

Engineering Digital Twins (EDT)

Ou “La Fabrique des Jumeaux Numériques”

#ANR-25-APJN-0001

Réunion de lancement

Mercredi 24 Juin 2026



Benoit COMBEMALE

**EDT Scientific Director
(Inria & Pr. Univ. Rennes)**



Pascale VICAT-BLANC

**EDT Scientific Director
(Inria)**

Kickoff Meeting, Program EDT, Paris, France
June 24th, 2026

Agenda

13h30 – 14h00 • Ouverture du séminaire

- Pascale Vicat-Blanc et Benoit Combemale (Inria)
- Florent Kirchner (SGPI), Ouidad Labbani-I. (SSRI/DGRI), Sophie Proust (Inria)

14h00 – 14h30 • Présentation du programme EDT Benoit Combemale et Pascale Vicat-Blanc

14h30 – 15h30 • Projets scientifiques ciblés

- **PC1 — Catalyst** — Julien Déantoni
- **PC2 — DT Compose** — Jean-Marc Jezequel et Jannik Laval
- **PC3 — TwinOps** — Jean-Michel Bruel et Antoine Beugnard
- **PC4 — Synchronic** — Hind Bril el-Haouzi
- **PC5 — Genuine** — Thierry Duval et Arnaud Blouin

15h30 – 15h50 • Actions transverses Guy De Spiegeleer, Benoit Combemale et Pascale Vicat-Blanc

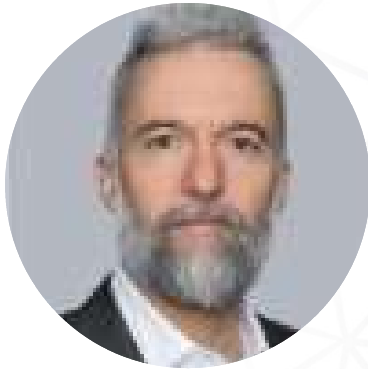
- **AT1** — Animation et structuration de la communauté
- **AT2** — Cas d'usage et démonstrateurs
- **AT5** — Dissémination, exploitation, standardisation, formation

15h50 – 16h00 • Intervention de partenaires industriels

16h00 – 16h25 • Présentation par l'ANR Axelle Croise (ANR).

16h25 – 16h30 • Q&A et Conclusion

EDT Kickoff Meeting: Opening



Florent KIRCHNER
(SGPI)



Ouidad LABBANI-IGBIDA
(SSRI/DGRI)



Sophie PROUST
(Inria)

The EDT Program

Génèse et motivations

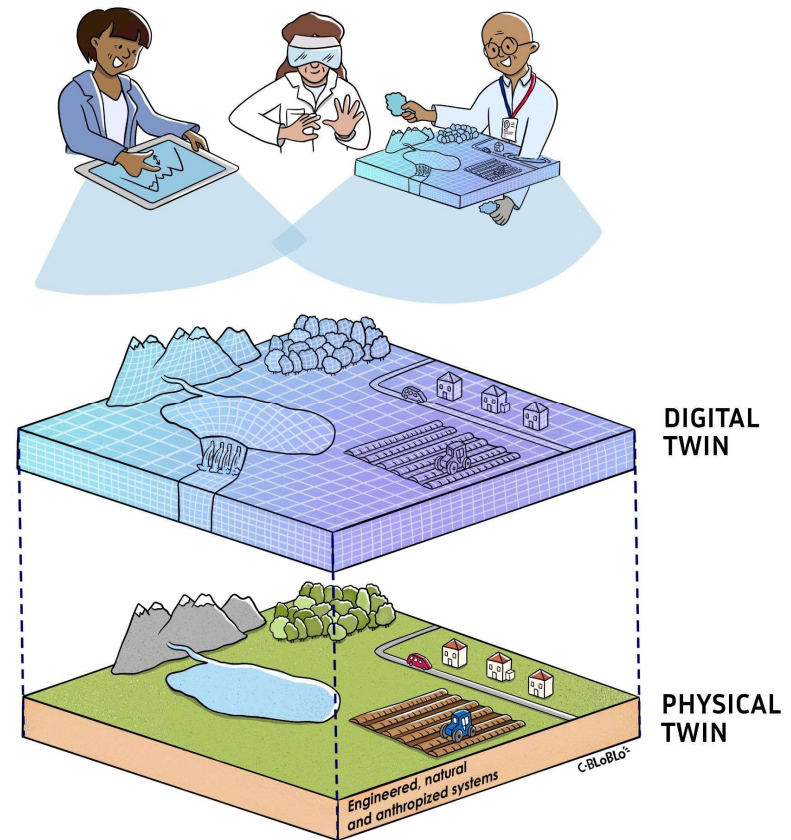
- **Le Jumeau numérique , clé de voûte de la transformation numérique (industrie, agriculture, santé, territoires...)**
- **Marché à très forte croissance (+50% entre 2025-2030)**
- **Mais:**
 - ❖ Concept et architecture mal définis, déficit de fondements scientifiques
 - ❖ Fragmentation de l'offre de solutions, besoin de standardisation
 - ❖ Absence de socle logiciel commun
- **Risques:**
 - ❖ **Souveraineté:** Perte de contrôle de la chaîne logicielle, des modèles et des données d'exploitation,
 - ❖ **Compétitivité :** retard et dépendance pour la transformation industrielle,
 - ❖ **Résilience industrielle:** retard dans la réindustrialisation et la décarbonation
- **Proposition d'un programme national**
 - ❖ Centré sur la fabrication du Jumeau numérique comme objet d'étude scientifique du domaine des Sciences du Logiciel
 - ❖ Et sur la création d'une plate-forme logicielle ouverte de développement, de composition et de gestion de jumeaux numériques.



