

Smart Cities – ICT for low carbon solution

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Presented at:

De La Salle University Manado

20 March, 2018, Indonesia

$$f(x+\Delta x)=\sum_{i=0}^{\infty}\frac{(\Delta x)^i}{i!}f^{(i)}(x)$$

Thanks to



- Angreine Kewo, LPDP (PhD student at DTU with LPDP scholarship)
- Centre to IT Intelligent Energy System, CITIES, which pays the cost me being here
- InnovationsFond Denmark (main funder of CITIES)

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- The Danish Power hub
- European legislation on protection of person data
- IoT solution on air pollution monitoring
- Summary

What will you be doing?

Work in the IT department of a company?

Work in a software company?

Will you work in a company developing IoT solutions?

Work on Blockchain solutions? Robotics?

Data security? --- Hacker!!!???

Develop Selfdriving – autonomous vehicles? Machine learning

Develop Selfdriving – autonomous businesses? Machine learning

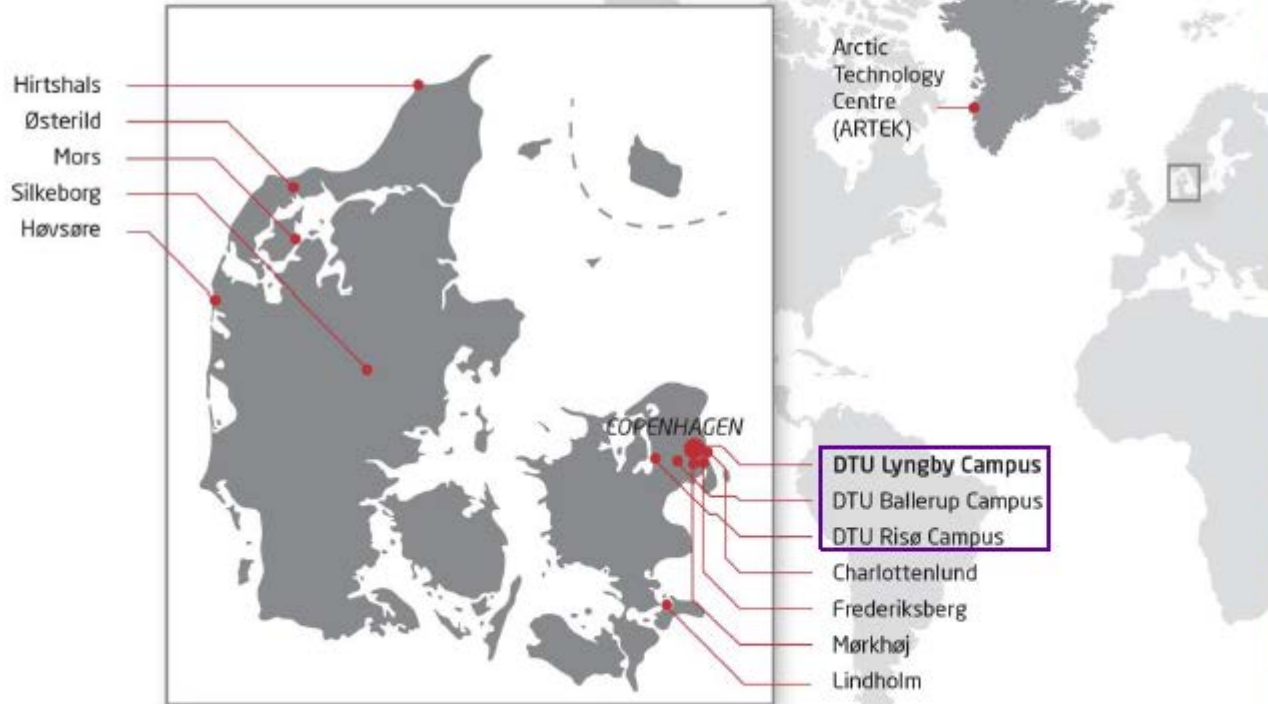
Work in the city/municipality/local government? Make smart cities?

Will you do a masters degree?

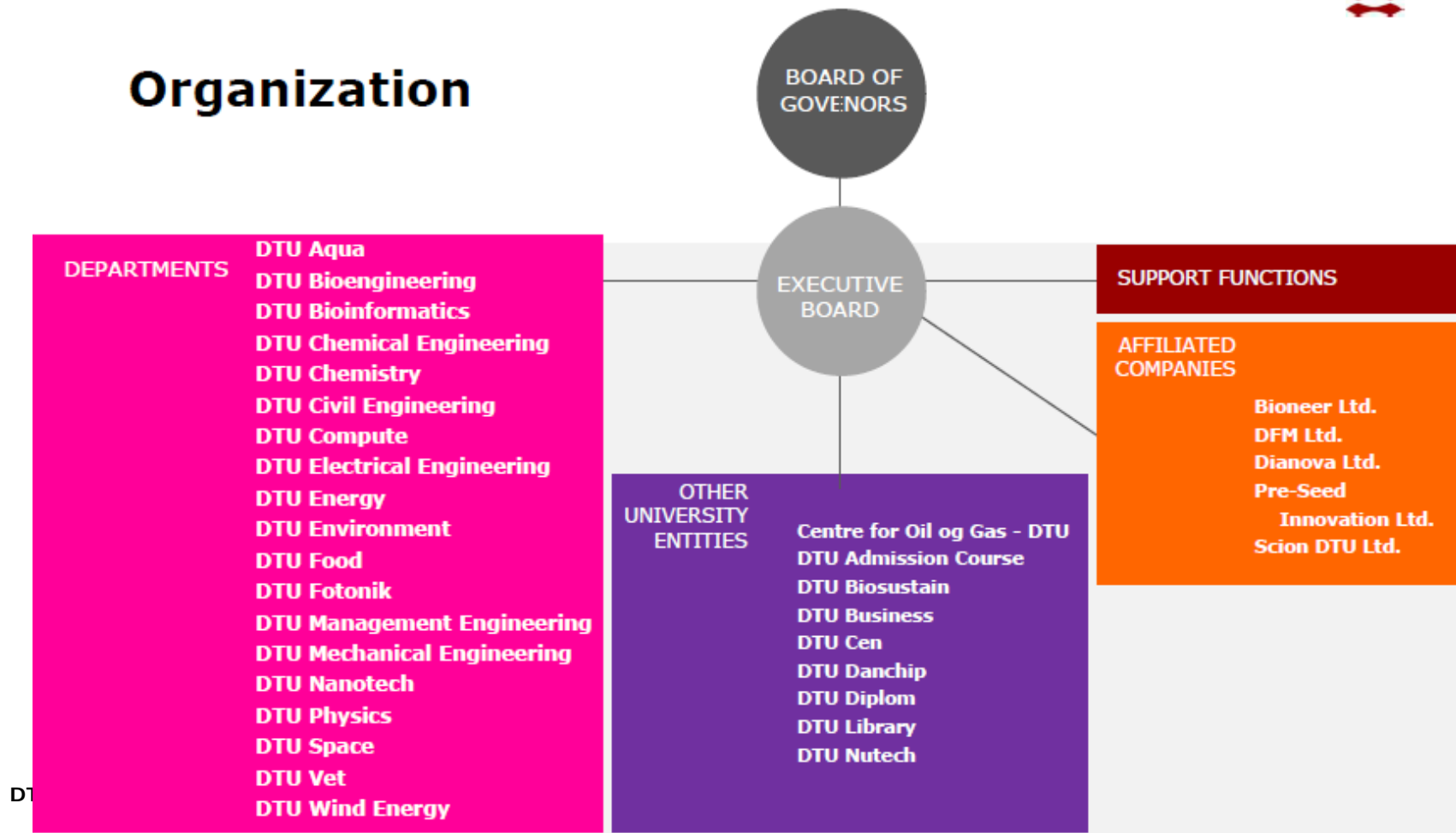
Will you stay in Manado?

