ThingsOnInternet

Sistemi IoT non invasivi per l'efficientamento della produzione

The Industrial Internet of Things has been heralded primarily as a way to improve operational efficiency. But in today's environment, companies can also benefit greatly by seeing it as a tool for finding growth in unexpected opportunities.

In the future, successful companies will use the Industrial Internet of Things to capture new growth through three approaches: boost revenues by increasing production and creating new hybrid business models, exploit intelligent technologies to fuel innovation, and transform their workforce.

https://www.accenture.com/us-en/_acnmedia/Accenture/next-gen/reassembling-industry/pdf/Accenture-Driving-Unconventional-Growth-through-IIoT.pdf

By Paul Daugherty, Prith Banerjee, Walid Negm and Allan E. Alter

INDUSTRIAL IOT: STAKEHOLDER

- **Manufacturing companies and warehouses** aim to monitor their production processes by acquiring data from old and new machines produced by different vendors;

- **Industrial machines producers** aim to innovate the marketed products with on-board data analysis and remote maintenance features;

- **System integrators** aim to provide solutions that fit with different enterprise infrastructures with result-driven solutions;

INDUSTRIAL IOT: THE CHALLENGE

The Industrial Internet of Things (IoT) is therefore a **concrete opportunity** of innovation for small and large enterprises. The digitalization of industrial processes (Industry 4.0) is a **trending topic** that includes the IoT as a core capability.

However, the digitization of industrial environments is often limited by practical **obstacles**:

- Replacing existing machines can be very expensive;
- The machines' output data is often locked by vendors, making it hard to integrated with 3rd party hardware/software;
- Industrial IOT gateways are usable only when digital data are accessible;
- General-purpose IOT Sensor platforms are versatile but hard to convert in "solutions";
- IOT platforms lock customers imposing their clouds.

4ZEROPLATFORM

TOI provides **4ZeroPlatform**: a plug-and-play data gathering, processing, and reporting solution for small and large enterprises who need to achieve full visibility and optimization of **Industrial Processes**.

Our technology includes a complete, adaptable and Machine/Cloud independent IoT Stack ranging from a smart acquisition unit (**4ZeroBox**) to Cloud analytics and dashboard (**4ZeroManager**).

The solution is compatible with modern and old machines, it can be easily integrated with already available **MES**, **ERP** and with the top **Cloud** services like Microsoft Azure, Amazon Web Services, Google Cloud Platform, IBM Bluemix and others

