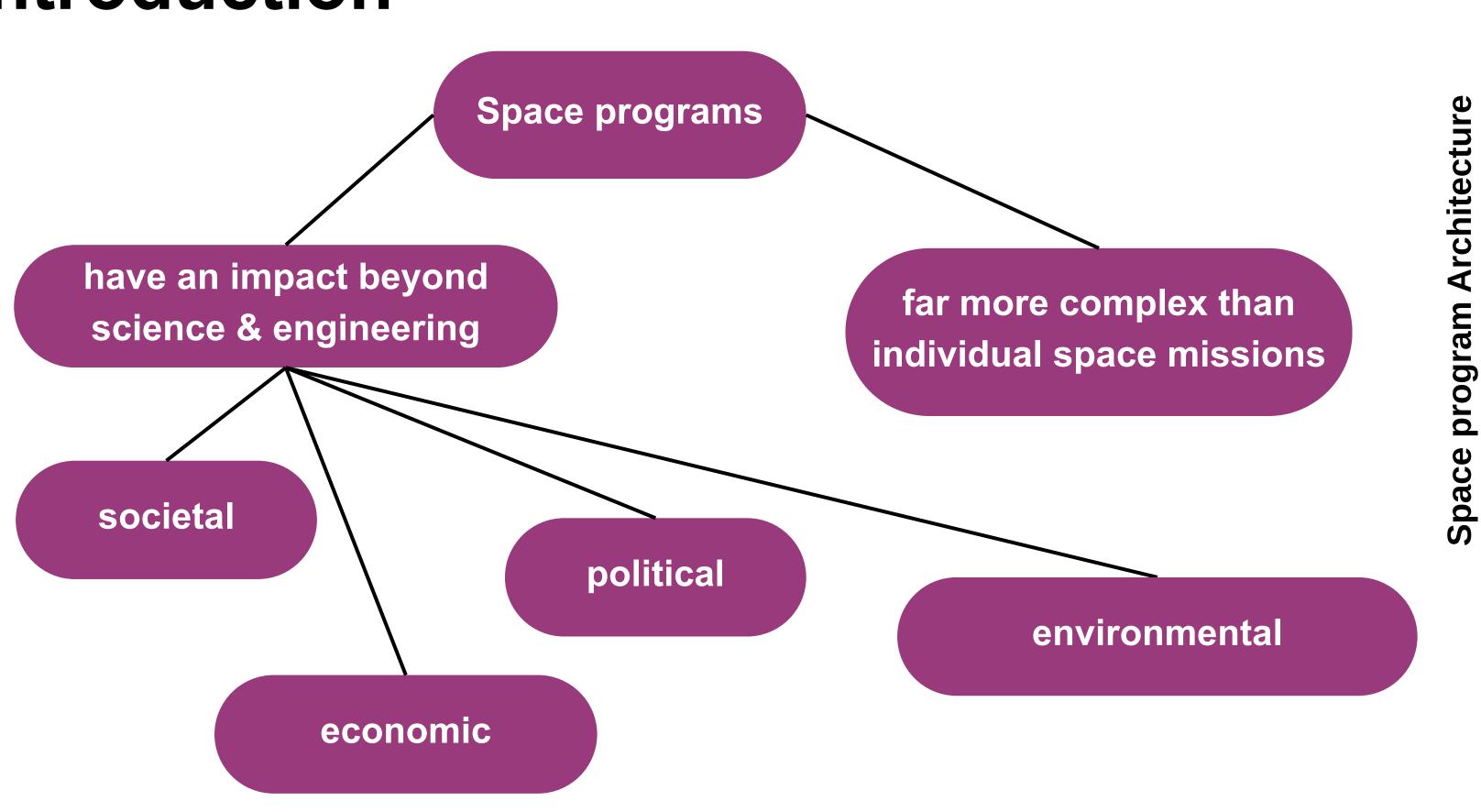
Leveraging MBSE to support decision-making in space program design

