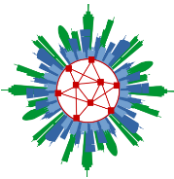


Smart Cities viewed as IoT-Systems

Andreas Winter
winter@se.uol.de



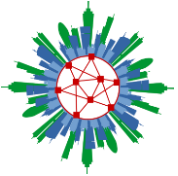
Promise of Smart Cities

Problem behind

- Global community must cope with comprehensive change in environment and economy
 - climate change
 - increase of population in urban areas
 - population is expected to double in 2050
 - cities have to improve their organization to provide their services to citizens
 - aging population

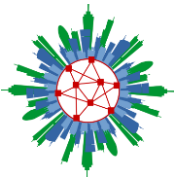


request a *“holistic approach integrating technological, societal, and political dimensions [...] leading to associating all the stakeholders of a complex living area”*



Smart Cities

- improve the quality of human life
 - facilitation of everyday life
 - social and respectful coexistence of people
 - economic sense of action
 - environmental protection
 - sustainable management and use of resources
- increase the efficiency of services in residential areas through the use of **information and communication technologies**



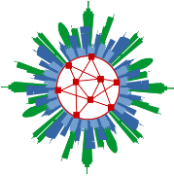
Smart Cities

“Smart City” describes

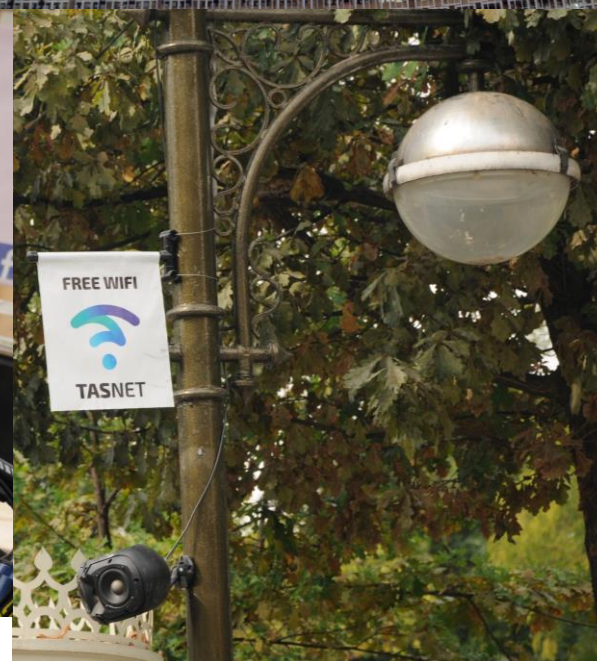
- the use of information and communication technologies for a more sustainable, social and ecological shaping of the coexistence of people in urban and rural areas.

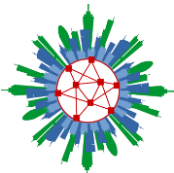


[https://ieeexplore.ieee.org/mediastore_new/IEEE/content/media/5/8326750/8326764/betis7-2814239-large.gif]



