



CAN @ Airbus

Overview of use of CAN bus at Airbus Defence and Space

DEFENCE AND SPACE

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AIRBUS

Agenda

Overview of use of CAN bus at Airbus Defence and Space

- Eurostar E3000 and Eurostar Neo Payload Serial Bus
 - Mission
 - Eurostar E3000 and Eurostar Neo implementation
 - Development status
- Eurostar Neo Platform Modules Communication Bus
 - Mission
 - Development status
- Other uses of CAN bus
- Developments Feedbacks

Eurostar E3000 and Eurostar Neo Telecom Payload Serial Bus

Payload Serial Bus

Aim and characteristics

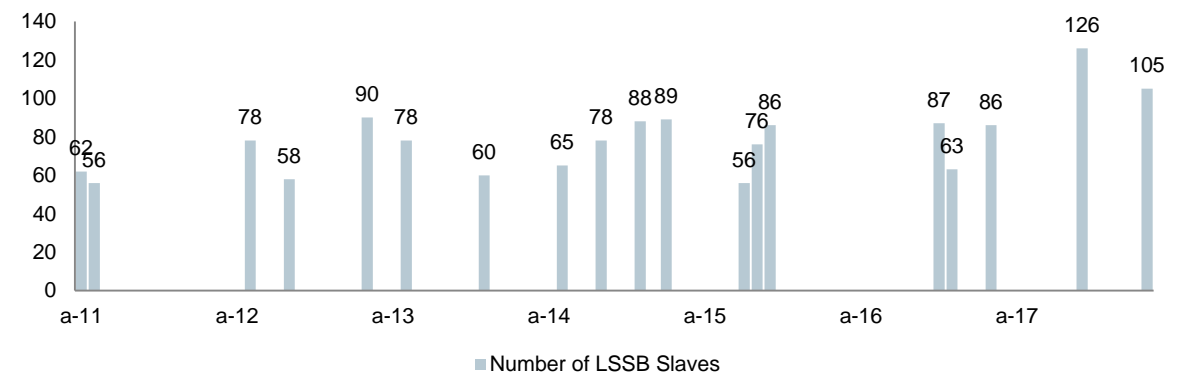
Telecom Payload Serial bus saves discrete TM/TC links and harness
 It brings improved commandability and observability of the repeater
 It gives efficient operability of the payload

During decades Airbus used proprietary serial bus : LSSB

With drawbacks : limited data rate and number of nodes, non optimized harness (5 pairs per bus), proprietary definition leading to specific development effort on suppliers side.

CAN bus is replacing LSSB :

- Improved data rate (250kb/sec),
- # node up to 64,
- single pair per bus,
- relying on established standard.



