

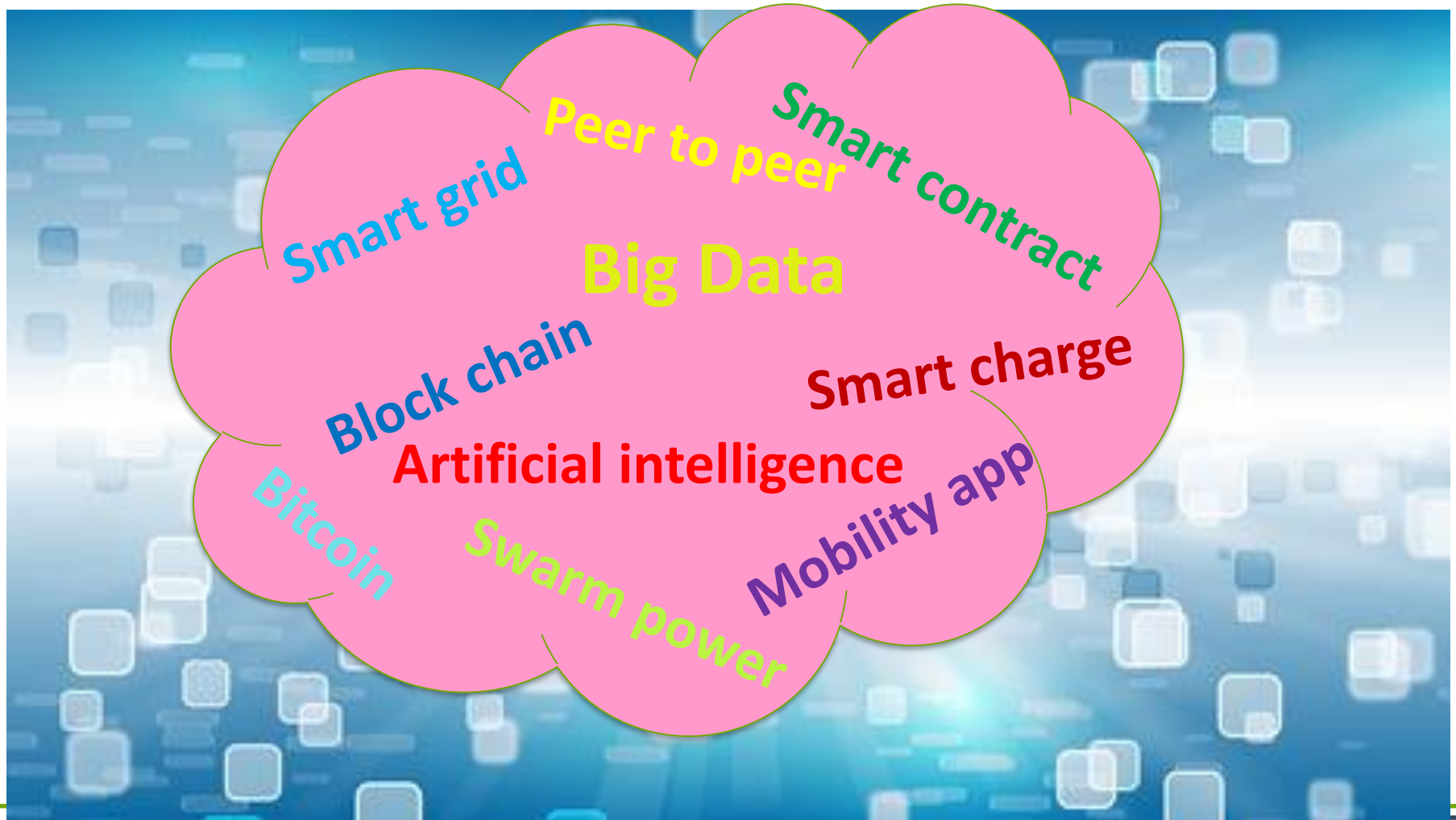
A landscape photograph showing a green field in the foreground, a line of trees in the middle ground, and a clear blue sky with a bright sun setting on the horizon. Several high-voltage power lines stretch across the sky from a pylon on the left towards the right. The sun is low on the horizon, creating a lens flare effect.

Digitisation - a systemic view

RGI Webinar 25.11.2019

Holger Loew

Shiny, smart, helpful



Agenda

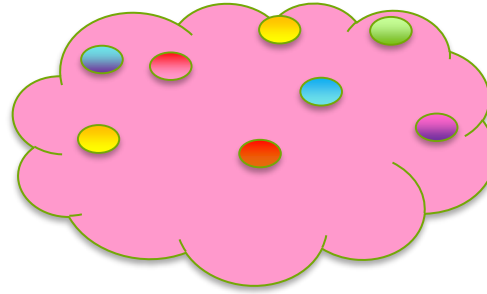
- Characteristics of digitisation
- Risks
- Solutions

The question

- How can the digitisation help to implement a sustainable energy transition ?

