```
/*
 * Just any arbitrary offset to the start of the vmalloc VM area: the
 * current 8MB value just means that there will be a 8MB "hole" after the
 * physical memory until the kernel virtual memory starts.  That means that
 * any out-of-bounds memory accesses will hopefully be caught.
 * The vmalloc() routines leaves a hole of 4kB between each vmalloced
 * area for the same reason. ;)
 */
#define VMALLOC_OFFSET        (8*1024*1024)
#define VMALLOC_START         (((unsigned long)high_memory + VMALLOC_OFFSET) & ~(VMALLOC_OFFSET-1))
#define VMALLOC_END        0xff000000UL
```

high_memory = 0xef80,0000

VMALLOC_START = 0xef80,0000 + 0x80,0000 = 0xf0000000 (3840M)

VMALLOC_END   = 0xff000000UL = 4080M

There is the following log in kernel boot log

Virtual kernel memory layout:

   vector : 0xffff0000 - 0xffff1000   (4 kB)

   fixmap : 0xffc00000 - 0xffe00000   (2048 kB)

   vmalloc : 0xf0000000 - 0xff000000   (240 MB)

lowmem : 0xc0000000 - 0xef800000   (760 MB)

pkmap   : 0xbfe00000 - 0xc0000000   (2 MB)

modules : 0xbf000000 - 0xbfe00000   (14 MB)

.text : 0xc0008000 - 0xc05cde80   (5912 kB)

.init : 0xc05ce000 - 0xc0602000   (208 kB)

.data : 0xc0602000 - 0xc0638728   (218 kB)

.bss : 0xc0638728 - 0xc06a8af4   (449 kB)

```
/**
 *   vmalloc  -  allocate virtually contiguous memory
 *   @size:        allocation size
 *   Allocate enough pages to cover @size from the page level
 *   allocator and map them into contiguous kernel virtual space.
 *
 *   For tight control over page level allocator and protection flags
 *   use __vmalloc() instead.
 */
void *vmalloc(unsigned long size)
```

```c
{
    return __vmalloc_node_flags(size, NUMA_NO_NODE,
                                GFP_KERNEL | __GFP_HIGHMEM);
}
EXPORT_SYMBOL(vmalloc);


static inline void *__vmalloc_node_flags(unsigned long size,
                                         int node, gfp_t flags)
{
    return __vmalloc_node(size, 1, flags, PAGE_KERNEL,
                          node, __builtin_return_address(0));
}


/**
 *    __vmalloc_node  -  allocate virtually contiguous memory
 *    @size:          allocation size
 *    @align:         desired alignment
 *    @gfp_mask:   flags for the page level allocator
 *    @prot:          protection mask for the allocated pages
 *    @node:          node to use for allocation or NUMA_NO_NODE
 *    @caller:   caller's return address
 *
 *    Allocate enough pages to cover @size from the page level
 *    allocator with @gfp_mask flags.  Map them into contiguous
 *    kernel virtual space, using a pagetable protection of @prot.
```

```
    */
static void *__vmalloc_node(unsigned long size, unsigned long align,
                gfp_t gfp_mask, pgprot_t prot,
                int node, const void *caller)
{
    return __vmalloc_node_range(size, align, VMALLOC_START, VMALLOC_END,
                gfp_mask, prot, node, caller);
}
```

gfp_mask = GFP_KERNEL | __GFP_HIGHMEM

vmalloc()从0xf0000000 - 0xff000000的240M virtual address space中挖出一块size的空间来分配，并且physical page将优先利用highmem中的memory。这样如果你的request要求physical address space也需要是连续的，比如给DMA用的，那么就不能用vmalloc()来申请了。当然如果只是申请one page，那么就不存在physical address连续不连续的问题了。

/proc/vmallocinfo文件记录了整个由"vmalloc"分配的状况。由于kernel module本身的memory也是通过"vmalloc"分配的，所以在该文件中也能看到。

另外，由于通过ioremap() mapping的device address也被位于VMALLOC和CMALLOC_END之间，所以在该文件中也能看到。

ioremap()申请的virtual address space也是通过"vmalloc"分配的。

ioremap() --> __arm_ioremap() (ioremap的实现完全是平台相关的) --> __arm_ioremap_caller() --> get_vm_area_caller()

get_vm_area_caller()用于为device address申请一段virtual address space，使得该address space mapping to the device address space.

```c
struct vm_struct *get_vm_area_caller(unsigned long size, unsigned long flags,

                    const void *caller)

{

    return __get_vm_area_node(size, 1, flags, VMALLOC_START, VMALLOC_END,

                    NUMA_NO_NODE, GFP_KERNEL, caller);

}
```

root@granite2:~# cat /proc/vmallocinfo

0xbf000000-0xbf003000   12288 module_alloc_update_bounds+0xc/0x5c pages=2 vmalloc

0xbf005000-0xbf007000   8192 module_alloc_update_bounds+0xc/0x5c pages=1 vmalloc

0xbf009000-0xbf00d000   16384 module_alloc_update_bounds+0xc/0x5c pages=3 vmalloc

0xbf010000-0xbf013000   12288 module_alloc_update_bounds+0xc/0x5c pages=2 vmalloc

0xbf038000-0xbf03f000   28672 module_alloc_update_bounds+0xc/0x5c pages=6 vmalloc

0xbf042000-0xbf045000   12288 module_alloc_update_bounds+0xc/0x5c pages=2 vmalloc

0xbf047000-0xbf049000   8192 module_alloc_update_bounds+0xc/0x5c pages=1 vmalloc

0xbf04b000-0xbf057000   49152 module_alloc_update_bounds+0xc/0x5c pages=11 vmalloc

0xbf06b000-0xbf070000   20480 module_alloc_update_bounds+0xc/0x5c pages=4 vmalloc

0xbf093000-0xbf096000   12288 module_alloc_update_bounds+0xc/0x5c pages=2 vmalloc

0xbf09f000-0xbf0a8000   36864 module_alloc_update_bounds+0xc/0x5c pages=8 vmalloc

