



Cyber physical systems and Smart cities

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Joseph von Fraunhofer (1787 - 1826)



Scientist

Discovery of the "Fraunhofer-Lines" in the solar spectrum

Innovator

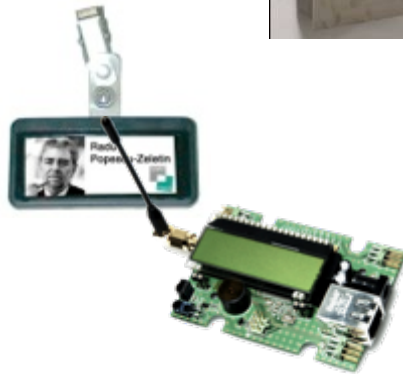
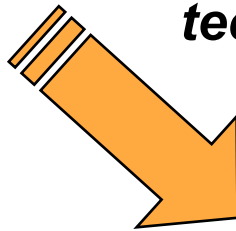
New tooling methods for lenses

Entrepreneur

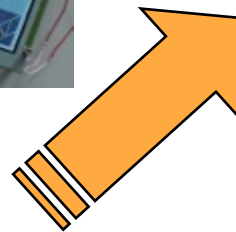
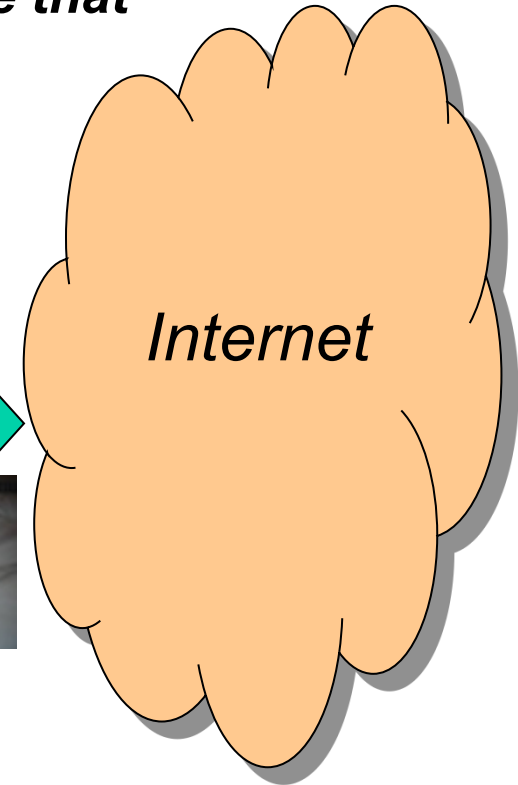
Director and associate of a glass factory



„The most profound technologies are those that disappear“



IPfication of devices



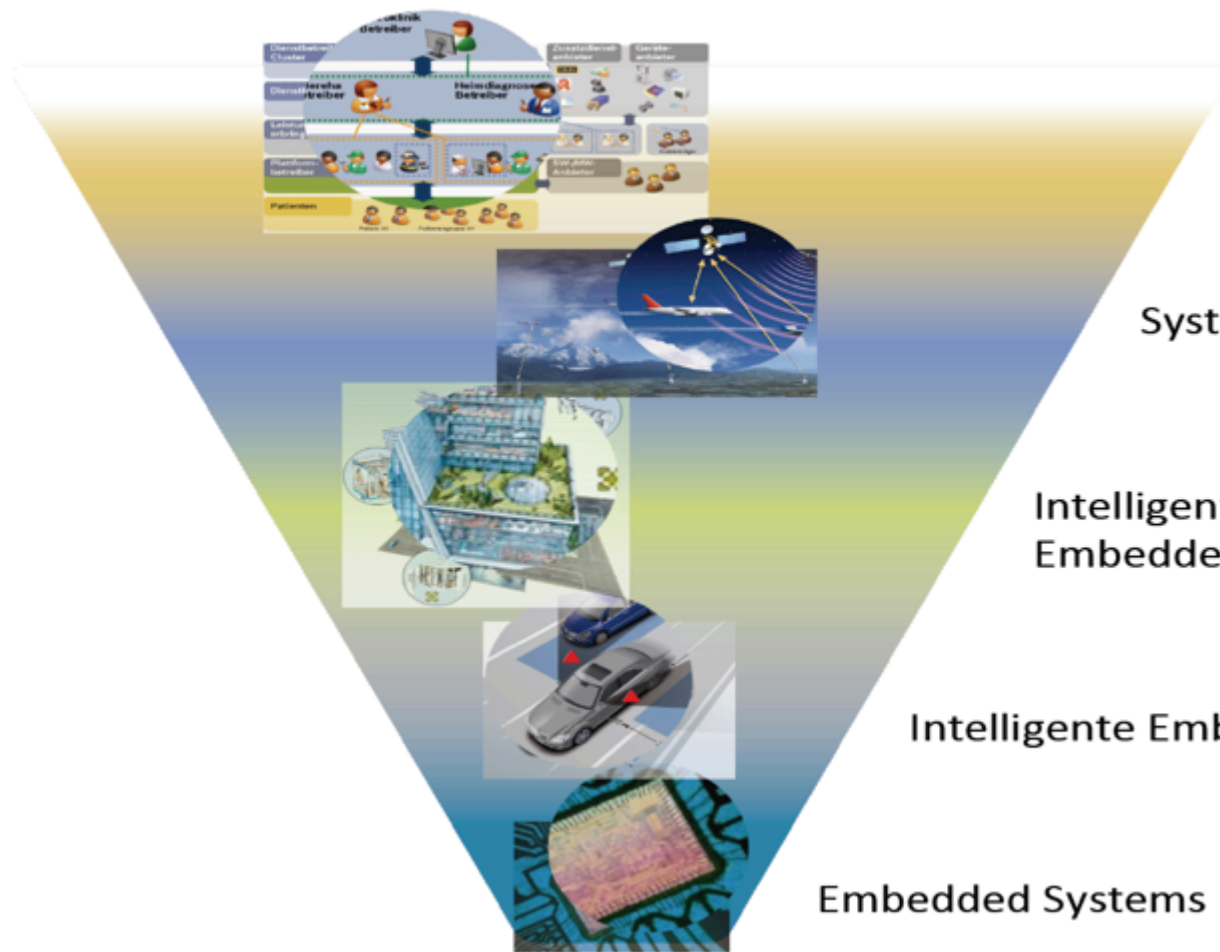
Zero-Gateway Architecture



Real, physical world

Internet





Cyber-Physical Systems

Systems-of-Systems

Intelligente und Kooperative Embedded Systems

Intelligente Embedded Systems

Embedded Systems



From CIM to Cyber physical Systems- a look behind

- 1973 Josef Harrington introduced CIM (computer integrated manufacturing)
 - CIM is the integration of total manufacturing enterprise by using integrated systems and data communication coupled with new managerial philosophies that improve organizational and personnel efficiency (Wikipedia)
 - Islands , physical separation closed systems (even in the enterprise, no communication with the outside world)
 - Limited attack potential
 - Limited potential attackers (only from inside)

- Cyber physical Systems are networks of ITC subsystems with mechanical and electronical components over a data communication infrastructure like Internet (Wikipedia)
 - Interconnected systems - open systems
 - End - systems – the embedded systems
 - Geographical non limited attack potential and nr of attackers

Cyber-physical Systems

The openness and complexity of a system defines the dimension of the attack space

- CP Systems Security a NP complex problem

- Security for CP systems redefined :
 - Security against attackers
 - Safety of the controlled systems
 - Intellectual Property

- There is no Secure System; we can improve but we never achieve a complete secure system (fata morgana effect)

- It is better to learn how to live in an insecure cyber space rather than hope that technology will provide secure systems.

- we need Security “Gebrauchsanweisung” for products and services we are using and integrate.



