# FIWARE: THE OPEN SOURCE PLATFORM OF CHOICE FOR BUILDING SMART FARMING SOLUTIONS

FIWARE

Smart farming aims to optimise the production in farms by using the most modern means in a sustainable way, hereby increasing the production and delivering the best products in terms of quality while maximizing the return. It makes use of a wide range of technologies including IoT sensors, wearables, GPS services, UAVs, robots and drones operating in the field which provide real-time data to systems helping to monitor the production line and support decisions. This enables less waste and maximum efficiency in operations.
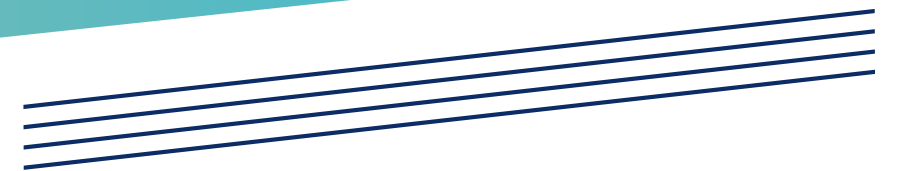
❯ ❯ ❯ CHALLENGES IN SMART FARMING

❯ ❯ ❯ EVOLUTION OF SMART FARMING

❯ ❯ ❯ TECHNOLOGICAL

1. Wireless broadband coverage in rural zones.
2. Lack of standards regarding IoT protocols.
3. Lack of standards for interoperability.
4. Lack of standards easing integration.
5. Debate on data ownership and data security.
6. Ability to bring new valuable insights from Big Data.
7. Usability of end applications.
8. Cost-effective solutions.

❯ ❯ ❯ FARMING SECTOR

1. Limited availability of arable land.
2. Impact on productivity derived from climate change.
3. Urgent need to reduce waste and increase efficiency.
4. Impact on natural resources derived from intensive farming.
5. Increasing need for freshwater.
6. Price and availability of energy.
7. Uncertainty regarding weather events.
8. Assessment and monitoring food quality.
9. Regulations, documentation.
10. Fluctuating prices.
11. Public awareness.
12. Average age of farmers increasing.

- No single company can provide the best solution for all challenges.
- Agile SMEs/startups are constantly emerging, bringing innovative vertical solutions based on the deployment of IoT combined with real-time Big Data, AI and dashboard tools on the cloud.
- There is the opportunity and the need to integrate these new solutions coming from multiple parties.
- Data from vertical solutions deployed in a Farm can be integrated to build a holistic picture of what is going on in the Farm: **context data**.
- Overall Farm Management Systems can be developed on top of a standard context information management layer.

SMART FARMING SOLUTIONS SHOULD BE

❯ Cost-effective: cheap implementation with guaranteed return of investment.

❯ User-friendly: ease the management and provide knowledge and training.