Digital Twins, Wait! What?

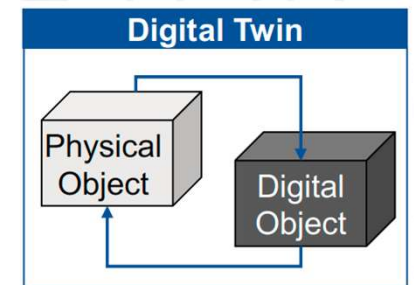
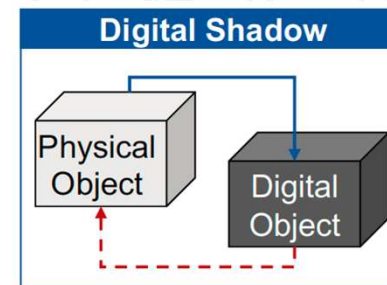
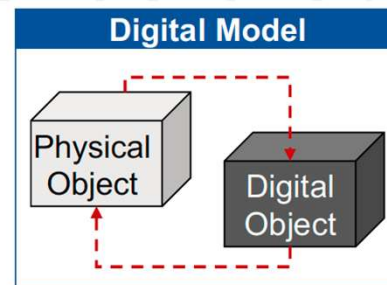
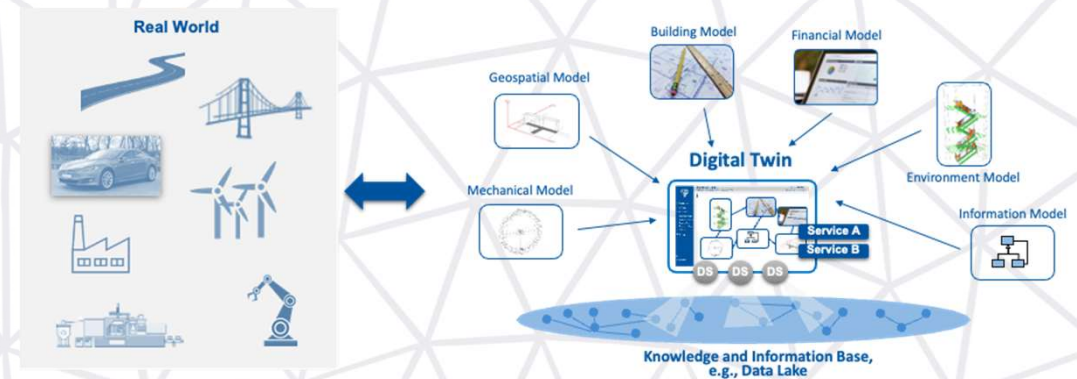
*“A digital twin is a **software system** that **purposefully represents** an original, **accurately reflects** its changes, can **act upon** its original, and provides **added value to users or other systems.**”*

-- Michael, Rumpe, Wortmann, Combemale, Jézéquel.



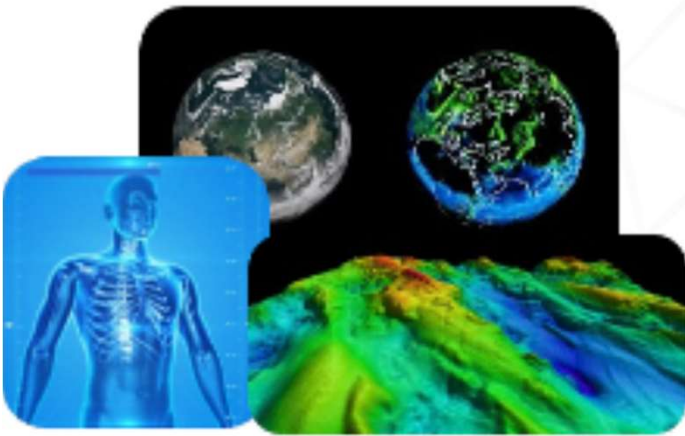
Creating Digital Twins for...

... elements in the "real" world that can be sensed, monitored, actuated and controlled



W. Kritzinger, M. Karner, G. Traar, J. Henjes, W. Sihn: *Digital Twin in manufacturing: A categorical literature review and classification*. IFAC-PapersOnLine, 2018.

Creating Digital Twins for...



