

## Smart Cities Vertical Session Summary

Smart Cities rely on an intersection of people, policy, technology, and operations to deliver value. IoT can be a significant enabler in how decisions are made to allocate resources for developing future infrastructure, services, and processes to meet the needs of citizens. The promised benefits in turn depend on adopting practices that engage citizens and city managers in informed discussions confronting the reality of complex issues and competing interests. In this setting understanding how cities work is the first priority, and is essential in fulfilling the promise of the improvements that cross-domain system integration, and the cycle of sensing, data gathering, analytics, and action can bring to cities in the form of smarter decisions and smarter operations.

The **2018 WFloT Smart Cities track** focused on drawing together content from global thought leaders aligned with these goals and perspectives, structured into 4 themes including:

- 1) **People, Policy and Technology** – Exploring the frameworks for success
- 2) **Industries & Services** – Exploring how systems are being drawn together for different industry and service oriented pursuits
- 3) **IoT Technology and Applications** – Exploring specific technologies and applications of IoT
- 4) **Policy & Regulation** – Exploring how policy and regulation are addressed within governments and how stakeholders are addressing IoT in terms of benefits to humanity

This review describes the sessions and primary points of interest in summary of the WFloT event.

### **Session 1: People, Policy and Technology** – *Exploring frameworks for success*

This was one of the most packed sessions at the conference, with standing room only throughout the presentations. The session's first speaker, Derrick de Kerckhove (Univ. of Toronto), addressed key aspects of smart city development concerning citizen sentiment, including novel methods for exploring and qualitatively assessing the benefits of IoT. A note of interest for the audience was "What is a Smart City" and how it differs from a "Happy City." It was followed by speaker John Taylor (Georgia Tech) on the practical uses of IoT data, through the novel application of a city "digital twin," or a spatio-temporal database collected from the Internet of Things, creating a model for application and research in city planning and policy exploration. This session's next speaker, Paolo Traverso (Bruno Kessler Center – Trento), presented approaches for the design of a smart community information system platform, dividing information and services within a private and public-centric architecture to manage information and encourage service orchestration. His case study on the Children Independent Mobility Project, or CLIMB, was very popular with the audience, describing the benefits of the information architecture being used in a game-centric application, enabling location-based-modeling of school children for safety, while tracking their walk to school as a game to measure distance (virtually walking to Africa!). The last speaker, Chin-Sean Sum (Wi-SUN Alliance), presented on the benefits of Wi-SUN, a specification for wireless communications networks intended to advance IoT across smart city domains of interest. His presentation reviewed the certification process and open nature of Wi-SUN based solutions. Many participant questions in this session were pointed at understanding how privacy concerns are addressed, to the end that large-scale integration between systems requires a careful approach.

### **Session 2: Industries & Services** – *Drawing systems together*

This session addressed various aspects of a smart city's operation exploring what industry can provide and what kind of services can be deployed. The first speaker, Yang Yang (Shanghai Tech University),

presented requisite approaches to Smart City services through fog computing. Audience interest focused on questions about open architectures at the edge of the system, the definition of fog computing, and cross-domain challenges with complex transactions – as billions of devices are integrated, it is a challenge to draw communications to a central repository – requiring more computing closer to the edge of the system. Yang’s research involves a novel approach to architecture and service provisioning involving fog computing which was found very attractive. The second speaker, Roberto Saracco (EIT ICT Labs), presented novel approaches to the development of shared, self-organizing, and supportive communication and sensing infrastructure at the edge, enabled using smart phones. One particular point of interest with the audience was Saracco’s mention of the smart phone as a super-computer by any recent standards, and utilization of these systems as a sensing platform to create digital twins of a city. This was the second mention of “digital twins” within the Smart City track that resonated well with the audience. The third speaker, Yasunori Mochizuki (NEC Research Laboratories), presented the FIWARE platform, an initiative developed under a public-private partnership of the European Commission to make data collection, plug & play integration and standardized API available for third party services serving the interests of eight separate smart city knowledge domains. Audience interests centered on FIWARE use of context as a data requirement, referring to the need to associate a contextual component with the gathering and need for data, and not limit a common information model to the exchange of the data itself. The final speaker, Lyn Chua (Autodesk) presented Smart City applications for Autodesk, demonstrating advanced use of the Autodesk suite of modeling tools, and benefits for planning, engineering, and logistics. Many participant questions in this session were pointed at understanding how system characteristics were assigned to input and output features, how latency is managed for real-time decision support, and how different users in different layers of systems have access to layers of information without compromising identity or privacy.

