Ubiquitous Computing in Business Processes
Part VI

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Darmstadt
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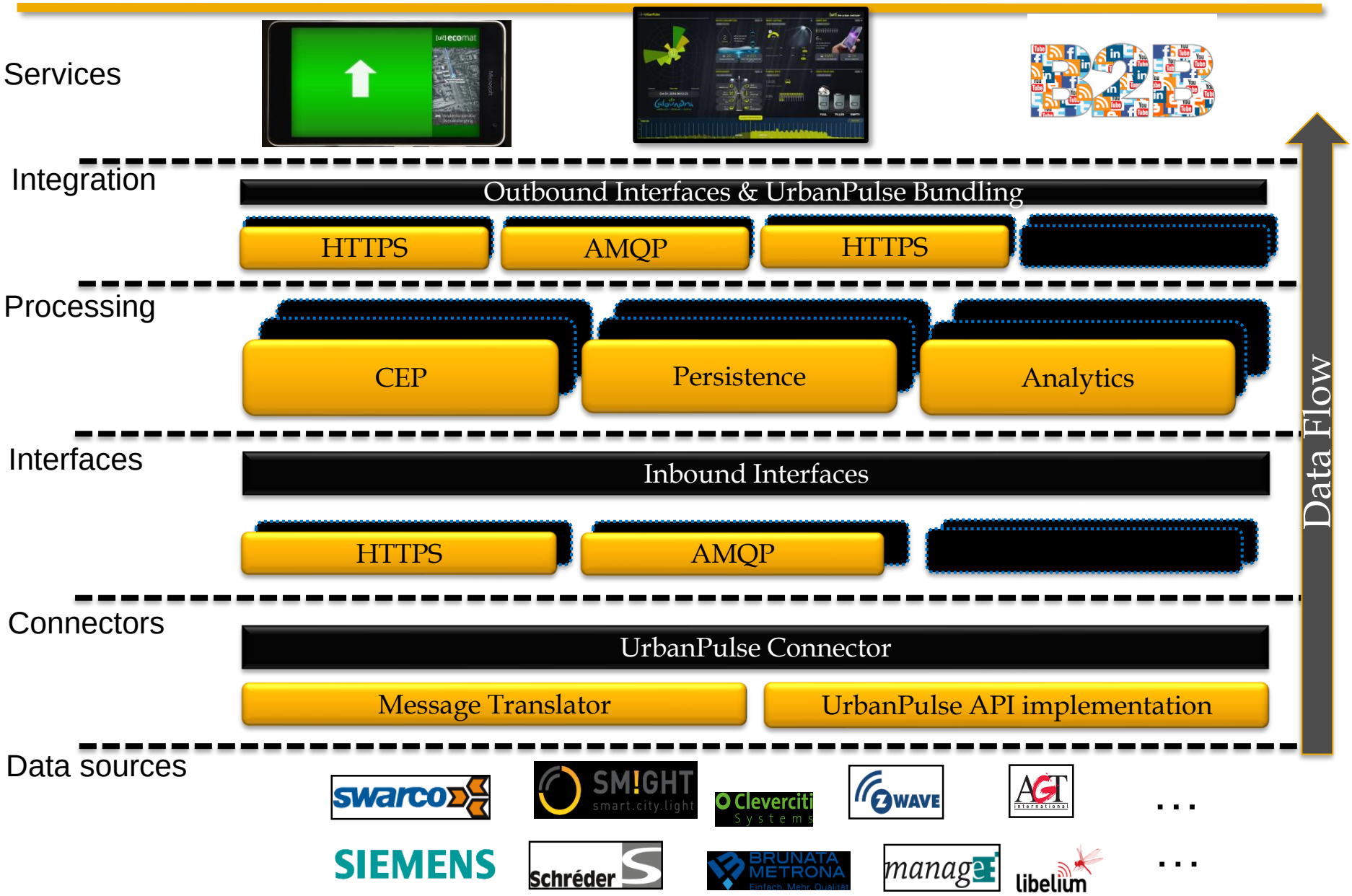
Outline

