HOLISTIC, OMNIPRESENT, RESILIENT SERVICES FOR FUTURE 6G WIRELESS AND COMPUTING ECOSYSTEMS (HORSE)

Prof. Fabrizio Granelli

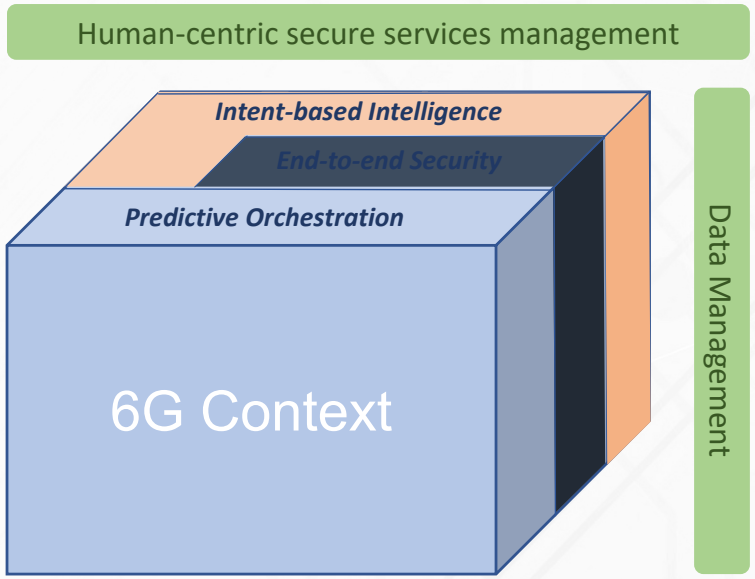
SNS Lunchtime Webinar, Feb. 23, 2023, online

