



Transform+

D4a.4 Evaluation Results of the Test Phase and the System-Architecture of the Pilot Application

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Executive Summary

In the context of the research project Transform+, a prototype of a platform for serving different types of data provided by heterogeneous organizations of a city and classified by diverse data protection needs was developed. The technical architecture of the “Smart Citizen Assistant” consists of different components to be able to ensure the highest flexibility in the use of data. Therefore SCA is to be understood as a data market place where different data types of different sources can be provided. Stakeholders of such a market could be different city administration organizations as well as their citizens. In this way a platform such as the SCA increases the efficiency in data usage in municipal departments and stimulates the citizens' participation.

In order to clearly understand the impact of deploying the smart citizen Assistant and create an example System-architecture, the smart citizen assistant has been deployed and is in operation in Seestadt Aspern, where it serves as the backbone of a mobile application (App), used by the residents in this rising district of Vienna.

This document is a summary of the experiences we have collected in the test phase so far and the system architecture of the pilot application.

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Abbreviations

| | |
|------|--|
| AIT | Austrian Institute of Technology |
| API | Application Programming Interface |
| ASCR | Aspern Smart City Research |
| BI | Business Intelligence |
| CSV | Comma Separated Values |
| DB | Database |
| DC | Data Concentrator |
| ICT | Information and communication Technologies |
| JSON | JavaScript Object Notation |
| KB | Knowledge Base |
| MDM | Meter Data Management |
| MDMS | Meter Data Management System |
| MQ | Message Queue |
| OGD | Open Government Data |
| PLC | Programmable logic controller |
| ReST | Representational State Transfer |
| SCA | Smart Citizen Assistant |
| SG | Smart Grid |
| SUL | Smart Urban Lab |
| UDA | Unified Data Architecture |
| UI | User Interface |
| XML | Extensible Markup Language |

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1 Introduction

Transform+ is a research project funded by „Klima- und Energiefonds“, as part of the Austrian research funding agency FFG. The goal of the project is to prepare and operationalize the contributions of the EU project „TRANSFORM“¹ in the city of Vienna. One of the outputs of the project will be implementation plans for pilot projects in "Liesing-Groß Erlaa" and "Seestadt Aspern" (Smart Urban Labs).

As part of this project, a "Smart Citizen Assistant" (SCA) is to be designed for Seestadt Aspern, which is a platform for making smart city data available to the residents and municipal departments. The aim is to provide a novel interface through which relevant data, provided by heterogeneous sources, which can be accessed individually and in a timely manner.

1.1 Project Status

As planned in the project proposal for Transform+, the work package 4A is working according to the planned schedule. As it can be seen in Figure 1, this deliverable is the fourth and the last deliverable of the work package, where the experiences of the test phase are described. The previous deliverables are available online².

| Meilensteine, Ergebnisse und Deliverables: | |
|--|---|
| Meilensteine | |
| M4a1 | Start der Smart Citizen Assistant Implementierung (05/2015) |
| M4a2 | Smart Citizen Assistant Prototype – Abschluss (11/2015) |
| Deliverables | |
| D4a.1 | Requirements Analyse und Szenariendefinition: Anforderungsanalyse und Beschreibung des Standes-der-Technik und deren Anwendbarkeit beim Entwurf des Smart Citizen Assistant (Dokumentation) (02/2014) |
| D4a.2 | Architektur und Design der Smart Citizen Assistant Schnittstelle: Definition und Beschreibung des Smart Citizen Assistant Prototype, grundlegende Design-Entscheidungen (Dokumentation) (09/2014) |
| D4a.3 | Implementierung: Prototypische Implementierung der Schnittstelle (Software) (05/2015) |
| D4a.4 | Evaluierungsergebnisse der Testphase: Beschreibung der System-Architektur und der beispielhaften Verwendung der Schnittstelle durch eine Pilot-Applikation (Dokumentation) (11/2015) |

Figure 1. An excerpt of the planned deliverables of the project and the current status.

¹ TRANSFORM: Transformation agenda for low carbon cities <http://urbantransform.eu/>

² Transform+ website <http://www.transform-plus.at/>

1.2 Purpose of this document

The key objective of this document is to sum up the results and the findings which were identified during the implementation of the SCA in a real environment. The planned implementation can be understood as an end-to-end test to prove the concept of the SCA as a data marketplace.

