

Digital Reality: fostering and leveraging the ongoing Digital Transformation

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In its November 2018 meeting in Vancouver, the leadership of the Future Directions Committee (FDC) considered the growing interest occurring worldwide in the Digital Transformation. In 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 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!