

Cyber-secure experimentation platform

@ K A N G A S



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Summary

- 5K is an EU funded "smart city" university research project
- Key issues in today's presentation:
- Cyber security is an important part of a smart city strategy, including protection of IoT devices and managing access to personal data
- Smart city ecosystems require active orchestration
- In this project, integration of several IoT devices in a closed network behind a "home gateway" and external interface was investigated, instead of a typical open cloud system



Agenda

- Background of Kangas, city strategy and 5K project
- Kangas ecosystem observations
- Smart home device control platform prototype by 5K



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Jyväskylä Kangas development project

- Objective of city of Jyväskylä: the former Kangas paper factory area to be the "the most cyber secure residential area of Finland" within 2015-2040, with over 5000 residents and 2000 jobs (3000 residents by 2025)
- City bought the land from the factory, and will set conditions to constructors



University of Jyväskylä and IT faculty

- University of Jyväskylä (JYU) is featured in the top 300 of QS World University Rankings.
- The faculty of information technology has (10/2016) over 2500 graduate students, 172 postgraduates and ca. 180 staff members.
- Core fields of JYU:
 - Learning, teaching and the learning and growth environments that support development
 - Basic natural phenomena and mathematical thinking
 - Languages, culture and communities in global change processes
 - Physical activity, health and wellbeing
 - Information technology and the human in the knowledge society (including Cyber security as a focal area of development)



Objectives of City of Jyväskylä at Kangas

Some of the central objectives of the city ICT strategy of Kangas:

- Multiple supplier model with open architecture and standard interfaces
- Easy integration, low threshold for new and innovative services
- Locally unified electronic identification and access control; "one tag everywhere" (doors, garage, recycling bins, club rooms, car heating electricity outlets)

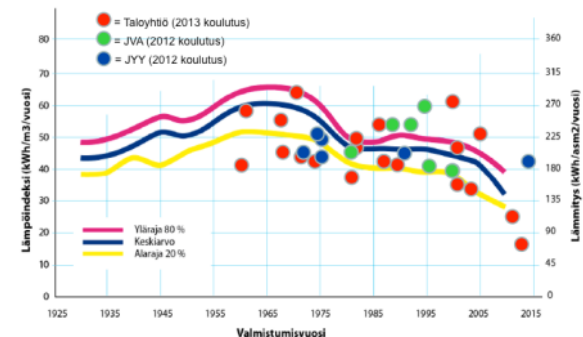


More information (Finnish): http://www3.jkl.fi/blogit/kangasjyvaskyla/?page_id=336



Specialty areas of the Kangas and Jyväskylä IT ecosystem

- **Cyber Security**, including National co-ordination of the cluster by Jyväskylä City and research at University and JAMK
- **Well-being** research at the Sports Faculty and top technology firms (Polar Electro, Firstbeat Technologies etc.)
- **Energy metering** and technology firms (Landis & Gyr, Aidon etc)
- **Horizontal integration** of vertical solutions in an ecosystem orchestrated by Jyväskylä known as the **Human Technology City**



The 5K Project

- ”Kankaan kokeilevan kyberturvallisen älykaupunkialustan kehittäminen”
 - ”Development of Kangas experimental, cyber-secure smart city platform”
- University of Jyväskylä project, together with City of Jyväskylä, 6 commercial partners, TEKES fund, EU/European Regional Development Fund
- 1.1.2016 - 31.5.2017
- New methods to protect private information
- The forming of a smart city ecosystem
- Experimental platform for fast cycle application development
- Open architecture for horizontal integration of devices



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Kangas ecosystem observations



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“Smart city” ecosystem observations

- Smart city strategy requires a clear vision and resources for technological coordination and expertise
- Challenges: compatibility of technologies, uncertainty of new technology functionality (responsibility, reputation), marketing (knowledge of new possibilities)
- Direct, open dialogue between customer and technology providers is needed, and may require an active moderator
- Implementation of the Kangas strategy is delayed, but the city still aims to have smart locks in future apartments



“Demo room” in Kangas

- Demo room was used when describing technology possibilities to builders and residents
 - Alarm: “You left home, but the coffee maker is on – shall it be switched off?”
- New personal services:
 - Electronic locking
 - Real time energy metering
 - Water consumption
 - Device control
 - ...



5K demonstration equipment at Kangas



Smart city identity management

- Background: a city like Jyväskylä may operate over 100 separate IT systems, each storing personal user data for public services
- So that it is possible to determine access to the local cloud platform, identity management is needed

In Kangas residential area:

- Central concept for identity management would be helpful: single-sign-on, combined services
- Safer and less costly to manage than silo systems
- Transitions: moving in / out of the area
- Permanent or temporary identities of owners, tenants, employees, visitors, services (mail, pizza delivery, health care, emergency services)
- Parking, package delivery, shared facilities
- Increasingly: IoT devices, personalized services
- Test ground for future city wide public services
- Integration to city IT systems



Questions on background or ecosystem?



