Operating Systems
CSCI 5806

Spring Semester 2020 — CRN 21176 / 26762

Term Project — Step 2 — Disk Partition Access

Target completion date: Friday, February 7, 2020

Goals

- Provide the five basic file I/O functions to access disk space inside a disk partition, which is contained in a VDI file.
- Create a structure or class to contain the data necessary to implement the five functions.

Details

As with the lower-level VDI file, you'll want to set up a basic structure or class to hold the data necessary to work with partitions. The necessary data can take one of two forms — either a pointer to an opened VDI file and a partition table entry, or the VDI file pointer, the start location of the partition within the disk and the size of the partition in bytes.
Pro tip: I use the latter option, you only have to do the calculations once.

Wikipedia has a good article on Master Boot Records (MBRs) at https://en.wikipedia.org/wiki/Master_boot_record; it has all of the information you need to extract the necessary data for this step.

In addition to the structure, you'll need to implement the five basic file I/O functions:

- **`struct PartitionFile *partitionOpen(struct VDIFile *,struct PartitionEntry)`**
  Combine the open VDI file and the given partition into a single structure and return a pointer to that structure.
- **`void partitionClose(struct PartitionFile *f)`**
  Close the file whose pointer is given. Deallocate any dynamically created memory regions.
- **`ssize_t partitionRead(struct PartitionFile *f,void *buf,size_t count)`**
  Operates the same as **`vdiRead()`**. Restrict **`count`** so that it does not read beyond the end of the partition.
- **`ssize_t partitionWrite(struct PartitionFile *f,void *buf,size_t count)`**
  Operates the same as **`vdiWrite()`**. Restrict **`count`** so that it does not write beyond the end of the partition.
- **`off_t partitionSeek(struct PartitionFile *f,off_t offset,int anchor)`**
  Operates the same as **`vdiSeek()`**. Restrict the function so that the cursor remains unchanged if a location outside the partition is requested.

If you are using a class, then the `VDIFile *` parameter is omitted.

You should also write a function that takes a pointer to a VDIFile and an array of PartitionEntry as parameters and fills the array with the disk's partition table. The function simply needs to set the cursor to offset 446 and read 64 bytes into the table.

Finally, write a function that takes a PartitionEntry structure and displays its fields in an easy-to-read manner. Again, your exact format may differ somewhat from my example.

▸*Example 1*

This is the output from my step 2 program, on the dynamic VDI file with 1KB blocks. It shows the four entries in the partition table. It then reads a 1KB block from the disk, starting at an offset of 1024. This is displayed using the **`displayBuffer(,)`** function.

Spoiler alert: That 1KB block is called the *superblock*, and it's *really* important, so it's a critical check here that your program is reading the same bytes you're seeing in this output.

```
Partition 1
Status: Inactive
First sector CHS: 0-32-33
Last sector CHS: 16-81-1
Partition type: 83 linux native
First LBA sector: 2048
LBA sector count: 260096

Partition 2
Status: Inactive
First sector CHS: 0-0-0
Last sector CHS: 0-0-0
Partition type: 00 empty
First LBA sector: 0
LBA sector count: 0

Partition 3
Status: Inactive
First sector CHS: 0-0-0
Last sector CHS: 0-0-0
Partition type: 00 empty
First LBA sector: 0
LBA sector count: 0

Partition 4
Status: Inactive
First sector CHS: 0-0-0
Last sector CHS: 0-0-0
Partition type: 00 empty
First LBA sector: 0
LBA sector count: 0

Offset: 0x400
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-------------------------------------------------+  +----------------+
00|00 7f 00 00 00 fc 01 00 66 19 00 00 3b d6 01 00|00|        f   ;   |
10|f4 7e 00 00 01 00 00 00 00 00 00 00 00 00 00 00|10| ~              |
20|00 20 00 00 00 20 00 00 f0 07 00 00 db ea bc 56|20|               V|
30|19 eb bc 56 03 00 ff ff 53 ef 01 00 01 00 00 00|30|   V    S       |
40|9a bb ba 56 00 00 00 00 00 00 00 00 01 00 00 00|40|   V            |
50|00 00 00 00 0b 00 00 00 80 00 00 00 38 00 00 00|50|           8    |
60|02 00 00 00 01 00 00 00 71 2b 0f f6 04 66 4a a7|60|        q+   fJ |
70|86 c4 5d b7 72 22 07 09 00 00 00 00 00 00 00 00|70|  ] r"          |
80|00 00 00 00 00 00 00 00 2f 6d 65 64 69 61 2f 62|80|        /media/b|
90|6f 62 2f 37 31 32 62 30 66 66 36 2d 30 34 36 36|90|ob/712b0ff6-0466|
a0|2d 34 61 61 37 2d 38 36 63 34 2d 35 64 62 37 37|a0|-4aa7-86c4-5db77|
```

```
b0|32 32 32 30 37 30 39 00 00 00 00 00 00 00 00 00|b0|2220709         |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 2d 98 fc 1b|e0|            -   |
f0|11 69 47 40 93 c8 52 24 9c 57 46 c9 01 00 00 00|f0| iG@  R$ WF     |
  +-----------------------------------------------+  +----------------+

Offset: 0x500
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-----------------------------------------------+  +----------------+
00|0c 00 00 00 00 00 00 00 9a bb ba 56 00 00 00 00|00|           V    |
10|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|10|                |
20|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|20|                |
30|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|30|                |
40|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|40|                |
50|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|50|                |
60|01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|60|                |
70|00 00 00 00 00 00 00 00 b8 0f 00 00 00 00 00 00|70|                |
80|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|80|                |
90|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|90|                |
a0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|a0|                |
b0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|b0|                |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|e0|                |
f0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|f0|                |
  +-----------------------------------------------+  +----------------+

Offset: 0x600
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-----------------------------------------------+  +----------------+
00|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|00|                |
10|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|10|                |
20|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|20|                |
30|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|30|                |
40|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|40|                |
50|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|50|                |
60|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|60|                |
70|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|70|                |
80|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|80|                |
90|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|90|                |
a0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|a0|                |
b0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|b0|                |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|e0|                |
f0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|f0|                |
  +-----------------------------------------------+  +----------------+

Offset: 0x700
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-----------------------------------------------+  +----------------+
00|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|00|                |
10|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|10|                |
```

```
20|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|20|                |
30|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|30|                |
40|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|40|                |
50|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|50|                |
60|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|60|                |
70|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|70|                |
80|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|80|                |
90|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|90|                |
a0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|a0|                |
b0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|b0|                |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|e0|                |
f0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|f0|                |
  +-----------------------------------------------+  +----------------+
```