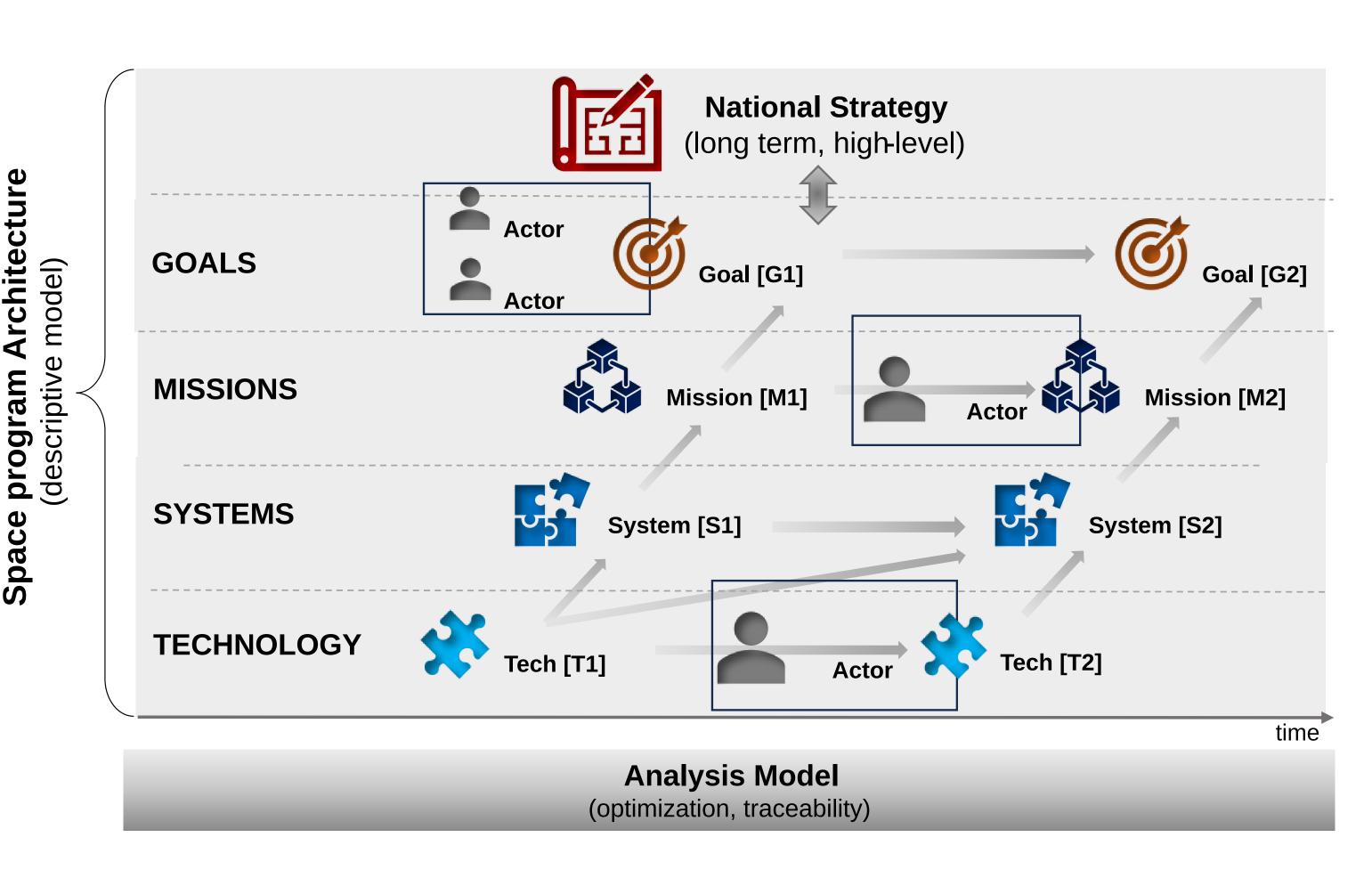
MBSE Workshop 2024 Bremen, Germany 28.05.2024-29.05.2024

A. Bühler, L. Rana, A. M. Hein, S. Lazreg, and M. Cordy SnT, University of Luxembourg









State of the art in space program architecture design

Space mission architecture design Space Mission Architecture and Risk Analysis Tool

