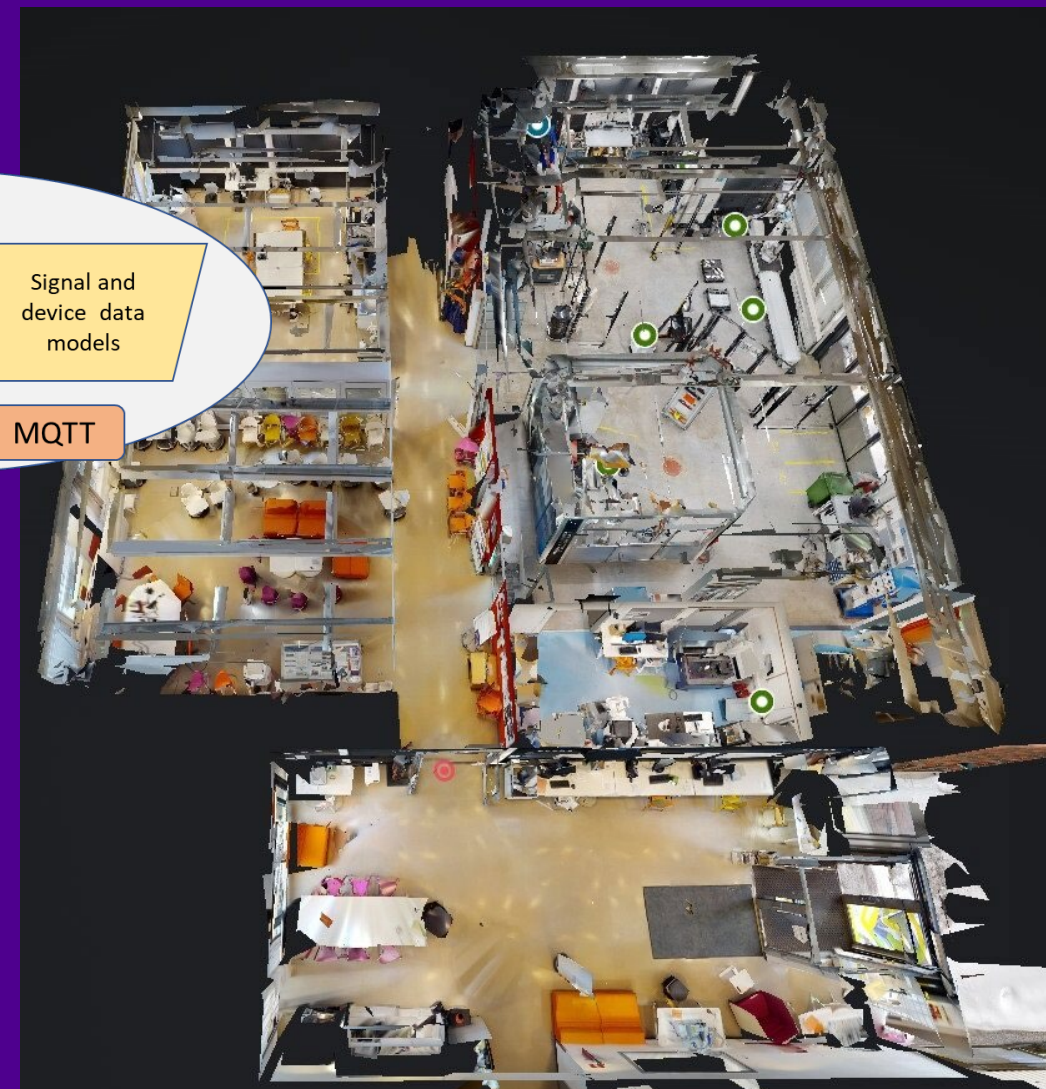
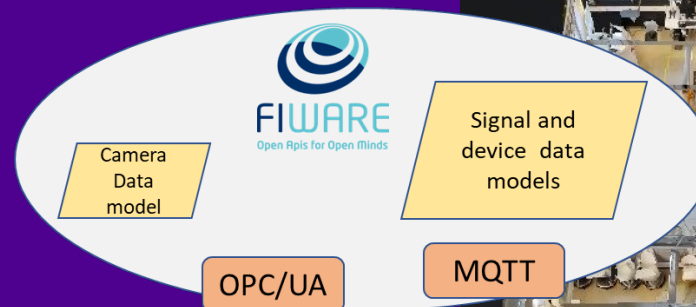


Results of TAMK Fiware-piloting

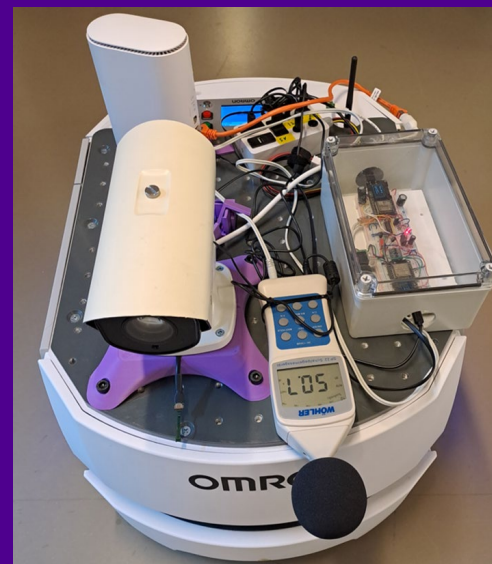
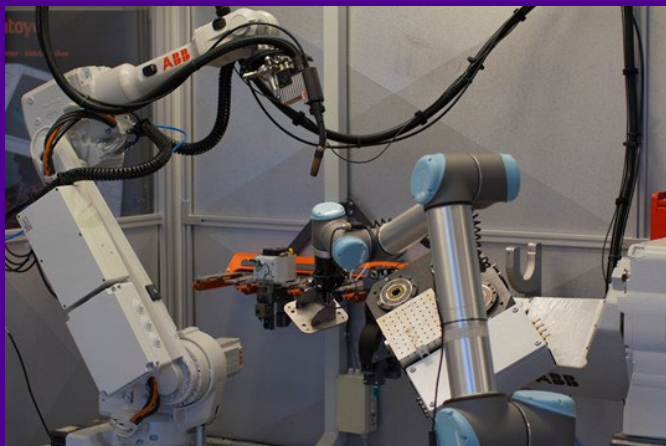
FIIF Event: FIWARE
Feb. 15th, 2024, Tampere