▸*Example 2*

Same output from the fixed-allocation VDI file with 1KB block size.

```
Partition 1
Status: Inactive
First sector CHS: 0-32-33
Last sector CHS: 16-81-1
Partition type: 83 linux native
First LBA sector: 2048
LBA sector count: 260096

Partition 2
Status: Inactive
First sector CHS: 0-0-0
Last sector CHS: 0-0-0
Partition type: 00 empty
First LBA sector: 0
LBA sector count: 0

Partition 3
Status: Inactive
First sector CHS: 0-0-0
Last sector CHS: 0-0-0
Partition type: 00 empty
First LBA sector: 0
LBA sector count: 0

Partition 4
Status: Inactive
First sector CHS: 0-0-0
Last sector CHS: 0-0-0
Partition type: 00 empty
First LBA sector: 0
LBA sector count: 0

Offset: 0x400
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
```

```
  +-------------------------------------------------+  +----------------+
00|00 7f 00 00 00 fc 01 00 66 19 00 00 ef 53 00 00|00|        f    S  |
10|af 7d 00 00 01 00 00 00 00 00 00 00 00 00 00 00|10| }              |
20|00 20 00 00 00 20 00 00 f0 07 00 00 5f e7 a9 58|20|             _  X|
30|87 e7 a9 58 04 00 ff ff 53 ef 01 00 01 00 00 00|30|   X    S       |
40|88 bb ba 56 00 00 00 00 00 00 00 00 01 00 00 00|40|   V            |
50|00 00 00 00 0b 00 00 00 80 00 00 00 38 00 00 00|50|            8   |
60|02 00 00 00 01 00 00 00 5f 86 41 71 27 65 4b c9|60|        _ Aq'eK |
70|87 be a7 4a bb 9f 7d 28 00 00 00 00 00 00 00 00|70|   J  }(        |
80|00 00 00 00 00 00 00 00 2f 6d 65 64 69 61 2f 62|80|        /media/b|
90|6f 62 2f 35 66 38 36 34 31 37 31 2d 32 37 36 35|90|ob/5f864171-2765|
a0|2d 34 62 63 39 2d 38 37 62 65 2d 61 37 34 61 62|a0|-4bc9-87be-a74ab|
b0|62 39 66 37 64 32 38 00 64 32 38 00 00 00 00 00|b0|b9f7d28 d28     |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 b5 7f 76 83|e0|              v |
f0|7f cd 4d 67 a6 34 20 ae 2f fd b0 6b 01 00 00 00|f0|  Mg 4  /  k    |
  +-------------------------------------------------+  +----------------+

Offset: 0x500
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-------------------------------------------------+  +----------------+
00|0c 00 00 00 00 00 00 00 88 bb ba 56 00 00 00 00|00|           V    |
10|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|10|                |
20|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|20|                |
30|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|30|                |
40|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|40|                |
50|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|50|                |
60|01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|60|                |
70|00 00 00 00 00 00 00 00 44 93 01 00 00 00 00 00|70|        D       |
80|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|80|                |
90|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|90|                |
a0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|a0|                |
b0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|b0|                |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|e0|                |
f0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|f0|                |
  +-------------------------------------------------+  +----------------+

Offset: 0x600
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-------------------------------------------------+  +----------------+
00|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|00|                |
10|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|10|                |
20|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|20|                |
30|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|30|                |
40|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|40|                |
50|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|50|                |
60|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|60|                |
70|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|70|                |
80|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|80|                |
90|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|90|                |
a0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|a0|                |
```

```
b0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|b0|                |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|e0|                |
f0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|f0|                |
  +-----------------------------------------------+  +----------------+

Offset: 0x700
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f   0...4...8...c...
  +-----------------------------------------------+  +----------------+
00|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|00|                |
10|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|10|                |
20|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|20|                |
30|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|30|                |
40|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|40|                |
50|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|50|                |
60|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|60|                |
70|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|70|                |
80|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|80|                |
90|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|90|                |
a0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|a0|                |
b0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|b0|                |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|e0|                |
f0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|f0|                |
  +-----------------------------------------------+  +----------------+
```

