

SD-CARD's structure is below;

This is simplified.

Please refer <http://www.microsoft.com/whdc/system/platform/firmware/fatgen.mspx> about details.

| <i>FAT system</i> | <i>Sector Number</i>   |
|-------------------|--|
| <i>MBR</i>        | <i>0x0</i>   |
| <i>BPB</i>        | <i>firstSectorNumbers</i>  |
| <i>FAT</i>        | <i>FirstSectorNumbers + reservedSector</i>   |
| <i>RDE</i>        | <i>FirstSectorNumbers + reservedSector + (numberOfFATS X sectorsPerFAT)</i>  |
| <i>User Area</i>  | <i>FirstSectorNumbers + reservedSector + (numberOfFATS X sectorsPerFAT) + (rootEntries X 0x20) / bytePerSector</i> |

BPB's address = firstSectorNumbers X 0x200

Other SD-CARRD's address = Sector Number X bytePerSectors.

RDE's size for SDHC is zero, because RDE is not system area.

RDE for SDHC is within User Area and it has cluster-chain same as files.

First RDE for SDHC generally exist next to FAT area.

sd\_viewer's buffer is end of Hub RAM.

| <i>Hub RAM</i>      | <i>address</i>         |
|---------------------|------------------------|
| <i>Forth kernal</i> | <i>0x0</i>             |
| <i>dictionary</i>   |                        |
|                     | <i>here</i>            |
| <i>sd_buf</i>       | <i>dictend - 0x200</i> |
|                     | <i>dictend</i>         |

*MBR(Master Boot Record) Sector:0x0 Address:0x0*

```
1C0 0C 00 06 38 F8 B8 89 00 00 00 77 9F 3A 00 00 00 ...8.....w.:...
1D0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
1E0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
1F0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 55 AA .....U
```

| <i>numberOfFATS</i>             |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | <i>bytePerSector</i> |                    |  |  |  |  |  |  |                         |  |       |  |  |  |  |  |                        |  |  |  |  |  |  |  |
|---------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----------------------|--------------------|--|--|--|--|--|--|-------------------------|--|-------|--|--|--|--|--|------------------------|--|--|--|--|--|--|--|
| <i>rootEntries</i>              |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | <i>sectorsPerFAT</i> |                    |  |  |  |  |  |  | <i>sectorPerCluster</i> |  |       |  |  |  |  |  | <i>reservedSectors</i> |  |  |  |  |  |  |  |
|                                 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |                      |                    |  |  |  |  |  |  |                         |  |       |  |  |  |  |  |                        |  |  |  |  |  |  |  |
| 0 1 2 3 4 5 6 7 8 9 A B C D E F |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |                      |                    |  |  |  |  |  |  |                         |  |       |  |  |  |  |  |                        |  |  |  |  |  |  |  |
| 000                             | EB | 00 | 90 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 00 | 02 | 40 | 01 | 00                   | ...                |  |  |  |  |  |  |                         |  | ..@.. |  |  |  |  |  |                        |  |  |  |  |  |  |  |
| 010                             | 02 | 00 | 02 | 00 | 00 | F8 | EB | 00 | 3F | 00 | 40 | 00 | 89 | 00 | 00 | 00                   | .....?.@.....      |  |  |  |  |  |  |                         |  |       |  |  |  |  |  |                        |  |  |  |  |  |  |  |
| 020                             | 77 | 9F | 3A | 00 | 80 | 00 | 29 | 2D | 9D | 76 | 62 | 4E | 4F | 20 | 4E | 41                   | w.:...) - .vbNO NA |  |  |  |  |  |  |                         |  |       |  |  |  |  |  |                        |  |  |  |  |  |  |  |
| 030                             | 4D | 45 | 20 | 20 | 20 | 20 | 46 | 41 | 54 | 31 | 36 | 20 | 20 | 20 | 00 | 00                   | ME FAT16 ..        |  |  |  |  |  |  |                         |  |       |  |  |  |  |  |                        |  |  |  |  |  |  |  |
| 040                             | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00                   | .....              |  |  |  |  |  |  |                         |  |       |  |  |  |  |  |                        |  |  |  |  |  |  |  |

*bigTotalSectors*

FAT(File Allocation Table) Sector:0x8A Address:0x11400

Sample FAT is FAT16.

