



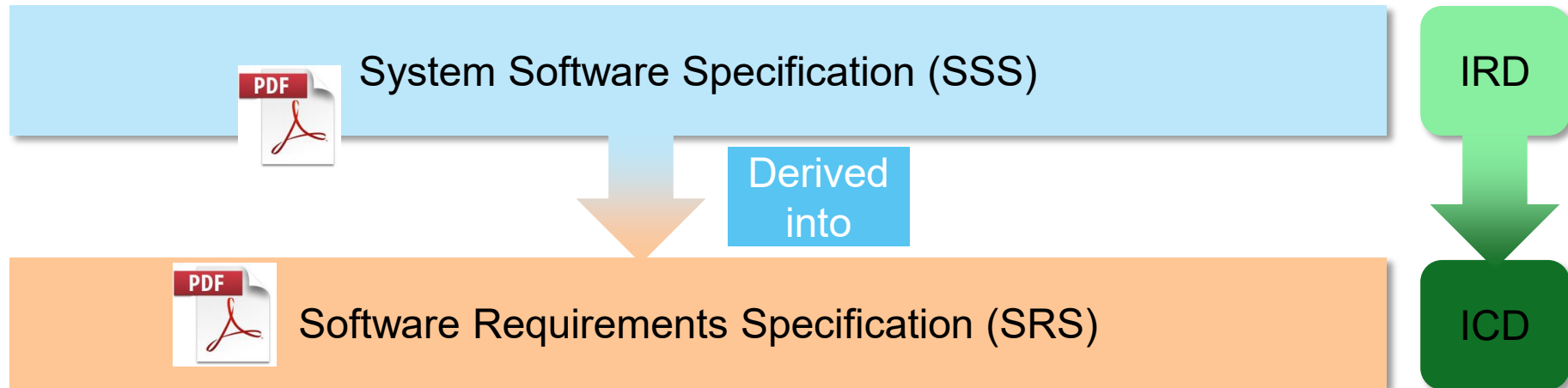
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MBSE ON ARIANE 6 APPLIED TO FLIGHT SOFTWARE

