DISCUSSION CONCLUDING AAS 13-503

YASUHIRO KOYAMA referred to *timestamp authorities* throughout his presentation; STEVE ALLEN asked "what is the business of a timestamp authority" in Japan? KOYAMA replied that timestamp authorities are trying to create business in many areas. One of the best customers is hospitals keeping medical records; hospitals want to make their records secure by using certified timestamps to track changes to a document, so a user can prove that a document has not been changed after a certain amount of time. This would make it impossible for hospital personnel to alter medical records to increase their credibility. Also, if someone from the general public invents something, then it is possible to certify the time when the patent application was filed.

HARLAN STENN asked if NICT acted as the timestamp authority, or if commercial companies acted as timestamp authorities in Japan. KOYAMA responded that commercial companies are the timestamp authorities, where NICT is acting as a national metrological institute that provides stability to the timestamps. JIM KIESSLING said it was unclear why timestamp authority is necessary for basic data-certification purposes; a digital checksum on the data should be able determine whether an electronic record has been modified, regardless of whether the timestamp is being applied. KOYAMA noted that a checksum will indeed indicate if a record had been changed after the checksum had been created, but the primary timestamping issue is to certify when the last modification took place; the time that a checksum is written would need to be proved absolutely. ALLEN summarized the concern as "What did you know, and when did you know it?" MARTIN BURNICKI added that it may be important to know whether a contract was modified after it was effective.

KIESSLING found it odd that timestamping would be sold as a commercial product. STENN responded that "legally traceable time is a good thing, because you can sue people" over timestamps if they can be legally proved. KIESSLING therefore wondered how a commercial service provides timestamps with proven integrity. STENN responded that customers are only willing to pay for such a service if the service provider is able to prove why a timestamp is correct when it was taken.

ROB SEAMAN observed that these timestamping authorities desire to avoid going offline, yet they *choose* to go offline to avoid leap seconds, even though different solutions could have been chosen. STENN agreed, adding that these services could use a timestamp based on the Global Positioning System (GPS) and never worry. KOYAMA replied that these services maintain their own techniques which can operate until right before the leap second and also change immediately after leap testing, but it is their own definition. KIESSLING wondered if their commercial fee structure causes them to be strongly against alternative sources for time, such as GPS.

GEORGE KAPLAN observed that the first question of the survey was whether there were any problems associated with the leap second, and it appeared that 21% responded "No." Among the users who responded to that survey question, KAPLAN asked if there was a distinct difference between the people who answered "Yes" versus "No"? KOYAMA said KAPLAN's question was a good one, but he was unable to recall that level of detail. Rather, it was his impression that the people who wanted changes to Coordinated Universal Time (UTC) are from the timestamping system.

DENNIS MCCARTHY said it was important to understand that the leap second can occur in the middle of a busy commercial day in Asia. The type of timestamping discussed by KOYAMA is important for financial transactions, and if the leap second occurs on, say, June 30th, it could occur during a time when business traffic is high, unlike a holiday at the end of the year. KOYAMA added that midnight UTC is 9 o'clock in the morning in Japanese local time.

SEAMAN was entertained by KOYAMA's movie of the public anticipating the appearance of a leap second on NICT's public digital clock display, and asked how many people were in the crowd. KOYAMA replied that about 300 people attended the display in 2012, but the event was also recorded and broadcast through news programs, thus "a lot of people saw it." SEAMAN suggested that this seemed to be one of those circumstances where "you should be careful what you wish for." Do the people who want to redefine UTC really want timekeeping to become invisible in the culture? Is it really a good thing for time authorities to no longer have such visibility with the public? KOYAMA replied that there are two sides to that issue: the leap second gives public-relations visibility to NICT, but such visibility makes authorities nervous about getting the leap second wrong.

JOHN SEAGO asked how many responses were represented by the survey results: was it dozens, or hundreds, or thousands? KOYAMA replied "less than a hundred but more than ten;" fifty was conjectured to be a representative number, but KOYAMA supposed the specifics were recorded in the paper. KEVIN BIRTH wondered about how the survey responses were solicited: who was given a survey and who decided to take the survey? KOYAMA replied that because NICT participates in the ITU-R, ITU-R invites responses to the study issue. BIRTH clarified that he wanted to know who heard about the survey conducted by NICT. KOYAMA replied that NICT sent out a questionnaire "to as many people as possible" whom they thought would participate, but it was essentially NICT's own. When BIRTH concluded that it appeared there was no specific sampling strategy for conducting the questionnaire, KOYAMA replied that NICT wanted input from all of the community, but he was unsure that all of the community was reached. KIESSLING said that it appeared the sampling strategy targeted those that NICT perceived as its own users.