Chapter XV

A Remotely Accessible Embedded Systems Laboratory

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Abstract

To teach modern embedded systems including operating systems in a meaningful way, a moderately sophisticated processor is required to demonstrate many key concepts, such as multitasking, multithreading, a structured and abstracted hardware management layer, communications utilising various protocols over network interfaces, and memory resident file systems. Unfortunately, high-end 32-bit embedded systems processors capable of supporting these facilities are expensive compared to conventional 8-bit and 16-bit targets, and it is not feasible to acquire a large number of them to house in a laboratory in an effort to enable practical exercises for over 100 students. This chapter describes the development and use of a remotely accessible embedded systems laboratory that uses a small number of 32-bit development systems and makes them available to students over the Internet.
Learning Objectives

After completing this chapter, you will be able to:

- Discuss the usefulness of a remotely accessible embedded systems laboratory in teaching and learning contexts.
- Define the following key terms: embedded computer system, multitasking, and multithreading.
- Suggest further enhancements to practical activities proposed in the chapter.

Introduction

In 2001, the Information and Communications Group in the Faculty of Engineering at the University of Technology, Sydney, decided — after surveying industrial trends — to focus upon embedded computer systems as a basis for case studies and application areas in which to demonstrate theoretical concepts. In particular the undergraduate subject 48450 Real-Time Operating Systems strove to differentiate itself from computer science and IT-styled subjects in that area by using embedded computer system hardware platforms. To demonstrate many of the concepts that are essential to a modern operating system, for example, multitasking, multithreading, a structured and abstracted hardware management layer, communications utilising various protocols over network interfaces, and memory resident file systems, a moderately sophisticated processor is required. Unfortunately, high-end 32-bit embedded systems processors capable of supporting these facilities are expensive when compared to conventional 8-bit and 16-bit targets, and it is not feasible to acquire a large number of them to house in a laboratory in an effort to enable practical exercises for over 100 students. Instead, a remotely accessible embedded systems laboratory has been constructed which uses a small number of 32-bit development systems and makes them available to students over the Internet. Students can use them in the conventional way following a development path that commences with cross-development and concludes with testing on the 32-bit target and viewing the results.
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