Therefore the document describes both, the implementation of the SCA platform in the smart urban lab at Seestadt Aspern and the integration of the pilot application. The pilot application was carefully chosen to reflect the innovative nature of the applications that can be built on top of SCA. The pilot application is an APP for the people living in Seestadt Aspern, who have declared their wish to be part of the research on urban labs, coordinated by ASCR (Aspern Smart City Research).

By using several data sources the pilot application is suitable to test different properties of the SCA platform as data market place in a city context. Special attention during the test will be paid to the question whether data and authentication credentials can be routed in a transparent way to and from several data sources or not. To answer this question positively is the key requirement for a flexible data market.

1.3 Contents of this document

This document is structured as follows. Section 2 presents an overview of the pilot application, where we describe the goals of the pilot and the key stakeholders. Section 3 presents the activities that were related to setting up the pilot application, including the resulting architecture of the overall system. In Section 4, we summarize our experiences of developing the SCA, using it in the pilot application and the lessons we have learned from the overall project.

2 Overview: Pilot Application

The pilot application for the Smart Citizen Assistant (SCA) is a smart meter mobile app, specially designed for the citizens of Seestadt Aspern, the urban living lab in Vienna. In this context, the SCA is used as the “backend” of the APP which provides different data collected from several organizational sources

2.1 Goals of Pilot Application

The goal of the pilot application is to enable the citizens of Seestadt Aspern to access the smart meter readings in their apartments, through a mobile application. From the perspective of this project and the Smart Citizen Assistant, this application is a demonstration of how the SCA can be utilized to share/publish even closed (personal) data through an adequate ICT infrastructure.



Figure 2. Screenshot of the pilot application, available in the app store.

2.1.1 Design a pilot architecture for the usage of SCA.

As SCA is a software component, that has to be integrated in the overall architecture of any application using it, the goal of the pilot phase was also to design a pilot architecture for integrating SCA.

Given the heterogeneity of the applications, that can be built based on SCA, the architecture is of course not suitable for all kinds of applications, but it should serve as an example for new mobile apps.

2.1.2 Demonstrate the accessibility of personal data through the SCA.

One of the main focuses of SCA is the proper dissemination of personal data through a data platform. In this context, it is important for the pilot application to demonstrate that it can serve as a window for “closed data”, as opposed to the open data platforms that are available in several cities already. Therefore the SCA clearly complements the existing open data platform of the city of Vienna³ and does not aim to replace it.

2.1.3 Publish machine readable data.

Many data platforms publish data, but not all of these can be automatically processed by the applications accessing these. The main reason for this is the format of data – data in PDF files for example are not easily accessible for an app developer, before these are pre-processed and stored in machine readable formats. The pilot application accesses data from the SCA in JSON format, which can be easily processed on the fly by the mobile application by calling the corresponding REST services – thereby providing the required credentials for calling these services.

2.2 Stakeholders

There are several stakeholders involved in the pilot application. We list the most important ones here, as similar stakeholders are likely to be involved in other applications of this type.

2.2.1 App Owner

The Aspern Smart City Research Gmbh & Co KG (ASCR)⁴ is the owner of the end-user application which is used as the pilot application for the smart citizen assistant. ASCR is a research company, which is exploring the concepts of smart city in Seestadt Aspern. It is expected that ASCR will release further mobile applications for testing different use cases in the fields of home automation, energy efficiency and participation, which will need different data types. In this context a flexible data marketplace will support these requirements in a useful way.

³ <https://open.wien.gv.at/site/>

⁴ <http://www.ascr.at/>

2.2.2 App Users

The citizens of Seestadt Aspern are not directly involved in the development of the App, but these are the end-users whose requirements are considered by the App. This group represents important stakeholders in the pilot application because their consent is required, before their smart meter data can be processed.

