

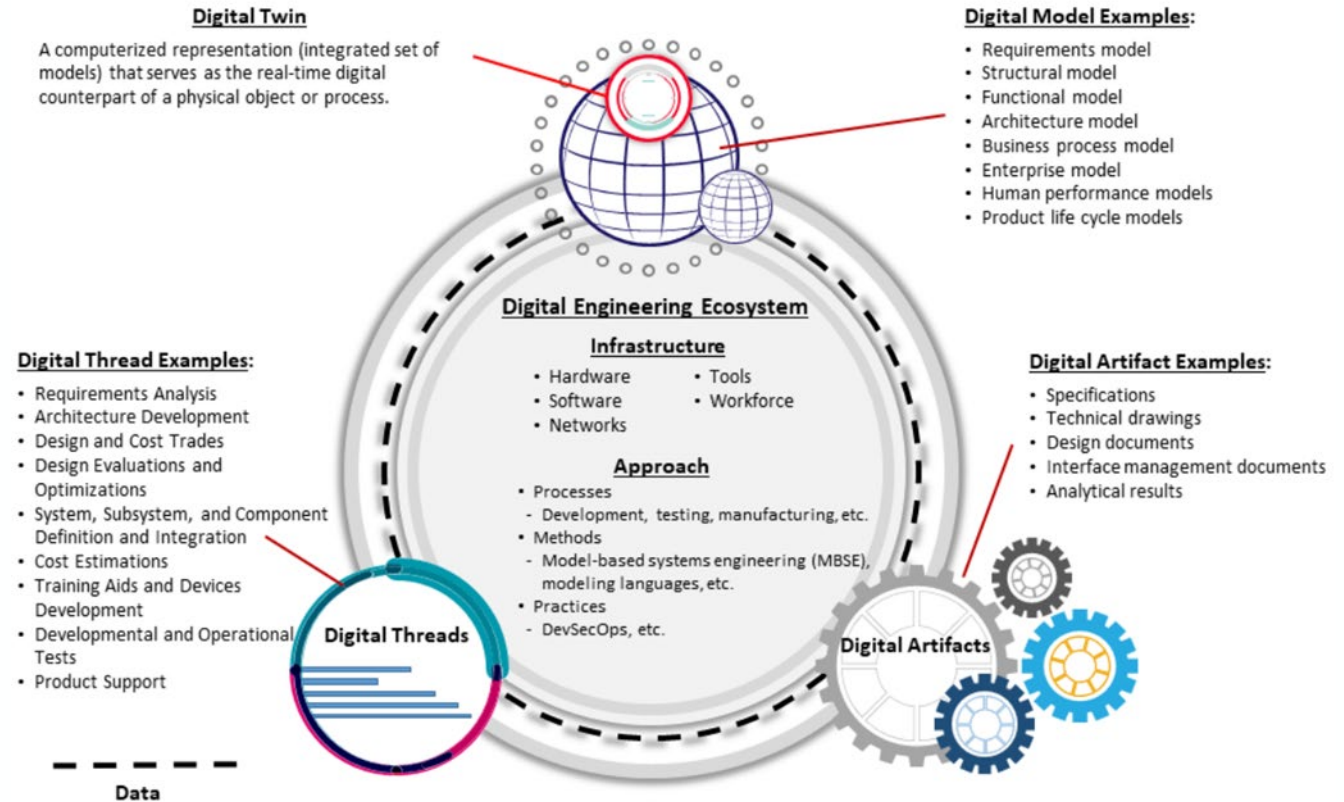
MB4SE harmonisation roadmap status

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“Model-based systems engineering (MBSE) is the formalized application of modelling to support system requirements, design, analysis, verification and validation activities beginning in the conceptual design phase and continuing throughout development and later life cycle phases.”

(INCOSE SE Vision 2020)



MBSE is the key enabling technology used to implement digital engineering

key to win the **time – quality – complexity – cost** battle is to *improve communication*:

- **Time**: we must *communicate more often* (iteration, access to consistent data)
- **Quality**: we must *continuously increase the confidence* of the information exchanged
- **Complexity**: we need to *succinctly communicate* (abstraction, depth, purpose)
- **Cost**: we need to *detect / prevent* potential *problems* as *early* as possible

model-based systems engineering (MBSE) addresses these concerns by:

