TALON

Autonomous and Self-Organized
Artificial Intelligent Orchestrator for
a Greener Industry 5.0

Infocom World 2023

Athens, 14 December 2023

Dimitris Kastrinakis,
Eight Bells ltd

EIGHTBELLS
Independent Research & Consultancy

talon-project.eu

Funded by
the European Union

EIGHT BELLS today

EIGHT BELLS Ltd is a technology & research firm based in Nicosia, Cyprus and Athens, Greece.

Specializing in **Defense**, **Security**, **Space**, **Telecommunications**, **Cybersecurity**, **eHealth** and **Environmental Protection**, with disruptive IT solutions.
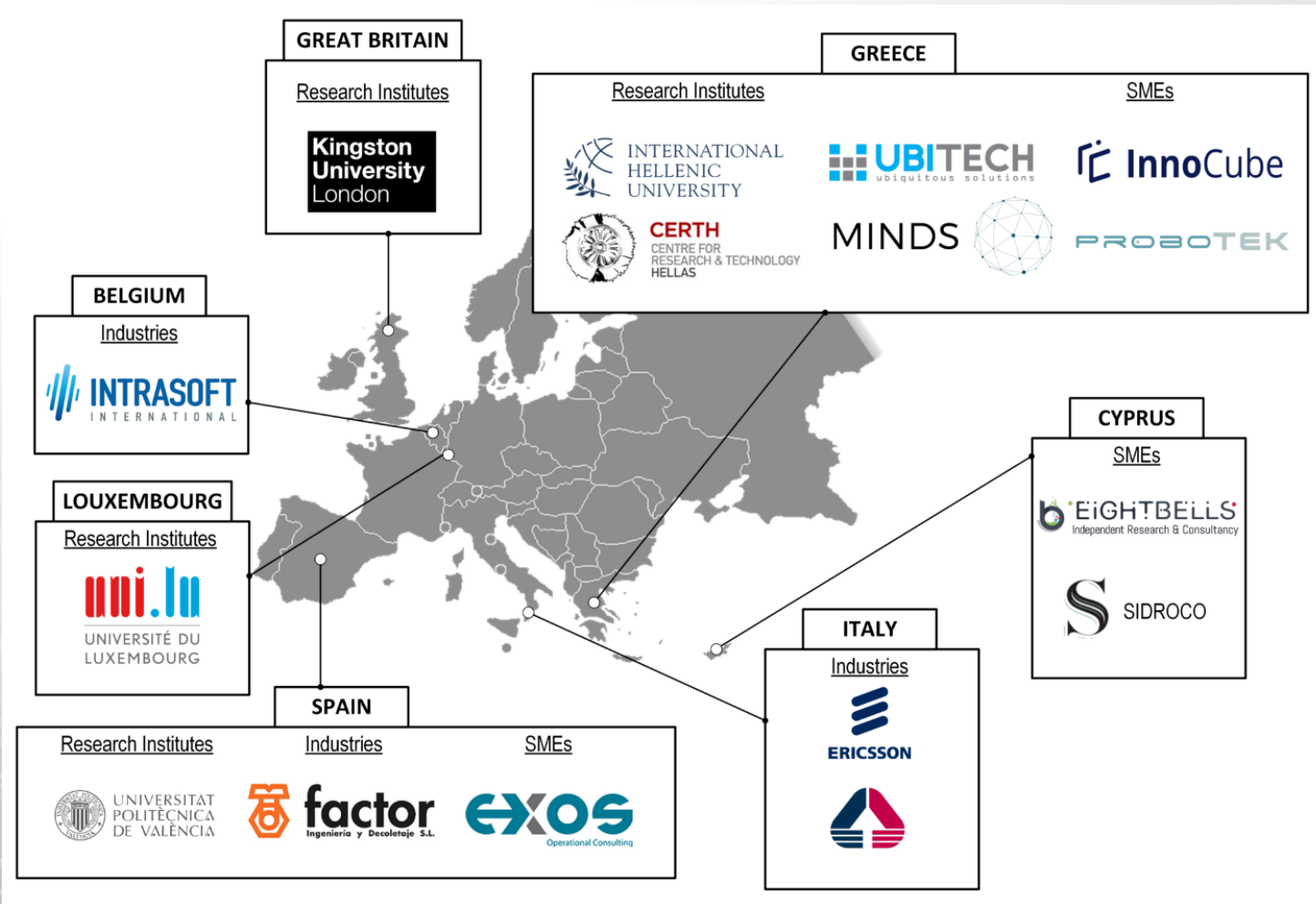
Our technical capabilities include **Systems & Networks Engineering, Cloud Computing**, **Privacy**, Security & Data Protection and Software development.

