System Engineering Data Repository

- 09:00 Engineering data in the MBSE life-cycle
- 09:20 EGS-CC in the system context
- 09:40 Conceptual Modelling and ECSS
- 10:00 eCASCADE
- 10:20 A snapshot of systems engineering data management in the automotive industry
- *10:40 Coffee Break*
- 11:00 Perspective on system database management at CNES
- 11:20 System Engineering Data Repository: Return of Experience and Recommendation for the future
- 11:40 Realizing the ideas of Space System Data Repository
- 12:00 Discussion – Way Forward
- *13:00 Lunch*

Engineering Data in the MBSE context

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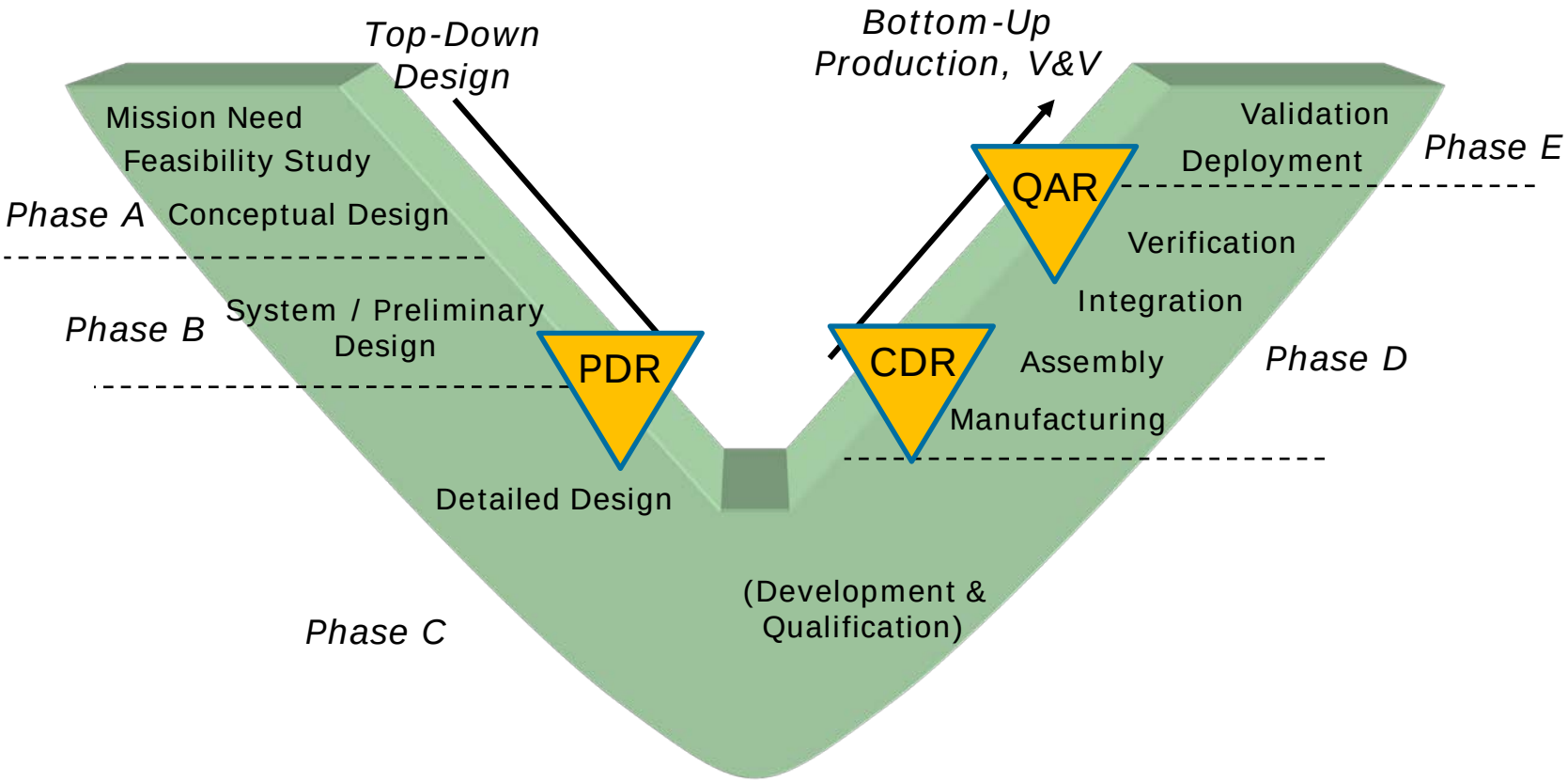
@: ADCSS 2012