❯ Interoperable: able to export relevant data that is required to fulfill other steps of the value chain.
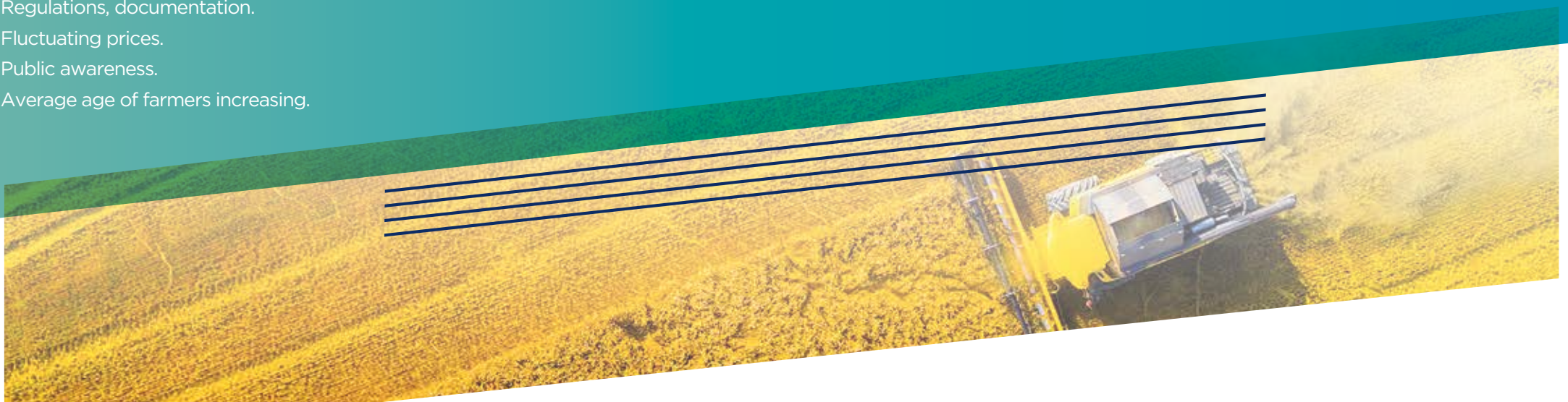
FIWARE: A STANDARD WAY TO DEVELOP AND INTEGRATE SMART FARMING SOLUTIONS

FIWARE is a curated framework of **open source platform** components which can be assembled together with other third-party platform components **to accelerate the development of Smart Solutions.**

The **FIWARE Orion Context Broker** is the core component of FIWARE: it gathers, manages and provides access to Information coming from different sources that describes what is going on in the Farm: the "Farm Context".

Building around the FIWARE Context Broker, **a rich suite of complementary FIWARE components** are available in order to facilitate:

- Interfacing with IoT sensors, robots or drones operating in the farm.

- Processing of current and historic data using event rules or advanced Big Data and AI algorithms to extract valuable insights supporting smart decisions or automated smart actions.

- Creation of dashboards for monitoring progress of processes within the farm.

- Generation of valuable reports as well as the analysis and monitoring of KPIs (Key Performance Indicators).

The FIWARE Context Broker technology can easily integrate with **blockchain technologies** to provide a trustworthy and immutable tracing of certain updates on context linked to steps in the smart farm and food value chain.

FIWARE also bring supports to the potential **publication of farm data for transparency** or the **monetization of farm data offered to third parties,** enabling new sources for revenues.

The FIWARE Context Broker enables management of context information at large scale through the **FIWARE NGSI API,** a public and royalty-free API adopted as an open industry standard by relevant organisations.

SIMPLE
FIWARE NGSI provides an intuitive RESTful API using JSON readily accessible to any web developer. Any web programmer can learn how to use it in a single day.

POWERFUL
FIWARE NGSI supports subscription/notification, geo-queries, federation, pagination, ... and soon support of Linked Data (JSON-LD)!

