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Editors

Complex, Intelligent, and Software Intensive Systems

Proceedings of the 11th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2017)

Springer

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Welcome Message of CISIS-2017 International Conference Organizers

Welcome to the 11th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2017), which will be held from July 10 to 12, 2017, at Istituto Superiore Mario Boella (ISMB), Torino, Italy, in conjunction with the 11th International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS-2017).

The aim of the conference is to deliver a platform of scientific interaction between the three interwoven challenging areas of research and development of future ICT-enabled applications: software-intensive systems, complex systems, and intelligent systems.

Software-intensive systems are systems, which heavily interact with other systems, sensors, actuators, devices, other software systems, and users. More and more domains are involved with software-intensive systems, e.g., automotive, telecommunication systems, embedded systems in general, industrial automation systems, and business applications. Moreover, the outcome of Web services delivers a new platform for enabling software-intensive systems. The conference is thus focused on tools, practically relevant and theoretical foundations for engineering software-intensive systems.

Complex systems research is focused on the overall understanding of systems rather than its components. Complex systems are very much characterized by the changing environments in which they act by their multiple internal and external interactions. They evolve and adapt through internal and external dynamic interactions.

The development of intelligent systems and agents, which is each time more characterized by the use of ontologies, and their logical foundations build a fruitful impulse for both software-intensive systems and complex systems. Recent research in the field of intelligent systems, robotics, neuroscience, artificial intelligence, and cognitive sciences is very important factor for the future development and innovation of software-intensive and complex systems.

The CISIS-2017 is aiming at delivering a forum for in-depth scientific discussions among the three communities. The papers included in the proceedings cover all aspects of theory, design, and application of complex systems, intelligent systems, and software-intensive systems. The conference received 170 papers and accepted 43 papers (about 25% acceptance rate), which were selected after a careful review process.

We are very proud and honored to have 2 distinguished keynote talks by Dr. Sven Helmer, Free University of Bozen-Bolzano, Italy, and Dr. Patrick Demichel, Hewlett Packard, France, who will present their recent work and will give new insights and ideas to the conference participants.

The organization of an International Conference requires the support and help of many people. A lot of people have helped and worked hard to produce a successful CISIS-2017 technical program and conference proceedings. First, we would like to thank all the authors for submitting their papers, the program committee members, and the reviewers who carried out the most difficult work by carefully evaluating the submitted papers.

We are grateful to Honorary Co-Chairs Prof. Makoto Takizawa, Hosei University, Japan, and Dr. Paolo Mulassano, Istituto Superiore Mario Boella, Italy, for their guidance and advices.

This year in conjunction with CISIS-2017 we have 8 International Workshops that complemented CISIS-2017 program with contributions for specific topics. We would like to thank the Workshop Co-Chairs and all workshops' organizers for organizing these workshops.

We thank Shinji Sakamoto, Donald Elmazi, and Yi Liu, Fukuoka Institute of Technology, Japan, as Web Administrators for their excellent and timely work.

Finally, we would like to thank the local arrangement team of ISMB for their support and good local arrangement for the conference.

We hope you will enjoy the conference and have a great time in Torino, Italy.

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Welcome Message from CISIS-2017 Workshops Co-chairs

Welcome to the Workshops of the 11th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2017), which will be held from July 10 to 12, 2017, at Istituto Superiore Mario Boella (ISMB), Torino, Italy.

We are pleased that for this edition of CISIS International Conference we have 8 International Workshops. Some of these workshops are in 7th, 8th, 9th, and 10th editions. The objective was to complement as much as possible the main theme of CISIS 2017 with specific topics of different workshops in order to cover topics from the three challenging areas of ICT-enabled applications: software-intensive systems, complex systems, and intelligent systems.

The list of workshops is as follows.

