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Architecting Systems of Systems

Module 3: *The AMADEOS* *architectural framework*

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towards a SoS profile and supporting tools



Module 3 - outline

- The AMADEOS Architectural Framework
- Details on conceptual, logical and implementation level

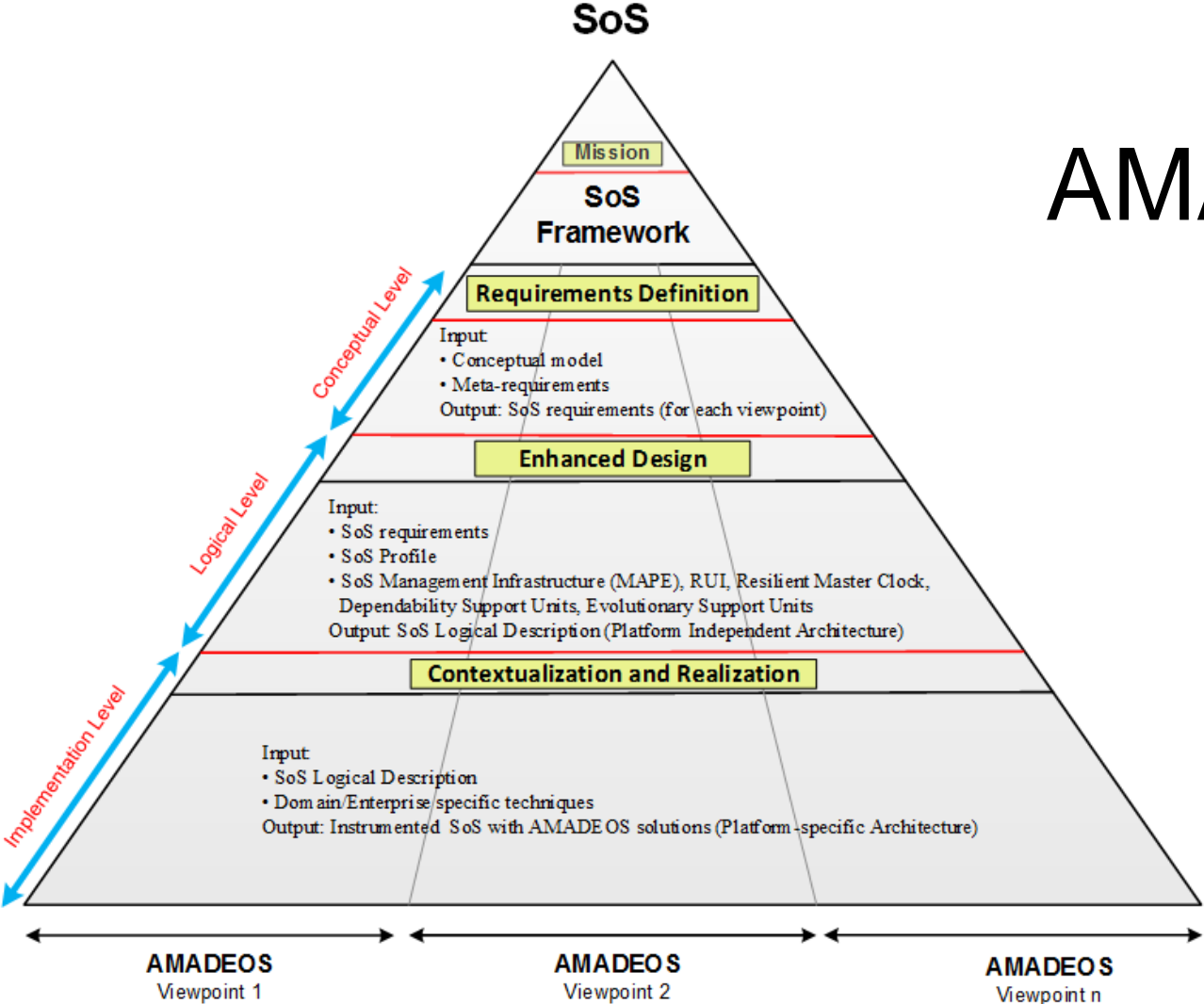
P. Lollini

THE AMADEOS ARCHITECTURAL FRAMEWORK

Architectural Frameworks

- An **Architectural Framework** (AF) **is not** an architecture itself, but it provides
 - the rules, guidance, and artefacts (architectural views) for collaboratively developing, presenting and communicating architectures.
- The **AMADEOS AF** provides guidance towards **designing and building SoS** that are
 - *evolvable, dynamic, secure, dependable*, that can *evolve* and manage *emergence* and that can properly support *time*.

