

Arcadia and Capella: As much as I can tell and demonstrate in a bit less than one hour, from core concepts to advanced practices and perspectives

CAPELLA DAY, MUNICH, SEPT. 16TH 2019

Stéphane Bonnet
THALES



A focused journey in a Capella model

Extremely quick and simple example
to introduce both the method and the tool

Methodology and
high level concepts
and viewpoints



Purpose-built to
provide the
notation and
diagrams fitting the
Arcadia approach



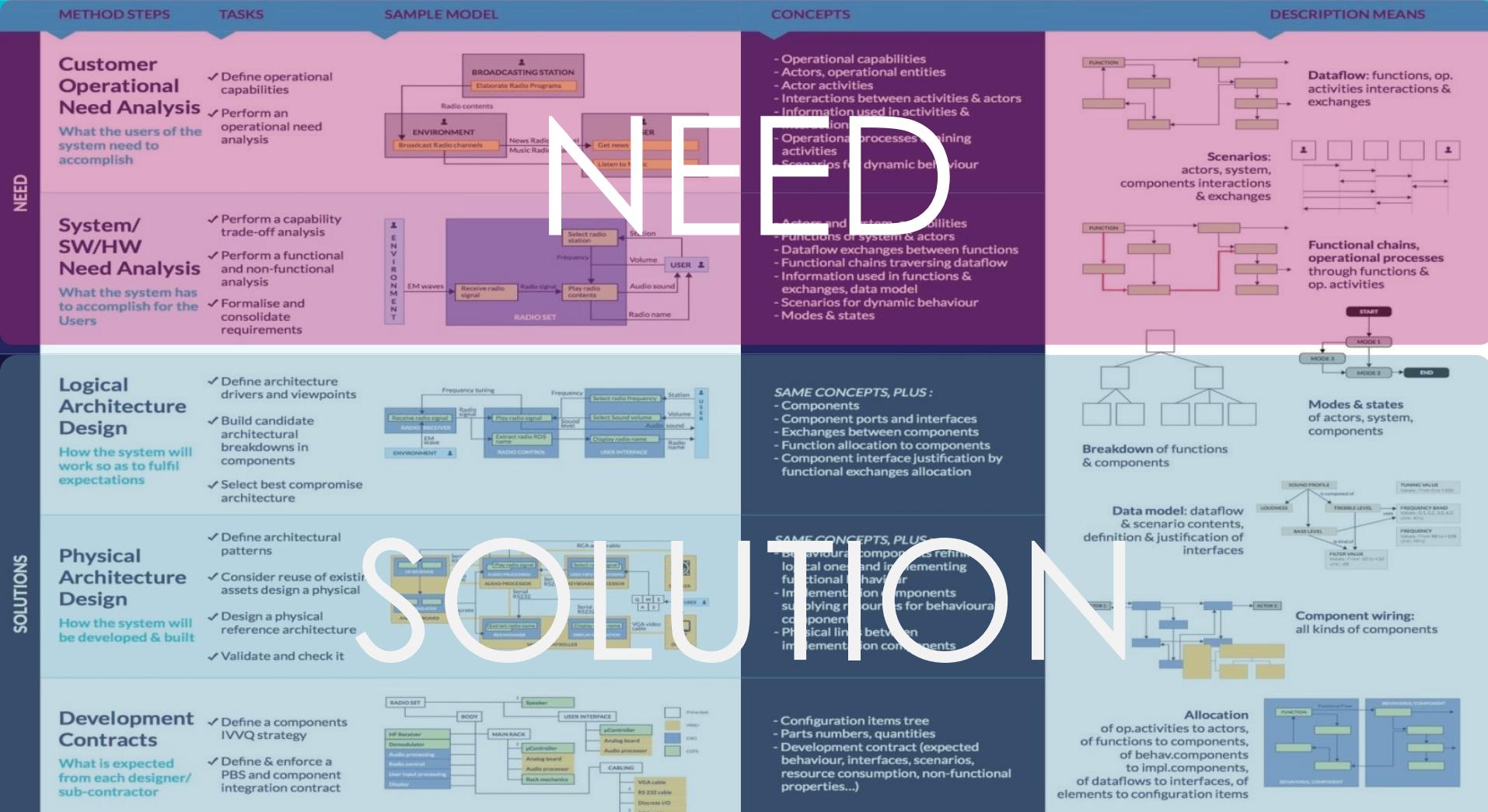
Understand the customer/user need

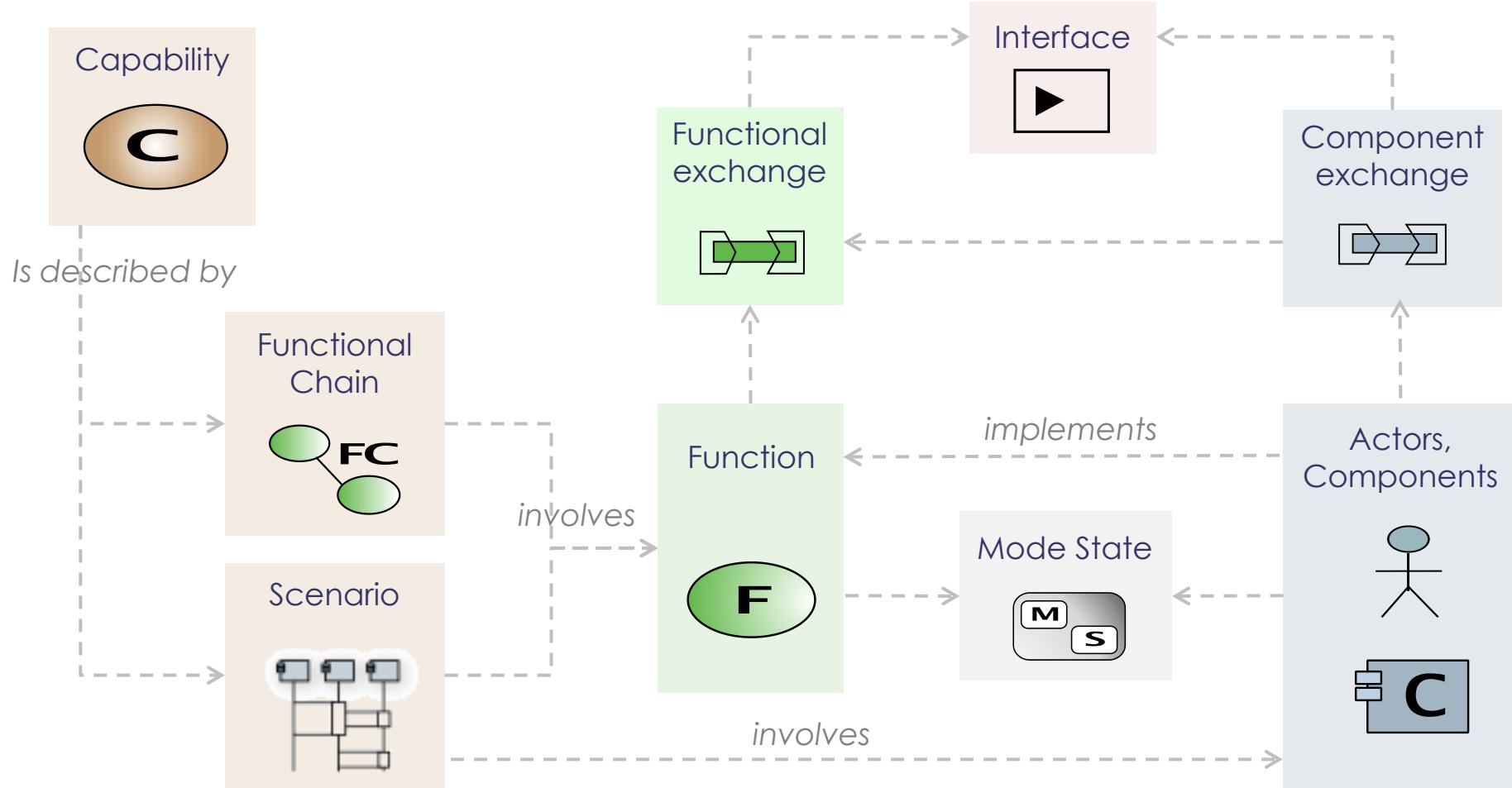
Define and share the solution among stakeholders

Secure SYS/SW/HW engineering, prepare subcontracting

Early evaluate and justify architectural design

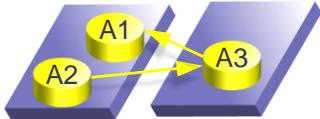
Prepare and master V&V







Bird eye view of the approach



Operational Analysis

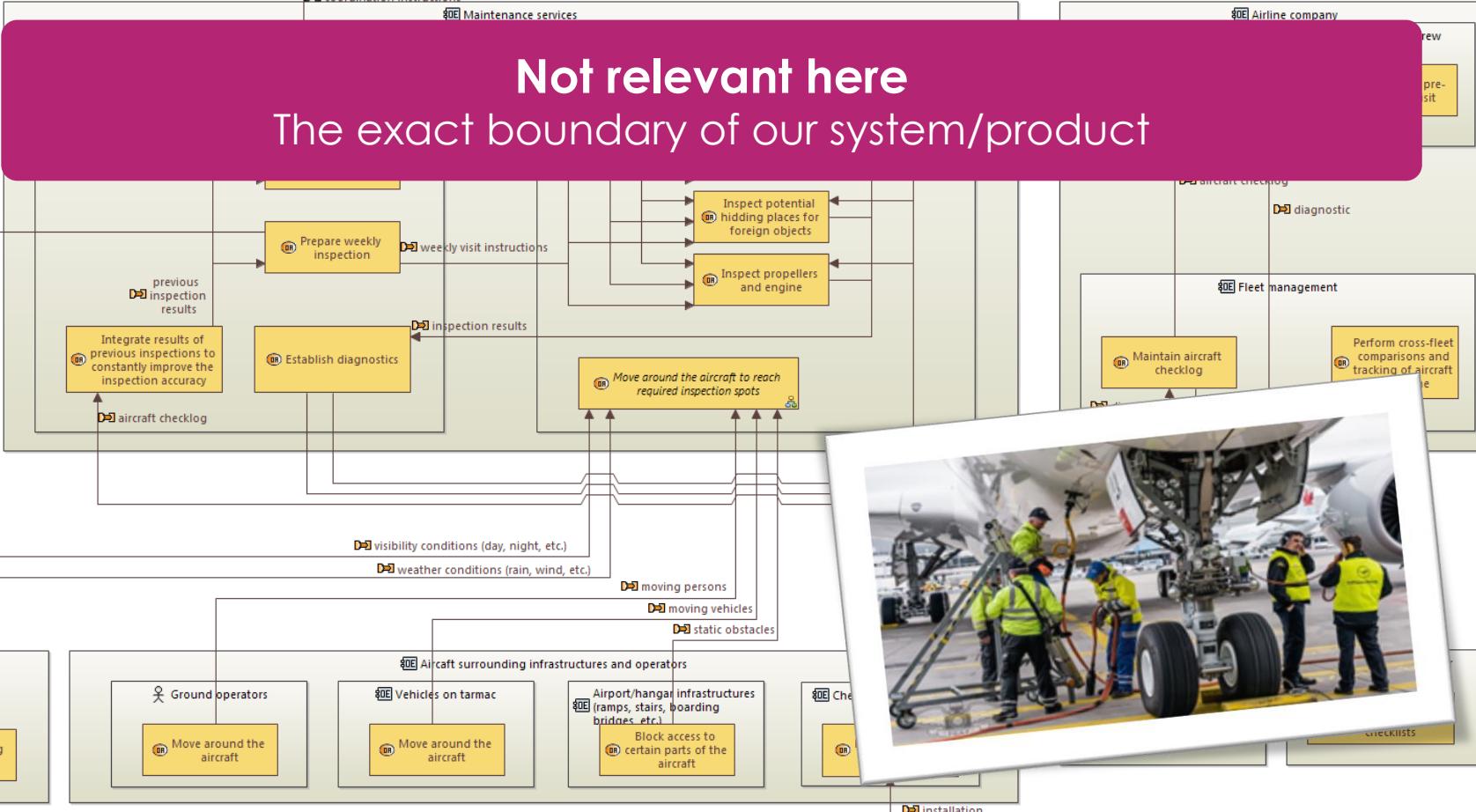
WHAT THE USERS/STAKEHOLDERS
NEED TO ACCOMPLISH

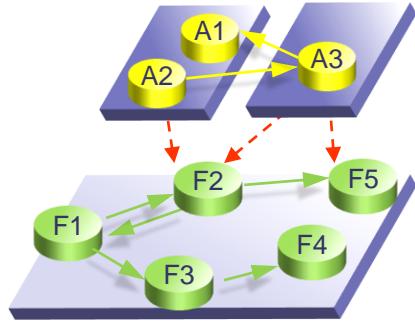
Support of discussions
with the customer, objectives,
activities and processes,
pains, gains, etc.