... natural systems



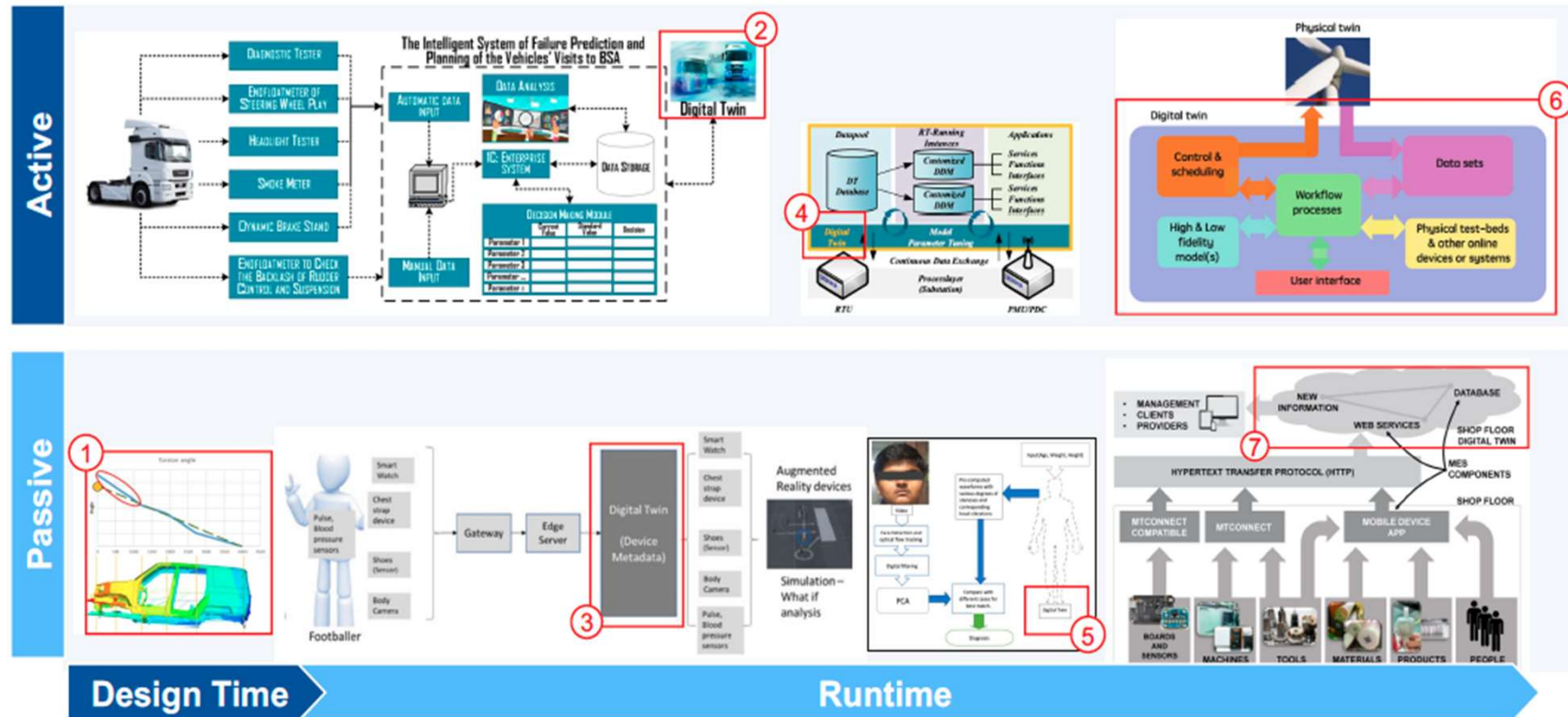
... anthropized systems



... engineered systems

(Cyber-Physical Systems, infrastructures, and business processes)

Creating Digital Twins for...



Dalibor, Jansen, Rumpe, Schmalzing, Wortmann: A Cross-Domain Systematic Mapping Study on Software Engineering for Digital Twins. In: Journal of Systems and Software, 2022.

Digital Twin: Capabilities Periodic Table

1 Data Acquisition & Ingestion	9 Synthetic Data Generation	17 Enterprise System Integration	23 Edge AI & Intelligence	29 Prediction		39 Basic Visualization	45 Dashboards
2 Data Streaming	10 Ontology Management	18 Eng. System Integration	24 Command & Control	30 Machine Learning ML		40 Advanced Visualization	46 Continuous Intelligence
3 Data Transformation	11 Digital Twin (DT) Model Repository	19 OT/IoT System Integration	25 Orchestration	31 Artificial Intelligence AI	35 Prescriptive Recommendations	41 Real-time Monitoring	47 Business Intelligence
4 Data Contextualization	12 DT Instance Repository	20 Digital Twin Integration	26 Alerts & Notifications	32 Federated Learning	36 Business Rules	42 Entity Relationship Visualization	48 BPM & Workflow
5 Batch Processing	13 Temporal Data Store	21 Collab Platform Integration	27 Reporting	33 Simulation	37 Distributed Ledger & Smart Contracts	43 Augmented Reality AR	49 Gaming Engine Visualization
6 Real-time Processing	14 Data Storage & Archive Services	22 API Services	28 Data Analysis & Analytics	34 Mathematical Analytics	38 Composition	44 Virtual Reality VR	50 3D Rendering
7 Data PubSub Push	15 Simulation Model Repository	52 Device Management	54 Event Logging	56 Data Encryption	58 Security	60 Safety	51 Gamification
8 Data Aggregation	16 AI Model Repository	53 System Monitoring	54 Data Governance	57 Device Security	59 Privacy	61 Reliability	62 Resilience

○ Data Services
○ Integration
○ Intelligence
○ UX
○ Management
○ Trustworthiness

<https://www.digitaltwinconsortium.org/initiatives/capabilities-periodic-table/>

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Research question for **Engineering Digital Twins**:

*What are the **principles, tools and methods** for integrating these capabilities into **scalable, reusable, and trustworthy digital twins**?*

○ Data Services
○ Integration
○ Intelligence
○ UX
○ Management
○ Trustworthiness

<https://www.digitaltwinconsortium.org/initiatives/capabilities-periodic-table/>

French National Program on Engineering Digital Twins (EDT)



RESEARCH PROGRAM
Engineering Digital Twins

Expected outcomes

A Multidisciplinary Community
Scientific Foundations
An Open Source Platform
End-to-end Demonstrators

Ressources

40+ PhDs / PostDocs
40+ Uses Cases
35+ Partners involved



Engineering Digital Twins: A Research Roadmap.