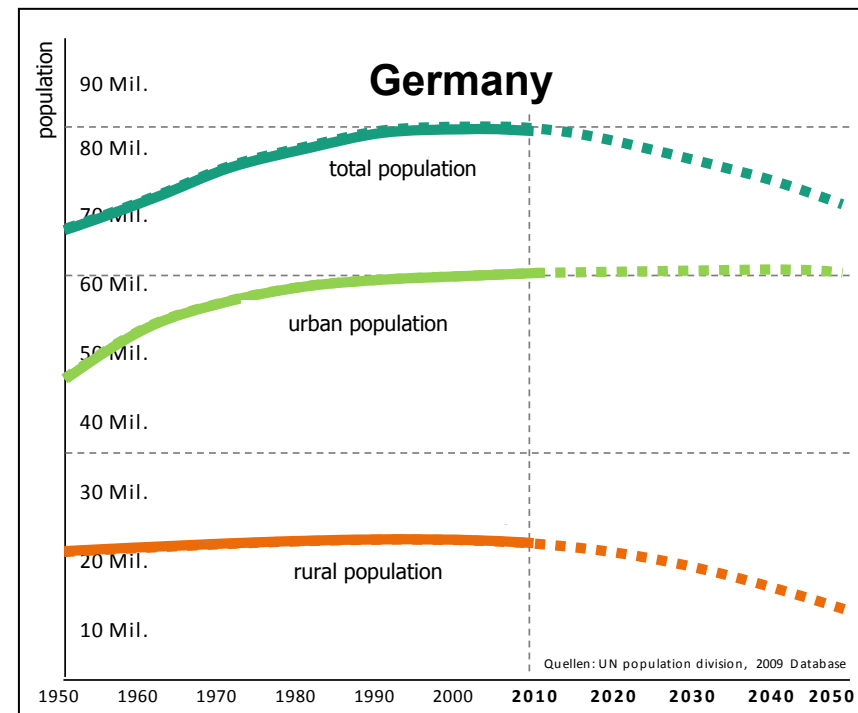
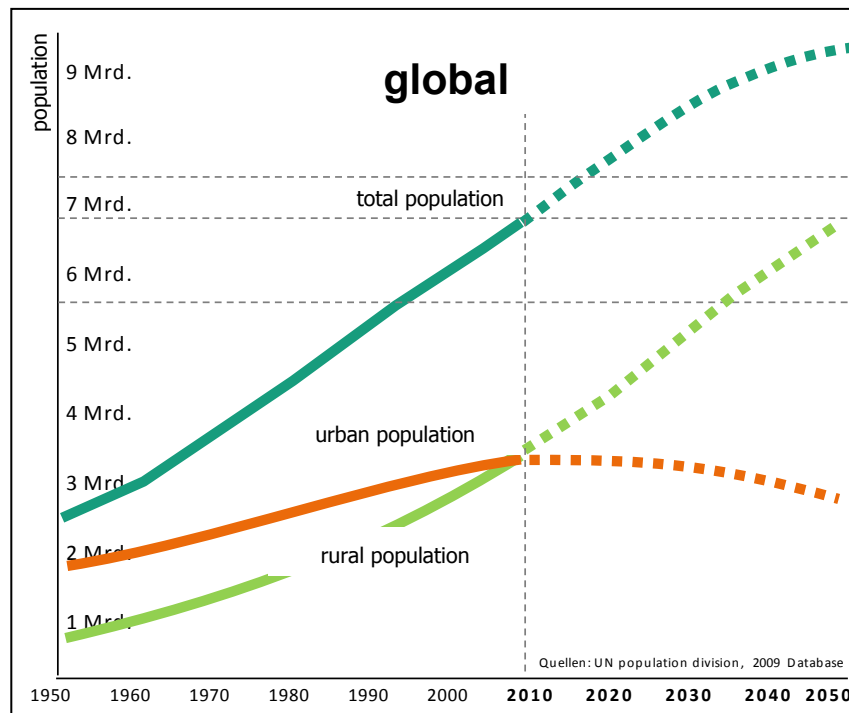
Cyber physical Systems

- Security by design
 - Dream or reality?
 - For CP systems secured by designed Internet has to be redefined
 - CP systems require a NP complex security framework
 - Security is expensive (Discussion on the BSI smart meter profile)
 - Security (technological, governance, laws, etc) independent of countries borders.
- What should be done
 - Identity ,identity, identity of persons, of objects, of services of everything
 - Identity the bridge between real world and cyberspace
 - Certification of everything in the communication space of the CP systems
 - End to end authentication in order to provide trust and responsibility
 - Different levels of security needed different technologies
 - Provide Security Gebrauchsanweisung und learn to evaluate the RISC of your application in a certain system (consider physical separation)

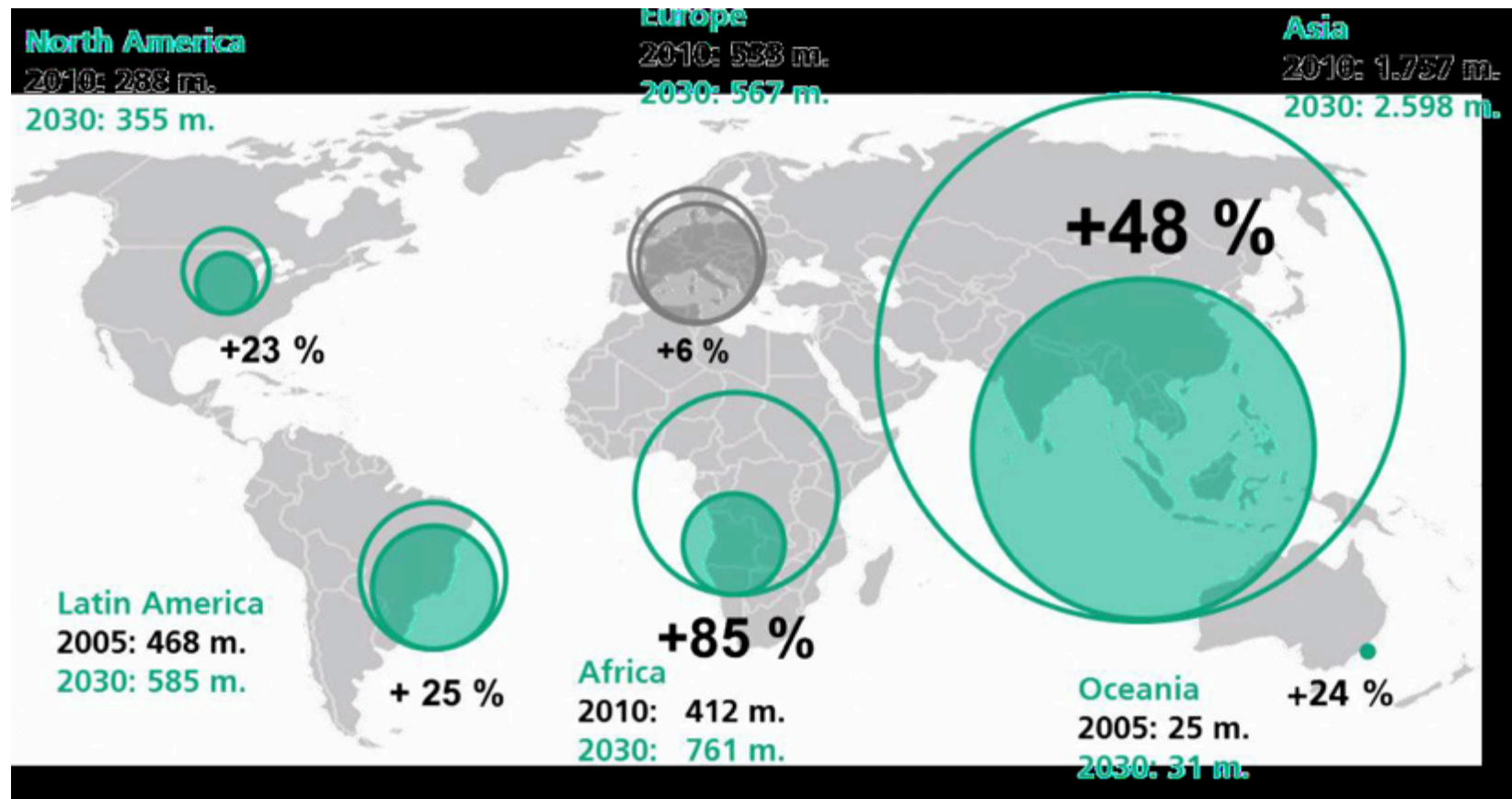
The 21st Century's Challenge

Growth of cities and sustainable development

- In 2050, more than 6.3 billion people will be living in urban environments – nearly twice as much as today
- Germany is considered as an archetype of an urban knowledge society

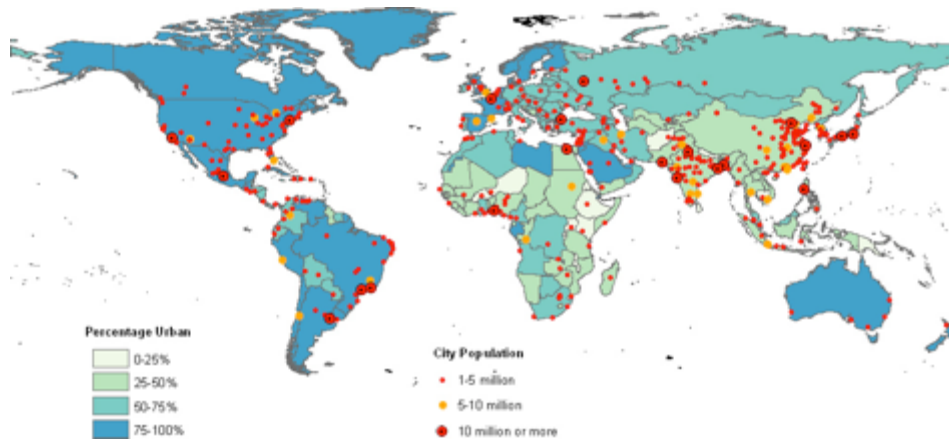


Growth of urban population until 2030 (UN 2010)

