DKE/DIN ROADMAP

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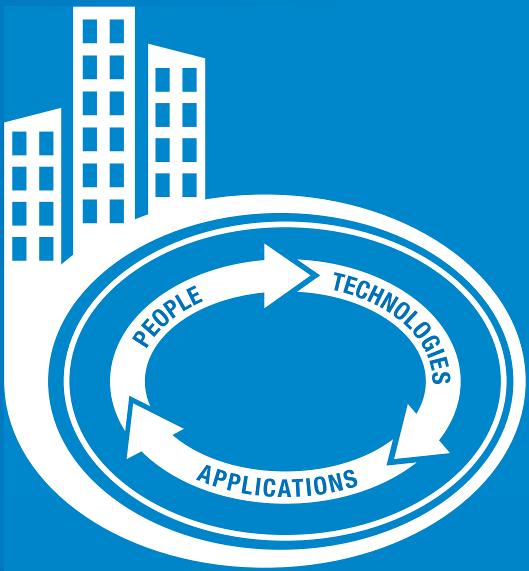

THE GERMAN STANDARDIZATION ROADMAP SMART CITY

Concept

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Publisher

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TABLE OF CONTENTS

1 Foreword . . . 7

2 Definition . . . 8

3 Summary . . . 7
3.1 Background and motivation . . . 7
3.2 Standards and specifications . . . 7
3.3 National standardization activities . . . 8
3.4 Initiatives/Projects/Model regions/Studies . . . 8
3.5 European and international categorization . . . 8
3.6 Methodology for determining demand for standardization . . . 8
3.7 Recommendations from the German Smart City Standardization Roadmap . . . 8
3.8 Outlook . . . 8

4. Background and motivation . . . 8
4.1 Social background and long term prospects . . . 8
4.2 Scope and delimitationg . . . 15

5 Standards and specifications . . . 17
5.1 DIN, CEN and ISO . . . 18
5.2 DKE, CENELEC and IEC . . . 18
5.3 ETSI and ITU-T . . . 19
5.4 Standardization mandates of the European Commission . . . 11
5.5 Other standards institutions, forums and consortiums . . . 20

6 National activities . . . 21
6.1 Standardization activities . . . 21
6.1.1 Structure . . . 21
6.1.2 Standardization roadmaps . . . 22
6.1.3 Buildings and Constuctions . . . 23
6.1.4 Security and protection . . . 31
6.1.5 Mobility . . . 32
6.1.6 Energy . . . 34
6.1.7 Information and Communication (ICT) . . . 38
6.1.8 Urban processes and organization . . . 40
6.1.9 Production . . . 42
6.1.10 Logistics . . . 44

7 Initiatives/Projects/Model regions/Studies 46

8 European and international categorization 47
8.1 International 47
8.1.1 IEC 47
8.1.2 ISO 47
8.1.3 Joint Technical Committee (JTC) 1 48
8.2 Europe 49
8.2.1 CEN-CENELEC Coordination Group on Smart and Sustainable Cities and Communities (SSCC-CG) 49
8.2.2 EU Commission 50

9 Methodology for determining demand for standardization 51

10 Recommendations from the German Smart City Standardization Roadmap 53
10.1 General recommendations (AE) 53
10.1.1 AE 1 Terminology 53
10.1.2 AE 2 Scope 53
10.2 Recommendations of the joint working groups (GAK-E) 53
10.2.1 GAK E 1 Methodology 53
10.2.2 GAK E 2 System Architecture Model 54
10.2.3 GAK E 3 Energy 54

11 Outlook 55

12 Abbreviations 56

13 References 62

14 Notes 63
14.1 Definitions 63
14.1.1 User story 63

14.1.2 Use Case . . . 63
14.2 Conceptual model and architecture based on smart grid example . . . 64
14.3 Derivation of structure for smart cities . . . 66
14.4 Examples of initiatives/projects/model regions/studies . . . 67

FIGURES

Figure 1:	Principal elements of the standardization landscape and the relationship to regulation [2]	17
Figure 2:	Structure of national smart city standardization bodies	22
Figure 3:	Structure of the IT security coordination body [6]	31
Figure 4:	Use case method - Process for analysing gaps in standardization	52
Figure 5:	Interoperability levels for describing interoperability between systems of different domains [7]	65
Figure 6:	Smart Grid Architecture Model (SGAM) [7]	66
Figure 7:	Smart City Infrastructure Architecture Model (SCIAM) as basis for discussion	66

1 FOREWORD

As places of knowledge and creativity, areas will continue to serve as drivers of economic and social development in the future. Ongoing urbanization and the accompanying increase in social and geographic inequalities, demographic and social changes in urban communities and climate change are placing enormous demands on the planning and administrative capacities of cities. The structural crisis of local finances and widely fluctuating trade tax revenues carry great risks for the range of financial options open to cities.

Yet behind all these changes and uncertainties there are also opportunities for bringing about further synergies. These arise from linking up systems, processes and technologies to help safeguard public services and increase the quality of life in cities.

With the aid of interested experts from industry, science, various associations and German cities, the DIN and DKE organizations would like to support these efforts by issuing the German Smart City Standardization Roadmap. Its purpose is to highlight the need for standards and to serve as a strategic template for national and international standardization work in the field of smart city technology.

The Standardization Roadmap highlights the main activities required to create smart cities. It does not aim to examine the situation within the different areas of activity, as this is taken care of in the form of discrete standardization activities. The focus of version 1 of the Standardization Roadmap is on the interaction between different areas, their demarcation with regard to need for action, and the representation of the standardization activities within the areas. Examples of the approach are taken from initial projects, and the different actors are named. The present version 1 of the Standardization Roadmap is expressly not intended to be used to identify any specific need for standardization within the individual areas. The question of the actual need for standardization in the specified fields of activity remains to be clarified.

The draft aims to highlight the first key standardization steps over the next few years and then to form the basis for further recommendations in later versions.

The present Smart City Standardization Roadmap represents the first step in an ongoing process of defining smart city standardization activities in Germany. The DKE and DIN organizations will continue this in partnership with the various actors involved and will contribute to the public discussion. The document will be developed on an ongoing basis - a process which we would like to invite you in the warmest of terms to contribute to.

2 DEFINITION

The smart city concept is deliberately defined in broad and general terms in order to reflect the current dynamism of the topic.

The purpose of the definition is to help create a common understanding and a vision of,

- what a „smart city“ is
- what motivation lies behind the smart city concept
- which areas are involved
- what the overriding goals are

The definition provides no indication of the requirement for standardization. This is being assessed and developed separately during the course of preparing this joint DIN/DKE standardization roadmap. The definition of „smart city“ will be reviewed on a regular basis and revised if necessary.

Motivation	Global urbanization on the one hand, and the resulting migration away from rural areas on the other hand, are posing new challenges in the development of the structure, services and resources of settlement areas (in Germany and worldwide). The development of ICT and the resulting integratability are facilitating new, intelligent solutions in the different areasby linking up stand-alone solutions. This will give rise to new, integrated technological, service and/or process solutions with a correspondingly high demand for interface management in the future
Delimitation	Smart city is the name given to a settlement area in which systemically (ecologically, socially and economically) sustainable products, services, technologies, processes and infrastructures are used. It is supported by highly integrated and networked information and communication technologies.

Objectives of the smart city	**The main objectives of the smart city are to:** • improve the quality of life and possibilities for citizens to play a worthwhile role in society • reduce the use of finite resources and to establish the use of renewable resources • safeguard and optimize public services • reinforce the ability of the settlement area to survive, adapt and prevail (resilience) • create a transparent decision-making culture and information society and to • maintain or increase the competitiveness of the region as an economic location and, as a consequence, to improve the future viability of the settlement area and reduce or avoid the negative consequences of urbanization.
Areas affected	**These include** • Public services • Energy • Supply and disposal services (water, waste) • Natural environment • Mobility and transport • Buildings and building infrastructures • Information and communication • Security and protection • Production and logistics • Commerce and services • Social infrastructure (education, health, culture) • Urban development and planning and • Politics and administration (governance)
Central component	A basic distinguishing feature of the smart city is the further development of the integration and networking of these areas in order to increase the efficiency, effectiveness and resilience of the overall system, thereby unleashing potential for ecological and social improvement.
Process preconditions	**The main preconditions** • Vision of “integrated urban development” • Capacity for innovation • Close collaboration and acceptance of the actors, plus participatory access to the creation of a culture of involvement • Comprehensive integration of the social aspects of the urban society.

3 SUMMARY

3.1 Background and motivation

Digital infrastructures are a prerequisite for the increasing networking of municipal infrastructures. In order to be able to exploit the resulting opportunities for increased economic performance and quality of life, and for the sparing use of resources in the settlement areas, new standardized and automatic communication processes need to be developed for key interfaces between systems and infrastructures within a settlement area, as do methods for standardising basic security mechanisms to protect critical infrastructures and privacy.

3.2 Standards and specifications

Standards and specifications are voluntary instruments which are developed by „interested groups“ (companies, the commercial sector, universities, consumers, skilled traders, testing institutes, authorities, etc.). This work is organized within Germany by DIN and DKE organizations. They dispatch experts to take part in the European (CEN, CENELEC and ETSI) and international (ISO, IEC and ITU) standardization organizations. Besides the internationally recognized standardization institutes, there are also other national and global organizations working on specifications or recommendations, some of which constitute quasi-standards.

3.3 National standardization activities

Version 1 of the Standardization Roadmap concerns itself primarily with describing the current smart city standardization situation. The smart city topic is subdivided into a total of eight thematic blocks. In each thematic block the context to Smart City and if possible their interconnections are described with reference to the German standardization roadmaps already published on the topics of AA L, e-Mobility, e-Energy/Smart Grids, Smart Home + Building, Industry 4.0 and IT-Security. The specialist work on the Standardization Roadmap is carried out in joint DKE and DIN working groups and coordinated and controlled by the joint Smart Cities DIN/DKE steering body. The actual smart city standardization work is conducted in the more than 20 relevant DKE and DIN standardization bodies.

3.4 Initiatives/Projects/Model regions/Studies

Existing smart city initiatives, projects, model regions and studies are evaluated in terms of their possible effects on existing or future standardization.

3.5 European and international categorization

All European and international standardization organizations are currently setting up strategy groups to develop cross-disciplinary plans for coordinating and investigating the demand for possible future standardization. The present German Smart City Standardization Roadmap is intended to make a major national contribution in this regard.

3.6 Methodology for determining demand for standardization

A conceptual model and a functional architecture (Smart City Infrastructure Architecture Model – SCIAM) are required to describe complex systems such as smart cities, in order to outline the interactions of the different areas with each other and with the immediate environment. The requirements need to be managed at the system level in order to break complex situations down into simpler aspects, thereby allowing them to be processed by the relevant standardization bodies.

The use case method is to be used. Use cases describe individual functions and their interactions which are realized or supported by the system. They form the basis for determining the system requirements..

3.7 Recommendations from the German Smart City Standardization Roadmap

The German Smart City Standardization Roadmap contains the following recommendations:

- Terminology
- Scope
- Methodology
- System architecture model
- Energy

3.8 Outlook

Publication of this version 1 of the Smart City Standardization Roadmap also signals the start of the revision and further development work in the different areas. Previously unaddressed topics are to be evaluated, existing or incipient projects are to be assessed in terms of their relevance for standardization, and any interfaces which could become necessary in the future are to be checked in terms of their interoperability. The German representatives working on the strategic activities of the European and international standards organizations (CEN/CENELEC and ISO/IEC) need to be organized with regard to the European and international smart city standardization activities. These are just some of the future tasks which DIN and DKE would like to complete with the aid of the experts in the steering body and in the joint working groups.

Any interested experts who would like to become involved in this process can contact any of the addresses listed at the start of the document. They are cordially invited to become actively involved in the later versions of the Smart City Standardization Roadmap.