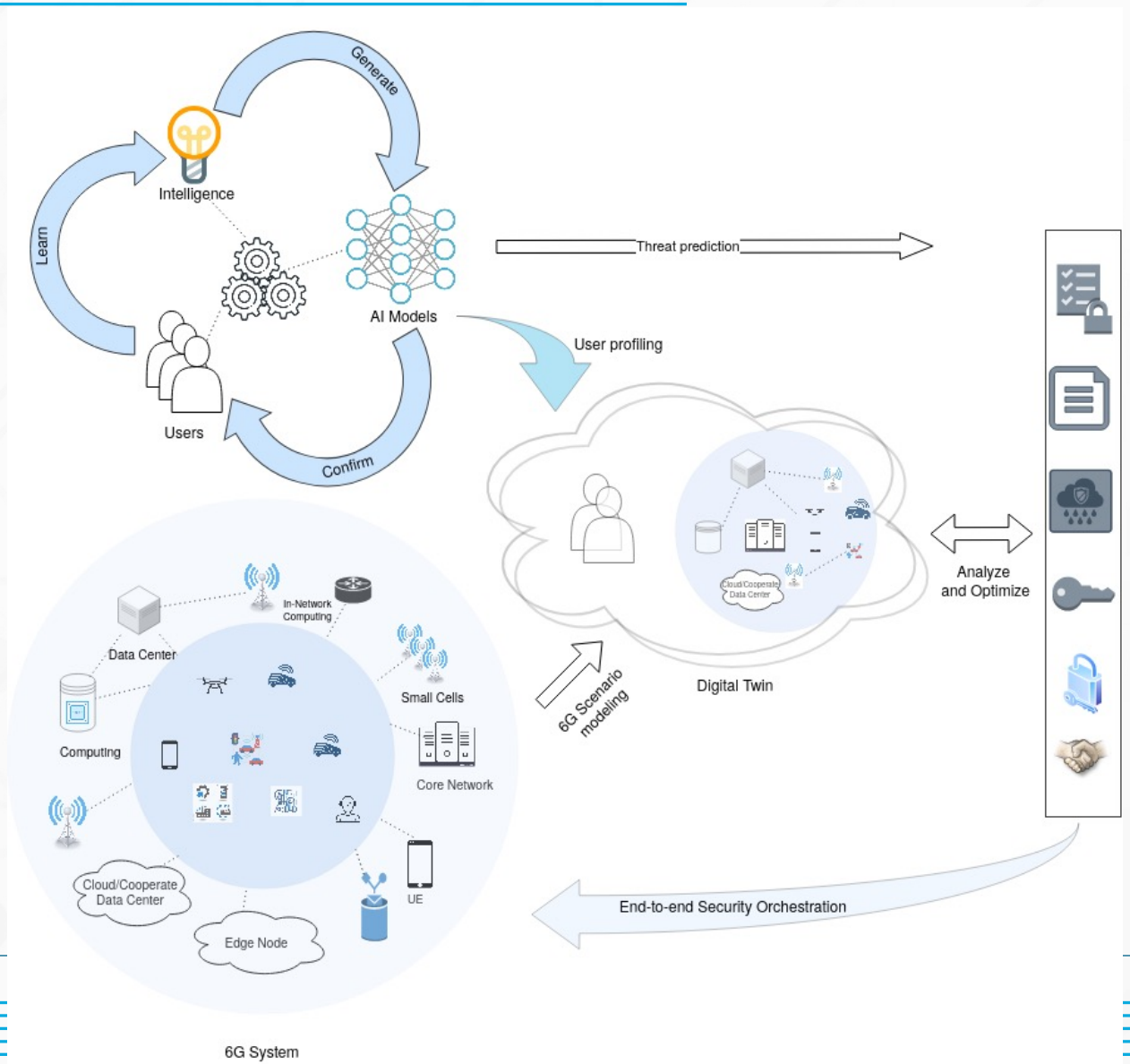
PROJECT OVERVIEW

- **Project Name:** Holistic, Omnipresent, Resilient Services for Future 6G Wireless and Computing Ecosystems (HORSE)
  - **Project website:** horse-6g.eu
- **Stream:** SNS Phase 1 (2022) Stream B
- **Members:** CNIT, ATOS, Ericsson, UPC, TUBS, Telefonica, NKUA, Suite5, EFACEC, ZORTE, 