0xbf0ac000-0xbf0af000   12288 module_alloc_update_bounds+0xc/0x5c pages=2 vmalloc

0xbf0c4000-0xbf0c8000   16384 module_alloc_update_bounds+0xc/0x5c pages=3 vmalloc

0xbf0cc000-0xbf0cf000   12288 module_alloc_update_bounds+0xc/0x5c pages=2 vmalloc

0xbf0d7000-0xbf104000 184320 module_alloc_update_bounds+0xc/0x5c pages=44 vmalloc

0xbf113000-0xbf118000   20480 module_alloc_update_bounds+0xc/0x5c pages=4 vmalloc

```
0xbf11c000-0xbf131000   86016 module_alloc_update_bounds+0xc/0x5c pages=20 vmalloc

0xbf13a000-0xbf144000   40960 module_alloc_update_bounds+0xc/0x5c pages=9 vmalloc

0xbf15c000-0xbf16b000   61440 module_alloc_update_bounds+0xc/0x5c pages=14 vmalloc

0xbf18a000-0xbf199000   61440 module_alloc_update_bounds+0xc/0x5c pages=14 vmalloc

0xbf1a3000-0xbf1a5000    8192 module_alloc_update_bounds+0xc/0x5c pages=1 vmalloc

0xbf1ab000-0xbf1c2000   94208 module_alloc_update_bounds+0xc/0x5c pages=22 vmalloc

0xbf1df000-0xbf1e4000   20480 module_alloc_update_bounds+0xc/0x5c pages=4 vmalloc

0xbf1e7000-0xbf1e9000    8192 module_alloc_update_bounds+0xc/0x5c pages=1 vmalloc

0xbf1eb000-0xbf230000  282624 module_alloc_update_bounds+0xc/0x5c pages=68 vmalloc

0xbf245000-0xbf26e000  167936 module_alloc_update_bounds+0xc/0x5c pages=40 vmalloc

0xf0000000-0xf0002000    8192 of_iomap+0x30/0x38 phys=d1d01000 ioremap

0xf0002000-0xf0004000    8192 of_iomap+0x30/0x38 phys=d1d02000 ioremap

0xf0004000-0xf0007000   12288 of_iomap+0x30/0x38 phys=d0620000 ioremap

0xf0008000-0xf000a000    8192 of_iomap+0x30/0x38 phys=d0621000 ioremap

0xf000a000-0xf000c000    8192 of_iomap+0x30/0x38 phys=d0627000 ioremap

0xf000c000-0xf000e000    8192 of_iomap+0x30/0x38 phys=d0622000 ioremap

0xf000e000-0xf0010000    8192 of_iomap+0x30/0x38 phys=d0622000 ioremap

0xf0010000-0xf0012000    8192 of_iomap+0x30/0x38 phys=d0623000 ioremap

0xf0012000-0xf0014000    8192 of_iomap+0x30/0x38 phys=d0623000 ioremap

0xf0014000-0xf0016000    8192 of_iomap+0x30/0x38 phys=d0625000 ioremap

0xf0016000-0xf0018000    8192 of_iomap+0x30/0x38 phys=d0625000 ioremap

0xf0018000-0xf001a000    8192 of_iomap+0x30/0x38 phys=d0625000 ioremap

0xf001a000-0xf001c000    8192 of_iomap+0x30/0x38 phys=d0625000 ioremap

0xf001c000-0xf001e000    8192 of_iomap+0x30/0x38 phys=d0625000 ioremap

0xf001e000-0xf0020000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap
```

```
0xf0020000-0xf0022000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0022000-0xf0024000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0024000-0xf0026000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0026000-0xf0028000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0028000-0xf002a000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf002a000-0xf002c000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf002c000-0xf002e000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf002e000-0xf0030000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0030000-0xf0032000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0032000-0xf0034000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0034000-0xf0036000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0036000-0xf0038000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0038000-0xf003a000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf003a000-0xf003c000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf003c000-0xf003e000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf003e000-0xf0040000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0040000-0xf0042000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0042000-0xf0044000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0044000-0xf0046000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0046000-0xf0048000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0048000-0xf004a000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf004a000-0xf004c000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf004c000-0xf004e000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf004e000-0xf0050000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0050000-0xf0052000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap
```