The digital sundae

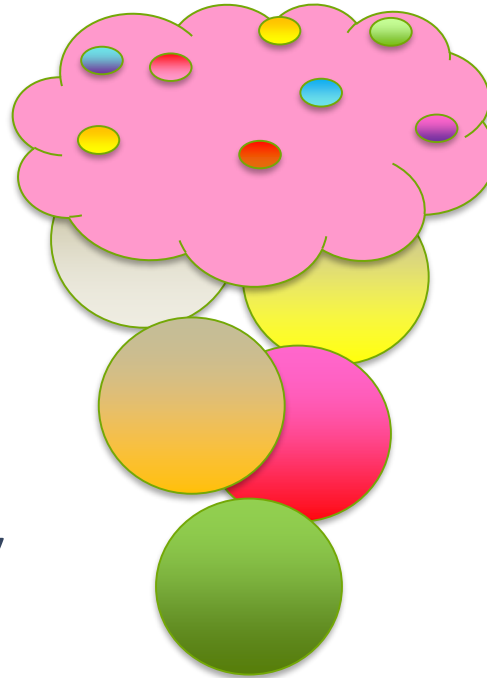
The cherry on the cake
The bubble business



The digital sundae

The cherry on the cake

The bubble business



The ice cream

Stable run of energy supply

The digital sundae

The cherry on the cake

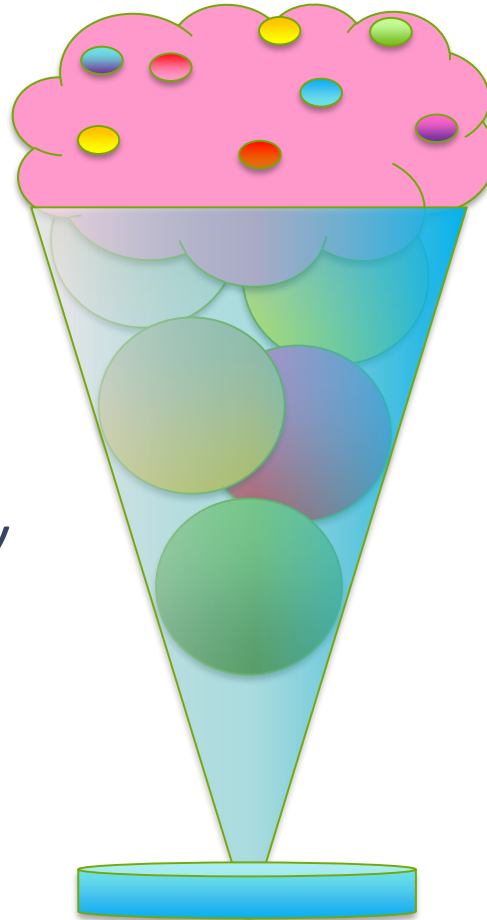
The bubble business

The ice cream

Stable run of energy supply

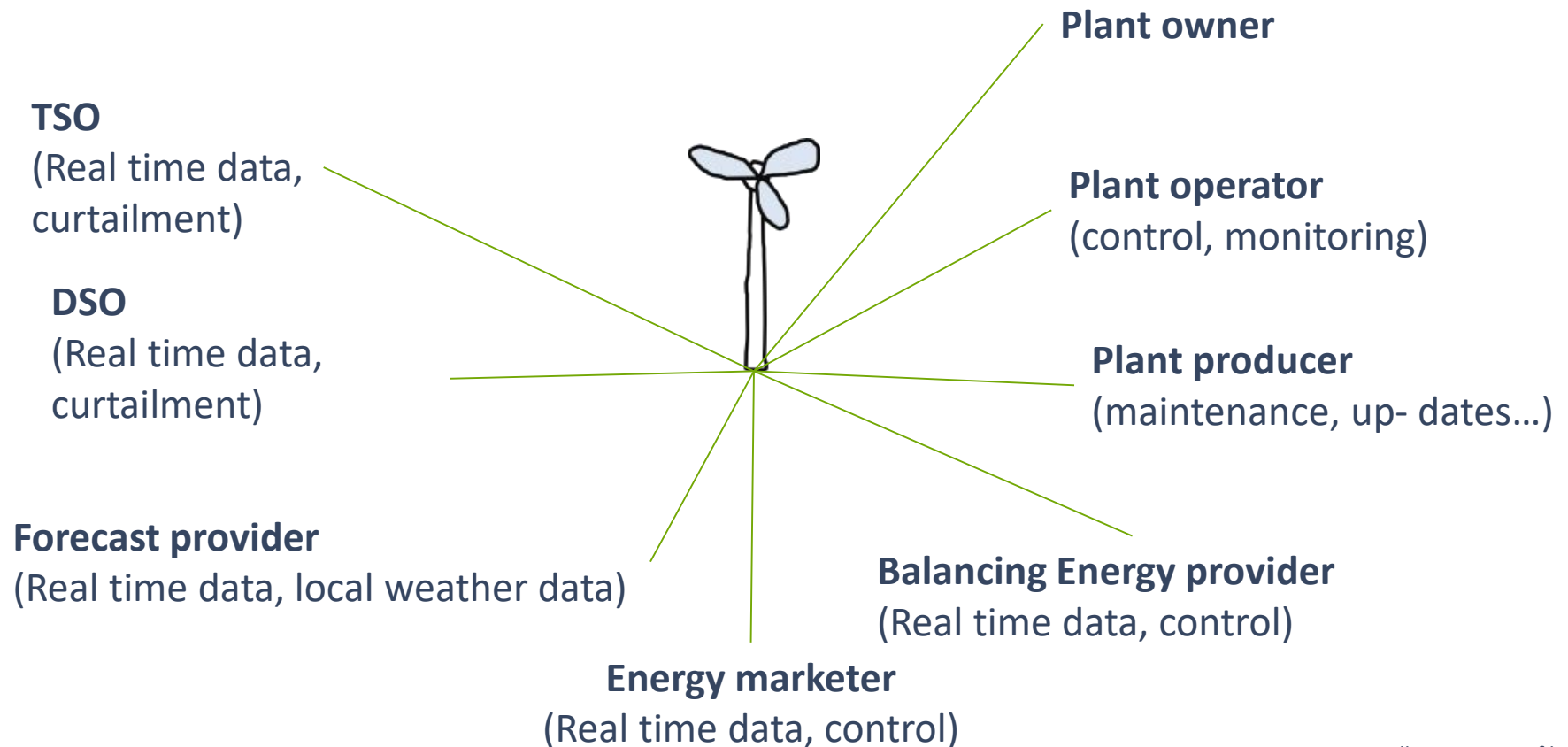
The goblet

Basic emergency functions



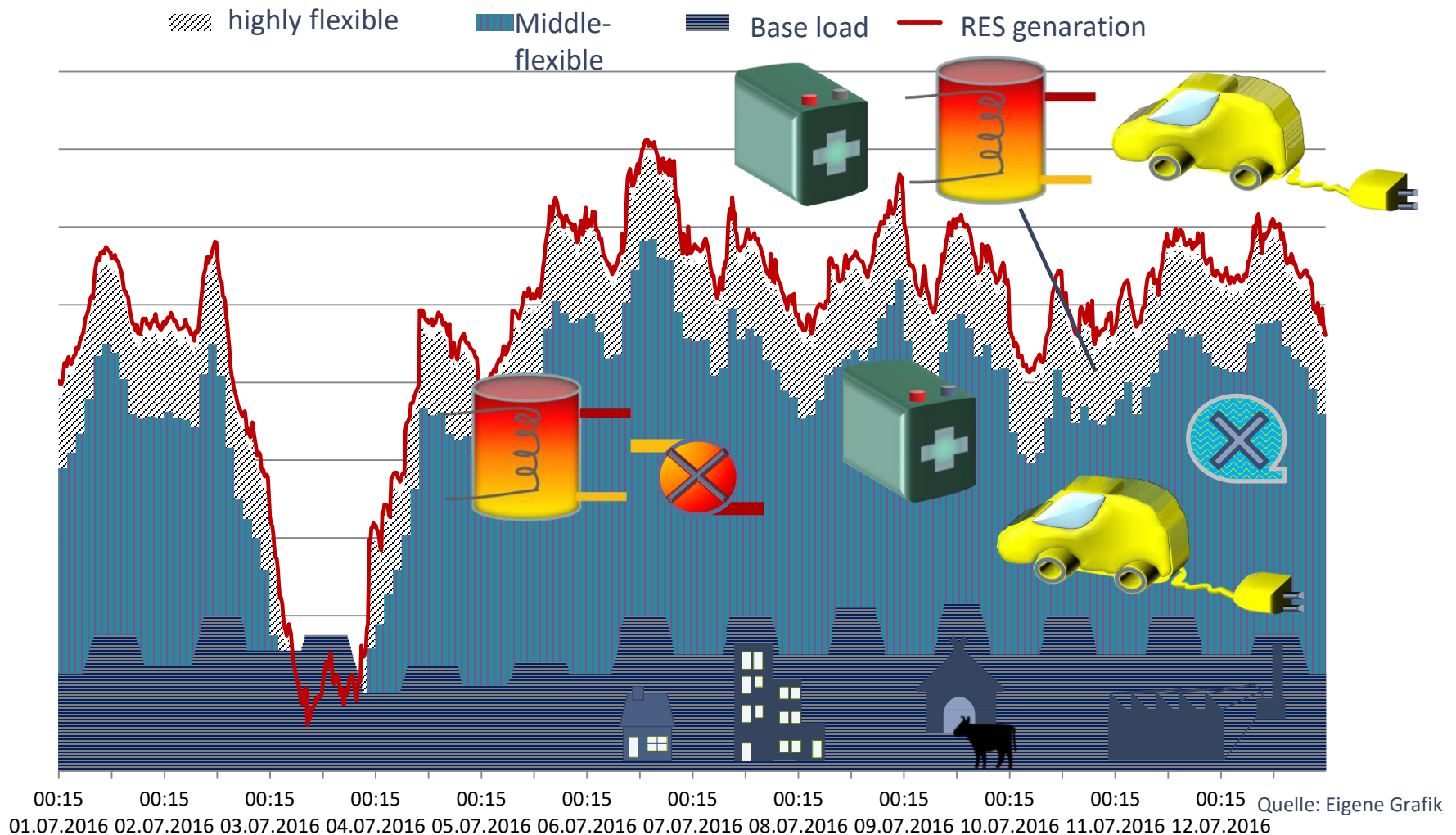