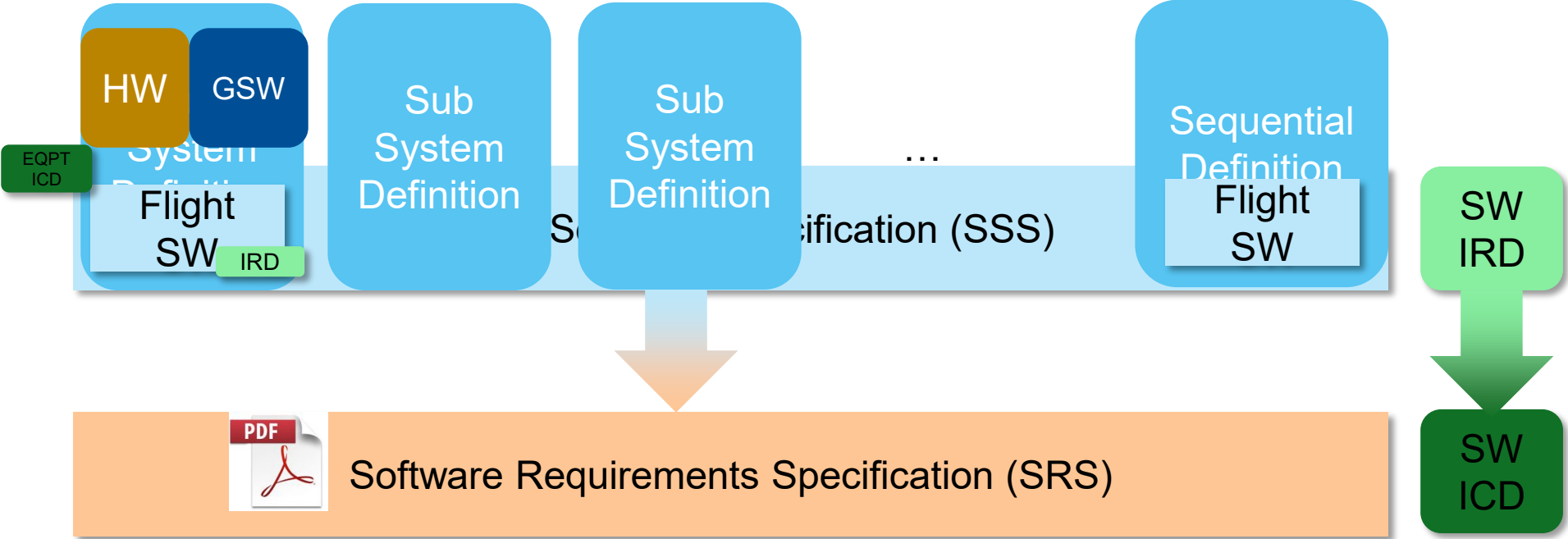
P.Moro : 02/09/2022

Pierre.moro@ariane.Group

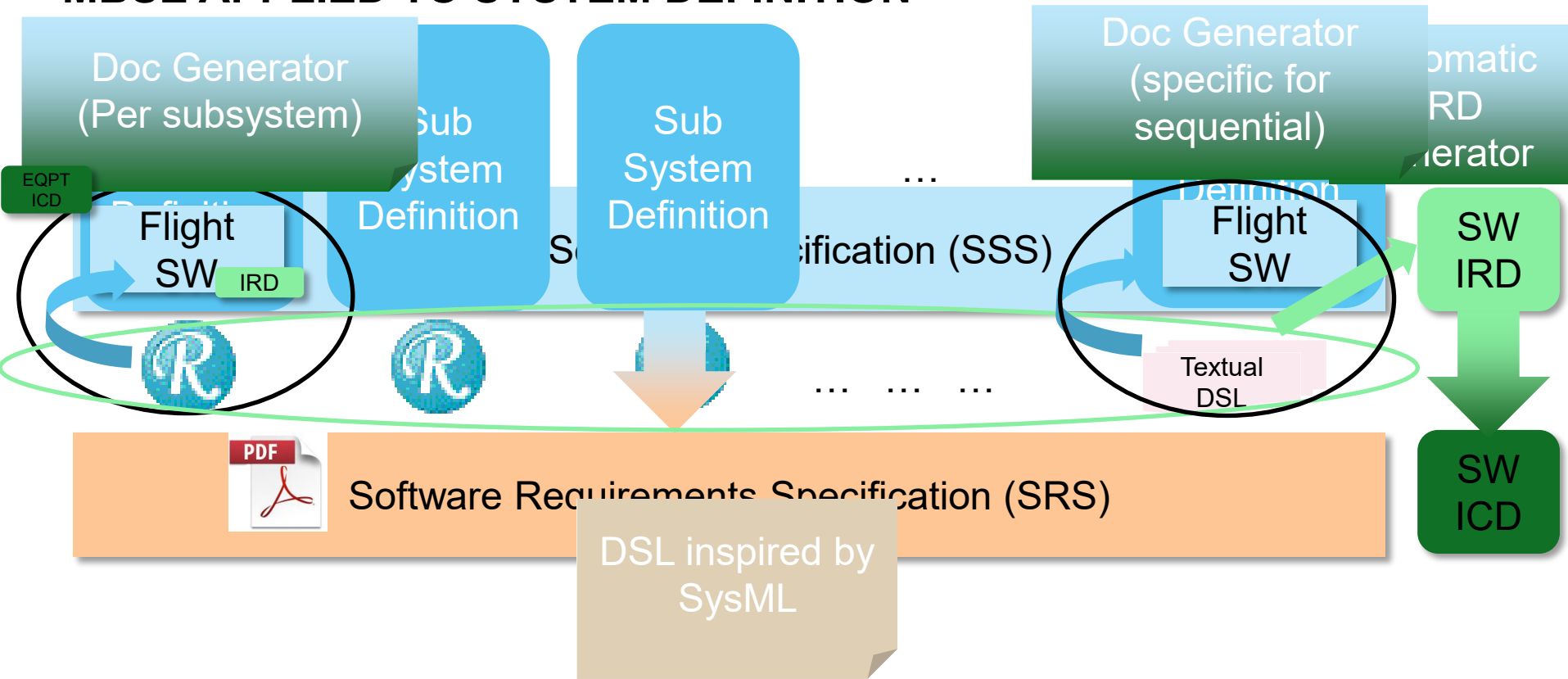
ECSS DOCUMENTS, STANDARD PROCESS



A6 DOCUMENTATION TREE



MBSE APPLIED TO SYSTEM DEFINITION



Sub System Definition Flight SW