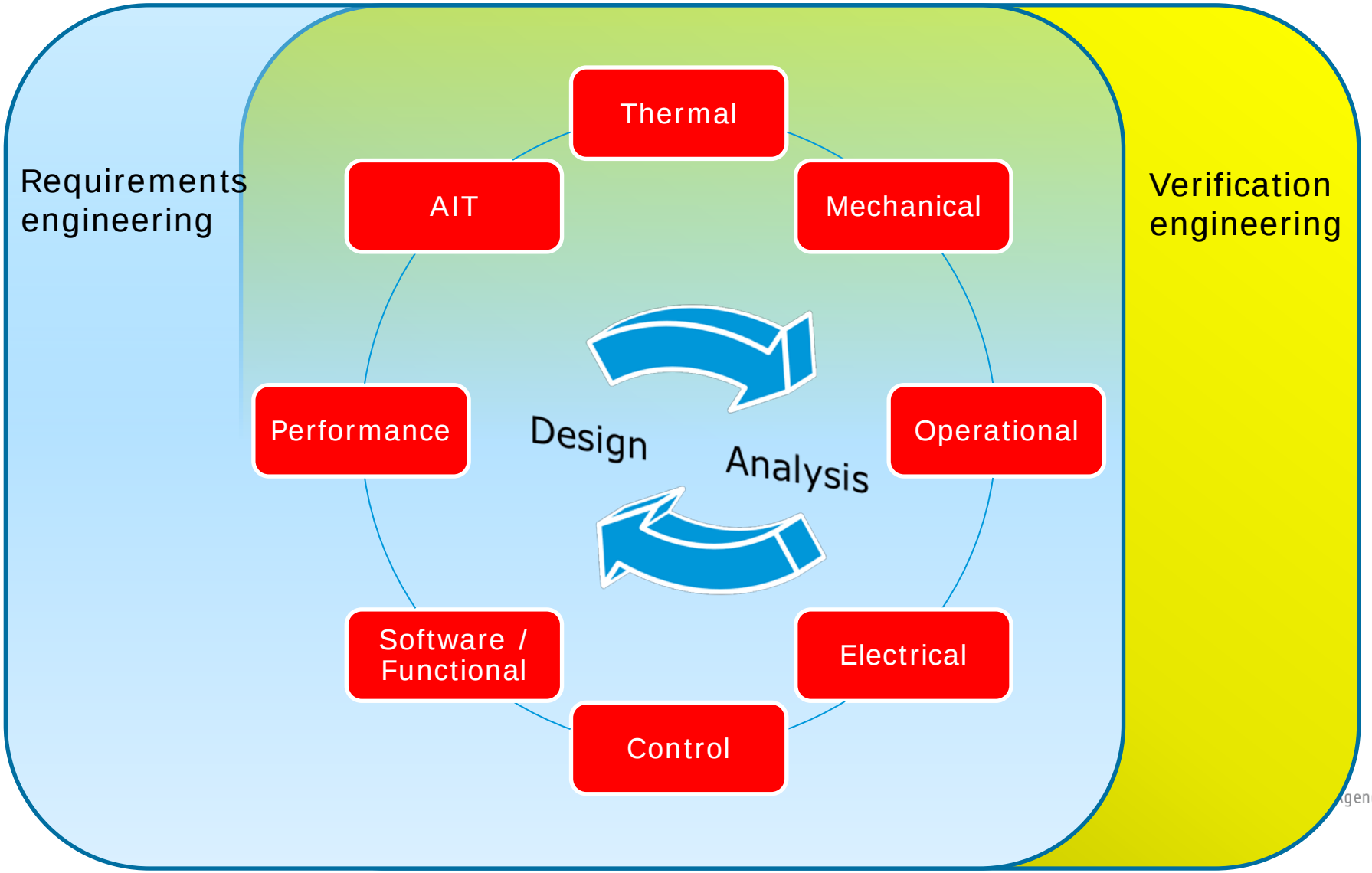
System Engineering

- According to ECSS:
  - ✓ Requirements engineering
  - ✓ Analysis
    - Decomposing and allocating requirements during functional analysis
    - Assessing system effectiveness
    - Providing trade studies for assessing effectiveness, risk, cost and planning
  - ✓ Design and configuration
  - ✓ Verification, including qualification and acceptance
  - ✓ System engineering integration and control throughout all the project phases.