0xf0052000-0xf0054000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0054000-0xf0056000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0056000-0xf0058000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0058000-0xf005a000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf005a000-0xf005c000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf005c000-0xf005e000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf005e000-0xf0060000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0060000-0xf0062000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0062000-0xf0064000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0064000-0xf0066000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0066000-0xf0068000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0068000-0xf006a000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf006a000-0xf006c000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf006c000-0xf006e000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf006e000-0xf0070000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0070000-0xf0072000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0072000-0xf0074000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0074000-0xf0076000   8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf0076000-0xf0078000   8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf0078000-0xf007a000   8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf007a000-0xf007c000   8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf007c000-0xf007e000   8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf007e000-0xf0080000   8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf0080000-0xf0082000   8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf0082000-0xf0084000   8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

```
0xf0084000-0xf0086000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf0086000-0xf0088000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf0088000-0xf008a000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf008a000-0xf008c000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf008c000-0xf008e000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf008e000-0xf0090000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf0090000-0xf0092000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf0092000-0xf0094000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf0094000-0xf0096000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf0096000-0xf0098000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf0098000-0xf009a000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf009a000-0xf009c000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf009c000-0xf009e000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf009e000-0xf00a0000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf00a0000-0xf00a2000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf00a2000-0xf00a4000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf00a4000-0xf00a6000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf00a6000-0xf00a8000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf00a8000-0xf00aa000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf00aa000-0xf00ac000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf00ac000-0xf00ae000    8192 of_iomap+0x30/0x38 phys=f9080000 ioremap

0xf00ae000-0xf00b0000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf00b0000-0xf00b2000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf00b2000-0xf00b4000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf00b4000-0xf00b6000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap
```

```
0xf00b6000-0xf00b8000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf00b8000-0xf00ba000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf00ba000-0xf00bc000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf00bc000-0xf00be000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf00be000-0xf00c0000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf00c0000-0xf00c2000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf00c2000-0xf00c4000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf00c4000-0xf00c6000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf00c6000-0xf00c8000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf00c8000-0xf00ca000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf00ca000-0xf00cc000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf00cc000-0xf00ce000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf00ce000-0xf00d0000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf00d0000-0xf00d2000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf00d2000-0xf00d4000    8192 of_iomap+0x30/0x38 phys=d4014000 ioremap

0xf00da000-0xf00dc000    8192 of_iomap+0x30/0x38 phys=d0630000 ioremap

0xf00dc000-0xf00de000    8192 of_iomap+0x30/0x38 phys=d0610000 ioremap

0xf00e0000-0xf00e2000    8192 of_iomap+0x30/0x38 phys=d401d000 ioremap

0xf00ee000-0xf00f0000    8192 bpf_prog_alloc+0x44/0xb0 pages=1 vmalloc

0xf00f0000-0xf0131000  266240 atomic_pool_init+0x0/0x13c user

0xf0132000-0xf0134000    8192 pxa_gpio_probe+0x134/0x6f0 phys=d4019000 ioremap

0xf0134000-0xf0136000    8192 devm_ioremap_nocache+0x40/0x78 phys=d0000000 ioremap

0xf0136000-0xf0138000    8192 mckinley_probe+0x174/0x23c phys=d1000000 ioremap

0xf0138000-0xf013a000    8192 devm_ioremap+0x40/0x78 phys=d401e000 ioremap

0xf013a000-0xf013c000    8192 devm_ioremap_nocache+0x40/0x78 phys=d008b000 ioremap
```

```
0xf013c000-0xf013e000    8192 devm_ioremap+0x40/0x78 phys=d07c0000 ioremap

0xf013e000-0xf0140000    8192 devm_ioremap_nocache+0x40/0x78 phys=d0702000 ioremap

0xf0140000-0xf0159000  102400 devm_ioremap_nocache+0x40/0x78 phys=d1000000 ioremap

0xf0159000-0xf03b2000 2461696 pxa168fb_probe+0x508/0x918 user

0xf03b2000-0xf03bb000   36864 mv_m2m_probe+0x174/0xa5c user

0xf03bc000-0xf03be000    8192 devm_ioremap+0x40/0x78 phys=d07d0000 ioremap

0xf03be000-0xf03c7000   36864 mv_m2m_probe+0x174/0xa5c user

0xf03c8000-0xf03cb000   12288 devm_ioremap_nocache+0x40/0x78 phys=d0700000 ioremap

0xf03cc000-0xf03ce000    8192 devm_ioremap+0x40/0x78 phys=d0740000 ioremap

0xf03ce000-0xf03d0000    8192 devm_ioremap+0x40/0x78 phys=d0740000 ioremap

0xf03d0000-0xf03d2000    8192 devm_ioremap+0x40/0x78 phys=d0740000 ioremap

0xf03d2000-0xf03d4000    8192 devm_ioremap_nocache+0x40/0x78 phys=d4220000 ioremap

0xf03d4000-0xf03d6000    8192 devm_ioremap_nocache+0x40/0x78 phys=d0626000 ioremap

0xf03d6000-0xf03d8000    8192 devm_ioremap_nocache+0x40/0x78 phys=d0627000 ioremap

0xf03d8000-0xf03da000    8192 sdhci_pltfm_init+0x128/0x220 phys=d4280000 ioremap

0xf03da000-0xf03dc000    8192 sdhci_add_host+0x1ac/0xcac user

0xf03dc000-0xf03de000    8192 sdhci_pltfm_init+0x128/0x220 phys=d4280000 ioremap

0xf03de000-0xf03e0000    8192 sdhci_add_host+0x1ac/0xcac user

0xf03e0000-0xf03e2000    8192 sdhci_pltfm_init+0x128/0x220 phys=d4281000 ioremap

0xf03e2000-0xf03e4000    8192 sdhci_add_host+0x1ac/0xcac user

0xf0418000-0xf041a000    8192 devm_ioremap_nocache+0x40/0x78 phys=d0625000 ioremap

0xf041a000-0xf041c000    8192 devm_ioremap_nocache+0x40/0x78 phys=d4014000 ioremap

0xf041c000-0xf041e000    8192 devm_ioremap_nocache+0x40/0x78 phys=d0626000 ioremap

0xf043e000-0xf0440000    8192 i2c_pxa_probe+0x288/0x4c0 [i2c_pxa] phys=d4011000 ioremap

0xf0440000-0xf0442000    8192 i2c_pxa_probe+0x288/0x4c0 [i2c_pxa] phys=d4031000 ioremap
```

0xf0466000-0xf0468000   8192 ipc_platform_probe+0xb4/0x228 [ipc_driver] phys=d401d000 ioremap

0xf04f8000-0xf04fa000   8192 devm_ioremap_nocache+0x40/0x78 phys=d4224000 ioremap

0xf051c000-0xf051e000   8192 devm_ioremap_nocache+0x40/0x78 phys=d4291000 ioremap

0xf051e000-0xf0520000   8192 dma_pool_alloc+0xb8/0x1a4 user

0xf053b000-0xf053d000   8192 dma_pool_alloc+0xb8/0x1a4 user

0xf053d000-0xf053f000   8192 dma_pool_alloc+0xb8/0x1a4 user

0xf053f000-0xf0541000   8192 ehci_setup+0x1fc/0x434 [ehci_hcd] user

0xf0558000-0xf055a000   8192 stepper_mod_platform_probe+0x164/0x3cc [stepper_mod_a0] phys=f8150000 ioremap

0xf0560000-0xf0562000   8192 devm_ioremap_nocache+0x40/0x78 phys=d4292000 ioremap

