

Required fields are shown with yellow backgrounds and asterisks.

Page 1 of * 125	SECURITIES AND EXCHANGE COMMISSION WASHINGTON, D.C. 20549 Form 19b-4		File No.* SR - 2016 - * 005	Amendment No. (req. for Amendments *)
Filing by Financial Industry Regulatory Authority Pursuant to Rule 19b-4 under the Securities Exchange Act of 1934				
Initial * <input checked="" type="checkbox"/>	Amendment * <input type="checkbox"/>	Withdrawal <input type="checkbox"/>	Section 19(b)(2) * <input checked="" type="checkbox"/>	Section 19(b)(3)(A) * <input type="checkbox"/>
			Section 19(b)(3)(B) * <input type="checkbox"/>	
Pilot <input type="checkbox"/>	Extension of Time Period for Commission Action * <input type="checkbox"/>	Date Expires * <input type="text"/>	Rule	
			<input type="checkbox"/> 19b-4(f)(1)	<input type="checkbox"/> 19b-4(f)(4)
			<input type="checkbox"/> 19b-4(f)(2)	<input type="checkbox"/> 19b-4(f)(5)
			<input type="checkbox"/> 19b-4(f)(3)	<input type="checkbox"/> 19b-4(f)(6)
Notice of proposed change pursuant to the Payment, Clearing, and Settlement Act of 2010			Security-Based Swap Submission pursuant to the Securities Exchange Act of 1934	
Section 806(e)(1) * <input type="checkbox"/>	Section 806(e)(2) * <input type="checkbox"/>	Section 3C(b)(2) * <input type="checkbox"/>		
Exhibit 2 Sent As Paper Document <input type="checkbox"/>	Exhibit 3 Sent As Paper Document <input type="checkbox"/>			
Description				
Provide a brief description of the action (limit 250 characters, required when Initial is checked *).				
<input type="text" value="Proposed Rule Change to Reduce the Synchronization Tolerance for Computer Clocks that are Used to Record Events in NMS Securities and OTC Equity Securities"/>				
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 *	<input type="text" value="Alexander"/>	Last Name *	<input type="text" value="Ellenberg"/>	
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Signature				
Pursuant to the requirements of the Securities Exchange Act of 1934,				
has duly caused this filing to be signed on its behalf by the undersigned thereunto duly authorized.				
(Title *)				
Date	<input type="text" value="02/09/2016"/>	<input type="text" value="Senior Vice President and Director of Capital Markets Policy"/>		
By	<input type="text" value="Stephanie Dumont"/>	<input type="text" value="Stephanie Dumont,"/>		
(Name *)				
NOTE: Clicking the button at right will digitally sign and lock this form. A digital signature is as legally binding as a physical signature, and once signed, this form cannot be changed.				

SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

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

Form 19b-4 Information *

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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 *

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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 1A- Notice of Proposed Rule Change, Security-Based Swap Submission, or Advance 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, security-based swap submission, or advance notice 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

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Exhibit Sent As Paper Document

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 3 - Form, Report, or Questionnaire

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Exhibit Sent As Paper Document

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 4 - Marked Copies

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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

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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

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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) Pursuant to the provisions of Section 19(b)(1) of the Securities Exchange Act of 1934 (“Act”),¹ Financial Industry Regulatory Authority, Inc. (“FINRA”) is filing with the Securities and Exchange Commission (“SEC” or “Commission”) a proposed rule change to reduce the synchronization tolerance for members’ computer clocks that are used to record events in NMS securities, including standardized options, and OTC Equity Securities. This proposal would not change the current clock synchronization requirement for members’ mechanical time stamping devices or computer clocks that are used to record events for securities other than NMS securities or OTC Equity Securities.

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

At its meeting on September 18, 2014, the FINRA Board of Governors authorized the filing of the proposed rule change with the SEC. No other action by FINRA is necessary for the filing of the proposed rule change.

If the Commission approves the proposed rule change, FINRA will announce the effective date of the proposed rule change in a Regulatory Notice to be published no later than 90 days following Commission approval. As discussed in greater detail below in Items 3 and 4, FINRA would implement the proposed rule change in phases to allow members sufficient time to adapt their systems as necessary.

¹ 15 U.S.C. 78s(b)(1).

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

(a) Purpose

Current FINRA rules require that firms synchronize their business clocks in conformity with procedures prescribed by FINRA. Specifically, FINRA Rule 7430 requires that firms synchronize their business clocks that are used for purposes of recording the date and time of any event that must be recorded pursuant to the FINRA By-Laws or other FINRA rules (e.g., the time a trade was executed or the time an order was received or routed), with reference to a time source as designated by FINRA. As specified in the current OATS technical specifications, all computer system clocks and mechanical time stamping devices must be synchronized to within one second of the NIST atomic clock.² To maintain clock synchronization, clocks should be checked against the NIST atomic clock and re-synchronized, if necessary, at pre-determined intervals throughout the day.³ FINRA understands that currently, some firms

² Any time provider may be used for synchronization; however, all clocks and time stamping devices must remain accurate within a one-second tolerance of the NIST clock. This tolerance includes (1) the difference between the NIST standard and a time provider's clock, (2) transmission delay from the source and (3) the amount of drift of the member firm's clock. The OATS technical specifications further specify that computer system and mechanical clocks must be synchronized every business day before market open to ensure that recorded order event timestamps are accurate.

³ The OATS technical specifications also provide that member firms must document and maintain their clock synchronization procedures. In addition, the technical specifications state that member firms should keep a log of the times when they synchronize their clocks and the results of the synchronization process, including notice of any time a member's clock drifts more than the one second standard. The technical specifications further provide that such logs should be maintained for the period of time and accessibility specified in SEC Rule 17a-4(b), and maintained and preserved for the required time period in paper format or in a format permitted under SEC Rule 17a-4(f).

synchronize their clocks continuously throughout the day, while others do so at various times during the day and still others do so only once a day.⁴

Given the increasing speed of trading in today's automated markets, FINRA believes the current one second tolerance is no longer appropriate for computer system clocks recording events in NMS securities⁵ and OTC Equity Securities⁶ under FINRA rules. Automated systems have evolved to the point where order placement and trading decisions in these asset classes are made on a millisecond basis, if not finer. Moreover, in many cases firms report events to FINRA's equity trade reporting and audit trail facilities in milliseconds.⁷

⁴ FINRA generally believes that the firms that synchronize once daily are firms that accept manual orders.

⁵ The term "NMS security" is defined in Rule 600 of Regulation NMS to mean "any security or class of securities for which transaction reports are collected, processed and made available pursuant to an effective transaction reporting plan, or an effective national market system plan for reporting transactions in listed options. 17 CFR 242.600(b)(46). As Commission staff has noted, the term NMS security generally "refers to exchange-listed equity securities and standardized options, but does not include exchange-listed debt securities, securities futures, or open-end mutual funds, which are not currently reported pursuant to an effective transaction reporting plan." See Division of Trading and Markets Staff's Responses to Frequently Asked Questions Concerning Large Trader Reporting, question 1.1, available at <https://www.sec.gov/divisions/marketreg/large-trader-faqs.htm>.

⁶ The term "OTC Equity Security" is defined in FINRA Rule 6420(f) to mean "any equity security that is not an 'NMS stock' as that term is defined in Rule 600(b)(47) of Regulation NMS; provided, however, that the term 'OTC Equity Security' shall not include any Restricted Equity Security."

⁷ See Securities Exchange Act Release No. 71623 (February 27, 2014), 79 FR 12558 (March 4, 2014) (order approving SR-FINRA-2014-050, FINRA's proposal to require firms to report order and trade information to the FINRA TRFs, ADF, ORF, and OATS in milliseconds, if the firms' systems capture time in milliseconds). See also Regulatory Notice 14-21 (May 2014) (announcing the effective date of millisecond reporting changes); Regulatory Notice 14-47

Accordingly, FINRA is proposing to tighten the synchronization requirement for computer system clocks that record events in NMS securities and OTC Equity Securities. The proposal would reduce the drift tolerance for computer clocks that record events in these securities from one second to 50 milliseconds. The proposal would not change the current one second standard for securities other than NMS securities or OTC Equity Securities and would not change the current one second standard for events recorded by mechanical clocks or time stamping devices, as opposed to computer clocks.

As a technical matter, the proposal would codify the existing OATS technical specifications cited above, along with the new proposed 50 millisecond standard, in FINRA's Rule 4500 Series (Books, Records and Reports). The purpose of this technical change is to relocate the clock synchronization requirements from OATS rules to a rule set where it is clear the requirements apply to the recording of the date and time of any event that must be recorded under FINRA By-Laws or rules. As noted above, under a combination of Rule 7430 and the OATS technical specifications, the current one second synchronization standard already applies to the recording of the date and time of any event that must be recorded under FINRA By-Laws or rules. Under this proposal, FINRA would consolidate and codify the clock synchronization requirements in new Rule 4590 for clarity and ease of reference. This consolidation would include the current provision in the OATS technical specifications that conveys guidance on recordkeeping to demonstrate compliance with the synchronization standard, which would be codified without material change as Supplementary Material .01 to Rule 4590.

(November 2014) at page 7, n. 7 (describing the extended implementation schedule for millisecond reporting changes).

In arriving at this proposal, FINRA solicited and received feedback from its industry advisory committees, as well as through a public request for comment. After thoroughly evaluating all of the feedback received, FINRA has determined that the proposed 50 millisecond standard is the best approach given existing technology and FINRA's regulatory needs. In addition, as described in more detail below, FINRA further determined that it should proceed with the proposal now, rather than wait for approval and implementation of the clock synchronization requirements proposed in the National Market System Plan governing the Consolidated Audit Trail ("CAT NMS Plan").⁸

As an initial step, FINRA staff solicited industry input from several of its industry advisory committees prior to publishing the proposal for comment in a Regulatory Notice. These committees were generally supportive. To the extent the committees raised concerns, they focused on the proposal's potential impact on small firms, particularly firms that do not rely on highly automated systems. In response to these concerns, and similar concerns raised in the comment letters discussed below, FINRA modified the proposal to allow for phased implementation which would grant less automated firms up to 18 months to comply with the proposed 50 millisecond standard. In addition, the proposal retains the current one second standard for events recorded by mechanical clocks or time stamping devices, which FINRA believes are more likely to be used by small firms.

⁸ The CAT NMS Plan, which was submitted by the national securities exchanges and FINRA on February 27, 2015, is available at catnmsplan.com.

Next, in November 2014, FINRA published Regulatory Notice 14-47 to request written comments on the proposal. FINRA received eight comment letters in response.⁹ In general, five of the eight commenters supported tightening current clock synchronization requirements, at least to some extent.¹⁰ Two of the eight commenters opposed the proposal to some extent, questioning either the proposed 50 millisecond standard or the need for FINRA to amend its clock synchronization requirement at this time, before the CAT NMS Plan is approved and implemented.¹¹

Of the five commenters that supported tightening clock synchronization requirements at least to some extent, all agreed that a millisecond standard is necessary given the speed of trading in today's markets. For example, according to FSMLabs, FINRA's proposal is "timely and necessary" because "[w]ide use of electronic trading systems and proliferation of trading venues make it impossible to understand market operation or to manage risks without precise and reliable time information."¹² Similarly,

⁹ See Letters from Crews & Associates, January 5, 2015 ("Crews Letter"); FSMLabs, dated January 7, 2015 ("FSMLabs Letter"); Quincy Data, LLC, dated January 9, 2015 ("Quincy Data Letter"); Wiley Bros. Aintree Capital, dated January 9, 2015 ("Wiley Bros. Aintree Capital Letter"); IEX Services LLC, February 12, 2015 ("IEX Letter"); Financial Information Forum, dated February 20, 2015 ("FIF Letter"); Sync-n-Scale, dated February 20, 2015 ("Sync-n-Scale Letter"); and KOR Group LLC, dated February 20, 2015 ("KOR Letter").

¹⁰ See FSMLabs Letter, Quincy Data Letter, IEX Letter, Sync-n-Scale Letter, and KOR Letter.

¹¹ See Crews Letter and FIF Letter.

¹² See FSMLabs Letter at 6-7.

IEX stated its belief that “the proposal represents an important and beneficial advance over the current [one second] standard.”¹³

The commenters that supported the proposal generally took the view that the proposed 50 millisecond standard would not be overly burdensome to adopt, even for smaller firms. FSMLabs stated that a 50 millisecond standard “can be met with low cost off-the-shelf software only.”¹⁴ According to KOR, “the technology to perform such high-resolution synchronization is low-cost and has been available for years.”¹⁵ Sync-n-Scale took the view that the proposed 50 millisecond standard “is highly likely not an onerous imposition on market participants in any of the relevant dimensions: financially, technologically and operationally.”¹⁶

Several of these commenters proposed tightening the clock synchronization standard even further, to below 50 milliseconds. For example, FSMLabs said that a one millisecond standard would not impose significant additional costs, while even a one microsecond standard could be practical with low-cost off-the-shelf technology.¹⁷ KOR agreed that reducing the standard to one millisecond “would not impose significant additional costs to market participants over a 50 millisecond requirement.”¹⁸ And

¹³ See IEX Letter at 2.

¹⁴ See FSMLabs Letter at 1.

¹⁵ See KOR Letter at 2.

¹⁶ See Sync-n-Scale Letter at 1.

¹⁷ See FSMLabs Letter at 1.

¹⁸ See KOR Letter at 2.

according to IEX, “the permitted variance could be further reduced consistent with the systems capabilities of most member firms.”¹⁹

Two commenters took different views and opposed the proposal. Crews & Associates stated that any standard less than 200 milliseconds is not feasible at any cost, based on the time it takes to receive data packets with updated time information from NIST servers.²⁰ The Financial Information Forum (“FIF”), which conducted an industry survey on current synchronization practices and the anticipated costs of tighter synchronization standards, did not take issue with the proposed 50 millisecond standard itself. In fact, FIF supported a 50 millisecond standard; however, FIF suggested that FINRA “work through the CAT NMS Plan process to achieve [its] clock synchronization objectives and avoid redundant, and potentially conflicting, rule-making.”²¹

Finally, several of the commenters argued that FINRA should consider different standards for different types of market participants. KOR suggested that highly automated firms – i.e., firms that co-locate their equipment at an exchange datacenter or in a data center with modern clock synchronization technology – should be held to a one millisecond standard, while all other firms should be subject to a 50 millisecond

¹⁹ See IEX Letter at 2. Additionally, another commenter submitted its own proposal, which it said could “replace CAT requirements.” Under this commenter’s proposal, all matching engines would be time synchronized to an accuracy that is within 10 microseconds of the global time standard, and manual trades would be time stamped within an accuracy of 1 minute. See Quincy Data Letter at 1.

²⁰ See Crews & Associates Letter at 1.

²¹ See FIF Letter at 3. As noted elsewhere in this filing, FIF cautioned that its survey did not necessarily reflect small firms, which it thought would be more likely to have trouble meeting the proposed clock synchronization standard.

standard.²² Crews & Associates said that there should be a separate rule for firms that engage in high frequency trading, although this commenter did not offer a detailed recommendation on how the standards should differ for firms that do and do not engage in HFT.²³

FINRA carefully considered the committee views and written comments. After analyzing this feedback, FINRA believes it is necessary and appropriate to proceed with the proposed 50 millisecond standard for NMS securities and OTC Equity Securities, with a phased implementation that allows less automated firms more time to adjust their systems. FINRA believes that 50 milliseconds is the right standard at this time, given prevailing technology for trading systems and clock synchronization, because it strikes an acceptable balance between audit trail integrity and the costs of compliance. FINRA also believes it is important to apply the same standard to all computer-recorded events, regardless of firm size or activity type. Audit trail integrity relies on the ability to accurately sequence events for a given period of time, including events generated by firms that do not engage in HFT.²⁴

FINRA's decision to pursue the proposed 50 millisecond standard is informed in part by the CAT NMS Plan filed in February, 2015. The CAT NMS Plan was required by SEC Rule 613, which directed FINRA and the national securities exchanges to submit

²² See KOR Letter at 2.

²³ See Crews & Associates Letter at 2.

²⁴ While FINRA does not believe it is practicable to adopt different standards for firms that engage in HFT and those that do not, as some commenters suggested, it is proposing to provide less automated firms with more time to adjust their systems to the new proposed standard, as discussed more below.

a national market system plan to govern the creation, implementation, and maintenance of a consolidated audit trail and central repository.²⁵ Rule 613 further contains specific provisions that require the CAT NMS Plan to adopt a clock synchronization standard “consistent with industry standards.”²⁶ Guided by these provisions, the CAT NMS Plan contains detailed discussion of current clock synchronization practices, as well as the potential costs that broker-dealers would incur under various synchronization standards ranging from 1 second to 100 microseconds.²⁷ As part of its cost analysis, the CAT NMS Plan refers to the same FIF survey that accompanied the FIF’s comment letter to FINRA on this proposal.²⁸

Ultimately, the CAT NMS Plan concluded “that a clock offset of 50ms represents an aggressive, but achievable, industry standard.”²⁹ FINRA agrees that, at present, while a 50 millisecond standard may impose some costs on firms, it is nevertheless achievable with existing technology, and that it would allow FINRA significantly greater regulatory and surveillance capabilities. Moreover, FINRA recognizes that proposing a standard different from the CAT NMS Plan could create additional and potentially burdensome costs for firms.³⁰

²⁵ 17 C.F.R § 242.613(a).

²⁶ 17 C.F.R. § 242.613(d)(1).

²⁷ See CAT NMS Plan, available at catnmsplan.com, at Appendix C-125.

²⁸ See CAT NMS Plan at Appendix C-125 to C-126 (citing the FIF Clock Offset Survey, which FIF also attached to its comment letter on this proposal).

²⁹ See id.

³⁰ The FIF comment letter supported the view that FINRA should not adopt a standard that is different from what was proposed in the CAT NMS Plan, even if that standard were more lenient and less costly to implement now than the CAT

But while FINRA believes it is appropriate to propose the same 50 millisecond clock synchronization standard advanced by the CAT NMS Plan, FINRA does not agree with the comment that FINRA should forego this proposal and wait for the CAT NMS Plan to become effective. It may be some time before the clock synchronization requirements of the CAT NMS Plan take effect.³¹ Meanwhile, as the Commission has recognized, a sub-one second clock synchronization standard is an important element of market data reliability.³² And FINRA, as a national securities association, relies on the accuracy of market data to fulfill its regulatory obligations. Accordingly, FINRA believes it has a current need to tighten the clock synchronization standard for events that must be recorded pursuant to the FINRA By-Laws or other FINRA rules.

FINRA acknowledges that a tightened clock synchronization standard could impose costs, particularly on small or less automated firms. As a result, FINRA has

NMS Plan standard. See FIF Letter at 2 (noting that respondents to the FIF Clock Offset Survey “questioned the benefits of an interim tolerance citing that any changes to the current clock offset would require modifications to systems and processes”).

³¹ The CAT NMS Plan was filed pursuant to Rule 608 of Regulation NMS, which provides the general procedure for national market system plans. Under Rule 608(b)(2), the Commission has 120 days from the date it publishes a national market system plan, or up to 180 days of such date if it finds such longer period to be appropriate and publishes its reasons for so finding or as to which the sponsors of the plan consent, to approve the plan, with such changes or subject to such conditions as the Commission may deem necessary or appropriate. As proposed, the CAT NMS Plan would become effective upon approval by the Commission and execution by all of the participants that submitted the plan (see CAT NMS Plan, Section 2.1), and the clock synchronization requirements would apply within four months of the effective date (see CAT NMS Plan, Section 6.7(a)(ii)).

³² See Securities Exchange Act Release No. 67457 (July 17, 2012), 77 FR 45722, 45774 (August 1, 2012) (“Consolidated Audit Trail Adopting Release”) (“The Commission believes that the current industry standard for conducting securities business is more rigorous than one second.”).

revised the proposal in response to comments in two ways, in order to minimize the burden associated with the proposed rule and ease implementation. First, FINRA has narrowed the scope of the proposal so that the 50 millisecond standard proposed in this filing would apply only to NMS securities and OTC Equity Securities, and not to fixed income securities. FINRA believes this modification is warranted because fixed income products generally are not traded with the same level of automation as equity or option securities. Moreover, the revised scope would parallel the current scope of the CAT NMS Plan, which, as filed, would apply to NMS securities and OTC Equity Securities, but not debt securities.³³ FINRA notes that the CAT NMS Plan contemplates whether debt securities may become subject to CAT reporting in the future, and FINRA will continue to consider the appropriate clock synchronization standard for systems that record events in debt securities.

Second, as noted in Item 2 of this filing, FINRA proposes to adopt a phased implementation for the proposed 50 millisecond standard. If the Commission approves the filing, FINRA will announce the effective date of the proposed rule change in a Regulatory Notice to be published no later than 90 days following Commission approval. FINRA would then require firms with systems that capture time in milliseconds to comply with the new 50 millisecond standard within six months of the effective date;

³³ See, e.g., CAT NMS Plan at Appendix C-127 (discussing the Plan's applicability to OTC Equity Securities in addition to NMS securities, and whether debt securities may be subject to the CAT NMS Plan in the future). Because the scope of this proposal would align with the scope of the current proposed CAT NMS Plan, FINRA believes that costs incurred by firms to meet the proposed FINRA clock synchronization standard would support the changes needed to meet any future requirement imposed under CAT and, therefore, should not result in duplicative efforts.

remaining firms that do not have systems which capture time in milliseconds would have 18 months from the effective date to comply with the 50 millisecond standard.³⁴

(b) Statutory Basis

FINRA believes that the proposed rule change is consistent with the provisions of Section 15A(b)(6) of the Act,³⁵ which requires, among other things, that FINRA rules must be designed to prevent fraudulent and manipulative acts and practices, to promote just and equitable principles of trade, and, in general, to protect investors and the public interest. FINRA believes that the proposed rule change will bolster FINRA's ability to meet its regulatory obligations as a national securities association. As the Commission has noted, time drift away from a universal, synchronized standard is an important issue to address to enhance the integrity of audit trail data.³⁶ FINRA therefore believes it is important to pursue a 50 millisecond standard at this time, for the reasons explained above, so that it can compile more accurate audit trail data and conduct surveillance with more precise time-sequenced data. By doing so, the proposal would facilitate FINRA's efforts to detect and prevent fraudulent and manipulative acts and practices, to promote

³⁴ FINRA recognizes that a phased implementation does not necessarily on its own reduce the costs of the proposal. However, a phased implementation could allow firms, particularly smaller or less automated firms, a greater time period over which they can identify and implement the most cost effective clock synchronization solution that meets the standard required by this proposal. FINRA notes that the FIF Clock Offset Survey recommended a delayed implementation and noted that “[w]hile additional time may not reduce costs, it may ease implementation as firms manage this effort in conjunction with other compliance initiatives.” See FIF Letter and attached FIF Clock Offset Survey.

³⁵ 15 U.S.C. 78o-3(b)(6).

³⁶ See Consolidated Audit Trail Adopting Release, 77 FR at 45774.

just and equitable principles of trade, and, in general, to protect investors and the public interest.

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

FINRA does not believe that the proposed rule change will result in any burden on competition that is not necessary or appropriate in furtherance of the purposes of the Act. FINRA has undertaken an economic impact assessment, as set forth below, to analyze the regulatory need for the proposed rule change, its potential economic impacts, including anticipated costs and benefits, and the alternatives FINRA considered in assessing how to best meet its regulatory objectives.