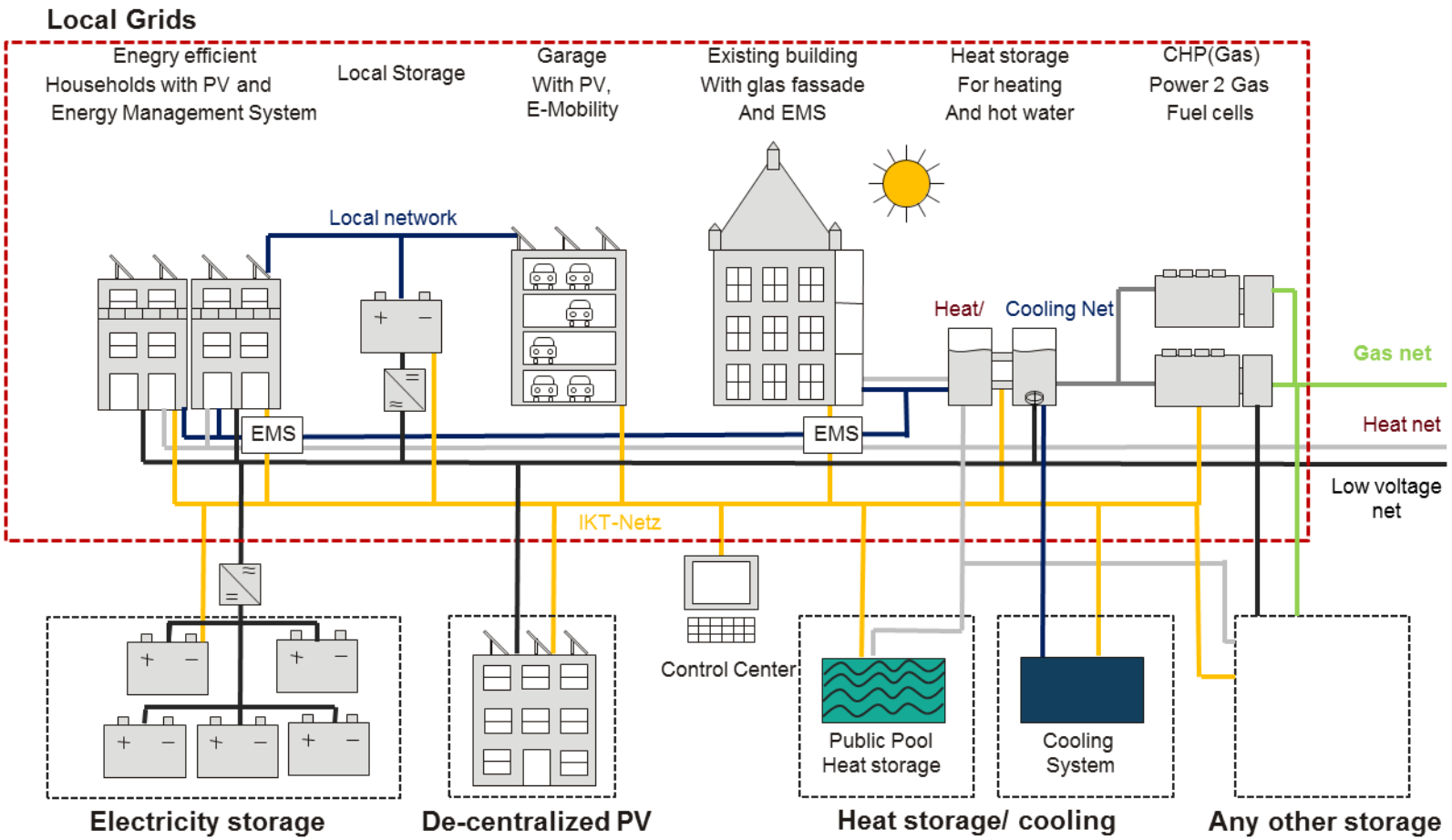
1. Recap

Mapping of the Reference Architecture to a concrete System Architecture



Demonstrator (http://vasec.software-cluster.com:8080/UrbanPulse/index.html)

Poly-Energy Networks



Source: MVV Energie AG, T-I

Outline

2. Integrated multifunctional Humble Lamppost - imHLa

Definition - imHLa

integrated multifunctional "humble" lamppost [1]

lighting system consisting of at least one lamppost and a luminaire, which as well as providing illumination includes other functional components; the prerequisite is a constant electric power supply and a connection to the telecommunications network.