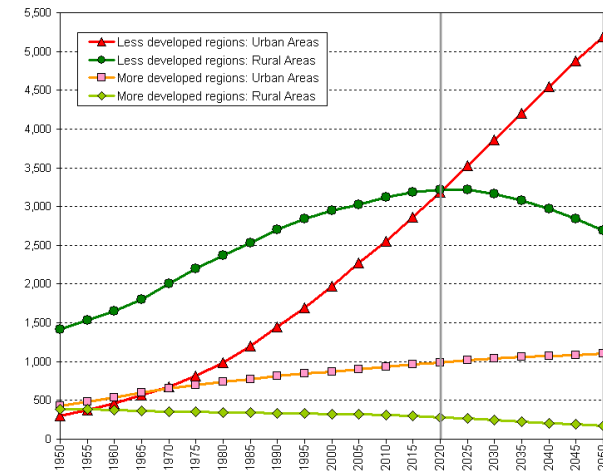


World Urbanization Prospects, the 2009 Revision

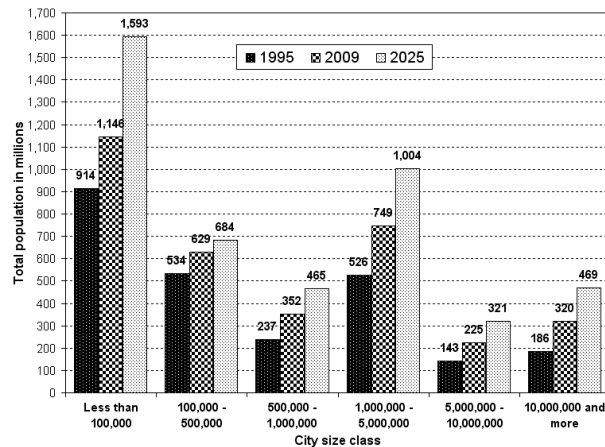
United Nations, Department of Economic and Social Affairs, Population Division



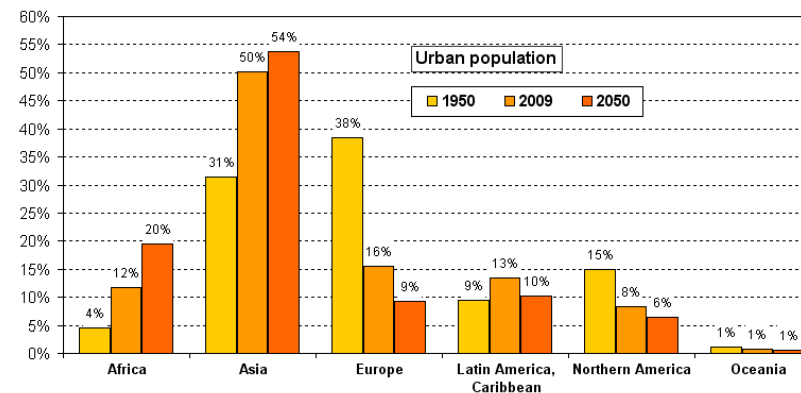
Urban Agglomerations in 2009 (proportion urban of the world: 50.1%)



Urban and rural population by development regions (in mill.)



Total population by city size class (in millions)



Distribution of the world urban and rural population by major area





What makes a city smart(er)?

Environment

The city produces **nearly zero CO₂ emissions**.

Energy

The city is highly **energy efficient**.

Administration

The city owns a **transparent and collaborative** administration.

Quality of Life

The city offers **best quality of life for every citizen**.

A Smart City links its urban subsystems and by this all of its potentials

... and many more...

Economy

The city is attractive for establishing **new business models**.

Climate Change

The city **responds to** the Auswirkungen **climate change's impacts**.

Mobility

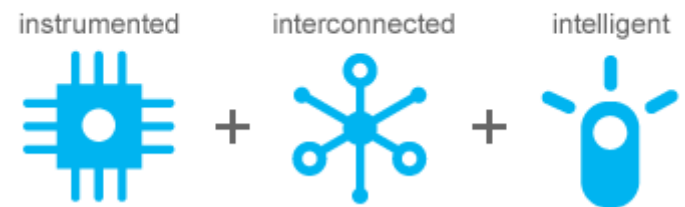
The city is a field for **continious eMobility**.

Quelle: www.big.dk



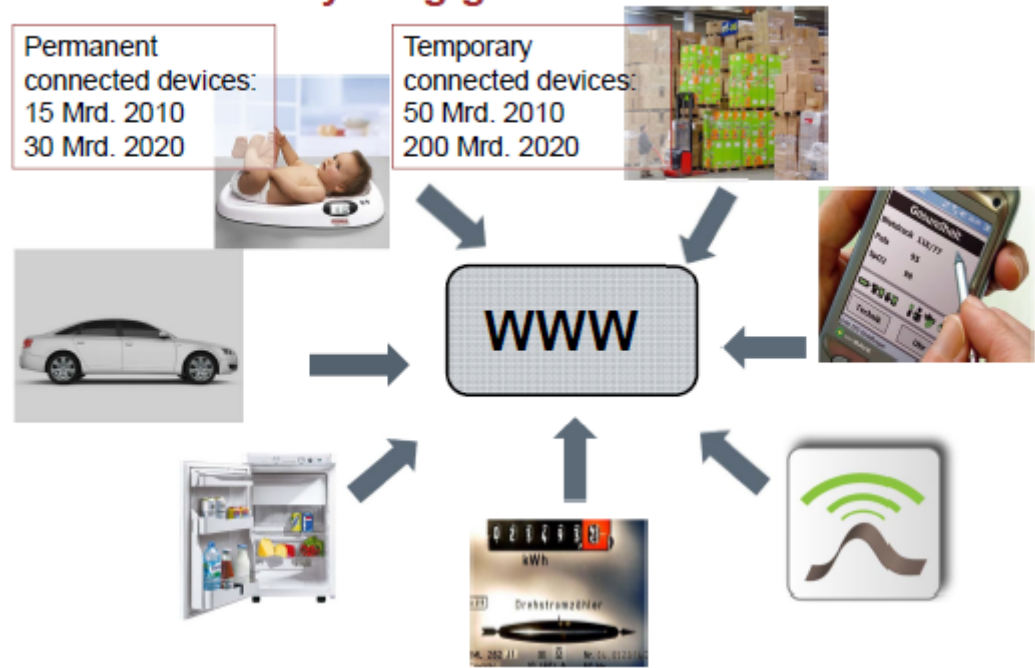
SMARTER ?

By smarter, we mean the world
is becoming:



End Systems

Web 3.0: Everything goes connected



Produce and consume DATA

Data, Data, Data... 2.5 trillion! Day by Day

Informationslärm? Datenmüll? Overload ?



Nation / Administration / Citizen

Der DigNat Tsunami rollt auf Public Sector zu...



Hallo Staat...

... du hast alle Daten – gib' sie wieder her,
denn sie gehören Dir nicht!

OPEN DATA

... du bist völlig intransparent, das geht nicht!

OPEN GOVERNMENT

... ich will mitmachen, also lass mich rein!

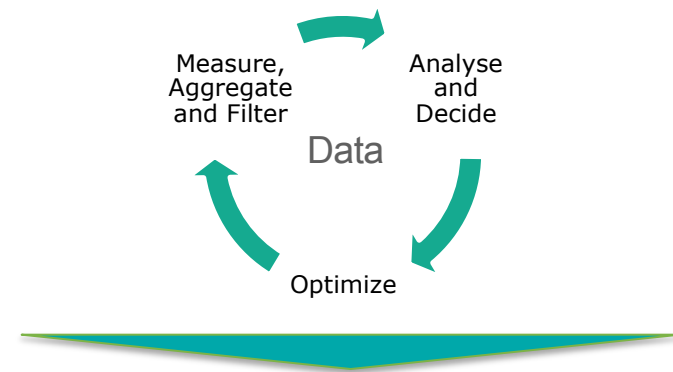
E-PARTIZIPATION

... du hast alle Daten – werde endlich
effizient!