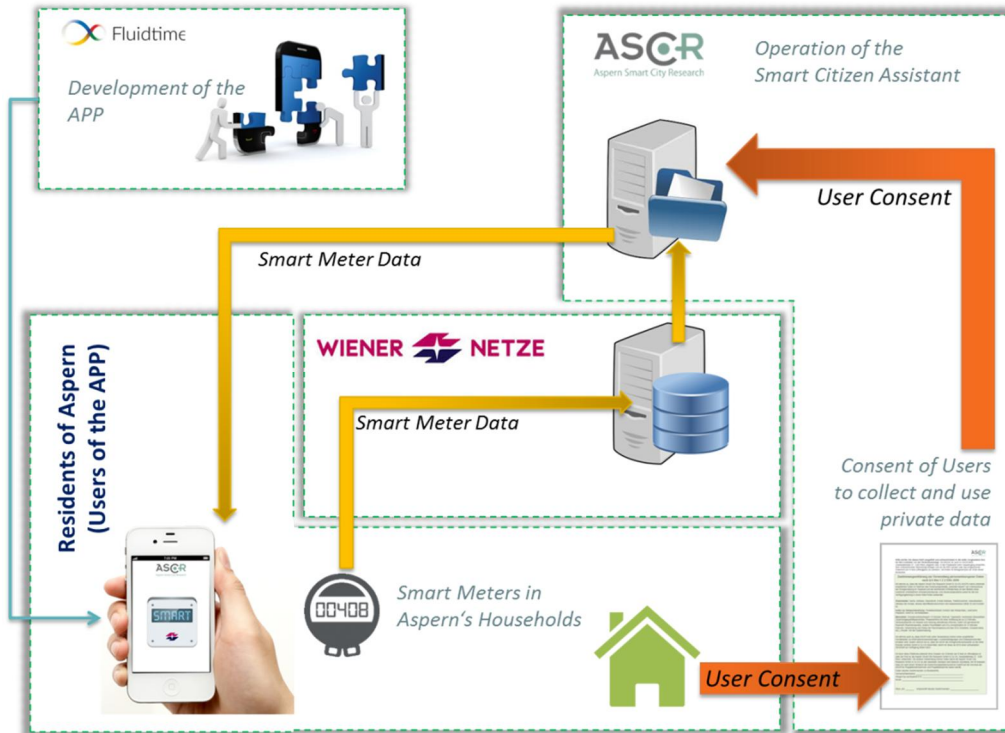


Figure 3. Involved Stakeholders and their roles in the pilot application

2.2.3 SCA Operator

The SCA runs in a central server, which is used as the backend of the APP. The server must therefore be hosted by an organization/company. For the pilot application, this role is taken by ASQR.

2.2.4 Data Publisher

The data that is served to the pilot application comes from the meter data management systems of Wiener Netze. These data are stored in the internal data bases and not publicly available. Only after the prerequisites are fulfilled (user has given consent and the user has provided the correct credentials), the data becomes accessible for the corresponding end-user.

2.2.5 App Developer

An external company takes the role of the app developer in this context. The company is able to access example data for developing the app. The actual visualization of the data within the app is not subject of this pilot study. Only the possibility of accessing the data through the SCA is considered.

2.2.6 Interaction of Stakeholders

As mentioned above a considerable number and different types of stakeholders are already interacting during the usage of one single mobile application. Therefore, this prototype is a good demonstration for a functioning data marketplace. It can be concluded that further application deployments will rise the number of participants strongly, which demonstrate the urgent need of a platform like SCA to provide data in a secure and a practical way.

2.3 Out-of Scope of Pilot Application

The full-fledged deployment and roll out of the smart citizen assistant is out-of-scope of this pilot phase. In particular, the following aspects are not in the scope of the pilot phase of SCA.

2.3.1 Data collection and preparation

SCA is not a data collection tool. It is also not a tool that can be used for preparing data to be distributed, e.g., quality check of data should be done by the publisher of the data. The pilot application assumes that the data already exists and the legal prerequisites for collecting the data have been fulfilled.

2.3.2 Integration of open data

As already discussed in previous deliverables, it is possible to use SCA to integrate open data sources such as the OGD platform in Vienna. However, this is not in the scope of the pilot, as we focus here more on the distribution of personal data through adequate infrastructures.

2.3.3 Platform for external third party data publishers

The pilot installation of SCA is not open for third party data publishers and it is not available for adding new data sources for productive use. The main reason is that the prototypic implementation of SCA has not been tested for high volume data applications. And the goal of this project was not the development of a marketable productive system, which can be readily used by third parties.

3 Experiences: Setting up the Pilot

The pilot application – after its conception and planning phase, was set up to serve Smart meter data from existing Wiener Netze infrastructures to a mobile APP, that visualizes the energy consumption of the corresponding user, by using several data sources in the ASCR field of research.

