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Microsemi Frequency and Time Division (formerly Symmetricom)

Request for Information Internet Time Service Comments

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Agency: Department of Commerce

Office: National Institute of Standards and Technology (NIST)

Location: Acquisition Management Division

Solicitation Number: RFI_InternetTimeServiceComments

Notice Type: Special Notice

Executive Summary

Microsemi is pleased to submit the following comments in response to the *NIST Request for Information Internet Time Service*. Microsemi is the world's leading source of timing and synchronization solutions. The solutions offered generate, distribute and apply precise time for the communications, aerospace/defense, IT infrastructure, public utilities and metrology industries. Customers range from communications service providers and network equipment manufacturers to governments and their suppliers worldwide. Using the technology offered by Microsemi, customers are able to build more reliable networks and systems by using the Company's advanced timing technologies, atomic clocks, services and solutions. The above systems support today's precise timing standards, including GPS-based timing, IEEE 1588 (PTP), Network Time Protocol (NTP), Synchronous Ethernet and DOCSIS(R) timing.

Microsemi views *private sector provision of the Internet Time Service* perhaps differently than the more commonly understood privatization of a government asset such as a change of ownership or the operation of a government asset. In this case there is no tangible asset; rather we see it as a closely monitored and very cooperative public/private (commercial) partnership delivering an essential and very time critical service, almost in the class of a utility, but using the Internet as the distribution mechanism. Key attributes of this time stamping service are accuracy, reliability, and security, to name a few, and all at no charge to the consumer. Yet to maintain and build out infrastructure to maintain those attributes will require a substantial amount of investment. Microsemi agrees with NIST that in the future time services may grow beyond what is offered for free today, but questions the size and potential of that market. To that end Microsemi believes the partnership ought to be exclusive for a defined period to allow the commercial entity time to introduce additional/new services and attempt to recoup investments required to maintain the free time services. Without the



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exclusivity there is little incentive to assume the time and expense of upgrading and maintaining the NIST Internet Time Service as it is today.

Below we offer our comments in response to the request for information.

1. What diversity of the geographical locations of the servers will provide the best balance between cost and accuracy consistent with the requirements outlined above?

Geographical diversity should be combined with ISP diversity. A system providing critical services should be at least triply redundant. The logic behind this statement is that one element is guaranteed to fail eventually. When that happens, the residual system should remain redundant. Thus, the minimum number of elements that a truly redundant system should have is three. This includes three different ISP's that should be used to provide the time services connection to the Internet backbone.

2. How should the sites be configured to provide the integrity, reliability, and accuracy that are required as part of a time service that must support the national infrastructure?

As mentioned above, multiple sites (minimum three) provide service redundancy. No single failure should be allowed to impact the capacity required to meet the anticipated service load. Additionally, sites should be able to be added or removed from service without impacting services offered by other sites. DNS pooling should be used to attach site services to the national service. Sites which fail monitoring tests should be removed from the pool.

Local redundancy is essential. In order for a failure to occur without any service disruption, every site should be dual-redundant with switching done in hardware. Local redundancy, where each half of the site is able to carry the full timing load for the entire service guarantees a minimum of twice the peak-to-average load capacity. Aggregate system capacity must meet expected load with two years growth potential.

Truly effective redundancy requires three more aspects. First, there should be a depot of spares available either locally or for an overnight shipment to the failing site. Second, there should be on-site personnel responsible for performing any necessary maintenance and repairs. Lastly, effective reliability for a time critical service of this type requires both battery backup to handle transient electrical events and standby generator capacity in the event of longer-term power failures.

3. How should the monitoring and supervisory functions be configured to ensure that the time signals are accurate and that any failure be detected? In addition, how should

logging functions be implemented so that the log files can be used in the case that the accuracy of the time signals become involved in a legal proceeding?

The timing system(s) should be monitored at the physical timing layer, network layer, and service layer using active probing both internally and externally to each site. Real-time metrics including availability, accuracy and stability should be collected and made externally visible. The monitoring system should include traceability information showing the connection to UTC(NIST). Additionally, system statistics should be monitored for client loading, types of requests and packet counts to allow for service planning and system management. There should also be a security monitoring aspect to identify bad packets and clients as well as system attacks such as DoS. All data collected must be logged permanently and be electronically accessible for historical conformance validation.

4. **How should the link to the NIST atomic time scale be realized? What is the appropriate relationship between NIST and time service provider(s)? How should this relationship be designed to preserve the requirements of legal and technical traceability of the time stamps to national time standards?**

The traceability of the network timing service should be viewed to be at the third level of the standard traceability pyramid - National Standards Laboratory to Calibration Laboratory. The measurements used to relate the time and frequency of the Timing Service Provider to NIST should be verifiable and should not depend on a third party responsible for meeting performance specifications as an intermediate step. Two methods that meet this criterion are Two Way Satellite Time and Frequency Transfer and portable clock trips. One-way GPS does not meet this criterion since it depends on GPS meeting its requirements. Common view GPS falls in the middle, since many but not all GPS system errors cancel.