Economic Impact Assessment

A. Regulatory Need

FINRA's current rules require members to synchronize their business clocks to within one second of the NIST atomic clock. Considering the speed of trading in today's automated equity and options markets, FINRA believes that the current one second tolerance is no longer appropriate for computer system clocks recording time for events in these securities under FINRA rules. For example, the wide use of automated trading systems entails order placement and trading decisions made on a millisecond, or finer, basis. In such a fast-paced environment, the one second tolerance is insufficient for audit trail and surveillance purposes. Accordingly, FINRA is proposing a tighter synchronization standard for NMS securities and OTC Equity Securities that will give FINRA the capability to better determine the order in which reportable events occur, thereby bolstering its surveillance of the markets and enhancing investor protection.

B. Economic Impacts

The proposed rule change would impact member firms that receive or route orders or execute trades directly in NMS securities and OTC Equity Securities. As a baseline, FINRA estimates that there are approximately 1,720 firms that would be subject to the proposal.³⁷ These firms would be required to synchronize their computer clocks that are used to record applicable events in equity and options securities to within 50 millisecond of the NIST atomic clock.

FINRA understands that some firms already synchronize their computer clocks within 50 milliseconds, and as a result, will not experience any material direct economic impacts as a result of this rule. Additionally, the proposed rule change would not alter the current clock synchronization requirement for members' mechanical time stamping devices. As a result, members solely using mechanical time stamping would not be impacted. Based on FINRA staff's experience, FINRA estimates that only a small fraction of firms use mechanical time stamping devices for trading in NMS securities and OTC Equity Securities.

The proposal would be implemented in phases that would allow less automated firms more time to comply with the 50 millisecond clock synchronization standard. Specifically, FINRA would require firms with systems that capture time in milliseconds to comply with the new 50 millisecond standard within six months of the effective date. Of firms that report to OATS, FINRA estimates that there are 736 firms that report some

³⁷ This baseline estimate is intended to capture the total number of firms that received orders in any security subject to OATS reporting, as reflected by the number of unique routing firm market participant identifiers from a recent calendar quarter.

or all of their order events in milliseconds, accounting for 76 percent of OATS-reporting firms and 95 percent of OATS reportable order events (ROE). FINRA further estimates that there are roughly 237 less automated OATS-reporting firms, accounting for 24 percent of OATS-reporting firms and five percent of ROE, that are not currently reporting order events in milliseconds; these firms would have 18 months from the effective date to comply with the proposed standard. For the remainder of firms that would be subject to the proposal but do not currently report to OATS, FINRA believes that the majority rely on systems provided by their clearing firm or are not likely to have systems that capture time in milliseconds, and they would therefore also have 18 months to comply.

(i) Anticipated Benefits

The proposed rule change would allow FINRA to more accurately determine, with respect to NMS securities and OTC Equity Securities, the sequence of order, quote and trade events across market participants and market centers. By doing so, the proposal would improve FINRA's surveillance program, and as a result, support FINRA's compliance with its regulatory obligations set forth in Section 15A(b)(6) of the Act. In particular, the proposal would enhance FINRA's ability to monitor for manipulative trading practices, including spoofing or layering, and to evaluate best execution and compliance with SEC Regulation NMS, among other things. For example, potentially manipulative trading practices often involve large numbers of orders placed in short periods of time, such that more granular and precise order event sequencing would enhance FINRA's market surveillance abilities. As a result, the proposal would facilitate

FINRA's efforts to prevent fraudulent and manipulative acts and practices, to promote just and equitable principles of trade, and to protect investors and the public interest.

(ii) Anticipated Costs

Member firms that receive or route orders or execute trades directly in NMS securities and OTC Equity Securities would likely incur costs associated with updating their systems and procedures to comply with a tightened clock synchronization standard. These costs may include costs to develop and maintain software programs that allow and monitor for synchronization within 50 milliseconds. FINRA notes that there are third party software products that could help firms maintain the proposed 50 millisecond standard. Firms may find these software products to be more cost effective than developing and maintaining their own programs. Some firms may also need to update their technology hardware, including servers and event logging platforms, or implement other networking enhancements to achieve the 50 millisecond drift standard. These costs will likely vary across firms depending on their current technology systems and procedures, their business models and the frequency with which they synchronize their clocks, as well as their current drift standards.

FINRA's analysis of current practices and potential costs is informed in part by the industry survey that FIF performed and submitted along with its comment on this proposal. The FIF Clock Offset Survey, which is discussed in detail in the CAT NMS Plan, collected information on existing synchronization systems, current clock management costs, and anticipated costs of meeting tighter synchronization standards

from 28 firms, including 23 broker-dealers and 5 service bureaus.³⁸ The survey found that 39% of responding firms do not already synchronize their clocks to at least a 50 millisecond standard, suggesting that many firms may already have the capacity to meet the proposed standard.

The FIF survey estimates an average cost of adopting a 50 millisecond standard would be roughly \$550,000 per firm.³⁹ FINRA notes, however, that the FIF survey seems to estimate the costs of implementing a synchronization standard with the assumption that synchronization logs would be required to be maintained for more than three years.⁴⁰ Since this FINRA proposal would require synchronization logs to be stored for only three years, FINRA believes the FIF cost estimate may overstate the implementation costs of this aspect of the proposal. FINRA notes further that the FIF survey estimates did not include data from smaller firms and therefore may not be informative as to what small firm implementation costs may be.

³⁸ See FIF Letter and attached FIF Clock Offset Survey.

FINRA notes that the respondents primarily comprised of firms with a significant amount of reportable order events (ROE) in OATS. For example, 64% of the respondents reported 3 million or more ROE/month. Smaller firms with low ROE/month tiers did not generally respond to the survey. As a result, these survey results may not be representative of the views of smaller firms with less trading activity. The FIF survey notes that an effort is underway to solicit feedback from smaller firms. See the attached FIF Clock Offset Survey.

³⁹ See id.

⁴⁰ See id. at Survey page 12 (noting survey respondent comments about the costs of implementing larger storage requirements to log synchronization events) and 23 (recommending a requirement to log only exceptions for a period of three years to reduce costs).

Implementation costs would likely vary across firms based on their current clock synchronization systems and procedures, their business models and trading activity. Firms that already synchronize their clocks to the 50 millisecond standard would likely incur much lower implementation costs, whereas other firms with less tight synchronization standards may incur relatively higher costs. As noted above, FINRA is aware of third party clock synchronization software products that could help firms, in particular smaller firms, reduce costs relative to developing and maintaining their own programs.

The survey results indicate that the average annual costs of maintaining a 50 millisecond standard are anticipated to be approximately \$313,000 per firm and this represents a 31% increase over current annual clock management costs. Based on these survey results, FINRA estimates current annual clock management costs to be approximately \$239,000 per firm. Hence the anticipated increase in the annual cost from the current standard to the proposed 50 millisecond synchronization standard is expected to be approximately \$74,000 per firm. FINRA notes again, however, that to the extent the FIF survey assumed a more than 3 year log retention period, its maintenance cost estimates may be greater than the maintenance costs of this proposal, which requires that synchronization logs be retained for three years.

According to the FIF survey, implementation and maintenance costs would increase significantly for synchronization standards below 50 milliseconds. For instance, survey respondents indicated that a 1 millisecond standard, recommended by some of the

commenters on this proposal, would cost over \$1.1 million to implement and more than \$530,000 to annually maintain.⁴¹

Based on its evaluation of the FIF Clock Offset Survey, as well as the CAT NMS Plan's economic analysis of potential clock synchronization requirements, FINRA believes that a 50 millisecond standard is the best achievable standard at this time. Furthermore, to minimize undue cost burdens, particularly for small or less automated firms, FINRA modified the proposal as described above – specifically, FINRA narrowed the scope of the proposal to apply only to NMS securities and OTC Equity Securities, and FINRA is proposing a phased implementation that would allow less automated firms up to 18 months to come into compliance. In addition, FINRA notes that the scope of this proposal would align with the scope of the CAT NMS Plan that has been filed with the Commission. As such, in the presence of an adopted CAT NMS plan, the costs associated with this proposal are only associated with the timing of the obligation to meet the proposed clock synchronization standard. Accordingly, FINRA believes that costs incurred by firms to meet the proposed FINRA clock synchronization would support the changes needed to meet any future requirement imposed under CAT and therefore, should not result in duplicative efforts.

C. Alternatives

In considering how to best meet its regulatory objectives, FINRA considered several alternatives to particular features of this proposed rule change. For example, FINRA considered whether to impose less costly 100 or 200 millisecond standards. For the reasons referenced in part above, FINRA chose not to pursue these alternatives.

⁴¹ See id.

FINRA's decision not to pursue these alternatives is based in part on its own observations. The range of variance among market participants' clocks may be up to twice the permitted synchronization standard; for example, one participant's clocks may drift ahead of the NIST clock by 50 milliseconds, while another's may drift behind by 50 milliseconds, meaning their clocks would be 100 milliseconds apart. FINRA studied OATS data for a single trading day and found a large number of events that occur within any single 100 millisecond window of time. However, FINRA observed that the number of events within 200 or 400 millisecond windows – twice the possible alternative 100 and 200 millisecond standards – increased significantly. Departing from the 50 millisecond standard would therefore cause significantly greater numbers of events to be recorded with less certainty and accuracy.

In addition, FINRA notes that the FIF Clock Offset Survey supported the proposed 50 millisecond standard, as opposed to a 100 or 200 millisecond standard. The survey asked respondents about possible reduced burdens if FINRA were to adopt one of these alternative standards in advance of tighter tolerances imposed as part of the CAT NMS Plan. In response, survey respondents “questioned the benefits of an interim tolerance citing that any changes to the current clock offset would require modifications to systems and processes.”⁴²

In developing this proposal, FINRA also considered suggestions by commenters regarding different clock synchronization standards depending on the type of market participants (e.g. tighter standard for highly automated or HFT firms and less strict standard for other firms). FINRA believes it is important to apply the same standard to

⁴² See FIF Letter at 2.

all computer-recorded events, regardless of firm size or activity type, since the integrity of the audit trail relies on the ability to accurately sequence all events for a given period of time, including events generated by firms that do not engage in HFT. As discussed above, FINRA believes that in light of the prevailing technology for trading systems and clock synchronization, 50 milliseconds is the right standard for all participants, and strikes a reasonable balance between audit trail integrity and the costs of compliance.

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

The proposed rule change was published for comment in Regulatory Notice 14-47 (November 2014). Eight comments were received in response to the Regulatory Notice. A copy of the Regulatory Notice is attached as Exhibit 2a. Copies of the comment letters received in response to the Regulatory Notice are attached as Exhibit 2c. The comments are summarized above in Item 3.

6. Extension of Time Period for Commission Action

FINRA does not consent at this time to an extension of the time period for Commission action specified in Section 19(b)(2) of the Act.⁴³

7. Basis for Summary Effectiveness Pursuant to Section 19(b)(3) or for Accelerated Effectiveness Pursuant to Section 19(b)(2) or Section 19(b)(7)(D)

Not applicable.

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

Not applicable.

⁴³ 15 U.S.C. 78s(b)(2).

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

Exhibit 1. Completed notice of proposed rule change for publication in the Federal Register.

Exhibit 2a. Regulatory Notice 14-47 (November 2014).

Exhibit 2b. List of commenters.

Exhibit 2c. Comments received in response to Regulatory Notice 14-47.

Exhibit 5. Text of the proposed rule change.

EXHIBIT 1

SECURITIES AND EXCHANGE COMMISSION
(Release No. 34- ; File No. SR-FINRA-2016-005)

Self-Regulatory Organizations; Financial Industry Regulatory Authority, Inc.; Notice of Filing of a Proposed Rule Change to Reduce the Synchronization Tolerance for Computer Clocks that are Used to Record Events in NMS Securities and OTC Equity Securities

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 , Financial Industry Regulatory Authority, Inc. (“FINRA”) 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 FINRA. 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

FINRA is proposing to reduce the synchronization tolerance for members’ computer clocks that are used to record events in NMS securities, including standardized options, and OTC Equity Securities. This proposal would not change the current clock synchronization requirement for members’ mechanical time stamping devices or computer clocks that are used to record events for securities other than NMS securities or OTC Equity Securities.

¹ 15 U.S.C. 78s(b)(1).

² 17 CFR 240.19b-4.

The text of the proposed rule change is available on FINRA's website at <http://www.finra.org>, at the principal office of FINRA 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, FINRA included statements concerning the purpose of and basis for the proposed rule change and discussed any comments it received on the proposed rule change. The text of these statements may be examined at the places specified in Item IV below. FINRA 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

Current FINRA rules require that firms synchronize their business clocks in conformity with procedures prescribed by FINRA. Specifically, FINRA Rule 7430 requires that firms synchronize their business clocks that are used for purposes of recording the date and time of any event that must be recorded pursuant to the FINRA By-Laws or other FINRA rules (e.g., the time a trade was executed or the time an order was received or routed), with reference to a time source as designated by FINRA. As specified in the current OATS technical specifications, all computer system clocks and mechanical time stamping devices must be synchronized to within one second of the NIST atomic clock.³ To maintain clock synchronization, clocks should be checked

³ Any time provider may be used for synchronization; however, all clocks and time stamping devices must remain accurate within a one-second tolerance of the NIST clock. This tolerance includes (1) the difference between the NIST standard and a

against the NIST atomic clock and re-synchronized, if necessary, at pre-determined intervals throughout the day.⁴ FINRA understands that currently, some firms synchronize their clocks continuously throughout the day, while others do so at various times during the day and still others do so only once a day.⁵

Given the increasing speed of trading in today's automated markets, FINRA believes the current one second tolerance is no longer appropriate for computer system clocks recording events in NMS securities⁶ and OTC Equity Securities⁷ under FINRA

time provider's clock, (2) transmission delay from the source and (3) the amount of drift of the member firm's clock. The OATS technical specifications further specify that computer system and mechanical clocks must be synchronized every business day before market open to ensure that recorded order event timestamps are accurate.

⁴ The OATS technical specifications also provide that member firms must document and maintain their clock synchronization procedures. In addition, the technical specifications state that member firms should keep a log of the times when they synchronize their clocks and the results of the synchronization process, including notice of any time a member's clock drifts more than the one second standard. The technical specifications further provide that such logs should be maintained for the period of time and accessibility specified in SEC Rule 17a-4(b), and maintained and preserved for the required time period in paper format or in a format permitted under SEC Rule 17a-4(f).

⁵ FINRA generally believes that the firms that synchronize once daily are firms that accept manual orders.

⁶ The term "NMS security" is defined in Rule 600 of Regulation NMS to mean "any security or class of securities for which transaction reports are collected, processed and made available pursuant to an effective transaction reporting plan, or an effective national market system plan for reporting transactions in listed options. 17 CFR 242.600(b)(46). As Commission staff has noted, the term NMS security generally "refers to exchange-listed equity securities and standardized options, but does not include exchange-listed debt securities, securities futures, or open-end mutual funds, which are not currently reported pursuant to an effective transaction reporting plan." See Division of Trading and Markets Staff's Responses to Frequently Asked Questions Concerning Large Trader Reporting, question 1.1, available at <https://www.sec.gov/divisions/marketreg/large-trader-faqs.htm>.

rules. Automated systems have evolved to the point where order placement and trading decisions in these asset classes are made on a millisecond basis, if not finer. Moreover, in many cases firms report events to FINRA's equity trade reporting and audit trail facilities in milliseconds.⁸

Accordingly, FINRA is proposing to tighten the synchronization requirement for computer system clocks that record events in NMS securities and OTC Equity Securities. The proposal would reduce the drift tolerance for computer clocks that record events in these securities from one second to 50 milliseconds. The proposal would not change the current one second standard for securities other than NMS securities or OTC Equity Securities and would not change the current one second standard for events recorded by mechanical clocks or time stamping devices, as opposed to computer clocks.

As a technical matter, the proposal would codify the existing OATS technical specifications cited above, along with the new proposed 50 millisecond standard, in FINRA's Rule 4500 Series (Books, Records and Reports). The purpose of this technical change is to relocate the clock synchronization requirements from OATS rules to a rule set where it is clear the requirements apply to the recording of the date and time of any

⁷ The term "OTC Equity Security" is defined in FINRA Rule 6420(f) to mean "any equity security that is not an 'NMS stock' as that term is defined in Rule 600(b)(47) of Regulation NMS; provided, however, that the term 'OTC Equity Security' shall not include any Restricted Equity Security."

⁸ See Securities Exchange Act Release No. 71623 (February 27, 2014), 79 FR 12558 (March 4, 2014) (order approving SR-FINRA-2014-050, FINRA's proposal to require firms to report order and trade information to the FINRA TRFs, ADF, ORF, and OATS in milliseconds, if the firms' systems capture time in milliseconds). See also Regulatory Notice 14-21 (May 2014) (announcing the effective date of millisecond reporting changes); Regulatory Notice 14-47 (November 2014) at page 7, n. 7 (describing the extended implementation schedule for millisecond reporting changes).

event that must be recorded under FINRA By-Laws or rules. As noted above, under a combination of Rule 7430 and the OATS technical specifications, the current one second synchronization standard already applies to the recording of the date and time of any event that must be recorded under FINRA By-Laws or rules. Under this proposal, FINRA would consolidate and codify the clock synchronization requirements in new Rule 4590 for clarity and ease of reference. This consolidation would include the current provision in the OATS technical specifications that conveys guidance on recordkeeping to demonstrate compliance with the synchronization standard, which would be codified without material change as Supplementary Material .01 to Rule 4590.

In arriving at this proposal, FINRA solicited and received feedback from its industry advisory committees, as well as through a public request for comment. After thoroughly evaluating all of the feedback received, FINRA has determined that the proposed 50 millisecond standard is the best approach given existing technology and FINRA's regulatory needs. In addition, as described in more detail below, FINRA further determined that it should proceed with the proposal now, rather than wait for approval and implementation of the clock synchronization requirements proposed in the National Market System Plan governing the Consolidated Audit Trail ("CAT NMS Plan").⁹

As an initial step, FINRA staff solicited industry input from several of its industry advisory committees prior to publishing the proposal for comment in a Regulatory Notice. These committees were generally supportive. To the extent the committees raised concerns, they focused on the proposal's potential impact on small firms,

⁹ The CAT NMS Plan, which was submitted by the national securities exchanges and FINRA on February 27, 2015, is available at catnmsplan.com.

particularly firms that do not rely on highly automated systems. In response to these concerns, and similar concerns raised in the comment letters discussed below, FINRA modified the proposal to allow for phased implementation which would grant less automated firms up to 18 months to comply with the proposed 50 millisecond standard. In addition, the proposal retains the current one second standard for events recorded by mechanical clocks or time stamping devices, which FINRA believes are more likely to be used by small firms.

Next, in November 2014, FINRA published Regulatory Notice 14-47 to request written comments on the proposal. FINRA received eight comment letters in response.¹⁰ In general, five of the eight commenters supported tightening current clock synchronization requirements, at least to some extent.¹¹ Two of the eight commenters opposed the proposal to some extent, questioning either the proposed 50 millisecond standard or the need for FINRA to amend its clock synchronization requirement at this time, before the CAT NMS Plan is approved and implemented.¹²

Of the five commenters that supported tightening clock synchronization requirements at least to some extent, all agreed that a millisecond standard is necessary given the speed of trading in today's markets. For example, according to FSMLabs,

¹⁰ See Letters from Crews & Associates, January 5, 2015 (“Crews Letter”); FSMLabs, dated January 7, 2015 (“FSMLabs Letter”); Quincy Data, LLC, dated January 9, 2015 (“Quincy Data Letter”); Wiley Bros. Aintree Capital, dated January 9, 2015 (“Wiley Bros. Aintree Capital Letter”); IEX Services LLC, February 12, 2015 (“IEX Letter”); Financial Information Forum, dated February 20, 2015 (“FIF Letter”); Sync-n-Scale, dated February 20, 2015 (“Sync-n-Scale Letter”); and KOR Group LLC, dated February 20, 2015 (“KOR Letter”).

¹¹ See FSMLabs Letter, Quincy Data Letter, IEX Letter, Sync-n-Scale Letter, and KOR Letter.

¹² See Crews Letter and FIF Letter.

FINRA's proposal is "timely and necessary" because "[w]ide use of electronic trading systems and proliferation of trading venues make it impossible to understand market operation or to manage risks without precise and reliable time information."¹³ Similarly, IEX stated its belief that "the proposal represents an important and beneficial advance over the current [one second] standard."¹⁴

The commenters that supported the proposal generally took the view that the proposed 50 millisecond standard would not be overly burdensome to adopt, even for smaller firms. FSMLabs stated that a 50 millisecond standard "can be met with low cost off-the-shelf software only."¹⁵ According to KOR, "the technology to perform such high-resolution synchronization is low-cost and has been available for years."¹⁶ Sync-n-Scale took the view that the proposed 50 millisecond standard "is highly likely not an onerous imposition on market participants in any of the relevant dimensions: financially, technologically and operationally."¹⁷

Several of these commenters proposed tightening the clock synchronization standard even further, to below 50 milliseconds. For example, FSMLabs said that a one millisecond standard would not impose significant additional costs, while even a one microsecond standard could be practical with low-cost off-the-shelf technology.¹⁸ KOR

¹³ See FSMLabs Letter at 6-7.

¹⁴ See IEX Letter at 2.

¹⁵ See FSMLabs Letter at 1.

¹⁶ See KOR Letter at 2.

¹⁷ See Sync-n-Scale Letter at 1.

¹⁸ See FSMLabs Letter at 1.

agreed that reducing the standard to one millisecond “would not impose significant additional costs to market participants over a 50 millisecond requirement.”¹⁹ And according to IEX, “the permitted variance could be further reduced consistent with the systems capabilities of most member firms.”²⁰

Two commenters took different views and opposed the proposal. Crews & Associates stated that any standard less than 200 milliseconds is not feasible at any cost, based on the time it takes to receive data packets with updated time information from NIST servers.²¹ The Financial Information Forum (“FIF”), which conducted an industry survey on current synchronization practices and the anticipated costs of tighter synchronization standards, did not take issue with the proposed 50 millisecond standard itself. In fact, FIF supported a 50 millisecond standard; however, FIF suggested that FINRA “work through the CAT NMS Plan process to achieve [its] clock synchronization objectives and avoid redundant, and potentially conflicting, rule-making.”²²

Finally, several of the commenters argued that FINRA should consider different standards for different types of market participants. KOR suggested that highly automated firms – i.e., firms that co-locate their equipment at an exchange datacenter or

¹⁹ See KOR Letter at 2.

²⁰ See IEX Letter at 2. Additionally, another commenter submitted its own proposal, which it said could “replace CAT requirements.” Under this commenter’s proposal, all matching engines would be time synchronized to an accuracy that is within 10 microseconds of the global time standard, and manual trades would be time stamped within an accuracy of 1 minute. See Quincy Data Letter at 1.

²¹ See Crews & Associates Letter at 1.

