Smart Liveable Cities

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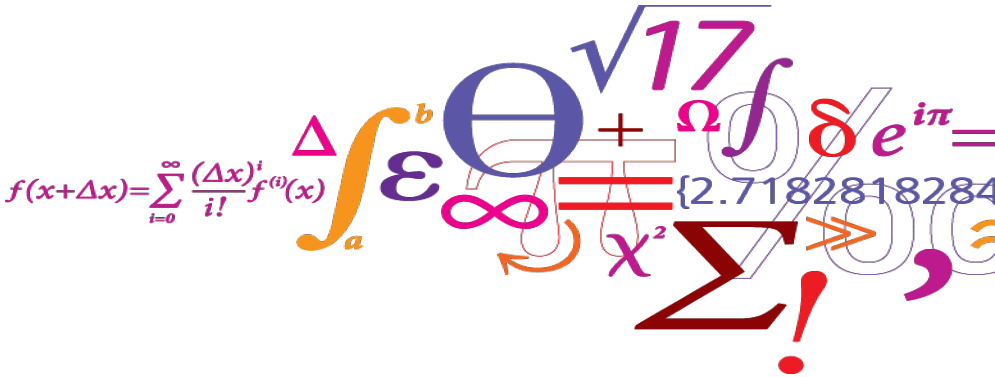
Presented at:
Sam Ratulangi University Manado
22 March, 2018, Indonesia



DTU Management Engineering
Institut for Systemer, Produktion og Ledelse

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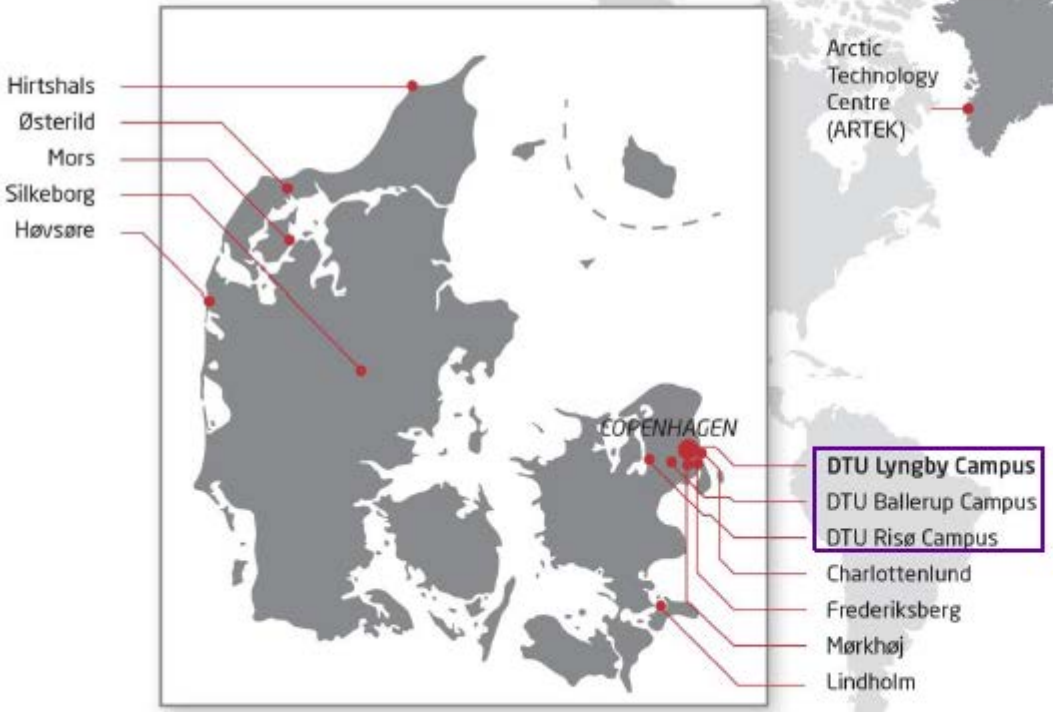
- The Danish Power hub
- European legislation on protection of person data
- IoT solution on air pollution monitoring
- Summary

What will you be doing?

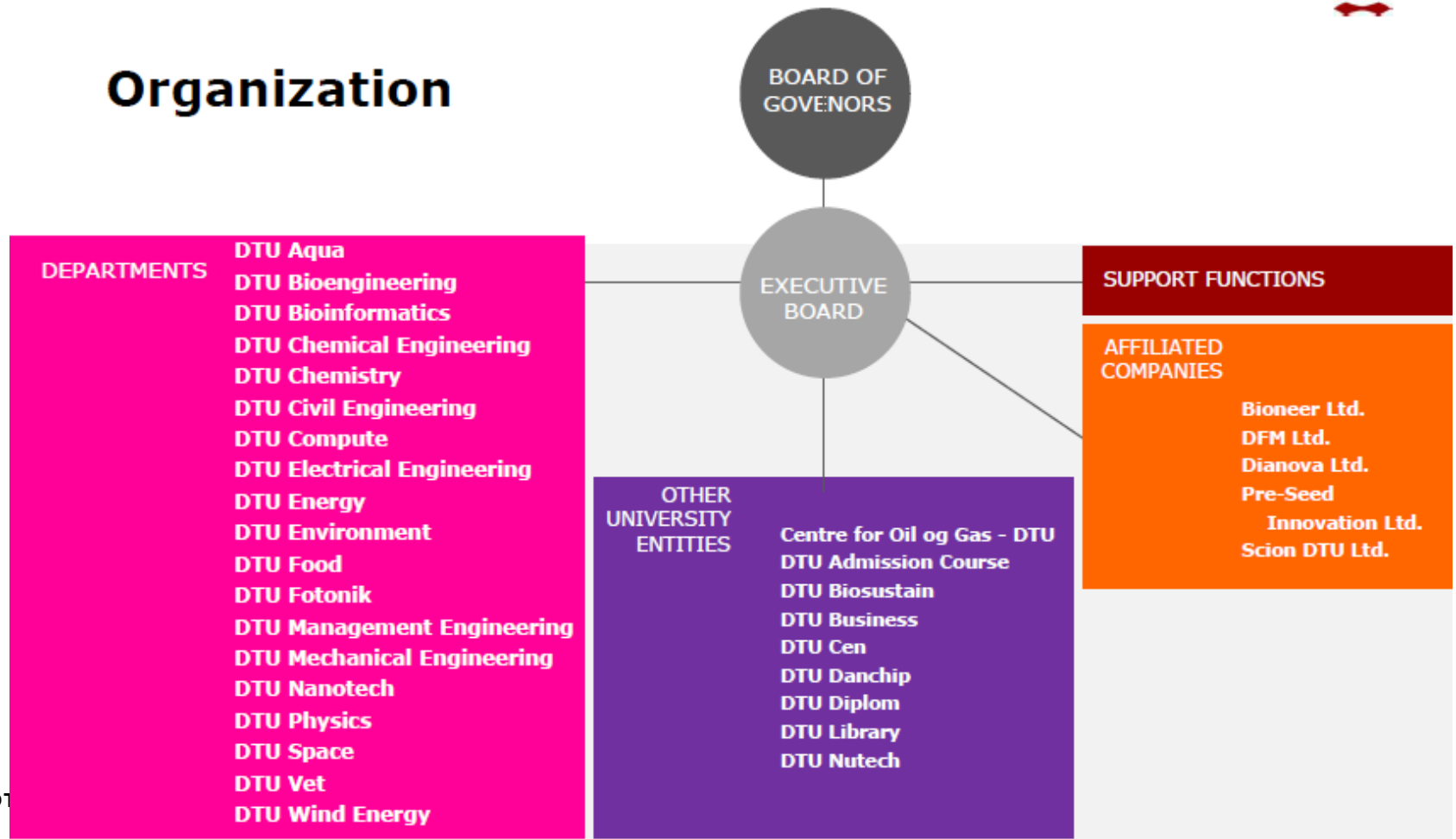
Work in the IT department of a company?
Work in a software company?
Will you work in a company developing IoT solutions?
Work on Blockchain solutions? Robotics?
Data security? --- Hacker!!!???
Develop Selfdriving – autonomous vehicles? Machine learning
Develop Selfdriving – autonomous businesses? Machine learning
Work in the city/municipality/local government? Make smart cities?
Will you do a masters degree?
Will you stay in Manado?