University locations across the kingdom

- centered in the capital region



Organization



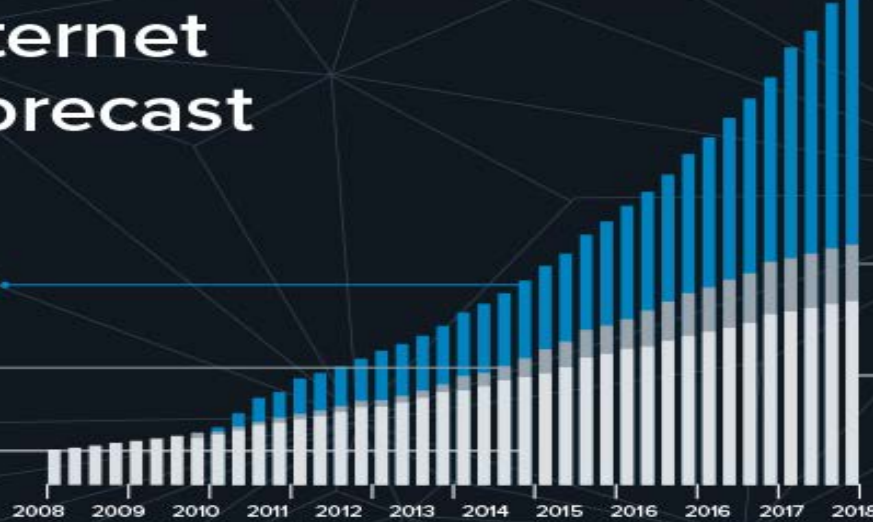
Global Internet Device Forecast

INTERNET OF THINGS
40 Billion Devices
in Use by 2020

INTERNET OF THINGS
8 Billion Devices
in Use by 2014

TABLETS
6 Billion Devices in Use
by 2014

SMARTPHONES
5 Billion Devices
in Use by 2014



TABLETS
9 Billion Devices
in Use by 2018

SMARTPHONES
8 Billion Devices
in Use by 2018

There will be as many as
40 To 80
BILLION
connected objects
by 2020.



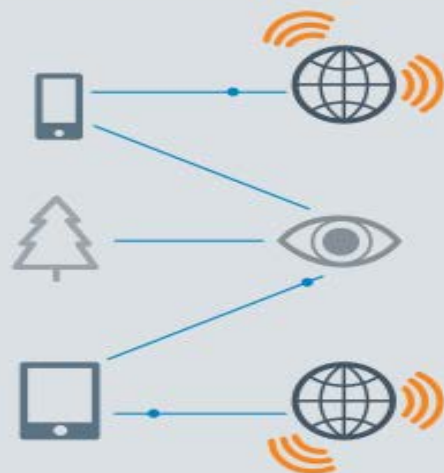
There will be
10 connected
objects
for every man,
woman, and child
on the **PLANET.**

<http://visual.ly/future-internet-things>

[†]There will be as many as
40 To 80
BILLION
connected objects
by 2020.



There will be
10 connected
objects
for every man,
woman, and child
on the **PLANET.**



Through the power of smart
devices, people will not only
consume data, but contribute
observed data to the IoT through
their phones and tablets as

human sensors

<http://visual.ly/future-internet-things>

Five global mega trends shaping the future



Rapid urbanisation



Demographic and social change



Climate change and resource scarcity



Shift in global economic power



Technological breakthroughs



35% more

Expected increase in global food demand by 2030¹

2030

E7 E7 E7
E7 E7 E7
E7

We predict that seven of the world's biggest 12 economies in 2030 will come from emerging markets, the 'E7'²



Years taken for telephone to reach half of US households; the smartphone in under ten³

50%

of the world's population growth between now and 2050 is expected to come from Africa⁴



1.5 million

people are added to the global urban population every week⁵



The world's **85** richest people own as much wealth today as the poorest **3.5 billion**⁶



2015

In 2015 the size of the middle class in Asia Pacific is expected to overtake Europe and North America combined⁷



50%

of global GDP is generated by the 300 largest metropolitan areas⁸



Around half of US jobs are at risk of being computerised over the next two decades⁹

**AN AUTOMATIVE
REVOLUTION IS COMING**
AND THE IMPACTS WILL BE HUGE.

DRIVERLESS CARS

FREE POWER

FREE ELECTRIC POWER
SET TO SHAKE UP THE STATUS QUO

SET TO REDUCE



Industries will need to adapt or fade away:



