Open Source Community Day

23 - 24 September

ECLIPSE FOUNDATION

CEI-Sphere part of EUCloudEdgeIoT.eu

Co-located with AIOTI Days 2025

# Agriculture digital twin

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# Agenda: Agriculture digital twin

- SPADE Project: multi-purpoSe Physical-cyber Agri-forest Drones Ecosystem for governance and environmental observation
- Open-source goals
- Synergy through standards
- Synergy with data space
- Synergy with sister projects: SPADE, CHAMELEON, and ICAERUS

# SPADE

- SPADE: multi-purpoSe Physical-cyber Agri-forest Drones Ecosystem for governance and environmental observation
- Start date: 01/09/2022 - End date: 31/08/2026

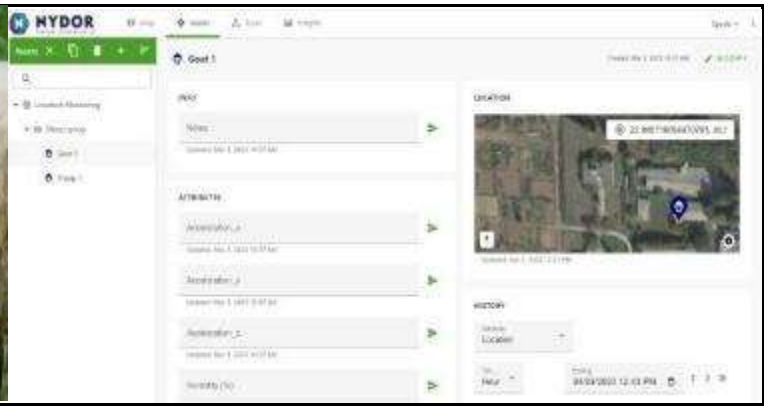

https://www.youtube.com/watch?v=ZL-C7abxMx4

# SPADE: 3 pilots

- Livestock: optimization of both animal grazing and healthcare management in Greece with the usage of drones
  - 350,000 purebred animals
  - IoT sheep collars with accelerometer and GPS to detect the position of the animal
    - Real time tracking of animals' status
    - Detection of specific animal behaviour patterns (grazing, limping, moving in cycles).
- Agriculture
- Forestry

OpenRemote IoT open-source platform

The prototype version has been customized by NYDOR (http://www.nydorsystem.com/) for position tracking and activity status monitoring




Paper: Advanced UAV edge computing ML solutions for livestock management [Tagarakis et al.]

