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1 Why this guide?

Climate change, changes in technology and within society have all had an impact on modern cities and on those communities that aspire to the modern ideal.

Today's trends are pushing cities towards Smartness. This is a development FTTH Council Europe wants to promote.

During discussions, the Business Committee of the FTTH Council decided on the idea of writing a Smart City Guide which would equal the very successful FTTH Guide. It did not take long before an enthusiastic team was formed who was willing to put the idea into practice.

With the name Smart City Guide in mind, the team decided to call themselves “Smarties”.

While many topics relating to Smart Cities are hazy and still evolving and with a large number of unrealized expectations, a common view held by the members of the FTTH Council is:

A Smart City is based on a strong, reliable communication network which is the foundation for applications and services.

For this reason the Council decided it was time to establish a new group: The Smart City Group.

The version which you are reading is number two and we intend to update the Guide continuously.

Politicians, managers of utilities and telecom service providers can all benefit from the guidelines and the knowledge provided in this Guide.

We wish you interesting reading and look forward to hearing your views – perhaps when we meet at one of our conferences.
2 Foreword

Welcome to the third edition of Smarties – The Smart City Guide.

This updated version of the Guide specifically includes information on Smart City methodology and existing standards. In addition, it also explores the principles of Smart City business cases as well as giving an in-depth look at “Internet of Things”.

The days when networks were built almost exclusively to cater for services such as telephony and television are long gone and have been replaced by other offers on the internet. Networks of the future will provide almost unlimited fast access to the increasingly vital internet and FTTH networks in particular, will be crucial in supporting the future development of these services in all sectors of society. The past two years have demonstrated how quickly digitization has encapsulated everything, turning business models, the economy and our lives upside down. What is today a product or a piece of equipment may tomorrow become a virtual component ordered and purchased, with related services, from the cloud. And with devices communicating with each other, the amount of data is exploding. This phenomenon is also known as the Internet of Things. People are interacting with each other and with machines at an increasing rate, thus contributing to the growing mountain of data; all this data is useless if we are not able to process and evaluate it. Big Data makes it possible to be successful in business and to efficiently manage utilities and cities in the future.

2014 has clearly proved that the internet of things is no longer just a buzzword. Most elements of the puzzle are now fitting together. The internet of things has become real on a large scale.

Smart connected products will be the engine behind the next chapter of IT-driven productivity improvements, including cities and all industries.

Traditional business models will be challenged yet again however, for those who are able to positively exploit the changes, a vast array of opportunities will appear.

This new reality promotes inventiveness and rewards people who understand how to develop new services resulting from available information; a situation recognized by cities who now make large volumes of data easily accessible to the public. This is called “Open Data”.

These cities see themselves more as places where business is facilitated and where innovation is encouraged, not least those aspects which are enabled by a Smart City. It should be noted that a Smart City is much more than just improving efficiency thanks to the establishment of technology, if a city really is Smart, then the residents, their needs, their requirements and their demands should be central to that Smart City. Of course, efficiency and sustainability remain important aspects of a city of the future. Low carbon use and high quality of life are the two main pillars of a Smart City, or put in another way, they combine convenience with the clever use of resources.

The network can be described as a common denominator in a Smart City. This Guide we will even use the term ‘Nervous System’ to describe the function of an FTTH Network in the context of a city - interlinking all
elements in a city creates the preconditions for a Smart City. Seen from this perspective, FTTH is a basic infrastructure and an important step on the way for a city developing from Standard to Smart. This is especially true when considering the Internet of things; it is clear, that any kind of wireless technology has to go hand in hand with FTTH. FTTH is responsible for transporting large quantities of data and wireless to every corner of the city, even if the object is moving. The comparison with the human body could be:

\[
\text{FTTH} = \text{Central Nervous System} \quad \text{Wireless} = \text{Decentralised Nervous System}
\]

Without doubt, an ideal combination when both systems fit together.

Paolo Sebben
Chair of the Smart City Committee “Smarties”, FTTH Council Europe
2.1 Acknowledgements

The Smart City Guide has been produced by the FTTH Council Europe and draws heavily on the expertise of its member organisations. We thank the following individuals for their time, effort and contributions, and acknowledge their original material and graphics, which have been included in this guide:

First edition


Second edition

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Third edition

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The Smart City Guide is an initiative of the Smart Cities Committee of the FTTH Council Europe.

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All editions were edited by **Eileen Connolly Bull**, Connolly Communication AB.
3 Concept

A SMART City is based on the idea of an intelligent organism.

The most important elements of an organism are the sensory organs, the brain and the nervous system which are responsible for the connections within the body. Sensory organs process information with the nervous system sending signals to the brain where they are evaluated and the information stored.

The brain then sends commands to the body’s extremities and it is through this connected teamwork we are able to master everyday tasks and to continuously learn new things.

Our exceptionally fast nervous system immediately sends information in all directions within our body. Without this clever express system, our species would have disappeared from earth long ago.

Our exceptionally fast nervous system is comparable to a comprehensive FTTH network in a Smart City.

A slow nervous system in an organism limits its ability to learn which may have adverse effects.

Imagine putting your hand into a fire and your nervous system fails or simply delays forwarding that message to the brain.
Then imagine that the command “withdraw hand” does not lead to a reflexive action because of slow communication.

And lastly, imagine that parts of the body are not connected through the nervous system but react autonomically.

Unfortunately, that is how our cities work today with various disciplines being separated from one another as in silos.

A Smart City is like a living organism that can adapt to changing situations.

A city, which increases its level of Smartness daily, has an FTTH nervous system that connects all elements and disseminates information bi-directionally at the speed of light.

Figure 2: Smart City Nervous System (©effectas)
4 Definition of a Smart City

The term “Smart City” is inconsistently applied as the concept has, so far, not been precisely defined. In other words, there is no standard definition of a “Smart City”. Hence the various uses of this term.

Many organisations have created their own catalogues of criteria to define whether a city is Smart or not. Those criteria typically can include all or some of the terms listed below:

- Smart energy production and conservation
- Smart mobility
- Smart economy
- Smart living
- ICT economics
- Smart environment
- Smart governance
- Standard of living
- Smart society

If there is no real standard by which cities can be judged to be really Smart or otherwise how can this topic be handled?

The FTTH Council Smart Cities Committee has agreed that for a city to be labelled Smart, it must have implemented all of the three initiatives mentioned below:

- a strong and reliable communication network, preferably based on fibre optics (FTTH)
- government involvement to provide added value to the citizens
- initiatives to promote the use of renewable energy

4.1 Scope of a Smart City

After intense discussion, the “Smarties” team agreed on the following description of a Smart City:

A Smart City will increase efficiency, productivity, ecological awareness; it will reduce pollution and improve quality of life in a world of increasing urban complexity.
5 Vision of a Smart City

More and more people are moving into cities. To cope with this large-scale urbanization and to use all types of resources efficiently, new approaches need to be found to manage these expanding cities.

Since most cities in Europe are already built the challenge is to ‘transform’ traditionally grown cities into Smart Cities.

In the future, a city may be viewed as being a living organism with which we, its inhabitants, can interact. The city can provide updates about traffic situations; it can help us to find parking spaces; it will manage and inform on the status of electrical power, light and pollution.
6 Smart Society

An Intelligent or Smart Society will optimize its resources by using ICT in an efficient way, thus improving its knowledge bank. It will also take better care of natural resources. Travel times will be reduced thanks to telecommunications and collaborative technologies.

The Smart Society will also be challenged by new ways of production and distribution similar to that experienced by the entertainment industry. An example of this is iTunes.

In addition, production and logistical industries will face demands to find new ways of production. 3D Printing has the potential to start a revolution in production and logistics. Imagine using the iTunes concept which allows you the opportunity of downloading the code for several articles and then producing them at home through the use of your 3D Printer.

These are just a few examples of how we should be thinking outside the box; we should be open to new opportunities made available by the future Smart City.
7 Drivers behind a Smart City

What is happening at the moment is not only affecting our cities, it is also changing our whole economies and the way we live and communicate worldwide.

Radical changes are not new to our society; not so long ago the steam-powered machine revolutionised the way people lived and worked, changing almost every aspect of everyday life: society, structures, productivity, living standards. This era of industrialization was replaced by the information age and again everything was turned upside down. New Industries emerged and others disappeared. Societies, countries and businesses which opposed or failed to embrace this development, missed the economical rise.

Every time a new “age” was introduced and where the old order of things changed - societies, countries - it was those that were willing and able to take advantage of the new technology that also benefited from it.

And now we witness the next revolution, welcome the next new “age”. This new “steam-powered machine” is called Digitalization. And digitalization is also one of two main drivers behind Smart Cities.

The other one is clean energy switch. Since most cities are growing, digitalization and Clean Cities are to be seen in the context of urban densification.

Digitization and convergence conquer almost any area. Nicholas Negroponte, Founder and Chairman Emeritus of MIT’s Media Lab, recognized over twenty years ago the dimension of change which will be driven by digitalization. He used the following metaphor:

“Shifting from processing atoms to processing bits.”

We move from transportation of materials, mass and goods to weightlessness, instant, virtual and global movement. In this new economy, digital networking and communication infrastructures provide a global platform over which people and organizations devise strategies, interact, communicate, collaborate and search for information. This becomes visible through a vast array of digitizable products - databases, news and information, books, magazines, etc. which are all delivered over a digital infrastructure at any time of day or night and anywhere in the world.

The Internet and digitization are driving the virtual world. People maintain social contacts on the Internet, thus forming their digital footprint. New applications and business models can be constructed by using a combination of the tangible and the digital world.
When devices are equipped with sensors and networked, physical objects can also be part of the digital world.

In other words, sensors and networking are now creating bridges between the two worlds. This is also known as “the Internet of Things”.

Urban densification requires efficiency at all levels, covering all disciplines of a city. Clean energy switch drives Smart Grids and Smart Homes with both requiring networks, sensors and actors to achieve the desired goals.
8 Living in a Smart City

ICT has been introduced in several industries and in people’s daily lives to improve efficiency levels of the processes in operation. The amount of data being created every day is exploding; by 2003, 5 billion gigabytes of data had been produced, in 2011, the same amount of data was created in 48 hours and today it takes just 10 minutes. This increasing complexity is slowly but surely overwhelming people.

In a Smart City large quantities of data are being processed, enabling people to easily make decisions based on facts.

Figure 4: Example Open Data by Anja Jentsch
In a wider sense, a Smart City should be seen as a workbench. It should create an ideal environment for the community to drive innovation.

Figure 5: Workbench of Innovation
9 Economic Factors in a Smart City

A Smart City creates above-average, knowledge-based jobs which tend to be attractive to businesses and inhabitants and contributes to an economic positive spiral. As already mentioned above, Open Data enables, in particular, programmers to combine data from arbitrary and useful sectors to develop new applications. The Swiss federal government estimates that the annual economic potential for Switzerland amounts to between 900 million and 1.2 billion Swiss francs (about 1 billion Euro) as a result of Open Data.

To create value you need raw materials. Data will become an even more precious commodity than it is today.

However, data is like a rough diamond; the real value only appears when is has been processed in an intelligent way.

Data is the diamond or the gold of tomorrow’s societies.

Data is the precious commodity of our century

In a city full of sensors and networked devices the generation of data will assume unpredictable dimensions. Complexity will increase dramatically. Although data is an important resource, value can only be created if data can be aggregated in an intelligent way and processed efficiently.

In order to handle this cities have to enter the field of so called Big Data.

Big Data is the term used to describe a massive volume of both structured and unstructured data that is so large that it is difficult to process using traditional databases and software techniques. A particular challenge is real-time processing.
One of the core competencies of big city management will be Big Data handling. Structures, technologies and policies all have to be designed properly.

9.1 Dimensions of a Smart City

When looking at a city, several dimensions can be identified with some aspects being a given and others needing to be designed.

The dimensions are:
- **Environment** – landscape, buildings, parks, lakes, rivers
- **Infrastructure** – public transport
- **Collaboration System** - Open Data, innovation, synergy, collaboration, creativity
- **Solutions** – e-government, e-learning, e-traffic
- **Living** – work, recovery, playing

9.2 Structures of a Smart City

The biggest opportunity to create value in a Smart City is at the interfaces between the various disciplines.

And when talking about Smart Cities it is also important to mention services that are enabled by technology. In this context people and their needs are often neglected.
It should be remembered that a Smart City is not created for its own sake but for the people.

Disciplines and sectors which historically did not strongly interact with each other now need to be interlinked in a value-creating manner. Often Smart City projects are approached in a purely technological manner. However, it is important to address several other aspects which are not technological, such as the culture of the society, organizational conditions and the culture of the city departments.
10 Making Business in a Smart City

A Smart City is not an end in itself, nor some neutral, self-sufficient benefit.