Kari Naakka, TAMK
Katri Salminen, TAMK



Project "FieldLab- The testbed and capability creation for Industry 4.0"

- Industry 4.0 machines available
- 5-axis machining center
- Track Mounted 6-axis Industrial Robot
- Large scale enabled 3D printing platform
- Industrial automated welding operations
- Mobile robot fleet
- "Nuusku" mobile robot



Flab – FIWARE – 5G : I4.0 testbed : IoT/ Data/ AI/ Data models

Objective:

Flab is testbed for local SME companies, for IoT/Data utilization/ AI trials/ POC:s

Give ideas for SME companies what are new possibilities with data utilization by demonstrating practical SME level use cases

Practical/realistic example cases/environment for education (TAMK courses)

Experience of data models and their usage

Developing and verify IT-environment (TITE cloud) for IoT/ Data/ AI system

Flab – FIWARE – 5G : I4.0 testbed : IoT/ Data/ AI/ Data models

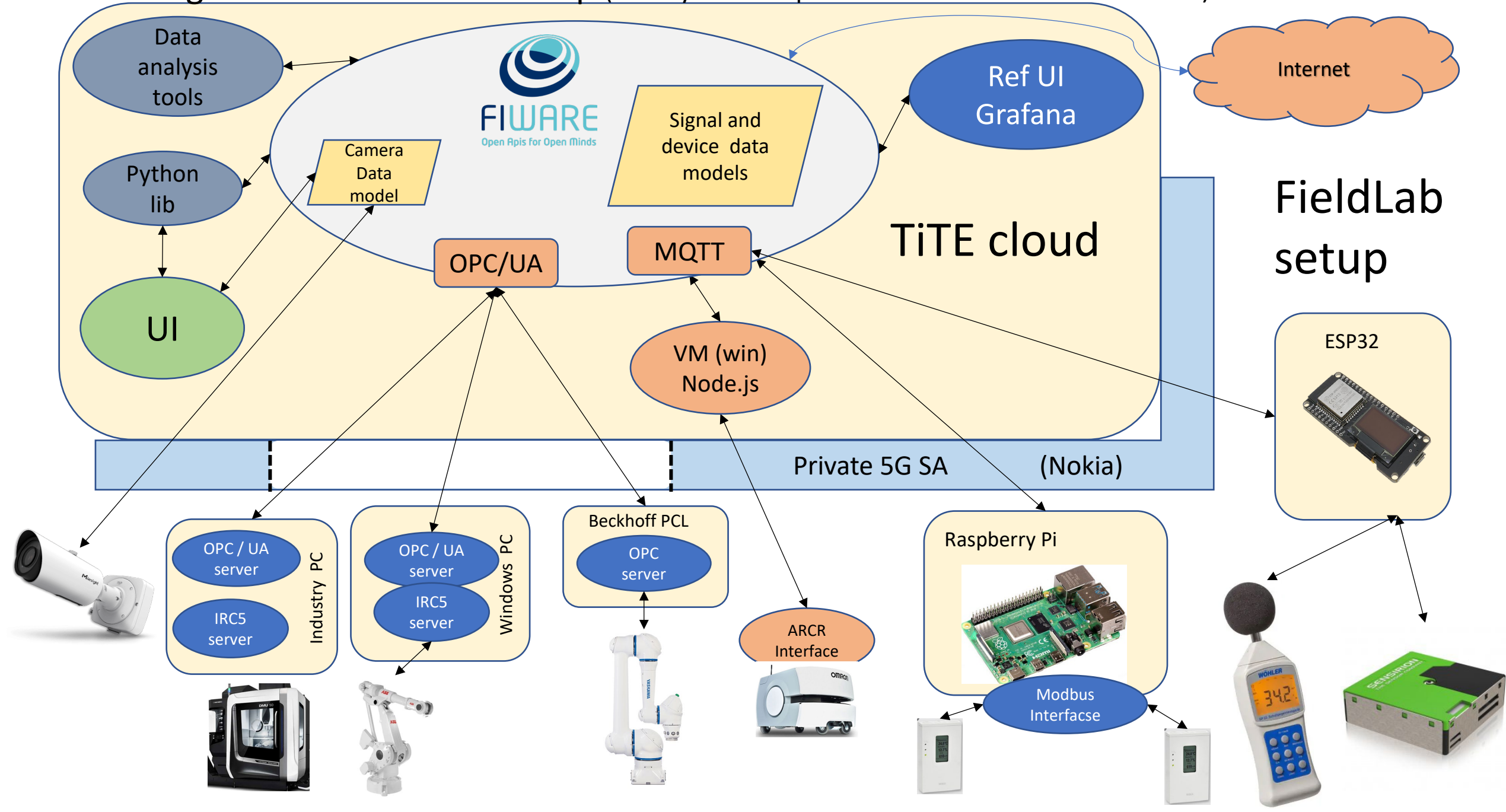
Why FIWARE ?

- all available IoT/AI system blocks available
- configurable for different kind of setups, scalable
- available APIs for OPC/UA, MQTT, Rest-API
- support for different DB:s like Mongo/Crate etc.
- Open Source (free)
- could be run in docker
- free support organization
- easy to replicate/clone

