Co-Design in the Wilderness

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Abstract

Hardware technology platforms are blurring at the edges as the integration frontier, a co-design frontier, holds promise of new functionality being achieved beyond electronics and software, through photonic and fluidic technologies. The problems here are complex as one considers the multiple technology partitions and the possibilities for exploring trade-offs and so this co-design frontier is largely untamed. A co-design "box", somewhat empirical by nature, supports exploratory research interests. It is motivated by trying to merge two lines of activity: one involving electronic-software rapid-prototyping and the other involving the design and fabrication of novel non-electronic devices or structures. The expectation initially is to demonstrate from an embedded system perspective whether novel fluidic devices perform as intended. Other devices will be considered in the future. Individuals and groups working in these frontier areas have attempted to promote some degree of standardization which might help clear a path forward in support of less empirical co-design techniques. Experience with microelectronics is most often used as a model with reference to the hierarchy of leaf-cells, components, functionally-designated subsystems and defined physical and signal interfaces. Physical aspects of internet connectivity are an example of advances made at the photonics-electronics frontier using multiple signal wavelengths and command, control and communication involving software, microelectronics, photonics and signal conversion. Progress with fluidics is at an early stage and major outcomes, no less transformative than the internet in the last 20 years, will occur whether in health-care or the environment or in some other sector. Complex devices or micro-assemblies that carry electronic, photonic and fluidic signals are now made regularly. Co-design technology, while lagging seriously, has the potential to reduce exploration barriers at the integration frontier, multiplying the number of exploratory paths being pursued by an increasing number of practitioners and yielding beneficial outcomes sooner than might otherwise be expected.

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Bio

Dan Gale is Vice-President and Chief Technology Officer of CMC Microsystems (www.cmc.ca) and Vice-Chair of the corporation's Technical Advisory Committee. He is also Vice-Chair of the Board of Directors of the Canadian Photonics Consortium and Chief Delegate for Canada to the annual World Micromachine Summit. Over a period of more than 25 years, starting with an emphasis on microelectronics, he shaped CMC programs to enable university researchers to collaborate with their sponsors in projects involving leading-edge microsystems technologies which today include MEMS, microfluidics, photonics and embedded software. He has helped launch several successful research initiatives including a System-on-Chip Research Network partnering with 37 universities and a National Microelectronics and Photonics Testing Collaboratory partnering with 21 universities.

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