4 BACKGROUND AND MOTIVATION

4.1 Social background and long term prospects

Digital infrastructures are a precondition for further interconnection and the development of synergies. As a consequence, social principles and procedures evolve and exist in a constant state of flux along with the similarly rapid development of even smaller information technology structures. Increasing numbers of aspects of life, components and systems are being penetrated by information technology and becoming interlinked. How this change is shaped is one of the key issues concerning the future-proof development of cities.

The higher interconnection and digitization levels are increasing the number of opportunities for people, for companies and for cities in terms of new forms of the regional economic cycle in settlement areas. This starts with the fact that digitization, automation, miniaturization and the increasing replacement of hardware by software are fundamentally changing the structure of economies. The resulting economic cycle can strengthen the financial position of settlement areas. Shaping these change processes can represent an opportunity for improving the quality of life in the settlement areas and for making better use of their resources. This also applies to utilization of the potential regional energy resources and flexibilities within the energy infrastructure, for instance.

The comprehensive introduction of information technology into the urban infrastructure opens up new possibilities in the design of buildings and settlements. These active energy systems can be used e.g. to independently generate, store and use energy, optimize energy flows and even exchange energy. Knowledge of the wide variety of circumstances in the settlement area‘s systems allows us to replace distributed services in real time (while observing data protection regulations), and to develop a type of network economy within the settlement area. The value added can increase considerably in proportion to the number and commitment of those actively involved. This basic principle applies whenever ideas, innovations and economic power are shared with others. The creation of value added lies in cooperation. Participants develop into prosumers. This is now referred to as the sharing economy.

A considerably more complex and varied system is created in the settlement area, requiring structured ties and organization. The technical requirements, the communication and the security mechanisms need to be defined for this. Interconnection is a basic precondition which must ensure individuality but also be sensitive to the needs of the environment and the advantages of globalized convergence. Of course, this should only happen if personal data protection can be assured.

With regard to the development of the required digital system architecture, it is of utmost importance that comprehensive flexibility be maintained.

A change process affecting the settlement area is the fact that networked information and communication technology will make information ubiquitous in the future, i.e. it will be accessible at all times in all places. This includes information on the status of the environment, of things, i.e. components and systems (buildings, fittings, equipment, etc.) and also of flows and potential in infrastructures, for example in energy infrastructures.

In order to be able to exploit the resulting opportunities for new functions, services and business models, new standardized and automatic communication processes need to be developed for key interfaces between systems and infrastructures within a settlement area. New, more secure types of IT architecture need to be defined in order to combat the risks associated with potential privacy infringement which arise in conjunction with this networking. New types of cyber crime are also giving rise to a new form of vulnerability in the critical infrastructures and institutions.

A smart city standardization roadmap must therefore identify the key new applications which arise as a result of networking the different areas of activity and infrastructures of a settlement area, and describe the resulting demand for standardized communication between core processes.

It is important to offer the opportunities presented by this change to society at large, while developing new mechanisms for protecting society and individuals. The tension arising between the transmission of information for new functions and the concerns surrounding privacy must be resolved. This requires a system with a high degree of privacy, information security, functional safety, a pronounced ability to survive, adapt and prevail (resilience) and low vulnerability. Standardization work must therefore devote itself to solutions aimed at standardising basic safety mechanisms.

It should be borne in mind that IT development fits into a particular cultural and social context. Basic processes therefore require a high degree of flexibility with regard to changes and deployment in different cultural and social contexts.

Increased intelligent technological interconnection in urban areas must help ensure that the residents are offered increased flexibility in their lifestyle while greater sensitivity is shown in handling resources. But it should also help urban life become simpler, more relaxed and leisurely. Certain value patterns - regarding mobility for example - will be questioned more intensively and changed. For smart cities to become reality, much more is required than simply new technologies.
A change of cultural values and a stronger emphasis on shared responsibility are called for.

4.2 Scope and delimitation

The increase in so-called intelligent technologies is immediately apparent, a development which is making its presence felt in a variety of forms in the field of standardization. Standards are gaining in importance as a means of ensuring good communication between the different areas. This is especially true in the field of Information and Communication Technology (ICT), which is at the heart of all smart technologies,. Development and related standardization used to be conducted in the vertical plane, whereas ICT is favouring the development of a horizontal approach with the aid of numerous experts from different fields.

In the recent past, smart technology applications were developed which shifted the focus to ICT-supported urban development. In modernising our cities, it is important to take an integrated approach with regard to the utilities and to ensure a dynamic infrastructure which responds in a targeted way to temporary changes (e.g. peak loads in the power grid) and which, similar to a central nervous system, safeguards the networking and communication of the individual demands (power, water supply, information and communication services, security, health system, mobility, etc.) while taking demographic changes into account.

As the official representatives of German interests in international standardization, DIN and DKE help ensure that products and services are harmonized with developments in other markets by means of interface standards. They help ensure that the innovations developed in Germany are implemented internationally.

The primary objectives of this Standardization Roadmap are both to present the international work which is already under way, and also to outline the needs of German interest groups in the individual areas of urban development. This means that the results set forth in this Standardization Roadmap should not necessarily be seen as unambiguous, immutable signposts. Rather, the document serves as a guide for the investigative work required to identify and, if necessary, initiate concrete standardization work.

5. STANDARDS AND SPECIFICATIONS

Standards and specifications are developed by different organizations at different levels (national, European, international). So-called „interested groups" (companies, commercial enterprises, universities, consumers, skilled trades, testing institutes, authorities, etc.) send their experts to working groups in a standardization organization. The standardization work is organized and carried out in these working groups.

A clearer overview of the standardization organizations and their connections is shown in the diagram below.

The International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC) and the International Telecommunication Union (ITU) all work to provide consensus-based standards and are the main standardization organizations at the international level. The related standardization organizations at the European and national levels are the European Committee for Standardization (CEN), the German Institute for Standardization (DIN), the European Committee for Electrotechnical Standardization (CENELEC), the European Telecommunications Standards Institute (ETSI) and the German Commission for Electrical, Electronic & Information Technologies of DIN and VDE (DKE) (see figure 5). The corresponding national standardization organizations are members of ISO, IEC, CEN and CENELEC.

Figure 1: Principal elements of the standardization landscape and the relationship to regulation [2]

5.1 DIN, CEN and ISO

The DIN German Institute for Standardization offers all interested parties a platform for developing standards and specifications as a service to industry, the state and society. DIN is a private sector organization with the legal status of a non-profit association. DIN members include companies, associations, authorities and other industrial, commercial, skilled trade and scientific institutions.

Together with representatives of the interested groups, the main function of DIN is to develop timely, consensus-based standards that meet market needs. On the basis of a contract concluded with the Federal Government of Germany, DIN is recognized as a national standardization organization by the European and international standardization organizations.

Almost 90 % of DIN's standardization work today is at the European and international level, although the DIN staff organize the entire process of non-electrotechnical standardization at the national level and ensure German involvement at the European and international levels through its relevant national bodies. The DIN organization represents Germany's standardization interests as a member of CEN and ISO.

5.2 DKE, CENELEC and IEC

DKE represents the interests of the electrical engineering, electronics and information technology industry in international and regional electrotechnical standardization work and is funded by the VDE. DKE is responsible for standardization work which is handled by the corresponding international and regional organizations (IEC, CENELEC and ETSI). It represents German interests both within CENELEC and the IEC. DKE serves the general public as a modern service organization by ensuring the safe and efficient generation, distribution and utilization of electricity.

It is DKE's responsibility to prepare and publish standards in the field of electrical, electronic and information technologies. The results of the DKE's electrotechnical standardization work are set down in DIN standards and are accepted as German standards in the DIN set of German standards. Those which contain safety-related stipulations are also included as VDE requirements in the VDE set of regulations.

The working bodies are assigned as German „mirror committees" to the corresponding technical committees of the IEC (or CENELEC), meaning that only one German body is responsible for the entire national, European and international work or collaboration in a particular specialist area.

5.3 ETSI and ITU-T

ETSI (European Telecommunications Standard) develops standards and specifications which can be applied worldwide for use in radio-based and cable-linked information and communication technology. Corresponding specifications of the ITU-T (International Telecommunication Union - Standardization Sector) are known as recommendations.

ETSI, CEN and CENELEC, ETSI are officially recognized by the European Union as the European Standardization Organization (ESO). The standardization mandates of the EU Commission are also sent to ETSI. The ETSI members and their publications also supervise forums and consortiums.

Thanks to the DKE's work in implementing public enquiry proceedings in Germany, ETSI can also develop and publish European standards (ENs) which are harmonized throughout the continent. DKE bodies often take a leading role in consolidating the German position and in providing German comments. The standards and specifications published by ETSI are only available in English. The DKE also takes care of transferring ETSI ENs into national standards in Germany (DIN EN 3xxx xxx).

ETSI currently has roughly 700 independent paying members in the form of European and global organizations and companies of different sizes from all 5 continents. There are no national delegates to the technical ETSI bodies. A German delegation is headed by the Federal Ministry of Economics and Technology (BMWi) at the General Meeting.

ITU-T is part of the International Telecommunication Union, a sub-organization of the United Nations, with which the Federal Republic of Germany has signed a binding agreement under international law.

193 nations are members of the ITU. Germany is represented by the Federal Ministry for Economic Affairs and Energy (BMWi). Approximately 700 companies and academies worldwide are independent sector members of the ITU-T. Within the organization, however, the latter have fewer rights than the nations.

5.4 Standardization mandates of the European Commission

There is no mandate for smart cities. There are, however, mandates for selected individual domains (e.g. smart grids - M490).

Mandates are orders of the European Commission, the primary intention of which is to provide further detail for EU directives and regulations. Mandates can be used in standardization, for instance, to issue orders for the generation of technical standards to the European standardization organizations (CEN, CLC, ETSI).

The mandate generation procedure is based on Directive 98/34/EC of 22 June 1998 „Laying down a procedure for the provision of information in the field of technical standards and regulations and of rules on Information Society services" and the handbook for European standardization. Parts of Directive 98/34/EC were replaced by EU Regulation 1025/2012 which describes the legal framework for European standardization.

5.5 Other standards institutions, forums and consortiums

Besides the internationally recognized standardization institutes, there are other global organizations which issue specifications or recommendations, some of which constitute quasi-standards. These can also serve as the preliminary stage and basis of an eventual official standard.

A good example is the World Wide Web Consortium (W3C) which concerns itself with specifying the technologies associated with the World Wide Web. The W3C is currently processing e.g. the recommendation for a programming interface (API) which would enable Web applications to access devices using the NFC near field communication standard. This would facilitate the creation of an NFC-based payment system.

As a further example, the Organization for the Advancement of Structured Information Standards (OASIS) has set up the Energy Market Information Exchange (EMIX), an information model and XML vocabulary for the interoperative and standardized exchange of price and product definitions in transactive energy markets.

6. NATIONAL ACTIVITIES

6.1 Standardization activities

6.1.1 Structure

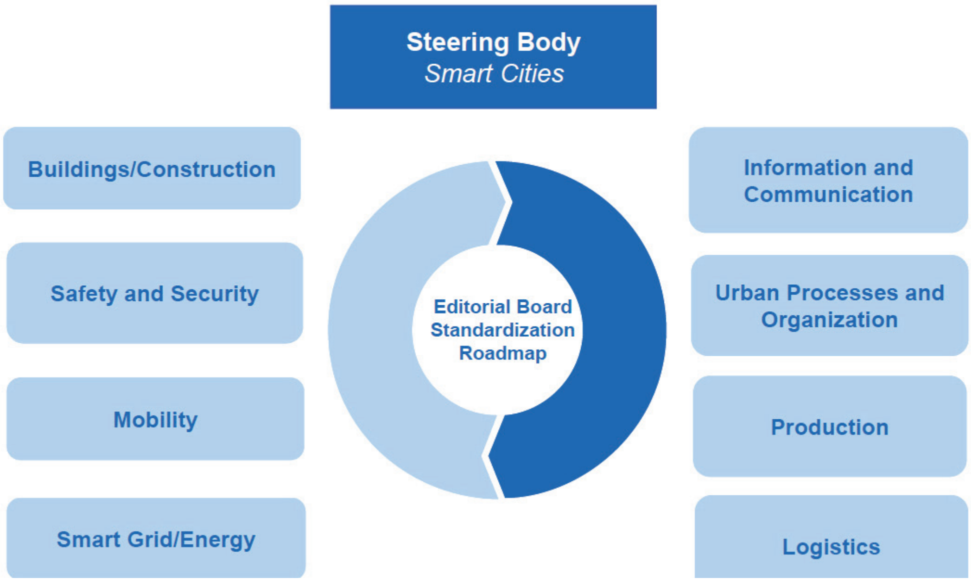
In order to respond as efficiently as possible to the universal smart city challenges, DIN and DKE have decided on a common approach with a joint steering body and joint working groups. This common structure is shown in Figure 2.