L2L

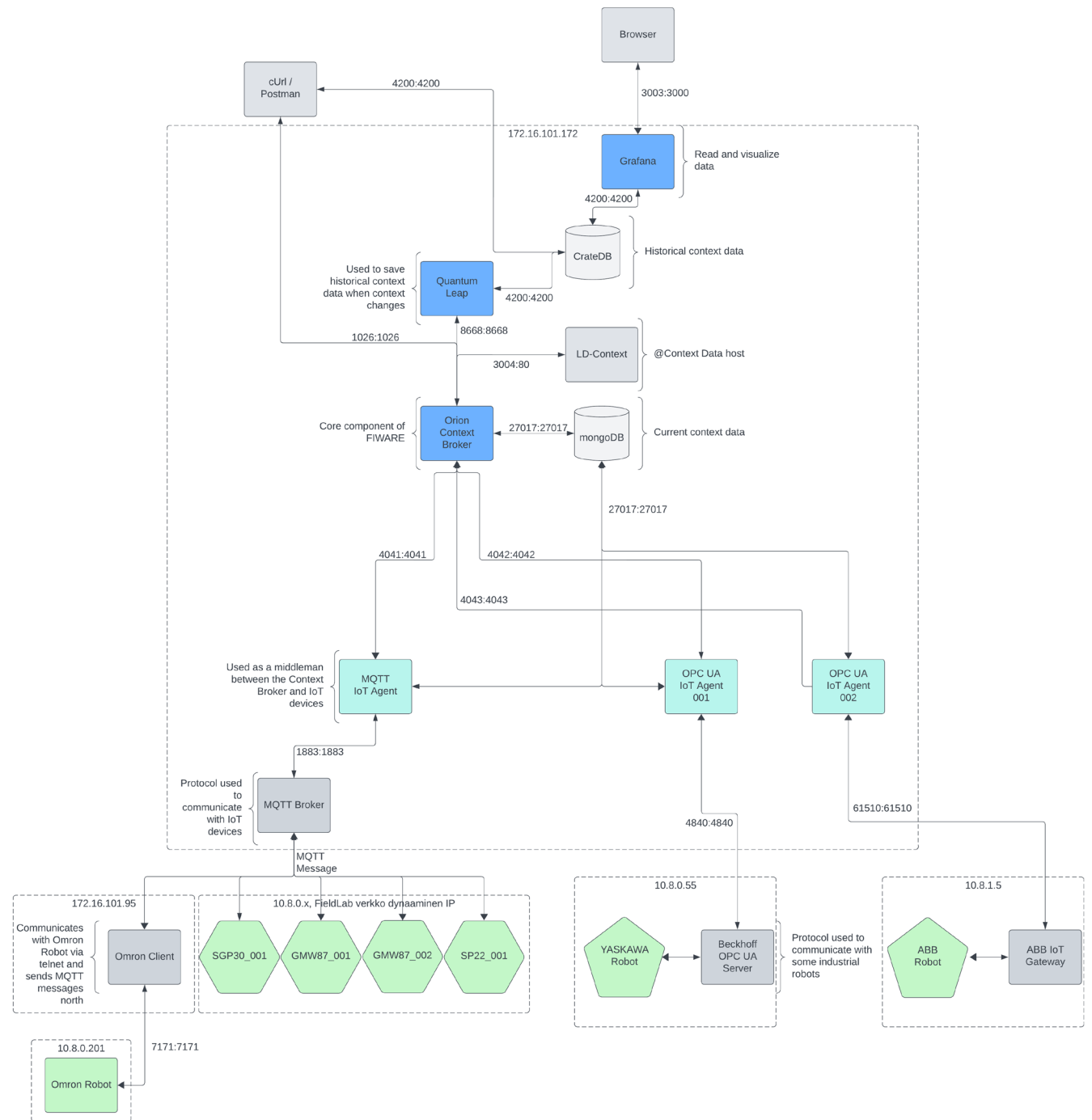
- tutorial examples mostly working as they are, implementing own features required studies/work
- human support available from Fiware org

Existing TAMK Fieldlab trial setup (new systems implementation with Fiware continue)



TAMK FieldLab FIWARE platform Block diagram

- IoT agents
 - OPC/UA
 - MQTT
- MongoDB – snapshot data + data models
- CrateDB – time series data
- Orion API for context broker for MongoDB
- QuantumLeap API for CrateDB



TAMK FieldLab

Data model

fieldlabCamelCase.yaml

createEntities.py



Real world
entity

Create a
template for
entity

Datamodel
concept

Robot:
type: object
required:
- ownedBy
- entityType
description: >
An autonomous robot in TAMK
FieldLab`.
properties:
robotType:
type: array
robotManufacturer:
type: object
robotModel:
type: object
robotMaximumLoad:
type: object
robotMaximumSpeed:
type: object
robotKitType:
type: object
robotSafety:
type: array
robotStandards:

Filling the data
model with data
and creating an
entity with it via
Orion API

Datamodel
in use

```
{  
  "id": "urn:ngsi-Id:Robot:001",  
  "type": "Robot",  
  "robotType": [{  
    "type": "Property",  
    "value": "Mobile robot"  
  }],  
  "robotManufacturer": {  
    "type": "Property",  
    "value": "LD-90"  
  },  
  "robotModel": {  
    "type": "Property",  
    "value": "LD-90"  
  },  
  "robotMaximumLoad": {  
    "type": "Property",  
    "value": "60",  
    "unitCode": "kg"  
  },  
}
```

TAMK FieldLab

Data model example: OMRON -LD90

```
{  
  "id": "urn:ngsi-ld:Robot:001"  
  "type": "Robot",  
  "robotType": [{  
    "type": "Property",  
    "value": "Mobile robot"  
  }, {  
    "type": "Property",  
    "value": "LD-90"  
  }],  
  "robotManufacturer": {  
    "type": "Property",  
    "value": "Omron"  
  },  
  "robotModel": {  
    "type": "Property",  
    "value": "LD-90"  
  },  
  "robotMaximumLoad": {  
    "type": "Property",  
    "value": "60",  
    "unitCode": "kg"  
  },  
}
```

```
"robotConnections": [{  
  "type": "Property",  
  "value": "WLAN OFF"  
}, {  
  "type": "Property",  
  "value": "RJ45 ON"  
}],
```

```
"robotDatasheet": {  
  "type": "Property",  
  "value": "https://industrial.omron.fi/fi/products/ld-60-90",  
  "unitCode": "url"  
},
```

```
"ownedBy": [{  
  "type": "Relationship",  
  "object": "urn:ngsi-ld:FieldLab:001"  
}],
```

```
"ownerOf": [{  
  "type": "Relationship",  
  "object": "urn:ngsi-ld:Microphone:001"  
}, {  
  "type": "Relationship",  
  "object": "urn:ngsi-ld:Camera:001"  
}]
```

TAMK FieldLab - Data model visualization UI

Flab digital Twin

TAMK, Field lab F0-29



Some nice and descriptive text regarding the selected entity.
(This content should be available via Fiware.)