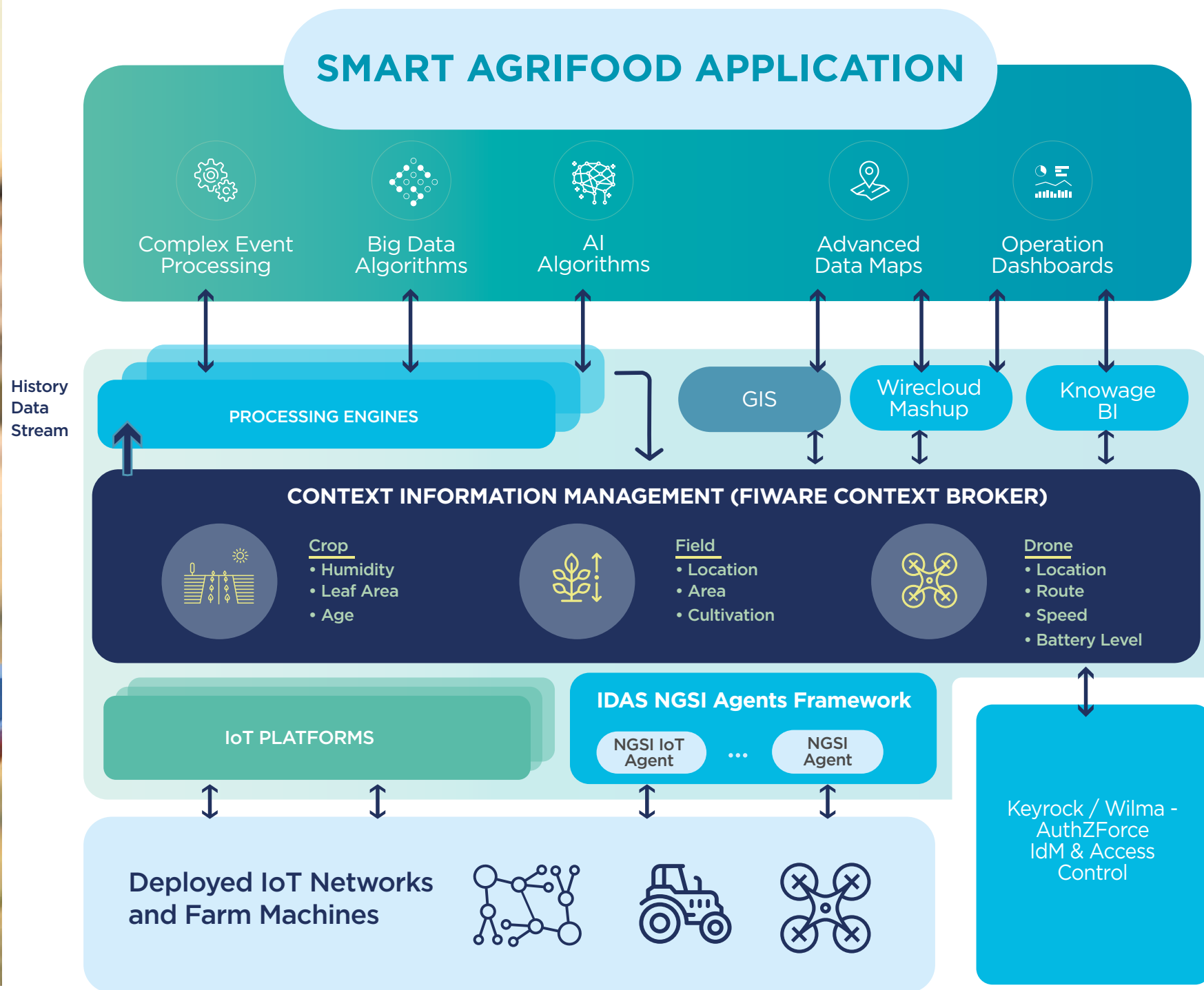### OPEN STANDARD
Current FIWARE NGSI specifications are public and royalty-free and they will align with the future ETSI NGSI-LD specifications.

The open standard nature of **FIWARE NGSI** offers programmers the ability to port their applications across different "Powered by FIWARE" platforms and a stable framework for future development.

REFERENCE ARCHITECTURE FOR IOT-ENABLED SMART FARMING SOLUTIONS "POWERED BY FIWARE"

SMART AGRIFOOD APPLICATION

- Complex Event Processing
- Big Data Algorithms
- AI Algorithms
- Advanced Data Maps
- Operation Dashboards

History Data Stream

PROCESSING ENGINES

GIS

Wirecloud Mashup

Knowage BI

CONTEXT INFORMATION MANAGEMENT (FIWARE CONTEXT BROKER)