²² See FIF Letter at 3. As noted elsewhere in this filing, FIF cautioned that its survey did not necessarily reflect small firms, which it thought would be more likely to have trouble meeting the proposed clock synchronization standard.

in a data center with modern clock synchronization technology – should be held to a one millisecond standard, while all other firms should be subject to a 50 millisecond standard.²³ Crews & Associates said that there should be a separate rule for firms that engage in high frequency trading, although this commenter did not offer a detailed recommendation on how the standards should differ for firms that do and do not engage in HFT.²⁴

FINRA carefully considered the committee views and written comments. After analyzing this feedback, FINRA believes it is necessary and appropriate to proceed with the proposed 50 millisecond standard for NMS securities and OTC Equity Securities, with a phased implementation that allows less automated firms more time to adjust their systems. FINRA believes that 50 milliseconds is the right standard at this time, given prevailing technology for trading systems and clock synchronization, because it strikes an acceptable balance between audit trail integrity and the costs of compliance. FINRA also believes it is important to apply the same standard to all computer-recorded events, regardless of firm size or activity type. Audit trail integrity relies on the ability to accurately sequence events for a given period of time, including events generated by firms that do not engage in HFT.²⁵

FINRA's decision to pursue the proposed 50 millisecond standard is informed in part by the CAT NMS Plan filed in February, 2015. The CAT NMS Plan was required

²³ See KOR Letter at 2.

²⁴ See Crews & Associates Letter at 2.

²⁵ While FINRA does not believe it is practicable to adopt different standards for firms that engage in HFT and those that do not, as some commenters suggested, it is proposing to provide less automated firms with more time to adjust their systems to the new proposed standard, as discussed more below.

by SEC Rule 613, which directed FINRA and the national securities exchanges to submit a national market system plan to govern the creation, implementation, and maintenance of a consolidated audit trail and central repository.²⁶ Rule 613 further contains specific provisions that require the CAT NMS Plan to adopt a clock synchronization standard “consistent with industry standards.”²⁷ Guided by these provisions, the CAT NMS Plan contains detailed discussion of current clock synchronization practices, as well as the potential costs that broker-dealers would incur under various synchronization standards ranging from 1 second to 100 microseconds.²⁸ As part of its cost analysis, the CAT NMS Plan refers to the same FIF survey that accompanied the FIF’s comment letter to FINRA on this proposal.²⁹

Ultimately, the CAT NMS Plan concluded “that a clock offset of 50ms represents an aggressive, but achievable, industry standard.”³⁰ FINRA agrees that, at present, while a 50 millisecond standard may impose some costs on firms, it is nevertheless achievable with existing technology, and that it would allow FINRA significantly greater regulatory and surveillance capabilities. Moreover, FINRA recognizes that proposing a standard

²⁶ 17 C.F.R. § 242.613(a).

²⁷ 17 C.F.R. § 242.613(d)(1).

²⁸ See CAT NMS Plan, available at catnmsplan.com, at Appendix C-125.

²⁹ See CAT NMS Plan at Appendix C-125 to C-126 (citing the FIF Clock Offset Survey, which FIF also attached to its comment letter on this proposal).

³⁰ See id.

different from the CAT NMS Plan could create additional and potentially burdensome costs for firms.³¹

But while FINRA believes it is appropriate to propose the same 50 millisecond clock synchronization standard advanced by the CAT NMS Plan, FINRA does not agree with the comment that FINRA should forego this proposal and wait for the CAT NMS Plan to become effective. It may be some time before the clock synchronization requirements of the CAT NMS Plan take effect.³² Meanwhile, as the Commission has recognized, a sub-one second clock synchronization standard is an important element of market data reliability.³³ And FINRA, as a national securities association, relies on the accuracy of market data to fulfill its regulatory obligations. Accordingly, FINRA

³¹ The FIF comment letter supported the view that FINRA should not adopt a standard that is different from what was proposed in the CAT NMS Plan, even if that standard were more lenient and less costly to implement now than the CAT NMS Plan standard. See FIF Letter at 2 (noting that respondents to the FIF Clock Offset Survey “questioned the benefits of an interim tolerance citing that any changes to the current clock offset would require modifications to systems and processes”).

³² The CAT NMS Plan was filed pursuant to Rule 608 of Regulation NMS, which provides the general procedure for national market system plans. Under Rule 608(b)(2), the Commission has 120 days from the date it publishes a national market system plan, or up to 180 days of such date if it finds such longer period to be appropriate and publishes its reasons for so finding or as to which the sponsors of the plan consent, to approve the plan, with such changes or subject to such conditions as the Commission may deem necessary or appropriate. As proposed, the CAT NMS Plan would become effective upon approval by the Commission and execution by all of the participants that submitted the plan (see CAT NMS Plan, Section 2.1), and the clock synchronization requirements would apply within four months of the effective date (see CAT NMS Plan, Section 6.7(a)(ii)).

³³ See Securities Exchange Act Release No. 67457 (July 17, 2012), 77 FR 45722, 45774 (August 1, 2012) (“Consolidated Audit Trail Adopting Release”) (“The Commission believes that the current industry standard for conducting securities business is more rigorous than one second.”).

believes it has a current need to tighten the clock synchronization standard for events that must be recorded pursuant to the FINRA By-Laws or other FINRA rules.

FINRA acknowledges that a tightened clock synchronization standard could impose costs, particularly on small or less automated firms. As a result, FINRA has revised the proposal in response to comments in two ways, in order to minimize the burden associated with the proposed rule and ease implementation. First, FINRA has narrowed the scope of the proposal so that the 50 millisecond standard proposed in this filing would apply only to NMS securities and OTC Equity Securities, and not to fixed income securities. FINRA believes this modification is warranted because fixed income products generally are not traded with the same level of automation as equity or option securities. Moreover, the revised scope would parallel the current scope of the CAT NMS Plan, which, as filed, would apply to NMS securities and OTC Equity Securities, but not debt securities.³⁴ FINRA notes that the CAT NMS Plan contemplates whether debt securities may become subject to CAT reporting in the future, and FINRA will continue to consider the appropriate clock synchronization standard for systems that record events in debt securities.

FINRA proposes to adopt a phased implementation for the proposed 50 millisecond standard. If the Commission approves the filing, FINRA will announce the effective date of the proposed rule change in a Regulatory Notice to be published no later

³⁴ See, e.g., CAT NMS Plan at Appendix C-127 (discussing the Plan's applicability to OTC Equity Securities in addition to NMS securities, and whether debt securities may be subject to the CAT NMS Plan in the future). Because the scope of this proposal would align with the scope of the current proposed CAT NMS Plan, FINRA believes that costs incurred by firms to meet the proposed FINRA clock synchronization standard would support the changes needed to meet any future requirement imposed under CAT and, therefore, should not result in duplicative efforts.

than 90 days following Commission approval. FINRA would then require firms with systems that capture time in milliseconds to comply with the new 50 millisecond standard within six months of the effective date; remaining firms that do not have systems which capture time in milliseconds would have 18 months from the effective date to comply with the 50 millisecond standard.³⁵

2. Statutory Basis

FINRA believes that the proposed rule change is consistent with the provisions of Section 15A(b)(6) of the Act,³⁶ which requires, among other things, that FINRA rules must be designed to prevent fraudulent and manipulative acts and practices, to promote just and equitable principles of trade, and, in general, to protect investors and the public interest. FINRA believes that the proposed rule change will bolster FINRA's ability to meet its regulatory obligations as a national securities association. As the Commission has noted, time drift away from a universal, synchronized standard is an important issue to address to enhance the integrity of audit trail data.³⁷ FINRA therefore believes it is important to pursue a 50 millisecond standard at this time, for the reasons explained above, so that it can compile more accurate audit trail data and conduct surveillance with

³⁵ FINRA recognizes that a phased implementation does not necessarily on its own reduce the costs of the proposal. However, a phased implementation could allow firms, particularly smaller or less automated firms, a greater time period over which they can identify and implement the most cost effective clock synchronization solution that meets the standard required by this proposal. FINRA notes that the FIF Clock Offset Survey recommended a delayed implementation and noted that “[w]hile additional time may not reduce costs, it may ease implementation as firms manage this effort in conjunction with other compliance initiatives.” See FIF Letter and attached FIF Clock Offset Survey.

³⁶ 15 U.S.C. 78o-3(b)(6).

³⁷ See Consolidated Audit Trail Adopting Release, 77 FR at 45774.

more precise time-sequenced data. By doing so, the proposal would facilitate FINRA's efforts to detect and prevent fraudulent and manipulative acts and practices, to promote just and equitable principles of trade, and, in general, to protect investors and the public interest.

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

FINRA does not believe that the proposed rule change will result in any burden on competition that is not necessary or appropriate in furtherance of the purposes of the Act. FINRA has undertaken an economic impact assessment, as set forth below, to analyze the regulatory need for the proposed rule change, its potential economic impacts, including anticipated costs and benefits, and the alternatives FINRA considered in assessing how to best meet its regulatory objectives.

Economic Impact Assessment

A. Regulatory Need

FINRA's current rules require members to synchronize their business clocks to within one second of the NIST atomic clock. Considering the speed of trading in today's automated equity and options markets, FINRA believes that the current one second tolerance is no longer appropriate for computer system clocks recording time for events in these securities under FINRA rules. For example, the wide use of automated trading systems entails order placement and trading decisions made on a millisecond, or finer, basis. In such a fast-paced environment, the one second tolerance is insufficient for audit trail and surveillance purposes. Accordingly, FINRA is proposing a tighter synchronization standard for NMS securities and OTC Equity Securities that will give

FINRA the capability to better determine the order in which reportable events occur, thereby bolstering its surveillance of the markets and enhancing investor protection.

B. Economic Impacts

The proposed rule change would impact member firms that receive or route orders or execute trades directly in NMS securities and OTC Equity Securities. As a baseline, FINRA estimates that there are approximately 1,720 firms that would be subject to the proposal.³⁸ These firms would be required to synchronize their computer clocks that are used to record applicable events in equity and options securities to within 50 millisecond of the NIST atomic clock.

FINRA understands that some firms already synchronize their computer clocks within 50 milliseconds, and as a result, will not experience any material direct economic impacts as a result of this rule. Additionally, the proposed rule change would not alter the current clock synchronization requirement for members' mechanical time stamping devices. As a result, members solely using mechanical time stamping would not be impacted. Based on FINRA staff's experience, FINRA estimates that only a small fraction of firms use mechanical time stamping devices for trading in NMS securities and OTC Equity Securities.

The proposal would be implemented in phases that would allow less automated firms more time to comply with the 50 millisecond clock synchronization standard. Specifically, FINRA would require firms with systems that capture time in milliseconds to comply with the new 50 millisecond standard within six months of the effective date.

³⁸ This baseline estimate is intended to capture the total number of firms that received orders in any security subject to OATS reporting, as reflected by the number of unique routing firm market participant identifiers from a recent calendar quarter.

Of firms that report to OATS, FINRA estimates that there are 736 firms that report some or all of their order events in milliseconds, accounting for 76 percent of OATS-reporting firms and 95 percent of OATS reportable order events (ROE). FINRA further estimates that there are roughly 237 less automated OATS-reporting firms, accounting for 24 percent of OATS-reporting firms and five percent of ROE, that are not currently reporting order events in milliseconds; these firms would have 18 months from the effective date to comply with the proposed standard. For the remainder of firms that would be subject to the proposal but do not currently report to OATS, FINRA believes that the majority rely on systems provided by their clearing firm or are not likely to have systems that capture time in milliseconds, and they would therefore also have 18 months to comply.

(i) Anticipated Benefits

The proposed rule change would allow FINRA to more accurately determine, with respect to NMS securities and OTC Equity Securities, the sequence of order, quote and trade events across market participants and market centers. By doing so, the proposal would improve FINRA's surveillance program, and as a result, support FINRA's compliance with its regulatory obligations set forth in Section 15A(b)(6) of the Act. In particular, the proposal would enhance FINRA's ability to monitor for manipulative trading practices, including spoofing or layering, and to evaluate best execution and compliance with SEC Regulation NMS, among other things. For example, potentially manipulative trading practices often involve large numbers of orders placed in short periods of time, such that more granular and precise order event sequencing would enhance FINRA's market surveillance abilities. As a result, the proposal would facilitate

FINRA's efforts to prevent fraudulent and manipulative acts and practices, to promote just and equitable principles of trade, and to protect investors and the public interest.

(ii) Anticipated Costs

Member firms that receive or route orders or execute trades directly in NMS securities and OTC Equity Securities would likely incur costs associated with updating their systems and procedures to comply with a tightened clock synchronization standard. These costs may include costs to develop and maintain software programs that allow and monitor for synchronization within 50 milliseconds. FINRA notes that there are third party software products that could help firms maintain the proposed 50 millisecond standard. Firms may find these software products to be more cost effective than developing and maintaining their own programs. Some firms may also need to update their technology hardware, including servers and event logging platforms, or implement other networking enhancements to achieve the 50 millisecond drift standard. These costs will likely vary across firms depending on their current technology systems and procedures, their business models and the frequency with which they synchronize their clocks, as well as their current drift standards.

FINRA's analysis of current practices and potential costs is informed in part by the industry survey that FIF performed and submitted along with its comment on this proposal. The FIF Clock Offset Survey, which is discussed in detail in the CAT NMS Plan, collected information on existing synchronization systems, current clock management costs, and anticipated costs of meeting tighter synchronization standards

from 28 firms, including 23 broker-dealers and 5 service bureaus.³⁹ The survey found that 39% of responding firms do not already synchronize their clocks to at least a 50 millisecond standard, suggesting that many firms may already have the capacity to meet the proposed standard.

The FIF survey estimates an average cost of adopting a 50 millisecond standard would be roughly \$550,000 per firm.⁴⁰ FINRA notes, however, that the FIF survey seems to estimate the costs of implementing a synchronization standard with the assumption that synchronization logs would be required to be maintained for more than three years.⁴¹ Since this FINRA proposal would require synchronization logs to be stored for only three years, FINRA believes the FIF cost estimate may overstate the implementation costs of this aspect of the proposal. FINRA notes further that the FIF survey estimates did not include data from smaller firms and therefore may not be informative as to what small firm implementation costs may be.

Implementation costs would likely vary across firms based on their current clock synchronization systems and procedures, their business models and trading activity.

³⁹ See FIF Letter and attached FIF Clock Offset Survey.

FINRA notes that the respondents primarily comprised of firms with a significant amount of reportable order events (ROE) in OATS. For example, 64% of the respondents reported 3 million or more ROE/month. Smaller firms with low ROE/month tiers did not generally respond to the survey. As a result, these survey results may not be representative of the views of smaller firms with less trading activity. The FIF survey notes that an effort is underway to solicit feedback from smaller firms. See the attached FIF Clock Offset Survey.

⁴⁰ See id.

⁴¹ See id. at Survey page 12 (noting survey respondent comments about the costs of implementing larger storage requirements to log synchronization events) and 23 (recommending a requirement to log only exceptions for a period of three years to reduce costs).

Firms that already synchronize their clocks to the 50 millisecond standard would likely incur much lower implementation costs, whereas other firms with less tight synchronization standards may incur relatively higher costs. As noted above, FINRA is aware of third party clock synchronization software products that could help firms, in particular smaller firms, reduce costs relative to developing and maintaining their own programs.

The survey results indicate that the average annual costs of maintaining a 50 millisecond standard are anticipated to be approximately \$313,000 per firm and this represents a 31% increase over current annual clock management costs. Based on these survey results, FINRA estimates current annual clock management costs to be approximately \$239,000 per firm. Hence the anticipated increase in the annual cost from the current standard to the proposed 50 millisecond synchronization standard is expected to be approximately \$74,000 per firm. FINRA notes again, however, that to the extent the FIF survey assumed a more than 3 year log retention period, its maintenance cost estimates may be greater than the maintenance costs of this proposal, which requires that synchronization logs be retained for three years.

According to the FIF survey, implementation and maintenance costs would increase significantly for synchronization standards below 50 milliseconds. For instance, survey respondents indicated that a 1 millisecond standard, recommended by some of the commenters on this proposal, would cost over \$1.1 million to implement and more than \$530,000 to annually maintain.⁴²

⁴²

See id.

Based on its evaluation of the FIF Clock Offset Survey, as well as the CAT NMS Plan's economic analysis of potential clock synchronization requirements, FINRA believes that a 50 millisecond standard is the best achievable standard at this time. Furthermore, to minimize undue cost burdens, particularly for small or less automated firms, FINRA modified the proposal as described above – specifically, FINRA narrowed the scope of the proposal to apply only to NMS securities and OTC Equity Securities, and FINRA is proposing a phased implementation that would allow less automated firms up to 18 months to come into compliance. In addition, FINRA notes that the scope of this proposal would align with the scope of the CAT NMS Plan that has been filed with the Commission. As such, in the presence of an adopted CAT NMS plan, the costs associated with this proposal are only associated with the timing of the obligation to meet the proposed clock synchronization standard. Accordingly, FINRA believes that costs incurred by firms to meet the proposed FINRA clock synchronization would support the changes needed to meet any future requirement imposed under CAT and therefore, should not result in duplicative efforts.

C. Alternatives

In considering how to best meet its regulatory objectives, FINRA considered several alternatives to particular features of this proposed rule change. For example, FINRA considered whether to impose less costly 100 or 200 millisecond standards. For the reasons referenced in part above, FINRA chose not to pursue these alternatives.

FINRA's decision not to pursue these alternatives is based in part on its own observations. The range of variance among market participants' clocks may be up to twice the permitted synchronization standard; for example, one participant's clocks may

drift ahead of the NIST clock by 50 milliseconds, while another's may drift behind by 50 milliseconds, meaning their clocks would be 100 milliseconds apart. FINRA studied OATS data for a single trading day and found a large number of events that occur within any single 100 millisecond window of time. However, FINRA observed that the number of events within 200 or 400 millisecond windows – twice the possible alternative 100 and 200 millisecond standards – increased significantly. Departing from the 50 millisecond standard would therefore cause significantly greater numbers of events to be recorded with less certainty and accuracy.

In addition, FINRA notes that the FIF Clock Offset Survey supported the proposed 50 millisecond standard, as opposed to a 100 or 200 millisecond standard. The survey asked respondents about possible reduced burdens if FINRA were to adopt one of these alternative standards in advance of tighter tolerances imposed as part of the CAT NMS Plan. In response, survey respondents “questioned the benefits of an interim tolerance citing that any changes to the current clock offset would require modifications to systems and processes.”⁴³

In developing this proposal, FINRA also considered suggestions by commenters regarding different clock synchronization standards depending on the type of market participants (e.g. tighter standard for highly automated or HFT firms and less strict standard for other firms). FINRA believes it is important to apply the same standard to all computer-recorded events, regardless of firm size or activity type, since the integrity of the audit trail relies on the ability to accurately sequence all events for a given period of time, including events generated by firms that do not engage in HFT. As discussed

⁴³ See FIF Letter at 2.

above, FINRA believes that in light of the prevailing technology for trading systems and clock synchronization, 50 milliseconds is the right standard for all participants, and strikes a reasonable balance between audit trail integrity and the costs of compliance.

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

The proposed rule change was published for comment in Regulatory Notice 14-47 (November 2014). Eight comments were received in response to the Regulatory Notice. A copy of the Regulatory Notice is attached as Exhibit 2a. Copies of the comment letters received in response to the Regulatory Notice are attached as Exhibit 2c. The comments are summarized above in Item A.

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

Within 45 days of the date of publication of this notice in the Federal Register or within such longer period (i) as the Commission may designate up to 90 days of such date if it finds such longer period to be appropriate and publishes its reasons for so finding or (ii) as to which the self-regulatory organization consents, the Commission will:

(A) by order approve or disapprove such proposed rule change, or

(B) institute proceedings to determine whether the proposed rule change should be disapproved.

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 (<http://www.sec.gov/rules/sro.shtml>); or
- Send an e-mail to rule-comments@sec.gov. Please include File Number SR-FINRA-2016-005 on the subject line.

Paper Comments:

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

All submissions should refer to File Number SR-FINRA-2016-005. This file number should be included on the subject line if e-mail 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 (<http://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 such filing also will be available for inspection and copying at the principal office of FINRA. All comments received will be posted without change; the Commission does not edit personal identifying information from submissions. You

should submit only information that you wish to make available publicly. All submissions should refer to File Number SR-FINRA-2016-005 and should be submitted on or before [insert date 21 days from publication in the Federal Register].

For the Commission, by the Division of Trading and Markets, pursuant to delegated authority.⁴⁴

Robert W. Errett
Deputy Secretary

⁴⁴ 17 CFR 200.30-3(a)(12).

Regulatory Notice

14-47

Equity Trading Initiatives: Synchronization of Business Clocks

FINRA Requests Comment on a Proposal to Tighten Business Clock Synchronization Requirements

Comment Period Expires: Friday, January 9, 2015

Executive Summary

FINRA is soliciting comment on a proposal to reduce the synchronization tolerance for computer clocks. The current clock synchronization requirements allow for a tolerance of one second from the National Institute of Standards and Technology (NIST) atomic clock. Under the proposal, the tolerance for computer clocks would be reduced to 50 milliseconds. The tolerance for mechanical time stamping devices would remain at one second.

The proposed rule text is set forth in Attachment A.

Questions regarding this *Notice* should be directed to:

- ▶ Shelly Bohlin, Vice President, Quality of Markets, at (240) 386-5029;
- ▶ Lisa Horrigan, Associate General Counsel, Office of General Counsel (OGC), at (202) 728-8190; or
- ▶ Alex Ellenberg, Assistant General Counsel, OGC, at (202) 728-8152.

November 2014

Notice Type

- ▶ Request for Comment

Suggested Routing

- ▶ Compliance
- ▶ Trade Reporting
- ▶ Legal
- ▶ Operations
- ▶ Systems
- ▶ Trading
- ▶ Training

Key Topics

- ▶ Books, Records and Reports
- ▶ Business Clocks
- ▶ Clock Drift
- ▶ OATS Reporting
- ▶ Recording of Order, Quotation, and Trade Information
- ▶ Time Stamping
- ▶ Trade Reporting

Referenced Rules

- ▶ FINRA Rule 7430
- ▶ SEC Rule 613

Action Requested

FINRA encourages all interested parties to comment on the proposal. Comments must be received by Friday, January 9, 2015.

Comments must be submitted through one of the following methods:

- ▶ Emailing comments to pubcom@finra.org; or
- ▶ Mailing comments in hard copy to:

Marcia E. Asquith
Office of the Corporate Secretary
FINRA
1735 K Street, NW
Washington, DC 20006-1506

To help FINRA process and review comments more efficiently, persons should use only one method to comment on the proposal.

Important Notes: The only comments that FINRA will consider are those submitted pursuant to the methods described above. All comments received in response to this *Notice* will be made available to the public on the FINRA website. Generally, FINRA will post comments as they are received.¹

Before becoming effective, the proposed rule change must be filed with the Securities and Exchange Commission (SEC) pursuant to Section 19(b) of the SEA.²

Background and Discussion

The proposal set forth in this *Notice* is one of seven FINRA initiatives relating to equity market structure and automated trading activities, including high frequency trading (HFT).³ These initiatives are designed to increase the scope of trading information FINRA receives, provide more transparency into trading activities to market participants and investors and require firms engaged in electronic trading and their employees to be trained, educated and accountable for their role in equity trading.