↳ Maintenance services

↳ Airline company

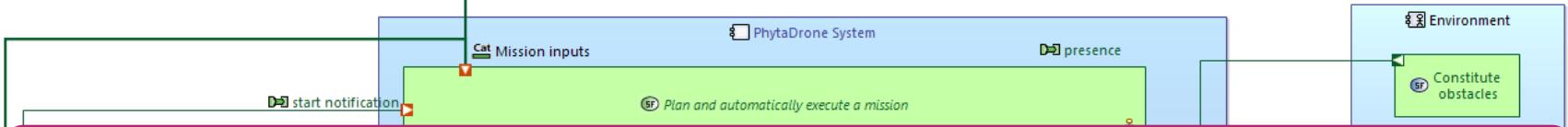




System Need Analysis

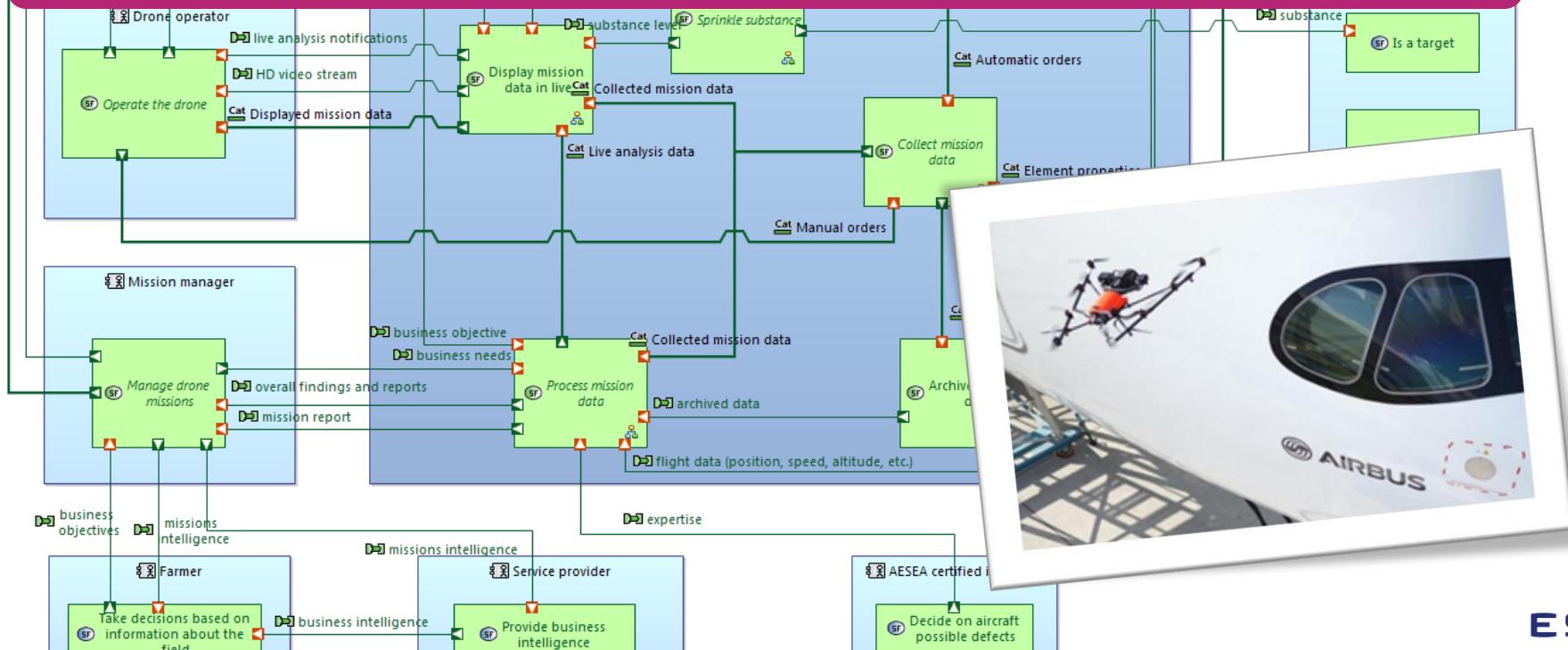
WHAT IS EXPECTED
FROM THE SYSTEM

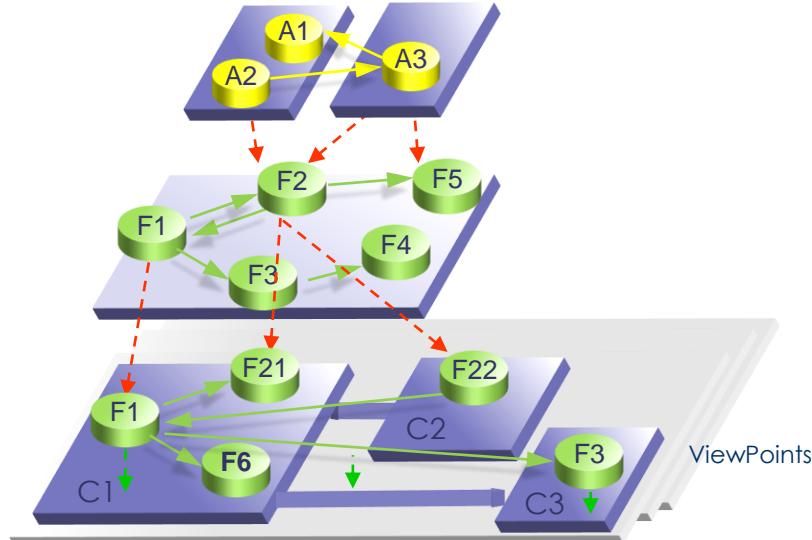
Capability trade-off analysis,
system boundaries, external
interfaces, actors



Not relevant here

Anything solution-related: how things work, which technologies, etc.

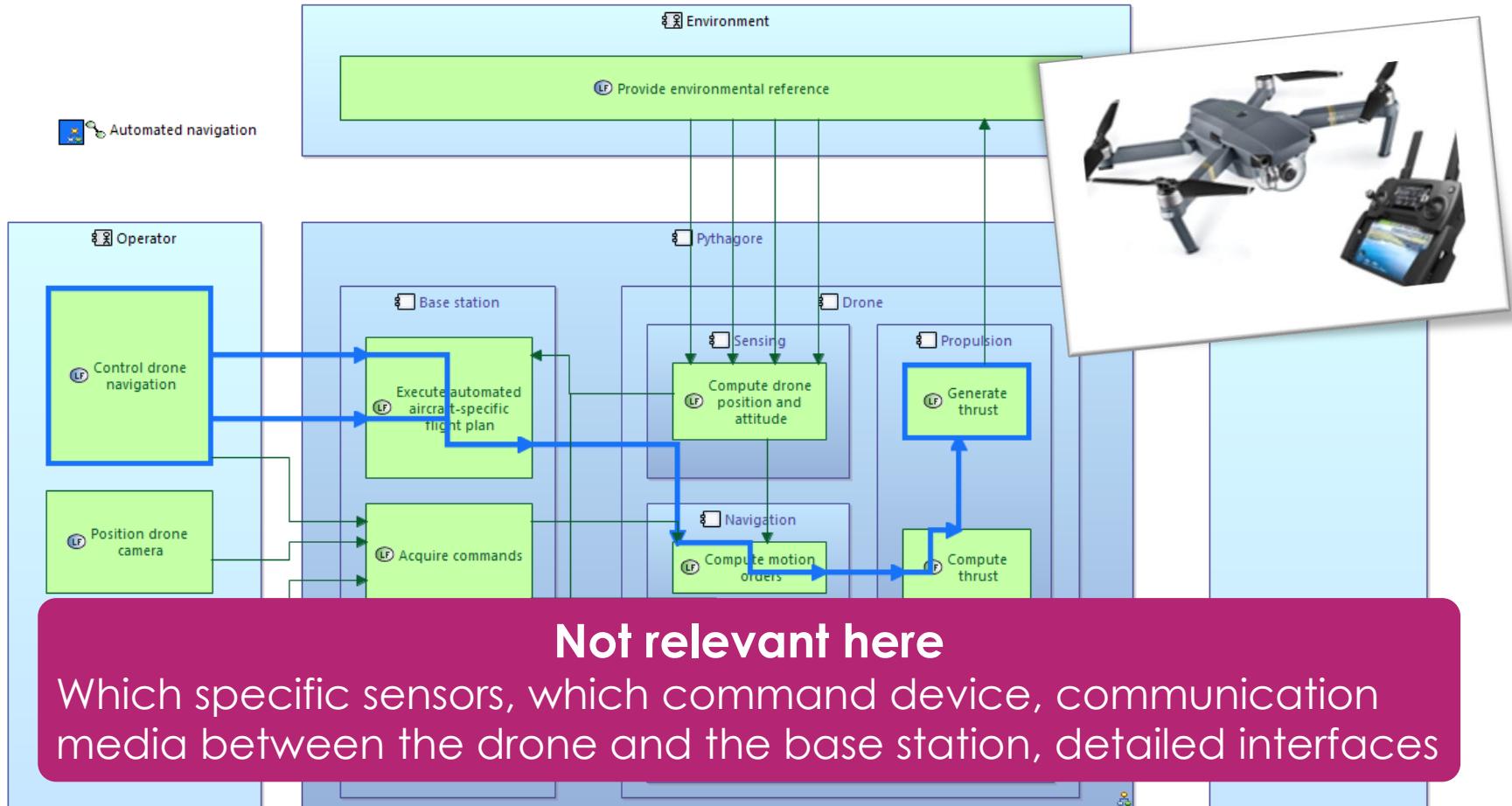


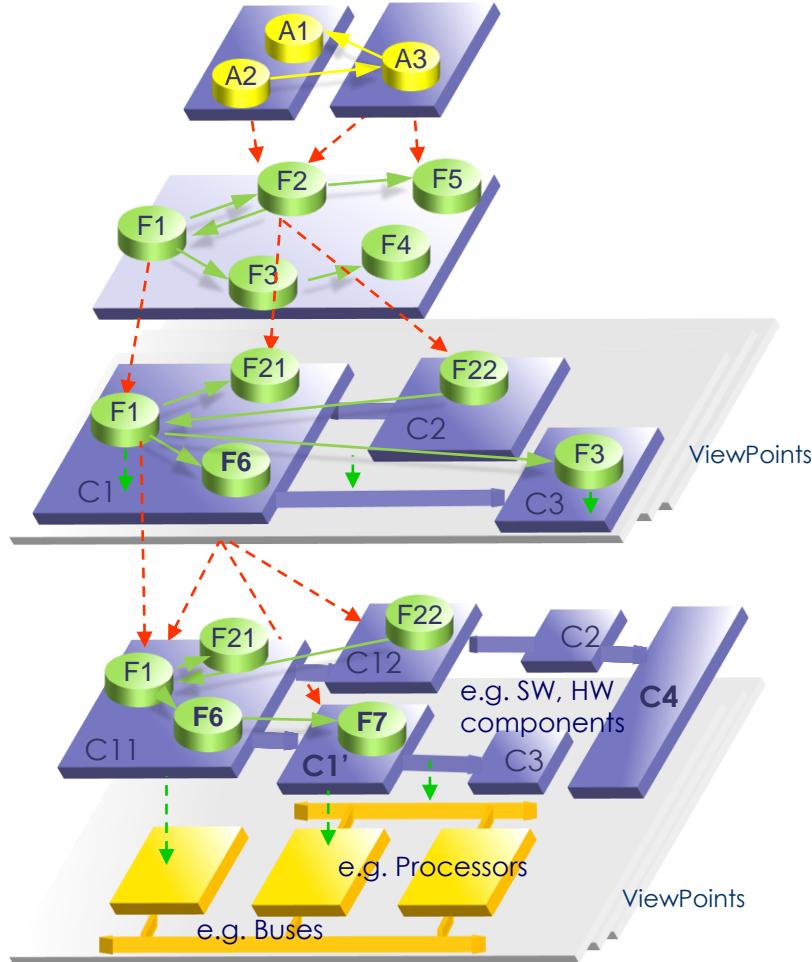


Conceptual solution

HOW THE SYSTEM WILL WORK SO AS TO FULFIL EXPECTATIONS

High-level architecture description, functional refinement, architectural drivers, functional allocation, first trade-offs, modes and states analysis





