**CCSDS Time BoF Meeting Notes**

Nov 20 2018

Attendees: Scott Reeves, Victor Sank, John Hamkins, Peter Shames, David Berry, Gian Paolo Calzolari, Sinda Meijri, Erika Sanchez, Lee Pitts

1. Discussion on definitions of terms (from draft Charter)
   1. Clock correlation - a method by which we relate the reading on a remote clock with the “master timing source” (i.e. UTC, continuous time scales)
   2. Clock synchronization - a method of adjusting the remote clock/or the clocks frequency source to maintain its integrated time within an acceptable tolerance to the master clock source.
   3. Coordinated time - time keeping that considers relativity (i.e. Barycentric Dynamical Time)
2. Alternative definitions of terms (from IOAG Service Catalog 2)
   1. Time transfer - ”**time transfer**” is performed by exchanging time data formatted according to some agreed ”**time code**”
   2. Time correlation – ”**clock correlation**” uses the data exchanged by ”**time transfer**” in order to determine the offset between the clocks at the sending and receiving ends.

NOTE - Clock correlation does not imply alignment of clocks, but it may require knowledge of clock stability, skew, and drift and most importantly the propagation delay induced by the signal path(s) involved in the time transfer. Clock correlation may also involve comparison of local clock times to some standard high precision clock that accurately reflects a common timescale such as UTC.

* 1. Time Synchronization - supports aligning clocks to a common timescale, such

as UTC and it requires both *clock correlation* and *time transfer* be performed.

1. Time Synchronization is sometimes referred to as “NTP for space”. This implies some sort of (nominally “local”) time servers and a protocol to subscribe to one or more of the servers, maintain clock drift, and provide means to sync its own clock to the server
2. At present CCSDS has Time Code Format, which is a stand-alone data format spec, and an optional use of it in the first field of the packet secondary header as a way to exchange time stamps. A number of missions have adopted this to do Time Transfer, but it is not in universal use.
3. Reviewed parts of the draft BoF Charter doc and made some edits, as follows:
   1. Documents are to be set up as separate (but related) pieces so that they can be layered, some missions may choose to only implement Time Correlation, or Time transfer, not all missions may want to implement Time Synchronization
   2. Transfer of Time Information BB, formal interoperable, standard
   3. Time Correlation MB, a recommended practice re how to perform time correlation. This is algorithmic in nature and different types of missions may have different constraints. Perhaps we can identify one, or a few, methods and make these optional in a Blue Book.
   4. Time Synchronization BB for space networks, or “Space NTP”, a protocol spec with associated behavior.
   5. Suggestion that we start with Time Correlation Green Book, move to Time Transfer and Correlation Blue/Magenta, and then Time Synchronization BB.
   6. Time Synchronization needs to involve the SIS area and experts in protocols like NTP as well as SLS area and space operations.
4. ACTION ITEMS for next meeting:
   1. Everyone identify and provide their local agency, center, or community definitions and implementation methods for time transfer, time correlation, time synchronization, time management, clock, time, time stamp
   2. Review the NASA NASA Architecture for Solar System Time Synchronization and

Dissemination: Concept of Operations, “COO for Time” document on CWE. In <https://cwe.ccsds.org/sea/docs/Forms/AllItems.aspx?RootFolder=%2Fsea%2Fdocs%2FSEA%2DTIME%2FReference%20Materials&FolderCTID=0x012000F83FD93BEFF45E4FB5D1769B01CA762F&View=%7BA709F322%2D0E67%2D45C7%2D932D%2DCB78C55CE268%7D>

* 1. Peter S.- Send out Doodle for next meeting in Dec