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5K smart home device control prototype



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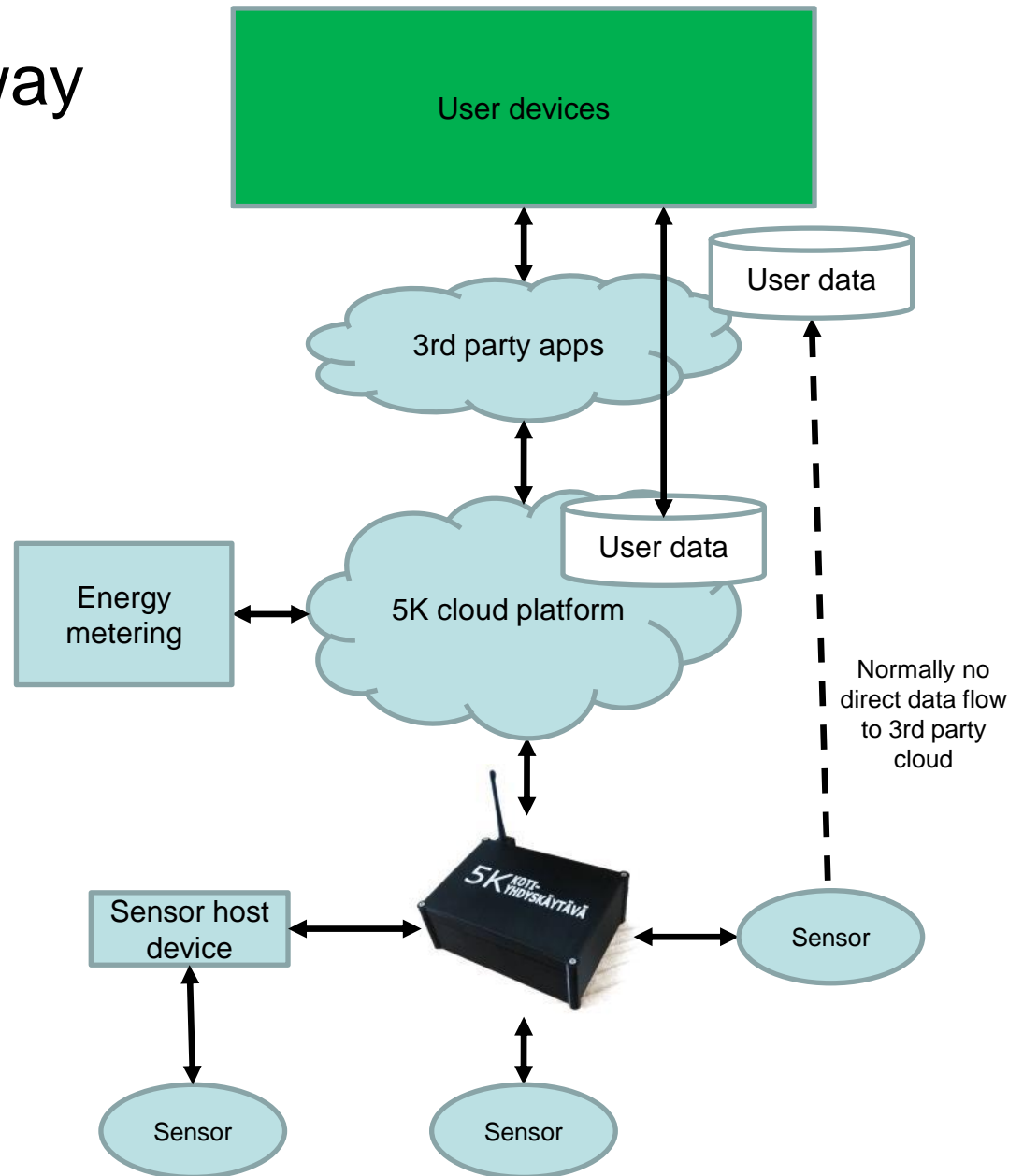
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5K device management objectives

- Drivers – we need:
 - Integration of heterogeneous sensor data
 - Chance for casual and professional application developers to quickly experiment new ideas (“fail fast”)
 - Protection of private data (EU data protection directive)
- Unknown app developers cannot be trusted
 - But developers have less responsibility of data security
- “Anyone able to try a new IoT application idea in a 30 minutes development cycle”



5K-home gateway and test architecture



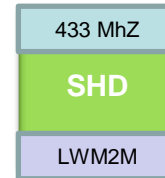
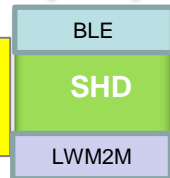
Temperature /
humidity

Presence

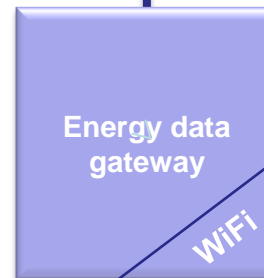
Door/window

Sleep sensor
mattress

WiFi

Home gateway
software (JAVA)