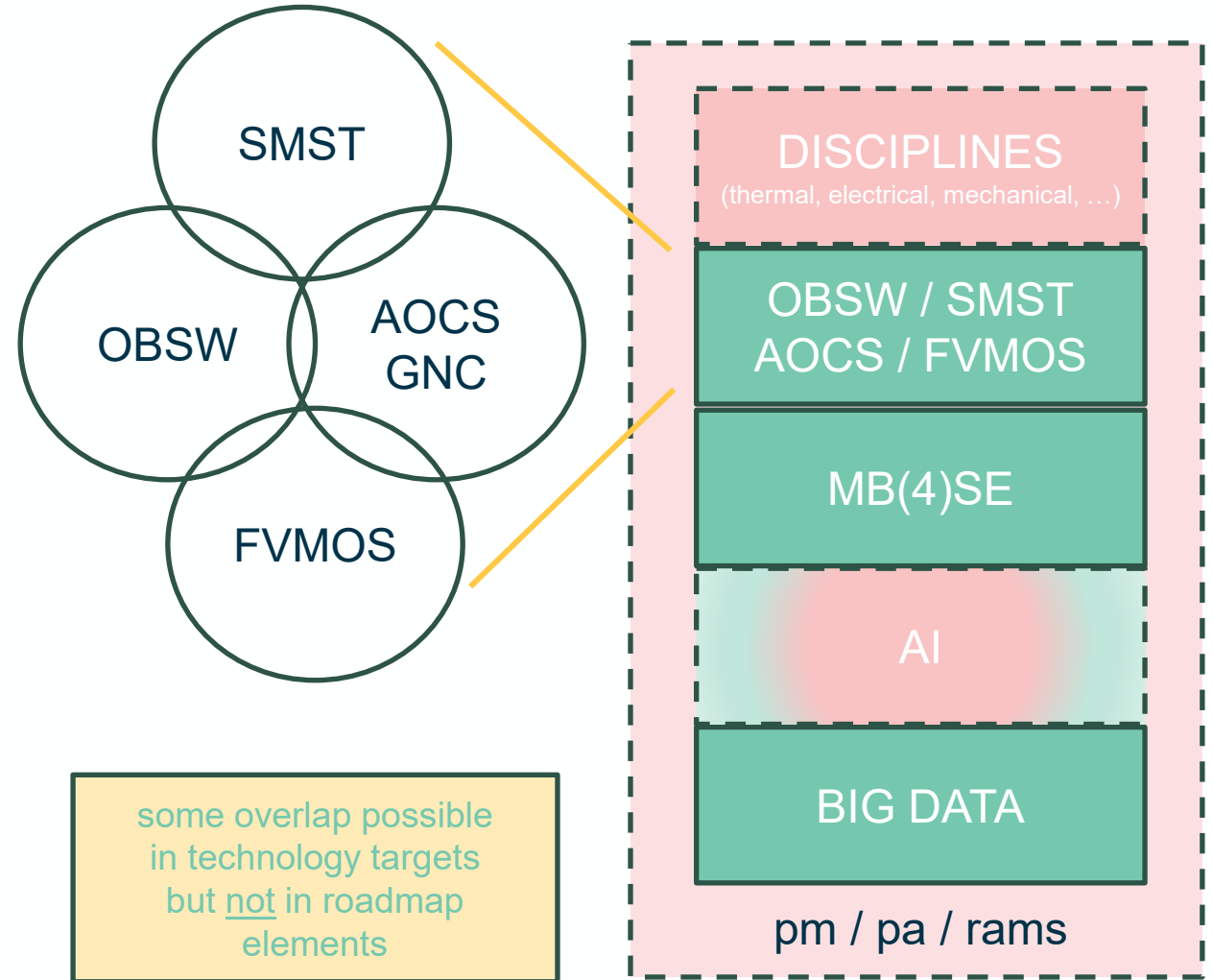
- providing an *explicit notation to create models* (abstractions of the real world),
- providing means to *continuously verify the model* (to check internal consistency),
- providing means to *validate models early* (to check external consistency)

aim is to establish an *authoritative source of truth*:

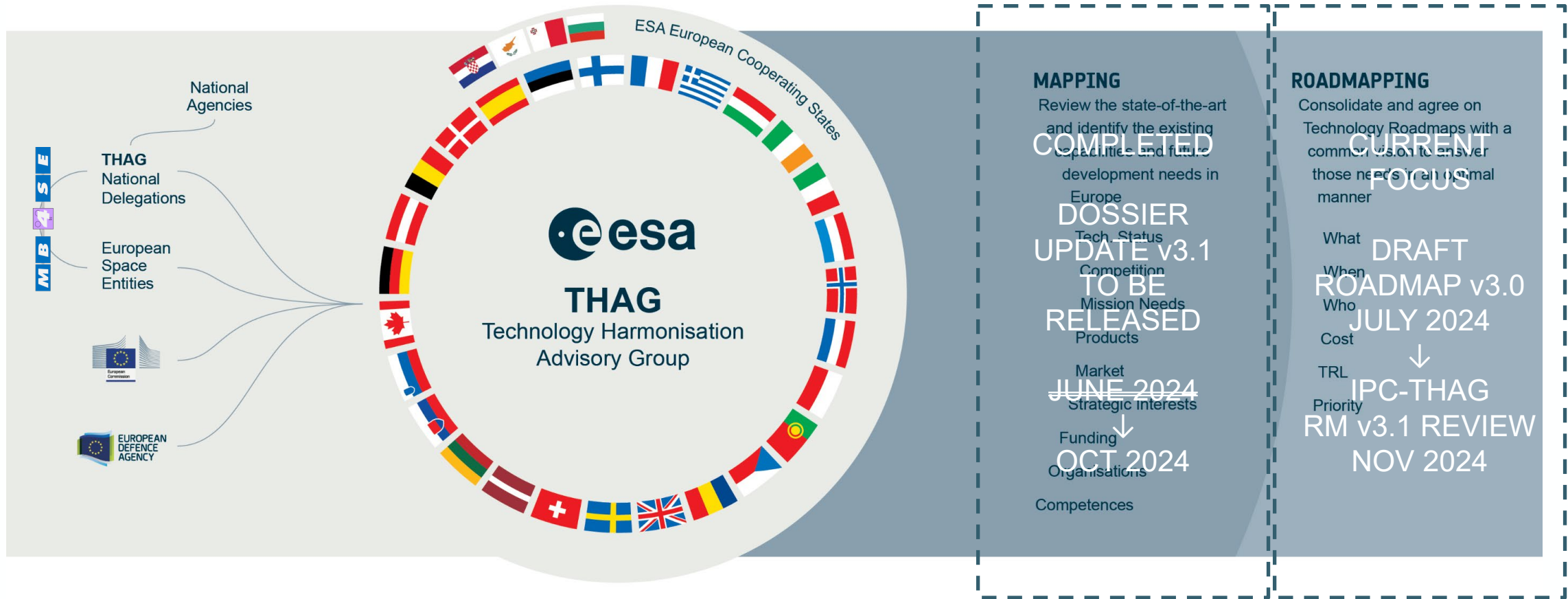
- across all disciplines (including pm and pa)
- across all life cycle phases
- across the supply chain

Technologies Covered

Technology Domain		Technology Sub-Domain		Technology Group		Coverage (Partial/Total)	Comments
ID	Name	ID	Name	ID	Name		
8	System Design and Verification	A	Mission and System Specification	I	Specification Methods and Tools	Partial	Related: TD10-A-I TD21-E-II TD25-A-I TD25-C
8	System Design and Verification	B	Collaborative and Concurrent Engineering	II	Multidisciplinary Data Exchange for Collaborative Engineering	Partial	Related: TD21-E-II
8	System Design and Verification	C	System Analysis and Design	II	Multidisciplinary Analysis	Partial	Related: TD21-E-II
9	Mission Operation and Ground Data Systems	C	Ground Data Systems	I	Mission Control System, Automation, Mission Planning, Simulators and Station M&C and Data Centre Architecture and Technologies	Partial	
9	Mission Operation and Ground Data Systems	C	Ground Data Systems	II	Preparation and Procedure tools for Ground Data Systems	Partial	Related: TD25-A-I



Technology Harmonisation – well established process



- For details see <https://technology.esa.int/page/harmonisation>
- Model Based for System Engineering is part of harmonisation cycle 2024.2
- Coordinated in close collaboration with the MB4SE advisory group





1. Methodology and process

- No common adopted methodology
- Weak embedding in current engineering processes and (applicable) standards

