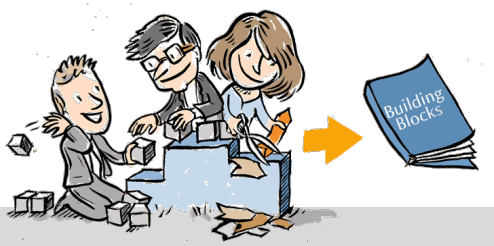
SAVOIR

space avionics open interface architecture

On-board Software Reference Architecture (OSRA)

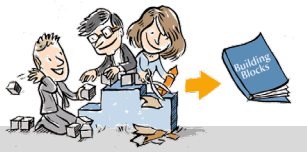
SAVOIR4Cubesats Workshop – ESTEC – 24 Oct 2022



What was presented so far?

- Presentation on TASTE *so far* showed a "general-purpose" approach to developing ***embedded software***

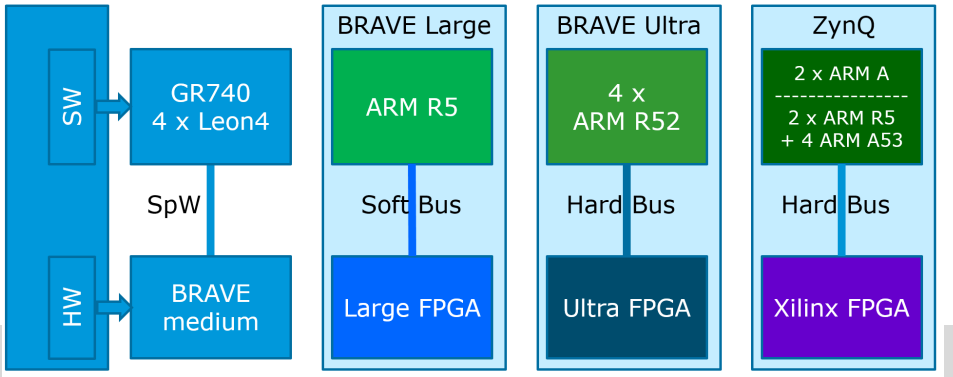
- History:
  - TASTE started in a EU project called ASSERT (2005-2008) on model-based approach for embedded SW development
  - Focus on model-based (functional) development with multitude of advanced features (e.g. SW analysis: stack, scheduling, code coverage, model checking; Simulink integration; VHDL and hardware-software co-design; SQL databases, ...)
  - Application of TASTE already in various domains



Where was TASTE used? Some examples

- Control of large solar dish and stirling engines at FBK
- European Space Robotics Control and Operating System (ESROCOS)

CoRA: Compact Reconfigurable Avionics



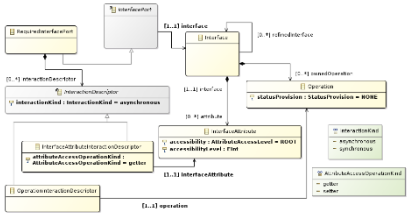
…all good, but what about space?

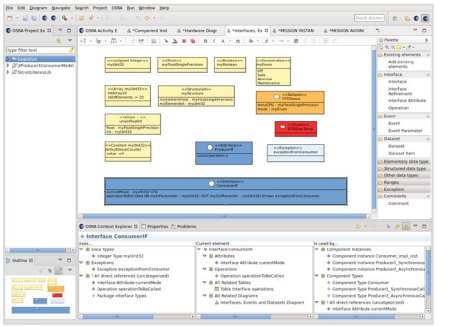
- ***Space systems*** have ***specific additional features*** that need to be captured too, and this is what the ***On-board Software Reference Architecture*** (OSRA) is capturing.

- Software reference architecture for on-board software
  - A response to strategic goals set by ESA and its industrial partners
  - An **agreed architectural framework** for the development of on-board software of future missions
  - **Accompanied by a development process/methodology and architectural practices** that fit the domain
  - A single software system is the "instantiation" of the reference architecture to specific mission needs

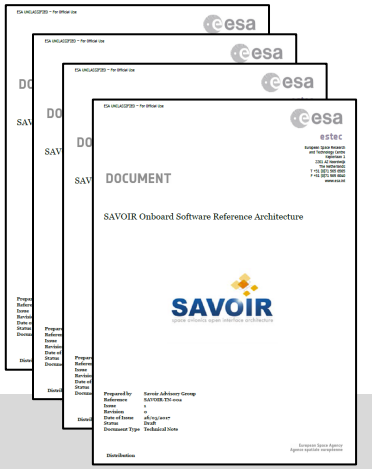
Software and documentation

- Software artifacts
  - Space Component Metamodel (SCM) and SCM Model Editor & SCM-to-TASTE functional prototype





