



CREATE-IoT

Hyper-connected Society



European  
Large-Scale Pilots  
Programme

# *IoT European Large-Scale Pilots Programme*

**Standardisation, Architecture and Interoperability**

ACTU  
VAGE  
PROJECT

AUTOPILOT

IOF  
INTERNET OF FOOD & FARM

MONICA

SYNCHRONICITY

CREATE-IoT

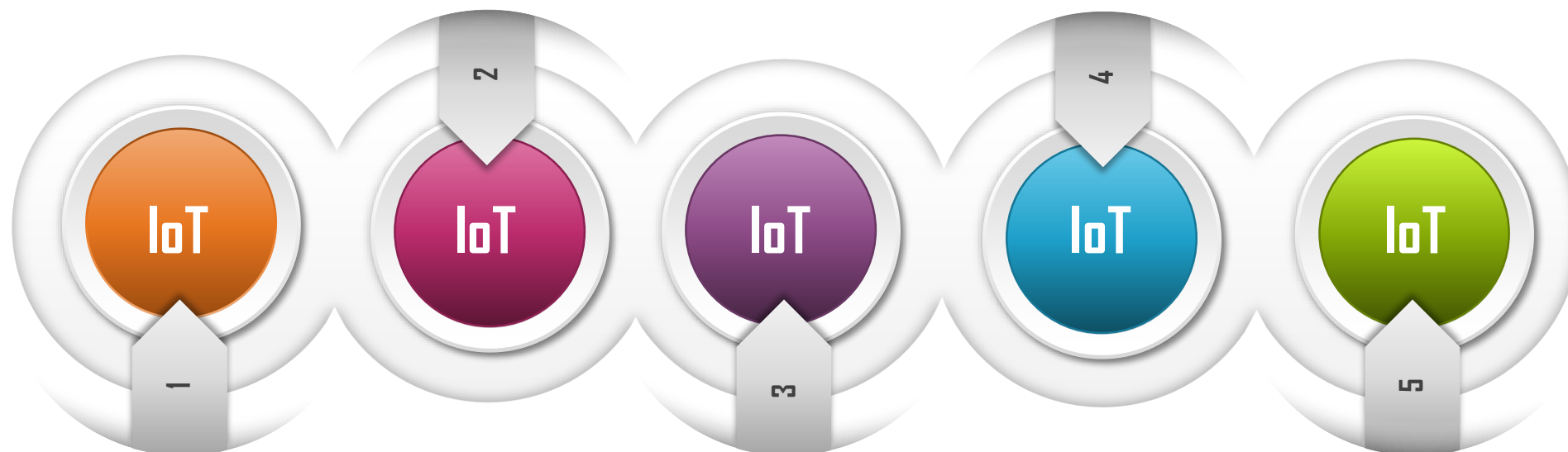


Co-funded by  
Horizon 2020 programme  
of the European Union



ARCHITECTURES THAT MAY BE REUSED ACROSS MULTIPLE  
USE CASES AND ENABLE INTEROPERABILITY ACROSS THOSE

INTEROPERABILITY AND INTEGRATION  
TESTING ON OPEN IoT PLATFORMS



BEST PRACTICES FOR MAPPING OF  
PILOT ARCHITECTURE APPROACHES

INTEROPERABILITY AND STANDARDS APPROACHES  
AT TECHNICAL/SEMANTIC LEVELS

ARCHITECTURES THAT MAY BE REUSED ACROSS MULTIPLE  
USE CASES AND ENABLE INTEROPERABILITY ACROSS THOSE

# Why an Activity Group on Standardisation, Architecture and Interoperability?



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## Commonalities

*Methods and solutions*  
*Interoperability Framework*  
*IoT standards*  
*Gaps and resolution*

## Consolidation

*Use Cases*  
*Lessons learned*  
*Best practices*  
*Guidelines*

## Influence

*Reference Architecture*  
*Coordinated contributions to standardisation*  
*Relevant pre-normative activities*

## Dissemination

*Leveraged LSPs innovations*  
*Involvement of end-users and SMEs*  
*Influence in Europe and beyond*

## The Interoperability Framework

- Reference Architectures
  - Support for IoT communications
  - Gateway capabilities and protocol conversion
  - Unique device ID / Naming
- Alignment with other IoT architectures
- Interoperability Points and Mechanisms
- Platforms and technologies
  - Support of common IoT communication protocols
  - Extensibility for different sensor types
  - User Device Detection Capability
- Support of the main IoT middleware platforms
- Support of design and development
- Standards and pre-normative activities
  - Standard protocols for device communications
  - Semantic and syntactic interoperability

## A collaborative work



8 workshops in 2018/19



## European Large-Scale Pilots Programme

### Use case 1.4: Farm Machine Interoperability



**Domain application areas addressed**  
Sustainable soil tillage; Machine to machine communication for application of task maps;  
Farm equipment data sharing.  
(Farming)

