



CFDP FILE TRANSFER PROTOCOL

-Final Presentation Days-

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Agenda

1. CFDP file transfer protocol - “What is CFDP?”
2. Project overview
 - budget, tasks, milestones, standards, challenges
3. Technical approach
4. Q&A



“What is CFDP?”

- CFDP provides the capability to transfer ‘files’ to and from a spacecraft mass memory.
- The content of the files may be anything
- Offers multi-hop capabilities (SFO – store and forward overlay)



“What is CFDP?”

- Files can be transferred reliably, where it is guaranteed that all data will be delivered without error (class 2), or unreliably, where a ‘best effort’ delivery capability is provided (class 1).
- Files can be transmitted with a unidirectional link, a half-duplex link, or a full-duplexlink
- File transfer can be triggered automatically or manually



Project overview (budget)

Original contract: 199,878 Eur

Extension: 42 000 Eur

Start Date: 16 April 2014

End Date: 14 April 2016



PROJECT CONTEXT

ENEA is prime contractor and Airbus subcontractor



Project overview (scope)

C implementation required (class 1, class 2, SFO and latest modification of the standard)

Linux (x86)

PikeOS (Leon 4-SPARC V8)

RTEMS (Leon 4-SPARC V8)



Project overview (timeline)

- SRR milestone : 07.11.2014
- PDR milestone : 29.05.2015
- CDR milestone : 11.12.2015
- QR milestone : 03.03.2016
- AR milestone : 14.04.2016



Project overview (standards)

ECSS-E-ST-40C (tailored)

ECSS-Q-ST-80C (tailored)



Project overview (challenges)

ECSS-E-ST-40C (tailored)

ECSS-Q-ST-80C (tailored)



Technical approach (Applied standards)

[1] CCSDS File Delivery Protocol (CFDP). Recommendation for Space Data System Standards, CCSDS 727.0-B-3. Blue Book.

[2] CCSDS File Delivery Protocol (CFDP)—Part 2: Implementers Guide. Report Concerning Space Data System Standards, CCSDS 720.2-G-3. Green Book.



Technical approach (Modular design)

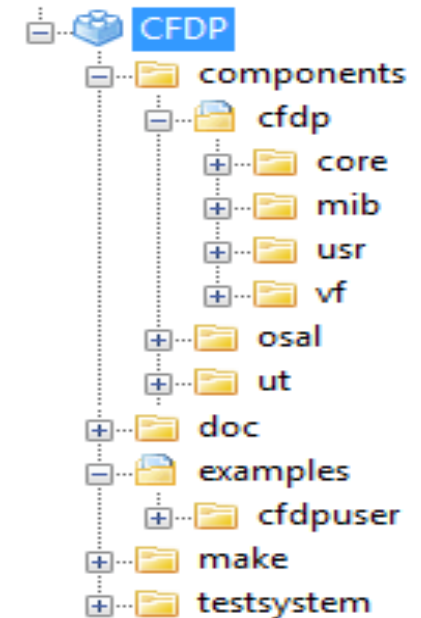
CFDP library

OSAL library (POSIX-Linux and RTEMS, Kars-PikeOS)

UT library

cfdpuser

Testsystem framework





Technical approach (Logical Model Description)

The CFDP implementation software consists of three major components:

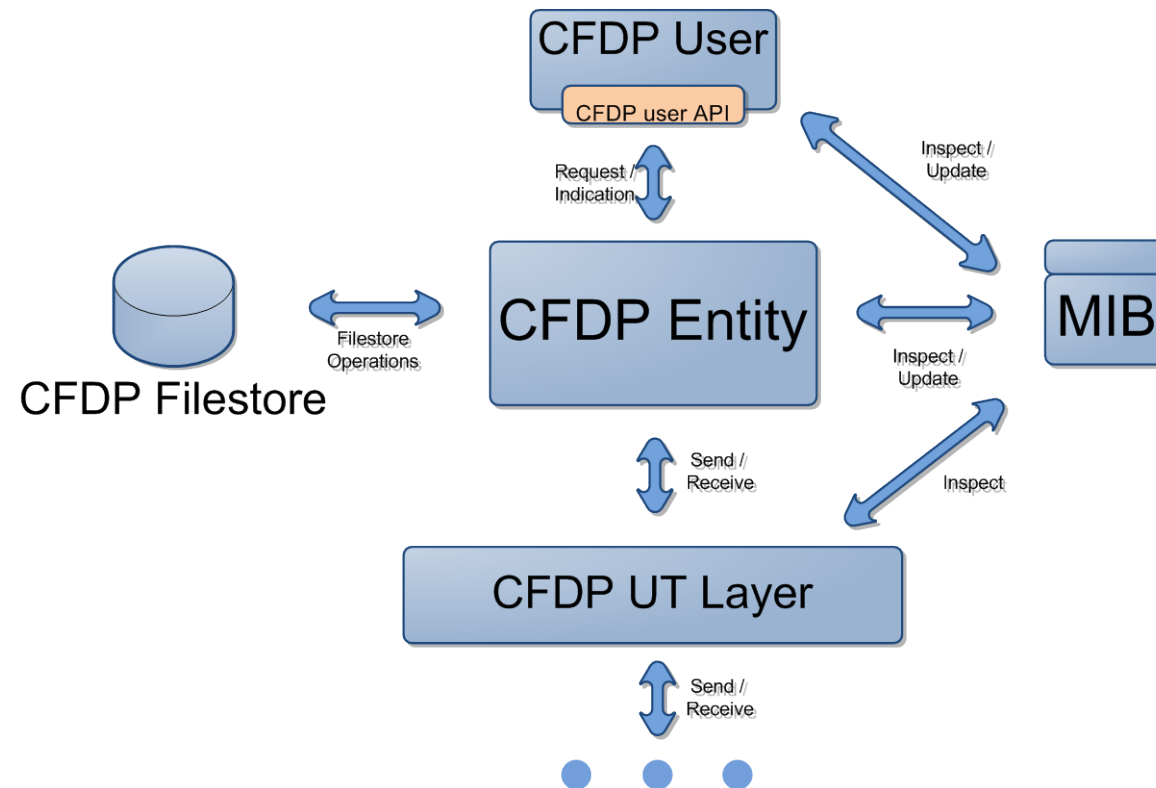
CFDP Core – this implements the CFDP class 1 and class 2 and sfo

CFDP User – this is using the CFDP User library to exercise the CFDP Core features

UT – this component is transferring the in/out CFDP PDUs of CFDP Core.

Each component is available as standalone executable application.

Technical approach (Logical Model Description)

