MPAI publishes 3 Calls for Technologies and 5 Standards for Community Comments

1st to 12th September 2023
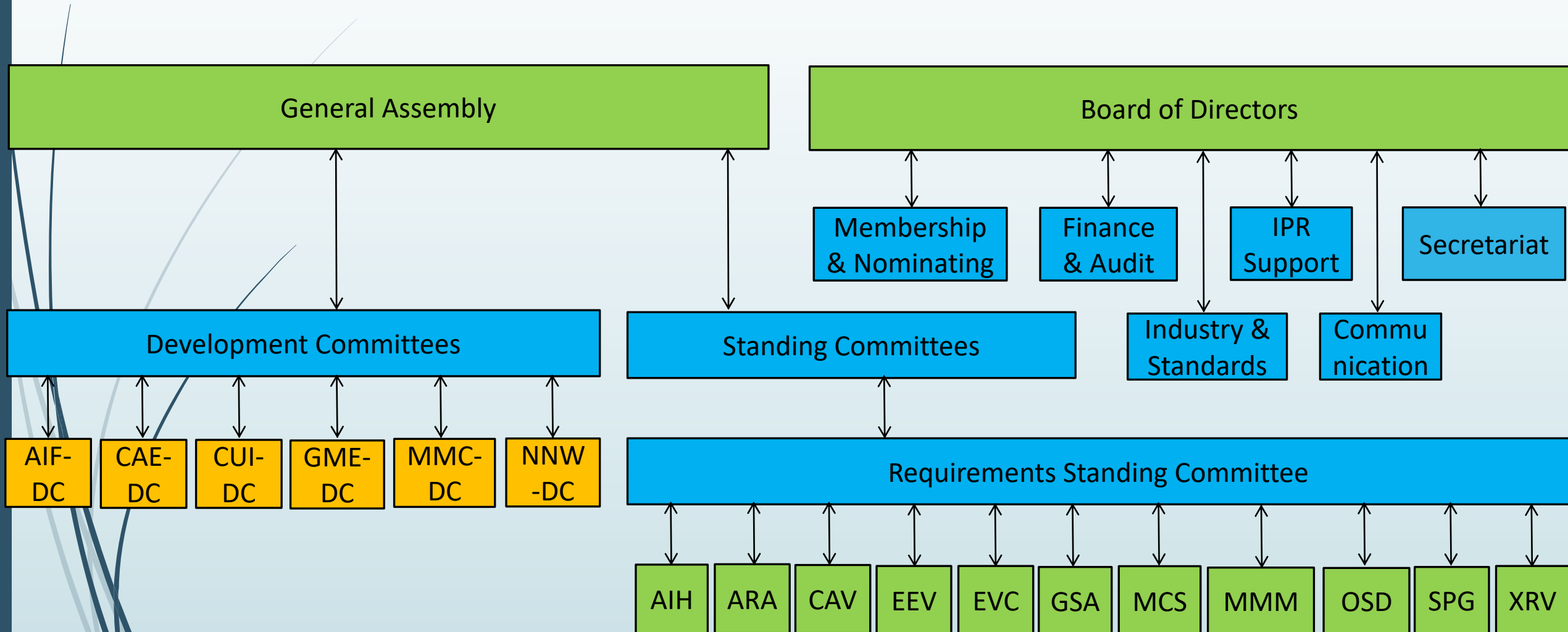
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MPAI stands for Moving Picture, Audio, and Data Coding by Artificial Intelligence.

International, unaffiliated, non-profit SDO.

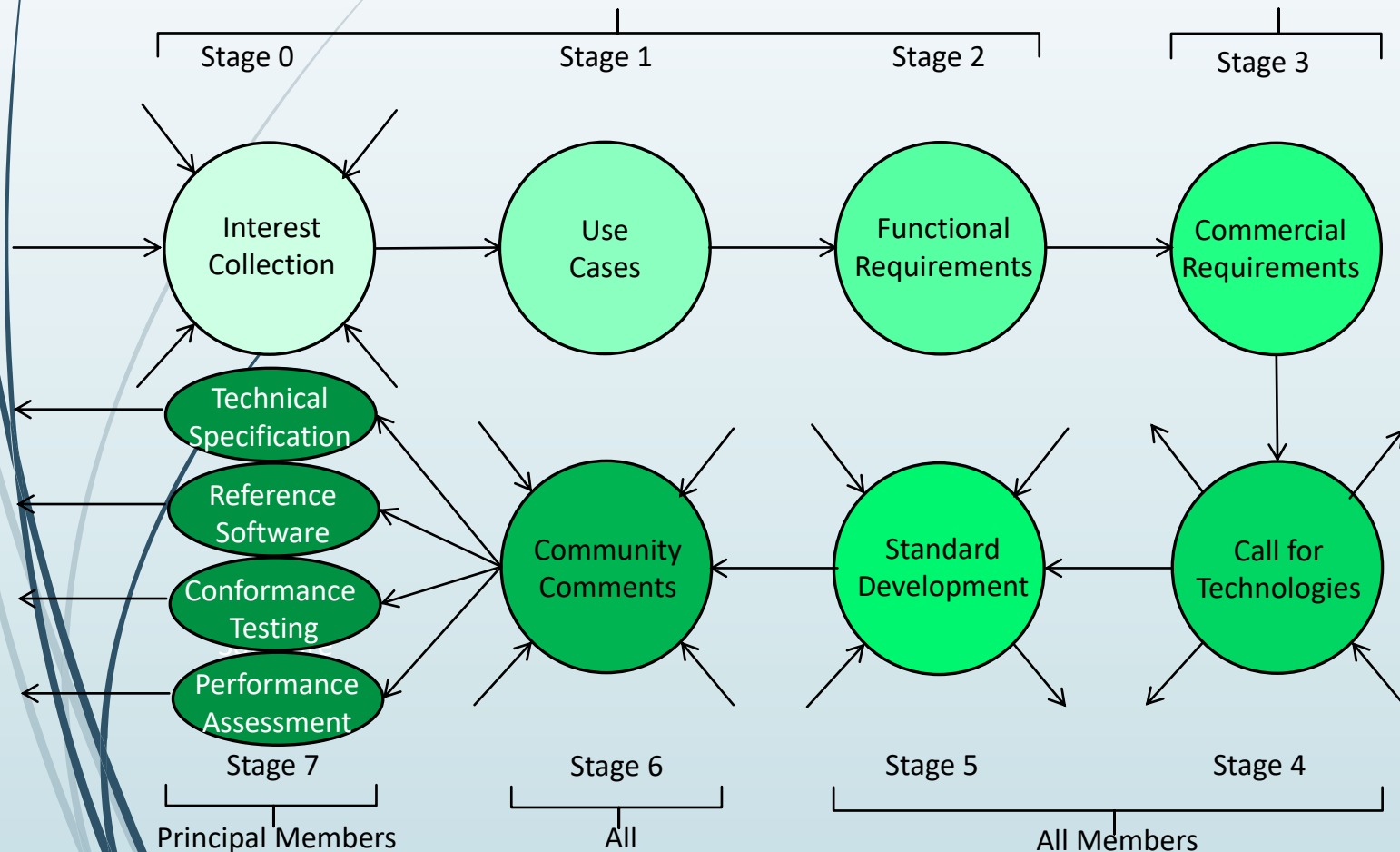*Developing AI-based data coding standards.*