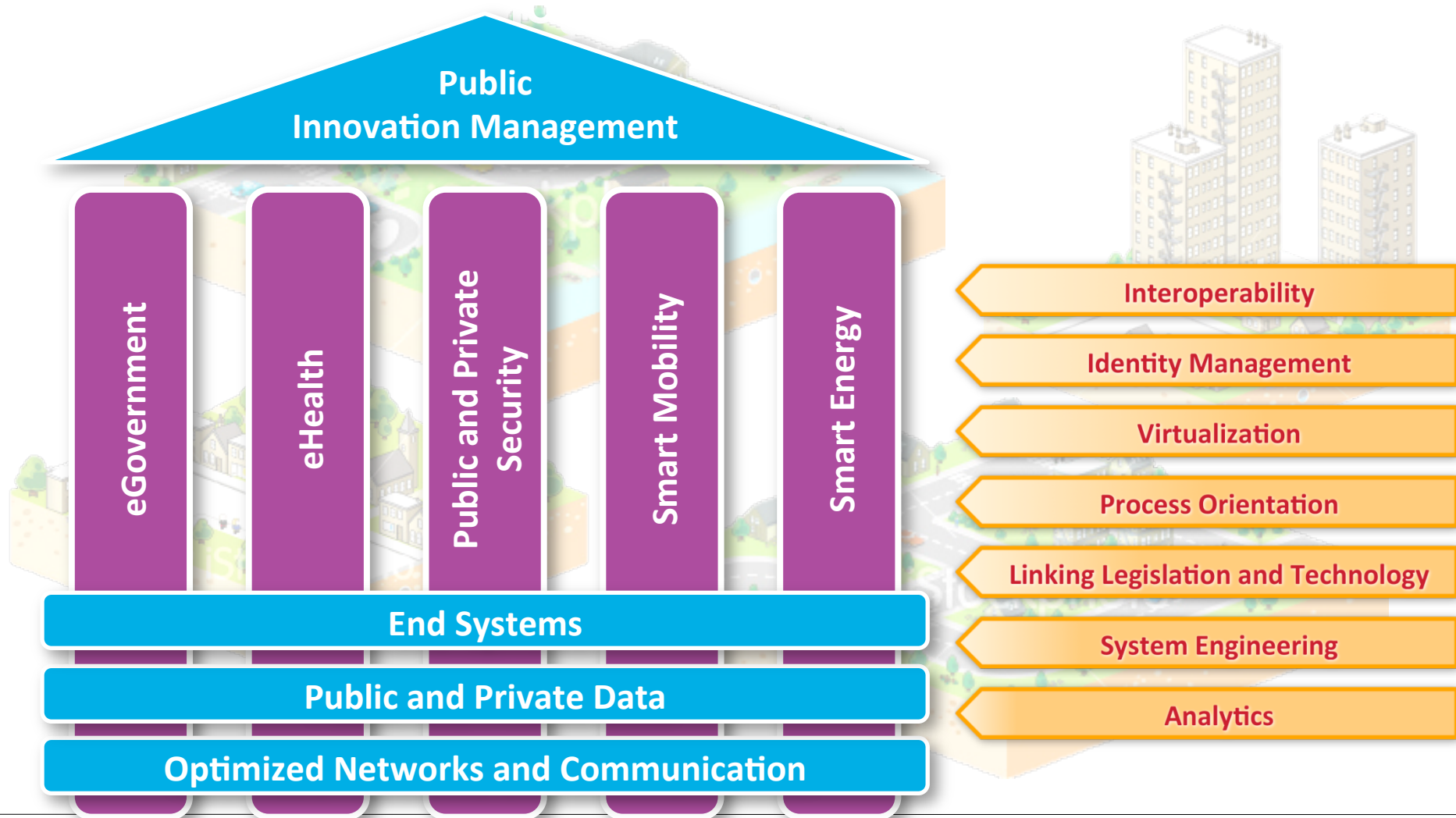
E-GOVERNMENT

WHERE TO START?

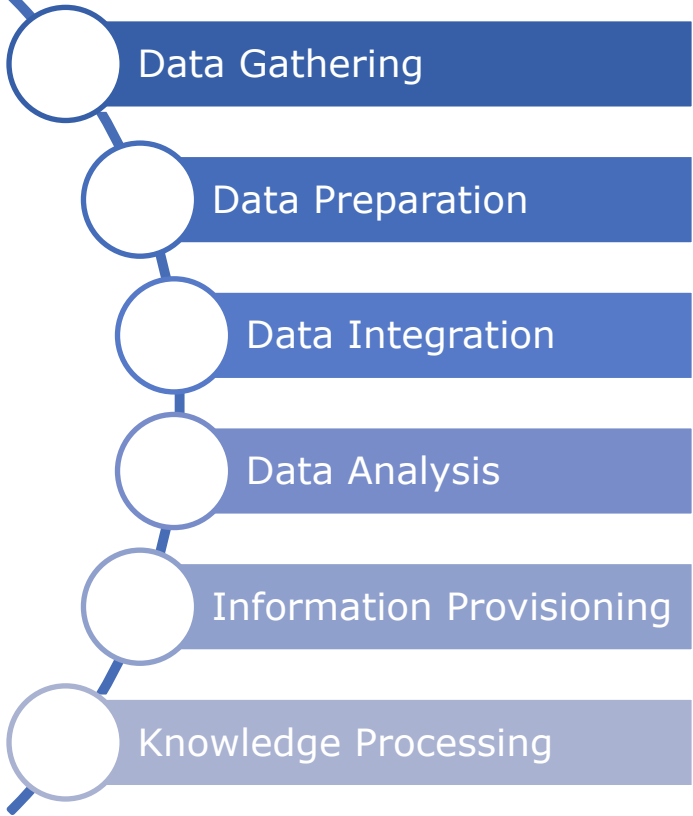
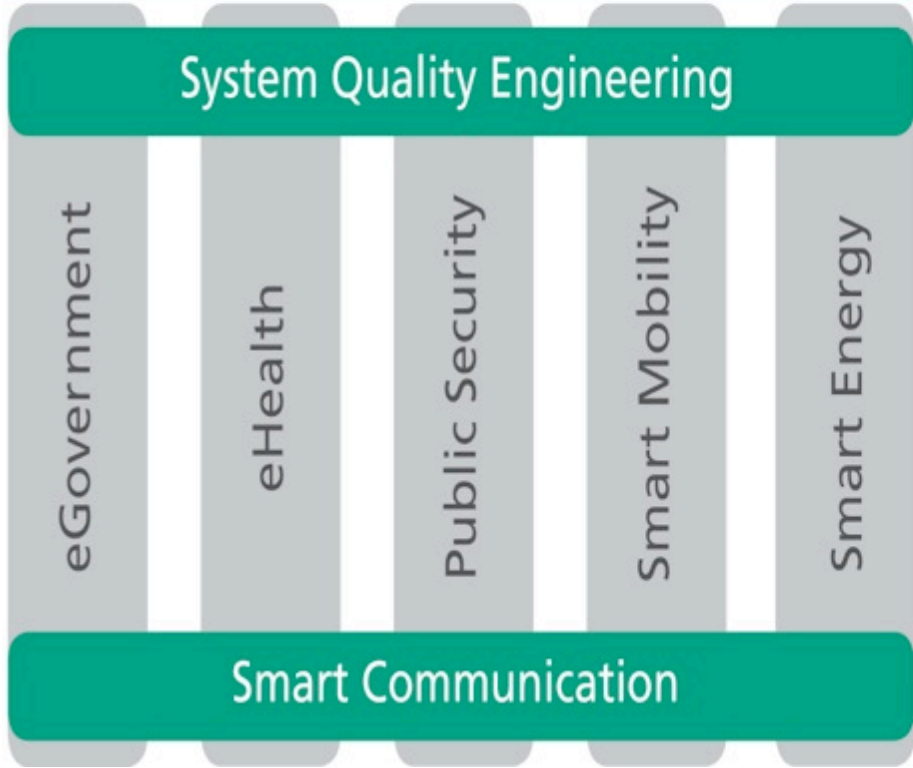
- **ICT Architecture: Data Centric**
- **Data sources: government, citizens utilities, traffic data, open data**
- **Big Data (2020 : 30 Zettabytes)**
- **Analytics**
- **Use Cases**
- **Legislation**
- **Business models**