Crop
- Humidity
- Leaf Area
- Age

Field
- Location
- Area
- Cultivation

Drone
- Location
- Route
- Speed
- Battery Level

IoT PLATFORMS

IDAS NGSI Agents Framework

NGSI IoT Agent ... NGSI Agent

Keyrock / Wilma - AuthZForce IdM & Access Control

Deployed IoT Networks and Farm Machines

A SYSTEM OF SYSTEMS VISION FOR THE GLOBAL MANAGEMENT OF A FARM

FIWARE for the creation of the System of Systems

PRODUCT · SMART PRODUCT · CONNECTED PRODUCT · PRODUCT SYSTEM · SYSTEM OF SYSTEMS

Planter · Combine Harvesters · Till

data · data

Weather forecasts · Weather data application · Weather maps · Rain, humidity, temperature sensors

Weather Data System

Farm performance database · Seed database

Seed Optimizing System

Seed optimization application

Irrigation System · Irrigation application · Irrigation nodes

Field sensors

Farm Equipment System

FARM MANAGEMENT SYSTEM

Tradicional players/products → New (kind of) players new business models → Tradicional players new business models

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The Reference Architecture of Smart Farm Management Systems "Powered by FIWARE" relies on a **"system of systems"** vision. The existence of a context information management layer breaks the silos of information associated to the several vertical smart solutions, information systems and connected devices, enabling an overall management of Farm processes.

OPEN SOURCE
- No licenses on platform components
- Enabling contribution from multiple organizations

STANDARD-BASED
- Enabling an open and competitive marketplace of compatible farm management systems and vertical smart farming solutions
- Lower costs to achieve interoperability of vertical solutions or their integration with farm management systems
- Lower costs for integration with multiple IoT protocols, farm machines, robots, drones, etc.
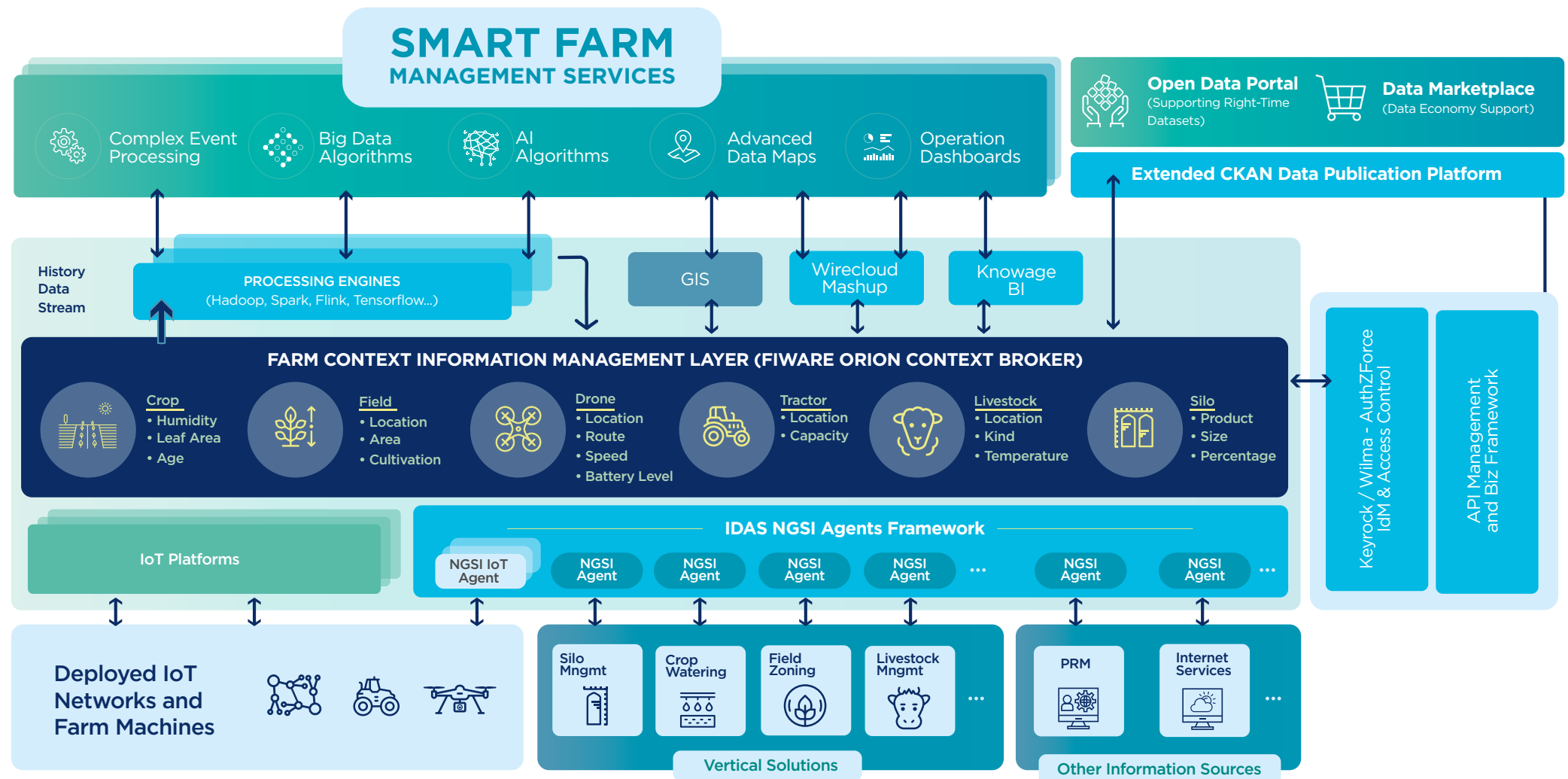
MODULAR, THEREFORE FLEXIBLE
- Adding platform components parallel to business needs
- Ability to add innovative features: blockchain-based traceability, open data publication, monetization of data and more.