With clear Intellectual Property Rights licensing frameworks.

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The MPAI organisation

The MPAI standard development process

- Develop Use Cases and Functional Requirements.
- Develop Commercial Requirements (Framework Licence).
- Issue Call for Technologies with attached:
  - Functional Requirements.
  - Commercial Requirements.
- Develop standard (MPAI members only).
- SEP holders select patent pool administrator.

23-Sep-8

MPAI standards for a better AI

➡ MPAI's data coding standards make explicit the computing workflow of AI applications.

➡ An MPAI standard **breaks up monolithic AI applications** into a set of interacting components of known data semantics (as far as possible).

➡ **Developers compete** offering "improved" performance "standard" components.

➡ Humans can **select applications whose internal operation they can somehow understand**.

MPAI's AI standardisation is "component-based".

An AI application is:

- Subdivided in smaller components: AI modules (AIM).

- Aggregated in one or more AI workflows (AIW).

- Executed in a standard environment (AIF).

1 foundational Technical Specification
AI Framework (MPAI-AIF)

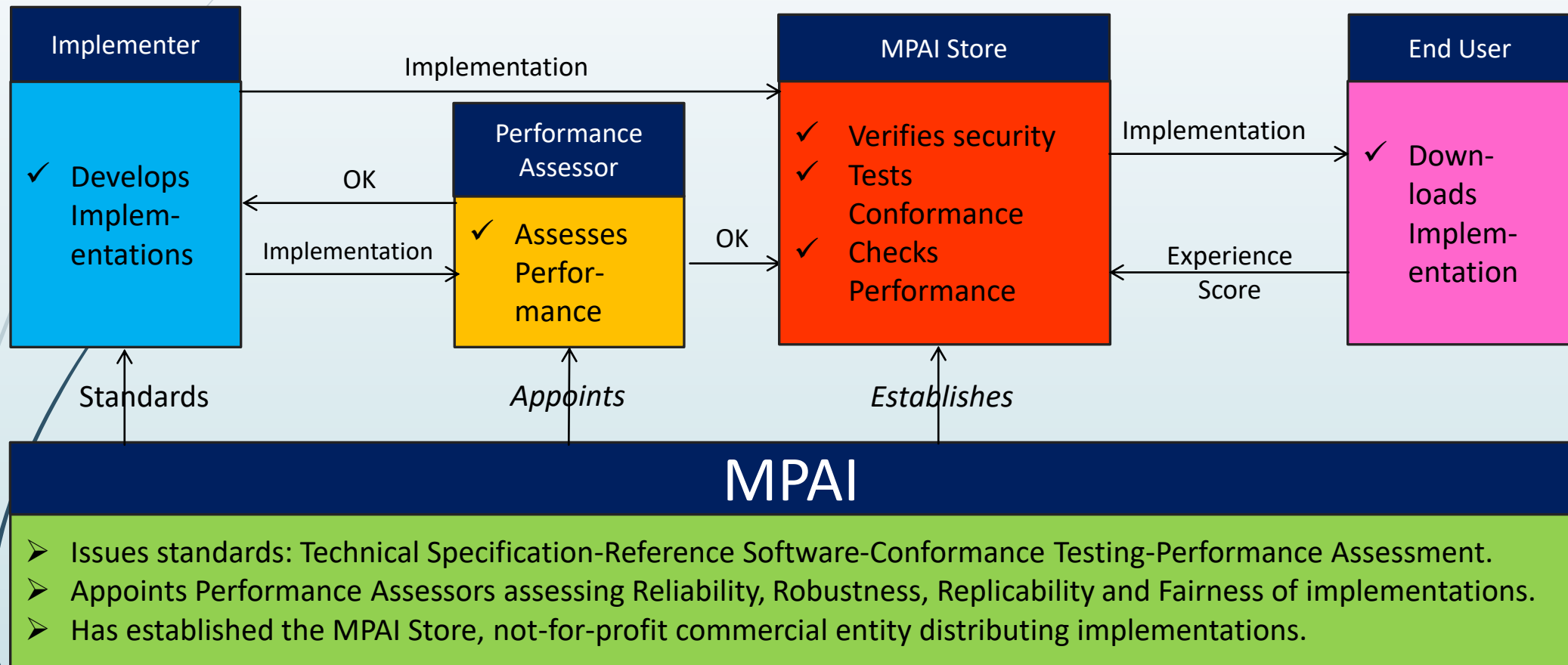**MPAI.** community

The MPAI AI Framework
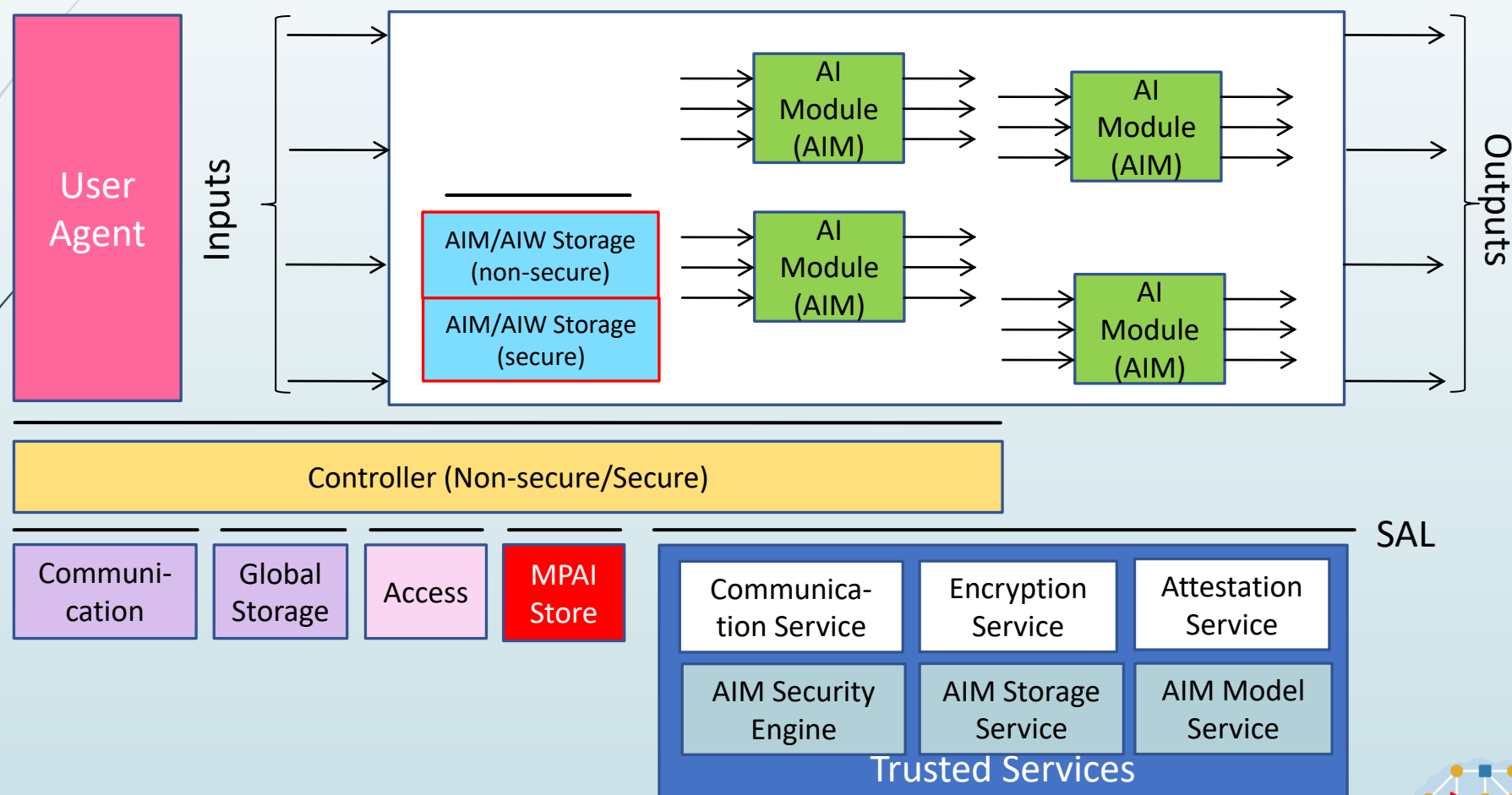
A sustainable MPAI Ecosystem

- **MPAI standards** create an ecosystem composed of:

  - **Developers**: develop components
    → require interoperability to bring their components to the market.

  - **Integrators**: assemble components
    → require ability to assemble third party components.

  - **Consumers**: use assembled components
    → require that the assembled components be trusted.

- The MPAI Store guarantees that AIMs/AIWs are:

  - Interoperable.

  - Trusted.

  - Available.

1 system Technical Specification:
Governance of the MPAI Ecosystem (MPAI-GME).

The MPAI ecosystem

Implementer			
✓ Develops Implem-entations			

Implementation →

Performance Assessor
✓ Assesses Perfor-mance

← OK

Implementation →

OK →

MPAI Store
✓ Verifies security ✓ Tests Conformance ✓ Checks Performance