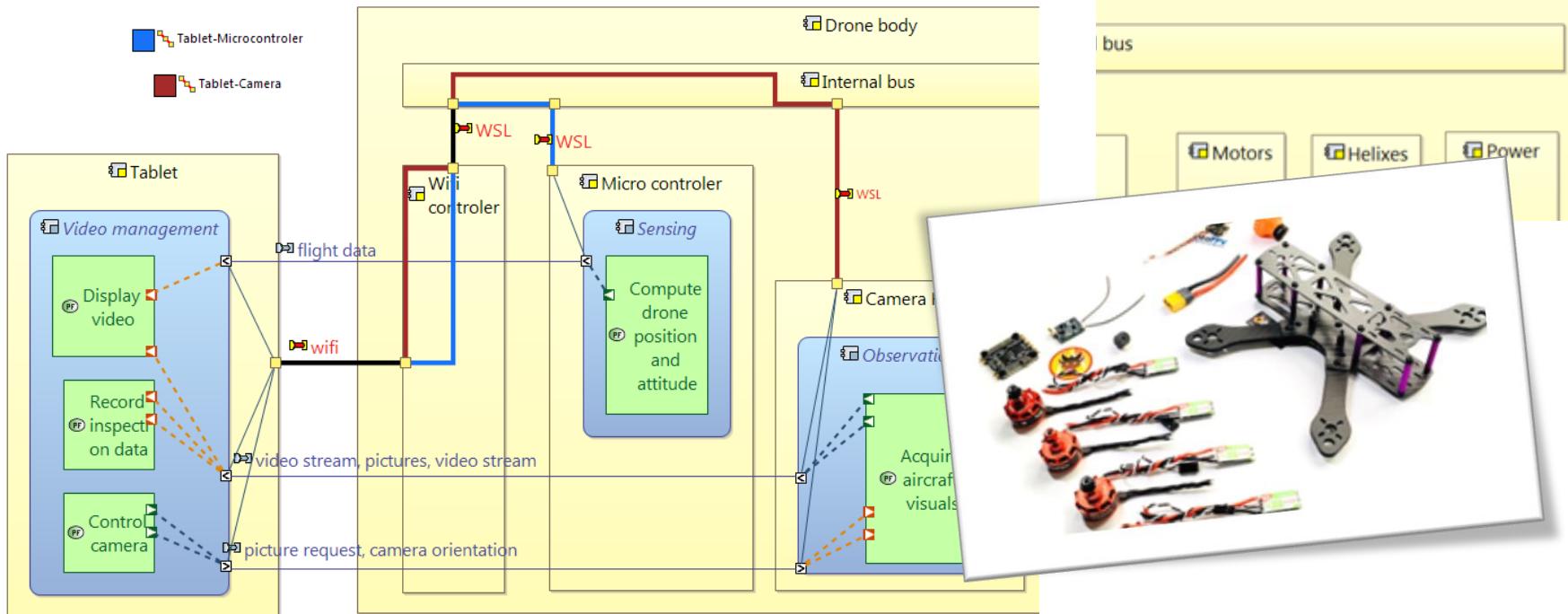
Finalized Architecture

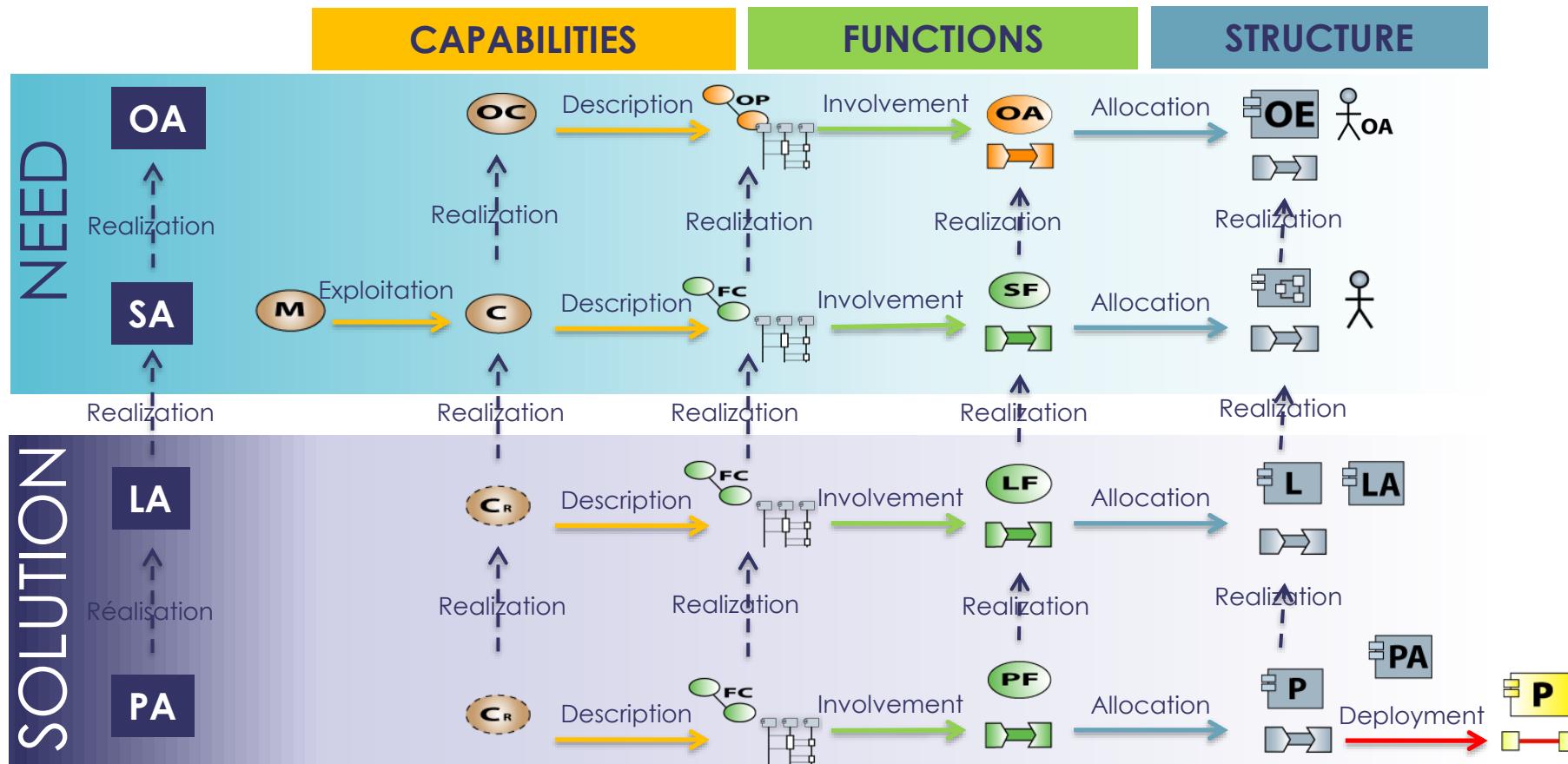
HOW THE SYSTEM WILL BE
DEVELOPED AND BUILT

Implementation constraints,
reuse, refined trade-offs,
M/T/B strategy,
finalized detailed interfaces

Not relevant here

Internal detailed design of each system constituent







Focus on (some) key features

1. Functional chains
2. Replication of elements
3. Filtering (add-on)
4. Property Values Management Tool (add-on)

1. Functional chains

What?

Creation and composition of functional chains

Why?

To capture system usage examples, to enforce design completeness and consistency, to drive engineering activities (e.g., V&V or development strategy)

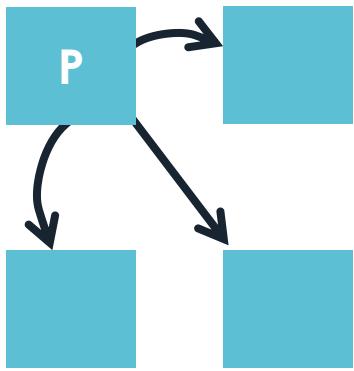
2. Replication of elements

What?

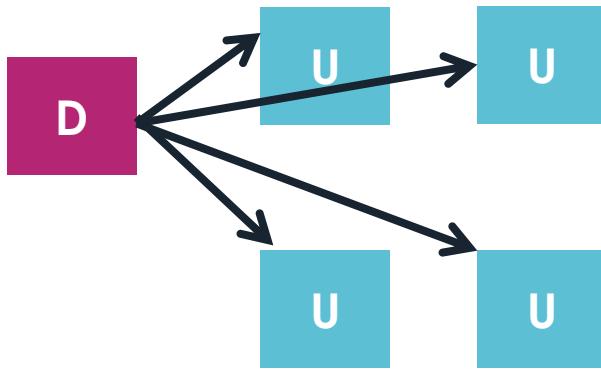
Automated synchronization of model parts, automated reconnections

Why?

Enabler for instance-level modeling (cloning of a prototype instance), enabler for reuse of building blocks



Prototype pattern
the « type » is also an instance



Definition and usages
« types » are defined separately

3. Filtering (add-on)

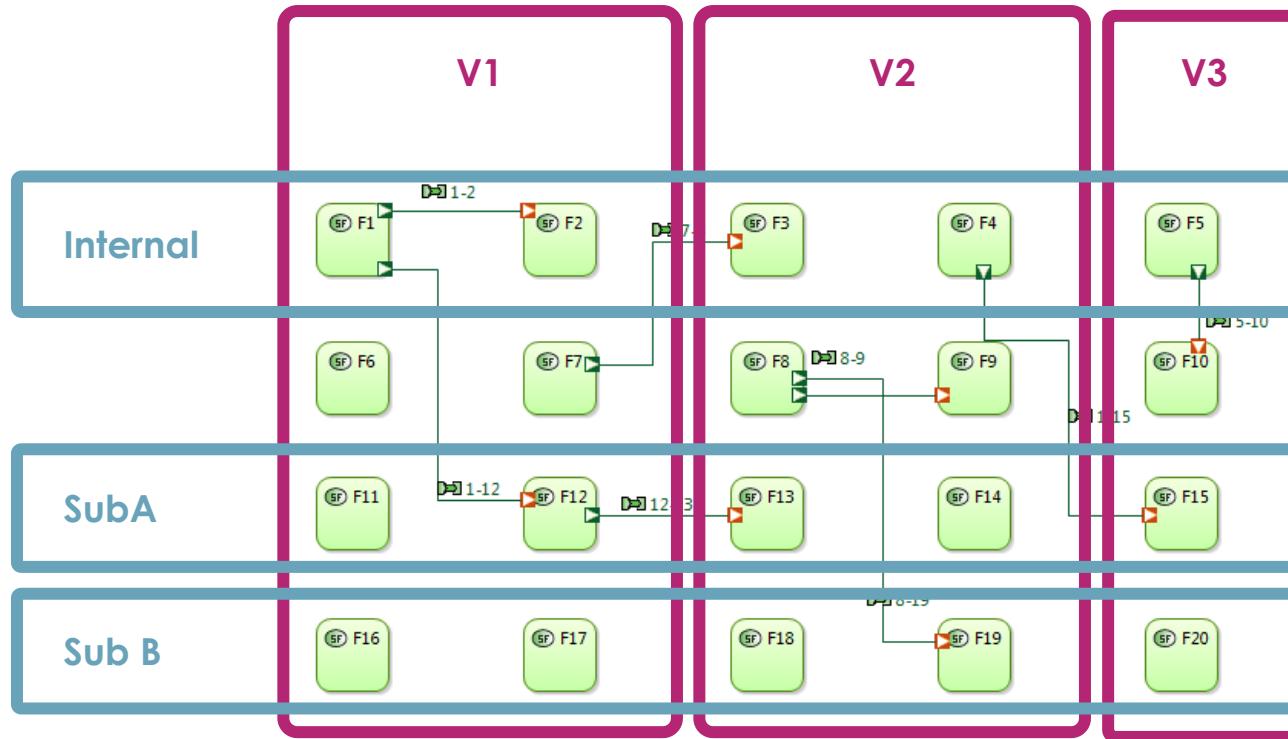
What?

Definition of criteria on model elements, automated preview and derivation of filtered models

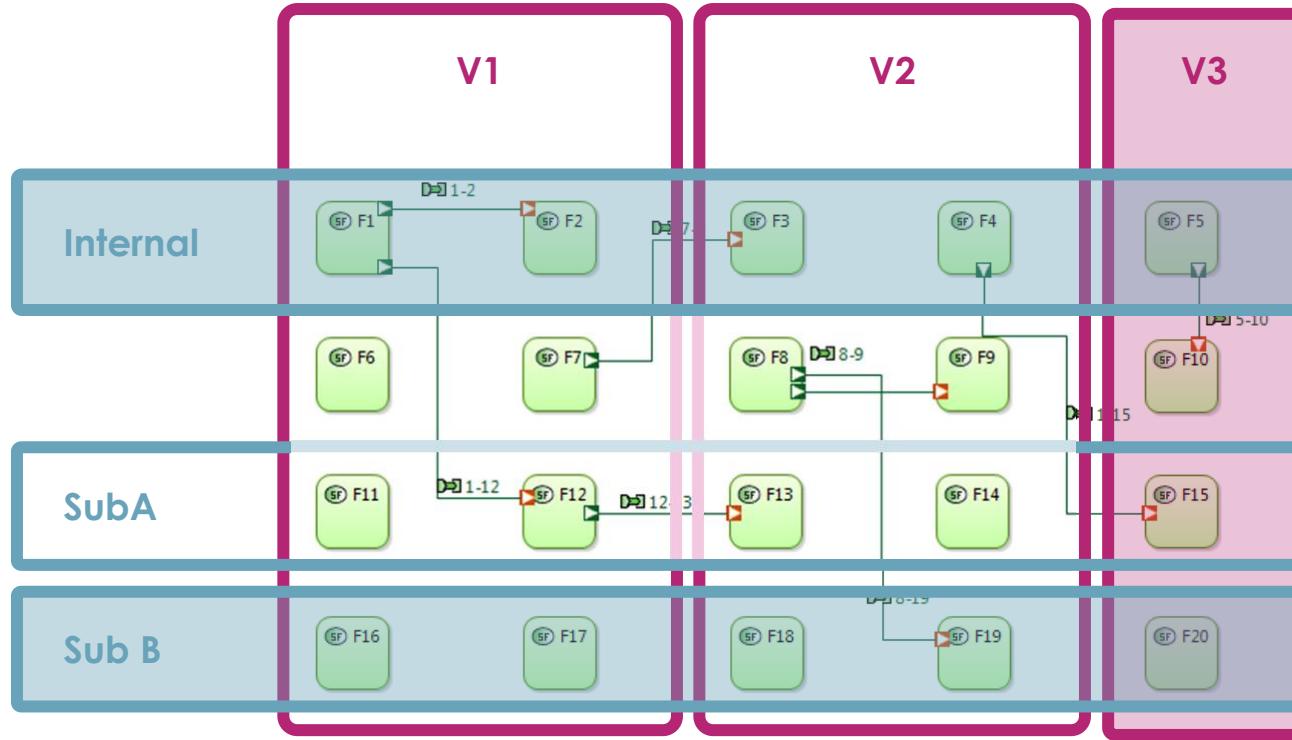
Why?

Master system increments, master the data exchanged with customer or sub-contractors, etc.

Overall need solution model



V1 and V2 for Sub A



4. Property Values Management Tool (add-on)

What?

Easy creation of model extensions and customization of diagram graphical rendering

Why?

Characterization of models with meaningful, domain-specific information, instant perception of added-value for models

Augmenting requirements with models

to improve the articulation between engineering levels
and optimize verification and validation activities



1. Model elements ARE requirements

Textual requirements

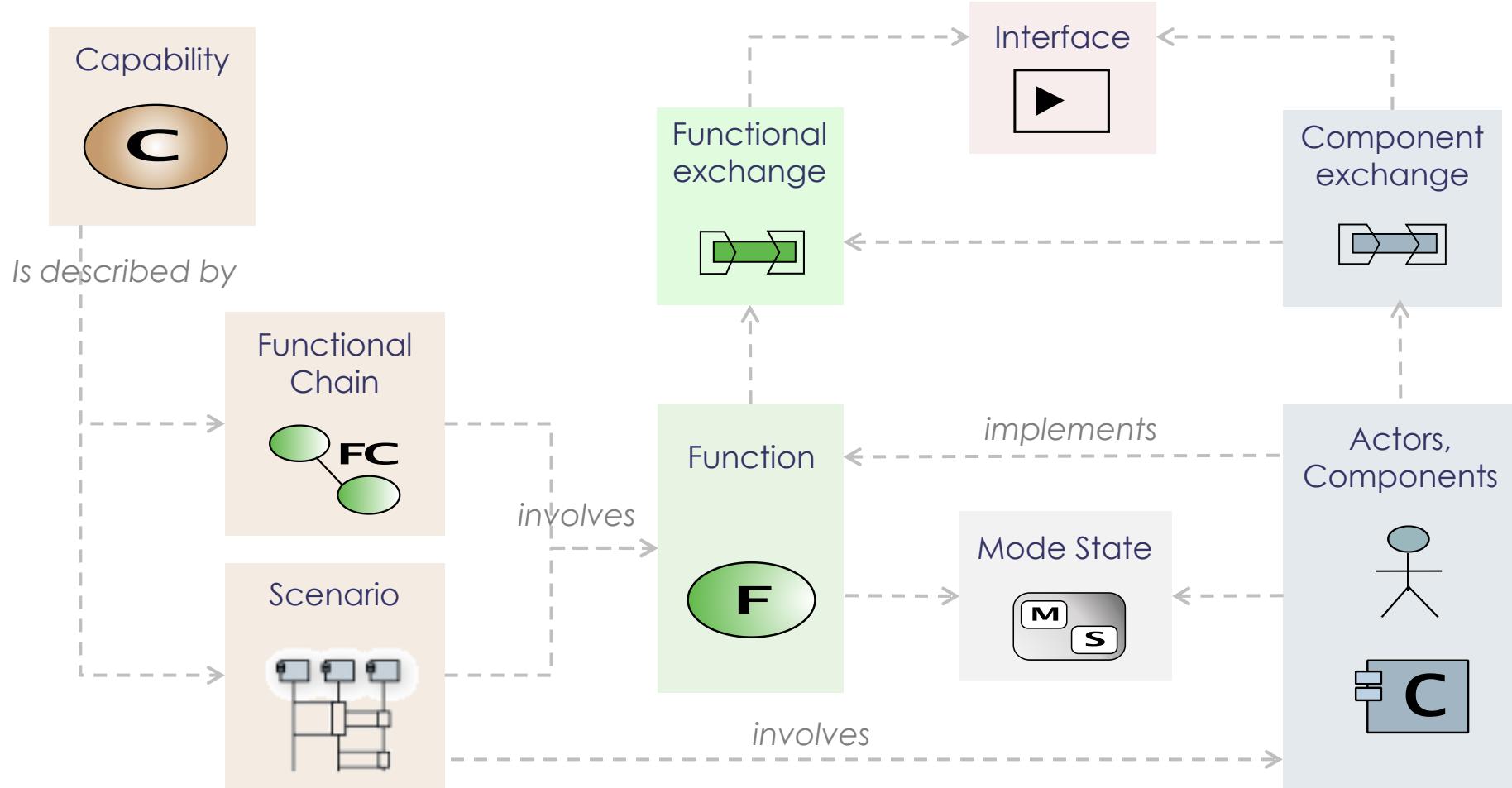
are at the heart of
the current
engineering
practices