3.1 Prerequisites

In order to use the SCA in the context of the APP, some preconditions had to be fulfilled. Although these activities were not carried out as part of the Transform+ project, these are listed here for the sake of completeness and generalizability of the experiences.

3.1.1 Notification of Data Application to Authorities

The Austrian data protection authority (in German Datenschutzbehörde) is a governmental authority charged with data protection. The data protection authority is the Austrian supervisory authority for data protection, the equivalent of a national data protection commissioner in other countries.

Before any private/personal data can be processed, the processing organization must notify the authority before commencing a data application. In the case of the pilot application, this was done by the involved organizations Wiener Netze (for collecting the smart meter data) and ASCR (for using the data in research projects).

This step is considered a prerequisite for any personal data application and therefore not handled by the SCA. SCA assumes that this is already the case, when data sources are registered for data distribution.

3.1.2 Data Storage and Services

The basic idea of SCA is not to store the data, but only serve these to the right stakeholders following all the necessary precautions and security measures. This means, one of the prerequisites for the adoption of SCA is the availability of the data in some data storage, which is accessible to the outside world through web services.

Future versions of SCA could also have their own data storage capabilities, but this is not yet the case. This is therefore considered a prerequisite at the moment.

3.2 Hardware and Software Requirements

As the SCA is a central server software component, it requires dedicated hardware and software resources for its deployment and adequate infrastructure management to guarantee its availability. For the purpose of the pilot application, new hardware was bought by ASCR, which hosts the application. The hardware and the software is operated by Siemens IT services, on behalf of ASCR.

The server currently runs Windows Server 2012 R2, with new features and enhancements in virtualization, management, storage, networking, virtual desktop infrastructure, and access and information protection.

In order to add to the security of the overall application, new SSL certificates were deployed on the server to provide privacy and data integrity between two communicating computer applications: in this case the server running SCA and the app being used by the end-user. The connection is secured by TLS (Transport Layer Security) to enable a private connection for transferring personal data through the network.

3.3 Selection of Pilot Users

The process of selection of the pilot users was straight forward, although the actual implementation of the plan was not that trivial. All residents of one of the research-buildings (only a few buildings are involved in ASCR research program) in Seestadt Aspern is potentially a pilot user of the planned app. And as the APP used SCA in the backend, we consider (for the sake of the pilot phase) these users to be the users of SCA.

3.3.1 Collection of end-user consent

In order to “motivate” a potential user to be a real pilot user, several activities were carried out by ASCR, the research organization in Aspern. As this process was conducted without the involvement of Transform+, we cannot describe the details here.

However, it is noteworthy to mention that all the users, who agreed to be users fo the APP signed a legal consent, that their smart meter data can be processed as part of the research project. This process is planned and executed by ASCR.

3.3.2 User Administration

After the users provide their consent, it is important that the SCA “knows” the users, who may access their personal data through the SCA. This is done by representatives of ASCR through a user administration component, deployed as part of the SCA.

The users have the right to withdraw their consent at any time. This means, the SCA must be updated with the latest user information about the provided consent as soon as these are binding. SCA provides features to update this list.

3.4 Licensing

A license is a legal instrument (usually by way of contract law, with or without printed material) governing the use or redistribution of intellectual property. When publishing data on the SCA, it is important to consider the conditions under which the APP may consume the data and what the obligations of the data publisher are.

3.4.1 License for WN data

In the pilot application, as the only user of the data is a single application – the licensing issues have been regulated through the end-users consent. The data is not available for usage for other apps and therefore, there is no need for a license model.

3.4.2 License for SCA

The Smart Citizen Assistant itself is a software component, which has been made available for unlimited use to ASCR in the context of this pilot application. This gives both ASCR and Transform+ a good opportunity to test the concepts of SCA and test it in a field application – under some closed environment and for a set of selected users.

3.5 App Development

The development of the app for visualizing the smart meter data is an important step of the pilot application but not in scope of the Transform+ project. An external company has taken the role of developing the APP. The app is able to access all the required data through the SCA. Further processing of data is not in the scope of SCA.

3.6 Deployment Architecture of SCA

The smart citizen assistant has been deployed in ASCR servers and is connected to the Wiener Netze Systems in the backend, pulling the smart meter data as required. The deployment architecture of the SCA is depicted in Figure 3, where the distribution of the functionality between the ASCR infrastructure and the Wiener Netze Infrastructure is clearly marked.