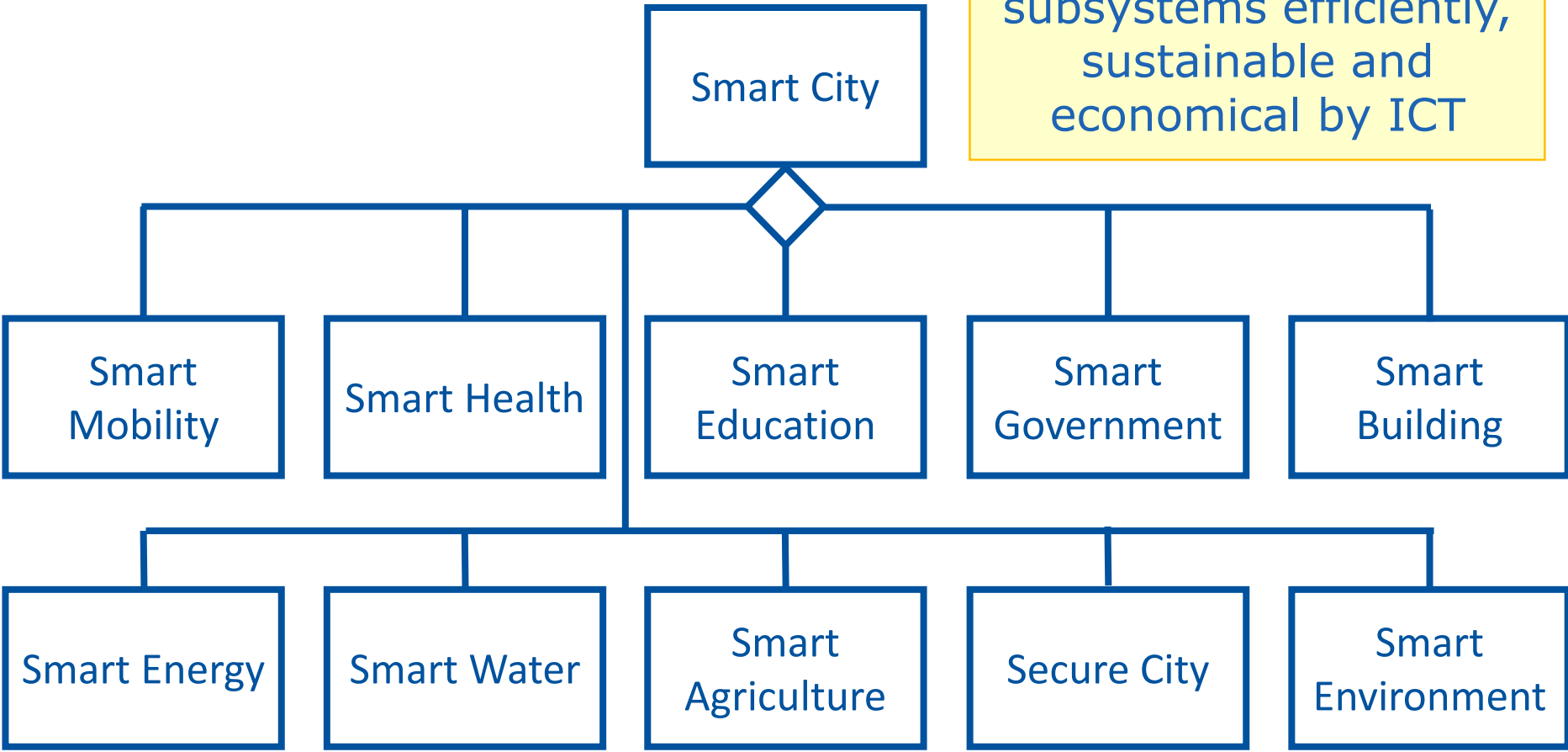
Smart City Tashkent



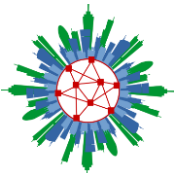


Application Areas

manage and operate subsystems efficiently, sustainable and economical by ICT