1. The 11th International Workshop on Engineering Complex Distributed Systems (**ECDS-2017**)
2. The 10th International Workshop on Engineering Parallel and Multi-Core Systems (**ePaMus-2017**)
3. The 10th International Workshop on Intelligent Informatics and Natural Inspired Computing (**IINIC-2017**)
4. The 8th International Workshop on Frontiers on Complex, Intelligent, and Software Intensive Systems (**FCISIS-2017**)
5. The 8th International Workshop on Virtual Environment and Network-Oriented Applications (**VENOA 2017**)
6. The 7th Semantic Web/Cloud Information and Services Discovery and Management (**SWISM-2017**)

7. The 7th International Workshop on Intelligent Computing In Large-Scale Systems (**ICLS-2017**)
8. The 4th International Workshop on Energy-Aware Systems, Communications and Security (**EASyCoSe-2017**)

These workshops bring to the researchers conducting research in specific themes the opportunity to learn from this rich multi-disciplinary experience. The Workshop Co-Chairs would like to thank CISIS-2017 International Conference Organizers for their help and support. We are grateful to the workshops' organizers for their great efforts and hard work in proposing the workshops, selecting the papers, and the interesting programs and for the arrangements of the workshops during the conference days. We are grateful to Shinji Sakamoto, Donald Elmazi, and Yi Liu, Fukuoka Institute of Technology, Japan, for their excellent work and support as Web Administrators. We would like to give special thanks to the Local Organization Team of ISMB, Torino, Italy.

We hope you enjoy the workshops' program and proceedings.

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Welcome Message from ECDS-2017 International Workshop Co-chairs

It is our great pleasure to welcome you to the 11th International Workshop on Engineering Complex Distributed Systems (ECDS-2017), which will be held in conjunction with the 11th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2017) from July 10 to 12, 2017, at Istituto Superiore Mario Boella (ISMB), Torino, Italy.

In the past, this field included technology concerns related to middleware solutions, dealing with the heterogeneity of the miscellaneous hardware and software environments and computing infrastructure. These technologies have been used to address the integration of existing legacy applications and improve the interoperability between applications across enterprises. The advances in wireless communication and pervasive computing extend this traditional wired area of distributed systems and make new advanced application possible. The complexity of today's applications requires additional approaches to be able to realize an enterprise application time- and cost-saving. This includes the ability to model business processes, business policies, and event-oriented aspects of large systems and express these models through design solutions to address the complexity of enterprise applications and ease software design efforts. In addition, the engineering of complex distributed systems also requires a good understanding of the problem areas of concern for information systems and business administration, such as process management, supply chain management, security issues, and electronic business. These topics need to be addressed in order to deal with the complexity of today's increasingly dynamic, mobile, cross-organizational, and cross-jurisdictional systems.

In this workshop, various aspects of the design and implementation of distributed systems will be discussed. The scope of the presented papers ranges from engineering approaches and techniques to applications.

This workshop would not have been possible without the help of many people. First of all, we would like to thank all the authors for submitting their papers to our workshop. We also like to thank the Program Committee Chair, program committee members, and additional reviewers, who carefully evaluated the submitted papers.

We hope that you find the ECDS-2017 program inspiring and that the workshop provides you with the opportunity to interact, share ideas with, and learn from other

distributed systems researchers from around the world. We also encourage you to continue to participate in future ECDS workshops, to increase its visibility, and to interest others in contributing to this growing community.

ECDS 2017 Workshop Co-chairs

Leonard Barolli	Fukuoka Institute of Technology, Japan
Makoto Takizawa	Hosei University, Japan

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Welcome Message from ePaMuS-2017 International Workshop Chair

Welcome to the 10th International Workshop on Engineering Parallel and Multi-Core Systems (ePaMuS-2017), which will be held in conjunction with the 11th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2017) from July 10 to 12, 2017, at Istituto Superiore Mario Boella (ISMB), Torino, Italy.

The need for increase in computational power has led to the multi-core era. Multi-core processors are becoming all pervasive, and nowadays, the multi-core processors are found not only in computers (servers, PCs, and laptops) but also in mobile and many other devices. The multi-core systems thus increase the computational power yet achieving this is not straightforward. In order to take advantage of multi-core systems, it is necessary to fully exploit their parallel computing nature. Additionally, as the number of cores that can be packed into a chip is increasing, advanced parallel software approaches are needed to bridge the gap between the potential and real performance of multi-core systems and applications.

This workshop aims to bring together researchers and developers from the fields of parallel computing, multi-core systems, and software engineering to contribute and discuss on the latest findings in parallel programming techniques, hardware architectures, and parallel software platforms for multi-core systems.