Classical SE Process



Relevant Domains at System Level



Project Context

- Challenges
  - ✓ Increased complexity
  - ✓ Decreasing resources
  - ✓ Increased use of existing designs and boxes
  - ✓ Increased need for interoperability of systems (in particular for cooperative developments)
  - ✓ Concurrent engineering by different stakeholders
  - ✓ Stakeholder handover at milestones
- Interaction between the different domains
  - ✓ Model-based, cross discipline collaboration
- Institutional projects
  - ✓ Different level of responsibility
  - ✓ Shift of responsibility between stakeholder
  - ✓ Several levels of interaction
  - ✓ Technical vs. managerial boundaries

Areas for Improvement

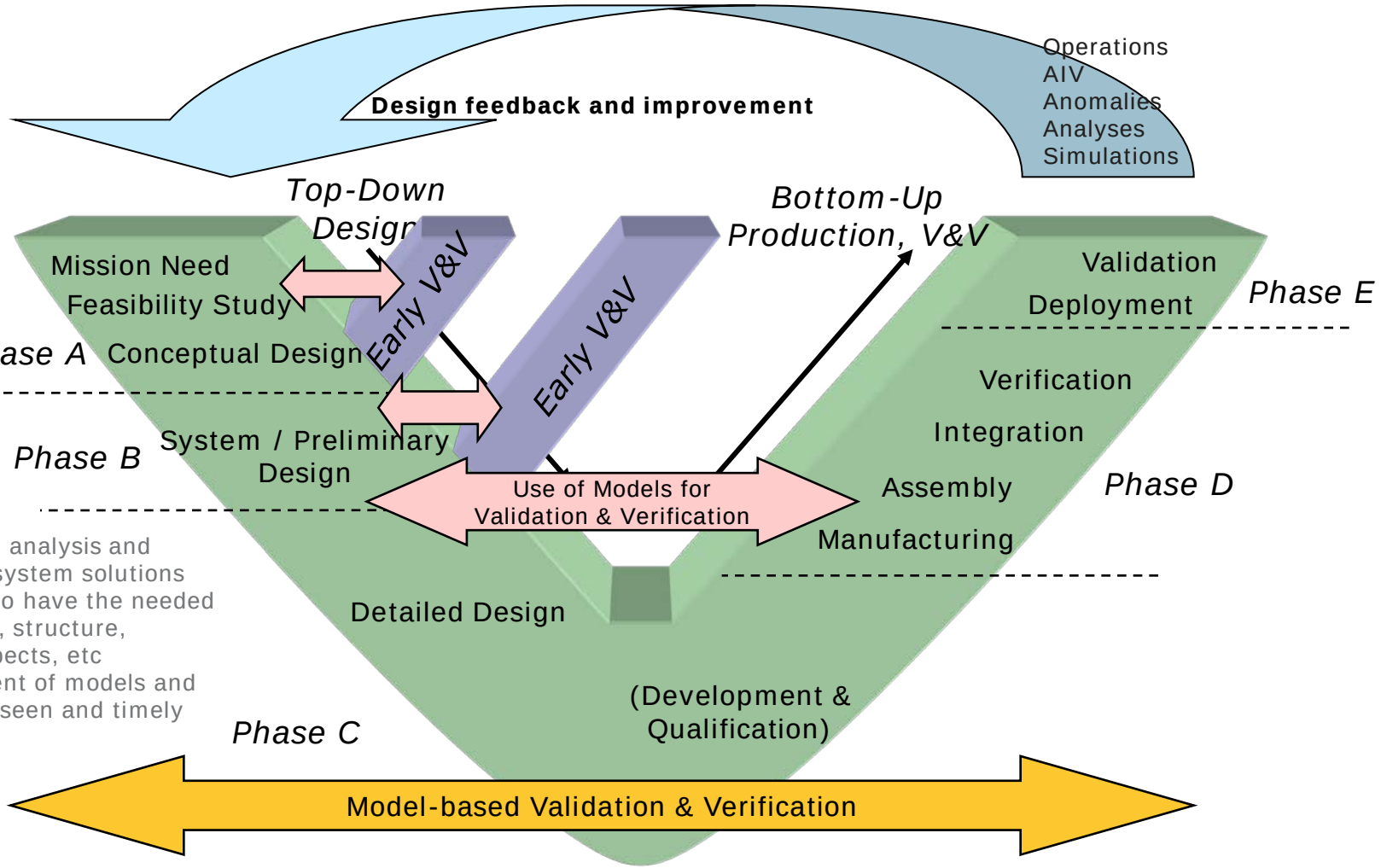
- Improvements are possible in the following areas:
  - ✓ Requirements management and verification
  - ✓ Design trade-offs at system level
  - ✓ Analysis of system operability issues
  - ✓ Assessment of engineering margins
  - ✓ Coherence between Analysis and Testing
  - ✓ Preparation and execution of AIT
  - ✓ Transition from AIT to operations
  - ✓ Data sharing

Virtual Spacecraft Model

- A Virtual Model is the computer-based representation of (elements of) a system, its environment or the required test equipment
- Data represented should include
  - ✓ Requirements
  - ✓ Functionality and Behaviour
  - ✓ Appearance
  - ✓ Design Definition / Engineering Data
  - ✓ Analysis / test definitions and results
  - ✓ Links to Domain Specific tools and models
- Required enabling features
  - ✓ Consistent, comprehensive data management (incl. e.g. persistence, versioning, …)
  - ✓ Multi-disciplinary, shared S/C model / representation

