

Real-Time Systems Development with RTEMS and Multicore Processors

The proliferation of multicore processors in the embedded market for Internet-of-Things (IoT) and Cyber-Physical Systems (CPS) makes developing real-time embedded applications increasingly difficult. What is the underlying theory that makes multicore real-time possible? How does theory influence application design? When is a real-time operating system (RTOS) useful? What RTOS features do applications need? How does a mature RTOS help manage the complexity of multicore hardware? Real-Time Systems Development with RTEMS and Multicore Processors answers these questions and more with exemplar Real-Time Executive for Multiprocessor Systems (RTEMS) RTOS to provide concrete advice and examples for constructing useful, feature-rich applications. RTEMS is free, open-source software that supports multi-processor systems for over a dozen CPU architectures and over 150 specific system boards in applications spanning the range of IoT and CPS domains such as satellites, particle accelerators, robots, racing motorcycles, building controls, medical devices, and more. The focus of this book is on enabling real-time embedded software engineering while providing sufficient theoretical foundations and hardware background to understand the rationale for key decisions in RTOS and application design and implementation. The topics covered in this book include: - Cross-compilation for embedded systems development - Concurrent programming models used in real-time embedded software - Real-time scheduling theory and algorithms used in wide practice - Usage and comparison of two application programmer interfaces (APIs) in real-time embedded software: POSIX and the RTEMS Classic APIs - Design and implementation in RTEMS of commonly found RTOS features for schedulers, task management, time-keeping, inter-task synchronization, inter-task communication, and networking - The challenges introduced by multicore hardware, advances in multicore real-time theory, and software engineering multicore real-time systems with RTEMS All the authors of this book are experts in the academic field of real-time embedded systems. Two of the authors are primary open-source maintainers of the RTEMS software project. The Open Access version of this book, available at <http://www.taylorfrancis.com>, has been made available under a Creative Commons Attribution-ShareAlike 4.0 (CC-BY-SA) International license.



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