HERE BY
2020

TECHNOLOGY & LIFE SCIENCES MEGA TRENDS TO WATCH



SOLAR CAPACITY
ABOUT TO EXPLODE



Battery Technology
Rapidly Improving



Utilization of water
increasing

CYBER CASH & MOBILE PAYMENTS



The new
normal yields
**Incredible
Fintech
Possibilities**

FINTECH



CYBERCASH

CLOUD COMPUTING



Closed systems
getting integrated
via **Cloud
Connections**



Shift in Decision Making to Business Units



IT MANAGER



LINE OF BUSINESS MANAGERS

THE INTERNET OF THINGS



Smart City

Home

Social
Network

Incredible
Engineering
Opportunities



Definition of a smart city

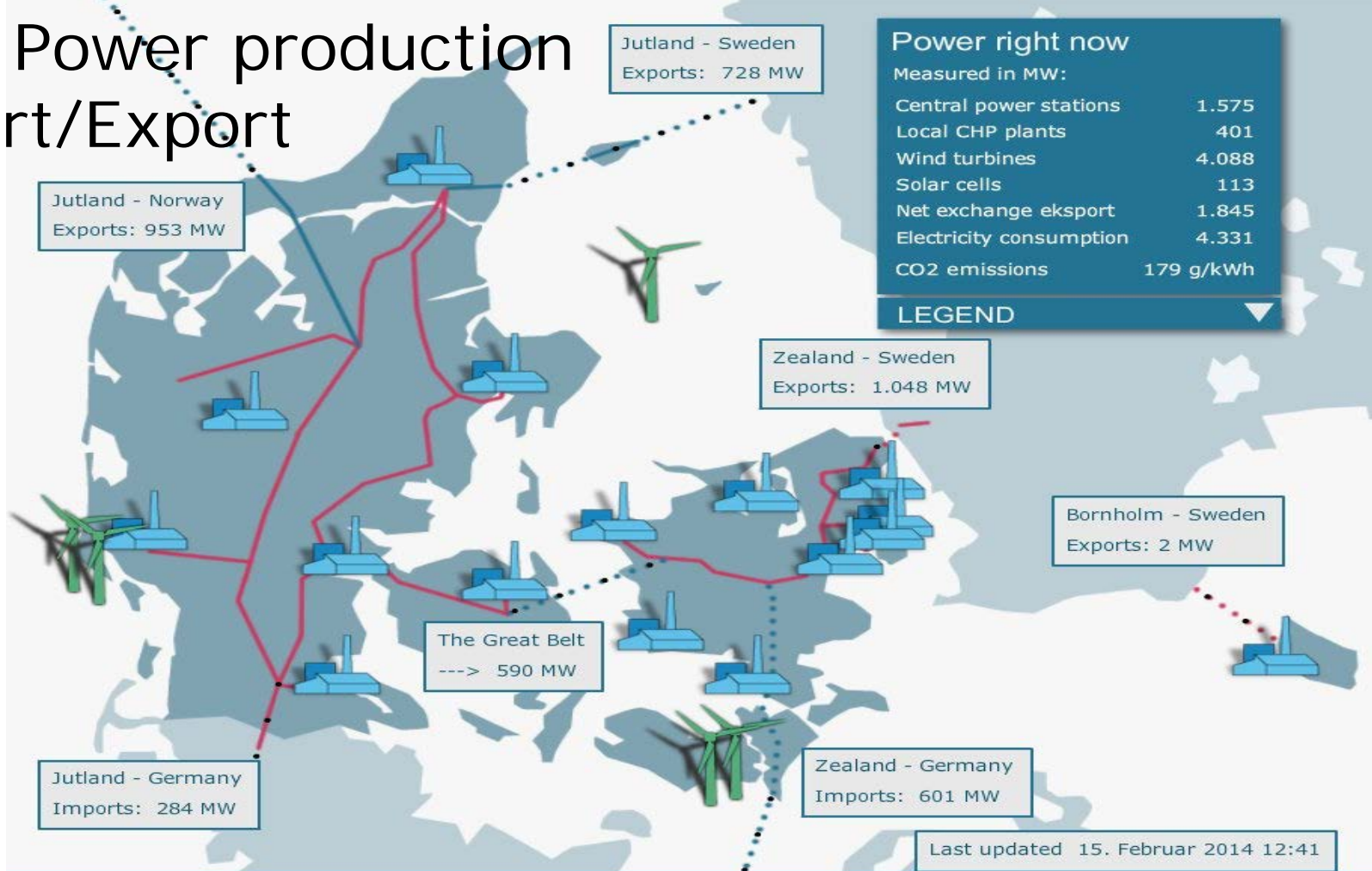
“The Smart Energy City is **highly energy** and **resource efficient**, and is increasingly powered by **renewable energy sources**; it relies on integrated and resilient resource systems, as well as insight-driven and innovative approaches to strategic planning. The application of **information, and communication technology** are commonly a means to meet these objectives. The Smart Energy City, as a core to the concept of the Smart City, provides its users with a liveable, affordable, climate-friendly and engaging environment that supports the needs and interests of its users and is based on a sustainable economy.”

What does it mean that we try to connect all aspects of Smart City?