Need model

helps formalize and
consolidate
customer and
system requirements

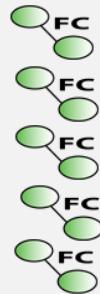
Solution model

helps validate
feasibility,
elicit/justify new
requirements for the
system/subsystems

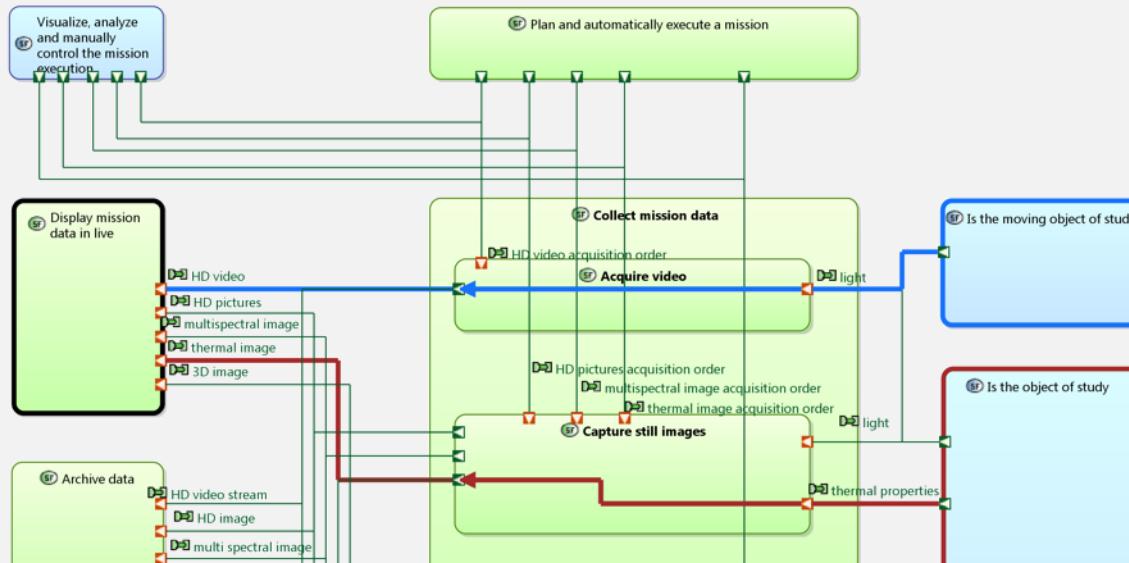




Visualize data in live during flight



- Display acquired HD video in live ■
- Display multi-spectral image in live
- Display thermal image in live ■
- Visualize all collected mission data
- Visualize substance level in live