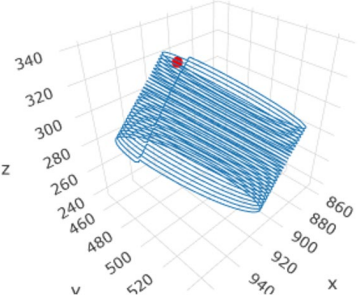
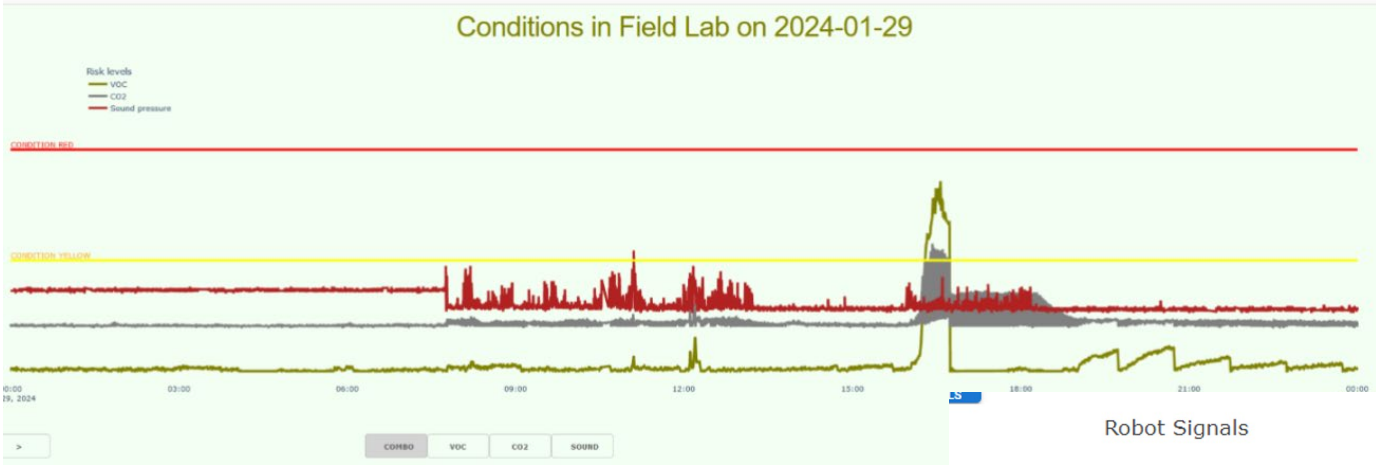
<< TOP LEVEL

Subentities:

URN:NGSI-LD:MICROPHONE:002

URN:NGSI-LD:ROBOT:001

URN:NGSI-LD:AIRQUALITYSENSOR:003



Mobile Robot 1. Omron LD90



Some nice and descriptive text regarding the selected entity.
(This content should be available via Fiware.)

<< TOP LEVEL

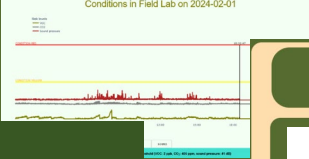
Subentities:

URN:NGSI-LD:MICROPHONE:002

URN:NGSI-LD:ROBOT:001

URN:NGSI-LD:AIRQUALITYSENSOR:003

Conditions in Field Lab on 2024-02-01



Sound level meter, SP22



Some nice and descriptive text regarding the selected entity.
(This content should be available via Fiware.)

<< TOP LEVEL

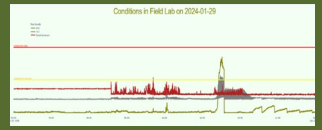
Subentities:

URN:NGSI-LD:MICROPHONE:002

URN:NGSI-LD:ROBOT:001

URN:NGSI-LD:AIRQUALITYSENSOR:003

Conditions in Field Lab on 2024-01-29



Entity: urn:ngsi-ld:FieldLab:001



Some nice and descriptive text regarding the selected entity.
(This content should be available via Fiware.)

<< TOP LEVEL

Subentities:

URN:NGSI-LD:MICROPHONE:002

URN:NGSI-LD:ROBOT:001

URN:NGSI-LD:AIRQUALITYSENSOR:003

Conditions in Field Lab on 2024-02-01



Flab – FIWARE – 5G : I4.0 testbed : IoT/ Data/ AI/ Data models

Next steps

- working prototype version of UI

Measured Data

- traditional time series
- 2D – omron mobile robot
- 3D – printing head position

Data models

prototype versions of device datamodel's

Usability feedback

- time synchronized image/video data for visualization of process
(images are equal data as time series measurements in FIWARE/Grate)

> Visual analysis > Image data for AI/ML to create quality loop control

Flab – FIWARE – 5G : I4.0 testbed : IoT/ Data/ AI/ Data models

Next steps

- TAMK use case's
 - 3D / large scale Abb printer
 - Abb/ W AAM
 - Cobot - mobile robot (Omron)/ Yaskawa
 - 5-axis machining center - DG Mori
- use case's from SME
 - under projects (Datatehdas)
- **data utilization with automatic tools / AI / ML / etc.**
 - > 1. non Realtime feedback loop for improve functionality**
 - > 2. Realtime control loop – final goal**
- technical cross function trials (data and data models) with other sites
 - project activities