Benoît Combemale, Pascale Vicat-Blanc, Arnaud Blouin, Hind Bril El Haouzi, Jean-Michel Bruel, Julien Deantoni, Thierry Duval, Sébastien Gérard, Jean-Marc Jézéquel.
EDTConf, 2025. preprint: <https://hal.science/hal-05223776>

Focused Projects	9.2 M€
Cross-cutting Actions	3.4 M€
Governance	1 M€
Administrative fees	3.4 M€
Total	17 M€

AT1:
Animation



AT2: Use cases &
Demonstrators

AT3:
Integration

AT5:
Dissemination
& Exploitation

AT4: Ethics &
Sustainability

DIGITAL
TWIN

PC4: SYNCHRONIC
Smart and Sustainable
SYNCHRONIZATION for
Reliable Digital Coupling
and Infrastructure

PHYSICAL
TWIN

Pascale Vicat-Blanc
Inria
EDT Scientific Co-Director

Benoît Combemale
Inria - Pr University of Rennes - IRISA
EDT Scientific Co-Director

Guy De Spiegeleer

Inria
EDT COO

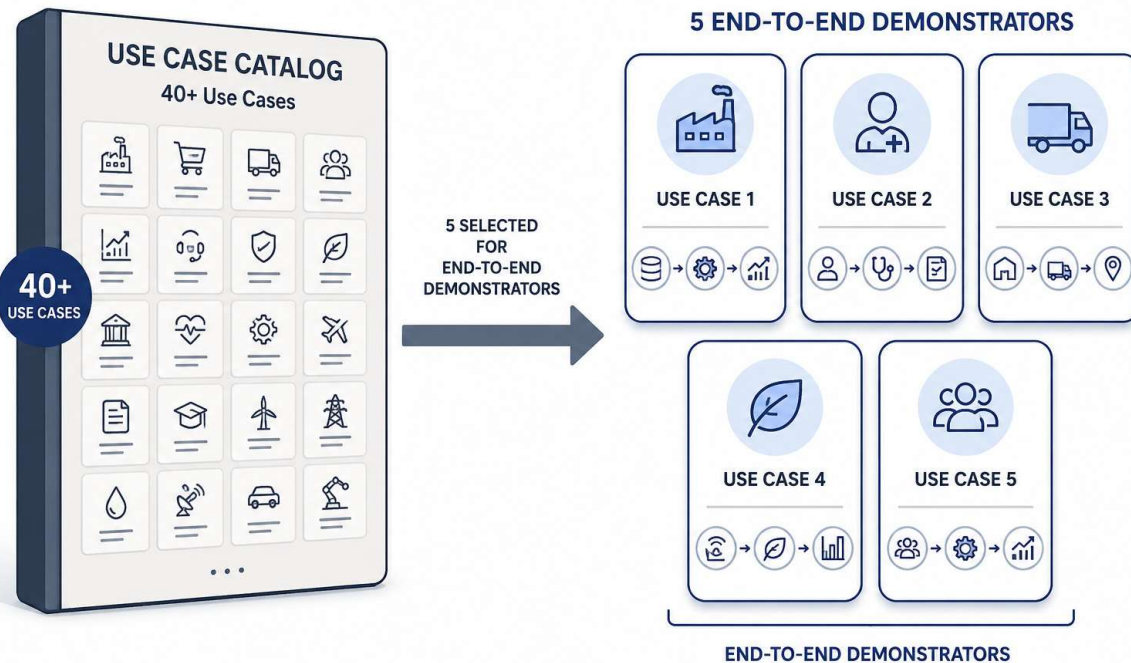
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Engineering
DIGITAL TWINS
<https://www.edtlab.fr>

