

networking. Here he concentrated on the issue of quality of service. Their collaboration with Intel on TSNs over wireless was next described, followed by a short video of their work in progress regarding experiments on bandwidth efficiency. Dr. Candell concluded his presentation with a chart on the future of wireless TSNs, where he listed “current problems” with “recommended solutions.”

One example of a current problem is the synchronization of clocks over wireless, followed by a recommended solution of better clocks, with synchronization over wireless connections.

A panel discussion followed, which generated lively discussions on various aspects of the topics of the workshop among the speakers and between speakers and the audience (see Figure 3). The

chairs thanked the speakers and the organizers for another successful edition of the workshop.

—Victor Huang 

Associate Editor

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Magazine

Vice-Chair

Industrial Electronics Standards

Committee

Industry Forum at IECON 2022 Brussels

The 48th Annual Conference of the Industrial Electronics Society (IES) (IECON 2022) was held 17–20 October 2022 in Brussels, Belgium. The general chairs were Prof. Abdelah Touhafi, Vrije University Brussels and Prof. Peter Palensky, TU Delft. The Industry Forum at IECON 2022 was organized by Industry Forum Cochairs Dr. Michael Condry, ClinicAI; Dr. Victor Huang; and Stamatis Karnouskos, SAP.

In this series, the Industry Forum featured three sessions over three days, 18–20 October 2022, covering “Strategies and Innovations in Digital Health,” “New Infrastructure for Digitalization and Sustainability,” and “European Innovation: Policies and Directions.”

The first session, “Strategies and Innovations in Digital Health,” was held on 18 October and chaired by Dr. Condry. He organized the session with short presentations by the speakers, followed by panel discussions between the speakers and the audience. As first speaker, Dr. Condry gave “An Overview of IES Digital Health Informatics Workshop,” summarizing the workshop held at IECON 2022 that reviewed standards, and the impact that health informatics had across multiple sectors on individuals and industry. Next he talked about medical data sources and needs for standards, showed a typical digital health

measurement device architecture (see Figure 1), looked toward achieving international sharing of information, established road maps for consumer and medical professional data integration, defined standards, and established security and authentication requirements.

The second speaker, Dr. Gora Datta, visiting professor, University of California, Berkeley, presented “Disruptive Technologies Meets Global Demand—The World of Mobile and Emerging Technologies.” Here he first described mobile technology

disruption, covering mobile platform differentiators and how they fueled the Internet of Things (IoT) revolution that drove the emerging technological revolution: digital health, wearables, medical devices, mobile technology, robotics, advanced manufacturing, mobility, genetic technology, and cybersecurity, to name a few. He then focused on mobile health scenarios, addressing the theme of the session. The scenarios covered included caregiver on the move, patient empowerment, independent living, behavioral health, and mobile messaging.



FIGURE 1 – Dr. Michael Condry delivers “An Overview of IES Digital Health Informatics Workshop,” at IECON 2022 Industry Forum Session 1. (Photo courtesy of Dr. Victor Huang.)

The third talk was on “Ecosystem Transformation Through Secure Plug and Play Interoperability,” by Dr. Christoph Fischer, Roche, in which he discussed that standardized secure plug-and-play interoperability for health and medical devices is available today to build a health-care ecosystem. However, adoption of the use of abundantly available devices is lacking in the system today. As an example of need, he cited the World Health Organization’s projection that the diabetes crisis will be the seventh-leading cause of death by 2030, calling for the need for integrated, personalized diabetes management to facilitate solutions in health-care delivery, and to set and use secure interoperability standards for secure data exchange among health and medical devices, for which many of these standards exist. These standards will provide secure plug-and-play interoperability, leading to an improved quality of life for patients and caregivers, and reduce cost. He concluded by stating that the problems that still need to be solved are to convince detractors to accept interoperability of health/medical devices and systems, which will result in health-care ecosystem transformation through secure plug-and-play interoperability.