4ZeroBox

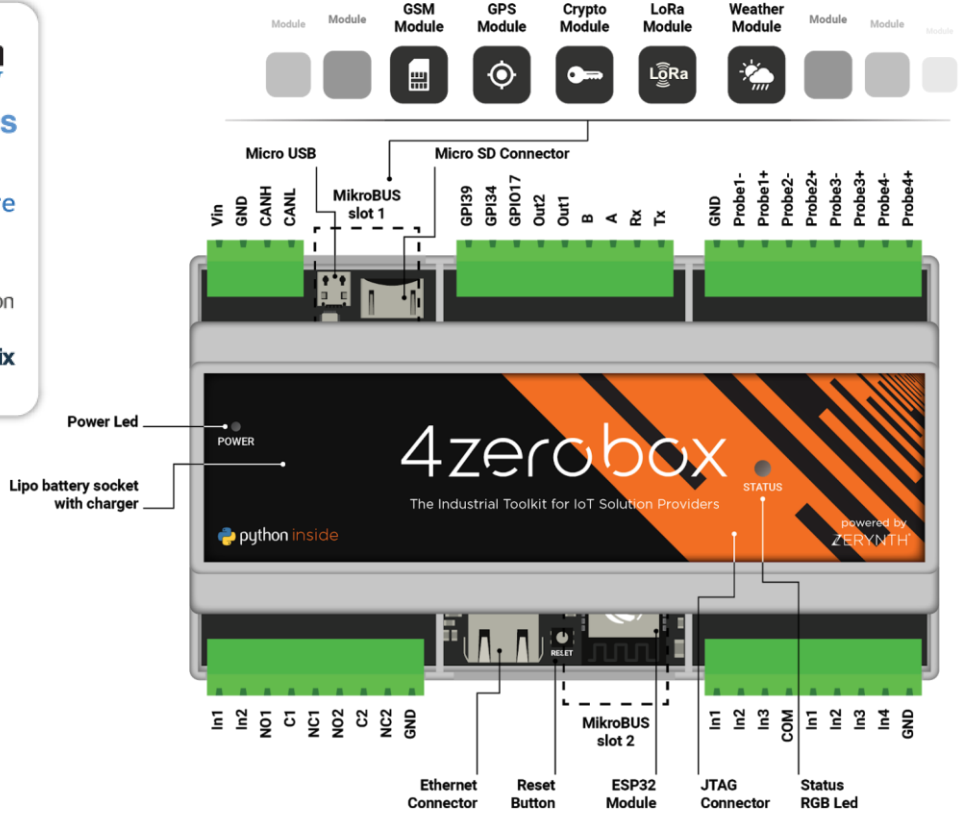
4ZeroManager

4ZEROBOX - HARDWARE SPECIFICATIONS

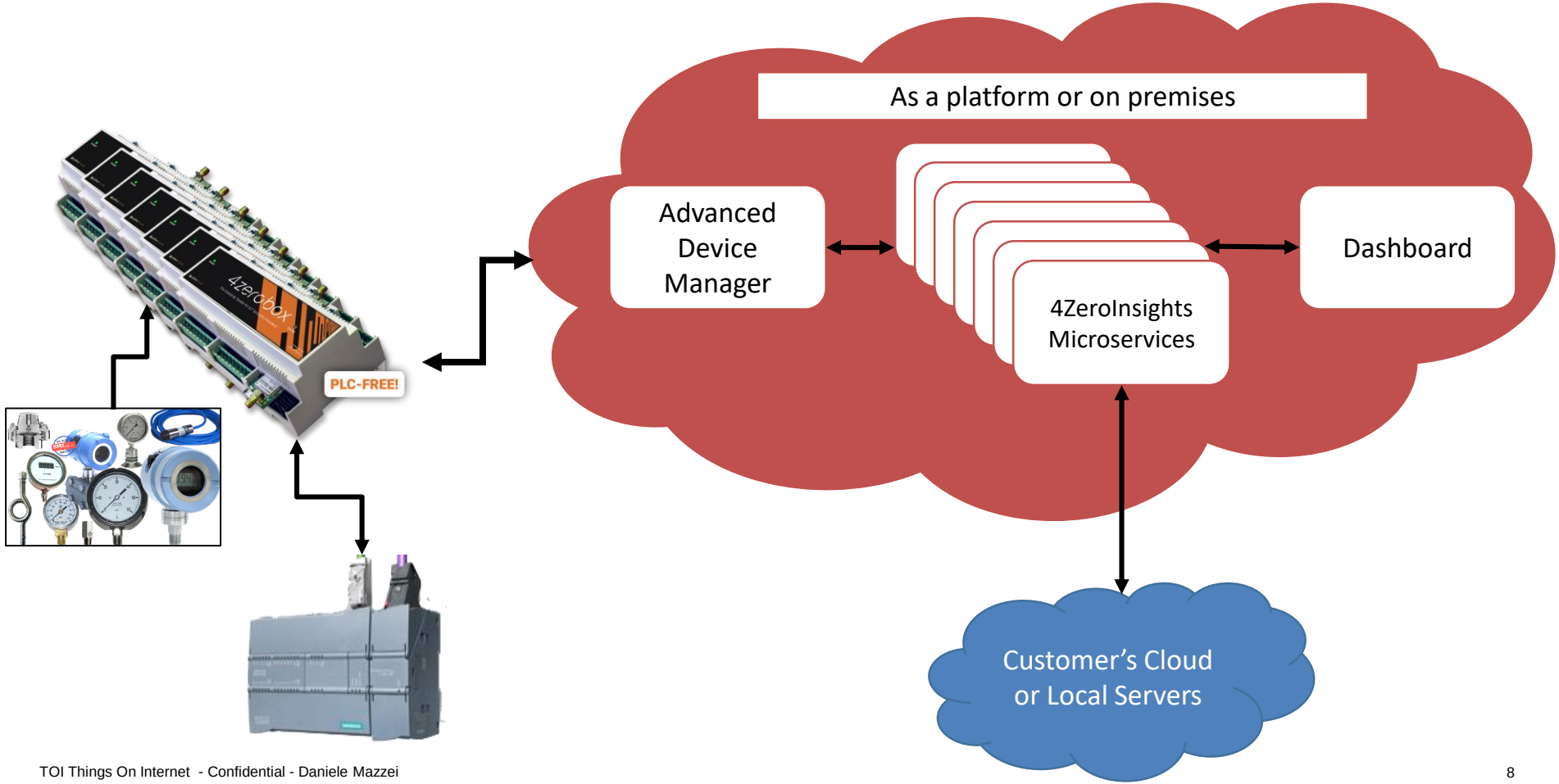
FEATURES

- DIN-rail mountable (9 slots)
- 7 to 28 V Power Supply
- 4 selectable analog input channels:
  - 4-20mA single-ended
  - 4-20mA differential
  - 0-10V standard
- 3 split core current sensor (non-invasive)
- 4 resistive sensor channels (RTD, contact, proximity, etc.)
- 2 opto-isolated digital inputs
- 2 sink digital output (60A @ 30V)
- MicroSD card slot
- 1 Digital I/O + 2 Digital Input (3.3V)
- 2 NO/NC Relay (10A @ 250V AC)
- Connectivity:
  - WiFi (Client and AP mode supported)
  - Bluetooth® Low-Energy
  - Ethernet
  - RS-485 and RS-232
  - CAN
- 2 onboard mikroBUS sockets (hundreds of Click Boards available)
- LiPo battery support with onboard charging unit
- JTAG support
- RGB status led
- Espressif ESP32 - 32bit Microcontroller (240MHz clock, 4Mb of Flash, 312Kb SRAM) Python-Programmable thanks to Zerynth technology