Actual Communication Needs

Parties with communicative access to a wind farm



Quelle: Eigene Grafik

Further system needs



Characteristics of digitalisation

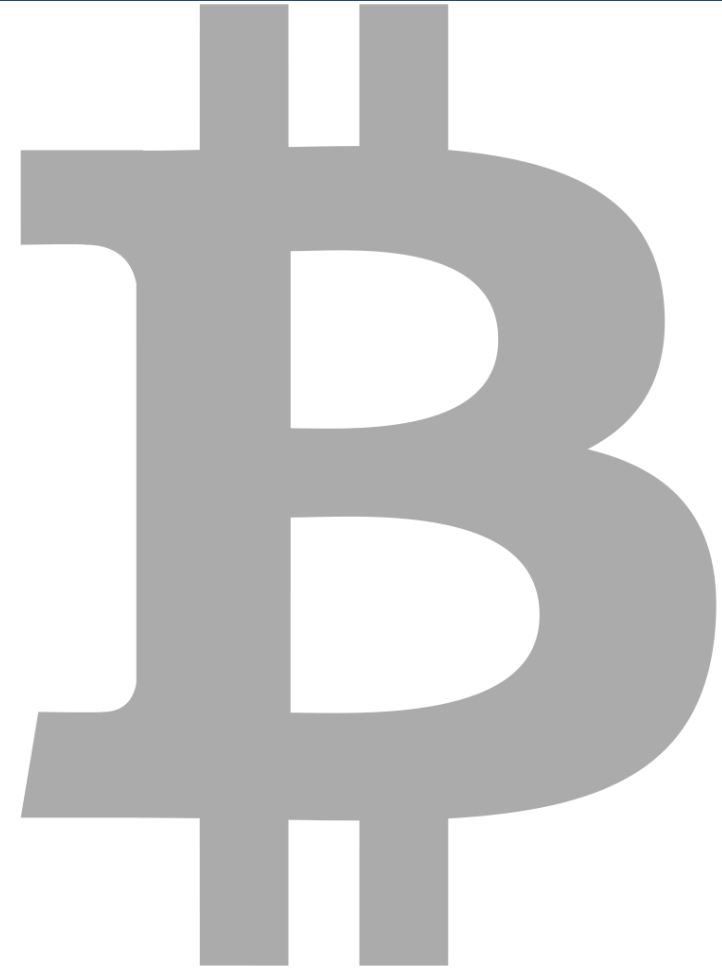
- Prediction as central tool
- Small transactions getting possible
- Coordinated control of high quantity of devices
- Smart contracts, automatized private trade agents
- Peer to peer, Block chain

Risks

The environmental side of digitalisation

Energy Demand Bitcoin:
(state Nov. 2018)

45.8 TWh and estimate
that annual carbon emissions
range from 22.0 to 22.9 MtCO₂
(Estonia 2017 - 20.9 MtCO₂)



Source: [https://www.cell.com/joule/fulltext/S2542-4351\(19\)30255-7](https://www.cell.com/joule/fulltext/S2542-4351(19)30255-7)

The oil of the 21th century / poison to democracy ?

Estimated growth of yearly data volume (exabit)



https://www.brz.gv.at/downloads/studien/2015-03-30_Big_Data_in_der_oeffentlichen_Verwaltung_v1.2_pub.pdf?55m9h7