The fourth speaker, Dr. Stefan Sauermaun, University of Applied Sciences, Technikum Wien, touched on “Visions for Health in Europe: Standards, European Health Data Space.” His talk covered an overview of the need for electronic health records and the approach implemented in Austria. He stated that the health challenges today include demographic changes, the chronic disease burden placed on health care, and limits of health-care systems, which include the lack of workforce. What is needed is the empowerment of individuals to be given personal responsibility of their health, well-being, and preven-

DR. LUNZENFICHTER THEN INTRODUCED AND DESCRIBED M+ HUB, THE FIRST GLOBAL MEDICAL IOT INFRASTRUCTURE PLATFORM, WITH THE GOAL OF ENABLING THE “HOSPITAL AT HOME.”

tion of illness, and integration and assistance of technology into everyday health care. With this introduction, he presented the core architecture of and standards in Austria’s electronic health record systems, based on the Austrian approach to utilizing the European Union’s (EU’s) interoperability layers of eHealth networks, and showed the progress under the myHealth@EU system, with its corresponding EU data spaces in health-care electronic record systems. The issue then is, “How do we scale up efficiently?”, and he covered some examples on requirements and use cases for doing so. These included health-care systems for diabetes, IT support for mobile care, robotic surgery systems, and polymerase chain-reaction (PCR) test systems.

Closing the series of talks was Dr. Gilles Lunzenfichter, Medisante Group, who presented “Medical IoT: Why Healthcare Is Lagging Behind Other Industries in IoT Adoption.” He began his talk by saying that devices are the new data collection engine in virtual health care. So, why is IoT adoption in health care lagging behind other industries? A reason is because medical technology software “silos” stand in the way of interoperability and systems integration and poses a privacy and security risk. Therefore, a paradigm shift is required in the device experience leading to device interoperability. Dr. Lunzenfichter then introduced and described M+ Hub, the first global medical IoT infrastructure platform, with the goal of enabling the “hospital at home.”

A short panel session, chaired by Dr. Condry, was held between the speakers and audience, which was lively and informative. In conclusion, Dr. Condry thanked the speakers for their presentations and participation at the forum, and thanked the audience for its attendance and participation.

The second session of the Industry Forum was held on 19 October 2022,

titled “New Infrastructure for Digitalization and Sustainability.” The chair for this session was Dr. Huang.

The first speaker was Dr.-Ing. Bernard Wille-Haussmann, Fraunhofer Institute for Solar Energy Systems. He presented “Electric Vehicle Supply Equipment—Testing of Smart Grid Functionality.” He started off by stating the motivation for smart grid integration. The share of electric vehicles (EVs) in transportation is increasing steadily, and to meet environmental requirements, electricity should come from renewable sources. Therefore, it is essential that required smart or controlled charging of EVs must increase the use of renewables and avoid electric grid bottlenecks while also considering the balance between grid needs and the residential profile impact due to the influence of EVs. Additionally, many research areas in smart charging, including solar-optimized charging coupled with bidirectional charging concepts, must be applied to deployment. And, where the control requirements on the chargers need to be integrated into the EV’s supply equipment, control regulations on the external operators must be introduced. He then focused on the motivation for smart charging control development and discussed the needs for testing to validate the control requirements. He described the research being conducted with an EV digital twin model emulating the real charging power station with the power hardware-in-the-loop (HIL) setup at the HIL test facility at the Fraunhofer Institute’s Digital Grid Lab. Emulated charging controllers in the digital twin setup follow established communication standards for EV chargers, namely, IEC 61851 and ISO 15118.

The second speaker, Dr. Zhibo Pang, ABB, discussed “5G Communications and Computing for Industrial Control Systems: Where we are and directions.” Dr. Pang spoke on research findings from his work in systematic evaluation of 5G latency, reliability, and compatibility to industrial networks, especially demonstrating via use cases in time-critical control systems. He sees a realistic pathway toward the development of cloud-fog

automation systems. Time-critical systems have been one of the main drivers of 5G development, and with their release roughly five years ago, commercial 5G products with enhanced mobile broadband profiles have been available for two years. Dr. Pang proceeded to identify directions that need more efforts from industry and academia, such as “promise versus delivery” by 5G systems from the 5G Release 15 version of the technology. He reported that one-way latency of 50 ms with 99.9999% reliability was achieved in specific test settings, which was promising for many time-critical applications, but was still far from the promise regarding 0.5-ms one-way latency of 5G from the beginning. He pointed out important functional gaps of the 5G product of today, such as the lack of support to the Ethernet protocol data unit session, lack of support to Internet Protocol/User Datagram Protocol multicast, and lack of interfaces for user applications to get the time synchronization. He also looks to the security and long-term availability of telecommunications services, providing “safety, security, and availability” for 5G and wireless safety-critical and time-deterministic applications (see Figure 2).

