LIGHTKONE

LIGHTKONE Project

Lightweight computation for networks at the edge

See Web site:
lightkone.eu

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Edge computing (Internet of Things)

- Edge computing is the next big frontier for the Internet
  - In 2020 there will be 50 billion Internet of Things devices
  - In 2027 there will be >1000 IoT devices per human on earth

- Killer apps are rapidly appearing for edge computing
  - A good example is personal health monitoring: each human being will have a personal sensor array and a personal data center
  - Data streams from the sensor array are continuously analyzed using deep learning algorithms to detect early signs of health problems
  - This will reduce costs and increase quality of healthcare for all
  - For example: C. Stamate et al, "Deep Learning Parkinson's from Smartphone Data", IEEE PerCom 2017, March 2017

LightKone project in a nutshell

- LightKone: Lightweight computation for networks at the edge
  - H2020 Project ID 732505, Jan. 1, 2017 – Dec. 31, 2019
  - 9 partners (4 industrial, 5 academic), 3.57M€ budget
- The goal of LightKone is to develop a scientifically sound and industrially validated model for general-purpose computing on edge networks
  - This is a challenge because edge networks are heterogeneous, loosely coupled, highly dynamic, and unreliable (frequent partitions, frequent offline or failed nodes)
  - This is why today's computations are mostly done on data centers!
- We take up the challenge because edge networks have great potential:
  - Greatly increased scalability (edge devices *far outnumber* data center nodes)
  - Much lower latency (edge computing makes real-time control possible)
  - Increased resilience (the connection to the data center is a weak point)
  - Increased security (edge computing avoids data center security and privacy issues)
  - Local decision making ability (edge computing enables quick action in crisis situations)

Project partners

Academic / industrial partners

1.	UCL (Belgium)	Université catholique de Louvain (coordinator)
2.	UPMC + INRIA (France)	Université Pierre et Marie Curie + INRIA
3.	INESC TEC + UMinho (Portugal)	Instituto de Engenharia de Sistemas e Computadores – Tecnologia e Ciência + Universidade de Minho
4.	TUKL (Germany)	Technische Universität Kaiserslautern
5.	NOVA ID + UNL (Portugal)	Associação para a Inovação e Desenvolvimento da FCT + Universidade Nova de Lisboa
6.	Scality (France)	Scality
7.	Gluk (Netherlands)	Gluk Advice BV
8.	UPC + Guifi (Spain)	Universitat Politècnica de Catalunya (Guifi Community Network)
9.	Stritzinger (Germany)	Peer Stritzinger GmbH

