Ask the expert - Gerard Phillips
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Gerard Phillips, leading expert in broadcast IP and subject matter expert in media and entertainment, explains how to use PTP in a hybrid SDI/IP environment.

Q1 Hybrid SDI/IP environments are becoming more commonly used now.   How does a user manage genlock in a hybrid environment?

A1 In SDI environments, there would traditionally be bi-syncs or tri-sync, the Black and Burst (B&B) signal. Devices synchronise frames and lines so the studio is all lined-up. For 59Hz and 50Hz studios there would be different signals. For applications such as lines-in or lines-out, maybe sports productions, where there are standards converters, you would need both of those references.

In the IP world, it's all asynchronous, so getting accurate time is quite a different task. The time arrives over an asynchronous ethernet connection. IEEE-1588v2 defines Precision Time Protocol (PTP). PTP is a mechanism whereby you can obtain accurate lock to a very accurate clock at an end point using only asynchronous ethernet. That can give you a time lock which is accurate to +/- 500 ns (ST.2059-2).

Thus endpoints can be locked to a global reference, GPS for example, to +/- 500ns. SDI devices can be locked to B&B if you need that level of accuracy for SDI generation. In the IP world you don't need the same level of accuracy, but +/- 500 ns is a high level of accuracy.

You want a single source of that time, so many architectures will have a pair of PTP Grandmasters which will create PTP time, and from that PTP time, specifically designed master sync devices will take the PTP and from that create the station's B&B.

Q2 If I've got a product which supports both SDI and IP, can I lock the SDI output to the PTP clock?

A2 You can create SDI from PTP. If you need really accurate for clean cut RP-168, run B&B to those devices. In general, you can run an entire TV station off PTP. This reduces the amount of copper in the system. Instead of miles of cable run to every end point to give it B&B, now it's integral to the data stream as PTP in the media network.

Q3 In frame rate conversion products, we can often find a situation where a user is converting from let's say 59 to 50. They'll be using a 59Hz reference with a 50Hz output signal. Is there an equivalent in the IP world? Can PTP handle this type of use case?

A3 Think of PTP differently to B&B. B&B gives you a really good frequency lock and a really good phase lock, but the phase is an instantaneous lock and doesn't contain any time data, unless you choose to encode Timecode into B&B.

The messages in PTP describe the number of nanoseconds since the epoch (midnight on 1 Jan 1970). The number at your end point is the number of nanoseconds from the epoch, so you can lock frequency and phase but also time, so there is a known time stamp in PTP space for every conceivable video frame.

Therefore for the 50Hz and the 59Hz streams, you can project back to there being a frame that starts with a time stamp (camera capture point) at PTP time zero (midnight 1 Jan 1970). Then work your way forwards from there. The standards converter knows at what point it must make a new frame. The number will be based off 2059-1. Therefore you can operate in the same way as you did with SDI references.

You still use the data coming in as your source time references. They will have RTP time stamps which are derived from PTP time. They don't carry the full resolution but they're accurate to 12 hours so if you have wall clock time you can determine exactly when they were captured. You can then use your internal PTP time stamps, which you are creating based off the PTP you are receiving, running your clocks which tell you exactly when to make a new frame.

Exactly the same methods as you did with B&B, except that there's a standardised grid on which every output should exist.

To learn more, have a look at these webinar recordings and the Arista PTP white paper:

3 part series:

- PTP Overview
  https://youtu.be/7ADhoEa4ylA
- Best Practices and Architectures
  https://youtu.be/HTX3-UmRubg
- Commissioning and Troubleshooting
  https://youtu.be/tTGZMLpXozg

AIMS IP Oktoberfest Presentations:
PTP/ST 2059 Best Practices Developed from PTP Deployments and Experiences
https://www.youtube.com/watch?v=izJe1rnpaKc&feature=emb_logo

The Arista PTP white paper:
https://www.arista.com/assets/data/pdf/Whitepapers/ME-PTP-White-Paper.pdf

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