Activity Domains

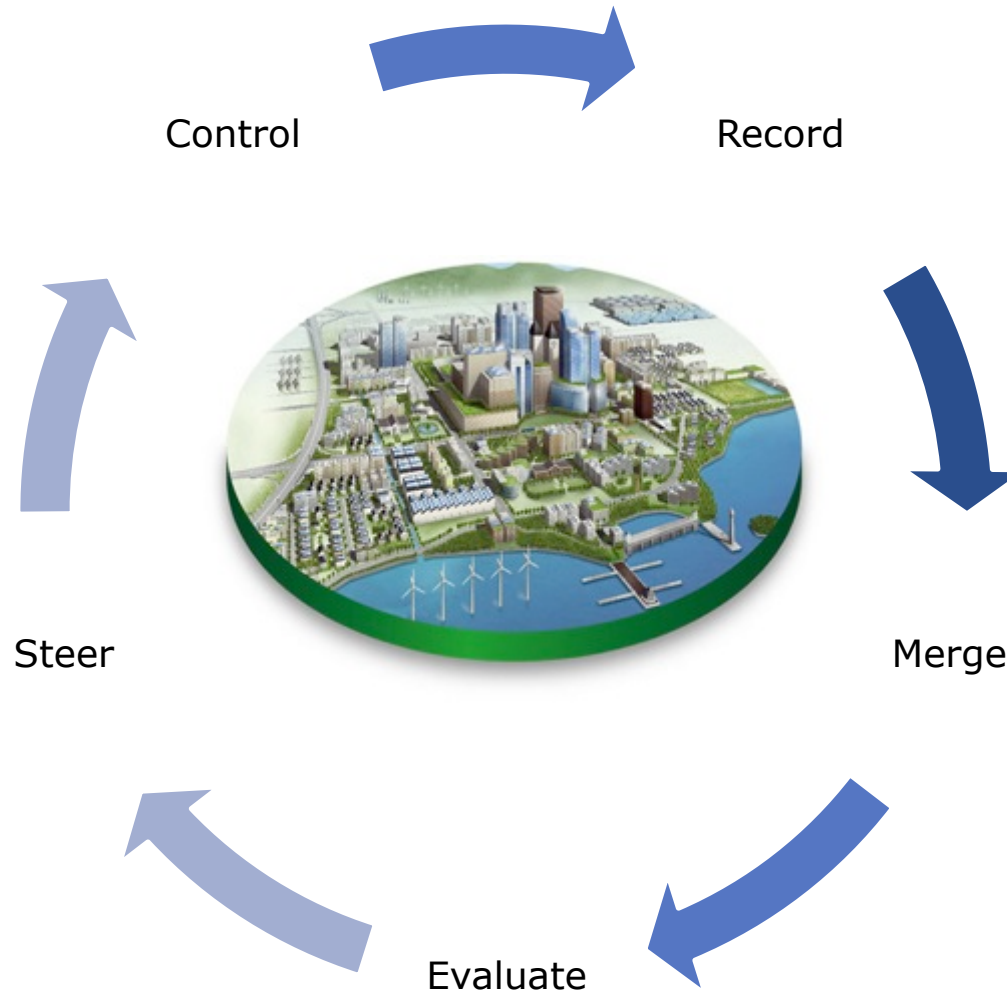


Data as Power of Tomorrow's Cities' Topics



Tomorrow's City is steered by Data

Tomorrow's city is steered by a control cycle of data.



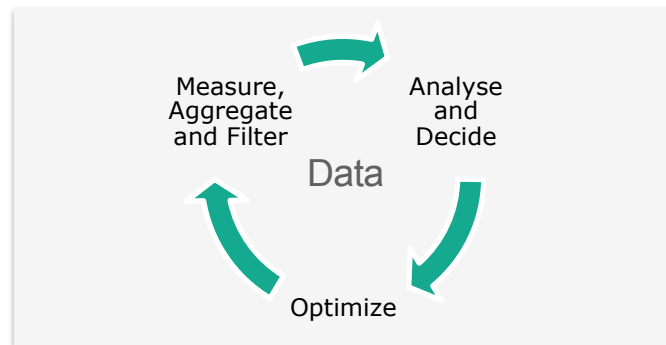
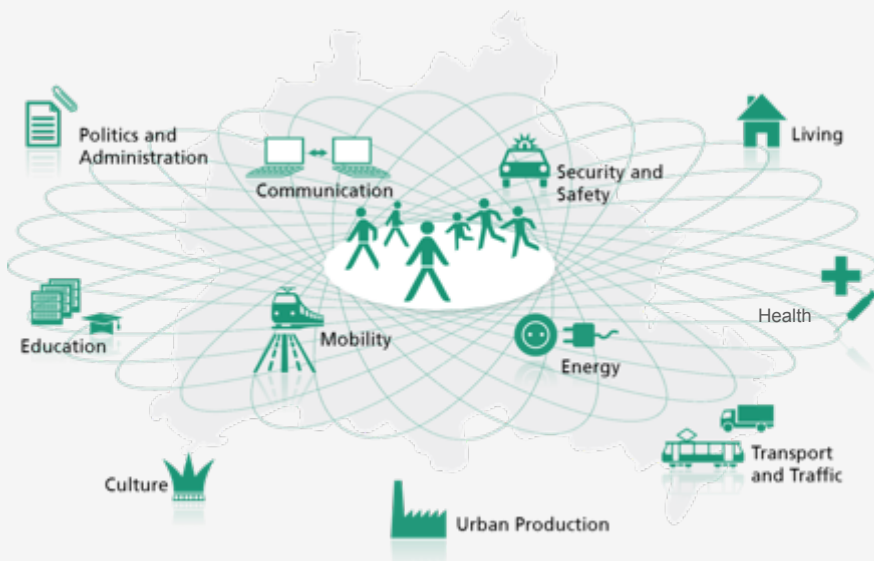
ICT in Smart Cities

Backbone for Smart Cities

City as a system of systems



Effectivity and efficiency results from optimized integration of separated systems