Implementation →

← Experience Score

End User
✓ Down-loads Implem-entation

Standards

Appoints

Establishes

MPAI

➢ Issues standards: Technical Specification-Reference Software-Conformance Testing-Performance Assessment.
➢ Appoints Performance Assessors assessing Reliability, Robustness, Replicability and Fairness of implementations.
➢ Has established the MPAI Store, not-for-profit commercial entity distributing implementations.

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More published MPAI standards

4 Technical Specifications

1 - Context-based Audio Enhancement (MPAI-CAE)

2 - Compression and Understanding of Financial Data (MPAI-CUI)

3 - Multimodal Conversation (MPAI-MMC)

4 - Neural Network Watermarking (MPAI-NNW)

2 Technical Reports

1 - MPAI Metaverse Model (MPAI-MMM) – Functionalities

2 - MPAI Metaverse Model (MPAI-MMM) – Functionality Profiles

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Five standards published for Community Comments to become standards on 29 September

Existing MPAI standards extended

1 - AI Framework V2 (MPAI-AIF)

2 - Multimodal Conversation V2 (MPAI-MMC)

New MPAI standards being approved

3 - Avatar Representation and Animation V1 (MPAI-ARA)

4 - Connected Autonomous Vehicles V1 (MPAI-CAV) – Architecture

5 - MPAI Metaverse Model V1 (MPAI-MMM) – Architecture

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Brewing in the pot

Calls for Technologies issued

1 – Artificial Intelligence for Health (MPAI-AIH)

2 – Object and Scene Description (MPAI-OSD)

3 – Extended Reality Venues (MPAI-XRV) - Live Theatrical Stage Performance

New opportunities being explored

1 - AI-based End-to-End Video Coding (MPAI-EEV)

2 - AI-Enhanced Video Coding (MPAI-EVC)

3 - Server-based Predictive Multiplayer Gaming (MPAI-SPG)

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MPAI and IEEE

MPAI Technical Specifications adopted as IEEE standards

1. MPAI-AIF – 3301-2022

2. MPAI-CAE – 3302-2022

3. MPAI-MMC – 3300-2022

4. MPAI-CUI – 3303-2023

5. MPAI-NNW (on its way)

All this achieved in less than 3 years!