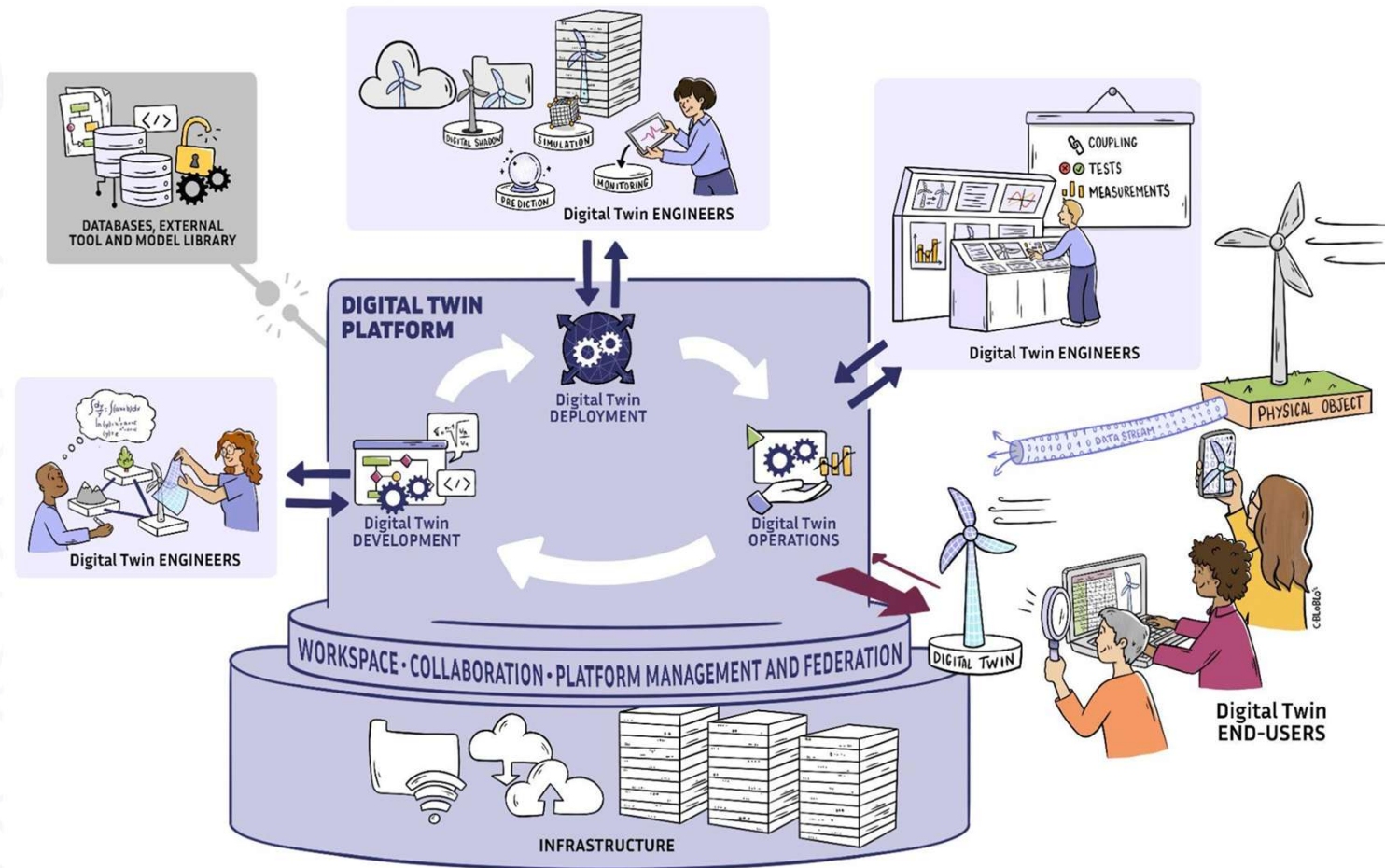
The Use Case Catalog (AT2)



- 40+ use cases provided to the focused projects
- 5 selected use cases to provide end-to-end demonstrators
 - Natural system
 - Anthropized system
 - Engineered system (Cyber-physical system, Infrastructure, Business processes)

The Artemis Platform (AT3)

- Methods & tools for engineering digital twins
- End-to-end lifecycle support (Dev-Deploy-Ops)
- Collaborative by design
- Open Source
- Tool and model libraries



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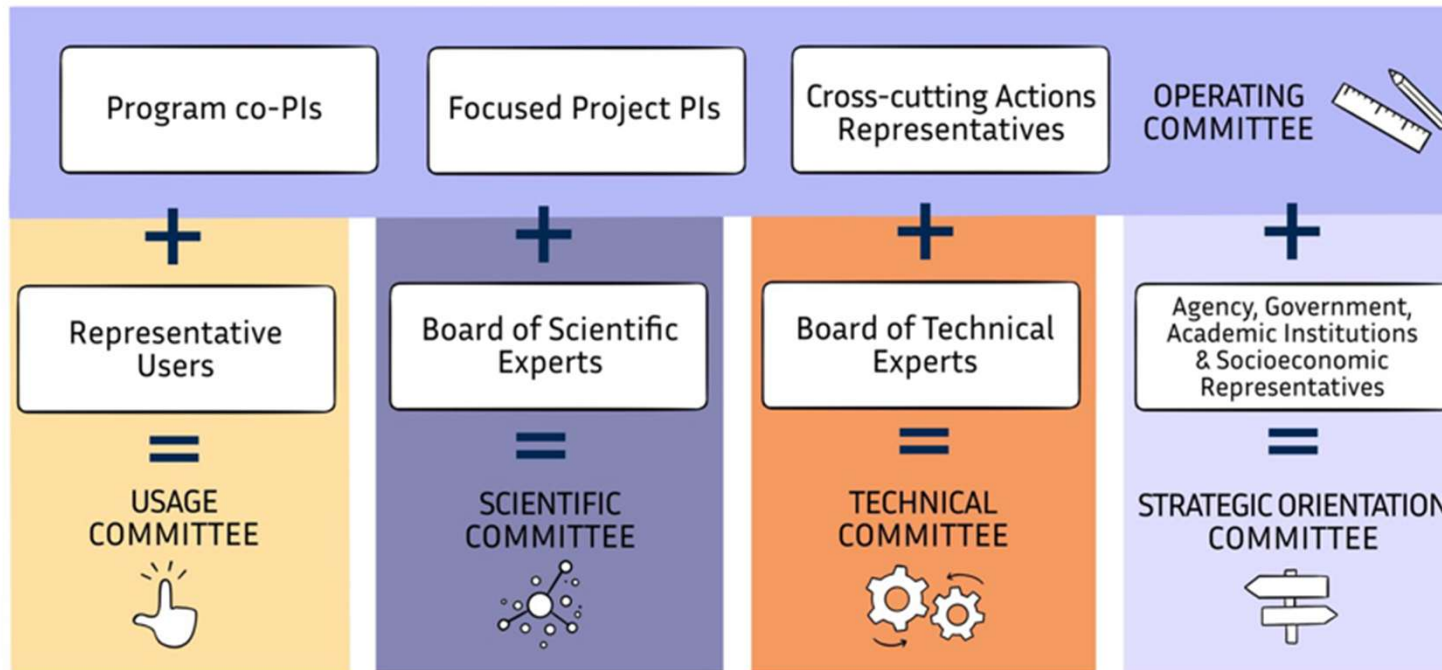
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Questioning Technology (AT4)

Ensuring that digital twins are developed and deployed responsibly, sustainably, and for the benefit of society.