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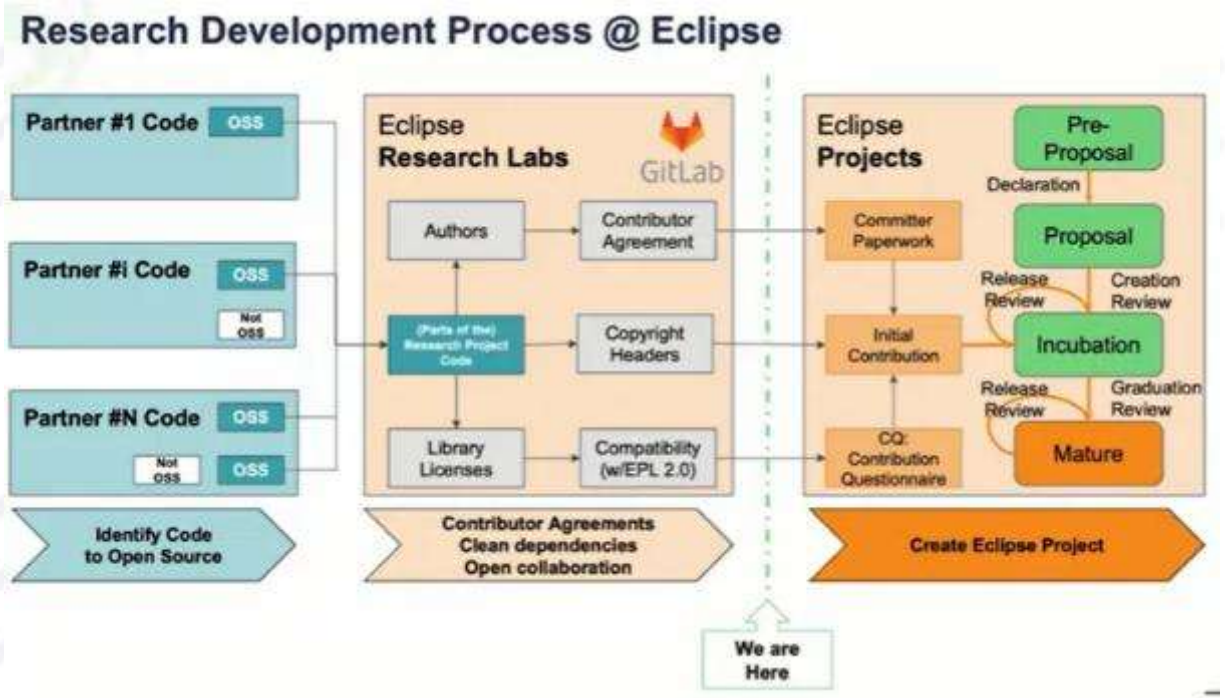
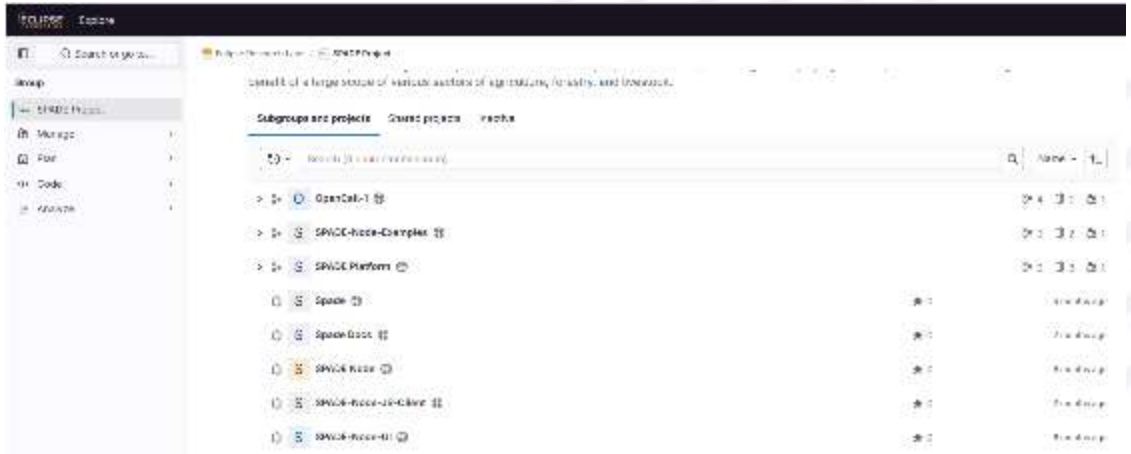
# Open-source goals
# Eclipse Foundation and Gradiant






https://youtu.be/bb60VwuQq7c
https://youtu.be/iXBxYaZO96Q
https://www.youtube.com/watch?v=IT9P-VRV4pc

https://gitlab.eclipse.org/eclipse-research-labs/spade-project

# Synergy among Sister Projects: SPADE, CHAMELEON, ICAERUS

- Focusing on agricultural use cases:
- Crop monitoring (e.g., potatoes), disease detection from SPADE
- Crop monitoring from ICAERUS to detect diseases and weed detection
- Drone spraying from ICAERUS
- Vineyards monitoring from CHAMELEON to track plant health status
- Livestock monitoring with IoT collars from CHAMELEON