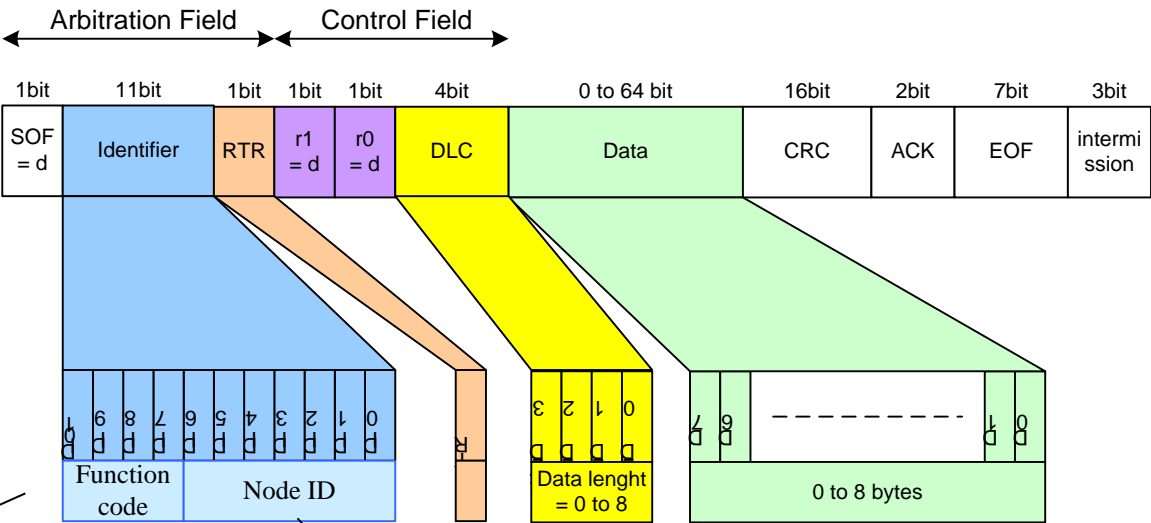
Payload Serial Bus

Higher Level Protocol

In the frame of Neosat and Artes 5.2 Protocol has been agreed with TAS, TESAT and Airbus DS

Master/Slave + Time Triggered

Message coding is CANopen



Master (PIU) -> Slave		Slave -> Master (PIU)	
PDO Label	Function Code	PDO Label	Function Code
RPDO1	bx0100	TPDO1	bx0011
RPDO2	bx0110	TPDO2	bx0101
RPDO3	bx1000	TPDO3	bx0111
RPDO4	bx1010	TPDO4	bx1001

Message type	Direction	PDO	Data	Comment
TM Request	Master -> Slave	RPDO1, 2, 3, 4	Optional	