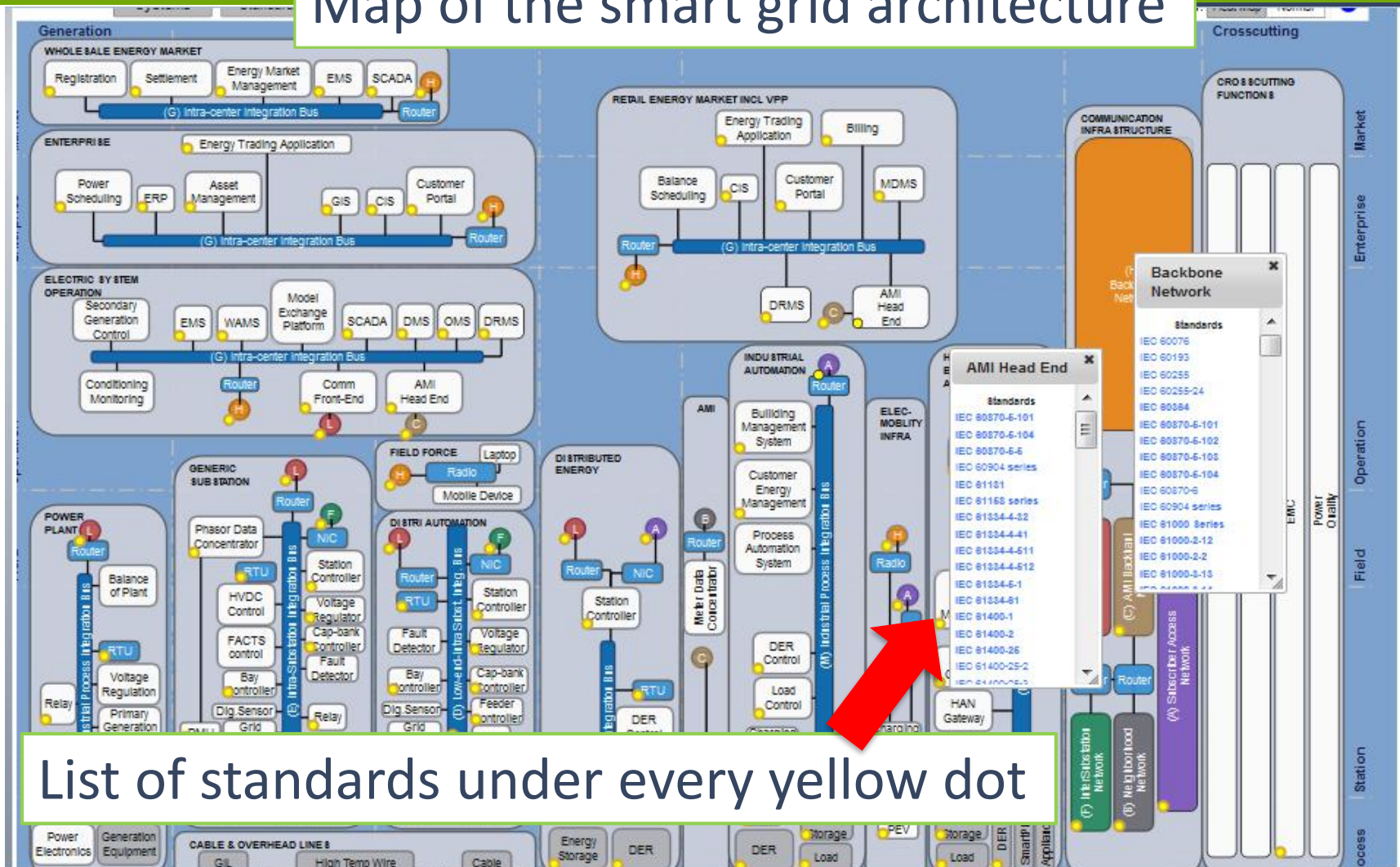
Many applications are not designed to support the system

Most business cases focus on generation of big data, energy demand and democratic* aspects have taken into account