The work on the German Standardization Roadmap is strategically controlled by the joint steering body. The nine DIN/DKE joint working groups (GAKs), the content of the Standardization Roadmap, the distribution of the Standardization Roadmap and its continuous revision are all coordinated by this steering body. The joint steering body can elaborate proposals for new standardization projects based on the results of the GAK. It is the national contact for all universal European and international standardization activities on smart city-related issues. In the future, it will organize the German representation in the strategic activities of the European and international standardization organizations (CEN/CENELEC and ISO/IEC), with the goal of assuming a leading role.

The „Standardization Roadmap“ GAK is responsible for drawing up the German Smart City Standardization Roadmap. It also carries out needs-based revision of the Standardization Roadmap.

The other eight joint working groups take care of discussing and documenting all standardization-related information within the topic areas in close collaboration with the national bodies, especially the joint steering body. This information is fed into the content design of the national standardization roadmap. The GAKs consult regularly with each other through joint meetings and the exchange of documents. The demand for standardization in each of the eight joint working groups is not yet clear.

Figure 2:
Structure of national smart city standardization bodies



6.1.2 Standardization roadmaps

The 6 existing German standardization roadmaps on AAL, e-Mobility, e-Energy/Smart Grids, Smart Home + Building, Industry 4.0 and IT Security contain extensive, and in some cases overlapping, descriptions of the standardization landscape. The present document does not concern itself in detail with the content of the existing standardization roadmaps. There are, however, brief descriptions in the sections on the relevant applications.

6.1.3 Buildings and Constuctions

6.1.3.1 Basic aspects and interfaces

Building technology plays a not inconsiderable role in the analysis of smart cities. If we consider the development of building technology over the last 20 years, one of the main tendencies has been the interconnection of individual system components with each other or with other systems. The developments - including everything from smart metering, smart homes and smart buildings through to smart grids - are the major factors which have influenced the smart city concept.

The development of smart buildings containing e.g. centrally controlled heating/cooling systems, lights and other appliances (including remote control via smartphone or tablet PC) is regarded as especially promising for the future. Such networked equipment control would noticeably increase the ease of operation for users. Energy saving effects can also be obtained if the system is designed correctly.

To enable such equipment control systems to function, the relevant interfaces of the individual products and systems through to the communication protocols must be compatible and the different domain must be carefully coordinated to ensure problem-free interaction and intermeshing. Standardization suggests itself as the right tool for ensuring such compatibility. This presupposes coordination of the specialist groups and skilled trades involved.

The integration and networking of the wide range of aspects involved in a settlement area require new forms of communication and data exchange. All the information needed for making decisions should be available and accessible at the appropriate time, while taking data protection considerations into account.

The interfaces required for the above aspects need to be considered / defined.

6.1.3.2 Standardization landscape

Building automation

Building automation is described in detail in ISO CEN DIN 16484 „Building automation and control systems“. The project planning and execution, hardware, functions, applications and data communication protocols and the influence on building energy efficiency are described in the 7 sections of the standard. The connections of building automation systems to the smart grid and a comprehensive calculation method for building energy requirements (Mandate M480) are currently being worked on by CEN TC 247.

The environment-friendly design of buildings requires the use of complex automation and control processes. The functional integration of other equipment such as heating, ventilation and air conditioning systems (HVAC systems) represents a common task for all those involved in the development of integrated, cross-domain technical building equipment. Integration includes e.g. lighting control, electrical power distribution, alarm systems, elevator control, maintenance or facility management. It offer users advantages in the form of synergies arising from the interaction of different systems/equipment.

The standard serves as the basis for linking up facilities and systems. The different parts of a building automation system require a uniform data communication protocol and information model to ensure interoperability. Standardized bus protocols (e.g. Bacnet, Lon, KNX) permit cross-domain communication within a building, and also communication with users or points outside the building.

Further standardization projects on instrumentation and control systems for heating systems, for the automation of HVAC applications, for data communication in building automation, building management and remote meter reading are currently being worked on in the DIN HVAC (NHRS) committee and the relevant CEN and ISO bodies.

Future smart city standardization work may have a direct impact on the building technology standards. The large number of cross-disciplinary smart city topics requires the involvement of a large circle of experts. This also helps boost the level of interest in building technology standardization.

Smart Home + Building

In the last few years the term „smart home“ has come to describe the technologies deployed in residential rooms and buildings in which networked devices and systems help enhance the quality of living, safety and efficient energy use levels.

The continuing digitization and networking of nearly all areas of human experience are leading to changes in the home environment which are resulting in turn in new possibilities for living and working at home. Smart home technology is an integral element in the efforts to create sustainable infrastructure development and to improve the quality of life in the urban environment. This includes such aspects as the economy, the domestic and working environments, the social environment, assisted mobility and interaction with the authorities. Smart home is all about integrating and using information and telecommunication technologies in the domestic environment to open up a new world of experience and to make existing entertainment, comfort, energy management, health and safety activities more cost-efficient or convenient.

Those involved in the smart home standardization efforts consist of representatives of academic institutions and industrial companies in the fields of home automation, HVAC, consumer electronics, decentralized energy supply and management and other areas such as system integration or security technology. The goal of the consortium is to create and maintain an international series of standards which facilitates the sustainable development of interoperable, safe, mobile and reusable applications and services in the home environment.

The Smart Home + Building Standardization Roadmap is a joint effort between the DKE German Commission for Electrical, Electronic & Information Technologies of DIN and VDE and the companies involved in the project. The starting point for this project was a preliminary study, the purpose of which was to document information on existing studies, projects, standards and products in the smart home environment. This information was structured and evaluated in consensus-based collaboration with the parties involved.

The main tasks of this standardization roadmap are to collect, coordinate and prepare use cases and user stories within the smart home + building environment. A further purpose is to coordinate existing work on use cases at the national, European and international levels.

www.dke.de/smarthome_roadmap

Ambient Assisted Living (AAL)

AAL (Ambient Assisted Living) is a set of solutions designed to support people of all ages in everyday situations and in any environment. AAL is not therefore restricted to the domestic environment; it also includes the environment of those who are still mobile and can leave the home. AAL only became established a few years ago as a separate area of research and activity, before it was seized upon and developed by numerous national and European actors. Today it is a highly topical and much-discussed area, covering a comprehensive range of activities at the national and international levels. The demand for AAL developments stems from the demographic shift and the desire for greater convenience which result from advances in human-technology interaction. Demographic change is giving rise to steadily increasing demand for technical assistance systems which can support and facilitate everyday activities in a situation-dependent and unobtrusive manner. This is accompanied by close intermeshing of the technical and social systems which is resulting in turn in the increased use of ICT in our everyday lives. The vital and ambient data are captured by sensor systems close to people‘s bodies or distributed throughout the room. The AAL technology can be modular and interconnected, thereby permitting it to be adapted to the needs and the environment of each individual, allowing optimized assistance by taking an integrated view of the data. Characteristic of AAL is high level indisciplinarity, which gives rise to a large number of partners from different medical, technological, sociological and economic fields. Many specifications exist and are already being applied for individual systems today.

The highly heterogeneous group of AAL system and service users has given rise to large numbers of functional and non-functional user demands. Legal requirements are defined primarily by data protection laws and the Medical Products Act. However, the mere existence of these specifications is not enough to satisfy the specific requirements of the AAL systems and products. From the wide range of specifications it is necessary to identify and select the ones which are actually system-relevant. It is also important to plug any gaps - especially with regard to the integration and interoperability of the individual systems, but also e.g. with regard to quality assurance and to the training of specialists. The present AAL Standardization Roadmap (version 2) promotes a common approach for all those involved in the AAL environment, while sensitising them in the process to smart city concerns.

www.dke.de/Roadmap-AAL

BIM – Building Information Modelling

Building Information Modelling (BIM) generally signifies 3D „virtual building models“ or „structural information models“. IT models of varying structural depths are used for the BIM of major infrastructure projects in particular. These should be designed to cover the entire planning, construction and use process, including technology. The ISO has developed initial data exchange standards:

- ISO 29481-1 Building information modelling - Information delivery manual – Part 1: Methodology and format (IDM)
- ISO 29481-2 Building information modelling - Information delivery manual – Part 2: Interaction Framework (IDM)
- ISO 16739 Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries (IFC)
- ISO 12006-3 Building construction -- Organization of information about construction works - Part 3: Framework for object-oriented information (IFD)

It is hoped that the use of BIM will yield the following benefits:

- Increased efficiency
- Synergy effects, cost benefits
- Possibilities for optimising building functions
- Punctual deliveries, high quality
- Closer collaboration between all parties
- Long-term and multiple use of data

Barrier-free access

Of the DIN 18040 „Construction of accessible buildings - Design-principles“ series of standards which already exist in Germany, Article 4 of the Federal Ordinance on Barrier-Free Information Technology (BGG) in particular has already been implemented. This renders building structures generally accessible and usable for people with disabilities - with no great difficulty and without any external assistance. Some of the requirements in this standard also simplify use for other groups such as the elderly or children. It concerns publicly accessible buildings (DIN 18040-1), dwellings (DIN 18040-2) and public circulation areas and open spaces (DIN 18040-3). There are also further standards concerning barrier-free access, e.g. on ground surface indicators in public areas (DIN 32984), quality requirements for providers of „Assisted living for the elderly“ (DIN 77800) or designing visual information in the public area for accessible use (DIN 32975).

An overview of existing standards needs to be drawn up to establish the future demand for the generation of new standards on barrier-free access. The key purposes of this Standardization Roadmap are the collection, coordination and processing of existing standardization work and general issues which are relevant for the overall settlement area system. The future demand for standardization can only be ascertained in close collaboration with the local authorities. Such an overview or platform would also make it easier for users to conduct searches on the subject of barrier-free buildings and give them greater security with regard to the reliability of the information they obtain.

Barrier-free access also plays a great role in the information technology and media which are deployed in smart cities. Wherever physical access is replaced by electronic access, this needs to be designed in the same barrier-free way as structural buildings. With regard to the electronic publishing of official information provided by the local communities, districts and ministries, it should be designed in accordance with the latest BITV-II in such a way as to ensure access regardless of the physical disability. W3C WCWG has also ensured very similar requirements at the international level. Above all, smart cities will need to meet these requirements through the digitization of many processes if they are to ensure equal opportunities in the future, too.

Sustainability

Appropriate standards can define the parameters of relevant information and processes and be included on a uniform basis in a qualitative evaluation of the environmental, social and economic effects.

Environmental declarations for building products and building components, for example, are described on the basis of verifiable environmental information which creates an incentive for continually improving environmental quality based on market mechanisms. These can be aggregated so that information can be provided for buildings. Which parameters should be regarded as crucial for the system of smart cities and how these can be integrated needs to be discussed in terms of the extent to which investigations into the life cycle process optimization of buildings, and topics such as the interaction of buildings and building technology with the environment and the urban infrastructure, are covered in the standardization. Systems need to interact and compatibility must be ensured if the idea of „smart cities“ is to be realized.

Waste supply and disposal

As a basic resource which is essential for life, water plays a pivotal role in the sustainable and intelligent development of a smart city.