ROBUST, SCALABLE AND SECURE
- Quality Assurance testing on every component
- Designed to get the most out of the cloud and scale on demand.
- Enabling to define and enforce compliance with data access control policies.

> > > A REFERENCE ARCHITECTURE FOR SMART FARM MANAGEMENT SYSTEM POWERED BY FIWARE

SMART FARM MANAGEMENT SERVICES

- Complex Event Processing
- Big Data Algorithms
- AI Algorithms
- Advanced Data Maps
- Operation Dashboards

Open Data Portal (Supporting Right-Time Datasets)
Data Marketplace (Data Economy Support)

Extended CKAN Data Publication Platform

History Data Stream

PROCESSING ENGINES (Hadoop, Spark, Flink, Tensorflow...)

GIS

Wirecloud Mashup

Knowage BI

FARM CONTEXT INFORMATION MANAGEMENT LAYER (FIWARE ORION CONTEXT BROKER)

Crop
- Humidity
- Leaf Area
- Age

Field
- Location
- Area
- Cultivation

Drone
- Location
- Route
- Speed
- Battery Level

Tractor
- Location
- Capacity

Livestock
- Location
- Kind
- Temperature

Silo
- Product
- Size
- Percentage

Keyrock / Wilma - AuthZForce IdM & Access Control

API Management and Biz Framework

IDAS NGSI Agents Framework

IoT Platforms

NGSI IoT Agent · NGSI Agent · NGSI Agent · NGSI Agent · NGSI Agent · ... · NGSI Agent · NGSI Agent · ...

Deployed IoT Networks and Farm Machines

Silo Mngmt · Crop Watering · Field Zoning · Livestock Mngmt · ...

Vertical Solutions

PRM · Internet Services · ...

Other Information Sources

- The **Orion Context Broker** integrates information from drones, sensors and other machines as well as vertical smart solutions and information systems, breaking information silos.
- **IDAS IoT Agents** connect to sensors, handling multiple IoT protocols (MQTT, CoAP/OMA-LWM2M, OneM2M,...). Alternative IoT platforms can be used for this purpose.
- ROS-2 robots are interfaced using **Fast RTPS,** adopted as default communication middleware in ROS-2.
- Historical data is processed using different **processing engines** (e.g., Hadoop, Spark or Flink) to extract valuable insights or derive smart actions. Complex Event Processing, Advanced AI or machine learning functions can be implemented on top of integrated processing engines.