* https://en.wikipedia.org/wiki/Cambridge_Analytica

Complexity a systemic danger

Map of the smart grid architecture

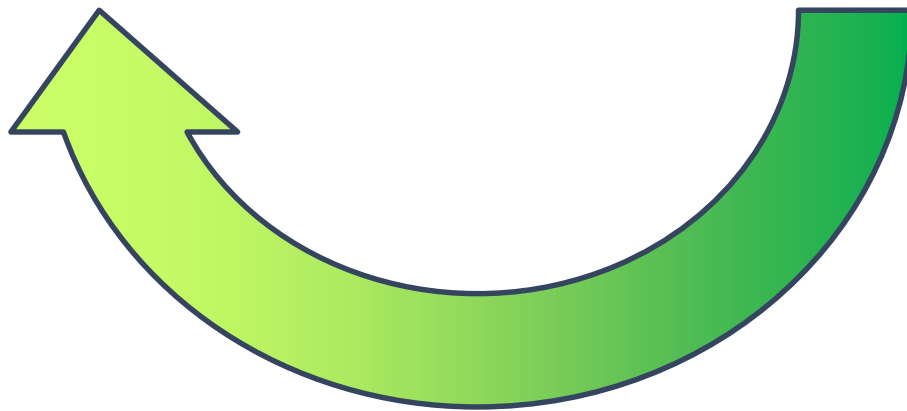


List of standards under every yellow dot

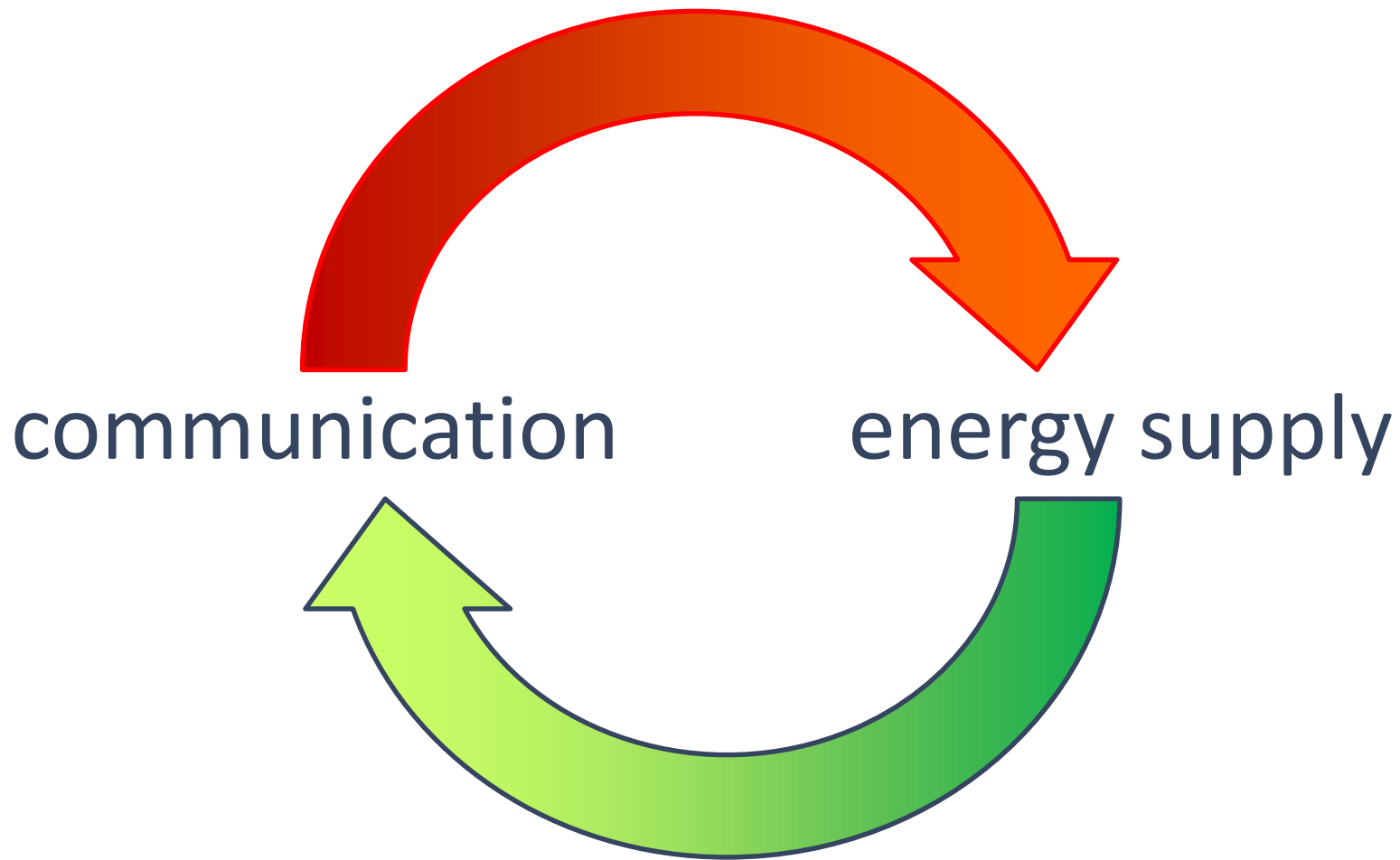
dependency

communication

energy supply

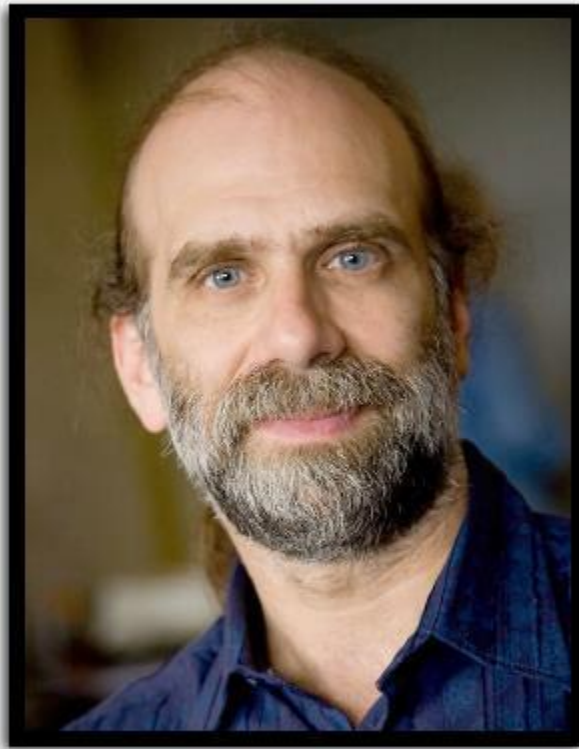


Fatal interdependence



What to do ?