8-BELLS, HOLO-LIGHT, STS, Martel
- **Coordinator:** Fabrizio Granelli (CNIT, ITALY)

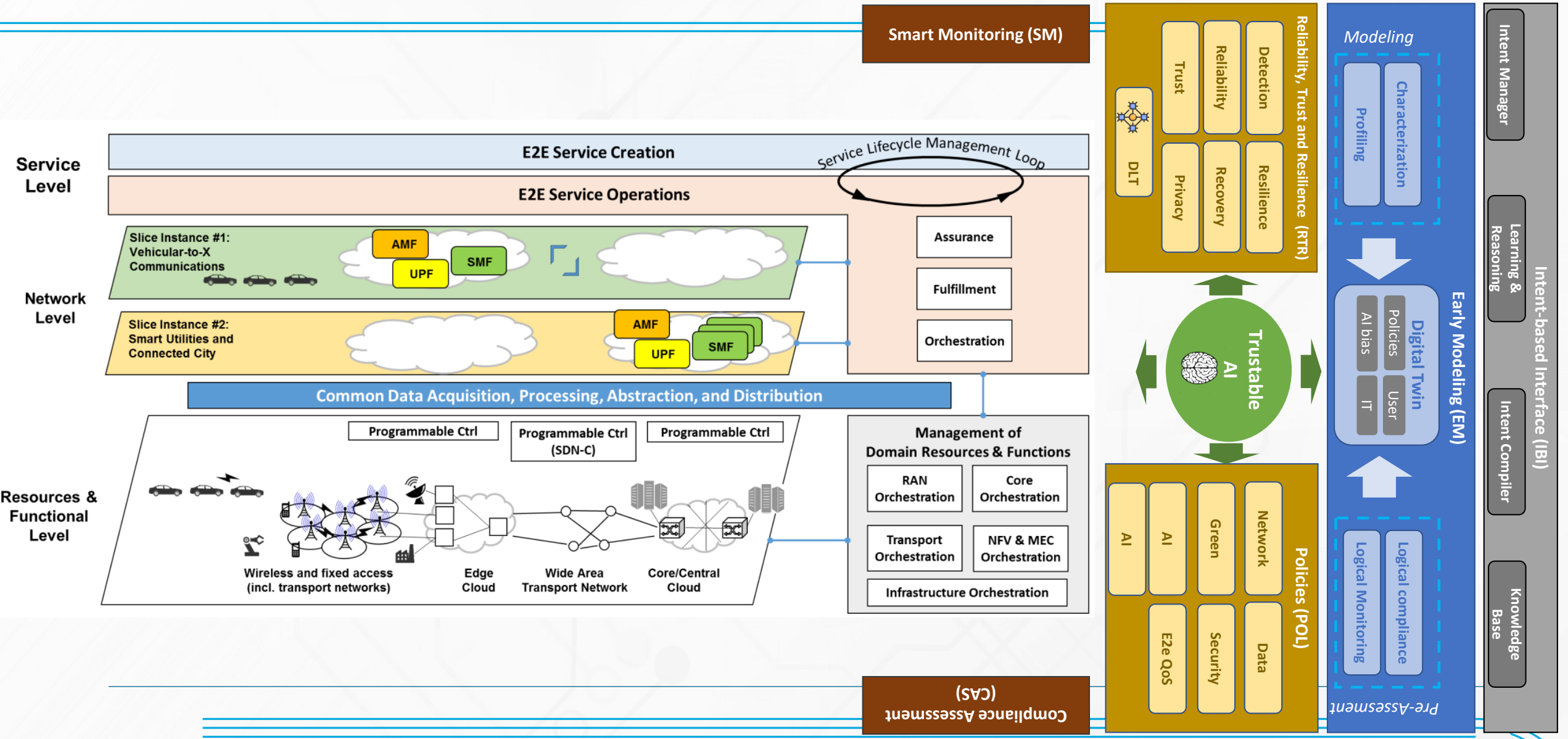
- **Other:** 6G infrastructure operation for smart connectivity and service management, 2 use cases: light transportation & extended reality