**Short description and location**  
Data exchange between field machinery and farm management information systems for supporting cross-over pilot machine communication.  
(DK, NL, DE, BE)

### Architecture View



**SW/HW Infrastructure**  
Farm sensors, Farm gateway,  
Farm app, Farm mics.  
Manufacturer data storage, IoT  
system, FMI data storage, FMI  
machine connector, FMI  
reporting engine,

**IoT Applications**  
Soil-plant-atmospheric algorithms; Weather forecast; GIS and zoning tool; Traffic optimization modules. Control persons; Control machines, Planning and scheduling of tasks

**IoT Platforms and Software**  
365FarmNet, ThingWorx IoT platforms , FIWARE infrastructure

## IoT Technologies and Standards

**IoT Devices**  
Soil and yield sensors on 2 tractors, 2 soil tillage implements and on 1 combine; 10 stations for precipitation, humidity, air and soil temperature, soil moisture and 1 weather station.

### Use case 2.1: Monitor Sound Levels; Use case 3.1: Get Event Information



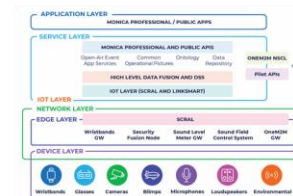
**Domain application areas addressed**  
Enhanced sound experience and noise control  
at concert and festival events.

**Short description and location**

Monitor sound levels inside and outside of the venue making use of sensor technologies. Subjective feedback will also be collected in order to receive a full overview of the perceived sound quality from the point of view of visitors, staff members and neighbours. Data can be visualized in the form of a heat map and graphs through the COP interface. The solution is also able to send alerts when sound overcomes thresholds in specific locations to enable users to act on time and avoid unwanted scenarios.

**Copenhagen (DK), Lyon (FR), Bonn (DE), Torino (IT)**

### Architecture View



SW/HW Infrastructure  
Airship  
Communication Infrastructure/  
Contribution Algorithm (built in  
IoT microphones),  
ASECS

**IoT Applications**  
COP, MONICA App (for staff), MONICA App (for visitor), MONICA App (for neighbours), Heat map (requires almost full ASFC functionality); Harmonica Index (to inform users)

**IoT Platforms and Software**  
oneM2M Network Service Capability Layer / GW; LinkSmart, RioT, SCRA  
Azure, ASFCS (Adaptive Sound Field Control System)

**IoT Technologies and Standards**  
 IEC/IEEE 42010:2011 (used for architecture views and  
 OGC SensorThings API, OASIS MQTT; ETSI SAREF,  
 SSN, SO/IEC/IEEE 42010:2011, AIOTI HLA; Bluetooth  
 DASH7 / WiFi – IEEE 802.11;

