



Due to COVID-19 the World's Activities Stopped, but not Research: Workshop on *Very Large Internet of Things (VLIoT 2020)*

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ABSTRACT

The Very Large Internet of Things (VLIoT) workshop aims at discussing the solutions of problems arising especially for large-scale configurations. After continuously monitoring the global COVID-19 pandemic this year, the workshop changes the format the first time to an online event in order to overcome problems like travel restrictions. Besides missing face-to-face meetings the online format also has chances like an increased number of participants, less travel burdens and saving budget. Hence we received many high-quality submissions, from which we accepted 9 to be introduced in this editorial.

TYPE OF PAPER AND KEYWORDS

Editorial: *Internet of Things, Very Large Internet of Things, VLIoT@VLDB 2020, IoT visions*

1 INTRODUCTION

The Internet of Things (IoT) is not only about small devices, but also the interplay between them and the user with the goal of higher-level applications. Research questions may arise to optimize the communication regarding message number and sizes, the processing to speed up performance, and minimize latency for optimal user experiences and power consumption to increase battery lifetime. High availability is often achieved by intelligent replication of data and processing. Masses of data are generated by the IoT devices, which are often processed and aggregated by streaming engines

the components of which are placed along the topology of the IoT devices. Intelligent utilization of the heterogeneity of the IoT environment is another key for the success of IoT systems. There is a strong need of all IoT systems and applications to be designed for security and privacy. Hence, research in the area of IoT tackles these areas in combination with other areas like databases, security and cryptography, machine learning, Semantic Web, networks, operating systems, smart home and cities applications, distributed systems, compression and many more.

Hence, many different research areas are discussed at the Very Large Internet of Things (VLIoT) workshop being the fourth edition this year. Having open ears many researchers proclaimed this year that it has been very difficult for IoT research for developing new applications for IoT devices and running real-world experiments due

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to restrictions of the COVID-19 pandemic. We are very proud that we still got many high-quality submissions and accepted many valuable contributions.

Fortunately, many of the papers accepted for VLIOt 2020 address some of these relevant aspects of the development, implementation, and deployment of large-scale, distributed, mobile, stream handling, heterogeneous and multi-tenant Internet of Things systems. This year we have also accepted many very strong vision papers, which is a sign for Internet of Things as active research area with many open challenges for many years of research.

Since its first edition in 2017 the main goal of the VLIOt workshop has been to bring together academic researchers and industry practitioners working in the broad field of IoT and related subjects, and to allow them to present and exchange their research findings, their experience and share their vision about the future of IoT at a very large scale. Besides the above mentioned issues, this workshop also intended to discuss other related topics, such as coordination between fog-, edge-, and dew-computing in IoT, Connected Nanotechnology, Artificial Intelligence for IoT (AIoT), Internet of Vehicles, Connected Automated Vehicles, and others.

2 VLIOt CALL: TYPES OF PAPERS

This fourth edition of VLIOt solicited papers of different types containing contributions describing original ideas, promising new concepts, and practical experience, namely:

- Research papers: proposing new approaches, theories or techniques related to IoT, including new data structures, algorithms, whole systems, and frameworks. They should make substantial theoretical and empirical contributions to the research field.
- Experiments and analysis papers: focusing on the experimental evaluation of existing approaches including data structures and algorithms for the IoT and bring new insights through the analysis of these experiments. Results of experiments and analysis papers can be, for example, showing benefits of well known approaches in new settings and environments, opening new research problems by demonstrating unexpected behavior or phenomena, or comparing a set of traditional approaches in an experimental survey.
- Application papers: reporting practical experiences on Internet of Things applications. Application papers might describe specific application domains in the IoT such as smart homes/offices/cities, continuous

health care, waste management, emergency response, intelligent response, and Industry 4.0.

- Vision papers: identifying emerging or future research issues and directions, and describing new research visions in the IoT area that may have a great impact on our society.

3 VLIOt CALL: TOPICS OF INTEREST

The VLIOt 2020 solicited papers in the following, non-exclusive, list of topics:

- Semantics and Spatial and temporal reasoning for IoT
- Privacy-by-design and security-by-design in IoT
- System architectures for IoT, e.g. things-, data-, event- and service-centric.
- IoT applications including smart homes, smart cities, healthcare, etc.
- Internet of Nano Things, Nano Computing and Communications.
- IoT programming toolkits, frameworks and evaluation test-beds
- IoT data mining and analytics
- IoT management and interoperability
- Management of distributed data streams
- Enabling technologies and standards for the IoT
- Sustainability of IoT platforms, e.g. business models for deployment and maintenance
- Societal challenges and IoT, e.g. urban planning and decision making tools
- Ownership of data in IoT scenarios
- Fog, Edge and Dew Computing for IoT
- IoT benchmarks and performance measurement
- Indexing and search in IoT environments, discovery of devices, services and data
- IoT transactions, concurrency control and recovery
- Hardware accelerators and energy savers for IoT applications and core infrastructure

4 SUMMARY OF THE ACCEPTED PAPERS

In total, nine papers were accepted for presentation at the workshop. This year the contributions deal with very hot topics like IoT during pandemic (e.g., [5, 3]), but also application-oriented contributions like standards for exchanging data modeling parking [7] and modeling the Internet of Multimedia Things tackling challenges of large-scale video streaming [6].

[1] deals with properties of low power networks that gather information from the environment. Computations in FPGAs are also known to be energy-saving besides acceleration in areas like IoT security monitoring [4]. The authors in [8] propose a framework for resource discovery in semantic-enhanced pervasive environments,

which leverages an information-centric networking approach.