THE 6G SCENARIO





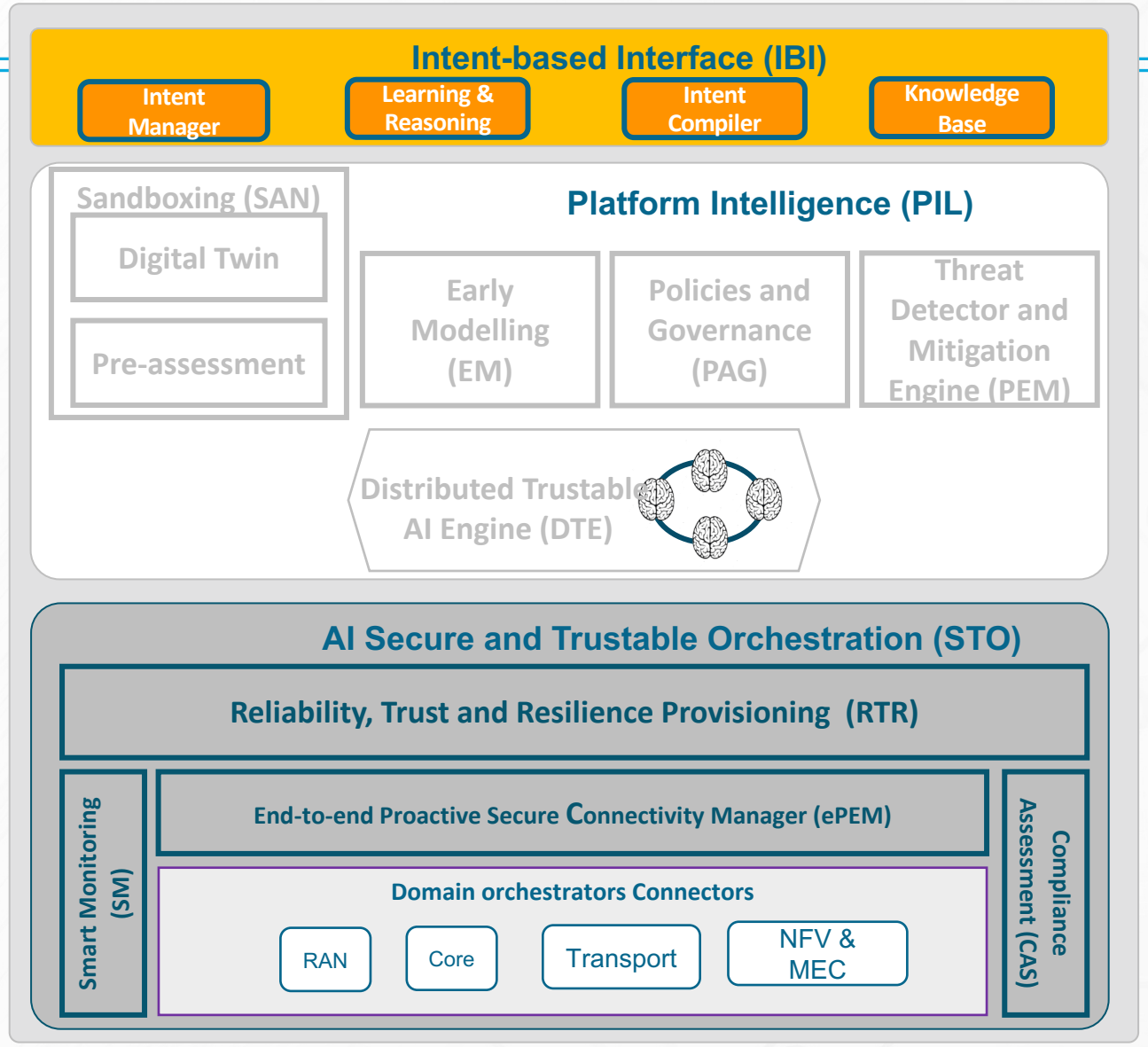
THE 6G HORSE HOLISTIC SCENARIO



HORSE KEY OBJECTIVES

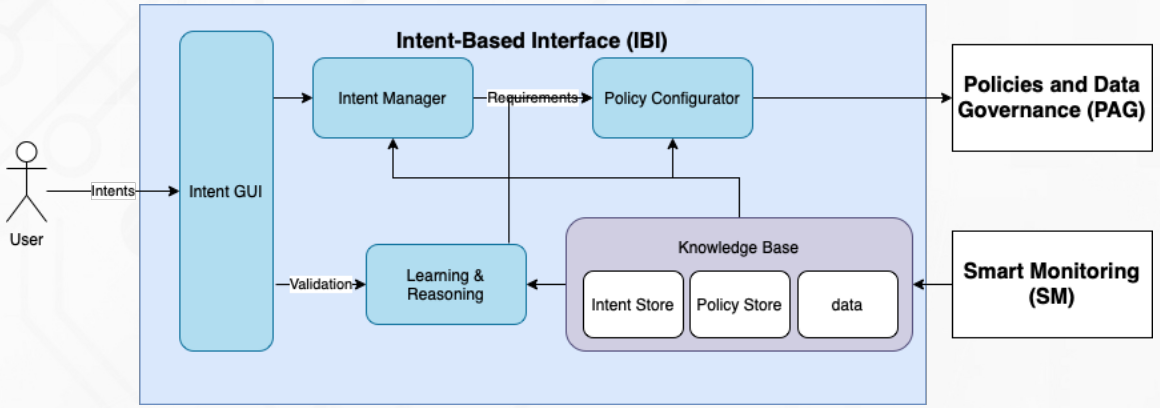
- **Project Key Objectives:**
- Comprehensive analysis of foreseeable 6G scenarios
- Designing the necessary end-to-end security solutions
- Development of a human-centric, holistic, omnipresent, and resilient smart services management and operation programmable platform
- Deploying AI technologies driving a completely predictive approach to security management, fully addressing high services, systems, risks, and threats dynamicity
- Characterize the user profile and the 6G system as a digital twin, to feed the AI distributed decision processes
- Designing the system interface to be intent-based to implement the role of the “Human-In-The-Loop”
- Deploy, demonstrate and validate HORSE in selected use cases
- Creating impact and promoting of open access to the HORSE platform for broad and sustainable exploitation of results