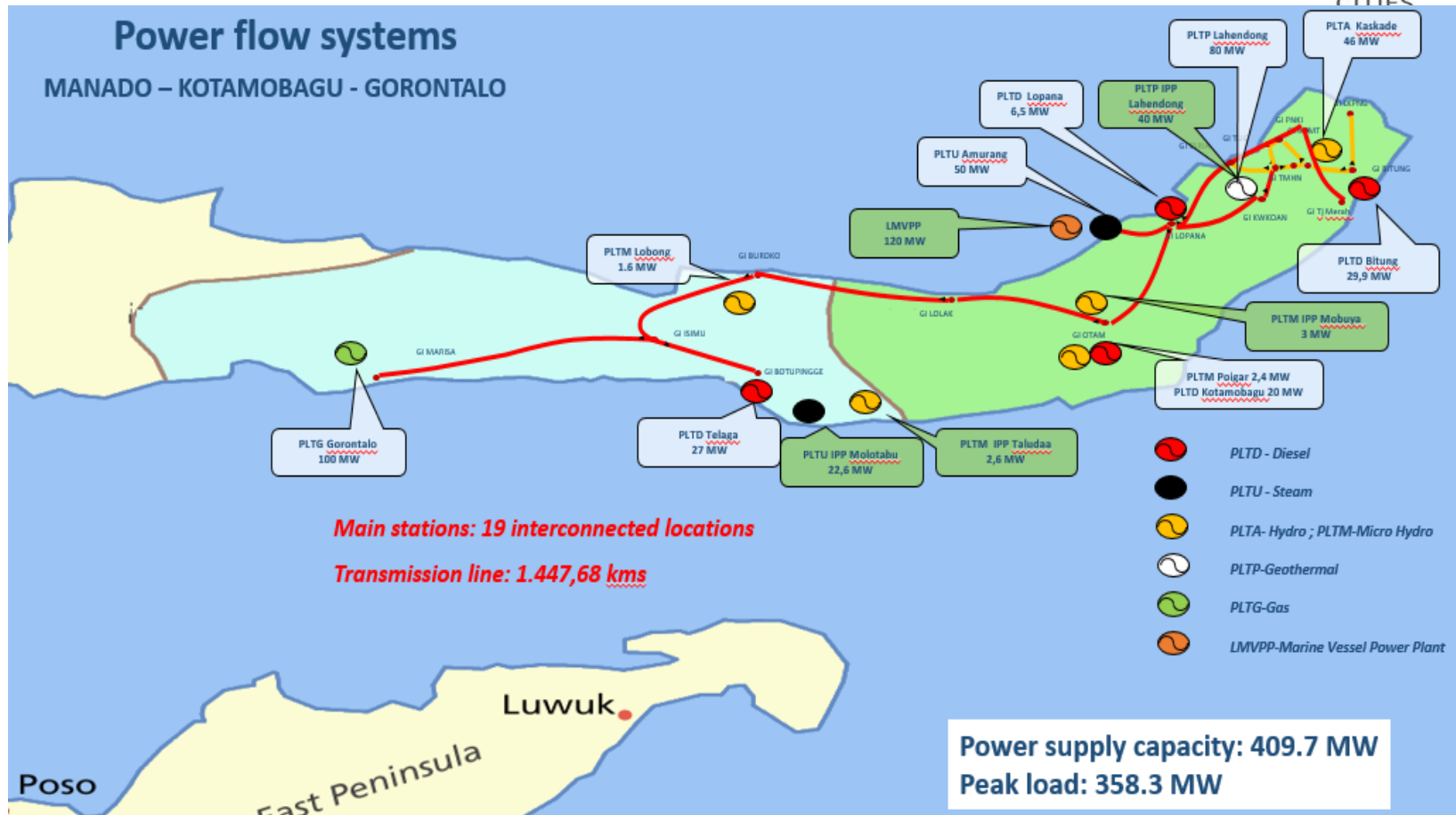


Danish Power production

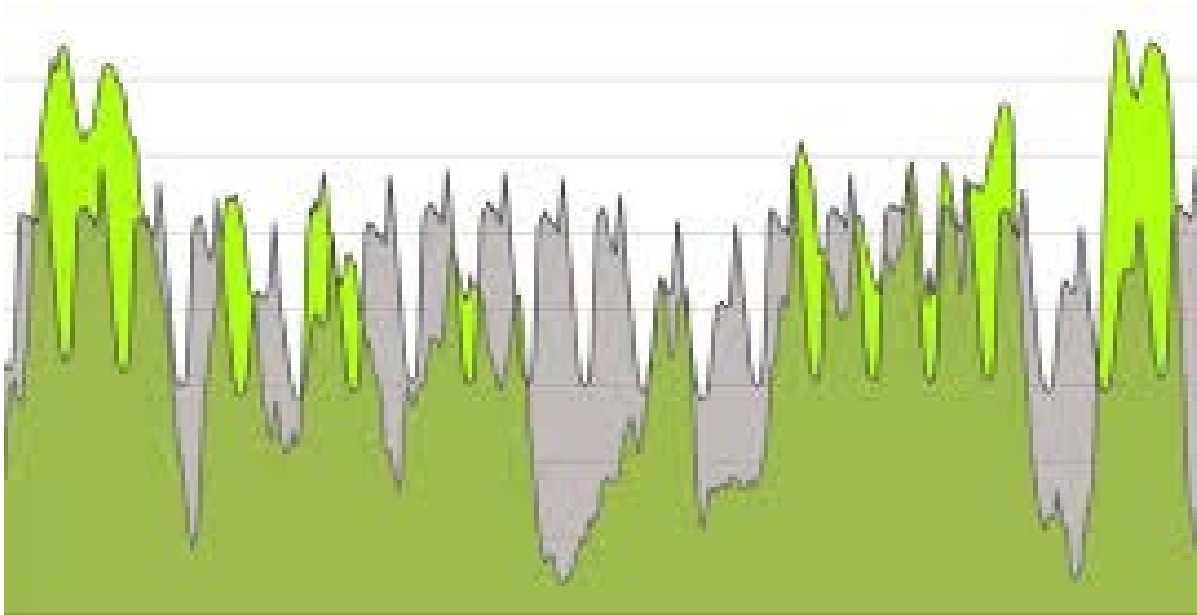
– Import/Export



Power flow systems in Manado

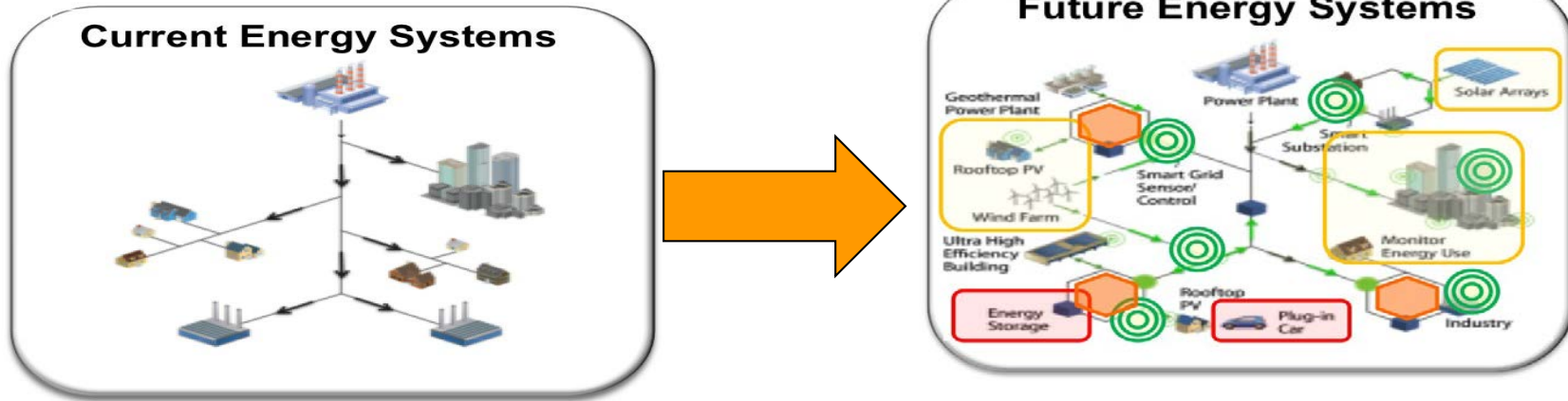


Electricity production (green) and electricity consumption (grey) over **three weeks** in Denmark