FAT16's cluster number occupy 2byte.

Cluster number0 and Cluster number1 are reserved on sd-card system.

First cluster number's area point next cluster number.

If its contents is 'FFFF', file data end at its cluster.

In case of FAT32(SDHC) occupy 4byte as cluster number.

But its number's valid value is 28bit.

RDE(Root Directory Entry) Sector:0x260 Address:0x4C000

|     | 0  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | A  | B  | C  | D  | E  | F  | Entry of file    |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|------------------|
| 000 | E5 | 45 | 57 | 46 | 49 | 4C | 45 | 58 | 54 | 58 | 54 | 00 | 00 | 00 | 00 | 20 | .EWFILTEXT....   |
| 010 | 27 | 36 | 00 | 00 | 00 | 00 | 00 | 20 | 27 | 36 | 02 | 00 | 78 | 00 | 00 | 00 | '6..... '6..x... |
| 020 | E5 | 59 | 5F | 50 | 4F | 53 | 20 | 20 | 54 | 58 | 54 | 00 | 00 | 00 | 00 | 00 | .Y_POS TXT.....  |
| 030 | 41 | 3B | 00 | 00 | 00 | 00 | 00 | 00 | 41 | 3B | 03 | 00 | 7B | 01 | 00 | 00 | A;.....A;...{... |

Top data'E5' for entry of file is deleted file.

Top data'00' for entry of file is end of file.

SFN & LFN

When filename exceeds 8-characters, LFN is made.

LFN entry has 13-character. Total LFN entry is 20(decimal).

LFN's max character is 255-characters.