- Establish methods, guidelines, and assessment frameworks to integrate **ethical, societal, environmental, and economic considerations** throughout the digital twin lifecycle.
- Evaluate and improve the **sustainability footprint** of digital twins, including data management, computation, infrastructure, and operational practices.
- Address key concerns such as **trustworthiness, transparency, accountability, privacy, security, inclusiveness, and human oversight**.
- Develop metrics, tools, and best practices to support **responsible engineering and operation** of digital twins.
- Foster interdisciplinary collaborations with experts in sustainability, social sciences, ethics, and law.
- Provide recommendations and actionable guidance to the EDT community, industrial stakeholders, and public institutions.

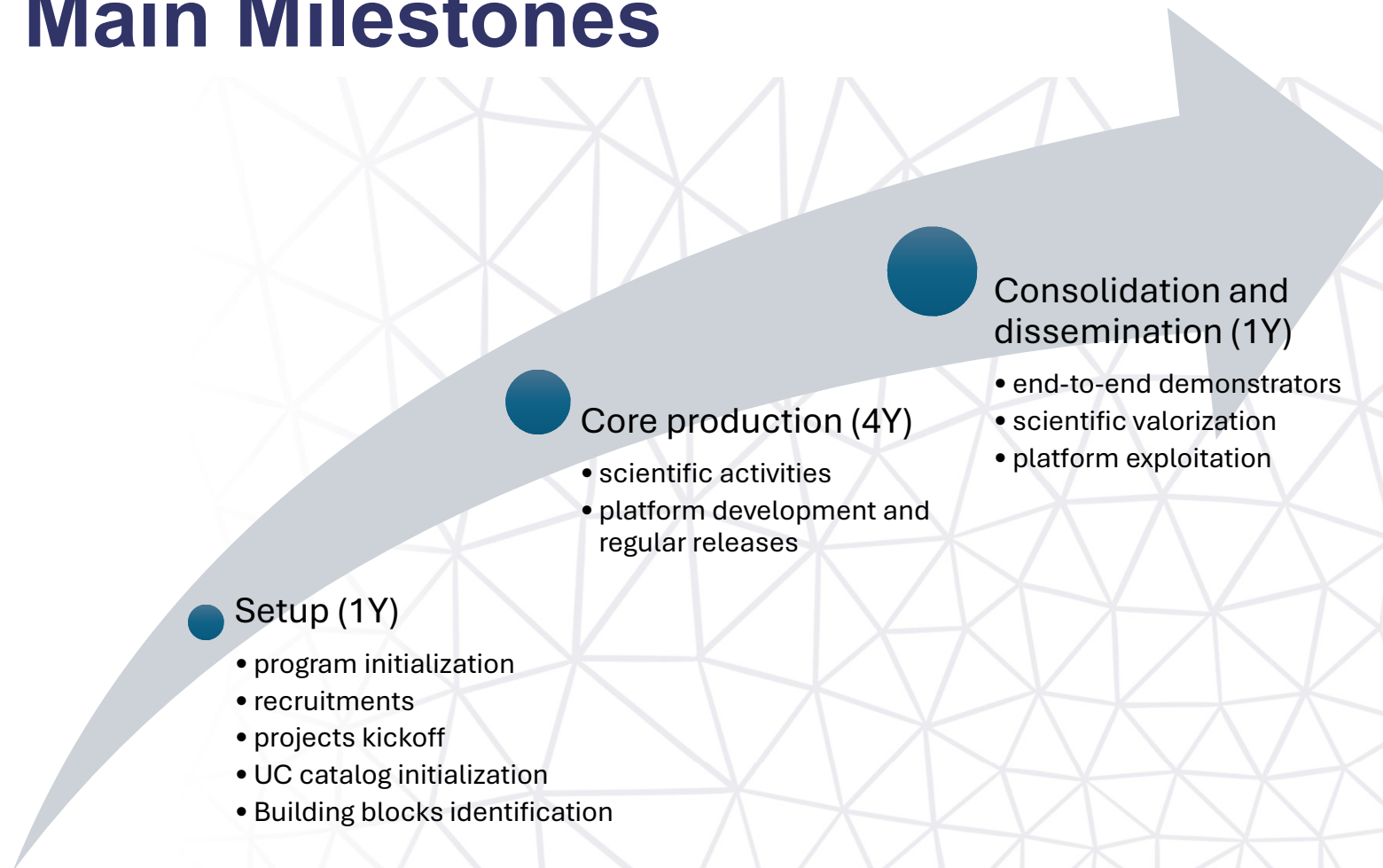
EDT Governance



First Actions

- Workshop on Use Cases (Jan. 7th, 2026)
- Online seminar series on Building Blocks (monthly, since Apr., 2026)
- *Scientific Workshop (Jul. 6-8, 2026)*
- *Main PhD / PostDoc Recruitment Wave (20+ PhD/PostDoc)*
- *PhD Students Club, Affiliated Partners Club*
- *Standardization Working Group*
- *Responsable Technology Working Group*