The AMADEOS AF



Mission



- Objective:
 - definition of the overall objectives and functionalities of an SoS.
- Input:
 - shortened version of the glossary, to illustrate main SoS concepts, and to identify the relevant arguments that should be captured in the mission.
- Output:
 - **Document of intents** created by enterprise managers having in mind
 - a **high-level perspective of the system** and
 - a **clear definition of business-related issues**.

Conceptual level



- Objective:
 - Elicitation of SoS requirements for the different viewpoints
- Input:
 - the document of intents formalizing the SoS mission
 - the **SoS AMADEOS conceptual model**
 - the **SoS AMADEOS meta-requirements**, guiding the identification of SoS requirements
- Output:
 - **SoS requirements**

AMADEOS Meta-requirements

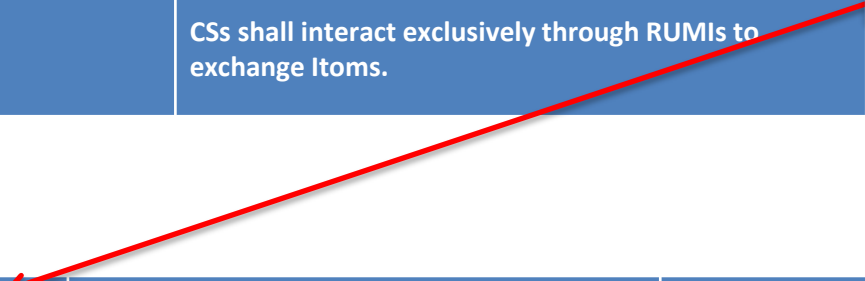
- Meta-Requirements framework
 - 124 meta-requirements describing SoS **elements**, **peculiarities**, or **characteristics** that should be identified when describing an SoS.
 - Structured based on viewpoints
- Goal: guide the identification of SoS requirements

Few examples

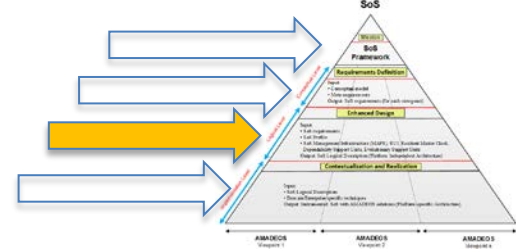
- Architectural meta-requirement:
 - [ARCH 3] CSs shall interact **exclusively** through RUMIs to exchange Itoms.
- Dynamicity meta-requirement:
 - [DYNAM 5] In an SoS, the **influence of dynamicity** on dependability, security, and handling of time shall be analyzed and, if necessary and possible, may be mitigated.
- Emergence meta-requirement:
 - [EMERGE 2] Appropriate efforts shall be devoted to **observe and predict detrimental emergence** phenomena and mitigate their effect on the SoS.

From meta-requirements to SoS requirements (extracted from Smart grid HH scenario)

ID Meta-Requirements	Description	ID SoS Requirement
[ARCH 3]	CSs shall interact exclusively through RUMIs to exchange Itoms.	REQ_ARC_004, REQ_ARC_013, REQ_ARC_014, REQ_ARC_015, REQ_ARC_016, REQ_ARC_017, REQ_ARC_018, REQ_ARC_019, REQ_ARC_020, REQ_ARC_021
REQ_ARC_004	Architecture	Home appliances shall have RUMI in order to receive commands/set points from EMG.

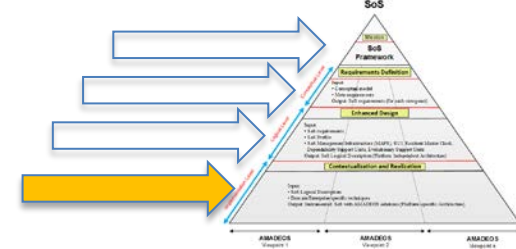


Logical level



- Objective:
 - SoS architectural design
- Input:
 - viewpoint-based SoS requirements
 - the SoS profile
 - the building blocks (**RUI, MAPE, RMC**)
- Output:
 - **SysML model** of the targeted SoS