The authors in [2] propose knowledge infusion with the goal to automate the inclusion of knowledge from existing knowledge bases and domain experts and to combine it with traditional data-driven machine learning techniques. The authors in [3] propose a vision of a privacy-aware database machine integrated into the IoT environment, which massively distributes the calculation of analysis results on sensor nodes and other low-resource appliances for reasons of privacy besides performance. The contributions of [9] describe challenges and opportunities for an IoT data management system to enable complex analytics of data streams of large-scale IoT environments like smart cities beyond the cloud.

5 SUMMARY AND CONCLUSIONS

The IoT domain offers many chances for interesting research and as result of it interesting applications for daily life improving the living conditions and conveniences of its users. We recognize that there is a shift in IoT research going away from very special limited topics and more and more researchers try to offer complete systems providing solutions for large scale IoT configurations. However, still many visions need to be realized having space for many years of research.

We wish you interesting hours when studying the contributions of this year's Very Large Internet of Things (VLIoT) workshop.

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A WORKSHOP ORGANIZATION

Chairs

- Sven Groppe, Universität Lübeck, Germany
- Mu-Chun Su, National Central University, Taiwan

Program Committee

We have recruited 31 PC members and chairs listed below who are experts in the topics of interest of our workshop. The current PC members and chairs are selected from 13 nations all over the world. While most PC members are from academia, we have 2 experts also from industry (6%). 8 of the PC members and chairs are women (26%).

- Omar Boucelma, Aix-Marseille University, France
- Arsenia Chorti, ETIS / University Paris Seine, University Cergy-Pontoise, ENSEA, CNRS France
- Flávia C. Delicato, Universidade Federal Fluminense (UFF), Brazil
- Lorena Etcheverry, Universidad de la República, Uruguay
- Mirian Halfeld Ferrari, Université d' Orléans, France
- Jonathan Fürst, NEC Labs Europe, Heidelberg, Germany
- Abdessamad Imine, INRIA-LORIA Nancy Grand-Est, France
- Peiquan Jin, University of Science and Technology of China, China
- Verena Kantere, University of Ottawa
- Ahmed Khaled, Northeastern Illinois University, USA
- Abdelmajid Khelil, Landshut University of Applied Sciences, Germany
- Jan Lindström, MariaDB Corporation, Finland
- Anne H. Ngu, Texas State University, USA
- Riccardo Martoglia, University di Modena and Reggio Emilia, Italy
- Abderrahmen Mtibaa, University of Missouri-St. Louis, USA
- Luis Muñoz, University of Cantabria, Spain
- San Murugesan, Western Sydney University, Australia
- Rahul Pandey, George Mason University, USA
- Paulo F. Pires, Universidade Federal Fluminense (UFF), Brazil
- Elaheh Pourabbas, National Research Council of Italy, Italy
- Luis Sánchez, University of Cantabria, Spain
- Gowri Sankar Ramachandran, University of Southern California, USA
- Georgios Smaragdakis, TU Berlin, Germany
- Reza Tourani, Saint Louis University, USA
- Igor Leão dos Santos, Centro Federal de Educação Tecnológica Celso Suckow da Fonseca (CEFET-RJ), Brazil
- Sana Sellami, Aix-Marseille University, France
- Marco Vieira, University of Coimbra, Portugal
- Yingwei Wang, University of Prince Edward Island, Canada
- Demetris Zeinalipour, University of Cyprus, Cyprus
- Steffen Zeuch, DFKI, Germany

AUTHOR (AND CO-CHAIR) BIOGRAPHIES



Sven Groppe earned his diploma degree in Informatik (Computer Science) in 2002 and his Doctor degree in 2005 from the University of Paderborn. He earned his habilitation degree in 2011 from the University of Lübeck. He worked in the European projects B2B-ECOM, MEMPHIS, ASG and TripCom.

He was a member of the DAWG W3C Working Group, which developed SPARQL. He was the project leader of the DFG project LUPOSDATE, an open-source Semantic Web database, and one of the project leaders of two research projects, which research on FPGA acceleration of relational and Semantic Web databases. He is also leading a DFG project in the Semantic IoT area and a DFG project on GPU and APU acceleration of main-memory database indexes. He is also the chair of the Semantic Big Data workshop series, which is affiliated with the ACM SIGMOD conference (so far 2016 to 2020), and of the Very Large Internet of Things workshop in conjunction with the VLDB conference (so far 2017 to 2020). His research interests include databases, Semantic Web, query and rule processing and optimization, Cloud Computing, acceleration via GPUs and FPGAs, peer-to-peer (P2P) networks, Internet of Things, data visualization and visual query languages.



Mu-Chun Su received the B. S. degree in electronics engineering from National Chiao Tung University, Taiwan, in 1986, and the M. S. and Ph.D. degrees in electrical engineering from University of Maryland, College Park, in 1990 and 1993, respectively.

He was the IEEE Franklin V. Taylor Award recipient for the most outstanding paper co-authored with Dr. N. DeClaris and presented to the 1991 IEEE SMC Conference. He has authored more than 100 journal and refereed conference papers. From August 1993 to July 2000 he was an associate professor of electrical engineering at Tamkang University, Taiwan. He is currently a professor of computer science & information engineering at National Central University, Taiwan. He is a senior member of the IEEE Computational Intelligence Society and Systems, Man, and Cybernetics Society. His current research interests include neural networks, fuzzy systems, swarm intelligence, assistive technologies, pattern recognition, physiological signal processing, and image processing.