Drinking water is an essential foodstuff and, as such, it must be possible to use it at all times, without any hesitation, for the preparation of meals, for drinking and for bodily hygiene. It must be supplied both to homes and to industry in the required quality and quantity, at the necessary pressure throughout the settlement area and arrive safely and dependably in the buildings. This requires sustainable supply management and protection of the water resources. It also requires a level of processing which is appropriate for the quality of the raw water and which is as natural as possible, involving environment-friendly pumping, storage and transportation to, and distribution within, the settlement areas. High water quality, including that of the hot drinking water within plumbing systems in buildings, must be ensured at all costs. The efficient use of energy, the prevention of water loss and the sparing use of drinking water are all accorded a high priority. The collection, drainage and purification of local and industrial waste water, including rainwater and sewage, plus non-toxic return to the water circulation system and the safe re-use or disposal of the residues are also of prime importance. The supply of drinking water and the disposal of waste water safeguard the health and development of the smart city. The reduced sealing, or even unsealing, of surfaces and the local and natural seepage of rainwater reduce the quantities of water needing to be drained by the sewage system, including all necessary costs, and lower the risk of flooding in the settled areas.

A great deal of importance should be attached to the planning, construction, operation and maintenance of the water infrastructure inside and outside public and private buildings in order to prevent health risks and damage to buildings, the urban infrastructure and the environment. This includes monitoring the operating status and quality of the raw, drinking and waste water and residues, and measuring the water quantities. Resource-friendly, trenchless construction methods which make use of the existing infrastructure and have minimum impact on the existing transport infrastructure are increasingly gaining in acceptance in the construction and modernization of drinking water pipes and sewers. Standards and technical regulations ensure the high quality necessary for ensuring long-term use. The infrastructures and technologies required for water extraction, treatment and supply, and those needed for waste water drainage and the purification and disposal of residues should be systematically identified, analysed and adjusted in line with the demographic and climate changes and migration movements of the population. The appropriate structural, logistical and technical foundations need to be laid for this. Anthropogenic changes to the raw water quality also need to be taken into consideration. Sanitation and hygiene requirements need to be adapted to climate change, demographic changes in the settlement areas and the reduction in water consumption. Planning, construction, maintenance and also product standards help to ensure reliable supplies and disposal, and to prevent catastrophes.

Extreme weather such as heavy rain or flooding and any resulting widespread contamination and hygiene problems and destruction of the infrastructure and the natural environment need to be taken into account and instruments provided for regulating and monitoring this, and also for risk and crisis management. Current legal regulations, standards and other rules for dykes, dams and sewers are designed to cope with expected natural events including those arising as a consequence of climate change. Procedures exist for defining retention areas required for improving the ability to cope with flooding. However, the implementation of such plans requires a great deal of public and political support. The density and level of the generally accepted rules for technology in Germany in the field of water engineering are very high and can serve as models for other regions in the world. Recently published European and international standards for risk and crisis management in the water supply and disposal sector are helping to improve the reliability of drinking water quality, optimization of the supply and disposal reliability and improved preparation for, and the resolution of, crises such as those following extreme weather events or unauthorized tampering with the supply and disposal systems.

In water shortage areas, the use of rainwater and treated waste water is gaining in significance for the irrigation of agricultural land and for urban purposes. Rainwater and treated grey water are to be included in new building and settlement plans with regard to the use of available resources. Here, standards help to prevent the spread of disease and epidemics, thereby providing a high level of living comfort and minimum impact on the environment. The first national standards and regulations for the use of rain and treated waste water for use in buildings have been generated to establish the basic principles. The extraction of methane from the sludge created during the waste water purification process is gaining in significance, as too is use of the sludge to produce energy. Development¬ work is currently being carried out on the efficient use of energy in the supply of drinking water, the disposal of waste water and the recovery of heat from waste water.
No corresponding requirement for standardization has yet been identified within the Smart City Roadmap. International standards are being elaborated on the planning and operation of water installation systems, on sustainable asset management of the water infrastructure, on the efficient use of water, on the monitoring and prevention of water loss, on rainwater management on land areas and in buildings, and for energy recovery from waste water in buildings as part of the ISO „Water access and use“ initiative.

Lighting technology

Street lighting accounts for a significant proportion of local electricity consumption in Germany. Improving the efficiency and reducing CO2 emissions from such lighting therefore represent major challenges for the future. As a result of the EU Ecodesign Directive, roughly 40 % of the street lamps in the EU will need to be replaced given that e.g. low-pressure sodium vapour lamps and mercury vapour lamps have already been banned, or are about to be. The demand-based management of outdoor lighting systems also represents a highly influential factor with regard to potential energy savings and improving the quality of life. This broad category also includes street and tunnel lighting, pedestrian crossings and the illumination of outdoor workplaces. The DIN Lighting Technology standardization committee (FNL) is responsible for this.

An example of a European approach is the ESOLI (Energy Saving Outdoor Lighting) project which is being overseen in Germany by Berliner Energieagentur. In Oslo, for example, a dynamic street lighting system has been introduced based on a powerline with LON bus system.

6.1.4 Security and protection

6.1.4.1 Basic aspects and interfaces

Reports of IT system attacks now appear almost daily in the media. Areas are increasingly being targeted which nobody would have associated with Internet attacks just a few years ago. The ICT-based interlinking and penetration of previously independent systems necessary for the planning of a smart city therefore requires careful consideration of IT security aspects - right from the outset of the development of new systems. Even from the earliest stages, technical and organizational protection mechanisms must play a key role in devising ways of minimising possible damage which could be caused by a breakdown of the IT systems in a densely networked settlement area. New secure and self-healing architectures need to be defined for interconnecting the information technology in order to counter the possible risks. Existing and established IT security standards should be used wherever possible.

6.1.4.2 Standardization landscape

Information security

The DIN IT security coordination body (KITS) has drawn up an overview which can be used as a starting point for identifying suitable existing IT security standards (see also www.kits.focusict.de). In order to be able to exploit the resulting opportunities for new functions, services and business models from the smart city concept, new standardized processes need to be defined for automatic communication, and the key interfaces defined between the smart city systems and infrastructures.

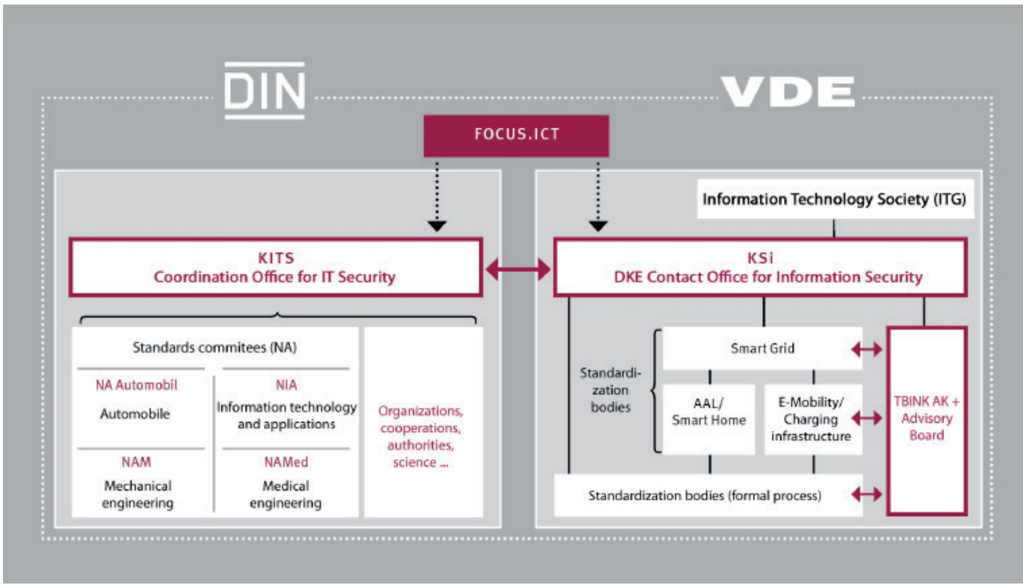


Figure 3: Structure of the IT security coordination body [6]

www.dke.de/KITS_NR_IT-Sicherheit

DIN and DKE have drawn up an IT security roadmap within the KITS advisory committee. In the 4 main areas of:

- Data protection
- Energy supplies (smart grid)
- Industrial production (Industry 4.0)
- Medical engineering

the roadmap shows the current state of standardization and charts the areas requiring action. IT security topics are listed which will grow in importance in the future.

6.1.5 Mobility

6.1.5.1 Basic aspects and interfaces

In the analysis of smart cities, mobility plays a significant role. Aspects such as the changing mobility needs of younger generations, the development of a wide range of drive technologies and associated scenarios for their intended purpose plus integration in, and interlinking with, other systems such as smart grids, smart homes or urban logistics ideas are relevant here.

The future design and planning of urban mobility also play an important role. The implementation of so-called intermodal transport systems, i.e. the combination of different modes of transport such as buses, trains and car-sharing, should also be mentioned here. The development of new communication systems such as car-to-car or car-to-X communication which are already under way, will facilitate optimization in the controlling and management of traffic which could, in turn, constitute part of a smart city system.

The seamless interaction between the respective areas, i.e. the compatibility of the necessary interfaces between the systems, requires correctly dimensioned standardization dimensions at the right time. The precise points which need to be addressed must be determined in an interactive procedure during the development of the smart city concepts and determined in conjunction with the groups concerned.

With regard to the development of the different drive technologies, electromobility in particular currently holds a commanding position both nationally and globally. This necessitates strong political resolve and close collaboration with industry and academia. Nevertheless it should be noted that the German automobile industry, for instance, has adopted a fuel-diversity strategy. This means that different drive technologies, from conventional or hybrid through to pure electric drives and fuel cells, will need to developed or refined. It remains to be seen which system comes to dominate for which purpose, although electromobility is currently regarded as the optimum choice for urban transport on account of the ranges currently being achieved. The establishment of one or more concepts will ultimately also influence the nature of the smart city, e.g. of the required infrastructure.

The rising popularity of electric vehicles will require completely new concepts to be devised for charging the vehicles which are integrated in the smart home infrastructure. In the future electric vehicles will be used as energy storage units which are charged using a photovoltaic system. The over or under production of electricity could then be compensated in a nationwide smart grid. The networking of ICT systems inside and outside the home is a precondition for this. Local charging stations which can be supplemented by home solar carports and battery storage systems must be integrated in such a smart grid system. If a user needs to use a fully charged electric vehicle the next morning, s/he will take the power from the mains. Conversely, it would be possible to feed power back into the grid if the user does not need to use the vehicle. Different electricity tariffs will be necessary here - already a legal requirement. When defining an efficient method for introducing innovative concepts, it is always important to ensure compatibility and interoperability with the existing systems.

Despite these many imponderables in connection with the development and market penetration of certain technologies and the related specific demand for standardization, initial findings and roadmaps already exist for some of the technological areas mentioned above which could be incorporated into future considerations.

6.1.5.2 Standardization landscape

Electromobility

DIN and DKE have been commissioned by the Nationale Plattform Elektromobilität (NPE) to collaborate on producing the „German Electromobility Standardization Roadmap“. The first version was published back in 2010 and has been regularly revised ever since.

Besides defining the system itself, the roadmap also contains use scenarios for electric vehicles and then describes the energy and data streams. The application areas of vehicle, energy storage units and charging infrastructure are examined. It also lists the related national and international standards and gives a large number of recommendations for action on necessary standardization work.