0xf0562000-0xf0564000   8192 dma_pool_alloc+0xb8/0x1a4 user

0xf0564000-0xf0566000   8192 dma_pool_alloc+0xb8/0x1a4 user

0xf0566000-0xf0568000   8192 ehci_setup+0x1fc/0x434 [ehci_hcd] user

0xf0568000-0xf056b000   12288 sccp_platform_probe+0x90/0x2d8 [sccplite] phys=f8180000 ioremap

0xf056c000-0xf056f000   12288 sccp_platform_probe+0x90/0x2d8 [sccplite] phys=f8184000 ioremap

0xf0570000-0xf0572000   8192 stepper_mod_platform_probe+0x164/0x3cc [stepper_mod_a0] phys=f8151000 ioremap

0xf0572000-0xf0574000   8192 stepper_mod_platform_probe+0x164/0x3cc [stepper_mod_a0] phys=f8153000 ioremap

0xf0574000-0xf0576000   8192 stepper_mod_platform_probe+0x164/0x3cc [stepper_mod_a0] phys=f8154000 ioremap

0xf0576000-0xf0578000   8192 stepper_mod_platform_probe+0x164/0x3cc [stepper_mod_a0] phys=f8155000 ioremap

0xf058a000-0xf058c000   8192 of_iomap+0x30/0x38 phys=f9090000 ioremap

0xf0590000-0xf059a000   40960 devm_ioremap_nocache+0x40/0x78 phys=f9060000 ioremap

