2010/12/1

SD-CARD's structure is below;
This is simplified.
Please refer http://www.microsoft.com/whdc/system/platform/firmware/fatgen.mspx about details.

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

BPB's address = firstSectorNumbers X 0x200
Other area's address of SD-CARRD = Sector Number X bytePerSectors.

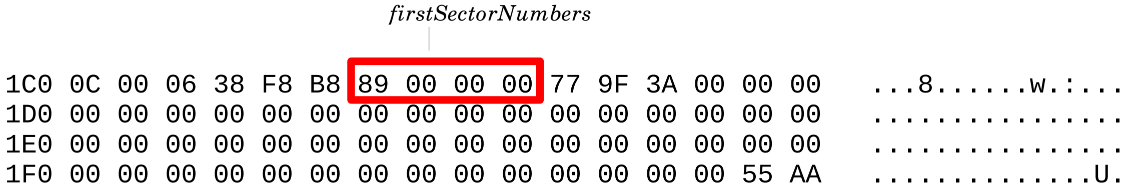
RDE's size for SDHC is zero, because RDE for SDHC is not system area.
RDE for SDHC is within User Area and it has cluster-chain same as files.
First RDE for SDHC generally exist next to FAT area.

sd_viewer's buffer is end of Hub RAM.

Hub RAM	*address*
Forth kernal	*0x0*
dictionary	
	here
sd_buf	*dictend - 0x200*
	dictend

Sample is 2G(SDSC:kingston)

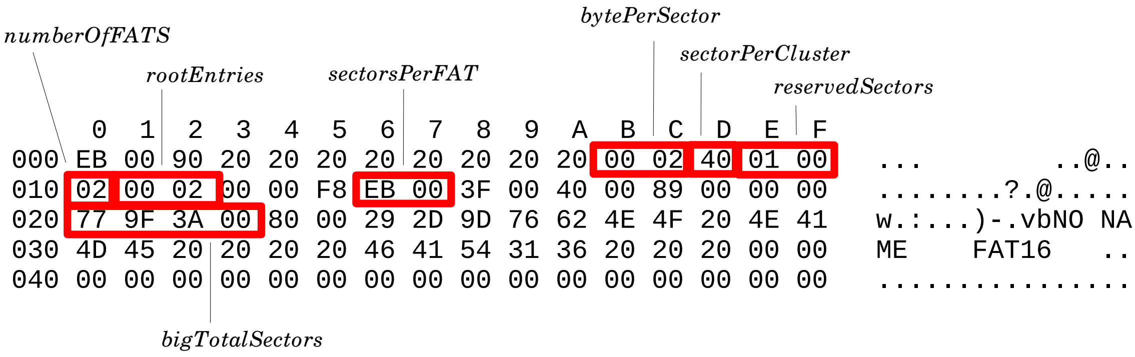
MBR(Master Boot Record) Sector:0x0 Address:0x0



```
                                  firstSectorNumbers

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.
```

BTB(BIOS Parameter Block) Sector:0x89 Address:0x11200



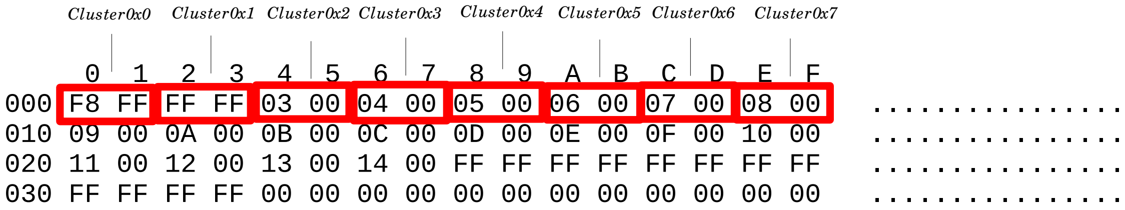
```
                                                 bytePerSector
numberOfFATS                                              sectorPerCluster
                 rootEntries      sectorsPerFAT                  reservedSectors

     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
```

Refer WORD'collect_infi' and WORD'info'.

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



```
    Cluster0x0 Cluster0x1 Cluster0x2 Cluster0x3 Cluster0x4 Cluster0x5 Cluster0x6 Cluster0x7

     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
000 F8 FF FF FF 03 00 04 00 05 00 06 00 07 00 08 00   ................
010 09 00 0A 00 0B 00 0C 00 0D 00 0E 00 0F 00 10 00   ................
020 11 00 12 00 13 00 14 00 FF FF FF FF FF FF FF FF   ................
030 FF FF FF FF 00 00 00 00 00 00 00 00 00 00 00 00   ................
```

Sample FAT is FAT16.
FAT16's cluster number occupy 2byte.
Cluster number0 and Cluster number1 are reserved on sd-card system.