HORSE ARCHITECTURE



The Intent-Based Interface (IBI) is responsible for mapping high-level intents into security workflows able to react to security threats and vulnerabilities, which will itself use AI for intent optimisation:

- Maintaining the «Human-in-the-Loop»
- Understanding service demands



HORSE ARCHITECTURE

Intent-based Interface (IBI)

- Intent Manager
- Learning & Reasoning
- Intent Compiler
- Knowledge Base

Sandboxing (SAN)

- Digital Twin
- Pre-assessment

Platform Intelligence (PIL)

- Early Modelling (EM)
- Policies and Governance (PAG)
- Threat Detector and Mitigation Engine (PEM)
- Distributed Trustable AI Engine (DTE)

AI Secure and Trustable Orchestration (STO)

- Reliability, Trust and Resilience Provisioning (RTR)
- Smart Monitoring (SM)
- End-to-end Proactive Secure Connectivity Manager (ePEM)
- Domain orchestrators Connectors
  - RAN
  - Core
  - Transport
  - NFV & MEC
- Compliance Assessment (CAS)

Infrastructure (continuum, network, data)

Distributed Trustable AI Engine (DTE)

Trustable AI

- Explainability
- Ethics Compliance
- Digital Twin Manager

Model Maintainer

- Model catalgog
- Model hardening
- Model defense

- Distributed tools

Early Modelling

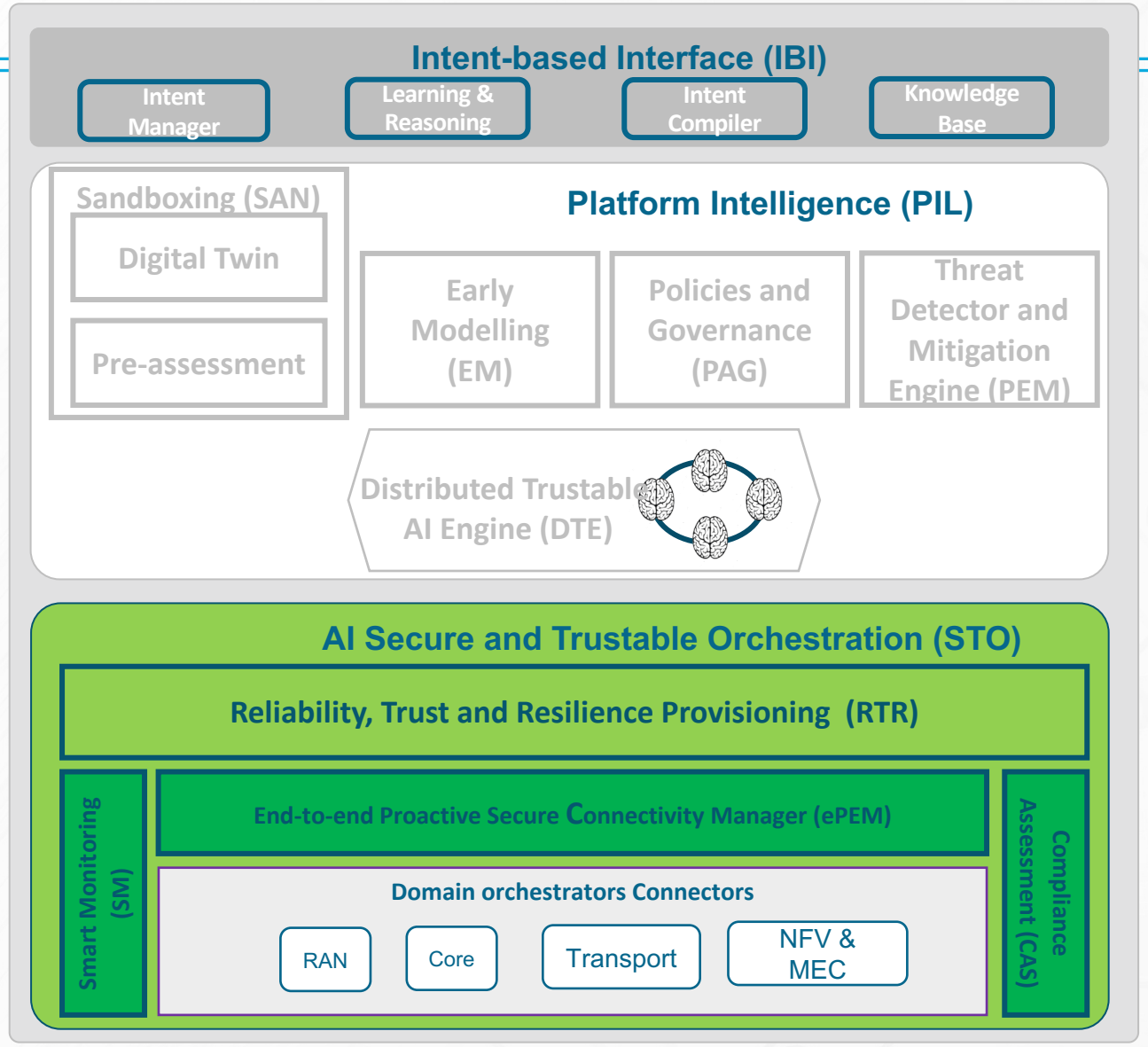
Taxonomy

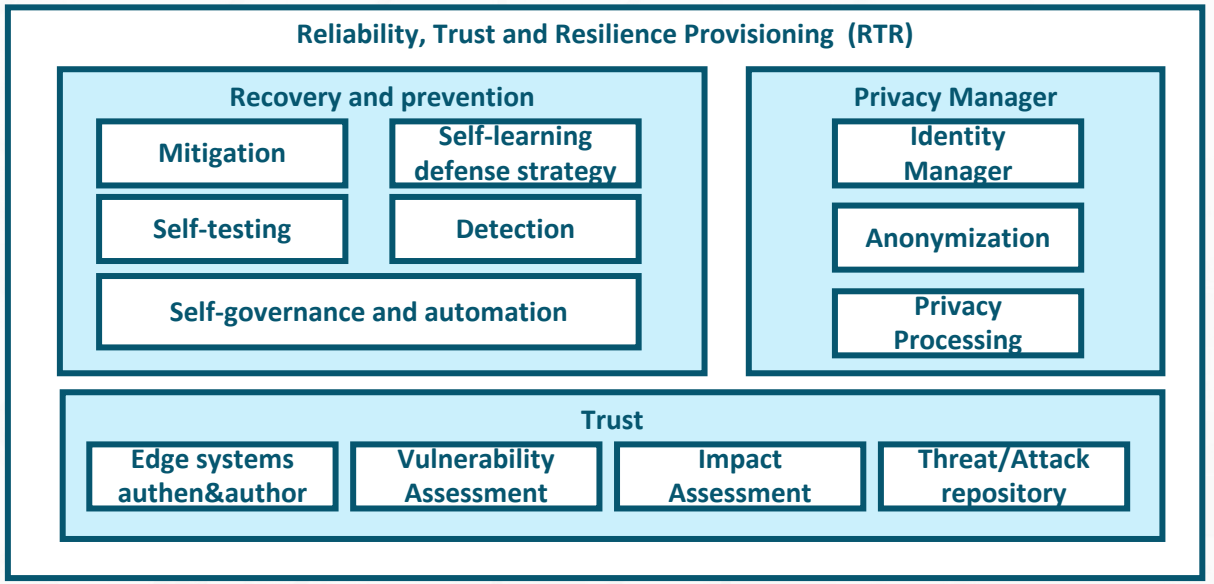
- Characterization
- Profiling

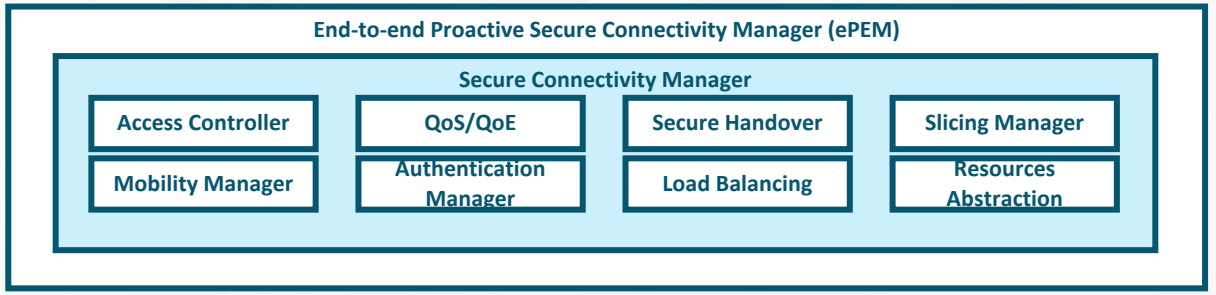
Attributes

- Users
- Infrastructure
- Policies
- Services
- Behaviour

HORSE ARCHITECTURE

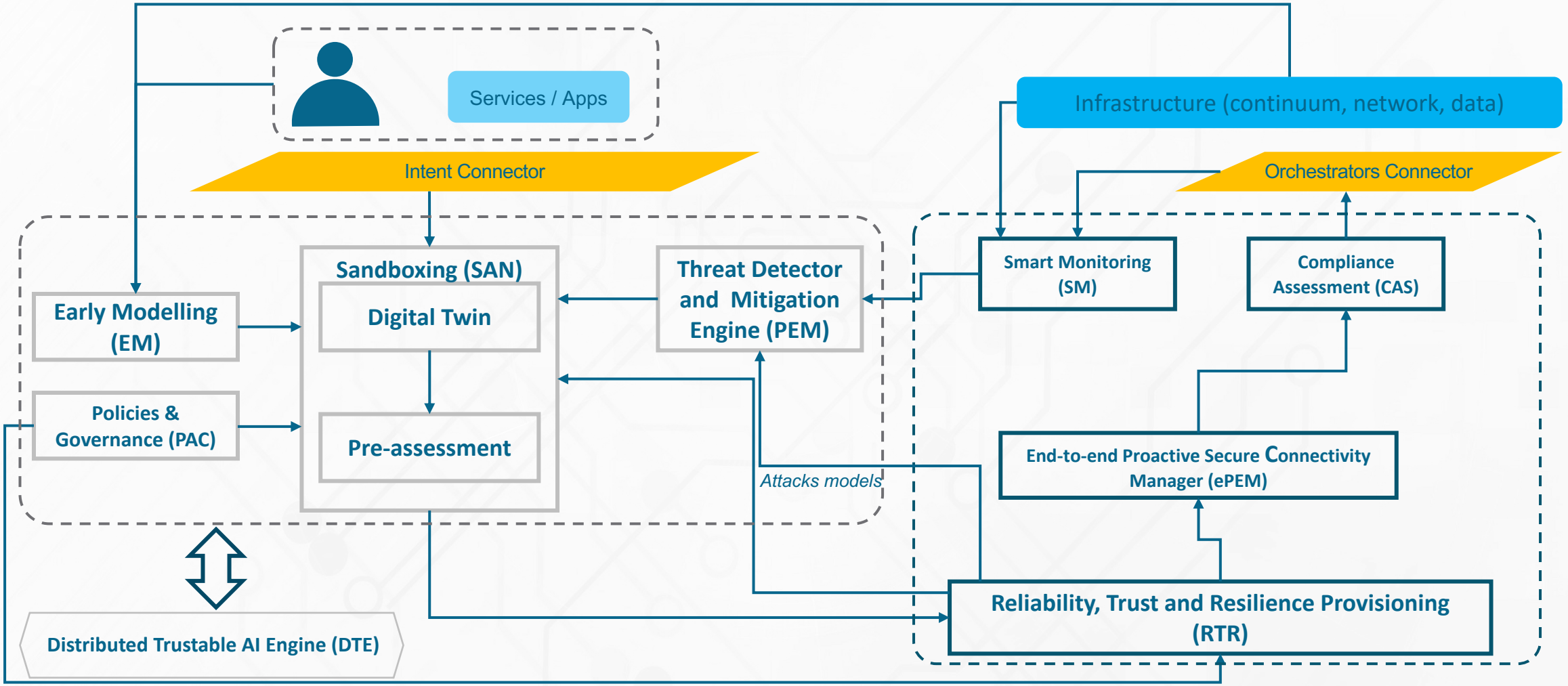






Infrastructure (continuum, network, data)