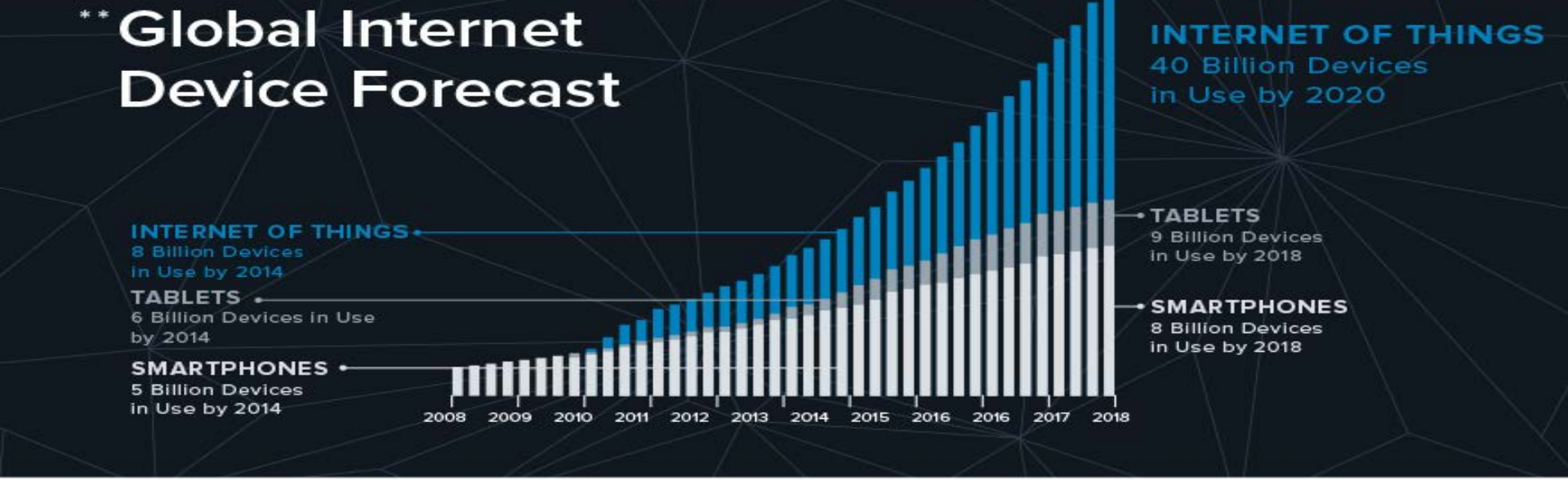
University locations across the kingdom

- centered in the capital region



Organization





† 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

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connected objects by 2020.

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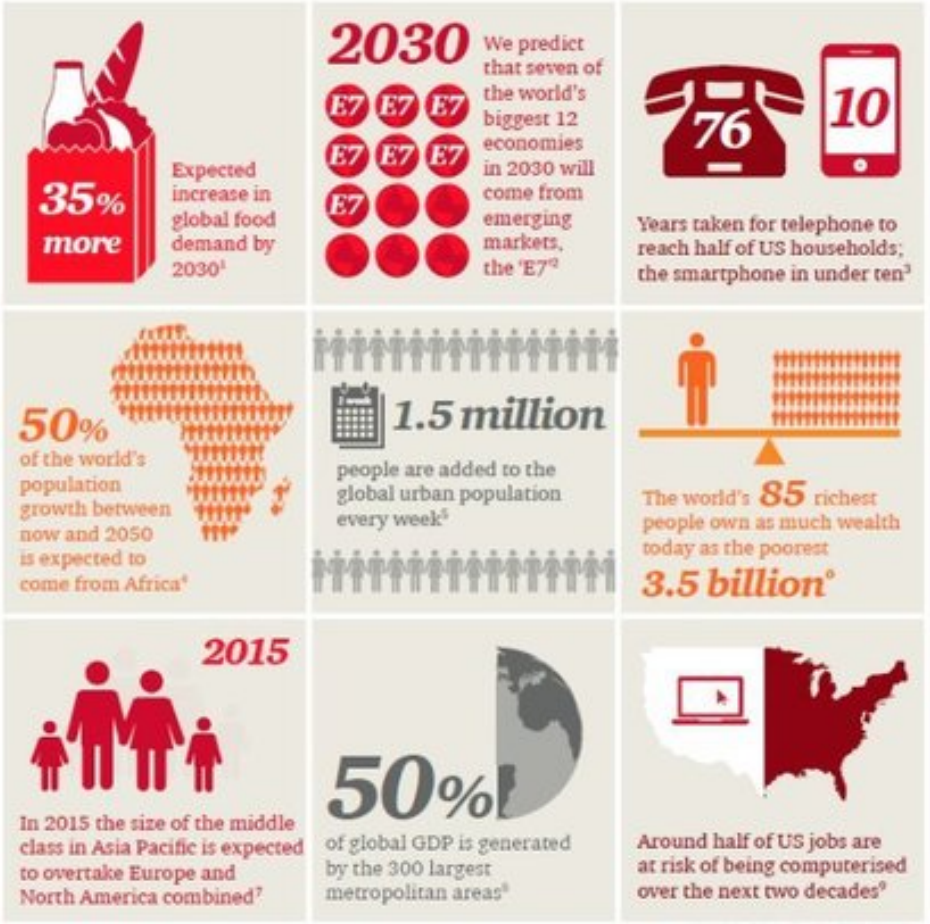
Through the power of smart devices, people will not only consume data, but contribute observed data to the IoT through their phones and tablets as