In this architecture (see Figure 4), Wiener Netze is simply an example of a data source for one mobile app. In a full-fledged deployment of the SCA, several components and systems of this type will be “contacted” by the SCA to gather the required data – demanded by different APPS.

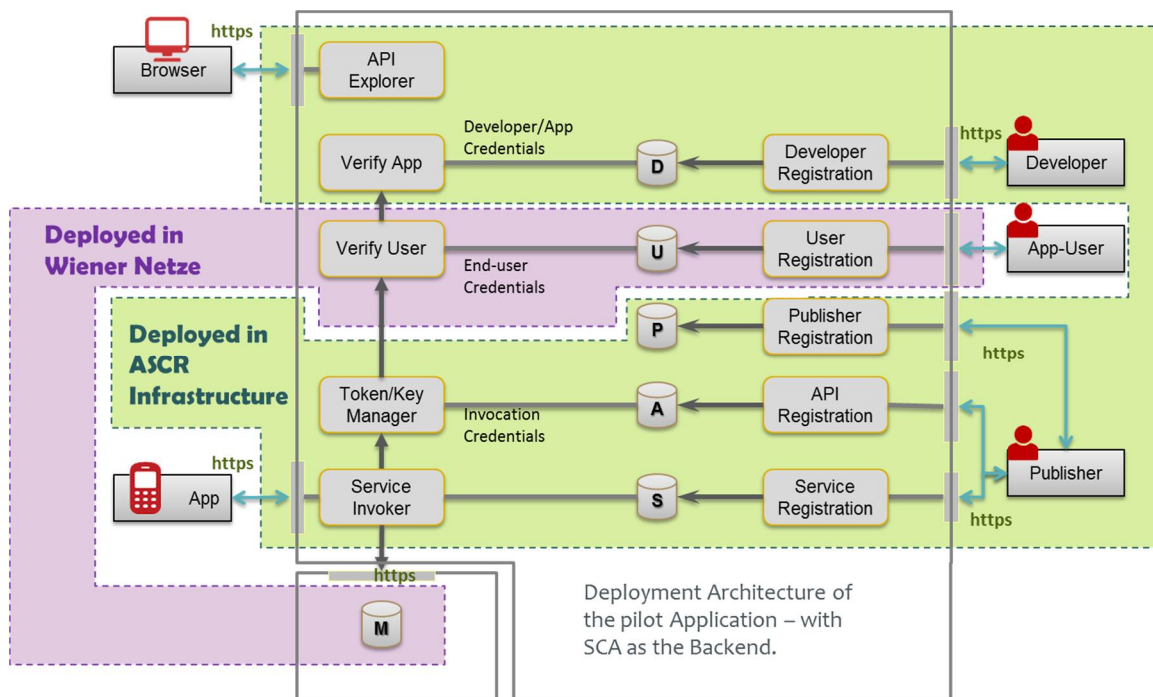


Figure 4. Pilot deployment architecture of SCA -components distributed in ASCR and Wiener Netze.

Developer credentials and end-user credentials may be reused across apps. However it is important to note that the end-user credentials for personal data are managed and administered by the data publisher and it not part of SCA. This enables a fully distributed deployment of SCA, where the data “owners” have full control of what “flows” through the SCA and in which granularity the data is delivered.

4 Summary of Experiences

In general, the smart citizen assistant has been successful in generating new thoughts and provoking ideas for data-driven applications—especially considering personal and private data distributed through a central platform. There are several key findings of the project, which have the potential for further research and relevance in many other domains. We summarize the lessons learned in this Section.

4.1 Potential Applications of SCA

As an exchange platform between users, businesses and municipal organizations SCA is a fertile ground for new innovations. The development of novel applications (for the public) is necessary for the market-driven economy, because a platform like SCA can boost the innovativeness of all interested participants in the city.

4.1.1 SCA as a Digital Marketplace

In this way, it can be expected that SCA fosters the participation of citizens in eGovernment solutions. City organizations gain advantage through the exploitation of distributed innovation networks. For companies, SCA allows economic growth through new products and services driven by data.