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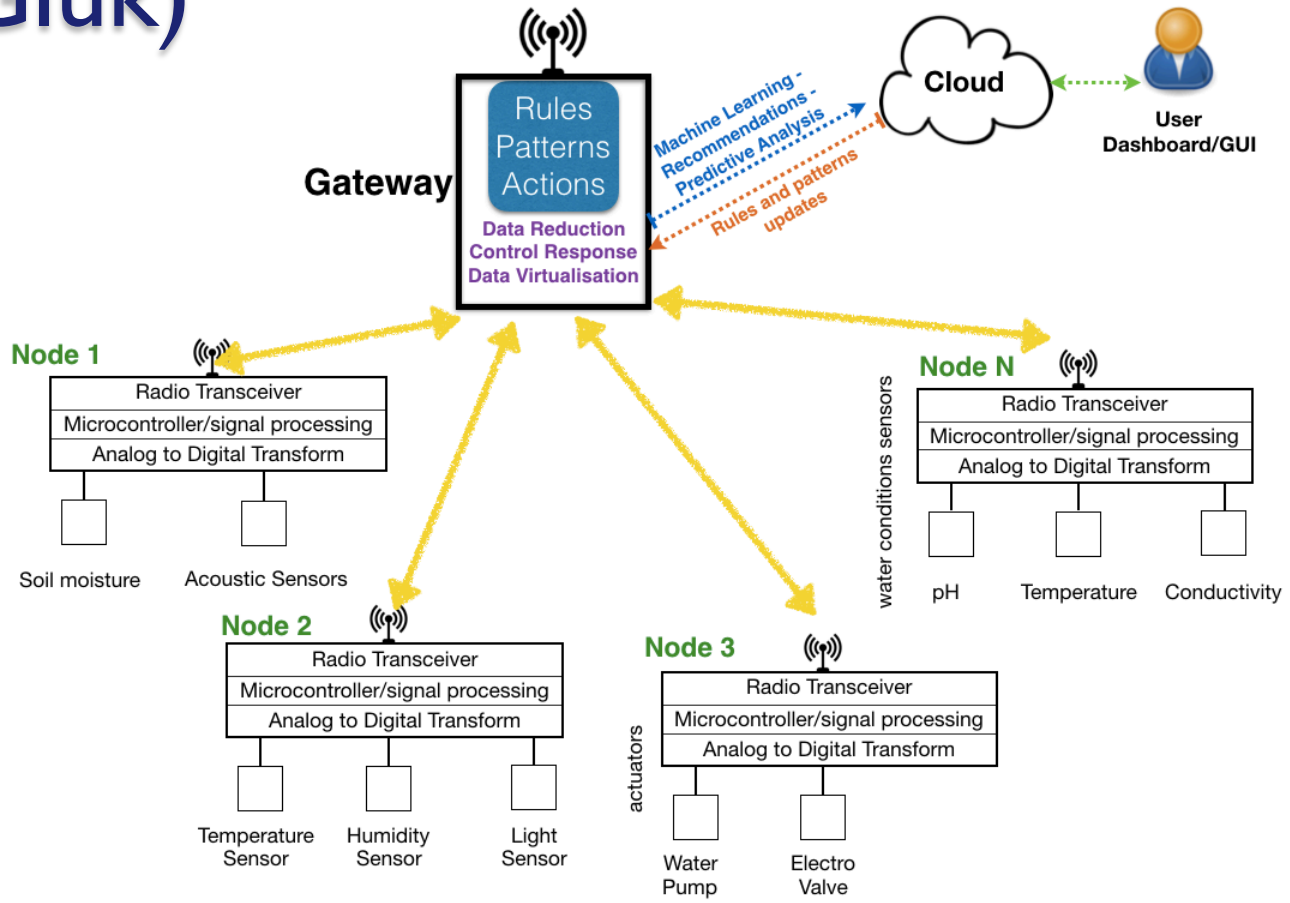
LightKone technology

LightKone combines two recent advances in distributed computing to enable general-purpose computing on edge networks:

- Synchronization-free programming: Large-scale applications can run efficiently on edge networks by using convergent data structures (based on **Lasp** and **Antidote** from previous project SyncFree)
  → tolerates dynamicity and loose coupling of edge networks

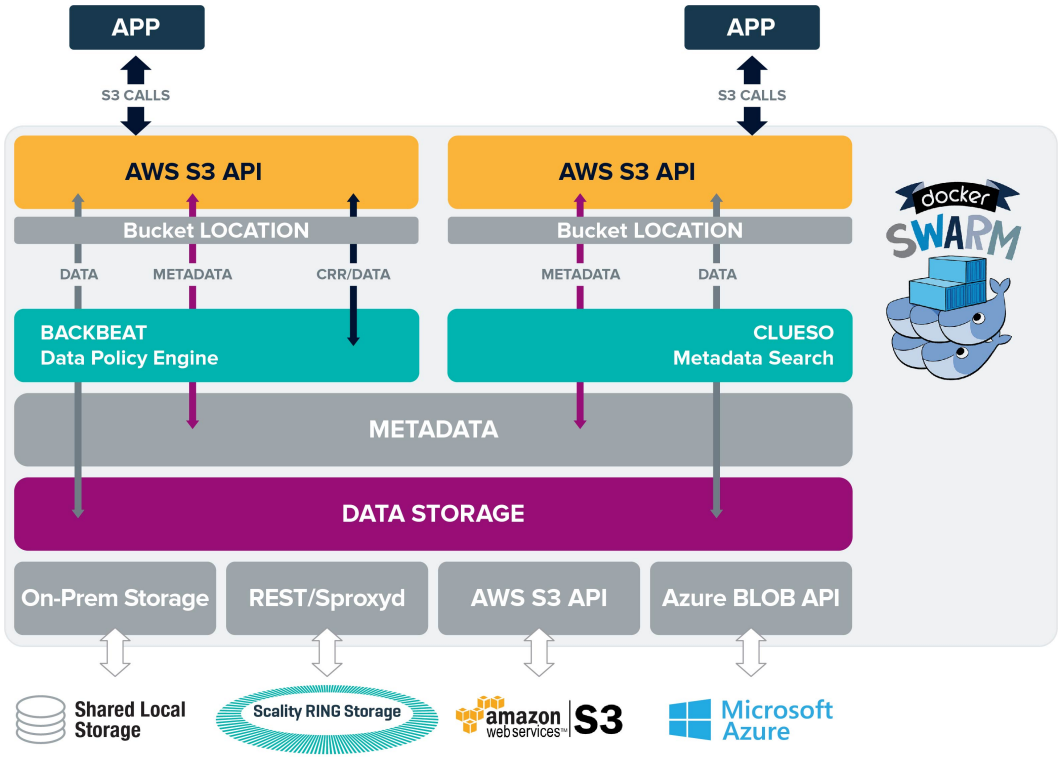
- Hybrid gossip: Communication can be made highly resilient on edge networks by combining gossip with classical distributed algorithms (based on **Plumtree** epidemic broadcast trees used in industry)
  → combines naturally with synchronization-free programming