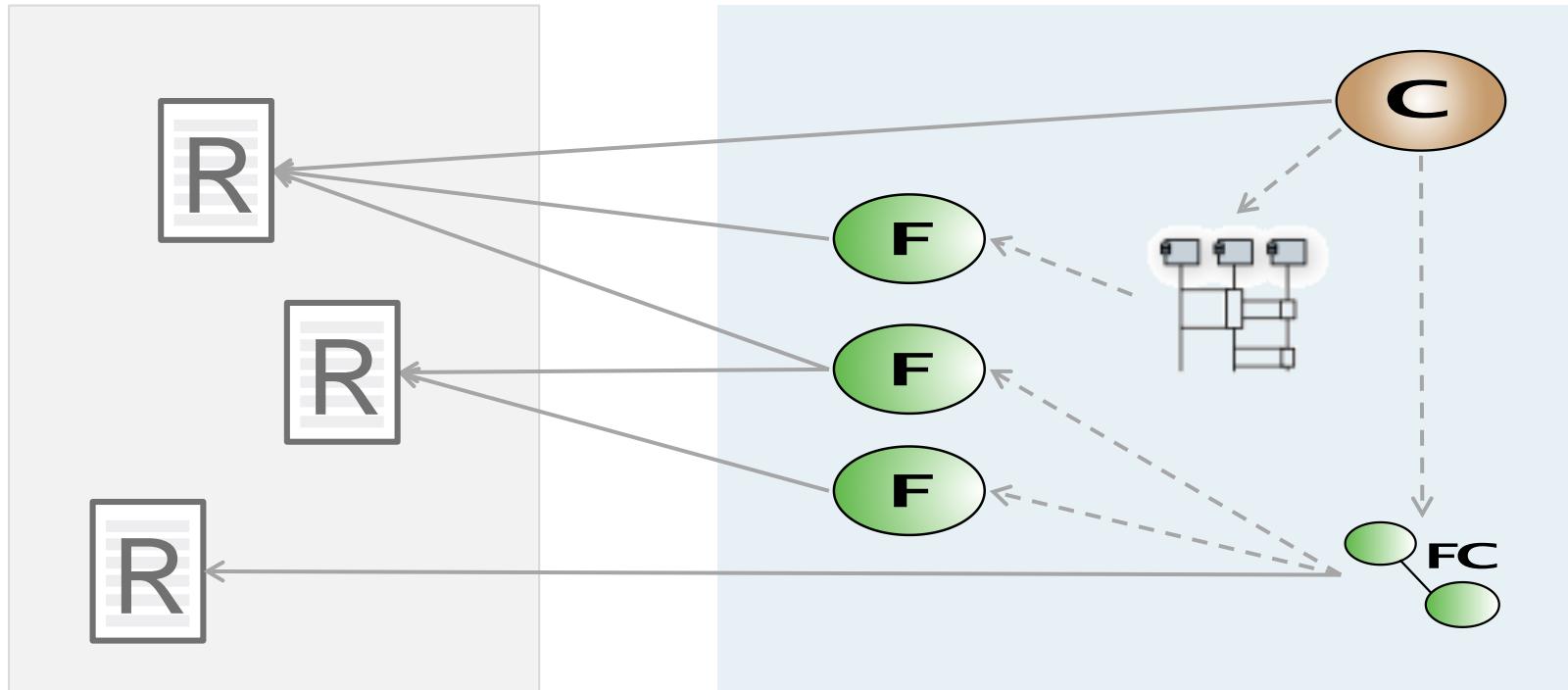


Models add rigor to need expression / solution description

Models enable automated processing

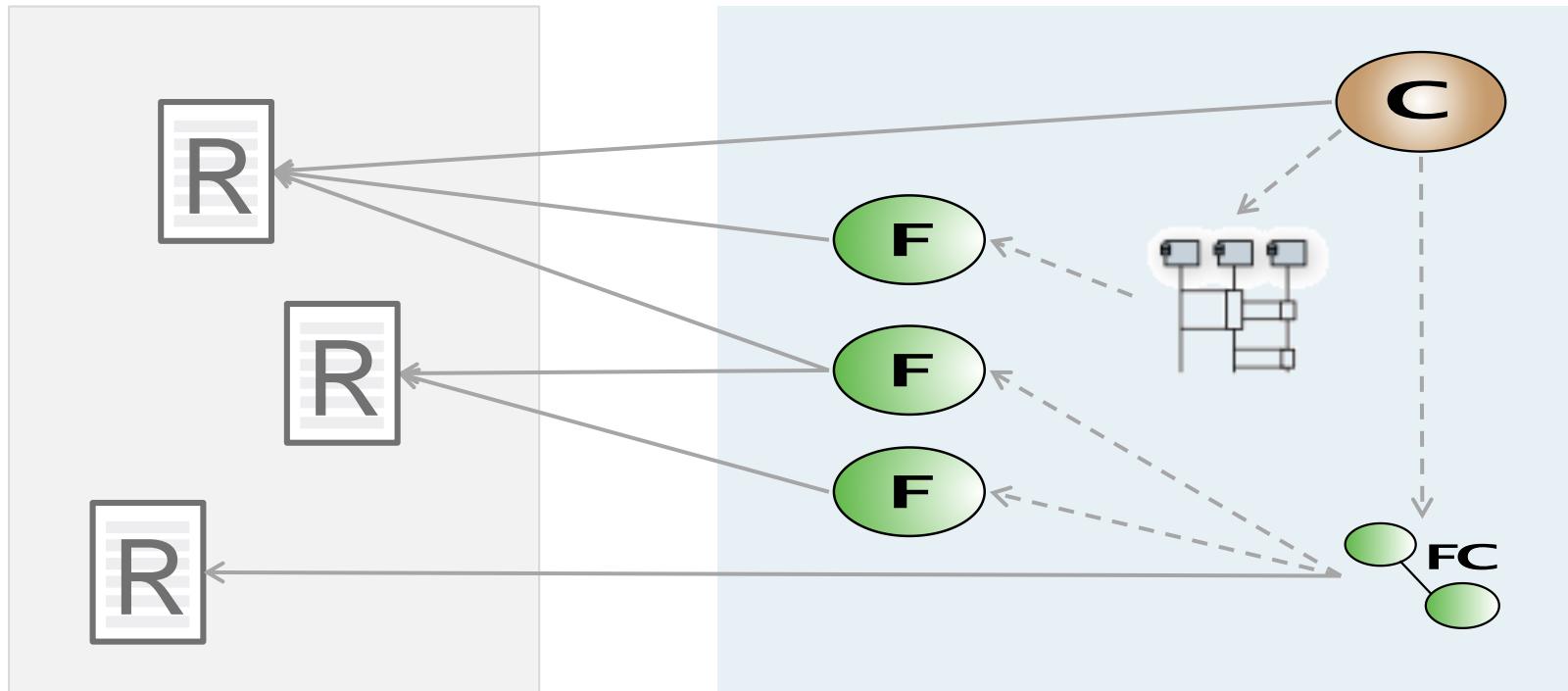
Requirements

Model elements

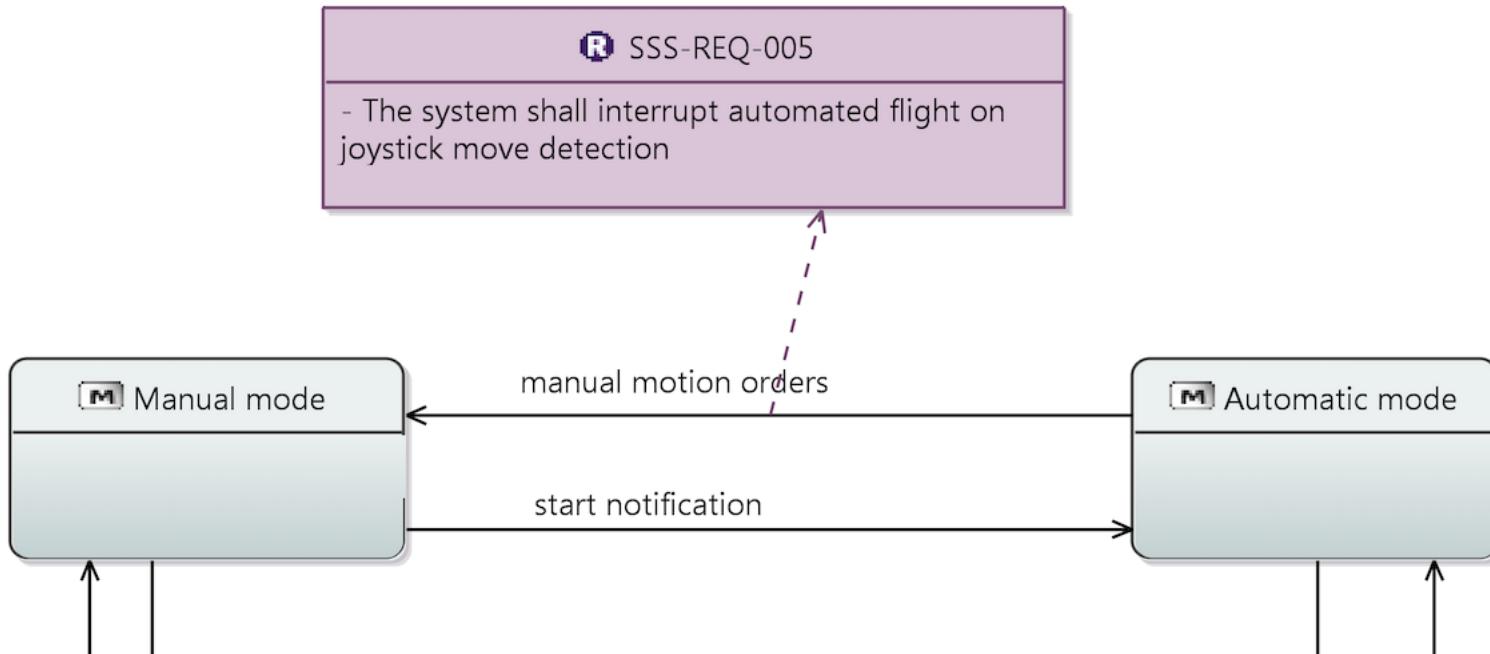


Textual Requirements

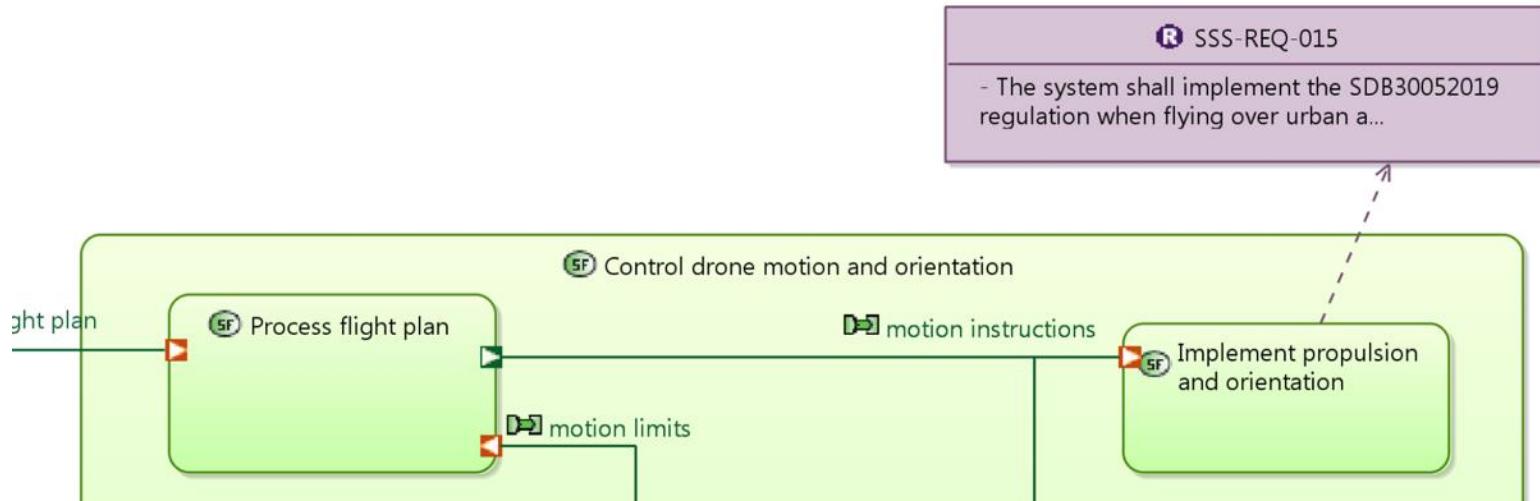
Model elements Requirements



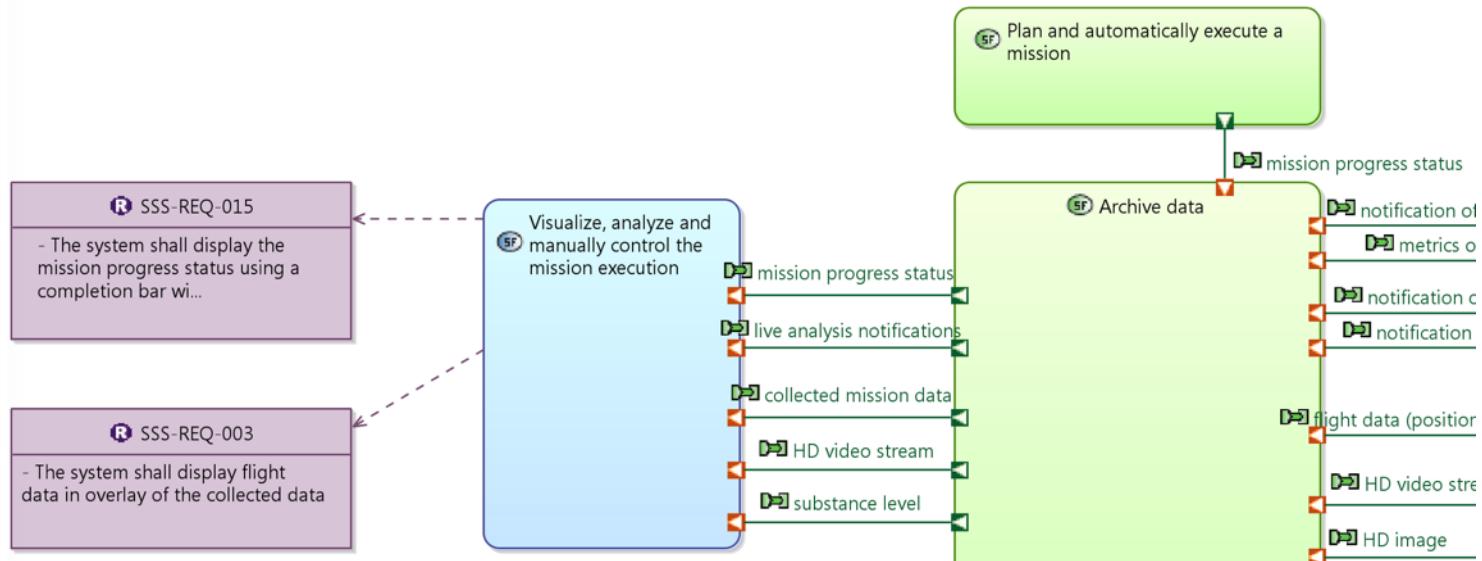
A model requirement can formalize a textual requirement
and explicit its effects and ramifications

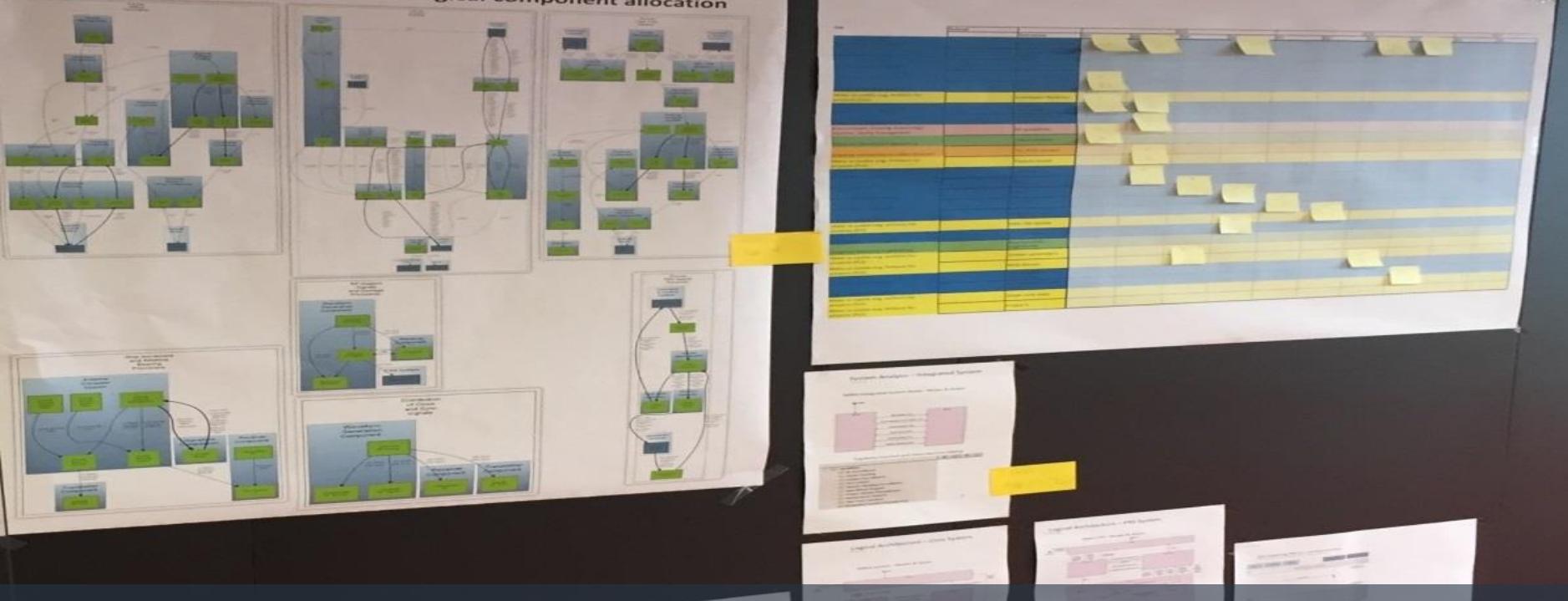


Some expectations (environmental, regulations, etc.)
are easier to express with textual descriptions.



Some expectations on a model element at a given engineering level do not require a formal modeling (which is left to subsystem design)

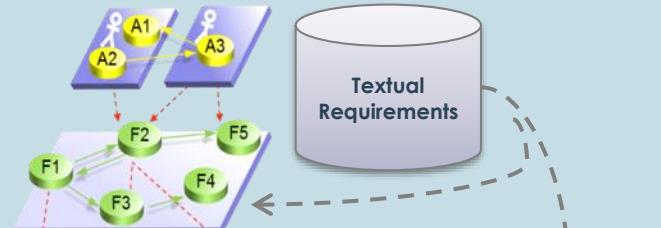




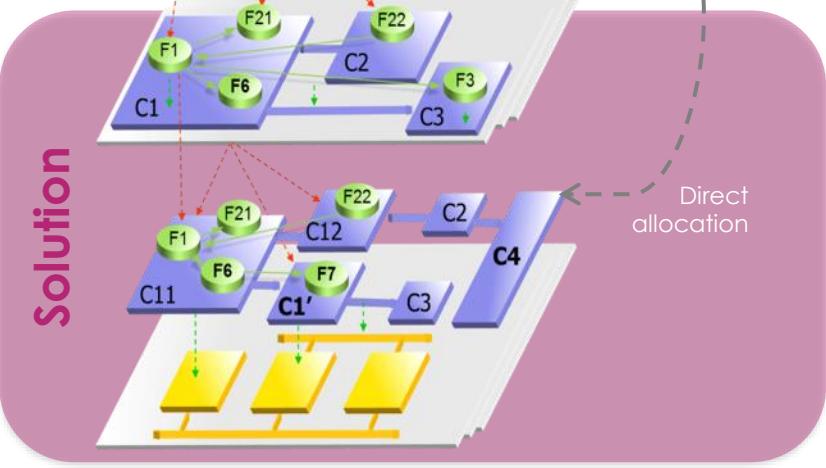
2. Contracts between engineering levels: workflow

