



## ELECTRONICS COMMUNITY FORUM



# Synchronisation at ms and $\mu$ s level

(without dedicated WREN hardware)

# BACKGROUND

2022

## EF#6 Ethernet-based Fieldbuses for Custom Electronics

- SY-EPC: Custom raw-Ethernet protocol
- TE-MPE: Custom UDP protocol
- DI/OT: UDP/TCP CoAP protocol
- Note: FESA in SoC was not an option at that point

Electronics-forum #6: Ethernet Fieldbuses for Custom Electronics		
Wednesday 6 Jul 2022, 14:00 → 17:30 Europe/Zurich		
774/R-013 (CERN)		
Electronics Forum Conveners		
14:00	→ 14:05	<b>Introduction</b> 5m
Speakers: Evangelia Gousiou (CERN), Slawosz Uznanski (CERN)		
14:05	→ 14:25	<b>Overview of relevant network protocols and standards</b> 20m
Speaker: Maciej Marek Lipinski (CERN)		
14:25	→ 14:55	<b>Raw Ethernet session</b>
Conveners: Evangelia Gousiou (CERN), Slawosz Uznanski (CERN)		
14:25		<b>Raw Ethernet-based protocol in SY-EPC</b> 15m
Speaker: Raul Murillo Garcia (CERN)		
14:40		<b>RF over White Rabbit</b> 15m
Speaker: John Robert Gill		
14:55	→ 15:55	<b>Ethernet UDP session</b>
Conveners: Evangelia Gousiou (CERN), Slawosz Uznanski (CERN)		
14:55		<b>Custom Ethernet-based protocol over UDP for TE-MPE</b> 15m
Speaker: Tomasz Podzorny (CERN)		
15:10		<b>UDP communication protocols in SY-BI</b> 15m
Speaker: Hampus Sandberg (CERN)		
15:25		<b>Protocol for White Rabbit trigger distribution</b> 15m
Speaker: Dimitris Lampridis (CERN)		
15:40		<b>Ethernet UDP protocol for DI/OT</b> 15m
Speaker: Greg Daniluk (CERN)		
16:10	→ 17:10	<b>Ethernet TCP session</b>
Conveners: Evangelia Gousiou (CERN), Slawosz Uznanski (CERN)		
16:10		<b>Ethernet TCP protocols for DI/OT</b> 15m
Speaker: Greg Daniluk (CERN)		
16:25		<b>TCP protocols for SY-BI</b> 15m
Speaker: Hampus Sandberg (CERN)		
16:40		<b>S7 protocol (Siemens) and open-source implementation (Snap7)</b> 15m
Speaker: Léa Strobino (CERN)		
16:55		<b>Romulus TCP protocol for CROME project</b> 15m
Speaker: Hamza Boukabache (CERN)		
17:05	→ 17:30	<b>Round Table discussion</b> 25m



# BACKGROUND

2023



## Fieldbuses Survey Recommendations for custom electronics

- Rad-Tol environment → WorldFIP
- ns-level synchronisation → White Rabbit
- Wireless (future) → Wireless Task Force
- $\mu$ s-level synchronisation → Requests for centrally-supported, low-cost solution

# BACKGROUND

2023



## Fieldbuses Survey Recommendations for custom electronics

- Rad-Tol environment → WorldFIP
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- µs-level synchronisation → Requests for centrally-supported, low-cost solution

### Requirements

- Centrally supported
- Solution without dedicated hardware or IP-core; mostly SoC-based
- µs-level synchronization to UTC\*/TAI\*
- GMT data - available before their due time
- Example: different nodes shall react within  $\mu$ s upon a beam extraction event

\*UTC = Coordinated Universal Time

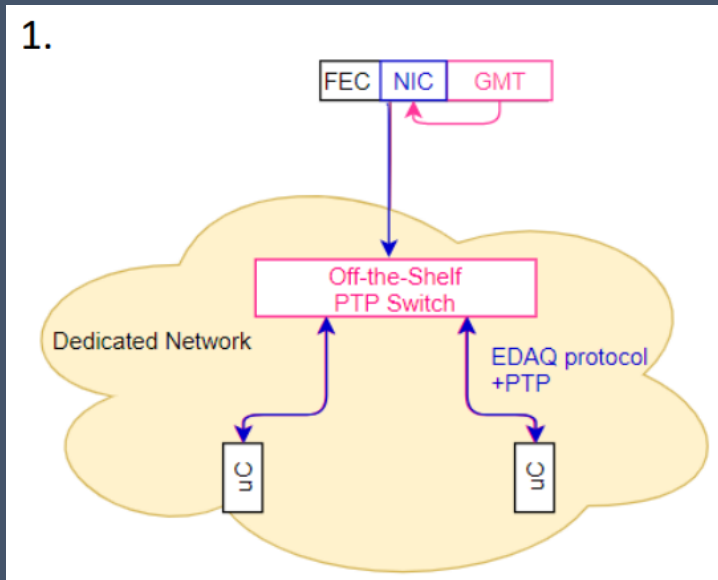
\*TAI = International Atomic Time



# μS-LEVEL SYNCHRONISATION

## Dedicated Network

- Examples: FGC-Ether, EDAQ
- Custom protocol behind a FEC
- Hard to centrally support