2. Languages and tools

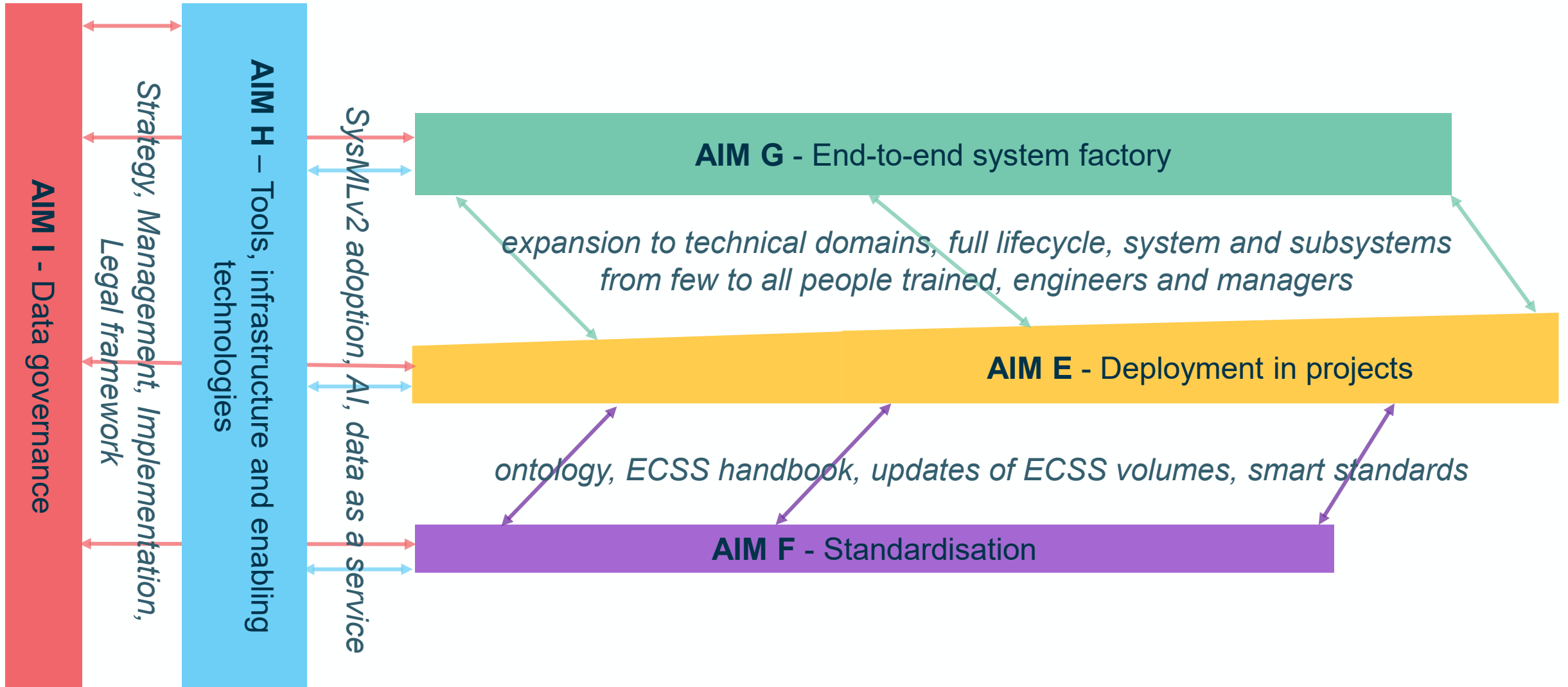
- Large diversity in notations, languages and tools (rapidly evolving) high adoption threshold (useability concerns)
- Many tailor-made (but silo-ed) solutions exist or are being developed (local optima, globally decoupled)