Fail smartly

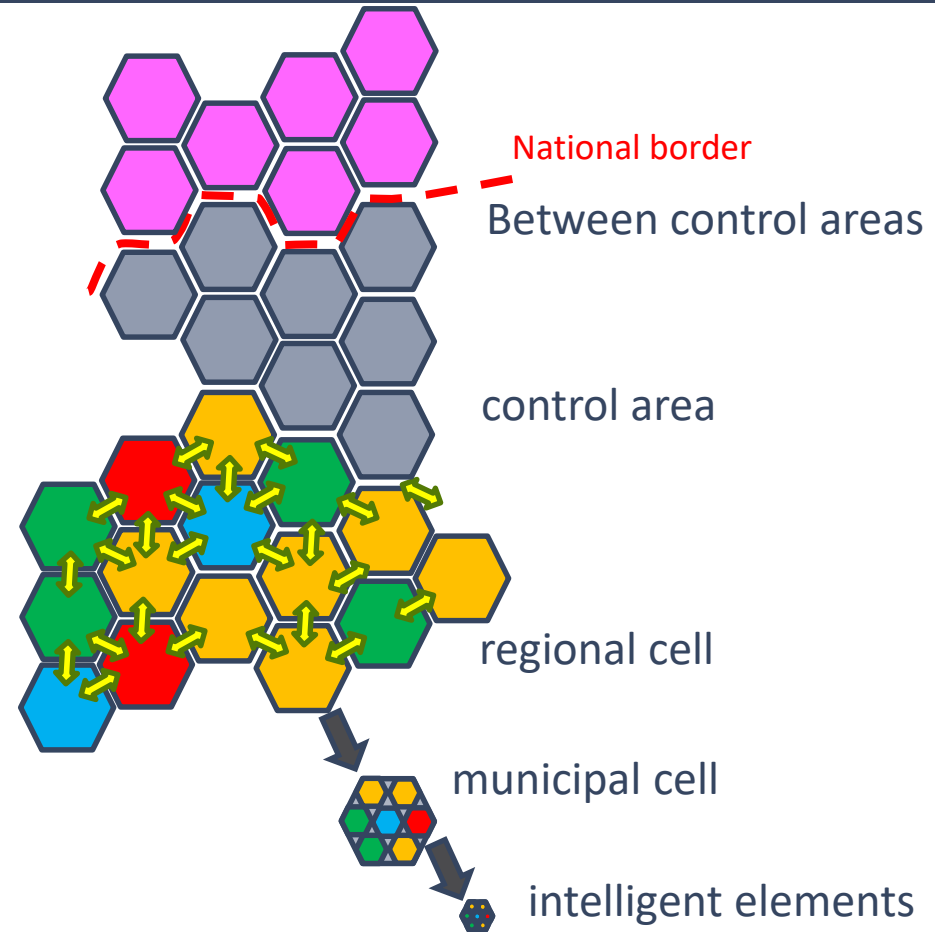
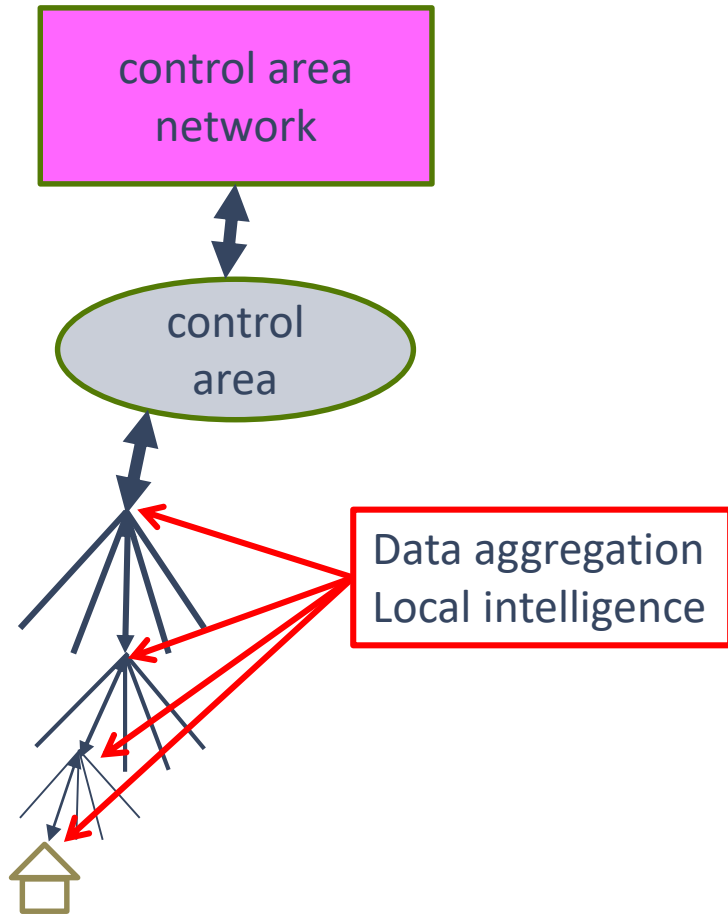


“We need systems that
'fail smartly'!”

