Using Multicore Architectures in Cyber-Physical Systems

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The demand for higher performance computing platforms has dramatically increased during the last decade due to the continuous feature enhancement process. For instance, in automotive systems new safety features like `night view assist? and `automatic emergency breaking? require the fusion of sensor data, video processing and real-time warnings when an obstacle is detected on the road; in the avionics domain new applications such as the helmet-mounted display systems require intensive video processing capabilities. Commercial-Off-The-Shelf (COTS) components are increasingly used in an effort to raise performance and lower production costs. Fast multicore CPUs and high-performance DMA peripherals are needed for servicing these new demanding applications. However, they are difficult to use due to problems with timing predictability and security. A multicore architecture is substantially different from a single core implementation in that concurrently executing tasks (on the parallel cores) share critical physical resources such as caches, peripherals, on-chip interconnect networks, etc. This extensive sharing of physical resources on critical paths can jeopardize the timing predictability and at times, security, of safety-critical software applications even when system resources are under the control of a real-time operating system. The stark reality is that without addressing these issues, high assurance product developments will be unable to take full advantage of emerging multicore CPUs.

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