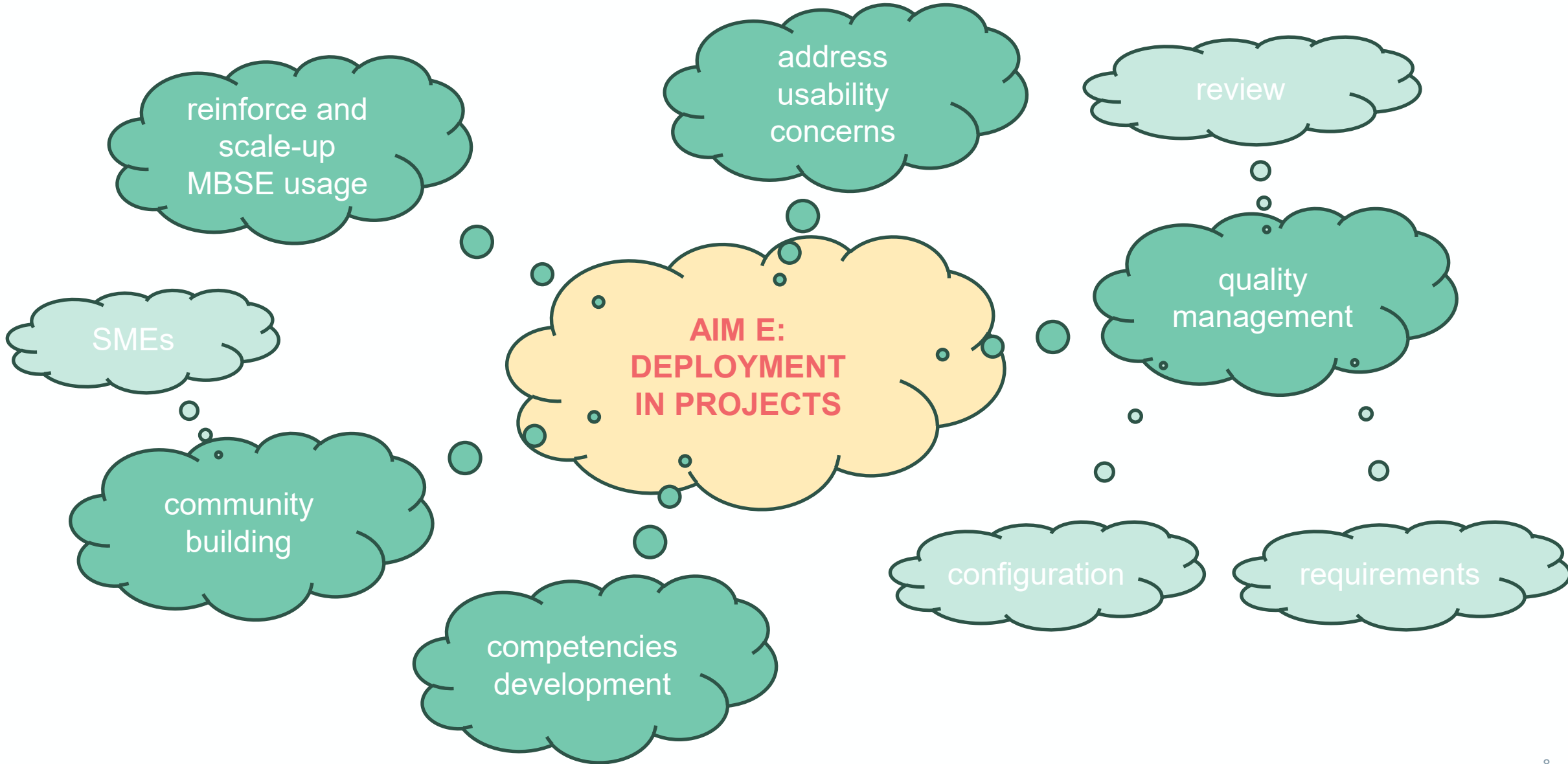
3. Infrastructure and data governance

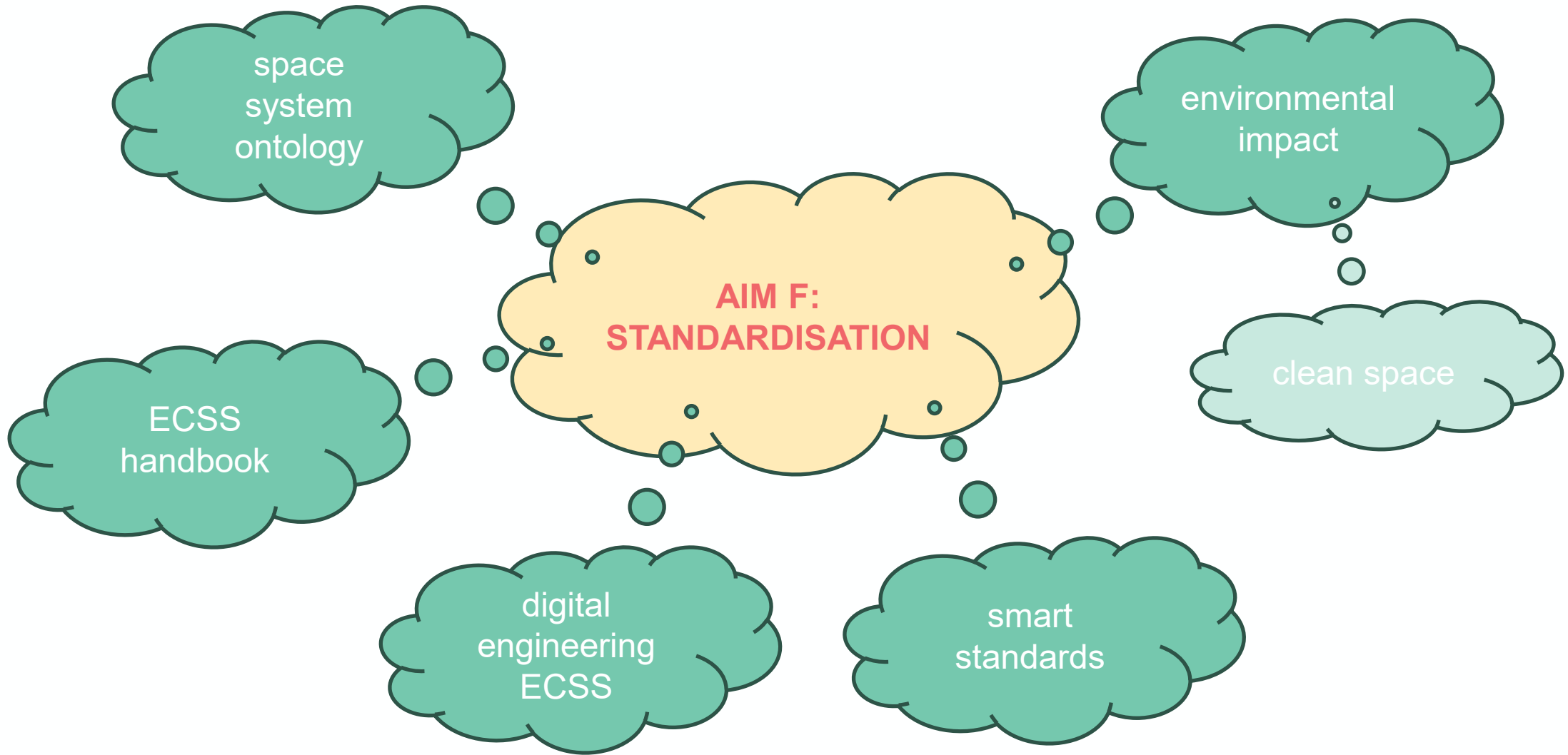
- Poor interoperability hampering extended enterprise data exchange
- Intellectual property concerns and data security constraints

