Internet of Things – The Call of the Edge

Everything Intelligent Everywhere

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Internet of Things – The Call of the Edge

Everything Intelligent Everywhere

Editors

Ovidiu Vermesan
SINTEF, Norway

Joël Bacquet
EU, Belgium

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Dedication

"Simplicity is the ultimate sophistication."

– Leonardo Da Vinci

"Logic will take you from A to B. Imagination will take you everywhere."

"Creativity is intelligence having fun."

– Albert Einstein

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Ovidiu Vermesan

Joël Bacquet

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Preface

Internet of Things Intelligence and Senses

The next wave of the Internet of Things (IoT) technological development grows with radical advances in artificial intelligence (AI), edge computing processing, new sensing capabilities and autonomous functions accelerating progress towards the ability to self-develop, self-maintain and self-optimise.

IoT applications' collective intelligence will eventually enhance the autonomous capabilities of the IoT while creating new possibilities for humans to connect seamlessly, enabling new ways to collaborate among machines and between humans and machines.

Strengthening human–machine interaction, collaboration and cooperation using hyper autonomous IoT technologies and applications provides new opportunities for economic development and the digitisation of industries in the new digital age, extending the wave of continuous innovation and disruption of IoT business models.

The emergence of hyper autonomous IoT with enhanced sensing, distributed intelligence, edge processing and connectivity, combined with human augmentation, has the potential to power both the transformation and optimisation of industrial sectors and change the innovation landscape.

IoT sensing, actuating and computing processing at the edge provide IoT systems the capabilities to deliver disconnected or distributed functions to the embedded physical environment and provide the digital representation and modelling, simulation and augmented functions through 'digital twins' in digital, virtual and cyber environments.

Combining AI and distributed ledger technologies (DLTs), the IoT and edge computing continuum create a distributed intelligent architecture consisting of a wide range of sensing/actuating intelligent things and services linked in a dynamic mesh connected by a set of distributed and federated edge/cloud services. The significant advances of hyper autonomous IoT include collaborative robotic things integrated into real-time industrial and intelligent business processes across different sectors that create a

multi experience combining product design, visualisation, field service, operations, modelling, virtualisation, simulations into extended reality and virtual environments.

AI-driven IoT autonomous capabilities increase the decision capabilities of IoT edge devices, creating new business scenarios that incorporate the use of intelligent things into traditional manual and semiautomated tasks.

Protecting AI-based hyper autonomous IoT from malicious cyberattacks requires leveraging AI to enhance security defence, predicting the use of AI by attackers and creating techniques for quarantining the IoT devices as well as preventing the attack security solutions based on Machine Learning (ML) at the training and prediction stages.

Editors Biography

Dr. Ovidiu Vermesan holds a PhD degree in microelectronics and a Master of International Business (MIB) degree. He is Chief Scientist at SINTEF Digital, Oslo, Norway. His research interests are in the area of mixed-signal embedded electronics and cognitive communication systems. Dr. Vermesan received SINTEF's 2003 award for research excellence for his work on the implementation of a biometric sensor system. He is currently working on projects addressing nanoelectronics, integrated sensor/actuator systems, communication, cyber–physical systems and the IoT, with applications in green mobility, energy, autonomous systems and smart cities. He has authored or co-authored over 85 technical articles and conference papers. He is actively involved in the activities of the Electronic Components and Systems for European Leadership (ECSEL) Joint Technology Initiative (JTI). He has coordinated and managed various national, EU and other international projects related to integrated electronics. Dr. Vermesan actively participates in national, H2020 EU and other international initiatives by coordinating and managing various projects. He is the coordinator of the IoT European Research Cluster (IERC) and a member of the board of the Alliance for Internet of Things Innovation (AIOTI).

Joël Bacquet is a senior official of DG CONNECT of the European Commission, taking care of the research and innovation policy for the Internet of Things. Before working in this field, he was programme officer in "Future Internet Experimental Platforms", head of the sector "Virtual Physiological Human" in the ICT for health domain. From 1999 to 2003, he was head of the sector "networked organisations" in the eBusiness unit. He started working with the European Commission in 1993, in the Software Engineering Unit of the ESPRIT Programme. He started his carrier as visiting scientist for Quantel a LASER company in San José, California in 1981. From 1983 to 1987, he was with Thomson CSF (Thales) as software development

engineer for a Radar System. From 1987 to 1991, he worked with the European Space Agency as software engineer on the European Space shuttle and international Space platform programmes (ISS). From 1991 to 1993 he was with Eurocontrol where he was Quality manager of an Air Traffic Control system. He is an engineer in computer science from Institut Supérieur d'Electronique du Nord (ISEN) and he has a MBA from Webster University, Missouri.

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