Change towards smart networks or decentral solutions

- From centralised to decentralised production



Centre for IT Intelligent Energy Systems - CITIES

Scientific Objective

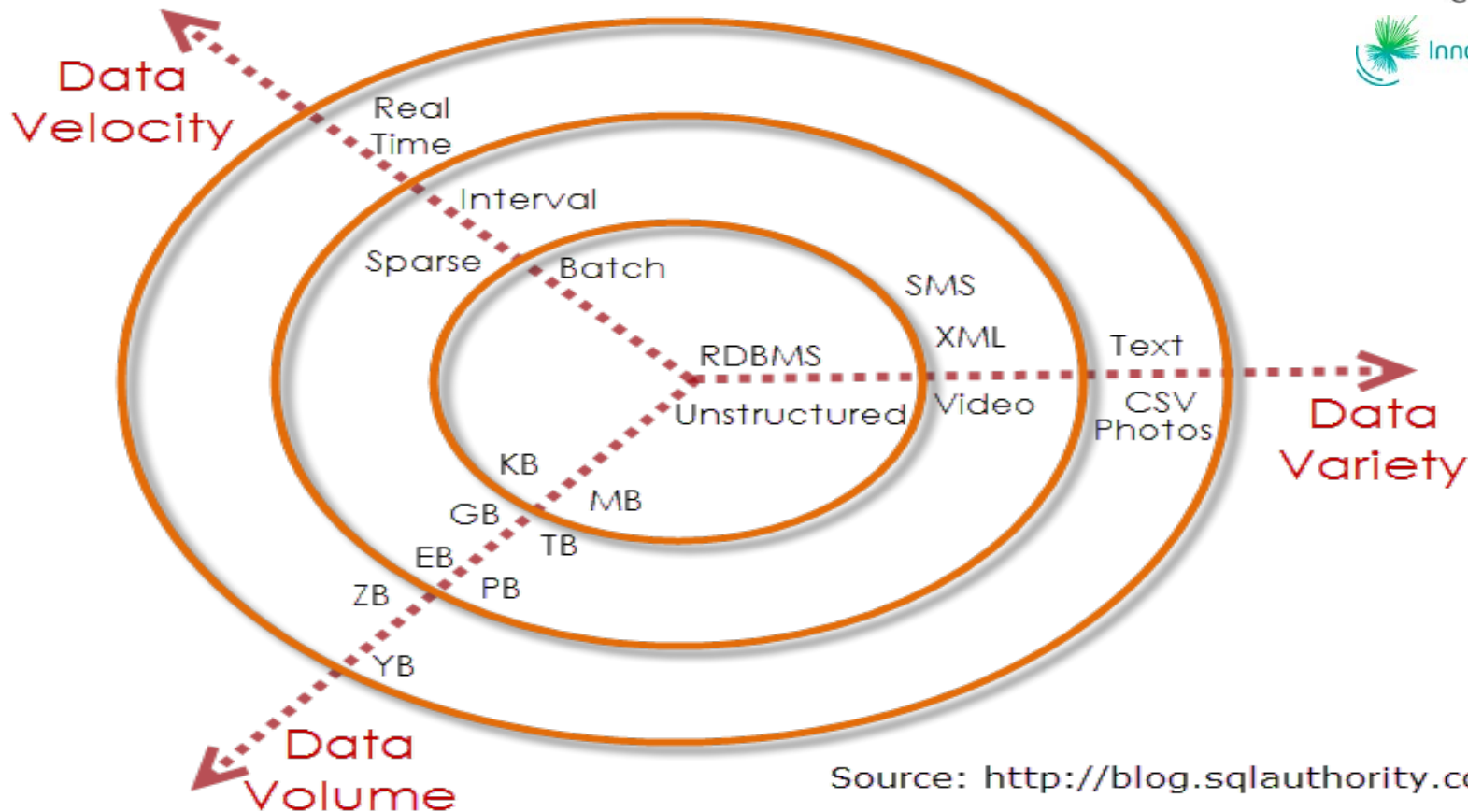
To establish **methodologies and ICT solutions** for **design and operation** of integrated electrical, thermal, fuel pathways at all scales.



Key Outcomes

- Modular **forecasting and control models/tools** for a variety of energy system components, including their interactions
- **Market structures** that support energy systems integration
- Operational **methods and scenarios** for energy systems integration and management, scenarios towards a fossil free future (Power and heating sectors fossil fuel free in year 2035)
- **2014-2019, 10 €Mio (Innovationfond Denmark 6 €Mio, 38 partners)**
- **18 Demo Projects finished, ongoing and planned.**
- **80 published papers**
- **Setting up an Innovation Centre**
- **www.smart-cities-centre.org**

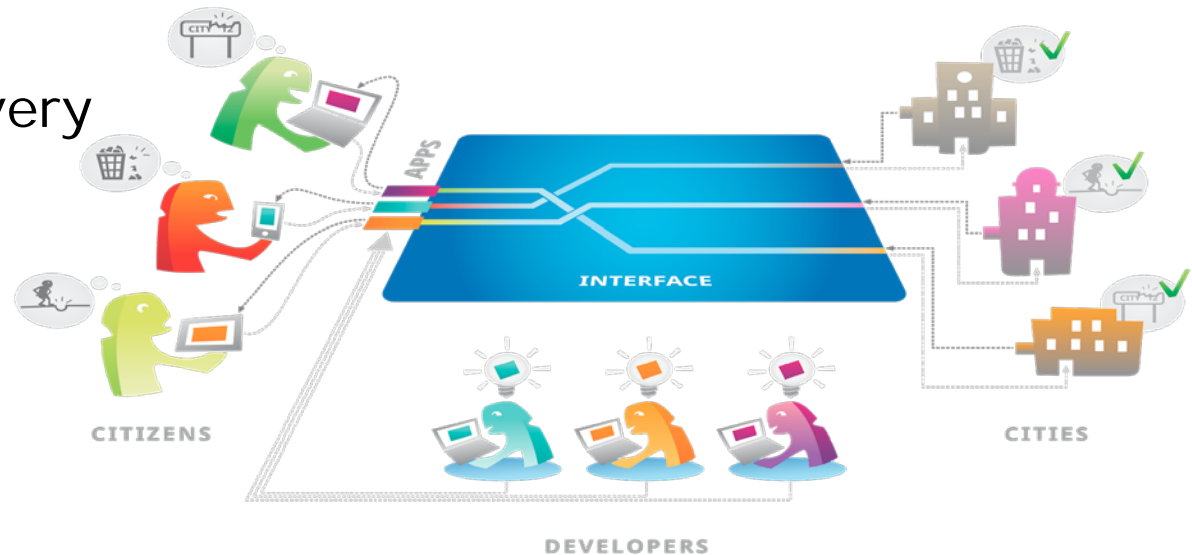
3Vs of Big Data



Source: <http://blog.sqlauthority.com>

Open Data for Smart Cities: what are the benefits?