Sensor-based management (Gluk)



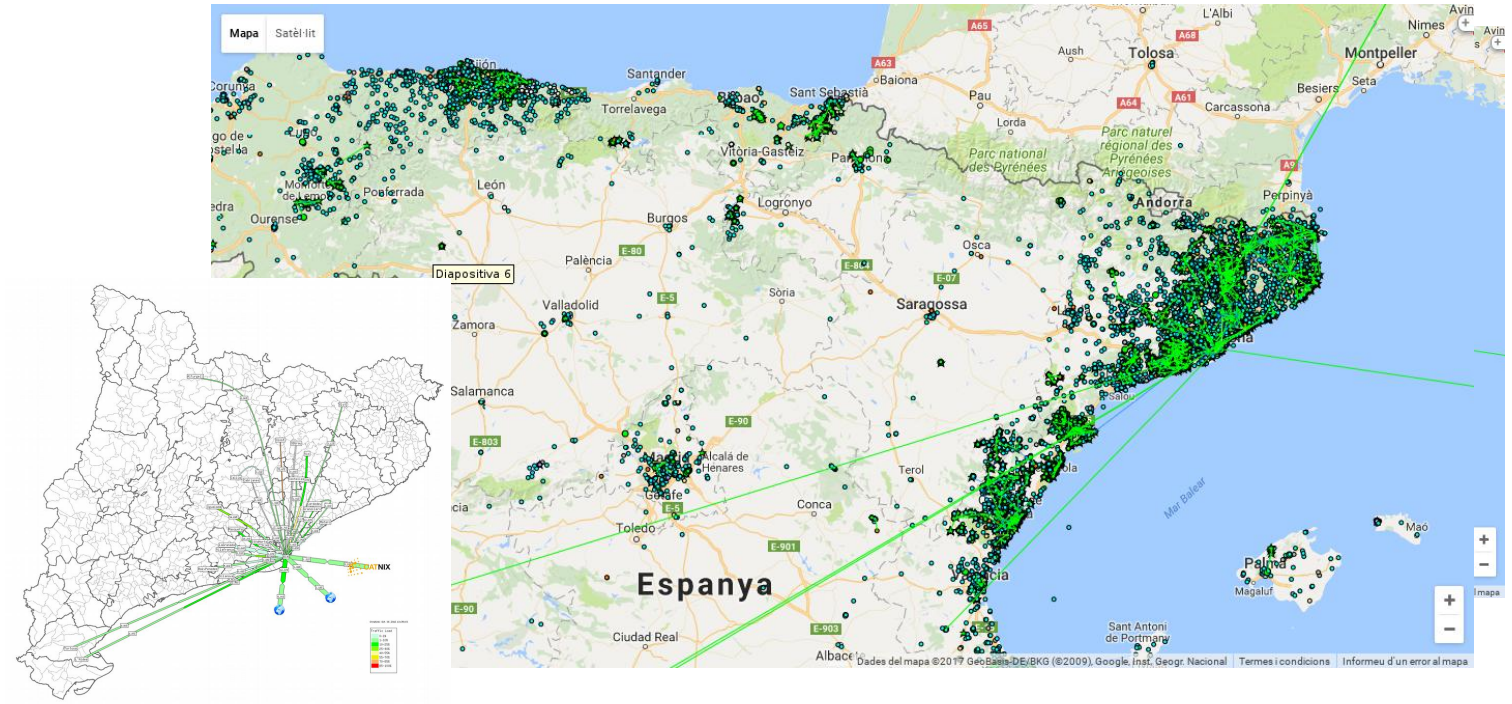
- By adding edge computing, sensor and actuator arrays can manage systems directly on the edge
- We target precision agriculture, healthcare, and smart homes