human sensors

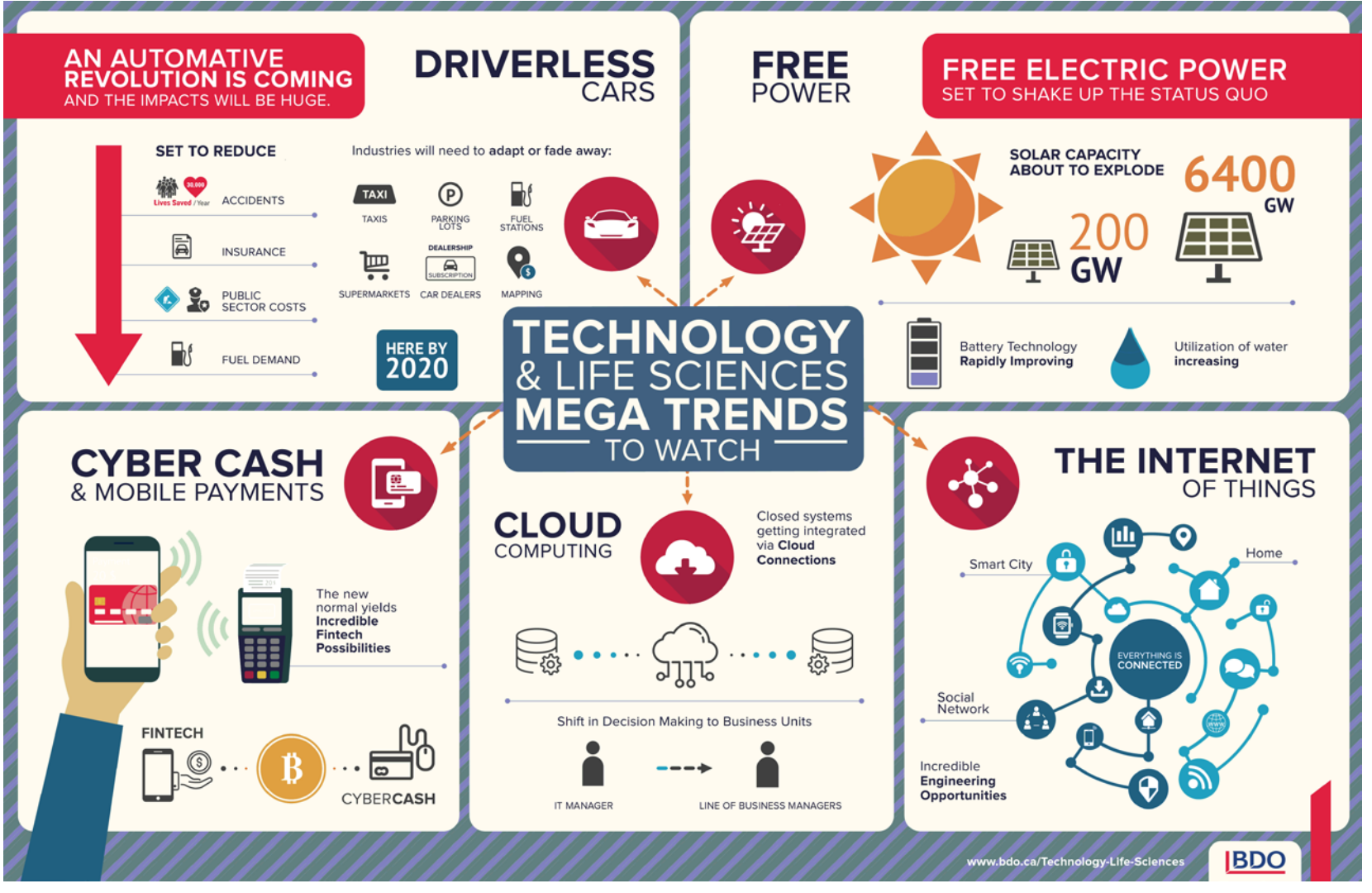
http://visual.ly/future-internet-things

Five global mega trends shaping the future

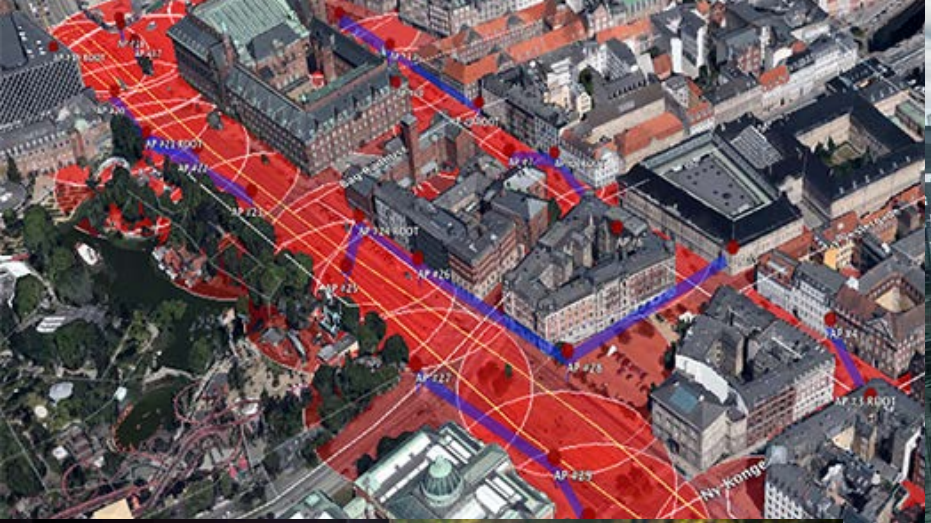
- **Rapid urbanisation**
- **Demographic and social change**
- **Climate change and resource scarcity**
- **Shift in global economic power**
- **Technological breakthroughs**



source: PwC via @mikequindazzi


AN AUTOMATIVE REVOLUTION IS COMING
AND THE IMPACTS WILL BE HUGE.
DRIVERLESS CARS
SET TO REDUCE
Lives Saved /Year
ACCIDENTS
INSURANCE
PUBLIC SECTOR COSTS
FUEL DEMAND
Industries will need to adapt or fade away:
TAXIS
PARKING LOTS
FUEL STATIONS
SUPERMARKETS
CAR DEALERS
MAPPING
HERE BY 2020
FREE POWER
FREE ELECTRIC POWER
SET TO SHAKE UP THE STATUS QUO
SOLAR CAPACITY ABOUT TO EXPLODE
6400 GW
200 GW
Battery Technology Rapidly Improving
Utilization of water increasing
TECHNOLOGY & LIFE SCIENCES MEGA TRENDS TO WATCH
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
EVERYTHING IS CONNECTED
Social Network
Incredible Engineering Opportunities
www.bdo.ca/Technology-Life-Sciences
BDO