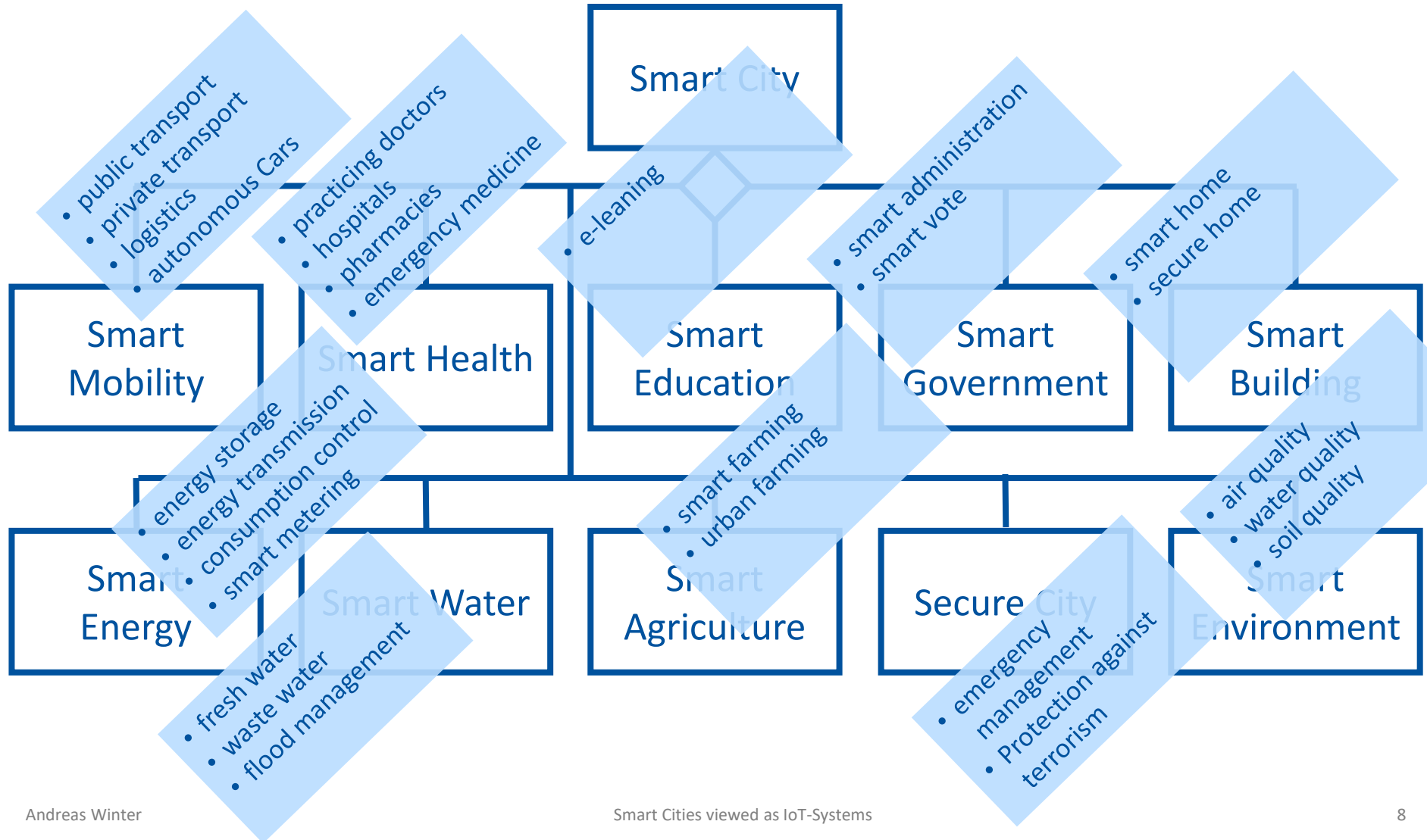


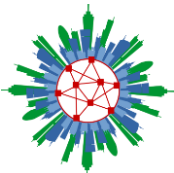
cf. [Lim, C., Maglio, P. P. (2018). Data-driven understanding of smart service systems through text mining. *Service Science*, 10(2), 154–180.]