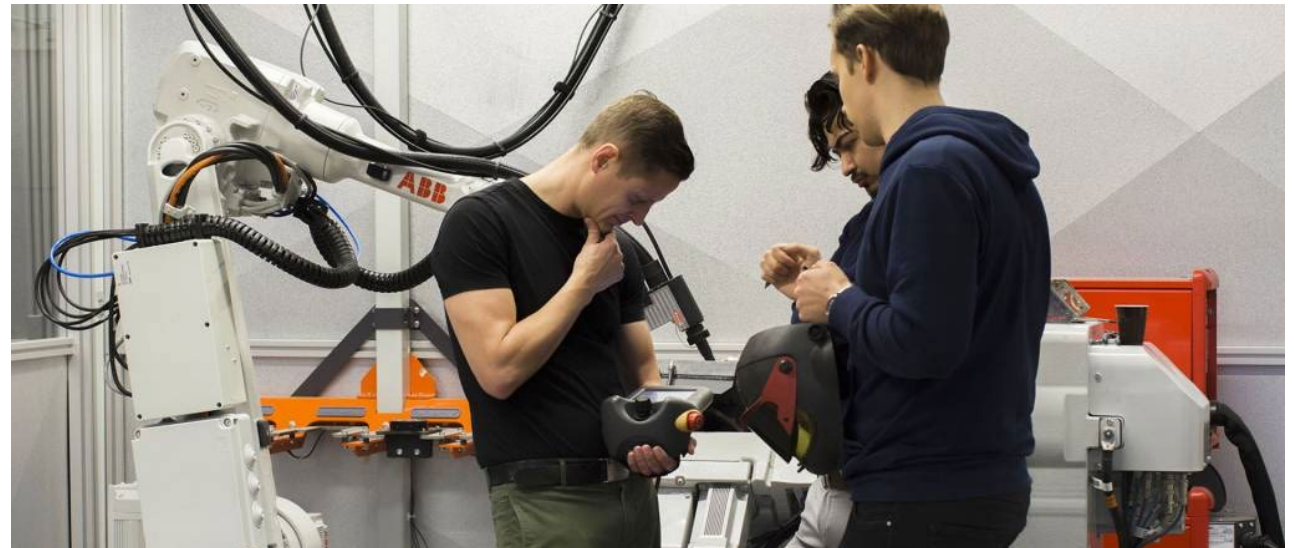
Flab – FIWARE – 5G : I4.0 testbed : IoT/ Data/ AI/ Data models

Questions ?
Comments ?
Thanks !

kari.naakka@tuni.fi

+358 40 7294269

New skills
unleashing the
engineering
potential



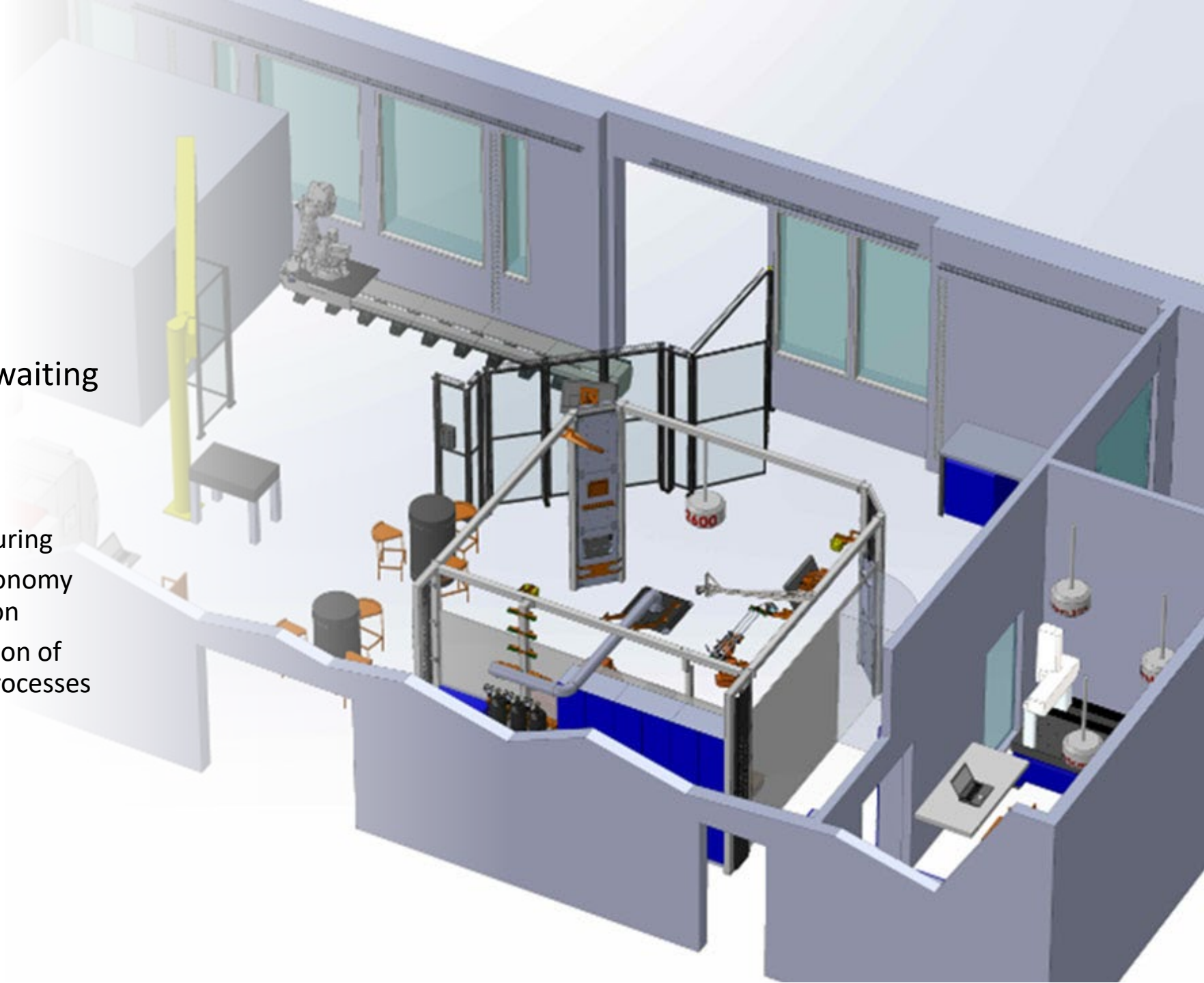
<https://sites.tuni.fi/fieldlab-en/>

How to collaborate with us?