Many people were involved in this workshop. We would like to thank all the PC members and authors for their contribution to make this workshop a successful event.

We would like to wish you fruitful discussions during the workshop and a pleasant stay in Torino, Italy.

ePaMuS-2017 Workshop Chair

Leonard Barolli Fukuoka Institute of Technology, Japan

ePaMuS-2017 Organizing Committee

Workshop Chair

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Message from IINIC-2017 International Workshop Organizers

Advanced information processing technologies have the potential to significantly accelerate research in different fields. In particular, techniques from artificial intelligence, machine learning, and data mining can assist researchers in the discovery of new knowledge for next-generation applications. This workshop aims to attract state-of-the-art solutions and novel attempts in this direction.

The 10th International Workshop on Intelligent Informatics and Natural Inspired Computing (IINIC-2017) will provide a platform for researchers to meet and exchange their thoughts. IINIC-2017 will be held in conjunction with the 11th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2017) from July 10 to 12, 2017, at Istituto Superiore Mario Boella (ISMB), Torino, Italy.

Many people contributed to the success of IINIC-2017. We wish to thank the program committee members for their great effort. We also would like to express our gratitude to the main organizers of CISIS-2017 for their excellent work in organizing the conference. We would like to thank and congratulate all the contributing authors for their support to the workshop.

IINIC-2017 Workshop Co-chairs

Hui-Huang Hsu	Tamkang University, Taiwan
Leonard Barolli	Fukuoka Institute of Technology, Japan

IINIC-2017 Organizing Committee

Workshop Co-chairs

Hui-Huang Hsu	Tamkang University, Taiwan
Leonard Barolli	Fukuoka Institute of Technology, Japan

Program Committee Members

Tun-Wen Pai	National Taiwan Ocean University, Taiwan
Oliver Ray	University of Bristol, UK
Oda Tetsuya	Fukuoka Institute of Technology, Japan
Elis Kulla	Okayama University of Science, Japan
Salvatore Vitabile	University of Palermo, Italy
Omar Khadeer Hussain	University of New South Wales Canberra, Australia
Takuo Suganuma	Tohoku University, Japan
Makoto Ikeda	Fukuoka Institute of Technology, Japan
Fatos Xhafa	Technical University of Catalonia, Spain
Santi Caballé	Open University of Catalonia, Spain
Farookh Hussain	University of Technology Sydney, Australia
Takahiro Uchiya	Nagoya Institute of Technology, Japan

Message from FCISIS-2017 International Workshop Organizers

It is our great pleasure to welcome you for the 8th International Workshop on Frontiers on Complex, Intelligent, and Software Intensive Systems (FCISIS-2017). The workshop will be held in conjunction with the 11th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2017) from July 10 to 12, 2017, at Istituto Superiore Mario Boella (ISMB), Torino, Italy.

The objective of FCISIS workshop is to foster the discussion in a rich inter-disciplinary context of the three challenging areas of ICT-enabled applications: software-intensive systems, complex systems, and intelligent systems. FCISIS-2017 is conceived in terms of special papers, which were also carefully selected, from the organizers.

We would like to thank all participants of the workshop for submitting their research works and for their participation and look forward to meet you again in forthcoming editions of the workshop.

FCISIS-2017 Workshop Chair

Leonard Barolli — Fukuoka Institute of Technology, Japan

FCISIS-2017 Organizing Committee

Workshop Co-chairs

Leonard Barolli — Fukuoka Institute of Technology, Japan

Program Committee Members

Tatsushi Tokuyasu — Fukuoka Institute of Technology, Japan
Makoto Ikeda — Fukuoka Institute of Technology, Japan

Tomoya Enokido	Rissho University, Japan
Farookh Hussain	University Technology Sidney, Australia
Nik Bessis	Edge Hill University, UK
Hiroaki Kikuchi	Meiji University, Japan
Akio Koyama	Yamagata University, Japan
Keita Matsuo	Fukuoka Institute of Technology, Japan
Hiroaki Nishino	Oita University, Japan
Tetsuya Shigeyasu	Hiroshima International University, Japan
Makoto Takizawa	Hosei University, Japan
Salvatore Vitabile	University of Palermo, Italy
Admir Barolli	Aleksander Moisiu University of Durresi, Albania
Elis Kulla	Okayama University of Science, Japan
Evjola Spaho	Polytechnic University of Tirana, Albania
Noriki Uchida	Fukuoka Institute of Technology, Japan
Hiroshi Maeda	Fukuoka Institute of Technology, Japan