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On 23 August MPAI has published eight documents

Proj.	Name	Stage	dd	Time
MMM	MPAI Metaverse Model - Architecture	Community Comm.	01	08–15
MMC	Multimodal Conversation V2	Community Comm.	05	08–15
CAV	Connected Autonomous Vehicle - Architecture	Community Comm.	06	08–15
ARA	Avatar Representation and Animation	Community Comm.	07	08–15
OSD	Object and Scene Description	Call for Tech.	07	09–16
AIH	AI for Health Data	Call for Tech.	08	08–15
AIF	AI Framework	Community Comm.	11	08–15
XRV	XR Venues - Live Theatrical Stage Performance	Call for Tech.	12	07–17

(Federated) AI for Health (MPAI-AIH)

Ana de Almeida and Maurício Breternitz

08 and 15 UTC 08 September 2022

istar _iscte

**Information Sciences,
Technologies and Architecture
Research Centre**

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Artificial Intelligence for Health data
MPAI-AIH

MPAI project supporting:

- collection of
- AI-based processing of
- access to

health related data.

- using **secure federated learning** and distribution of updated AI Models

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Motivation

- **FCT Nacional project**

- **What is it**
  - A smartphone app and a trustworthy Artificial Intelligence distributed service-based platform

- **For what**
  - To identify symptomatic and asymptomatic COVID-19 patients and issue an alert for the user when a meaningful alteration of health status is detected.

A system leveraging AI for Health

1. **End Users** acquire and process health data using the AIWs executed in the AIF installed in their handsets (AIH Front-Ends).

2. **AIH Back-End**

   - **Stores/processes** health data delivered by AIH Front-Ends with associated Smart Contracts specifying the rights.

   - **Collects** AI Models trained by AIH Front-Ends while processing the health data.

   - **Updates** the AI Model.

   - **Distributes** the AI Model to AIH Front-Ends (Federated Learning).

3. **Third-Party Users** process their own or End User-provided data based on the rights granted by End Users via smart contracts.

4. **External Data Sources** provide subsidiary data governed by smart contracts.

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Reference Model of the MPAI-AIH system

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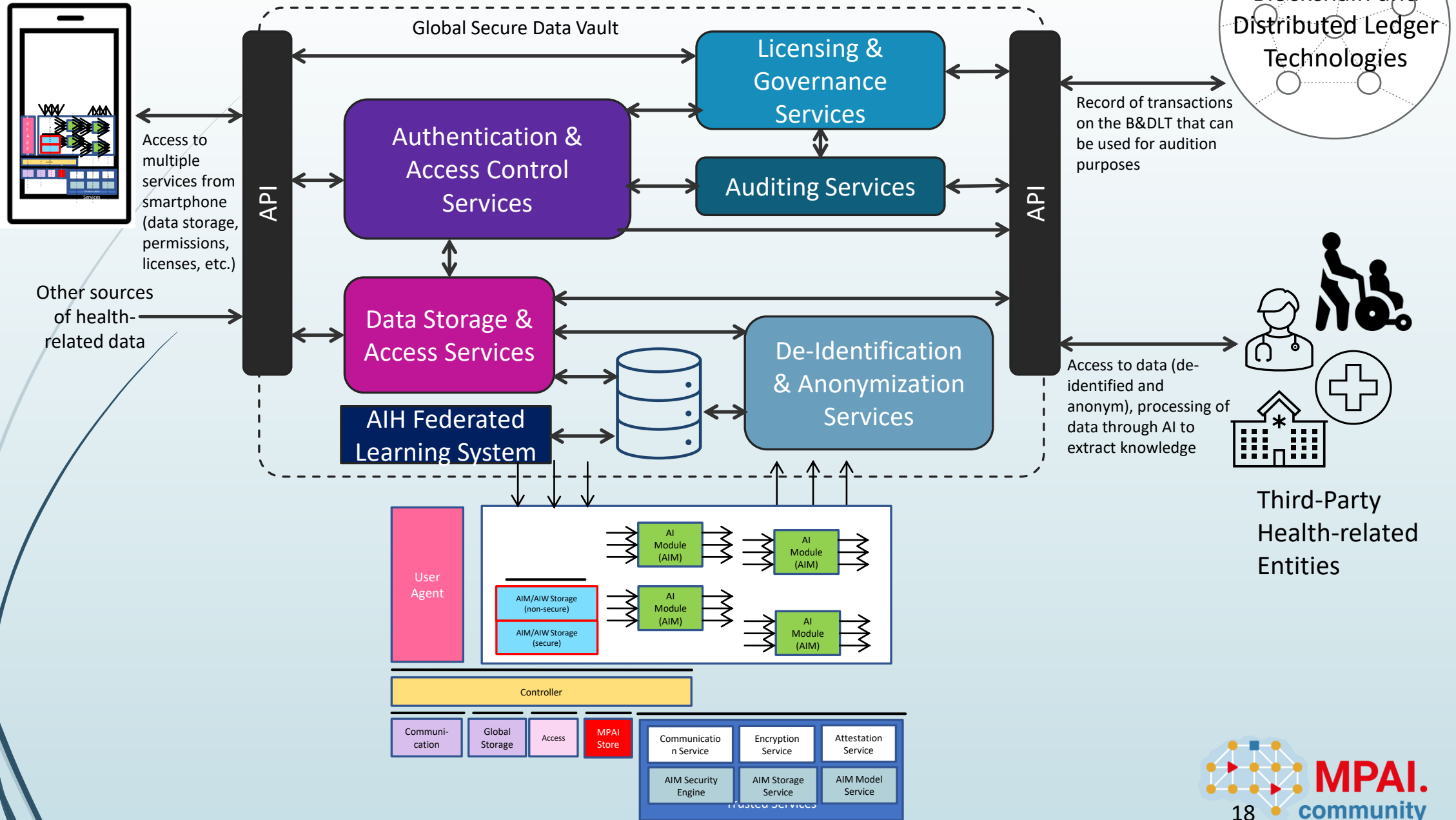
The MPAI-AIH Front-End
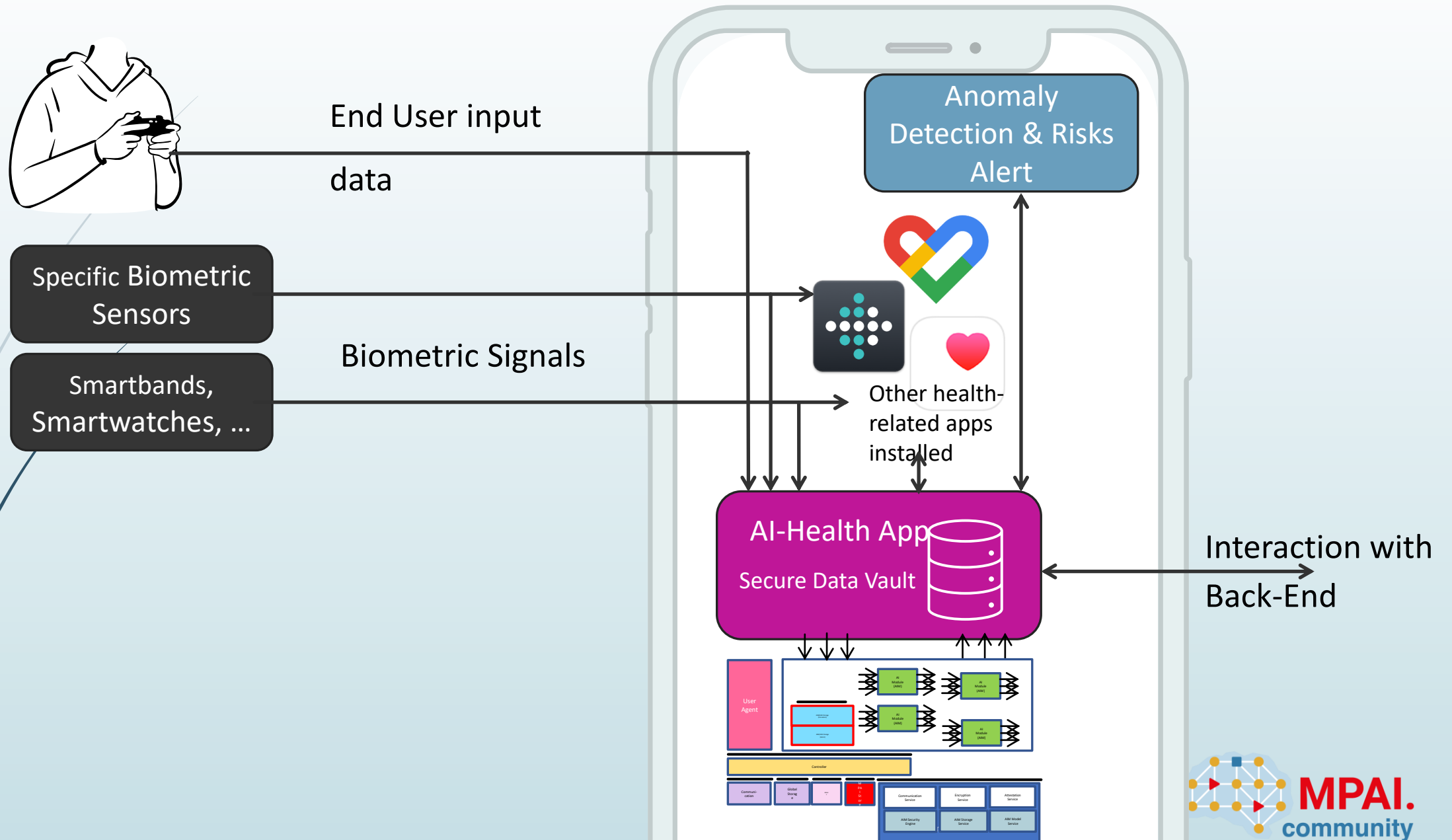
User health data collection