Current FINRA rules require that firms synchronize their business clocks in conformity with procedures prescribed by FINRA. Specifically, FINRA Rule 7430 requires that firms synchronize their business clocks that are used for purposes of recording the date and time of any event that must be recorded pursuant to the FINRA By-Laws or other FINRA rules (*e.g.*, the time a trade was executed or the time an order was received or routed), with reference to a time source as designated by FINRA. As specified in the current OATS technical specifications, all computer system clocks and mechanical time stamping devices must be synchronized to within one second of the NIST atomic clock.⁴ To maintain

clock synchronization, clocks should be checked against the NIST atomic clock and re-synchronized, if necessary, at pre-determined intervals throughout the day.⁵ FINRA understands that some firms synchronize their clocks continuously throughout the day, while others do so at various times during the day and still others do so only once a day.⁶

Given the increasing speed of trading in today's automated markets, FINRA believes the current one second tolerance is no longer appropriate for computer system clocks recording time under FINRA rules. Automated systems have evolved to the point where order placement and trading decisions are made on a millisecond, or finer, basis. In such an environment, the one second tolerance is insufficient for audit trail and surveillance purposes, particularly since firms are reporting to OATS in milliseconds and will begin trade reporting in milliseconds in the near future.⁷

As the SEC has recognized, it is critical for regulators to have the capability to accurately determine the sequence in which all reportable events occur.⁸ Timestamp accuracy at the millisecond level is essential for the accurate sequencing of order, quote and trade events across market participants and market centers. FINRA's surveillance programs rely on the timestamps firms report, among other things, to monitor for intentional manipulative trading practices such as spoofing or layering (*i.e.*, bidding or offering with the intent to cancel the bid or offer before execution) and to evaluate best execution and compliance with SEC Regulation NMS.

Accordingly, FINRA is proposing to tighten the synchronization requirement for computer system clocks. The allowable drift tolerance for mechanical time-stamping devices (*e.g.*, used for time-stamping an order ticket for a manual trade) would remain at one second. FINRA believes that a drift tolerance of 50 milliseconds for computer system clocks is the best option to facilitate surveillance of high frequency and algorithmic trading. In addition, FINRA and the exchanges have publicly stated their current belief that 50 milliseconds is the appropriate synchronization standard for purposes of the Consolidated Audit Trail (CAT) under SEC Rule 613.⁹ However, FINRA recognizes that it may be more burdensome for firms to comply with a 50 millisecond tolerance than a 100 or 200 millisecond tolerance and requests comments specifically on the costs and benefits of complying with the different synchronization requirements.¹⁰ In this regard, FINRA notes that the range across market participants could in fact be twice as large as the allowable drift. For example, if one firm's clock is 50 milliseconds behind and another firm's clock is 50 milliseconds ahead, the variance between events reported by these firms could be 100 milliseconds. Accordingly, FINRA believes it is important to set the shortest allowable drift that is reasonable and can be achieved by the majority of firms.

As part of the proposal, FINRA also would codify the existing OATS technical specifications cited above, along with the reduced drift tolerance for electronic business clocks, in the Rule 4500 Series (Books, Records and Reports). Thus, the clock synchronization rule would be moved from the OATS rule series to make clear that these requirements apply to the recording of the date and time of any event that must be recorded under FINRA By-Laws or rules, not just OATS requirements.

Economic Impacts

Anticipated Benefits

As discussed above, the proposal would allow FINRA to more accurately determine the sequence of order, quote and trade events across market participants and market centers, thereby improving FINRA's surveillance program and enhancing investor protection. In particular, the proposal would enhance FINRA's ability to monitor for manipulative trading practices, such as spoofing or layering, and to evaluate best execution and compliance with SEC Regulation NMS.

Anticipated Costs

Firms that receive or route orders or execute trades directly would likely incur costs associated with updating their systems and procedures to comply with a reduction in the allowable drift for computer system clocks. These costs may include costs to develop and maintain software programs that allow synchronization within 50 milliseconds. FINRA notes that there are third party software products that could help firms maintain synchronization within 50 or 100 milliseconds. Firms may find these software products to be more cost effective than developing and maintaining their own programs. Some firms may also need to update their technology hardware and servers to achieve the 50 millisecond drift standard.

These costs will likely vary across firms depending on their current technology systems and procedures, their business models and the frequency with which they synchronize their clocks, as well as their current drift standards. FINRA understands that some firms already synchronize their computer clocks within 50 milliseconds, and as a result, they will not incur any material costs associated with this proposal.

Request for Comment

FINRA requests comment on all aspects of the proposed requirement, including the incremental costs of complying with a synchronization standard of 50 milliseconds versus a standard of 100 or 200 milliseconds for computer system clocks. FINRA requests specific comment on the following questions:

- ▶ Does your firm currently synchronize its computer clocks to within less than a second of the NIST (*e.g.*, to within 50 or 100 milliseconds), and if so, what are the costs associated with maintaining that standard?
- ▶ What, if any, systems changes would firms need to make for purposes of complying with a reduction in the allowable drift tolerance for computer system clocks? What are the anticipated costs associated with these system changes?
 - ▶ FINRA understands that there may be off-the-shelf software products generally available that could help firms achieve a 100 millisecond, and possibly a 50 millisecond, drift standard. What would the costs be, including systems and labor costs, of using such software? What are the benefits and drawbacks of using these types of products?
 - ▶ Would the necessary systems changes and the associated costs vary depending on whether the synchronization standard is 50 milliseconds versus either 100 or 200 milliseconds?
 - ▶ Would the proposed adoption of a 50 milliseconds standard cause any residual or other “downstream” impacts on a firm’s systems? If so, would those impacts be mitigated if FINRA adopted a 100 or 200 millisecond standard instead?
- ▶ How much time would firms need to make any necessary systems changes to comply with a 50 millisecond standard?
 - ▶ Would the implementation timeframe change materially under a higher (*e.g.*, 100 or 200 millisecond) standard?
- ▶ If FINRA adopts a 50 millisecond standard, should a separate more permissive standard apply to firms with a de minimis amount of order and trading activity that are not engaged in algorithmic or high frequency trading, and if so, what should that standard be? How should FINRA define the universe of firms to which such a separate standard would apply?
- ▶ What would be the impact of a 50 millisecond standard on smaller firms? Would the impact change materially under a 100 or 200 millisecond standard?
 - ▶ If smaller firms had a longer implementation period, would this lessen the impact on these firms of complying with a 50 millisecond standard?

- ▶ What would be the impact of a 50 millisecond standard on firms that use their clearing firm's system for order routing and execution and regulatory reporting?
- ▶ As noted above, the synchronization standard for the CAT may be 50 milliseconds. Do firms have concerns about making systems changes in the near-term to comply with a higher drift tolerance under FINRA rules, *e.g.*, 100 milliseconds, given that they may have to comply with a 50 millisecond standard under CAT in the longer term?
- ▶ Should the one second requirement for manual clocks remain? If not, what is an appropriate standard for manual clocks?
- ▶ What other economic impacts might be associated with this proposed rule? Who might be affected and how?

FINRA requests that commenters provide empirical data or other factual support for their comments wherever possible.

Endnotes

1. FINRA will not edit personal identifying information, such as names or email addresses, from submissions. Persons should submit only information that they wish to make publicly available. *See* [NTM 03-73](#) (November 2003) (Online Availability of Comments) for more information.
2. *See* Section 19 of the Securities Exchange Act of 1934 (SEA) and rules thereunder. After a proposed rule change is filed with the SEC, the proposed rule change generally is published for public comment in the Federal Register. Certain limited types of proposed rule changes, however, take effect upon filing with the SEC. *See* SEA Section 19(b)(3) and SEA Rule 19b-4.
3. *See* FINRA September 19, 2014, News Release [“FINRA Board Approves Series of Equity Trading and Fixed Income Rulemaking Items.”](#)
4. Any time provider may be used for synchronization, however, all clocks and time stamping devices must remain accurate within a one-second tolerance of the NIST clock. This tolerance includes (1) the difference between the NIST standard and a time provider’s clock, (2) transmission delay from the source and (3) the amount of drift of the member firm’s clock. The OATS technical specifications further specify that computer system and mechanical clocks must be synchronized every business day before market open to ensure that recorded order event timestamps are accurate.
5. The OATS technical specifications also provide that compliance examinations include a review for the existence of adequate procedures and checks to fulfill this obligation, as well as a test of the degree of accuracy of clocks that are used for providing audit trail information against the NIST standard. To facilitate examinations, member firms must document and maintain their clock synchronization procedures. In addition, member firms should keep a log of the times when they synchronize their clocks and the results of the synchronization process. This log should include notice of any time the clock drifts more than one second.
6. FINRA generally believes that the firms that synchronize once daily are firms that accept manual orders.
7. Earlier this year, the SEC approved a proposed rule change to amend FINRA’s equity trade reporting and OATS rules to require firms to report time in trade reports and OATS reports in milliseconds, if their systems capture milliseconds. *See* [Regulatory Notice 14-21](#) (May 2014). For OATS, the rule change codified long-standing guidance and was implemented on April 7, 2014. The millisecond reporting requirement was implemented on November 10, 2014, for the ADF and TRFs, and will be implemented on November 17, 2014, for the ORF. As technology advances, FINRA expects to see an increasing percentage of firms both capturing milliseconds and making submissions to the FINRA trade reporting facilities and OATS reflecting time in milliseconds.

8. In its release adopting Rule 613 (Consolidated Audit Trail or "CAT"), the SEC noted that time drift is an issue that must be addressed to prevent a deterioration of the accuracy of the data in the consolidated audit trail. *See* Securities Exchange Act Release No. 67457 (July 18, 2012), 77 FR 45722, 45774 (August 1, 2012)
9. FINRA notes that the implementation of CAT is likely several years away and believes there are clear and important benefits to reducing the drift tolerance for computer system clocks in the near-term.
10. FINRA notes that NIST itself uses a 50 millisecond advance to account for network delays, see [NIST Internet Time Service](#), and, as a result, FINRA does not believe a tolerance of less than 50 milliseconds currently is necessary or appropriate.

ATTACHMENT A

Below is the text of the proposed rule change. Proposed new language is underlined; proposed deletions are in brackets.

4000. FINANCIAL AND OPERATIONAL RULES

4500. BOOKS, RECORDS AND REPORTS

[7430]4580. Synchronization of Member Business Clocks

(a) Each member shall synchronize its business clocks, including computer system clocks and mechanical time stamping devices, that are used for purposes of recording the date and time of any event that must be recorded pursuant to the FINRA By-Laws or other FINRA rules, with reference to a time source as designated by FINRA, and shall maintain the synchronization of such business clocks in conformity with such procedures as are prescribed by FINRA.

(b) All computer system clocks and mechanical time stamping devices must be synchronized to the National Institute of Standards and Technology (NIST) atomic clock. Any time provider may be used for synchronization, however, all computer system clocks must remain accurate within a 50-millisecond tolerance of the NIST clock and mechanical time stamping devices must remain accurate within a one-second tolerance of the NIST clock. This tolerance includes all of the following:

- (1) The difference between the NIST standard and a time provider's clock;
- (2) Transmission delay from the source; and
- (3) The amount of drift of the member's clock.

(c) Computer system and mechanical clocks must be synchronized every business day before market open to ensure that recorded event timestamps are accurate. To maintain clock synchronization, clocks must be checked against the standard clock and re-synchronized, as necessary, throughout the day.

••• Supplementary Material: -----

.01 Compliance examinations include a review for the existence of adequate procedures and checks to fulfill the obligation under this Rule, as well as a test of the degree of accuracy of clocks that are used for providing audit trail information against the NIST standard. To facilitate examinations, members must document and maintain their clock synchronization procedures. In addition, members should keep a log of the times when they synchronize their clocks and the results of the synchronization process. This log should include notice of any time the clock drifts more than the tolerance specified in paragraph (b) of this Rule. This log should be maintained for the period of time and accessibility specified in SEC Rule 17a-4(b), and it should be maintained and preserved for the required time period in paper format or in a format permitted under SEC Rule 17a-4(f).

Exhibit 2b

Alphabetical List of Written Comments

1. Gary Chambers, Crews & Associates, Inc. (January 5, 2015)
2. Manisha Kimmel, Financial Information Forum (February 20, 2015)
3. Christopher Nagy and Dave Lauer, KOR Group LLC (February 20, 2015)
4. John Ramsay, IEX Services LLC (February 12, 2015)
5. Sync-n-Scale (February 20, 2015)
6. Stephane Tyc, Quincy Data, LLC (January 9, 2015)
7. B. Haden Wiley, Wiley Bros. Aintree Capital, LLC (January 14, 2015)
8. Victor Yodaiken, FSMLabs (January 7, 2015)

Exhibit 2c

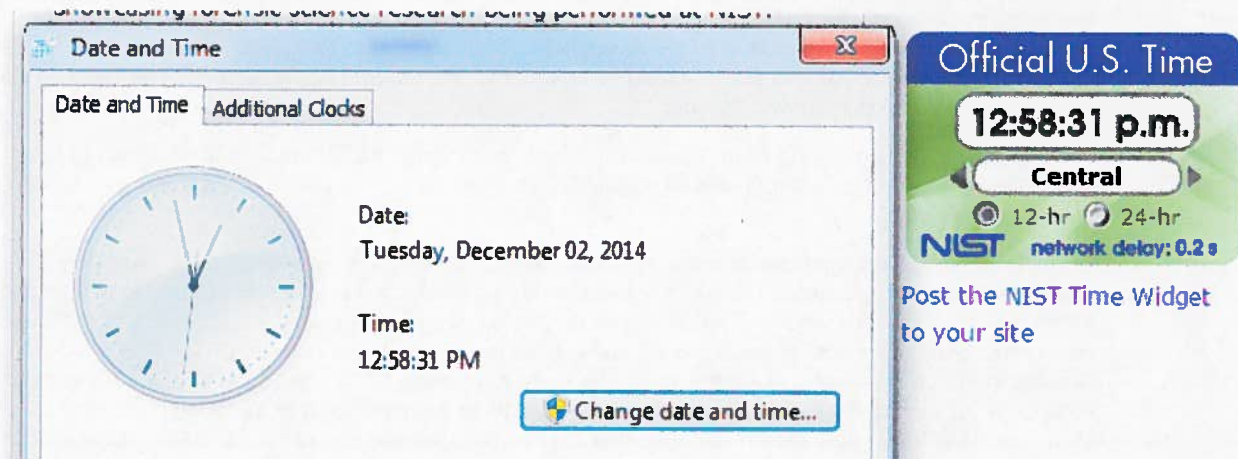
Marcia E. Asquith
Office of the Corporate Secretary
FINRA

Ms. Asquith:

FINRA is requesting comment on all aspects of the subject proposed requirement, including the incremental costs of complying with a synchronization standard of 50 milliseconds versus a standard of 100 or 200 milliseconds for computer system clocks.

FINRA's questions have been re-printed below followed by comments from Crews for FINRA's consideration:

- Does your firm currently synchronize its computer clocks to within less than a second of the NIST (e.g., to within 50 or 100 milliseconds), and if so, what are the costs associated with maintaining that standard?
Comment: Yes. We typically are synchronized within less than 1 second; however, the entire industry is limited to the time it takes for the roundtrip time sync request to receive updated time from NIST. That round trip time is variable depending on which server time.nist.gov routes each user to and the multitude of possible internet routes the data packet can travel. All of this is out of the participant's control. Once we obtain the packet we can typically update the time on all our systems within 50ms about 90% of the time. The network delay between each industry participant and NIST can be 200ms or more as seen by this image.



- What, if any, systems changes would firms need to make for purposes of complying with a reduction in the allowable drift tolerance for computer system clocks? What are the anticipated costs associated with these system changes?
Comment: Given the majority of the delay in receiving the data from NIST and not our ability to update internal systems, there is really no system changes our firm can make. The network delay results are determined from how far our internet connection is from the NIST core internet backbone, which cannot be changed without physically relocating our firm's center of operations.
- FINRA understands that there may be off-the-shelf software products generally available that could help firms achieve a 100 millisecond, and possibly a 50 millisecond, drift standard. What would the costs be, including systems and labor costs, of using such software? What are the benefits and drawbacks of using these types of products?

Comment: We can achieve internal synchronization to the new standard with our current systems, but there is no off-the-shelf system that can obtain the time packet from a NIST server to our firm any faster than we are receiving the packets now. That packet delay is a function of how far away the participants are from NIST servers (as the data packet travels) and how many routers and switches it must traverse to arrive to us.

- Would the necessary systems changes and the associated costs vary depending on whether the synchronization standard is 50 milliseconds versus either 100 or 200 milliseconds?

Comment: It is extremely unlikely any system change, no matter how expensive, would allow us to remain synchronized to NIST time with less than 200 ms of drift.

- Would the proposed adoption of a 50 milliseconds standard cause any residual or other “downstream” impacts on a firm’s systems? If so, would those impacts be mitigated if FINRA adopted a 100 or 200 millisecond standard instead?

Comment: It is extremely unlikely any system change, no matter how expensive, would allow us to remain synchronized to NIST time with less than 200 ms of drift

- How much time would firms need to make any necessary systems changes to comply with a 50 millisecond standard?

Comment: We cannot achieve a 50ms minimum drift for the reasons stated above.

- Would the implementation timeframe change materially under a higher (e.g., 100 or 200 millisecond) standard?

Comment: No.

- If FINRA adopts a 50 millisecond standard, should a separate more permissive standard apply to firms with a de minimis amount of order and trading activity that are not engaged in algorithmic or high frequency trading, and if so, what should that standard be? How should FINRA define the universe of firms to which such a separate standard would apply?

Comment: A separate rule for HFTs would be advisable. We do not engage in such activities and can easily accommodate the current 1s rule.

- What would be the impact of a 50 millisecond standard on smaller firms? Would the impact change materially under a 100 or 200 millisecond standard?

Comment: See above.

- If smaller firms had a longer implementation period, would this lessen the impact on these firms of complying with a 50 millisecond standard? How should FINRA define the universe of firms to which such a separate standard would apply? What would be the impact of a 50 millisecond standard on firms that use their clearing firm’s system for order routing and execution and regulatory reporting?

Comment: Given the orders are initiated at our firm, requiring the clearing firm to achieve less than 50ms drift for our trades but our inability to achieve the same may result in auditor confusion. Auditing rules should make it clear that comparisons of cleared trade timestamps and order timestamps should use the current 1s rule for firms that don’t engage in HFTs.

- As noted above, the synchronization standard for the CAT may be 50 milliseconds. Do firms have concerns about making systems changes in the near-term to comply with a higher drift tolerance under FINRA rules, e.g., 100 milliseconds, given that they may have to comply with a 50 millisecond standard under CAT in the longer term?

Comment: Given the orders are initiated at our firm, requiring the clearing firm to achieve less than 50ms drift for our trades but our inability to achieve the same may result in auditor confusion. Auditing rules should make it clear that comparisons of cleared trade timestamps and order timestamps should use the current 1s rule for firms that don’t engage in HFTs.

- Should the one second requirement for manual clocks remain? If not, what is an appropriate standard for manual clocks?

Comment: Yes

Gary Chambers

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FINANCIAL INFORMATION FORUM

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Via Electronic Delivery

February 20, 2014

Marcia E. Asquith
Office of the Corporate Secretary
FINRA
1735 K St. NW
Washington, DC 20006-1506

Re: Regulatory Notice 14-47 - Proposal to Tighten Business Clock Synchronization Requirements

Dear Ms. Asquith,

The Financial Information Forum (FIF)¹ would like to take this opportunity to comment on Regulatory Notice 14-47 - Proposal to Tighten Business Clock Synchronization Requirements (the "proposal"). We appreciate the extension of the comment period which has allowed FIF to conduct a clock synchronization survey as part of our analysis of the proposal. In addition to the comments below, the Preliminary FIF Clock Synchronization Survey Report (the "FIF survey") is attached to this comment letter.

The FINRA proposal discusses tightening business clock synchronization requirements to 50 milliseconds and also asks for the burden associated with a 100 or 200 millisecond offset. The FIF survey revealed that 39% of respondents are above the proposed clock offset of 50 milliseconds including 29% at the current mandated clock offset of 1 second for all systems. The average cost of moving to 50 milliseconds is roughly half a million dollars per firm. Survey respondents identified the following implementation activities that would be required in support of a 50 millisecond offset:

- Rollout colocation server implementation to all other servers in scope
- Replace Windows Event Log with separate log/archive infrastructure
- Dedicate new hardware, software, OS and personnel
- Address challenges with desktop PCs meeting stricter tolerance limit
- Software changes to switch from NTP Stratum 2 to GPS source and potentially PTP
- Process changes to escalate to support teams/business and remediation work on drift
- Replacement of 25% of infrastructure and reengineering effort

¹ FIF (www.fif.com) was formed in 1996 to provide a centralized source of information on the implementation issues that impact the financial technology industry across the order lifecycle. Our participants include trading and back office service bureaus, broker-dealers, market data vendors and exchanges. Through topic-oriented working groups, FIF participants focus on critical issues and productive solutions to technology developments, regulatory initiatives, and other industry changes.

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- To achieve consistent 50ms precision, dedicated stratum-2 servers required
- Larger storage requirements due to log of increased synch events
- Networking enhancements
- Windows servers would require NTP replacement of a workaround to Win32Time issues
- Development/deployment of alternative alert and event logging platform
- Mainframe change to PPS derived local stratum-1 source
- Possible refactor of certain applications based on change in timestamp precision
- Need to tune current NTP infrastructure to achieve
- Implement CDMA or GPS time sources and NTP via internal time sources
- Dependent on service bureau for clock synch

One concern raised in the study was the lack of participation by small firms. Given that the 20% of the firms responding to the FIF survey did not have in-house clock synchronization expertise, we would expect lack of clock synchronization expertise to be an issue for small firms as well. FINRA should offer an exemption for small firms or re-iterate existing OATS guidance which relieves firms of clock synchronization requirements if all relevant times are recorded by a clearing firm or other third party.²

Given that the CAT NMS Plan submitted in September 2014 already includes a clock offset requirement of 50 milliseconds, FIF does not believe a separate FINRA proposal is required. We acknowledge FINRA's concerns with the timing of CAT; however, it is our understanding that the SRO consortium, which includes FINRA, is actively working on an amendment to the CAT NMS Plan that should be filed within 1Q2015. It is also worth noting that clock synchronization requirements go into effect four months after the approval of the CAT NMS Plan and are not dependent on the selection of the CAT Processor.

As part of the FIF clock synch survey, respondents were asked about the potential for reduced burden if FINRA were to require a tolerance of 100 or 200 milliseconds in advance of tighter tolerances imposed as part of the CAT NMS Plan. Survey respondents questioned the benefits of an interim tolerance citing that any changes to the current clock offset would require modifications to systems and processes.

It is also worth noting that CAT clock synch tolerances are still under discussion, the CAT-mandated clock tolerances included in the amendment to the CAT NMS Plan will have a significant impact on how clock synch requirements will be implemented at firms. As indicated in the FIF survey, the implementation effort required by firms will vary depending on the scope and granularity of clock offset tolerances. Additionally, any mandated reduction in clock offset will need to address compliance with new requirements. FIF recommends a pattern and practices approach to compliance that minimizes the need for generating and archiving clock synchronization logs. Changes made in support of interim FINRA

² OATS Clock Synchronization FAQ S15 states: If the times required under OATS Rules are all recorded by your clearing firm or another third party, you are not required to synchronize your business clocks. However, if there are any cases when you must record the time yourself, such as when the computer system malfunctions and you must record the order on a paper ticket, you must maintain a synchronized clock for recording the times required under OATS Rules.

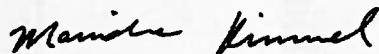
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tolerances may not be sufficient to meet CAT tolerances. Firms would like to avoid multiple clock offset projects if at all possible. Additionally, we question the value of tighter clock offsets when the mandated timestamp granularity remains at the second level. Mandated millisecond timestamps are another change already required by Rule 613 and the CAT NMS Plan.

