TaRDIS Trustworthy and Resilient Decentralised Intelligence for Edge Systems

GOAL

Significantly ease the complexity and reduce the effort of building correct and efficient heterogeneous swarms.

NOVA SCHOOL OF SCIENCE & TECHNOLOGY

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NEW

Actyx

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Caixa Mágica Software

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MARTEL innovate

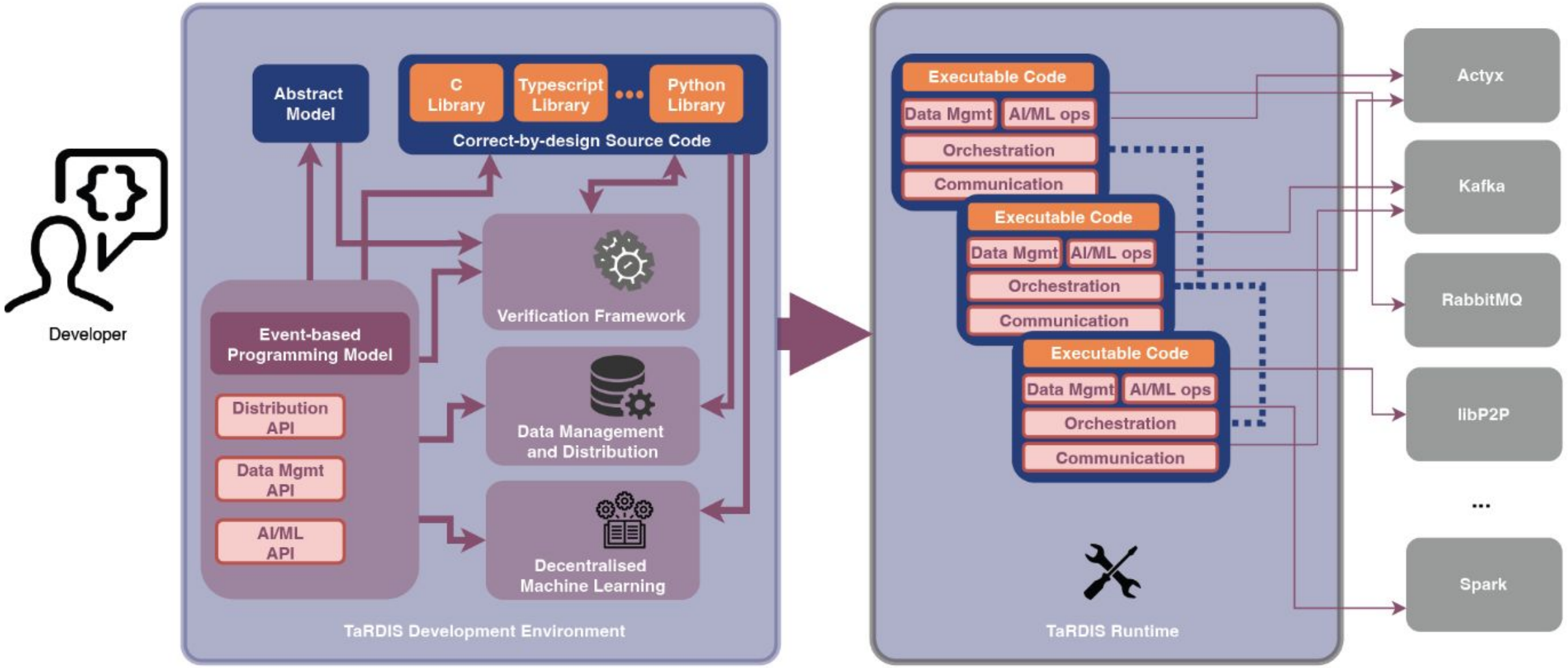
Energy Communities

Intelligent Homes

Satellite Swarms

Smart Factories

TaRDIS Toolbox



Intelligent Homes

Concept:

The smart home paradigm usually includes a **range of highly heterogeneous devices** designed to work together as a **swarm,** through **artificial intelligence (AI)** algorithms, to assist us and make our lives more comfortable.

Concerns:

1. Privacy of personal information;

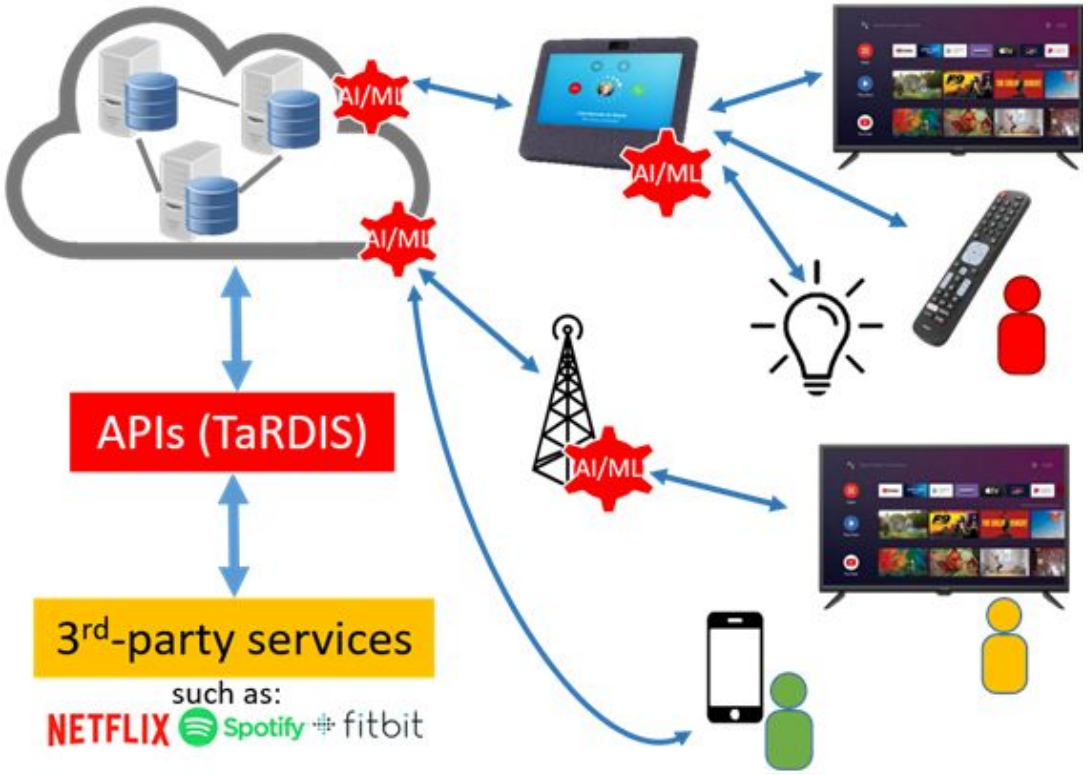
2. Heterogeneity of computational resources.