**IoT Devices**  
Sound level sensors; Environmental sensors (wind, temperature, humidity); Smart glasses, Smartphones



## Use Case 1.4



## Use Case 2.1

# Identifying the IoT Architecture Layers

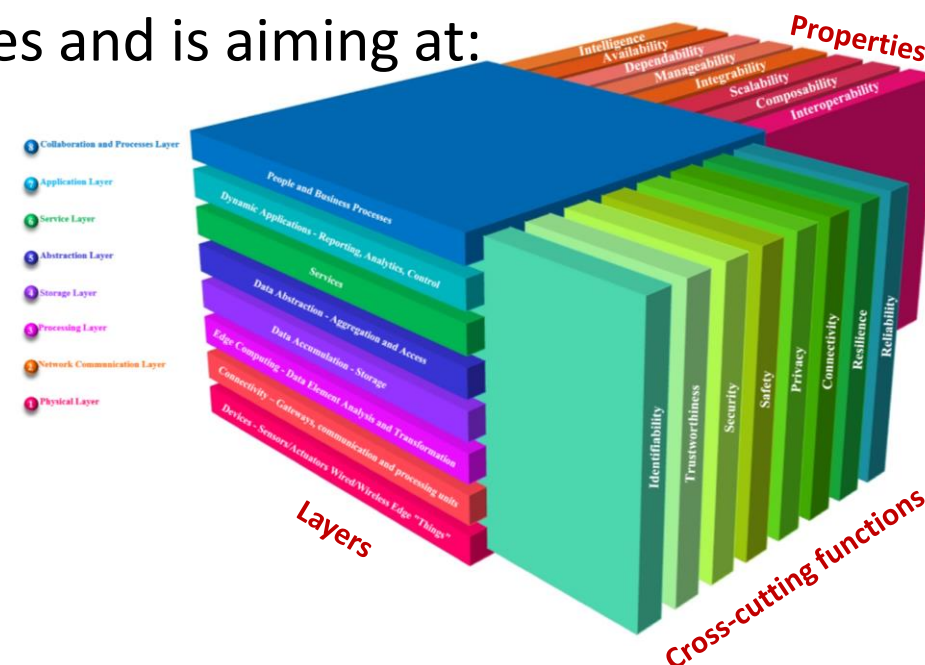


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IoT ARCHITECTURE LAYERS	COMPONENTS	ACTIVAGE	AUTOPILOT	IoF2020	MONICA	SYNCHRONICITY
COLLABORATION & PROCESSES	Business System Integration	✓		✓	✓	✓
APPLICATION	Visualization	✓	✓	✓	✓	✓
SERVICE	Development Environment	✓		✓		✓
	Service Orchestration	✓	✓	✓	✓	✓
	Advanced Analytics	✓	✓	✓	✓	✓
ABSTRACTION	Event & Action Management	✓	✓	✓	✓	✓
	Basic Analytics Action	✓	✓	✓	✓	✓
STORAGE	Storage/Database	✓	✓	✓	✓	✓
PROCESSING	Device Management	✓		✓	✓	✓
	Edge Analytics	✓	✓	✓	✓	✓
NETWORK & COMMUNICATIONS	Connectivity Network / Modules	✓	✓	✓	✓	✓
	Edge Gateway (HW based)	✓	✓	✓	✓	✓
PHYSICAL / DEVICE LAYER	Operating System	✓	✓	✓		✓
	Modules & Drivers	✓	✓	✓	✓	✓
	MPU / MCU	✓		✓		✓

The LSP model extends current IoT reference architectures and is aiming at:

- Ensuring a common view of the different layers of the IoT systems from Physical up to Business;
- Providing additional viewpoints to the different stakeholders (not just to the developers) regarding some additional cross systems functions such as security, privacy or safety and the shared analysis of some properties (e.g., integrability) between different stakeholders.



The additional dimension of properties is a new way to discuss the properties of the IoT system between different involved parties (e.g., users, contractors, designers) and identify the elements in support (e.g., functional building blocks, APIs) and those missing.

### Examples of contributions include:

The collaborative development by LSPs of a [3D Reference Architecture model](#) expanding the reach of architecture specification and aimed at contributing to standardisation;

The development by the MONICA of requirements for a new [standard for time-critical data links for IoT sensors](#) (with a submission for a new wireless interface);

The development by the AUTOPILOT of requirements for new [OneM2M](#) standards;

The LSPs contributions to SAREF (Smart Appliances REference ontology), a modular network of [standardised semantic models](#) led by ETSI, which is being extended to IoT application environments such as Smart Cities and Smart AgriFood, contributing to the development of a strong EU standards ecosystem;

The contributions of SynchroniCity to the ITU Study Group 20 on IoT and Smart Cities, where 2 standards promoted by the project are under work since 2017: Draft recommendation on [Open API for IoT in Smart Cities](#) and the Technical Report on Artificial Intelligence in the IoT and Smart City ecosystem. SynchroniCity is also contributing to the Focus Group (FG) on Data Processing and Management.



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ACTOVAGE  
PROJECT

Breaking barriers for a sustainability  
Active and Healthy Ageing through  
IoT technologies.



AUTOPILOT

Unlocking the potential of IoT to  
take autonomous driving to the  
next level.



Strengthen competitiveness of  
farming and food chains in Europe.

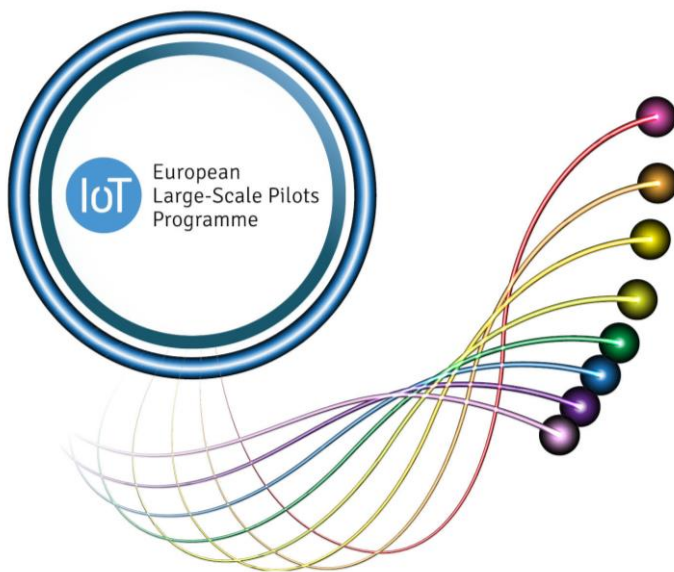


MONICA

Sound and security solutions for  
large open-air events in the smart  
city.

SYNCHRONICITY

Single digital city market of Europe.



CREATE-IoT

Stimulate collaboration between  
IoT initiatives. Development and  
growth of IoT ecosystems based on  
open technologies and platforms.

Common  
Innovative  
Solutions

Standards  
Architectures  
Interoperability

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PROJECT

AUTOPILOT



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
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