TREEspan™ File System

An embedded transactional file system with native flash support, that provides embedded system designers with robust, fail-safe, data storage through a simple file interface. All within a few kilobytes of RAM.

Features

Transactional File System
Write operations can be grouped into atomic write transactions so as to enforce strictly defined behaviours and guarantee data integrity, despite untimely interruptions such as power losses.

Extensive Media Support
TSFS supports virtually all storage devices used in embedded systems, including:

- Parallel and serial QSPI/xSPI NOR
- Parallel and serial QSPI/xSPI SLC & MLC NAND
- SD/eMMC 4 & 8 lanes with UHS/HS modes
- RAM-like technologies including MRAM, ReRAM and FRAM

Fail-Safety
File system integrity is guaranteed on raw NOR, raw NAND, industrial-grade SD card and eMMC.

RTOS Support
TSFS supports bare-metal, FreeRTOS, PX5, Zephyr, ThreadX, uC/OS.

Low RAM usage
Minimum requirement of 6KB on raw NOR flash, 12KB on raw NAND flash, and 8KB on SD/MMC.

Fast Mount
TSFS has no journal and no clean-up procedure which makes for very low mount times: maximum 20ms on NOR, 200mson NAND, and around 1s on SD/MMC.

Real-time Behavior
TSFS provides real-time guarantees supported by strict scheduling of flash management tasks like wear-leveling and garbage collection.

High Random Write Throughput
On raw flash, TSFS provides minimal metadata overhead and optimal garbage collection, resulting in the highest possible random write throughput. TSFS also unlocks the full potential of SD card and eMMC by producing efficient, large sequential accesses at the device level, independent of the access pattern at the file level.

Native Flash Support
TSFS natively supports raw flash storage technologies. It does not require an extra flash translation layer (FTL), reducing resource usage, complexity and cost.

Dynamic and Static Wear-Leveling
Flash support includes both static and dynamic wear-leveling, maximizing the flash device lifetime, independent of the application's access patterns.

Advantages

Reduced application complexity
TSFS's transactional nature makes the application development easier by providing a centralized and uniform way of dealing with unexpected failures, avoiding complex, error-prone, ad hoc recovery schemes.

Reduced risk and time to market
Because it can be deployed with minimal resource usage, on top of a wide array of storage technologies, TSFS enables flexible and resilient development processes, immune to last-minute hardware design modifications.

High reliability
TSFS transactional design guarantees performant, fail-safe operations ready to support mission-critical applications.

Scalability
TSFS is designed to support a wide range of applications, ranging from low-power designs based on modest processors with a few megabytes of sparsely accessed storage, to the heaviest workloads, involving terabytes of data.

Progressive learning curve
TSFS's main functionalities are exposed through a conventional, POSIX-like, fileAPI, allowing for a quick initial approach and deployment.

Platform and OS agnostic
TSFS is not tied to any OS orplatform and can be deployed anywhere, as long as the minimum requirements are met.

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Package Content

- Full C99 source code
- Reference drivers
- Integration test code and benchmarks
- Documentation

Supported Platforms

CPU
32 or 64-bit architecture is recommended for optimal performance.

RAM/ROM
Requirements are dependent on the underlying media technology and performance expectations. The strict minimum is 6 KB but more RAM can be used to improve overall performances. ROM usage is approximately 40 KB.

Supported Media
RAM disk, NOR, NAND SLC & MLC, SD/MMC, MRAM, ReRAM, FRAM.

Toolchain
ISO/IEC 9899:1999 (a.k.a C99) compliant compiler.

About JBLopen

Founded in Montreal, Canada in 2016, JBLopen provides embedded software components and consulting services. JBLopen is specialized in offering platform support products and services as well as RTOS and third party library integration.

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