Input Address(hex) > 4c800

|     | 0  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | A  | B  | C  | D  | E  | F  |                   |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-------------------|
| 000 | E5 | 48 | 49 | 4B | 41 | 57 | 7E | 31 | 20 | 20 | 20 | 10 | 00 | 0E | 2A | 5E | .HIKAW~1 ...*^    |
| 010 | 51 | 3D | 51 | 3D | 00 | 00 | 2B | 5E | 51 | 3D | 14 | 00 | 00 | 80 | 00 | 00 | Q=Q=..+^Q=.....   |
| 020 | E5 | 65 | 00 | 64 | 00 | 64 | 00 | 69 | 00 | 6E | 00 | 0F | 00 | 05 | 67 | 00 | .e.d.d.i.n....g.  |
| 030 | 00 | 00 | FF | FF | FF | FF | FF | FF | FF | FF | 00 | 00 | FF | FF | FF | FF | .....             |
| 040 | E5 | B3 | 30 | D4 | 30 | FC | 30 | 20 | 00 | 5E | FF | 0F | 00 | 05 | 20 | 00 | ..0.0.0 .^....    |
| 050 | 43 | 00 | 68 | 00 | 69 | 00 | 6B | 00 | 61 | 00 | 00 | 00 | 20 | 00 | 57 | 00 | C.h.i.k.a... .W.  |
| 060 | E5 | 52 | 83 | 73 | 81 | 5B | 7E | 31 | 20 | 20 | 20 | 10 | 00 | 03 | 90 | 5E | .R.s.[~1 ....^    |
| 070 | 51 | 3D | 51 | 3D | 00 | 00 | 91 | 5E | 51 | 3D | BD | 51 | 00 | 80 | 00 | 00 | Q=Q=..+^Q=.Q....  |
| 080 | 41 | 66 | 00 | 61 | 00 | 74 | 00 | 5F | 00 | 31 | 00 | 0F | 00 | 4B | 2E | 00 | Af.a.t._.1...K..  |
| 090 | 30 | 00 | 2E | 00 | 66 | 00 | 00 | 00 | FF | FF | 00 | 00 | FF | FF | FF | FF | 0...f.....        |
| 0A0 | 46 | 41 | 54 | 5F | 31 | 30 | 7E | 31 | 46 | 20 | 20 | 20 | 00 | 46 | 87 | 73 | FAT_10~1F .F.s    |
| 0B0 | 6D | 3D | 6D | 3D | 00 | 00 | 59 | AB | 44 | 3D | 15 | 00 | AF | 05 | 00 | 00 | m=m=..Y.D=.....   |
| 0C0 | 41 | 73 | 00 | 64 | 00 | 5F | 00 | 66 | 00 | 75 | 00 | 0F | 00 | 31 | 6E | 00 | As.d._.f.u...1n.  |
| 0D0 | 63 | 00 | 5F | 00 | 31 | 00 | 2E | 00 | 30 | 00 | 00 | 00 | 2E | 00 | 66 | 00 | c._.1...0....f.   |
| 0E0 | 53 | 44 | 5F | 46 | 55 | 4E | 7E | 31 | 46 | 20 | 20 | 20 | 00 | 62 | 8B | 73 | SD_FUN~1F .b.s    |
| 0F0 | 6D | 3D | 6D | 3D | 00 | 00 | 36 | 9B | 44 | 3D | 16 | 00 | 62 | 30 | 00 | 00 | m=m=..6.D=..b0..  |
| 100 | 42 | 2E | 00 | 66 | 00 | 00 | 00 | FF | FF | FF | FF | 0F | 00 | 0E | FF | FF | B..f.....         |
| 110 | FF | FF | FF | FF | FF | FF | FF | FF | FF | FF | 00 | 00 | FF | FF | FF | FF | .....             |
| 120 | 01 | 73 | 00 | 64 | 00 | 5F | 00 | 76 | 00 | 69 | 00 | 0F | 00 | 0E | 65 | 00 | .s.d._.v.i....e.  |
| 130 | 77 | 00 | 65 | 00 | 72 | 00 | 5F | 00 | 31 | 00 | 00 | 00 | 2E | 00 | 30 | 00 | w.e.r._.1.....0.  |
| 140 | 53 | 44 | 5F | 56 | 49 | 45 | 7E | 31 | 46 | 20 | 20 | 20 | 00 | 2C | 8E | 73 | SD_VIE~1F .,s     |
| 150 | 6D | 3D | 6D | 3D | 00 | 00 | 8F | A5 | 56 | 3D | 17 | 00 | 5D | 27 | 00 | 00 | m=m=...V=..]'     |
| 160 | 53 | 50 | 45 | 45 | 44 | 20 | 20 | 20 | 46 | 20 | 20 | 20 | 18 | 90 | A0 | 73 | SPEED F ...s      |
| 170 | 6D | 3D | 6D | 3D | 00 | 00 | E0 | 4C | 51 | 3D | 18 | 00 | AF | 02 | 00 | 00 | m=m=...LQ=.....   |
| 180 | 41 | 64 | 00 | 69 | 00 | 63 | 00 | 74 | 00 | 5F | 00 | 0F | 00 | 39 | 74 | 00 | Ad.i.c.t._....9t. |
| 190 | 65 | 00 | 73 | 00 | 74 | 00 | 2E | 00 | 66 | 00 | 00 | 00 | 00 | 00 | FF | FF | e.s.t...f.....    |
| 1A0 | 44 | 49 | 43 | 54 | 5F | 54 | 7E | 31 | 46 | 20 | 20 | 20 | 00 | 8B | 07 | 74 | DICT_T~1F ...t    |
| 1B0 | 6D | 3D | 6D | 3D | 00 | 00 | D7 | 73 | 6D | 3D | 19 | 00 | 2D | 01 | 00 | 00 | m=m=...sm=...-... |
| 1C0 | 43 | 6C | 00 | 65 | 00 | 72 | 00 | 5F | 00 | 53 | 00 | 0F | 00 | D8 | 70 | 00 | Cl.e.r._.S....p.  |
| 1D0 | 65 | 00 | 63 | 00 | 2E | 00 | 70 | 00 | 64 | 00 | 00 | 00 | 66 | 00 | 00 | 00 | e.c...p.d...f...  |
| 1E0 | 02 | 5F | 00 | 48 | 00 | 6F | 00 | 73 | 00 | 74 | 00 | 0F | 00 | D8 | 5F | 00 | _.H.o.s.t...._.   |
| 1F0 | 43 | 00 | 6F | 00 | 6E | 00 | 74 | 00 | 72 | 00 | 00 | 00 | 6F | 00 | 6C | 00 | C.o.n.t.r...o.l.  |