WiFi

Power consumption
(LED sensors in
electricity
switchboard)

= sensor



5K test applications

- Leverage the 3 identified local expertise areas:
 - cyber security, well-being research, energy metering
- 6 volunteer households in new Kangas apartments are testing the equipment (April-May 2017)
- Apartment specific sensors:
 - Temperature & moisture
 - Door/window sensors
 - Real time electricity consumption
- Personal sensors
 - Presence sensor (beacon key ring)
 - Sleep sensor under the mattress
- HTML user interface (smart phone or browser)
 - E-mail or SMS alerts would be possible to implement
- Simple test applications, for example “electricity consumption when exiting the apartment”, “nobody is home but window is open”, “report of apartment status”



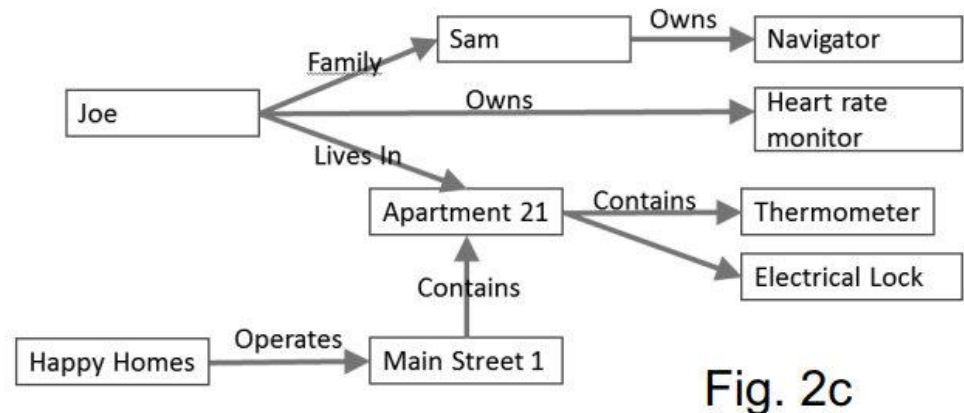
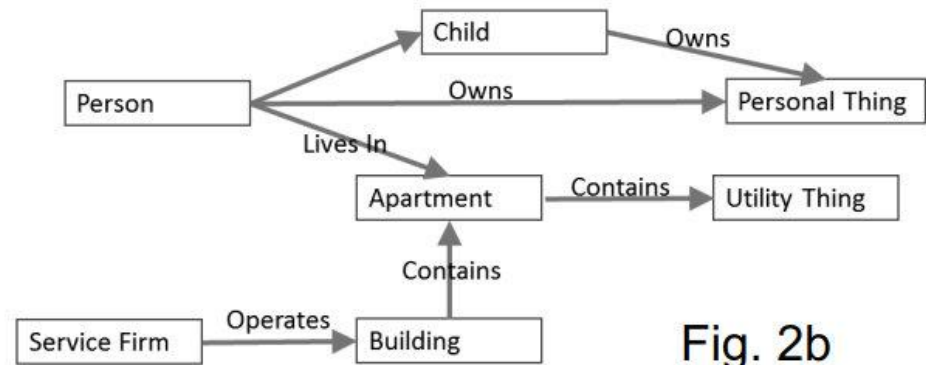
5K platform security

- Personal data and device control in one platform
 - Traditional way: each device manufacturer has all users' data in their cloud
- Applications access the data only with each user's permissions
- Use privileges are defined e.g. through entity relations between residents, apartments and IoT devices (ontology model), for example:
 - Smart refrigerator belongs to the apartment
 - Apartment belongs to person X
 - Pulse meter belongs to person Y
 - X is the guardian of Y



Ontology based smart home permission control system

- Ontology = structure to model entities and their relations
- Patent applied in February 2017 for the 5K ontology based IoT device control method
- Changes are in certain scenarios easier than in group or role based systems



Conclusions

- It may be easier to develop new personal local services, if much of the cyber security can be managed in the local platform level
 - For example less likely to encounter botnet attacks, if there is no open Internet connection directly to IoT devices but only through local API
 - Human error is perhaps the most common IT security risk – simple rules and management mitigate the risk
- A centrally managed concept for a smart city strategy, with technical expertise and leadership, is essential
 - Identity management, cyber security, financial sustainability (subsidies or real revenue)
- For Jyväskylä there is infrastructure potential – the atmosphere is positive for agile development and experimentation, and if resources (financing, technical expert coordination) are made available, the concept of a smart city part with specific regional focus areas is attractive



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Next for 5K project

- Several scientific articles have been published related to the 5K project; the project ends 31.5.2017 and results will be still published during the summer
- Another university project for IoT business and security will take over the platform in the future; some components will be possibly published as open source
- More information about the project:
<https://www.jyu.fi/it/hankkeet/rakennerahasto/5K>
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pasi.tyrvainen@jyu.fi (Vice dean of IT faculty, 5K responsible lead)



Questions?



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