



Advanced Technology



Funding



Networking

Expertise

Competencies

Open Call 2 TECHNICAL OFFER

Part 2

14/10/2020

Innovative Solutions





Welcome







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Before we start

DigiFed

Programme:

DigiFed: Digitising Europe's Industry together 22 September 2020 10am CEST

The Digital Challenge 1 October 2020 10am CEST

Meet DigiFed technical partners

Part 1 7 October 2020, 10am CEST Part 2 14 October 2020, 10am CEST Webinar Series

16. 10. 2020

DigiFed WEBINAR

Before we start

- This webinar will be recorded & published
- During the webinar you can use the question box to ask all your questions, we will answer them during the Q&A session at the end
- After the webinar, the slides will be available for download on the Digifed website :

https://digifed.org/



DigiFed : Digitising Europe's Industry Together

DigiFed

DigiFed is a H2020 funded project dedicated to support **European cross-border** partnerships to foster industry to digitalize their product/service and reach get into new markets enabled by **Cyber Physical Systems (CPS) & embedded Systems**

- 12 Partners from 9 European Countries
- Duration: 3 years, 01/01/20 to 31/12/22,
- **Budget**: 8 M€
- **Cascade Funding:** 3.9 M€ to SMEs, start-ups & MidCaps



DigiFed is part of the European Commission "Digitising European Industry - DEI- strategy" https://smartanythingeverywhere.eu/

Reminder

SINGLE AE: one company (55k€)

- The applicant Company :
 - Want to develop a Cyber Physical System innovation, has a clear market vision,

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- Need technical support from a DigiFed Technology partner (cross border)

TWIN AE: 2 companies from 2 different countries (2x 55k€ max)

- Company #1 :
 - want to develop a Cyber Physical System innovation, has a clear market vision,
 - need complementary expertise to validate the concept,
- **Company #2**:
 - bring the complementary expertise to realize the prototype or access the market
 - NO DigiFed Technology partner involved





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Competencies



DIGITAL CATAPULT

Nathan COULSON Csaba KIRALY

DigiFed

Future Networks Lab

 Function: Digital Catapult's Future Networks Lab has been created to support the adoption of IoT, LPWAN and 5G technologies.

• Principle:

- Lab based network access to a variety of loT network technologies including LoRaWAN, SigFox, NB-IoT, LTE-M, and 5G
- Access to expertise and equipment for evaluating energy consumption
- Access to expertise on tinyML and benchmarking edge products.
- Access to a larger outdoor LoRaWAN test network in London, Northern Ireland and . in other parts of the UK
- Access to a 5G test network in Brighton as well as other live networks through operator relationships in the UK

 Access to expertise and environments for performance evaluation of future network protocols

Uniqueness:

- Only lab that combines access to these network testbeds
- Unique partnerships of Digital Catapult, BT, PTC, IBM, ServiceNow, Semtech and Texas Instruments

Maturity/TRL:

Technology Readiness Level

1 > 2 > 3 > 4 > 5 > 6 > 7 > 8 > 9

Applications:

- Benchmarking of a solution/product with respect to other products/solutions on the market
- Identification of product improvements and support for product roadmaps



DIGITAL CATAPULT – UK



Accelerating Al startups

Increasing AI adoption in Industry

Leading on applied AI Ethics









AI Compute, Machine Learning and AI Ethics Capability.

- **Function**: Artificial Intelligence and Machine learning can enable new services and innovations. However, smaller and medium AI startups often lack the resources to test their solutions at large scale. By offering access to compute resources, either cloud based or physical machines at our offices, Digital Catapult can help to alleviate this issue.
- Principle:
 - Time and support on internal infrastructure (access to two DGX1 servers)
 - Ethics Support
 - Combined Al/IoT Technical support
 - Access to cloud credits/vouchers
- Uniqueness:
 - In AI specific solutions, Digital Catapult already supported over 90 startups across multiple industries
 - Access to resources provided by Google, Nvidia, AWS

- Maturity/TRL:
 - Technology Readiness Level
 - 1 > 2 > 3 > 4 > 5 > 6 > 7 > 8 > 1
- Applications:
 - Support early stage AI startups to bring new products to market in an ethical and efficient way
 - Access to compute for resource constrained startups/smaller SMEs
 - Al ethics advice for startups, smaller and larger SMEs