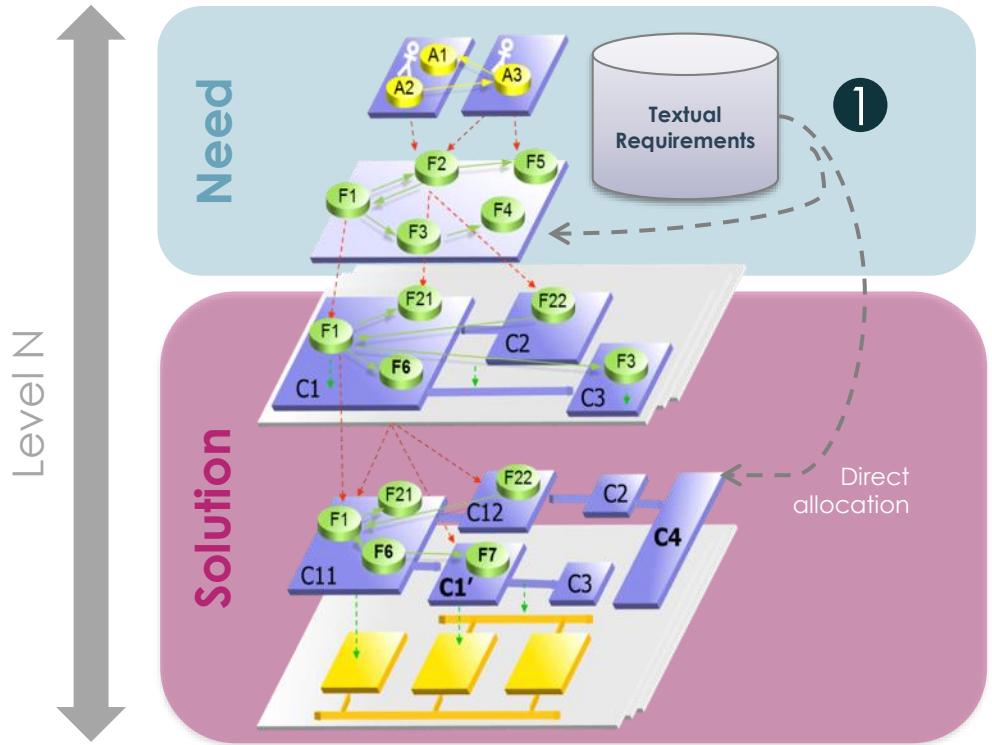
Level N

Need

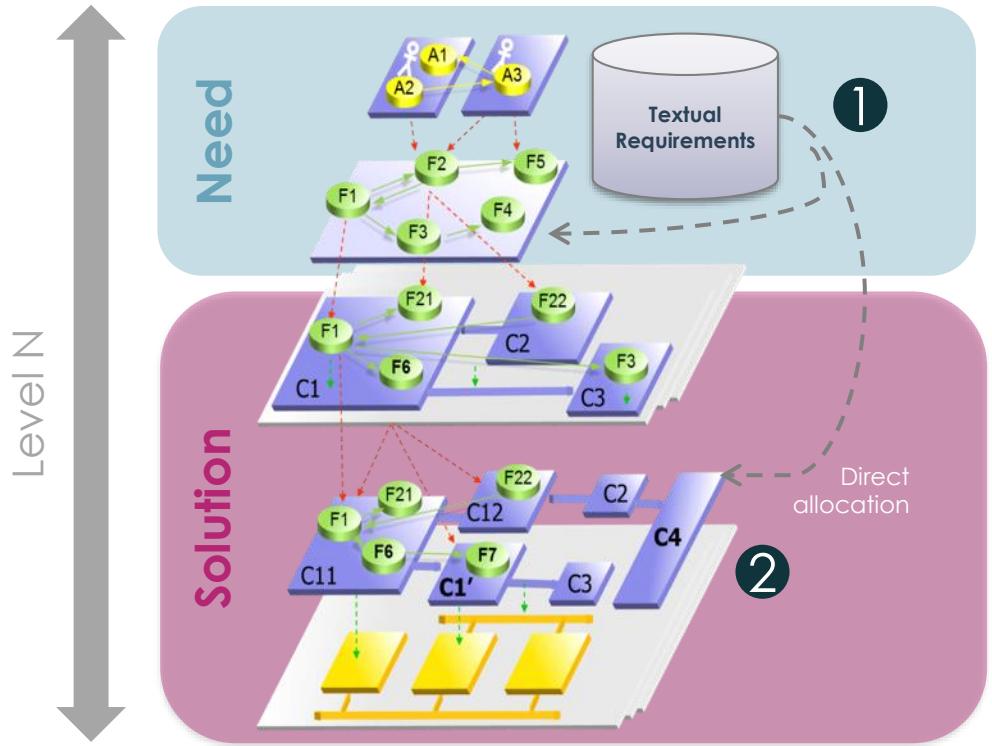


Solution





1. Elicitation of model and textual requirements on the system



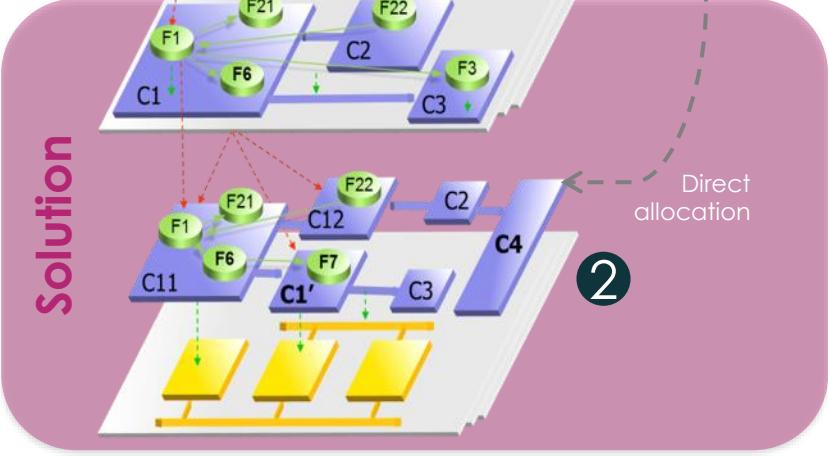
2.

Architecture description specifies with the adequate level of detail how the system works and what is expected from each constituent

The goal here is to prepare the contracts for all subsystems and guarantee their proper integration.

Level N

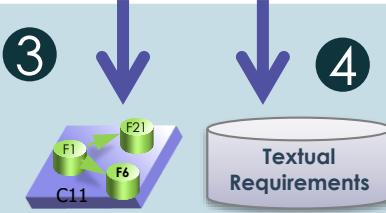
Need



2

Direct allocation

Need



3



4

1

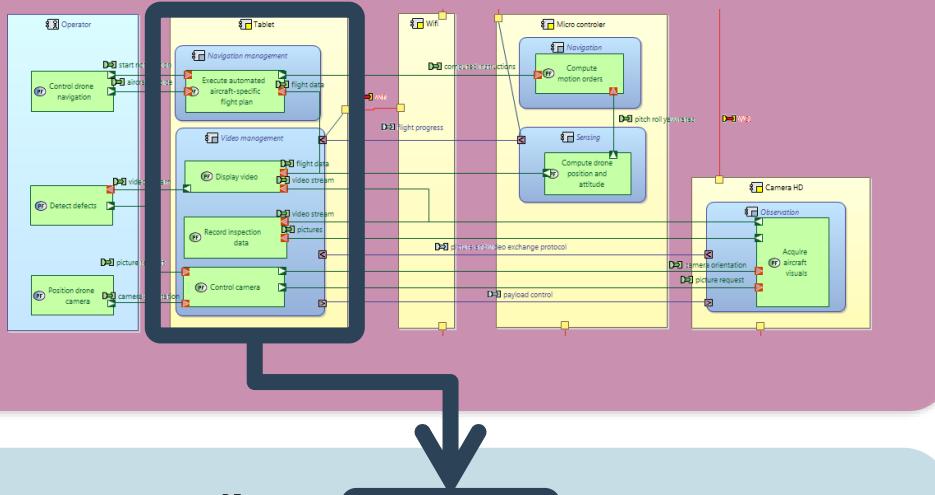
3.
The context of a given system constituent is entirely computed (anything contributing to the definition of this constituent including allocated Functions, interfacing Components, etc.)

4.

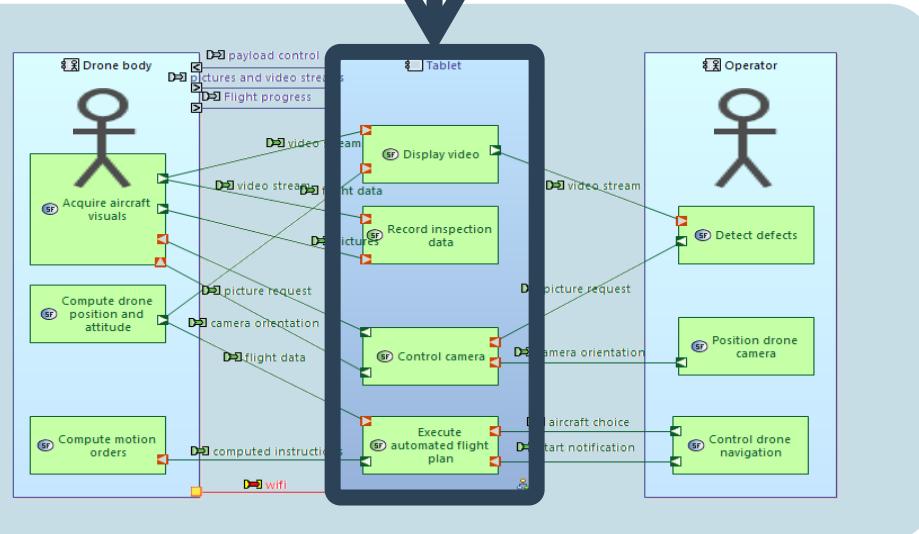
Textual requirements are created when needed, in addition to the model requirements: legal, non-functional, additional specification of internal expected behaviour

3

Tablet is a constituent of a drone-based system



Tablet is the (sub)system of interest





Model-based workflow favors co-engineering over the traditional differentiation between “customer” requirements and “system” requirements

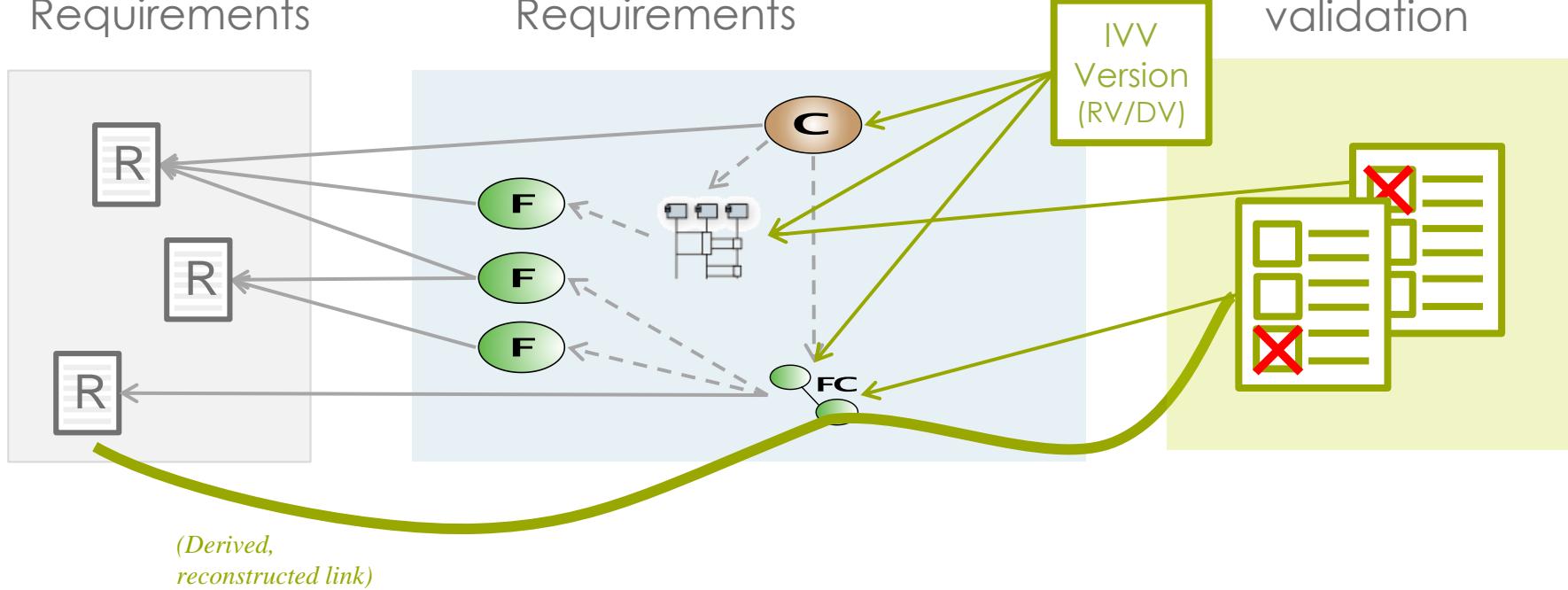


3. (Happy) consequences on V&V and incremental development strategy

Textual Requirements

Model Requirements

Verification and validation



C

Visualize data in live during flight



Display acquired HD video in live



Display multi-spectral image in live



Display thermal image in live



Visualize all collected mission data

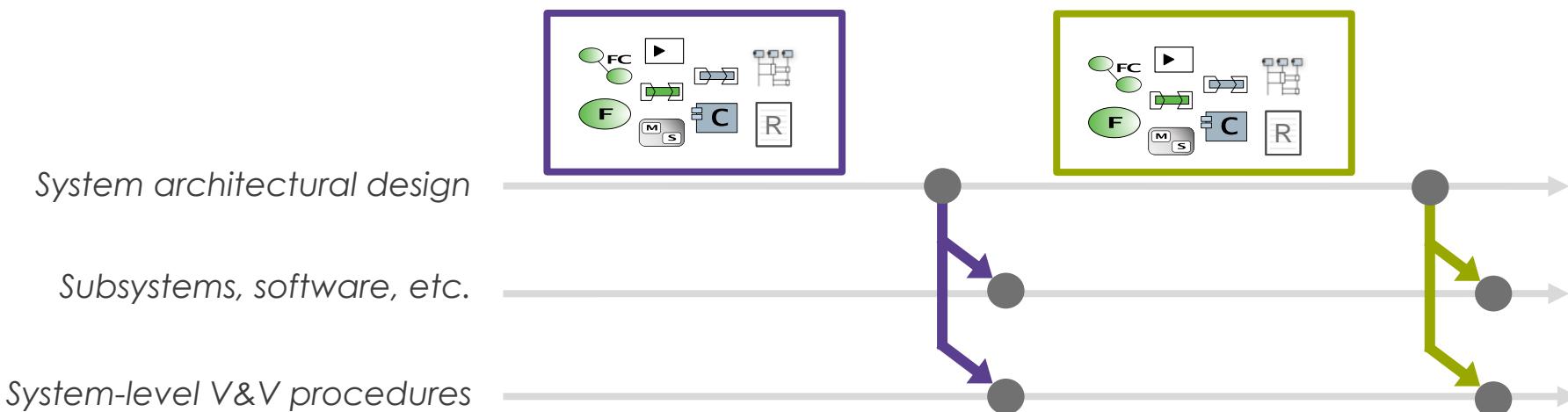


Visualize substance level in live



Definition of increments with expected functional chains (user stories)

