

ADAPTIVE RESOURCE MANAGEMENT ALGORITHMS, ARCHITECTURES, AND
FRAMEWORKS FOR DISTRIBUTED REAL-TIME EMBEDDED SYSTEMS

NISHANTH SHANKARAN

Dissertation under the direction of Professor Douglas C. Schmidt

There is an increasing demand for adaptive capabilities in distributed real-time and embedded (DRE) systems that execute in open environments where system operational conditions, input workload, and resource availability cannot be characterized accurately a priori. A challenging problem faced by researchers and developers of such systems is devising effective adaptive resource management strategies that can meet end-to-end quality of service (QoS) requirements of applications. To address this challenge, this dissertation presents three contributions to the research on adaptive resource management for DRE systems. First, it presents the Hierarchical Distributed Resource-management Architecture (HiDRA), which provides adaptive resource management using control techniques that enables the system to adapt to workload fluctuations and resource availability for both bandwidth and processor utilization simultaneously. Second, it describes the structure and functionality of the Resource Allocation and Control Engine (RACE), which is an open-source adaptive resource management framework built atop standards-based QoS-enabled component middleware. Third, it presents three representative DRE system case studies where RACE has been successfully applied. These case studies demonstrate and evaluate the effectiveness of RACE in the context of representative DRE systems.

Approved _____ Date _____