Partners and collaborators







https://bit.ly/2W1 WI3K https://bit.ly/2Swt MOQ

Digital Catapult

12

Marie Sophie MASSELOT

SECURE infrastructure for trusted IoT platform

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- Function: security infrastructure establishing an environment to isolate trusted code executed or data manipulation by an IoT platform from an untrusted world
- Principle:
 - Integration of a secure hardware module
 - Integration of a trusted OS isolated from Linux with hardware mechanisms
 - Drivers and software bricks to drive the secure hardware module inside the trusted OS
 - Interfaces between untrusted world and trusted world to drive the secure hardware module.
- Key Performances:
 - The security hardware module accesses and sensitive data manipulation are hardware isolated from untrusted OS
 - Trusted applications can be developed to have secure services interfacing with untrusted OS
- Uniqueness:
 - Hardware isolation from an untrusted world for secure hardware module accesses
 - Stack in trusted OS for hardware secure module accesses
 - Bridge between untrusted OS and trusted world

Maturity/TRL: Technology Readiness Level

- **Applications:**
 - Any application using a set of IoT devices to collect personal and/or critical data
 - Support for IoT applications developers to secure their product
 - Smart factories, Energy production and distribution, Healthcare, critical infrastructure

Example of SECURE infrastructure implementation using STM secure elements STM32 and TPM with Linux

IKERLAN

Jesus RUANO LOPEZ

Information and Communication Technologies

IoT & Digital Platforms

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- Short-range IoT connectivity:
 - BLE, ZigBee, NFC, UWB, WiFi.
- Long-range connectivity:
 - Non-licensed bands: LoRa, Sigfox.
 - Licensed bands: 2G/3G/4G (NB-IoT, LTE-M) and towards 5G.
- IoT / IIoT protocols and interoperability:
 - MQTT, CoAP, DDS, LwM2M, AMQP, Websoket, NodeRed, etc.
- Indoor (UWB, BLE) and outdoor (GPS, GNSS, cellular) location
- Intelligence of Things:
 - IA + ML on edge nodes.

Data Analytics & Artificial Intelligence

- Smart Digital Platforms:
 - Highly scalable.
 - Public, private and hybrid cloud architectures.
- Artificial Intelligence and Data Analysis:
 - Predictive maintenance.
 - Data Lakes for Data Analytics.
- Data interpretability and Al-algorithms:
 - Smart Digital Platforms
- Smart Interaction with data platforms :
 - Natural interaction with data (chatbots, etc.).
- Development of platforms based on micro-services and "serverless"

Dependable Embedded Systems

- Function: Development of dependable systems by experts on safe software engeenering and real-time electronics
- Principle:
 - Embededd Systems developement certified up to SIL4
 - Software development and virtualization for real-time control
 - Automated Testing and Validation (HiL)
 - Artificial vision for embedded safety
- Key Performances:
 - +20 years experience on electronic and safe embedded systems developement
 - Safety Certified methodology (TÜV)
- Uniqueness:
 - +10 Fuctional Safety Engeeniers
 - 1 Fuctional Safety Expert (unique in Spain)
 - Referential on the development of advanced and safe functionality executed in complex chips (SoC, multicore, GPUs)

Maturity/TRL:

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Technology Readiness Level

$1 \ 2 \ 3 \ 3 \ 4 \ 5 \ 5 \ 6 \ 7 \ 7 \ 8 \ 9$

Applications:

- Development of software for control-units on transport (e.g., traction, elevation)
- Development and validation of up to SIL4 certified applications (e.g., railway signaling)
- Virtualization of applications and plants (e.g., an elevation system)

HW and Communication Systems

HARDWARE SYSTEMS (HWS)

·**HW** developments:

- · Sensorization solutions
- $\cdot\,$ Low consumption electronics
- · Signal conditioning

SW developments

- System software (operating system, drivers)
- FPGA and programmable logic

·Integration and assembly

- Electronic cards mounting (PCB assembly)
- Extreme conditions / hostile environments •Non functional developments
- · Standards compliance
- **Tests** and troubleshooting (**EMC**, electrical security, environmental)

╤COMMUNICATION SYSTEMS (KOS)

·Industrial connectivity

- Wireless & Wired solutions fot embedded systems
- \cdot Wired

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·Real-time communications

· Applied to **industrial** control and sensorization

·Antennas

· Design, simulation and characterization

·Verification and validation

· Wireless communication systems

Industrial Cybersecurity

- Function: Protection of embedded electronic systems and digital platforms (from sensors to cloud)
- Principle:
 - Secure Product Development
 - Cybersecurity Evaluation
 - Industrial IoT Cybersecure Communications
 - Cybersecure Cloud and User Interfaces
- Key Performances:
 - Security Life-Cycle and Certification
 - Trust Technologies based on Distributed Ledger Technologies
- Uniqueness:
 - Certified methodologies and addressing compliance with product cybersecurity standards
 - Cybersecurity solutions covering the entire value chain: from the sensor, the electronics, the embedded software, the connectivity solution, the processing and data ingestion platform, to the analytics and its advanced display