Smart City Applications

Application Areas provide sma



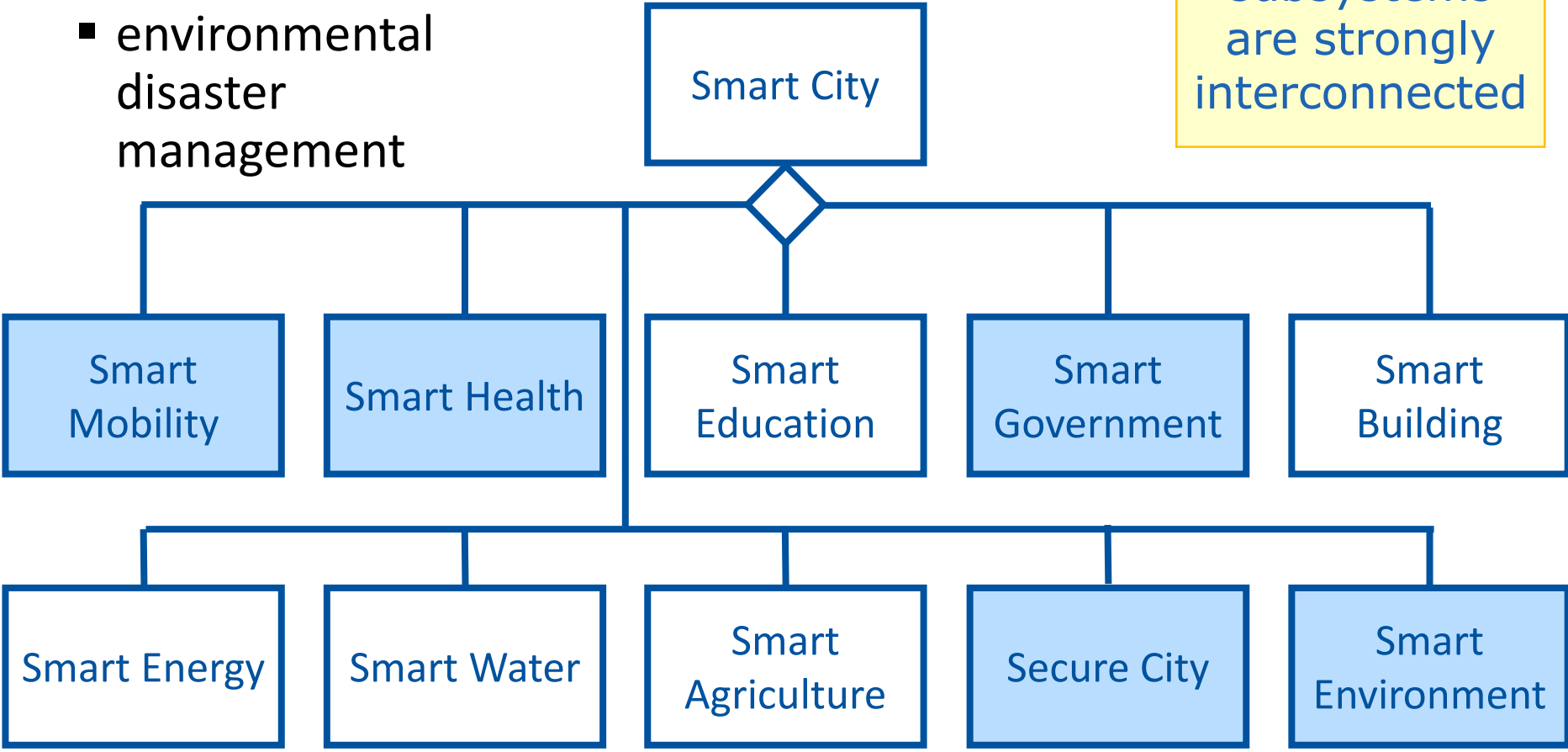


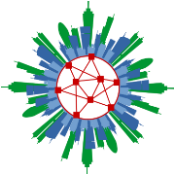
Smart City Applications

Scenario:

- environmental disaster management

subsystems are strongly interconnected





Smart Cities

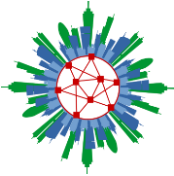
- will consist of various interconnected smart systems
- can not be created in “one shot”