- The power supply and availability of telecommunications must be suitable for the requirements of the service (e.g. as regards voltage and bandwidth).
- The term is based on the EIP "Humble Lamppost" initiative.
- The imHLa is distinguished from other lighting systems such as those mounted on overhead lines or on walls, which do not need lampposts.
- The difference between an imHLa and a conventional lamppost is that it is an intelligent product whose physical integration must be ensured. In some cases this can be done by retrofitting. The functional components described can significantly expand the original range of services.
- Connectivity enables the functional components to be integrated as devices in the Internet of Things (IoT). This means the imHLa and its functional components are uniquely identifiable. All the elements and functions can be reached and exchange data via an IPv6 address. The imHLa thus acts as an intelligent element in an integrated urban infrastructure.
- Connection via ICT systems makes various autonomous/automatic functions possible, such as self-configuration, automatic synchronization and autonomous maintenance, and provides knowledge of the integrated material and immaterial components in the form of a bill of materials. Digitalization makes the imHLa an intelligent urban infrastructure module which can interact with other services outside the network (if necessary, autonomously by means of a platform) and use them to fulfil its tasks.
- The current discussion on smart cities uses various terms, such as humble lamppost and smart street light.
- The imHLa can be characterized as follows:

imHLa = physical integration (electricity + communication +∑0..n functional components)

[1] **DIN 91347 "integrierter multifunktionaler Humble Lamppost" (Beuth Verlag)**

Figures & Facts on Street Lighting

<90m	Estimated nos. streetlights across Europe
75%	Percentage of streetlights over 25yrs old
20-50%	Proportion of city's energy bill from streetlights
€3 bln	Approx. annual street lighting energy cost
50-75%	Energy saving potential thru SLL/LED
€1.9 bln	Annual energy saving from SSL/LED
2.6 mln	GHG equivalent in removing nos. cars from EU roads

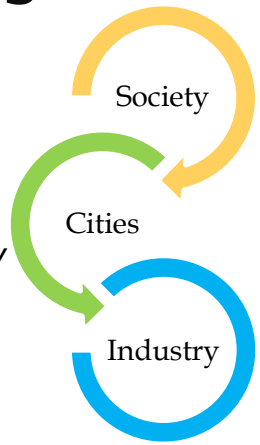
An open affordable component-based city lighting solution

... that enables other smart city initiatives;