On the one hand, decreasing environmental impact will improve the quality of life for residents and staff whilst on the other hand, a Smart City is a place where businesses and innovation are supported. This support takes the form of various services such as: E – Government, which makes it easier for enterprises to interact with the relevant authorities; Optimized transportation brings the employee to work quickly and safely; Performance and price of telecommunications media are a competitive factor for companies operating internationally; Local cloud services can build trust with respect to data security; and, A reliable power supply is an important foundation for business continuity. Cheap energy is not least a competitive factor.

Innovation today is often realized in the development of software. The raw material for new applications is information. If the city provides data in a machine-readable form for free disposal, the software developer will have the opportunity to combine this information into new applications. This accessibility in cities is called Open Data.

The goals of the Open Data movement are similar to those of other "Open" movements, such as open source, open hardware, open content and open access. Open Data are all data sets that are made freely available to the general public and companies without any restriction, free to use, for dissemination and re-use.
11 Smart City Business Model

11.1 Why is a Business Model important?

Business model innovation is more profitable than product or process innovation (+6% over five years). 50% of executives believe that innovative business models generate more advantage than innovations in products and services. (University of Sankt Gallen, Competence Centre for Business Models: http://www.item.unisg.ch/de/chairs/innovation+mgmt/research/business+model+innovation).

![Image of a triangle illustrating the innovation triangle]

This article will try to demonstrate how experiences from other sectors, such as book sales, education etc can benefit cities.

The idea that digitalization drives new business models is recognized, though sometimes unwillingly, by most industries nowadays, however, not necessarily by city administrations. Having discussed this issue with various people involved in smart city initiatives, our conclusion is that smart city business models are not being discussed with the urgency they deserve. We are convinced that discussing business models is at least as important as talking about projects and business cases; the latter being the first area of importance when considering smart city development.

We would like to contribute to this discussion or at least help it along its way as it is far too important to be neglected. A smart city business model turns the existing city business model upside down.

11.2 Digitalisation drives new business models
Despite its importance, business model innovation remains outside standard management practice. More resources and focus are channeled to product and process innovation. Why is this? Product and process innovation is a well-established management practice however business model innovation is a much younger discipline and practiced only by ‘innovators’ and perhaps ‘early adopters’ of managers.

For decades, business models remained unchanged: a bookstore was like any other bookstore. A bakery operated like a bakery. A travel agency worked like any other travel agency. To be a more successful bookstore, bakery or travel agency, product or process innovation was the key. Broader book selections, tastier bread, more interesting destinations or just lower prices. Focus was also directed on to the processes: increasing convenience for the customer, more efficient logistics or cheaper production.

Then, something happened: you may call it INTERNET, you may call it DIGITALISATION. In the end, it multiplied the variety of ‘how’ businesses could be operated.

A bookstore can be run along the lines of a local traditional bookstore or solely as an online store. An online store is like any other online store. Whether it is selling books, electronics or stationery. The customers, not the physical in-store sales people recommend the books, core competence is not the book, but the ‘online business operation’. The same applies to the travel business.

Customers rate hotels. A travel agency is confronted with big challenges. And we have not even mentioned DVD rental stores. Therefore, it is not very surprising that Amazon, for example, started to market a wider range of products and not just books – their core competence is not limiting them only to the book sales.

So, business model innovation can be applied to cities as well as business.

For decades, cities have had the same business model: Taxes and fees are used to maintain infrastructure and administration.

Today, big data analytics and the Internet open up opportunities for cities to generate value and monetize services to their citizens; this should not be missed. If a city is not monetizing the data it generates, it should at least consciously decide against this opportunity.

11.3 Traditional city vs. Smart City in the view of a Business Modelist

When discussing the business model of a smart city, we use the framework of Alex Osterwalder et al., specified in his book ‘Business Model Generation’. This framework is very useful for our purpose as it is not only very pragmatic but is also an excellent tool differentiating between the various business models.

11.3.1 How does a business modelist describe a traditional city?

A city spends money on infrastructure and personnel to run and maintain the facilities needed by its citizens and visitors. The citizens are provided with access to culture, business, education, housing, water, gas, heating, streets etc. and hopefully also a safe environment. These services are funded through taxes and fees which come from the citizens, the same citizens who are able to influence (according to the political system) through elections and votes.
11.3.2 How does a business modelist describe a smart city?

A smart city spends money on infrastructure, personnel, ICT, data and partner management – the latter is needed to run and maintain facilities, ICT and data platforms for consumers and prosumers of its services. The citizens and visitors of this smart city have access to a good quality of life, low stress environment and an eco system that encourages creativity and a relaxing/vibrant life style, according to their personal desires. They are also kings and queens of their data – they own their data. They decide which data they want to share with the city and which to keep private. The smart city earns money by monetizing the value of raw or augmented data from the installed sensors in the city. Some data and information access is free, while other has to be paid for (freemium model). Income through taxes and fees is reduced when compared with that of a traditional city.

The smart city needs to build up (or buy) competence in data management and ICT operations. Data is key to success. The city may host a developer platform for companies that are interested in providing services on the city data.

<table>
<thead>
<tr>
<th>‘Traditional’ City</th>
<th>Smart City</th>
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<tbody>
<tr>
<td><strong>Value</strong></td>
<td>Access to culture, business, education</td>
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<td>Safety</td>
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<td><strong>Customer</strong></td>
<td>Citizens</td>
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<td><strong>CRM</strong></td>
<td>Taxes</td>
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<td>Votes</td>
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<td>Election</td>
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<td><strong>Key Partners</strong></td>
<td>Utilities</td>
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<td>State, Government</td>
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<td><strong>Key Activities</strong></td>
<td>Infrastructure</td>
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<td>Administration</td>
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### Table 1: Traditional vs. Smart City

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<thead>
<tr>
<th>Key Resources</th>
<th>Money</th>
<th>Data</th>
<th>Networks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs</td>
<td>Infrastructure</td>
<td>Administration</td>
<td>Personnel</td>
</tr>
<tr>
<td>Revenue</td>
<td>Taxes</td>
<td>Fees</td>
<td>Apps</td>
</tr>
</tbody>
</table>

### 11.4 Open data

Cities provide sets of data on their homepage for businesses, which are then able to download files and implement them into their apps and market them. Sometimes this data is free however, the range of available data is still limited partly due to the lack of sensors that record ‘interesting’ data.

If an ecosystem for innovation is implemented, residential areas and businesses can introduce their own suggestions for data generation and usage. In some cases, infrastructure co-investment between city and private organization is possible. Companies can propose the type of data that should be gathered as input for new services; they may even be interested in investing in sensors and infrastructure, if there is a business case for it.

City administrators tend to be reluctant to profit from data produced in their city. They weigh the risk of data security and privacy issues heavier than the potential benefit a city may gain from monetizing its data.

We produce data and hand over our private lives to companies such as google, facebook, Samsung or Apple who are then able to exploit them at will. This opens up opportunities for cities. Potentially, citizens trust their cities and utilities and are comfortable with them managing their personal data. However, the inhabitants are still the rightful owners, or are they? What an opportunity for a city!
The following images are screen shots from the homepages of Zurich and Vienna and show the type of open data sets already available today.

Anwendungen

Übersicht (151 Einträge)

- 48er-App
- A story about Vienna
- Abfahrt
- Accessible Vienna
- Adressservice-Unterstützung für geocoder-php Bibliothek
- ALLSEARCH.com
- Allryster
- Ambulanzen in Wien
- AppFahrt
- Baby benannten
- Behindertennarzële
- Bevölkerungszahlen und –dichte in Wien nach Zählbezirken
- Büchereien in Wien
- Budgetvisualisierung
- Burgen und Schlosser in Wien
- Bushaltestellen in Wien
- Citybike Wien
- crowdfranking
- Datatak und Semantifier
- Defis in Wien
- Demographic Indicators Vienna
- Der Radfahrbegleiter für Wien
- Dogator

*Figure 10: Example of open data from Vienna.*
11.5 ICT Infrastructure of a smart city

The ICT infrastructure of a smart city can be visualized in three layers. The first layer is composed of M2M communication and so-called CPS (Cyber Physical Systems), for example, a car that communicates with its surrounding (GPS, wireless, ...) is a CPS.

The following layer comprises of ambient intelligence, such as sensors and the system that hosts and manages open data and provides big data analysis.

These two layers are mainly managed by the city.

On the top layer are the smart city apps and digital devices that provide the interface to the citizens and users. These are developed and run by service providers.
11.6 Smart City Ecosystem

The ecosystem is a key success factor for the type of business model that is being discussed here. It is as important as the ICT infrastructure.

An ecosystem includes the following ingredients:

1. Service providers who are ambitious and willing to unleash the potential available in the city data and commercialize it
2. A business model between the city and the service providers that is attractive for both sides and helps the service providers to develop and operate attractive services to the benefit of the end user
3. A platform where consumers and producers meet and create new services

Cities need to build up their competences in these areas if they wish to establish a business model in a smart city similar to that being described here.

11.7 Conclusions

A city interested in embracing the qualities of a smart city needs to initiate serious discussions about their business model. Neglecting the business model is a big risk. The city may force its citizens into paying for its services, as was the case a century ago, however revenues can be generated in a much fairer and more individualized manner. Standard services can be provided for free, with added value services being monetized.
In worst-case scenario, if a city fails to address this topic, valuable data could be monetized by private companies leaving the city to be administered in the same way it was a century ago. Digitalization would instead offer countless opportunities in running the city.

11.7.1 Minimum and maximum expectancy
A city should at least analyze its current business model and design a new one once the city is ‘smart’.

11.7.2 Maximum expectancy
A smart city will adjust the business model and generate value for service providers and citizens. Standard services are free of charge but citizens pay premiums for extraordinary services. In this way the city is less dependent and less vulnerable on economic shifts that may affect the industries that pay taxes to the city.
12 Getting started

Turning a traditional city into an intelligent one involves not only technology but also the engagement of people in all areas of the city. It means winning over people to the cause, to inspire them and to exploit their potential. The challenge is how to make this happen.

Initially an idea which arouses curiosity in the city should be encouraged and ideally this idea would come from the mayor or from the city council.

But an idea alone will not necessarily develop and lead to something long term unless a figurehead in the city is willing to drive the process and make sure that the idea develops into a broad-based initiative which is supported by the city council, the population and the economy.

Smart initiatives should ideally be processed contemporaneously top down and bottom up.

Top down covers the formulation of a vision and a strategy with bottom up working with utilities within the city and the relevance of existing infrastructures.

The issue is complex and if it is to be successful needs broad-based support. How is it possible to deal with such complex issues whilst at the same seeking and gaining broad support?

One approach is to set up a Smart Advisory Board and a Smart City Team. The Smart Advisory Board keeps the momentum going and creates content whilst the Smart City Team reviews and approves outcome.

The Smart Advisory Board should consist of interdisciplinary experts who are capable of formulating suggestions and driving projects very quickly. Focus and pace must be maintained.

The members of the Smart City Team should include as many representatives as possible from all departments and their role is to review the work carried out and apportion projects.

In Central Europe, there are no stupid cities. Intelligent infrastructures and services can be found in every city. However, services and infrastructures are not necessarily consistently intelligent and not always linked to each other across the city. And above all, a number of elements may be missing which constitutes the difference between a Standard and a Smart City. Infrastructures and Services do not fit together to form a complete picture.

Vision is needed to identify the gap between the current situation and how it should be. In some instances the vision can be called the big picture. The current situation is shown as smart fragments of the big picture.
When developing the vision it is important it is specifically tailored to meet the needs of the city. The ingredients to build a Smart City Vision are the same for every city and include elements already mentioned such as Smart Mobility, Smart Grid and so on. This tailored vision must focus on the specific issues of that city and those elements of a Smart City that go towards solving the issues will get more relevance in the vision.

In order to follow the top down/bottom up approach, the content of the vision has to be broken down into three levels. Level one displays the services, level two covers the organization and the processes and the third level shows the infrastructures and IT Systems.

Fulfilling the vision means identifying and eliminating the gaps in all levels.

Working through this procedure not only helps to achieve Smart City status, it also clarifies and exposes all the services which are, at present, provided by the city. Having analyzed the list of services the city will have a detailed catalogue.

The target should be to replace the services catalogue with Smart Services and at the same time reduce the number of processes, infrastructures and systems.

It will soon become clear, that invoicing services, for example, can be achieved using the same processes and the same systems operating on the same infrastructure.

This is just one significant step that takes a Standard city to the level of a Smart City.
The consolidation of infrastructures on the network layer can lead to a single “Public Private Service Network”. This idea has been adopted in Stockholm, where St. Eriks Kommunikation realized that this kind of FTTH – Public Private Service Network, can be used to address all kind of services.