Developing Smart Cities

- requires an iterative and incremental approach, providing more and more “smart services”
- requires to stepwise integrate and improve “smart services”

Smarter Cities getting smarter and smarter

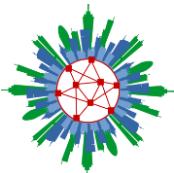
[thanks to
Peyman Khodabaksh at
SuMoCoS-Mongolia]



Smart cities are

- **sensible** environment is sensed by sensors
- **connectable** networks provide data in web and cloud
- **accessible (and visible)** information on the environment is published to users on the web and on (retrofitted) physical things
- **ubiquitous** data is mobile, accessible anytime, anywhere
- **sociable** data can be published by users through their social network
- **sharable** data and physical objects are freely usable (if public)

c.f. [Cassandras, C.G., (2016). Smart Cities as Cyber-Physical Social Systems. Engineering 2. 156–158.]



Smart City Stages

Stage 1: Technology Driven

- initiated by technology providers
- fancy technology used by early adopters
- impact to citizens quality of life not reflected



[<https://www.dpreview.com/files/p/articles/2474307225/device-car.jpeg>]

Stage 2: Technology Enabled

- initiated by innovative municipalities and city administrations
- use technology to improve quality of life

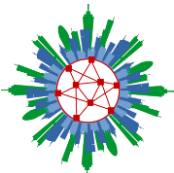


Stage 3: Citizen Co-created

- initiated by intensive involvement of citizens
- citizens participate in design, development and operation



[Boyd Cohen: The 3 Generations of Smart Cities
<https://www.fastcompany.com/3047795/the-3-generations-of-smart-cities>, 2015]



Stage 3: Fliegerhorst, Oldenburg

Raum für Ko-Kreation

Smart City Plattform



Identifikation, Entwicklung und Erprobung von Anwendungsmöglichkeiten und Geschäftsmodellen für eine interaktive Nachbarschaftsplattform

Nachbarschaften



Quelle: Stadt Oldenburg und Machleidt GmbH, Jens Gehrken

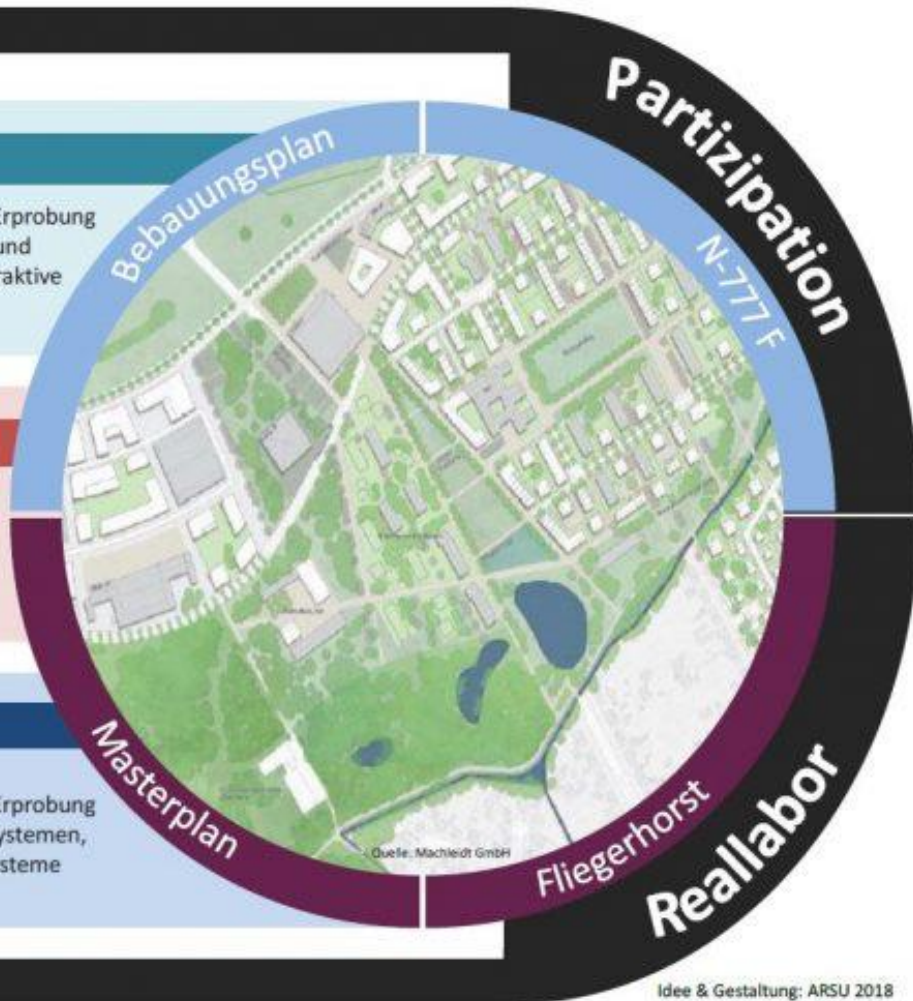
Identifikation, Entwicklung und Erprobung neuer Wohnformen sowie neuer Konzepte lokalen Wirtschaftens und nachbarschaftlicher Quartiere