- Two ongoing projects
 - DataFactory
 - Manufacturing data from FieldLab using FIWARE, demonstrations and pilots
 - We will be more than happy to discuss with companies regarding use case and demonstration definitions
 - Forthcoming Open Lab day and demo event
 - FairDatAct
 - Multidisciplinary project (health, construction, manufacturing and business) considering also data management, ethical and business value cases from data
 - Skills and education for data and AI
 - Company input for use cases, interviews, surveys, information sharing
- Participation is free for the companies
- We are also open for research collaboration

Next steps

- Project topics in prep on waiting for funding decision
 - Data sharing
 - Traceability
 - Digital twins for manufacturing
 - Data and AI for circular economy and CO2 emission reduction
 - Simulations and optimization of different manufacturing processes
- Collaboration possibilities depend on the topic



Contact

- Katri Salminen
 - katri.salminen@tuni.fi
 - +358406824741

Flab – FIWARE – 5G - mobile environment sensing trial

Objective:

Create

simple
fast

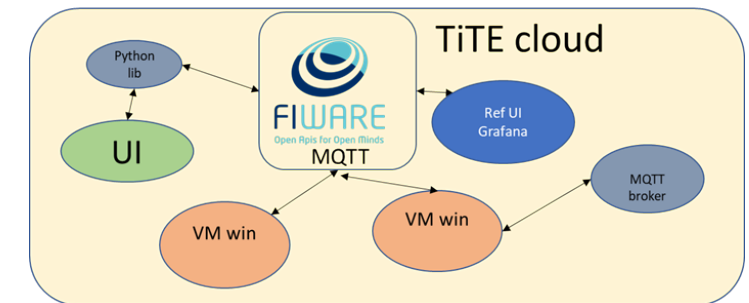
trial Use case
with

FIWARE

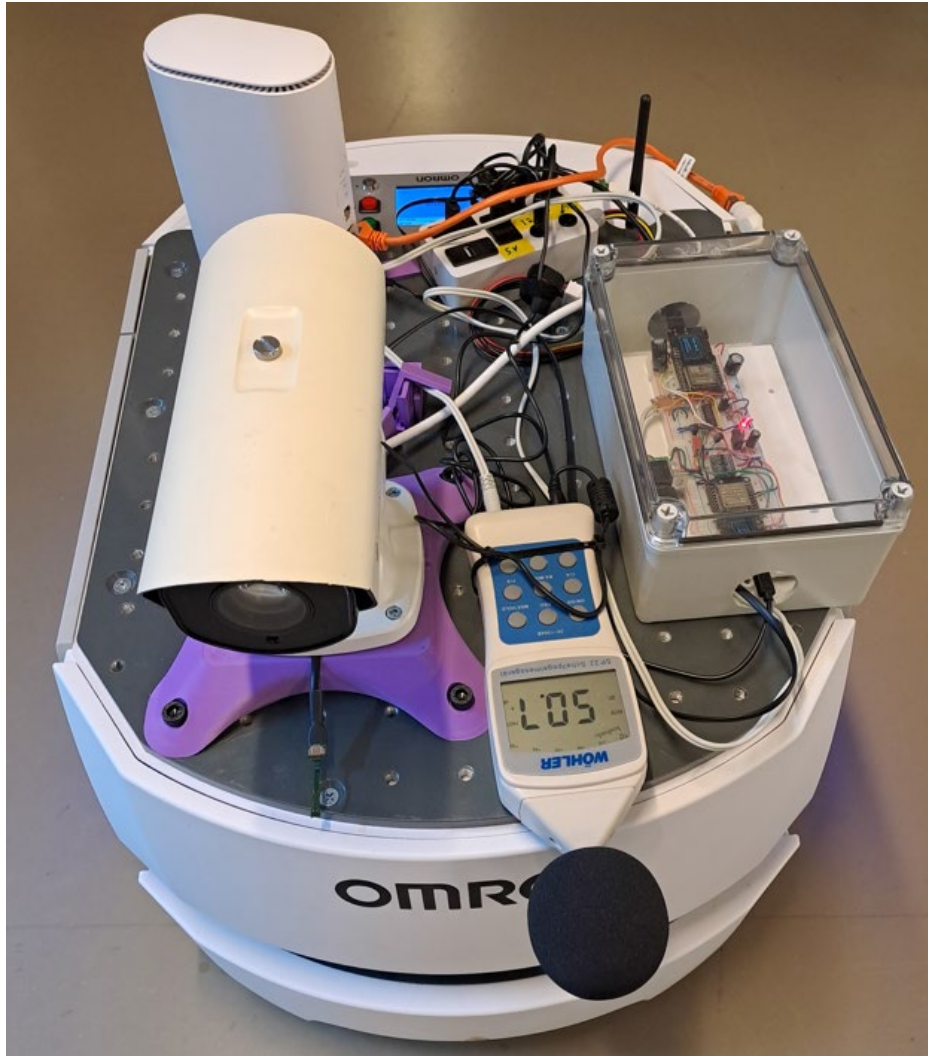
Data models

5G

Robot
Environment sensing
Camera



Flab – FIWARE – 5G - mobile environment sensing trial



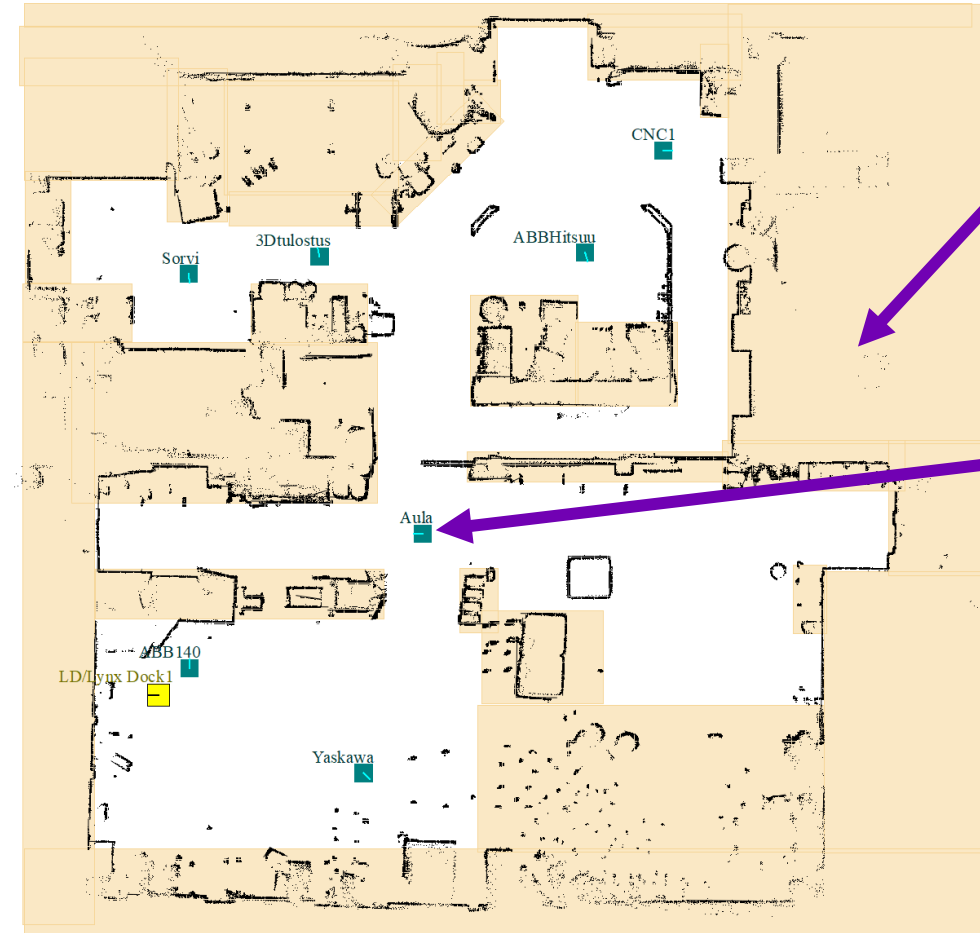
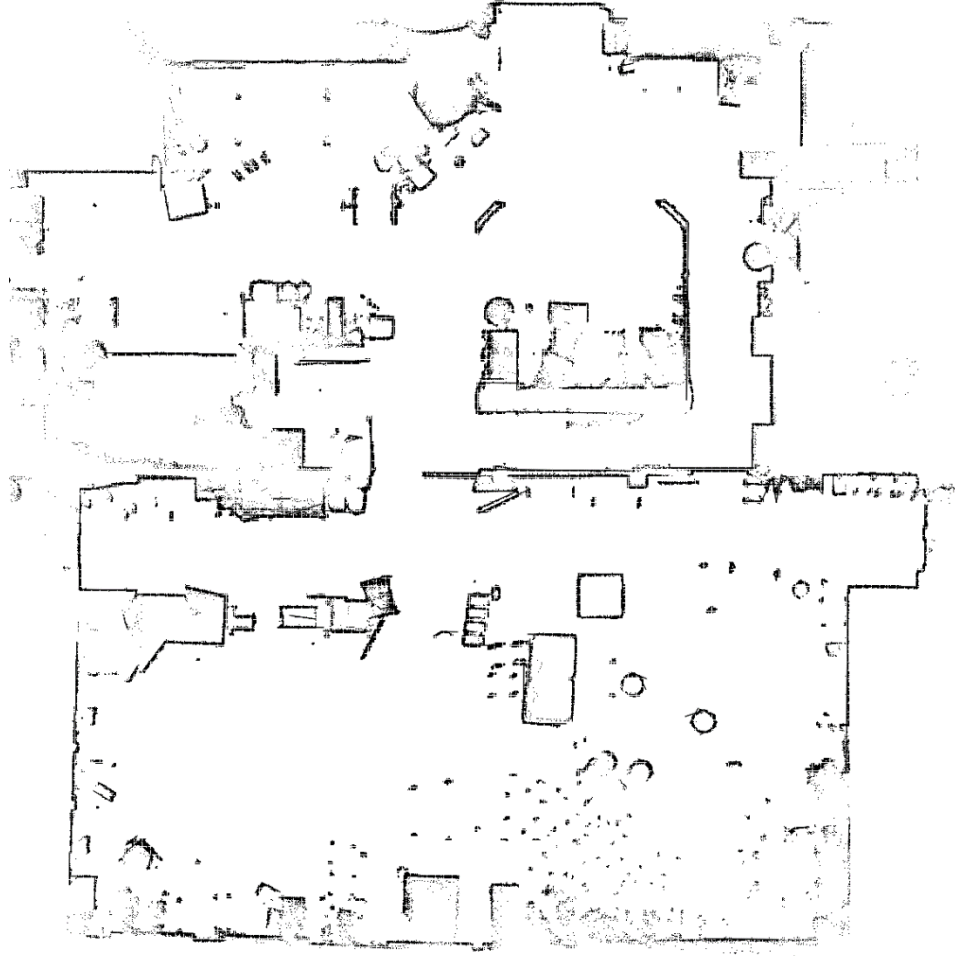
Private 5G network:	Nokia
5G modem:	MC801A
Robot:	OMRON LD90
dB :	Wöhler SP22
CO2/TVOC:	SGP30
Particle sensor	SPS30
Camera:	Milesight PRO PTZ

FIWARE

ORION,
MONGO DB,
Grate DB,
MQTT broker,
OPC UA server
Data models for
devices
measurements