- **Common Services:** City of Stockholm
- **Specific Individual Services per administration**
- **“Individual” Engineering Networks**

*Figure 15: More Services less infrastructures, processes and systems*

*Figure 16: One FTTH Network for all applications*
13 Developing Services for a Smart City

There are hundreds of services available which are called Smart or have the potential to be “Smartized”.

Some may be fancy, some may be useful, some may even be revolutionary, others can be profitable, others not. Smart City is hype. As Smart Services and Smart Cities became buzzwords, cities and industry increasingly began to develop many so-called Smart Services. Sometimes this activism is misleading because services are not developed for their own sake but intended to add value for people. This generates a certain amount of friction and can lead to projects and services failing on the market.

In other words as in developing all types of common services, developing Smart Services in areas where they are not perceived or appreciated by the customer, can lead to wasted investment and other resources.

Creation of radical new services where the future is shaped by mega trends

Needs and services will be driven by trends with digitalization being a key driver for almost all other trends. Without virtualization and digitalization, no clouds. Things become virtual and the cloud their home. The masses are empowered by the internet. They organize themselves, they act, they react.

By using their force it is possible to use their market access; by using their creativity they can be transformed into customers which help to create value whilst at the same time pay for value. Another important phenomenon is that coming generations will be more used to sharing things, to using them, to accessing them without the need to possess, this generation likes to own things.

Cities, concentrate service development on areas within core competences
Smart Services should be offered based on the core competencies of a city. Do not enter fields where a private operator is already offering services which are better than those available from a city.

But enable them by providing an open infrastructure.

Figure 17: Open Enabling Platform
14 Stakeholders of a Smart City

Creating a Smart City is not a ‘one-man show’; many parties with various views, opinions and not least interests need to be involved.

Societies face exploding energy costs, globalization, more cars and growing traffic congestion, as well as the need to find and implement efficient processes; they experience empty public purses, increasing security issues and a growing concentration on greener environments. These are just a few areas that require major structural investments in cities and communities around the globe. If these investments are planned and implemented without being an integral part of an overarching framework, success and ROI are limited. However, there is one common denominator to all these necessary investments and addressing it can have significant impact on modern urban challenges: the installation of a high-speed broadband network infrastructure based on fibre technology.

14.1 Residents

City residents are investing in Smart Homes by installing sensors and networks throughout their properties. This facilitates the control and automation of several systems, such as a heating system, a video surveillance system, illumination, plant and garden irrigation, and so on. To take full advantage of these investments, a remote control process is required. The Smart Home needs to be connected to the internet through an FTTH network.

14.2 Municipalities

City councils everywhere are facing and having to cope with financial problems. Since many of their decisions are dependent on election results, it is often hard for them to devise and implement long-term strategies. On occasion, today’s generation pays for the mistakes made by the previous generation. In addition healthy competition exists to attract businesses, which in turn provide tax income as well as jobs to the city. To incorporate long-term strategic changes and to be attractive to businesses, a city must have a high-speed broadband network fibre infrastructure in place. Such a broadband network can support other needs facing municipalities as well as encouraging more efficient work processes and more effective video surveillance of public areas. Municipalities are in a coveted position; within their own geographical boundaries they own all right of ways to lay fibre optic cables and ducts.

14.3 Utilities

Energy providers must cope with smaller distribution power plants (privately-owned renewable power plants) and the need to optimise OPEX by closely following end user demands. They can also benefit from surplus energy being created by their customers. Utility transportation service provider’s face challenges relating to highly complex schedules and tariffs, cashless e-tickets as well as the need to react faster to delays or unforeseeable demands or even to new cooperation’s with other utilities. Passengers expect real time
information about bus or train services – when is the next one due to arrive? are there any delays? A high-speed fibre broadband network is crucial in providing the level of service expected by customers today.

14.4 Corporations

Today’s global business world demands a strong, reliable communications network to support all business applications. Financial losses and damages caused by network connection problems can rapidly mount up. The availability today of a high-speed, high quality, fibre broadband network is an essential pre-condition in establishing any business in a specific city or region.

The major benefits in connecting all distributed networks through a Smart Grid include reducing complexity, offering high security standards as well as an efficient use of infrastructure.

In other words, today's progress doesn’t mean more complexity, rather Smarter connectivity through an FTTH/B network towards Smart Grid and Smart Homes.

14.5 City Organization

From an historical perspective, cities used to work most efficiently when organized in silos with every department being highly specialized and able to drive innovation within its own boundaries. Today many cities are still working on the development and improvement of services, which means that there is room to develop existing services so that they become more efficient. This is very much the case with the use of IT. Most often when new technologies arise, these are used to improve existing processes and business models instead of enabling new models.

![Figure 18: Traditional City organisation in silos](image)

By enhancing the organization and moving towards a Smart City it is possible to enable the development of new models and encourage radical innovation.
Implementing and improving a Smart City requires multidisciplinary professionals. Not only do the technology and its possibilities need to be understood it also requires strong leadership and meditational capabilities.

However in the context of a real Smart City, innovation takes place across organizational boundaries. Introducing radical restructuring from silo to integrated organization will need mechanisms that provide consistency. This is where a Smart advisory team can have an integrative role.
15 Smart Grid

In our vision, resources are managed efficiently in a Smart City and one key element to achieving this is a Smart Grid.

Efficient management of resources involves providing real time information about usage and production which is processed in a Smart way and incorporates control measures. This is the concept of a Smart Grid, independent of the resources.

According to the ‘Smart Grid European Technology Platform’ Smart Grids are: “...electricity networks that can intelligently integrate the actions of all the users connected to it – generators, consumers and those that do both, in order to efficiently deliver a sustainable, economic and secure electricity supply”.

This definition is suitable for what most experts understand as being a ‘Smart Grid’. However, we believe that in a Smart City, a Smart Grid concept, which is confined to electricity only, is not broad enough. Electricity is not the only resource for which ‘the actions of all the users should be intelligently integrated’. The same requirement applies to other resources as well. The need to manage for example water demand efficiently is probably as important as electricity, especially in dry regions. Other important resources could be gas or heat.

We believe that there should not be a Smart Grid for electricity, a Smart Grid for water, another for gas, and so on... There should be ONE SMART GRID for all resources.

A true Smart Grid should therefore cover usage and production of all resources in a Smart City.

This may be called “convergence of the networks”. On a small scale, hot water boilers and heat pumps in households are used in virtual power plants through demand side management (e.g. https://be-smart.ch/). On larger scales, power to gas projects do the same. Gas pipelines become an extension or an alternative to the electricity networks (e.g. http://www.northseapowertogas.com/).

Convergence of Cloud Computing and heating is taken up by www.aocloud.de. By decentralizing servers and using their heat for heating, efficiency can be optimized. There is no reason not to call this a Smart Grid as well.

This concept can even be taken one step further by counting ‘broadband internet access’ as a resource as well.

Mobile data usage is exploding, as is fixed internet traffic. What if a Smart Grid concept included Internet traffic? Prioritizing very important over less important traffic to guarantee functioning control systems in a Smart Grid is important, however it is clear that this can be simplified if the underlying telecommunication network is strong: i.e. a fibre to the home network.

Regarding the definition of a Smart Grid (above) and replacing ‘electricity network’ with ‘fibre network’ and ‘electricity’ with ‘information’:
“...electricity/fibre network that can intelligently integrate the actions of all the users connected to it – generators, consumers and those that do both, in order to efficiently deliver a sustainable economic and secure electricity/information supply”.

Basic Smart Grid Business Cases involve major investments for the network and depend on efficiency gains in processes and IT as well as changes to customer behaviour. The new customer behaviour is based on one assumption: people will make informed choices in their energy consumption. This, of course, is very difficult, when energy is as cheap as it is today.

We believe that the Smart Grid Business Case is much more indirect than direct, as is so often the case for infrastructure investments.

The tighter the system boundaries for a Smart Grid Business Case, the less likely it will be positive. To build a positive business case around cost elements for Smart Meters and IT systems, efficiency savings in processes and additional income from new services to the consumer remains a big challenge. It should be noted that without adaption from regulations, most utilities would prefer NOT to invest.

However, the system boundary for the business case might be too tight. Take the analogy of a motorway: the immensely high cost of building it is seldom, if ever, covered by the people using it, but the economical benefit of such an infrastructure is that much higher.

A Smart Grid should be valued equally. Its benefit is not solely limited to the utility it serves.

Third party service providers are able to market new services based on the availability of a Smart Grid: it opens the market to consultants which leads to energy optimization; new devices for demand side management need to be developed and sold; the whole Smart Home industry will benefit; E-mobility becomes more attractive as the value of the car battery as an energy storage device gains popularity. And least of all we should not forget the potential in consumers creating their own markets as they become energy producers. All of this is also applicable to other resources, such as water, gas etc.

According to McKinsey “By 2014 the global market for Smart Grid technology and services will run into tens of billions of dollars.” *(http://www.mckinsey.com/client_service/electric_power_and_natural_gas/latest_thinking/mckinsey_on_smart_grid, 3 October 2013)*

Massive amounts of data are produced and used by a Smart Grid. This data needs to be processed, which in turn requires vast IT capacity. Traditionally, telecom companies are used to working with such quantities of data - actually it is one of their core competencies - while utilities have not. Having the data and being able to make sense of it (e.g. when somebody gets home in the evening and plugs in the electric car) is of the highest value. Companies such as Google, Facebook and similar survive by knowing a lot about their users (which is financed by other companies). The information that can potentially be acquired from Smart Grid data is extremely valuable; however, security and data secrecy policies limit their usage. This attitude will change. There is a wide gap between what people reveal about themselves when using the internet and what appears to be confidential regarding the energy consumption in their home.
We believe that a Smart Grid will outstrip any other technology in terms of data creation capability regarding consumer behavior; which will make it as much or even more powerful than Google or Facebook. If that data was available for use, the Smart Grid would become a data creation machine of unimaginable value.

A business case that includes such a potential would become highly profitable. According to Cisco’s Visual Networking Index for global IP traffic forecasts for 2016 a total of 1,300 exabyte of data will be transported through global data networks. This is 6,500 times the information of all books that were ever printed or 328 billion DVD’s. According to IEEE, the data volume on the internet doubles every other year.

Being able to manage and analyze huge quantities of data will be a key success factor to making a Smart Grid successful.

We conclude that:

- the value of Smart Grids is totally underestimated as the system boundary is too limited therefore indirect effects are neglected
- Smart Grids are limited to electricity. Other resources such as water, heat, gas etc. should be included
- data generation and processing are IT challenges but have immense potential
- the Smart Grid, as a data generating machine for monitoring customer behaviour, is a powerful feature: if that data could be used for marketing and developing new products, the Smart Grid case would be highly profitable

For Smarties’ it is obvious that a Smart City needs a Smart Grid; this may be regional or local. But what is more important is that it is open and that it includes connectivity as well as data management.
16 Smart Home

16.1 What is a Smart Home?

A Smart Home is a house that has advanced, automatic or remotely operated control systems to manage the living environment; these include temperature gauge, lighting, multi-media, security, window and door operations as well as numerous other functions.

Smart Homes, which can also be referred to as Intelligent Buildings, use computer systems, sensors and controls to monitor many aspects of daily living and are becoming increasingly sophisticated.

![Components of a Smart Home](image)

Figure 20: Components of a Smart Home

Recently introduced into the world of Smart Homes is the term “domotics”, from the Latin word domus meaning home; it literally means home robotics and encompasses all areas of Smart Home technology.

There are four major areas that function within a Smart Home: Energy Management, Multi-Media, Control Systems and Security. It has been said that remote health care and medical diagnosis could be considered a fifth function but in reality this potentially life changing service is delivered using a combination of features from the other four.
16.2 Energy Management

Whether monitoring energy usage with meters or making adjustments to the central heating before arriving home, energy management has extended its reach into new, innovative concepts and now incorporates areas such as Smart Grid connection, photovoltaic (PV) and micro-generation of electricity, combined heat and power systems (CHP), low voltage DC networks, grid independence and power management including time shifting energy usage. One of the biggest challenges for future energy management is storage. Since energy is not always produced when it is needed, power storage and its related management systems will increasingly become part of the home energy management system.

16.3 Multi-media

Primarily considered to be the means with which to connect up to the Internet, multi-media incorporates all forms of communication from traditional telephony to digital technologies such as data streaming, VoIP, video-on-demand (VOD) and gaming. Ranging from low to very high speed data requirements, internet connection functions not only act as a link to communications but also as a remote access route. Data streaming includes services such as video conferencing, which is increasingly being used by the health industry for remote medical consultations and requires symmetrical, high speed bandwidth. Also on the increase are security management solutions. Possibly, ‘best effort’ internet connections with limited security features will need to be adapted to assure secure transportation of sensitive data.