Dr. Dietmar Bruckner, B&R Industrial Automation, followed with his presentation on “Emerging Technologies in Industrial Automation for Enhancing Digitalization and Sustainability.” Dr. Bruckner started with stating the problem: today’s challenges in the manufacturing of consumer-packaged goods. He focused on product proliferation and smaller batch sizes, shorter product lifecycles, unpredictable demand and supply fluctuation, and mass customization. To meet these challenges, new machine capabilities for packaging machinery are needed, such as zero-downtime changeover, being ready for unknown future products, meeting high productivity and accelerated time to market, and providing a profitable, small-batch production of products. Dr. Bruckner states that such adaptive machines have emerged from the synergy of new and existing technologies, including machine vision, electromagnet-

ic transport, robotics, and digital twins. This comes about from utilizing state-of-the-art devices in real-time applications in the production environment. He further stated that the deployment of two standards technologies will further ensure success: the Open Platform Communications Unified Architecture and time-sensitive networks standards and technologies. He concluded his presentation with some highlights of technology examples, such as track-based transport and digital twins, mass customization and robotics, and machine vision. A video of a real-life example of battery production for EVs was shown.

Rounding out the second session was Dr. Chih-Lin I, China Mobile Research Institute, who spoke on “Green Technologies for Sustainability—An Operator’s Pursuit.” In her presentation, Dr. I gave a comprehensive account on China Mobile’s commitment to environmental sustainability with the pursuit of green technologies in its development of telecommunications equipment and applications.

For China Mobile’s framework of green pursuit, Dr. I stated that it will use a technical framework approach and energy-efficient technologies at all levels, that is, materials, devices, subsystems, and base stations, all the way to networks, over its 4G, 5G, and subsequently to its 6G technology deployments. Dr. I listed details on its hardware (HW) and software equipment energy savings achievements and goals: for continuing energy savings commitments in 5G HW, current achievements include higher-efficiency power amplifiers, high-integration devices, and the use of newer materials in products for reduced heat dissipation. For network-level solutions, power consumption of base stations was reduced by 60%.

Dr. I next discussed challenges in the coming 6G technologies in terms of energy savings and consumption. 6G considerations include opportunities in optimal network structure design using on-demand deployment and plug-and-play functions; use of new materials

THE EDF GROUP PLANS TO BUILD A NET-ZERO ENERGY FUTURE, UTILIZING ELECTRICITY AND INNOVATIVE SOLUTIONS, DRIVING WELL-BEING AND ECONOMIC DEVELOPMENT.

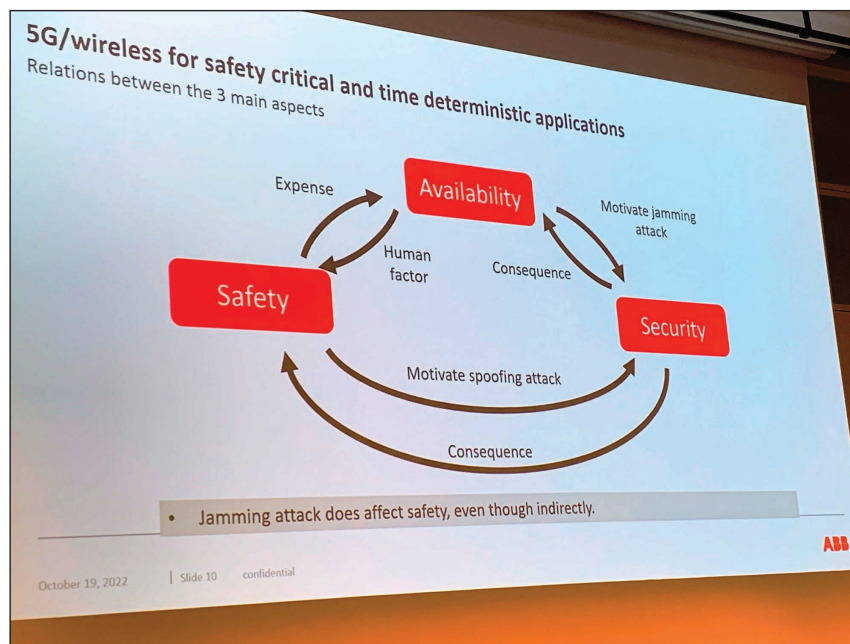


FIGURE 2 – Dr. Zhibo Pang presents at IECON 2022 Industry Forum Session 2. (Photo courtesy of Dr. Victor Huang.)