Message from VENOA-2017 International Workshop Organizers

Welcome to the 9th International Workshop on Virtual Environment and Network-Oriented Applications (VENOA-2017), which will be held in conjunction with the 11th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2017) at Istituto Superiore Mario Boella (ISMB), Torino, Italy, from July 10 to 12, 2017.

The past eight workshops were very successful, and many high-quality papers were presented and published in these workshops. We are pleased to announce the continuation of this workshop for serving as a forum for the exchange of information and ideas in the field of 3D computer graphics, virtual reality (VR), augmented reality (AR), mobile communications, IoT, and Web and network applications. We again received many unique and high-quality paper submissions in this workshop. We strictly follow the CISIS review procedures and finally selected excellent papers for publication and presentation. The program shows a variety of research activities with high relevance to the scope of the workshop.

This workshop cannot be organized without hard and excellent work of CISIS-2017 conference organizers. We would like to express our sincere appreciation to VENOA-2017 program committee members and reviewers for their cooperation in completing their efforts under a very tight schedule. We also give our special thanks to all authors for their valuable contributions. We hope that these papers will have significant impacts and stimulate future research activities.

VENOA-2017 Workshop Co-chairs

Yong-Moo Kwon	Korea Institute of Science and Technology, Korea
Hiroaki Nishino	Oita University, Japan

VENOA-2017 Organizing Committee

Workshop Co-chairs

Yong-Moo Kwon	Korea Institute of Science and Technology, Korea
Hiroaki Nishino	Oita University, Japan

Program Committee Members

Minoru Ikebe	Oita University, Japan
Eiji Aoki	Institute for Hypernetwork Society, Japan
Byungrae Cha	Gwangju Institute of Science and Technology, Korea
Makoto Fujimura	Nagasaki University, Japan
Nobuo Funabiki	Okayama University, Japan
Ken'ichi Furuya	Oita University, Japan
Nobukazu Iguchi	Kinki University, Japan
Tsuneo Kagawa	Oita University, Japan
Laehyun Kim	Korea Institute of Science and Technology, Korea
JongWon Kim	Gwangju Institute of Science and Technology, Korea
Byung-Gook Lee	Dongseo University, Korea
Jong Weon Lee	Sejong University, Korea
Yukikazu Murakami	Kagawa National College of Technology, Japan
Makoto Nakashima	Oita University, Japan
Dahlan Nariman	Ritsumeikan Asia Pacific University, Japan
Satoshi Ohtake	Oita University, Japan
Yoshihiro Okada	Kyushu University, Japan
Yoshitaka Sakurai	Meiji University, Japan
Shinji Sugawara	Chiba Institute of Technology, Japan
Shigeto Tajima	Osaka University, Japan
Kenzi Watanabe	Hiroshima University, Japan
Kazuyuki Yoshida	Oita University, Japan

Message from SWISM-2017 International Workshop Organizers

Welcome to the 7th International Workshop on Semantic Web/Cloud Information and Services Discovery and Management (SWISM-2017), which is held in conjunction with the 11th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2017) at Istituto Superiore Mario Boella (ISMB), Torino, Italy, from July 10 to 12, 2017.

SWISM-2017 will bring together scientists, engineers, computer users, and students to exchange and share their experiences, new ideas, and research results about all aspects (theory, applications, and tools) of intelligent and semantic methods applied to Web and cloud-based systems and to discuss the practical challenges encountered and the solutions adopted.

The program of SWISM-2017 includes papers related to information retrieval, ontologies, intelligent agents, intelligent techniques for management, and programming of cloud services and business processes. The program for the conference is the result of excellent work of reviewers and program committee members. We hope you will find the final program enriching and stimulating.