DTU



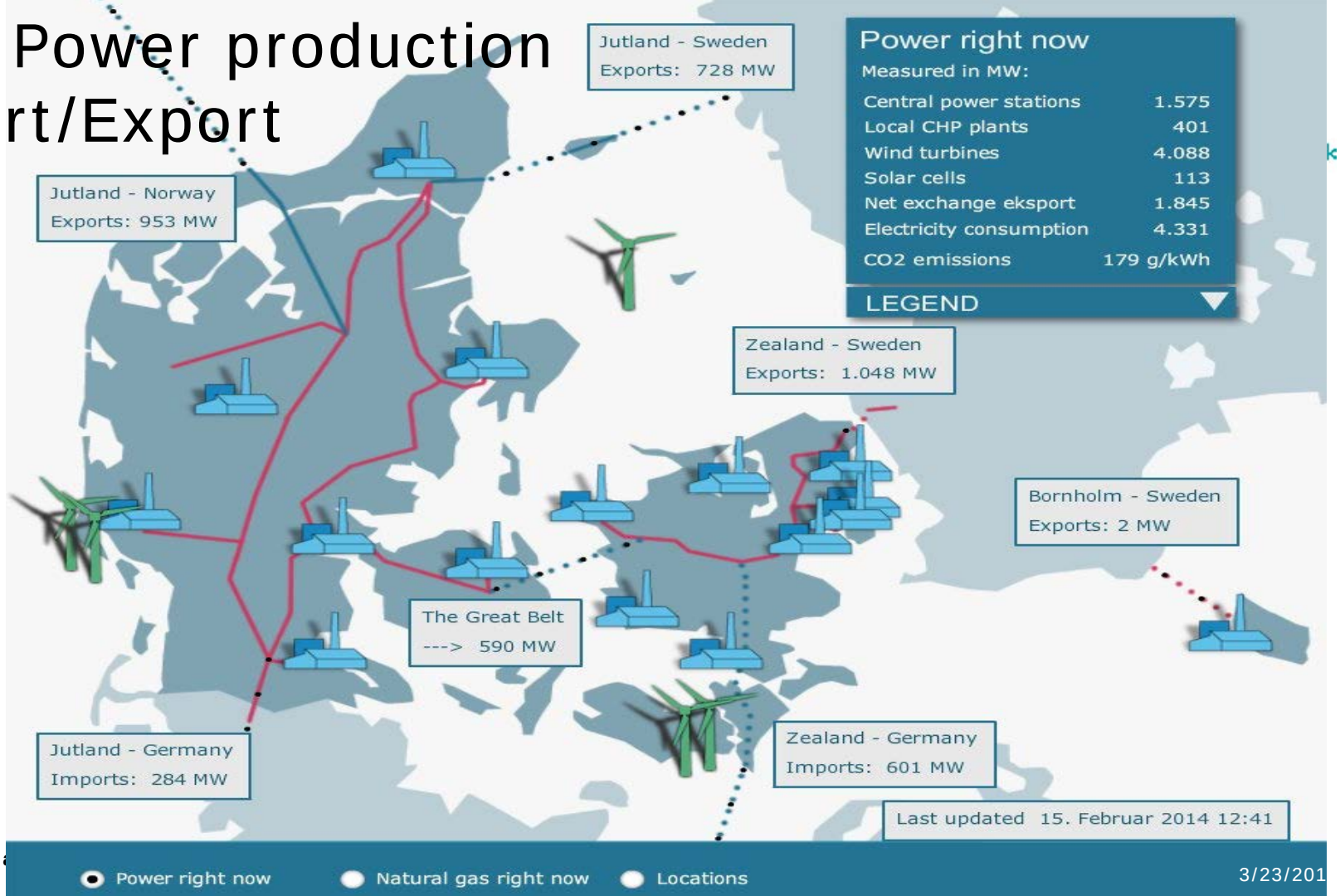
Translation

Definition of a smart city

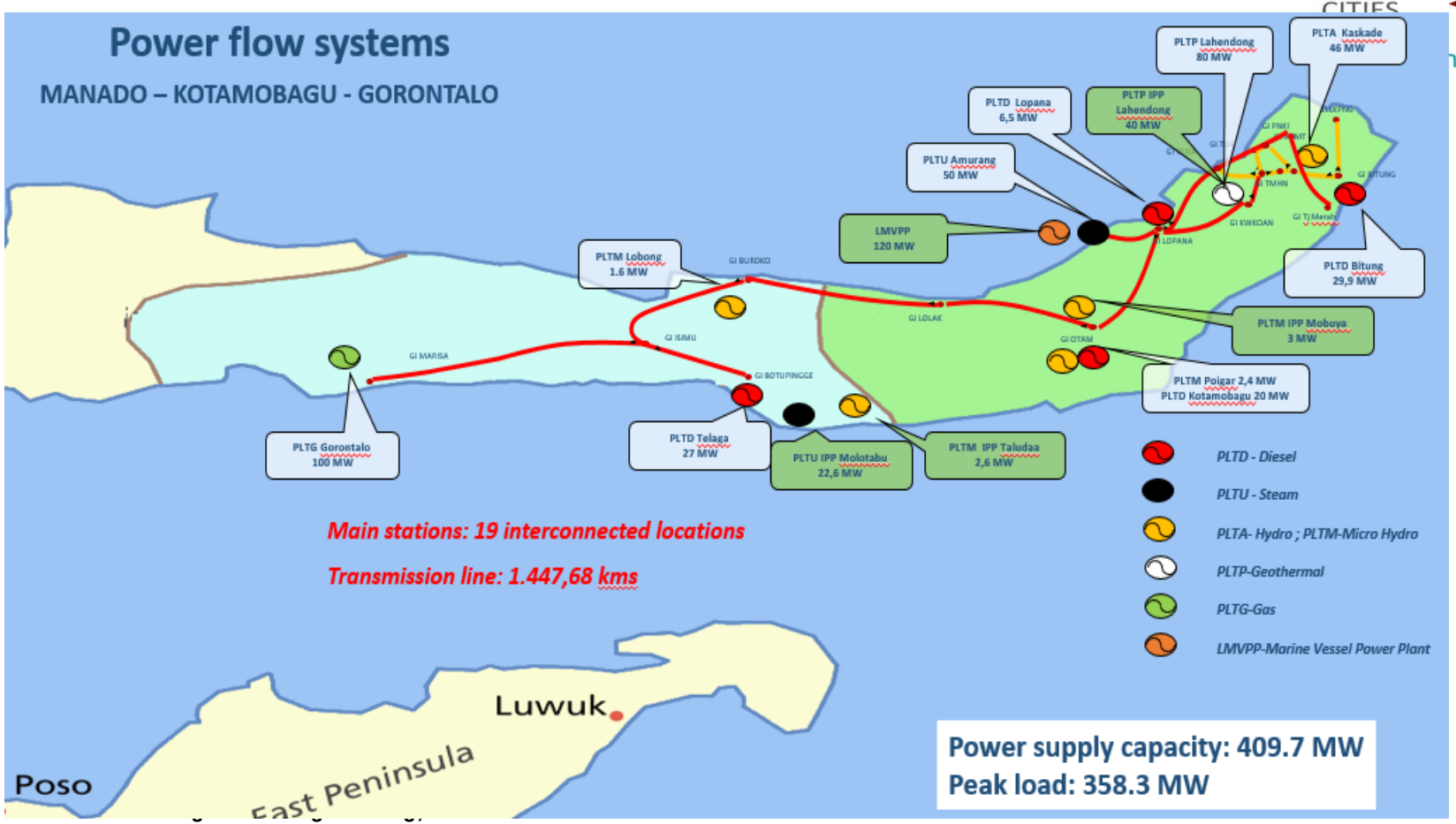
“The Smart Energy City is highly energy and resource efficient, and is increasingly powered by renewable energy sources; it relies on integrated and resilient resource systems, as well as insight-driven and innovative approaches to strategic planning. The application of information, and communication 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?