Smart City Infrastruktur

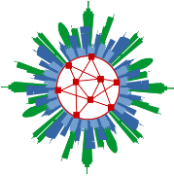


Identifikation, Entwicklung und Erprobung von multimodalen Versorgungssystemen, sozialer und finanzieller Anreizsysteme

Raum für Realexperimente



[<https://www.enaq-fliegerhorst.de/buergerbegeiligung/>]



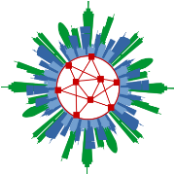
Smart Cities

- connect
 - local resources (things)
 - government
 - companies
 - citizens and visitors
- by mobile devices

Smart Cities are based on *Technological Factors*

- connection between people and things
- collection of data
- calculation in the cloud
- communication by wireless means

[Lim C., Kim K.-J., P. P. Maglio (2018). Smart cities with big data: Reference models, challenges, and considerations. *Cities*, 82, 86-99.]

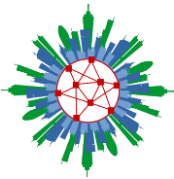


Smarter Cities request

- efficient collection of data
- efficient analysis and evaluation of this data
- efficient visualization of evaluation results
- efficient and effective implementation of actions
- efficient proposals of recommendations for action

technical Smarter Cities support requests

- infrastructure of sensors to gather data and actuators (**things**)
- infrastructure to integrate widely distributed, heterogeneous things (**sensor/actuator-network**)
- infrastructure (**software architecture**) to create, evolve and integrate smart smart services
- infrastructure to implement and provide (distributed) services
- infrastructure to store and manage heterogenous data (**big data**)



Things

- include any everyday objects
- own an unique identity and
- communicate autonomously

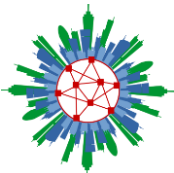
Internet of Things

- describes a **technical vision** to integrate all kinds of things (objects) into a universal digital network
- **is ubiquitous** accessible anytime, anywhere
- **is invisible** disappears from the visual perception
- **reacts autonomously** acts without direct user-interaction