16.4 Control Systems

Generally considered part of the automated building, coded signals are sent through a home’s wiring to switches and outlets that are programmed to operate appliances and electronic devices in every part of the house. These include automated temperature, lighting and security systems, as well as interacting with other essential process functions such as water management. A good example is monitoring the harvesting of rainwater and the control and use of grey water from various sources that reduces the use of clean drinking water. Smart Home systems might even take care of feeding the cat and watering the plants. Recently, control systems have been using wireless connectivity to reduce cabling within a building.

16.5 Security

When mentioning security most people think of alarm systems but there are many ways in which the use of automated security systems can benefit the living environment. Remote door entry systems, CCTV cameras, baby monitors, gate control, flood and fire warnings all work towards providing improved living environments. Devices such as panic alarms and motion sensors can detect if someone has not moved for a period of time and therefore may require medical assistance.
16.6 What is the impact?

Unless considered early in the planning stage, Smart Homes rarely happen instantly, tending to evolve and grow over time. Occasionally they grow quickly due to external circumstances; for example, a member of a household may require monitoring due to ill health or a person may change their work location – from office to home, which necessitates an upgrade of security measures. Or perhaps a property is undergoing major renovation providing the opportunity to include the latest gadgets. Whatever the reason, introducing Smart Home technology can mean the difference in someone staying in his or her present home or having to move.

Automated Homes can be more efficient and use less energy. This is not only good for the environment but also reduces running costs. Heating systems that take into consideration the latest and expected weather conditions mean less wasted energy; lights are switched on only when needed; individual rooms set to required temperatures, not just one thermostat for the entire house.

With a Smart Home linked to the Smart Grid, utility providers would be able to control energy usage during peak load periods, remotely switching off devices such as immersion heaters and washing machines for short periods of time if grid load capacity is nearing maximum.

Mains energy and locally generated energy from wind, PV or CHP systems could be stored in battery banks and used during peak periods in what is called ‘time shifting’ energy usage. This would save money and at the same time reduce peak loads on the grid.

The ability to link products to the Internet brings a whole new range of opportunities to create consumer electronics that not only react to an environment but can also collate information on how people live.

Smart Homes will bring added value not only to the people living within them but also to companies supplying them with goods and services. For example, the frequently quoted supply of remote health services will not only benefit the consumer and the health service provider but will also present opportunities for all stakeholders, including equipment suppliers, product manufacturers, pharmaceutical companies, ISP’s, virtual as well as physical service industries etc, offering them the opportunity to create and develop new ways to assist and improve home living for the sick, infirm and elderly.

Now add a small portion of entrepreneurial creativity and it is possible for the Smart Home to become a catalyst for a range of entirely new business models involving both existing as well as yet-to-be considered enterprises.

Quite obviously the building industry can benefit from property upgrades with data cable and electrical installation companies getting an additional boost but also self-install and DIY solutions providers may also flourish.

Can we look forward to a time when education, governance and policy making are delivered to the people alongside the day-to-day stream of TV and media? Perhaps the mix of home working, e-commerce, on-line gaming, social media with real time, face-to-face video interaction, dating agencies, reality TV and auction sites will fundamentally change the way in which we interact with each other.
16.7 What are the implications?

How will Smart Homes affect the people living in them and who will really benefit?

Home automation can be especially useful for elderly and disabled people wishing to maintain their independence and safety. This in turn will reduce demand on health service resources and probably offer the patient a better quality of life.

Home working can reduce travel and the carbon footprint. Cloud computing will have a massive effect on how people are able to work however; a high-speed connection would be essential.

Obvious examples of home security, such as intruder and fire alarms, hide a whole range of other benefits. These include peace of mind from remote CCTV monitoring incorporating the option that allows for settings to be adjusted remotely when the home owner is away from their property.

Automated homes are potently a hot-bed of sensors offering multiple uses. Security alarm systems have door, window and infrared movement sensors that could be connected to the homes’ heating and lighting systems so that rooms, where windows or doors have been left open, have the heating levels reduced to avoid energy waste. Lights could be switched off in rooms that unoccupied.

Technologies found in video gaming systems such as the X-box Kinect are already able to recognise people moving and stationary in the home making it possible to build systems that actively react to the homeowners needs. Smart Homes, linked to the Internet, can operate as part of the smart town/city concept with local services, energy planning, information and entertainment all playing their part.

Social and political governance could benefit from being able to speak directly to the constituents with the added bonus of online voting from home. Maybe we could see the rise of the online Community voice.

It is easy to get swept up in all of the benefits that Smart Homes could bring but there are some concerns and fears that have to be addressed. Could a ‘home virus’ make our digitally operated Smart Home a target for malware? Would criminals be able to gain access to your home by infiltrating your digital security network and opening the doors? And let’s not forget the paranoia of cyber voyeurs gaining access to your CCTV cameras and watching your every move.

During a recent Consumer Electronics Show in Las Vegas, high tech companies demonstrated how they are poised to gather unprecedented insights into consumers’ lives including how much they eat, whether they exercise, when they are home and who they count as friends.

Today the increasing number of gadgets seems to make life more and more complicated but, at some point, they need to make life easier. If our truly connected world is designed correctly then the gadgets and systems that control, operate and report, should be able to operate invisibly and improve our living environment imperceptibly.
16.8 How to develop a Smart Home

Currently the biggest problem with developing a Smart Home is that there are many different protocols and devices, wiring systems and gadgets but very few of them are designed to work together. The result is that homes are full of wires and battery operated sensors that are a nightmare to maintain. However, the technology is in place and many of the above mentioned systems can be bought off the shelf. Integrating them is the big challenge.

Traditional home and building automation products such as those used to control heating, lighting, blinds, ventilation, security technology, audio/video and numerous other functions use simple data transfer protocols such as KNX. The utility providers opt for a protocol called EEbus for energy management. Many digital products such as computers, game consoles, tablet and Smart phones use Ethernet IP and wireless.

A number of companies have tried to make sense of this confusion and the introduction of control systems such as Zigbee and Zwave have made attempts to build a cohesive system.

Microsoft is looking to unify electrical appliances within the home and establish itself in the burgeoning “Smart Home” market with the development of HomeOS. Essentially a lightweight “Smart Home” operating system that aims to make it easy for users to manage their home networks and ease the creation of applications by third party developers, HomeOS is designed to provide a central hub through which various household devices can be controlled.

Google’s Android@home project is also reaching out into the Smart Home territory and would like to think that ”every appliance in your home” as being a potential accessory to the phone.

Even the electrical power systems providers have had to reconsider their traditional delivery with the introduction of low voltage energy systems such as PV and the replacement of high voltage lighting with low voltage DC. Now systems such as Dc48 are looking at low voltage DC networks that will use energy generated locally and distributed around the house alongside data and control signals in an attempt to build an independent home distribution network connecting up all the homes’ devices

The mantra is ‘pay upfront to make long term savings’, but are Smart Homes really good value for money and how much does it cost to make a home Smart?

Building from new or retrofitting? Making a home Smart will always involve a cost. It is true that there are cost savings in energy and water (if you pay for yours) but the real benefits are probably less obvious.

16.9 Relationship to FTTH

Without a digital connection it would be difficult to control many of the modern, Smart technologies and impossible to deliver high speed streaming data. Early examples of home automation used simple, wired control systems and required only a low data rate to send signals. However most of the new, life-changing innovations will require fast data delivery and probably symmetrical download and upload speeds as well. This data connection will need to be secure and robust to ensure the consumer has confidence in the functionality of the system.
Companies such as Verizon are marketing home automation and security services as part of their FTTH package. Such products are attempting to make the FTTH offering financially viable and more attractive to the consumer.

With companies that are developing these interface systems it looks like the Smart Home is becoming the interface between the consumer and FTTH.

16.10 Elderly living and Smart Homes
A Smart Home that includes special features for the elderly can enable people to live independently in their homes longer. If the Smart Home is combined with a communications system and integrated with a care robot then it all becomes a lot more interesting; and that is what Ambient Assisted Living is about.

The care robot Hobbit, which has been developed in Vienna, is about to make its debut in private households. His role is to prevent people from falling and giving them support in their everyday activities. The robot is able to monitor vital human functions and trigger an alarm if necessary, it can also entertain and keep them mentally fit with targeted exercises.

Figure 21: Hobbit Robot
Urban mobility and transport is vital for the functioning of cities. Transportation systems contribute to the overall quality of life, the economic competitiveness of today’s cities and will also become even more important in the Smart Cities of the future.

The world population is increasingly city-based; 51% or 3.5 billion people currently live in urban areas and by 2050 this number is expected to reach 70% of the population or 6.3 billion people.¹

Cars, once synonymous with freedom and ease of mobility, have become a victim of their own success. In cities around the world, congestion is undermining mobility, imposing huge costs not just on commuters but on society as a whole.

The problem that confronts transportation planners is that adding new infrastructure capacity to relieve congestion is notoriously slow and costly.

Innovative new ways of making more efficient use of existing infrastructures are already coming onto the scene. The arrival of the “information everywhere” world has opened up new opportunities to make existing transportation infrastructure far more efficient and user friendly.

One of the key concepts of a future urban transportation system will be the understanding of the transport infrastructure as a single system, wherein all participants, vehicles, services and components are linked to the “digital nervous system” of a Smart City. Building blocks for this system are high-speed fibre networks, high-speed wireless networks, sensor networks, cloud-computing services, GPS, GIS-data, machine to machine communication (including vehicle to vehicle communication and vehicle to grid communication), smartphones, tablets, personal computers, wearable devices and, most importantly, Open Data and Open Standards.

Deloitte Research suggests a roadmap for preparing the future urban transport system²:

**Optimize the performance of the network**
- Shift from a culture in which state and local transportation department employees identify as ‘builders of transportation infrastructure assets’ to one in which agency employees view their role more broadly as ‘managers of the transportation network’
- Develop multimodal trip planners to help citizens compare all modes of public and private transport
- Leverage third party traffic data and analytics for real-time traffic management and incident response
- Publish public transportation data as a real-time data feed
- Examine how existing business models can be re-imagined in light of digital disruption

**Adopt a networked view**

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¹ Arthur D. Little Future Lab, „The Future of Urban Mobility”, 2011
² Deloitte Research, „Digital-Age Transportation: The Future of Urban Mobility”, 2012
- Put legislation in place to promote new forms of public private collaboration
- Promote new multimodal payment mechanisms to facilitate easy transfers across different modes
- Change the metrics from vehicle throughput to people throughput to reinforce a broader view of mobility
- Tie transportation funding to improvements in overall transportation system performance

**Lay the groundwork for next-generation vehicles and mobility services**
- Remove legislative and regulatory barriers to new mobility services
- Address the cyber-security issues related to connected vehicle technology
- Put in place the requisite legislative and regulatory frameworks for the development, testing and operation of next-generation driverless vehicles
- Protect citizens by understanding the privacy issues related to location-based data and developing adequate privacy safeguards with a focus on educating citizens and consumers about what data is being collected and how it’s being used
- Implement variable pricing pilots to balance supply of road and parking assets with demand
Next generation urban transport systems will connect transportation modes, services, and technologies together in innovative new ways that pragmatically address a seemingly intractable problem.

We can already see very promising and successful companies with highly innovative services and business models in this field of next-generation urban mobility.

Some examples from Austria, Germany, Switzerland:

Car-Sharing: [www.mobility.ch](http://www.mobility.ch), [http://www.carsharing.at](http://www.carsharing.at)

Ride-Sharing: [www.mitfahrgelegenheit.ch](http://www.mitfahrgelegenheit.ch), [www.mitfahrzentrale.de](http://www.mitfahrzentrale.de)

Smart Parking: [www.parkit.ch](http://www.parkit.ch), [www.parku.ch](http://www.parku.ch)

Integrated Fare Management: [www.sbb.ch/abos-billette/e-tickets.html](http://www.sbb.ch/abos-billette/e-tickets.html), [www.handyparken.at](http://www.handyparken.at)

Bike-Sharing: [www.citybikewien.at](http://www.citybikewien.at)
As the examples above suggest, we are already seeing aspects of what this new world might look like. Smartphones are expanding their reach in both user numbers and phone capabilities, thus creating new models for getting people from point A to point B. Social networking is encouraging new ways of thinking: organizing communities and motivating change.

And, of course, emerging technologies are impacting on just about every aspect of how we get around. The field of transportation has become rich with possibilities but unpredictable developments may occur. In any foreseeable scenario high speed networks and telecommunications will play an essential role in urban transportation systems of the future.