3rd(last) LFN

2nd LFN

Input Address(hex) > 4ca00

|               |     | 0  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | A  | B  | C  | D  | E  | F  |                   |
|---------------|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-------------------|
| 1st LFN       | 000 | 01 | 53 | 00 | 69 | 00 | 6D | 00 | 70 | 00 | 6C | 00 | 0F | 00 | D8 | 69 | 00 | .S.i.m.p.l....i.  |
|               | 010 | 66 | 00 | 69 | 00 | 65 | 00 | 64 | 00 | 5F | 00 | 00 | 00 | 53 | 00 | 44 | 00 | f.i.e.d....S.D.   |
| SFN           | 020 | 53 | 49 | 4D | 50 | 4C | 49 | 7E | 31 | 50 | 44 | 46 | 20 | 00 | 6C | C7 | 8C | SIMPLI~1PDF .l..  |
|               | 030 | 70 | 3D | 70 | 3D | 00 | 00 | F3 | 88 | 1D | 3D | 02 | 00 | 9B | 0B | 09 | 00 | p=p=.....=.....   |
| 3rd(last) LFN | 040 | 43 | 46 | 00 | 69 | 00 | 6C | 00 | 65 | 00 | 4E | 00 | 0F | 00 | E8 | 61 | 00 | CF.i.l.e.N....a.  |
|               | 050 | 6D | 00 | 65 | 00 | 5F | 00 | 74 | 00 | 65 | 00 | 00 | 00 | 73 | 00 | 74 | 00 | m.e._.t.e...s.t.  |
| 2nd LFN       | 060 | 02 | 66 | 00 | 69 | 00 | 6C | 00 | 65 | 00 | 5F | 00 | 0F | 00 | E8 | 66 | 00 | .f.i.l.e._....f.  |
|               | 070 | 6F | 00 | 72 | 00 | 5F | 00 | 4C | 00 | 6F | 00 | 00 | 00 | 6E | 00 | 67 | 00 | o.r._.L.o...n.g.  |
| 1st LFN       | 080 | 01 | 54 | 00 | 68 | 00 | 69 | 00 | 73 | 00 | 5F | 00 | 0F | 00 | E8 | 69 | 00 | .T.h.i.s._....i.  |
|               | 090 | 73 | 00 | 5F | 00 | 74 | 00 | 65 | 00 | 78 | 00 | 00 | 00 | 74 | 00 | 2E | 00 | s._.t.e.x...t...  |
| SFN           | 0A0 | 54 | 48 | 49 | 53 | 5F | 49 | 7E | 31 | 46 | 49 | 4C | 20 | 00 | 80 | 9C | 7C | THIS_I~1FIL ...   |
|               | 0B0 | 73 | 3D | 73 | 3D | 00 | 00 | F6 | 7E | 73 | 3D | 1A | 00 | 04 | 00 | 00 | 00 | s=s=...~s=.....   |
|               | 0C0 | 41 | 73 | 00 | 69 | 00 | 7A | 00 | 65 | 00 | 5F | 00 | 0F | 00 | 3F | 7A | 00 | As.i.z.e._....?z. |
|               | 0D0 | 65 | 00 | 72 | 00 | 6F | 00 | 2E | 00 | 74 | 00 | 00 | 00 | 78 | 00 | 74 | 00 | e.r.o...t...x.t.  |
|               | 0E0 | 53 | 49 | 5A | 45 | 5F | 5A | 7E | 31 | 54 | 58 | 54 | 20 | 00 | 43 | CF | B9 | SIZE_Z~1TXT .C..  |
|               | 0F0 | 73 | 3D | 73 | 3D | 00 | 00 | B8 | B9 | 73 | 3D | 00 | 00 | 00 | 00 | 00 | 00 | s=s=...s=.....    |
|               | 100 | 4E | 4F | 54 | 48 | 49 | 4E | 47 | 20 | 20 | 20 | 20 | 10 | 08 | 5E | 43 | 48 | NOTHING ..^CH     |
|               | 110 | 74 | 3D | 74 | 3D | 00 | 00 | 2C | 48 | 74 | 3D | 1B | 00 | 00 | 00 | 00 | 00 | t=t=...,Ht=.....  |
|               | 120 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....             |
|               | 130 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....             |
|               | 140 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....             |
|               | 150 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....             |
|               | 160 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....             |
|               | 170 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....             |
|               | 180 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....             |
|               | 190 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....             |
|               | 1A0 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....             |
|               | 1B0 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....             |
|               | 1C0 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....             |
|               | 1D0 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....             |
|               | 1E0 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....             |
|               | 1F0 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | .....             |