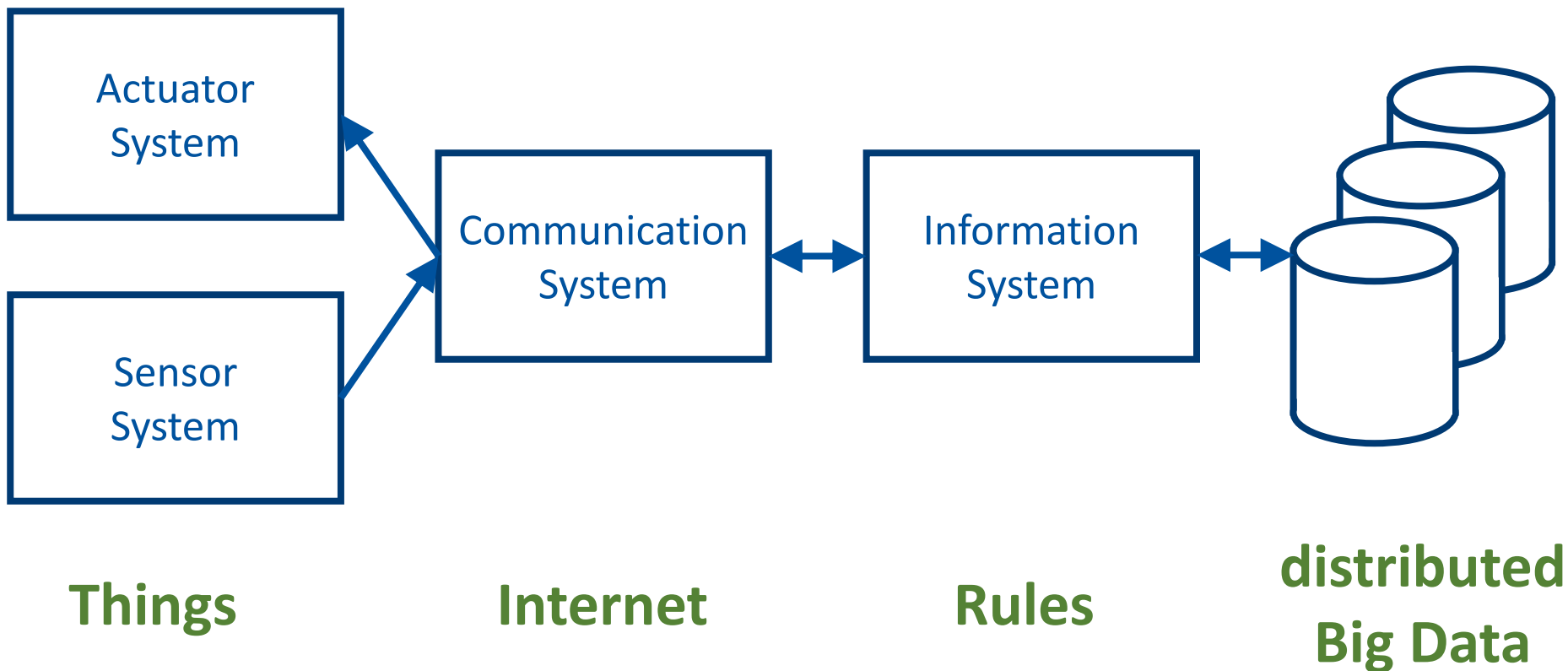


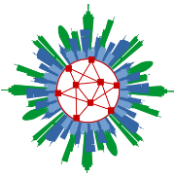
Wissenschaftlicher Dienst
des Deutschen Bundestags