delivered collaboratively between cities & Industry

to speed integrated valuable delivery

BENEFITS

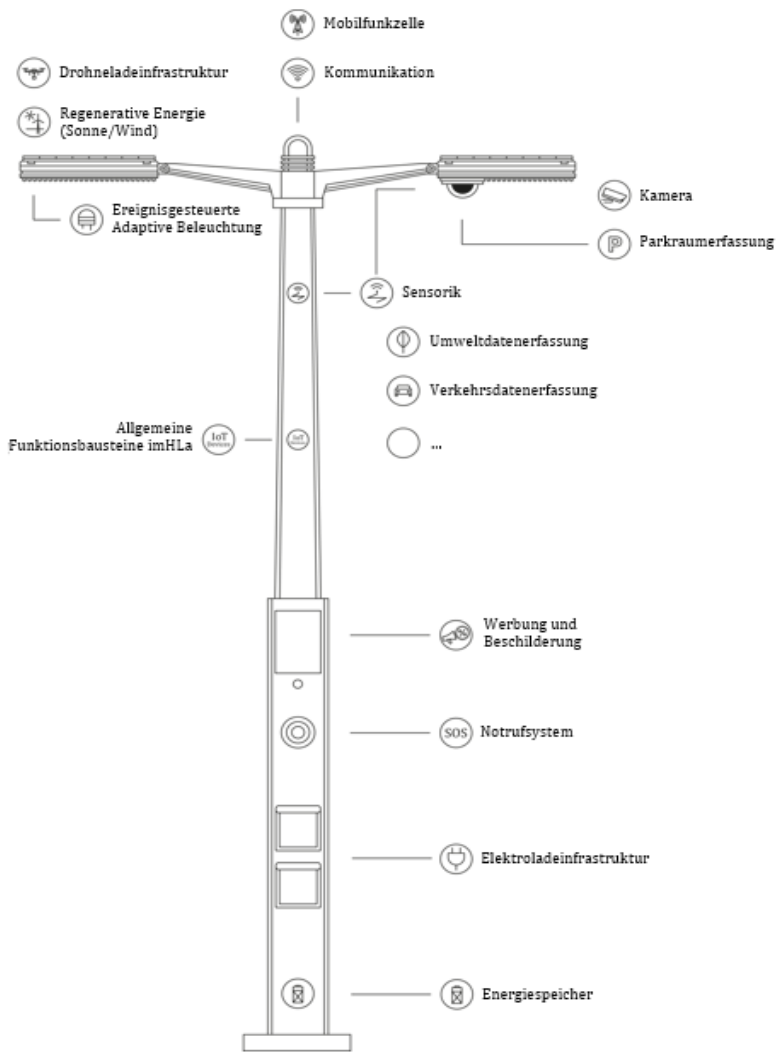


- *Efficiencies*
- *Savings*
- *New Services*
- *Bootstrap S.City*

- *Better experience*
- *Better connected*
- *Safer society*
- *Pride in community*

- *Innovation*
- *Extended Portfolio*
- *Add'l Revenue*
- *Export potential*

Schematic Picture



DIN 91347 “integrierter multifunktionaler Humble Lamppost” (published by Beuth Verlag)

- Intergated infrastructure
  - Adaptive light
  - Sensing of environment
  - Re-use and re-purpose sensor information
- Mechanical integration
  - Fit into the post
  - Resistant and reslient
- Electrical Integration
  - Joint electrical unit
  - 24h power
  - (Battery packs)
- Communication Integration
  - IP supported
  - All imHLas can communicate with each other and with a backend system
  - Outgoing communication to the environment (e.g. Public WiFi)
- Data Integration
  - Re-use of raw data via OUP
  - Data consumption model (licensing), e.g. Open Data.
- Business Integration
  - Business model
  - Operational model

Integrated multifunctional street light poles

Shuffle by Schréder

SM!GHT by EnBW

- Smart Item
- Provides power 24h
- Communication infrastructure
- Public WiFi
- Sensor nodes
- EV Charging
- Adaptive Lighting

Classification of imHLa

CLASS 1

Basic

Minimal components: internet communication (IP) + electricity

CLASS 2

Connectivity

Possible components :

Tele-management, WiFi, oder emergeny call…

CLASS 3

Sensors

Possible components: environmental sensor,

camera, parking sensor …

CLASS 4

Actuators

Possible components: display or audio …

CLASS 5

Energy Systems

Possible components: EV-charging station,

Drone charging station, battery oder photovoltaic…

Use Case Adaptive Light

Event-controlled adaptive street lighting system

Brief description

This use case describes how a lighting management system and a system of multiple imHLa can save additional energy by using communicating luminaires”, only providing light when required, without compromising road safety

Use scenario

Luminaires, groups of luminaires or the entire lighting system are intentionally dimmed using state-of-the-art tele-management systems in order to reduce energy costs. Also, the light intensity and the times each luminaire is switched on and off are defined individually. A calendar function allows individual illumination scenarios to be set. It also offers users a broad range of control functions such as information on the luminaire status, continuous dimming to adjust light levels, electricity-saving mode with night-time reduction function, maintenance and early detection of defective luminaires, and optional enhancement with motion detectors, light meters or radar.

