

# **SOLS Synchronization Service and SpW-RT**

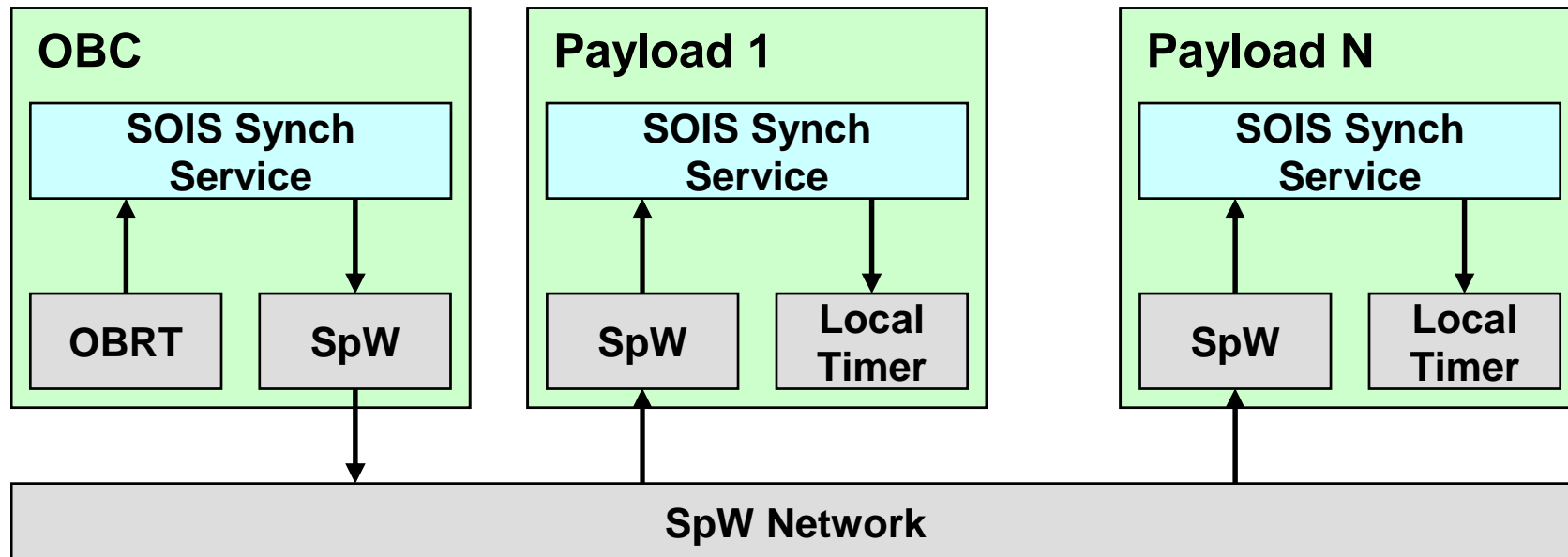
SpaceWire WG Meeting 14  
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# SOIS Synchronization Service

## SOIS Synchronization Service:

- Reception of onboard time across the sub-network.
- Notification of events to the sub-network users.
- The service assumes an OnBoard Reference Time master (normally the **OBC**) which enables time distribution to the users on the sub-network:
  - The value of the onboard elapsed time.
  - The synchronization pulse (PPS) to latch in users local timers the previously distributed elapsed time.
  - A mechanism for event transmission and reception
- *Note that all SOIS subnetwork specs are now published and available for download from the CCSDS web site*

# System context



# Synch Service in SpW Network Context

## Assumptions:

- a. The SpaceWire network master has access to the OBRT without degradation in the onboard time precision and resolution.

## Requirements:

1. Elapsed time shall be broadcasted to the SpW network users.
2. Elapsed time shall be in CCSDS Unsegmented Time Code (CUC) format.
3. Synchronization pulse shall be broadcast to the SpW network users with less than  $S\_MAX$   $\mu\text{sec}$  latency.
4. Time event messages shall be distributed to the requesting SpW network users with less than  $E\_MAX$   $\mu\text{sec}$  latency.
5. Synchronization pulse and time events shall be generated synchronously with the network schedule (when present).

