Welcome

At this table, you can’t speak, and it is normal.

To zoom in and out
To display the presentation full screen
To chat with us
Agenda

• Introduction, objectives and agenda (10 minutes)

• Partners’ presentations
  • University of Ljubljana
  • IKERLAN
  • Digital Catapult

• Open floor discussion with Q&A
IoT & AI technology support services from University of Ljubljana

Electrical switch with Ethereum support
IoT prototyping & service design
Percipio<BigData> analytics tool

Prototype supporting interesting use-cases
Open source platform
BigData analytics

University of Ljubljana
Faculty of Electrical Engineering
**SWETHER - Electrical switch with Ethereum support**

- **Function**: IoT-Blockchain Prototyping kit
- **Principle**:
  - End-to-end prototype kit
  - Control electrical switch via blockchain transactions
- **Application cases**:
  - Charging of electric vehicles,
  - Arbitrary control of IoT devices,
  - Device-to-device transactions and interactions.

**Maturity/TRL**:
- Technology Readiness Level
  - 1 2 3 4 5 6 7 8 9
IoT prototyping & service design

- **Function:** Integration of commercial IoT sensors & platform and implementation consultation
- **Principle:**
  - Capacity to develop own IoT boards,
  - due to popular demand we can help develop services on widely available commercial platforms such as: Libelium, Raspberry Pie, Arduino,…
  - Sensors based on context and environment
  - Proper mode of connectivity 4/5G, LPWAN (LoRa, NB)
  - Various modes of computing/databases
- **Cases:**
  - Smart City,
  - Smart Agriculture,
  - Smart Industry,…

- **Maturity/TRL:**
  - Technology Readiness Level
  - 1 2 3 4 5 6 7 8 9

IoT Components
- Semantics
- Services
- Computation
- Communication
- Sensing
- Identification
percipio<BigData> analytics tool

- **Function**: Big Data Analytics Tool: „Find the (un)known unknowns and discover new insights!“

- **Principle**:
  - Context selection
  - Correlation and trends dashboard

- **Key Performances**:
  - Sources
    - 250M tech and sci articles
    - Patents
    - Web and social media

- **Maturity/TRL**:
  - Technology Readiness Level
    - 1 2 3 4 5 6 7 8 9
IKERLAN in a Nutshell

Since 1974!

- 350 high-skilled professionals
- 150 ICT professionals
- 24.1 M€ turnover
- 13 M€ technology transfer projects
- 2 M€ investment in world-class labs
- 10 M€ fundamental research
- 45 PhDs
Information and Communication Technologies

**IoT & Digital Platforms**

- **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, Websocket, 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 AI-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 in safety and real-time electronics engineering
- **Principle:**
  - Embedded Systems development 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 development
  - Safety Certified methodology (TÜV)
- **Uniqueness:**
  - +10 Functional Safety Engineers
  - 1 Functional Safety Expert (unique in Spain)
  - Referential on the development of advanced and safe functionality executed in complex chips (SoC, multicore, GPUs)
- **Maturity/TRL:**
  - Technology Readiness Level
  - 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**

- HW developments:
  - Sensorization solutions
  - Low consumption electronics
  - Signal conditioning
- SW developments
  - System software (OS, 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**

- Industrial connectivity
  - Wireless & Wired solutions for embedded systems
- Wired
- Real-time communications
  - Applied to industrial control and sensorization
- Antennas
  - Design, simulation and characterization
- Verification and validation
  - Wireless communication systems
  - In-house designed channel emulator
Industrial cybersecurity

- **Function:** Protection of embedded electronic systems and digital platforms
- **Principle:**
  - Embedded System Security
  - Security Evaluation
  - Cybersecure IoT, 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:**
  - Technology Readiness Level
    - 1 2 3 4 5 6 7 8 9
- **Applications:**
  - Cybersecure Digital platform and IIoT oriented to teleservice.
  - Cybersecure Digital platform for fleets of automatic warehouses. Multi-business deployment, multi-warehouse
EXAMPLES
AI-powered Digital Platforms

- **Function**: Digital Platform to provide tools to develop AI-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**:
  - Heterogenous cloud architecture (private, public and hybrid).
  - Smart Data Lakes provisioning.
  - Microservice-oriented service deployment.
- **Key performances**:
  - AI-powered Digital Platform.
  - Data Lake provision for Data analytics.
  - AI-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, energy-harvesting

- **Principle**:
  - Several transducers for sensing
  - Indoor photovoltaic cells (off-the-shelf)

- **Uniqueness**:
  - **Low power** → sense & harvest at the same time
  - **High processing capabilities**
  - **Robust and synchronized** communications

- **Maturity**:
  - 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
Safety and real-time software on COTS platforms

- **Function**: Certification of embedded real-time and non-real time software
- **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

30.11.2020
IoT Benchmarking: the Future Networks Lab

A unique facility that is fast forwarding the adoption of future networks technologies to deliver value to industry

Infrastructure: LoRaWAN, Sigfox, NB-IoT, 5G

Keysight N6705C DC power analyzer
Redwood 5020A LoRaWAN tester
RSC Step Attenuator