- Transparency
- Accountability
- Efficiency
- Public Service Delivery
- Engagement
- Data Improvement
- Societal value
- Economic value

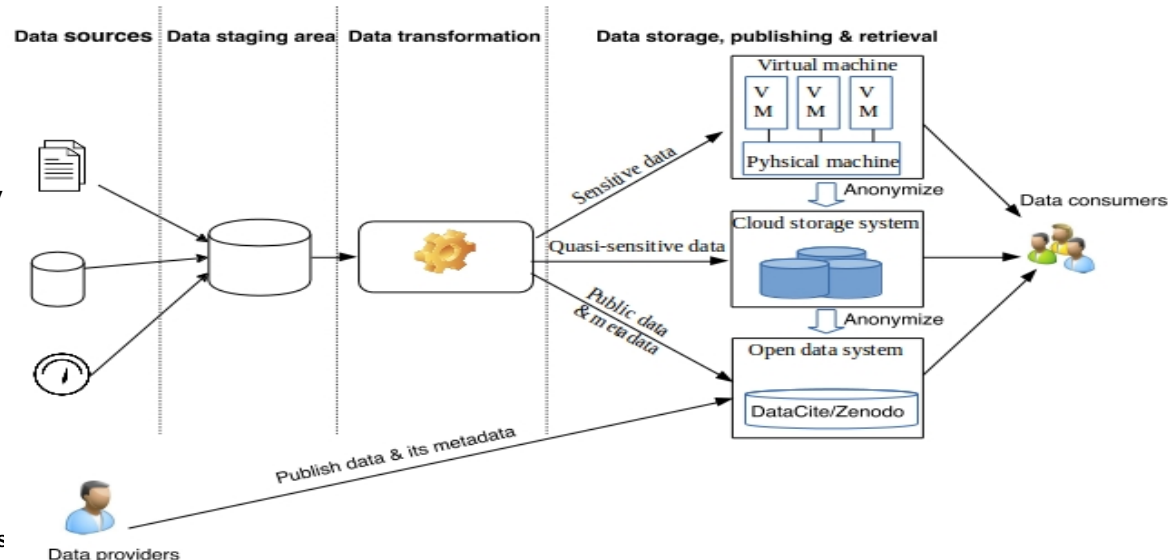


Overview of CITIESData Platform

Data security assurance

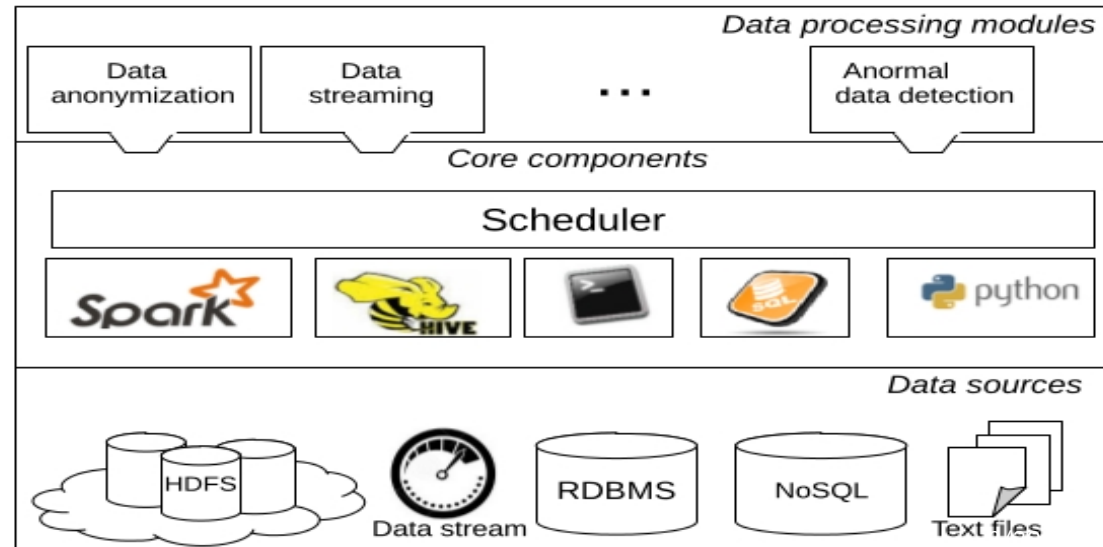
- Data anonymization (e.g., for sensitive data)
- Secured data management (VM-based environment/private ownCloud)

- Quality assurance
 - Data cleansing quality checking
- Data fusion
 - Open data platform
 - Linked data



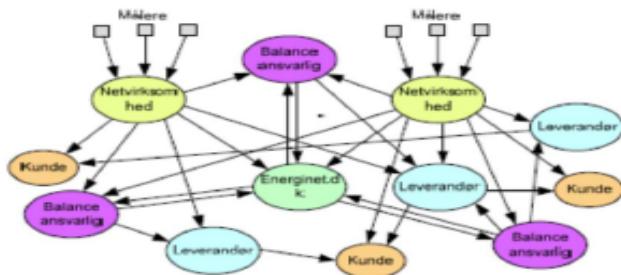
Components of CITIESData Platform

- Support for
 - Diverse data sources
 - Multiple processing systems
 - Different processing modules/algorithms
- Big data technologies, e.g., Spark/Hadoop/Hive
- Real-time and batch jobs