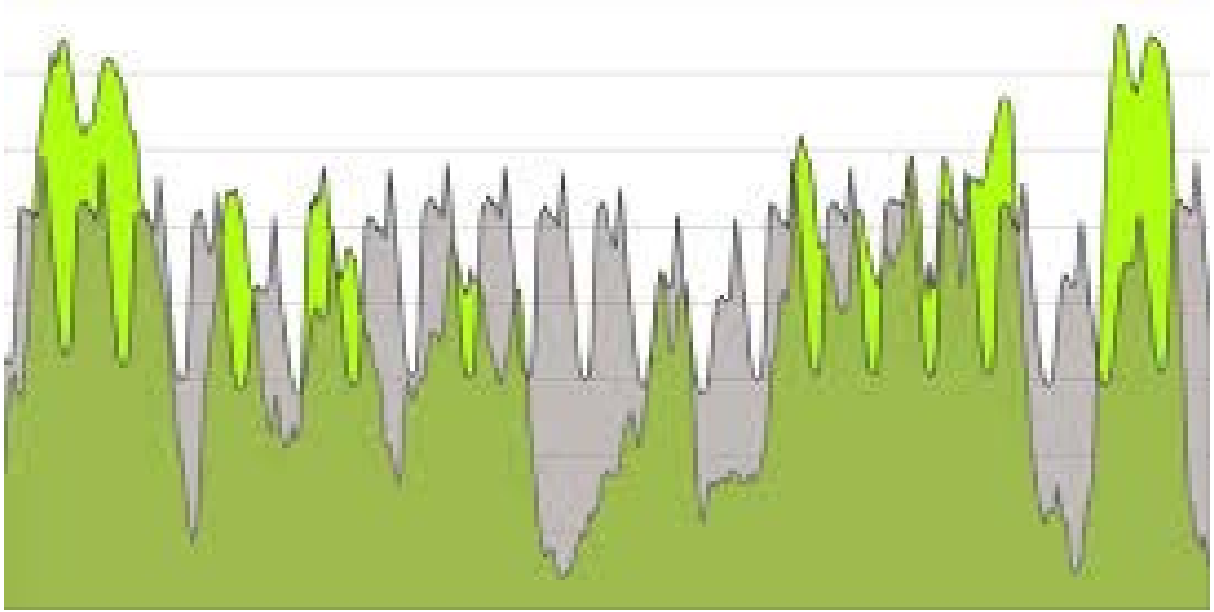
Danish Power production – Import/Export



Power flow systems in Manado

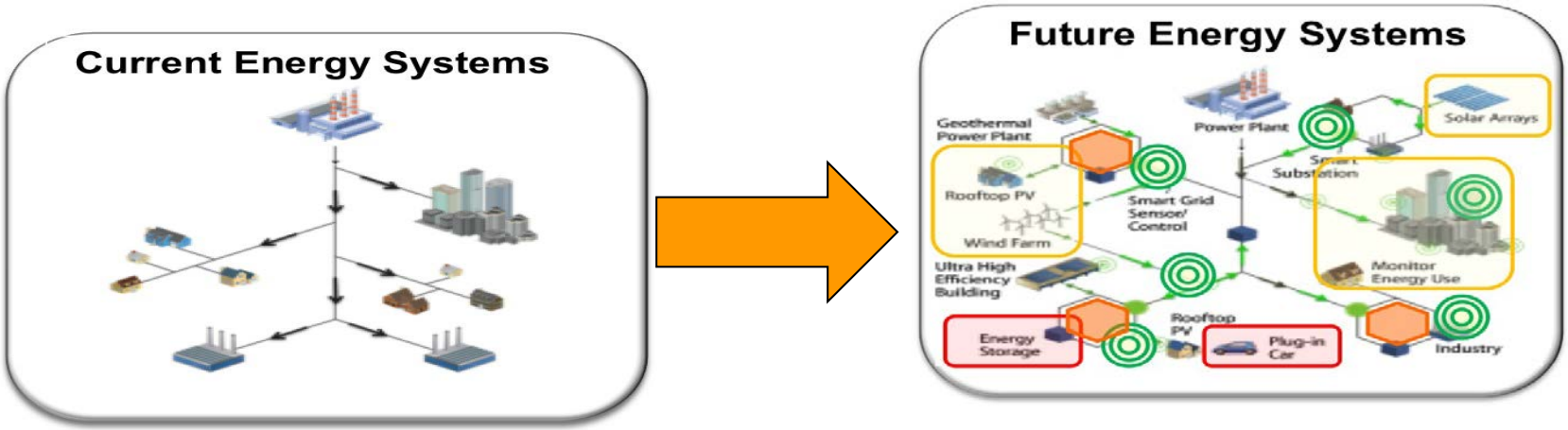


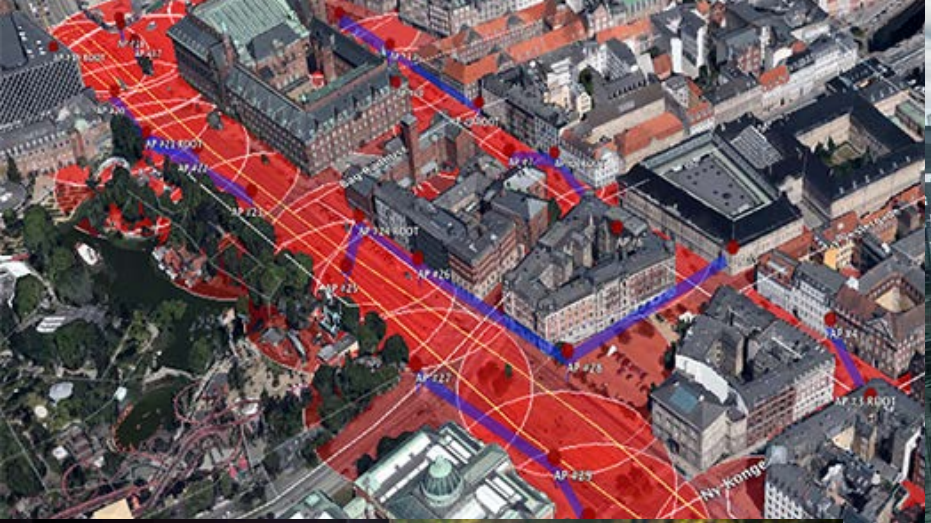
Electricity production (green) and electricity consumption (grey) over three weeks in Denmark



Change towards smart netvorks or decentral solutions

- From centralised to decentralised production





Translation

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**

Results: some examples

Software:

- HPMPC: A toolbox for High-Performance MPC
- MPC-R: A toolbox for MPC in R
- CTSM-R: A toolbox for semi-physical modelling in R Modelling and

Planning tools

- Modelling tools for aggregated loads
- Multiple Execution Tool (MultiNODE) for EnergyPLAN
- Sifre (Energinet.dk) - incl. tests in Sønderborg

Hardware

- SN-10 Smart House Controller
- MPC setup – LabView – OPC-UA client (next PASSYS test cell)

Data Analytics and Energy Informatics

- WEB-service for forecasting and control (load, wind, solar,...)
- Cloud based model predictive control
- Smart-Energy Data Management Systems (OS, DATA, REP)

Demo projects

- Building Energy Demand Modelling
- Control of heat pumps
- Dynamic CO2-based control of summerhouse swimming pool heating
- Dynamic prices for heat delivered to district heating systems
- Energy Supply Modelling in cities: A Case Study of Sønderborg Municipality
- Heating of indoor residential swimming pools by solar collectors in Denmark
- Load forecasting for District Heating
- Optimal Control of District Heating Supply Temperatures to Greenhouses
- Smart Meter Data Analytics
- Thermal mass for energy storage: Impacts and perspectives on a system scale
- Optimization under uncertainty of heat and power production in district heating systems
- Regulating Power Market; Modelling and Forecasting
- Data Intelligent Temperature Optimization of DH networks

CITIES

Centre for IT-Intelligent Energy Systems in cities

Software solutions

Software for combined physical and statistical modelling

Continuous Time Stochastic Modelling (CTSM) is a software package for modelling and simulation of combined physical and statistical models. You find a technical description and the software at CTSM.info.

Software for Model Predictive Control

Search ...