Data Transmission	Slave -> Master	TPDO1, 2, 3, 4	Yes	Shall always be initiated by TMReq
Unconfirmed Command	Master -> Slave	RPDO1, 2, 3, 4	Optional	

Connector address


Payload Serial Bus

Bus Management

Slave implementation :

- Slave Nodes are CPU-less units
- Cost Driven \Rightarrow simplest implementation, simplest validation
 - No CPU added to manage CAN bus
 - Single CAN bus Controller with bus selection allowed in order to minimize Logic resources

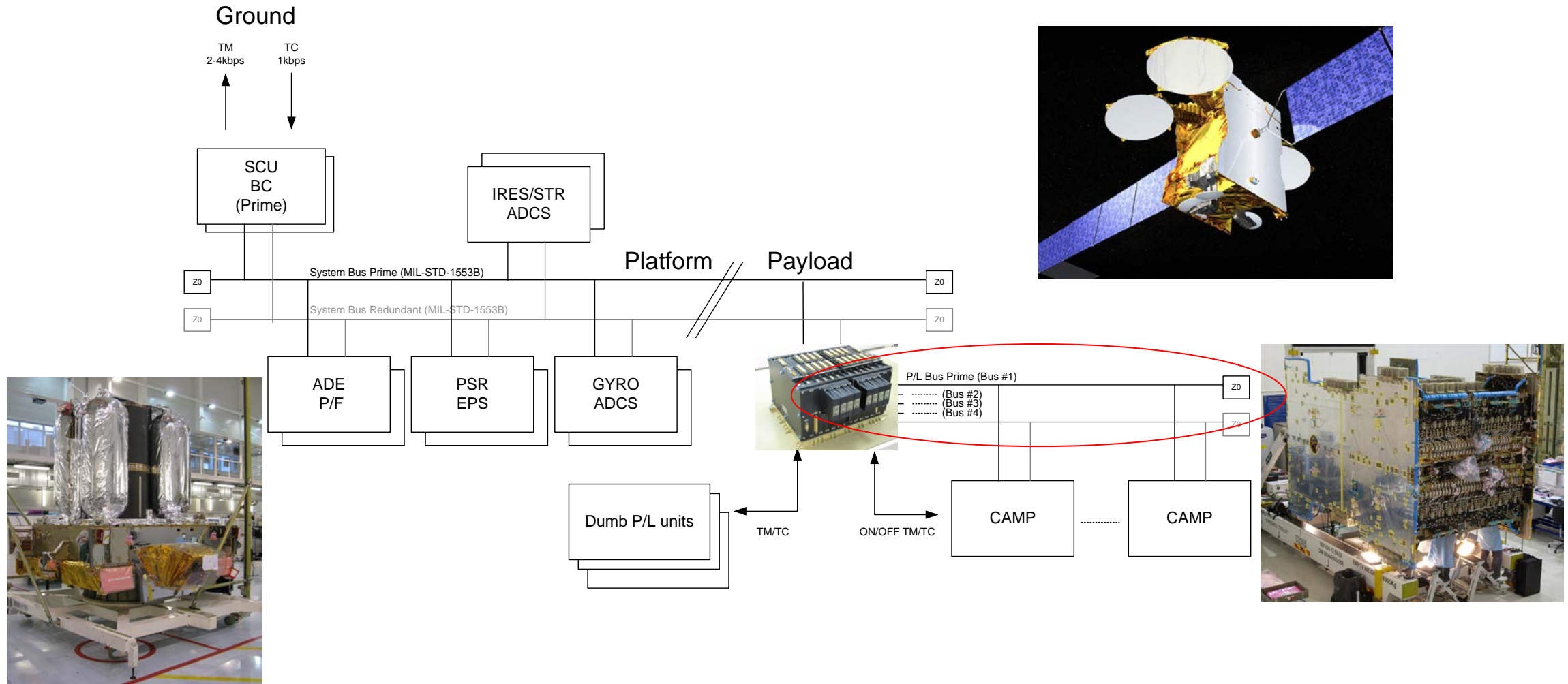
Master implementation :