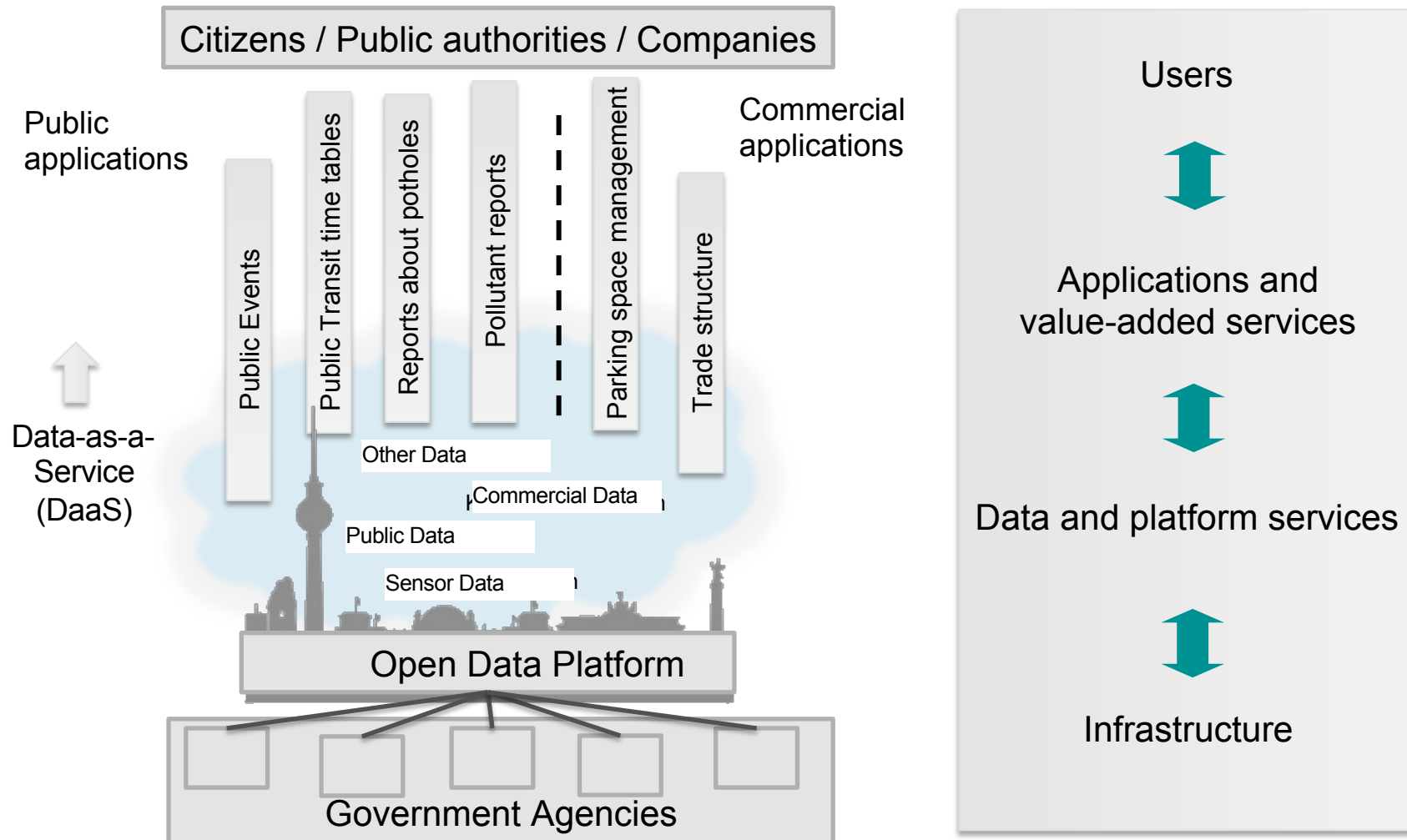


**as Enabler and Integrator for
ICT-based Solutions**

**SMART CITY: A CONTINUOUS
PROCESS**



Open Government Data



Data Sources for Tomorrow's City



Social media



Logistic



Education



Open government

Sensor data, un-/poly-/structured data, open / private data , high volume data

Smart grid



Smart mobility



Public safety



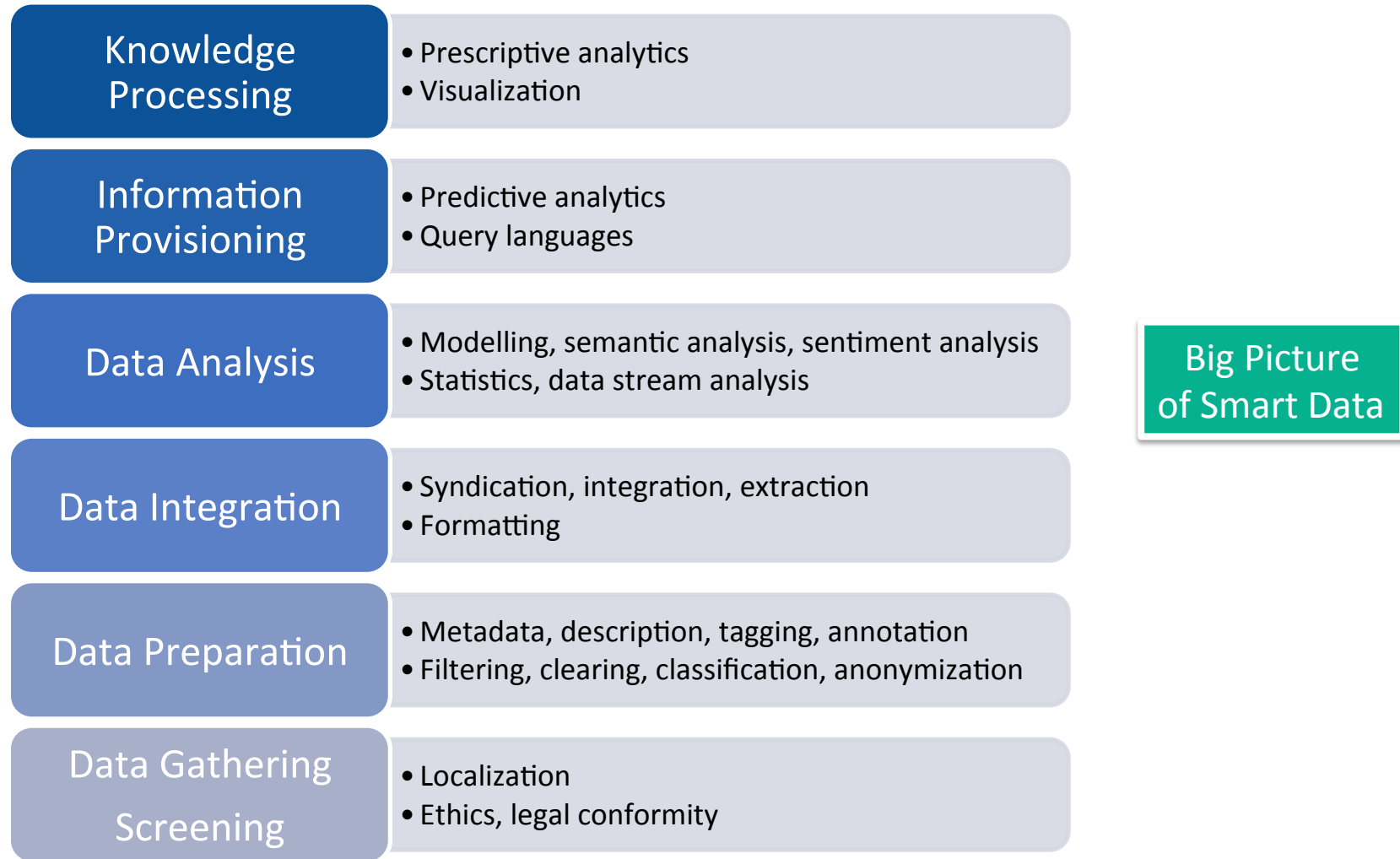
Production Industry 4.0



Life logs



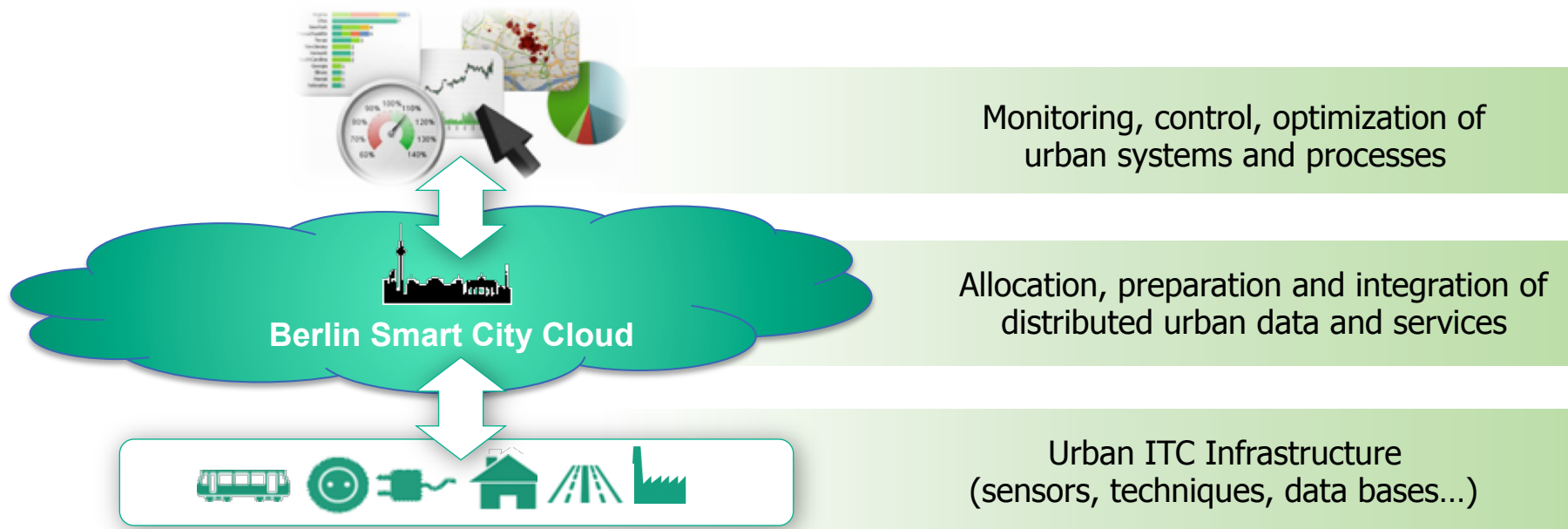
Classification of Action Field in Smart Big Data Reference Model



Data, Data, Data!

Smart City Cloud is the ICT Fundament for the Smart City of Berlin

- Data and services are the key to control and optimization of urban systems and processes
- Berlin need an infrastructure to provide and link urban data and electronic services



Partizipation and Open Innovation

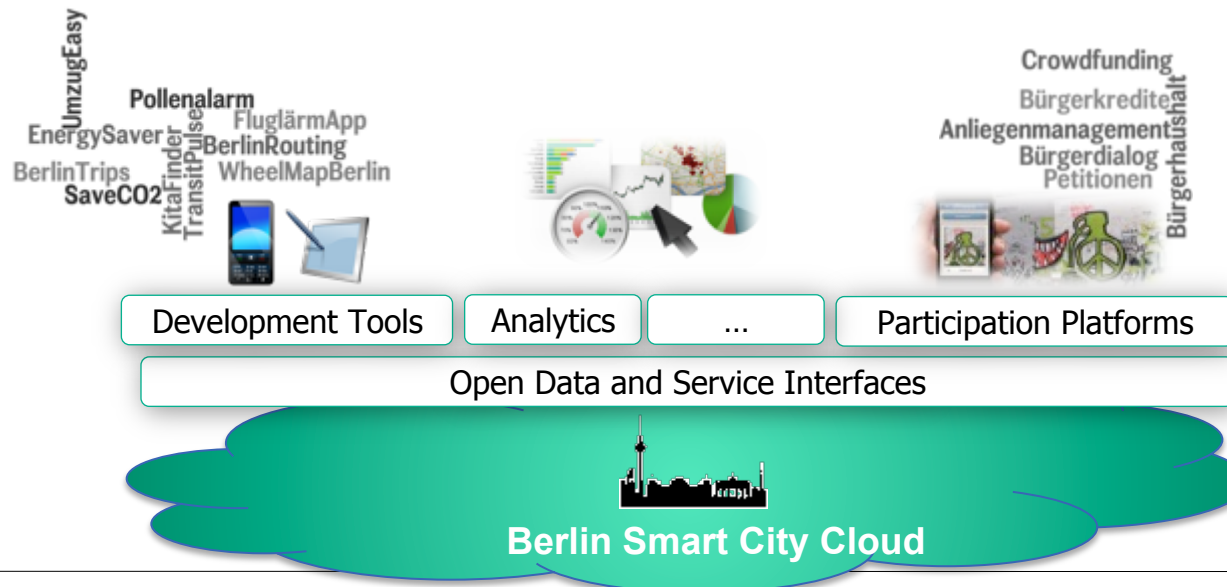
Berlin Smart City Cloud is the Enabler of new Business Models in Order to Involve the Citizens

- The *partial* opening of Smart City Cloud's data and services is the basis for numerous new business models and development innovative city apps
- Informed citizens actively take part in decision processes and support public authority's duties

DIE WELT 05. Juni 2013

Warum Berlin das nächste Silicon Valley wird

Die deutsche Hauptstadt hat sich in den letzten Jahren zu einem Epizentrum der Technologie-Start-ups entwickelt. Investor *Matt Cohler* kennt fünf Gründe, die für Berlin sprechen.