0xf0620000-0xf0622000	8192 pogo_dma_init+0xc/0x64 [piedriver] pages=1 vmalloc
0xf0622000-0xf0624000	8192 pogo_dma_init+0x18/0x64 [piedriver] pages=1 vmalloc
0xf0624000-0xf0626000	8192 of_iomap+0x30/0x38 phys=f9400000 ioremap
0xf0626000-0xf0628000	8192 of_iomap+0x30/0x38 phys=f95b0000 ioremap
0xf0638000-0xf063a000	8192 of_iomap+0x30/0x38 phys=f95c8000 ioremap
0xf063a000-0xf063c000	8192 of_iomap+0x30/0x38 phys=f9091000 ioremap
0xf066c000-0xf066e000	8192 pie_common_init+0x10/0x80 [piedriver] pages=1 vmalloc
0xf066e000-0xf0670000	8192 of_iomap+0x30/0x38 phys=f9404000 ioremap
0xf0670000-0xf0672000	8192 pie_pogo_idma_udma_init+0x10/0x84 [piedriver] pages=1 vmalloc
0xf0672000-0xf0674000	8192 of_iomap+0x30/0x38 phys=f9404000 ioremap
0xf0674000-0xf0676000	8192 pie_pogo_idma_core_init+0x14/0x84 [piedriver] pages=1 vmalloc
0xf0676000-0xf0678000	8192 of_iomap+0x30/0x38 phys=f9408000 ioremap
0xf0678000-0xf067a000	8192 pie_pogo_idma_udma_init+0x10/0x84 [piedriver] pages=1 vmalloc
0xf067a000-0xf067c000	8192 of_iomap+0x30/0x38 phys=f9408000 ioremap
0xf067c000-0xf067e000	8192 pie_pogo_idma_core_init+0x14/0x84 [piedriver] pages=1 vmalloc
0xf067e000-0xf0680000	8192 of_iomap+0x30/0x38 phys=f940c000 ioremap
0xf0680000-0xf0682000	8192 pie_pogo_idma_udma_init+0x10/0x84 [piedriver] pages=1 vmalloc
0xf0682000-0xf0684000	8192 of_iomap+0x30/0x38 phys=f940c000 ioremap
0xf0684000-0xf0686000	8192 pie_pogo_idma_core_init+0x14/0x84 [piedriver] pages=1 vmalloc
0xf0686000-0xf0688000	8192 of_iomap+0x30/0x38 phys=f9410000 ioremap
0xf0688000-0xf068a000	8192 pie_pogoizer_init+0x10/0x68 [piedriver] pages=1 vmalloc
0xf068a000-0xf068c000	8192 of_iomap+0x30/0x38 phys=f9414000 ioremap
0xf068c000-0xf068e000 vmalloc	8192 pie_pogo_otidma_udma_init+0x10/0x84 [piedriver] pages=1
0xf068e000-0xf0690000	8192 of_iomap+0x30/0x38 phys=f9414000 ioremap

```
0xf0690000-0xf0692000    8192 pie_pogo_otidma_core_init+0x10/0x84 [piedriver] pages=1 vmalloc

0xf0692000-0xf0694000    8192 of_iomap+0x30/0x38 phys=f9418000 ioremap

0xf0694000-0xf0696000    8192 pie_otpogoizer_init+0x10/0x68 [piedriver] pages=1 vmalloc

0xf0696000-0xf0698000    8192 of_iomap+0x30/0x38 phys=f941c000 ioremap

0xf0698000-0xf069a000    8192 pie_colorshift_init+0x10/0x70 [piedriver] pages=1 vmalloc

0xf06b2000-0xf06b4000    8192 of_iomap+0x30/0x38 phys=f95f0000 ioremap

0xf06bc000-0xf06be000    8192 of_iomap+0x30/0x38 phys=f95c0000 ioremap

0xf06be000-0xf06c0000    8192 of_iomap+0x30/0x38 phys=f95c1000 ioremap

0xf06c0000-0xf06c2000    8192 of_iomap+0x30/0x38 phys=f95c2000 ioremap

0xf06c2000-0xf06c4000    8192 of_iomap+0x30/0x38 phys=f95c6000 ioremap

0xf06c4000-0xf06c6000    8192 of_iomap+0x30/0x38 phys=f95c7000 ioremap

0xf06c6000-0xf06c8000    8192 of_iomap+0x30/0x38 phys=f95d8000 ioremap

0xf06c8000-0xf06ca000    8192 of_iomap+0x30/0x38 phys=f95d0000 ioremap

0xf06ca000-0xf06cc000    8192 of_iomap+0x30/0x38 phys=f95d1000 ioremap

0xf06cc000-0xf06ce000    8192 of_iomap+0x30/0x38 phys=f95d2000 ioremap

0xf06ce000-0xf06d0000    8192 of_iomap+0x30/0x38 phys=f95d6000 ioremap

0xf06d0000-0xf06d2000    8192 of_iomap+0x30/0x38 phys=f95d7000 ioremap

0xf06d2000-0xf06d4000    8192 of_iomap+0x30/0x38 phys=f95b0000 ioremap

0xf06d4000-0xf06d6000    8192 devm_ioremap_nocache+0x40/0x78 phys=f9080000 ioremap

0xf06d6000-0xf06d8000    8192 devm_ioremap_nocache+0x40/0x78 phys=d0630000 ioremap

0xf06d8000-0xf06da000    8192 devm_ioremap_nocache+0x40/0x78 phys=f9080000 ioremap

0xf06da000-0xf06dc000    8192 pic_common_init+0x14/0x88 [picdriver] pages=1 vmalloc

0xf06dc000-0xf06de000    8192 of_iomap+0x30/0x38 phys=f95f0000 ioremap

0xf06de000-0xf06e0000    8192 pic_adcnorm_init+0x10/0x88 [picdriver] pages=1 vmalloc

0xf06e0000-0xf06e2000    8192 of_iomap+0x30/0x38 phys=f95f0000 ioremap
```

```
0xf06e2000-0xf06e4000    8192 pic_bulbmon_init+0x10/0x88 [picdriver] pages=1 vmalloc

0xf06e4000-0xf06e6000    8192 of_iomap+0x30/0x38 phys=f95f0000 ioremap

0xf06e6000-0xf06e8000    8192 pic_lrmargin_init+0x14/0x88 [picdriver] pages=1 vmalloc

0xf06e8000-0xf06ea000    8192 of_iomap+0x30/0x38 phys=f95f0000 ioremap

0xf06ea000-0xf06ec000    8192 pic_idma2d_init+0x10/0x6c [picdriver] pages=1 vmalloc

0xf06ec000-0xf06ee000    8192 of_iomap+0x30/0x38 phys=f95f0000 ioremap

0xf06ee000-0xf06f0000    8192 pic_pd_init+0x10/0x6c [picdriver] pages=1 vmalloc

0xf06f0000-0xf06f2000    8192 of_iomap+0x30/0x38 phys=f95f1000 ioremap

0xf06f2000-0xf06f4000    8192 pic_hscale_init+0x10/0x88 [picdriver] pages=1 vmalloc

0xf06f4000-0xf06f6000    8192 of_iomap+0x30/0x38 phys=f95f1000 ioremap

0xf06f6000-0xf06f8000    8192 pic_wdma_init+0x10/0x68 [picdriver] pages=1 vmalloc

0xf06f8000-0xf06fa000    8192 of_iomap+0x30/0x38 phys=f95f1000 ioremap

0xf06fa000-0xf06fc000    8192 pic_wdma_channel_init+0x14/0x88 [picdriver] pages=1 vmalloc

0xf06fc000-0xf06fe000    8192 of_iomap+0x30/0x38 phys=f95f1000 ioremap