Latest news

Summer School at DTU, Lyngby, Denmark – July 4th-8th 2016

CITIES INNOVATION CENTER

Integrated energy systems powered by intelligent data

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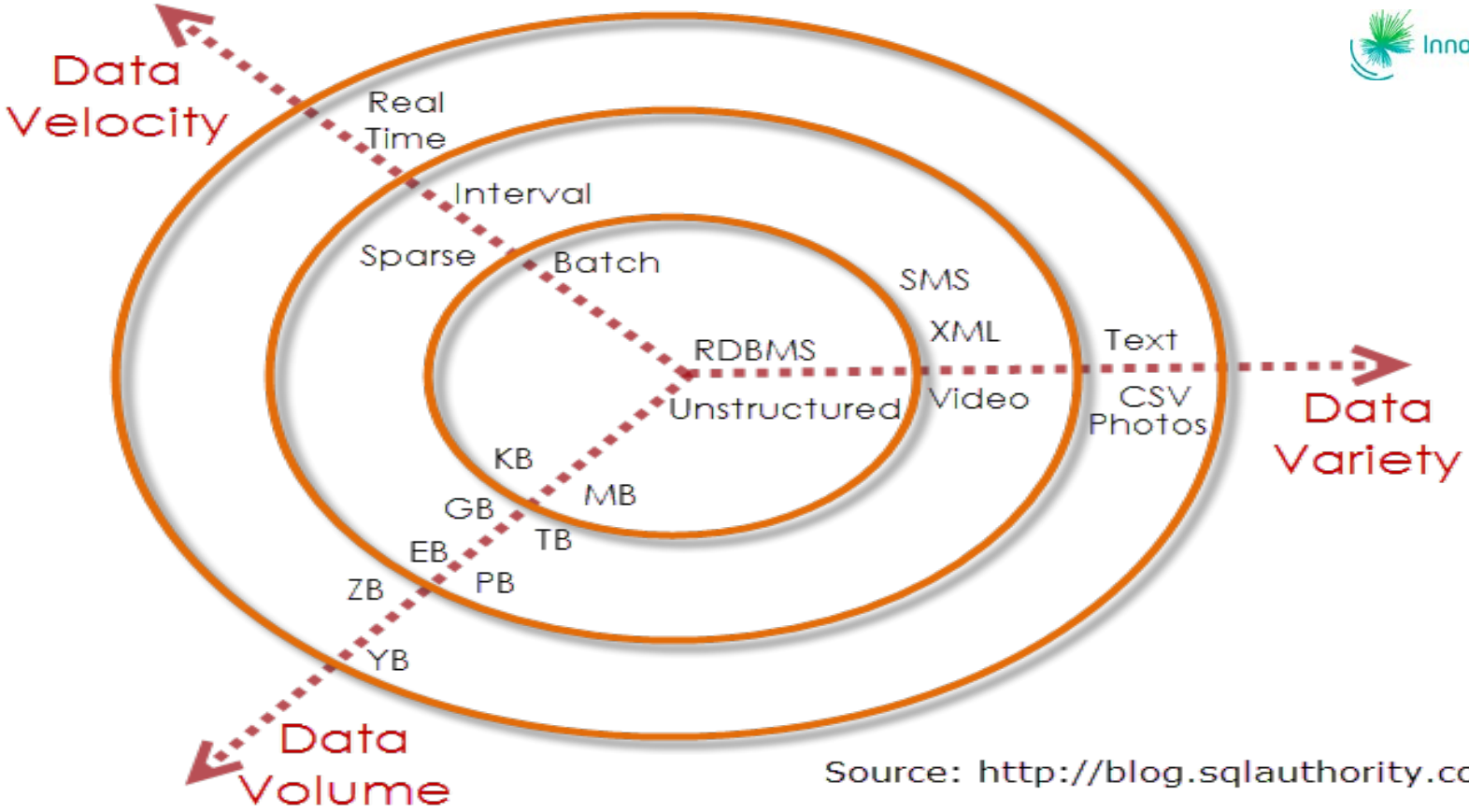
Topics

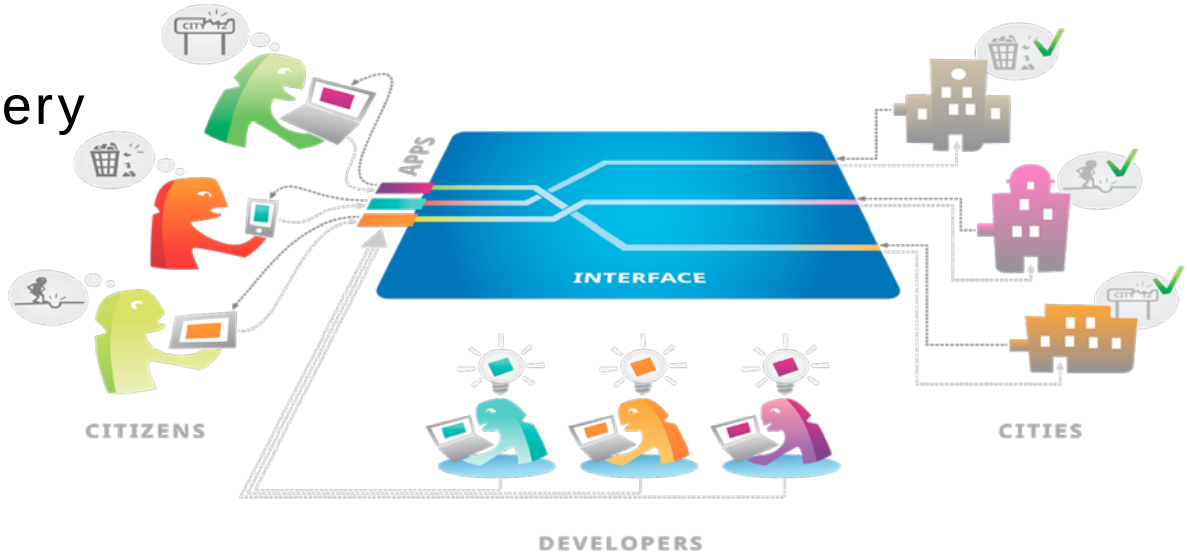
3Vs of Big Data



Source: http://blog.sqlauthority.com

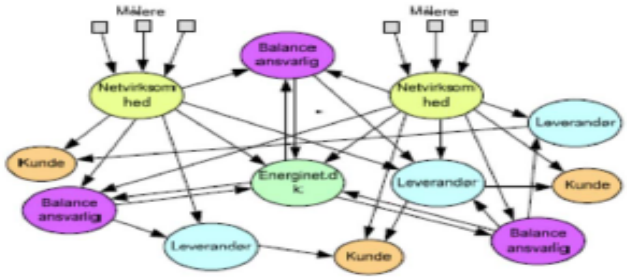
Open Data for Smart Cities: what are the benefits?