- Master CAN bus manager is also hardware implemented
- Telemetry polling via frames :
 - Cyclic
 - Generic
 - Deterministic \Rightarrow Shrink Validation Time
- Slave Nodes send messages only on Master Request

Payload Serial Bus

Eurostar E3000 implementation

- P/L buses managed by PIU/RTU
- Decentralized management
- Minor and major deterministic frames
- P/L Data available every 1second for CSW



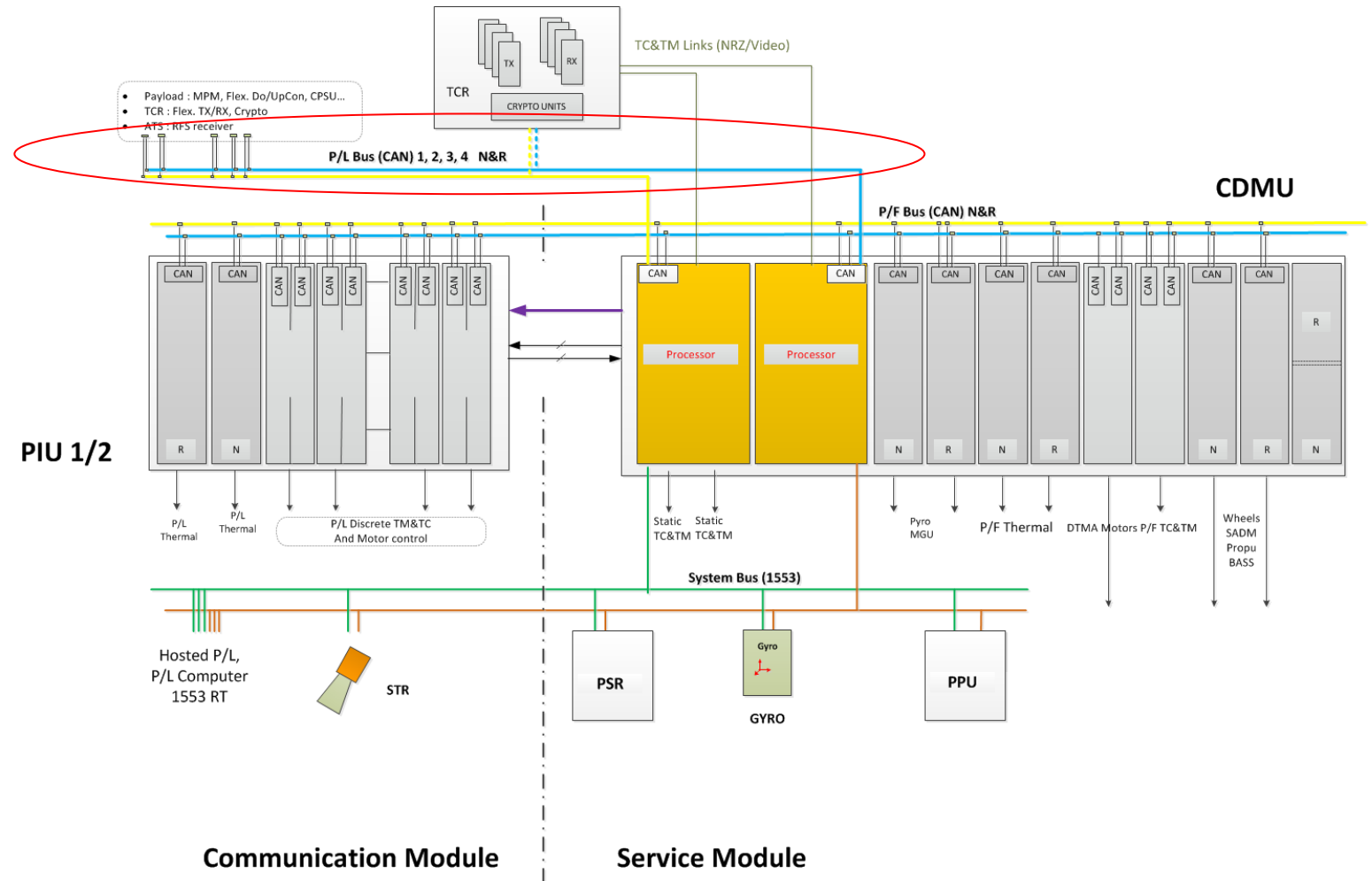
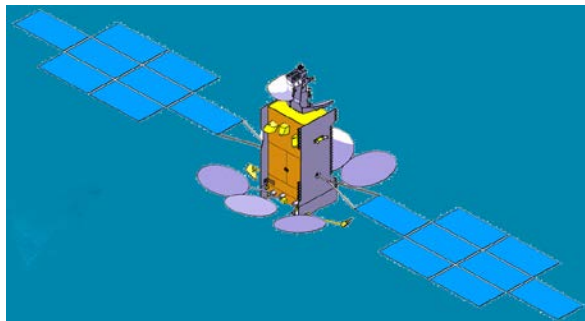
Payload Serial Bus