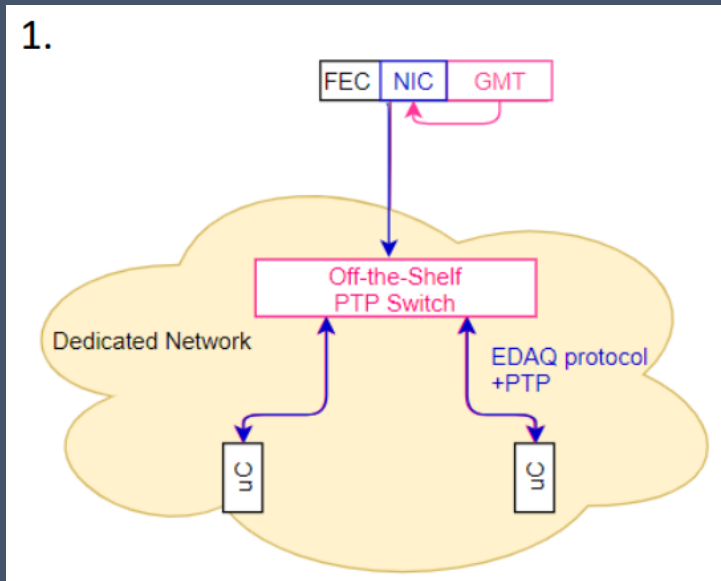




# μS-LEVEL SYNCHRONISATION

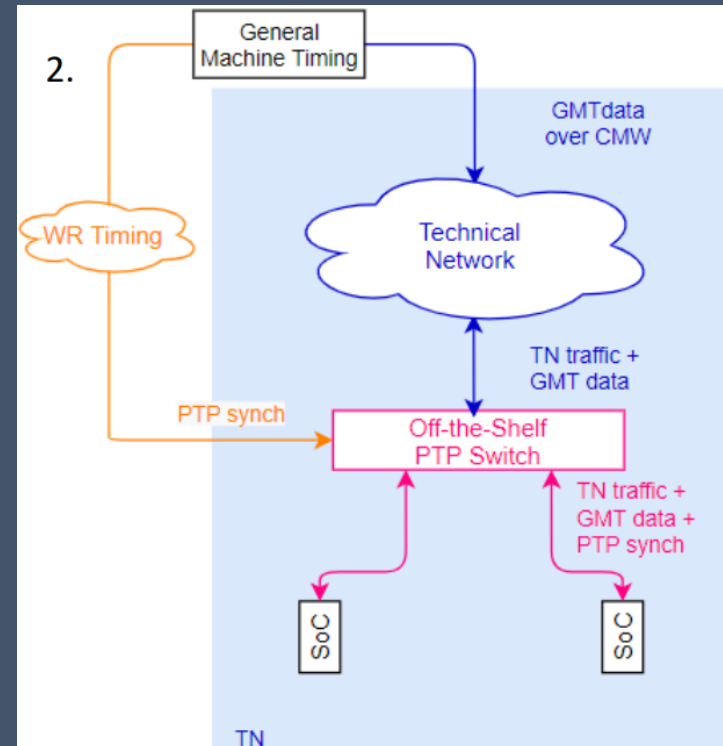
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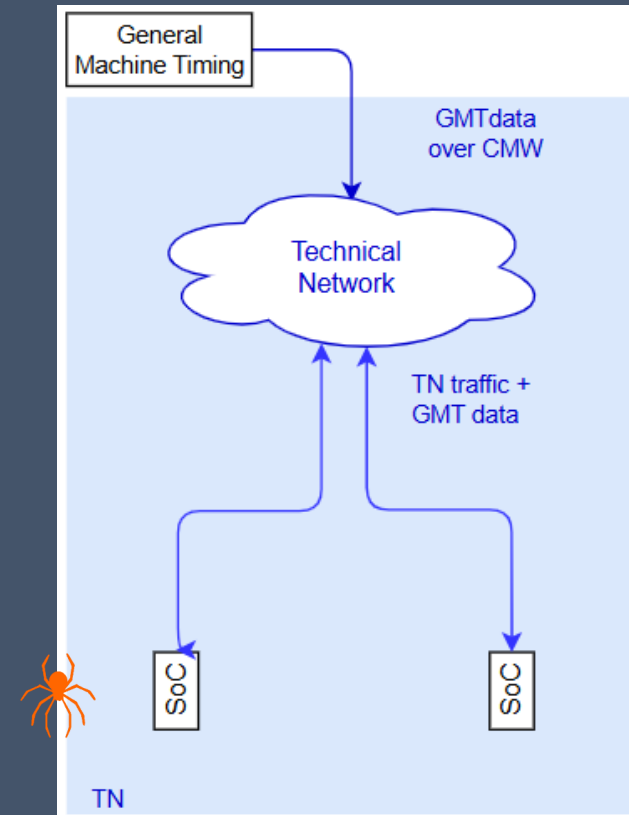
## TN

