F3S Failsafe Flash File System

Description

Single Board Computer with WindowsCE generally use the file system FAT32. This file system is operating with allocation tables (FAT). If there occurs an **electrical power outage** during a write cycle the FAT and also the file itself can be damaged (inconsistent state). In last resort it's necessary to reformat the storage. With the file system TFAT from Microsoft you can avoid damaging the allocation table but not the data within a file itself. F&S has developed the **Failsafe Flash File System (F3S)** which is designed for NAND-Flash-Memories especially. In contrary to other file systems it is able to guaranty a reliability in transaction on file-level. The user has the option to define the point of validation of modified data. In easiest case by closing the file-handle.

Because of the unique, transaction-based concept, it is fundamentally robust against unexpected electrical power outages.

In this way important data can be stored permanently and safely.
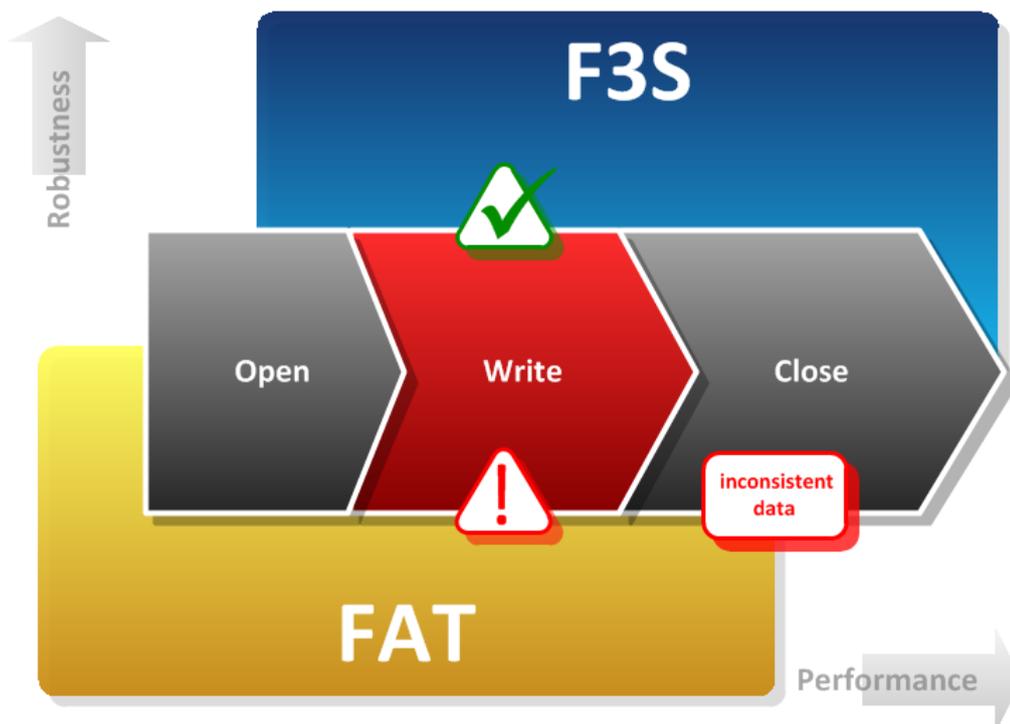
- Modifying file contents can be accepted only in completed operations (state-transistion)

- During Modification transitions can also be accomplished by using explicit calls within the application.

Consistency of file contents is warranted in all situations

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Product details

F3S is developed for WindowsCE 5.0 and use on NetDCU8, but ports to other platforms are still planned. It could exchange FAT filesystems and also be applied in use of 2 parallel partitions.

F3S belongs to the family of log-structured filesystems. It basically contains elements from YAFFS but even goes beyond. Each time a write operation has finished, the file is getting a special marking and can be used without problems.

Finishing a transaction can be achieved by one of the following conditions:

- The file is closed
  `CloseFile()`

- All used file-buffers should be flushed
  `FlushFileBuffers()`

- When the `WRITE_THROUGH`-flag is set a transactions is closed after each write operation
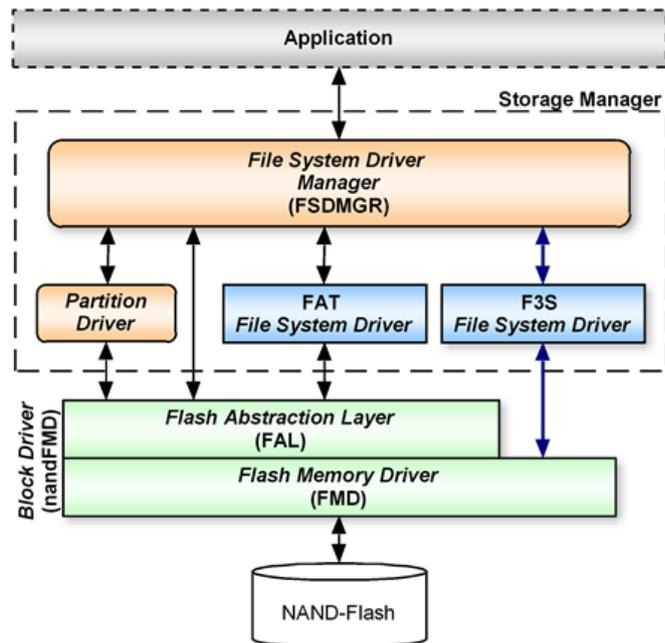
Further attributes

- ✓ Loss of file structure can be excluded (by disclaiming usage of allocation tables)
- ✓ Full replacement of the FAT file system
- ✓ Optimized throughput on all file operations
- ✓ Wear-Leveling strategies to reduce flash abrasion (including Garbage Collector)
- ✓ Transaction-based concept already cooperates with a lot of applications and protects data-modifications (e.g. Microsoft SQL Server database)

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Performance

Contrary to conventional file systems for WindowsCE, F3S is targeted to take advantage of flash memory characteristics. Thereby the physically required write operations are minimized. This mainly improves the transfer rate on write operations dramatically. An at the same time this reduces wearing of flash memory and thereby enhances its lifetime, which is limited anyway.