- **End User**
  - Signs into the AIH Platform and initializes the End User Secure Data Vault.
  - Connects the AIH App to the data sources and personal data (age, weight, specific health conditions, etc.).

- **AIH Front-End** collect and securely stores data from End User locally on the Secure Data Vault.

- **End User** gives permission to export specific subsets of their AIH data to the AIH Platform and potentially to other Third-Party Users.

- **AIH Back-End** creates a Smart Contract, collects AIH data via API, de-identifies and anonymizes all permitted AIH data.

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Processes/1

Processes in the AIH Front-End and in the AIH Back-End include:

➡ **Housekeeping services**: ancillary processes tasked with the proper functioning of the system.

scheduling, communications (messaging, file transfer), security, hardware and software diagnosis, calibration, as well as resource allocation (memory, storage, data bandwidth allocation)

➡ **Inference services**: services processing data and using machine learning models to produce results for use by Third-Parties.

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Processes/2
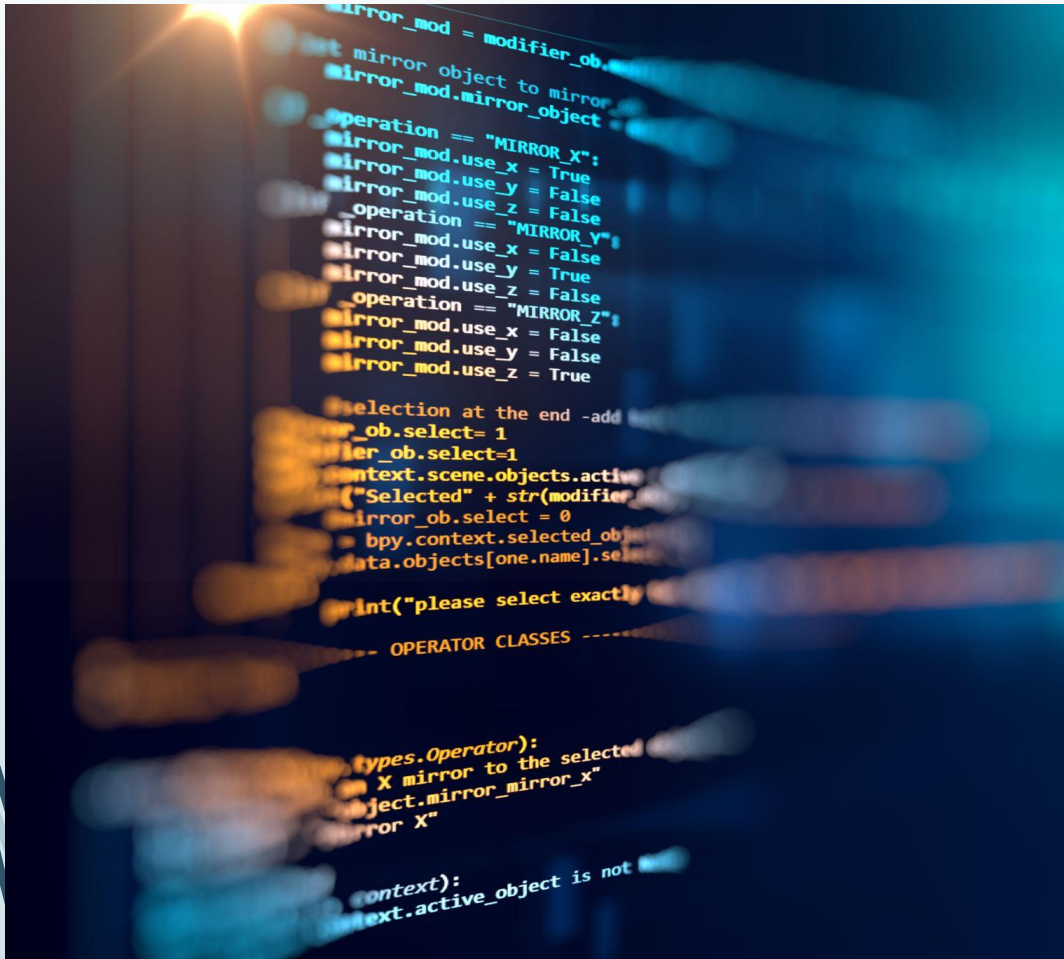
➡ **Third-Party Entity** (when authorized & authenticated) may request data access.

➡ **Third-Party** requests access to the data catalogue existing on the system using a query interface.

➡ **Catalogue** provides the metadata with the appropriate level of detail.

➡ **Third-Party** optionally selects an intelligent mechanism to process the data and extract some type of results and intelligence from the data.

➡ **Data** may be processed inside the Front-End and there shall be no need for a Smart Contract to process the data inside the smart phone.

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Processes/3
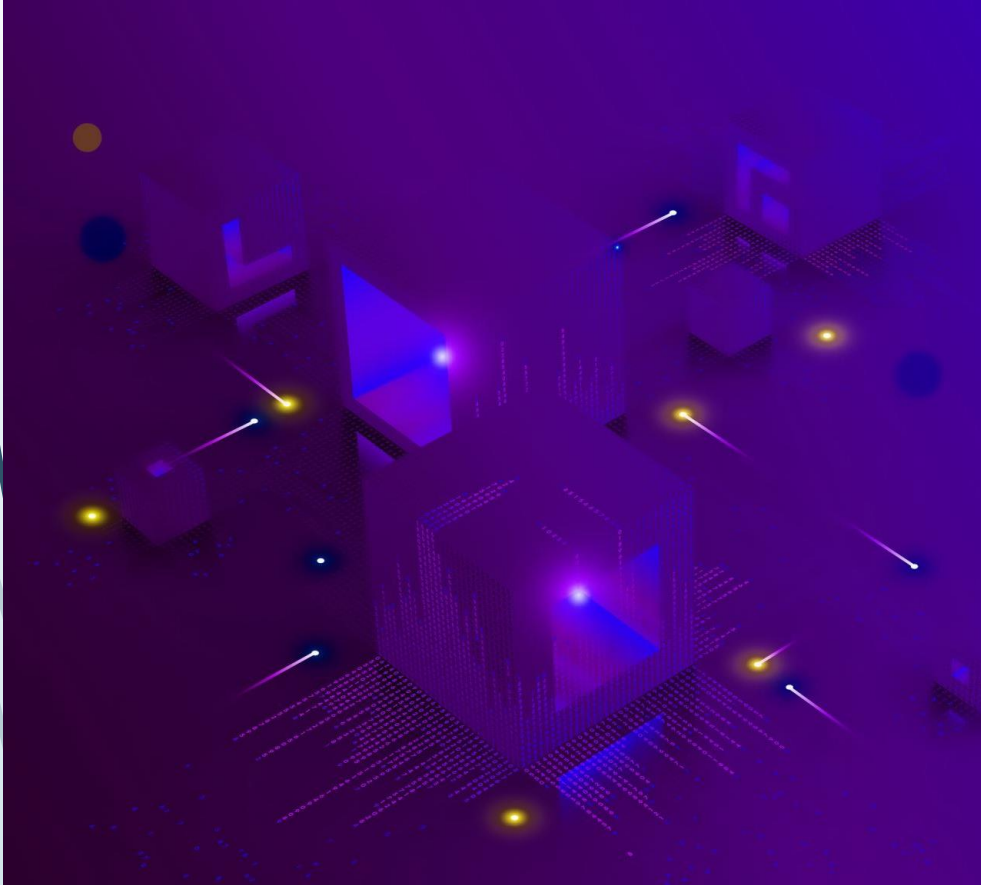
➤ **Third-Party Entity** requests to process data:

- Request is executed under the terms of the applicable Smart Contract(s).
- Paradigm for Smart Contract terms: AIH Back-End grants Third-Party Entity the right to process the data with proc1, proc2, etc.

➤ **AIH Back-End** selects services to process the AIH data based on the service taxonomy used in Smart Contracts.

➤ **Third-Part Entity** accepts the Smart Contract created by the B&DLT on behalf of End Users.

➤ **AIH Back-End** performs intelligent processing of health data either via proper AIWs or via FLS.

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MPAI-AIH main Actors

- End-User

- Third-Party

- External Data Sources

Citizens
(Caretakers, Family,
Researchers, etc.)