Eurostar Neo Implementation

CAN bus definition :

- Same as E3000
- 64 nodes
- 40 meters
- 250 kb/sec

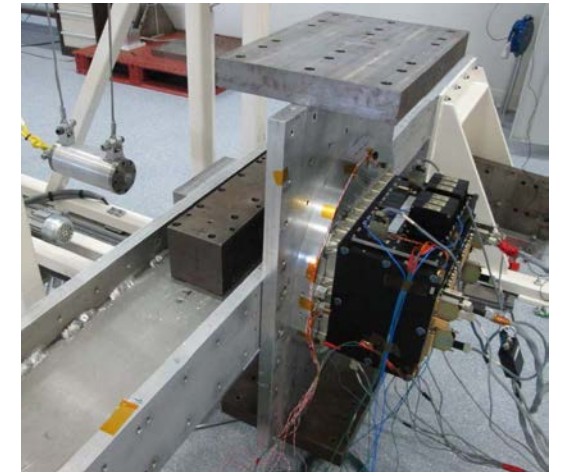
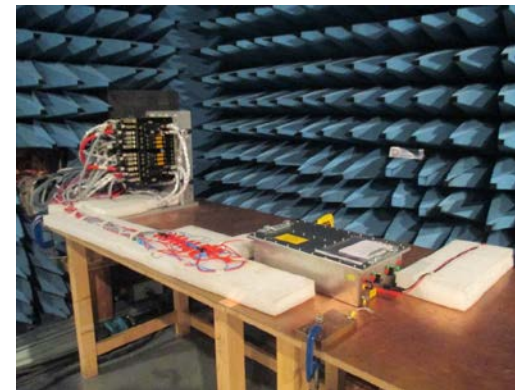
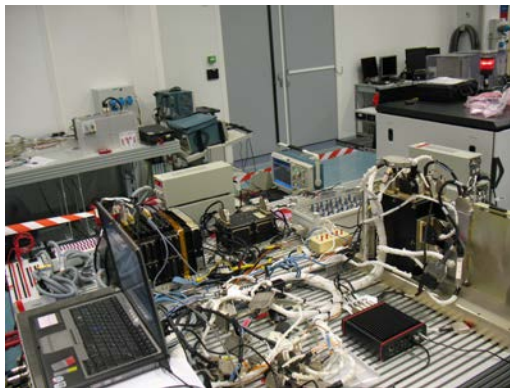
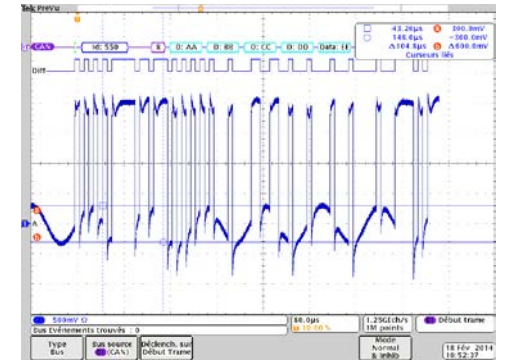
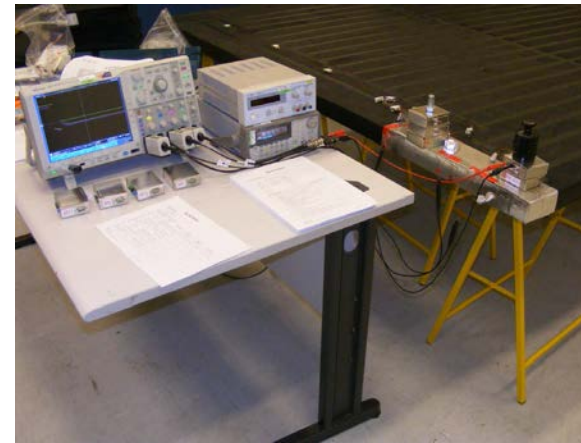
P/L buses managed directly by OBC
 4 buses available
 P/L data available every 1 sec @ OBC