### **Session 3: IoT Technology and Systems – Applications and operations making it happen**

This session addressed sensing and IoT in specific applications. Mobility and autonomous systems of transportation, energy management & blockchain, general artificial intelligence and IoT, and the process of certification for IoT devices were all topics. The first speaker, Francesco Mazzola (T.Net) reviewed a feature driven reference architecture for IoT applicable to many smart city domains of interest including mobile (vehicle) systems communication including V2I and V2V, smart buildings, agriculture, environmental sensing, and others. The audience engaged with interest concerning the predictive modeling capabilities related to air quality and intelligent transportation systems. The second speaker, Sijie Chen (Tsinghua University) reviewed the application of blockchain for Smart Cities in a transactive energy system, an economic control paradigm that allows utility customers to trade energy peer-to-peer and optimize the electrical network with real-time supply and demand balancing. The third speaker, Shawn Chandler (Navigant Consulting & IEEE Smart Cities) explored the concept of integrated systems for IoT, sensing, and analytics across Smart City domains of interest, and outlined the application of different forms of computational intelligence based on the need for real-time telemetry as a system feature. Audience questions reflected previous session interests focused on limiting the data within exchanges in order to optimize communications flows between system participants, latency concerns in the overall exchange of data, and the need to balance privacy and security. The final speaker, Cedric Koh (Rohde & Schwarz) reviewed solutions for compliance with IoT communication standards and a suite of tools available from Rohde & Schwarz for certification. The audience was very interested in the concept of certification, and how methods linking data across many domains might be accomplished through future common ontologies, and who would hold responsibility for such testing and success in integration. A key issue raised within many sessions, privacy and security were again a common topic of interest.

### **Session 4: Smart Cities Policy and Regulation I**

The fourth session within the Smart Cities track concerned policy and regulation. Presenters addressed the application of fixed sensor networks, system platforms and IoT devices for improving government planning, improving capabilities for law enforcement, and addressing methods to permit industry and

residents to improve their quality of life. The first speaker, Woon-Seng Gan (Nanyang Technological University) presented NTU's living lab approach to improving Singapore as a smart city, including efforts advancing use cases developed in partnership with government agencies. The audience was particularly interested in trends and applications for smart audio sensing, with interest in major advances in contextual awareness and analytics using sound, and attenuating noise using sound wave interference patterns without obstructing ventilation in buildings (reducing city noise levels while leaving the window open!). The next speaker, Ooi Ghee Leng (Hong Kong University of Science and Technology), presented his laboratory's approach to the four pillars of a smart city, including service level agreements, trusted data through secure logging, agnostic interoperable infrastructure, and audit trails using technology such as blockchain. The audience showed interest in advances related to bitemporal database solutions (two-dimensional time axis), for tracking events with record times and event times as a best practice to better address the legal weight that data holds in a more connected world. The final speaker, Dale Seed (Chordant / Interdigital) presented on future proof planning approaches for Smart Cities using the "OneM2M" service layer and software framework. OneM2M was illustrated to have a distributive and scalable architecture intended to address IoT services that are common across application domains, such as device registration and discovery, group management, application management, semantics, transactions and other common features of a smart city and integrated IoT enabled system.

### **Session 5: Smart Cities Policy and Regulation II**

The final session within the Smart Cities track reviewed a global standards based approach to developing IoT and smart sustainable cities, and hosted an extended panel discussion with audience participation about the "Internet of People." The first speaker, Bilel Jamoussi (Chief, Study Groups Department – International Telecommunication Union) reviewed the drivers for change requiring smarter and more sustainable cities, and drew attention to the issues from a policy perspective, including quality of service across communication networks, data security, regulations for device interaction, and the development of open standards for interoperability between smart city knowledge domains (such as health and telecom). The audience was particularly interested in the United Nations definition of Smart Cities. The final speakers, Nahum Gershon (Mitre Corporation) and Joel Myers (Domila, Ltd) hosted an interactive discussion with the session audience concerning the intersection of smart cities, social networking, ethics and philosophy. The discussion, titled the "Internet of People" focused on exploring the goals of the smart city industry movement juxtaposed with the need for humanity to remain connected as people. The audience was very responsive to the format of the discussion, with contributors focusing on the ethics of increased automation, impacts of automation on employment and the economy, the need for connectivity between people and redefining the meaning of connectivity given electronic means, and the rights of citizens in a more connected world.