These recommendations also serve as the basis for integrating electromobility into future smart city systems. For smart grid integration, the „e-Energy/Smart Grid Standardization Roadmap“, version 2 of which was published in March 2013, should also be consulted.

www.dke.de/e-mobility_roadmap2

6.1.6 Energy

6.1.6.1 Basic aspects and interfaces

The fuel of gas and the energy forms of electricity and heating are covered here. Key aspects considered are those which are typical of smart cities and which go beyond existing studies conducted elsewhere (e.g. in the standardization roadmaps for smart grids or smart homes). This is typically the case whenever potential for optimization arises from the interaction of different domains. The conversion of excess, ecologically generated electrical energy into hydrogen or synthetic natural gas and its addition to gas networks makes it possible to store large quantities of electricity from renewable energies on a long-term basis. Further possibilities here include the use of waste heat from industrial plants for heating residential buildings or the use of traffic management systems to increase the energy efficiency of vehicles. In order to obtain a flexible and efficient municipal energy system it is therefore also important to regard the individual electricity, gas, heating and water systems as part of the overall energy system.

The „magic energy supply triangle“ applies in particular for electricity supplies in smart cities: cost-effectiveness, service reliability, environmental compatibility. All three goals are important and inextricably entwined. Key elements of such a sustainable system include e.g. efficient buildings, intelligent transport and a comprehensive energy management system which facilitates the efficient handling of energy and the infrastructure.

A smart grid delivers a large number of these preconditions: a largely automated and self-healing supply network, smart meters, decentralized power generation and intermediate storage, local energy¬ management, transfer of grid services to smart homes and buildings, concentration of smaller units to create virtual power plants and electronic market places for energy and control power. Information on power generation, power consumption, electricity offers and electricity prices is collected by all of these, permitting efficient and intelligent management and control of the energy system.

Smart homes (detached and semidetached houses), smart buildings (office buildings and small businesses), large businesses and industrial buildings can make a contribution to energy efficiency not only through the design of the buildings but also through intelligent management of generators, consumers and storage systems. Here, too, the domains of electricity, hot water, heating, air conditioning and ventilation are closely linked by the trend towards energy-efficient and low-CO2 hybrid applications (heat pumps, CHP, peak heaters). Besides greater integration and networking of the building technology (devices and systems) there is also increased integration in external systems (Internet and distribution grid).

The energy supply of entirely or partially electrically-driven modes of transport takes on special significance. On the one hand this involves comparatively large amounts of energy which are to be provided via private, semi-public and public infrastructures. On the other hand, intelligent integration of vehicles into energy management through the smart use of any available storage capacity, plus flexible charging power and periods represent ideal opportunities for yielding further balancing effects.

It is therefore apparent that the interaction of the individual actors is of particular significance in smart cities. Basic preconditions include a blanket communication infrastructure (Internet), interoperability and compatibility of all the systems involved (Internet of Things and services). It is important, however, not to forget people here. All the systems must function in the background where possible and always serve the needs of people. Otherwise they will not perceive the city as „smart."

6.1.6.2 Standardization landscape

Electricity supply

The smart grid is an integrated, intelligent energy supply system which combines the operation of active power distribution and transmission grids with new ICT-based technologies for grid auto¬mation. This involves centralized and decentralized power generation plants and storage systems through to consumers in order to achieve better networking and control of the system as a whole.

The integration of customers in their role as consumers and possibly also generators (prosumers) in a smart building, smart home or in an electric vehicle represents a key component in the smart grid.

Customers communicate e.g. via smart meter technologies or active distribution grids as active participants in the energy system. High resolution information is already being provided on the consumption and energy efficiency of devices such as refrigerators. Consumers, as active participants, take decentralized decisions on the basis of external incentives in order to create a stable overall energy system. It is also possible for external market actors to control the system directly or indirectly.

This form of networked energy management is therefore a further driver of building automation. Whereas energy management systems have been in use on the industry-related side of building and industrial automation for many years now, the approaches are now being expanded to include domestic homes and commercial businesses. The key to this is communication between the energy provider and the customer. It will probably only be possible to integrate a small proportion of customers in these options in the short to medium term.

Customer acceptance of these smart home solutions can be improved e.g. by the intelligent use of new equipment and its interoperable incorporation into the network. Electronic meters, energy management, energy management gateways, consumer electronics, thermal storage units (e.g. refrigerators, CHP systems with heat storers are just some of the possible components.

Further incentives deriving from this equipment include possibilities for new markets, products and services.

The „e-Energy/Smart Grids Standardization“ competence centre was set up in October 2009 on the basis of the findings from the e-Energy projects and with the aid of the DIN FOCUS.ICT group.

With the support of the DKE Competence Centre and the preparatory work of the IOP group in the e-Energy projects it was possible to take substantial contributions, new findings and requirements from the e-Energy project initiative and feed them directly into the national and international standardization bodies in the smart grids area and to influence their work accordingly.

These include:

- At the national level in the elaboration of the e-Energy / Smart Grids Standardization Roadmap in 2010 and its successor which was presented in spring 2013
- At the European level as part of the elaboration of the M/490 EU Mandate in the individual Smart Grid Coordination Group (SGCG) working groups, e.g. in the drafting of a smart grid reference architecture, in systematic needs management as the basis for process definitions and standards profiling or in the establishment of information security as a key interdisciplinary area.
- At the international level in the further development of smart grid-related standards such as IEC 61850, the CIM model or the establishment of the EEBus as a standardized and consensus-oriented smart grid and smart home networking concept which is based on and extends internationally recognized and common communication standards.

www.dke.de/smartgrid_roadmap2

Gas supply

An analysis of the fuel of gas and its special significance for smart cities will be provided in one of the next versions of the Smart City Standardization Roadmap.

Waste water disposal

Development work is currently being carried out on heat recovery from waste water and its special significance for smart cities. Of particular importance is the cost-effectiveness of such solutions. The industry associations are currently drawing up regulations for its use. Further need for standardization cannot be ascertained at present. A closer analysis will be provided in one of the next versions of the Smart City Standardization Roadmap.

Heat supply

An analysis of the energy carrier of heating and its special significance for smart cities will be provided in one of the next versions of the Smart City Standardization Roadmap.

Interconnection of the supply systems

The interconnection of electricity, gas and heating networks could play a major role in the future storage and use of renewably generated electricity. The amount of electricity generated from wind power or photovoltaic systems is already exceeding consumption at certain times in certain regions. Techniques such as „power to gas“ or „power to heat“ can provide solutions for the use of excess electricity. Cross-domain communication is needed to control these processes. Use cases and then the necessary interfaces between the domains need to be defined for this. Furthermore, the regulatory framework must be created or existing laws checked to see if and in what ways they restrict technical necessities. This may concern e.g. data exchange which is a technical necessity between two actors but which is currently proscribed by legal stipulations. It should also be checked whether new market roles will become necessary in the future or whether the strict separation of certain market roles will represent an obstacle at certain points. Nevertheless, such interconnection of energy supplies also requires new security systems, as successful cyber attacks can have cross-domain effects on the entire energy supply system.

6.1.7 Information and Communication (ICT)

6.1.7.1 Basic aspects and interfaces

ICT is a combination of crossover technologies and forms the basis for interconnecting the other areas. This demands special care in standardization, as it impacts upon all other areas inside and outside standardization. The crucial aspects of security and data protection involved in all ICT applications are addressed in general terms in their own roadmaps and are linked to the present Smart City Standardization Roadmap. General data security systems are necessitated by the information exchange, both within and beyond the individual areas.

In contrast to the other areas of innovation identified in the smart city scenario, there is already an established and, in the meantime, extensive ICT structure in the urban centres which has developed over the last 20 years. Below we cite a few areas of action as examples in order to illustrate the planned approach as clearly as possible.

The Standardization Roadmap defines the smart city ICT not by listing the different technologies but, in contrast to some of the other areas, by deploying use cases/user stories.

6.1.7.2 Standardization landscape

Standards Committee on Information Technology and Applications (NIA)

The Standards Committee on Information Technology and Applications (NIA) concerns itself with elaborating standards in the field of information and communication, i.e. it also plays an important role in the field of smart city standardization. Chip cards, radio frequency identification (RFID), near field communication (NFC), networks, distributed application platforms and services are of possible relevance for smart cities.

NIA 17 „Cards and personal identification“ is responsible for standardising both contact and contactless chip cards. These chip cards can be used in smart cities e.g. for identifying individuals, by the health service, in payment transactions and by the transport system. Of particularly importance here are the ISO/IEC 7816 „Identification cards - Chip cards“ series of standards, and for contactless chip cards also the ISO/IEC 14443 „Identification cards - Contactless chip cards“ series of standards. Biometrical standardization carried out in NIA 37 also plays a significant role in the field of identification. Special mention should be made of the exchange formats for biometric data which are defined in the ISO/IEC 19794 „ Information technology — Biometric data interchange¬ formats“ series of standards. In the transport sector, chip cards are gaining in importance in connection with smart ticketing. At the European level, standards have already been generated on this topic in CEN/TC 224. EN 1545-1 and -2 „Identification card systems. Surface transport applications“ have been created under German leadership. Also at the European level, CEN/TC 278 is currently working on an application profile of contactless chip cards in connection with an interoperable payment system.

RFID and AIDC (automatic identification and data capture) techniques which are being worked on by NIA 31 are already playing a decisive role in logistics and could also make an important contribution to smart cities in the identification of goods through a radio interface.

Networks are important in smart cities as they enable the resulting large amount of information to be transported quickly and securely between different systems. Of particular importance here are the ISO/IC 8802 „Telecommunications and information exchange between systems -- Local and metropolitan area networks“ and ISO/IEC 15149 „Telecommunications and information exchange between systems -- Magnetic field area network“ series of standards.

The work of NIA 38 on web services, service-oriented architectures (SOA) and cloud computing will also be of relevance, as IT services are crucial for smart cities. With regard to SOA, a reference architecture and related ontology are currently being elaborated in the ISO/IEC 18384 series of standards. A reference architecture is also being drawn up for cloud computing (ISO/IEC 17789).

The subject of mobile payment may also increase in significance as the result of smart cities. In banking (ISO/TC 68), work is already under way on the ISO 12812 „Mobile Payment“ series of standards which will make payment transactions in the smart city even faster.

6.1.8 Urban processes and organization

6.1.8.1 Basic aspects and interfaces

The potential of the integrated smart city approach becomes clear in the area of „Urban processes and organization“.

A large number of factors are involved in influencing the shaping and management of city infrastructures with regard to sustainability. Urban processes with relevance for the roadmap include e.g. infrastructure and supply processes such as water or gas supplies, and also medical provision and services. The description of the standardization landscape given in the following section is merely exemplary in nature, on account of the broad overall scope. There is still much heated discussion regarding the demand for standardization in this field and regarding the extent to which standardization supports implementation of the „smart city concept“.

6.1.8.2 Standardization landscape

Sustainable development in local communities

The ISO resolved to set up a new ISO/TC 268 „Sustainable Development in Communities“ under French leadership and secretariat management despite the reservations of the groups involved which were represented as the German position by DIN. The work is mirrored in Germany in the DIN Principles of Environmental Protection Standards Committee (NAGUS) in working group NA 172-00-12 AA. Sustainability in cities is at the heart of the work of ISO/TC 268.

Standards and specifications are to be elaborated initially in three areas:

- Management system standards for sustainable development in local communities (under French leadership)
  Current status: the first project in this field, ISO 37101 “Sustainable development and resilience of communities – Management systems – General principles and requirements”, is still at an early stage. A draft version is currently under preparation.
  Germany has proposed carrying out a Preliminary Work Item on “Guidance for the application of ISO 37101 for communities”. The proposal has been well received internationally and the establishment of an ad-hoc group under German leadership resolved.

- City indicators (leadership: Canada)
  Status: ISO 37120 “Sustainable development and resilience of communities – Indicators for city services and quality of life” is based on preliminary work carried out by the Global City Indicators Facility (GCIF) and is scheduled for publication in 2014.
- Measurement methods for efficient and intelligent local infrastructures (leadership: Japan)
  Status: the first project was the drafting of Technical Report ISO/TR 37150 “Smart infrastructures for communities – Review of existing metrics” which is to serve as the basis for the Technical Specification ISO/TS 37151 “Smart community infrastructures – General principles and requirements” which is yet to be developed.

According to the ISO, the above three areas are to be gradually developed and linked.