The Main Milestones



The EDT Ecosystem

Research Partners



- Research partners involved in the scientific activities (PCs)
 - Only the main supervisors host the corresponding budgets
 - The legal entity hosting the budget depend of the local agreement
- ~30 national research institutes, universities and engineering schools

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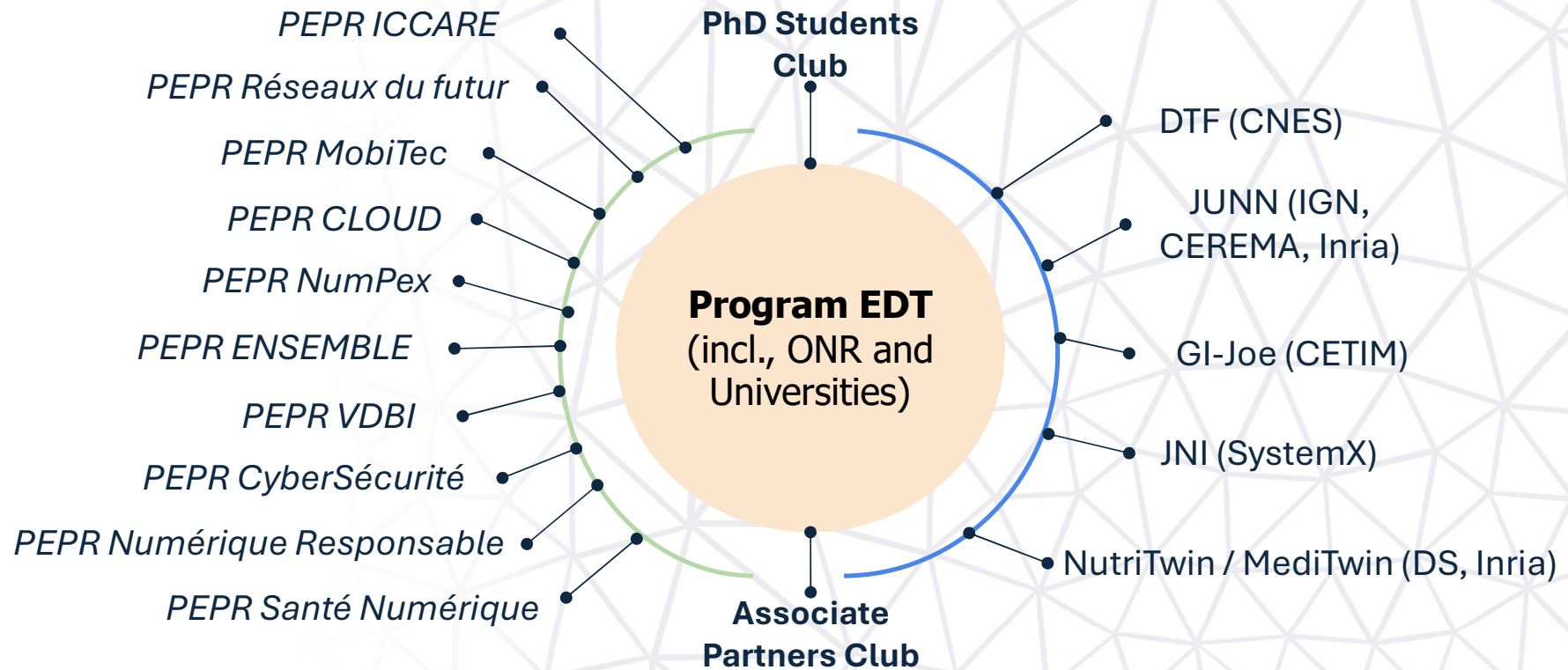
The EDT Ecosystem

External Partners



- External partners
 - Use case providers
 - Contributors to the working groups
 - Additional funding for specific topics
- *List to be completed!*
- *Join eventually the Associate Partners club*