PROCESSING FCM_CHECK_1ST_VINCI_BOOST

processing activation

processings activation:

Processing name	Activation Conditions	Activation Period (ms)
FCM_CHECK_1ST_VINCI_BOOST	FCM_MS_MON_BEG_BST1	100

Table 9.2-1 - Conditions for processing activation

9.2.2 Inputs

Table Processing inputs:

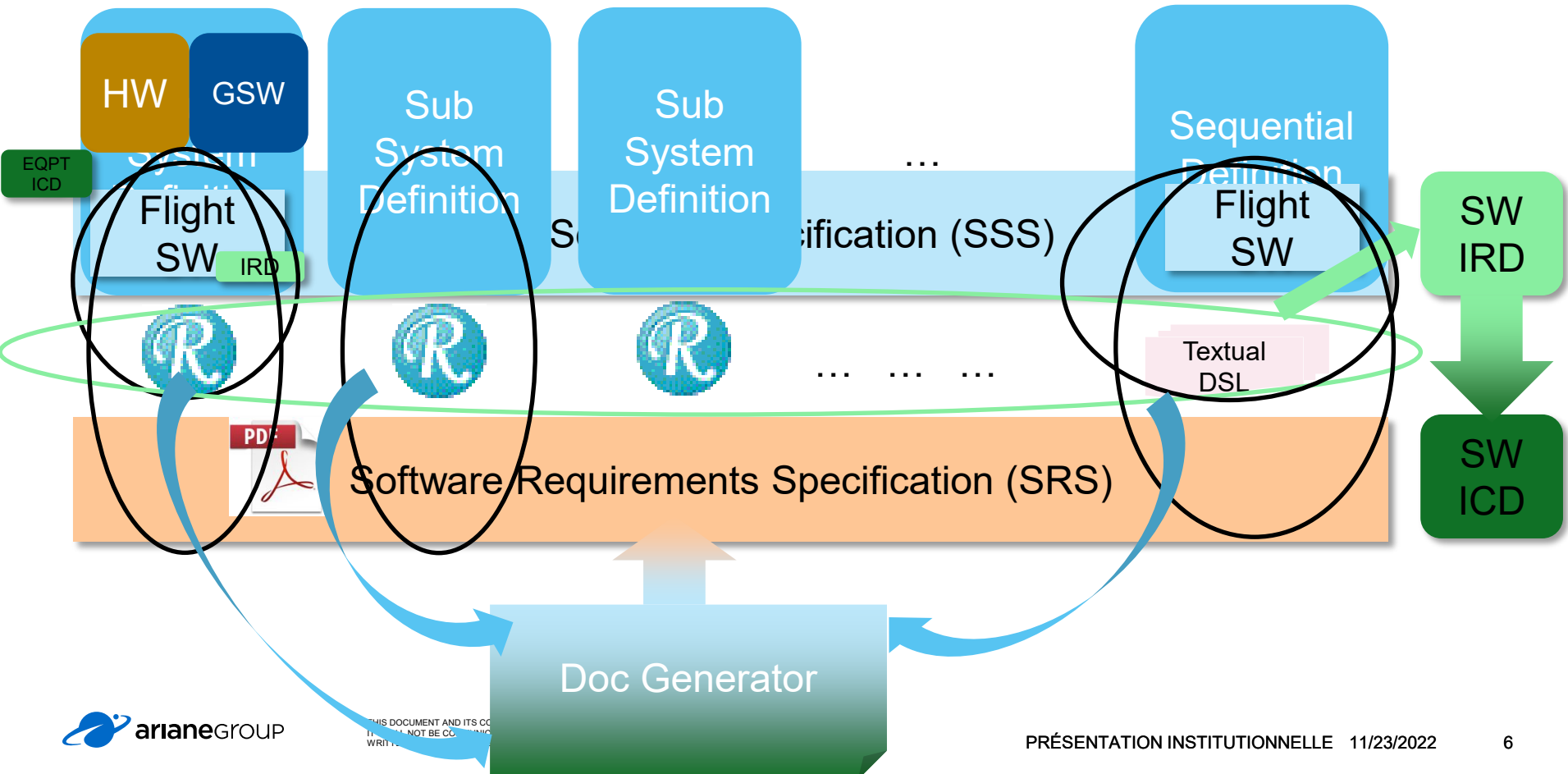
Input	Source	Type				
NAV_ANGRATE_RLV_UF_10_1	NAV	T_Angular_Rate_Ver_F64				
NAV_ANGRATE_RLV_UF_10_2	NAV	T_Angular_Rate_Ver_F64				
NAV_IMU1_DATA_IS_OK	NAV	T_Boolean				
NAV_IMU2_DATA_IS_OK	NAV	T_Boolean	Synthesis of IMU2 data validity.	-	-	5