User's start-cluster is 2.
Each file has first cluster number inside each file's entry on RDE.
Its first cluster number point out datas inside FAT.
Each data of FAT point out 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
```

Entry of file

```
     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
000 E5 45 57 46 49 4C 45 58 54 58 54 00 00 00 00 20   .EWFILEXTXT....
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.

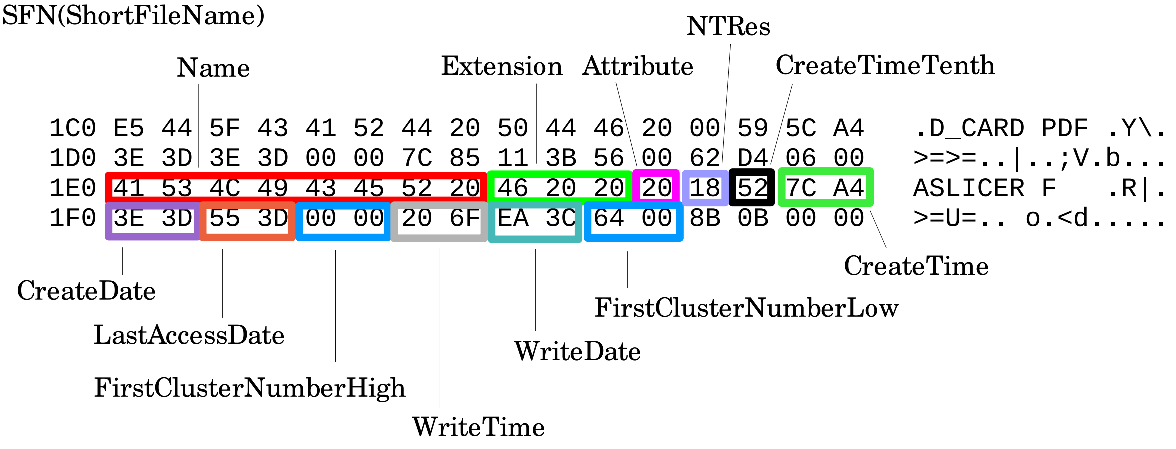
File's entry has 32byte(0x20).

There are 16 entry inside 1-sector(generally 512bytes).

FAT16 has 512(0x200) entry. 512 / 16 = 32sectors

FAT32 can have many file entry, because its RDE has structure of cluster-chain.

SFN(ShortFileName)



```
1C0 E5 44 5F 43 41 52 44 20 50 44 46 20 00 59 5C A4   .D_CARD PDF .Y\.
1D0 3E 3D 3E 3D 00 00 7C 85 11 3B 56 00 62 D4 06 00   >=>=..|..;V.b...
1E0 41 53 4C 49 43 45 52 20 46 20 20 20 18 52 7C A4   ASLICER F   .R|.
1F0 3E 3D 55 3D 00 00 20 6F EA 3C 64 00 8B 0B 00 00   >=U=.. o.<d.....
```