EIGHT BELLS, following a specific development plan, invests in high value-added, thus bringing forward an employee-centric management approach.

EiGHTBELLS
Independent Research & Consultancy

TALON PARTNERS

TALON

Clustering Towards a Trustworthy AI

Problem 1: Manual handling is not effective

Long failed component identification time

Large operating costs

Low resource utilization rates

High Energy consumption

The solution

TALON'S AI ORCHESTRATOR FOR AUTONOMOUS, DYNAMIC AND GREENER AI NETWORKS

O-1: To enable zero-touch deployment and operation

O-2: To reduce the energy footprint of the whole AI network

How?

AI orchestration mechanisms

Social-aware caching

Mobility manager

Self-healing, self recovery, self-organizing

Problem 2: Privacy is limited
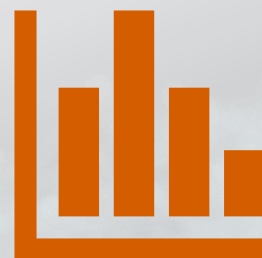
Not so safe

The solution

TALON'S DISTRIBUTED BLOCKCHAIN FOR HIGH-SECURITY, PRIVACY AND TRUST
O-3: To guarantee high-level security and privacy in heterogeneous application environments

How?

Low-latency consensus mechanisms

Novel resilience, security, and privacy mechanisms

Decentralized and hierarchical distributed blockchain-based mechanism

Problem 3: Latency is our enemy
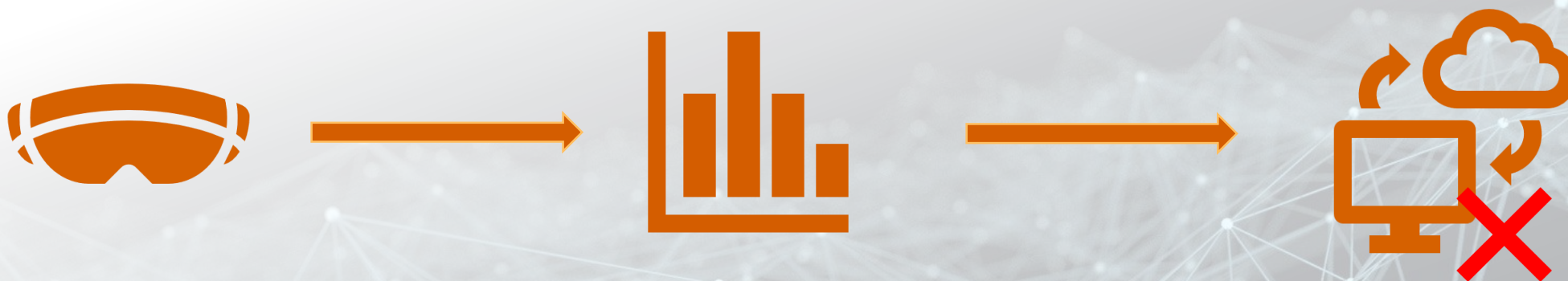
High latency

High Traffic

Lower data accuracy in timestamped sensors

The solution

Edge Computing for almost-zero latency and high-computational capabilities near sensors
O-4: To efficiently assess and boost the AI E2C performance
O-5: To enable reusability of datasets, algorithms, metrics and models

How?

Improved E2C deployment, management and recourse usage

Semantics that enable reusability and reduce the learning latency

DTs that enable fast off-and on-line learning

EiGHTBELLS
Independent Research & Consultancy

Problem 4: AI is a black-box
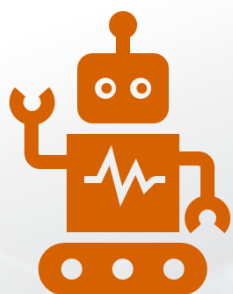
Black-box

Low explainability

The solution

DIGITAL TWINS AND HUMAN-IN-THE-LOOP TO BOOST AI EXPLAINABILITY & TRANSPARENCY
O-6: To present AI theoretical framework
O-7: To boost the explainability and transparency of the AI approaches

How?