Vertical slices of architectural design across need and solution models

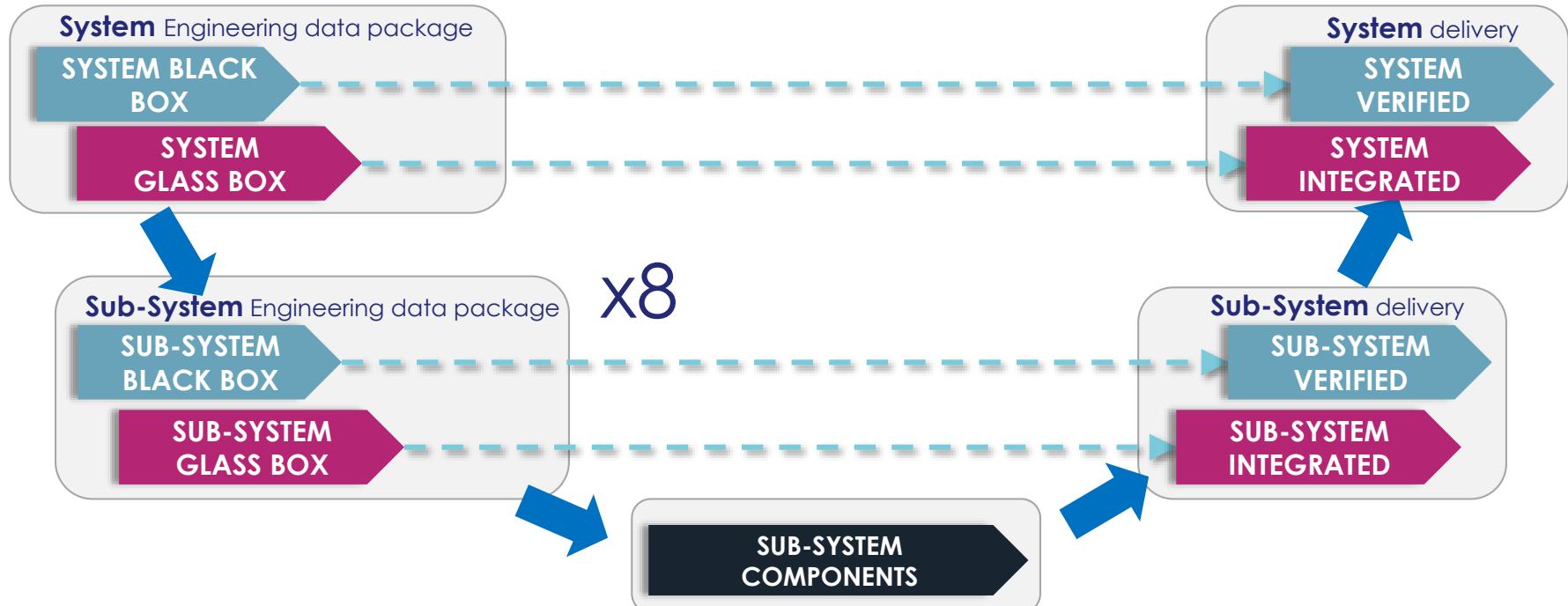




Instanciated workflow

Two years, 30 persons

Classical scheme, rolled out by increments



Functional Chains list

Functional Chains release definition

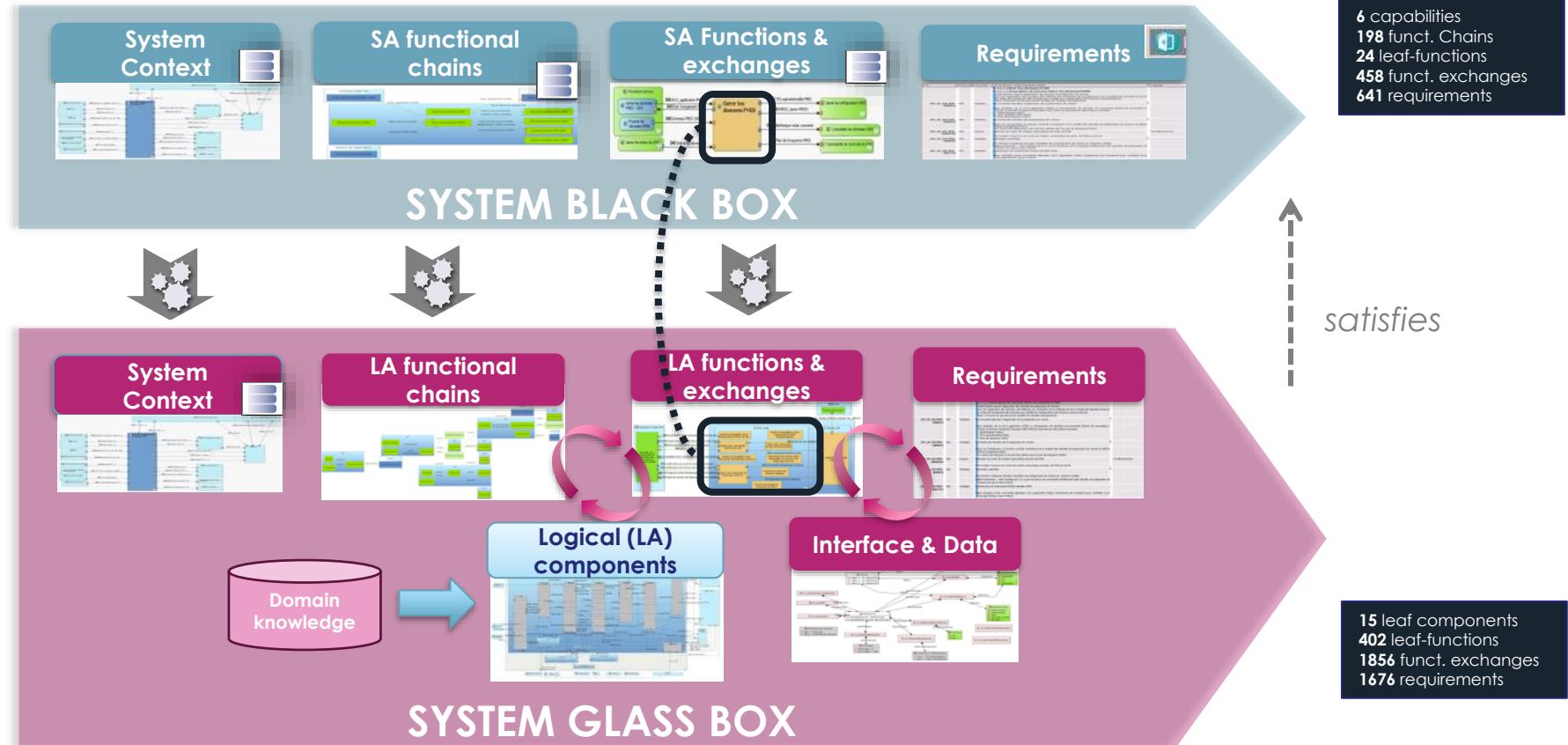
Functional chain

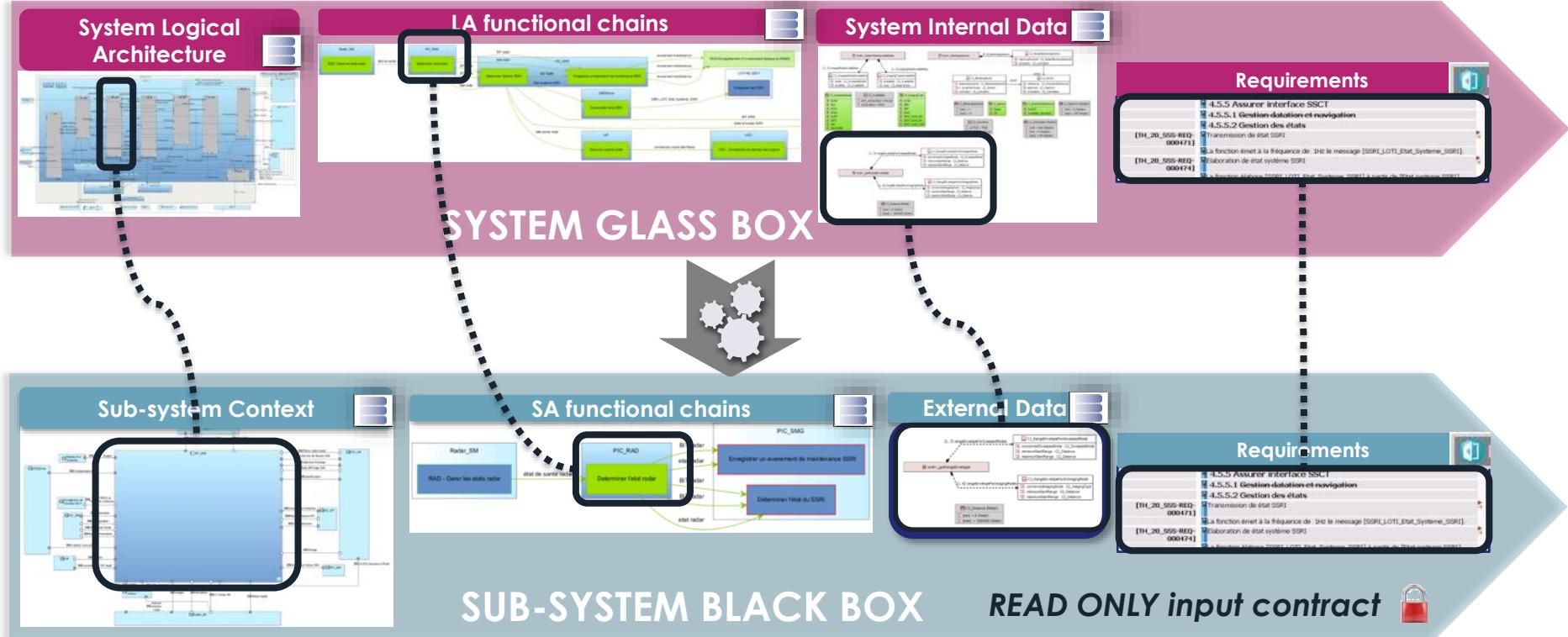
Requirements

IVV Test Suite Repository

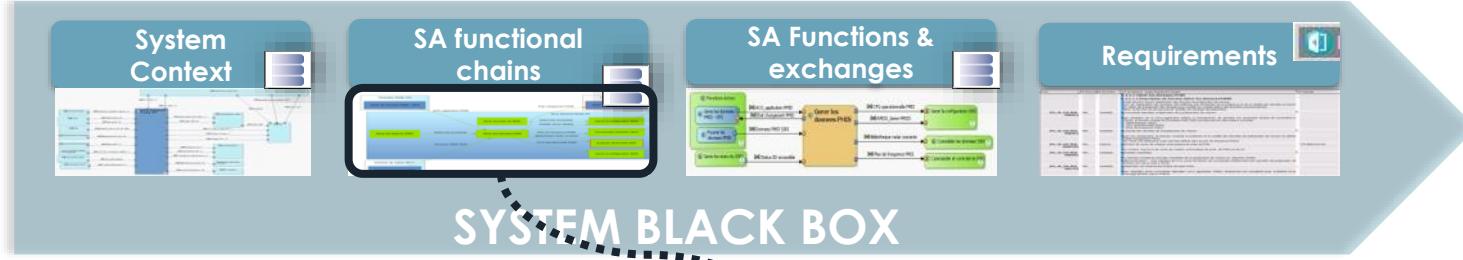
IVV procedure

Legend	To be filled	Automatically filled	Context Phase	Append test case(s)
3 Positionner l'axe de fin du même secteur à 15°	TH_20_SSR-REQ-000397 (-3)			
4 Vérifier que le secteur de blanking est affiché dans la vidéo radar FF en mode édition	TH_20_SSS-REQ-000397 (-5)			
5 Appliquer le secteur de blanking défini				
6 Activer le secteur de blanking n°1	TH_20_SSS-REQ-000397 (-2)			
7 Vérifier que le secteur de blanking n°1 est affiché dans la vidéo radar-IFF	TH_20_SSS-REQ-000397 (-3)			

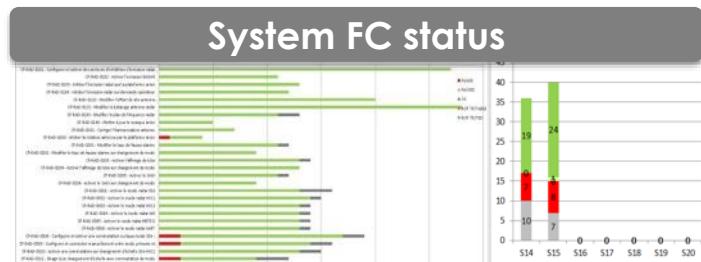
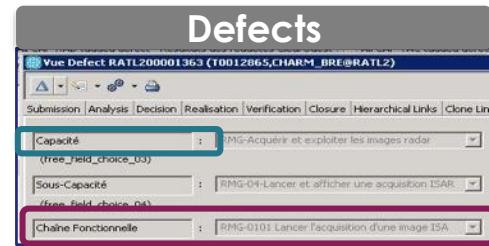
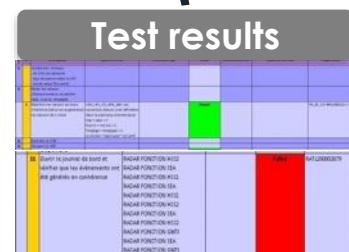




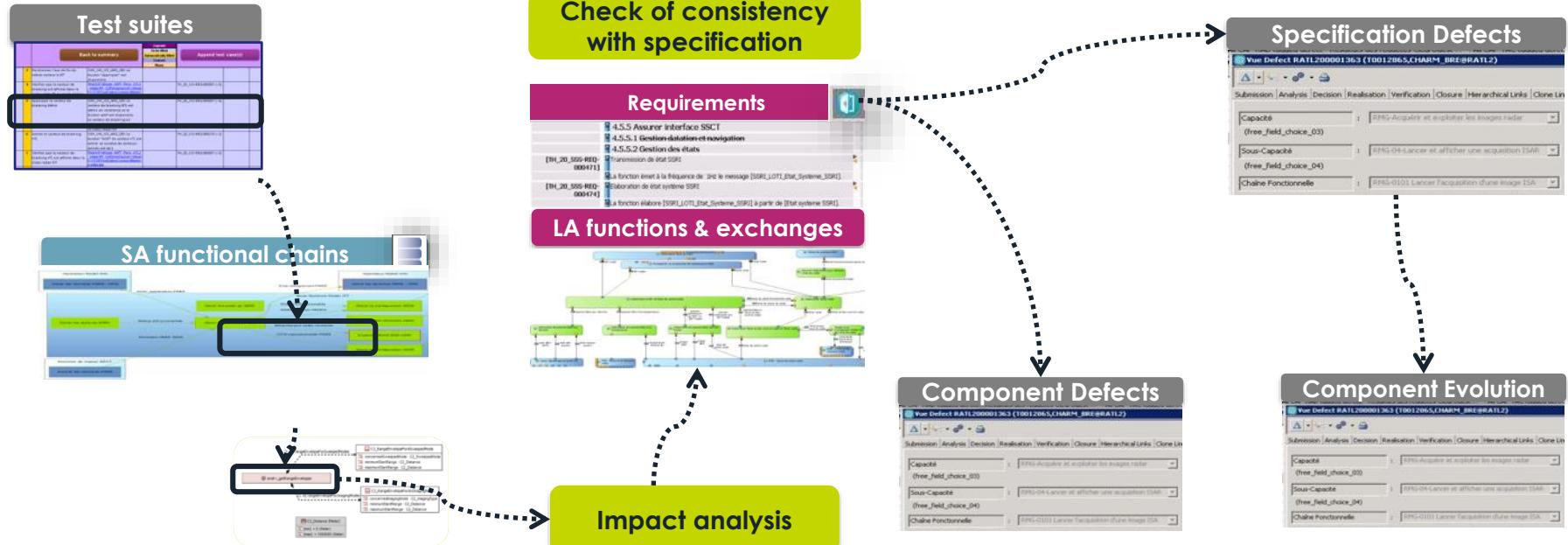
Enhanced monitoring of progress and verification