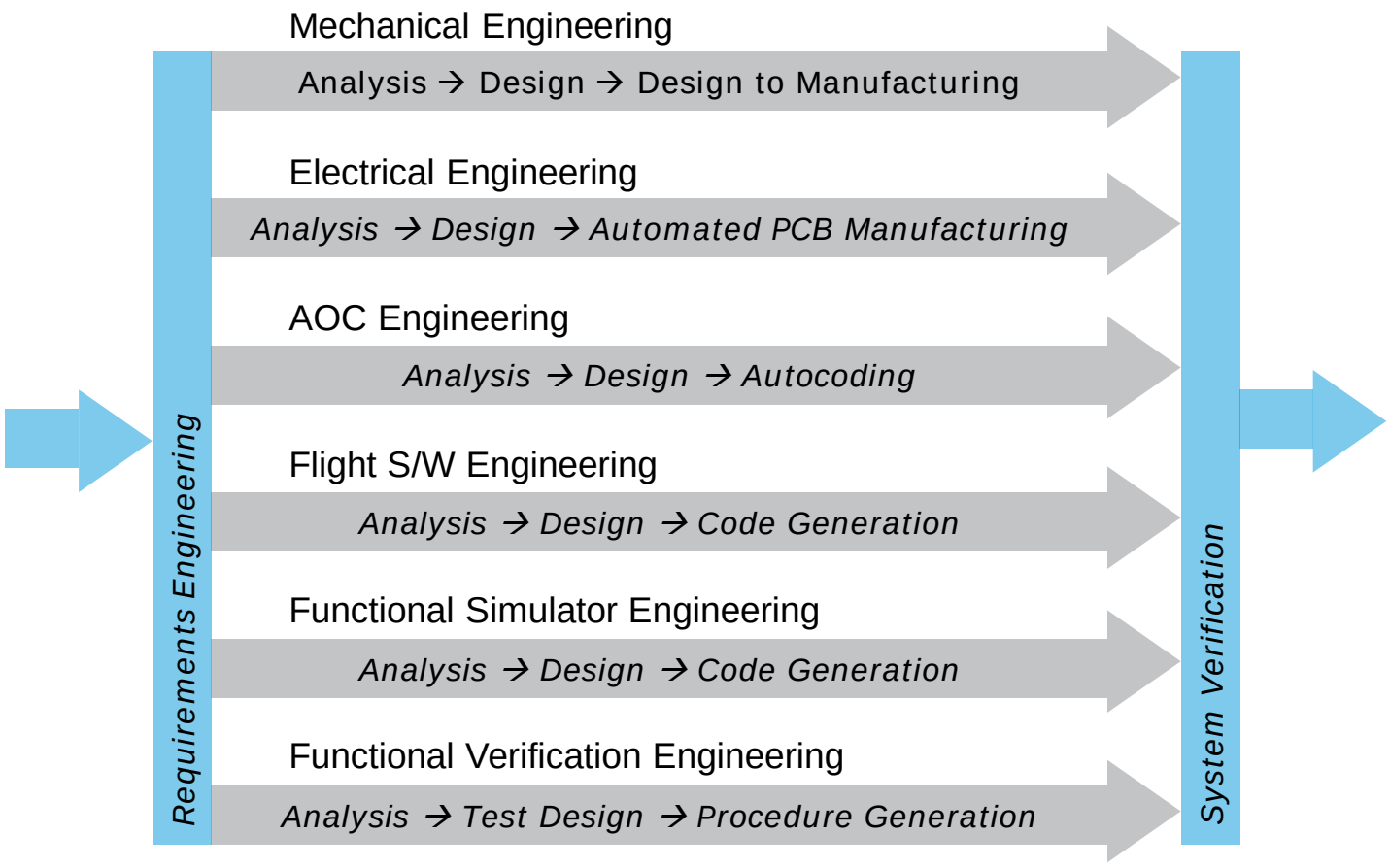
Use of the model (like simulation)

End-to-end Model-Based SE Process

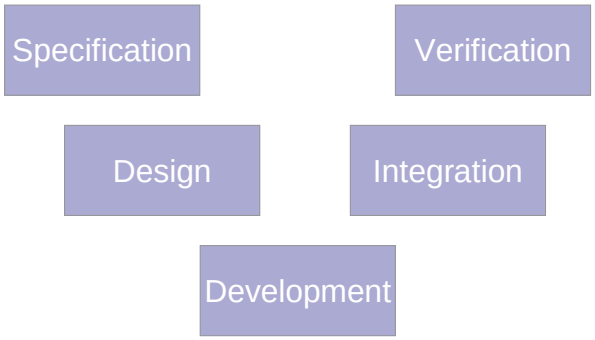


- Simulations for analysis and verification of system solutions
- Modelling has to have the needed fidelity, effects, structure, operational aspects, etc
- The development of models and simulators foreseen and timely initiated

