MODERN SYSTEMS Experts Panel
IoT-based Systems Challenges

PANEL

MODERN SYSTEMS

IoT (Internet of Things)-based Systems Challenges
Hype Cycle for the Internet of Things, 2020

- Digital Thread
- Digital Business Technology Platform
- Indoor Location for People Tracking
- IoT Services
- IoT in Healthcare
- Model-Based Systems Engineering
- IoT Security
- Digital Twin
- Event Stream Processing
- IoT Edge Architecture
- IoT Platform
- Managed IoT Connectivity Services
- Asset Performance Management
- Internet of Things

As of July 2020
Topics

Petre Dini, IARIA, EU/USA petre@iaria.org

Chair

- IoT frameworks (push, pull)
- Information gathering (on-path, off-path cashing)
- Volatile, time-sensitive, obsolete, ... collections
- Cooperative data collection (synchronized, selective)
- Monitoring applications (rivers, forest, glaciers, people crowd, crop, irrigation, bird migration, livestock, buildings, waste management)
Panelists

• Alan Martin Redmond, Centre Scientifique et Technique du Bâtiment, France
  Digitalization in the Construction Industry

• Fahim Salim, University of South-Eastern Norway, Norway
  Context; Thinking beyond Binary

• Oliver Michler, TU Dresden, Germany
  Joint Communication, Localization and Sensing Technologies

• Lorena Parra Boronat, Universitat Politècnica de València, Spain
  Sustainable Development; Reliability of gathered data; Energy consumption of IoT-based systems: Green IoT-based Systems
Panellist Position

INTEROPERABILITY 4 CONSTRUCTION INDUSTRY BREAKTHROUGH TECHNOLOGIES

Alan Martin Redmond, PhD, CSEP, PGCert
CSTB – Sophia Antipolis
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- Common Information Model Infrastructure
- Big Data & Ontologies
- French National Building Database
- Urban Planning
- Common Data Exchange Platform

⇒ Digitalization in the Construction Industry – Market Readiness
⇒ Meta Models for Metabuild Platforms
⇒ Integrated Systems – Interoperability, Standardizations, data matching and data verification
Moving Beyond Data Dashboards and Traditional Processors, Processing & Storage Solutions

Fahim A. Salim, USN, Norway fahim.a.salim@usn.no

- Beyond Data Dashboards
- Post Binary Processing and Data Storage
- Storing Raw Data vs Processed Information

→ Context is King
→ Thinking Beyond Binary Terms
→ Do we need to store all the raw data?
Panellist Position

Revolution in mobile IoT devices using Joint Communication, Localisation and Sensing Technologies (JCLS)

- Oliver Michler, TU Dresden, EU-Germany  oliver.michler@tu-dresden.de

- Mobility-as-a-Service -> Highly efficient next Generation Mobility Concepts
- High Data rate with low Latency -> New Radio Communication
- Positioning and Tracking only in Software -> Robust precise Localization
- Passive Environment detection only in Software -> RF based Sensing
- Low energy System design -> Software instead of parallel electronic components
- Multi functional IoT Standards -> Software Defined Radio
- IoT as Multifunctional networked trackable radar-like sensor (transport modes, mobility, production, hospital, agriculture, forest, …)

→ IoT + JCLS = Hybrid ICT Sensors to replace or integrative complement of 5G and GNSS and Radar systems
IoT-based Systems as key Enablers of Sustainable Development

Lorena Parra, Universitat Politecnica de Valencia, Spain loparbo@doctor.upv.es

- IoT and data generation
- Necessity of data for sustainable management
- IoT-based systems in cities
- IoT-based systems in rural areas
- Future challenges for reaching a sustainable development based on IoT data

→ Reliability of gathered data

→ Energy consumption of IoT-based systems: Green IoT-based Systems
FULL PANELISTS’ POSITIONS

= to be added into the booklet =
OPEN DISCUSSION
Panellist Position

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Chronologie

1995-1999
1999-2002
2002-2009
2009-2015
2015-2016
2016-2018
2018-2021
2021-
Designing a Framework for Exchanging Partial Sets of BIM Information on a Cloud-Based Service (2013)
Development of Knowledge Management within DTI

- PPC Support Actions
  - Review & evaluate deliverables
  - Edit & redraft deliverables
  - Participate in the drafting of new Horizon Calls

- Integrate PPC knowledge with CPI Process
  - Analyse & evaluate Horizon Calls for DTI
  - Identify & present to DAS potential calls
  - Identify, and select potential partners for Horizon Calls Consortiums