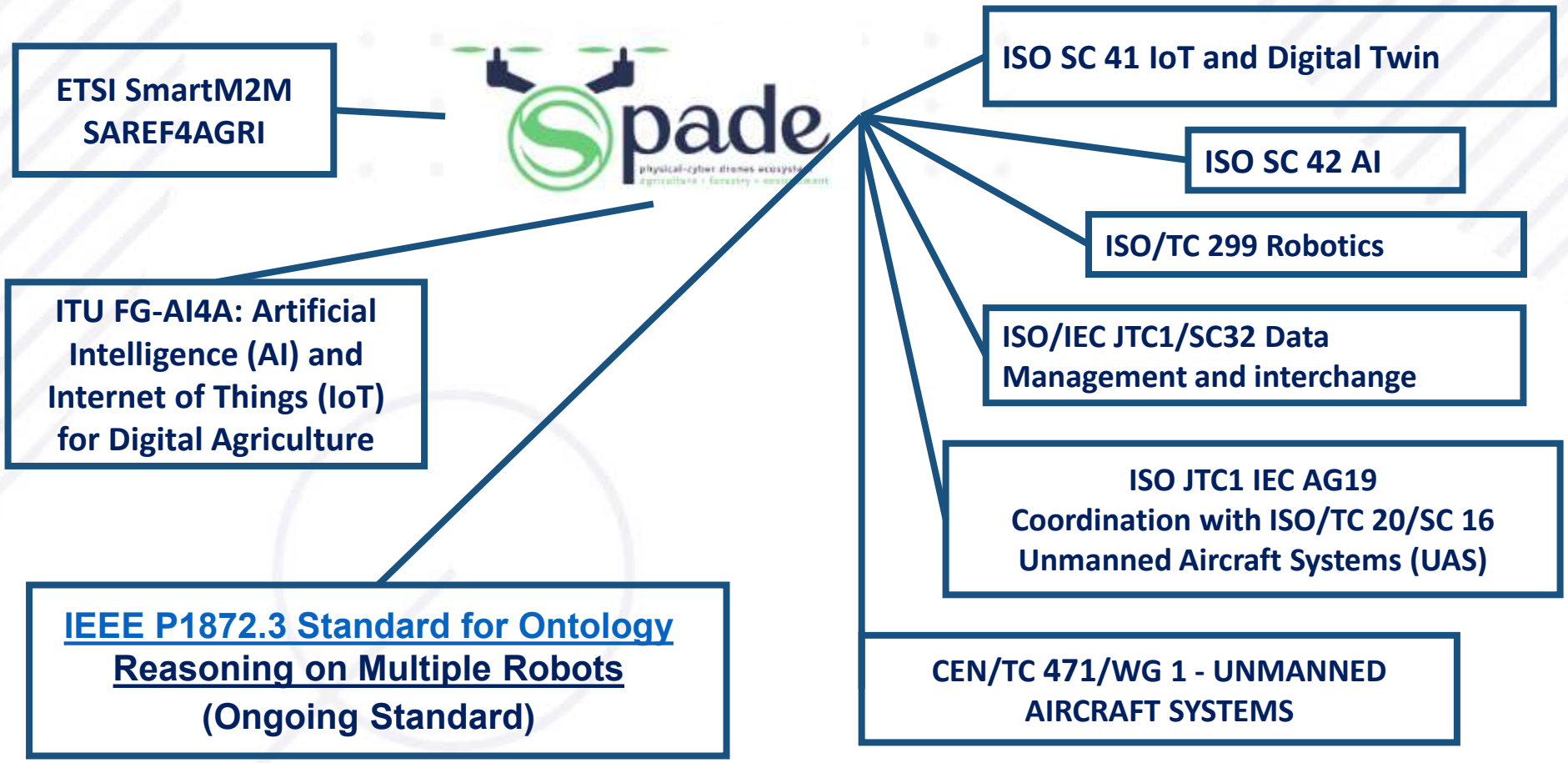
# Synergy Paper Interests on standards

- Which **sensor types** are used within the project?
- **AI** Algorithms?
- **Standards** already used or involved in projects/technologies (**drone, IoT/sensor/devices, AI**)?
- Semantic Web technologies? Ontologies? Knowledge Graphs? => IoT Semantic Interoperability
- Security and Privacy?
- Real-time for data, real-time decisions in agriculture
- Lessons learnt from sister projects
- Next challenges from sister projects