The Danish DataHub solution

From decentralized market management



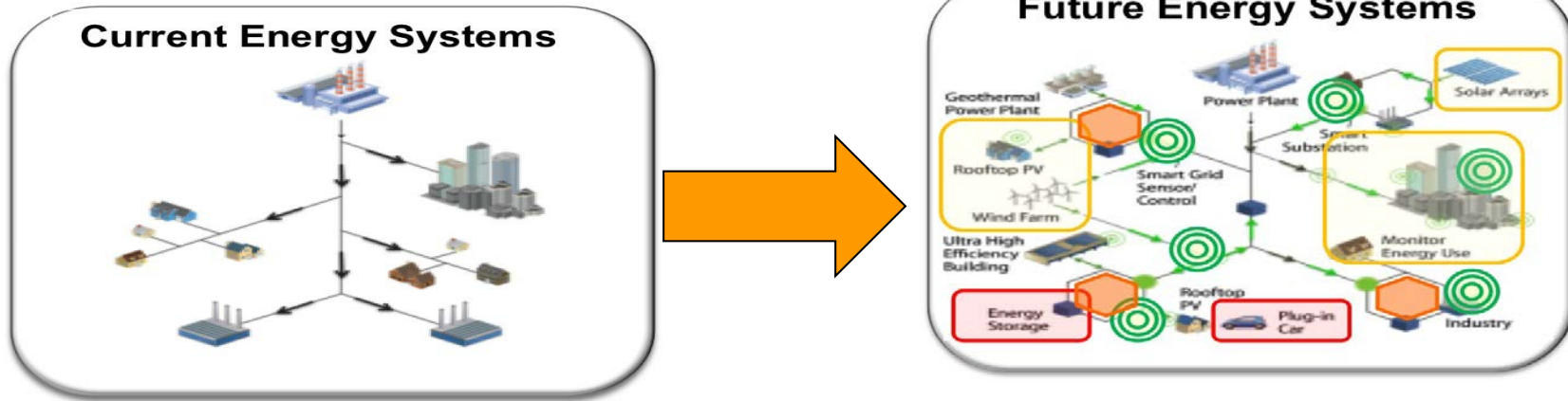
to centralized market management



Keywords: Digitization, unbundling, efficiency and transparency

Change towards smart networks or decentral solutions

- From centralised to decentralised production



Upcoming European protection of personal data

Regulate the use and protection of personal data.

Major changes:

- Elaborates the right of the registered
- Right to be forgotten
- Data portability: Take ALL your data from one social media to another.
- Stricter documentation requirements: Must be able to document the effort in securing data
- Greater fines: % of global sales

Intended to harmonize

- But approximately 50 areas where each country can make own legislation
- Still going to be complicated

Consequences for Science

- We as researchers need to become more aware of
 - Sensitivity of personal data
 - Data/IT security
 - Data responsibility when handed the data
- This conflicts with
 - The idea of Open data
 - Makes peer review harder as data cannot be shared

