



Security & Trust in Smart Cities

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Overview

- General Intro
- Smart City / Digital Trust Activities
- Quest for Specific Smart City Activities
- Quest for Corresponding Digital Trust
- Quest for Action

- **Research Center "Energy and Environment"**
 - The Research Centre "Energy and Environment" acts as coordination platform for the interdisciplinary networking.
- **Research fields**
 - Energy active buildings, settlements and spatial infrastructures
 - Sustainable and low emission mobility
 - Climate neutral, renewable and conventional energy supply systems
 - Environmental monitoring and climate adaptation
 - Efficient utilisation of natural resources
 - Sustainable technologies, products and production

- **Research Center's foci with high ICT-involvement**
 - Modeling and Simulation
 - Distributed Automation Systems, Intelligent Housing
 - Energy Efficient Cloud Computing
 - Environmental Informatics (Doctoral College)
 - ICT for Smart Grids, Smart Metering, e-Mobility
 - Project SEMERGY (Simulation in Building Physics for Energy Savings using Ontologies)

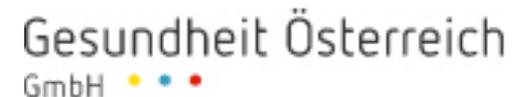
SBA Research-COMET Center

(COMET=Competence Center for Excellent Technologies)

- Academic institutions in the area of IT-Security Research:



- Some of our relevant partner companies:



Research Areas

Area 1 (GRC): Governance, Risk and Compliance

- P1.1: Risk Management and Analysis
- P1.2: **Secure BP Modeling, Simulation and Verification**
- P1.3: Computer Security Incident Response Team
- P1.4: Awareness and E-Learning

Area 2 (DSP): Data Security and Privacy

- P2.1: **Privacy Enhancing Technologies**
- P2.2: Enterprise Rights Management
- P2.3: Digital Preservation

Area 3 (SCA): Secure Coding and Code Analysis

- P3.1: Malware Detection and Botnet Economics
- P3.2: Systems and Software Security
- P3.3: Digital Forensics

Area 4 (HNS): Hardware and Network Security

- P4.1: Hardware Security and Differential Fault Analysis
- P4.2: Pervasive Computing
- P4.3: Network Security of the Future Internet

Smart City / Digital Trust

Smart Cities entail both

a) the application of existing technologies in new ways

and

b) the development and application of new technologies, including sensor, communication and analytical technologies and design solutions to urban infrastructure such as energy, water and transport systems

Source: Science Foundation Ireland: Priority area K: Smart Cities Action Plan

Smart City / Digital Trust

- Smart Cities is about to conceive “the human habitat as a network and make physical and digital worlds compatible”.
- Six categories of network of infrastructures:
 - Information
 - Water Cycle
 - Energy
 - Matter Cycle
 - Mobility
 - Nature (Streets, Gardening, Parks, Agriculture, Forest)
- People having kinship/work relations that forms the social organisation of a City
- A City is made up as a System of Systems made up of: Environment, Infrastructures, Public Space, Nodes, Information and Citizens

The promise of big data for cities

- Real-time information and services for citizens
- More transparency and accountability of government and services
- Enhanced participation in city life
- Better models and simulations for future development; enhanced understanding of cities
- More efficient, competitive and productive service delivery; better run cities
- Able to tackle particular issues more effectively; enhanced quality of life
- Stimulate creativity, innovation and economic growth

Smart City / Digital Trust

What is trust?

„... the willingness to be vulnerable, based on positive expectation about the behavior of others.“¹

→ “Trust has an economic incentive, it avoids the use of costly measures that guarantee assurance in the absence of trust-enabled interaction. We note that assurance is the established means of realizing ‘IT security’ “. ²

What is **transparency**?

Julian Assange: “The goal is justice, the method is transparency”

→ Access to information about a party enables others to exercise control over the transparent party.

This control enabled through transparency is also what makes transparency a key privacy principle.