# Synch Service and SpW-RT

**Need to identify mechanisms to implement the service in an efficient way**

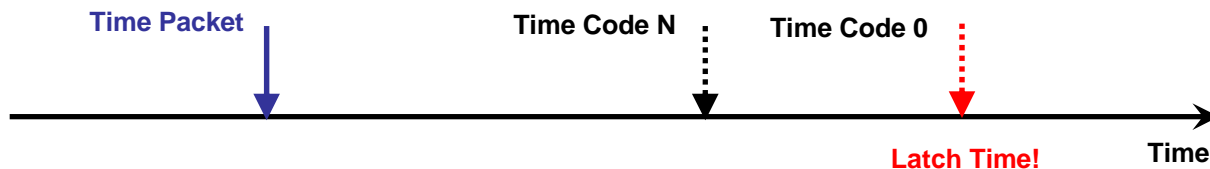
## **Open points for discussion:**

1. Mechanism to mimic broadcast to be analysed for SpW-RT.
2. Use of time-code as synchronization pulse (better if with a frequency of 1Hz).
3. Jitter associated with the SpaceWire network topology.
4. How are other events signalled?

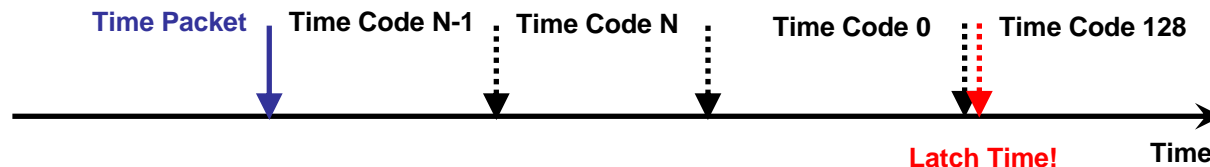
# SpW-RT and Synch Pulse (1/2)

## Options:

1. Latch time on time-code 0 occurrence.
2. Latch time every M time-code 0 occurrences.
3. Latch time on the time-code 0 occurrence right after time packet reception.

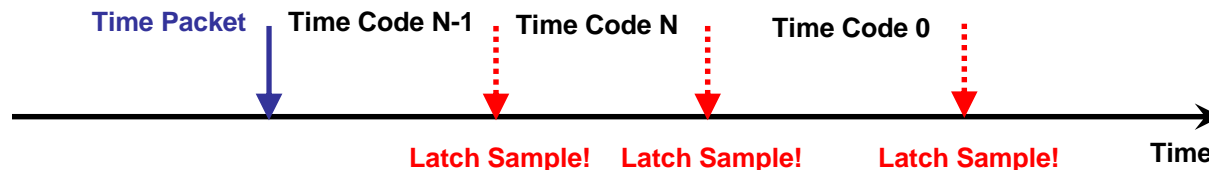


4. To use one of the spare/reserved bits in the time-code format as PPS and/or other time event message codes.



## SpW-RT and Synch Pulse (2/2)

- Time correction is applied continuously on the reception of every Time Code (e.g. using a digital filter).



*Options 1, 2, 3 are simple to implement but might have some drawbacks due to the Elapsed Time distribution mechanism.*

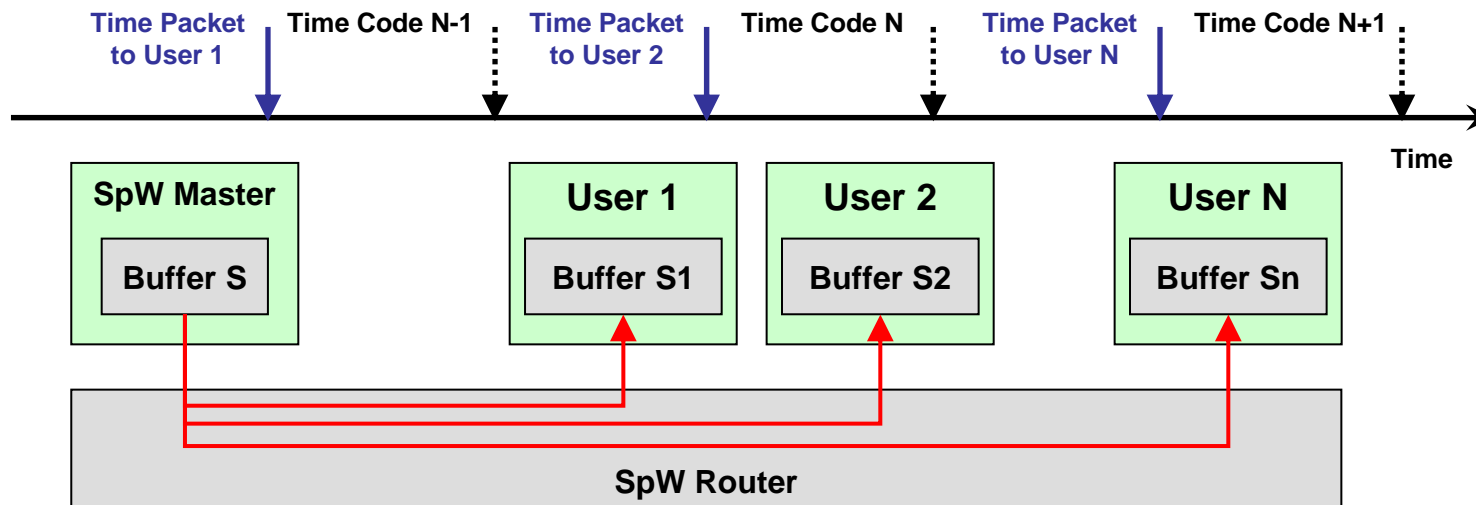
*Option 4/5 require changes in the SpW standard, thus not practical for the short term.*