Another concern of FIF members is the scope of the FINRA proposal. In evaluating scope within the FIF survey, the recommendation is to focus tighter clock offsets on server-side trading systems only. The proposal states "that these requirements apply to the recording of the date and time of any event that must be recorded under FINRA By-Laws or rules, not just OATS requirements." FIF requests that any future rule-making associated with this proposal itemize all records to which the tighter clock offsets would apply. Activities for which the sequencing of events is still possible at the 1 second tolerance may not require tighter clock offset tolerances.

In closing, we encourage FINRA to work through the CAT NMS Plan process to achieve their clock synchronization objectives and avoid redundant, and potentially conflicting, rule-making.

Regards,



Manisha Kimmel
Managing Director
Financial Information Forum

Enclosure

cc: Richard G. Ketchum, Chairman and Chief Executive Officer
Stephanie Dumont, Senior Vice President and Director of Capital Markets Policy
Shelly Bohlin, Vice President, Market Analysis and Audit Trail Group, Market Regulation
Lisa Horrigan, Associate General Counsel, Office of General Counsel (OGC)

Stephen Luparello, Director, Division of Trading and Markets, Securities and Exchange Commission

Gary Goldsholle, Deputy Director, Division of Trading and Markets, Securities and Exchange Commission

David S. Shillman, Associate Director, Division of Trading and Markets, Securities and Exchange Commission



FIF Clock Offset Survey Preliminary Report

Updated: February 17, 2015

Contact: Manisha Kimmel, Managing Director, FIF, kimmel@fif.com

Key Conclusions

- 39% of firms manage clock offsets that are not at the proposed 50 ms
- Even firms with clock offsets at 50 ms or lower have significant investment to meet compliance requirements
- Low clock offsets require GPS and PTP (used today in specialized applications only)
- Very costly to apply low clock offset broadly across a firm's infrastructure
- Compliance methodology key driver of cost

Key Recommendations

- Establish clock offset tolerance at 50 ms.
- Allow firms sufficient implementation time to meet new tolerances, e.g., requirement set in first quarter for implementation in fourth quarter (i.e., 9 month lead time)
- Rule should mandate reasonably designed policies and procedures to prevent a pattern or practice of clock offsets outside of mandated tolerances
- Only require logging of exceptions with archived data requirements of 3 years
- Limit mandated clock offset tolerances to electronic CAT reportable events such that manual events are excluded as well as off-production hours

Agenda

- Purpose of Clock Offset Survey
- Survey Respondent Profile
- Survey Responses
 - Current Clock Offset Environment
 - Achieving Lower Cost Offsets
- Opportunities To Reduce Cost Of Compliance
- Recommendation

Purpose of Clock Offset Survey

- The SEC/SROs and FINRA are considering new regulation to reduce clock offset tolerances when recording events for CAT or in the interim, FINRA-related submissions.
- To better understand the cost and implementation concerns of these proposals, FIF conducted a Clock Offset Survey.
- The survey was distributed to the FIF CAT Working Group and other industry participants.
- Cost feedback was requested on four target clock offset tolerances – 100 microseconds, 1 millisecond, 5 milliseconds and 50 milliseconds.
- Follow-up interviews were conducted with 8 firms to better understand cost of compliance and suggestions to better frame regulation
- Management of clock offsets was discussed with cloud providers

Survey Respondent Profile

- **By Firm Type**
 - Broker Dealers – 23 (82%)
 - Service bureaus – 5 (18%)
- **By Business Model - Introducing/Clearing**
 - Clearing Only - 10 (35.7%)
 - Clearing/Introducing – 7 (25%)
 - Introducing Only – 1 (3.6%)
 - None of the above (e.g., Institutional BD, Self-Clearing or Service Bureau) – 10 (35.7%)
- **By Business Model - Retail/Institutional**
 - Retail Only – 4 (14%)
 - Retail & Institutional – 11 (39%)
 - Institutional Only – 4 (14%)
 - None of the above (i.e., principal traders, market makers, service bureaus) – 9 (32%)
- **Additional Categories**
 - Twelve firms identified themselves as registered market makers including two that were not self-clearing
 - Ten firms identified themselves as principal traders

Note: Responses were not consistent across firm type. 6 firms indicated they did not have in-house clock synchron expertise.

Survey Respondent Profile – OATS Records Perspective



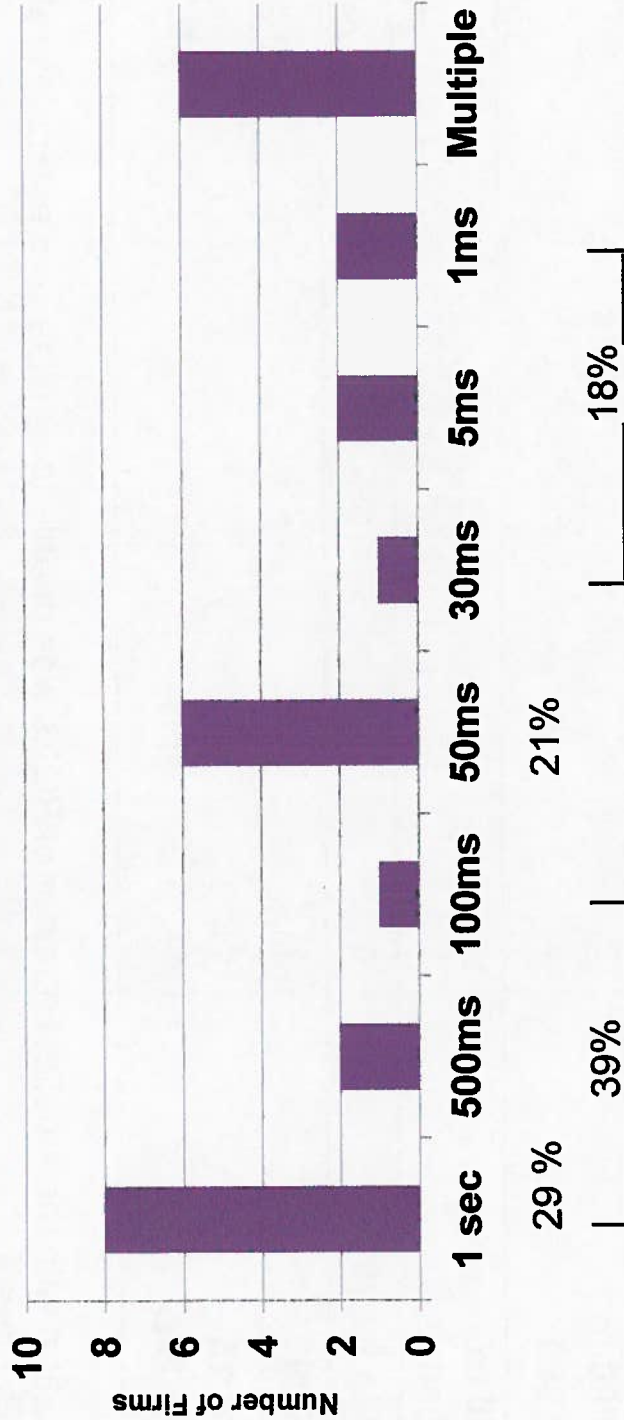
ROE/month	# Respondents	% of Respondents in Tier	Respondents as % of All Firms in OATS ROE Tier
100,000,000 or more	11	39%	27%
3,000,000 to 99,999,999	7	25%	15%
100,000 to 2,999,999	7	25%	9%
10,000 to 99,999	0	0%	0%
1 to 9,999	1	4%	0.2%
non-FINRA member B/D	2	7%	N/A

Note:

- The firm with the smallest number of ROEs was unable to provide cost estimates relating to target clock offsets
- No data from smaller firms in lower Tiers (representing over 400 firms). An effort is underway to solicit small firm input.
- Firms in OATS ROE Tier based on FINRA provided data from August 2014 for OATS Reporting Firms only

Current Offset Achieved

Distribution of Current Clock Offsets



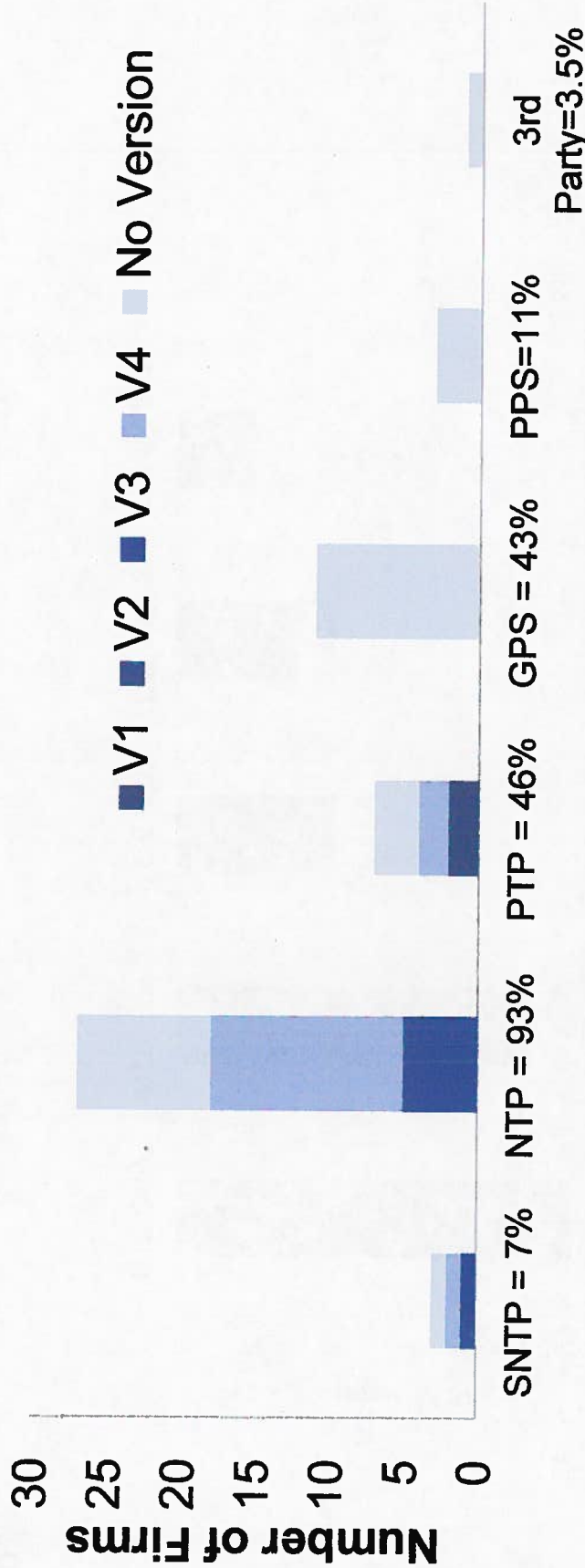
Notes:

- 39% of respondents are above the currently proposed clock offset of 50 milliseconds including 29% at the current mandated clock offset of 1 second for all systems
- 21% are currently at the current CAT NMS proposed clock offset of 50 ms for all systems
- 18% are below the 50 millisecond offset as shown in the table below for all systems
- 22% of firms have multiple clock offsets and indicated the following: 1 sec, 100 ms, 50 ms (2 firms); 100 ms, 100 μs; 50 ms to less than 1 ms; 50 ms, 100 μs; 5 ms, 5 μs
- 69% of firms (11 out of 16) achieving 50ms or better (in all or part of their installation) are Tier 1 and 2 firms
- Even where firms were at the target clock offset, many firms cited additional costs associated with compliance including logging and achieving greater degrees of reliability

Current Clock Technologies Used



Distribution of Clock Technologies

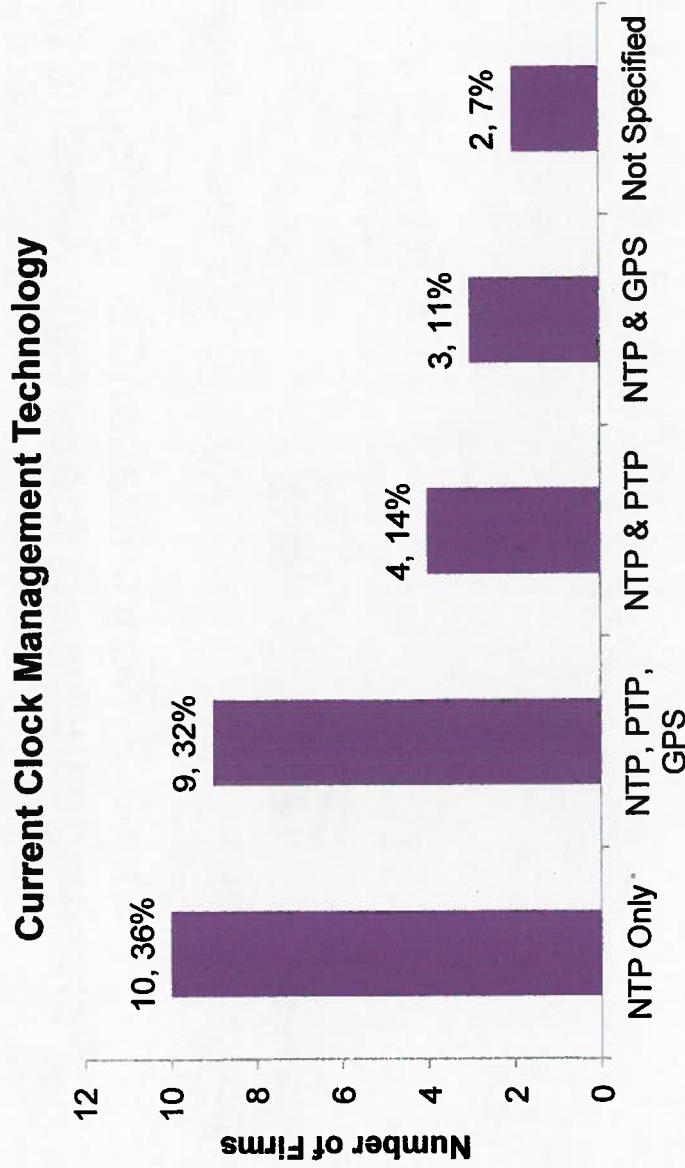


Clock Synchronization Technologies Percentage Installed Today with Versions in Use

Note:

- PTP and GPS (or similar) technologies would be required to achieve the lowest proposed clock offsets included in the survey yet less than half of the respondent firms use this technology today
- 100% of PPS usage is by Tier 1 firms and 100% usage of PTP and GPS is by Tier 1 and 2 firms

Current Clock Technologies Used – Alternate Perspective



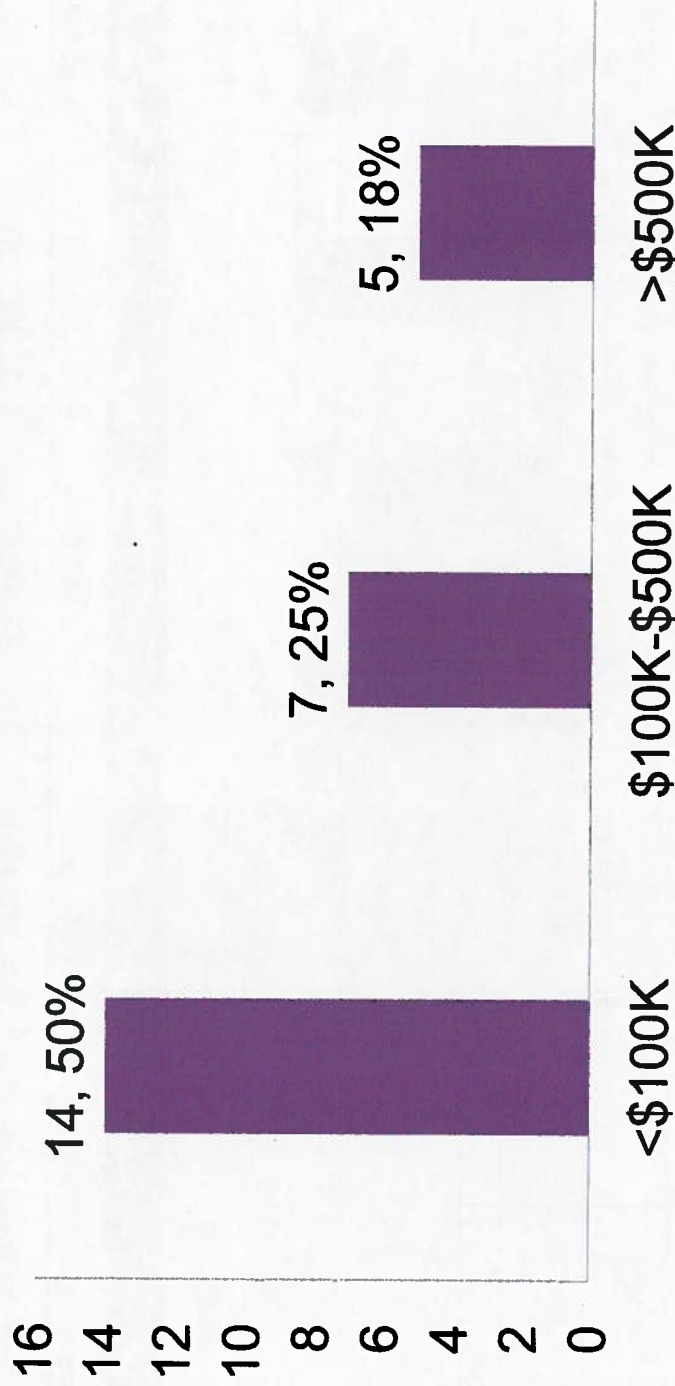
Note:

- All firms that answered the question (26 of 28) use NTP today. This is significant because PTP and GPS (or similar) technologies would be required to achieve the lowest proposed clock offsets included in the survey.

01/28/14

Current Clock Management Costs

Annual Cost for Current Clock Management

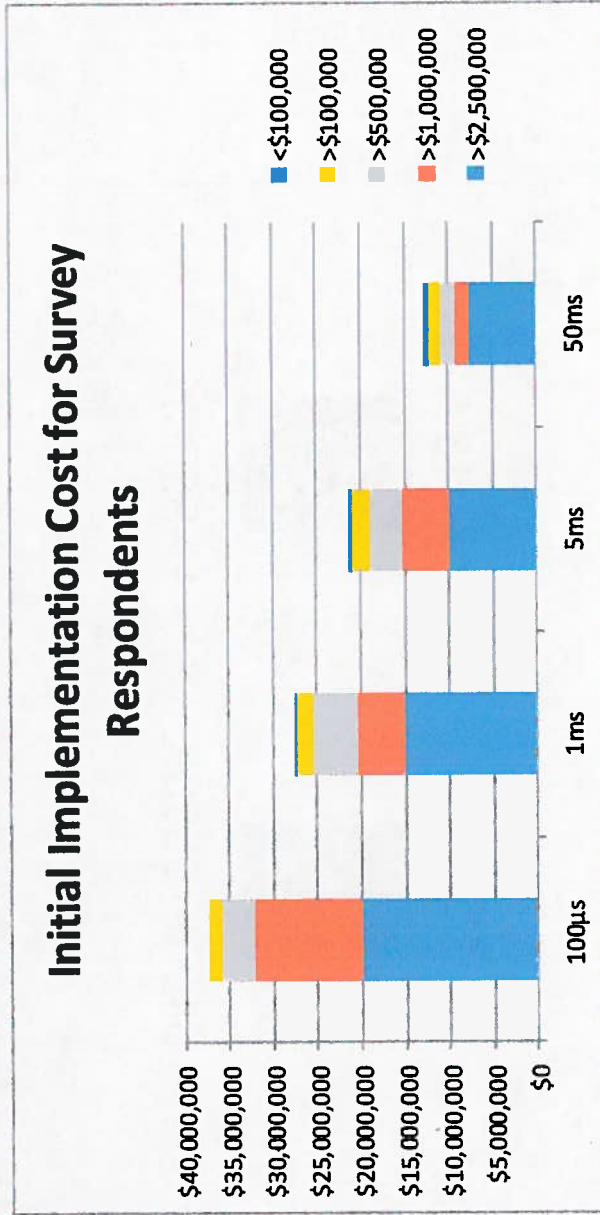


Note:

- Half of the firms spend less than \$100K on clock management today
- Two firm (7%) did not respond to the question
- 80% of firms with current costs over \$500K are in Tier 1; 20% in Tier 5
- 64% of firms with current costs less than \$100K in Tier 1 and 2

Initial Implementation Costs for Proposed Clock Offsets

Range in Survey	Amount Used
Less than \$100K	50,000
Between \$100K and less than \$500K	300,000
Between \$500K and less than \$1M	750,000
Between \$1M and less than \$2.5M	1,750,000
\$2.5M and over	2,500,000



Clock Offset	100µs	1ms	5ms	50ms
Average Cost	\$ 1,550,000	\$ 1,141,667	\$ 887,500	\$ 554,348
Total Cost for Respondents	\$ 37,200,000	\$ 27,400,000	\$ 21,300,000	\$ 12,750,000
% Cost Increase over 50 ms	192%	115%	67%	

Note:

Although some firms already have a monitor/log/archive infrastructure in place, many firms would require significant infrastructure and process investment at any clock offset tolerance.

