be paid by Distributors for processing BX Depth data sourced from a BX hardware-based market data format shall be:

Hardware-Based Delivery	Monthly Fee
Internal Only Distributor	$3,500 Per Distributor
External Only Distributor	$350 Per Distributor
Internal and External Distributor	$3,850 Per Distributor

[(b)](c) Definitions

For purposes of this Section, the terms set forth below shall have the following meanings:

(1) The term "Non-Professional" shall have the same meaning as set forth in Equity 7, Section 123(b).

(2) The term "Distributor" shall have the same meaning as set forth in Equity 7, Section 119(b)

(3) The term "Subscriber" shall have the same meaning as set forth in Equity 7, Section 123(c)

(4) The term "BX TotalView" shall have the same meaning as set forth in Equity 7, Section 123(a)

(5) The term "BX Depth data" shall mean any data feed set forth in Equity 7, Section 123.

(6) The term "Hardware-Based Delivery" means that a distributor is processing data sourced from a hardware-coded market data format such as field-programmable gate array ("FPGA") technology.

(d) Distributors of BX Depth data also are subject to the market data fees set forth in this Section and Equity 7, Sections 119(a) and 123.

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