MPAI-AIH Services

- Front-End System

- Back-End System

- Blockchain & Distributed Ledgers

- AI Services

MPAI-AIH Intelligent Computational Service Organization

- Centralized Federated Learning

- Federated Learning Clients: Mobile Applications

- Multisourced AI modules (AIMs)

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Smart Contract Functional Requirements/1

➡ End User and AIH Back-End:

1. End User ID

2. Health Data ID

3. Health Data Type ID

4. Date of issuance of Smart Contract

5. Duration of Smart Contract

6. List of permitted Processing Types

7. List of permitted Export Types (Seen from the End User)

Smart Contract Functional Requirements/2

AIH Back-End and Third-Party Entity #1:

1. Third-Party ID
2. Health Data ID
3. Health Data Type ID
4. Date of issuance of Smart Contract
5. Duration of Smart Contract
6. List of permitted Processing Types
7. List of permitted Export Types (seen from the AIH Back-End)

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Smart Contract Functional Requirements/3

The Third-Party Entity and AIH Back-End #2:

1. Third-Party ID
2. Health Data ID
3. Health Data Type ID
4. Date of issuance of Smart Contract
5. Duration of Smart Contract
6. List of permitted Processing Types
7. List of permitted Export Types (seen from the Third-Party)

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Data Types and Usage requirements

Data Type	Short Description
Historical User Health Data	End User's medical history, lab results, etc
Time series	Vital sign measurements (such as heart rate and blood pressure)
Sensor	Data from wearable devices: smartwatches, fitness trackers, etc.
Geolocation	Geographic location of individuals/samples
Social media	Chats, posts, comments, and other related data
Text	Unstructured data, e.g., clinical notes and patient-generated data
Audio	Speech and audio recordings
Video	Data from endoscopic procedures, laparoscopic surgeries, etc.
Medical images	X-ray, CT, MRI, and ultrasound images
Genomic	DNA sequencing data and other types of genetic information
Medical imaging	3D images, 4D images (e.g., MRI over time), and multimodal images

Examples of health data, units of measurement, and representation formats

Name	Unit	Format
Temperature	Celsius (C)	Floating-point
Blood Pressure	Millimeters of mercury (mmHg)	Floating-point
Heart rate	Beats per minute (bpm)	Integer
Blood glucose	Milligrams per deciliter (mg/dL)	Floating-point
Timestamp	YYYY-MM-DD HH:MM:SS	String
Respiratory rate	Breaths per minute (bpm)	Integer
Hemoglobin A1c	Percentage of Hemoglobin A1c	Floating-point
Serum cholesterol	milligrams per deciliter (mg/dL)	Floating-point
Serum triglycerides	milligrams per deciliter (mg/dL)	Floating Point
Steps	Number of steps within a given period t	Integer
Medical imaging	3D images, 4D images (e.g., MRI over time), multimodal images	

Aggregated Health Data Format

➤ A **container** to carry data from a Front-End to the Back-End.

➤ **Electronic Health Records** (EHR) improve the efficiency and quality of healthcare by offering comprehensive, up-to-date, and accurate information about a patient's health history to healthcare providers.

➤ **Fast Healthcare Interoperability Resources** (FHIR): one example of a data standard used for exchanging healthcare information electronically.

➤ The **Aggregated Health Data Format** should be wrapped in a secure envelope along with associated encryption methods and containing the user's health data records.

➤ **MPAI AIH healthcare information** should be exchanged electronically and wrapped in an adequate envelope.

➤ The **envelope format** should be independent of the data it contains.

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API: AIH Platform Back-End ↔ Platform Front-End/1

➡ This API should provide:

- The necessary services to register, authenticate and control access of the user in the AIH Platform.

- The mechanisms for storing AI data, granting, and acquiring permissions via smart contracts for data usage, and data usage auditing.

➡ The list of required services and their parameters is:

- **Authentication_register**: Register a new End User on the AIH Platform Back-End. If a key is specified, the user will be registered in the blockchain using the address (derived from the private key) specified.

- **Authentication_signin**: Sign in the End User on the AIH Platform Back-End and create an authentication and authorization token (JWT).

- **Storage_store**: Store the health data of the End User on the Global Secure DataVault. Data must be encrypted from the End User before the insertion.

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- **Storage_retrieve**: Retrieve End User's health data on the Global Secure DataVault.

- **Storage_delete**: Delete End User's health data on the Global Secure DataVault - Only the owner of the data can delete it.

- **Storage_update**: Update the End User's health data on the Global Secure DataVault.

- **Auditing_createSmartContract**: Create a smart contract containing all the licenses that an End user and a Third-Party entity share. When is invoked from the End User, the contract is endorsed by default.

- **Auditing_createPermission**: Create a new record on the smart contract of the specific Third-Party user that holds a new smart contract for the specific permission (data_query) to be shared.

- **Auditing_validatePermission**: Update the grant of a Third-Party permission, authorized to access to the End User's health data on the Global Secure Data Vault.

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API AIH Platform Back-End (Federated Learning) ↔ AIH Platform Back-End

The list of required services and their parameters is:

- **Model_Get:** Retrieve global model parameters (**W**) from the Federated Learning System central node in the Back-End to initialize the Federated Learning local process.

- **Model_Store:** Send local parameters (**Δw**) from the local Federated Learning client to the central Federated Learning System at the Back-End for possible aggregation.

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API AIH Platform Back-End ⟷Third-Party User

➤ This API should provide:

1. The necessary services to register, authenticate and control access of Third-Party Users in the AIH Platform.

2. The service of retrieving the user's health data requested by the Third-Party.

➤ The list of required services and their parameters is:

- **Authentication_register**: Register a new End User on the AIH Platform Back-End. If a key is specified, the user will be registered in the blockchain using the address (derived from the private key) specified.

- **Authentication_signin**: Sign in the Third-Party on the AIH Platform Back-End and create an authentication and authorization token (JWT).

- **Storage_retrieve**: Retrieve health data from the Global Secure DataVault.

- **Storage_import**: Import health data from the Back-End system for a specific user address

- **Auditing_createPermission**: Create a new record on the smart contract of the specific Third-Party user that contains a new smart contract for the specific permission (*data_query*) to be shared.

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API AIH Platform Back-End System ⟷ Blockchain

This API provides the necessary services to register and check the validity of the smart contract between the End User and the Third-Party. The list of required services and their parameters is:

- **Smartcontract_create**: Registration of a smart contract that contains all the permissions of data sharing authorization by Third-Party entities towards user's data.

- **Smartcontract_permission**: Create a specific permission.

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Framework Licence: Coverage

➡ This **Framework Licence** applies to Technical Specification: Artificial Intelligence for Health Data – in the following "Standard" – as it will be defined in document 'N____ Artificial Intelligence for Health Data' planned to be approved by "Moving Picture, Audio and Data Coding by Artificial Intelligence (MPAI)".