In the field of Indicators, a technical report is planned in which existing sustainability¬ indicator systems are to be analysed for cities and compared with each other prior to harmonising them at a later stage. The resulting indicators are also to be used to support the management system standards.

A standardization project is being prepared in the field of measurement methods for infrastructures. This will help create a uniform framework for the development and operation of intelligent local infrastructures.

Municipal Services

For waste disposal and urban cleaning, the DIN Municipal Services Standards Committee (NKT) is drawing up European/international standards for the technical and logistical aspects involved in the capture, collection, transport, storage, reloading and treatment of solid and liquid waste and for street cleaning, road maintenance and winter road treatment.

Examples include road status and weather information systems (SWIS) which serve as decision-making aids for road maintenance and generally consist of the following components: meteorological sensors and instruments, transmission technology, computer systems for the processing, presentation and storage of information, road status and weather forecasts, traffic management and traffic information system warnings. Road weather monitoring and weather forecasts require the compilation of road parameters, atmospheric parameters and data which are used by the road maintenance service for predicting future environmental conditions on the roads. The EN 15518:2011 „Winter maintenance equipment. Road weather information systems“ series of standards from NKT defines the road status and weather information systems (SWIS) for public roads and transport regions.

6.1.9 Production

6.1.9.1 Basic aspects and interfaces

In industrial automation a wide range of systems from different manufacturers need to work reliably and efficiently together. Global users expect to be able to access their products and solutions anywhere in the world. In order to ensure such global accessibility and cross-system compatibility, international standardization has always been accorded great importance in industrial automation, and actively supported. Standards either already exist or are currently being elaborated for key aspects of industrial automation. However, new technologies and new requirements constantly create demand for new standardization. The goal of the Industry 4.0 future initiative is to take the potential arising from the

- extensive use of the Internet
- integration of technical and business processes
- digital representation and virtualization of the real world and
- possibility of “intelligent” products

and make active use of them.

Exacting demands are placed in particular on urban production facilities with regard e.g. to space requirements and optimized burden levels on the environmental. At the same time, industrial plants integrated in or close to the settlement areas offer major advantages in terms of jobs and sensible use of environment-friendly transport methods.

6.1.9.2 Standardization landscape

A large number of new concepts and technologies are necessary in order to exploit the available potential. However it will only be possible to put these new concepts and technologies into successful industrial practice if they are strengthened by consensus-based standards, as only these provide the necessary investment security and trust amongst manufacturers and users.
A standardization roadmap was elaborated by the „TB Concept Standardization for Industry 4.0“ working group of the DKE „Process measurement and control technologies“ division (FB 9) to get an early start on standardization. The purpose of the first version of the Industry 4.0 Standardization Roadmap, which is now available, is to provide all actors with an overview of the relevant standards within the Industry 4.0 environment and of the need for standardization which is already apparent.

The underlying goal is to render the advances already made in information and communication technologies, and those expected in the foreseeable future, utilizable for production companies.

Increasing and consistent embedding in the production systems must therefore be prepared - in ever smaller systems and components. Mechatronic systems are turned into cyber physical systems (CPS) as the result of additional communicability and (partial) autonomy in their response to external influences and internally stored models. The resulting targets are the ICT adaptation - developments for production applications: robustness, fail-safety, information security, real-time capability.

It is also important to improve energy and resource efficiency and to adapt industry to the social requirements arising from the demographic shift.

Industry 4.0 describes a new emergent structure in which production and logistics systems as CPPS (Cyber-Physical Production Systems) make intensive use of the globally accessible information and communication network for the largely automatic exchange of information. The production and business processes are also coordinated in this structure. In such a broad environment, many different models, systems and concepts from a wide range of domains play a major role. They do not, however, represent the heart of the Industry 4.0 concept itself. Industry 4.0 can be regarded as an additional integration level which is based on the existing structures and which provides the foundation for the new emergent structure and therefore for the new quality levels. Industry 4.0 is also expected to provide increasing interconnectivity between previously autonomous systems, e.g. in the areas of production, logistics, energy supplies, e.g. IEC/TC 65/WG 17 „System interface between industrial facilities and the smart grid“, building management or smart cities. A system of systems is being created.

A particular difficulty arises with regard to the concept itself and standardization. It should actually suffice to describe only the additional integration level and its emergent behaviour. However, in order to do this the existing system environment must be described in a logical, comprehensive and globally standardized form. Which is not universally the case. The relevant traditional architecture models need to be integrated and harmonized in addition to Industry 4.0.

www.dke.de/industrie4

6.1.10 Logistics

6.1.10.1 Basic aspects and interfaces

Globalization, population growth and increasing urbanization are just some of the clear megatrends which have emerged in the last few years and which pose major challenges, especially for the urban conurbations. Urbanization in particular is leading to a concentration of people in cities, the infrastructure of which needs to meet a growing variety of demands and gives rise to new problems especially for urban logistics.

The smooth transport of goods and the provision of logistics services in the economic centres play an important role in creating stable and sustainable economic development and present transport companies, businesses, consumers and residents alike with major challenges. Within a very small geographical area the population needs to be supplied with the goods it needs for its daily existence. Similarly, businesses, traders and industry require production equipment in order to function.

On the other hand, it is both a national and a European target to considerably reduce the negative effects caused in the urban area by traffic and transport.

6.1.10.2 Standardization landscape

With its „Goods transport and logistics action plan - Logistics initiative for Germany“ the Federal German Government has set the basic course for a future-proof and effective logistics and goods transport system in Germany. The main goal is to facilitate the problem-free transportation of goods and thereby put in place the conditions for growth and employment, but without neglecting environment and climate protection concerns.

The European Commission has also founded a new high-ranking group for Logistics[9]. It is responsible for providing strategic advice to the European Commission on transport policy which affects the logistics sector. Synergies are to be identified between the European Commission and the logistics sector and a robust framework established. The high-ranking group contains e.g. logistics service providers, their clients, transport companies, port and terminal operators, scientists and IT companies.

The European Commission has also published a white paper on transport policy entitled „Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system“ [8]. This recognizes the importance of the logistics sector to the EU economy.

The white paper includes future transportation challenges such as:

- Dependency on oil as an energy source
- CO2 emissions
- Volume growth
- Increased costs from overburdening the infrastructure
- Transport security

Based upon this, ten targets have been set for a competition-based and resource-friendly transport system. The plans in the white paper include making city centre traffic emission-free by 2050. A CO2-neutral urban logistics system is planned by 2030. New regulations will ensure a flourishing urban living environment which also offers a high quality of life. Current targets can only be achieved with modern technology, innovative and sustainable planning and, where appropriate, with corresponding standards.

In order to ensure functioning supply and disposal systems in the future despite the rising levels of transport, current smart city initiatives will need to include urban logistics. Linking distribution logistics to reverse logistics and disposal logistics in compressed agglomerations will doubtless represent a major challenge.

The increasing interlinking of the different areas and the interaction of a variety of systems require suitable and comprehensive standardization. In the area of green logistics, for example, there is significant demand for standardization in combined goods transport and electronic communication processes. Further aspects will need to be identified and discussed together with the groups concerned on a regular basis while elaborating the smart city concepts. It must be the overriding goal of such a smart city approach to integrate „smart“ logistics into the urban concepts which take the growing logistical demands regarding the supply and disposal systems of urban areas into account while managing the flows of goods and people in a sustainable and resource-friendly manner.

7 INITIATIVES/PROJECTS/ MODEL REGIONS/STUDIES

There are many initiatives, projects, model regions and studies offering promising smart city approaches which can be used as sources of existing experience and findings which can feed into standardization. Just some of these are mentioned in the „Examples/Initiatives/Projects/Model regions/Studies" section of this document. In the future, all initiatives, projects and model regions which are in contact with the DIN and DKE bodies with regard to smart cities will be listed under www.smartcities.din.de. Naturally, all those involved are cordially invited to become proactively involved.

8 EUROPEAN AND INTERNATI-ONAL CATEGORIZATION

8.1 International

8.1.1 IEC

In response to an invitation from Japan, the German standardization organizations DIN and DKE, and China are setting up a Smart Cities Systems Evaluation Group (SEG) which is under the umbrella of the International Electrotechnical- Commission (IEC) but which can act independently and not as part of an existing technical committee (TC). The objectives of this SEG are to evaluate the different smart city technical areas and to identify the required standardization actions to be published in an international standardization roadmap. The inaugural meeting took place on 9 and 10 December 2013 in Berlin (DIN).

For German industry and science this opens up the possibility of working together with cities, associations and authorities to help shape the international standardization activities.

8.1.2 ISO

Like the IEC, the ISO is also addressing the subject of smart cities at the strategic level, but it has already initiated concrete standardization activities in many areas.
In 2013 the Technical Management Board of the ISO (ISO/TMB) set up a Smart Cities Task Force to collect and coordinate the ISO‘s ongoing standardization work on this subject on the one hand, and to serve as a point of contact for initiatives outside the ISO (e.g. IEC SEG, see 6.1.1) on the other.
The standardization work carried out in the ISO/TC 268 „Sustainable Development in Communities“ Technical Committee set up in 2012 under French leadership and secretariat has strong links to smart cities (see Normungslandschaft). The main focuses of ISO/TC 268‘s work at present are:

- Management system standards for sustainable development in communities (ISO/TC 268/WG 1) (French leader¬ship)
- City indicators (ISO/TC 268/WG 2) (Canadian leadership)
- Measurement methods for efficient and intelligent local infrastructures (ISO/TC 268/SC 1) (Japanese leadership)

8.1.3 Joint Technical Committee (JTC) 1

JTC 1 has been working intensively on the subject of smart cities since May 2013. The work was initiated by a contribution from the Chinese delegation to the Special Working Group on Planning (SWG-P). The paper provides an initial overview of smart cities, revealing which current JTC 1 smart city topics could become relevant and which smart city standardization work is still required. Technological and market-related preconditions plus social aspects also need to be taken into consideration here. The following topics were identified in JTC 1 with regard to technological preconditions:

- Sensor networks (JTC 1/WG 7)
- Governance of IT (JTC 1/WG 8)
- Telecommunications and information exchange between systems (JTC 1/SC 6)
- Software and systems engineering (JTC 1/SC 7)
- Cards and personal identification (JTC 1/SC 17)
- Interconnection of information technology equipment (JTC 1/SC 25)
- IT security techniques (JTC 1/SC 27)
- Automatic identification and data captures techniques (JTC 1/SC 31)
- Data management and interchange (JTC 1/SC 32)
- Information technology for learning, education and training (JTC 1/SC 36)
- Biometrics (JTC 1/SC 37)
- Distributed Application platforms and services (JTC 1/SC 38)
- Sustainability for and by information technology (JTC 1/SC 39)

In terms of future standardization, the paper identifies various activities such as the development of a guide which shows how existing standards can be applied for smart cities. The main goal being pursued here is that of combining the different data and information flows of the various services and infrastructures at the settlement area level.

The paper also recommends setting up a study group in JTC 1 to continue working on the subject. JTC 1 took up this recommendation at the plenary session at the end of 2013 and worded a resolution for setting up a study group under Chinese leadership. The objective of this study group is to identify the key smart city concepts and to elaborate a definition. The main standardization requirements and the current status of smart city standardization work are also to be outlined and recommendations issued on how JTC 1 should respond to the requirements.

8.2 Europe

8.2.1 CEN-CENELEC Coordination Group on Smart and Sustainable Cities and Communities (SSCC-CG)

In 2012 the European standardization organizations CEN and CENELEC founded the „Smart and Sustainable Cities and Communities“ Coordination Group (SSCC-CG). It purpose is to advise on and coordinate the standardization and specification needs and special features in the field of intelligent cities and communities in Europe. ETSI is also involved as the third European standardization organization in the SSCC-CG in the area of smart city ICT.

In contrast to the technical committees, the SSCC-CG does not develop standards, rather it reports directly to the management boards of the standardization organizations and plays an advisory role. Current members of the SSCC.CG include representatives of the relevant technical committees, the CEN/CENELEC secretariat, the European Commission, the European associations and the national standardization organizations.

