

CONNECT Middleware Datasheet

A suite of robust and feature rich middleware components specifically designed for embedded systems, delivering high performance and data throughput, whilst utilizing minimum resources.

Functional Overview

- Networking and secure communications components
- File systems and data storage solutions
- Device drivers
- Bespoke Board Support Packages
- Royalty free, perpetual licensing with no production limits
- Support for a wide range of microprocessor platforms and development tools
- Supported by a team of expert embedded software engineers
- Tightly integrated for use with **OPENRTOS®** and **SAFERTOS®**
- Supplied with full source code
- Runs “out of the box”

Removing Complexity and Risk

The increasing need for connectivity in embedded products has resulted in added complexity and greater integration requirements between the RTOS, middleware components and the underlying drivers.

CONNECT Middleware solutions provide you with components that are used in mission critical applications all over the world. They are delivered as one highly integrated, fully optimized and verified package, accompanied by an “out of the box” demonstration application.

Licensing

CONNECT Middleware components are supplied with full source code, distributed under a straightforward perpetual license, with no runtime fees or royalties. Customers receive comprehensive documentation and our full support.

Key Features

- Networking and secure communications
- File systems and storage solutions
- Royalty free perpetual licensing

Optimized Integration for **OPENRTOS®** and **SAFERTOS®**

All of our CONNECT Middleware products are available with a tight integration for **OPENRTOS** or **SAFERTOS**. This close integration results in a higher throughput of data, faster response times, and a reduced memory footprint.

Middleware for Safety Critical Systems

When integrating middleware components into safety critical applications, designers need to ensure the middleware components do not interfere with the functions performed by the safety critical code.

This issue is resolved by using the **SAFERTOS** Task Isolation functionality, which can be configured to isolate the middleware code segments, from **SAFERTOS** and other safety critical code segments.

The **SAFERTOS** Task Isolation functionality uses the underlying Memory Protection Unit (MPU)/ Memory Management Unit (MMU) to isolate code segments from each other. Each time a context switch is performed, **SAFERTOS** will re-configure the MPU/MMU registers to the permitted memory access regions assigned to the new task.

The isolation properties of **SAFERTOS** allow our CONNECT Middleware components to become a cost effective solution in safety critical systems.

CONNECT File System

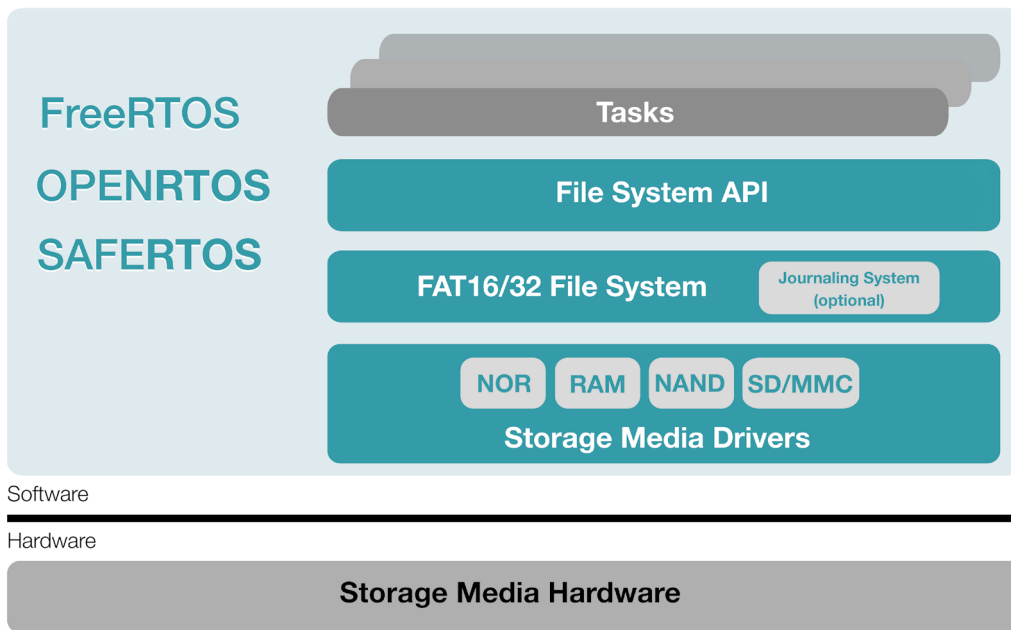


Figure File System Architecture

CONNECT File System

The CONNECT File System is a compact and highly reliable embedded FAT16/FAT32 File System, designed for embedded applications requiring data storage to physical media such as SD/MMC and Flash drives.

Functional Overview

- Compact & full featured embedded File System
- Supports RAM, NAND, NOR, SD, and MMC Mass storage devices
- Microsoft DOS/ Windows compatible FAT16/32 File System
- FLASH Translation Layer providing Wear Levelling, Bad Block Management, ECC and Garbage Collection
- Multiple logical volumes and storage devices
- Full C source code supplied
- Close integration with **OPENRTOS** and **SAFERTOS**
- Delivers high levels of data throughput, whilst utilizing minimum system resources
- Long file names
- Easily integrated with virtually any FLASH or physical media device.

File System Architecture

The CONNECT File System architecture (shown above) has a modular design allowing it to support multiple different storage I/O devices. The File System has a close integration with **OPENRTOS** or **SAFERTOS**.

File System API

The File System API layer contains two interfaces. One is a POSIX interface that provides standard file API functions such as `fopen()`, `fread()`, `fwrite()` and `fclose()` etc. The second is a Native interface that provides non-standard API calls for operations such as directory and file system management.

FAT16/FAT32 System

The File System layer implements the FAT16/FAT32 protocol. This layer translates the file system operations to block I/O requests and forwards them to the corresponding Storage Media Driver. This layer also manages the dynamic attachment/removal of storage devices.

