Nanotechnology in the Service of Embedded and Ubiquitous Computing

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Embedded systems are now ubiquitous and ubiquitous computing is now getting embedded in our day-to-day lives. Such systems are cost and power sensitive. Various nanotechnologies will provide an excellent vehicle to reduce cost and power consumption, while still meeting performance constraints. Nanoscale device technologies, such as carbon nanotube transistors, nanowires, resonant-tunneling devices, quantum cellular automata, single electron transistors, tunneling phase logic, and a host of others, have made significant advances in the last few years. However, circuit and system design methodologies for these technologies are still in their infancy. Industrial roadmaps project that these emergent technologies will make inroads in the commercial market within a decade. Therefore, such design methodologies are necessary for precise design and fabrication of nanocircuits and nanoarchitectures.

In this talk, we will try to bring together the three exciting disciplines of embedded systems, ubiquitous computing and nanotechnology. We will show how various nanotechnologies may be of service to embedded and ubiquitous computing.

In many nanotechnologies, the basic logic primitive is a threshold gate or a majority/minority gate. Using traditional logic design methods for such technologies is inadequate. Testing and defect tolerance techniques for such technologies will also merit special consideration. To meet the challenges of low-cost/low-power computing in the coming decade, we will need analysis and synthesis tools at all levels of the system design hierarchy. We will discuss initial efforts in this area and speculate on how merging of nanotechnology with embedded/ubiquitous computing can be brought about.