DTs that enable visualization of the AI decision making process

Testbeds to experimentally verify the theoretical framework

Project Scope & Objectives

| Vision	Obj. Id.	Description
Pillar 1	O-1	To enable zero-touch deployment and operation
	O-2	To reduce the energy footprint of the whole AI network
Pillar 2	O-3	To guarantee high-level security and privacy in heterogeneous application environments
Pillar 3	O-4	To efficiently assess and boost the AI E2C performance
	O-5	To enable reusability of datasets, algorithms, metrics and models
Pillar 4	O-6	To present AI theoretical framework
	O-7	To boost the explainability and transparency of the AI approaches

EiGHTBELLS
Independent Research & Consultancy

These weren't just examples but TALON'S Real-world Testbeds

Demonstrator #1: UATVs coordination (PROBO, UL, UBITECH, MINDS, INTRA, EXOS)

- **Impact:** TALON's AI-orchestrator will reduce the reaction latency by broadening the execution field of AI algorithms in the E2C continuum and shifting the balance of intelligent systems towards the edge.
- **Quantitative Improvements and KPIs:** Decrease response time to < 2ms (latency reduction), >90% decrease in UATV-to-Node feed forwarding latency, >60% reduction in transferred data/size (EE, data efficiency), and at least 30% energy conservation on operated flights (EE).

Demonstrator #2: I5.0 Automation & Planning (FACT, EXOS, UPV, TEI, SID, IC)

- **Impact:** TALON's developed technologies will lead industrial manufacturing to qualify the health of the process and ensure the quality of the product, avoiding defects and optimizing the processes.
- **Quantitative Improvements and KPIs:** 5% increase in quality ratio, 4% increase in effectiveness, 15% increase in availability, 3% increase in overall equipment effectiveness.

Demonstrator #3: AR/VR for training and maintenance (IHU, FACT, KU, TEI, UPV, 8BELLS)

- **Impact:** This demonstrator aims to illustrate the utilization of AI-enabled function deployed on the edge supporting real time onsite AR/VR guided maintenance and support crew training and in extent human-AI collaboration.
- **Quantitative Improvements and KPIs:** Rendering latency time < 20 ms, >50% AI-human collaboration effectiveness, >90% decrease in AR-to-node POV transmission latency, Training attendance rate > 95% (reusability), >90% gesture/environment recognition (accuracy)

Demonstrator #4: HRC (CERTH, ENG, UBITECH, IC)

- TALON will create a more explainable, trustworthy and safe operation for HRC scenarios
- **Quantitative Improvements and KPIs:** >70% reduction in AI-to-AI communication latency, >30% robot production efficiency, >80% in environment recognition and augmentation accuracy, and 15% increase in assembly efficiency.