- Documentation
  - OSRA TN, Execution Platform Functional Specification, Component Metamodel Specification

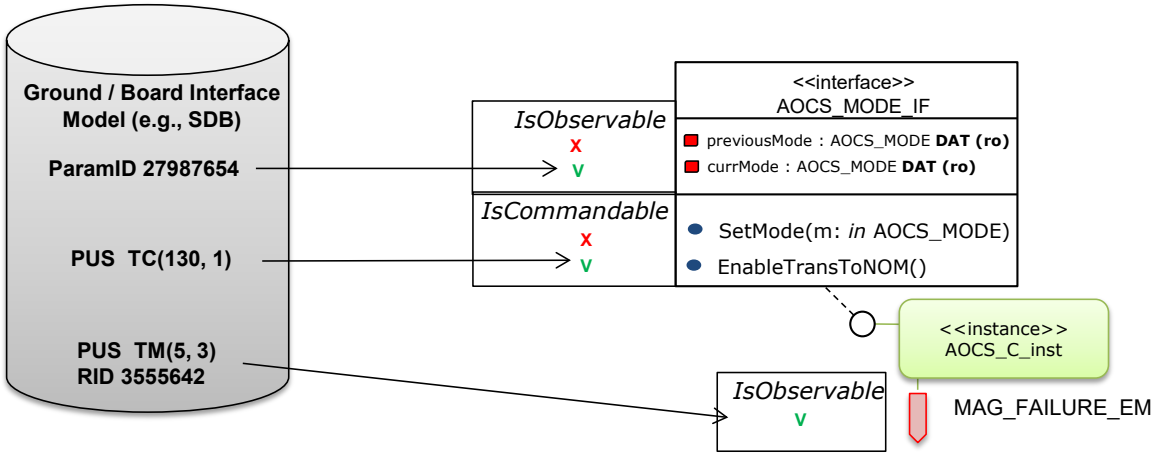


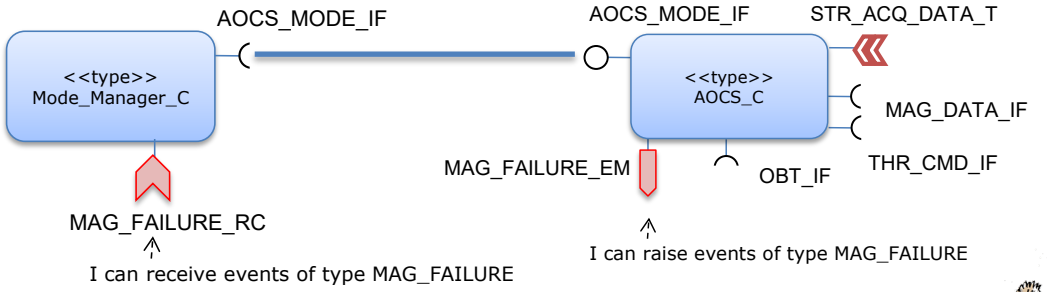
- Website: https://essr.esa.int/project/osra-onboard-software-reference-architecture

Space domain specific features

Typical space domain features:

- Packet Utilization Standard
  - monitoring
  - house keeping
  - command report
  - parameter configuration
  - patching
- Events and data sets





PUS packets

Telecommand (SEQUENCE) ASN.1 ACN — Min: 14 bytes Max: 60 bytes

Finally instantiate the Telecommand type

No	Field	Comment	Present	Type	Constraint	Min Bits	Max Bits
1	packet-version		always	NULL	N.A.	3	3
2	packet-type		always	NULL	N.A.	1	1
3	secondary-hdr		always	NULL	N.A.	1	1
4	dest-apid	Possible values: • *ground* (2047) • *flight* (2046)	always	APID	N.A.	11	11
5	sequence-flags		always	NULL	N.A.	2	2
6	packet-seq-count		always	SEQ-COUNT-OR-NAME	N.A.	14	14
7	packet-data-len		always	NULL	N.A.	16	16
8	secondary-header		always	Telecommand-secondary-header	N.A.	35	35
9	packet-data		always	TCs	N.A.	22	397

TCs (CHOICE) ASN.1 ACN — Min: 3 bytes Max: 50 bytes

Create the full list of TCs used in my project

No	ACN Parameters [?]	Type
1	tc-type	TYPE-ID
2	tc-subtype	TYPE-ID

No	Field	Comment	Present	Type	Constraint	Min Bits	Max Bits
1	tc2-4		tc-type=2 AND tc-subtype=4	TC-2-4	N.A.	22	397

