

exFAT

A File System for Flash Memory

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The Need for exFAT

- **A Bit of History**
 - FAT began life as a simple file system for floppy disks
 - Variations capable of handling larger and larger volumes were invented for hard disks
 - FAT is currently supported by nearly every operating system on nearly every platform

The Need for exFAT

- **A Bit of History (cont)**
 - Today, FAT has moved beyond just the PC
 - FAT32 is supported by virtually all consumer electronics devices:
 - digital still and video cameras, cell phones, game consoles, music players, e-book readers, digital photo frames, flat panel televisions, DVD players, and the list goes on....

The Need for exFAT

So why do we need a new file system
for removable storage interchange
now?

The Need for exFAT

- **In a nutshell, FAT32 has run out of bits**
 - There are no empty fields left in the on-disk structures
 - FAT32 was designed to allow for file sizes up to 4GB...
 - ...and volumes up to around 32GB
 - At the time (1996), these were huge compared to the capacity of a standard hard disk

The Need for exFAT

- **...and the nature of storage has changed**
 - Capacity of removable storage devices has grown by leaps and bounds
 - USB flash drives as big as 64GB
 - SD cards moving to +32GB
 - And is moving more and more to flash based media

Introducing exFAT

ExFAT builds on the strengths of FAT32...

...addressing modern flash storage requirement, exFAT is also extensible, allowing changes to address future needs.

Introducing exFAT

- **Some of the key advantages of exFAT include**
 - Support for very large files and storage devices
 - Performance Enhancements
 - Extensibility of the on-disk format
 - Addition of file system metadata checksums
 - Removal of short filenames and the addition of UTC time stamp support
 - **Added compatibility for flash media**

Introducing exFAT

- **Support for very large files and storage devices**
 - ExFAT uses 64 bits to describe the file size
 - Enabling applications which depend on files larger than 4 GB
 - ExFAT allows for clusters as large as 32MB
 - Enabling very large storage devices without expanding the FAT table to impractical sizes

Introducing exFAT

- **Performance Enhancements**
- A cluster bitmap for faster allocation
 - Scanning for free clusters no longer requires traversal of the FAT table itself
- A per-file contiguous bit that allows non-fragmented files to bypass the FAT table entirely
 - Useful for recording movies or writing photos
- Better alignment of the FAT table and cluster heap
- On-disk storage of file Valid Data Length (VDL)

Introducing exFAT

- **Extensibility of the on-disk format**
- The exFAT file system incorporates extensibility into its design
 - Enables the file system to keep pace with innovations in storage and changes in usage
 - Includes interop rules for extensions and new allocation types
 - Allows OEMs and ISVs to add extensions seamlessly
- Specifically exFAT:
 - Adds template-based metadata structures to allow custom extensions
 - Allows implementations to persist and manage these extensions without having to know details about their internal format

Introducing exFAT

- **Addition of file system metadata checksums**
- ExFAT maintains checksums on file system metadata
 - This allows an implementation to detect corruption such as a torn write or bit rot

Introducing exFAT

- **Unicode and UTC time stamp support**
- exFAT natively employs Unicode
- exFAT uses UTC timestamps

Introducing exFAT

- **Additional flash friendly features**
- Alignment of the file system metadata on device-optimal write boundaries
- Alignment of the cluster heap on device-optimal write boundaries
- Addition of a Flash Parameters structure to capture manufacturer-specific flash capabilities

Introducing exFAT

- **Next generation Flash File System**
 - Adopted by the SDA
 - Adopted by the Memory Stick Association
 - Supported in-box on Windows Vista and above
 - Download available for Windows XP

Thank you for your time

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