The screenshot shows a software tool interface. On the left, a tree view displays the structure of a component named «05» FCM_CHECK_1ST_VINCI_BOOST. The tree includes folders for Attributes, Proxy Ports, SWRequirements, Tags, activation_condit..., and period. Under Tags, there are entries for «15» FCM_EST and «20» FCM_CH. A detailed view of a tag is shown on the right, titled "Tag : activation_condition in FCM_CHECK_1ST_VINCI_BOOST". The tag's Name is "activation_condition", its Type is "Processing", and its Value is "FCM_MS_MON_BEG_BST1".



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MBSE APPLIED TO SOFTWARE REQUIREMENTS SPEC



RHAPSODY MODEL : PROCE

Constant Data Identification	Type	Description	Range	Unit	Constant Value
C_Initial_FCM_1ST_VINCI_BOOST_RES	T_FCM_1ST_VINCI_BOOST_RES	Initial value of FCM_1ST_VINCI_BOOST_RES	Enumerate	-	NOT_FAILED
C_Initial_FCM_ACCNG_LONGI_THD	T_Acceleration_F64	Initial value of FCM_ACCNG_LONGI_THD	-	Meter. PerSquareSecond	0

Table: List of Constants Data

«05» FCM_CHECK_1ST_VINCI_BOOST

- Attributes
- Proxy Ports
- SWRequirements
 - «01_Req_Activation_Condition» FCM_CHECK_1ST_VINCI_BOOST_ACTIVATION_CONDITION
 - Tags
 - ValidationMethod

- «02_Req_Period» FCM_CHECK_1ST_VINCI_BOOST_PERIOD
- «03_Req_InitValue» FCM_CHECK_1ST_VINCI_BOOST_INITVALUE
- «04_Req_Missionisable» FCM_CHECK_1ST_VINCI_BOOST_MISSIONISABLE
- «09» FCM_CHECK_1ST_VINCI_BOOST_PERIOD
- «10» FCM_CHECK_1ST_VINCI_BOOST_PERIOD
- «10» FCM_CHECK_1ST_VINCI_BOOST_PERIOD
- «10» FCM_CHECK_1ST_VINCI_BOOST_PERIOD
- Tags
- activation_condition
- period
- Usages
- «15» FCM_ESTIMATE_MISSILE
- «20» FCM_CHECK_DEPOINTMENT
- SWRequirements
- «01_Req_Tm» FCM_TM_DATA
- «02_Req_DataModifiableByTC»

