Australian Government
National Measurement Institute

National Measurement Institute Response to ASIC Consultation Paper 145 (CP145) 'Australian equity market structure: Proposals'

Overview

This response:

- introduces the National Measurement Institute (NMI) and its key statutory responsibilities, including maintaining national reference standards for time and for a wide variety of other physical, chemical and biological measurements
- outlines NMI's experience in providing accurate and reliable time to support a wide variety of applications, including the development and maintenance of complex and critical systems
- supports the proposal that market operator clocks be synchronised to the Australian reference time standard maintained by NMI, and notes some key challenges to be considered
- identifies several additional proposals in CP145 where time and timing may be important in the practical implementation
- comments briefly on implementation costs, noting that it is impossible to be more specific without a detailed study of implementation details including networks and software, and
- notes that the capabilities and experience of NMI are available, on a cost-recovery basis, to support ASIC, market operators and other stakeholders through the future refinement and implementation of the draft market integrity rules.

Background: National Measurement Institute (NMI)

NMI is responsible for Australia's national measurement system and top-level infrastructure in physical, chemical, biological and legal measurements. Under the *National Measurement Act 1960 (Cth)*, NMI establishes and maintains the measurement units and standards that allow Australian industry to operate competitively in a global environment.

NMI represents Australia on international measurement organisations that secure international mutual recognition of Australia's measurement standards, which underpins acceptance of Australian commodities and products and facilitates international trade.

NMI maintains a broad range of scientific and technical capabilities and undertakes research to support Australian innovation, the application of new developments in science and technology, and the increasing demand from industry and government agencies for new services and greater accuracy in measurement. NMI's role and expertise enable it to form strategic partnerships with industry and government to solve measurement problems.

Background: NMI time standards and services

The *National Measurement Act 1960 (Cth)* establishes Coordinated Universal Time, designated UTC, as the primary reference for time in Australia for legal purposes. Internationally, UTC is derived from a global network of atomic clocks by the International Bureau of Weights and Measures in Paris. In Australia, NMI maintains a local realization, denoted UTC(AUS), using an ensemble of atomic clocks, and ensures that UTC(AUS) is closely synchronised to UTC.

NMI has substantial experience in disseminating UTC(AUS) to provide precise and high-integrity timing for a wide variety of applications throughout Australia. NMI has developed custom time dissemination systems to support important applications at the highest levels of accuracy and reliability, including in the telecommunications, transport and academic sectors and particularly including electronic time references in computer networks. NMI has significant experience in the design, operation and support of complex hardware and software systems where maximum integrity is a critical requirement.

Synchronisation of clocks

CP145 L3 proposes that market operator clocks be synchronised to a reference clock designated by ASIC, and specifically to UTC(AUS) as maintained by NMI. This has significant advantages over any alternate reference clock:

1. UTC(AUS) as maintained by NMI has a specific legal standing under the *National Measurement Act 1960 (Cth)* as the primary reference for time in Australia. No other clock or timescale has this standing in Australian legislation or in Australia's measurement system. Section 10 of the *National Measurement Act* specifies the relationship between UTC(AUS) and clocks that are to be used for legal purposes, as detailed below.
2. UTC(AUS) is maintained by extensive infrastructure at NMI designed to maximise reliability and redundancy, not only for the atomic clock ensemble but also for continuous international comparison to UTC. This includes backup power systems, monitoring and alarms, and significant IT infrastructure. Establishing an alternate timing reference of similar performance would require similarly significant infrastructure, and in particular, substantial expertise to maintain it, which would essentially duplicate existing resources.
3. NMI has similarly developed significant technical infrastructure for the purpose of disseminating or making available UTC(AUS) at high levels of accuracy and reliability to support a wide variety of applications around Australia. Disseminating an alternate timing reference in the same way would similarly entail duplication of existing infrastructure.
4. Referencing market operations to UTC(AUS) automatically links the timing infrastructure of Australian markets to international markets which have similarly adopted UTC as the reference, extending a single common timescale for global trading. (Note that for the purposes of financial markets UTC(AUS) and UTC are identical; in practice there is a small difference, but this is always below one microsecond and is known at the level of a few nanoseconds.)

Section 10 of the *National Measurement Act 1960 (Cth)* states that measurements of a physical quantity 'for any legal purpose' must be made by comparison with an appropriate Australian primary standard of measurement, either directly or through an intermediate chain of secondary standards. In metrology, these requirements can be met by establishing formal 'traceability', meaning that 'a measurement… can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties' (Australian Standard AS3807-1988). In the case of time, the relevant Australian primary standard of measurement is UTC(AUS) as maintained by NMI.