|     | 5 characters |    |    |    |    |    |    |    |    |    | 2 characters |    |    |    | 6 characters |    |                  |  |  |
|-----|--------------|----|----|----|----|----|----|----|----|----|--------------|----|----|----|--------------|----|------------------|--|--|
| 040 | 43           | 46 | 00 | 69 | 00 | 6C | 00 | 65 | 00 | 4E | 00           | 0F | 00 | E8 | 61           | 00 | CF.i.l.e.N....a. |  |  |
| 050 | 6D           | 00 | 65 | 00 | 5F | 00 | 74 | 00 | 65 | 00 | 00           | 00 | 73 | 00 | 74           | 00 | m.e._.t.e...s.t. |  |  |
| 060 | 02           | 66 | 00 | 69 | 00 | 6C | 00 | 65 | 00 | 5F | 00           | 0F | 00 | E8 | 66           | 00 | .f.i.l.e._....f. |  |  |
| 070 | 6F           | 00 | 72 | 00 | 5F | 00 | 4C | 00 | 6F | 00 | 00           | 00 | 6E | 00 | 67           | 00 | o.r._.L.o...n.g. |  |  |
| 080 | 01           | 54 | 00 | 68 | 00 | 69 | 00 | 73 | 00 | 5F | 00           | 0F | 00 | E8 | 69           | 00 | .T.h.i.s._....i. |  |  |
| 090 | 73           | 00 | 5F | 00 | 74 | 00 | 65 | 00 | 78 | 00 | 00           | 00 | 74 | 00 | 2E           | 00 | s._.t.e.x...t... |  |  |
| 0A0 | 54           | 48 | 49 | 53 | 5F | 49 | 7E | 31 | 46 | 49 | 4C           | 20 | 00 | 80 | 9C           | 7C | THIS_I~1FIL ...  |  |  |
| 0B0 | 73           | 3D | 73 | 3D | 00 | 00 | F6 | 7E | 73 | 3D | 1A           | 00 | 04 | 00 | 00           | 00 | s=s=...~s=.....  |  |  |

LFN entry's top data is LFN's number. (Max 0x20)

Last LFN entry's top data is added 0x40. LFN use 2byte code.

Refer WORD" longname" and "file\_detail" .

sd\_viewer don't display 2byte code.

WORD" longname" display about current sector and previous sector.

If LFN exceed 208-characters and SFN exist on top of sector, sd-viewer cause stack error.

I think no one make such a long file name.