Goal: Exploit the **hierarchies** in the system in order to:

1. develop a privacy-preserving federated learning framework;

2. allow resource-constrained devices to participate in the FL training (through Split Learning).

TaRDIS toolkit will be used to **abstract the infrastructure, data distribution, and learning algorithms** from the developer.



Benefits:

1. **Collaborative intelligence** irrespective of heterogeneity in local data, resources, learning goals, etc.;
2. A **correct-by-design development environment** implementing privacy-preserving solutions.

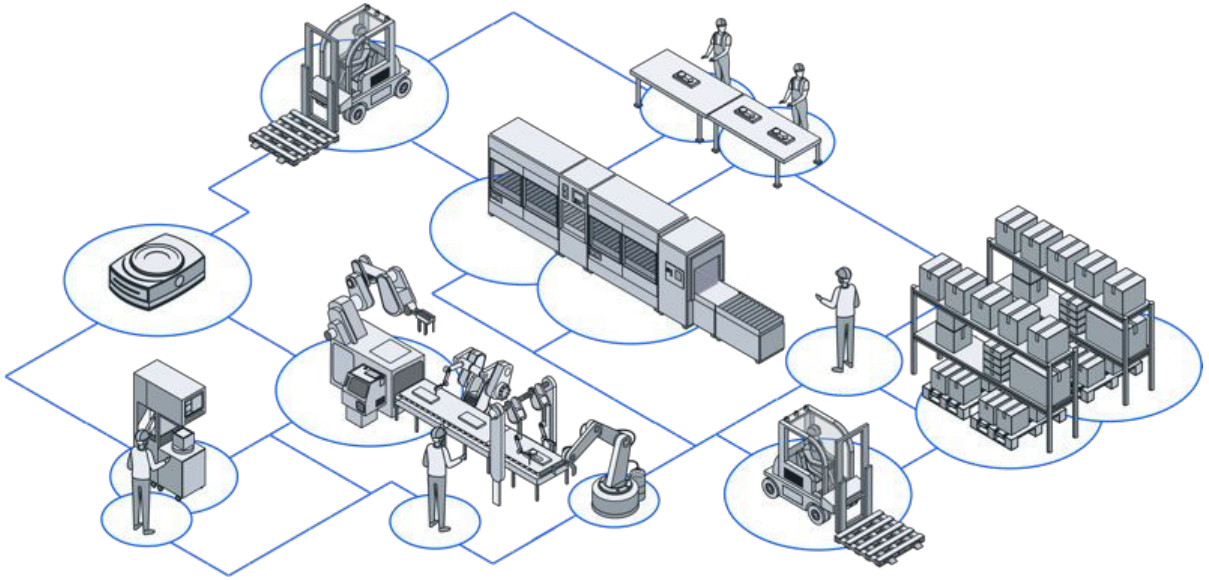
Smart Factories

Concept:

Next-generation factories are built from **intelligent components** (stationary machines, fixed and mobile robots, ground and air drones, humans) that **collaborate autonomously** to perform mission-critical tasks without central infrastructure. Data flows peer-to-peer, using LAN (wifi) or WPAN (IEEE 802.15) connections.

Implementing this dynamic machine-to-machine cooperation **correctly and resiliently** is made possible by TaRDIS through protocol design, analysis, verification, and validation tools. Rigid classical automation approaches (i.e. PLCs) lack the flexibility and agility to efficiently express such high-level orchestration.

Local-first data storage, communication, and computation are realised based on the Actyx middleware as a local peer-to-peer software stack that takes full advantage of mesh networking, with the option of sending data to the cloud for archival and analysis.



Benefits:

Next-generation factories can much more quickly react to changing market demands **(agility)** down to variability between production orders or *lot size one* **(flexibility)**. All processes become not only fully transparent but intelligently steerable in real-time, allowing **stringent optimization of resource usage and minimizing waste**.

Research Collaborations

- Protocol Labs [Interoperation with libp2p being developed in TaRDIS]
- outsystems [Use of replicated data types developed in TaRDIS for collaborative app development]
- number 0 [Implementing TaRDIS decentralized protocols into the Iroh communication solution]

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