Links:
http://dupress.com/articles/digital-age-transportation/
http://www.sustainable-mobility.org/resource-centre/documentary-resources.html
www.adl.com/Urban_Mobility
http://www.ditcm.eu/media/documents/Towards%20Smart%20Mobility%20Roadmap_def_180312.pdf
http://www.futurecities.ethz.ch/
http://www.trb.org/Publications/Publications.aspx
http://audi-urban-future-initiative.com/
http://www.eu-smartcities.eu/mobility_transport
18 Smart Government

18.1 What is Smart Government?

The growing importance of Smart Cities is putting the spotlight on Smart Government operations which are indispensable to the guidance of their development. The rise of Smart Cities brings with it heavy responsibilities to local, regional and national authorities highlighting their ability to guide the transition of their cities and communities into Smart Cities.

In this aspect ‘Smart Government’ can be defined as ‘the use of innovative policies and technology to address the environmental and service challenges facing public sector organizations’. Smart Government includes specific applications and technologies to improve service delivery to their citizens and their businesses and the establishment of new platforms for communication and data sharing.

Smart Government fully relies on next generation IT networks with ultra-high speed internet connections installed by the public sector over the last decade. Back-office systems have improved process efficiency and the integration of service; front-office systems now support multi-channel communication with citizens including a growing range of transactional services.

In addition Smart City innovations in areas such as energy control (Smart Grids), transport (Smart Mobility) and waste management, all related to increased sustainability, provide Smart Governments with the tools to guide the development of their Cities and Communities into a healthy, happy and livable future.

Examples of innovative Smart Government applications can be found around the world. In India the National Institute for Smart Government (NISG) www.nisg.org is a not-for profit organisation incorporated by the Government of India in 2002, in the Republic of Korea a Smart Government Implementation Plan (2011~2015) has been set up ‘to realize the world's best e-Government in tune with its citizens’ and in Dubai the Dubai Smart Government www.dsg.gov.ae is a pioneering initiative in the region to provide government online services across the spectrum of corporate and community life in the Emirate. The vision of the Dubai Smart Government is ‘to ease the lives of people and businesses interacting with the government and contribute to establishing Dubai as a leading economic hub.’

In Europe active initiatives can be found in the UK, Denmark, Austria and particularly in Moldova, a Smart Developing Country. The country was able to fully leverage the funding received from the World Bank to realize its e-government ambitions. This is an example of how jurisdictions in less developed regions can use funding very effectively.
18.2 Improved Service Delivery to the citizens: e-Government

The most widely spread application of Smart Government is the improved delivery of a broad, and still growing, range of governmental services to the citizens and businesses of a city, region or country: e-Government.

e-Government (short for electronic government, also known as e-gov, Internet government or online government) consists of two-way digital interactions between a government and their citizens (called: G2C and C2G), government and businesses /commerce (G2B) and also between government and other governments or agencies (G2G).
‘Electronic Government’ (‘e-Government’) essentially refers to ‘the utilization of Information Technology (IT), Information and Communication Technologies (ICTs), and other web-based telecommunication technologies to improve and/or enhance the efficiency and effectiveness of service delivery in the public sector.’

e-Government describes the use of technologies to facilitate the operation of government and the disbursement of government information and services. e-Government relies heavily on Internet applications as a support. e-Government includes the use of electronics in government, but can also include surveillance systems, tracking systems such as RFID tags, and even the use of television and radios to provide government-related information and services to the citizens.

Today e-Government is widely available around the world. In the report: ‘United Nations e-Government Survey 2012: e-Government for the People’ in 190 countries, some level of e-Government services have been identified, ranking from the top 3 countries: the **Republic of Korea**, the **Netherlands** and the **United Kingdom** to Niger (nr. 188), Chad (nr. 189) and Somalia (nr. 190).

### 18.3 How Estonia became E-stonia

One of the most advanced e-societies in the world today is Estonia. ‘E-Estonia’ [http://e-estonia.com](http://e-estonia.com), is the term commonly used to describe Estonia’s emergence to this position, growing out of the partnership between a forward-thinking government, a pro-active ICT sector and a switched-on, tech-savvy population.

For citizens of Estonia, e-services have become routine: e-elections, e-taxes, e-police, e-healthcare, e-banking and e-school. The "e" prefix for services has almost become trite in the sense that it has become the norm.

The same developments are visible today in many other countries in Europe and around the world, but, for the time being, Estonia still has the (declining) advantage of the early adopter. Moreover, the e-services offered give an excellent overview of today’s possibilities.

#### 18.3.1 Electronic ID card

The Estonian ID card serves as an identity as well as a travel document. In addition to its physical use, the card also provides access and proof of identity when utilizing online services. In other words, the ID card is the key to almost every innovative e-service in Estonia. Inside this small document is a chip that not only

### Table 1.1 World e-government development leaders 2012

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>E-government development index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Republic of Korea</td>
<td>0.9283</td>
</tr>
<tr>
<td>2</td>
<td>Netherlands</td>
<td>0.9125</td>
</tr>
<tr>
<td>3</td>
<td>United Kingdom</td>
<td>0.8960</td>
</tr>
<tr>
<td>4</td>
<td>Denmark</td>
<td>0.8889</td>
</tr>
<tr>
<td>5</td>
<td>United States</td>
<td>0.8687</td>
</tr>
<tr>
<td>6</td>
<td>France</td>
<td>0.8635</td>
</tr>
<tr>
<td>7</td>
<td>Sweden</td>
<td>0.8599</td>
</tr>
<tr>
<td>8</td>
<td>Norway</td>
<td>0.8593</td>
</tr>
<tr>
<td>9</td>
<td>Finland</td>
<td>0.8505</td>
</tr>
<tr>
<td>10</td>
<td>Singapore</td>
<td>0.8474</td>
</tr>
<tr>
<td>11</td>
<td>Canada</td>
<td>0.8430</td>
</tr>
<tr>
<td>12</td>
<td>Australia</td>
<td>0.8390</td>
</tr>
<tr>
<td>13</td>
<td>New Zealand</td>
<td>0.8381</td>
</tr>
<tr>
<td>14</td>
<td>Liechtenstein</td>
<td>0.8264</td>
</tr>
<tr>
<td>15</td>
<td>Switzerland</td>
<td>0.8134</td>
</tr>
<tr>
<td>16</td>
<td>Israel</td>
<td>0.8100</td>
</tr>
<tr>
<td>17</td>
<td>Germany</td>
<td>0.8079</td>
</tr>
<tr>
<td>18</td>
<td>Japan</td>
<td>0.8019</td>
</tr>
<tr>
<td>19</td>
<td>Luxembourg</td>
<td>0.8014</td>
</tr>
<tr>
<td>20</td>
<td>Estonia</td>
<td>0.7987</td>
</tr>
</tbody>
</table>
holds information about the card's owner, but also two certificates, one of which is used to authenticate identity and the second to render a digital signature.

Due to its security level, the card is used in many web environments where ID verification is a necessity, such as Internet banking, participation in e-elections, buying public transport tickets and much more. The ID card is secure as PIN codes are also required for the card's operation. In addition to the ID card, a mobile phone can also be used as a means of identification for online services. This is very convenient as it means users do not need an ID card reader for the computer. In addition, a mobile phone can act as a card and a card reader at the same time.

18.3.2 E-services for citizens

e-Elections

Since 2005, all those eligible in Estonia have had the opportunity to vote electronically via the internet using an ID card or mobile ID; they do not even have to be in the country. This service is available a few days ahead of the paper balloting process, and has become the most comfortable way to vote. An ID card and PIN code establishes the voter's identity; however, the vote remains anonymous as immediately after indicating their choice, the vote is separated from the voter's connecting digital signature.

e-Tax Board

Estonian citizens can declare their income taxes electronically over the internet. Estonia's e-Tax Board offers a pre-completed form which makes it easy and fast to submit tax returns. The system identifies individuals using an ID card or mobile ID. A citizen need only log on to the e-tax system, check the information that has been automatically assembled, make any additions or changes (as necessary), and approve the declaration.

e-Business

An entrepreneur may create a company in Estonia through a bureaucracy-free process which requires only the applicants' personal computer. The e-business portal takes 18 minutes to record, register and create a company. To successfully complete this process the applicant needs an Estonian ID card, but the system also recognises ID cards from Belgium, Portugal, Lithuania, and Finland.

e-Banking

Citizens accustomed to the e-state also demand paperless solutions from the private sector. One of the best examples of this is banking. The expression "going to the bank" has all but disappeared from the Estonian language. An Estonian will generally "log in" to the bank instead. For the last ten years Estonians have not been required to physically visit the bank. Most people are unconcerned with what time the bank opens or closes or where it's located as they can access their internet bank 24 hours a day.

e-Ticket
Only tourists buy paper tickets to travel on public transport in Estonia's capital city. Locals buy their bus tickets via the internet and their virtual ticket is registered on their personal ID card, which can be checked by a card reader carried by conductors.

18.3.3 E-services in healthcare

Digital prescription

On 1 January 2010, an IT solution was applied to Estonia's healthcare, called a digital prescription system. In the past, patients had to take their paper prescriptions with them to the pharmacy. This system had several weaknesses: it was easy to lose the paper; the handwriting of the doctor could be illegible, etc. Electronic prescriptions have solved these problems because all prescriptions are sent to a central database. When the patient goes to the pharmacy of their choice, the pharmacist retrieves the prescription from the central database. No chance the patient will lose the prescription or that it may be unreadable.

![Figure 23: In Estonia wi-fi internet is even accessible in the forests](image)

e-Health record

In January 2010 Estonia began using a medical information system allowing the general public to view their own digital medical history. This system contains information on diagnoses, doctor's visits, tests, hospital treatments, medications prescribed by a doctor, etc. Access to this information is through the patient portal using an ID card as identification.

18.3.4 E-services in education

e-School

Since 2003 it is possible for all Estonian schools to use the web-based school-home communication environment e-School (eKool). The purpose of e-School is to engage parents more actively in the study process, to provide easy access by parents and students to information relating to subjects and to facilitate the work of teachers and school management. For example, via e-School it is possible to access information about the marks given to students, their absences from classes, the content of lessons and related homework as well as assessments given to students by teachers at the end of the study period.

*University via internet*
At the end of upper secondary school (aged 15-16 years), all Estonian students are required to take state exams. Exam results are uploaded directly into the information system and every upper secondary school graduate may retrieve them through the state portal eesti.ee, or opt to receive the results via text message to a mobile telephone. Upon completing upper secondary school, students may submit applications to universities via the state’s internet-based application system. This system unites the higher-education databases with the students’ exam results, thus greatly simplifying the exchange of information between the user and the university.

*e-Governance Academy*

The e-Governance Academy is a non-profit information society, development and analysis centre that aims to share Estonia’s experience in the areas of e-government, e-democracy, and information technology education. More than 700 individuals from 36 different nations have come here to study, including representatives from Canada, Japan, Georgia, India, Namibia, and Pakistan. Estonian experience and knowledge have aided many nations in making their election processes more transparent, democratic, and less encumbered by bureaucracy.

**18.3.5 Mobile applications**

Use of electronic services does not always require a computer. By phoning a specific number or sending an SMS, paying for parking is easy with a mobile phone (m-parking). To inform the parking controller that the payment is being effected by phone, an m-parking sticker is stuck on the windshield or the right-hand side window of the vehicle. The m-ticket service allows the individual to purchase a ticket on public transport without cash. It is also possible to buy and pay for theatre tickets at the grocery store using a mobile phone. M-services developed in Estonia have been successfully applied in other countries as well.

**18.4 Open Data generate new Apps**

A further step in broadening the concept and scope of Smart Government from, in the main, offering e-Services to citizens, who are almost always in a receptive ‘passive mode’, to inviting them to take an active role is to *make available free of charge all non-personal government data*. Using so-called ‘Open Data’ an unlimited range of new services (Apps) can be developed by citizens and businesses, which are useful to improve, ease and enrich virtually every aspect of a citizen’s life in a Smart City. Examples are endless, such as transport by car or bike, parking, education, art & culture, shopping, public trees and other flora, storage of personal data available from relevant companies and organizations etc. etc.

Open Data refers to the idea that certain data should be freely available to everyone to use and republish as they wish, without restrictions from copyright, patents or other mechanisms of control. The philosophy behind Open Data has been long established, but the term "Open Data" itself is recent, gaining popularity
with the rise of the Internet and World Wide Web and, especially, with the launch of Open-Data government initiatives such as Data.gov. This is a U.S. government website launched in late May 2009 and Data.gov.uk, a UK Government project which aims to make non-personal UK government data available. As of January 2013 it contains over 9,000 data sets. Providing Open Data by national, regional and local authorities, combined with stimulation programmes for the development of new apps in recent years, has really taken off. A list of over 200 local, regional and national Open Data catalogues is available on the open source datacatalogs.org project.

18.5 Telework policy

A fully rolled out Smart Government obviously has an integrated telework policy for all its own employees and consultants. Telework (telecommuting) today is widely applied by both profit and nonprofit organizations and allows employees to use technology to work from home or from an alternate worksite. Telework is recognized as an option that can meet a variety of interests, including:

- enhancing employee satisfaction and productivity
- reducing commute journeys
- allowing employees to work during inclement weather or suspended operations
- accommodating departmental workspace constraints.

