

Facilitating Eco-Systems for Smart Cities through Reference Architectures

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OVERVIEW

- Data for Smart Cities
- ICT Reference Architectures for Smart Cities
 - Research within the Triangulum Project
- Standardization Activities
 - MOU SCC EIP
 - DIN SPEC 91357 Open Urban Platform
- Conclusions



Data for Smart Cities

FIRST OPEN DATA PORTAL IN GERMANY

Open Data Berlin

- Concept and realization by Fraunhofer FOKUS
- Deployment of the backend system - CKAN
- Analysis of various Open Data aspects in a corresponding study
- Definition of a Meta-data Schema
- Transfer of the pilot to Berlin Online towards a sustainable Operation
- <http://daten.berlin.de>

The screenshot shows the Berlin Open Data portal interface. At the top left is the logo 'BERLIN OPEN DATA'. To the right are navigation links: 'Nutzungsbedingungen | Glossar | Suche | FAQ | Links | Login | Registrieren'. Below this is a search bar with a 'Suchen' button. A secondary navigation bar includes 'Startseite', 'Datensätze', 'Dokumente', 'Anwendungen', and 'Interaktion'. The main content area is titled 'Datensätze' and features a 'Datensätze filtern' dropdown menu. A featured dataset is 'Berliner Wochen- und Trödelmärkte 2013', with details: 'Wochenmarkt, Trödelmarkt, Flohmarkt, Antikmarkt', 'Kategorie: Wirtschaft', 'Aktualisiert: 18.03.2014', and 'Tags: Simplesearch'. Below it is another dataset: 'Berliner und Brandenburger Volks- und Straßenfeste 2013'. On the right side, there are sections for 'Die neuesten Datensätze' and 'Die neuesten Dokumente'. The 'beim Berlin' logo is visible in the top right corner of the page.

ENERGY OPEN DATA OF VATTENFALL

Netzdaten Berlin

- Since December 2012: Pilot/Prototype-Portal of Vattenfall Europe on Open Data regarding the Electrical Grid of Berlin
- <http://www.netzdaten-berlin.de>
- Strong push towards Open Data from Industry
- 93 Datasets
 - Electricity Supply
 - Balance Sheets
 - Connections with the Grid
 - Coverage Area
 - Electrical Grid Structure
 - ...
- Concepts and realization by Fraunhofer FOKUS

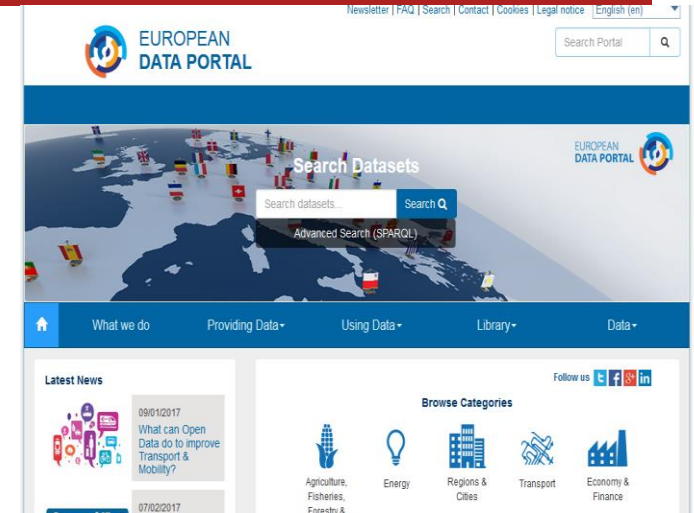
Startseite Daten Apps Über dieses Pilotportal Impressum

Netzdaten Berlin - das Pilotportal

Herzlich Willkommen auf dem Open Data Pilotportal des Berliner Verteilungsnetzbetreibers Vattenfall Europe Distribution Berlin GmbH. In Kooperation mit dem Fraunhofer Institut FOKUS, das Konzepte, Technologien und Lösungen rund um das Thema Open Data entwickelt, wird auf diesem Portal das Datenmaterial zum Berliner Stromverteilungsnetz als Open Data veröffentlicht. Wir hoffen, dass sich aus den Daten des Stromnetzes der größten deutschen Metropole interessante Anwendungen ergeben und freuen uns auf den Dialog mit Ihnen. Gerne können Sie uns unter info@netzdaten-berlin.punkt.de kontaktieren.