The work of the SSCC-CG is currently conducted in 3 task groups:

- TG 1: Identification of relevant international, European or national standardization activities
- TG 2: Identification of relevant stakeholders and interested groups in Europe
- TG 3: Identification of topics to be covered in future work (needs of interested groups, current gaps in standardization)

A roadmap containing recommendations for future work is being developed from the results of the three groups. This work is scheduled for completion by the end of 2014.

8.2.2 EU Commission

The EU Commission wishes to promote the development and implementation of smart city technologies. For this reason it set up a European Innovation Partnership (EIP) for Smart Cities and Communities (SCC) [10]) in July 2012.

The intention is to improve coordination of research fund investment in order to support reference projects in the areas of energy, transport and information and communication technology (ICT) for urban areas. Further aims are to promote collaboration of the energy, transport and ICT industries in cities, and technological integration.

The investment will consist of funds from industry and from public support programmes. The main focus in the future will be on the „Horizon 2020“ [11] framework research programme.

The European Commission is also involved in the European SSCC-CG in the form of representatives from its Mobility and Transport (MOVE), Communications Networks, Content and Technology (CNECT) and Joint Research Centre (JRC) directorates general (GD).

9 METHODOLOGY FOR DETERMINING DEMAND FOR STANDARDIZATION

A smart city is a complex system covering different aspects such as smart homes and intelligent transport. These aspects interact with each other but also with the surrounding environment. The large number of domains, functions, actors and components make optimum interaction a necessity in order to ensure an efficient and reliably functioning system.

This is also reflected in the standardization of smart city systems. The standardization organizations and technical committees directly or indirectly affected must collaborate more comprehensively and closely. In many cases, however, the connections in a complex system such as a smart city are so extensive that the bodies concerned are not capable of issuing a comprehensive statement on the basis of a simple analysis. The requirements need to be managed at the system level; this breaks complex situations down into simpler aspects.

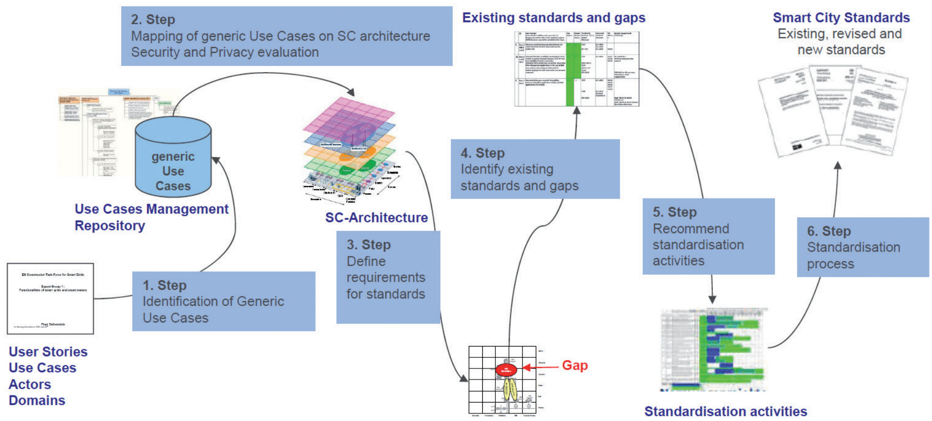
In terms of standardization this means that processes and connections will need to be separated into individual processes to enable the relevant technical committees (TCs) to develop solutions such as specifications and standards.

The most intensive analysis of standardization, taking system aspects into account, was carried out in the area of smart grids. The tried-and-tested use case method applied to smart grids would seem to be transferable. Accordingly it constitutes the basis for the following considerations (which are developed in section Konzeptionelles Modell und Architektur am Beispiel Smart Grid).

Deploying the use case method, the entire system is modelled on the basis of a functional system architecture, i.e. a description of the system expressed in terms of individual functions which interact with each other. The definition of the functional architecture (Smart City Infrastructure Architecture Model – SCIAM) is based on use cases which are realized or supported by the system. Use cases form the basis for determining the system requirements. In order to define and assign these requirements correctly, the actors who are responsible for the different functions of the system also need to be identified. Functional system architecture, use cases, actors and requirements form the basis for standardising the functionality and interfaces. A simple model is required for the functional modelling of complex systems. This model describes the main functions of a system and its interaction in an open-ended way with regard to possible solutions or technologies. Figure 4 shows a simplified version of the use case method.

The sections entitled „Conceptual model and architecture based on smart grid example“ and „Adaptation of the structure for smart cities“ provide a deeper analysis and a starting point for discussion.

Figure 4:
Use case method - Process for analysing gaps in standardization



10 RECOMMENDATIONS

10.1 General recommendations (AE)

10.1.1 AE 1 Terminology

As the basis of a common understanding of all aspects, shared terminology is a vital prerequisite for the future work of the bodies. There is, however, increasing fragmentation in the definitions of the basic terms. All national activities should therefore be bundled and given a broad foundation of information. Here, consensus-based results from the German mirror committee of ISO TC 268 „Sustainable development in communities“ should be constantly monitored.

10.1.2 AE 2 Scope

The scope of the standardization roadmap should continuously be scrutinized and narrowed if necessary. The same applies for the scope of the established bodies.

10.2 Recommendations of the joint working groups (GAK-E)

10.2.1 GAK E 1 Methodology

The process of collecting user stories, deriving use cases from these and the further steps involved in the successful approach adopted for smart grids would appear judicious here. It is therefore recommended that the method be tested on a number of examples which would then need to be adapted, where necessary, to meet the special needs of smart cities.

The aim would be to work towards a coordinated approach at the national, European and international levels in order to avoid duplication of work and to take advantage of synergies.

10.2.2 GAK E 2 System Architecture Model

In converting the smart grid architecture model into a smart city infrastructure architecture model, it has emerged that the model needs to be analysed critically on account of its complex structure. The SCIAM presented in the standardization roadmap should therefore initially only represent a starting point for further discussions, especially in combination with GAK E-1.

10.2.3 GAK E 3 Energy

It is recommended that DIN and DKE set up a GAK Smart Energy. This GAK should focus on the interaction of the constituent electricity, gas, water and heating systems.

11 OUTLOOK

Publication of this version 1 of the Smart City Standardization Roadmap also signals the start of the revision and further development work in the different areas. Previously unaddressed topics are to be evaluated, existing or incipient projects are to be assessed in terms of their relevance for standardization, and any interfaces which could become necessary in the future are to be checked in terms of their interoperability. The German representatives working on the strategic activities of the European and international standards organizations (CEN/CENELEC and ISO/IEC) need to be organized with regard to the European and international smart city standardization activities. These are just some of the future tasks which DIN and DKE would like to complete with the aid of the experts in the steering body and in the joint working groups.

Any interested experts who would like to become involved in this process can contact any of the addresses listed at the start of the document. They are cordially invited to become actively involved in the later versions of the Smart City Standardization Roadmap.

12 ABBREVIATIONS

Abbreviation/Acronym	Meaning
AE	General recommendation
AIDC	Automatic Identification and Data Capture
API	Application Programming Interface
BGG	Equality for the Disabled Act
BIM	Building Information Modeling
BITV	Barrier-free IT ordinance
BMWi	Federal Ministry for Economic Affairs and Energy
CEN	Comité Européen de Normalisation
CENELEC	Comité Européen de Normalisation Électrotechnique
CIM	Common Information Model
CNECT	Directorate General Communications Networks, Content and Technology
CPPS	Cyber-Physical Production System
CPS	Cyber-Physical System
DIN	German Institute for Standardization
DKE	German Commission for Electrical, Electronic & Information Technologies of DIN and VDE
EIP	Europäische Innovationspartnerschaft (European Innovation Partnership)
EMIX	Energy Market Information Exchange
EN	European Norm
ENER	Directorate General Energy
ESO	European Standardization Organisation

Abbreviation/Acronym	Meaning
ESOLI	Projekt Energy Saving Outdoor Lighting
ETSI	European Telecommunications Standards Institute
EU	Europäische Union
FNL	Normenausschuss Lichttechnik
GA	Gebäudeautomation
GAK	Gemeinschaftsarbeitskreis
GAK E	Empfehlungen aus den Gemeinschafts-Arbeitskreisen
GD	Generaldirektion
HLK-Anlage	Heizungs-, Lüftungs- und Klimaanlagen
IDM	Infrastruktur-Daten-Management
IEC	internationalen Elektrotechnikkommission
IFC	Industry Foundation Classes
IFD	International Framework for Dictionaries
IKT	Information und Kommunikation
IOP	Interoperabilität
ISO	International Organization for Standardization
IT	Informationstechnik
ITU	International Telecommunication Union
ITU-T	International Telecommunication Union – Telcommunication Standardization
JRC	Generaldirektion Gemeinsame Forschungsstelle

Abbreviation/Acronym	Meaning
JTC	Joint Technical Committee
KWK	Kraft-Wärme-Kopplung
LON	Local Operating Network
MOVE	Generaldirektion Mobilität und Verkehr
NAGUS	Normenausschuss Grundlagen des Umweltschutzes
NFC	Near Field Communication
NHRS	Normenausschuss Heiz- und Raumlufttechnik
NIA	Normenausschuss Informationstechnik und Anwendungen
NKT	Normenausschuss Kommunale Technik
NPE	Nationalen Plattform Elektromobilität
OASIS	Organization for the Advancement of Structured Information Standards
RFID	Radiofrequenz-Identifikation
SCC	Smart Cities and Communities
SCIAM	Smart City Infrastructure Architecture Model
SEG	Systems Evaluation Group
SGCG	Smart Grid Coordination Group
SOA	Service-orientierte Architekturen
SSCC-CG	Coordination Group „Smart and Sustainable Cities and Communities“
SWG-P	Special Working Group on Planning
SWIS	Straßenzustands- und Wetterinformationssysteme
TB	Technischer Beirat
TC	Technisches Komitee
VDE	Verband der Elektrotechnik Elektronik Informationstechnik e.V.
W3C	World Wide Web Consortium

Abbreviation/Acronym	Meaning
WCAG	Web Content Accessibility Guidelines
XML	Extensible Markup Language
HL7	Health Level Seven
http	Hypertext Transfer Protocol
ICF	International Classification of Functioning, Disability and Health
IDL	CORBA Interface Definition Language
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IKT	Informations- und Kommunikationstechnologie
IP	Internet Protocol
IP500	Internet Protocol 500
ISDN	Integrated Services Digital Network
ISO	International Organization for Standardization
ITU	International Telecommunication Union
IrDA	Infrared Data Association
JTC	Joint Technical Committee
JVM	Java Virtual Machine
KNX	„Konnex“ (kein Akronym)
LAN	Local Area Network
LLCP	Logical Link Control Protocol
LTE	Long Term Evolution
LON	Local Operating Network
LR-WPAN	Low-Rate Wireless Personal Area Network
M2M	Machine-to-Machine
MAC	Medium Access Control

Abbreviation/Acronym	Meaning
M-Bus	Metering Bus
MHP	Multimedia Home Platform
NAS	Network Attached Storage
NDEF	NFC Data Exchange Format
NFC	Near Field Communication
OASIS	Organization for the Advancement of Structured Information Standards
OEMG	Open Energy Management Gateway
OMG	Object Management Group
OSGi	Open Service Gateway Initiative
PDA	Personal Digital Assistant
PHMR	Personal Healthcare Monitoring Report
PHY	Physical Layer
PICS	Protocol Implementation Conformance Statement
PID	Patient Information Segment
PLC	Powerline Communication
PnP	Plug and Play
ProfiBus	Process FieldBus
RF	Radio Frequency
SDK	Software Development Kit
SG	Strategic Group
SGB	Sozialgesetzbuch
SIP	Session Initiation Protocol
SMG	Smart Meter Gateway
SMTP	Simple Mail Transfer Protocol
SOA	Service Oriented Architecture
SOAP	Simple Object Access Protocol
SSL	Secure Socket Layer
SWEX	Software Execution Environment Task Force

Abbreviation/Acronym	Meaning
TC	Technical Committee
TCP/IP	Transmission Control Protocol/Internet Protocol
TIA	Telecommunications Industry Association
TLS	Transport Layer Security
TP	Twisted Pair
TU	Technische Universität
UMTS	Universal Mobile Telecommunications System
UPnP	Universal Plug and Play
URC	Universal Remote Console
USB	Universal Serial Bus
VDE	Verband der Elektrotechnik Elektronik Informationstechnik
VDI	Verein Deutscher Ingenieure
VPN	Virtual Privat Network
WAN	Wide Area Network
WAVE	Wireless Access in Vehicular Environments
WG	Working Group
WHO	World Health Organization
WLAN	Wireless Local Area Network
WPAN	Wireless Personal Area Network
WS	Web-Services-Specification
WSDL	Web Services Description Language
XD*	(Oberbegriff für XDS, XDR und XDM)
XDM	Cross-enterprise Document Media Interchange
XDR	Cross-enterprise Document Reliable Interchange
XDS	Cross-Enterprise Document Sharing
XML	Extensible Markup Language
XPHR	Exchange of Personal Health Record Content
ZAP	ZigBee Application Profiles

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[9] Source: http://europa.eu/rapid/press-release_IP-12-717_de.htm?locale=en; last accessed on 03.03.2014

[10] Source: http://ec.europa.eu/eip/smartcities/; last accessed on 03.03.2014

[11] Source: http://ec.europa.eu/programmes/horizon2020/; last accessed on 03.03.2014

14 NOTES

14.1 Definitions

14.1.1 User story

User stories are generally text-based descriptions of a cross-domain application told from the perspective of the user.