When inclement weather prevents employees from coming to work, teleworking can allow them to accomplish work from home so long as the supervisor determines that they can do so effectively and safely.

A successful telework arrangement must work for both the department and the employee. Managers determine telework feasibility by evaluating the following:

- the adequacy and security of the technology resources available at the home work site (i.e., software compatibility, high speed internet connection, up-to-date computer security protection, etc.)
- the work to be accomplished
- the anticipated benefits to the department
- the interactions required between the teleworker and other staff members or customers
- the employee’s demonstrated skills.

Employees should realistically assess their ability to accomplish work in the home environment:

- can unplanned interruptions be controlled?
• is the hardware and software at the home location sufficient to ensure that normal productivity can be maintained - e.g., reliable high speed internet connection, current and compatible hardware and software, availability to talk with supervisor, colleagues, clients, etc.?

• will the work require access to resources that are not currently available at home: fax machine, scanner, photocopier etc?
19 Internet of Things (IoT)

IT is radically revolutionizing products. Until recently, most products used to be standalone, composed of mechanical and occasionally electrical parts.

In the not too distant future, our cars, our homes, our major appliances and even our city streets will be connected to the Internet. This type of network is called the Internet of Things or IoT for short.

What is the Internet of Things and what are the components of IoT?

It is a system which allows objects to communicate with each other, a phenomena not experienced previously. IoT components are things (or assets) and through a communication network they are connected and a computing system makes it possible for data to flow to and from these connected things. It is also possible through this infrastructure to optimize activities between them based on the analysis of data streaming through the network.

It has been predicted by Cisco that fifty billion devices will be connected to the Internet by 2020, however, the IT analysis firm Gartner also predicted that by 2020, there will be 26 billion connected IoT devices. No matter who is right, IoT will definitely play a disrupting role in our future and in the future of Smart Cities. IoT means that the next generation of products will include hardware, sensors and possibly microprocessors. The biggest change will be that they are no longer standalone as they will be connected to a system or even to many systems, as the following picture shows.

![Figure 25: From Product to IOT (© effectas)](image)

Smart connected products open up big opportunities for new functionalities and reliability.
The industrial Internet could add $10-15 trillion to the global GDP, essentially doubling the US economy, says General Electrics.

When products are connected to different systems, this could lead to changes in the business model and it might even raise the question “what kind of business I am in?”

According to Harvard Business Review, intelligence and connectivity enables the following four areas of capabilities:

1. Monitoring
2. Control
3. Optimization
4. Autonomy

Autonomy means that the product can operate itself and depending on the setup, even learn to a certain extent. That could mean improving functionality or efficiency.

This is really a major step in the direction of a smart city. As more things in a smart city are able to act and react without the interaction of people the better it is.

Cities will spend $41 trillion in the next 20 years on infrastructure upgrades for IoT, according to Intel.

The number of things that can be connected will literally explode during the coming years, exponentially leveraging possibilities in smart cities. The knock-on demand will be unlimited connectivity. FTTH as the “central nervous system” of the city will play a major role as big amounts of data will need to be transported in real time and secure across the city. An additional important factor involves connecting FTTH with wireless networks that can cover every corner of the city and guarantee the inclusion of moving things.

The following list of applications is far from complete but does offer up a taste of what can be expected from IOT in a Smart City:

- Waste management by connecting containers to the logistic system of the utility
  (Detection of rubbish levels in containers to optimize waste collection routes)
- Fire detection by connecting every fire detector to a central alarm system
- Structural health
  (Monitoring buildings, bridges and historical monuments for vibrations and material conditions.)
- Smart Parking (Monitoring parking space availability in the city)
- Smart Grid
  (Energy consumption monitoring and management.)
- Perimeter Access Control
  Access control to restricted areas and detection of people in non-authorized areas.
- Supply Chain Control
  (Monitoring storage conditions throughout the supply chain and product tracking for traceability purposes.)
- Smart Product Management
  Control of rotation of products on shelves and warehouses to automate restocking processes.
- Item Location
  Search of individual items in large storage facilities, such as warehouses or harbours.
- Animal Tracking
  Location and identification of domestic animals
- Intrusion Detection Systems
  Detection of windows and doors openings and violations to prevent intruders.
- Patients Surveillance
  Monitoring patient conditions inside hospitals and in old people's home.

Most of the listed examples are to some extent obvious when discussing IoT. But it should not be overlooked that IoT will also operate in some less obvious fields such as floors, cups, clothes and other everyday objects which can also be networked to stream data to and from the Internet.

Ideally various networks and technologies are combined into a system of networks.
This system could cover the function of a Public – Private Network for all needs of the city and its stakeholders.

But the Internet of things is not only about software, sensors and networks.
A big challenge is that thousands or millions of connected devices will generate a tremendous amount of data. This data only acquires value if it can be interpreted.
Without an integrated business analytics platform, sensor data will just lead to information overload.
Not all data is important. It is crucial that data that is really needed does not go missing and that time is not wasted on data which has little importance.
Cities need to run big data systems and must acquire the necessary analytics skills to cope with the data deluge. IoT will drive innovation and generate a wide range of new jobs.
20 Smart City Standards

Information and communication technologies (ICTs) play a crucial role in the challenges facing cities striving towards smartness and sustainability. To this end, globally accepted guidelines and standards could be very helpful. There is at present a number of international, regional, and national standardization organizations that have begun working on standards relating to Smart Cities. This Chapter is restricted to major organizations that are in the process of developing global standards and does not cover already existing standards for transmitting digital communications.

A comprehensive collection of worldwide activities on Smart Cities “ANSSC Directory Smart and Sustainable Cities Initiatives” prepared by ANSI is available here: http://bit.ly/1hVCr1Y.

20.1 International Organization for Standardization (ISO)

The Technical Committee ISO/TC 268 “Sustainable development in communities” has established a Subcommittee ISO/TC268/SC 1 “Smart Community Infrastructures”. Standardization in the field of Sustainable Development in Communities will include requirements, guidance and supporting techniques and tools to help all kinds of communities, their related subdivisions and interested and concerned parties to become more resilient and sustainable and demonstrate achievements in that field. The proposed series of International Standards will thus encourage the development and implementation of holistic, cross-sector and area-based approaches to sustainable development in communities. As appears in the programme of work, it will also include Management System Requirements, Guidance and Related standards.

The first ISO standard for city indicators was launched in May 2014, providing city managers, politicians and planners with the opportunity to objectively evaluate their progress and compare their achievements against other cities. This landmark ISO standard outlines key measurements for evaluating a city’s service delivery and quality of life. Its use will help city managers, politicians, researchers, business leaders, planners, designers and other professionals to focus on key issues, and put in place policies for more livable, tolerant, sustainable, resilient, economically attractive and prosperous cities. ISO 37120:2014 has been developed as
part of an integrated suite of standards for sustainable development in communities. It is designed for use by any city, municipality or local government irrespective of size and location or level of development. Profile indicators also provide basic statistics and information to help officials choose which cities most closely match their own for comparison purposes. It is being developed as part of an integrated suite of standards for sustainable development in communities.

The indicators included in ISO 37120:2014 will help cities to assess their performance and measure progress over time, with the ultimate goal of improving quality of life and sustainability. The standard’s uniform approach will enable cities to seamlessly compare where they stand in relation to other cities and the information gained can in turn be used to identify best practices and enable the cities to learn from one another. It can be used by any city, municipality or local government wishing to measure its performance in a comparable and verifiable manner, irrespective of size and location or level of development.

The following areas are covered by ISO 37120:2014

- Economy
- Education
- Energy
- Environment
- Finance
- Fire and emergency response
- Governance
- Health
- Recreation
- Safety
- Shelter
- Solid waste
- Telecommunications and innovation
- Transportation
- Urban planning
- Wastewater
- Water and sanitation

And these are the benefits of ISO 37120:2014

- More effective governance and delivery of services
- International benchmarks and targets
- Local benchmarking and planning
- Informed decision making for policy makers and city managers
- Learning across cities
- Leverage for funding and recognition in international entities
- Leverage for funding by cities with senior levels of government
- Framework for sustainability planning
- Transparency and open data for investment attractiveness
- Comparable data for city decision making, insight and global benchmarking

An additional document called ISO/TR 37150:2014 “Smart community infrastructures -- Review of existing activities relevant to metrics” provides a review of existing activities relevant to metrics for smart community infrastructures. The concept of smartness is addressed in terms of performance relevant to technologically implementable solutions, in accordance with sustainable development and resilience of communities, as defined in ISO/TC 268. It addresses community infrastructures such as energy, water, transportation, waste and information and communications technology (ICT) focusing on the technical aspects of existing activities which have been published, implemented or discussed.

The following image outlines the organization of ISO/TC 268.

![Structure of ISO/TC 268](image)

In July 2014, the ISO 37101, which sets requirements, guidance and supporting techniques and tools for sustainable development in communities, had reached Committee Draft stage.

This draft standard is designed to help all kinds of communities manage their sustainability, smartness and resilience, improve the contribution of communities to sustainable development and assess their
performance in this area. The final publication date is set for 2016. In addition the following drafts are available:

ISO/DTS 37151 – Smart community infrastructure metrics

ISO/DTR 37152 – Smart community infrastructures -- Common framework for development and operation

20.2 International Electrotechnical Commission (IEC)

IEC has established the Systems Evaluation Group SEG 1 - Smart Cities whose aim is to evaluate relevant works and propose the establishment of a Systems Committee (SyC) for Smart Cities. This will include the SyCs’ scope, general use cases, a possible reference architecture model, a standardization roadmap, a collection of defined terms and definitions, and a mapping of closely related activities in cooperation with ISO and other organizations, fora and consortia. SEG 1 has been set up to:

- Conduct an inventory of existing standards and standardization projects in progress in IEC, ITU-T and ISO
- Monitor TC/SC work in IEC to highlight any overlap of work or potential inconsistencies
- Liaise with ISO, ITU, and other organizations, fora and consortia. Represent IEC in coordination and cooperation with other organizations, fora and consortia in the field of smart cities
- To consider the economic aspects of smart cities, e.g. by identifying international market potential, identifying market drivers
- Draw-up a roadmap in IEC with a timeline that includes reference architecture and prospective standardization projects
- Tasks of the evaluation group will also include alignment of terms and definitions in the electro-technical field referring to smart cities, providing an efficient and transparent platform for information exchange and communication between IEC and other relevant stakeholder groups.

SEG 1 is organized in seven Working Groups:

- City service continuity
- Urban planning and simulation system
- City facilities management
- Use case – smart home
- Use case – smart education
- Smart cities assessment
- Standard development for smart cities using the city of Johannesburg as a piloting benchmark for smart cities implementation.

There are three TGs (Task Groups) working on special tasks in relation to Smart Cities:

- TG1: Inventory of existing standards
- TG2: Reference architecture model and supplemental research
- TG3: Roadmap based on the recommendations of WGs and TGs.

20.3 ISO/IEC JTC1 Study Group on Smart Cities
At its November 2013 plenary meeting, ISO/IEC Joint Technical Committee One (JTC1), Information technology, accepted a proposal from China to form a JTC1 Study Group on smart cities, following an earlier review by a JTC1 Special working group on planning. The activities of this Study Group will cover the following terms of reference:

1. Provide a description of key concepts related to Smart Cities, establish the definition of Smart Cities based on these key concepts, and describe relevant terminology.
2. Study and document the technological, market and societal requirements for the ICT standardization aspects of Smart Cities.
3. Study and document current technologies that are being deployed to enable Smart Cities.
4. Assess the current state of standardization activities relevant to Smart Cities within JTC 1, other relevant ISO and IEC TCs, other SDOs and in consortia.
5. Identify and propose how JTC 1 should address the ICT standardization needs of Smart Cities.
6. Provide a report with recommendations and potentially other deliverables, to the 2014 JTC 1 Plenary.

20.4 International Telecommunications Union (ITU)

The ITU Telecommunications Standardization Sector (ITU-T) formed the Focus Group on Smart Sustainable Cities (FG-SSC) and is part of Study Group 5. The FG-SSC acts as an open platform for smart-city stakeholders – such as municipalities, academic and research institutes, non-governmental organizations (NGOs), and ICT organizations, industry forums and consortia – to exchange knowledge in the interests of identifying standardized frameworks needed to support the integration of ICT services in smart cities.

At its fifth meeting in June 2014, the FG-SSC agreed on the definition of Smart Sustainable City which reads as follows:

“A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects”.

