Memory Card File System Specification (FAT)

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Sony Computer Entertainment Inc.
1-1, Akasaka 7-chome, Minato-ku
Tokyo 107-0052, Japan

Sony Computer Entertainment America
919 E. Hillsdale Blvd.
Foster City, CA 94404, U.S.A.

Sony Computer Entertainment Europe
Waverley House, 7-12 Noel Street
London W1V 4HH, U.K.

Table of Contents

File System Specification (FAT)

Memory Card Block Structure

A Memory Card contains 1 Mbit (128 KB) of flash memory and is organized in blocks of 8 KBytes. Memory Cards are managed with an independent file system known as the FAT. PDA application data is also managed in the blocks.

Table 1: Layout of Memory Card blocks

Block No.	Contents
0	FAT block
1	Data block 1
2	Data block 2
. .	. .
14	Data block 14
15	Data block 15

Writes to flash memory are performed in 128-byte units known as sectors. There are 64 sectors in each block. When reading PDA sectors on the PlayStation 2, set sceMcxGetMem(port,slot,buff,0x8000000+ 0x80 x sect,0x80). One sector of data (128 bytes) is read to buff. Sector writes are not possible.

FAT Block Format

A FAT block has the following structure:

Table 2: FAT block memory map

Sector No.	Contents
0	Format ID sector
1	Block information sector 1
.	. . .
15	Block information sector 15
16	Alternate information sector 1
.	. . .
35	Alternate information sector 20
36	Alternate sector 1
.	. . .
55	Alternate sector 20
56	Reserved sector 1
.	. . .
62	Reserved sector 7
63	Dummy write sector

Format ID Sector

Table 3

'M'	'C'	0	0	---	sum

The first 2 bytes of the Format ID are 'M' and 'C', and the remaining bytes are all '0'. However the 128th byte is the checksum, which contains the result obtained by XORing bytes 1-127.

When the first 2 bytes are 'MC', the card is identified as a formatted Memory Card. Otherwise, it is considered unformatted.

Block Information Sector

Table 4: Structure of block information sector

Contents	Data Type	Size (bytes)
Block list Information	(unsigned long)	4
File size	(long)	4
Next block	(unsigned short)	2
Filename	(char) X 21	21
Reserved	(unsigned char)	1
Unused	unknown	94
PDA application	(unsigned char)	1
Checksum	(unsigned char)	1

Block List Information

Table 5: Meaning of block list information

Value	Contents
51	Header block
52	Intermediate block
53	End block
A0	Free block
A1	Header block with delete mark
A2	Intermediate block with delete mark
A3	End block with delete mark

Immediately after formatting, all block list information fields are set to the value A0. When a file is created, the file's block list information has values 51-53. When a file is deleted, the block list information used by the deleted file has values A1-A3. Once a file has been deleted, it can be restored simply by restoring the original block list information. However, if the file has been deleted and another file is created such that the "header block - intermediate block - end block" chain is broken, all blocks of the broken chain will be set to A0 by a check during the next FAT read.

If a file is only 1 block long, the block list information will only be 51 (or A1). If the file size is 2 blocks, the block list information will only have values 51 and 53 (or A1 and A3), and there will be no blocks with a value of 52 (or A2).

File Size

File size is maintained in bytes, and the value is computed as follows:

File size = No. of blocks specified when creating a new file X 8192 bytes

Next Block

If a file spans multiple blocks, a pointer to the next block, which is 1 less than the block number, is stored. For example, if the next block were block number 1, 2,..., or 15, then the value 0, 1,..., or 14, respectively, would be stored as the pointer. When there is no next block, 0xFFFF is stored in this field.

Filename

Stores the filename. A NULL (0x00) is required at the end of the character string.

PDA Application

For a PDA application, use sceMcSetFileInfo to set the sceMcFileAttrPDAExec bit in the file attributes. Otherwise, leave it as 0. This information is not copied in the PlayStation 2 file management screen, so it is set to 0 when a PDA application is copied, but now downloaded from the PlayStation 2.

Checksum

The checksum is obtained by XORing bytes 1-127.

Alternate Information Sector

Table 6

(long) substituted sector number	0	---	sum

When a sector is specified as an alternate information sector, the alternate sector is used in place of the specified sector. For example, if alternate information sector 3 contained 123 as its substituted sector number and an attempt was made to read or write sector 123, alternate sector 3 of the same number as the alternate information sector would be read or written instead.

When the sector number is 0x1000000, this means that the sector substitution failed and so the alternate information is ignored. When the same alternate sector number is in the alternate information, the information found in the more recent sector takes priority.

The checksum data in the 128th byte is obtained by XORing bytes 1-127.