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



The Danish DataHub solution

From decentralized market management



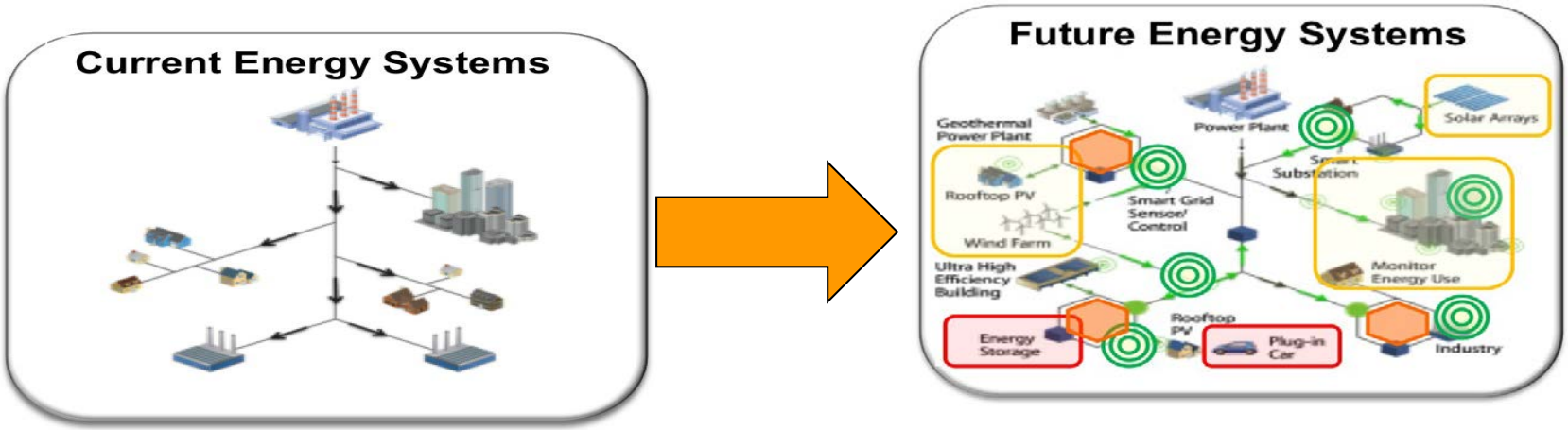
Winter 2012/-13

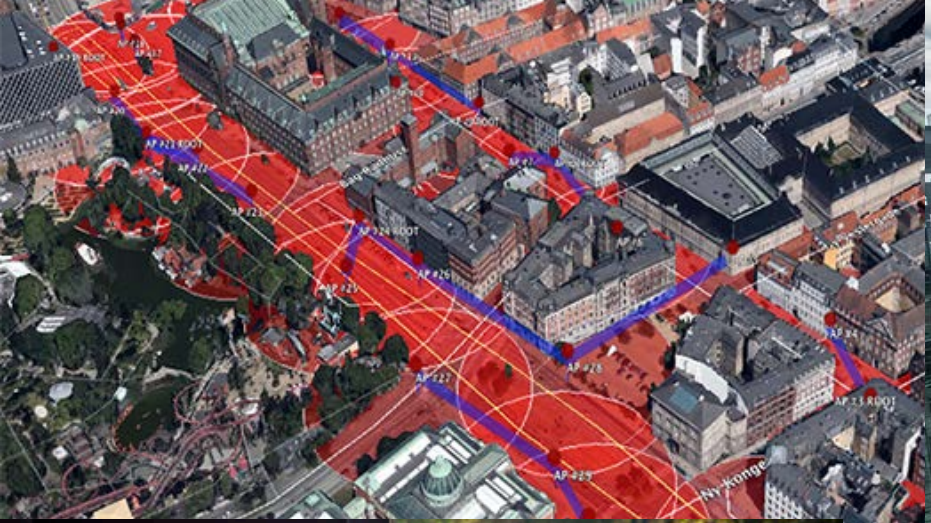
to centralized market management

Keywords: Digitization, unbundling, efficiency and transparency

Change towards smart netvorks or decentral solutions

- From centralised to decentralised production





Translation

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

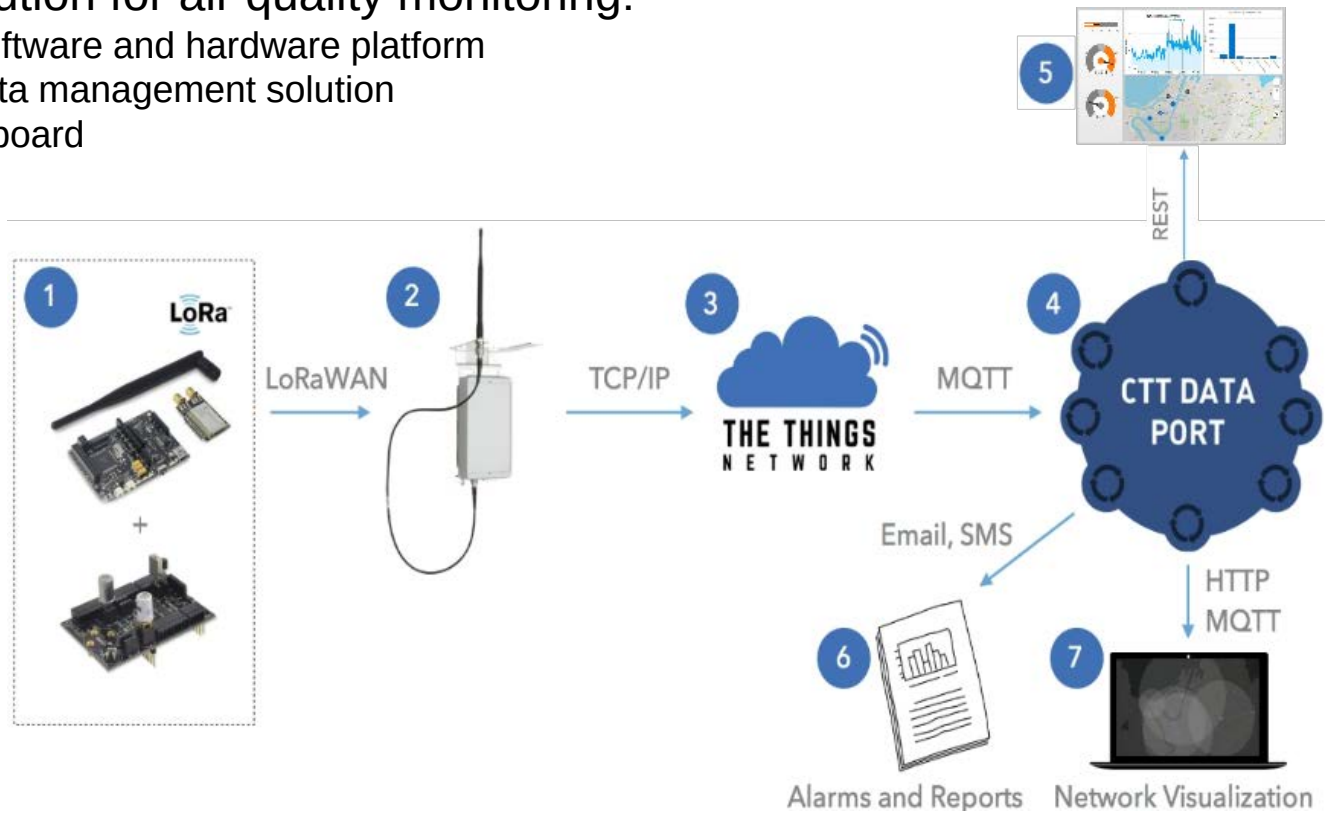
- But approximately 50 areas where each country can make own legislation
- Still going to be complicated