We believe that all of papers and topics will provide novel ideas, new theoretical and experimental results, work in progress and state-of-the-art techniques, and stimulate the future research activities in this area.

Papers collected in this international workshop were carefully reviewed by at least 3 reviewers. According to the review results, the program committee members selected high-quality papers to be presented in this workshop.

We would like to express our sincere appreciation to all program committee members for their cooperation. We are thankful to General Co-Chairs, Honorary Chairs, Program Committee Co-Chairs, and Workshops Co-Chairs of CISIS-2017 for excellent conference organization. It was a great pleasure working with them.

We are grateful to all authors for their valuable contributions and attendees who contributed to the success of the program with their papers and speeches on their research results, and with their attending the conference.

We hope you will enjoy the workshop and conference and have a great time in Torino.

SWISM-2017 Workshop Co-chairs

Beniamino Di Martino	Università degli Studi della Campania Luigi Vanvitelli, Italy
Salvatore Venticinque	Università degli Studi della Campania Luigi Vanvitelli, Italy
Antonio Esposito	Università degli Studi della Campania Luigi Vanvitelli, Italy

SWISM-2017 Organizing Committee

Workshop Co-chairs

Beniamino Di Martino	Università degli Studi della Campania Luigi Vanvitelli, Italy
Salvatore Venticinque	Università degli Studi della Campania Luigi Vanvitelli, Italy
Antonio Esposito	Università degli Studi della Campania Luigi Vanvitelli, Italy

Program Committee Members

Omer Rana	University of Cardiff, UK
Siegfred Benkner	University of Vienna, Austria
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Dieter Kranzlmueller	University Ludwig Maximilian of Munich, Germany
Antonino Mazzeo	University Federico II of Naples, Italy
Domenico Talia	University of Calabria, Italy
Rocco Aversa	Università degli Studi della Campania Luigi Vanvitelli, Italy
Thomas Fahringer	University of Innsbruck, Austria
Vincenzo Loia	University of Salerno, Italy

Message from ICLS-2017 International Workshop Chair

Welcome to the 7th edition of Intelligent Computing in Large-Scale Systems (ILCS-2017) International Workshop organized in conjunction with the 11th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2017) at Istituto Superiore Mario Boella (ISMB), Torino, Italy, from July 10 to 12, 2017.

Intelligent computing is usually defined as advanced computing methods and techniques based on classical computational intelligence, artificial intelligence, and intelligent agents. Large-scale distributed systems, such as grids, peer-to-peer and ad hoc networks, constellations, and clouds, enable the aggregation and sharing of geographically distributed resources from different organization with distinct owners, administrators, and policies.

With the advent of large-scale distributed systems, where efficient inter-domain operation is one of the most important features, it is arguably required to investigate novel methods and techniques to enable secure access to data and resources, efficient scheduling, self-adaptation, decentralization, and self-organization. The concept of intelligent computing in large-scale systems brings together results from both areas with a positive impact on the development of new efficient data and information systems.

The aim of ICLS workshop is to gather innovative academic and industrial researchers related to all aspects of intelligent computing in large-scale distributed systems, ranging from conceptual and theoretical developments to advanced technologies and innovative applications and tools.

I would like to thank all authors for submitting their research works to the workshop and the reviewers for their time and constructive feedback to authors.

I do hope all of you enjoy ICLS-2017 and will join again the next workshop edition.

ICLS-2017 International Workshop Chair

Leonard Barolli Fukuoka Institute of Technology, Japan

ICLS-2017 Organizing Committee

Workshop Chair

Leonard Barolli	Fukuoka Institute of Technology, Japan

Program Committee Members

Tomoya Enokido	Rissho University, Japan
Kin Fun Li	University of Victoria, Canada
Giovanni Morana	Catania University, Italy
Richard Hill	University of Derby, UK
Makoto Ikeda	Fukuoka Institute of Technology, Japan
Philip Moore	Lanzhou University, China
Hiroaki Nishino	Oita University, Japan
Evjola Spaho	Polytechnic University of Tirana, Albania
Makoto Takizawa	Hosei University, Japan
Olivier Terzo	ISMB, Italy
Salvatore Vitabile	University of Palermo, Italy
Muhammad Younas	Oxford Brookes, UK

Welcome Message from EASyCoSe-2017 International Workshop Co-chairs

Welcome to the 4th International Workshop on Energy-Aware Systems, Communications and Security (EASyCoSe-2017). The workshop is held in conjunction with the 11th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2017) at Istituto Superiore Mario Boella (ISMB), Torino, Italy, from July 10 to 12, 2017.