Maximum expandability with **hundreds of Click Boards** available



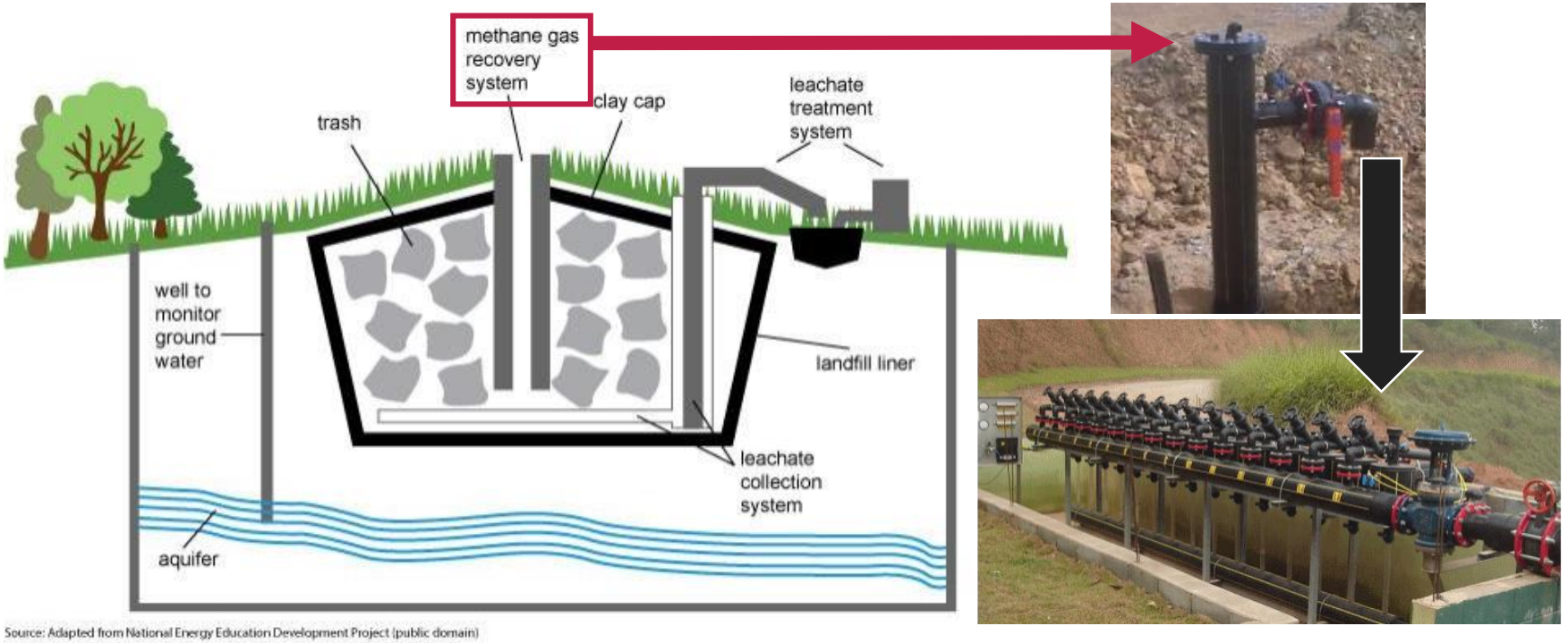
4ZEROMANAGER



Applications

Ottimizzazione del processo di produzione biogas da stoccaggio rifiuti speciali

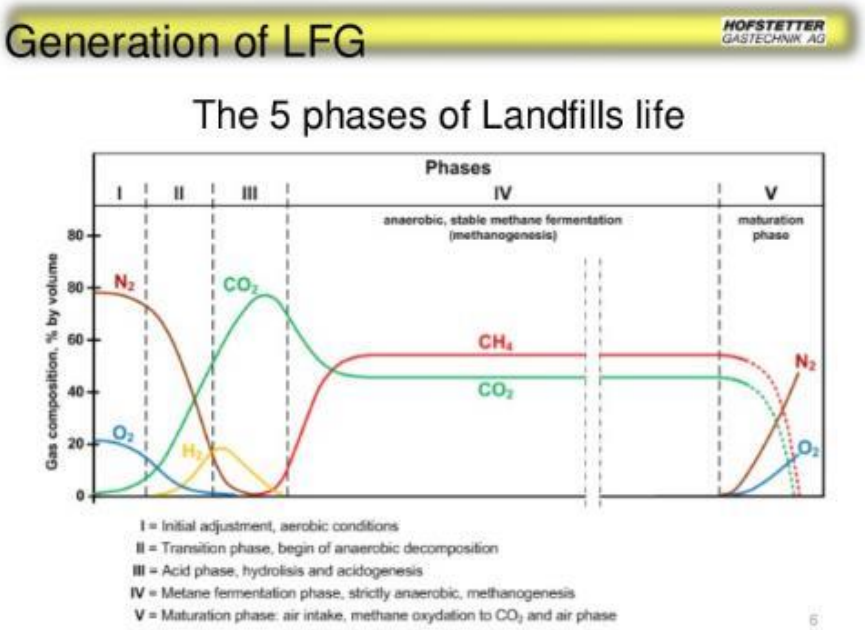
Biogas Production Monitoring in a Landfill



Source: Adapted from National Energy Education Development Project (public domain)