Maturity/TRL:

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• Technology Readiness Level

$1 \ 2 \ 3 \ 4 \ 5 \ 6 \ 7 \ 8 \ 9$

- Applications:
 - Cybersecure embedded systems evaluation and development
 - End-to-End Industrial IoT cybersecure communications
 - Cybersecure digital platforms for CPS monitoring and

IKERLAN - SPAIN

& TECHNOLOGY ALLIANCE

AI-powered Digital Platforms

• **Function**: Digital Platform to provide tools to develop Al-powered fog/edge-to-cloud solutions.

• Principle :

- Fog/Edge-to-cloud dynamic architectures.
- AI-powered Digital platform scenario.
- Microservices oriented edge devices architecture.
- Uniqueness:
 - Artificial Intelligence → fog-to-cloud architecture.
 - **Microservices based architecture**→ Deployment of AI-models to the edge.
 - Edge computing → Early analytics in the edge node to reduce delay.

Maturity:

1 > 2 > 3 > 4 > 5 > 6 > 7 > 8 > 9

- Heterogenous cloud architecture (private, public and hybrid).
- Smart Data Lakes provisioning.
- Microservice-oriented service deployment.

• Key performances:

- Al-powered Digital Platform.
- Data Lake provision for Data analytics.
- Al-powered predictive techniques.

Applications:

- Industry 4.0 & Smart Factories.
- Smart Cities.
- Smart Living and Ageing Well.
- Smart Mobility.
- Smart Buildings.
- Etc.

AUTONOMOUS WIRELESS SENSOR NODE

 Function: detect temperature and acceleration events, wireless data transmission, energized by harvester

• Principle :

- Several transducers for sensing
- Indoor photovoltaic cells (off-the-shelf)
- Uniqueness:
 - **Zero power** \rightarrow sense & harvest at the same time
 - High processing capabilities → no need of radiator and can be flexible
 - Robust and synchronized communications

Maturity:

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1 > 2 > 3 > 4 > 5 > 6 > 7 > 8 > 9

- Complete prototype (with RF) is working
- Miniaturization in progress
- Additional sensing and optimization in progress

Key performances:

- Sensing data local processing
- Wireless robust coms (BLE, TDMA based)
- Up to +-16us accuracy
- Applications:
 - Smart logistics, smart factory: impact and temperature measurements
 - Industrial environment Indoor sensing

Safe and real-time software upon commercial HW

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- **Function**: embed real-time and non-real time software on safety certified context.
- Principle :
 - Selection of multicore commercial HW
 - Integration of an embedded hypervisor
 - Software development based on modeling
 - Safety concept based on industrial machinery standard (ISO13489)
- Uniqueness:
 - Affordable cutting-edge HW
 - Simplification of complex SW development
 - Safety cognizant

- Maturity:
 - Integrated in product
- Key performances:
 - Safety up to PL-D level (SIL-2)
 - x1,5 performance
- Applications:
 - Wind-turbine control
 - Operation monitorization
 - Local recording of key variables

BME

14/10/2020

Introduction

• Every digital solution involves realization of some hardware...

- The solution must be safe, secure and reliable this is not only a software issue...
- Key elements of an IoT/CPS based solution are *longevity* and energy efficiency
- BME's technolgy offer addresses these:
 - General to every smart system:

Versatile Reliability Tester – test methods and tools for assessing how smart hardware will likely to behave under application conditions

 Specific to smart solid-state lighting system: LEDbeSmart – modelling methodologies and workflow for optimized LED based application design

DigiFed offer at BME

Technologies at BME offered for **application experiments**:

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- Versatile Reliability Tester test methods and tools for assessing how smart hardware will likely to behave under application conditions
- LEDbeSmart modelling methodologies and workflow for optimized LED based application design

Versatile Reliability Tester

- Function: The reliability test environment integrates a set of appropriate hardware and software components built around the de facto industry standard T3Ster equipment of Mentor Graphics. This versatile system monitors the electric, thermal and even optical parameters of the device under test during freely customizable test sequences.
- Principle:
 - Power/temperature cycling,
 - optional RH tests
 - In-situ hermal transient measurements and stucture function analysys of the DUTs during cycling
 - Options to measure other performance indicators of DUTs
- Guidelines:
 - Environmental and endurance test methods for semiconductor devices: <u>https://home.jeita.or.jp/tsc/std-pdf/ED-4701_100.pdf</u>
 - Whitepaper on an application:

G. Hantos, J. Hegedüs, M. Rencz and A. Poppe, ", **Aging tendencies of power MOSFETs — A reliability testing method combined with thermal performance monitoring**", The 22nd International Workshop on Thermal Investigations of ICs and Systems (THERMINIC), Budapest, 2016, pp. 220-223.

https://doi.org/10.1109/THERMINIC.2016.7749055

Maturity/TRL:

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• Technology Readiness Level

- Applications:
 - Cycling and structural integrity test of RF modules, sensors, PSUs, drivers, LEDs, FETs
 - LED luminaires' thermal assessment
 - When designed properly, applicable to certain reliability assessment of DigiFED demonstration systems

LEDbeSmart: background for energy saving

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- At constant forward current with
 decreasing junction temperature
 efficiency and efficacy increase
- This results in **increasing light Output** of luminaires
- Street-lighting luminaires are designed for the highest possible ambient temperature
- Power saving potential by adaptive dimming
 - In Colder weather conditions the forward current can be reduced ...

... while the light output remains constant

Cconstant light output (CLO) operation

- Changes in light output characteristics of SSL devices are compensated:
 - to assure consistent visual comfort
 - to possibly improve product reliability
 - to achieve additional power savings throughout the entire product life span

LEDbeSmart overview

BME proposes a methodology to develop LED based applications in which physical prototyping is almost avoided...

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- Design optimization is performed fully by digital means
- Reduce development time and cost by replacing physical prototypes by virtual prototypes

- Methodology:
 - virtual prototyping based on the <u>Delph4LED</u> industry 4.0 design workflow
 - simulation experiments to explore the target parameter space (temperature, current, elapsed life-time, luminous flux)

LEDbeSmart overview

 Function: complex testing, modelling and simulation methodology for LED luminaires to achieve reduced power consumption and improved reliability

Principle:

- **Constant light output (CLO) control** realized through multidomain, embedded digital twin of the LED luminaire
- Temperature compensation of the LEDs' driving current
- CPS approach in the implementation: luminaires with communications & "self-awareness" (sensors + edge computing)
- Key Performances:
 - Predicted annual power saving: ~6-8%
 - With pre-compensation for LED ageing total power saving further reduced over the entire product lifetime
 - With a fully digitalized product optimization workflow there is a substantial potential for reducing development reductions*
- Uniqueness:
 - CLO control scheme based on the LEDs' actual multidomain characteristics
 - Prepared for future predictive maintenance approaches

*Demonstration experiments in the Delphi4LED project reported 30-40% development cost reduction, depending on the company profile.

Maturity/TRL:

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- Technology Readiness Level
- 1 > 2 > 3 > 4 > 5 > 6 > 7 > 8 >

Applications:

- LED based streetlighting / tunnel lighting
- Methodology can be adapted to other LED lighting applications such as automotive headlights

102%

100%

98%

96% 94% 92%

900

88%

20 000

40 000

Constant current mode

Time [hours]

Isoflux mode

- · – L(90) limit

60 000

ption TNOM=27 * LEDO h_LEDO_0 LEDO 0 27.9011 h_LEDO_LED1 LED0 LED1 22

Rth_LED1_LED2 LED1 LED2 25 Rth_LED1_LED3 LED1 LED3 48

Rth_LED46_LED47 LED46 LED4' Rth_LED47_0 LED47 0 48.985(

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BME-DIH's DigiFED offer

LEDbeSmart way of working

LEDs tested according to the latest LED testing standards and recommendations (CIE, JEDEC)

Principle: Virtual prototyping using the Delphi4LED Industry 4.0 workflow

Application use-case, implementation : *temperature compensated CLO*

 BME performs luminaires' system level simulation to identify the I_F(T_{amb}) function that assures constant luminous flux output

BME and Partner decide together how to implement the in the actual luminaire the $I_F(T_{amb})$ function that assures constant luminous flux output

- Partner implements the corresponding embedded luminaire model
- BME provides test facilities to check the implementation

Relative Luminous flux vs. ambient temperature

Temperature dependence of luminaires' total light output tested in a climate chamber

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BME-DIH's DigiFED offer

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Important DigiFed links

- Website: https://digifed.org/
- Open Call for Application Experiments: <u>https://digifed.org/explore/open-calls/</u>
 - Guide for applications
 - <u>Application portal</u>

• BME contact for AEs: Andras Poppe andras.poppe@vik.bme.hu

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Q&A SESSION

Time for you to ask your questions