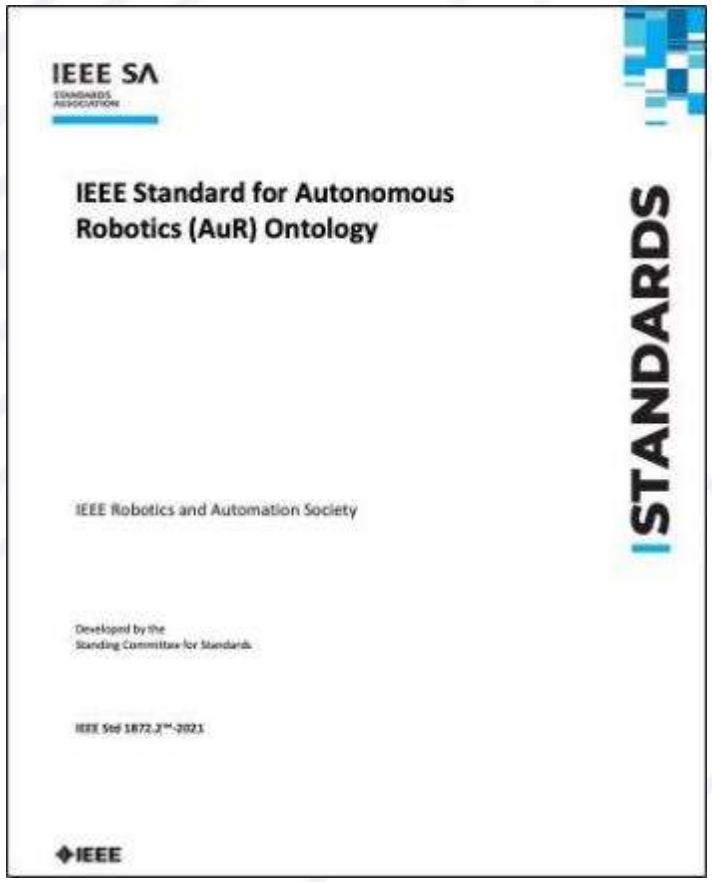



- We will focus on agricultural use cases (crop monitoring, etc.)
- Future work: forest use cases, and livestock use cases

# Standards relevant for SPADE



# IEEE Std 1872.2-2021 Autonomous Robotics (AuR) Ontology




- This standard extends **IEEE Std 1872-2015, IEEE Standard for Ontologies for Robotics** and Automation, to represent additional domain-specific concepts, definitions, and axioms commonly used in **Autonomous Robotics (AuR).**
- This standard is general and can be used in many ways--for example, to specify the domain **knowledge** needed to unambiguously describe the design patterns of AuR systems; to represent AuR system architectures in a unified way; or as a guideline to build **autonomous systems consisting of robots operating in various environments**.

https://standards.ieee.org/ieee/1872.2/7094/

# ISO Standards

- Trialog involved in ISO standards:
- ISO SC42 Artificial Intelligence (AI)
  - WG5 Computational approaches and computational characteristics of AI systems (Working Group Member)
    - ISO/IEC 5392 Knowledge Engineering Reference Architecture (KERA) (Contributor)
- ISO/IEC JTC1 SC41 Internet of Things and Digital Twin
  - WG4 IoT Interoperability
    - Co-editor ISO 21823 Internet of Things (IoT) - Interoperability for IoT Systems - Part 3 Semantic interoperability
- ISO/IEC SC27 Security, Privacy
- ISO 299 Robotics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