Theory vs. Reality in Parallel and Distributed Real-Time Systems

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A wide variety of scheduling models and algorithms exists for characterizing the behavior of distributed real-time systems. These models usually assume that system variables are known deterministically or can be characterized by stochastic behavior. We describe a more complete taxonomy for system variables and relate previous work to this taxonomy. We observe that most previous work in distributed real-time systems has assumed that all system behavior follows a statically known pattern.

With our taxonomy as a reference frame, we describe the results of an ongoing effort to develop a simulation model driven by actual instrumentation data to characterize the resource usage of a U.S. Navy distributed real-time tactical computer system. Data extracted via minimally intrusive instrumentation techniques from this system were analyzed to determine the distributional characteristics of system variables. Our findings indicate that most of these variables exhibit patterns that are not deterministic nor do they follow well-known probability distributions. We show further that the use of unwarranted distributional assumptions for these variables can lead to poor results when predicting resource usage. This work (1) strongly suggests that the distributional assumptions of existing models should be verified prior to their use, and (2) points to the need for additional research in developing models which can accommodate system variables with unknown distributional forms.