The main goal of this workshop is to bring together researchers and practitioners, from both the industrial and academic communities, who are interested in addressing issues and challenges related to optimizing computing and networking system power consumption, energy efficient systems, and energy-related issues. The papers included in the proceedings present novel ideas regarding several hot topics in state-of-the-art ICT and security arena, mainly concerning energy-aware decision making, enhanced access control, and energy-related attacks.

For organizing an international event, the support and help of many people are needed. First, we would like to thank all authors for submitting and presenting their papers. We also greatly appreciated the support from program committee members and reviewers who carried out the most difficult work of carefully evaluating the submitted papers.

We would also like to give our special thanks to Prof. Leonard Barolli, General Co-Chair of the CISIS-2017, for his strong encouragement and guidance.

We hope all of you will enjoy EASyCoSe-2017 and find this a productive opportunity to exchange ideas with many researchers.

EASyCoSe-2017 WorkShop Co-chairs

Mauro Migliardi	University of Padua, Italy
Francesco Palmieri	University of Salerno, Italy

EASyCoSe-2017 Organizing Committee

Workshop Chairs

Mauro Migliardi	University of Padua, Italy
Francesco Palmieri	University of Salerno, Italy

Program Committee

Davide Careglio	Universitat Politecnica de Catalunya, Spain
Aniello Castiglione	University of Salerno, Italy
Bruno Carpentieri	University of Salerno, Italy
Fred Chong	University of California Santa Barbara, USA
Massimo Ficco	Università degli Studi della Campania Luigi Vanvitelli, Italy
Ugo Fiore	Federico II University of Naples, Italy
Fang-Yie Leu	Tunghai University, Taiwan (ROC)
Mauro Iacono	Università degli Studi della Campania Luigi Vanvitelli, Italy
Alessio Merlo	University of Genoa, Italy
Sergio Ricciardi	Universitat Politecnica de Catalunya, Spain
Matthew Sorrell	University of Adelaide, Australia
Vaidy Sunderam	Emory University, USA

CISIS-2017 Keynote Talks

Raspberries on the Edge

Sven Helmer

Free University of Bozen-Bolzano, Bolzano, Italy

Abstract. With the advent of the Internet of Things (IoT), billions of new devices will join the data networks, many of them generating data streams originating from sensors or other sources. Instead of pushing all these data to centralized (cloud) servers, it makes a lot of sense to preprocess, analyze, and aggregate it on-site. This is the central idea of edge computing, reducing storage requirements for central servers, lowering the network load, and also decreasing reaction times for time-critical applications. Deploying the necessary infrastructure for edge computing is already a challenge in well-developed, urbanized settings, and it is even harder to do so in harsh environments located in rural and remote areas. Platforms based on small single-board computers, such as Raspberry Pis, could ameliorate this situation by providing a solution with low costs and power consumption. In this keynote, we look at some of the challenges faced by edge computing in general and also explore particular low-resource scenarios.

The Future of IT Technologies

Patrick Demichel

Hewlett Packard, Paris, France

Abstract. Our society and industry are facing a large number of MegaTrends. The IIoT, "Intelligent Internet of Things," and machine learning are some of the most promising. At the same time, we observe many signs that we are reaching some fundamental limits of our old technologies and infrastructures. Our laboratories demonstrated a decade ago that we have no choice but to implement a radical and holistic transformation, if we expect to reach the Exascale frontier at a reasonable power envelop. We anticipated also a set of news problems, such as edge computing and its requirements in term of security. This large research program called "The Machine" is now entering its final development phase with a group of partners grouped in a consortium named "gen-Z." We will explore what are the fundamental bricks enabling this historical evolution of our architectures. We will also consider some implications on how we could solve our most challenging problems in a short future, with a huge potentiality for the IIoT, Exascale, and ML ecosystems.

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