EUROPEAN OPEN DATA PORTAL

- European Data Portal (Pan European Open Data Portal)
 - 01. Jan. 2015 to 28. Febr. 2018
 - <https://www.europeandataportal.eu/>
- Open Data from 39 European states are captured and made easily searchable and reusable
- Fraunhofer FOKUS is part of an international consortium towards establishing the most challenging Open Data platform world wide
- As one of the main technical partners, Fraunhofer FOKUS develops various components as for example the data register and various harvesting mechanisms



GOVERNMENTAL DATA

Official Pilot of the German Ministry of Internal Affairs GovData.de



- The Pilot/Prototype is officially online since the 9th of February 2013
- <http://www.govdata.de>
- Development and Improvement of the Prototype
- Different Types of (Open) Data
 - Datasets
 - Documents
 - Applications
- Focus on free Licenses
 - Datenlizenz Deutschland (de-dl, ...)
 - Creative Commons (cc-by, ...)
 - ...





ICT Reference Architectures for Smart Cities

GOALS OF AN ICT REFERENCE ARCHITECTURE

The main goals of such an ICT Reference Architecture are as follows:

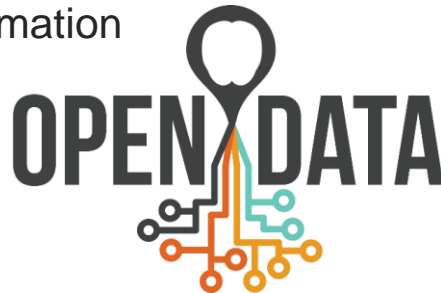
- Provide a **unified view and understanding on the ICT strategies** of the involved cities
- **Identify interfaces** for communication between the involved components
- Enable the **accommodation of legacy systems** into the ICT Reference Architecture



GOALS OF AN ICT REFERENCE ARCHITECTURE

...

- Enable the **exchange and interoperability** of various components and/or software packages along the identified and **standardized interfaces**
- Define the ICT Reference Architecture and interfaces in a way **that Open Source components can be used**, in order to **enable cities and communities to get independent from particular vendors**
- Put **Open Data at the heart of the ICT Reference Architecture** as a concept for sharing data and information

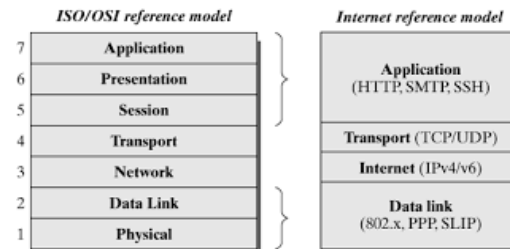


open source

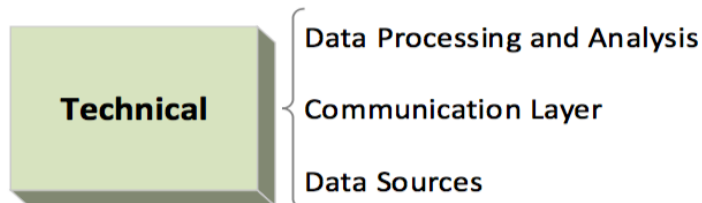
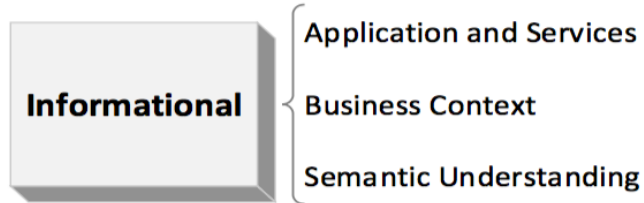
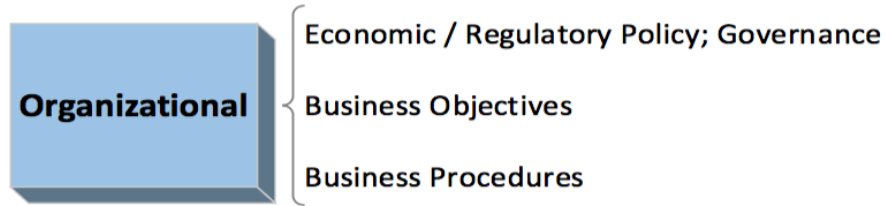
GOALS OF AN ICT REFERENCE ARCHITECTURE