- With FESA on SoC
- GMT data through TN (scheduled SPS/LHC events available in advance)
- WRT Switch disciplines Off-the-Shelf-PTP TN Switch
- Potentially central support by CEM/CSS/IT



# mS-LEVEL SYNCHRONISATION

- Main requirement for SoC applications
- NTP\* and data from TN are enough; no need for PTP
- Solution already in support by IT (NTP) and planned-support by CSS (data)



# TODAY'S OBJECTIVES

Updates since the EF#6 and the 2023 Fieldbuses Survey

- on the individual developments of **equipment groups**
- on the centrally supported **services**

<b>14:10</b>	→ 14:25	<b>SoC/ SoM timing</b>	Speakers: Irene Degl'Innocenti (CERN), Manoel Barros Marin (CERN)	🕒 15m	✎
<b>14:25</b>	→ 14:40	<b>CEM/CSS/IT services</b>	Speakers: Grzegorz Kruk (CERN), Maciej Marek Lipinski (CERN)	🕒 15m	✎
<b>14:40</b>	→ 14:55	<b>MPE requirements and on-going projects</b>	Speaker: Dr Tomasz Podzorny (CERN)	🕒 15m	✎
<b>14:55</b>	→ 15:10	<b>EPC requirements and on-going projects</b>	Speakers: Adrian Byszuk (CERN), Valerio Nappi	🕒 15m	✎
<b>15:10</b>	→ 15:30	<b>Discussion &amp; Wrap-up</b>	Additional time for questions	🕒 20m	✎

→ Any identified **common need for central support** will be passed on to CTTB/ ATS-IT



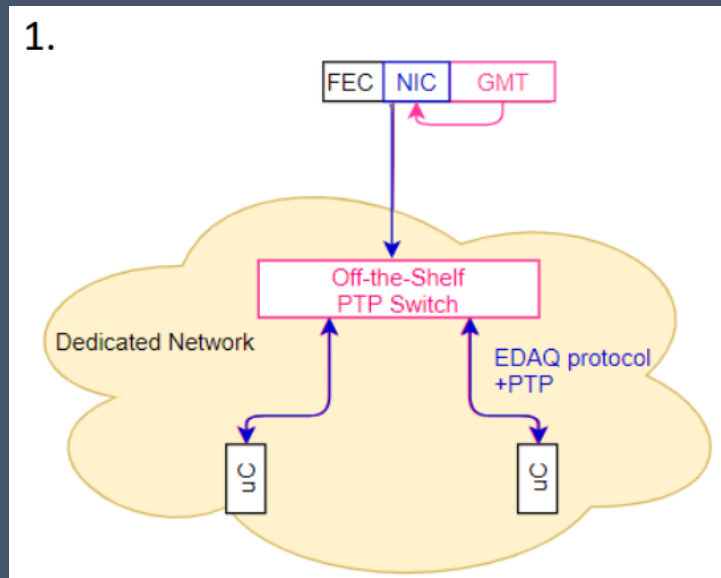
WRAP-UP



# WRAP-UP

- Do we need a common solution for us-level synch?
- Shall synch through the TN be centrally supported?
- Do we have an estimate of the number of nodes for a centrally-supported solution?
- When is this support needed?
- Shall non-SoC applications be covered?
- Shall non-SPS/LHC applications be covered?

Potential Users: FGCether, EDAQ, etc  
Potential Support: user-specific



Potential Users: SoC, DI/OT, etc  
Potential Support: CEM (WR), CSS (GMT), IT (TN, PTPswitch)

