Commercial RTOSes for Automotive Applications

Scott Ranville
Scientific Research Laboratory
Ford Motor Company

Steve Toeppe
The MathWorks, Inc.

Presentation Time and Place

Wednesday, October 18, 2000
11:30 AM - 12:30 PM
Nitschke Auditorium, Engineering College Complex
The University of Toledo

For UT parking permit contact dewing@eng.utoledo.edu by 10/16.

The Speakers

Scott Ranville graduated from the University of Michigan with a BSEE (1992), and a MSEE (Control Theory) in 1993. After graduation Scott joined Ford Motor Co. in the Electrical Fuel and Handling Division developing in-vehicle battery charging algorithms. In 1995 Scott transferred to the Scientific Research Laboratory where he is involved with research in automatic code generation from a model, automated unit testing, RTOS and other scheduling issues.

Steve Toeppe is a product manager at The MathWorks. He is primarily focused on developing simulation products for automotive and production intent applications. Previously he conducted research at Ford Motor Company Research Laboratories, focusing on software, control system modeling, and simulation technology. He has a MSEE and BSEE and 20 years of software engineering experience. He has held a variety of positions managing the development of embedded systems software.

Abstract

Automotive powertrain applications require demanding real time scheduling services that present significant challenges for current mainstream real time operating systems (RTOS). The greatest challenge to an RTOS is providing required services within a reasonable resource budget (CPU, RAM and ROM) which is affordable in the resource constrained automotive applications domain. In order to evaluate the RTOS, it is necessary to determine the real time processing requirements of the application and then to determine how the RTOS will satisfy these requirements. A resource modeling approach permits scalable evaluations. Fundamental RTOS measurements taken from the application perspective can be combined in a model to provide total RTOS overhead which can be used for evaluation purposes. Ford Research Laboratories has conducted a RTOS evaluation including 10 RTOSs for the Motorola 683xx and 7 RTOSs for the Motorola MPC5xx. Resource models have been developed. This presentation describes the evaluation approach and results.

Presentation Overview

This paper presents a general description of automotive powertrain real-time requirements and the corresponding RTOS requirements. Some of the current microprocessors in use are described emphasizing the resource constraints. The primary evaluation issues of CPU processing overhead and RAM are described along with the testing methodologies employed. CPU resource overhead models are defined. The evaluation results are presented. This paper focuses on standard commercial RTOSs that support preemptive multitasking and blocking. Concluding remarks on the applicability of commercial operating systems to automotive powertrain applications are presented.