see DIN SPEC 91347

Use Case Adaptive Light

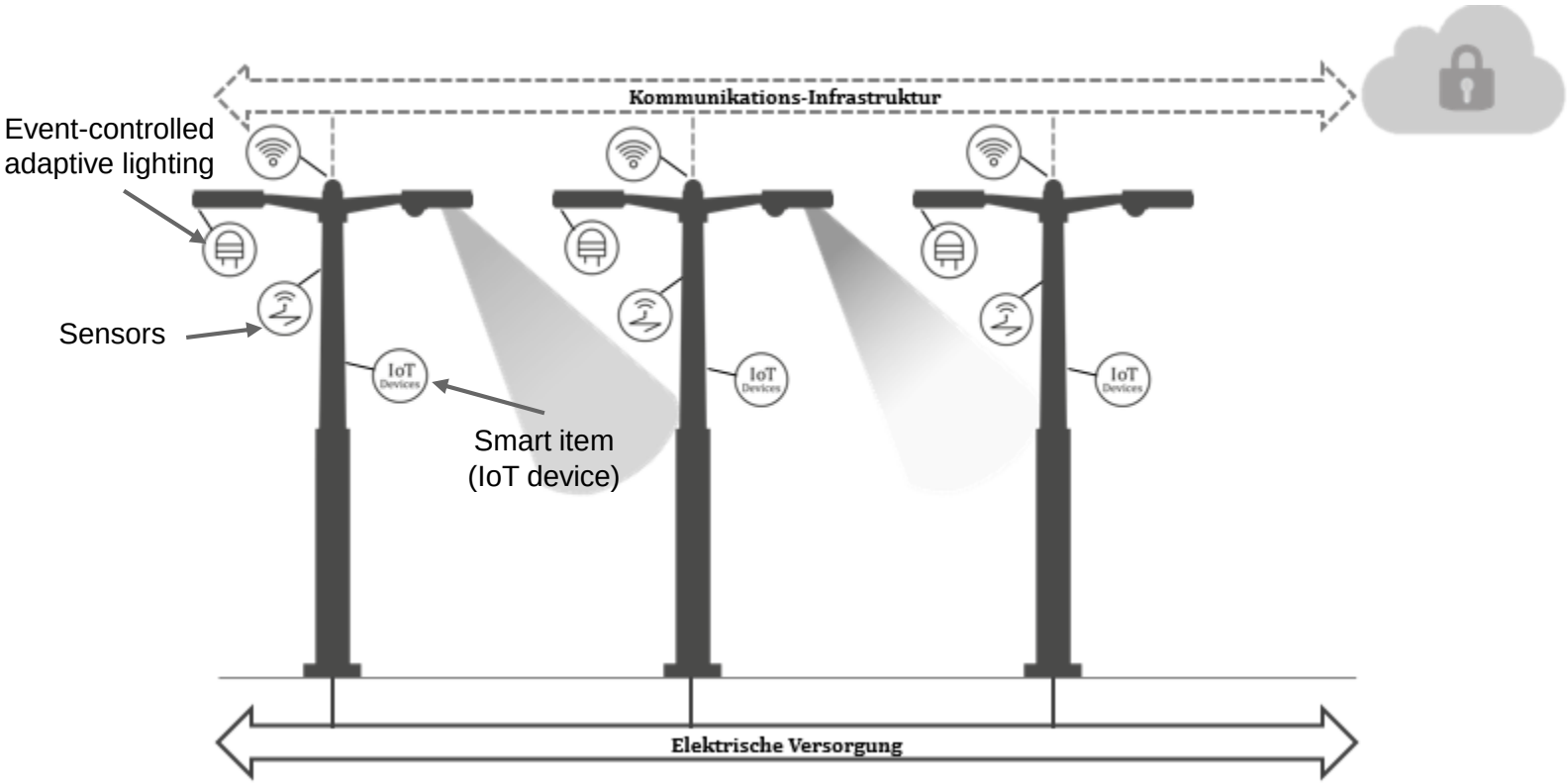
For intelligent, demand-led control of the lighting system which helps maximize energy savings, the first stage is to bring together the individual lights as a comprehensive network of communicating units.

Illumination levels can also be adjusted in specific contexts to take account of local circumstances such as rush hours and quiet periods, as well as sunrise and sunset times. Incorporating real-time data such as weather forecast, major events or emergencies requires integration with other functional components and external information systems. Another scenario concerns areas of fluctuating or sporadic use, such as cycle paths. In this case, detection of individual road users, cyclists or pedestrians can be used to activate maximum lighting levels. The lights then tell the next ones along about the occurrence. All these scenarios are based on suddenly occurring events which affect “normal dimming”. The use of real-time data thus ensures situation- and/or demand-led illumination that not only saves energy but also optimizes safety.

If communication is disrupted or fails, the light control units continue to operate using the dimming profile predefined in the light management system, i.e. they no longer react to outside events.

see DIN SPEC 91347

Use Case Adaptive Light



see DIN SPEC 91347

Use Case Public WiFi

Brief description

This use case describes how the imHLa provides citizens and visitors with this and other forms of communication via internet access and opportunities for interaction.