VERIFICATION ACTIVITIES



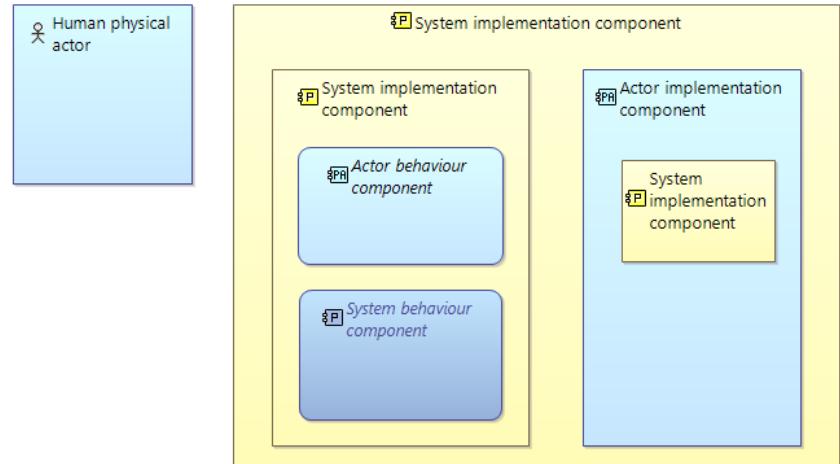
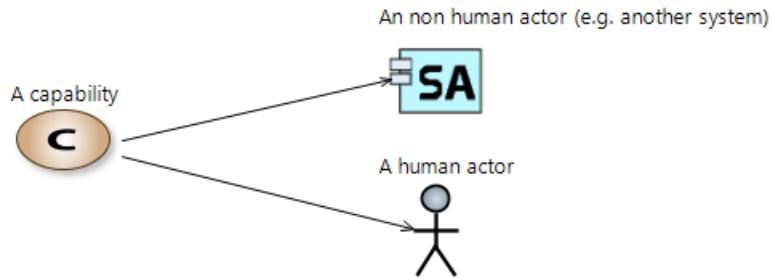
Test results, model facilitates analysis



Updates and perspectives

Sneek peak on 2 evolutions, global orientations

Refactoring of the modeling of actors



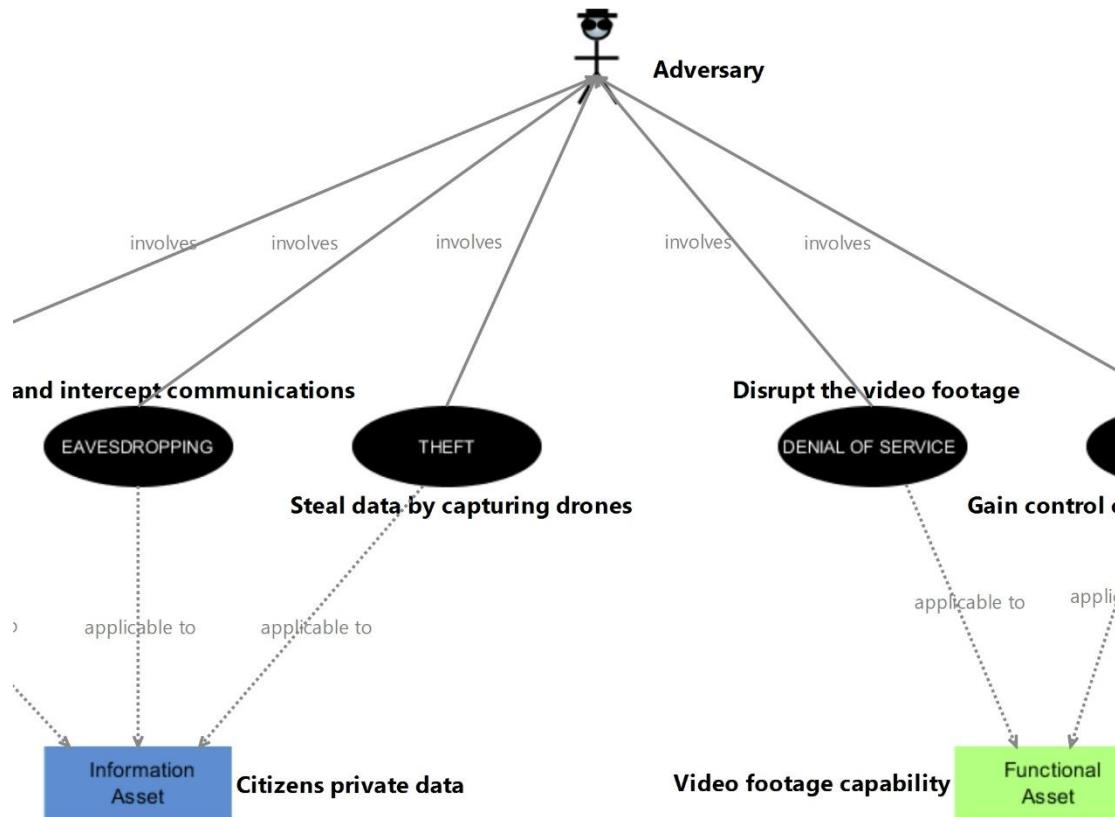
(Logical Component)
Editing of the properties of a Logical Component

Capella Description Extensions Management

Name : Any component
Summary :

Is abstract Is human Is actor

Assets & Threats Modeling for supporting cyber security risk management



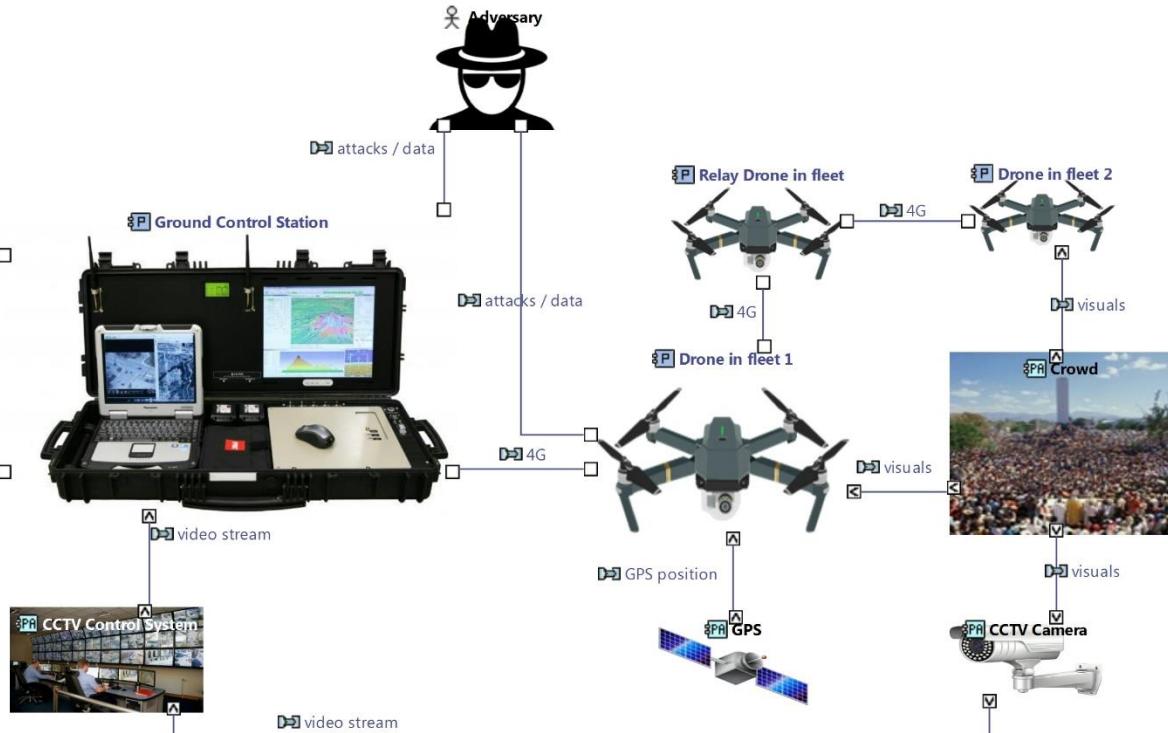
Describe the threats, threat sources, primary assets being threatened

Identify the critical data and the functions and components manipulating this data

Identify the trust boundaries

Visualize the security levels of the solution (Confidentiality, Integrity, Availability and Traceability security levels)

Assets & Threats Modeling for supporting cyber security risk management



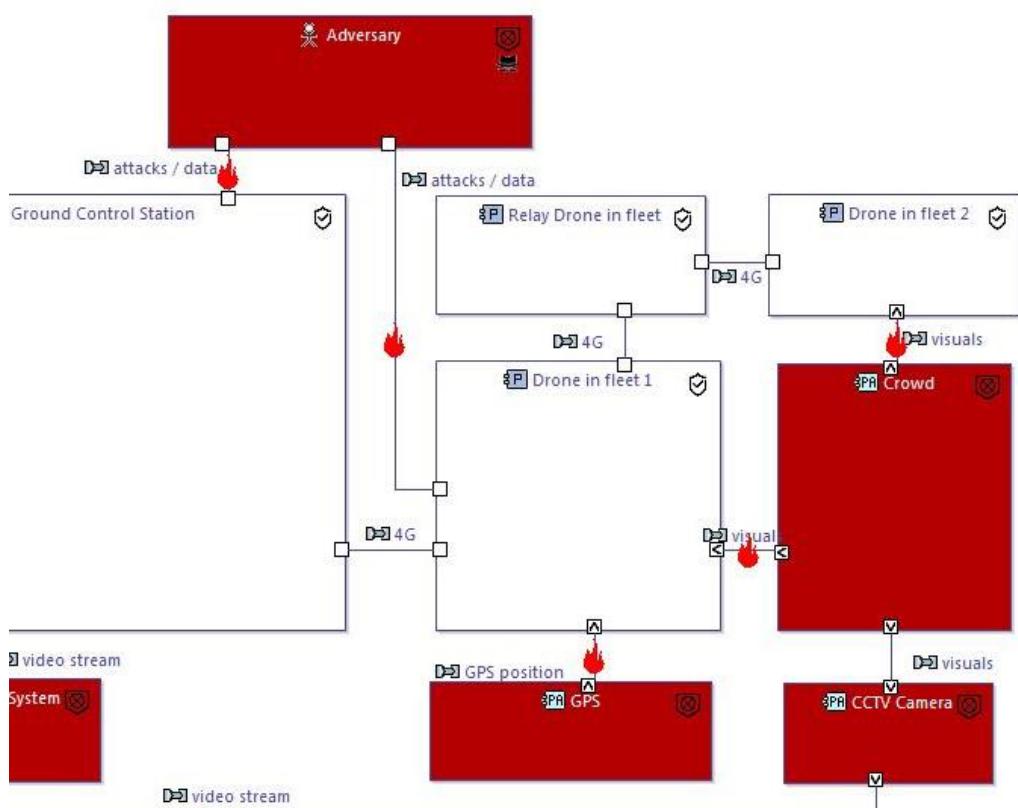
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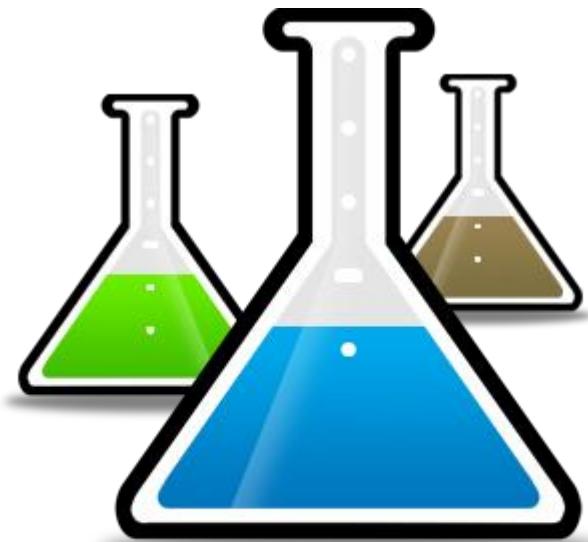


Describe the threats, threat sources, primary assets being threatened

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Visualize the security levels of the solution (Confidentiality, Integrity, Availability and Traceability security levels)



Coming soon...
(hopefully by the end of 2019)

A place to share open source
prototypes, experiments, small
non-industrialized developments.

IDEAS → PROTOTYPES → EXPERIMENTS → TESTS → LAUNCH

* LO - Launch Date



Resources

Forum		Messages	Topics	Last message
Capella - Capella Modeling Workbench and Arcadia MBSE Method - Click +/- to expand/collapse				
 General Information	Latest news about Capella	171	65	Mon, 29 October 2018 By: stephane.lacrampe.oobeo.fr ↗
 Arcadia	The Arcadia model-based engineering method	214	50	Wed, 21 November 2018 By: xurenfei.glaวย.com ↗
 Capella workbench	Any tool-related question, suggestions, problem, etc	1625	363	Thu, 06 December 2018 By: zhangtonghui.glaวย.com ↗
 Capella Studio	Capella Studio related questions.	296	85	Mon, 03 December 2018 By: yvan.lussaud.oobeo.fr ↗
[Mark all messages read] [New]				

<https://polarsys.org/forums/index.php/f/10/>

THALES

How is Capella different?

WEBINAR, SEPTEMBER 12th 2017

Stéphane Bonnet
In charge of Thales Corporate MBSE Coaching & Community
Capella Design Authority
stephane.bonnet@thalesgroup.com

www.thalesgroup.com

0:00 / 51:51

Capella Webinars

PolarSys Capella - 1/8

Capella - How is Capella different?
PolarSys Capella

[Webinar] Thales return on experience: usage of Capella in PolarSys Capella

2 Capella - webi 19:47

3 Capella - webi 44:46

4 Capella - 17:24

Equivalences and differences between Arcadia/Capella and PolarSys Capella

What's new in Capella 1.2?
PolarSys Capella

Systems Engineering Transformation

Naval Air Warfare Center Aircraft Division

<https://www.youtube.com/playlist?list=PLfrEYVpSGVLxEFRQDSWUTP8N5i3NTG4o->

[ARCADIA METHOD ▾](#)[WORKBENCH ▾](#)[SERVICES](#)[COMMUNITY](#)[CONTACT](#)[DOWNLOAD](#)

OPEN SOURCE SOLUTION FOR MODEL-BASED SYSTEMS ENGINEERING

Comprehensive, extensible and field-proven MBSE tool and method
to successfully design systems architecture

<https://polarsys.org/capella/index.html>



Capella Webinar on **Functional Chains**

September 19th , 2019

4 PM - 5 PM (Paris / Berlin local time)

http://bit.ly/Registration_CapellaWebinar19_5

Thank You! Questions?

Capella website:

<http://www.polarsys.org/capella/>

LinkedIn 

<https://www.linkedin.com/groups/8605600>

Twitter 

https://twitter.com/capella_arcadia

Arcadia forum:

<https://polarsys.org/forums/index.php/f/12/>

Capella forum:

<https://polarsys.org/forums/index.php/f/13/>

IFE model & doc.:

<http://www.polarsys.org/capella/start.html>

www.thalesgroup.com