➡ **All contributors to the Standard** shall confirm in writing their intention to make available a Licence for their Essential IPR based on the Conditions of use of the Licence.

Conditions of use of the Licence/1

The **Standard Essential IPR holders commit** themselves to issue a Licence with the following conditions:

1. The Licence will **be in compliance** with generally accepted principles of competition law and the MPAI Statutes.

2. The Licence will **cover**:

    i. **All claims** to Essential IPR and copyright of a Licensor that are practised by a Licensee of the Standard.

    ii. **Development Rights and Implementation Rights**.

3. The Licence will **grant** access to Essential IPRs of the Standard in a non-discriminatory fashion.

4. The scope of the Licence **may be subject** to legal, bias, ethical and moral limitations.

Conditions of use of the Licence/2

5. **Royalties** will apply:

    i.   To a baseline profile of the Standard and to other profiles containing additional tech-nologies.

    ii. To any Implementation that is based on the Standard, with the exclusion of the types of implementations specified in clause 7.1.

    iii. On a worldwide basis.

6. **An Implementation** of the Standard may use other IPR to extend the Implementation Standard or to provide additional functionalities.

7. **Exemptions**:

    i.   A Licence for Development and Implementation Rights, to the extent it is developed and implemented only for the purpose of **evaluation or demo solutions or technical trials**, will be free of charge.

    i.   A Licence may be granted free of charge **for particular uses** if so decided by the licensors.

    ii. A free of charge Licence **for a limited time and a limited amount of forfeited royalties** will be granted on request.

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Conditions of use of the Licence/3

8. A preference will be expressed on the entity that should **administer the pool** of holders of Patents Essential to the Standard.

9. The Licence will be **issued before** commercial implementations of the Standard become available on the market. Commercial implementation implies General Availability to any users and does not include trials.

10. The **total cost** of the Licences issued by IPR holders will be **in line** with the total cost of the Licences for similar technologies standardised in the context of Standard Development Organisations.

11. The total cost of the Licences will take into account **the value on the market** of the Standard Essential IPR.
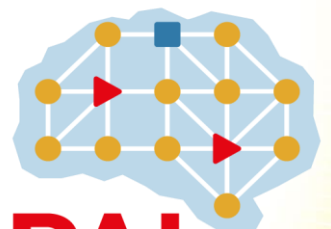
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The MPAI-AIH documents
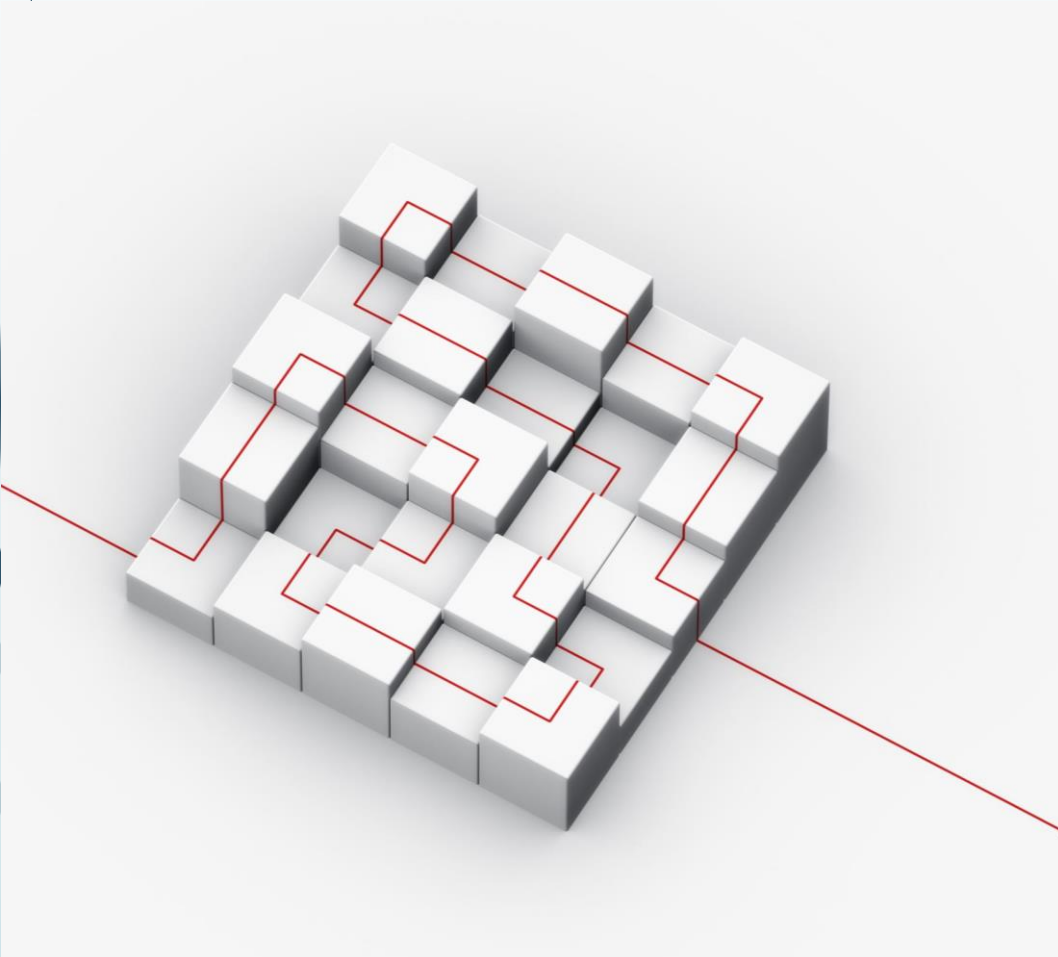
➡ Anybody is entitled to respond to the AI for Health Data Call for Technologies.

➡ Responses should reach secretariat@mpai.community by 2023/10/19T23:59 UTC

➡ Relevant documents:

Call for Technologies	**html**, **pdf**
Use Cases and Functional Requirements	**html, pdf**
Framework Licence	**html, pdf**
Template for responses	**html, docx**

We look forward to working with you
on this exciting MPAI project!

Join MPAI
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Build the future

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