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**MILCOM 2024**  
*PlugFest Europe*  
*DIFI 1.2.1 update*  
*Simon Swift – ETL Systems*

## Conclusions from PlugFest

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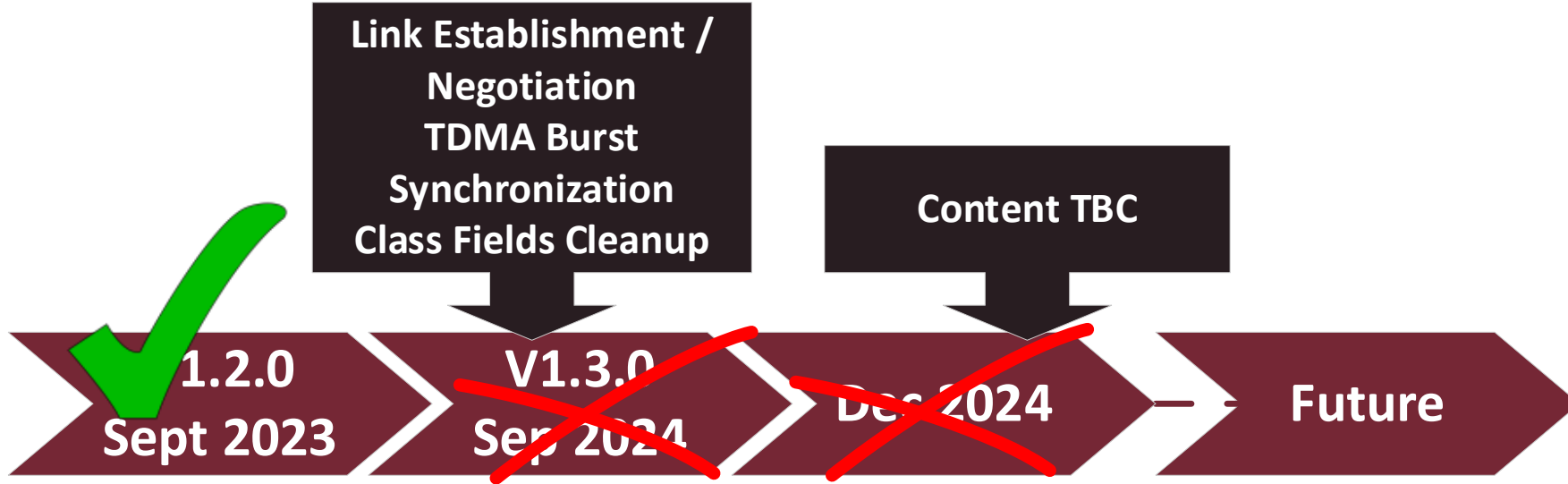
- PlugFest Europe was highly successful
- Benefitted from prior lessons learned
- Test case complexity and time will increase in proportion to the complexity of the specification
- Implementations of 1.2.0 information classes incomplete
  - Highlighted need for specification revision
- PlugFests should continue on an (roughly) annual basis
  - Suggest a 1-year gap between spec release and plugfest
  - 6 mths for minor releases?

## Learning from PlugFest

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- DIFI 1.2.0 introduced flow control
  - Along with associated information classes
- Vendors interpreted specification differently
  - It was realized that this was application dependent
- Concept of Use Cases employed
  - Along with recommended practices