4.1.2 Central Access to Distributed Data Sources

The e-participation project of the Austrian Institute of Technology (AIT) indicates that there is currently no uniform arrangements for the identification of citizens in the context of electronic citizen participation. Therefore, the SCA concept leaves the question of the identification / authentication of the respective data providing organization. By doing so, an inter-agency agreement as a single solution is not required. The SCA concept keeps hurdles of data access as low as possible in relation to solutions such as the citizen card. The goal is to use simpler authentication methods but the relationship between security level and sensitivity of the information has to be respected in any case.

4.2 Trusted and Trustworthy SCA Operator

For a smooth transition from a research project to a productive system, a trusted and a trustworthy operator must take over the role of the platform owner. Unified data deployments across organizational boundaries are only possible when the participant organizations trust the platform owner and are ready to use the platform to publish their data.

Following the SCA approach, only a narrow organizational layer for information security is placed on top of the individual data pots within the organizations. The SCA forwards them to the authorities concerned. Data security, as well as the data itself remains present at the respective responsible organization. At a local level this means that the SCA has the potential in contributing to the „orchestration of the nervous system of the Smart City Vienna" as postulated in the IT Governance of the City of Vienna⁵. For this vision to be a reality, the city must be willing to take the role of the SCA operator.

4.3 Potentials for Further Research

The basic idea followed by SCA in the field of urban data management is that, there is a need for a platform which enables intermediaries to collect data from multiple sources, combine and deploy innovative findings in the form of new applications. As a driver of such an approach by way of example the following topics should be explored further.

- Complex issues in public administration require decision-making and monitoring systems that ensure that certain targets are met. A platform such as SCA can be a medium for sustainability of public administration, which can contribute to data transparency and continuous monitoring.
- City Administration Processes must always be designed as efficiently as possible and with little effort. Linking suitably collected, structured information and presenting these in combination with the overlying processes, precisely offers this possibility for recognition of the efficiency.

4.4 Roll-out of SCA in the City

The biggest hurdles of rolling out a platform like SCA for the whole city do not lie in the technology in use and not in the implementation status of the platform. A lot of administrative and governance questions must be answered by the responsible stakeholders in the city before such a platform can be adopted.

- What is the strategy of the city in terms of administration data that cannot be shared through public "open data platforms"?
- Which are the stakeholders in the city, who would profit from such a platform – directly and indirectly through citizen participation and data-driven economy?
- How can the developers and businesses in the city be motivated to use the platform and create added value to the citizens?
- Etc.

⁵ https://smartcity.wien.gv.at/site/files/2014/09/SmartCityWien_FrameworkStrategy_english_doublepage.pdf

5 Summary and Conclusions

Activities in the work package “WP4a” have bundled the results of the research under “Smart Citizen Assistant” (SCA). This represents combined work results and deals with the question of how data sets from different community organizations, citizens, companies or regions in the city administration can be made available to the public – thereby improving the services of the involved institutions.

As a result, the concept of SCA pursued the creation of an information marketplace, which can be used in its realization as a meeting place for city dwellers, urban providers of data (such as municipal departments) and application developers.

It is essential that not only open data is collected in this marketplace, provided or to be processed, but also personal information can be used under adequate safeguards. The SCA concept offers its users a platform on which information remains secure, can be centrally accessed instead of having to laboriously search for these in each city administrative organizations. The SCA enables all involved stakeholders (data publishers, application developers and data consumers) to publish and access data in a controlled manner.

The prototypic implementation of the SCA has proven its technical feasibility to act as a platform to serve secure and personal data in the context of a smart city. The pilot application has proven its practical use in a real-world application.

The smart citizen assistant helps in raising the awareness among the data publishers and developers about the value of personal data in the smart city context. It is in the responsibility of the city administration to set up proper legal and technical framework for rolling out such a platform for the whole city.

The following measures are considered to be essential for the practical implementation of an urban information marketplace:

- The data provision has to be formalized by an organizational framework and licensing models in order to ensure clear responsibilities and rights.
- The city of Vienna has to act as a neutral intermediary organ, so that data can be shared across organizations.
- Individual departments of the city must be motivated to provide data on the SCA platform, so as to give this the necessary impulse for further use. The fact that the respective data owners remain in full control of the data can be used as an additional argument.
- In order to secure the SCA platform the necessary drive for long-term operation, it should be incorporated in the Smart City governance process and established itself as a support for the Digital Agenda of the City of Vienna.

Now, we do not pretend to have achieved perfection, but we do have a system, and it works.

The Day the Earth Stood Still (1951)