**Tasks and deliverables:**

- Defining the role of ICTs in environmentally sustainable smart cities, and identifying the ICT systems necessary to the development of a Smart Sustainable City
- Collecting and documenting information on existing smart city initiatives and technical specifications, focusing in particular on the identification of standardization gaps
- Identifying or developing a set of Key Performance Indicators (KPIs) to gauge the success of smart-city ICT deployments
- Identifying or developing terminologies and taxonomies for Smart Sustainable Cities
- Developing a stakeholder map outlining key players in the field of ICTs and Smart Sustainable Cities
- Establishing relationships and liaison mechanisms with other bodies engaged in smart-city studies and development
- Identifying future smart-city standardization projects to be undertaken by its parent group, ITU-T Study Group 5
- Developing a roadmap for the ICT sector’s contribution to Smart Sustainable Cities, providing cohesion to the development and application of technologies and standards.

ITU-T is known for its recommendations covering all aspects of data communications and transmission. All these standards can also be applied to Smart Cities.

**20.5 Institute of Electrical and Electronics Engineers (IEEE)**

IEEE – well known for its network standards, e.g. the IEEE 1901.2 Standard for Low-Frequency Narrow-Band Powerline Communications – has formed a Smart Cities Initiative Working Group. This Group focuses on technologies associated with Smart Cities. They are numerous and include those already available as well as those under development. Examples include:

- Intelligent lighting
- Smart building controls
- Demand response
- LED lighting
- Solar panels
- Fuel cells
- Wireless charging for automobiles
- NFC
- Facial recognition
- Transportation sensors
- Wind turbines
- Intelligent Buildings
- Micro and Macro GMDs
- Low power semiconductors
- An “RF-like” fabric
- Integrated transportation
- A connected self-aware environment that includes but is not limited to weather changes, traffic control, crowd sourcing strategies, medical alerts, etc.

**20.6 Internet Engineering Task Force (IETF)**

The IETF was established in 1986 to coordinate the operation, management and evolution of the Internet. It is overseen by the Internet Architecture Board (IAB) and receives administrative support from the Internet Society (ISOC). This arrangement was formalized in 2005 as the IETF Administrative Support Activity (IASA). IETF develops and promotes voluntary Internet standards, in particular the standards that comprise
the Internet protocol suite TCP/IP which is the common platform for all applications running over the Internet. It is an open standards organization, with no formal membership or membership requirements.

IETF standards are called RFC (request for comment). Until August 2014 more than 7,300 RFCs have been published.

### 20.7 European Committee for Standardization (CEN) and European Committee for Electrotechnical Standardization (CENELEC)

**CEN-CENELEC Smart and Sustainable Cities and Communities Coordination Group**

CEN/CENELEC have set up a joint body to coordinate standardization activities in Europe on smart cities and communities. The Smart and Sustainable Cities and Communities Coordination Group (SSCC-CG) will liaise with stakeholders, share information and encourage cooperation among the relevant technical bodies of CEN and CENELEC. It will also prepare a roadmap and a set of recommendations, including priorities for new standardization activities.

The SSCC-CG is composed of 3 ad-hoc Task Groups:

- **TG 1 “Mapping of relevant International, European and national standardization initiatives”**
- **TG 2 “Mapping of stakeholders and interested parties in Europe”**
- **TG 3 “Mapping of topics and issues to be dealt with under the scope SSCC-CG”**.

This mapping activity will lead to a roadmap presenting the outcome of the three Tasks Groups and recommendations for follow-up actions and for the future establishment of a Technical Committee(s) for future standardization work. The SSCC-CG will have completed its tasks no later than by the end of 2014.

The SSCC-CG will act on the following three levels:

1. **Strategic coordination**: the SSCC-CG will ensure complementarity and avoid duplication of work, of existing national, European (CEN/CENELEC Technical Committees and advisory and coordination bodies) and international initiatives (ISO/IEC/ITU) in the sector. It will liaise with European Commission initiatives (the Smart Cities Platform and the European Innovation Partnership for Smart Cities and Communities).

2. **Technical coordination**: the SSCC-CG will ensure the proper involvement of relevant European CEN/CENELEC and ETSI TCs and other bodies, serving as a platform for discussion among different stakeholders and technical experts. It will propose harmonization of general principles and terminology on Smart and Sustainable Cities and Communities and submit proposals to CEN/CENELEC and ETSI Technical Boards.

3. **Foster the mobilization and support of interested parties by identifying relevant and interested stakeholders in Europe and encouraging them to engage and commit towards common objectives. An Interested Parties Platform, including representatives from cities and communities’ organizations will be set up as an advisory body.**

### 20.8 European telecommunications Standards Institute (ETSI)
The working programme of the Technical Committee “Smart M2M” includes the view on Smart Cities. The scope of this TC includes:

- to develop and maintain an end-to-end overall telecommunication high level architecture for M2M
- to identify gaps in existing standards and provide specifications to fill these gaps.

TC Smart M2M has initiated the development of a standard for communication between Smart Appliances. This future standard will be based upon ETSI’s functional architecture for Machine to Machine communications, and will include a common data model and the identification of communication protocols. Also planned is a technical report TR 102 897 City Automation.

On 1 June 2013 ETSI organized the first Smart Cities Workshop, which was dedicated to examining major issues facing city authorities and infrastructure providers who are responsible for building the cities of tomorrow. These issues included, choice of technology, how to engage with the citizens, cyber security and data privacy, business models and clarification of the roles of the major actors.

### 20.9 American National Standards Institute (ANSI)

Launched in 2014, the ANSI Network on Smart and Sustainable Cities (ANSSC) serves as a one-stop shop where city authorities and others experienced in urban infrastructure planning and sustainable development can engage with ANSI. This also gives them the opportunity to hear about progress of the formal standards process, and articulate their issues and needs. The network will provide standards practitioners with a venue to hear these perspectives and describe how standardization can assist cities and local governments in addressing the challenges they face. Conversely, there are many resources and activities that have been developed outside the formal standards process (such as rating systems, readiness guides, and best practices) that standards practitioners may be unaware of but that could potentially form the basis of future standards and conformity assessment activities. The network dialogue will raise awareness of standardization initiatives, bring new participants into the process, and influence the direction of future standards development activities. ANSI is a member of ISO and IEC.

### 20.10 British Standards Institution (BSI)

To address the requirements that constitute a smart city standard, the Smart City Advisory Group of the British Standards Institution (BSI) recommended the following standards and publications:

- The development of a standard on Smart city terminology (PAS 180)
- The development of a Smart city framework standard (PAS 181)
- The development of a Data concept model for smart cities (PAS 182)
- A Smart city overview document (PD 8100)
- A Smart city document covering planning guidelines (PD 8101)

Beyond this, the Advisory Group has identified additional issues that should form the basis of a more detailed standards programme as well as addressing specific practical matters and potential risks that could be encountered in roll-out of smart city programmes. These will include:
- Standards relating to good practice in provision of digital services, including sharing of open data, privacy protection and inclusiveness of services
- Standards for evaluating smart city performance, developing the current ISO programme to include a means of evaluating the effectiveness of smart city products and services
- Standards covering the procurement of smart city services, expanding on the initial economic assessment and funding model
- Practical approaches to collaboration between partners covering the delivery of smart city programmes.
- Specific standards relating to interoperability of systems, including a framework description of smart city systems building on the work relating to mapping.

BSI's work will be available for incorporation internationally through CEN/CENELEC, ISO and IEC as appropriate, contributing to international recognition of the UK as a global hub in smart city applications. BSI will take a leading role in European and international standards activities, assiduously working to align programmes across standards bodies, building on existing knowledge and sharing UK initiatives with other countries to establish a global framework for smart cities knowledge.


A Publicly Available Specification (PAS) is a sponsored fast track standard driven by the needs of the client organisations and developed according to guidelines set out by BSI.

**PAS 180 Smart city terminology**

To help build a strong foundation for future standardization and good practices, PAS 180 provides industry-agreed approval of smart city terms and definitions to be used in the UK.

PAS 180 will help to improve communication and understanding of smart cities by providing a common language for developers, designers, manufacturers and clients. This aid will help industry to work more efficiently and effectively, as well as go someway to reduce confusion in the supply chain.

PAS defines terms for smart cities, including smart city concepts in use in various infrastructures and systems’ elements and applicable to all service delivery channels. It covers materials, processes, methodologies and applications. PAS is intended for city authorities and planners, buyers of smart city services and solutions, as well as product and service providers.

**PAS 181 Smart city framework**

PAS establishes a good practice framework for city leaders to help them develop, agree and deliver smart city strategies that can transform cities so that they meet future challenges and live up to aspirations.

The smart city framework (SCF) distills current good practices into a set of consistent and repeatable patterns that city leaders can use to help develop and deliver their own smart city strategies.
PAS is not intended to provide a one-size-fits-all model for the future of UK cities. It focuses on the enabling processes by which the innovative use of technology and data, together with organizational change, can help deliver diverse visions for future UK cities in more efficient, effective and sustainable ways.

PAS 182 Smart city data concept model

PAS 182 is being developed to tackle the barriers that hinder the implementation of smart city concepts, including the interoperability of systems and data sharing between agencies.

PAS will be developed to include the idea behind the public sector concept model (PSCM), aimed at providing the basis of interoperability at the upper ontology level and outline details of the smart city concept model (SCCM).

Standardisation establishes an interoperability framework for smart cities in which:

- information can be shared and understood between organizations and people at each level;
- the derivation of data in each layer can be linked back to data in the previous layer (i.e. the assumptions upon which a decision was taken);
- the impact of a decision can be traced back in operational data.

The smart city concept model (SCCM) provides a framework that can normalize and classify information from many sources so that data sets can be discovered and combined to gain a better picture of the needs and behaviours of a city’s citizens (residents and businesses).

The SCCM does not replace existing models, but through the simple mapping from a local model to a parent model, questions can be asked about data in a new and connected manner.

PAS is aimed at organizations that provide services to communities in cities, and manage the resulting data, as well as decision-makers and policy developers in cities.

PD 8100 Smart city overview

The role of smart city standards is to support widespread adoption of common approaches to the implementation of smart city products and services thus facilitating the rapid development of an effective smart city market.

In order to support this work, BSI is developing the Smart City Overview which will provide a simple and easy to read guide for smart city practitioners. It will help them find relevant standards to their particular situation and will include illustrations to simplify readability and impact of the text.

However it will also be suitable for use by standards professionals and provide a high level example of reference architecture for smart cities. As the Smart City Overview will be available as a Published Document, it can be widely tested for usefulness, providing a firm foundation for long term future development for use in a systematic and detailed technical reference architecture for smart cities.
PD 8101 Smart city planning guidelines

During major infrastructure development, it is more cost-effective to install new infrastructure or incorporate appropriate software at build stage than to retrofit it at a later date.

The challenge is that few cities have clear ideas as to their precise future smart city requirements and in addition, there are few models which can be used to give an accurate picture of what should be specified in order to cost effectively meet potential future requirements. By providing local authorities with models of good practice, new developments will be built in a way that will support smart city aspirations at minimal cost.

This document offers guidance on considerations needed to plan for any new development to support the smart city plans for a given area. It provides an overview of the key issues to be considered, as well as more detailed guidance on issues identified as priorities.

This PD 8101 Smart city planning guideline is for use by local authority planning and regeneration officers as an aid to identifying good practices in a UK context, and also provides them with suggestions for tools they could use to implement this good practice.

20.11 German Institute for Standardization (DIN)

The German national standards body, DIN, worked together with DKE, its counterpart on the electrotechnical side, to develop a standardized roadmap for smart cities (The German Standardization Roadmap Smart City). This was published in April 2014 and has the support of the German government. Click here to download the roadmap: https://www.dke.de/de/std/AAL/Documents/EN_Roadmap%20Smart%20City.pdf

The roadmap describes how Smart City standards can be developed.

![Figure 28 Use case method - Process for analyzing gaps in standardization (Source: VDE)](image)

20.12 City Protocol

City Protocol refers to both a programme of activities as well as the Society that is responsible for developing this system’s approach to rationalizing city transformations, under a shared platform. The CP programme
delivers agreements in the form of information and recommendations that have been developed within the City Protocol Anatomy which address issues agreed by the community of cities. Typical deliverables are:

- Projects and policies tested in cities that can be used as examples for other cities, together with indicators and certifications for those same projects and policies
- Recommendations and technological information.

**20.13 Conclusion**

The work to develop a standard tool to measure the smartness of a city is in progress. At the beginning of this Chapter the report “Mapping Smart Cities in the EU” was mentioned and is a good example of how to assess cities that exceed 100,000 residents in all 28 EU member states. Relevant standards that are already in existence or those under preparation can be valuable aids in developing a city to smartness. However, it is important that the measurements and metrics used in these standards are fully understood. Introducing a tool when working with a Smart City Project ensures good cross operations between all interconnecting projects and also as a comparison with other cities or regions.
21 Smart City Roadmap

As described earlier, there is no real standard definition of a Smart City.

