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IEEE Future Directions Newsletter

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In This Issue:

Digital Reality: fostering and leveraging the ongoing Digital Transformation

By Roberto Saracco, IEEE Digital Reality Initiative Co-chair

At the November meeting in Vancouver, Canada the leadership of the Future Directions Committee (FDC) considered the growing interest occurring worldwide in the Digital Transformation. At the February meeting, the decision was made to launch a new initiative regarding the Digital Transformation that can benefit from the participation of several Societies/OUs with Future Directions acting as a catalyst.

The Digital Transformation everyone is talking about today is fueled by advances in technology, mostly transducers (i.e., sensors and actuators), and semantics extraction tools (i.e., artificial intelligence supporting data analytics). The main reason why industries and institutions globally are interested in the Digital Transformation, however, is based on economics. The Digital Transformation is shifting the economy from one of atoms to one of bits. The economy of atoms is an economy of scarcity: atoms are limited; if you give an atom away you no longer have it. On the contrary, the economy of bits is an economy of abundance: you can give bits away while maintaining a copy that is indistinguishable from the original bits. Additionally, the economy of atoms has a high transaction cost (i.e., it costs money and resources to move atoms along a value chain), while the cost of operating on bits is very low. This is attracting new, smaller players into various industries.

The change in the economic structure occurring due to the Digital Transformation decreases both the capital expenses (CAPEX) required to enter into the business of bits and the operating expenses (OPEX) of managing the business, although in the area of support infrastructures, such as communications networks and data centers, CAPEX and OPEX are still large (hence the small number of companies operating in that space). Given the advantages of the economy of bits over the economy of atoms, industries are scrambling as much as possible to move their atoms-based operation to the bit domain. Bits and atoms can be integrated by technologies like augmented reality (AR) and virtual reality (VR). AR and VR provide unique access to the world of bits, and increasingly through Digital Twins they ensure the connection

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to the physical twins.

Digital Twins are at the same time a digital model of some physical entity (such as an object or process or a set of aggregated objects or processes) and a digital shadow of the physical entity, mirroring its present situation (supporting monitoring and simulation) and its history (supporting root cause analyses). The Digital Twin can, in some situations, also be used as a proxy of the physical twin, something that is leveraged in Industry 4.0 as well as in other areas. AR, in a way, connects the world of bits to the one of atoms by overlaying bits on atoms. VR, on the other hand, leverages bits and is used, as examples, in design phases, in training, or in presenting the customer possible solutions.

Two current IEEE Future Directions Initiatives have been working on crucial components of the Digital Transformation: Digital Reality (AR and VR) and Symbiotic Autonomous Systems (SAS) (Digital Twins). The results the two initiatives have achieved so far, and the communities they have aggregated are a perfect starting point for this new initiative aiming at leveraging the growing interest of industry to exploit the economy of bits. Several industries have already voiced support, and the most effective way to quickly provide value is to take advantage of the results achieved by these initiatives.

The SAS Initiative is finalizing its activities with:

- A third White Paper, in cooperation with industry, focusing on the application of Autonomous Systems in various verticals and
- Education material in cooperation with EIT Digital in a MOOC on Digital Transformation that will be expanded upon by the new initiative.

Additionally, other ongoing and previous Future Directions Initiatives and communities will be contributing to the new one. For example, the IoT Initiative is clearly covering a crucial part of the Digital Transformation, and the Future Networks Initiative is working on the communications fabric for the Digital Transformation. WiFi 6 is becoming a commercial reality by the end of 2019, and 5G has the capability to integrate, for the first time in a seamless way, the wireless communications stemming from the telecommunications world with the one stemming from computer networking spearheaded by IEEE (802.11 series standards). The new Digital Reality Initiative, co-chaired by Steve Dukes, Roberto Saracco, and Raj Tiwari, will collaborate among the various communities across IEEE to support and enable the coming Digital Transformation.

Learn more about the Digital Reality Initiative on the web portal and join the Technical Community today to stay informed and, even better, get involved in the new initiative … for the benefit of humanity!

Technology Policy and Ethics

Future Directions considers the reflection of technology through the lens of social implications a key tenet of our work as we incubate and promote technologies. During 2018 we released six issues encompassing 10 articles covering topics including traffic management, deep learning, big data, personal health, and more. As we move forward in 2019, we are looking to build upon our catalog and expand out topic areas. Review the Future Directions Technology Policy and Ethics catalog of articles.