SWRequirement : FCM_CHECK_1ST_VINCI_BOOST_ACTIVATION_CONDITION

General	Description	Relations	Tags	Properties
Name:	FCM_CHECK_1ST_VINCI_BOOST_ACTIVATION_CONDITION			
Stereotype:	«01_Req_Activation_Condition»			
Type:	Requirement			
ID:	LMS-SRS-FCM-1200			
Defined in:	FCM_CHECK_1ST_VINCI_BOOST			
Specification:	No text			

Anchored Elements:

Details of Processing

```

DEFINE_REQUIREMENT LMS-SRS-FCM-1200, FCM_CHECK_1ST_VINCI_BOOST_ACTIVATION_CONDITION
VALIDATION_METHOD Analysis
UPWARD_REQ
The LMS shall activate the processing FCM_CHECK_1ST_VINCI_BOOST on the following conditions:
FCM_MS_MON_BEG_BST1
RATIONALE
None
END_REQUIREMENT
    
```

1

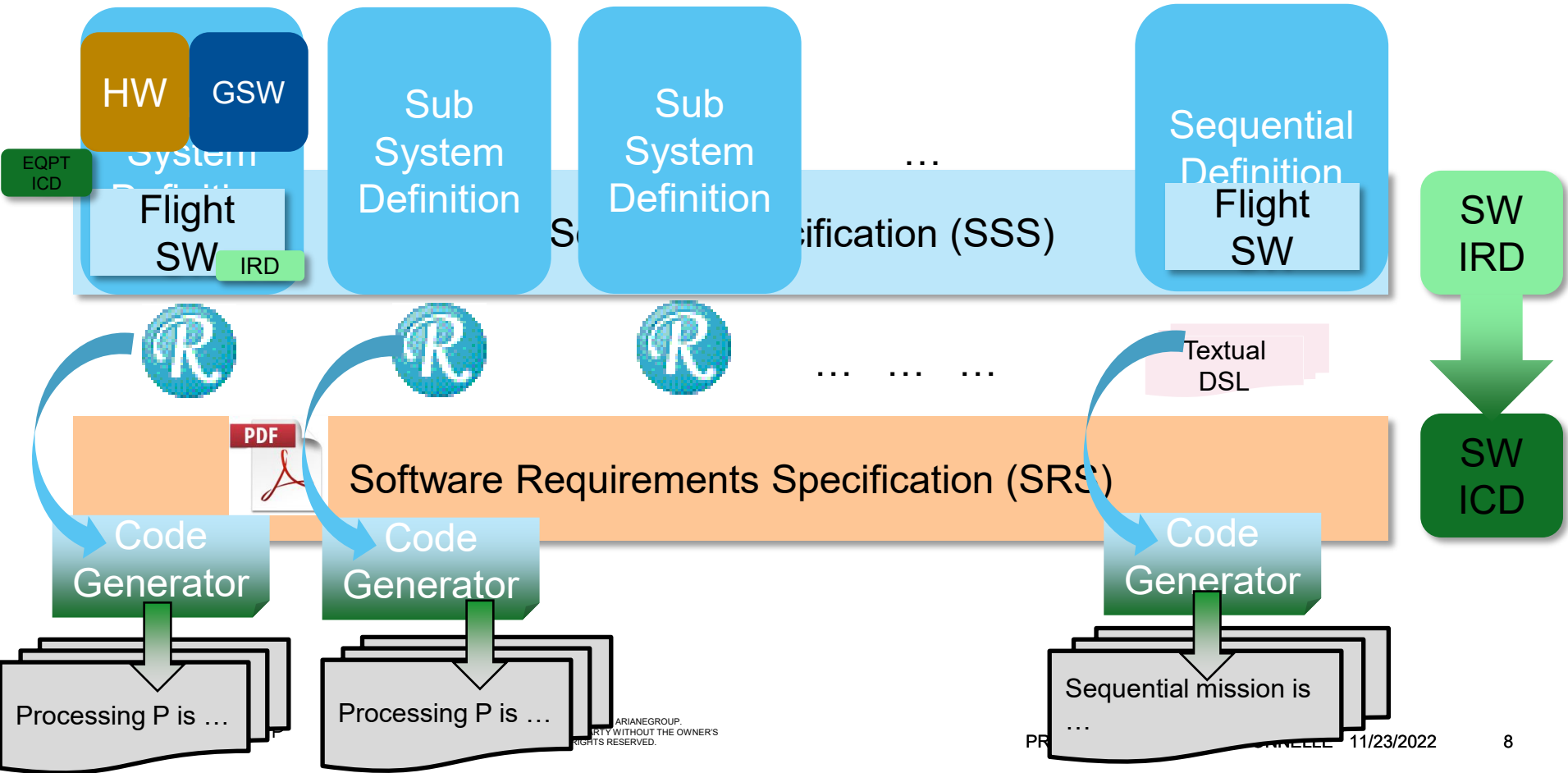
2

3

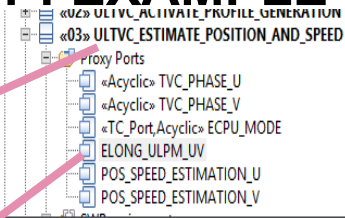
Some requirements are predefined sentences completed with information found in the model.