Therefore, to achieve a Smart City level, it is important to define the scope and targets for each city in question. In order to develop the city it is also necessary to have detailed knowledge of existing infrastructure and existing 'levels of Smartness'. Once the gap between today and the targeted Smart City has been identified, campaigns and initiatives can be implemented to move step by step towards a Smart City.

As a starting point, analysis and assessment are of fundamental importance. Data has to be gathered, measured and managed, as this will highlight patterns and inefficiencies.

When starting a Smart City initiative, it is effective to start with those areas that offer improved services to the inhabitants. This can be realized by implementing e-government. The initiative should be based on a business plan describing the kind of services that are to be considered, and which services can be combined to achieve composite services.

Typically service ideas can be gathered during a workshop which will explore different perspectives and areas where e-services can be developed.

In the business plan the goals of such an initiative have to be defined.

Possible goals in this context can include:

- improving organisational efficiency
- simplifying interaction between the citizens and the municipality
- involving more citizens in the social activities available
- decreasing organisational costs
- achieving better data quality to enhance decision making processes

For E-Health the targets could be:

- elimination of more adverse pharmaceutical events
- reduction of unnecessary hospitalizations per year
- reduction of medication processing time and problems relating to medication orders

For Mobility the targets could be:

- usage of renewable resources
- shift from individual to public transportation in urban areas
- reducing traffic jams

For Smart Homes the targets could be:

- reducing energy demands
- improving convenience
- security
- ambient Assisted Living

For a Smart Grid the targets could be:
- the inclusion of all resources in Smart Grid management, not only electricity (electricity could be the first but not the last)
- budgeting and monitoring total energy usage and production
- connecting all producers and users of all kind of energy types
- implementing an overall energy data management system
- controlling water usage
- optimising investments and adapting the electrical grid to decentralised and stochastic energy production by renewable energies
- ensuring electrical grid stability and maintaining energy delivery quality
- enabling the electrical grid to support demand response and advanced services
- developing global standards based on SGAM (Smart Grid Architecture Model)
- providing a framework for regulation and marketing models
- guaranteeing data protection and security
- installing user benefits such as “Smart Meters”
- providing efficient storage systems (battery, power to gas, pumped storage power station…)

Long term:
- developing user cases, incl. flexibility, Smart Charging, network management and similar

21.1 Smart City - key success factors

Since a Smart City interlinks various disciplines and technologies it is important to think interdisciplinary in order to achieve objectives. This means also involving several stakeholders. Defining a vision, targets and objectives shared by opinion builders as well as the population.

Check List:

1. Involve Key Stakeholders, such as:
   local politicians and their parties, local industries and enterprises, universities, utility providers, telecom companies and the local population.

2. Analyse the current situation for the various disciplines

3. Define the objectives for the city in question

For example:
• improving efficiency
• making it easier for people to interact with the municipality
• including more citizens in the social activities
• decreasing organisational costs
• achieving better data quality on which decisions are based

4. Conduct an analysis to identify gaps between the current situation and the objectives.

5. Initiate strategic initiatives/actions in order to develop infrastructure and deploy applications

21.1.1 Strategic initiatives

The e-government roadmap should include several disciplines, as follows:

![E-government Roadmap](image.png)

*Figure 28: e-government Roadmap*
22 Benefits of a Smart City for Key Stakeholders

As mentioned above, when a project encompassing the dimensions of a Smart City is in the start up phase it is imperative that the most important and influential players are on board. Each target group may benefit differently from the Smart City.

22.1 Benefits for the municipality
- Improving competitiveness (attract businesses and people to the area)
- Financing and facilitating infrastructures capable of surviving any short term directional electoral changes or other critical incidents
- Lowering OPEX and CAPEX by making working processes more efficient
- Increasing public security using video surveillance in public areas
- Providing real time information of public traffic, parking availability and traffic upheaval due to road works
- Making the city attractive for people to live in

22.2 Benefits for Utilities
- Connecting smaller, privately owned power plants to the grid
- Better understanding of the demands made by the end user and optimising their production
- Avoiding astronomical investments in the physical network
- Leveraging 3rd party power plants
- Adding intelligence to the power grid
- Bundling all types of energy sources into ‘energy services’

22.3 Benefits for the citizens
- Shorter travel times
- Increased security
- Reduced pollution
- 24/7 access to public service desk
- Fast access to all cloud services
22.4 Benefits for Public Transportation

- Manage increasingly more complex schedules and tariffs of the public transport system
- Provide real time information to passengers of public transport
- Faster reaction times to relieve delays or unforeseen demands to improve competitiveness (attract businesses and people to the area)
23 Overview of the Smart Cities in Europe

23.1 Mapping Smart Cities across the EU-28

The report “Mapping Smart Cities in the EU” – published in January 2014 (can be downloaded here: http://www.europarl.europa.eu/RegData/etudes/etudes/join/2014/507480/IPOL-ITRE_ET(2014)507480_EN.pdf) – was commissioned by ITRE, the European Parliament’s Industry Research and Energy Committee, inter alia to provide context for the European Innovation Partnership on Smart Cities and Communities. The study examined cities with at least 100,000 residents in all 28 EU member states, of which 240 (51%) have already implemented or proposed Smart City initiatives. Although almost half of European Smart Cities have a population of between 100,000 to 200,000 inhabitants, only 43% of this size category are smart or initiated smart city initiatives as opposed to almost 90% of cities exceeding 500,000 inhabitants. Smartness is clearly a large city phenomenon. That said, only about 50% of European Smart Cities are actually piloting or implementing such initiatives, with the remainder still at planning stage and therefore relatively immature. There are Smart Cities in all EU-28 countries, but these are not evenly distributed. Countries with the largest numbers are the UK, Spain and Italy, although the highest percentages are in Italy, Austria, Denmark, Norway, Sweden, Estonia and Slovenia.

The report also includes the following working definition of a Smart City: “A Smart City is a city seeking to address public issues via ICT-based solutions on the basis of a multi-stakeholder, municipally based partnership.”

23.2 List of Smart Cities

The following list of Smart Cities was compiled by the Smart City Group through internet research as well as personal knowledge and includes the cities identified in the above mentioned report. This list may not be complete and in addition, some cities claim to be ‘Smart’ without clearly indicating the reasons.

However, many of these cities are deploying fibre, which indicates a correlation between FTTH coverage and ‘Smartness’.

<table>
<thead>
<tr>
<th>Country</th>
<th>City</th>
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<tbody>
<tr>
<td>Albania</td>
<td>Tirana</td>
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<td>Armenia</td>
<td>Yerevan</td>
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<tr>
<td>Austria</td>
<td>Graz, Hartberg, Innsbruck, Linz, Salzburg, Vienna</td>
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<td>Bosnia and Herzegovina</td>
<td>Banja Luka, Sarajevo</td>
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<td>Belgium</td>
<td>Antwerp, Brussels, Bruges, Charleroi, Flanders, Ghent, Leuven, Liège</td>
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<td>Bulgaria</td>
<td>Burgas, Pleven, Plovdiv, Rousse, Sofia, Varna, Vidin</td>
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<td>Croatia</td>
<td>Dubrovnik, Rijeka, Zagreb</td>
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<tr>
<td>Country</td>
<td>Cities</td>
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<tr>
<td>Cyprus</td>
<td>Nicosia (Levkosia)</td>
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<td>Czech Republic</td>
<td>Brno, Liberec, Kosice, Plzen, Ostrava, Prague, Usti nad Labem, Zlin</td>
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<td>Denmark</td>
<td>Aalborg, Aarhus, Copenhagen, Esbjerg, Kalundborg, Odense, Vejle</td>
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<td>Estonia</td>
<td>Tallinn, Tartu</td>
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<td>Finland</td>
<td>Espoo, Helsinki, Jyväskylä, Lahti, Oulu, Tampere, Turku</td>
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<td>France</td>
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<td>Norway</td>
<td>Bergen, Oslo, Stavanger, Trondheim</td>
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<td>Poland</td>
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<td>Portugal</td>
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<tr>
<td>Romania</td>
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<td>Serbia</td>
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<td>Switzerland</td>
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</tr>
<tr>
<td>Ukraine</td>
<td>Kharkov, Kiev, Lviv, Odessa</td>
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</tbody>
</table>
Table 2: List of Smart Cities

23.3 Selected market insights

23.3.1 Netherlands

Amsterdam (http://www.amsterdamsmartcity.com/#/en)

Amsterdam Smart City is a unique collaboration between the inhabitants of Amsterdam, its business sector, research institutions and government authorities. The aim of this project is to show how energy can be saved now and in the future and is a joint initiative between Liander (the operator of Amsterdam’s electricity grid) and the Amsterdam Innovation Motor in close cooperation with the City of Amsterdam.

Amsterdam Smart City stands for innovative technology, the modification of the behaviour of Amsterdam’s citizens and sustainable economic development. By bringing partners together and setting up small-scale local projects, Amsterdam Smart City makes it possible to test all new initiatives. In this way the most effective initiatives can subsequently be implemented on a large scale and as such Amsterdam Smart City effectively serves as an accelerator for climate and energy projects.

23.3.2 Switzerland

St. Gallen

The city of Sankt Gallen in Switzerland has deployed FTTH through the power utility provider, which is owned by the city. As a second step it is now rolling out a wireless LAN infrastructure. Thanks to the FTTH network, connectivity is not a problem as wireless access points can be easily connected to the fibre network at many locations in the city.

On its path towards being a Smart City, Sankt Gallen is also focusing on three main campaigns called the three-dimensional energy concept, which include mobility, heating systems and electricity.

See: http://www.stadt.sg.ch/home/raum-umwelt/energie/energiekonzept-2050.html

Although the energy consumption in most cities is increasing year by year, Sankt Gallen has set the target to decrease consumption from today’s 1490GWh to 1010 GWh by the year 2050.

The overall target of the three-dimensional energy concept is the reduction of primary energy input by 50% while reducing the output (= energy demand of customers) by 30% without causing negative impact on citizens and the local economy. The key enabler of this significant shift will be high energy efficient transportation systems and buildings.

Changing the energy mix (non-renewable primary energy: 3060 GWh down to 850 GWh, renewable energy: 225 GWh up to 770 GWh) will be achieved by investing in photovoltaics, geothermal energy, small water power plants, combined heat and power systems as well as waste heat.

To reach the specified targets, 150 activities have to be implemented. These ambitious targets cannot be achieved without implementing Smartness.
eZürich

Zürich has deployed an FTTH network in the city centre, which will be followed by a second phase to connect the rest of the city within the next few years. Throughout Switzerland, Zürich has become the most important ICT city in the country with the University and hundreds of companies working towards cutting edge ICT solutions. In addition, Zürich has been awarded the honour of being the city with highest quality of life worldwide.

The City Council decided to exploit the excellent infrastructure and the enormous innovation potential provided by the local ICT industry by developing a strategy focusing on e initiatives. The e-Zurich programme is the result.

e-Zürich makes interaction between the population and the Behörden simpler. Zürich, in cooperation with the ICT industry, has developed projects and strategies which make the city the top ICT destination. e-Zürich will provide communication technology and all its advantages to the city’s inhabitants. Zürich will evolve into one of the most advanced cities worldwide having the best and Smartest infrastructure.

In addition the city is working towards e-mobility initiatives and has set the target to reduce energy consumption from today’s level of approximately 5000 Watt to 2000 Watt per household. This initiative is called 2000 Watt society.
24 Final remarks

The thought of living in a Smart City is exciting. Who doesn’t dream of how easy life could be? A better quality of life and the realisation of efficient work?

However, realisation will come step by step. What seems to be revolutionary today will be commonplace tomorrow. Nevertheless, we are convinced that using technology to address today’s environmental issues is a promising path to follow towards achieving a clean and lasting earth.

We are motivated to contributing towards a better planet through developing the places where we live into being better places in the future.
25 Glossary

Big Data:
High-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making.

FTTH “Fibre To The Home”:
An exceptionally fast optical network which connects all households and business

Smart City:
A Smart City uses intelligent systems and information to increase efficiency, productivity, and ecology awareness; it reduces pollution and improves quality of life in a world of increasing urban complexity.

Smart Home:
Smart Homes and assistive technology means increased convenience and comfort as well as optimising energy consumption. The key electrical appliances and services are connected allowing them to be remotely controlled, monitored and accessed when necessary.

Smart Grid:
A smart Grid is an electrical framework that uses information and communication technology to gather and act on information in an automated fashion.

3D Printing:
Additive manufacturing or 3D printing is a process of creating three dimensional solid objects from a digital model.

Photovoltaic:
Is a method of generating electrical power by converting solar radiation into direct current electricity using semiconductors (solar panels) that exhibit the photovoltaic effect.