▸*Example 3*

This is the program's output using the test VDI file with 4KB block size.

```
Partition 1
Status: Inactive
First sector CHS: 0-32-33
Last sector CHS: 16-81-1
Partition type: 83 linux native
First LBA sector: 2048
LBA sector count: 260096

Partition 2
Status: Inactive
First sector CHS: 0-0-0
Last sector CHS: 0-0-0
Partition type: 00 empty
First LBA sector: 0
LBA sector count: 0

Partition 3
Status: Inactive
First sector CHS: 0-0-0
Last sector CHS: 0-0-0
Partition type: 00 empty
First LBA sector: 0
LBA sector count: 0

Partition 4
Status: Inactive
First sector CHS: 0-0-0
Last sector CHS: 0-0-0
Partition type: 00 empty
First LBA sector: 0
LBA sector count: 0

Offset: 0x400
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-----------------------------------------------+  +----------------+
00|00 7f 00 00 00 7f 00 00 59 06 00 00 f2 15 00 00|00|        Y       |
10|af 7d 00 00 00 00 00 00 02 00 00 00 02 00 00 00|10| }              |
20|00 80 00 00 00 80 00 00 00 7f 00 00 d8 ea bc 56|20|               V|
30|19 eb bc 56 03 00 ff ff 53 ef 01 00 01 00 00 00|30|   V    S       |
40|92 bb ba 56 00 00 00 00 00 00 00 00 01 00 00 00|40|   V            |
50|00 00 00 00 0b 00 00 00 80 00 00 00 38 00 00 00|50|             8   |
60|02 00 00 00 03 00 00 00 8c b4 8d bc 5c 10 4e 70|60|             \ Np|
70|a5 68 cd d0 ad 4f 12 0e 00 00 00 00 00 00 00 00|70| h   O          |
80|00 00 00 00 00 00 00 00 2f 6d 65 64 69 61 2f 62|80|        /media/b|
90|6f 62 2f 38 63 62 34 38 64 62 63 2d 35 63 31 30|90|ob/8cb48dbc-5c10|
a0|2d 34 65 37 30 2d 61 35 36 38 2d 63 64 64 30 61|a0|-4e70-a568-cdd0a|
b0|64 34 66 31 32 30 65 00 32 30 65 00 00 00 00 00|b0|d4f120e 20e     |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 07 00|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 05 e6 e3 aa|e0|                |
f0|bf 36 43 4a 9f c4 82 9f af f7 80 c0 01 00 00 00|f0| 6CJ            |
```

```
  +-----------------------------------------------+  +----------------+

Offset: 0x500
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-----------------------------------------------+  +----------------+
00|0c 00 00 00 00 00 00 00 92 bb ba 56 00 00 00 00|00|            V     |
10|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|10|                  |
20|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|20|                  |
30|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|30|                  |
40|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|40|                  |
50|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|50|                  |
60|01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|60|                  |
70|00 00 00 00 00 00 00 00 38 95 01 00 00 00 00 00|70|         8        |
80|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|80|                  |
90|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|90|                  |
a0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|a0|                  |
b0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|b0|                  |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|c0|                  |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                  |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|e0|                  |
f0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|f0|                  |
  +-----------------------------------------------+  +----------------+

Offset: 0x600
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-----------------------------------------------+  +----------------+
00|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|00|                  |
10|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|10|                  |
20|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|20|                  |
30|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|30|                  |
40|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|40|                  |
50|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|50|                  |
60|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|60|                  |
70|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|70|                  |
80|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|80|                  |
90|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|90|                  |
a0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|a0|                  |
b0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|b0|                  |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|c0|                  |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                  |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|e0|                  |
f0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|f0|                  |
  +-----------------------------------------------+  +----------------+

Offset: 0x700
   00 01 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f    0...4...8...c...
  +-----------------------------------------------+  +----------------+
00|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|00|                  |
10|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|10|                  |
20|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|20|                  |
30|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|30|                  |
40|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|40|                  |
50|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|50|                  |
60|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|60|                  |
```

```
70|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|70|                |
80|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|80|                |
90|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|90|                |
a0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|a0|                |
b0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|b0|                |
c0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|c0|                |
d0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|d0|                |
e0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|e0|                |
f0|00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00|f0|                |
  +-----------------------------------------------+  +----------------+
```