Use scenario

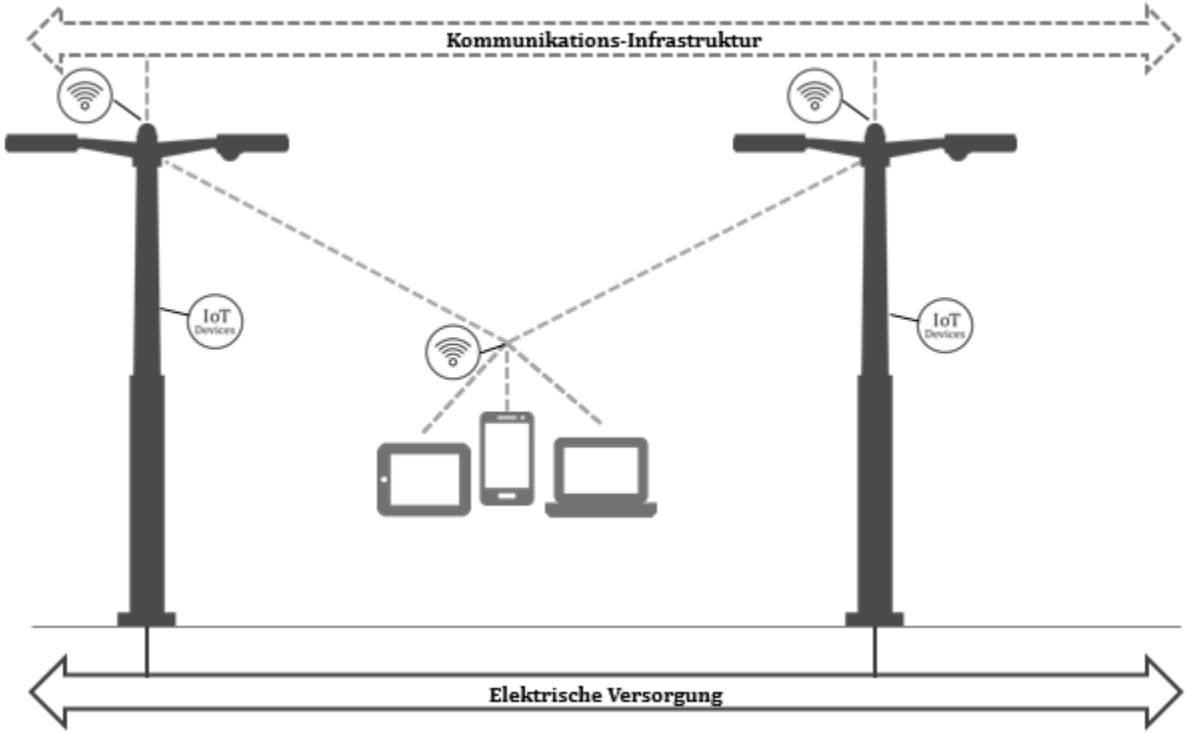
Due to the ubiquitous presence of street lighting, the imHLa is eminently suitable for communication with the public, exchanging information, and providing services to everyone.

This means that a system of at least one imHLa provides people with basic connectivity, which also makes the location and the area around it more attractive. Fast Internet access is increasingly becoming an indispensable resource in cities and municipalities, and should therefore be guaranteed using imHLa. The term most often used at present is “public WiFi”. In future, this functionality can also be enhanced with 5G, the next generation of the mobile phone standard.

Using Internet connections like this, the imHLa not only provides public internet access, but also the opportunity to incorporate other related systems and functions into the overall system. It also provides a basis for the targeted supply of information and services to users of public spaces. This can be done using digital marketing, specially designed login pages, web-based platforms (such as regional online forums) or special apps.