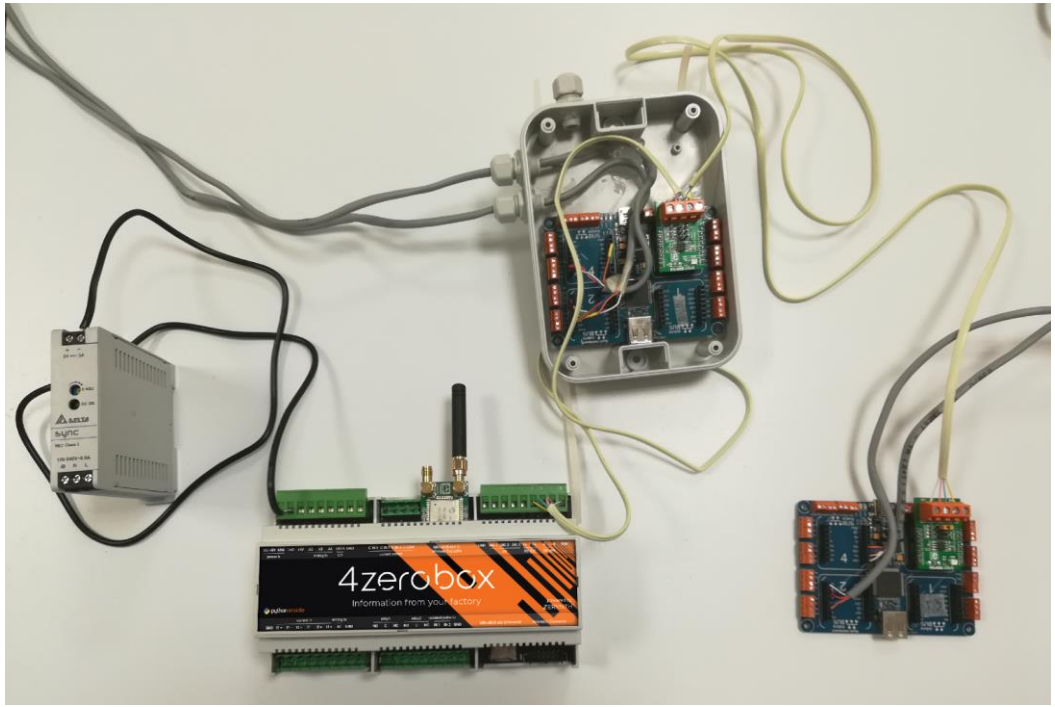
PRODUCTION CONTROL

1. **Maximize the amount of biogas extracted**
   a) Increase the energy production
   b) Reduce the amount of gas released in the atmosphere
      - Reduction of smell
      - Reduction of greenhouse gasses emission
2. **Maximize the percentage of methane in the Biogas**
   a) Improve performances of the generator engine
3. **Minimize the percentage of oxygen in the Biogas**
   a) Reduction of flammability risk
   b) Better combustion in the generator engine



