JIVE Uniboard Correlator Memo 9: VDIF epochs and leap seconds

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1   Introduction

The vdif standard[1] splits time across two fields: a 30-bit field for seconds from a reference epoch, and a 6-bit field for the reference epoch in use. The reference epochs are defined as midnight (UTC) every six months from 1 January 2000, so they are on either 1 January or 1 July on any year since.

While it is possible that the EVN may make a recommendation of a single epoch for all member stations it is equally possible that it may not; it is even conceivable that a possible recommendation might not be acted on in all cases. This document describes a proposed mechanism to allow the JUC to correlate vdif data streams from different sources with different epochs.

2   Why it is hard

The seconds from reference epoch field counts all seconds from the epoch, including leap seconds. Unix (or Posix) time handles leap seconds differently – roughly, they are not included in the global time counter except while they are happening. (So that some Unix *time_t* values are used twice.)

To translate between vdif reference epochs we need to know how many seconds there are between them – including leap seconds – and this cannot be found out with standard Posix tools.

The IANA time zone database[2] (also known as the TZ database and widely used in Unix systems) does include leap-second information (in the `leapsecond` file), so we propose to use that to calculate epoch offsets in seconds.

3   Offline processing

A python script (`ccs/scripts/epoch.py` has been written to read the TZ database of leap seconds and to calculate the interval in seconds between successive vdif epochs. This is then written out in a form that Erlang code can consult, and an Erlang module for translating between epochs has been written.

Note that the notification time for addition of leap seconds to UTC is as little as three months, so we will need to poll the TZ database regularly – monthly seems like a good choice.

4 JUC processing

The correlator will need to be augmented to allow the setting of a reference epoch for a correlation job, and for loading of the epoch-second-offset table. (And to use these in correlation, of course.)

5 Conclusions

Posix time is basically broken. Leap seconds make things hard, but do not make anything we want to do impossible.

References

[1] *VLBI Data Interchange Format (VDIF) Specification* Release 1.0, 29 May 2009

[2] Time Zone Database `http://www.iana.org/time-zones`