see DIN SPEC 91347

Use Case Public WiFi



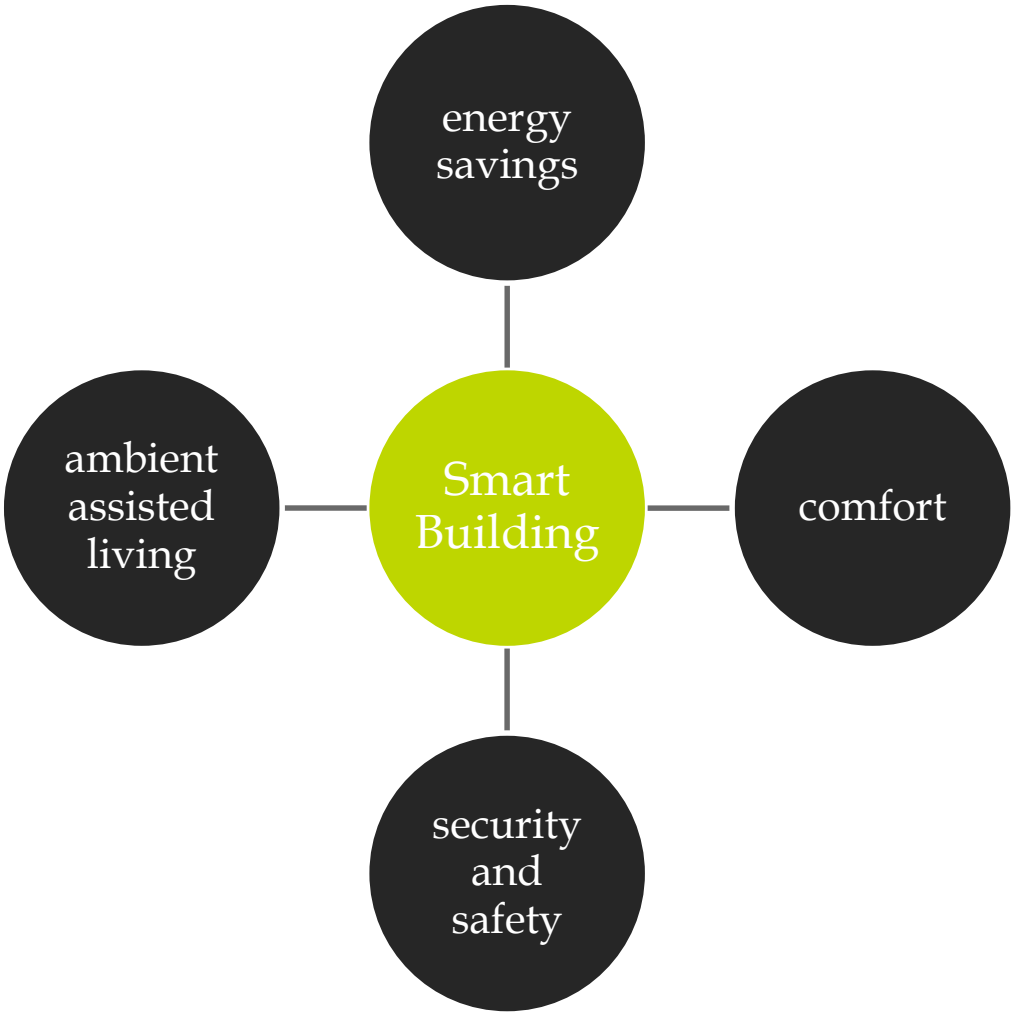
see DIN SPEC 91347

Literature on imHLa

Outline

3. Smart Home / Smart Building

Smart Home Use Cases



Market situation

- Multiple manufactures vs. multiple standards
  - Limited compatibility
  - No „one-fits-all“ System available

- Field BUS systems vs. wireless communication
  - Field BUS with high investment cost
  - wireless mesh-network with high reliability

Solution: open platform for the integration of different systems and manufacturers in order to combine the best from every system