Advanced content search (Scality)



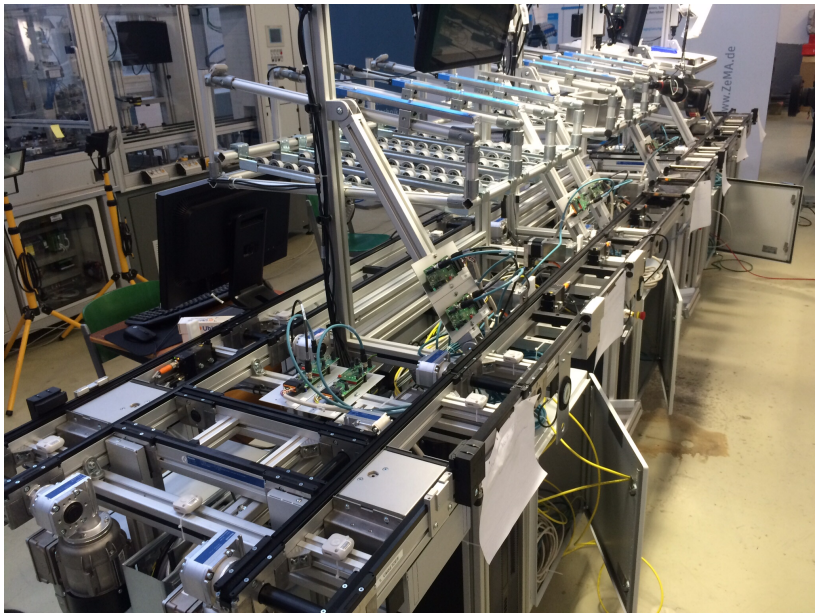
- Advanced search with indexed metadata (e.g., on image content) is done in data centers today
- Doing indexing directly at the edge gives much faster response and enables custom search based on machine learning

Services for a community network (Guifi / UPC)

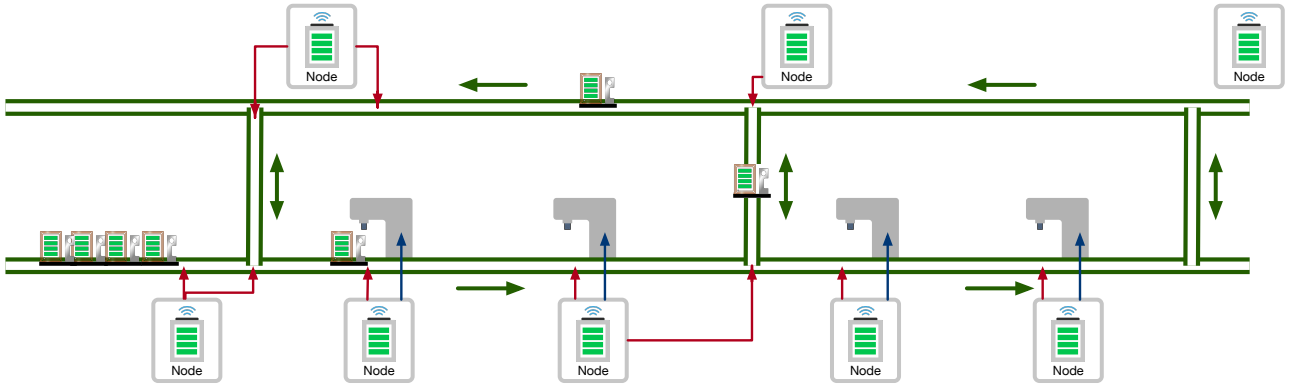


- Guifi.net is a common resource developed bottom-up by users
- It has more than 32,600 nodes (Jan. 2017), mostly in Catalonia
- We implement Guifi.net services by *edge microclouds*

Transport for manufacturing (Stritzinger)



- Automatic transport of partial products between processing stations in a factory
- Partial products have RFID tags and their paths through the factory are managed directly by the networked nodes



LightKone technology at your service

- We are developing open-source software both for light edge (edge by itself) and heavy edge (edge plus data center)
  - Lasp edge computing platform for light edge: `https://lasp-lang.org`
  - Antidote database for heavy edge: `http://antidotedb.org`

- Please contact us if you are interested in learning about our technology or collaborating
  - `https://lightkone.eu`