GeMRTOS: Multiprocessor RTOS

User and Development Manual — Chapter 1: Introduction

gemrtos.com

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CHAPTER 1

Introduction

1.1 Purpose of this Manual

As a detailed technical reference, this manual provides developers with the essential knowledge required to design, implement, and manage real-time embedded systems on Altera Field-Programmable Gate Array (FPGA) devices, all leveraging the power of Generic eMbedded Real-Time Operating System (GeMRTOS). This includes understanding GeMRTOS's core capabilities, such as task management, inter-process communication, and interrupt handling. It also details how to seamlessly integrate GeMRTOS with Altera FPGA hardware and development tools, enabling the creation of sophisticated and efficient embedded solutions.

Note: To facilitate understanding, a glossary of technical terms specific to GeMRTOS is included at the end of this manual. Readers less familiar with these terms are encouraged to consult the glossary as needed.

1.2 Overview of GeMRTOS

GeMRTOS is a powerful yet user-friendly Real-Time Operating System (RTOS) tailored for demanding multiprocessor embedded systems on Altera FPGAs. It enables the creation of complex, real-time applications through simplified processor management, synchronization, and resource allocation. Its features include a timer-tickless scheduler for minimal overhead, floating scheduling to prioritize critical tasks, and hybrid partitioning for adaptable task allocation. Using GeMRTOS, developers can achieve enhanced performance, reduced development time, and a modular, maintainable codebase.

1.2.1 Key Features of GeMRTOS

GeMRTOS boasts the following key features:

- Modular design for straightforward integration within Altera's Platform Designer.
- Broad processor support, compatible with both Nios II and Nios V soft processors.
- Timer-tickless scheduler, minimizing overhead and maximizing responsiveness.
- Floating scheduling, ensuring efficient management of high-priority tasks.
- Support for event-driven programming, enabling reactive system designs.

- Hybrid partition scheduling, for adaptable task management.

1.2.2 Benefits of Using GeMRTOS

Adopting GeMRTOS offers several significant benefits:

- Simplified multiprocessor system design, streamlining development efforts.
- Enhanced performance for embedded applications, achieving highly efficient resource utilization.
- Reduced development time, accelerating project completion.
- Modular and maintainable codebase, promoting long-term system stability and adaptability.

1.2.3 Hybrid Partition Scheduling

GeMRTOS introduces hybrid partition scheduling, an innovative approach that overcomes the limitations of traditional global and partitioned scheduling. Offering unparalleled efficiency and flexibility, this method uses scheduling lists to dynamically assign tasks and processors, adapting to the evolving needs of application subsystems. This allows dedicating processors to specific roles, such as sensor data collection or user interface management, maximizing system responsiveness and optimizing resource utilization.

1.3 Target Audience

This manual is tailored for embedded systems engineers, software developers, and hardware designers working with GeMRTOS on Altera FPGA platforms.