0xf06fe000-0xf0700000    8192 pic_wdma_channel_init+0x14/0x88 [picdriver] pages=1 vmalloc

0xf0700000-0xf0702000    8192 of_iomap+0x30/0x38 phys=f95f1000 ioremap

0xf0702000-0xf0704000    8192 pic_wdma_channel_init+0x14/0x88 [picdriver] pages=1 vmalloc

0xf0704000-0xf0706000    8192 of_iomap+0x30/0x38 phys=f95f1000 ioremap

0xf0706000-0xf0708000    8192 pic_lrmargin_init+0x14/0x88 [picdriver] pages=1 vmalloc

0xf0708000-0xf070a000    8192 of_iomap+0x30/0x38 phys=f95f0000 ioremap

0xf070a000-0xf070c000    8192 pic_chipgap_init+0x10/0x6c [picdriver] pages=1 vmalloc

0xf070c000-0xf070f000   12288 of_iomap+0x30/0x38 phys=f95f2000 ioremap

0xf070f000-0xf0711000    8192 pic_bdr_init+0x10/0x6c [picdriver] pages=1 vmalloc

0xf0712000-0xf0714000    8192 of_iomap+0x30/0x38 phys=f95f4000 ioremap

0xf0740000-0xf0745000   20480 of_iomap+0x30/0x38 phys=f9420000 ioremap
```

```
0xf0745000-0xf0747000    8192 pie_rgb2esrgb_init+0x10/0x70 [piedriver] pages=1 vmalloc

0xf0779000-0xf077b000    8192 pic_common_init+0x14/0x88 [picdriver] pages=1 vmalloc

0xf077c000-0xf077e000    8192 of_iomap+0x30/0x38 phys=f95f4000 ioremap

0xf077e000-0xf0780000    8192 pic_adcnorm_init+0x10/0x88 [picdriver] pages=1 vmalloc

0xf0780000-0xf0782000    8192 of_iomap+0x30/0x38 phys=f95f4000 ioremap

0xf0782000-0xf0784000    8192 pic_bulbmon_init+0x10/0x88 [picdriver] pages=1 vmalloc

0xf0784000-0xf0786000    8192 of_iomap+0x30/0x38 phys=f95f4000 ioremap

0xf0786000-0xf0788000    8192 pic_lrmargin_init+0x14/0x88 [picdriver] pages=1 vmalloc

0xf0788000-0xf078a000    8192 of_iomap+0x30/0x38 phys=f95f4000 ioremap

0xf078a000-0xf078c000    8192 pic_idma2d_init+0x10/0x6c [picdriver] pages=1 vmalloc

0xf078c000-0xf078e000    8192 of_iomap+0x30/0x38 phys=f95f4000 ioremap

0xf078e000-0xf0790000    8192 pic_pd_init+0x10/0x6c [picdriver] pages=1 vmalloc

0xf0790000-0xf0792000    8192 of_iomap+0x30/0x38 phys=f95f5000 ioremap

0xf0792000-0xf0794000    8192 pic_hscale_init+0x10/0x88 [picdriver] pages=1 vmalloc

0xf0794000-0xf0796000    8192 of_iomap+0x30/0x38 phys=f95f5000 ioremap

0xf0796000-0xf0798000    8192 pic_wdma_init+0x10/0x68 [picdriver] pages=1 vmalloc

0xf0798000-0xf079a000    8192 of_iomap+0x30/0x38 phys=f95f5000 ioremap

0xf079a000-0xf079c000    8192 pic_wdma_channel_init+0x14/0x88 [picdriver] pages=1 vmalloc

0xf079c000-0xf079e000    8192 of_iomap+0x30/0x38 phys=f95f5000 ioremap

0xf079e000-0xf07a0000    8192 pic_wdma_channel_init+0x14/0x88 [picdriver] pages=1 vmalloc

0xf07a0000-0xf07a2000    8192 of_iomap+0x30/0x38 phys=f95f5000 ioremap

0xf07a2000-0xf07a4000    8192 pic_wdma_channel_init+0x14/0x88 [picdriver] pages=1 vmalloc

0xf07a4000-0xf07a6000    8192 of_iomap+0x30/0x38 phys=f95f5000 ioremap

0xf07a6000-0xf07a8000    8192 pic_lrmargin_init+0x14/0x88 [picdriver] pages=1 vmalloc

0xf07a8000-0xf07aa000    8192 of_iomap+0x30/0x38 phys=f95f4000 ioremap
```

```
0xf07aa000-0xf07ac000    8192 pic_chipgap_init+0x10/0x6c [picdriver] pages=1 vmalloc

0xf07ac000-0xf07af000   12288 of_iomap+0x30/0x38 phys=f95f6000 ioremap

0xf07af000-0xf07b1000    8192 pic_bdr_init+0x10/0x6c [picdriver] pages=1 vmalloc

0xf07b2000-0xf07b4000    8192 of_iomap+0x30/0x38 phys=f9424000 ioremap

0xf07b4000-0xf07b6000    8192 pie_sccsc_init+0x10/0x6c [piedriver] pages=1 vmalloc

0xf07b6000-0xf07b8000    8192 of_iomap+0x30/0x38 phys=f9428000 ioremap

0xf07b8000-0xf07ba000    8192 pie_rgb2ycc_init+0x10/0x70 [piedriver] pages=1 vmalloc

0xf07ba000-0xf07bc000    8192 of_iomap+0x30/0x38 phys=f95e0000 ioremap

0xf07bc000-0xf07be000    8192 of_iomap+0x30/0x38 phys=f9092000 ioremap

0xf07be000-0xf07c0000    8192 of_iomap+0x30/0x38 phys=f9093000 ioremap

0xf07c0000-0xf07c2000    8192 of_iomap+0x30/0x38 phys=f942c000 ioremap

0xf07c2000-0xf07c4000    8192 pie_cstats_init+0x10/0x70 [piedriver] pages=1 vmalloc

0xf07c4000-0xf07c6000    8192 of_iomap+0x30/0x38 phys=f9430000 ioremap

0xf07c6000-0xf07c8000    8192 pie_otmarb_init+0x10/0x80 [piedriver] pages=1 vmalloc

0xf07c8000-0xf07cb000   12288 of_iomap+0x30/0x38 phys=f9434000 ioremap

0xf07cb000-0xf07cd000    8192 pie_ngadjust_init+0x10/0x70 [piedriver] pages=1 vmalloc

0xf07cd000-0xf07cf000    8192 pie_tcns_init+0x10/0x70 [piedriver] pages=1 vmalloc

0xf07d0000-0xf07d4000   16384 of_iomap+0x30/0x38 phys=f943c000 ioremap

0xf07d4000-0xf07d6000    8192 of_iomap+0x30/0x38 phys=f9093000 ioremap

0xf07d6000-0xf07d8000    8192 pie_dsmf_init+0x10/0x70 [piedriver] pages=1 vmalloc

0xf07d8000-0xf07db000   12288 of_iomap+0x30/0x38 phys=f9444000 ioremap

0xf07dc000-0xf07de000    8192 of_iomap+0x30/0x38 phys=f9448000 ioremap

0xf07de000-0xf07e0000    8192 pie_decim_init+0x10/0x70 [piedriver] pages=1 vmalloc

0xf07e0000-0xf07e2000    8192 of_iomap+0x30/0x38 phys=f9093000 ioremap

0xf07e2000-0xf07e4000    8192 of_iomap+0x30/0x38 phys=f944c000 ioremap
```