Alternate Sector

The actual sector specified in the alternate information sector is written here.

Dummy Write Sector

This sector is used for dummy writes in order to clear unidentified flags.

FAT Operation

Next, FAT operation using the PlayStation library, etc., will be described.

Format

The format operation sets up each sector as shown in the following table.

Table 7: State of formatted FAT

Target sector	Offset within sector / write contents								
	0	1	2	3	4~7	8	9	10~126	127
0	4D	43	00	00	00	00	00	00	sum
1~15	A0	00	00	00	00	FF	FF	00	sum
16~35	FF	FF	FF	FF	00	FF	FF	00	sum

* The values in the table are expressed as hex numbers.

The sum in the 127th byte is the checksum, and is obtained by XORing bytes 0-126.

Formatted FAT images are shown as Memory Card format images (see the Memory Card Format Image section).

Unformat

If the first two bytes of sector 0 are other than 'MC', the Memory Card is considered to be in an unformatted state.

Delete

The delete operation changes the high-order 4 bits of the first byte of all block information sectors of the appropriate file, from 5 to A. All other data (excluding the checksum in the 127th byte) remains unchanged.

Undelete

Following a delete operation, the undelete operation changes the high-order 4 bits of the first byte of all block information sectors of the appropriate file, from A to 5. All other data (excluding the checksum in the 127th byte) remains unchanged. The undelete operation restores data files that have been deleted.

Special Processing in PDA

Writing to the FAT Sector of an Executing PDA Application

When an attempt is made to write to a FAT sector corresponding to a block in which an executing PDA application is stored, (e.g., from the PlayStation 2 via the library), the write is inhibited and an error is generated. Furthermore, the library recognizes this state to mean that a Memory Card has been swapped.

Alternate Sector Write Disable Interval

During the execution of the "display while transferring file" command of the libmcx library, writing to the alternate information sectors (sectors 16-35) and to the alternate sectors (36-55) is disabled in order to protect the PDA application file and PDA icons. An attempt to write to these sectors generates an error.

Memory Card Format Image

The FAT state for a formatted Memory Card is shown below.

From alternate sector 1 to the dummy write sector, it is unnecessary to set the specified initial value.

```
00000  4D 43 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00   MC   Format ID sector
00010  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
00020  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
00030  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
00040  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
00050  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
00060  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
00070  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 0E
00080  A0 00 00 00 00 00 00 00 - FF FF 00 00 00 00 00 00    Block information sector 1
00090  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
000A0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
000B0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
000C0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
000D0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
000E0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
000F0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 A0
00100  A0 00 00 00 00 00 00 00 - FF FF 00 00 00 00 00 00    Block information sector 2
00110  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
00120  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
00130  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
00140  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
00150  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
00160  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
00170  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 A0
                              :
                              :
00780  A0 00 00 00 00 00 00 00 - FF FF 00 00 00 00 00 00    Block information sector 15
00790  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
007A0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
007B0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
007C0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
```

```
007D0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
007E0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
007F0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 A0
00800  FF FF FF FF 00 00 00 00 - FF FF 00 00 00 00 00 00    Alternate information sector 1
00810  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
00820  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
00830  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
00840  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
00850  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
00860  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
00870  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
00880  FF FF FF FF 00 00 00 00 - FF FF 00 00 00 00 00 00    Alternate information sector 2
00890  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
008A0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
008B0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
008C0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
008D0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
008E0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
008F0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
                              :
                              :
01180  FF FF FF FF 00 00 00 00 - FF FF 00 00 00 00 00 00   Alternate information sector 20
01190  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
011A0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
011B0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
011C0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
011D0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
011E0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
011F0  00 00 00 00 00 00 00 00 - 00 00 00 00 00 00 00 00
01200  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF    Alternate sector 1
01210  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01220  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01230  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01240  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01250  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01260  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01270  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
```

```
01280  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF    Alternate sector 2
01280  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01290  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
012A0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
012B0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
012C0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
012D0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
012E0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
012F0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
                          :
                          :
01B80  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF    Alternate sector 20
01B90  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01BA0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01BB0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01BC0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01BD0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01BE0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01BF0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01C00  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF    Reserved sector 1
01C10  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01C20  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01C30  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01C40  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01C50  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01C60  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01C70  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01C80  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF    Reserved sector 2
01C90  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01CA0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01CB0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01CC0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01CD0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01CE0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01CF0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
                          :
                          :
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01F00  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF    Reserved sector 7
01F10  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01F20  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01F30  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01F40  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01F50  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01F60  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01F70  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01F80  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF    Dummy write sector
01F90  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01FA0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01FB0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01FC0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01FD0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01FE0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
01FF0  FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF
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