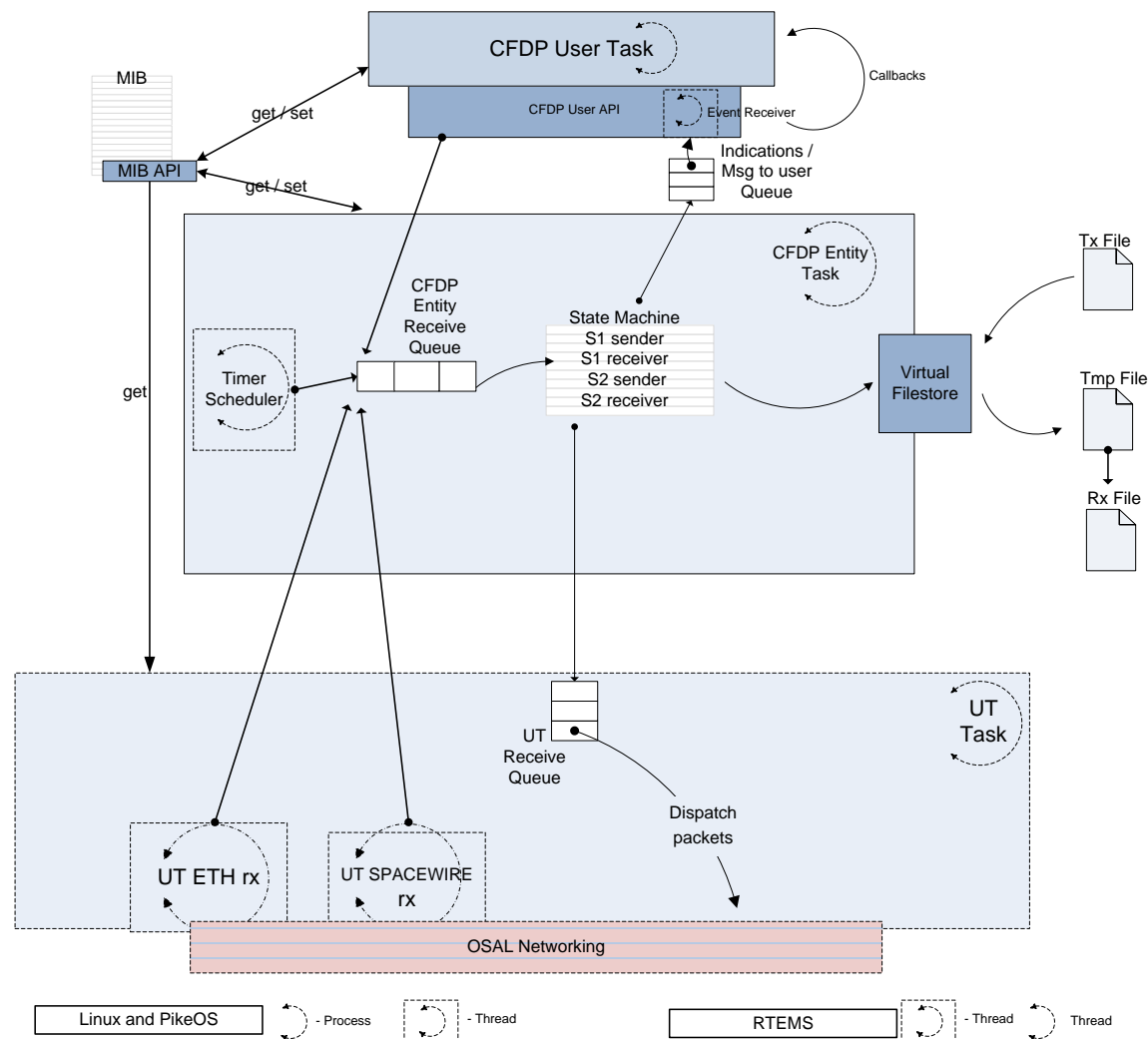




Technical approach (Process overview)

- Processes communicate through message queues
- Transaction with priorities
 - Named priority message queues
 - Starvation avoidance algorithm
- CFDP Entity process uses state machine for Class 1&2 receiver&sender
- CFDP Entity process uses a thread for timer events
- UT support both Ethernet (UDP) and SpaceWire

Technical approach (Process overview)





Technical approach (Validation - Applied standards)

[1] Procedures Manual for the Consultative Committee for Space Data Systems.
CCSDS A00.0-Y-9. Yellow Book.



Technical approach (Validation)

Java reference implementation

Develop test framework for test automation

Packet Control Bridge (PCB) – from Java implementation integrated in our test framework