SFN & LFN

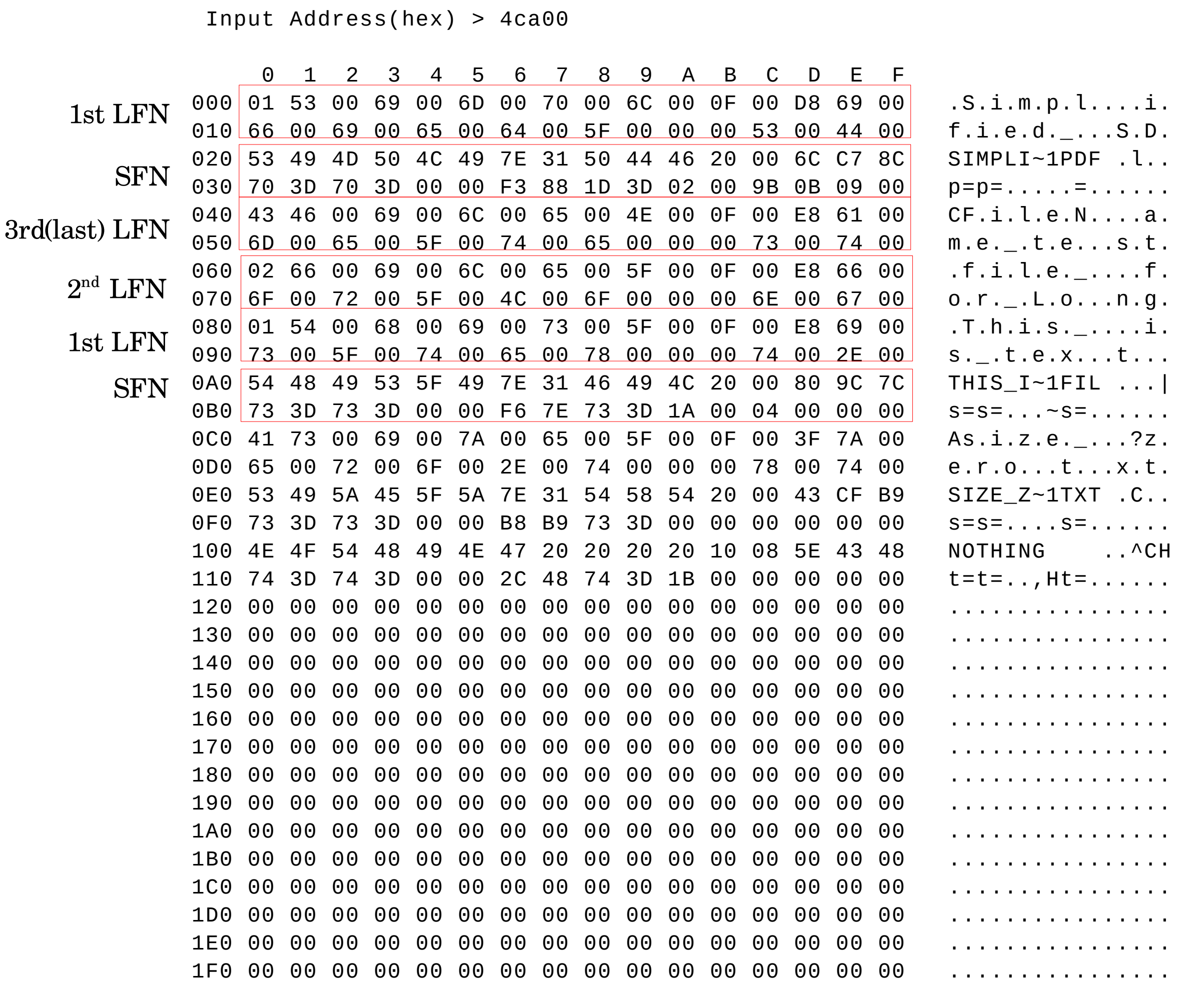
When filename exceesd 8-characters, LFN is made.

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

LFN's max character is 255-characters.

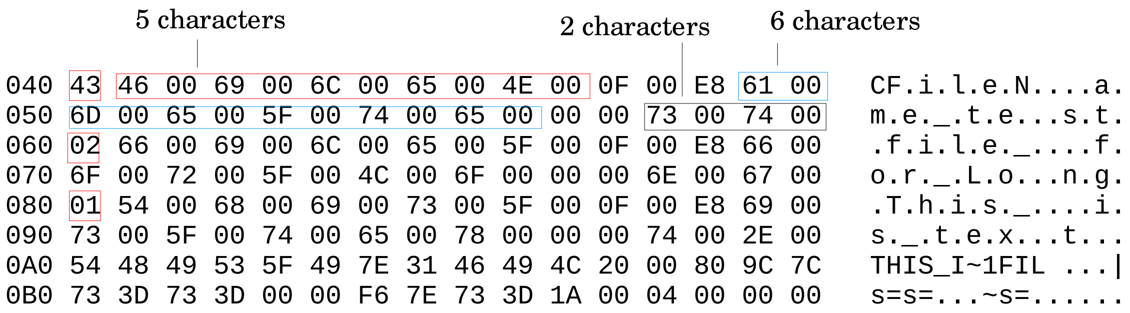
```
                   Input Address(hex) > 4c800

                       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=..-...
 3rd(last) LFN    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...
       2nd LFN    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.
```



```
Input Address(hex) > 4ca00

     0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
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.
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=.....=......
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=......
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   ................
```



```
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 20[decimal])

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.