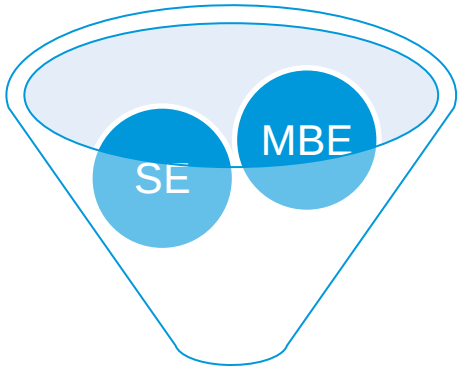
Existing Practice: Model-Based Engineering

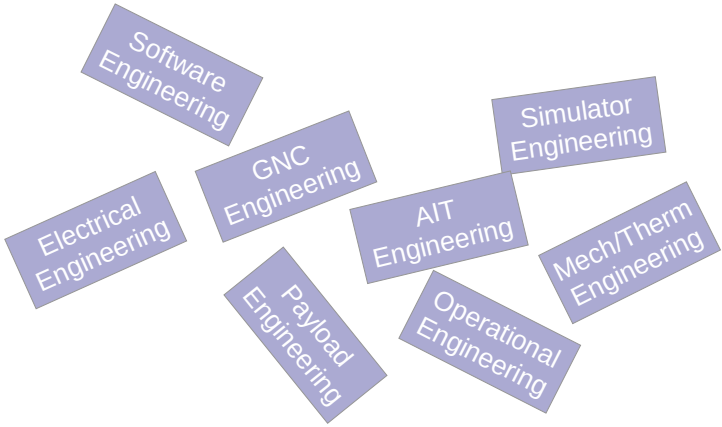


SE + MBE = MBSE

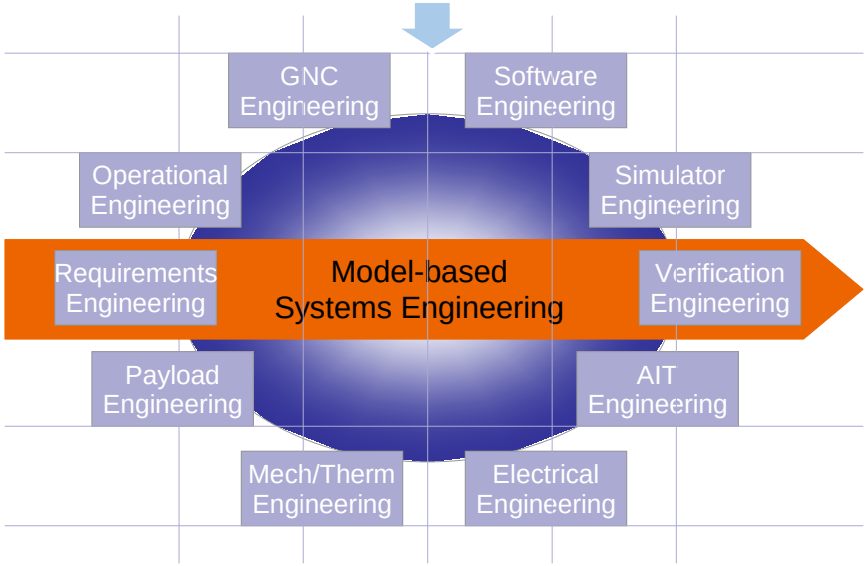


Classic
Systems Engineering

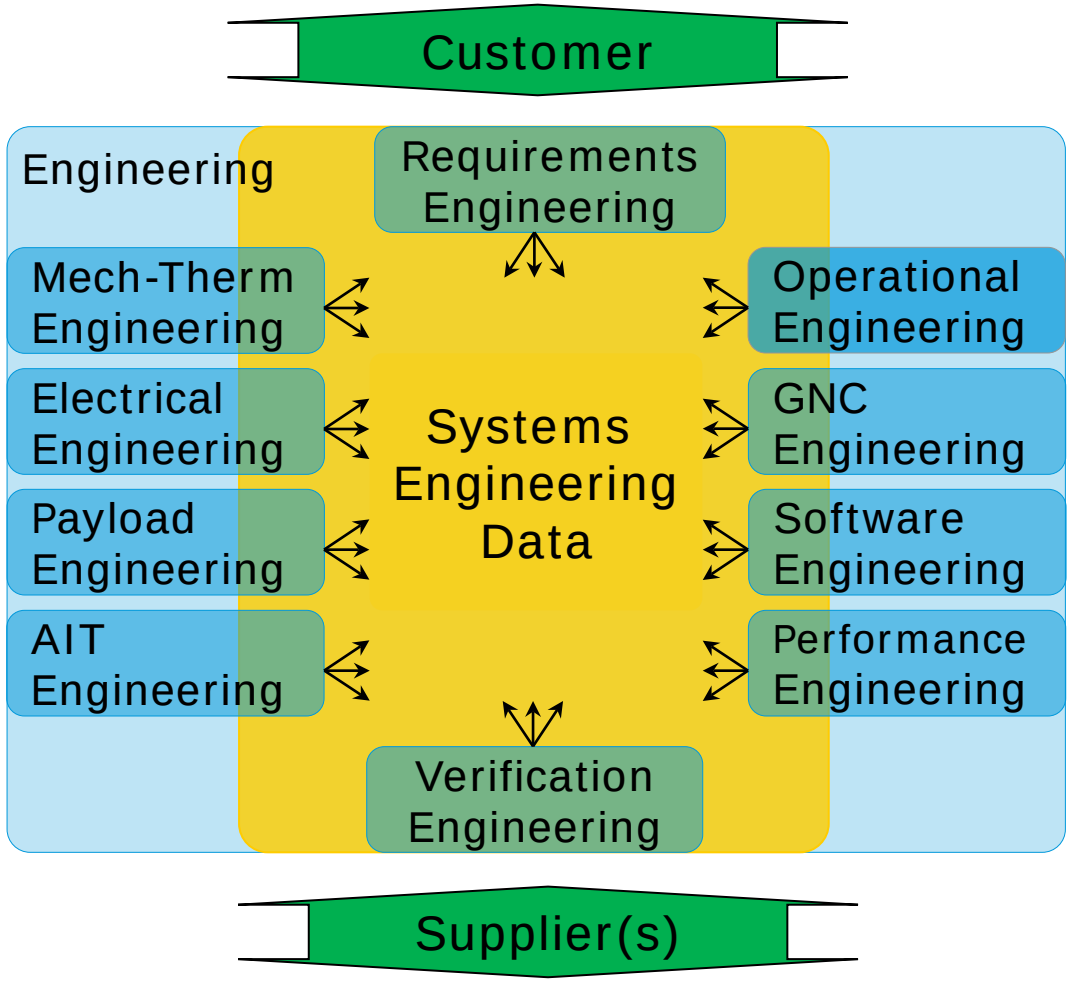




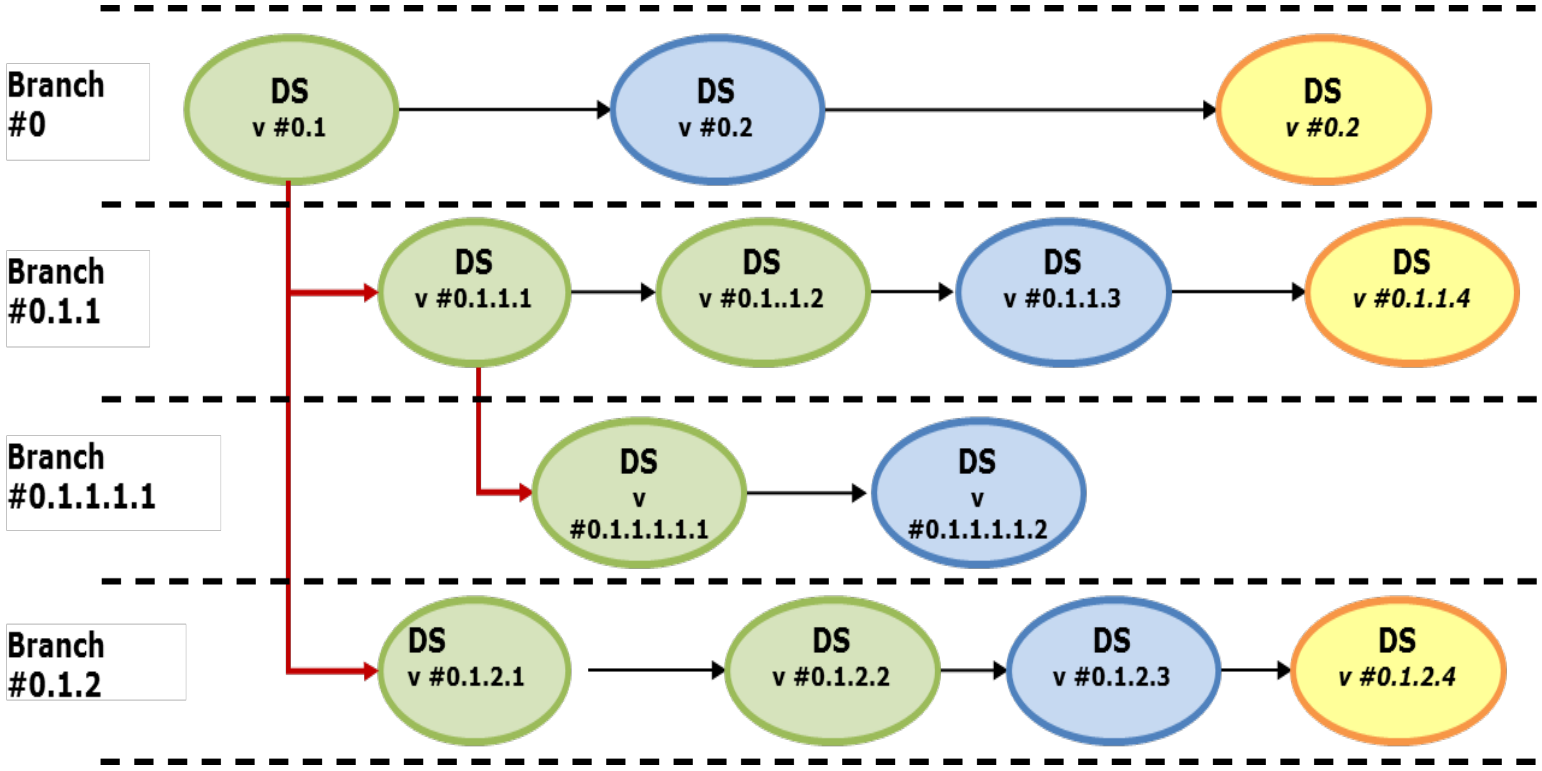