The Berlin Smart City Cloud takes form

First parts are already implemented...

Organizational Forms, examples:



FOKUS vertritt Berlin im Projekt Commons 4 Europe



Organization to merge urban demands and dedicated app developers

Applications, examples:

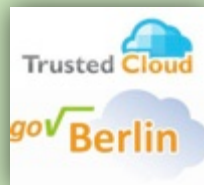


Mobile Early Warning System for Citizens



Efficient Reporting and Management of Citizen Requests

Plattformen, examples:



Cloud market place for administrative **and** economical services



Platform for Berlin's Open Data

...in cooperation with numerous Berliner based companies:



ENGINEERING ICT FOR SMART CITIES

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**Crowd Sourcing: genuine Kontribution vs.
kollaborative Schwarmintelligenz**

Linux
140.000 Apps
Folder@home
Intrade
Crowd Finance
Guttenplag-Wiki

Foto: Katja Mann/pixelio

Schwarmintelligenz ??

„Daß aber die Entscheidung eher bei der Menge als bei der geringeren Zahl der Besten zu liegen habe, das scheint zu bestehen und sich verteidigen zu lassen, ja vielleicht sogar wahr zu sein.

Denn die Menge, von der der einzelne kein tüchtiger Mann ist, scheint doch in ihrer Gesamtheit besser sein zu können als jene Besten.....

Aristoteles: Politik III, 11 (1281 a38–b9) Ausgabe TCFS 4.1, 1987

BigData Management – Gold

Transparenzgesetz: Laterale Auswertung und Prognostik: what is likely to happen?

Behördenübergreifendes Wissensmanagement via „Assoziationswolken“

Verwaltung 2.0 via Crowdsourcing und „self organizing communities“

EU-Großprojekt (FuturICT): ETH Zürich baut einen ‚Weltsimulator‘ zur Vorhersage von Krisen (Hunger, Kriege, Massenmigrationen....)

Big Data Management – Classic

Wirtschaftsförderung im Kontext von Konjunkturprognosen, Klimaveränderung, Demografie, Weltwirtschaft, Zukunftstrends

Städtebau im Kontext von Demografie, Urbanisierung, Energiewende, Weltwirtschaft, Ökologie, Verkehrsplanung, Optimierungsbedarfen

Energiewende im Kontext von Bedarfen, Kapazitäten, Demografie, Netzen, Wachstum, Technologiesprünge, Teilhabe

Digital Natives: Ich surfe, also bin ich



Foto: DIVSI

Big Data und Datenschutz – das digitale Paradoxon

Kenia: US-Forscher ermitteln Malariaquelle via Auswertung von Bewegungsdaten von Handy-Nutzern.

Post-Privacy vs. Schutz



Five Necessities of the Hightech Strategie 2020 for Germany and Innovation Topics of the Forschungsunion

<p>Climate / Energy</p>			<ul style="list-style-type: none"> ■ Morgenstadt ■ Intelligent conversion of energy supply
<p>Health / Nutrition</p>			<ul style="list-style-type: none"> ■ Individualized medicine ■ Self-determined ageing ■ Prevention widespread diseases
<p>Mobility</p>			<ul style="list-style-type: none"> ■ Electro Mobility ■ Affordable, CO₂ optimized mobility ■ Smart Mobility by flexible linking of carriers
<p>Safety</p>			<ul style="list-style-type: none"> ■ Secure Cloud made in Germany ■ Secure Identities ■ Embedded Security in Embedded Systems
<p>Communication</p>			<ul style="list-style-type: none"> ■ Future Internet, Green IT and IT for Green ■ Transformation to digital knowledge society on the basis of acceptance and participation

Quelle: BMBF 2010 und Arbeiten der Forschungsunion Wirtschaft-Wissenschaft



About the Fraunhofer Gesellschaft



The Fraunhofer Gesellschaft is Europe's largest organization for applied research.

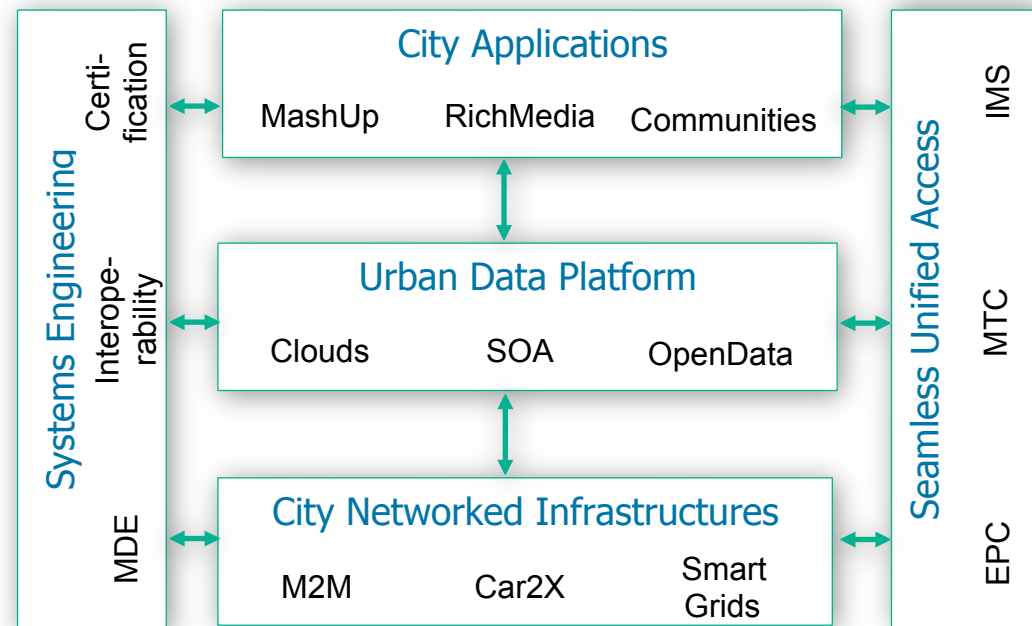
- Fraunhofer develops products and processes through to technical or commercial maturity
- Individual solutions are elaborated in direct contact with the customers
- The Fraunhofer Gesellschaft maintains
 - 60 self-contained Fraunhofer Institutes throughout Germany
 - with a staff of 21,000 scientists and engineers
 - 2.0 billion Euro annual budget
- 70% of funding are raised through innovative development projects, license fees and contract research
- Labs and representative offices all over the world