11 LoRaWAN GWs geolocation testbed in London

Expertise
• short-range: 802.15.4, BLE, RFID, NFC, UWB, WuR
• long-range: LoRa (LoRa2.4), LoRaWAN, Sigfox, NB-IoT
• multi-radio platforms
• testing and benchmarking methodology
• test plans and reports
IoT Benchmarking: tests

Power consumption laboratory tests
• Current/power consumption measurements
• Active/inactive states of a device
• Report: peak current, current/power per state
• Battery lifetime estimation for specific application/use-case

Communication performance tests
• Connectivity assessment indoor/outdoor
• Test different antenna orientations, heights from ground, communication and application parameters
• Report reliability, accuracy, and others (e.g., RSSI, SNR)

Device characterization
• Configurability, programmability
• I/O capabilities, built in sensing capabilities
• Mechanical properties
• Usability
From electrons to Edge and Cloud

We can provide advice and support wrt:

**Hardware**
- Local buses: I2C vs SPI
- Modules, SiP, SOC
- Sensors
- Low power modes and sequencing
- AI processors
- Crypto ICs

**Communications**
- L1/L2/L3/messaging protocols
- LoraWAN gateways
- FUOTA
- Industrial legacy protocols (e.g. Modbus)
- Heterogeneous networks
- Platform integration: e.g. getting data from TTN

**Software**
- low-power AI: TinyML and Tensorflow Lite for Micro
- embedded OSes, embedded Linux
- IoT gateway SW stacks

**Other success factors**
- UI/UX
- Dashboard design
- Adding intelligence
- Partnerships
- Hardware as a Service business model
Getting from TRL3 to pre-production

Report making your journey to production faster and less risky.

Why are connected products different and more difficult?

- Asking the right questions at the different stages of your project
- Realistic budgets
- Design to cost – Design for manufacturing
- IP protection

A tangible IoT solution with measurable innovation-based ROI

A roadmap for the route to scale deployment to address your business needs

Download it here: https://bit.ly/3avHmZg
Writing convincing IoT project proposals

Read Section 5.3 Evaluation and score carefully!

<table>
<thead>
<tr>
<th>EXCELLENCE</th>
<th>IMPACT</th>
<th>QUALITY</th>
<th>BUSINESS CASE</th>
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- Remember that projects are for up to 12 months only, add Gantt charts, make sure you plan for prototype building (component lead times...), measurements against initial objectives/metrics during pilot and second version based on pilot results.

- Show progression through TRL levels over time. Might include plan for BOM optimisation, design to cost, pre-certification for example.

- Add a risk mitigation table. Pilots rarely go without hiccups (to setup and to run), so be realistic and think about what might cause deviations from original plan, e.g., network/communications, Cloud setup, etc.

- Be realistic about timeframes (Add contingency factor) and remember that it will also take time/manpower to get familiar with platforms and more importantly write the deliverables.
AI/ML at the Digital Catapult

Accelerating AI startups

Increasing AI adoption in Industry

Leading on applied AI Ethics

MACHINE INTELLIGENCE GARAGE

SIEMENS

NEURAL INFORMATION PROCESSING SYSTEMS
AI Compute, Machine Learning & AI Ethics Capability

- **Function:** We are able to offer a specialised acceleration programme, that addresses the challenges that today’s artificial intelligence (AI) and machine learning (ML) startups face.

- **Principle:**
  - Time and support on internal infrastructure (access to two DGX-1 servers)
  - Ethics Support
  - Combined AI/IoT Technical support
  - Access to cloud credits/vouchers

- **Uniqueness:**
  - We have already supported over 90 startups across multiple industries (raising £38m in equity investment over 2 years)
  - Access to resources provided by Google, Nvidia, AWS, EPCC, Graphcore and more
  - Industry leading AI Ethics expertise through our Ethics Steering and Advisory boards

- **Maturity/TRL:**
  - Technology Readiness Level
    - 1 2 3 4 5 6 7 8 9

- **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
  - AI ethics advice for startups, smaller and larger SMEs
Technology partners and collaborators
Examples of tailored support for AI startups

**Tailored MI Garage support activities**

- Technical Office hours with the AI/ML team to design a support plan
- Supported onboarded to compute infrastructure (cloud or on-premise)
- AI Ethics consultation with members of our expert AI Ethics advisory board to discuss and mitigate potential ethical issues

**Technical, business and ethics workshops**

- Design tools for AI: Human Centred Design for AI startups
- AI & IoT Workshop: Deploying AI at the edge
- AI Platforms and Architecture workshop: Building for scale
Recent publications

Lessons in practical AI ethics: Taking the UK’s AI ecosystem from ‘what’ to ‘how’

https://bit.ly/2SwtMOQ

Machine Learning Platforms

Using, extending and creating platforms to accelerate machine learning efforts and generate growth

Research report 2019

Introduction to the Q&A session
Q&A session

Activate your camera

Activate your microphone

Grab your bubble and move around the room to meet the experts
Q&A session