- CPI Support Actions for Doctoral Students
  - Integrate PPC Topics, Horizon Topics, & International Innovated Topics
  - Draft Demande de Doctorant-e (2 x formulaires soumis)

- Design Strategy
  - Review Knowledge Management for Preliminary Strategy
  - Investigate commercial markets aspects of implementing Strategy

- Create Framework Strategy

- Review Knowledge Management
PANEL STATEMENT – INTEROPERABILITY 4 CONSTRUCTION INDUSTRY BREAKTHROUGH TECHNOLOGIES

Common Information Model (CIM) Infrastructure

Document Identifier: DSP004
Date: 2014-06-03
Version: 2.8.0
Repository

https://doi.org/10.1177/23998083211058798

https://doi.org/10.1016/j.advengsoft.2019.102731
The French national building database (BDNB): a database built by joining multiple national building databases, including property taxes, energy performance diagnostics, and energy consumption. The comprises more than 20 million localized buildings’ geometry with multiple thematic layers, such as and roof material, energy performance, and energy consumption at the scale of single buildings.
En pratique : périmètre de la BDNB open v1

Projet BAT-ID :
- Identifiant concerté

Référentiels nationaux :
- Base d’adresse nationale
- Cadastre
- BD Topo
- Code officiel géographique

Données ouvertes :
- DPE 2012 (ADEME)
- Données locale de l’énergie (ENEDIS, GrDF)
- Donnée de valeur foncières (CEREMA)
- ...

Données fermées :
- Fichier fonciers
- RNIC
- RPLS complet

Services « métier » CSTB :
- Prédiction des données manquantes
- Simulations (DPE 2021, cometh, …)
- Indicateurs décisionnels (Potentiel de rénovation, Valeur foncière, …)
- Métrés
- …

BDNB
- Identifiant bâtiment BDNB
- Référentiels ouverts bâtiments / adresses / parcelles
- Données issue de sources en open data
- Données fermées
- Services « métier » CSTB

Open Data
- data.gouv.fr

Accès restreint « Ayant-droits » Sous conditions commerciales

Accès restreint Sous conditions commerciales
Socio-economic Scenarios

CSTB - MithraSIG La cartographie du bruit

LIST & R2M Solution - Manage Urban Spaces Together
Exchange Parameter - “Address the problem of “data matching” and data verification”
BREAKTHROUGH TECHNOLOGIES
Panellist Position

Moving Beyond Data Dashboards and Traditional Processors, Processing & Storage Solutions

Fahim A. Salim, USN, Norway fahim.a.salim@usn.no

- **Beyond Data Dashboards**
- **Post Binary Processing and Data Storage**
- **Storing Raw Data vs Processed Information**

→ **Context is King**
→ **Thinking Beyond Binary Terms**
→ **Do we need to store all the raw data?**
About Fahim

• Research Fellow at Norwegian Industrial Systems Engineering (NISE) Research Group at University of South-Eastern Norway.
  — Harvesting big data in complex engineering environments by human centric AI.
• Formerly Post Doc Researcher at Biomedical Signals and System (BSS) at University of Twente.
  — Using sensors to model player behavior to create new forms of volleyball training.
• PhD in Computer Science, Trinity College Dublin
  — Transforming video streams to allow enhance exploration experience with content.
• Full Stack software engineer.
Beyond Data Dashboards

- Organizations perceived a rise in difficulty in terms of utilizing Big Data Analytics (Qlik and Accenture 2020).
- Only 21% of respondents reported to have access to exploration systems suitable for their job roles.
- Systems are designed for the content producer often designed for content producers and not the consumers.
Narrative Generation based on User (Consumer) Context

• User needs:
  – The right content. (both in terms of item and portion)
  – The right manner/modality (device or personal preference)
  – The right expanse i.e., the right amount of detail. (context, device, preference)

• By representing/curating content:
  – In a Non-linear Flow
  – Have Multimodality in the representation.
  – Allow greater User Control (in flow, modality, detail).
Data Processing Framework (Vision)
Energy Consumption in IOT (wearables) devices

- Size and formfactor of wearables.
- Battery life
- Communication protocol and frequency
- Edge computing
- Data Storage
- Solar powered wearables devices (smartwatches)
- Kinetic Energy Harvesting.
Can Post Binary Computing Help?

• Multiple-Valued logic (MVL) and analog computing.
• Less power usage in:
  – Computing
  – Storage
  – Communication.
• Less Hardware complexity:
  – In terms of registers and logic gates and interconnects.
Raw Data vs Processed Information
Developer mode

- Many commercial IOT wearables only grant API access to processed data.
- However, researchers usually preferred access to raw sensor data.
- Clinical research require higher-quality data than most commonly available wearables can provide.
- Security, privacy and ethical concerns.
Thank you!
Questions? comments?