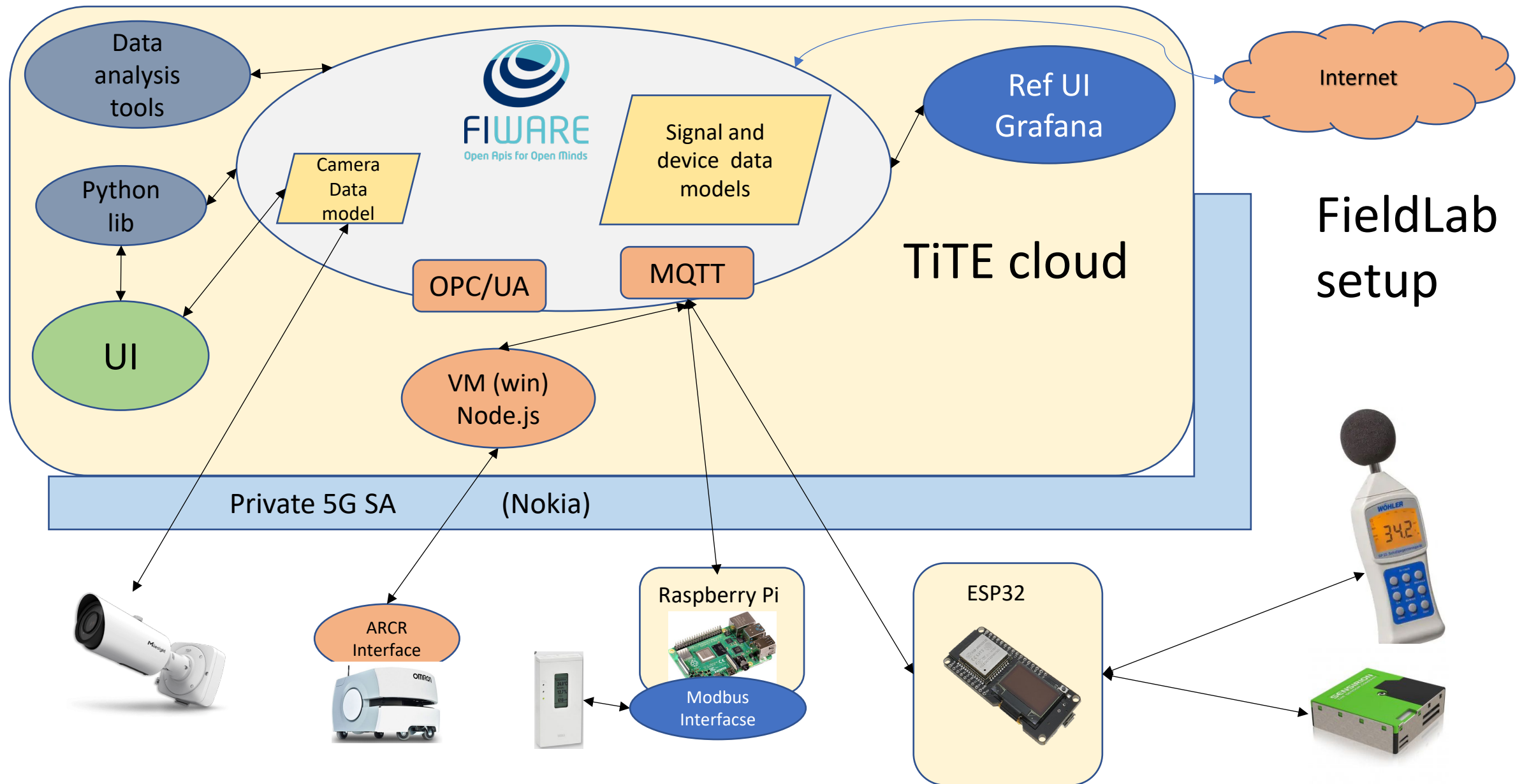
Flab – FIWARE – 5G - mobile environment sensing trial

Original scan map from Omron LIDAR

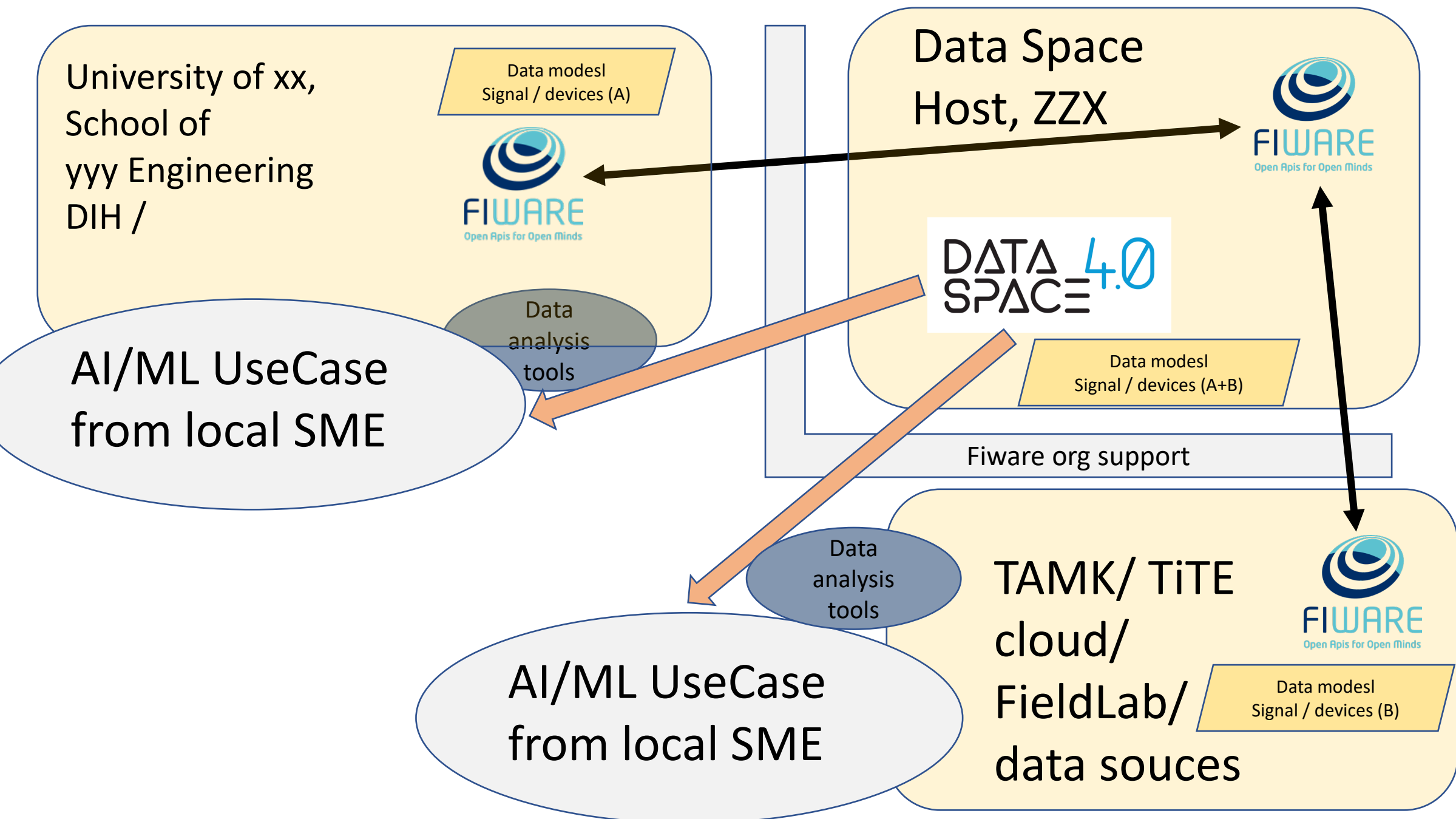


Goals

Flab – FIWARE – 5G - mobile environment sensing trial



Fiware/dataspace/datamodel/3D-robot manufacturing and post processing use case



Flab – FIWARE – 5G – 4.0 testbed – IoT/ Data/ AI