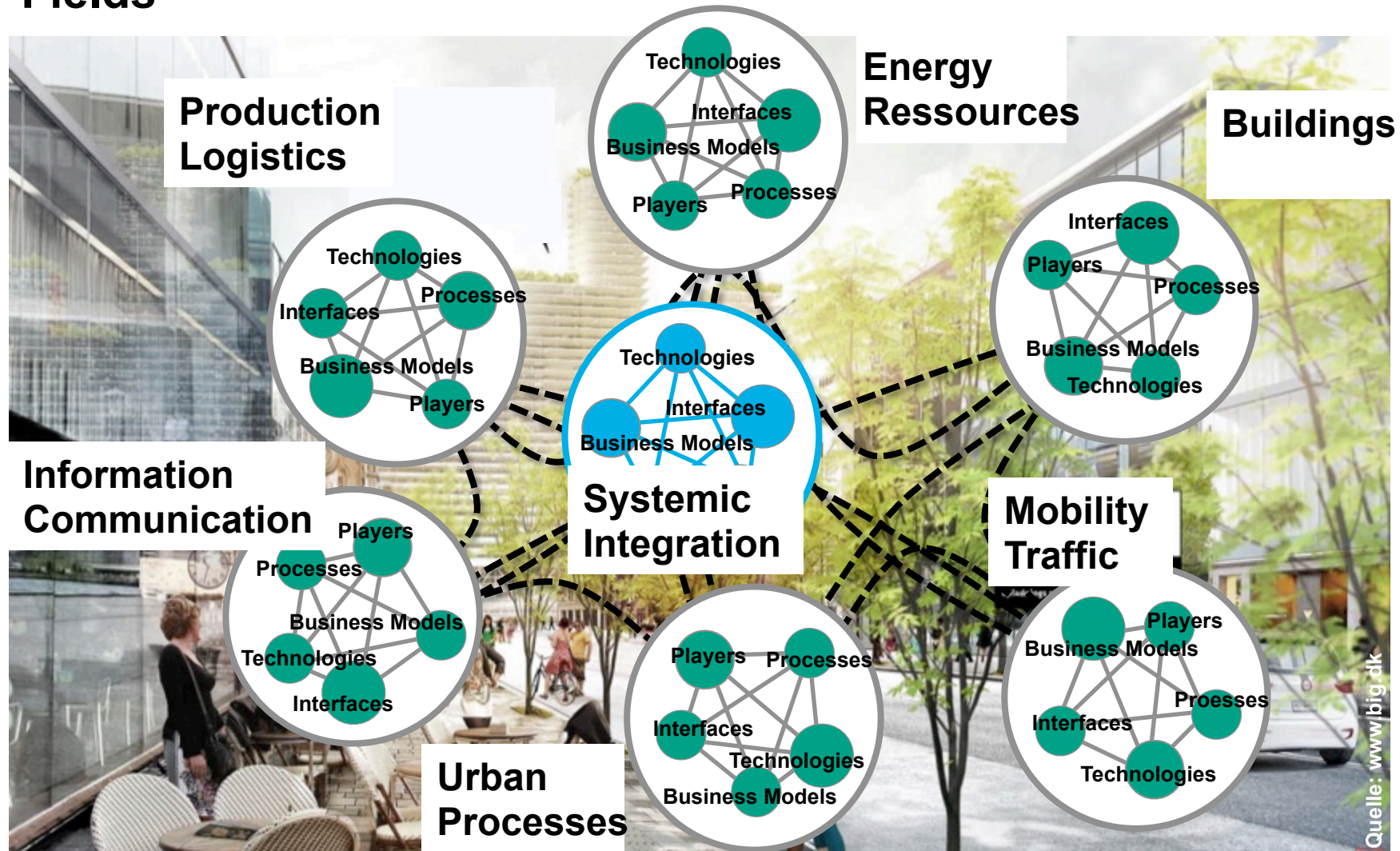
Open ICT Architecture for Smart Cities

A Multi-Layered Approach

- City application platform for advanced apps by city stakeholders and communities
- Urban data platform of secured, distributed, and interconnected data for managed information access
- Various types of fixed, mobile, adhoc, sensor networks connecting devices and sensors
- Seamless and unified access to raw, aggregated and consumer data and meta-data for fixed and mobile services
- Efficient engineering (design, development and testing) of validated secure, interoperable, and robust reliable systems



Objective of the systemic Linking of Smart Cities Research Fields



Our Smart Cities Vision Information is Key

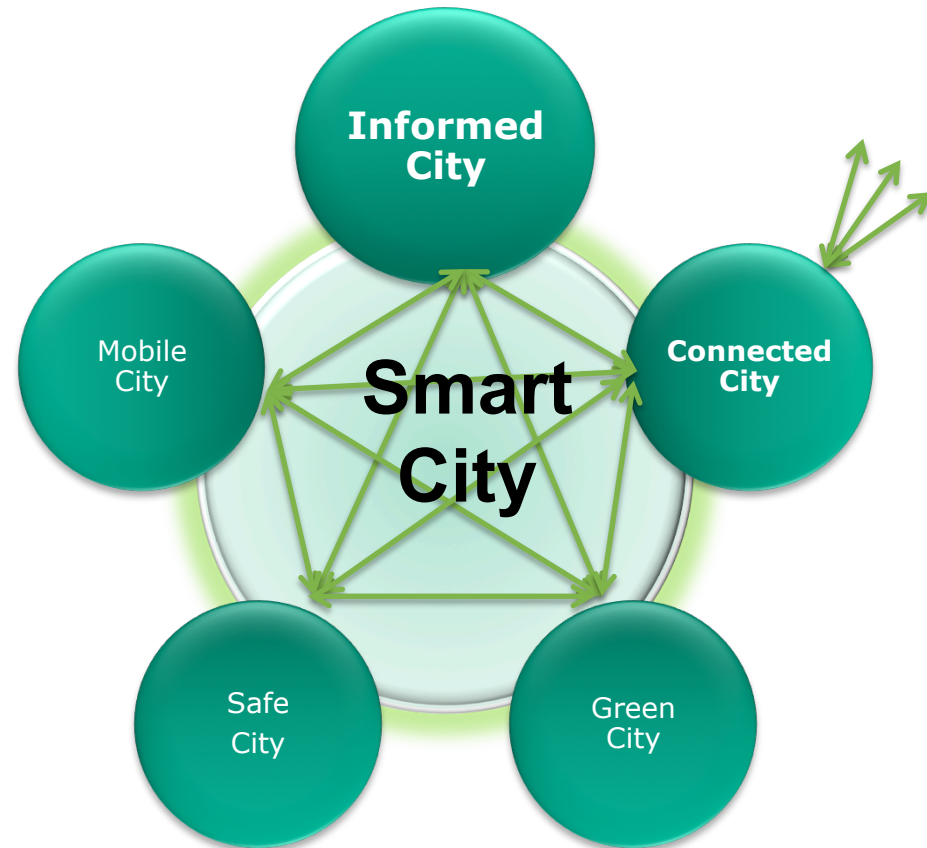
- City as **service provider**

for citizens, enterprises,
institutions, and tourists

- Smartness via

**Always Best Informed and
Inter-Connected Urban
Actors** (Machines, Systems
and People)

Information at any need, at any
place, at any device, at any
time, at any preference

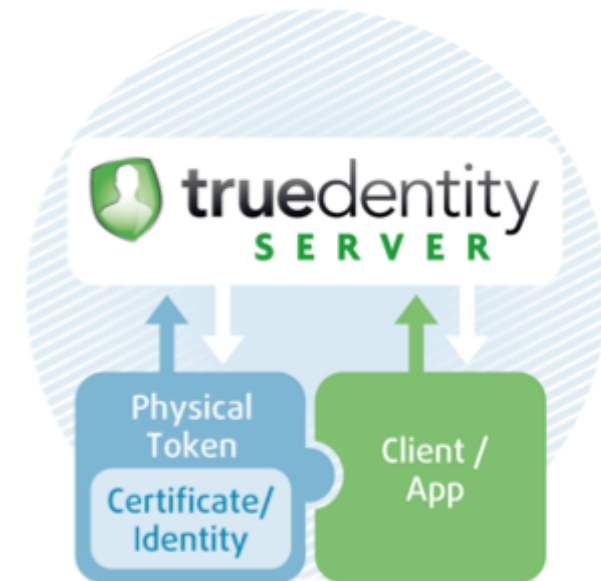


Requirements of eID Systems

- Stringent data privacy requirements for providing and processing personal data
- Unambiguity of digital identities
- § Usability (e.g. Card reader)
- § Security and complexity
- § Online and offline (using one ID)
- § Use of different Tokens for the same service provider
- Various protection requirements for ID's (e.g. different security levels for mobile device and desktop)

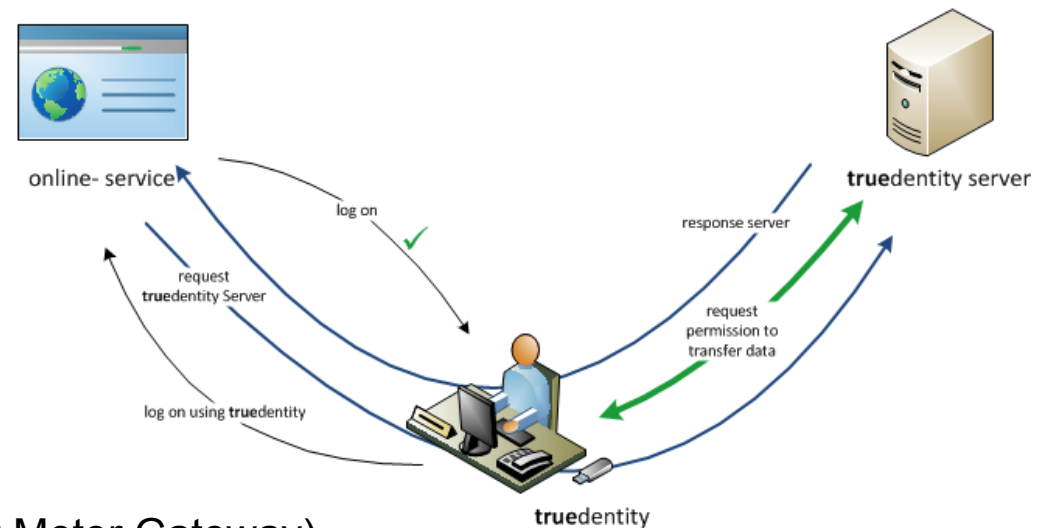
Example application: truedentity

- ✓ is a client/ server technology
- ✓ runs on a USB device, tablet PC or desktop computer, and on smartphones (Android)
- ✓ provides a technical infrastructure based on the new personal identity card
- ✓ can be combined with biometric attributes
- ✓ uses modern cryptographic protocols (e.g. ECC) and open standards (e.g. SAML, SOAP)



truidentity: application possibilities

- Logon
 - ✓ Web applications
 - ✓ SSO (local)
 - ✓ Access to Cloud service
- Physical access control (e.g. in combination with biometric attribute like the PalmSecure by Fujitsu)
- Authentication of devices (Smart Meter Gateway)





Es gibt nichts Gutes, außer man tut es!

Erich Kästner

Action Fields: Smart Data for Tomorrow's City

Architectures and Infrastructures
for Smart Data

Syndication and Analytics
for Smart Data

Standardization of selected
aspects of Smart Data in order
to enable interoperable
solutions



Realization of exemplary
solutions of the mentioned
action fields

Assessment and Improvement of Data Quality