# DIFI 1.2.1



## Synchronization use cases:

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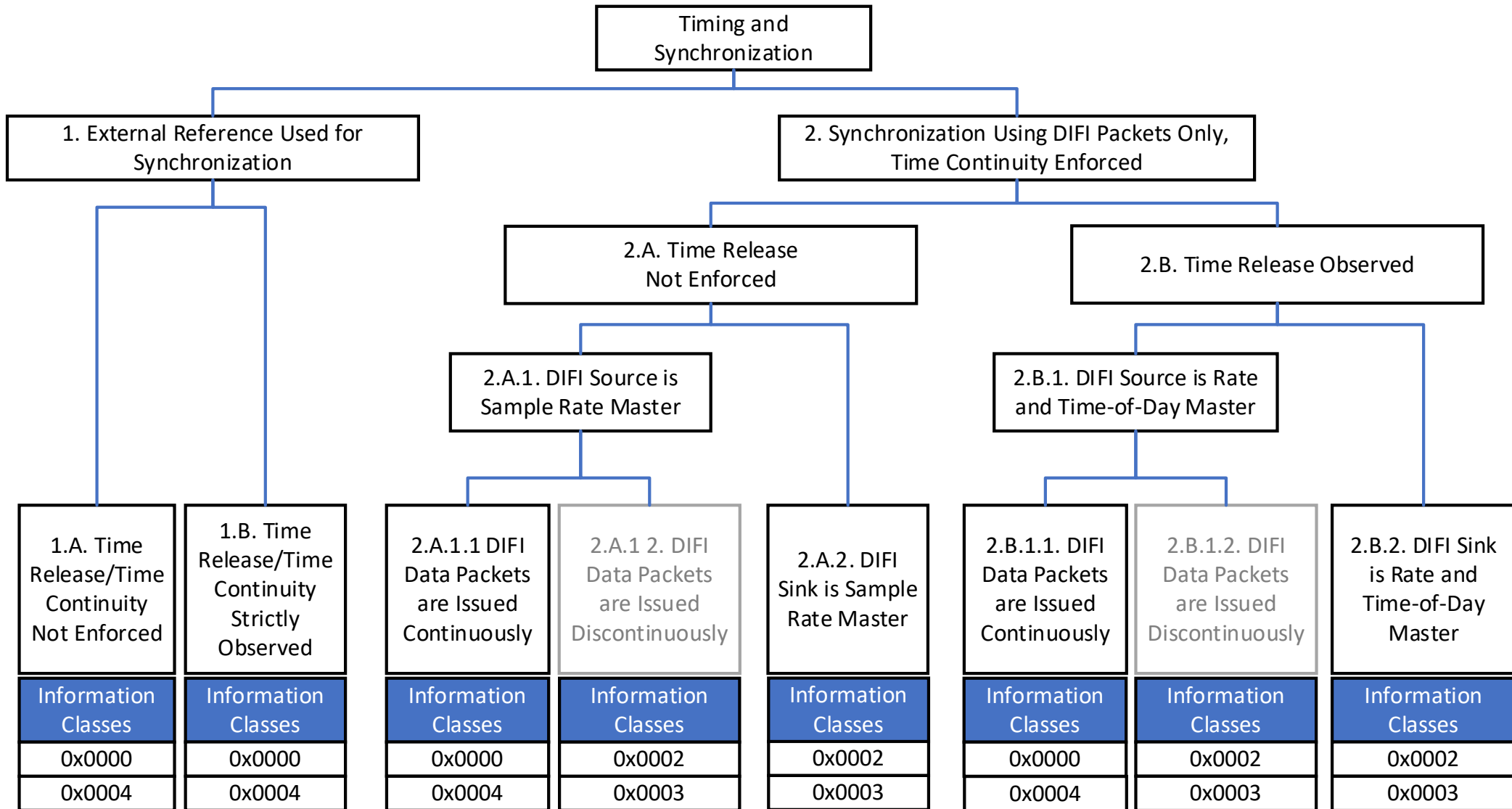
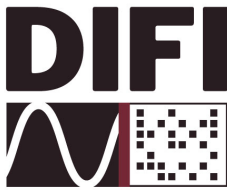
- A key question arose:
  - Does DIFI certified equipment need to do everything in the DIFI specification?
- Is there an external reference – GPS / IRIG / PTP etc?
- Are the real-time aspects of the timestamping important?
- Is the incoming data discontinuous or a constant stream?
- From a practical point of view, this comes down
  - Is flow control is needed or not?

# Synchronization – Important Concepts

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- Time Continuity (TC):
  - “Master Clock” for the system advances monotonically and with uniform increments,
  - simple arithmetic relationship between the clock increments and the sample period.
  - TC does NOT imply that the DIFI Source and Sink are synchronized to any external time of day reference
  - Transmitted samples not necessarily tied to any particular time of day
  - Timestamps may be disregarded by the Sink except for the purpose of Source/Sink synchronization.
- Timed Release (TR):
  - samples transmitted based on the timestamps on the Data Packets and the Sink’s clock.
  - DIFI timing master is aligned with some reference outside the Source or Sink.
  - approximately aligned with an “accurate” time-of-day reference
  - With TR, however, the issuance of samples from the Sink’s buffer to the DAC (on Tx) will be controlled by this external reference.
- Time-of-Day (TOD):
  - TR is observed; external timing reference is “accurate”, e.g., aligned with PPS or GPS/GNSS.

# DIFI 1.2.1



## DIFI 1.2.1

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- **1.A. External Reference, Time Release/Time Continuity Not Enforced;**
  - e.g. Rx digitization & transport of downlink from an EO satellite.
- **1.B. External Reference, Time Release/Time Continuity Strictly Enforced**
  - e.g. Rx digitization of ranging telemetry downlink.



## DIFI 1.2.1

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- **2.A.1.1 Synchronization Using DIFI Packets, Time Release Not Enforced, Source is Timing Master, Data Packets are Issued Continuously**
- e.g.: Tx from a h/w SCPC modem to IFC with only Ethernet connection between modem and IFC.
- **2.A.2 DIFI Sink is sample rate master**
- e.g.: Tx from a **S/W** SCPC modem to IFC with only Ethernet connection between modem and IFC.

## DIFI 1.2.1

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- **2.B.1.1 Synchronization Using DIFI Packets, Time Release Strictly Enforced, Source is Timing Master**
  - e.g.: Rx digitization of ranging telemetry downlink.
- **2.B.2 Synchronization Using DIFI Packets, Time Release Strictly Enforced, Sink is Timing Master;**
  - e.g. Tx transport of ranging telemetry uplink.
- **2.B.1.2 Synchronization Using DIFI Packets, Time Release Strictly Enforced, Source is Timing Master, Data Packets Issued Discontinuously**
  - e.g.: Tx direction transport of TDMA/MFTDMA data