Implementation Effort for 50 ms Clock Offset: Representative Comments

- Rollout Colocation server implementation to all other servers in scope
- Replace Windows Event Log with separate log/archive infrastructure
- Dedicate new hardware, software, OS and personnel
- Challenge – desktop PCs meeting stricter tolerance limit
- Software changes to switch from NTP Stratum 2 to GPS source and potentially PTP
- Process changes to escalate to support teams/business and remediation work on drift
- Replacement of 25% of infrastructure and reengineering effort
- To achieve consistent 50ms precision, dedicated stratum-2 servers required
- Larger storage requirements due to log of increased synchron events
- Networking enhancements
- Windows servers would require NTP replacement of a workaround to Win32Time issues
- Development/deployment of alternative alert and event logging platform
- Mainframe change to PPS derived local stratum-1 source
- Possible refactor of certain applications based on change in timestamp precision
- Potential to tune current NTP infrastructure to achieve
- Currently implementing CDMA or GPS time sources and NTP via internal time sources
- None – our service bureau provides support

Implementation Effort for 5 ms Clock Offset: Representative Comments

- Install GPS clocks in all locations
- Create custom time distribution network to connect all hosts to
- Migrate from NTP to PTP
- New enterprise level NTP client or PTP via current management network
- 3rd party time keeping software to get tolerance down that low
- Conversion of servers to PTP requires upgrades of oscillators, new physical cabling, GPS antenna arrays and lightning rods for each impacted datacenter
- Hardware configuration tuning for NTP/PTP with OS of current generation Linux
- Applications running on older generation HW or OS will need to be upgraded
- Enhancement of monitoring/logging tools
- MS Windows 7 desktop does not appear to be widely used at these tolerances – significant effort to ensure compliance
- Unpredictable load at user workstation (video, trading app, office tools) may impact clock synchronization, requiring change to trader workspace or dedicated equipment or move to thin clients
- Replacement of 25% of legacy/older infrastructure and reengineering effort
- Clock synchronizability (few minutes to hour) after server reboot
- Network level reengineering may be required to reduce jitter

Implementation Effort for 1 ms Clock Offset: Representative Comments

- GPS required time sources in every relevant data center
- New network segment physically cabled to each server for dedicated PTP access
- PTP software solution implemented for Windows and Unix servers, each with their own degree of complexity
- Do not have microsecond precision in DB (currently 3 millisecond tolerance); significant software changes and testing
- Requires replacement of stock NTP client with custom solution and possible dedicated switched LAN access to stratum-1 servers
- 1ms precision on virtual machines may not be possible and thus require reengineering or dedicated deployments
- Mainframes would require PPS access to local stratum-1 source
- If 1 ms offset to be achieved 99.9% of time, requires installing additional backup GPS devices per colocation as PTP over WAN will never achieve this
- 3rd party vendor would need to determine support
- Additional time synch hardware and OS changes

Implementation Effort for 100 μ s Clock Offset: Representative Comments



- May require PTP plus configuration changes and additional functionality to network
- Specialized NIC cards for hardware assisted time sync
- OS updates, new hardware and network design required
- Restructuring current server layout in data centers to minimize GPS sourced PPS timing along with PPS enabled time cards/server
- Outside vendors and expertise would need to be contracted
- Monitoring of systems clock drift would increase significantly
- Extremely expensive and may not be possible
- Requires significant reengineering, production certification efforts and global hardware upgrades to support pervasive PTP and PPS access to local reference time
- If a Windows based solution even exists, it would require significant engineering effort.
- Migrate to PTP with hardware / NIC time stamping
- Network infrastructure must be PTP aware and may need dedicated PTP network
- All applications must be upgraded to recent generation hardware and OS to ensure clock quality and use of PTP software
- If 100 μ s achieved 99.9% of time, requires physically dedicated time infrastructure, multiple GPS applications/center, reliable PCIe oscillators in many hosts
- Possible rebuild of entire trading environment; stable ambient & CPU temperature control critical

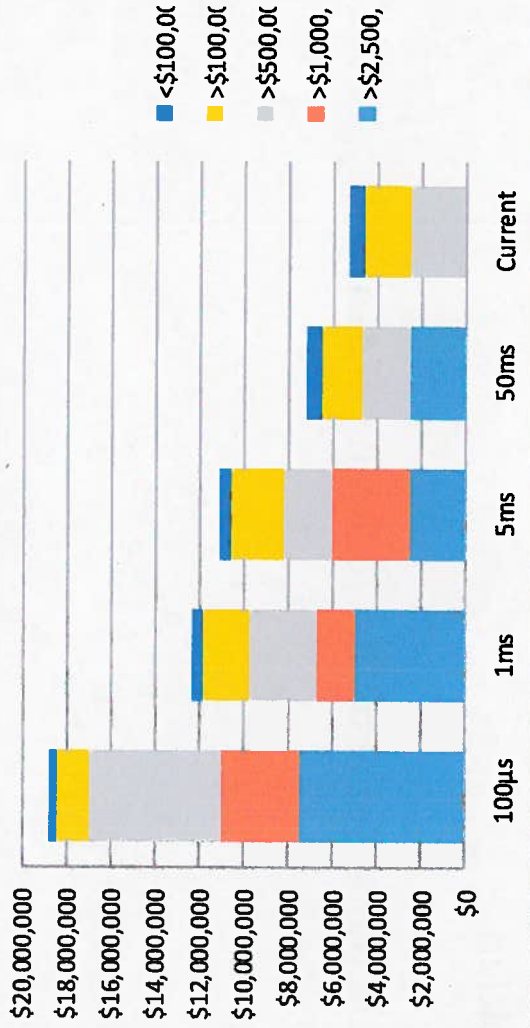
Annual Costs for Proposed Clock Offsets



Range for Projected Cost	Amount Used
Less than \$100K	\$ 50,000
Between \$100K and less than \$500K	\$ 300,000
Between \$500K and less than \$1M	\$ 750,000
Between \$1M and less than \$2.5M	\$ 1,750,000
\$2.5M and over	\$ 2,500,000

Range for Current Cost	Amount Used
Less than \$100K	\$ 50,000
Between \$100K and less than \$500K	\$ 300,000
Over \$500K	\$500,000

Projected Annual Cost



Cost Range	100µs	1ms	5ms	50ms	Current
Average Annual Cost	\$ 783,333	\$ 534,783	\$ 482,609	\$ 313,043	\$ 203,846
Total Annual Cost for Respondents	\$18,800,000	\$ 12,300,000	\$ 11,100,000	\$ 7,200,000	\$ 5,503,846
% Cost Increase Over Current	242%	123%	102%	31%	

Note:

The on-going costs to monitor/manage clock system increases significantly at 5 ms and again at 100µs.

The survey responses included a number of recommendations to reduce the cost of compliance for achieving a new clock offset:

- Maintain clock offset tolerance of 50 ms
- Reduce log/archive requirement
- If required, limit clock offsets < 50 ms to server-side trading systems only
- Delay Implementation Date
- Reduce ongoing compliance burden

Each of these suggestions are describe in more detail on the following slides.

Recommendation

Clock Offset Tolerance of 50ms

Opportunity:

Maintain current CAT Rule 613 clock offset tolerance of 50 ms

Recommendation:

Establish a clock offset tolerance of 50 ms

Sample of Survey Responses:

- To achieve a 50ms clock offset tolerance these 28 respondents must invest almost \$13M of initial development costs to achieve 50 ms
- The current annual costs of \$5.5M for this set of respondents increases by 31% to maintain a 50ms clock offset
- The Initial cost to establish a lower clock offset escalates by 67%, 115% and 192% as the clock offset moves to 5ms, 1ms and 100µs
- The Annual cost to maintain a lower clock offset escalates by 102%, 123% and 242% as the clock offset moves to 5ms, 1ms and 100µs
- Survey respondents are very concerned with the technology challenges and risks of applying low tolerances across their enterprises
- Survey respondents do not include small firms that may be more impacted by clock offset changes.

Recommendation: Reduce Logging/Archive Requirements

Cost Associated with Logging Requirement	Number of Firms	Percent of Total
High	10	36%
Medium	4	14%
Low	13	46%
Not Specified	1	4%
Total	28	100%

Recommendation:

- Only log exceptions and clock synchronization setting changes, not every synchronization event
- Reduce archive requirement to under 5 years
- Consolidated log format should not be required (was not assumed in survey)

Representative Comments from respondents on log/archive requirements:

- Requires implementing new log/archive system (current system logs 86K events/day across 400 machines which would grow to 35M events/day)
- Currently log synchron events, highly compressed, requiring 1 gig data storage each day for 1 second offset. The proposed clock offsets would increase data storage requirements at least 10 fold.

Recommendation: Limit Lower Clock Offsets to Server-side Trading Systems

Survey asked what savings could be expected if clock offsets <50ms were only required for server-side trading systems. Server-side trading systems were defined as those systems focused on execution that are managed by back-end servers as opposed to desktop applications.

	100µs		1ms		5ms	
	# firms	% firms	# firms	% firms	# firms	% firms
50% or greater cost savings	8	28.5%	4	14%	2	7%
<50% cost savings	6	21%	6	21%	6	21%
No cost savings	7	25%	9	32%	9	32%
No response or don't know	5	18%	7	25%	9	32%
N/A	2	7%	2	7%	2	7%

Note:

- 28% noted cost savings at a 5 ms offset with savings cited by 50% of respondents at a 100µs offset
- Based on follow-up interviews:
 - All firms agreed that clock offset tolerances close to 1 ms or lower should only be required for trading systems/matching engines/ATS
 - One reason cited for no cost savings was that clock offset is set and managed globally at their firms

Recommendation: Delay Implementation

- The survey asked what cost savings might be realized if the implementation date for a lower clock offset was end of 2016 or 2017.
- Many respondents (12 firms, 43%) did not believe that a delay would reduce costs. In follow-up interviews with 5 firms, they said that they answered this question purely from a cost perspective,. They said that much of their costs were hardware/software – and they couldn't predict any significant cost changes over the two year period.
- Eleven respondents (39% of firms) did not respond or indicated that cost savings are not known at this time
- Respondents did cite the need for sufficient implementation time especially for the lower clock offset tolerances. One firm indicated that to achieve any reduced clock offset by the end of 2015, the offset requirement would need to be set in 1Q2015.
- While additional time may not reduce costs, it may ease implementation as firms manage this effort in conjunction with other compliance initiatives. .

Recommendation: Reduce Ongoing Compliance Burden

Issue:

- Firms indicated concern regarding the level of reliability and expectations to demonstrate and achieve compliance that would be required to ensure clock offset at prescribed tolerances.

Recommendation:

- Compliance with any new clock offset should be based on reasonably designed policies and procedures to prevent a pattern and practice of clock offsets outside of mandated tolerances

Representative comments:

- “100ms 100% of the time is below the tipping point under any realistic scenario – for 100ms an entirely physically separated time infrastructure with full redundancy is required [to achieve 100% reliability]”
- Must the log/archive solution be managed for 100% reliability?
- Server reboot occurs due to failure during trading hours, application of maintenance after hours, periodic reboots on weekends. It causes clock instability until the server stabilizes (few minutes to an hour), causing a flurry of clock variances. These type of incidents should not constitute a “regulatory requirement for unusual action”.
- Clock protocols automatically adjust the clocks based on settings, etc. These low offsets cannot require manual intervention except when anomalies are noted.

Review of FIF Recommendation

- Establish clock offset tolerance at 50 ms.
- Allow firms sufficient implementation time to meet new tolerances, e.g., requirement set in first quarter for implementation in fourth quarter (i.e., 9 month lead time)
- Rule should mandate reasonably designed policies and procedures to prevent a pattern or practice of clock offsets outside of mandated tolerances
- Only require logging of exceptions with archived data requirements of 3 years
- Limit mandated clock offset tolerances to electronic CAT reportable events such that manual events are excluded as well as off-production hours

Appendix A. Tipping Points for Implementation Costs Associated with Proposed Clock Offsets & Additional Tipping Points Beyond 100 Microseconds

#	Firm ID	<100µs	100µs	1ms	5ms	50 ms
1	23	<100µs	H++	H++	H	H
2	7	50µs	H++	H+	H+	H
3	6		H	H	H	H, H for anything less than 100 ms
4	14	<100µs	H	H	M/H	M/H
5	19		H	H	H	L
6	22		H	H	No add'l cost	No add'l cost
7	11		H+	M/H	M/H	M
8	17		H	M/H, H for anything less than 1 ms	M/H	M
9	8	<50µs	M/H	M/H	L/M	N/A
10	1	20-50µs	M/H	M	M	L/M
11	5		M/H	M	L/M	L
12	13	<50µs	M/H	M	L/M	N/A
13	16	10µs	M/H	M	M	L/M
14	18		M/H	M	M	L
15	26		M/H	M, M/H for anything less than 1 ms	M	L
16	20	<100µs	M	L	L	L
17	12	TBD	M	L/M	L/M	L
18	25	<100µs	M	L/M, M for anything less than 1 ms and 100 µs	L/M	L/M
19	27		M	M	M	L
20	9	< 100 µs	M	L/M	L	L
21	4	<100µs	L/M	L	L	L
22	15	<50µs	L/M	L/M	L/M	L
23	21		L/M (Tipping point for Linux OS)	L/M (Tipping point for Windows OS)	L	L
24	2		L/M, costs due to logging	L/M, costs due to logging	L/M, costs due to logging	L/M, costs due to logging
25	10		TBD	TBD	TBD, current	
26	24		TBD	TBD	TBD	TBD
27	28		TBD	TBD	TBD	TBD
28	3		TBD	TBD, current		

Legend:

- L = Less than \$100K
- L/M = Between \$100K and less than \$500K
- M = Between \$500K and less than \$1M
- M/H = Between \$1M and less than \$2.5M
- H = \$2.5M and over
- H+ = Respondent indicated cost impact as significant within the \$2.5M and over range
- H++ = Respondent indicated cost impact as extremely significant within the \$2.5M and over range

Appendix B. Current Clock Offset Environment and Costs (Sorted by Firm Size based on ROE Tiers and then Current On-going Cost)

Firm #	Firm ID	Tier	Business Model	Current Offset	Clock Skills	Current Protocol(s)	Current On-going Cost
1	1	1	Inst, Retail, MM, PrinTr	50ms, <1ms. <1ms	yes	SNTP, NTP, GPS, PPS	>\$500K
2	7	1	Clr, Inst, Retail, MM	100ms, 100µs	yes	SNTP, NTP, PTP	>\$500K
3	14	1	Clr, Inst, Retail, MM	1sec	yes	NTP, PTP, GPS, PPS	>\$500K
4	23	1	Clr, Inst, MM, PrinTr	500ms	yes	NTP, PTP, GPS	>\$500K
5	8	1	Inst, Retail, MM	50ms	yes	NTP, PTP	\$100K-\$500K
6	15	1	Clr, Inst, Retail	50ms, 100µs	yes	NTP, PTP, GPS, PPS	\$100K-\$500K
7	16	1	Clr, Inst, Retail, MM, PrinTr	50ms	yes	NTP, PTP	<\$100K
8	17	1	Clr, Inst, Retail, MM, PrinTr	1sec	yes	NTP, PTP, GPS	<\$100K
9	21	1	Intr, Inst, MM, PrinTr	50ms	yes	NTP, PTP, GPS	<\$100K
10	26	1	Clr, Intr, Inst	50ms	yes	NTP, PTP, GPS	<\$100K
11	28	1	Clr, Intr, Inst, Retail, MM, PrinTr	1 sec	no	NTP	<\$100K
12	13	2	MM	50ms		NTP, PTP	\$100K-\$500K
13	22	2	Inst, PrinTr	<5ms, <5 µs	yes	NTP, PTP, GPS	\$100K-\$500K
14	4	2	SB	5ms	yes	NTP, GPS	<\$100K
15	9	2	Clr	1sec	yes	NTP	<\$100K
16	11	2	SB	1sec	yes	NTP, PTP, GPS, 3 rd Party	<\$100K
17	24	2	Clr, Retail	1sec	no	NTP	<\$100K
18	3	2	SB	1ms	no	NTP	No answer
19	12	3	Clr, Intr, Inst, Retail	50ms	yes	NTP	\$100K-\$500K
20	19	3	Clr, Intr, Retail	1sec, 100ms, 50ms	no	NTP	\$100K-\$500K
21	5	3	Clr, Intro, Inst, Retail	500ms	no		<\$100K
22	20	3	Clr, Intr, Inst, Retail, MM, PrinTr	1sec	yes	NTP	<\$100K
23	25	3	SB	100ms	yes	NTP	<\$100K
24	27	3	Clr, Retail	1sec, 100ms, 50ms	yes	NTP	<\$100K
25	6	3	Clr, Intro, Retail, PrinTr	1sec		NTP	No answer
26	10	5	SB	5ms, 1ms	yes		>\$500K
27	18	N/A	Clr, PrinTr	30ms	yes	NTP, PTP, GPS	\$100K-\$500K
28	2	N/A	MM	1 sec, 100ms, 50ms, <50ms	no	NTP, GPS	<\$100K

Business Model Legend:

- Clr – Clearing Firm
- Inst – Institutional
- Intr – Introducing Firm
- MM – Registered Market Maker
- PrinTr – Principal Trading
- Retail – Retail
- SB – Service Bureau



February 20, 2015

Via Electronic Mail (pubcom@finra.org)

Marcia E. Asquith
Office of the Corporate Secretary
FINRA
1735 K Street, NW
Washington, DC 20006-1506

RE: *Regulatory Notice 14-47 – Equity Trading Initiatives: Synchronization of Business Clocks*

Dear Ms. Asquith:

KOR Group LLC¹ "KOR" submits this letter in connection with the above release request for comments to Tighten Business Clock Synchronization Requirements. FINRA proposes to reduce the synchronization tolerance for computer clocks from a current standard of one second to 50 milliseconds. KOR applauds FINRA for seeking to tighten business clocks.

As we discussed in our testimony before the Senate Committee on Banking, Housing and urban Affairs on July 8, 2014², synchronization of server clocks plays a vital role in a regulators attempt to reconstruct events, study the market and to perform proper surveillance. In fact, recently, Thomas Gira, executive vice president of market regulation of FINRA noted³ that "making syncs extremely accurate is needed because of the proliferation of algorithmic trading" and "inaccuracies in time could make it difficult to determine whether a fast trader was engaging in layering". KOR agrees with Mr. Gira and in an age of electronic trading there is no substitute for high-resolution microsecond-level clock synchronization.

¹ KOR Group LLC is a research analysis and consulting firm that works with industry participants on market-structure related issues. Our client base includes US exchanges, algorithmic trading firms, buy-side institutions, investment banks and broker/dealers. KOR Group's founders operate Healthy Markets (healthymarkets.org) which is a non-profit 506(c) advocacy organization that promotes a platform of data freedom, increased transparency, competition and encouraging displayed price discovery. Healthy Markets brings together a diverse set of industry constituents to help foster positive market-structure change.

² See: Testimony of Dave Lauer http://www.banking.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=220da02a-8dd6-4976-8172-b00e1d2ac120

³ See comments of Thomas Gira to the Wall Street Journal <http://www.wsj.com/articles/regulators-traders-are-out-of-sync-1405295799>



Today timestamps are universally ignored because they are not synchronizing to a common clock source and therefore cannot be sequenced with each other across market centers. However, the technology to perform such high-resolution synchronization is low-cost and has been available for years. Furthermore, a reduction to 50 milliseconds would represent a first and long over-due first step but will not fully achieve the intended benefits sought for proper reconstruction of market events. A 50 millisecond resolution is only appropriate for servers communicating over the public internet. KOR believes that FINRA has the opportunity to take into account advances in technology combined with the fact that nearly all major broker/dealers have servers co-located in datacenters with exchange systems.

Therefore, KOR recommends that FINRA change their requirements to ensure that all firms are synchronizing their clocks to the greatest extent possible given their function in the market and technological capabilities. KOR recommends FINRA establish two tiers of clock synchronization requirements:

- **Non-Co-Located Broker/Dealer**
 - **Description:** This requirement would be for broker/dealers that do not have co-located equipment, or for any broker/dealer equipment that is not located in a datacenter with modern clock synchronization technology.
 - **Requirement:** 50 milliseconds, as per current FINRA proposal
 - **Implementation:** This can be accomplished with standard NTP, with little to no cost to the participant.
- **Co-Located Broker/Dealer**
 - **Description:** This requirement would be for any broker/dealers that have co-located equipment, either at an exchange datacenter or in a datacenter with modern clock synchronization technology.
 - **Requirement:** 1 millisecond
 - **Implementation:** This can be accomplished with standard NTP, with little to no cost to the participant, provided it is occurring within the same datacenter. Clock sources would have to be established (or simply designated from existing sources) in each datacenter, and those sources would have to be synchronized with each other at the SRO synchronization level.

Fundamentally, KOR disagrees with FINRA's justification for a blanket 50 millisecond synchronization based on the statement "that since the NIST itself uses a 50 millisecond advance to account for network delays that a tolerance of less than 50 milliseconds is neither necessary nor appropriate". NIST is not using a 50 millisecond advance to account, rather stating that users who authenticate via NTP may realize a timing accuracy of 50 milliseconds or better when using NIST authenticated NTP service over the public internet. NIST also supports applications that require millisecond-level accuracies and stability through NIST digital services. KOR therefore believes that reducing the tolerance to a 1 millisecond requirement overall would not impose significant additional costs to market participants over a 50 millisecond requirement.



Meeting a 50 millisecond standard would not represent a serious burden for industry participants and is a critical and long overdue move forward. However, it will not fully achieve the intended benefit. As part of FINRA's proposal, KOR recommends that FINRA seek to realize the incredible benefits of the industry synchronizing their clocks by modifying the requirements to segment participants by type and capability. This can provide a low-cost approach that fully realizes the possibilities that many participants currently utilize.

KOR thanks FINRA for the consideration of our comments. Should you have any questions please feel free to contact us.

A handwritten signature in blue ink, appearing to read "Chris Nagy".

Christopher Nagy
CEO KOR Group LLC

A handwritten signature in blue ink, appearing to read "Dave Lauer".

Dave Lauer
President KOR Group LLC

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February 12, 2015

Ms. Marcia E. Asquith
Office of the Corporate Secretary
FINRA
1735 K Street, N.W.
Washington, D.C. 20006-1506

Re: Regulatory Notices 14-47 and 14-48

Dear Ms. Asquith:

IEX Services LLC ("IEX") appreciates the opportunity to comment on two recent rule proposals by FINRA, which are among various FINRA initiatives relating to equity market structure and automated trading activities. In particular, IEX is commenting on: (i) the proposal to tighten business clock synchronization requirements (Regulatory Notice 14-47); and (ii) the proposal to publish OTC equity volume executed outside alternative trading systems ("ATs") (Regulatory Notice 14-48). In general, IEX supports both of these proposals and believes that together they will usefully enhance FINRA's ability to conduct surveillance of equity trading on a cross-market basis and also provide additional transparency of off-exchange trading activity that will provide important additional information to aid investors and broker-dealers in evaluating trading in "dark" venues.

IEX presently operates a non-displayed ATS for U.S. equities. IEX offers a simplified and transparent model designed to eliminate many of the conflicts that are currently present in the financial markets. Also, with investor-centric order types and advance technology and architecture, IEX has sought to neutralize on its trading platform certain negative effects of structural inefficiencies in the national market system. IEX intends to apply for registration as a national securities exchange in the near term and, in advance of exchange operation, plans to introduce a non-protected "lit" quote that is accessible to its subscribers during the first quarter of 2015.

Clock Synchronization

FINRA is proposing to require that member firms synchronize their computer business clocks used to record the time of events pursuant to various FINRA rules to within 50 milliseconds of the NIST atomic clock. Under current rules, firms must synchronize their business clocks that are



used for purposes of recording the date and time of any event that must be recorded pursuant to the FINRA Bylaws or other FINRA rules with respect to a time source as designated by FINRA. Further, the OATS technical specifications require that all computer system clocks must be synchronized to within one second of the NIST atomic clock.

IEX supports the proposal, although we believe that the permitted variance could be further reduced consistent with the systems capabilities of most member firms. The required synchronization of business clocks has far-reaching consequences for various regulatory reporting obligations and the ability of market regulators to conduct cross-market surveillance, as well as the ability of market participants to evaluate the performance of broker-dealers and market centers in satisfying best execution and other responsibilities. As FINRA notes in its Regulatory Notice, the evolution of automated trading systems since the one-second standard was first adopted has advanced such that routing and trading decisions are typically driven by timing differences of less than one millisecond. Also, the 50 millisecond standard is consistent with that recently proposed by the self-regulatory organizations in connection with the plan governing the consolidated audit trail. IEX in practice generally maintains synchronization of its business clocks to within approximately one millisecond based on our receipt of GPS signals that are processed by a local master clock and then passed on to our systems in Secaucus, New Jersey and Weehawken, New Jersey, as well as our disaster recovery systems in Chicago, to ensure that their individual systems are synchronized. Accordingly, we believe that the proposal represents an important and beneficial advance over the current standard. We also, believe, however, that FINRA, after acquiring experience in examining for compliance with and enforcing the 50 millisecond requirement, along with monitoring the evolution of industry capabilities, should consider a further reduction that would better narrow the gap between the time increments in which order and trade events are recorded and the allowable deviation from a standard time source.

Publication of OTC Equity Trading Volume

FINRA is proposing to publish the equity volume executed OTC by each member firm on a security-by-security basis. This proposal would complement the existing FINRA program, under which volume of each ATS by security is published. IEX supports the proposal. As FINRA noted in its Regulatory Notice, most of the off-exchange volume in NMS securities is executed away from ATSs. Accordingly, the effort to bring additional transparency to "dark" trading would be woefully deficient if it did not include data on trading that is internalized other than on an ATS. Such data can be used by market participants (including broker-dealers), regulators, and academics to better understand and track trends in off-exchange trading generally. It also will help investors to better evaluate the routing and execution practices of individual member firms



and thereby promote useful dialogue on these practices between broker-dealers and their buy-side customers.