FCM_1ST_VINCI_BOOST_RES	1stVinci boost	FCM_1ST_VINCI_BOOST_RES	FCM_1ST_VINCI_BOOST_RES

MBSE BONUS : CODE GENERATION STEP 1 : STATIC ARCHITECTURE



MBSE BONUS : CODE GENERATION STEP 1 : EXAMPLE



Interface Block: IB_PROFILE_TO_ULTVc in ULTVc_ESTIMATE_POSITION_AND_SPEED

General Description Attributes Flow Properties Operations Proxy Ports Constraints Relations Tags Properties

```

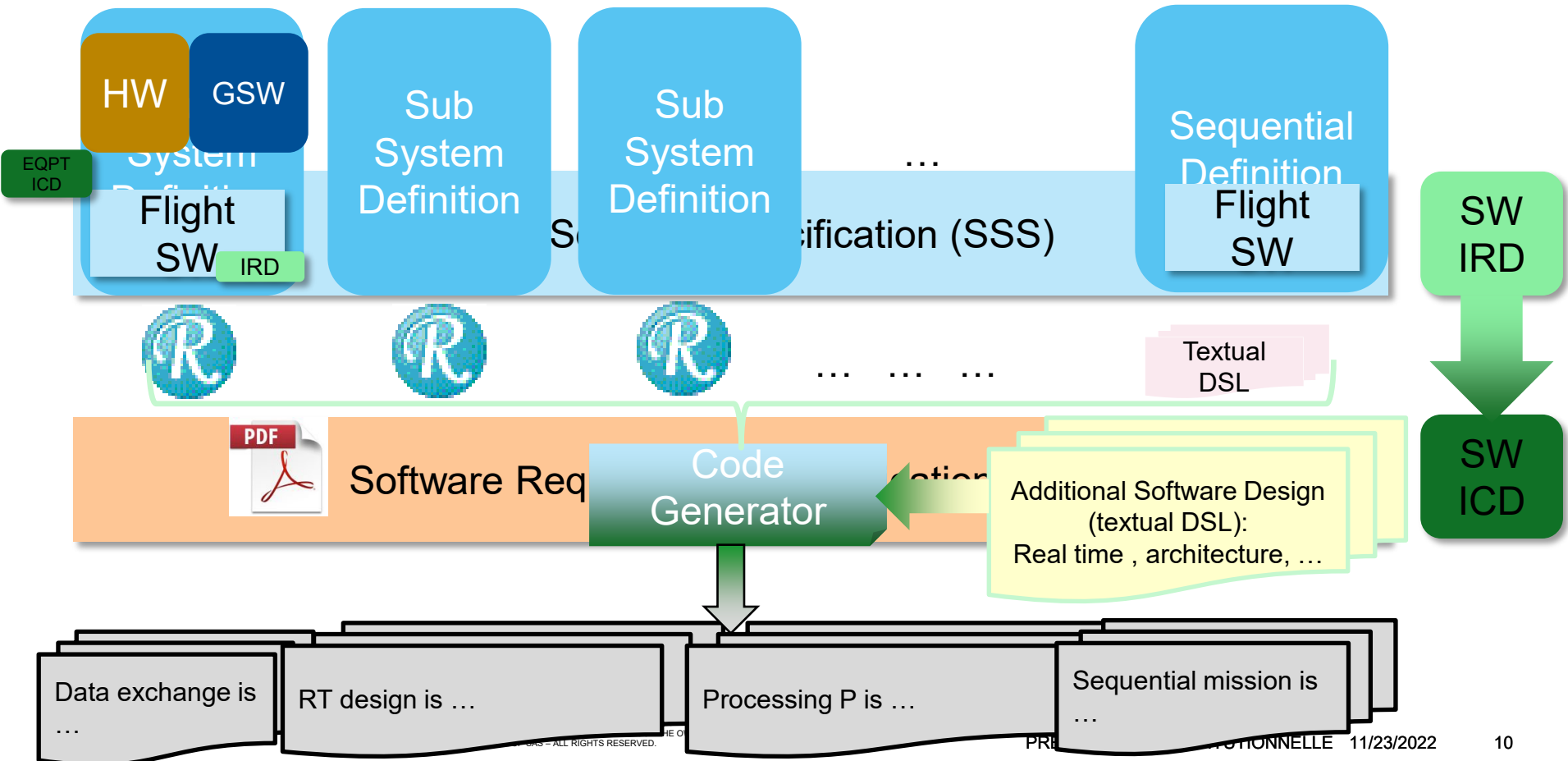
40
41
42 -- This processing computes a linear position estimation from an embedded TVC model taking as inputs the current linear setpoints (st
43
44 package A6.Ultvc_Estimate_Position_And_Speed generate is
45
46 procedure Execute (-- First_Start is true at the first execution of the Ultvc_Estimate_Position_And_Speed processing
47   First_Start      : in Boolean;
48   -- Restart is true each time the Ultvc_Estimate_Position_And_Speed processing is reactivated after deactivation
49   -- First_Start and Restart are never true at the same time
50   Restart          : in Boolean;
51   -- Commanded deflection for the ULTVc SH, expressed in jack axes
52   -- Unit: Meter
53   Elong_Ulpm_U     : in T_Linear_Setpoint_Points_Ulpm;
54   -- Commanded deflection for the ULTVc SH, expressed in jack axes
55   -- Unit: Meter
56   Elong_Ulpm_V     : in T_Linear_Setpoint_Points_Ulpm;
57   -- Speed estimation on U axis
58   -- Unit: Radianpersecond
59   Ultvc_Est_Angle_Spd_U_N : out T_Angular_Speed_Ulpm;
60   -- Speed estimation on V axis
61   -- Unit: Radianpersecond
62   Ultvc_Est_Angle_Spd_V_N : out T_Angular_Speed_Ulpm;
63   -- Position estimation on U axis.
64   -- Unit: Meter
65   Ultvc_Est_Pos_Sat_U_N  : out T_Linear_Setpointest_Ulpm;
66   -- Position estimation on V axis
67   -- Unit: Meter
68   Ultvc_Est_Pos_Sat_V_N  : out T_Linear_Setpointest_Ulpm)
69
70 with Inline;
71 end A6.Ultvc_Estimate_Position_And_Speed.Execute;