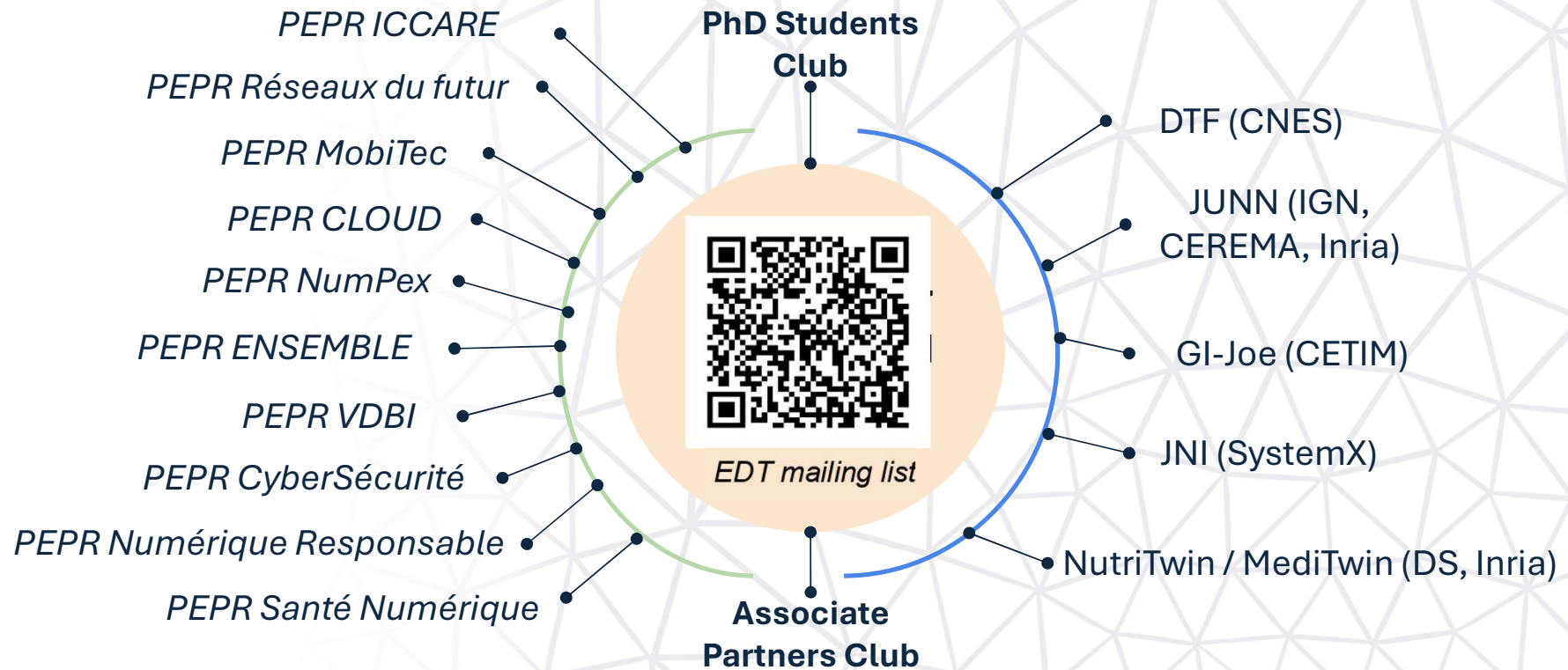
The EDT Ecosystem



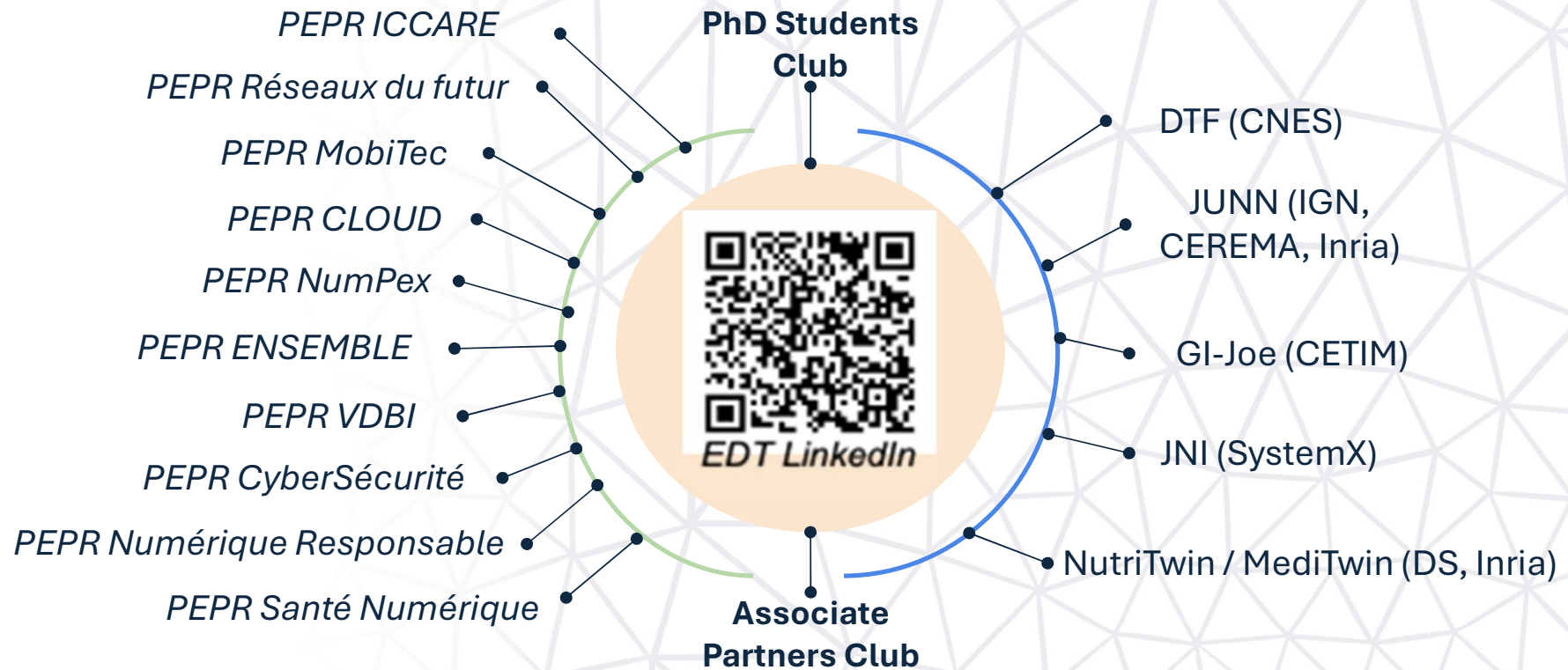
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The EDT Ecosystem



The EDT Ecosystem



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