We are currently seeking submissions of original content for 2019, short articles of 800-1200 words on the social implications of technology, including but not limited to policy and ethics topics. If interested, please email FDPolicyEthics@ieee.org. Learn more about submitting an article through the author guidelines.

Are Smart Cities Smart?
By: H. Kieu, L. Borrello, KC Samiran, J. Martin, K. Watts, S. Jones

It is estimated that by 2030, 70% of the global population will live in cities. Cities today need to accommodate more people, as well as create a sustainable environment with efficient resources. Therefore, the concept of smart cities, which entails utilizing technological innovations, has become an important priority on many cities' agendas [1]. We will attempt to answer the question: "Are smart cities smart?" by looking at the five pillars associated with smart cities – Smart Grid, E-Governance, Infrastructure and Transportation, Crime Prevention, and Information and Communication Technology (ICT) applications. Read more.

Caveats for the Emergence of Virtual Wallets
By: Najee Searcy and Syed Hassan Ahmed

As smartphones have become integrated in the daily lives of citizens of developed nations, common monetary transactions that at one point in time required the consumer to search their cars, couches, and coat pockets for spare change can now be completed with the tap of a finger on their smartphone. Examples of these situations may include paying a toll or purchasing a beverage from a vending machine. One major factor considered to be a catalyst for the shift to virtual wallets is the idea that cashless transactions are more convenient. Opposing ideas to this shift in commerce trends include concerns about security, and the criticisms can be translated to the fear of putting all your eggs in one basket. By analyzing the pros and cons of the strengthening relationship between the smartphone and commerce, a clearer understanding of its limitations can be achieved. Read more.

Current Activities in our Technical Communities

IEEE Big Data:
IEEE DataPort™ is now available for use! Go to ieee-dataport.org to be connected to this valuable one-stop shop data repository which serves the growing Big Data technical community. Contact Melissa Handa at melissa.handa@ieee.org for a coupon code to become a subscriber free of charge.

IEEE Blockchain:
Interested in how Blockchain and IoT will enable cutting-edge solutions? IEEE Blockchain Technical Briefs has you covered. Our special edition on Blockchain for IoT features four timely articles that examine innovative prospects between distributed ledger technology and IoT networks. IEEE Blockchain Technical Briefs is always seeking articles for future issues. To have an article considered for publication, see the Editorial Guidelines.

IEEE Brain:
IEEE Brain launched its bi-monthly one hour webinar series on 20 February 2019. Our first webinar was titled, "Data-Driven Modeling of Brain Circuits Based on a Systematic Experimental Platform," and contained 40 minutes of presentation with 20 minutes of Q&A. Our presenter was Anton Arkhipov, Ph.D., Associate Investigator,

Allen Institute for Brain Science. Watch the recording.

IEEE Cloud Computing:
IEEE Cloud Computing is a key platform for researchers, academicians, and industry practitioners to share and exchange ideas regarding cloud computing technologies and services, as well as identify the emerging trends and research topics that are defining the future direction of cloud computing. To this end, we publish the IEEE Cloud Computing Magazine. Read the latest issue.

IEEE Cybersecurity:
IEEE Secure Development Conference (SecDev) is now accepting papers until Monday, 8 April, for their 2019 conference in McLean, VA, USA, 25-27 September 2019. Examples of topics that are in scope include: development libraries, tools, or processes to produce systems resilient to certain attacks; formal foundations that underpin a language, tool, or testing strategy that improves security, and more. Visit their website for more information.

IEEE Digital Reality:
A special panel on mixed reality was held at the 2018 IEEE Technology Time Machine (TTM) Symposium, moderated by IEEE Digital Reality Co-Chair Raj Tiwari and featuring panelists Jason Kenagy, Nicholas Napp, and Conor Russomanno. This panel explored the world we will live in beyond tomorrow, enhanced with virtual, mixed, and augmented realities. View videos of the panel at the IEEE Digital Reality portal.

IEEE Future Networks:
The 2019 IEEE 2nd 5G World Forum (5GWF'19) in Dresden, Germany, 30 September - 2 October 2019 seeks papers on how to nurture and cultivate 5G technologies and applications for the benefit of society. Please submit your papers on EDAS. The deadline to submit a paper is 15 April 2019. Accepted and presented technical and workshop papers will be published in the IEEE 5G World Forum 2019 Conferences Proceedings and IEEE *Xplore*®. Full details of submission procedures and author guidelines are available at the conference website.