0xf07e4000-0xf07e6000   8192 pie_ycc2rgb_init+0x10/0x70 [piedriver] pages=1 vmalloc

0xf07e6000-0xf07e8000   8192 of_iomap+0x30/0x38 phys=f9450000 ioremap

0xf07e8000-0xf07ea000   8192 pie_xyscaler_init+0x10/0x70 [piedriver] pages=1 vmalloc

0xf07ea000-0xf07ec000   8192 i2c_pxa_probe+0x288/0x4c0 [i2c_pxa] phys=d4032000 ioremap

0xf07ec000-0xf07ee000   8192 of_iomap+0x30/0x38 phys=f9094000 ioremap

0xf07ee000-0xf07f0000   8192 of_iomap+0x30/0x38 phys=f9094000 ioremap

0xf07f0000-0xf07f2000   8192 of_iomap+0x30/0x38 phys=f9094000 ioremap

0xf07f2000-0xf07f4000   8192 of_iomap+0x30/0x38 phys=f9095000 ioremap

0xf07f4000-0xf07f6000   8192 of_iomap+0x30/0x38 phys=f9095000 ioremap

0xf07f6000-0xf07f8000   8192 of_iomap+0x30/0x38 phys=f9095000 ioremap

0xf07f8000-0xf07fa000   8192 of_iomap+0x30/0x38 phys=f9096000 ioremap

0xf07fa000-0xf07fc000   8192 of_iomap+0x30/0x38 phys=f9096000 ioremap

0xf07fc000-0xf07fe000   8192 of_iomap+0x30/0x38 phys=f9096000 ioremap

0xf07fe000-0xf0800000   8192 of_iomap+0x30/0x38 phys=f9097000 ioremap

0xf0800000-0xf0802000   8192 of_iomap+0x30/0x38 phys=f9097000 ioremap

0xf0802000-0xf0804000   8192 of_iomap+0x30/0x38 phys=f9097000 ioremap

0xf0804000-0xf0806000   8192 of_iomap+0x30/0x38 phys=f9098000 ioremap

0xf0806000-0xf0808000   8192 of_iomap+0x30/0x38 phys=f9098000 ioremap

0xf0808000-0xf080a000   8192 of_iomap+0x30/0x38 phys=f9098000 ioremap

0xf080a000-0xf080c000   8192 of_iomap+0x30/0x38 phys=f9099000 ioremap

0xf080c000-0xf080e000   8192 of_iomap+0x30/0x38 phys=f9099000 ioremap

0xf080e000-0xf0810000   8192 of_iomap+0x30/0x38 phys=f9099000 ioremap

0xf0810000-0xf0812000   8192 of_iomap+0x30/0x38 phys=f909a000 ioremap

0xf0812000-0xf0814000   8192 of_iomap+0x30/0x38 phys=f909a000 ioremap

0xf0814000-0xf0816000   8192 of_iomap+0x30/0x38 phys=f909a000 ioremap

0xf0816000-0xf0818000   8192 of_iomap+0x30/0x38 phys=f9003000 ioremap

0xf0818000-0xf081a000   8192 of_iomap+0x30/0x38 phys=f9004000 ioremap

0xf081a000-0xf081c000   8192 of_iomap+0x30/0x38 phys=f9005000 ioremap

0xf081c000-0xf081e000   8192 of_iomap+0x30/0x38 phys=f900b000 ioremap

0xf081e000-0xf0820000   8192 of_iomap+0x30/0x38 phys=f900c000 ioremap

0xf0820000-0xf0822000   8192 of_iomap+0x30/0x38 phys=f900d000 ioremap

0xf0822000-0xf0824000   8192 of_iomap+0x30/0x38 phys=f9013000 ioremap

0xf0824000-0xf0826000   8192 of_iomap+0x30/0x38 phys=f9014000 ioremap

0xf0826000-0xf0828000   8192 of_iomap+0x30/0x38 phys=f9015000 ioremap

0xf0828000-0xf082a000   8192 of_iomap+0x30/0x38 phys=f901b000 ioremap

0xf082a000-0xf082c000   8192 of_iomap+0x30/0x38 phys=f901c000 ioremap

0xf082c000-0xf082e000   8192 of_iomap+0x30/0x38 phys=f901d000 ioremap

0xf082e000-0xf0830000   8192 of_iomap+0x30/0x38 phys=f9454000 ioremap

0xf0830000-0xf0832000   8192 pie_clippad_init+0x10/0x70 [piedriver] pages=1 vmalloc

0xf0832000-0xf0834000   8192 of_iomap+0x30/0x38 phys=f9458000 ioremap

0xf0834000-0xf0836000   8192 pie_depogoizer_init+0x10/0x68 [piedriver] pages=1 vmalloc

0xf0836000-0xf0838000   8192 of_iomap+0x30/0x38 phys=f945c000 ioremap

0xf0838000-0xf083a000   8192 pie_pogo_odma_udma_init+0x10/0x84 [piedriver] pages=1 vmalloc

0xf083a000-0xf083c000   8192 of_iomap+0x30/0x38 phys=f945c000 ioremap

0xf083c000-0xf083e000   8192 pie_pogo_odma_core_init+0x10/0x84 [piedriver] pages=1 vmalloc

0xf083e000-0xf0840000   8192 of_iomap+0x30/0x38 phys=f9460000 ioremap

0xf0840000-0xf0842000   8192 pie_otdepogoizer_init+0x10/0x68 [piedriver] pages=1 vmalloc

0xf0842000-0xf0844000   8192 of_iomap+0x30/0x38 phys=f9464000 ioremap

0xf0844000-0xf0846000   8192 pie_pogo_otodma_udma_init+0x10/0x84 [piedriver] pages=1 vmalloc

0xf0846000-0xf0848000   8192 of_iomap+0x30/0x38 phys=f9464000 ioremap

0xf0848000-0xf084a000   8192 pie_pogo_otodma_core_init+0x10/0x84 [piedriver] pages=1 vmalloc

0xf084a000-0xf084c000   8192 of_iomap+0x30/0x38 phys=f9468000 ioremap

0xf084c000-0xf084e000   8192 pie_bde_init+0x10/0xbc [piedriver] pages=1 vmalloc

0xf084e000-0xf0850000   8192 of_iomap+0x30/0x38 phys=f946c000 ioremap

0xf0850000-0xf0852000   8192 pie_bde_init+0x10/0xbc [piedriver] pages=1 vmalloc

0xf0852000-0xf0854000   8192 of_iomap+0x30/0x38 phys=f9470000 ioremap

0xf0854000-0xf0856000   8192 pie_bde_init+0x10/0xbc [piedriver] pages=1 vmalloc

0xf0856000-0xf0858000   8192 of_iomap+0x30/0x38 phys=f9474000 ioremap

0xf0858000-0xf085a000   8192 pie_ddma_ac_data_init+0x14/0x90 [piedriver] pages=1 vmalloc

0xf085a000-0xf085c000   8192 of_iomap+0x30/0x38 phys=f9478000 ioremap

0xf085c000-0xf085e000   8192 pie_ddma_ac_data_init+0x14/0x90 [piedriver] pages=1 vmalloc

0xf085e000-0xf0860000   8192 of_iomap+0x30/0x38 phys=f947c000 ioremap

0xf0860000-0xf0862000   8192 pie_ddma_ac_data_init+0x14/0x90 [piedriver] pages=1 vmalloc