(SMART) Exploration Architecture Model for IN-space

and Earth-to-orbit (EXAMINE)

Value Assessment of System Architecting Using Rules (VASSAR)

technology portfolio design with respect to space missions

Low-level specific aspects design

Space System Architecture Code (SSAC)

Versatile ImpulSive Interplanetary Trajectory OptimizeR (VISITOR)

IDENTIFIED ISSUES

Focus either on individual space missions or on specific aspects, lack of emphasis on broader program considerations

Absence of systematic framework for space program design. Focus on application-specific needs or particular concerns rather than adherence to unified and systematic approach

Limited accommodation for collaborative strategic decision-making

Model-based systems engineering for space programs

Traceability through allocation across space program architecture hierarchy

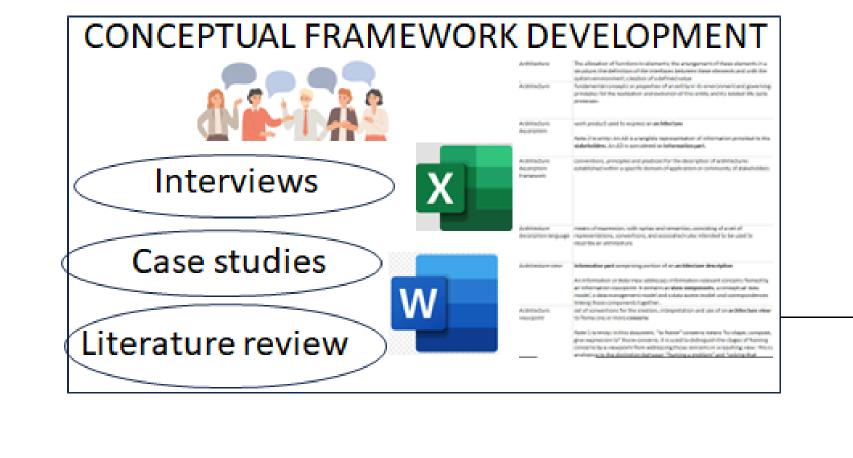
Variability management with feature, system, and parametric models including variant analysis and measurement of figures of merit

Space program Architecture Modelling Platform (SAMP) development methodology

Research question: How can a space program architecture be collaboratively designed, which integrates strategic goals, technologies, space missions, actors, etc. in order to facilitate decisionmaking?

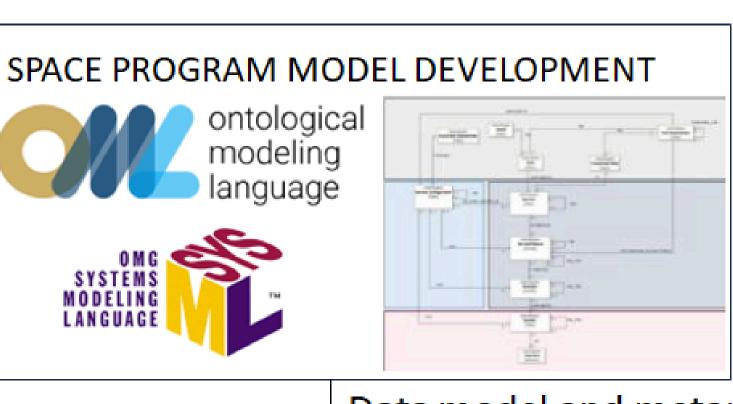
Aim: provide a framework containing information model and optimisation models

framework serves as platform for decision-makers, providing them with tools and structure for systematic and collaborative design of SPA at an early design stage



CASE STUDIES VALIDATION

Conceptual framework, concepts, definitions, relations



DEFINITION

Data model and metamodel describing space programs

& variability models

Analysis & trade studies

Lunar ISRU

case study

SPA EXPLORATION METHOD DEVELOPMENT

CMDAO

SPACE PROGRAM MATHEMATICAL FORMALISM

information model connects high-level goals and lower-level elements and associated actors in a traceable manner

supports decision-makers with optimisation models to evaluate impact of changes to SPA

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