IoT sensors for monitoring air quality

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

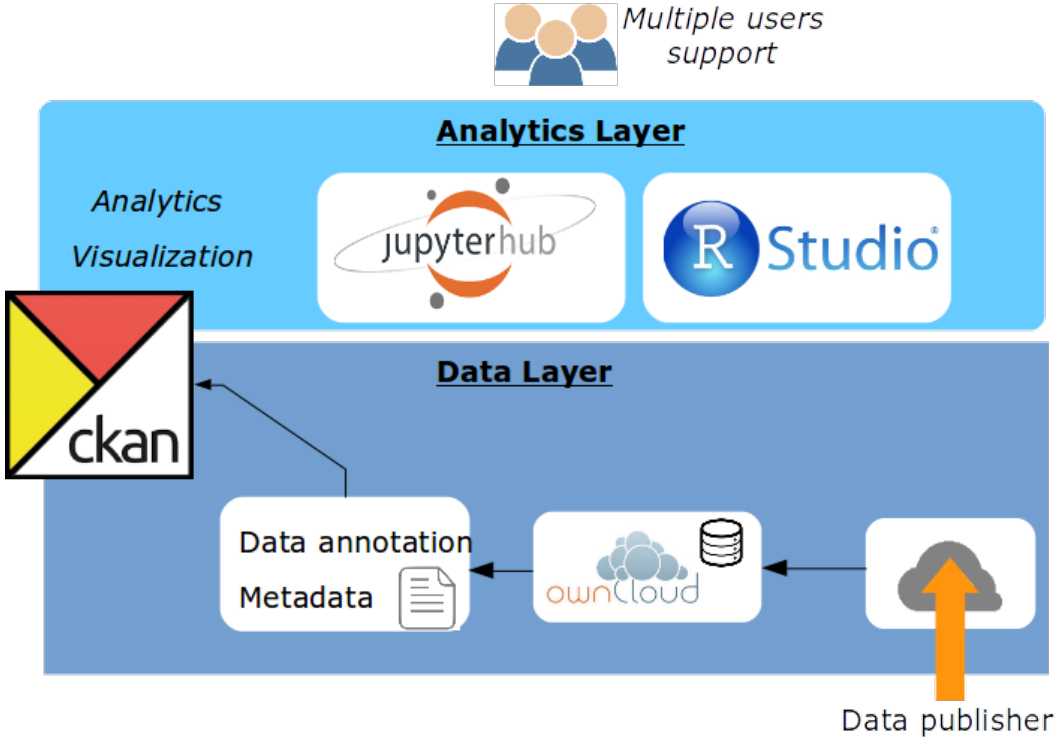


SciCloud Service - *Cloud-based data and analytics service*

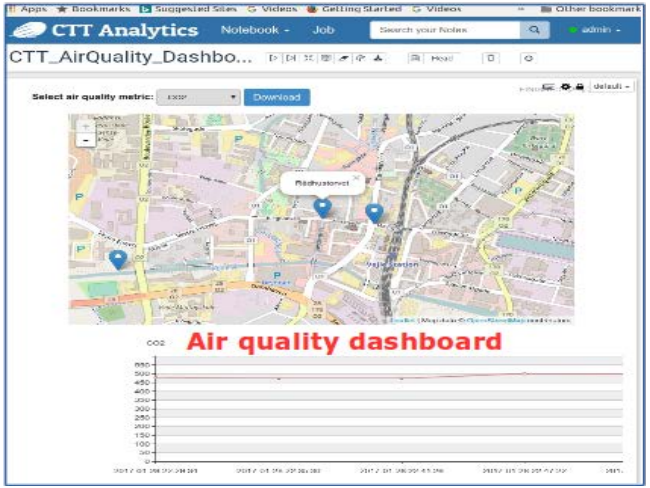
Cloud-based data management

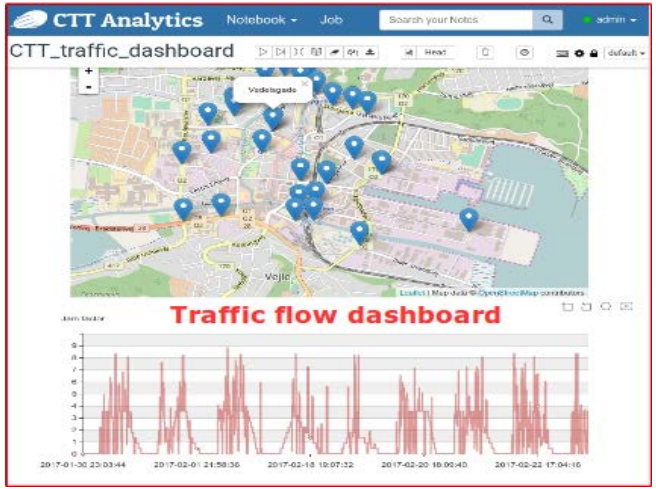
Open data portal

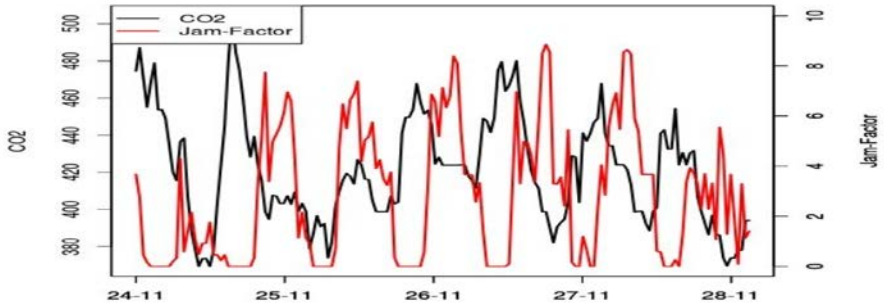
In-place data analytics service



Analytics and visualization







Model the correlation between traffic jam factor and CO2

Smart city projects in Denmark

Copenhagen city: https://cphsolutionslab.dk/en

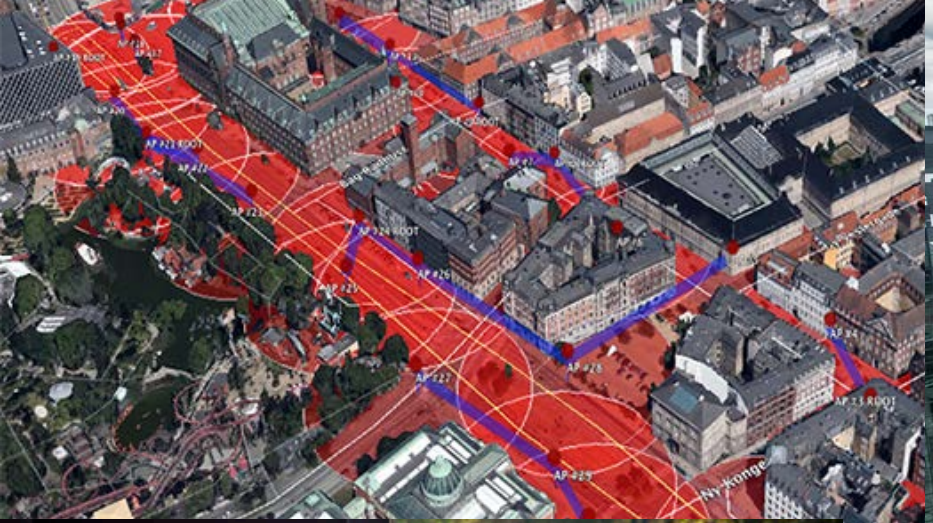
Aarhus: http://www.smartaarhus.eu/

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.



Thank you
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