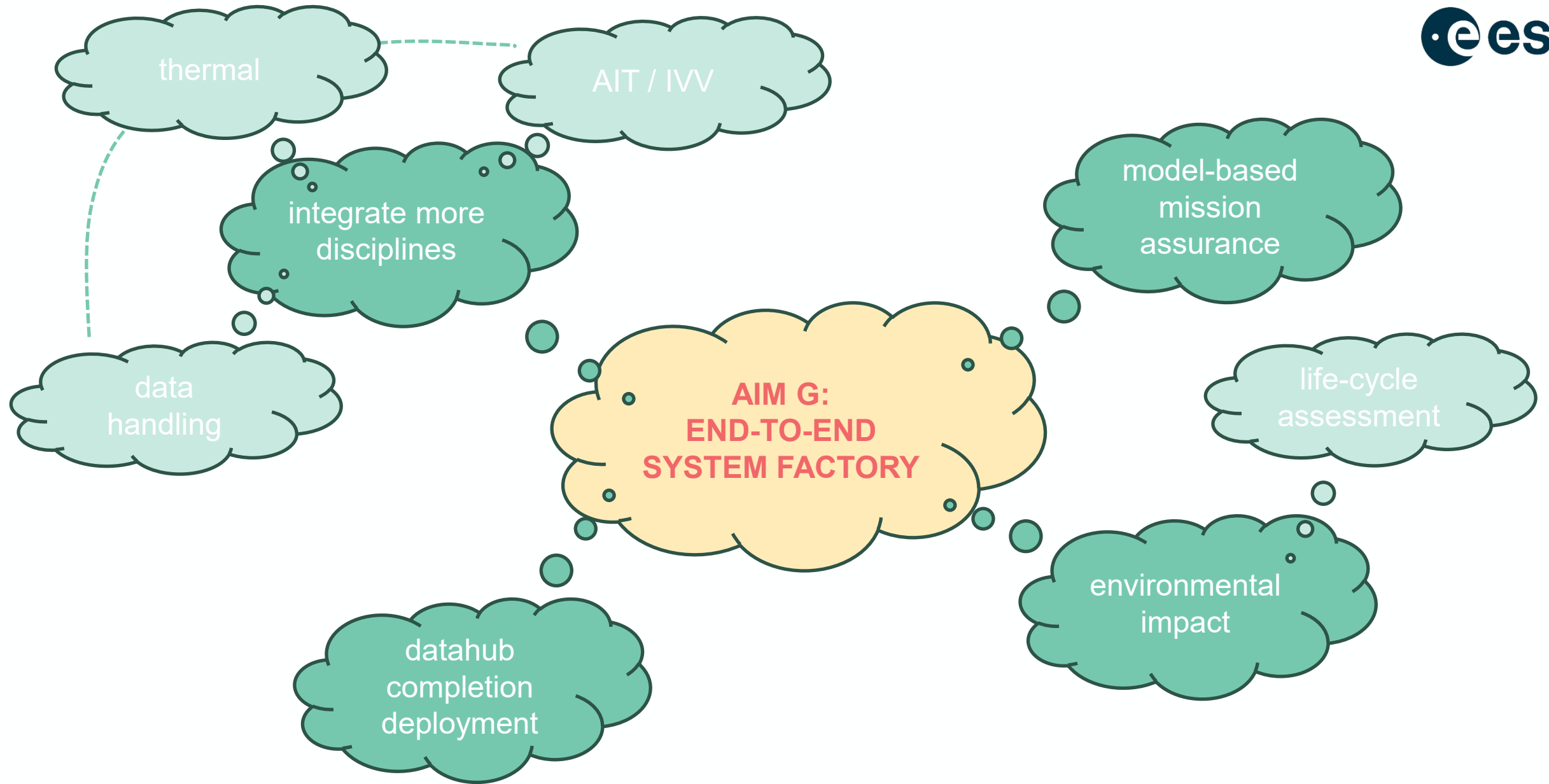
4. People

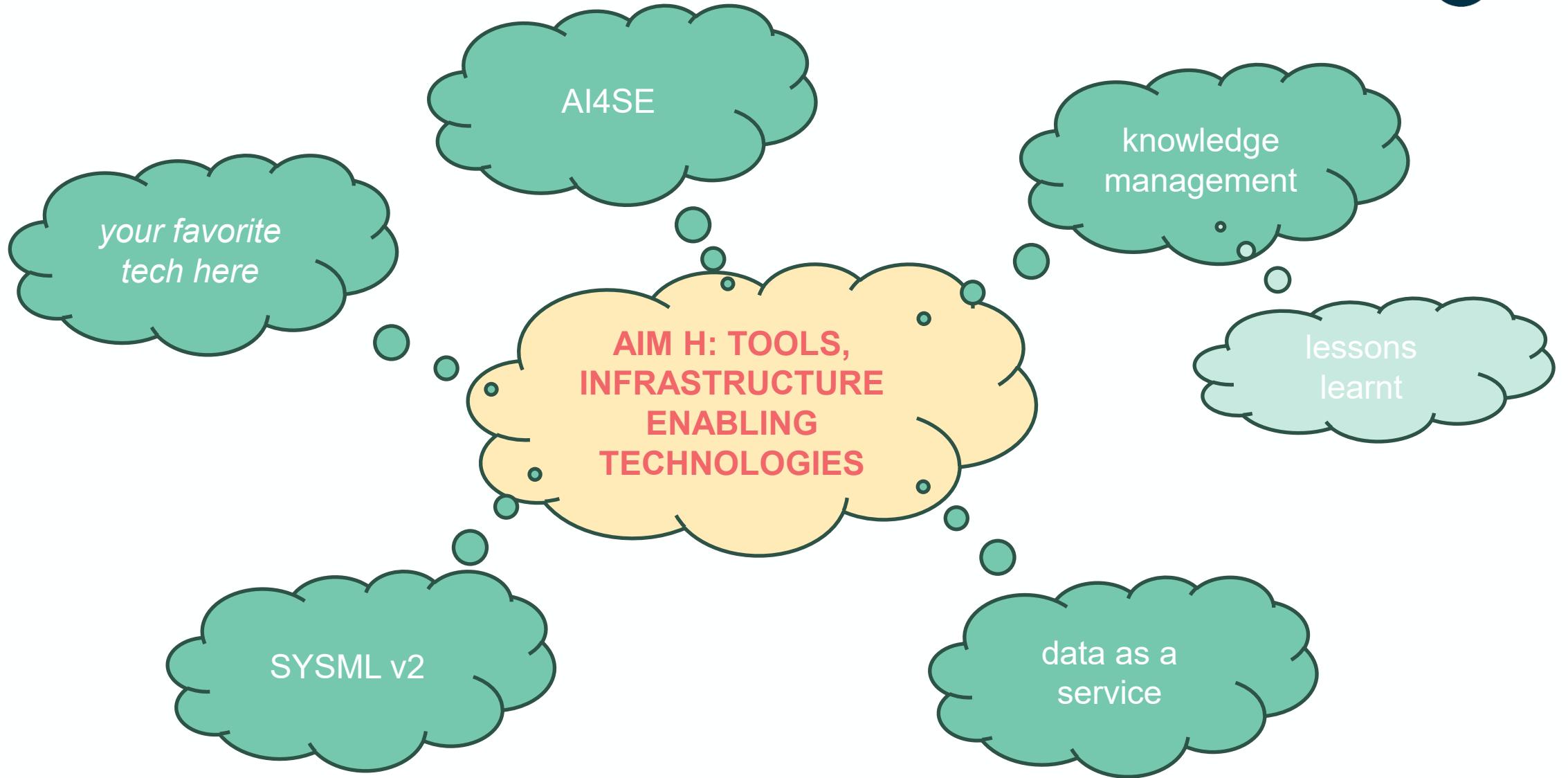
- Difficult transition from document based to digital engineering (legacy)
- Developing new skills and implementing new processes while maintaining “business as usual”