Model-driven
Engineering



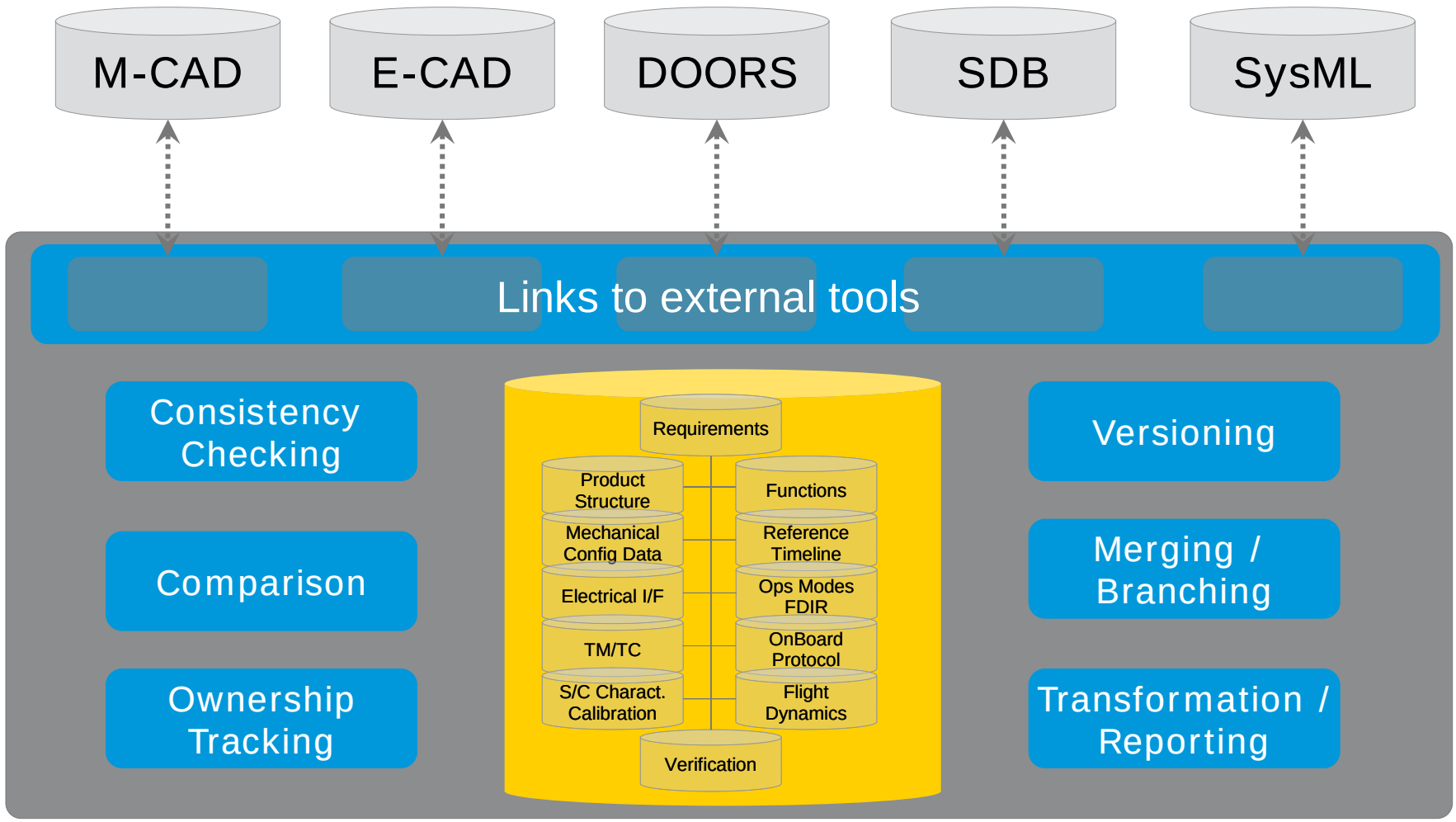
Resulting Data Challenge of SE



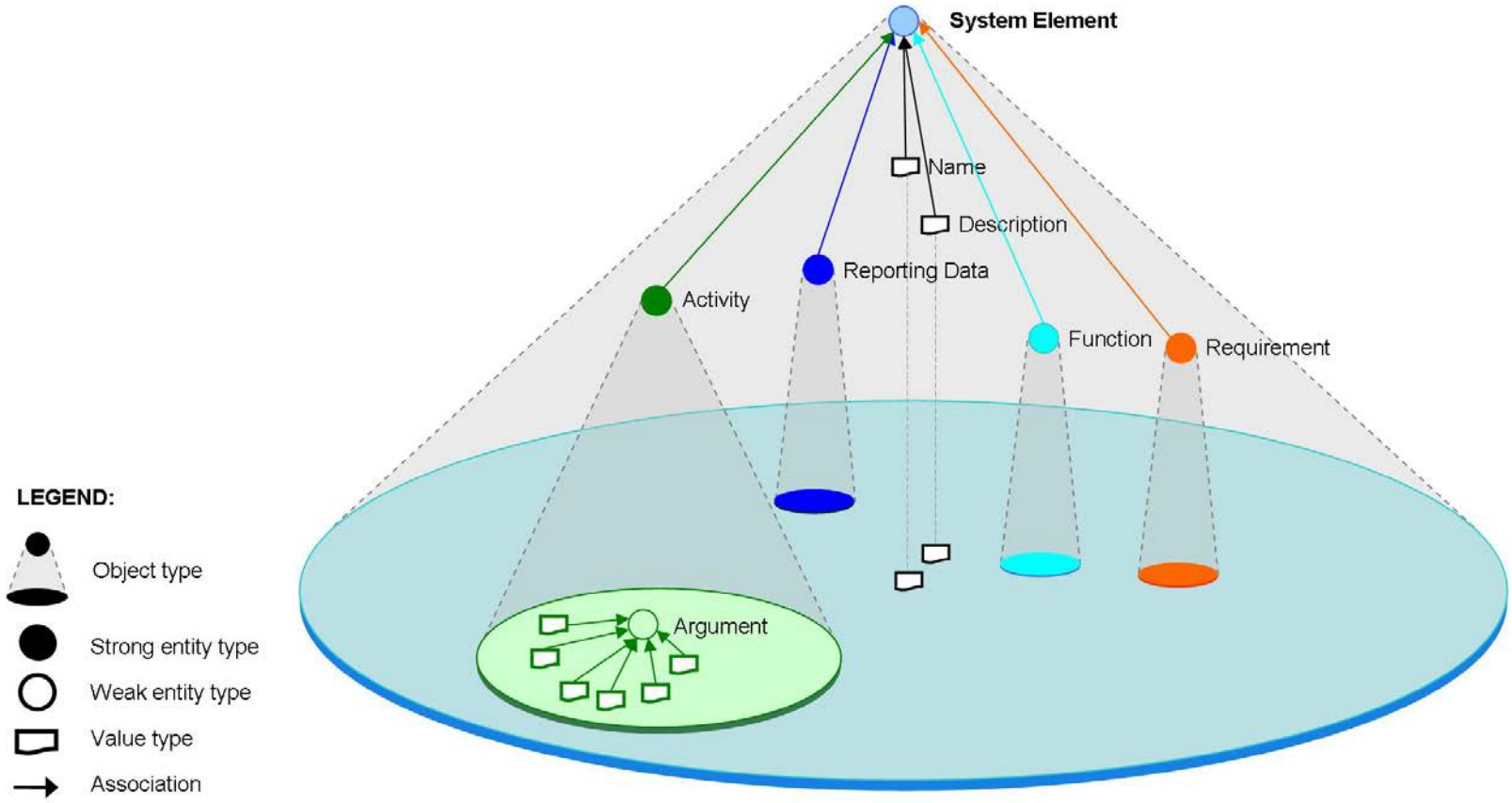
Data Management



System-wide coverage



Common Data Model



Summary

- Model-based System Engineering is relying on the fact that (SW) representations can address life-cycle issues before the actual production / manufacturing
- Formalisation of data and information allows to increase the consistency of that data across different dimensions (at any moment between stakeholders, and along the life-cycle)
- Modelling and the use of models relies extensively on the formal representation of data – depending on the use case all “connected” stakeholders need to agree

- Need to agree on the way data is specified, handled and ultimately exchanged

Thank you

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