Chapter 38 of the Society of Broadcast Engineers
SBE
EL PASO - LAS CRUCES - JUAREZ

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NEWS

TIMING AND SYNC: AN EPIC ON EPOCHS

WES SIMPSON /05.18.2015 10:00 AM

SMPTE recently published two new standards about timing and synchronization that are poised to have a significant impact on the way timing is handled for devices in professional broadcast applications. The basic idea is that each device can generate an accurate clock that is frequency- and phase-aligned to other devices in the network, eliminating the need for a "house clock" or "genlock" sync signal distribution system. This helps simplify the cabling needed to support cameras that are spread around a venue while still allowing them to have frame-accurate time-codes and synchronized video and audio recording and outputs. All that is required is a (very) accurate time reference at each location.

DEFINED PROFILE

The key underlying technology is IEEE- 1588 Precision Time Protocol, which enables an Ethernet network to distribute a highly accurate clock across a local area network. The basic technology of IEEE-1588 was described in my column in the Sept. 3, 2014 issue ("Using IEEE 1588 PTP in Video Networks"). Nodes must be synchronized to an accuracy of better than 1 microsecond, which is perfect for today's digital studio applications.

Because IEEE-1588 defines a broad range of features and capabilities, the standard requires a profile to be defined for each application space to allow interoperability between devices. SMPTE has done just that, with the release of ST 2059-2:2015 "SMPTE Profile for use of IEEE-1588 Precision Time Protocol in Professional Broadcast Applications." New products that support 2059-2 clocking will be coming on the market in the near future.

What's an epoch, and why do we need one? In order to tell time, you need two things: a working clock, and a reference for setting the clock. For many of us, the local time zone is an adequate reference point (mobile phones are actually pretty accurate timepieces). However, in order to achieve the level of accuracy needed to genlock a group of cameras or microphones, a much more accurate time reference is needed.

This is the purpose of an "epoch," which is a (very) specific point in time that can serve as a common time reference for multiple signals. The SMPTE standard ST 2059- 1:2015 "Generation and Alignment of Interface Signals to the SMPTE Epoch" provides this reference point, which happens to be precisely 1970-01-01T00:00:00 TAI.

So it's reasonable to ask "Why all this precision?" The answer is that with an epoch, it becomes possible to calculate the phase of any periodic signal that can be referenced to that epoch. So, by defining the phase of various common video and audio signals to a common reference point or epoch, it becomes possible to figure out the phase of that signal at any other point in time.

This in turn allows each device to align itself to a common, aligned reference simply by knowing the (precise) current time, as referenced to a common epoch. Fig. 1 shows a network made up of multiple devices that all share a common clock using PTP derived from GPS. Using this clock, each device can be referenced to the SMPTE epoch, and hence to each other, without any need for an overlay clock distribution network.

Contrast this with a traditional setup, which would have required separate sync distribution paths for each type of video and another one for audio. Clearly, the PTP-based solution is much simpler.

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OTHER EPOCHS AND LEAP SECONDS

The SMPTE epoch is identical to the one used for IEEE-1588, which is referenced to the TAI (International Atomic Time) epoch used by labs worldwide with the most accurate atomic clocks. Another epoch that is commonly used is the Global Positioning System epoch, which is 0000 UT (midnight) on Jan. 6, 1980, and is offset from TAI by a constant 19 seconds.

The epoch used for Coordinated Universal Time (UTC) is closely related to TAI, except that the epoch for UTC is 1972-01-01T00:00:00Z, or exactly 63,072,010 seconds later than the SMPTE epoch. The Network Time Protocol (NTP) is also based on UTC. The difference between UTC and SMPTE/PTP time is not fixed; it changes every time a leap second occurs.

Leap seconds are used to match a clock to the speed of the Earth's rotation. A normal day is 86,400 seconds (60 x 60 x 24), but in reality, it takes the Earth an extra millisecond or so to complete a full revolution. The amount of deviation isn't constant— some days the Earth revolves faster and other days slower, depending on the season, earthquakes and a host of other natural processes.

Adjusting for leap seconds can cause headaches for different applications, so the SMPTE system does not use them. Instead, the clock used for measuring time from the SMPTE epoch increases linearly, with no leap seconds added.

UTC takes a different approach, and adds leap seconds whenever they are needed by designating a single day to last 86,401 seconds. The next leap second will occur at midnight UTC between June 30 and July 1, 2015. Before this date, the difference between TAI time and UTC is 35 seconds, and after this date it will be 36 seconds.

Over time, as more devices adopt these new standards, it will become much easier to synchronize clocks for video, audio and any other function in the studio. This could be an example of using time to save time.

Wes Simpson has recently developed classes for both IEEE BTS and SMPTE on IP Video as used in broadcast applications. Comments and questions are most welcome at: wes.simpson@gmail.com.

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EL PASO, TX SBE CHAPTER 38 MEETING MINUTE

DATE 5/12/2015 LOCATION: "EL ARRIERO" MEX.BUFT

MEETING CALLED TO ORDER: 12:35 PM, BY ANTONIO CASTRO, THERE WERE 7 MEMBERS.

REPORT OF THE SECRETARY: MINUTES IN THE APRIL NEWSLETTER. ACCEPTED BY NORBERT MILES, SECOND BY CARLOS SOSA.

REPORT OF THE TREASURER: $ 9,905.93 IN THE BANK. ACCEPTED BY BRUNO CRUZ, SECOND BY OZZIE CARRILLO.

REPORT OF THE CERTIFICATION COMMITTEE: WAITING FOR TWO CTO FOR EXAM.

REPORT OF THE MEMBERSHIP COMMITTEE: NO REPORT.

REPORT OF THE FREQUENCY COORDINATOR COMMITTEE: NO REPORT

REPORT OF THE SCHOLARSHIP COMMITTEE: SENT INFORMATION TO SOME SCHOOLS ANS SPREAD THE VOICE AT OTHER LOCAL MEETINGS.

REPORT OF THE WEBSITE COMMITTEE: 1857 HITS LAST TIME, NOW 1879. (22). UPDATED THE SCHOLARSHIP APLICATION INFORMATION.

REPORT OF THE EAS CHAIRMAN: NO REPORT.

REPORT OF THE PROGRAM COMMITTEE: INVITATION FROM SPONSOR TO LUNCH AT THE STATE LINE ON MAY 28.

UNFINISHED BUSINESS: NONE.

NEW BUSINESS OR ANY ITEMS FOR THE CHAPTER INTERES: THE ENNES WORKSHOP TO BE HELD THIS COMING MAY 29.

NEXT MEETING DATE AND LOCATION: TUESDAY, JUNE 9TH 2015, AT NOON @ COMO'S ITALIAN RESTAURANT
MEETING ADJOURNED: AT 13:02:00 PM.

The final vote for the ENGINEER OF THE YEAR 2015 is on or before June 9 mid day. Elect only ONE engineer from the list of 6 NATIONAL members. Ballots to follow this week.
We count with your participation.

JUNE PROGRAM

There was no presentation for last month of MAY, just our regular meeting, held at the Mexican restaurant "El Arriero"

But in May 29, we had our fourth ENNES WORKSHOP !!!. There were 32 attendants and the program sessions were very informative and educational. It will be very interesting to know the Reviews.

We thank SBE national and their Education Department for their professionalism, dedication and support.

Kristin Owens, Wayne Pecena, John Bisset and Jeff Holdenrid made an excellent impression, and for that we say TANK YOU !!

For June, we have not a presentation, only our regular meeting and EOTY election time. Please bring your input comments about ENNES WORKSHOP.

See you at CARINOS Italian rest. Next Tuesday at NOON !!!