Examples of Smart Home Devices

- ✓ Movement sensor

- ✓ Dimming actor

- ✓ Thermal switch

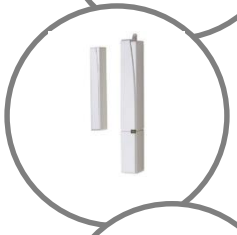
- ✓ Smoke detector

- ✓ CO_2 Sensor

- ✓ Shutters controler

- ✓ Wall plug

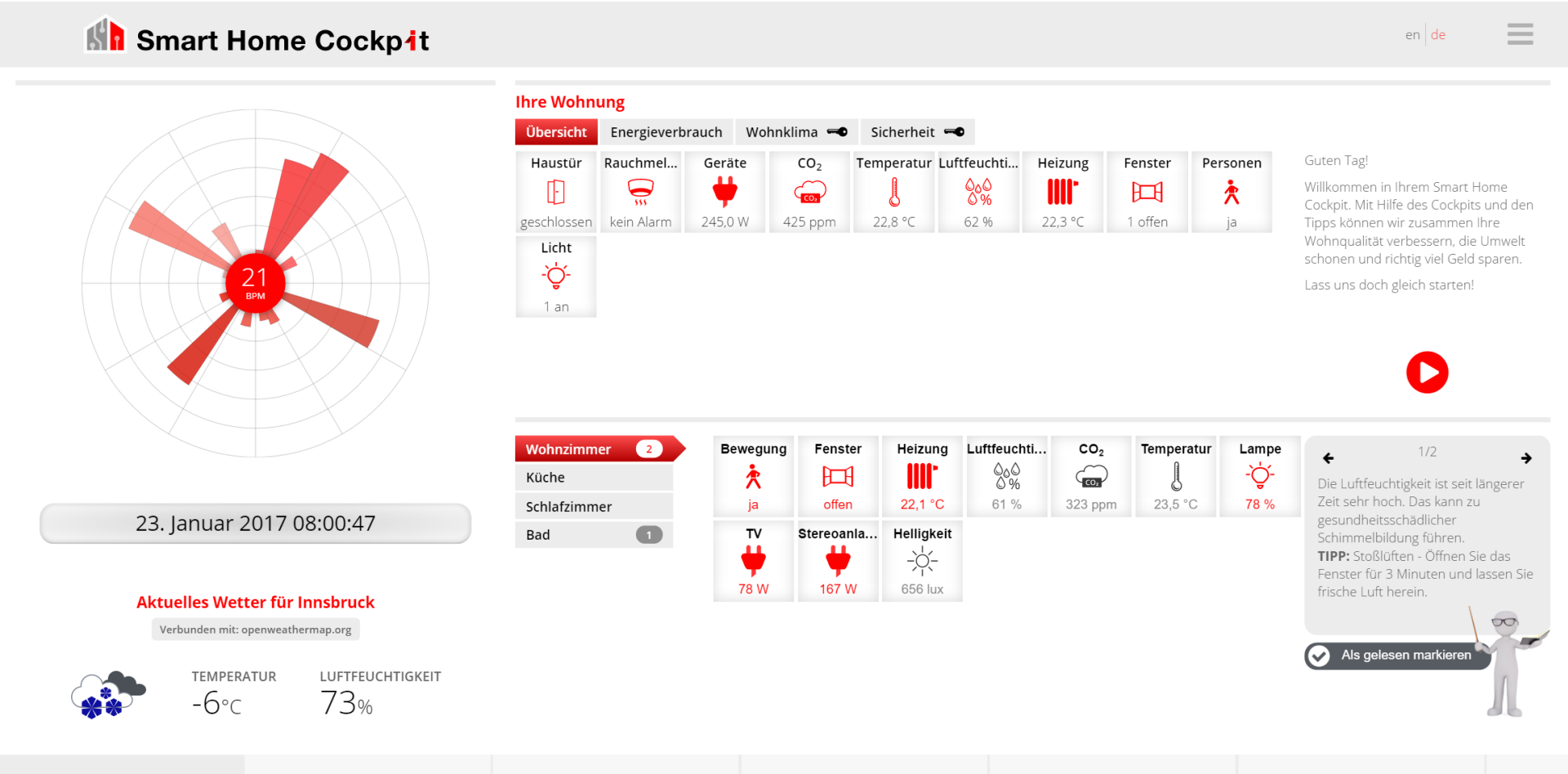
- ✓ Window sensor



- ✓ Window control

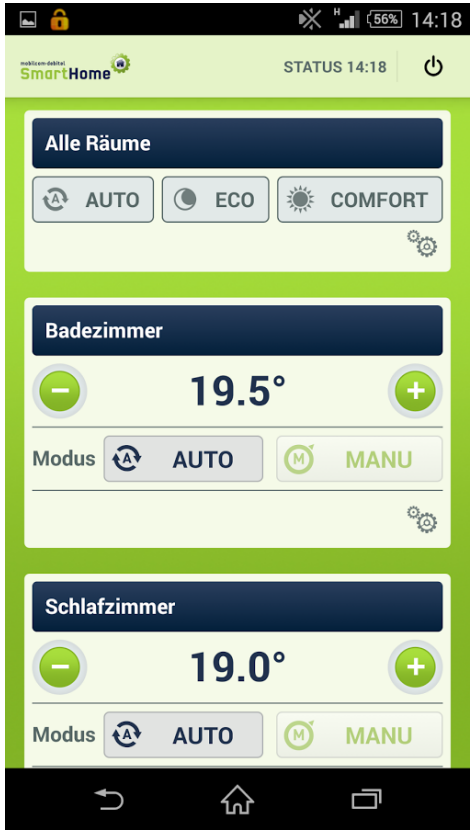
- ✓ Door lock

Smart Home Cockpit



iKB Eins für alle.

Value Added Services on top of Smart Home Data



„SmartHome heat control“ for private customers

„kWhapp“ for realtime energy cost control

alarm management for security services

Outline

4. Q & A