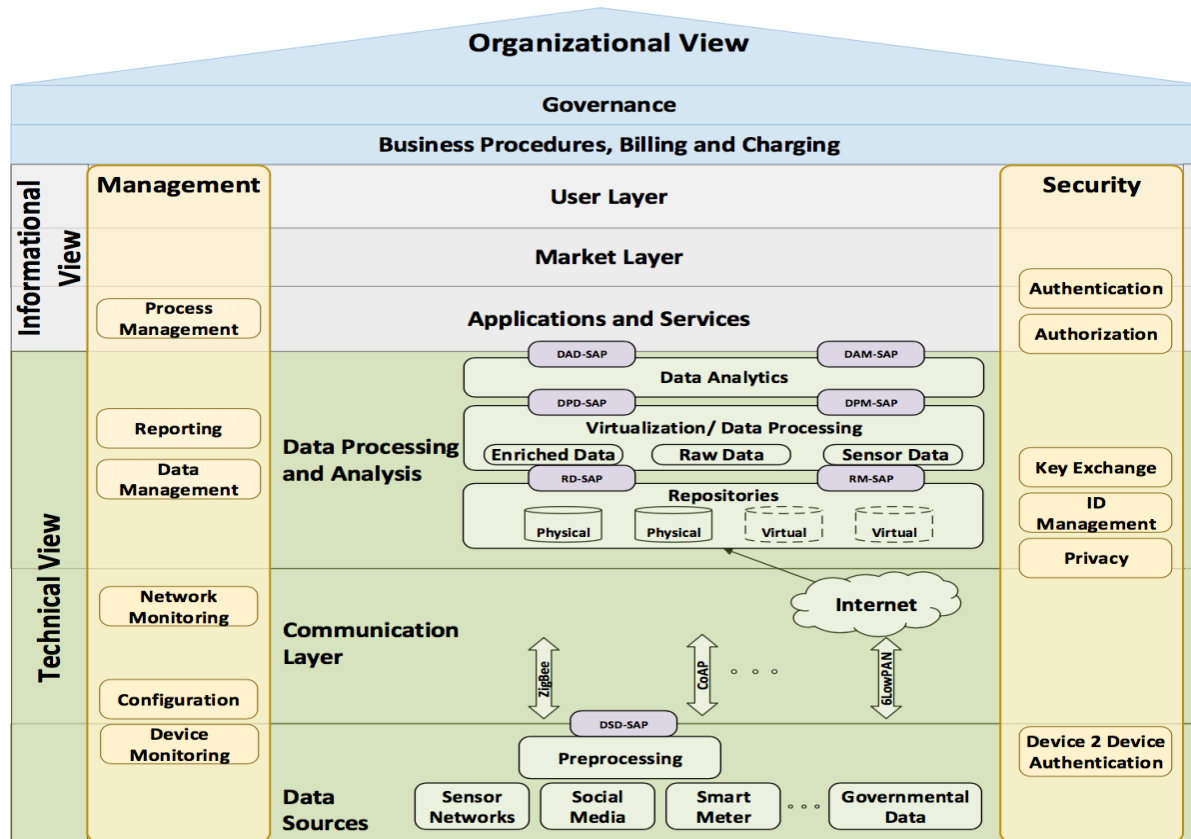
-
- Follow the example of the extremely successful Internet/Telekom Reference Models – TCP/IP and ISO/OSI layered models
 - Enable **reuse** of the **Triangulum** components and/or solutions by cities participating in the project but also by cities outside the consortium
 - Contributing to **Smart Cities standardization** at e.g. ISO or ETSI by proposing parts to the standardization bodies