and devices; such as intelligent reflecting surfaces, use of more efficient air interfaces and spectrum utilization, and finer granularity in energy savings management using flexible resource scheduling; and configuration based on artificial intelligence (AI) and multilevel device sleep-mode management.

Dr. I concluded her talk by summarizing the impact of China Mobile's equipment and products on enabling greener verticals (education, medical, commercial marketplace, and agriculture) where the experience thus far has been 10% of energy savings achieved. However, these verticals are in its growth stage, thereby allowing further impact in terms of energy savings by the commitments from China Mobile.

A short Q&A period followed, and the session ended with the chair

thanking the speakers for their presentations, thanking the audience for its participation, and looking forward to more engagements in the future.

On 20 October 2022, the third Industry Forum session took place, with the theme "European Innovation: Policies and Directions," with Karnouskos as the chair. Here, he introduced four speakers and the overall session context, which focused on sustainability, policies, and innovation efforts, with representatives from industry, the European Commission, and IEEE European Public Policy Committee (EPPC).

Olivier Dubois, e-mobility director of the EDF Group, presented EDF's strategic plan for electric mobility. He pointed out the pivotal role of the development of EVs as part of a global decarbonization strategy and started by showing the evolution of the consumption of electricity and energy in France from the 1960s to the 2050s, particularly on electricity, starting in the 2020s. Following scenarios of the mixture of renewables and nuclear energy, he showed the projected evolution of the annual electricity consumption of EVs in France from 2019

to 2050. The EDF Group plans to build a net-zero energy future, utilizing electricity and innovative solutions, driving well-being and economic development. One of EDF's strategic directions is toward international development and becoming the leading e-mobility energy company in key European markets such as France, the United Kingdom, Italy, and Belgium.

The strategic plan strives for leadership as an electricity supplier for EVs, charging points, and smart charging. Dubois pointed out that the EDF Group has already become a leading player for e-mobility in Europe as they offer energy-efficient solutions for all use cases in private and public domains (home, work, public sites, and travel). These actions also apply to EDF as a company as all light vehicles are expected to be 100% EVs by 2030.

Prof. Antonello Monti, IEEE EPPC and professor at RWTH Aachen University, then presented "Converging at the Edge: Energy and ICT for a Clean Future." In his talk, Prof. Monti highlighted the new role of edge and distribution grids and the importance data play in this new infrastructure. The new emerging grid is highly dependent on information and communication technologies that can capitalize on the data collected, exchanged, and analyzed among the different stakeholders, such as energy distribution system operators (DSOs), transmission system operators, customers, energy aggregators, e-mobility providers, and so on. The challenge is to structure DSO data exchange standards and requirements and build categories for data interfaces while also considering their specific requirements. A systems-of-systems approach is needed for these diverse requirements where field data inputs and sensors feed into DSO technical platforms that then interact with DSO business operations. A key added-value proposition is when the DSO platforms are provided with cellular 4G/5G automation solutions based on their

embedded security, edge networks, and scalability properties. The key items provided are management of time-sensitive data, reduction in transport latency using edge computing, and the use of open source for dual use of data for both technical operations and market services. Prof. Monti then analyzed some past and ongoing efforts in the field and concluded that digitalization has created new and complex requirements for grid operations. The domain is rapidly changing, with digitalization happening in parallel with the internal renewable transformation, and information and communication technologies are empowering new innovative architectures and platforms that address the new requirements posed. Especially, the role of open source is seen as pivotal as open source is emerging as the main enabler of the parallel 4D revolution: decarbonization, decentralization, democratization, and digitalization.