Full Yellow Book coverage



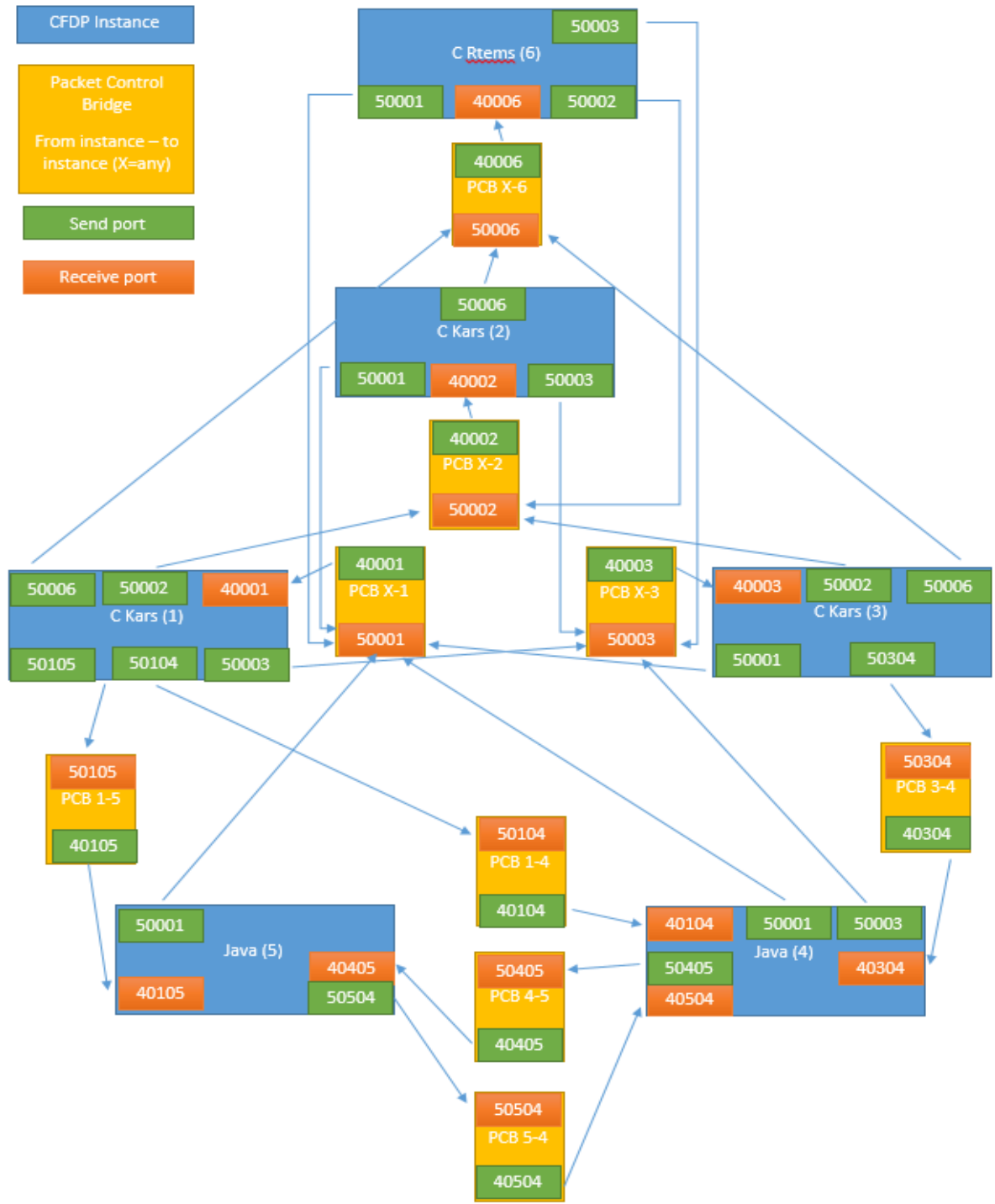
Technical approach (Validation)

Test environment:

- 1XRegular PC x86 and 1xLeon4-N2X-DS (quad core) board connected by Spacewire and Ethernet

Test setup:

- Multiple C CFDP instances running on x86 (Ubuntu VM)
- Multiple Java CFDP instances running on x86 (Ubuntu VM)
- One C CFDP instance running on Leon4 board (RTEMS)





Technical approach (challenges)

- Add support for multiple architectures (x86, SPARC) and OSes (RTEMS, PIKEOS and Linux)
- Write unit tests to achieve high code coverage numbers
- Develop a flexible functional test system able to handle complex test setup (see SFO functional tests)



QA?