Contact: fahim.a.salim@usn.no
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Everything moves and all is connected
By 2030
Urban population will grow from 3.5 billion to ~5 billion, mainly in developing countries

By 2025
75% of global GDP growth will be generated by middleweight cities in emerging markets

Gross Domestic Product = GDC

Today
25% of all green house gas emissions come from transportation

Important Mobility Trends for the Next Decade

- **Digitization**: Real-time mobility marketplace, Integrated mobility
- **Decarbonization**: E-Mobility
- **Use of personal data**: Additional transport features
- **Integrated and new forms of goods transport**: Addressing customer needs
- **Additional transport features**: Autonomous driving

References:
- Stopka, U.: Keynote Speech, ICL-Community Conference 2021, Germany, Dresden, 2021
Digitisation of Passenger Transport

PRODUCT INNOVATIONS

- Communication
  - Ranging
  - Localisation
  - Tracking
  - Sensing
...

- Software Defined Radio

BUSINESS MODEL INNOVATIONS

- On Demand Services
  - Shared Multimedia Services
  - Personalized Vehicle Sharing
  - Autonomous Driving Services
...

Fields of required competence (TUD)

- Simulation and radio planning
- Networking and localisation
- Experimental vehicles and test fields
- Methodology and procedures
Modular research framework (TUD)

Data input

Communication / Ranging / Positioning / Tracking / Sensing

Visualization

Client/Server ⇒ Database Software ⇒ JCLS - Algorithms / Procedures

Technology Candidates:
IEEE 802.15.x (BLE, UWB, ZigBee, ...), IEEE 802.11.x (WiFi 2,4/5GHz); MobilComm. (5G, 6G)
IEEE 802.15.7 (LiFi)
Revolution in mobile IoT devices using JCLS + SDR ⇒ Overview

- AoA
- ToA
- TDoA
- PoA
- RSSI
- CIR
- RF/VLC based Measurement Basics

Ranging

Communication

1010010100101 Comm. Signal

Signal raw data

Reflection Signal

Localisation Tracking

Sensing

Software Defined Radio (SDR)
Revolution in mobile IoT devices using JCLS + SDR ⇒ Cross Technologies
Example: Radio Sensing for Smart Parking Systems (1)
Example: Radio Sensing for Smart Parking Systems (2)

Channel Impulse Response (CIR)
Example: Radio **Sensing** for Smart Parking Systems (3)

**Channel Impulse Response (CIR)**

**CIR - Subtraction**

without vehicle
Example: Radio Sensing for Smart Parking Systems (4) ⇒ Result/Service

https://www.youtube.com/watch?v=FBv7WuiRKeQ
Mobility Applications ⇒ Extension to everything with IoT given (e.g. health)
Future Mobility and Transport – What Remains? What is to Come?

Position: Revolution in mobile IoT devices using Joint Communication, Localisation and Sensing (JCLS)

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- Necessity of data for sustainable management
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IoT and data generation

With IoT, almost every single item can generate data, providing thousands of registers every day.

The data can be generated by sensors:

  for example, temperature, GPS coordinates.

The data can be generated by the use:

  for example, bandwidth, remaining energy.
IoT and data generation

With IoT, almost every single item can generate data, providing thousands of registers every day.

The data must be pre-processed, send and stored before they use. Data gathering must be accurately planned to avoid generating unnecessary data. The generation of unnecessary data impacts on the energy requirements of the network and in its future storage necessities.
Necessity of data for sustainable management

For a sustainable development, real-time (or recent data), historical data, and indicators are necessary.

The IoT systems can be a key element to reach the sustainable development by providing accurate, recent, and reliable data to nurture the indicators used to measure the SDG.
IoT-based systems in cities

The use of IoT systems for e-health

E-health can provide access to high quality healthcare especially for communities living in remote areas. It is particularly important for vulnerable people (elderly or disable people and chronic patients).
IoT-based systems in cities

The impact of IoT systems on energy and cities

The IoT systems require form the use of energy. Most of it is used to communicate the data. The smart algorithms can optimize the energy consumption, impacting positively in reducing the use energy in the cities.

IoT-based systems in rural areas

The use of IoT systems for agriculture

IoT-based systems in rural areas

The use of IoT systems for oceans

Future challenges for reaching a sustainable development based on IoT data

• Generate, manage, and store data from different variables.

• Increase the acceptability and trustability of public and private institutions in IoT data to maximize sustainable development.

• The high cost of sensors and IoT systems might be a limiting factor.
OPEN DISCUSSION