Advances in technology redefine how we live

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About the author

Bill is currently a Senior Fellow at Texas Instruments and serves as Chief Technical Officer of Systems and Software Architecture for the DSP Systems Group. He holds a number of patents, serves on several technology advisory boards and previously cofounded Telogy Networks, a company pioneering Voice over IP. Bill received his BS in Electrical Engineering from Stevens Institute of Technology and his MS in Computer Science from Johns Hopkins University.

As Moore's Law shows no sign of slowing by 2020 with respect to transistor density, chip designers can be expected to create even more complex SoCs compared to today's already complicated SoCs. Given that frequency and voltage scaling do not continue to scale due to power/heat dissipation, it is clear that higher performance must be achieved through a heterogeneous mix of highly parallel-processing elements.

The cost to develop these SoCs will require that they can be easily repurposed across multiple applications. To achieve this, the inherent functionality of an SoC will be defined primarily by the software. We've already seen this happen with DSPs where signal-processing functions are implemented in software instead of fixed hardware blocks. With SoCs, the external interfaces, including radio technology and communications protocols, will be defined in software as well.

This approach places a huge emphasis on software – not only in terms of the sheer quantity of embedded software that will run on a year 2020 SoC – but also in what advanced tools will be required for complex system modeling, design, implementation, tuning and debugging. New programming languages, development methodologies and OS extensions/constructs will also be required to better enable parallel processing, as well as a stable ecosystem where software from different vendors can readily coexist and cooperate.

While power, performance and area will continue to be important, customers will place increased emphasis on protecting their software investment, demanding SoC platforms that abstract and virtualize design with tools that manage and hide complexity. Those vendors that can provide the most compelling software platforms will be the most successful.

So what will we do with all of this processing capacity? By scaling up performance we'll be able to solve problems that were previously not practical from a cost, power and/or area perspective. Alternatively, devices can scale down for ultra-low power and miniaturization.

Certainly it's hard to predict the future, but the underlying technological advances we'll see by 2020 will definitely change the way we live. The ubiquitous communications enabled by software-defined radio will extend to automatically take into

account our current locale through highly adaptive and context-sensitive algorithms, tearing down the final distance barriers to give people access to their world anytime and anywhere. This automation will be partially enabled through sensor networks. For example, carpet sensors detecting dirt will invoke the vacuum cleaner. In hospitals, patients will be monitored from check-in to check-out with the information being intelligently processed and correlated automatically.

Next-generation speech recognition and natural language understanding will redefine how we interact with all machines, not just our PCs and mobile devices but our cars, our home entertainments systems and the ATM. Nor will we have to speak into a special device; just saying out loud, "It's too hot," will trigger the air conditioning. We'll also see extended information mining including not only searches for text but also for video and audio based on context and natural language understanding.

For medical applications, advances in imaging and processing will save lives as well as improve overall quality of life. Robotics and virtual reality technology will provide more lifelike experiences – from learning to fly a plane or performing a surgical procedure to interactive gaming and movies.

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