IEEE Internet of Things:
The 2019 IEEE 5th World Forum on Internet of Things (WF-IoT 2019), is the premier conference for the IEEE IoT Initiative, will be held 15-18 April 2019 in Limerick, Ireland. The theme of the Conference, IoT and the Digital Revolution, signifies the importance of IoT technologies in bringing about the digital revolution and making it a reality. Participants from around the world will gather to present research results, share visions and ideas, obtain updates on latest technologies and expand professional and social networking. Register Today!

IEEE Life Sciences:
IEEE Life Science (LS) Committee focuses on the promotion of research fields in medicine, engineering, life science, and standards through the lenses of multi-disciplines. LS supports the advances in research for extreme environments and veterinary engineering medicine. These topics are communicated through a modernized newsletter, the IEEE Life Science Conference and multiple initiatives at IEEE conferences. Join the Technical Community to learn more.

IEEE Rebooting Computing:
Are you ready for the next milestone in computer vision recognition? Now in its fifth year, the 2019 IEEE Low-Power Image Recognition Challenge (LPIRC) is the premier competition seeking the best in image recognition solutions. We offer both onsite and online tracks and award cash prizes for solutions that exceed the state of the art. For scoring criteria, FAQs, and more, visit the LPIRC website, and join us at the competition on 17 June 2019 in Long Beach, CA, USA.

IEEE Smart Cities:
The IEEE Smart Cities has been producing a series of webinars. The latest one is titled, "Building a Working Group: IoT for Smart Cities", and can be found on our website. Check the portal often for new webinars.

IEEE Smart Grid:
Check out the content on IEEE Smart Grid Resource Center including webinars, tutorials, eNewsletters, interviews, etc. In addition to content, you can earn both CEU (continuing education unit) and PDH (professional development hour) credits from webinars and tutorials presented by global smart grid experts.

IEEE Software Defined Networks (SDN):
IEEE SDN has released its March 2019 issue of *IEEE Softwarization*, an online newsletter which houses a collection of short technical articles. Read the articles on their website.

IEEE Sustainable ICT:
"A Smart and Sustainable World through ICT" White Paper summarizes the outcomes of the 1st Sustainable ICT Summit in 2017, its recommendations, and the discussions that took place in the technical, economic, social, and policy spheres. Order the White Paper.

The white paper forms the basis for the 2nd Sustainable ICT Summit, which will be held in June 2019. Read more information about the summit.

IEEE Symbiotic Autonomous Systems (SAS):
New White Paper Available for Free to SAS Technical Community Members: The aims of this White Paper are to further develop the ideas presented in the first white paper: (1) to highlight impacts that are clearly identifiable today, and (2) to indicate emerging issues, thus providing a starting point to those involved in making public policy to understand the technical fundamentals, their evolution and their potential implications. Note that this White Paper is intended to be self-contained, without requiring the reader to read the previous white paper.

IEEE Transportation Electrification (TEC):
TEC has an upcoming webinar entitled, "Hybrid-Electric Air-Vehicle Propulsion: Challenges, Opportunities, and Impact," on 22 April 2019. Registration information can be found on our website.

Check the portal often for new webinars. You can also earn education credits through the TEC Resource Center. Both CEU (continuing education unit) and PDH (professional development hour) credits are available for the webinars and tutorials.

IEEE Future Directions Events and Activities

IEEE International Conference on Rebooting Computing (ICRC)-Digest, part of 2019 International Nanodevices and Computing Conference (INC), 3-5 April 2019, Grenoble, France

2019 IEEE 5th World Forum on Internet of Things (WF-IoT'19), 15-18 April 2019, Limerick, Ireland

2019 IEEE Low-Power Image Recognition Challenge (LPIRC), held at 2019 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 17 June 2019, Long Beach, CA, USA

[2019 IEEE Sustainability through ICT Summit (StICT)](#), 18-20 June 2019, Montréal, Quebec, Canada

[2019 IEEE Transportation Electrification Conference and Expo (ITEC)](#), 19-21 June 2019, Novi, MI, USA

[2019 IEEE Conference on Network Softwarization (NetSoft)](#), 24-28 June 2019, Paris, France

[AIAA/IEEE Electric Aircraft Technologies Symposium (EATS)](#), 22-24 August 2019, Indianapolis, IN, USA

[2019 IEEE Secure Development (SecDev)](#), 25-27 September, 2019, McLean, VA, USA

[2019 IEEE 5G World Forum (5GWF'19)](#), 30 September - 2 October 2019, Dresden, Germany

[2019 IEEE Rebooting Computing Week](#), 4-8 November 2019, San Mateo, CA, USA

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