Payload Serial Bus

Development Status

- Physical Layer validated by test and analysis
- MPIU with CAN interface has been developed and qualified
- System Validation tests done with flight representative Nodes
- CAN bus NEOSAT applicable document released (NSAT.SP.GPMPO.00000919 Issue 03)
- Several programs under development with P/L CAN bus



Payload Serial Bus

Development Status

- 3 E3000 + 1 GMP-T commercial programs under development
- Several units implement CAN bus interface :
 - Up/down flexible converters
 - Channels amplifiers
 - Stable Oscillators
 - Telemetry transmitters
 - Telecommand receivers
- From Several suppliers :
 - Tesat 
 - Thales Alenia Space  
 - Kongsberg Norspace 
 - NEC Space Technologies, Ltd. 
 - Airbus DS   

Eurostar Neo Platform Modules Communication Bus

Platform Modules Communication Bus

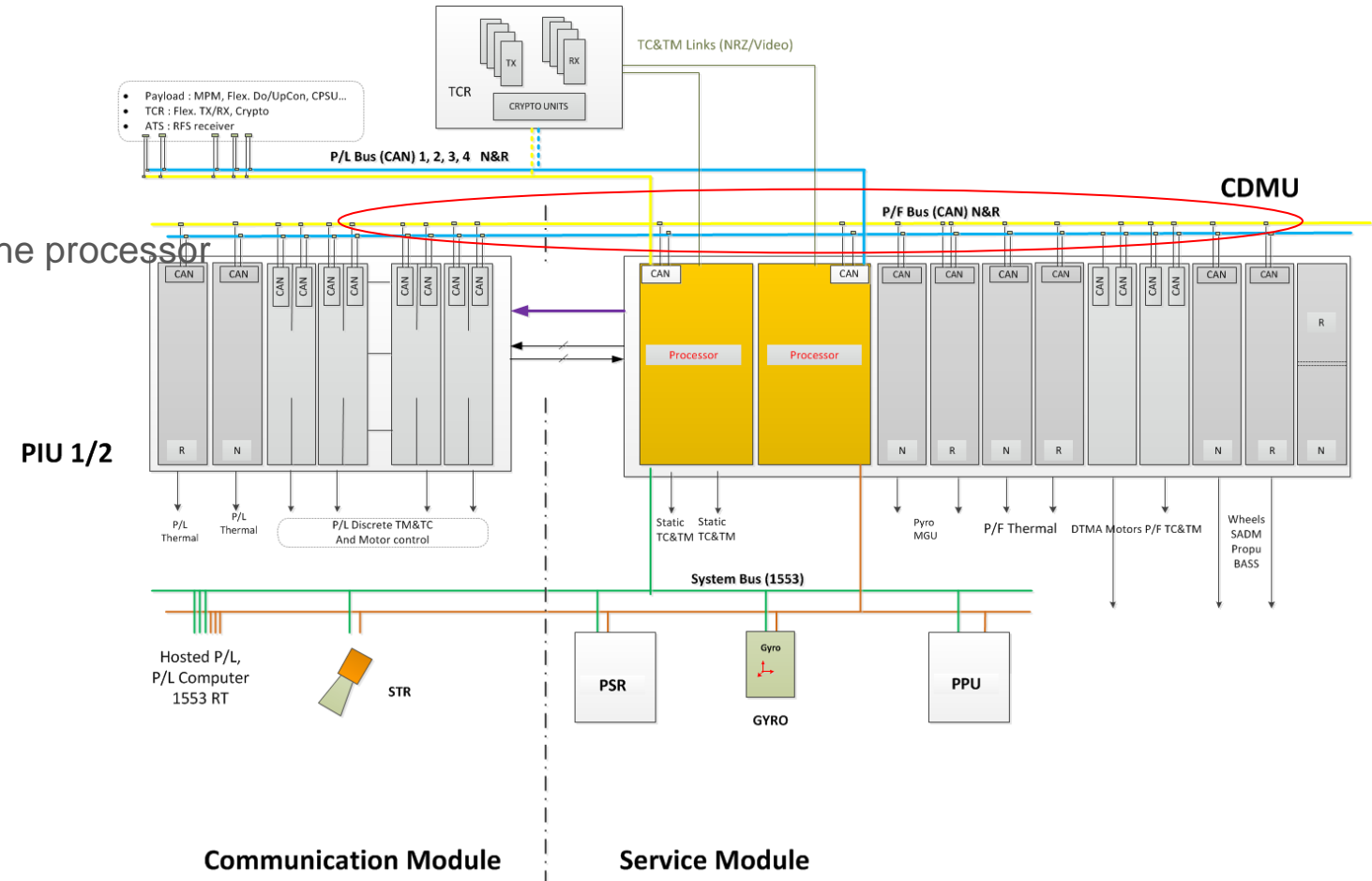


Aim and characteristics

Airbus DS is developing its new Telecom platform.

DHS units use CAN bus to connect I/O modules to the processor

- Data rate : 1Mb/sec
- Most distant nodes : ≤ 15 meters
- Nodes : ≤ 44



Platform Modules Communication Bus



Developpement Status

- Physical Layer validated
- System functional validation : 2017
- First launch End : 2019

Other uses of CAN bus

Other use of CAN bus at Airbus Defence and Space

Sentinel 1 SAR instrument

- 500kbps
- RS 485 (DS16F95)
- 16 nodes
- Higher level protocol : proprietary (not CANopen based)



ExoMars Rover

- 1 P/F + 1 P/L bus
- 1000 kbps
- RS 485 (DS16F95)
- Higher level protocol : CANopen (HurriCANE/CCIPC)
- Platform :
 - Lengths : 7m between most distant nodes 8,5m total.
 - 10 nodes per bus
- Payload :
 - Lengths : ~ 3.8 m between most distant nodes.
 - 8 nodes per bus

Developments Feedbacks

Developments Feedbacks

CAN interface Implementation is either done by multipurpose/versatile ASIC or by FPGA (54SX72, AX2000)

Implementation is almost straight forward :

- Thanks to integrated transceiver
- Bit timings always leads to questions -> AD Neosat updated
- Bus selection mechanism -> Design guide lines must be documented further
- CAN controller IP Core vs FPGA -> critical path can cross the IP !
- Attention must be paid to Internal node delay (Resynch FF, Bus selection mechanism...)

Electronic Data Sheet

- Current Neosat format not fully satisfactory
- CANopen EDS usable ?-> there is work to do here

Neosat Data bus specification (NSAT.SP.GPMPO.00000919) released at issue 03

- Well mature document but...
- further improvements need to be incorporated
- This document could be replaced by ECCS CAN section 9 if that section is updated

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Thank you