HORSE CONCEPTUAL OPERATING MODEL



HORSE USE CASES

Secure Smart Light Rail Transit Systems

Use case objective	*KPI*	*Target*
Resilience and disaster recovery	Down Time	Improve the down time in 50%
Resilience and disaster recovery (remotely operation)	Availability	Improve the availability in 20%
Decision support system	Statistics availability time	Capability to calculate the operation statistics data almost in real-time.

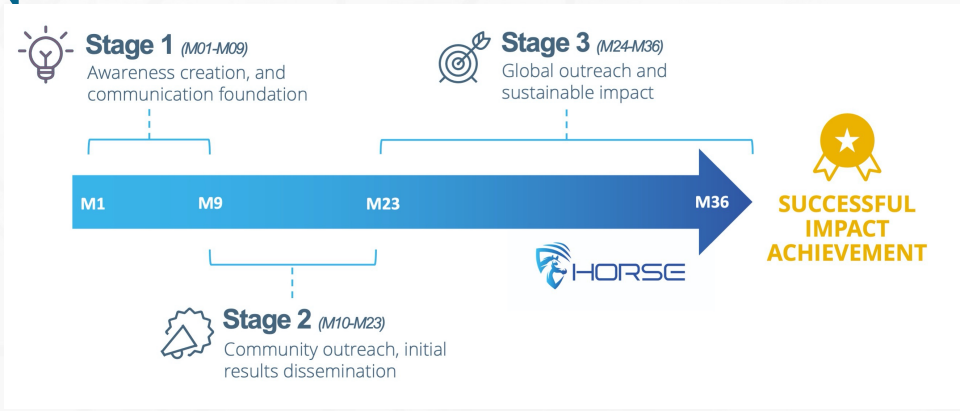
Remote Rendering to Power XR Industrial

Use Case objective	*KPI*	*Target*
Detection of Design Fault	Decrease of errors	- 90% faults
Cost reduction of prototypes	Reductions of costs	- 50% costs
Faster time-to-market	Faster release of the product	+ 20% faster release on the market

Use Case	Final applications	HORSE (security provisioning)	HORSE (intelligence)
Secure Smart LRT Systems (SS-LRT)	**Secure distributed operation:** Fast recovery and timely failures detection.	**Service management:** A threat is detected and/or predicted and the secure orchestrator launches the actions to properly react.	**Facilities:** Models running on the DT pre-assess the actions to be taken to evaluate the expected performance, considering a highly distributed scenario.
Remote Rendering to Power XR Industrial ($R^2$2XRI)	**Secure and reliable communication:** Secure offloading and secure multiuser remote interaction.	**Service management:** HORSE will provide a secure multiuser environment for teleportation, supporting a secure and flexible 6G components orchestration.	**Facilities:** Infrastrucure modelling, considering the strict constraints imposed by XR (ultra-low latency and highly dense contexts), as well as the attcaks models driven by global XR devices availability.

PLANNED STANDARDIZATION ACTIVITIES

- **Potential targeted standardization bodies / groups:**
- IETF WGs (I2NSF, SACM, ACME, PPM)
- ETSI MEC, NFV, ENI, ZSM, SAI
- 3GPP, SA3 (security) and SA5 (management aspects)
- ITU-T FGAN (Focus Group on Autonomous Networks)
- Open source: Linux Foundation ONAP, Akraino, Anuket, ETSI OSM and TFS
- Open source / open specs: OpenConfig, O-RAN
- **Standardization planning and estimated time plan:**



THANK YOU FOR YOUR ATTENTION

horse-6g.eu

HORSE project has received funding from the Horizon Europe research and innovation programme under grant agreement N° 101096342