Project at a glance

TALON

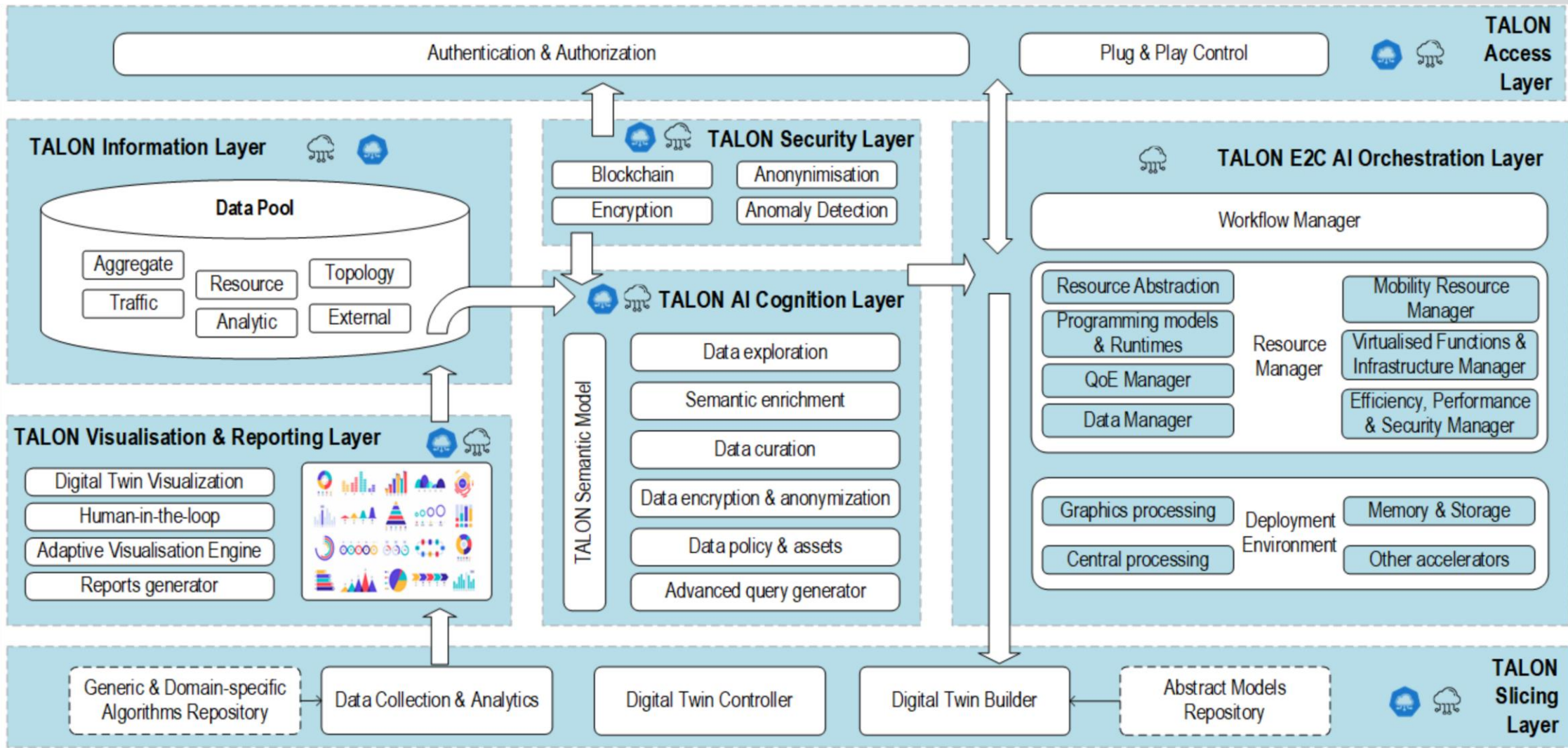| Pillars	Objectives	Actions	Testbeds	KPIs
AI orchestrator for autonomous and dynamic scalability as well as greener AI networks	O-1: To enable zero-touch deployment and operation	• AI orchestration mechanisms • Application specific slices • Mobility management • Social-aware caching • Off-loading mechanisms • AI self-healing, self-recovery, self-organizing and self-configurating	Automatic UATV coordination	50-60% reduction of failed component identification time; 70% reduction of operation cost; Resource utilization rate >99.99%; > 20% higher EE; > 20% higher data efficiency; Participation rate > 70%
	O-2: To reduce the energy footprint of the whole AI network	• Increase the ecosystem's EE. • Federated learning strategies • Optimum AI algorithms placement • Few-shot learning approaches • Smart pricing policies		
Distributed blockchain for high-security, privacy and trust in a heterogeneous application environment	O-3: To guarantee high-level security and privacy in heterogeneous application environments	• Low-latency consensus mechanisms • Novel resilience, security, and privacy mechanisms • Decentralized and hierarchical distributed blockchain-based mechanisms	Industry 5.0 automation & planning	Security of access and data transfer for any traffic load/ patterns (99.99%); Ultra-high privacy with probability of successful attack 10^{-7}
EC for almost-zero latency and high-computational capabilities near sensors	O-4: To efficiently assess and boost the AI E2C performance	• Novel KPIs • Novel optimization problems based on the newly-defined KPIs • Data-driven real-time optimization • Improved E2C deployment, management and recourse reusage	AR/VR for training & maintenance	Network latency lower than 1 ms; Reliability with outage probability approaching 10^{-7}; Data accuracy in timestamped sensor capture from 50 to 10 ms; 50% traffic reduction; 99.9999% resource availability; Dynamic reusability (estimated reusability rate>90%)
	O-5: To enable reusability of datasets, algorithms, metrics and models	• DTs that enable fast off- and on-line learning • Semantics that enable reusability and reduce the learning latency	Human-Robot collaboration	
Digital twins and human-in-the-loop to boost AI explainability, trustworthiness and transparency	O-6: To present AI theoretical framework	• DTs that enable the visualization of the AI decision making process and thus boost explain-ability. • Testbeds to experimentally verify the theoretical framework.		Theoretical model accuracy that approaches 100%; Explainability (+2 Likert scale)

EiGHTBELLS
Independent Research & Consultancy

Towards its realization

Our Motivation

- TALON aims at sculpturing the road towards the next industrial revolution and Industry 5.0

- Developing a fully-automated AI architecture

- Bringing intelligence near the edge

- In a flexible, adaptable, explainable, energy and data efficient manner.

- For a greener future in the Industry