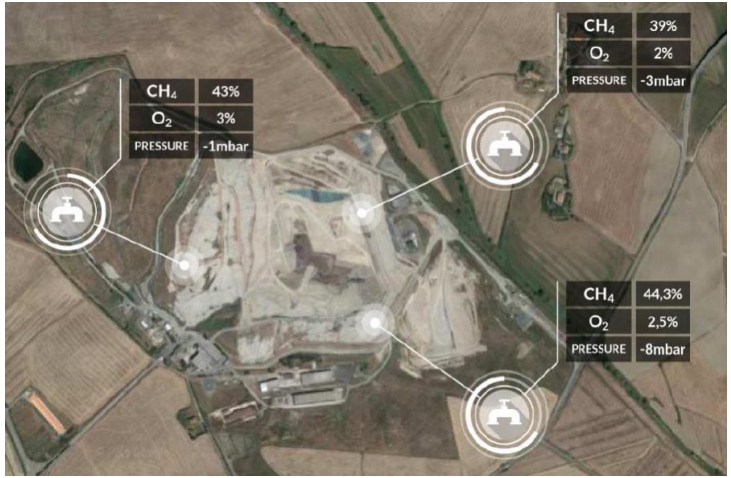
HARDWARE SETUP

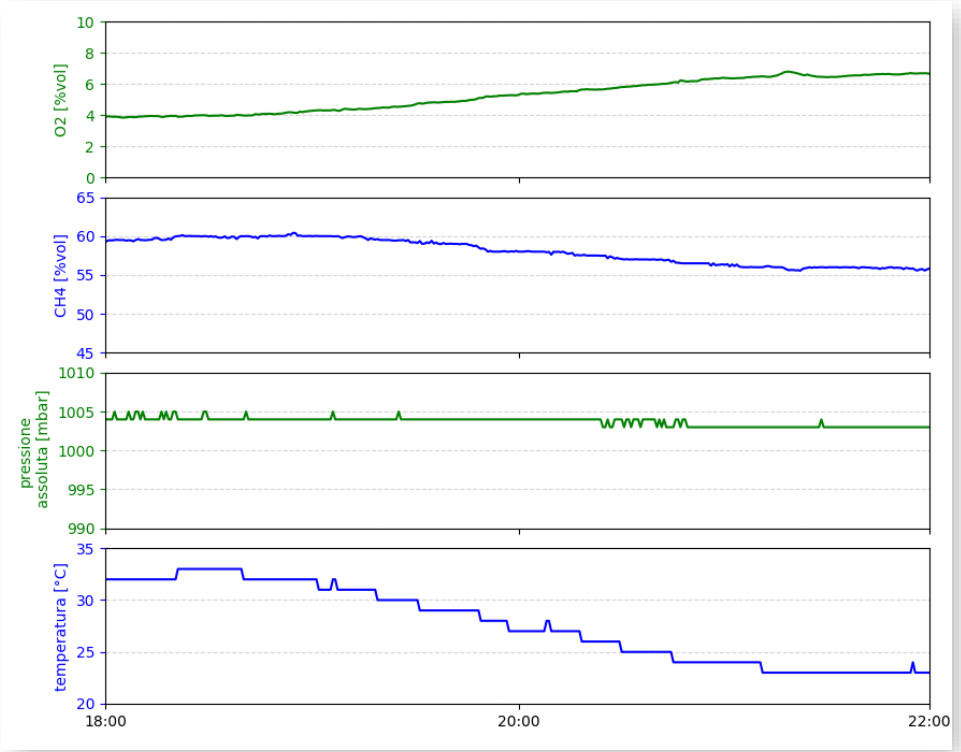
- CH4, O2, pressure, temperature and humidity sensors selection
- 4ZeroBox as data acquisition unit
- LoRa connection



CH_4 43%
O_2 3%
PRESSURE -1mbar
CH_4 39%
O_2 2%
PRESSURE -3mbar
CH_4 44,3%
O_2 2,5%
PRESSURE -8mbar

IMPROVING PROCESSES VISIBILITY





Applications

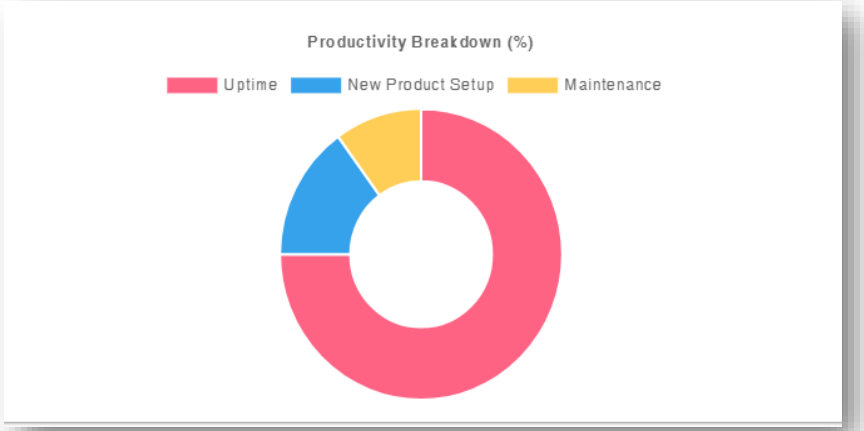
Calcolo automatico dell'OEE di macchinari «legacy»