5. **What are ways in which the relationship between the private operator(s) and NIST can best be realized? A formal agreement will be established between NIST and each private operator, and NIST seeks input on what type of agreement would best support the program.**

Except for the small authenticated NTP service, NIST delivers a free service to the private sector. In order to achieve successful commercialization of this service it will be necessary for the commercial entity to add services not offered today that segments of the public are willing to purchase. There have been unsuccessful attempts to monetize distributing time in the past. The proposed commercialization of the NIST network time service introduces new possibilities that are critical for success of a monetization program - the ability to

calibrate relative to NIST and oversight of the service by NIST. The market for the paid commercial services must be developed by the commercial entity that delivers the services. Thus, it is difficult to see an attractive commercial opportunity if the need to compete is introduced from the beginning. A period of exclusive access to NIST for calibration, validation, and general oversight would be needed to encourage a commercial entity to develop the market.

6. Should NIST hold a competition to select a private sector organization(s) to operate an ensemble of time servers to provide NIST-traceable time information, or should NIST make the opportunity available to all eligible parties?

Distribution of the national time will require the private sector organization to effectively execute at least four essential functions. First, to be able to replicate UTC(NIST) at various physical locations on the Internet in the US. Second, to deliver time services with extremely high availability and reliability. Next, to deliver those time services with advancing degrees of accuracy and precision into the future. And lastly, closely coordinate with NIST to monitor and report on the distributed time as well as troubleshoot/correct any problems in the shortest possible time.

In the interest of the public good we see NIST as selecting a single private sector organization to partner with. NIST, the incumbent source and distributor of national time, is well positioned to select the best possible partner in the public interest without the need for competition. This will also improve the public confidence by selecting a private sector organization capable of both taking over and improving on time distribution services currently offered by NIST.

Should NIST make the opportunity available to all “eligible parties” raises the question of what constitutes “eligibility” and the related qualifications to be eligible. This opens the door to a great deal of interpretation for a service that is far from a typical service that is transferred from the public to a commercial entity such as toll roads or public utilities such as water and power, etc. Should NIST choose multiple “eligible parties” to distribute UTC(NIST) raises questions as follows: How would NIST plan to monitor and control a potentially wide variety of time distribution mechanisms between NIST and the eligible party’s public facing clocks? How would NIST plan to communicate to the public any quality of service differences between eligible parties? How would NIST plan to control/monitor what could be a wide variety of additional service offerings provided by the eligible parties? Moving from a single public/private partnership to multiple partnerships to distribute the time jeopardizes the essential aspects of accuracy and reliability of the time across a broader time distribution ecosystem. We also see it as an increased burden on NIST at a

time when they are seeking to reduce the burden and responsibility of retail level time distribution.

Lastly, as mentioned above, past attempts to monetize time stamps have been largely unsuccessful. This is indicative of a lack of a large enough market to attract the needed investment. NIST has been providing for free the NTP time stamps the majority of the market desires. Should there be competing commercial entities investing to continue distributing these free time stamps while trying to add additional for-fee services, there will be a dilution of revenue potential in an already small market. What will likely happen is that there would not be enough revenue from fee-based services to sustain the partners and consolidation back to a very small number of partners would take place, or there may be no interested partners remaining at all. In this event NIST would likely be back to resuming the responsibility of time distribution, or working with a singular partner distributing the time and offering fee based services. It is the view of Microsemi to start with a single partner for an exclusive period of time to distribute UTC(NIST) for free via NTP and attempt to establish a market for fee based time services, if a large enough market exists. If an exclusive partner can create a market and is successful, then at a future point in time NIST could consider adding additional partners.

7. What are advantages and disadvantages of NIST's potential transition of time services from a NIST-only service to private sector operation of an ensemble of time servers that will provide NIST-traceable time information via the Internet? Note that NIST would continue to provide oversight of the accuracy and integrity of the Internet-based time services, and that the transition would not affect the traceability of the distributed time signals to national and international standards.

We see several clear advantages to migrate NIST time services to a commercial partner, not the least of which is to reduce NIST/Public expenses in running and upgrading the existing/aging time distribution systems. Upgrading the existing system would improve the time distribution accuracy and reliability over what is in operation by NIST today. Relieving NIST of the time distribution aspects would allow NIST to focus efforts on improving UTC(NIST) and not efforts in widely distributing it to consumers. The migration of time services also moves with it the traceability burden-of-proof to UTC(NIST) from NIST to the partner(s) responsible for distributing UTC(NIST). The NIST role would become similar to that of the calibration services as mentioned above. Finally, a commercial partner(s) may be better positioned to be able to provide time services not currently offered or planned by NIST.



There are also a number of disadvantages in releasing control of the distribution of the national time. There will likely be an effort and expense related to adequate time monitoring of the private sector(s) clocks. There may also be aspects of overcoming a public trust issue in NIST sponsoring third party(s) to distribute UTC(NIST) rather than providing the time directly. Concerns over accuracy, reliability, security and the motivation to provide a “quality” free service that is critical to so many network operations across US industry may also arise. Lastly, there will likely be questions of will the public be better off as privatization of public services can sometimes cost the consumer more.

8. What other considerations should be important in the design of the time services?

No additional comments.



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