With respect to certain other specific requests for comment contained in the Regulatory Notice, IEX agrees with the proposal to publish non-ATS volume information at the firm, rather than MPID, level. Firms execute trades through separate MPIDs for various business purposes which generally are not relevant to understanding the volume of trading internalized in particular securities. A firm-by-firm measure will therefore better serve the public informational value of publishing the data. IEX also believes that the proposal to aggregate volume information for firms that conduct a de minimis amount of OTC volume is a reasonable way to assure that the published information will be meaningful and free of the "noise" that could otherwise arise from a broader publication measure. We would suggest, however, that an alternate notional volume measure might also be helpful as part of this threshold so that firms doing relatively few trades but in large notional volume are included.

Sincerely,

A handwritten signature in black ink, appearing to read "John Ramsay", written over a light blue circular stamp.

John Ramsay

Chief Market Policy and Regulatory Officer

cc: Richard Ketchum, Chairman and Chief Executive Officer
Robert Colby, Chief Legal Officer
Steven Joachim, Executive Vice President, Transparency Services



357 Beloit Street, Burlington, WI 53105-0457, U.S.A.
Son VoBa, Director, Cloud & Enterprise Solutions – VoBaS@sync-n-scale.com

SYNC-N-SCALE PERSPECTIVES

*on FINRA Proposal to Tighten Business Clock Synchronization Requirements
([Regulatory Notice 14-47](#))*

February 19, 2015

TO: Marcia E. Asquith
Senior Vice President and Corporate Secretary
1735 K Street, NW
Washington DC 20006-1500

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Background

THE FINRA REQUIREMENT

The Financial Industry Regulatory Authority ("FINRA") issued its Regulatory Notice 14-47, a proposal to reduce the synchronization tolerance for computer system clocks for purposes of recording the date and time of any event that must be recorded pursuant to the FINRA By-Laws or other FINRA rules (e.g., the time a trade was executed or the time an order was received or routed), with reference to a time source as designated by FINRA. Under the proposal, the tolerance for computer system clocks would be reduced to 50 milliseconds.

FINRA believes the current one-second tolerance is no longer appropriate for computer system clocks recording time under FINRA rules. As the Securities and Exchange Commission (SEC) has recognized, it is critical for regulators to have the capability to accurately determine the sequence in which all reportable events occur. Timestamp accuracy at the millisecond precision level is essential for the accurate sequencing of order, quote and trade events across market participants and market centers.

FINRA acknowledges there will be costs in becoming compliant with the new required computer system clock tolerance. These costs will likely vary across firms depending on their current technology systems and procedures, and other business factors. FINRA understands that some firms already synchronize their computer clocks within 50 milliseconds, and as a result, they will not incur any material costs associated with this proposal.

Therefore, while it may be more burdensome for some of its 4,000+ member firms to comply with the new required tolerance, FINRA also believes it can be achieved by the majority of firms.

SYNC-N-SCALE PERSPECTIVES ON THE REQUIREMENT

We appreciate the opportunity to offer our perspectives and to comment on the FINRA proposed requirement. As a technology partner of the [National Institute of Standards and Technology \(NIST\) Time and Frequency Division](#) and of [Microsoft, Sync-n-Scale](#) brings significant expertise in this area to the discussion. We commend FINRA for its leadership and focus in addressing this technological issue across the financial services industry.

This proposal is timely. An industry-wide guideline for compliance is very much needed due to the complex and dynamic IT environments being employed by the financial services sector. A consistent application of this requirement will be critical in creating and maintaining fundamental transparency in the infrastructure that is often arcane and invisible to most.

This requirement is highly likely not an onerous imposition on market participants in any of the relevant dimensions: financially, technologically and operationally. State-of-the-art solutions are now commoditizing what used to be highly complex tools of the trade accessible only to those who can afford them and have the in-house sophisticated IT skills to operate them. Anxiety amongst FINRA member firms would likely be mitigated by increased awareness of these cost-effective options.

A Shared Outlook

Our technology partners share similar outlook and perspectives. We expect others across IT and financial services industries to agree with FINRA on the needs for this requirement, and the benefits garnered from its adoption.

"Virtualization technology, processor performance and networking complexity outpace deliverable accuracy in legacy time synchronization solutions. Worldwide large-scale datacenters and cloud-based IT solutions create new challenges for operators, developers and customers to meet business and regulatory requirements for workloads demanding system clock accuracy and precision across geographic locations" said Thomas Pfenning, Partner, Director of Software Engineering, Windows Server Foundation, Enterprise Cloud Group, Microsoft Corporation.

"Microsoft welcomes Sync-n-Scale as a hardware partner who is advancing the Windows Server platform in this technology space, completing our own engineering investments to meet customer computing needs spanning on-premises and cloud spaces in a cost-effective manner" added Chris Phillips, General Manager, Partner and Customer Ecosystems and Experiences, Enterprise Cloud Group, Microsoft Corporation.

Considerations

Sync-n-Scale respectfully submit the following topics for further consideration.

TRUST BUT VERIFY

For the implementation of this requirement to be an effective tool in restoring public trust, creating a level playing field and enhancing marketplace competition, compliance must be verifiable and uniformly applied to all FINRA member firms inclusive of their operating locales across US and worldwide geographies, as well as cloud space.

The unprecedented demand for hyper-transparent business practices will undoubtedly place those in equity trading at the top of concerns. Full transparency of compliance capabilities would allow FINRA member firms to inform their customers and to meet their expectations with respect to the risk or sensitivity of the engaged financial services being offered.

FINRA member firms should be allowed to decide on an end-point of their transitional period into compliance with this requirement according to their respective business priorities while maintaining the expected transparency for their customers.

A DEFINITIVE TRANSITION TIMETABLE

As a matter of policy, a time-bound transition period for FINRA member firms to become compliant with this requirement should be encouraged instead of simply allowing marketplace attrition to take its toll on those lagging behind in the technology curve.

A bifurcated distinction of mechanical time-stamping devices and computer system clocks, and different permissible drift tolerance for each would create opportunities however slight for *gaming the system*. The longer this duality is maintained the likely higher cost of enforcement and monitor will incur and be borne by the regulatory bodies.

A LONGER-TERM VISION

In parallel to this discussion, it has been widely accepted that precise time is crucial to other economic activities around the world. This is about keeping the economy, literally and figuratively, ticking. Effective solutions in this space are needed by other industry segments as well. Innovations for meeting the larger needs will undoubtedly emerge from collaborations across industry, government and academia.

We further submit that continued technical oversight by the appropriate national laboratories is critical in engineering, deployment and operational activities of this effort. This would establish a consistent set of guidelines for FINRA member firms to adopt and meet this requirement. The lessons learned in doing so would benefit similar endeavors implemented by those in other industry segments.



Submitted electronically to pubcom@finra.org

January 9, 2015

Marcia E. Asquith
Office of the Corporate Secretary
FINRA
1735 K Street, NW
Washington, DC 20006-1506

Re: Comments in Response to Regulatory Notice 14-47

Dear Ms. Asquith:

Quincy Data, LLC¹, appreciates the opportunity to offer comments regarding the Financial Industry Regulatory Authority's ("FINRA") Regulatory Notice 14-47, a proposal to reduce the synchronization tolerance for computer clocks. The current clock synchronization requirements allow for a tolerance of one second from the National Institute of Standards and Technology (NIST) atomic clock. Under the proposal, the tolerance for computer clocks would be reduced to 50 milliseconds.

Regulators are working to level the playing field, enhance competition and restore public trust. One of the issues raised in the book "Flash Boys" is the allegation of front running by high frequency traders. We believe the claims are not founded. However, beliefs are not sufficient and it would be important to ground this belief in publicly available data in order to foster the emergence of a shared consensus. In order to analyze this phenomenon, the accuracy of the publicly available time stamps needs to be significantly better than the time it takes to move information from one data center to another data center. The time of information transport is typically 100 μ s between the various New Jersey data centers. The time accuracy that FINRA should mandate needs to be significantly less. In the proposal that we attach we suggest that this time stamp accuracy should be 10 μ s for all electronic matching.

We respectfully submit a proposal which could replace the CAT requirements. It is simpler and more robust, and FINRA and market participants could adopt it very simply. In our proposal all matching engines would be time synchronized to an accuracy that is within 10 μ s of the global time standard UTC and manual trades would be time stamped within an accuracy of 1 minute. All trades should be made available at the end of each day to the public. Those trade records should be distributed in a single format and be accessible with an Open Data license.

Our proposal is attached.

Respectfully submitted,

A handwritten signature in blue ink, appearing to read "Stéphane Tyč".

Stéphane Tyč

Co-Founder, Quincy Data, LLC

¹ Quincy Data, LLC is the leading provider of extremely low latency financial market data distributed via microwave. The Quincy Extreme Data service offers an integrated and normalized feed of select financial market data sourced from multiple financial exchanges in the US and Europe. Quincy Data's service is offered in exchange colocation centers in Illinois, New Jersey, the UK and Frankfurt. Quincy Data is dedicated to leveling the playing field for low latency financial market data.

A technological solution to best execution and excessive market complexity

Stephane Tyc
stephane.tyc@quincy-data.com

Quincy Data, LLC

September 18th, 2014
Version 1

Introduction

The Flash Crash of May 2010, the software bug of Knight Capital, NASDAQ's glitch on the first day of trading of Facebook and the publication of *Flash Boys* all motivate the calls to improve regulation. Both the SEC and FINRA are examining ways to improve market structure and regulations to prevent any players from having an unfair advantage. Many of the proposed improvements involve reducing the number of trading venues and regulating how an order must be routed. There are additional calls for creating more comprehensive data gathering and identification of orders and executions across all trading venues. These changes would create an additional burden on brokers and traders who are already suffering from vastly increased compliance and data gathering costs due to the regulations created by Dodd-Frank.

We believe there is a way for regulation to be simplified and made more powerful at the same time. Trade publication standards can be created to support improved customer choice and to simplify and strengthen the market place. This would replace the need for more complex and costly regulation. Our suggestions apply to both the USA and to Europe but this paper will concentrate on the unique market structure of the U.S. equity markets after Regulation NMS (Reg NMS).

Our proposal would enable market participants to make rational choices on complete information about the quality of their execution. It would remove instability and complexity in the markets. It would also increase transparency for less liquid securities and keep the competition between trading venues fair and vigorous.

Best Execution and the organization of fair competition

In order to motivate our proposal, let's first revisit the two goals of Best Execution and Competition. In his 1996 paper, Lawrence Harris, discusses Best Execution: (Harris, 1996):

“When brokers take customer orders, they assume an agency responsibility to obtain “best execution”. Unfortunately, best execution is not well defined.

Best execution means different things to different people. To unsophisticated customers, best execution may mean "get the best price possible" for a market order and "trade as quickly as possible" for a limit order.

(...) The most sophisticated customers (...) only pay for the level of execution quality that they can audit. For them, best execution means "get me the execution that I expect you to provide given what I pay you and the limitations of my ability to audit your performance." These traders define best execution relative to the costs of auditing it."

The key to best execution is to empower consumers to analyze the quality of the execution they are getting. This way they can make the right decision and buy the level of service they need from the brokers. We have a proposal that would make this analysis simple, cheap and efficient.

The first stated goals of Reg NMS was to address competition, as a mechanism essential for markets (SECpg12):

NMS Principles and Objectives

Competition Among Markets and Competition Among Orders

The NMS is premised on promoting fair competition among individual markets, while at the same time assuring that all of these markets are linked together, through facilities and rules, in a unified system that promotes interaction among the orders of buyers and sellers in a particular NMS stock. The NMS thereby incorporates two distinct types of competition -- competition among individual markets and competition among individual orders -- that together contribute to efficient markets.

This goal was addressed by introducing order protection which links some of the markets and insures that, to a large extent, a market order sent to one of the protected markets will meet the best resting order of all protected markets. This goal is only partially achieved by the rule because it is simply impossible to achieve perfectly. Markets are physically separate and when the operator of a market identifies an order in a different place and sends a matching order, there is no guarantee that the order will be matched because it takes time to reach the away market.

Harris' comments on best execution were made before decimalization and before Reg NMS. They are still valid but the situation has changed as the vast majority of the trading is computerized and auditable.

Prior to the changes, order execution was primarily done by humans either in pits or "upstairs" on the phone at the desks of dealers. This presented several problems.

Trade auditing was a challenge: brokers were faced with a difficult task if they wanted to document best execution for clients. The trade information was recorded poorly and the time

stamps of the trades were approximate, the quotes were not formalized and could not be analyzed efficiently. Order handling was a lucrative business and brokers were directing their order flow to dealers on the basis of factors other than the quality of particular executions. In return dealers would offer various inducements to brokers including direct "payment for order flow". So, not only was the task difficult, but also the incentive of brokers to measure the quality of the executions provided by dealers was not very high.

The quality of the service offered by exchanges, mostly open outcry markets was also hard to assess. Pits are both inefficient and difficult to police. The famous article by Christies and Schultz that statistically demonstrated collusion between market makers led to a first swath of rule changes. Even with those changes, as long as the trading remained at the hands of humans, price and time priority were not fully enforceable and order-handling rules, in general, could not be "programmatically" defined.

In this context the average bid ask spread was large and the cost to end users was high.

Decimalization and then Reg NMS %changed this forever. It introduced competition between exchanges and made collusion between different market makers almost impossible in liquid stocks. It reduced the scope for dealers to execute outside the current bid/ask and disadvantage their clients. In addition, the introduction of the automated Small Order Execution System was first met with resistance but it is now the norm for equity trading.

The ultimate effect was to lower effective bid/ask spreads and to render markets more efficient and more traceable. But best execution is still not well defined and still not easy to assess for customers.

Despite the intention of insuring fair competition in the markets, there were unintended consequences. First the linkage between electronic order books introduced by the quote protection rule of Reg NMS has created a complex dynamic which is extremely hard to analyze and whose behavior is unpredictable. Second, most markets have introduced, and regulators have approved, many new complex order types mainly used by professionals. Those new orders have often been introduced to circumvent the difficulties introduced by quote protection and by routing between protected exchanges. There is complexity globally in the linkage and there is complexity locally in the order type. It is little wonder that there is broad agreement that the markets should be simplified.

Our Proposal

We are putting forward a very simple proposal that, in our opinion, would greatly improve market dynamics by changing the elements of Reg NMS that led to the increased complexity and would create more transparency.

The proposal has two legs. First, make data available in a format that will foster analysis and therefore enable rational choice. Second, remove the order protection rule which is the source of most of the complexity in current markets.

First, in order to make markets more efficient for market participants, they must have access to real numbers and real reporting on the quality of their executions. Mandating a particular form of data analysis is problematic. Access to the raw data should generally be preferred unless it imposes undue burden. The analyses are hard to define in a way that is sufficiently detailed to be completely trustworthy. The real test is simple. If two brokers with exactly the same executions data were to produce 605 reports it is unlikely that the reports would be identical. Defining the way to process the data is not as efficient as providing the data itself. What needs to be done is to provide access to the data free of charge to anyone who wants to do research and provide analyses.

%Second, to make markets easier to operate and more robust, the linkage imposed by order protection should be removed and arbitrage should be relied upon as a tested, trusted and visible market mechanism to keep the system in synch.

1. **Trade Data Publication:** standardize the publication of trades on all venues and make the data widely and publicly available.
2. **Linkage Removal:** rescind the order protection rules of Reg NMS (only if the first proposal is implemented)

Trade Publication can be implemented without Linkage Removal, but order protection cannot be rescinded without the availability of comprehensive trade execution data. The publication of trade data should have the following requirements:

- Apply to any trading of securities.
- Apply to all venues, including exchanges and dark pools and other forms of trading.
- Reported in a standardized way.
- Report only trades not quotes or other order messages, thereby greatly simplifying the implementation and empowering true independent analysis. This point of the proposal is key and will be discussed later.

Linkage Removal is simple to implement. It is sufficient to remove the rule making it compulsory, and exchanges and smart order routers can evolve at their own pace to stop following it.

The new regulation would require that:

1. All matching engines or individual traders effecting manual trades be registered with a unique number identifying them.
2. All matching engines be time synchronized to an accuracy that is within 10 μ s of the global time standard UTC and manual trades be time stamped within an accuracy of 1 minute.
3. All trade data be published, price, quantity, symbol, buy versus sell, etc, with the matching engine ID, the trade ID and with the time stamp of occurrence and time stamp of publication to a publicly accessible data stream
4. All the above trade data be made accessible free of charge and free of copyright in a common format at the end of the day with an open data license.

5. Brokers be legally required to communicate to clients, upon request, the list of all the trade IDs and matching engine IDs that constitute the execution of a given order. This report would be a simple .csv file with at least five columns including: Security identifier; matching engine identifier; date; trade identifier; fraction of the trade allocated.

Implementation issues and expected impact

How would it work?

Who produces the data, who aggregates it and how is it consumed?

The owners of matching engines or the employers of human traders produce the data. It is formatted according to a precise specification and it is sent to an organization that has a SIP-like mandate. This NMS organization makes the data available and is responsible for auditing it and reporting to regulators on the quality of the data per source. The data is then available for download free of charge and free of copyright.

How is this different from the TAQ data already available?

This only concerns the trade portion of the TAQ data, making it much smaller and easier to use. But it incorporates more information to help identify where trades occurred and the precise time stamps. It also removes any exception that may be present in the TAQ data, such as off hour trades. Perhaps it would be easy to generalize the TAQ data to include the new information. We are arguing that producing this data should be simple and that there is no good reason to delay implementation.

Why do you need two time stamps?

The time stamp of occurrence of the trade is the most important one. It is also interesting to study this impact of the dissemination of information in the trading system. If a very large block trade is done manually and reported only after some time it is interesting to know both time stamps to understand information transmission.

Who would create the matching engine ids and human ids.

In principle there are already trader ids available, so this would not need to be created. The matching engine ids would need to be registered with a regulatory body. The definition is that those ids should be sufficient to find the particular program that effected trades on a particular day. It should also include the location of the servers where the program would run. For instance, if a trade was done on the disaster recovery site of a dark pool it would need to carry a different matching engine id.

How is this new unique identifier different from the MIC?

The Market Identifier Code, defined by ISO 10383 is not precise enough. It cannot identify the actual matching engine that performed a trade. It does not have the precise location of the

matching engine. A given MIC code could correspond to matching engines which are 8000km apart. It would be useless to have a time stamping precise to better than 10^{-6} s without knowing where the matching engine is located.

How long would it take to implement?

The size of the data is very small. All the orders executed on any given day in a terse format would fit on a small thumb drive. Building applications to analyze executions would be possible at a small cost and effort. It would be open to anyone with some computer skills. The key to making this simple to use is to have a very precise specification of the data and to keep the data as simple as possible.

When should the Transaction Reporting be made accessible?

End of day reporting is adequate because this data is not supposed to be used in real time by brokers and proprietary traders. This is about enabling consumers to analyze the quality of their executions. The time scale involved in deciding to change an executing broker is closer to one year than to one day. Also, when studying the execution of illiquid securities it may be good to look at trades over many days.

Why is it cheap?

All electronic matching engines already have the necessary data on all trades. All it would take is to synchronize the data with the Institute of Electrical and Electronic Engineers Precision Time Protocol and provide the data with unique identifiers.

Why only publish trades, are quotes not also relevant?

Of course quotes are relevant. The market surveillance and abuse monitoring by regulators will still need access to quotes in some form. However, the key to empowering customers and to creating an independent cottage industry of individual trade analysis is to provide a simple system. Quotes come in a wide variety of guises. It will prove very difficult to document all quote types, including those provided by dark pools, in a single open data regime. Other data that is required to do the analysis is already available for lit exchanges and should also be available from dark pools and voice trading venues. The key insight is that trades are "sufficient" to empower customers to choose the best way to execute their trades.

Is this supposed to replace SEC Rule 605 and the publication of execution statistics?

This is not a replacement for Rule 605. It is meant to complement this rule. Current execution quality reports are centered on statistics per equity over all the executions in any given month. They provide no transparency on individual executions. The data used to compute the reports are not fully standardized and there are many exemptions. Providing open data on actual executions will help other and possibly more insightful analyses.

Why is it better than the current "best execution" reports required by Rule 605?

Some aspects of the reports could be gamed; in particular the number of shares that received price improvement can be gamed by providing an insignificant improvement to many shares in order to publish advantageous numbers. Providing the data will help better and more insightful analyses. For instance, nobody reports the quality of trade execution on "correlated assets". What about a broker who buys an ETF at the offer price on the leading cash market, in compliance with the quote protection rule, but ignores that there is a future on the same financial asset whose price was significantly below? It is impossible to define all the rules that should be applied by very good executing brokers. It is very simple to leave this to the investigation of a curious, competent and empowered public.

Why pick 10 μ s as the time precision?

There are two reasons: it is now routinely possible to synchronize to about one microsecond; and, the maximum error should be much less than the time information takes to go from one matching engine to another one. Ten microseconds seems to be a good compromise but 5 μ s or 20 μ s would probably be equally acceptable.

Can you introduce waivers for reporting?

Absolutely and categorically not. The whole point of the system is to provide a complete transparency and remove all the suspicion clouding the trading process. Waivers are often argued for in the case of large trades or illiquid securities. There is no reason to exclude large trades and illiquid securities as long as the reporting is done at the end of the day and not in real time.

How is this different from the consolidated tape proposals?

Consolidated tape proposals aim at improving the price formation process by providing rapid feedback on trades. Consolidated tape may be useful for market makers, professional traders and brokers. Our proposal is aimed at providing transparency for the end users, the money managers or individuals. Some money managers or individuals do not have the means or the interest to perform real-time analysis of trades and alter their real-time trading patterns even with the existence of a consolidated tape.

Do we need to trace orders through the various internalization, give-ups and other life cycle events?

Tracing orders can be useful but it is very difficult to put in place and probably impossible to make available publicly. Publicly available trade data are sufficient to study best execution. The end result of complex order routing strategies must be made available on a private basis. Executing brokers have internal mechanisms to allocate trades to particular clients. Those allocations must be made available for their clients upon request, so that the client can see the original execution of the trade. Armed with this data clients can see which split they received from executions and have the data at hand to request explanations from brokers if needed. This should be traceable down to the subaccounts.

How can this work with internal matching of trades by brokers?

It works with any normal allocation mechanism. Let's take examples:

1) Client A sends an order to buy 10 shares of IBM and Client B sends at the same time an order to sell 7 shares of IBM. The broker will match 7 shares internally at a price of $\$191.74$ and will buy an extra 3 shares on the NYSE-Arca for $\$191.77$. Client A would get an execution report with 100% of the first trade and 100% of the second trade, both trades would be on different matching engines, at different prices and different times. Client B would have 100% of the first trade.

2) Client A sends an order to buy 10 shares of IBM and client B sends an order to buy 30 shares of IBM. The broker executes a buy order for 15 shares at $\$191.05$ and another buy order for 25 shares at $\$191.02$. Both orders are allocated pro rata of the sizes to execute to the clients. Client A would get an execution report of $\frac{1}{4}$ th ($\frac{10}{10+30}$) of 15 shares at $\$191.05$ and $\frac{1}{4}$ th of 25 shares at $\$191.02$.