14.1.2 Use Case

Use cases provide a detailed operational sequence description from the viewpoints of the actors and components of the smart city system description. A set of functional use cases can be derived from user stories.

Multiple use cases generally need to be deployed in order to derive a user story. The connection between user stories and use cases can be represented by an assignment table (user story - use case mapping).

Use cases can be combined with text-based descriptions and represented as a sequence of individual steps in the form of sequence diagrams

.

14.2 Conceptual model and architecture based on smart grid example

The smart grid model will be transferred to a smart city model in version 2 of the Standardization Roadmap. The Smart Grid Architecture Model (SGAM) is described below.
The development of smart grids for controlling volatile and decentralized generation and the increasing need for cross-domain networking (electricity, heating, gas, transport) as the energy infrastructure of the smart city is characterized by the information-based and automatic interaction of different physical domains of the energy supply system. Here it is crucial to define the interoperability of the interaction interfaces between different domains and the necessary protection mechanisms for achieving supply reliability within an increasingly interconnected critical infrastructure. The following sensitive areas should be addressed:

- Data protection (privacy)
- Data security
- Functional safety
- Ability to survive, adapt and prevail (resilience)
- Minimization of vulnerability

The following smart grid domains are included in the investigation:

- Centralized generation in ultra high voltage grid
- Transmission grid
- Distribution grid
- Decentralized generation in distribution grid
- Property of the grid users as generators, storage operators and consumers (residential properties, commercial properties, mobile properties, industrial zones)

The functional design of all these domains is also characterized by different operational zones which might be at different geographical locations. In the totality of all operation zones, the effect of one domain is characterized by certain functions which need to interact beyond the boundaries of the domain. Communication and security standards are required in order to facilitate the non-discriminatory and secure participation of a wide range of different actors in a networked system. Yet common definitions of metamodels, architectures and a common terminology are also required in order to ensure mutual understanding within the integrated approach.

In devising the methodology it was particularly important to specify the system architecture for describing interoperability between two systems of different domains and operational zones.

Five basic levels must be distinguished between when describing the functional interface requirements: these levels were assigned in the diagram below to the different interoperability levels.

- Component level for physical link
- Communication level for network and syntactic interoperability
- Information level for semantic understanding and business context
- Functional level for business procedures
- Business level (or action level including basic action principles, actors, business, government and regulatory roles).

On this basis the domains and operational zones of the conceptual model and the different levels for ensuring inter-system operability were used to represent component architecture, communication architecture, information architecture, functional system architecture and

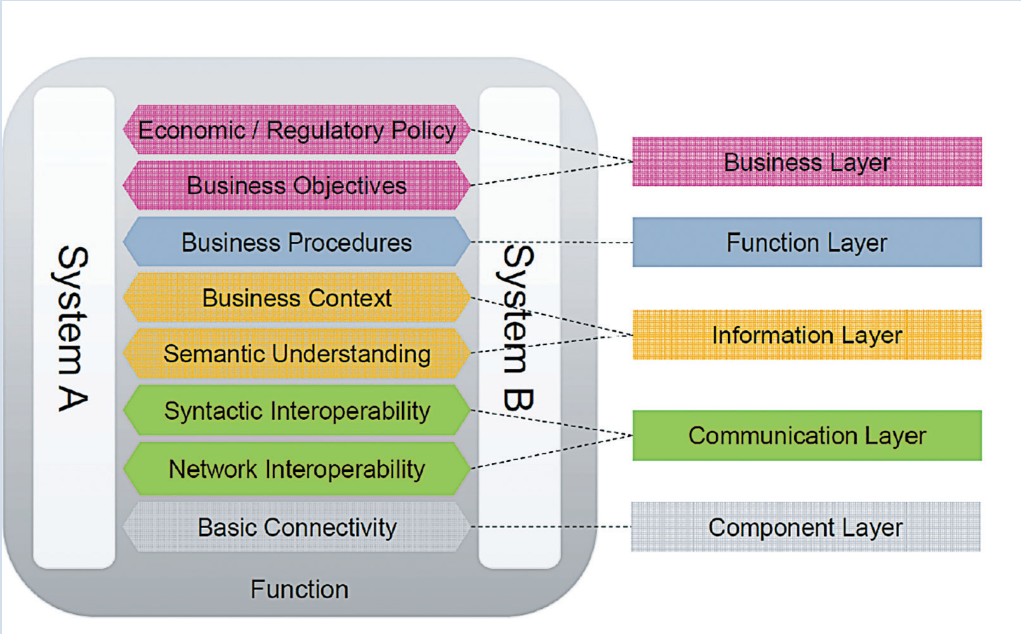
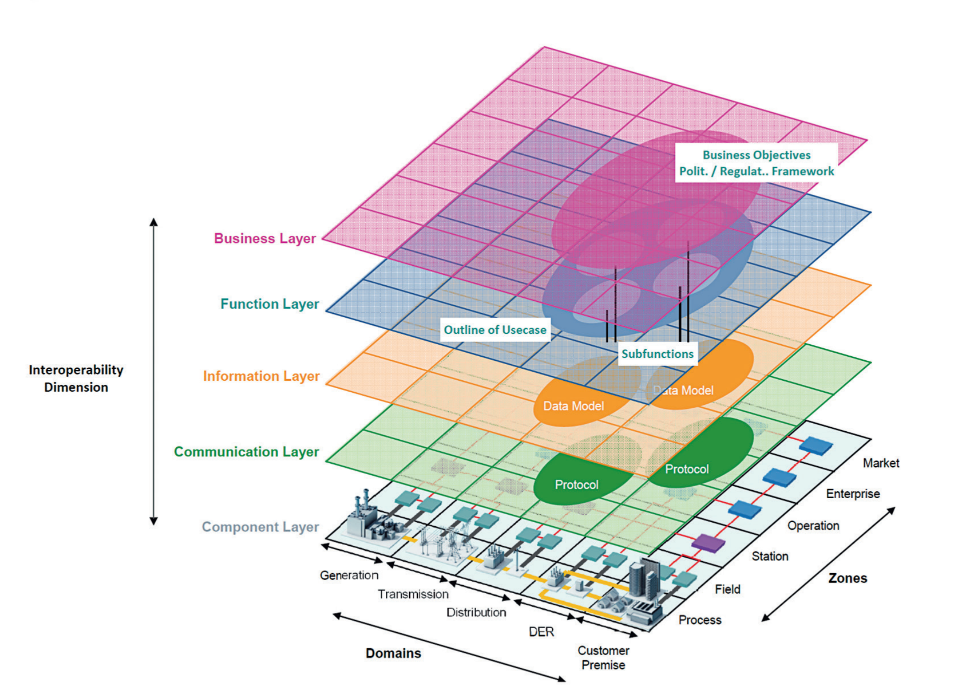


Figure 5:
Interoperability levels for describing interoperability between systems of different domains [7]]

business definition in a system architecture model framework. This permits a uniform approach and terminology for defining standards and for ensuring smart grid interoperability.

The Smart Grid Architecture Model (SGAM), as shown below, now unites domains, operational zones and interoperability levels.

Figure 6:
Smart Grid Architecture Model (SGAM) [7]



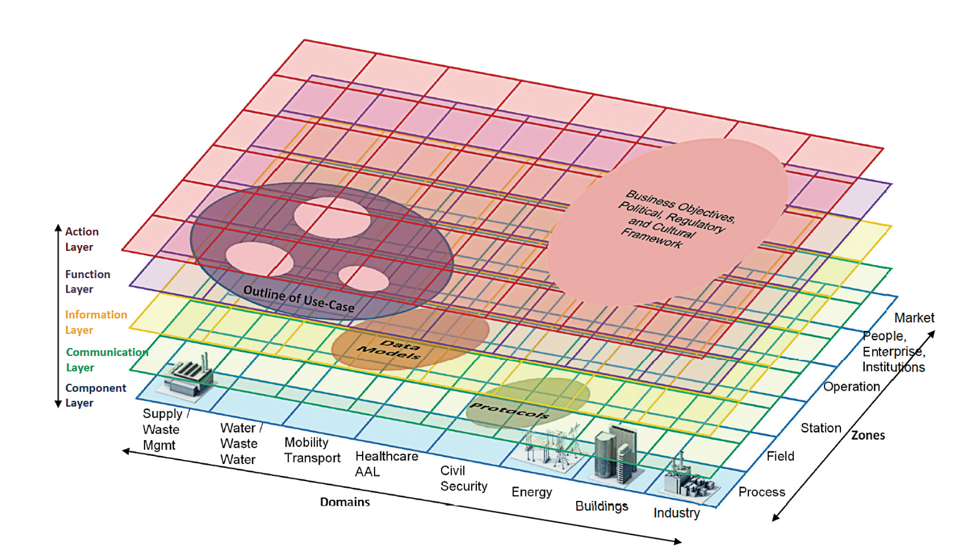
14.3 Derivation of structure for smart cities

In preparing the Smart City Standardization Roadmap, national experts drew up the first draft of a smart city architecture model based on previous findings.

It merely presents the current status of the discussion and is intended as a starting point for the national, European and international discussion.

The Smart City Infrastructure Architecture Model (SCIAM) had already been presented to the relevant European (SSCC-CG) and international (SEG) bodies.

Figure 7:
Smart City Infrastructure Architecture Model (SCIAM) as basis for discussion



14.4 Examples of initiatives/projects/model regions/studies

The initiatives, projects, model regions and studies listed are examples which represent promising smart city approaches.

INITIATIVES AND PROJECTS

Morgenstadt
http://www.morgenstadt.de

E-Energy Projekte
http://www.e-energy.de

Silicon Saxony
http://www.silicon-saxony.de

MODEL REGIONS

Model Region Berlin EUREF
http://www.eurefcampus.de

STUDIES

Acatech „Deutsche Hochtechnologie Für die Stadt der Zukunft Aufgaben und Chancen“ position paper
http://www.acatech.de/de/publikationen/publikationssuche/informations-und-kommunikationtechnologien/detail/artikel/smart-cities-deutsche-hochtechnologie-fuer-die-stadt-der-zukunft-1.html)

Munich District Study
http://www.zukunft-ikt.de

„IDC Smart Cities Benchmark 2012
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