0xf0862000-0xf0864000   8192 of_iomap+0x30/0x38 phys=f9480000 ioremap

0xf0864000-0xf0866000   8192 pie_distort_init+0x10/0x8c [piedriver] pages=1 vmalloc

0xf0866000-0xf0868000   8192 of_iomap+0x30/0x38 phys=f9484000 ioremap

0xf0868000-0xf086a000   8192 pie_xycscaler_init+0x10/0x70 [piedriver] pages=1 vmalloc

0xf086a000-0xf086c000   8192 i2c_pxa_probe+0x288/0x4c0 [i2c_pxa] phys=d4033000 ioremap

0xf086c000-0xf086e000   8192 i2c_pxa_probe+0x288/0x4c0 [i2c_pxa] phys=d4033000 ioremap

0xf086e000-0xf0870000   8192 i2c_pxa_probe+0x288/0x4c0 [i2c_pxa] phys=d4034000 ioremap

0xf087f000-0xf0881000   8192 stmmac_open+0x468/0x6d0 user

0xf0881000-0xf0883000   8192 stmmac_open+0x4a8/0x6d0 user

0xf0918000-0xf091a000   8192 gckGALDEVICE_Construct+0x2c4/0x824 [galcore] phys=d008d000 ioremap

0xf091a000-0xf091c000   8192 _CreateKernelVirtualMapping+0xac/0x110 [galcore]

0xf091c000-0xf091e000   8192 _CreateKernelVirtualMapping+0xac/0x110 [galcore]

0xf091e000-0xf095f000 266240 gckOS_AllocateMemory+0x68/0x80 [galcore] pages=64 vmalloc

0xf095f000-0xf09a0000 266240 _CreateKernelVirtualMapping+0xac/0x110 [galcore]

0xf09a0000-0xf09a2000   8192 _CreateKernelVirtualMapping+0xac/0x110 [galcore]

0xf09a2000-0xf29a3000 33558528 _CreateKernelVirtualMapping+0xac/0x110 [galcore]

0xf29af000-0xf29b3000   16384 n_tty_open+0x10/0x118 pages=3 vmalloc

0xf29b7000-0xf29bb000   16384 n_tty_open+0x10/0x118 pages=3 vmalloc

0xf9800000-0xf98c0000 786432 iotable_init+0x0/0xc phys=f9800000 ioremap

0xfe030000-0xfe031000   4096 iotable_init+0x0/0xc phys=d4030000 ioremap

0xfedec000-0xfee00000   81920 pcpu_get_vm_areas+0x0/0x598 vmalloc

0xfee00000-0xff000000 2097152 pci_reserve_io+0x0/0x30 ioremap

kernel param "vmalloc=nn[KMG]"可以调整vmalloc空间的size

mmc dev 1;ext2load mmc 1:2 0x400000 /boot/uImage;ext2load mmc 1:2 0xf00000 /boot/mv6220-toc.dtb;setenv bootargs $bootargs root=/dev/mmcblk1p2 uio_pdrv_genirq.of_id=generic-uio rootwait **vmalloc=300M**;bootm 0x400000 - 0xf00000

kernnel启动后，

Virtual kernel memory layout:

    vector : 0xffff0000 - 0xffff1000   (4 kB)

    fixmap : 0xffc00000 - 0xffe00000   (2048 kB)

vmalloc : 0xec800000 - 0xff000000   (296 MB)

lowmem : 0xc0000000 - 0xec400000   (708 MB)

pkmap   : 0xbfe00000 - 0xc0000000   (2 MB)

modules : 0xbf000000 - 0xbfe00000   (14 MB)

.text : 0xc0008000 - 0xc05cde68   (5912 kB)

.init : 0xc05ce000 - 0xc0602000   (208 kB)

.data : 0xc0602000 - 0xc0638728   (218 kB)

.bss : 0xc0638728 - 0xc06a8af4   (449 kB)

296M vmalloc

vmalloc : 0xec800000 - 0xff000000   (296 MB)

lowmem : 0xc0000000 - 0xec400000   (708 MB)

240M vmalloc

vmalloc : 0xf0000000 - 0xff000000   (240 MB)

lowmem : 0xc0000000 - 0xef800000   (760 MB)

vmalloc只能向下扩展，借用原来lowmem的空间。

下面是kernel param "vmalloc=nn[KMG]"的implementation

in arch/arm/mm/mmu.c

```
/*
 * vmalloc=size forces the vmalloc area to be exactly 'size'
 * bytes. This can be used to increase (or decrease) the vmalloc
 * area - the default is 240m.
 */
static int __init early_vmalloc(char *arg)
{
        unsigned long vmalloc_reserve = memparse(arg, NULL);

        if (vmalloc_reserve < SZ_16M) {
                vmalloc_reserve = SZ_16M;
                printk(KERN_WARNING
                        "vmalloc area too small, limiting to %luMB\n",
                        vmalloc_reserve >> 20);
        }

        if (vmalloc_reserve > VMALLOC_END - (PAGE_OFFSET + SZ_32M)) {
                vmalloc_reserve = VMALLOC_END - (PAGE_OFFSET + SZ_32M);
                printk(KERN_WARNING
                        "vmalloc area is too big, limiting to %luMB\n",
                        vmalloc_reserve >> 20);
        }

        vmalloc_min = (void *)(VMALLOC_END - vmalloc_reserve);
        return 0;
}
early_param("vmalloc", early_vmalloc);
```

unsigned long vmalloc_reserve = memparse(arg, NULL);

vmalloc_reserve = 300M

调整vmalloc_min的size。

vmalloc()申请的空间有如下特性：

1. virtual address is between [0xf0000000, 0xff000000), 240M size

2. virtual address space is contiguous

3. The physical address space may not be contiguous.

4. vmalloc优先从highmem中分配physical page,失败，才从normal zone中分配

5. [bf000000, 0xbfe00000)共14MB的module空间用于载入dynamic modules，但其allocato却是"vmalloc"。

6. kernel param "vmalloc=nn[KMG]"可以调整vmalloc的空间。