Storage Media Drivers

The Storage Media Drivers are hardware dependent and provide all the low-level functionality required by the File System for accessing NAND/NOR/SD/MMC and RAM Disk devices.

CONNECT Networking

TCP/IP Networking Components

CONNECT Networking is a scalable, thread safe TCP/IP stack. It provides a familiar, standards based, Berkeley sockets interface, making it as simple to use and as quick to learn as possible. An alternative callback interface is also available for advanced users.

CONNECT Networking's features and RAM footprint are fully scalable, making it equally applicable to smaller, lower throughput microcontrollers as to larger more powerful processors. It is available with a light weight HTTPS web server. Please ask one of our sales representatives for more details.

Functional Overview

- Berkeley sockets API
- Optionally supports TCP sliding windows
- Fully re-entrant and thread safe API
- Includes ARP, DHCP, DNS, LLNMR, NBNS
- Gratuitous ARPs
- Static, DHCP and Auto-IP address assignment
- Can also be used as a UDP only stack
- Optional callback interface
- Optional fragment outgoing packets

File	With -O1 Optimisation	With -Os Optimisation
_DHCP.c	1.9K	1.3K
_DNS.c	3.5K	2.0K
_Sockets.c	6.6K	4.9K
_Stream_Buffer.c	0.3K	0.3K
_IP.c	3.5K	2.6K
_ARP.c	8.4K	1.2K
_UDP_IP.c	0.7K	0.5K
_TCP_IP.c	7.0K	4.8K
_TCP_WIN.c	2.2K	1.7K
BufferAllocation_1.c	0.8K	0.8K
Worst case with everything enabled	34.9K	20.1K

Figure Code Size (example generated with GCC for ARM Cortex-M)

Berkeley Sockets API

```
_socket()
_setsockopt()
_bind()
_listen()
_connect()
_accept()
_send() / _sendto()
_recv() / _recvfrom()
```

CONNECT Device Drivers

WHIS supports a broad array of standard device drivers, for a wide range of microprocessors. The drivers include:

- I2C driver
- SPI driver
- ADC and/or DAC driver
- General purpose I/O driver
- Real-time clock driver

Bespoke and custom drivers are available upon request. Commercial and Safety Critical grade drivers are available; Safety Critical drivers are designed to comply with IEC 61508 SIL3, and are delivered with their own Design Assurance Pack.

CONNECT Board Support Packages

WHIS provides a full Board Support Package service, designing a platform to your specific requirements for use with either **OPENRTOS** or **SAFERTOS**.

Safety critical Board Support Packages using **SAFERTOS** are designed to comply with IEC 61508 SIL3, and are delivered with their own Design Assurance Pack.

The board supported can be a customer supplied application board or a commercially available evaluation/development board.

A Selection of Supported Processors

Manufacturer	Device	Family
Altera	Nios II	Nios II
Atmel	AVR32	AVR32
	SAM3	ARM Cortex-M3
	SAM4	ARM Cortex-M4
	SAM7	ARM7
	SAM9	ARM9
	SAMD20	ARM Cortex-M0
Cortus	APS3	APS3
Cypress	PSoc5	ARM Cortex-M3
Infineon	Tricore	Tricore
	AURIX	Tricore
	XMC4000	ARM Cortex-M4
	XMC1000	ARM Cortex-M0
Microchip	PIC32	PIC32
	PIC24	PIC24
	dsPIC	dsPIC
Microsemi	SmartFusion	ARM Cortex-M3
	SmartFusion2	ARM Cortex-M3
NXP	LPC40, LPC43	ARM Cortex-M4
	LPC13, LPC17, LPC18	ARM Cortex-M3
	LPC11, 12	ARM Cortex-M0
	Kinetis K series	ARM Cortex-M4
	Kinetis L series	ARM Cortex-M0
	Coldfire	Coldfire V1&2
Renesas	HCS12	HCS12
	i.MX6x	ARM Cortex-A9
	RX600	RX600
	RX200	RX200
	RL78	RL78
	RZ	ARM Cortex-A9
	RL78	RL78
Silicon Labs	H8/S	H8/S
	Gecko Range	ARM Cortex-M0+, Cortex-M3, Cortex-M4
ST Microelectronics	STM32F7	ARM Cortex-M7
	STM32F4, STM32F3, STM32L4	ARM Cortex-M4
	STM32F2, STM32F1, STM32L1, STM32W	ARM Cortex-M3
	STM32F0	ARM Cortex-M0
	STR7	ARM7
Synopsys	STR9	ARM9
	ARC	ARC600

Manufacturer	Device	Family
Texas Instruments	Stellaris LM3	ARM Cortex-M3
	Tiva	ARM Cortex-M4
	TMS32 Delfino	C28x
	Hercules RM4x, TMS570	ARM Cortex-R4
	Hercules TMS470	ARM Cortex-M3
	Concerto	ARM Cortex-M3
	MSP430X	MSP430X
	MSP432	ARM Cortex-M4F
Xilinx	Microblaze	Microblaze
	PowerPC	PowerPC
	Zync-7000	ARM Cortex-A9

This list is constantly being updated with new ports as we continue to work closely with our silicon partners. For the most recent list please contact us or refer to our website.

IDE Support

CONNECT Middleware is available for use with all the major IDE's including, IAR, Keil, Rowley, Codewarrior, GCC, Tasking, Attoic, Code Composer Studio and many others.

CONNECT Middleware Configuration

CONNECT Middleware is licensed according to the developer's choice of processor and tool chain.

The API and the core CONNECT Middleware design and code is common between all OPENRTOS and SAFERTOS variants; the remaining very small port layer is adapted to support the selected processor and compiler.

WITTENSTEIN high **integrity** systems

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