VIEWS ON THE TRIANGLUM ICT REFERENCE ARCHITECTURE



TECHNICAL VIEW ON ICT REFERENCE ARCHITECTURE



SERVICES BETWEEN LAYERS OF THE ICT RA

- Services ensure that the ICT Reference Architecture has the capabilities for enabling the *replicability* of ICT solutions
- based on the concept of *services* and *service access points* (SAP)
 - used to describe the capabilities of a specific layer within telecommunication networks
 - concepts will be extended to several systems (i.e. entities in different (sub-) systems)
- each layer of the emerging ICT Reference Architecture may access the services of the other layers through the layers' service access point



SERVICES BETWEEN LAYERS OF THE ICT RA

General:

- (N)-services describe the *capabilities* of the (N)-layer that are available to other layers
- The services are based on *discrete* events that describe the information flow between the (N)-user and the (N)-layer
 - An event consists of passing a *service primitive* from one layer to the other through a *service access point* associated with an (N)-user
- A service may have one or more related primitives that represent the activity that is related to that particular service

MAPPING OF STANDARDS TO SAP

After proceeding to a specific SAP, the belonging document presents a brief description and layer connections of the SAP along with common protocols that are used for the task that specific SAP performs, together with their advantages/usage (An example is given below).

Cloud Control Protocol (Stack)	Advantages
OpenStack Rest API + [HTTP/IP/...]	Pretty much standardized, open, rough mapping to other cloud providers (Google, Amazon) existing
SOAP / HTTP (also SMTP, TCP, or JMS)	Platform and language independent, very simple XML format for messaging
CORBA	Wide language and platform support, scalability (can handle both small and large number of objects), open standard
HTTP(S) / [TCP + TLS] / WiMAX or UMTS or LTE	control via mobile devices, works similar as the one above; use of wide range, high overhead/ reliable wireless protocols
Database/Data warehouse Control Protocol (Stack)	Advantages
SQL commands	well established, also distributed, as defined in the Distributed Relational Database Architecture (DRDA)
Open Network Computing (ONC) Remote Procedure Call (RPC)	

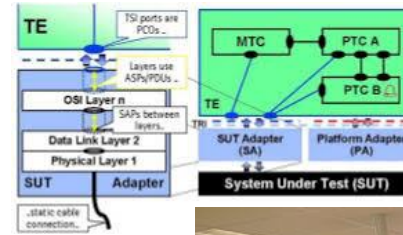
Further details of the protocols can be attained from the Protocol Details section.

Document Map ▾

- Contents
- ☑ Overview of SAPs
- ☑ Protocol Details
 - Protocol Template
 - MQTT (Message Queue Telemetry Transport)
 - CoAP
 - DDS Data Distribution Service
 - RTP (+ RTCP) Real-Time Transport Protocol, SRTP, DCCP
 - FTP File Transfer Protocol
 - Real Data Transport (RDT)
 - UMTS 3G ?
 - WiMAX
 - LTE
 - Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH)
 - BACNet
 - ModBus
 - Soap
 - Open Network Computing (ONC) Remote Procedure Call (RPC)
 - Lightweight Directory Access Protocol (LDAP)
- ☑ Security Considerations in Detail
- SAP Changes in RA from Del. 6.1

QUALITY ASSURANCE: CONFORMANCE & INTEROPERABILITY

- Conformance Testing of the SAPs
 - i.e. Testing of the Standard Protocols at the SAPs
 - Many available test suites for various protocols
 - SIP - TTCN-3 ETSI
 - IPv6 - IPv6 Ready Logo
 - 6LowPan
 - SOAP, HTTP, 3GPP, LTE ... TTCN3
 - ...
- Interoperability Testing at the SAPs
 - e.g. ETSI Interop PlugTests



MAPPING OF REAL MODULES FROM EUROPEAN CITIES

Smart gateway introduction and energy management

PICTURE REMOVED –
PROJECT IS STILL IN THE
EXECUTION PHASE

Big Data Analytics

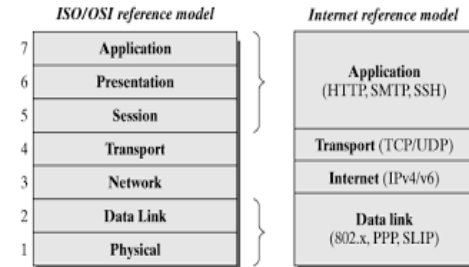
PICTURE REMOVED –
PROJECT IS STILL IN THE
EXECUTION PHASE



Standardization Activities

STANDARDISIERUNGSAKTIVITÄTEN

Memorandum of Understanding: Towards Open Urban Platforms for Smart Cities and Communities