When the transparent party is the government and the recipient of information

is the general public, this public control of the government may be viewed as the essence of democracy ³

¹ Mayer, R., Davis, J., Schoorman, F.D.: An integrative model of organizational trust. *Academy of Management Review* 20(3), 709(734 (1995)

² M., Huth and Jim Huan-Pu KUO: PEALT: A Reasoning Tool for Numerical Aggregation of Trust Evidence, Imperial College, 2013

³Frederick Schauer: Transparency in three dimensions, *University of Illinois Law Review*, volume 2011, number 4 in Tobias Pulls: *Privacy-Preserving Transparency-Enhancing Tools*, PhD Dissertation, Karlstad University

Smart City / Digital Trust Activities

- Smart Cities rely on (private) cloud services.
- (Blind) trust in services vs. testing the cloud (e.g. geolocation of a service, co-location of different services):
Cloudoscopy
- Fingerprinting of anonymized data

Cloudoscopy

- 1. IP address deanonymisation:** Expose the internal IP address of a victim instance
- 2. Hop-count measuring:** measure its hop-count distance from adversarial cloud instances
- 3. Co-residence testing:** test to find a specific instance which is close enough to the victim (e.g., co-resident) to allow (denial of service or side-channel) attacks.

Quest for Specific Smart City Activities

Solving Privacy, Security, Transparency, Trust
Issues for collaborative solutions leading to:

- Citizen participation for creating the necessary synergetic effects
- Smart ecological and economical optimization of the “systems of systems”
- Better decision support based on the available information / big data in smart cities

Quest for Specific Smart City Activities

Re-ordered the given list according to priorities

- Urban Data Provision for enterprises, citizens, researchers, ...
- Community Services, e.g.:
 - bringing together demand and supply for voluntary community services, paid services (new micro business opportunities such as 'I'll buy your groceries'), emergency response, ...
 - improving the city's community services (response time, personalization, convenience 24/7, ...)
- Smart Urban Planning and Management, e.g.:
 - supply and waste management delivered according to needs, not fixed schedules
 - mid and long term city planning and management according to 'observed' instead of 'guessed' changes
- Health & Wellbeing, e.g.:
 - spatial/temporal information / advice / solutions regarding allergenes, pollution / noise, ...
 - integration of hospital / doctor's office / ambulant / voluntary care
- Smart Infrastructures, e.g.:
 - Smart buildings (contributing to the above-mentioned applications such as energy, health, ...)
 - Smart lighting (LED based, customized to contexts ...)
- Mobility, e.g.:
 - better multi-modal transport, better (personalized) traffic control
 - scheduling of parking, EV (electric vehicle) charging stations, ...
- Energy, e.g.:
 - integrated E-Energy solutions @ city scale (bringing together local energy production & relaxed-constraints consumption & innovative energy storage (e.g., in EVs))
 - community measures for changing energy consumption behavior (gaming/incentives etc.)

Urban Data Provision for enterprises, citizens, researchers, ...

- Releasing data allows to use the data to develop services (Open Data)
- Less need for central planning of activities
- Bottom-up approach to innovation
- Active involvement of people living in the city

Example: Linked Open Data

- Based on (linked) Open Data new community services can be triggered
 - Some might than be commercialized or offered by the (local) government
- Transparency as enabler for strengthening trust

Example: Sensors

Sensors can help to avoid unnecessary work such as

- Empty trash only when needed (vacation times, etc.)
- Detect water pipes leakages
- Monitoring number of passengers in public transport and real-time response to increased demand
- Data-driven planning of bike routes, etc. and empirical evidence whether improvements really work

Quest for Corresponding Digital Trust

- Applied and empirical computer security explores and describes the hidden and secret properties of large systems.
- Design, implementation or operations errors cause security vulnerabilities that can destroy trust in a service or in an organization.
- We thus need to observe global systems (Facebook, Linked-in, etc.) and local systems (building automation, mobile applications).
- The interaction between the digital world (e.g. mobile phone apps) and the real world (e.g. car2go reservations, taxi apps) need to be explored and vulnerabilities exposed.

Quest for Action

- Need to strengthen computer security to solve real-world challenges. Need of applied research in this area.
- Research ethics
 - May limit useful research
 - Research may cross boundaries that should not be crossed
- Interdisciplinary research (automation systems and security, law and security etc.)
- Societal aspects such as security monitoring vs. democracy (e.g. investigative journalism needs protection of sources. Mass surveillance endangers the protection of sources and thus Mass surveillance could endanger an important aspect of democracy)

THANK YOU FOR YOUR ATTENTION!