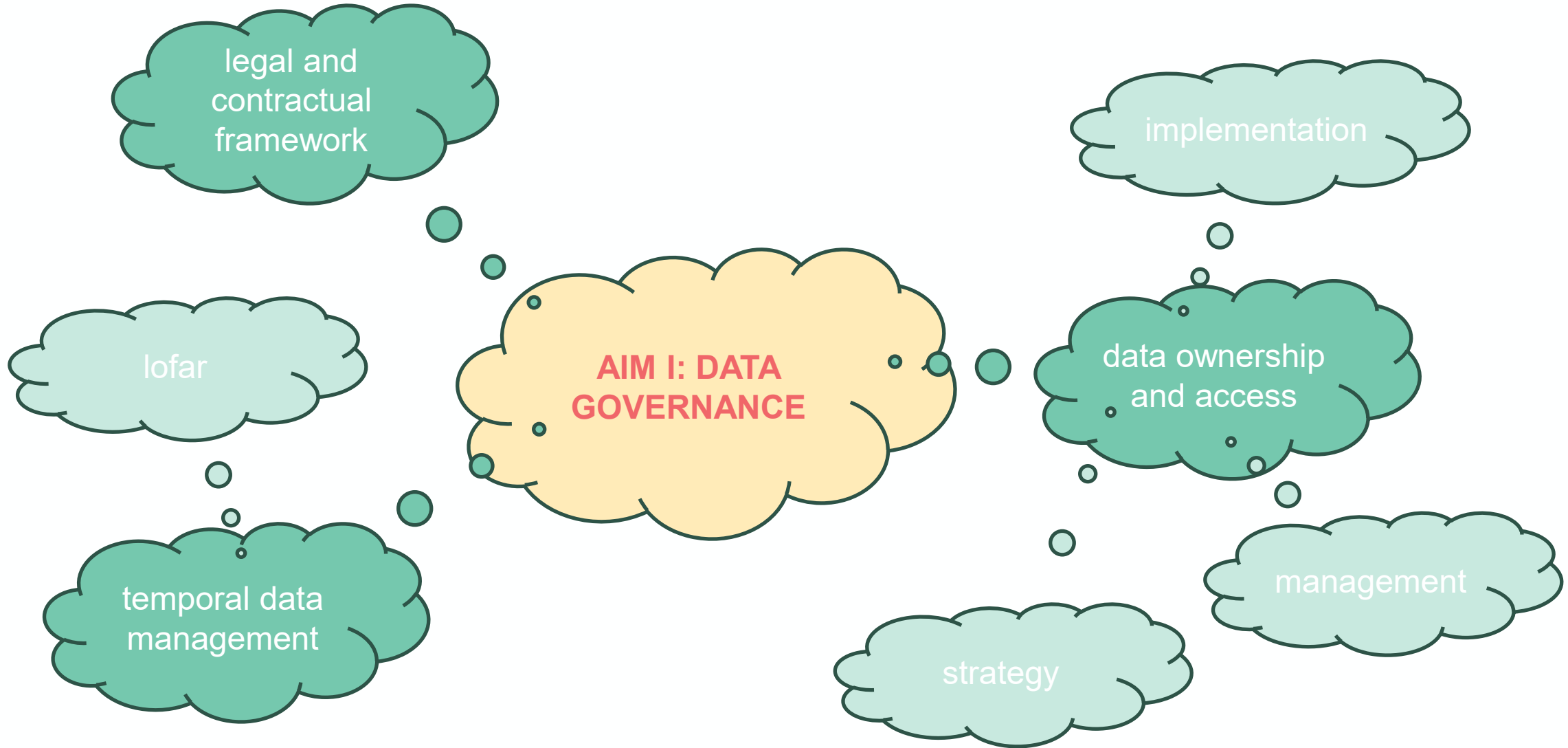












Draft roadmap 2024.2 – current status

- 18 activities remaining from 2020.1 roadmap (13.4 MEuro)
- Aim E (Deployment in projects) : 11 activities proposed (9.85 MEuro – including de-risk and flagship project(s))
- Aim F (Standardisation) : 3 activities proposed (1.4 MEuro)
- Aim G (End-to-end system factory) : 15 activities proposed (7.8 MEuro)
- Aim H (Infrastructure, tools and enabling technologies) : 19 activities proposed (12.5 MEuro)
- Aim I (Data governance) : 5 activities proposed (2.1 MEuro)

THANKS FOR YOUR ATTENTION!



M B 4 S E

<https://mb4se.esa.int>