DIN SPEC PAS Konsortium 91357 „Referenzarchitekturmodell Offene Urbane Plattform (OUP)“

MAIN GOALS OF THE MEMORANDUM OF UNDERSTANDING

- **Ambition to enroll cities, infra-structure and service companies, telecommunications and utilities to;**
 - Work with the partners of this Memorandum of Understanding
 - by 2018, create a strong EU city market for Urban Platforms
 - by 2025, ensure that the market of 300m residents of EU cities use Urban Platform(s) to manage their business with a city
 - and that the city in turn drives efficiencies, insight and local innovation through the platform(s)
- **To meet the above challenges and to deliver on these ambitions of the Memorandum of Understanding Group, the involved partners agree to supporting the work of this group**

PARTNERS

- **Partners:**
 - Industry
 - Academia
 - Industrial Research
 - Small Mid-size Enterprises
- **Among others** - SAP, Deutsche Telekom, Fraunhofer FOKUS, ...



WORKING STREAMS

Working Streams:

- WS1: Standards & Standardization
- WS2: Reference Architecture & Design Principles
- WS3: Scale (Market Perspectives, Business Models, Extend Reach, Collaboration, PMO...)

OVERVIEW: DIN SPEC OUP

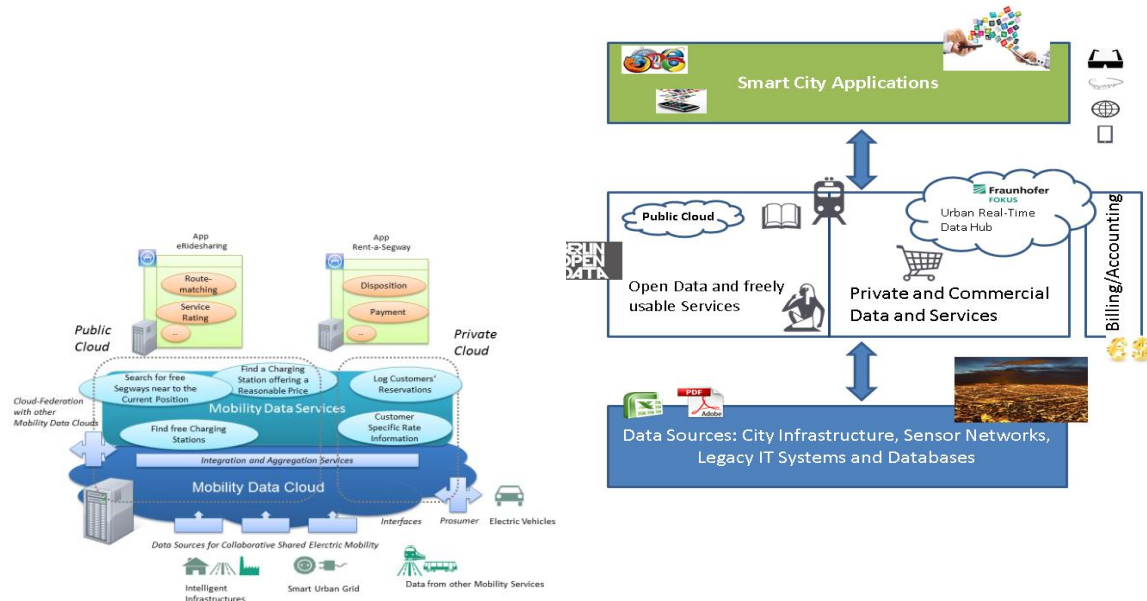
Key points:

- Start in November 2016 → Final voting is in a week from now
- More than 10 partners (cities, municipalities, industry, research, automotive, software, network providers ...)
- Goals: Open Urban ICT Reference Architecture for the German market
 - Open Interfaces
 - Layers for Communication and Data Processing
 - Security, Privacy ...
 - Use Cases

CONCLUSIONS

MoU SCC + DIN OUP + Triangulum ICT RA → OUPplus

- Modelling
- Testing
 - Security
 - Conformance
 - Interoperability



CONTACT

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