```

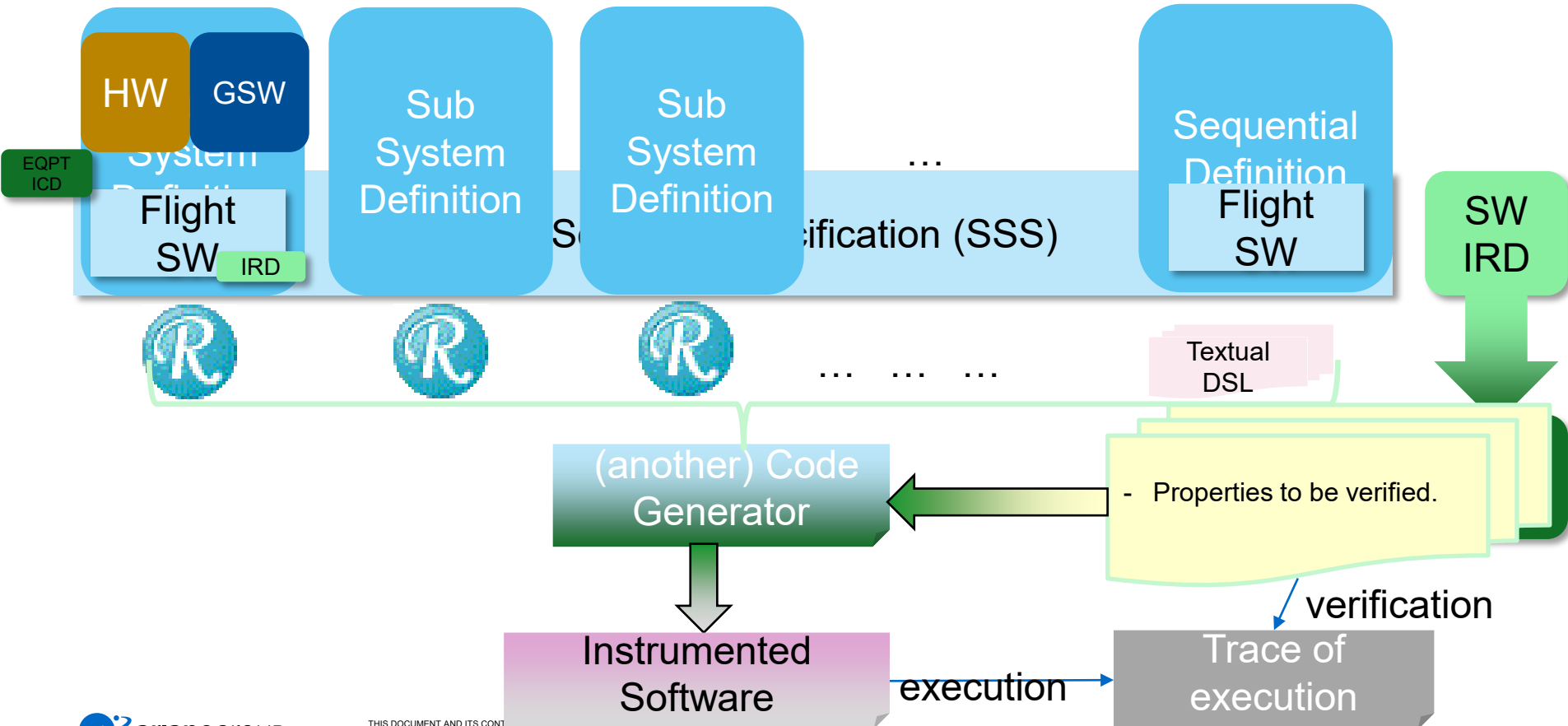
Show Inherited

Name	Visibility	Type	Initial Value	Flow Direction
ELONG_ULPM_U	Public	T_Linear_SetPoint_T...	0.0	Out
ELONG_ULPM_V	Public	T_Linear_SetPoint_T...	0.0	Out
<New>				

MBSE BONUS : CODE GENERATION STEP 2 : ARCHITECTURE



MBSE BONUS : EARLY VERIFICATION AND AUTOMATIC TESTS



CONCLUSION

- (not presented) The model is develop by the software team:
 - Improve the consistency System/Software
 - Additional cost, since SW team is involved much earlier in the process.
- A model which is able to generate the code and (part of) the system definition :
 - Impose to have a system definition very close to software (at least with our current modelling environnement, where there is no refinement possible for data/datatypes).
 - Allow verifying the system definition very early in the process.