We point out two key technical challenges which are critical to the effective implementation of timing infrastructure. First, although the synchronisation tolerances in ¶419 are broadly correct, these should not be relied upon without more detailed supporting information. In particular, the performance of Network Timing Protocol (NTP) depends strongly on factors such as software implementation, network topology and latency, and NMI strongly recommends that a detailed study be undertaken to determine the actual performance achievable for a specific real-world configuration. We anticipate it will be necessary to deploy NTP servers on local-area (LAN) networks to avoid variability associated with wide-area (WAN) links, and NMI has significant experience deploying, characterizing and supporting this configuration for other commercial clients.

Second, although several mechanisms exist to sychronise an internal computer clock to an external master reference, *the process by which software actually reads this computer clock must also be considered*. For example, it is useless to expend significant effort on achieving tight synchronisation between a local computer clock and a master reference if subsequently accessing this clock from the application layer introduces much larger or variable additional latency. In consequence, it is essential to consider the end-to-end timing from the master reference clock to the timestamp actually attached to a transaction, to confirm that the performance achievable will actually meet the levels required.

Timing issues relevant to other proposals in CP145

Although the primary support available from NMI relates to clock synchronisation in CP145, we have reviewed the complete consultation paper for additional background and detail. We note that timing issues are relevant to the practical implementation of a number of other proposals advanced in the consultation paper. We list several examples below in case the implementation requirements may in turn necessitate refinement of the policy proposals:

- *Electronic trading requirements* (F4, F5, F6) — Noting the background information regarding the impact of algorithmic trading, and the proposed requirement that algorithms be appropriately tested, we suggest that complete ‘stress testing’ of algorithms (¶189) may need to include conditions of high volatility and/or variable timing latency to multiple market operators. Simulating these conditions may require additional technical input beyond standard mechanisms for synchronisation of clocks, which may be relevant to questions F4Q3, F4Q4 and F4Q5. Similarly, ongoing review (F5 (b)) and control (F5 (c)) of algorithmic trading may require detailed timing information as part of ‘comprehensive order records and audit trails’ (F5 (c)(ii)), to develop an appropriate understanding of the operation of algorithms used (F5Q1).

- *Best execution* (G1, G2) — We note the proposal to require ‘reasonable steps… to obtain the best total consideration for the client’, but we are not clear on the level of diligence this might require. For example, price information will in general be available with differing and varying latencies from multiple market operators and execution venues, and it is not clear whether this latency should be explicitly considered when deciding the best total consideration (G1Q1). If this will be required, formal review and market surveillance may require high-resolution timing information to be included in audit trails (G2Q1, G4Q6).

- *Evidencing execution performance* (G5) — The required resolution for time stamps (G5Q7) will be determined by consultation with market operators and participants, as already set out in CP145. We point out that technical complexity and implementation costs obviously rise, potentially significantly, as the required resolution becomes finer. NMI can provide generic information on the level of synchronisation typically achievable by particular methods, but actual performance depends strongly on local factors such as network topology and latency and should be evaluated carefully on real-world systems as previously noted. We also note that compiling trade execution

statistics in the time-bands proposed in G5 (b)(ii) already implies sub-millisecond resolution for time intervals measured at the execution venue, but the required accuracy suggested in ¶421 may render the additional resolution meaningless.

We make two additional observations in this general context. First, we note that if timing issues do become significant in the implementation of these or similar proposals, the current obligation on market operators and participants to synchronise clocks may need to be extended to indirect market participants or other stakeholders as 'persons in scope' (question D2Q2). Second, the cost to establish robust synchronisation at the required tolerance may need to be considered as part of the cost of implementing such proposals; for example, this may be relevant to E2Q17, F1Q3, F1Q4, F4Q4, F5Q10, G1Q11, G2Q3, G5Q10 and similar questions. We note that the implementation costs may differ between indirect and direct market participants, depending on location and required tolerance.

Implementation costs

One of the aims of the consultation paper is to seek information on the likely costs associated with implementation of new proposals. Although ¶419 of CP145 is broadly correct, as noted above this information is necessarily abbreviated and should not be relied upon without more detailed supporting explanation. For example, commercial rubidium time standards are available for less than the $25,000 cost quoted; that figure refers to the capital cost of systems developed by NMI which additionally establish a formal link to UTC(AUS), and neglects an ongoing operational cost associated with data processing and reporting at NMI.

Similarly, although NMI has successfully operated a national network of NTP servers for many years and access to these servers is presently free, NMI may need to implement cost recovery for this service and therefore apply fees or charges in future, and all existing users of this service have been so advised.

Conclusion

To conclude, we would like to emphasise that the capabilities and experience of the NMI are available, on a cost-recovery basis, to support the future refinement and implementation of the draft market integrity rules. NMI can also prepare specific advice relating to timing and associated implementation issues to assist with educating the wider marketplace as required. We look forward to working with ASIC, market operators and other stakeholders to enhance the efficiency, reliability and integrity of market operations in Australia.