IoT sensors for monitoring air quality

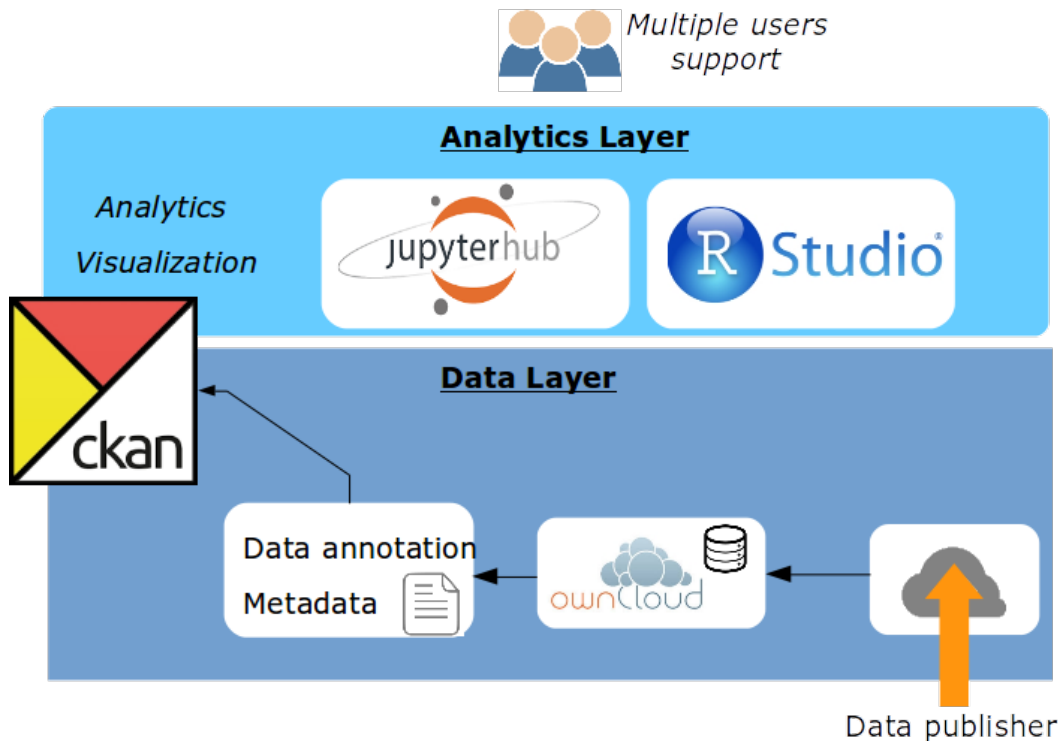


SciCloud Service - *Cloud-based data and analytics service*

Cloud-based data management

Open data portal

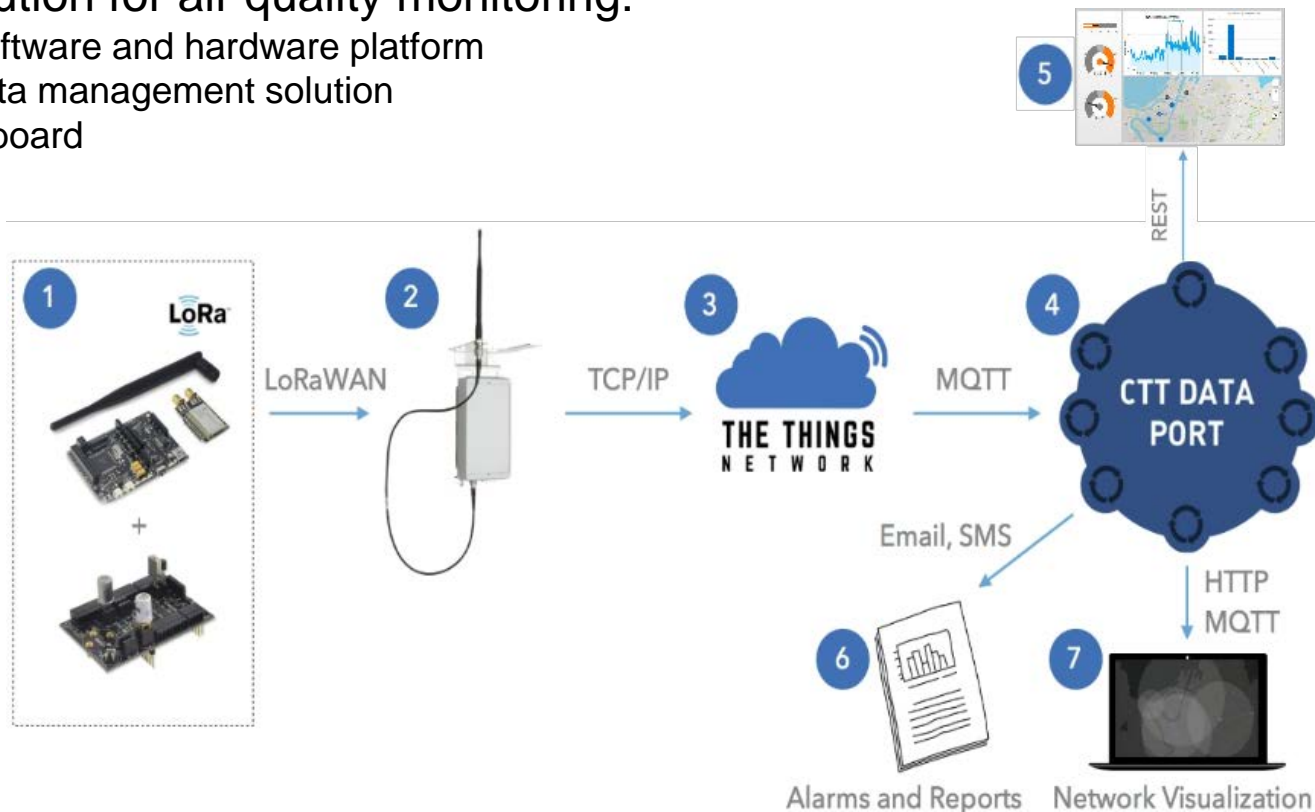
In-place data analytics service



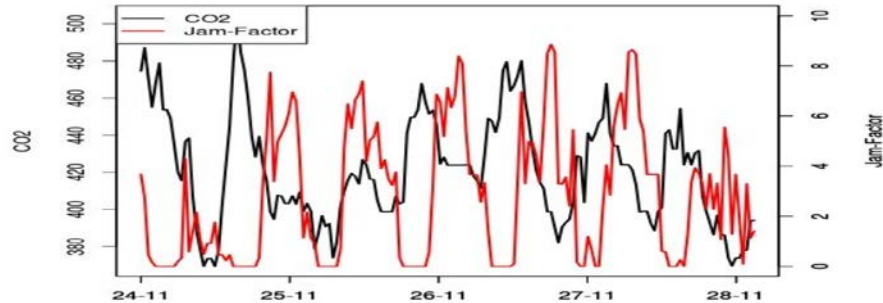
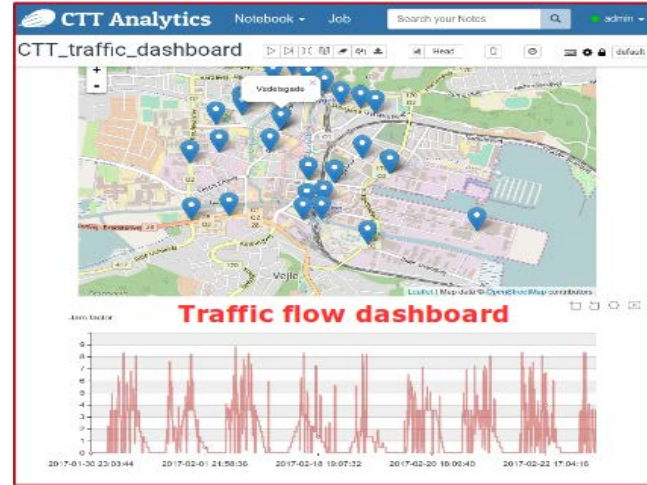
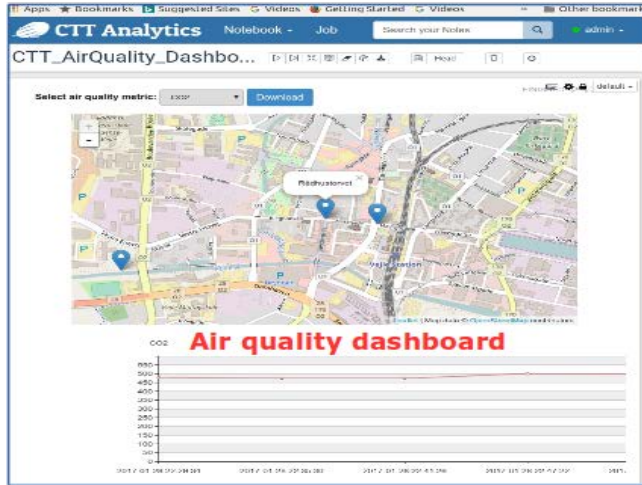
CTT: An IoT-based carbon track and trace system

A holistic IoT solution for air quality monitoring:

- Open source software and hardware platform
- Scalable IoT data management solution
- Real-time dashboard



Analytics and visualization



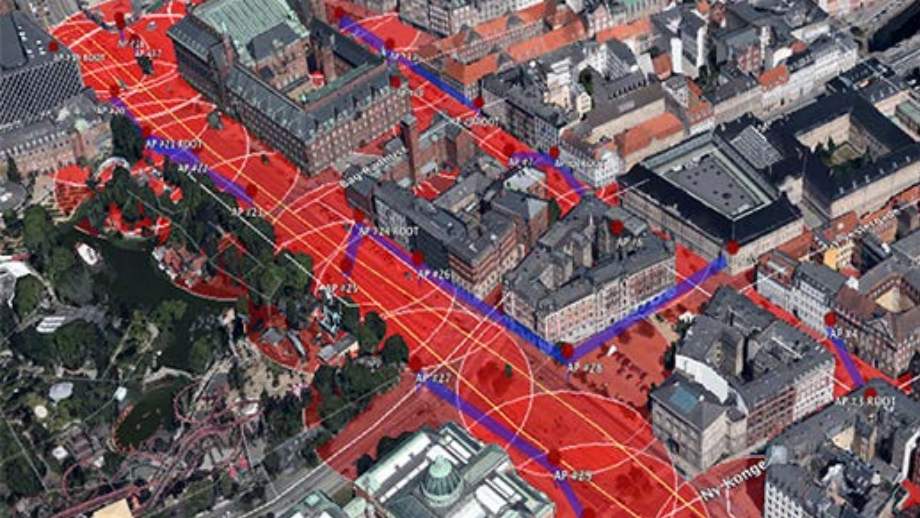
Model the correlation between traffic jam factor and CO2

Summary

You are ahead of the rest of the society with ideas which potentially can improve quality of life for its citizens.

You should remember to keep the big picture in mind in your systems development and remember where you are “right now” in this process.

Smart cities need smart people and smart stakeholders to work together. It will not happen by itself.



Du er cyklist nummer

4292

i dag

af sammenlagt

1258919

Cyklist siden 1. maj 2009
på denne strækning



Thank you
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www.smart-cities-centre.org