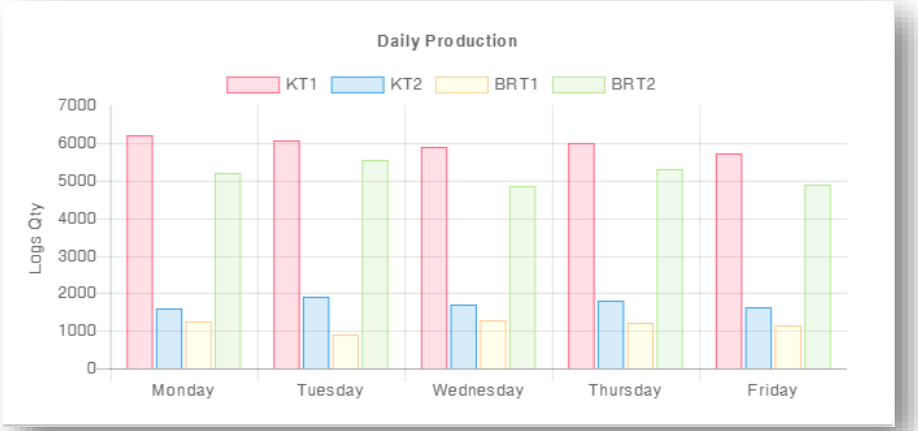
OPTIMIZING A CUTTING TOOLS PRODUCTION LINE

- Line composed of 4 PLC based CNC machines
- No access to PLC data, 4ZeroBox plugged in parallel to the PLC (retrofitting)
- Connection to the ERP simulated via imported CSV files (POC)
- Machine Learning algorithm for pattern recognition

	Data from the machine					Data from the company ERP server		
State	Semaphore Red lamp	Semaphore Yellow lamp	Semaphore Green lamp	Main Motor	Machine Window	Scheduled Maintenance	Scheduled Engineering	Scheduled Production
Nonscheduled	Off	Off	Off	Off	--	No	No	No
Unscheduled down	On (failure)	--	--	Off	--	No	No	Yes
Scheduled down	--	--	--	--	--	Yes	No	No
Engineering	--	--	--	--	--	No	Yes	No
Standby	Off	On (Waiting)	Off	--	Open	No	No	Yes
Productive	Off	Off	On (work in progress)	On	Closed	No	No	Yes