Bruce Schneier
Cryptographie Guru

Quelle: Charles C. Mann, "Homeland Insecurity", 2002

Multiple layer structure





Many thanks for your attention!

Photo by [Fabrizio Chiapani](#) on [Unsplash](#)

First Projects:
islanding /
local black start
are successful



© Siemens

Gespannt verfolgen die Experten von Siemens den Übergang des Netzes in den Inselbetrieb.

<http://www.iren2.de/de/aktuelles/194-meilenstein-unseres-projektes-erfolgreiche-live-demonstration-zum-betrieb-eines-inselnetzes>

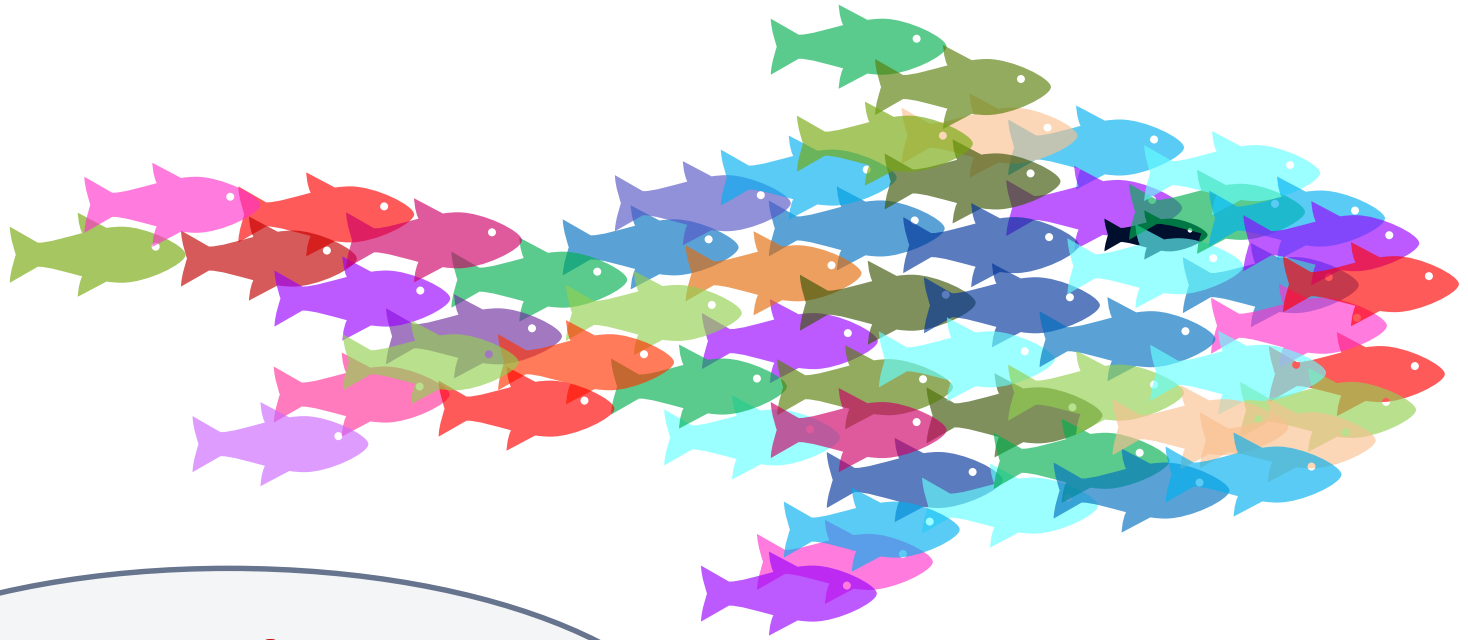
14 August 2017

Projektpartner wollen innovatives
Schwarzstartkonzept zur Marktreife bringen



Freuen sich im Batteriespeicher über den Erfolg der Phase 1: WEMAG-Projektkoordinator Tobias Struck (li) mit seinem Team sowie den Mitarbeitern von Younicos und der Universität Rostock. Foto: WEMAG/Stephan Rudolph-Kramer

Reduction of complexity



**Decentralization
reduces
complexity**

Risks (selection)

- Data and complexity lead to errors
- Attacks on network systems are steadily increasing
- Risks arising from interdependence of communication and energy supply
- High speed of automated systems complicates control of errors
- Increase in extreme weather events has implications for communication and energy supply

The tasks to resolve

- Main tasks (system optimization)
 - Efficient use of energy infrastructure
 - Coordinating many (billion) RES generators
 - Coordinating many (billion) flexible loads
 - Accuracy of weather/ production/ grid load/ forecasts
 - Raise efficiency of energy use

Reduction complexity