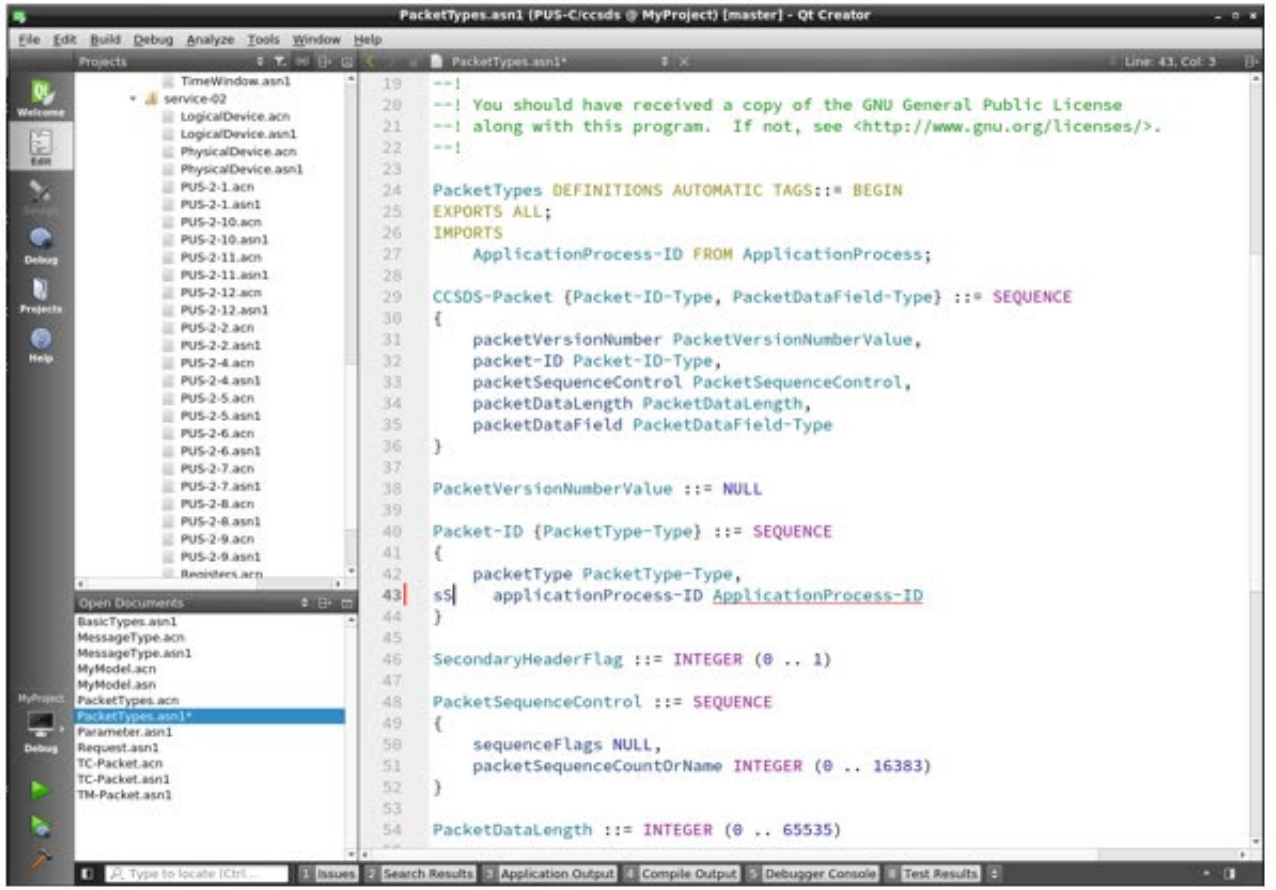
TC-2-4 (SEQUENCE-OF) ASN.1 ACN — Min: 3 bytes Max: 50 bytes

Instantiate the TC-2-4 for my project:

No	Field	Comment	Type	Constraint	Min Length (bits)	Max Length (bits)
1	Length	Special field used by ACN indicating the number of items.	unsigned int	(SIZE(1 .. max-Cpdu-Cmds))	1	1
2	Item #1		CPDU-Cmd	N.A.	21	198
	...					
3	Item #2		CPDU-Cmd	N.A.	21	198

CPDU-Cmd (SEQUENCE) ASN.1 — Min: 3 bytes Max: 25 bytes

No	Field	Comment	Present	Type	Constraint	Min Bits	Max Bits



OSRA x TASTE

- Stepwise integration of space domain specific features into TASTE

- Example PUS:
  - From tool supported PUS-C tailoring to configured execution platform components integrated into TASTE and code generation of flight software

  - Demo to follow now →

Contact

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