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Introducing RTOS for Blackfin

Fusion RTOS is a priority based, preemptive, multitasking, real-time operating system designed and optimized for high performance DSPs and media-centric microprocessors.

Tasks

Tasks are individual units of software with a dedicated purpose that share common system resources. The RTOS grants access to the shared system resource based upon a task's request for the resource, compared to other pending requests. Each individual task is assigned a priority level according to its importance within the system. Each task has its own dedicated stack.

Stack Sharing

To reduce total memory usage, Fusion RTOS is designed to share a common stack for Hardware Interrupts, Software Interrupts and the background task.

Task Communications & Synchronization

Each task is created independently from any other task. Since tasks may need to share information or otherwise communicate with other tasks, Fusion RTOS provides the following:

- Suspend/Resume
- Mailboxes
- Semaphores
- Queues
- Mutexes
- Packet Handlers
- Events

Time Management

Most embedded systems require some form of time management. Fusion RTOS provides an extensive set of time management capabilities. All Fusion RTOS objects that have the capability of task suspension have an optional time-out value to limit the suspension time. A complete suite of software timers is also available to handle timed events. These timers can be configured as one shot or periodic timers. Fusion RTOS tracks system time in seconds. This, along with the Time section of the Fusion Standard C library, provides for a complete time management solution.

Memory Management

Fusion's memory management capability is fully dynamic. The user can specify any number of independent memory pools. These pools provide variable memory allocation capabilities. Any task may suspend on a memory pool when memory is

not available. Memory pools have statistical tracking capabilities to determine current and worst case memory usage. To reduce/eliminate memory fragmentation, Fusion memory manager uses a method of contiguous memory recombination.

Packet Management

Many of today's embedded designs require the processing of streaming data. Fusion RTOS provides several methods to handle streaming data while minimizing processor loading. Fixed-size streaming data packets are handled using packet pools (pre-allocated packets that are all the same size and managed in a pool). The time to allocate / deallocate a packet is deterministic and an order of magnitude faster than a memory pool. Packet handlers are used to synchronize between interrupts and the tasks processing the data. These Fusion objects only pass the pointer to the packet, not the actual packet to the waiting task. This greatly reduces processor loading by creating systems that utilize zero data copies.

Interrupt Control

Fusion RTOS provides a flexible interrupt control mechanism that is fast and deterministic. Users can create their interrupt handler in C or Assembly, and all interrupts can call any Fusion RTOS object that does not try to perform a suspension. Task synchronization can thus occur directly from a Fusion RTOS managed interrupt.

- Optional Interrupt logging
- Support for nested interrupts
- Dedicated interrupt stack shared with SWIs and the background task.
- Supports delayed task rescheduling
- Provides a method to bypass Fusion Interrupt Dispatcher

Driver Model I/O Management

The Fusion Driver Model, FDM, is an extensible and portable, ANSI-C compatible model that provides a framework for organizing peripheral devices into a common subsystem. Its architecture is simple to use, easy to adapt and reusable across any platform, since it is not directly tied to any specific hardware. It abstracts this mechanism through objects which allows the user to integrate a frontend and backend specific to their environment.

Unicoi Fusion Product Suite

Fusion Reference Designs

- VoIP Gateway/Terminal Adaptor
- IP Phone

Fusion Net

- TCP/IPv4/v6 Dual-Mode Stack
- DHCP
- DNS
- FTP
- NAT
- OSPFv2
- RTSP
- RTP
- SIP
- SDP
- SNMP
- SNTP
- Telnet
- POP3
- SMTP

Fusion RTOS

- Real-Time Operating System optimized for high-performance DSPs and media-centric microprocessors

Fusion File Systems

- Flash File System
- CIFS

Fusion Web

- HTTP
- XML
- Microbrowser
- GUI Toolkit

Fusion Secure

- IPsec
- IKEv1
- HTTPS

Fusion Algorithms & Codecs

- Please call for details



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Power Management

Fusion RTOS provides full software support for Power Management including:

- Complete PLL Control
- Control of PLL Frequency
- PLL Bypass and Engage Functions
- Core and Bus Frequency Control
- Core Voltage Control

System Diagnostics

Fusion RTOS provides extensive internal diagnostic capabilities, including:

Statistical tracking for memory usage (current and worst case usage):

- All Stacks
- Memory Pools
- Packet Pools
- Packet Handlers
- Circular Buffers
- Queues

Data logging capabilities for:

- Interrupts
- Task Switches
- RTOS Object calls
- Error Conditions
- User specific

Standard C Library

Fusion RTOS provides an extensive, re-entrant, thread-safe, small footprint, integer-based, POSIX-style Fusion Standard C library. The capabilities are listed below in categories.

- Time
- Stdio
- Stdlib
- String
- Stddir
- Character

Command Line Debug SHELL

Fusion RTOS includes the Fusion Command Line Debug Shell. This is a UART driven interface from the PC to the embedded product running Fusion RTOS. Fusion SHELL provides general commands such as reading and writing to memory. It also provides mechanisms for the user to add additional commands. Fusion SHELL is also used when additional Fusion products are integrated with Fusion RTOS. Each product has command lists useful for debugging the specific Fusion Software Product.

Name Server

Fusion RTOS includes the Name Server. This is an RTOS object that translates between Fusion object pointers and character names. However, it is not limited to Fusion RTOS Objects. It can be used for any user specified function. Pass in a name to any previously installed pointer and the Name Server will return that pointer.

Features

- Tasks
- Mailboxes
- Mutexes
- Hardware interrupt controller for a number of ARM processors
- Software interrupt controller (SWI)
- Stack sharing for HWI, SWI and the background task
- Nested interrupts
- Mutex priority inversion protection
- 250 priorities for tasks & SWIs
- Heapless design
- Optional timeouts on all suspends
- Pre-emptible tasks
- Integrated with Fusion TCP/IP
- Small foot print re-entrant thread safe Fusion C Library

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