*Option 5 is more complex for what concerns specification and implementation, but might cope better with SpW network peculiarities (jitter).*

# SpW-RT and “Broadcast ET” (1/3)

## Option A:

- To assign predefined channels between **network/OBRT master** and the network users.
- To reserve bandwidth within one or more slots for the transmission of the elapsed time.
- Network/OBRT master distributes the ET packets.

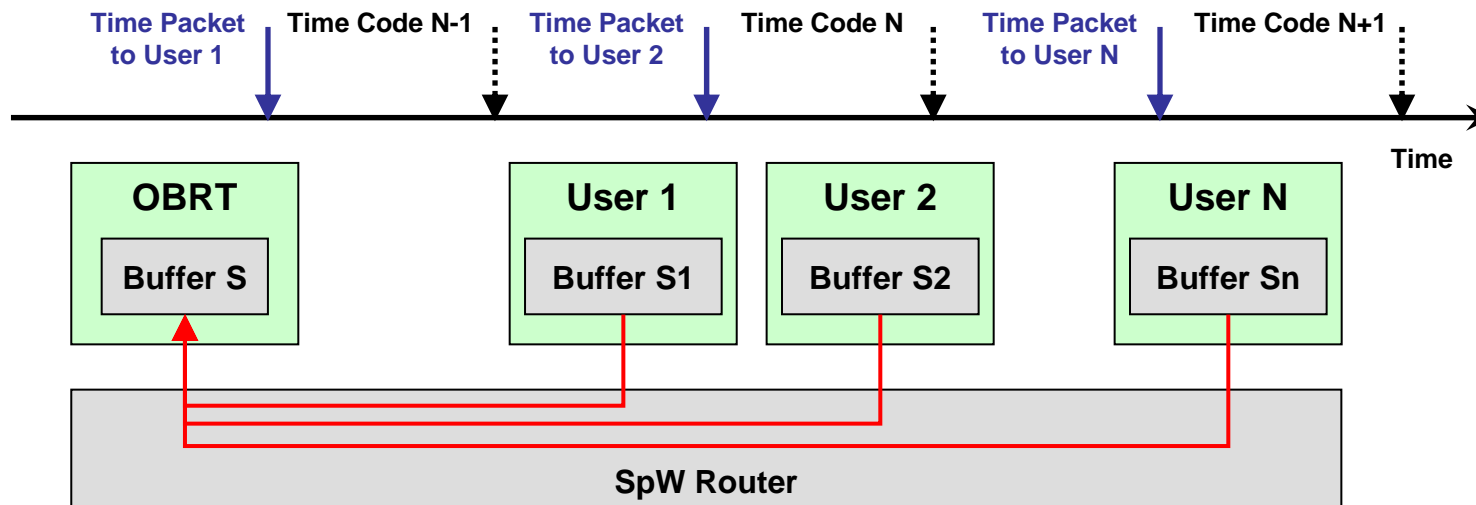




# SpW-RT and “Broadcast ET” (2/3)

## Option B:

- To assign predefined channels between **OBRT master** and the network users.
- To reserve bandwidth within one or more slots for the transmission of the elapsed time.
- Time users retrieve the ET value from the OBRT Master



## SpW-RT and “Broadcast ET” (3/3)

*Options A follows a conservative approach, management is centralized in the network master.*

*Option B follows a distributed approach, but it requires the specification and implementation of a time retrieval protocol (RMAP?) and predefined location on the OBRT master to allow the ET retrieval.*