Two talks from European Commission officers from the Directorate-General for Communication Networks, Content and Technology (DG CNECT) followed, focusing on the views and efforts of the European-Commission side on digital transformation. Jan Komarek, IoT, DG CNECT, spoke on "Europe's Digital Decade: Future European Platforms for the Edge: Meta Operating Systems," and Mr. Matthias Kuom, Digital Transformation of Industrial Ecosystems Unit, DG CNECT, continued with "Europe's Digital Decade: Digital technologies for Sustainability and Resilience."

Komarek began his talk with an introduction to EU data strategy that pertains to cloud and data actions and includes investments and new legislations. These actions are realized at the EU level via the European alliance for industrial data, edge, and cloud as well as the European common data spaces, while coordination is done for federation and interoperability of standards and implementation of technical architectures by initiatives such as GAIA-X. Komarek also focused on the cloud-edge-IoT orchestration in architecture and systems implementation, which creates a paradigm shift to bring compute resources closer to the data. In the European Commission,

DATA TRANSFORMATION, RESOURCE-OPTIMIZATION CAPACITIES, AND DATA-SHARING PROCESSES ARE PIVOTAL FOR BETTER DEMAND AND SUPPLY MANAGEMENT.

strategic initiatives of more than four years have been realized with different multimillion dollar European funding calls focusing, e.g., on open source for cloud/edge digital autonomy, pilots for smart IoT platforms, and cognitive computing continuums. Key funded innovation projects cover several strategic areas in IoT for future hyper-distributed applications embedded in a computing continuum. Such efforts are demonstrated in several use cases, e.g., in manufacturing, renewable energy, smart buildings, farming, and so on. Other efforts focus more on analyses predicting future long terms in computing systems, some of which are planned in cooperation with the National Science Foundation in the United States to address aspects such as infrastructure heterogeneity, everything as a service, dynamic provision, and migration as well as intelligent orchestration.

Kuom started his presentation by pointing out that everyone is experiencing a digital transformation in their lives, and the EU strategy is to ensure that Europe leads the way on the twin ecological and digital transitions. The beneficiaries of the EU strategy are Europeans via technology improvements tangible in their everyday life; businesses that can start, grow, innovate, and compete on fair terms; and the planet overall as digital technologies help the EU achieve pursued climate neutrality. The efforts toward sustainability are contemplated even more due to recent events, with an added focus on resilience and sovereignty. Data transformation, resource-optimization capacities, and data-sharing processes are pivotal for better demand and supply management. Therefore, in the Digital Europe program, the focus is on agile supply-chain management, dynamic asset management coupled with predictive/prescriptive maintenance, and data sharing for circularity, recycling, and



FIGURE 3 – The panel session of IECON 2022 Industry Forum Session 3. From left to right: Jan Komarek, Matthias Kuom, Prof. Antonello Monti, Olivier DuBois, and Stamatis Karnouskos (chair). (Photo courtesy of Dr. Victor Huang.)

remanufacturing. Digital technologies for sustainability in the industry are seen as indispensable, and therefore, several efforts have been made toward establishing the European industry as a leader in sustainable manufacturing and process industries through the application of trustworthy data sharing and AI technologies, with the aim to improve agility and resiliency of the European industry. Therefore, implications of AI for the Green deal, where AI could have a positive impact on the climate and environment, as well as greener AI, where the negative impacts of AI technologies such as energy consumption of models and platforms, are the focus of recent funding efforts of the European Commission. In addition, Kuom discussed the network of European digital innovation hubs and data governance regulations for the “2030 Digital Decade” of the EU. He concluded by pointing out the prioritization of resiliency and sustainability as value drivers, and that digital technologies can advance the data economy and help achieve the pursued objectives toward a sustainable and human-centered Industry 4.0.

After the talks, a lively panel session took place, with the speakers and audience discoursing how European digital innovation and digital transformation can be realized in

practice and pave the way for a more sustainable Europe, including the need for new policies and technology directions (see Figure 3).

As with every IES Industry Forum, the Forum strives to bring industry speakers to present their prevailing industry views and issues for discussions and interactions with the conference participants. The goal remains to bring together industry and academia to both benefit and tackle real-world problems.

More emerging topics of interest such as those presented in this Forum will be continued in forthcoming Industry Forums under the guidance of the IES Industry Activities Committee (IAC).

For more details on the IAC and Industry Forums, please find “IAC Activities” at the IES website at <http://www.ieee-ies.org/industry-forum>.

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—Dietmar Bruckner