The Internet of Things provides the technical
foundation of Smart Cities



Smarter City Reference Architecture

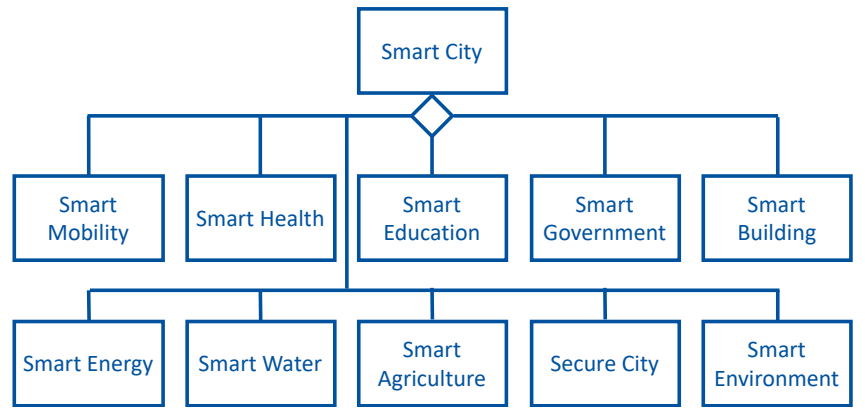


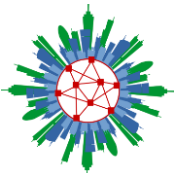


Challenges for the development and operation of smarter cities

Technical Challenges

- provision of appropriate technical infra-structure
 - things: reliable and correct sensors and actors
 - communication system: secure, reliable, high-performance Internet
 - information system: service- and component oriented architecture
 - data storage: distributed, big data
- targeted, efficient handling of large amounts of data
 - big data vs. data avoidance and data economy
- integrate **heterogeneous**, distributed devices into a common software system
 - sensors, actuators, data bases, server, (mobile) devices, ...
- integrate **heterogeneous** smart city subsystems
 - all those from the application areas



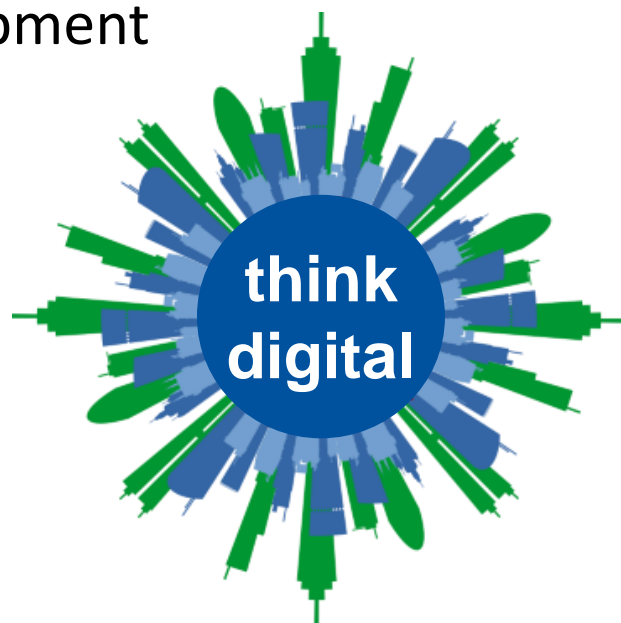


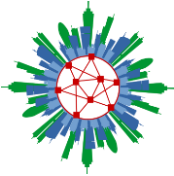
Challenges for the development and operation of smarter cities

Social and Political Challenges

- provide Smart City services for all citizens
 - digital natives vs. digital resisters
 - high band-width user vs. non available internet
- create awareness of the opportunities and risks of the Smart City
 - enable participative Smart City development
 - take fears seriously
 - educate potential user
- take data protection seriously
 - inform about data usage
 - pay attention to data economy
- solve legal issues

create
Smart Citizens





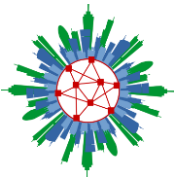
SuMoCoS Participants

- provide many competences to create and manage Smarter Cities
- request many competences to make use of Smarter City Applications

SuMoCoS Conference

- aims at collecting and sharing these competences





Smarter Cities

- are socio-technical systems of
 - people and organizations
 - data and information
 - technology
- cover a wide range of different but interconnected application
 - smart X
- require multiple technical support
 - sensor and actuator system
 - information/rule system
 - communication system

please
embed your
presentation
into that
frame for
smart cities





Prof. Dr. Andreas Winter
Carl von Ossietzky University Oldenburg
Department of Computing Science
Software Engineering Group
26111 Oldenburg
+49 441 798-2992
<https://uol.de/se?winter>
winter@se.uol.de