Implementation level

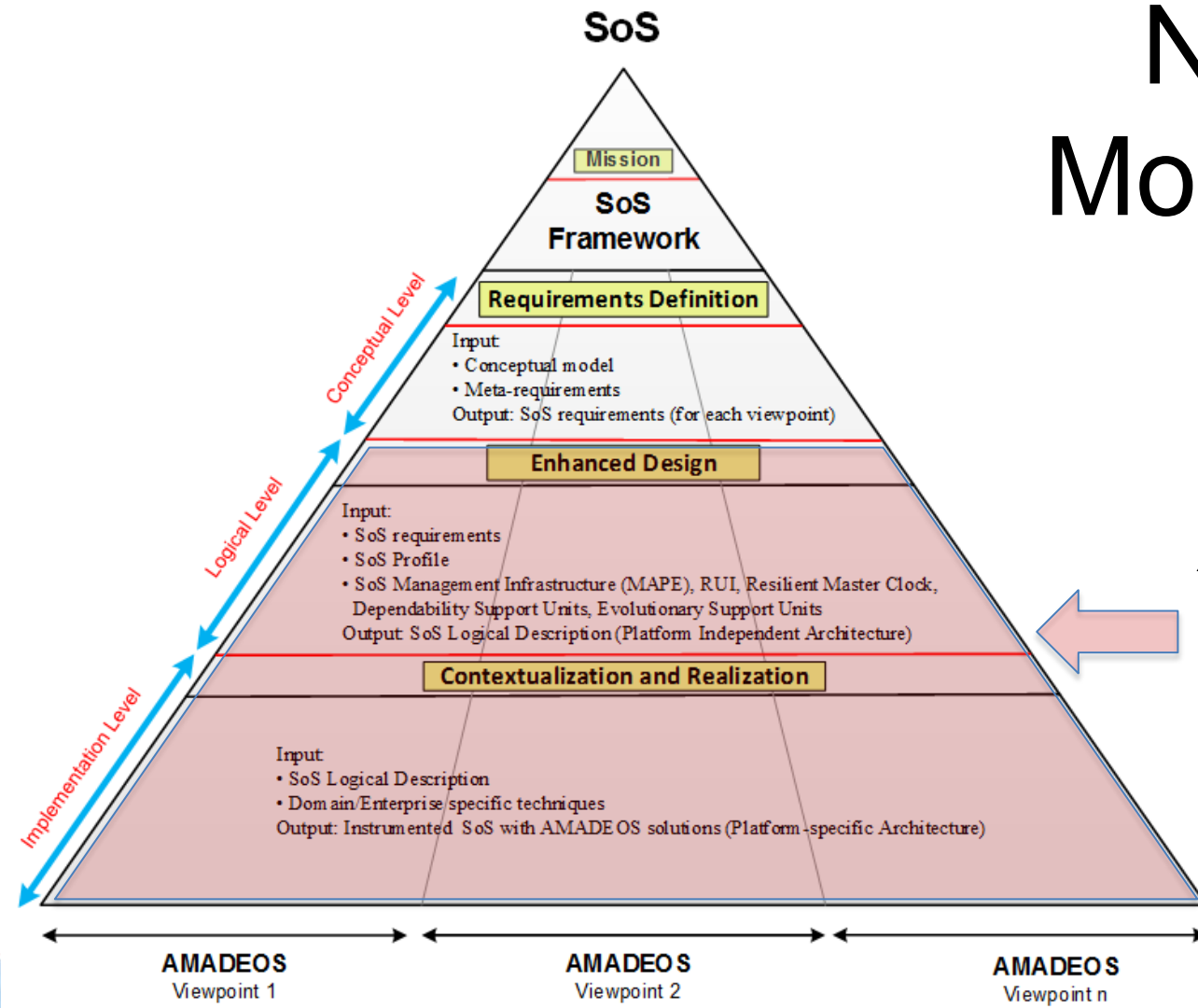


- Objective:
 - Implementation/realization/deployment/simulation of (parts of) the SoS
- Input:
 - Logical architecture
 - Domain/enterprise specific techniques
- Output:
 - Instrumented **SoS instance**

Conclusions

- Developed a three-layer AF specification, for each of the viewpoints
- Provided some more details on conceptual, logical and implementation level, discussing
 - Objectives
 - Expected input/output

Next: Module 3



AMADEOS supporting facilities using Google Blockly

References

AMADEOS – Public deliverables (<http://amadeos-project.eu/documents/public-deliverables/>)

- D3.1 - Overall Architectural Framework
- D3.2 – AMADEOS methodology, mechanisms, and implementations (to appear – end of 2016)
- A.Ceccarelli, M.Mori, P.Lollini, A.Bondavalli, “Introducing Meta-Requirements for Describing System of Systems” In Proceedings of the 16th International Symposium on High Assurance System Engineering (HASE), Daytona Beach, CA, USA, 8-10 January 2015, doi: 10.1109/HASE.2015.31.