OPTIMIZING A CUTTING TOOLS PRODUCTION LINE



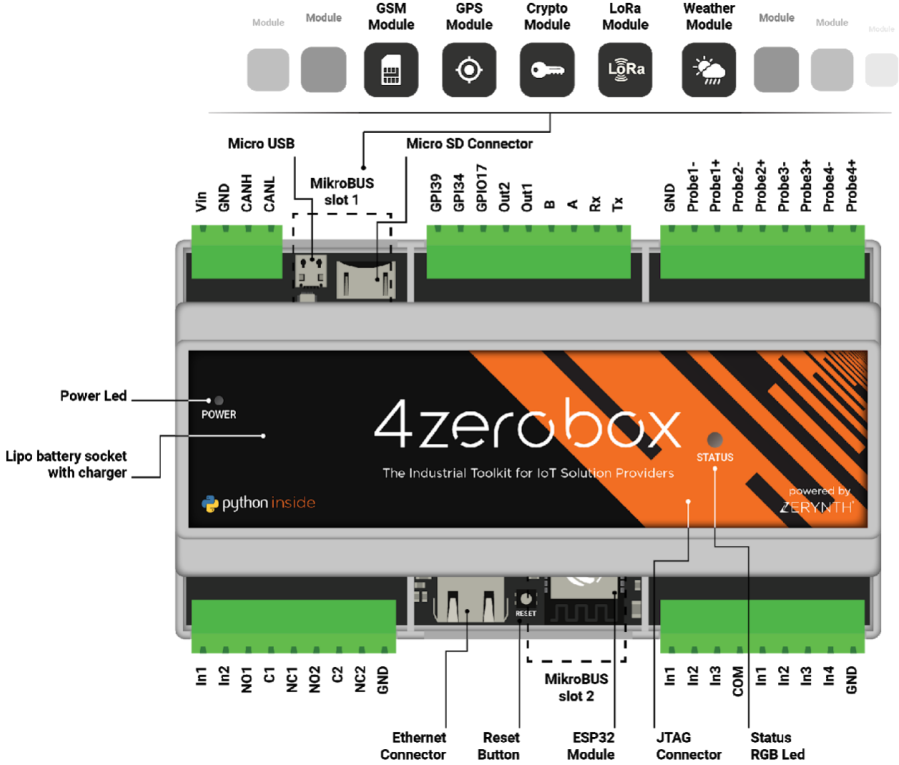


- **Plug and play OEE**
- **Plug and play "Time and Methods"**

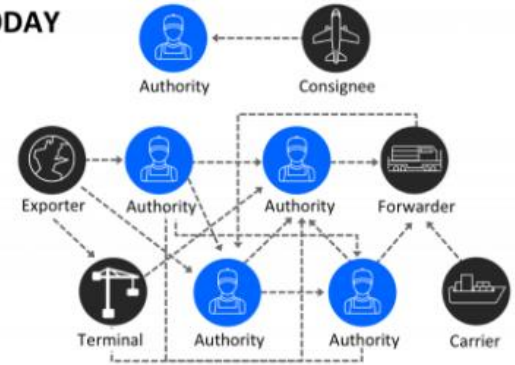
Coming soon…

The industrial Blockchain modem for 4.0

www.thingsoninternet.it



TODAY



- Inconsistent information across organizational boundaries and "blind spots" throughout the supply chain hinder the efficient flow of goods
- Complex, cumbersome, and costly peer-to-peer messaging
- Manual, time-consuming, paper-based processes
- Risk assessments often lack sufficient information; clearance processes subject to fraud
- The administrative cost of handling a container shipment is comparable to the cost of the actual physical transport

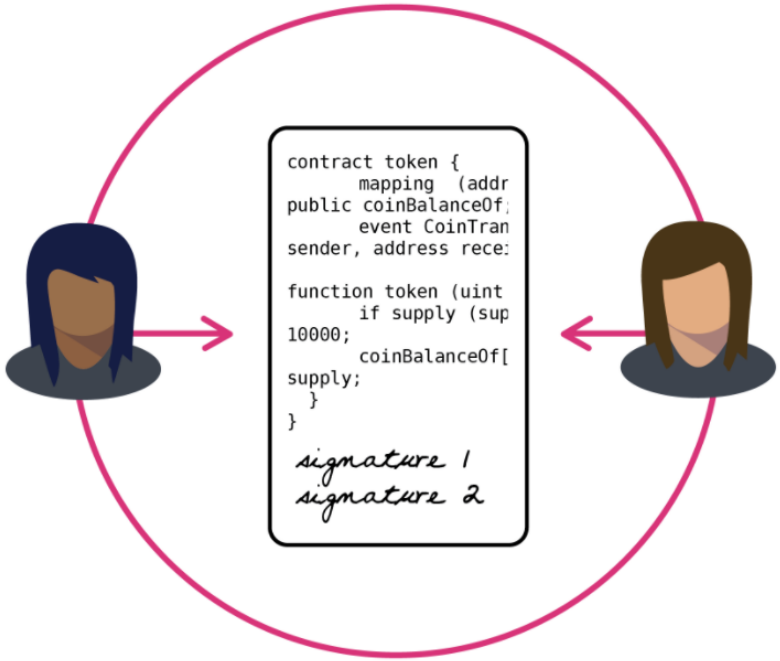
FUTURE

- Fast, secure access to end-to-end supply chain information; single source of the truth
- Verifiable authenticity and immutability of digital documents
- Trusted cross-organizational workflows
- Better risk assessments and fewer unnecessary interventions
- Far lower administrative expenses and elimination of costs to move physical paper across international borders

Blockchain Demo

Smart contracts

- A transaction is a function call
- The function is executed by a program (smart contract) on each blockchain node
- The result is immutably stored in the blockchain
- **“Code is Law”**



THANK YOU!

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