The important point to understand is that brokers have mechanisms to determine the share allocation and to compute the execution prices before margin for their clients. The point of the reporting standard is to make these mechanisms transparent for their clients.

What securities should this apply to?

Every security. There is no reason to single out equities and leave convertible bonds, treasury bonds, municipal bonds and the whole gamut of tradable things out of this.

What about OTC trades done by humans?

This is simply a case where the "matching engine" happens to be a human. It should already have a unique ID provided by the regulator. Of course, this particular "matching engine" would not have to be synchronized to better than 10^{-6} s. Time stamping to one minute accuracy for human trades is perfectly acceptable.

What are the expected impacts of our proposal?

What impact would it have on the competition between dark pools and exchanges?

It would narrow the regulation gap between exchanges and dark pools and help lit venues compete with dark pools more fairly.

Would this change market surveillance?

Today, only regulators have access to all the data necessary to police the markets. They have access to information identifying the parties to a trade and they also have quote information. This is powerful but hard to use. With our proposal, regulators could act upon request of parties who have done a first level of analysis and can identify particular trades on particular matching engines that are the cause of their supposed problem. Regulators would then be able to drill down and judge the claims on their merit. It would be very useful if regulators could actually document and publish the cases that they have investigated, both when they impose sanctions and when they decide that a particular pattern is not problematic. The creation of case law and the documentation of the reasoning of regulators would be very useful in building a consensus on what exactly is market manipulation and what is not.

How would it work to tame the bestiary of complex order types?

Many of those orders would become useless. The well-known ISO order type was created to circumvent a difficulty introduced by Reg NMS and mandatory routing. The routing algorithms can, in theory, produce infinite loops and be very costly. ISO orders were a natural response to this. Another famous order type, "hide not slide" which is used to gain priority in the case of locked markets, would disappear because the very concept of locked markets would disappear.

How would it help end users?

Armed with the Transaction Data, clients could take their trade IDs and matching engine IDs and have a company perform analysis to see if their broker was good at executing the orders. This would have the important effect of enabling rational choice and removing suspicion in the system. This would expose the potential problems and help the good brokers shine. Only access to the raw data can give real confidence in the system.

How would it help the analysis of best execution?

Customers who want to study their executions would request from their brokers an execution report.

Armed with this report, the customer would either compare trades in the same time period or send it to an external third party who would provide independent analysis. We actually expect that there would be many companies providing independent analysis because there would be a much lower barrier to entry.

What would this have changed for *Flash Boys*?

The plot of *Flash Boys* revolves around the discovery of order routing to several exchanges and the reaction this triggers. Two things would have been essentially different. The mechanism which is described in the book whereby an order hits a markets and triggers trades on other markets would have been simple to read in the data. Royal Bank of Canada would have understood much earlier that it was not executing its client trades optimally by providing signals in the markets. Even if RBC had not understood the phenomenon, the clients of RBC could have sent their execution data for analysis to many different analysis companies and would have been warned to direct their flow to a more sophisticated broker.

This analysis is made possible because of the precise time stamping. Without it, the causality of the trigger mechanisms would have been obscured.

If we remove quote protection, the system becomes simpler, but will the markets stay synchronized?

Today the price synchronization of markets is excellent for liquid securities in Europe where there is no quote protection. Arbitrageurs compete to synchronize prices across markets and also across asset classes. This is the most efficient mechanism for liquid securities. For illiquid securities we believe that the trade publication mechanism is also adequate. The TRACE program in the US is the right model and would benefit from a generalisation and the removal of all the exceptions.

What is the likely impact for illiquid securities?

The introduction of Trace is credited with reducing the cost of trading corporate bonds. It is generally agreed that more publicly available data will drive trading costs to a natural level imposed by the risk and cost of holding inventory. The same will probably hold for illiquid securities.

Is the proposal specific to the U.S. market structure?

There is nothing specific to the U.S. in this proposal. What is different is the current regulation and the future regulatory process. Europe does not suffer from the high costs imposed by Reg NMS. There is no order protection rule and each market functions independently. The prices for liquid securities are kept aligned by the natural arbitrage provided by participants. Expected regulatory changes are unlikely to introduce order protection. However, brokers may be required, in the new regulatory regime, to publish in a much more detailed way their best execution policies. However, Europe is currently discussing changes and could make the functioning of the markets much more onerous for little if any benefit. The same proposal would suit the same purpose in Europe.

Works Cited

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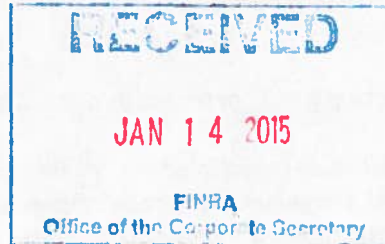
MEMBER SIPC

**WILEY BROS.
AINTREE CAPITAL, LLC.**

40 BURTON HILLS BOULEVARD

January 9, 2015

Ms. Marcia E. Asquith
Office of the Corporate Secretary
FINRA
1735 K Street, NW
Washington, DC 20006-1506



NASHVILLE, TENNESSEE 37215

Re: Regulatory Notice 14-47 Business Clock Synchronization Requirements

Dear Ms. Asquith,

Thank you for the opportunity to comment on the above referenced regulatory notice. Wiley Bros.- Aintree Capital, LLC is a small independent firm with less than 60 employees. We do not participate in algorithmic or high frequency trading nor do we self-clear. Also, we qualify for a de minimis amount of equity orders for purposes of Rule 605.

If FINRA adopts a 50 millisecond standard, should a separate more permissive standard apply to firms with a de minimis amount of order and trading activity that are not engaged in algorithmic or high frequency trading, and if so, what should that standard be? How should FINRA define the universe of firms to which such a separate standard would apply?

For small firms that are not self-clearing but handle de minimis equity trading activity away from their clearing firm, it is our understanding from the rule proposal that the one second standard would continue to apply for manually stamped trades. Our concern is that when making OATS reports for such trades, that these reports continue to be the one second standard rather than the 50 millisecond standard. If OATS reports for such trades are to be held to a 50 millisecond standard, we recommend for firms who use hand written tickets for less than 5% of the total number of orders, and have less than 500 such handwritten tickets time stamped per month not be held to the 50 millisecond standard for the OATS reporting of such transactions.

What would be the impact of a 50 millisecond standard on smaller firms?

If the firm were to be required to meet the 50 millisecond standard for OATS reporting involving trades conducted by manually writing an order ticket and stamping it, the expense of the equipment and operational compliance would be significant with no benefit to the investing public.

Would the impact change materially under a 100 or 200 millisecond standard?

A 100 or 200 millisecond standard would be equally costly and difficult to comply with.

If smaller firms had a longer implementation period, would this lessen the impact on these firms of complying with a 50 millisecond standard?

It is our opinion that a longer implementation period would not lessen the impact of complying with a 50 millisecond standard on small firms who qualify for a de minimis amount of equity orders as it relates to OATS reporting on hand written order tickets. Although longer implementation would be better, the ultimate result of a higher expense still does not offer a meaningful benefit to the investing public.

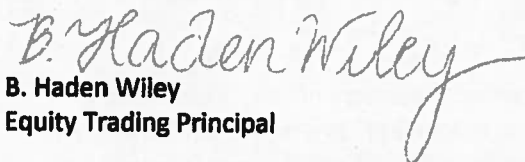
Should the one second requirement for manual clocks remain? If not, what is an appropriate standard for manual clocks?

Yes, the one second requirement is more than adequate for investing public protection on manually time stamped tickets.

What other economic impacts might be associated with this proposed rule? Who might be affected and how?

For firms that engage in limited de minimis equity trading activity to be required to meet the 50 millisecond standard for OATS reporting, the initial expense of investing in the equipment, software, trader training, along with the ongoing expense of ensuring compliance would result in many thousands of dollars of initial and ongoing expenses with zero additional protection to the investing public.

Sincerely,

A handwritten signature in cursive script that reads "B. Haden Wiley". The signature is written in dark ink and is positioned to the right of the typed name.

**B. Haden Wiley
Equity Trading Principal**

VIA ELECTRONIC MAIL

January 7, 2014

Marcia E. Asquith
Office of the Corporate Secretary
FINRA
1735 K Street, NW
Washington, DC 20006-1506

Dear Ms. Asquith:

RE: FINRA Regulatory Notice 14-47: Request for comment on a Rule Proposal to Tighten Business Clock Synchronization Requirements.

FINRA published Regulatory Notice 14-47 ("RN 14-47") on November 3, 2014 requesting comment on a proposed rule to implement the Tighten Business Clock Synchronization Requirements. FSMLabs appreciates the opportunity to comment on the proposed regulation and commend FINRA for its attention to this important issue.

In our view:

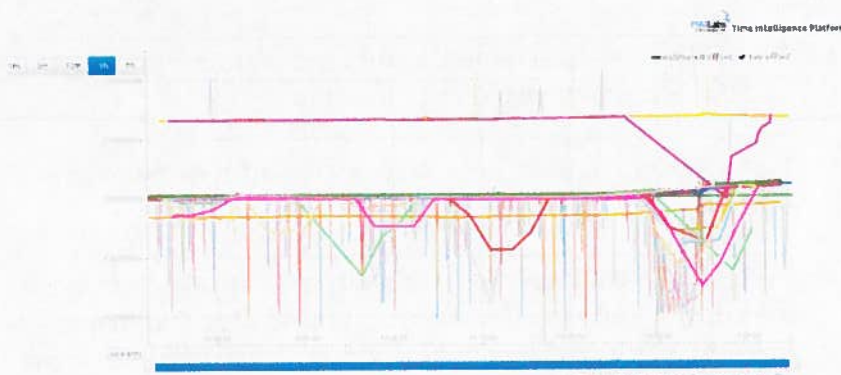
- The 50 milliseconds requirement for electronic clocks is a major improvement and can be met with low cost off-the-shelf software only.
- A 1 millisecond requirement would not impose significant additional costs on market participants.
- 1 microsecond is practical with low-cost off-the-shelf technology.
- Assurance, reliability, and traceability are critical issues. Even the current 1 second standard is often violated and many market participants do not have the ability to validate timing accuracy or to alarm on synchronization failure or even to support meaningful forensics in failure situations. This is despite the existence of low cost, off the shelf technical solutions.

- Long term data integrity will require that the 50 millisecond standard be a first step. Tighter standards will be necessary in the near future.

FSMLabs develops and markets time synchronization technology, software and hardware that is widely used in the financial trading industry, which places us in a knowledgeable position to comment on the feasibility of implementation for this proposed rule. Data for the Security and Exchange Commission (SEC) Midas system is collected on a computer network that uses FSMLabs' technology. There may be alternative methods to address the issues we highlight here, but our technology provides production solutions that are easily affordable and use off-the-shelf technology. To follow are our thoughts on why FINRA's proposal can be easily implemented by financial services organizations as outlined in the proposal and the core issues and risks related to data governance driving the need for regulation to address the issue.

At the end of this letter, we've provided an appendix which includes a glossary and additional background on clock synchronization.

Meeting the 50 millisecond standard and beyond.



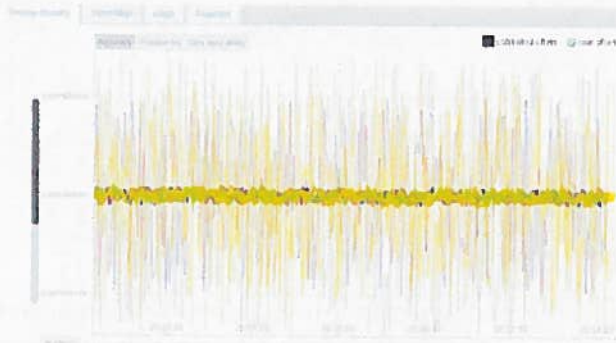
Client Time Synchronization Software can get time over the open Internet from National Institute of Standards and Technology (NIST) servers that is sufficiently accurate to meet the 50 millisecond

ond standard. Multiple sources are available, so sufficiently capable client software can implement cross-check, failover, and timestamp integrity monitoring.

Even cloud based clients can meet the millisecond standard.

Many systems already have internal requirements for better than 50 milliseconds. High-accuracy time is obtained by pulling time from GPS satellites or NIST TMS boxes and distributing that time within data centers and cluster. The critical need for those systems is reliability and assurance.

Assurance, Data Integrity, and Data Governance



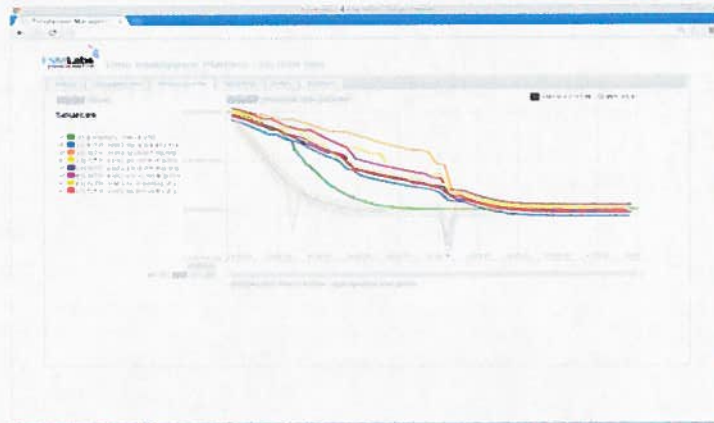
The main weakness of many existing clock synchronization technical systems is in Data Governance, specifically in assurance and traceability. Organizations need to be able to answer a number of questions, such as:

- What processes are in place to monitor time synchronization quality – both technical and operational?
- Does the time synchronization technology in use provide:
 - Cross-check of multiple sources?
 - Automatic failover?
 - A traceable audit record?
 - Alarms and alerts?
 - Reliable self-test (when it says it is within 10 milliseconds, is that reliable)?
 - Simple configuration, management, and provisioning (will it be, in practice, installed and operated properly)?
 - An upgrade path to better than 50 milliseconds?

- Do support staff have either sufficient time synchronization expertise or access to support from a qualified source?

Without good answers to these questions, market participants might, in theory, meet some requirement for synchronization, but may not meet it in practice.

Data Governance and Management



The biggest driver of costs in time synchronization and the greatest source of technology failures is data governance, specifically lack of comprehensive management of goals and risks and proper analysis of costs. Because clock synchronization is often considered a “down in the weeds” technical issue instead of a business logic requirement, it is often shuffled off to engineering staff without being integrated into general technology capability and risk management. Improvised solutions do not achieve accuracy goals and lead either to a sequence of increasingly costly “band-aids” (such as scripts to check for problems) or to wishful thinking (such as choosing to believe ntpq numbers are reliable). Clock synchronization, particularly in large networks is technically complex. The technical papers from IMC on their in-house clock synchronization (Estrela & Bonebakker, 2012) efforts show-case that a specialized, highly skilled IT team and significant technology budget may not be enough to provide robust solutions in the absence of clear requirements.

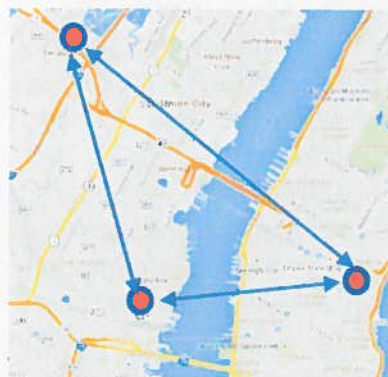
The call for comments includes this note:

In this regard, FINRA notes that the range across market participants could in fact be twice as large as the allowable drift.

For example, if one firm's clock is 50 milliseconds behind and another firm's clock is 50 milliseconds ahead, the variance between events reported by these firms could be 100 milliseconds. Accordingly, FINRA believes it is important to set the shortest allowable drift that is reasonable and can be achieved by the majority of firms.

This is a key point, and it makes fault tolerance and forensics even more critical. If either party lacks solid cross-check capabilities, even the 100 millisecond variance is not assured.

Fault Tolerance and Traceable Audit



Any basis for data integrity, reliability and traceable audit in clock synchronization must begin with multi-source client capability on application servers. In the absence of such capability, an application server relies on a single reference time source that it cannot validate or check and so trading software timestamps are not verifiable.

This is essential even in single site small platforms but becomes even more critical in large scale networks.

Failure Modes of Legacy Technology

This is a summary of problems in the "default" configurations which make use of free software time clients and traditional commercial GPS clocks.

- NIST time and GPS time are not easy to track concurrently and cross-check for sanity.
- GPS/GNSS device failures (lightning on an antenna, cabling, spoofing, GPS/GNSS radio failure or failure to properly interpret current time, networking failures ...). Here are three common types of failure:
 - One widely used GPS network clock device sometimes "forgets" to add in leap second adjustments, causing time to jump backward 35 or so seconds.

- Many GPS network clocks lack dual power supplies or even proper alarming on hardware failure.
- Out of date, obsolete, network interfaces can introduce significant “asymmetry” which will defeat the calculations of downstream “client” systems.
- Networking failures, configuration problems, fragile “time enabled” network devices such as switches and routers with built in PTP-1588 support, hidden asymmetries, and even load variation on networks can make time delivery unreliable or even unavailable. These types of errors are common in production systems.
- Widely used free software clients, NTPd and PTPd and variants are unreliable, produce misleading diagnostics, do not have any mechanisms for failover or crosscheck, require development of customized/improvised management software, and have complex, error prone, configuration. In addition, this software has a long history of serious security flaws that can be exploited to defeat time synchronization and to even bring down whole trading platforms.
- The “best master clock” protocol of IEEE-1588 does not address any of the issues of reliability in modern enterprise computing. Best master clock relies on the server computer to inform the client computers which time source has best quality – and the server computer rarely has any information needed to determine time quality at the client. IEEE-1588 Standards committee is, at this time, considering future changes to the standard that might address fault-tolerance, but completing the standard, developing technology around that standard, and validating designs is not likely to be a short term process.

Future issues and cloud

As financial services institutions continue to embrace cloud technology and infrastructures, the ability to achieve millisecond or better levels of precision for time synchronization in the cloud will also become important. Solutions that do not work in cloud environments will need to be supplemented by ones that do.

Conclusion

The proposed standard is a significant step forward but requires



proper attention be paid to assurance if it is to be more than symbolic requirement. Meeting the 50 millisecond standard should not be a serious burden for even smaller market participants and it is an essential step towards higher data integrity. Wide use of electronic trading systems and proliferation of trading venues make it impossible to understand market operation or to manage risks without precise and reliable time information. FINRA's proposed rule to implement the Tighten Business Clock Synchronization Requirements is timely and necessary. The technology needed to adhere to the proposed requirement is available to market participants, and the risks are too high to delay implementation of this standard. We commend FINRA for recognizing this important market structure issue.

Thank you for your consideration.

Sincerely,

Victor Yodaiken
CEO
FSMLabs.
www.fsmlabs.com

Appendix: Clock synchronization technology and terminology

NIST: Official time in the USA comes from atomic clocks operated by the National Institute of Standards and Technology (NIST).

GPS: Global Positioning System (GPS) satellites have time from atomic clocks then made available to GPS receivers. In practice, that time is within a few nanoseconds of NIST time. GPS radio signals are weak and can be lost or blocked or spoofed (see below). There are several international GNSS systems that are alternatives to GPS.

Spoofing: Where an attacker attempts to break security by providing false data. GPS spoofing involves overriding GPS signals and sending false timing information that appears to be from the satellites.

Network Clock: A device that receives time from some reference source, generally GPS or NIST servers, and sends that time out over computer network.

NTP: Network Time Protocol is the most widely used network protocol for sending time from a source (such as a device equipped with a GPS receiver) and clients (computers that run application code). NTP is a simple client/server protocol: the client asks the server for the current time, and the server then replies. Part of the complexity is for the client to try to figure out how long the reply has taken to arrive – and to adjust local time with that delay taken into account.

PTP – Precision Time Protocol also known as IEEE-1588 is an alternative to NTP. PTP has multiple modes of operation, many added as it has been modified to work better in enterprise networks. The original design was for very simple networks used in industrial control. PTP has evolved to look a lot more like NTP than it did originally. In PTP terminology, a server is a “grandmaster” and a client is a “slave”.

Hardware Assist: One of the innovations originally associated with PTP was to make network devices assist in computing the

delay of time packets. For example, network adapters now sometimes can be configured to tag incoming time packets with the time that the packet arrived at the device. This allows the client software to adjust for time that the packet spent in the operating system network stack. Many network devices now provide this support for both NTP and PTP packets. Additionally, some newer switches and routers can act as in-between servers (boundary clocks) or can add delay information to PTP packets.

Client Synchronization Software: runs on the application server computer and operates an “ideal clock” or “smart clock” that is driven by local timing hardware on the application computer and by information received from reference time sources – such as over the network via NTP or PTP or perhaps a mix of those.

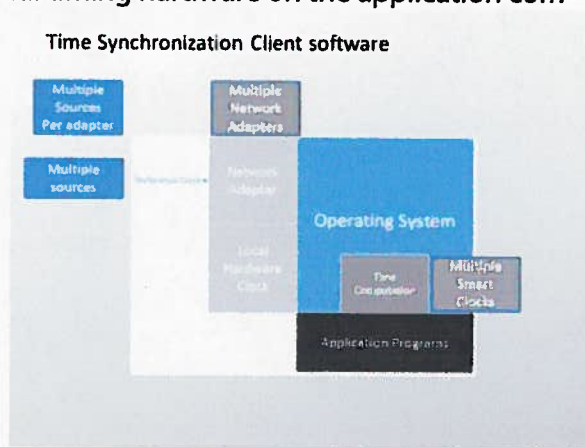


EXHIBIT 5

Below is the text of the proposed rule change. Proposed new language is underlined; proposed deletions are in brackets.

* * * * *

4000. FINANCIAL AND OPERATIONAL RULES

* * * * *

4500. BOOKS, RECORDS AND REPORTS

* * * * *

[7430]4590. Synchronization of Member Business Clocks

(a) Each member shall synchronize its business clocks, including computer system clocks and mechanical time stamping devices, that are used for purposes of recording the date and time of any event that must be recorded pursuant to the FINRA By-Laws or other FINRA rules, with reference to a time source as designated by FINRA, and shall maintain the synchronization of such business clocks in conformity with such procedures as are prescribed by FINRA.

(b) Business clocks, including computer system clocks and manual time stamp machines, must record time in hours, minutes and seconds and must be synchronized to a source that is synchronized to within a one second tolerance of the National Institute of Standards' (NIST) atomic clock, except that computer system clocks that are used to record events in NMS securities, including standardized options, and OTC Equity Securities as that term is defined in FINRA Rule 6420, must be synchronized within a 50-millisecond tolerance of the NIST clock. This tolerance includes all of the following:

- (1) The difference between the NIST standard and a time provider's clock;

(2) Transmission delay from the source; and

(3) The amount of drift of the member's clock.

(c) Computer system and mechanical clocks must be synchronized every business day before market open to ensure that recorded event timestamps are accurate. To maintain clock synchronization, clocks must be checked against the standard clock and re-synchronized, as necessary, throughout the day.

••• Supplementary Material: -----

.01 Members must document and maintain their clock synchronization procedures. Among other requirements, members must keep a log of the times when they synchronize their clocks and the results of the synchronization process. This log should include notice of any time the clock drifts more than the tolerance specified in paragraph (b) of this Rule. This log should be maintained for the period of time and accessibility specified in SEC Rule 17a-4(b), and it should be maintained and preserved for the required time period in paper format or in a format permitted under SEC Rule 17a-4(f).

* * * * *