- Operational dashboards are based on the **Wirecloud web mashup framework.**
- **Knowage** enables KPIs monitoring, Reporting and Business Intelligence functions.
- Part of the current and historic context data can be offered to third parties through and **extended CKAN portal** enabling publication of real-time data and the assignment of terms and conditions (including pricing) to data resources.
- **Data/API access control functions** warrant that context data is only accessible by parties owning the right privileges.
- **API management and business support functions** enable auditing of the system and monetization on data access.

› › › THE FIWARE MARKETPLACE

POWERED BY FIWARE

› **Smart Solutions** rely on FIWARE standards to manage context information at a large scale. They use FIWARE technologies to gather and process context information coming from different and highly distributed sources.

› **FIWARE platform service providers** offer FIWARE-compliant platforms as a Service on private and public clouds. Also, Platform Service Providers can deploy FIWARE platform instances on premises for their customers.

FIWARE-READY TECHNOLOGIES

› **FIWARE-ready IoT devices** come with easy-to-install drivers and instructions, which make them accessible to end applications using the FIWARE NGSI standard.

› **FIWARE-ready software enablers** are base platform technologies, which can easily be integrated with FIWARE to extend the basic capabilities of the platform with advanced added-value features

Check out: marketplace.fiware.org/join

The **FIWARE Marketplace** is a global one-stop shop that gives access to a wide range of **Powered by FIWARE** solutions and platforms, **FIWARE-ready** technologies, as well as related **FIWARE services** such as training, coaching, consultancy, integration and technical support.

The Marketplace offers everyone in the **FIWARE ecosystem** the platform to become more visible to their target customers or potential investors and partners.

FIWARE SERVICES

Online training material is available on the FIWARE Academy but many partners are offering tailored **training and coaching services**.

Finding the right experts offering **consultancy, integration or technical support services** is crucial in many projects. The FIWARE marketplace is helping to serve this need.

❯ ❯ ❯ GLOBAL ORGANIZATIONS ADOPTING FIWARE

The European Commission, under its **Connecting Europe Facility (CEF)** program, recently announced the adoption of FIWARE Context Broker technology as a CEF Building Block. The CEF program supports the development of digital infrastructures enabling a European Digital Single Market.

GSMA has produced a Reference Architecture for IoT-enabled Big Data Ecosystem solutions where the FIWARE NGSI API is recommended.

ETSI has launched an ISG (Industry Specifications Group) on cross-cutting Context Information Management (CIM) standards which identify OMA NGSI and FIWARE NGSI as starting points for the API specs.

TM Forum has also agreed to adopt FIWARE NGSI as the basis for providing right-time access to context information. FIWARE Business components, combined with Open TM Forum Business APIs, bring support to the monetization of Data, materializing the vision of a Data Economy.

> > > BECOME A MEMBER OF THE FIWARE FOUNDATION

ABOUT FIWARE

The FIWARE Foundation is the legal independent body providing shared resources to help achieving the FIWARE mission by promoting, augmenting, protecting, and validating the FIWARE technologies as well as bringing support to the activities of the FIWARE Community, empowering its members including end users, developers and rest of stakeholders in the entire ecosystem. The FIWARE Foundation is open: anybody can join contributing to a transparent governance of FIWARE activities and rising through the ranks, based on merit.

FIWARE's mission is to develop an open sustainable ecosystem around public, royalty-free and implementation- driven software platform standards that will ease the creation of Smart Applications in multiple sectors.

FIWARE - The Open Source Platform
for our Smart Digital Future.

fiware.org/foundation/members

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