Nandflash Support on Ucore

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Nandflash Model

Figure 2-1. K9F2G08U0M Organization

1 Block = 64 Pages
(128K + 4k) Byte

1 Page = (2K + 64)Bytes
1 Block = (2K + 64)B x 64 Pages
= (128K + 4K) Bytes
1 Device = (2K+64)B x 64Pages x 2048 Blocks
= 2112 Mbits

128K Pages
(=2,048 Blocks)

8 bit

2K Bytes   64 Bytes

Page Register   I/O 0 ~ I/O 7

2K Bytes   64 Bytes
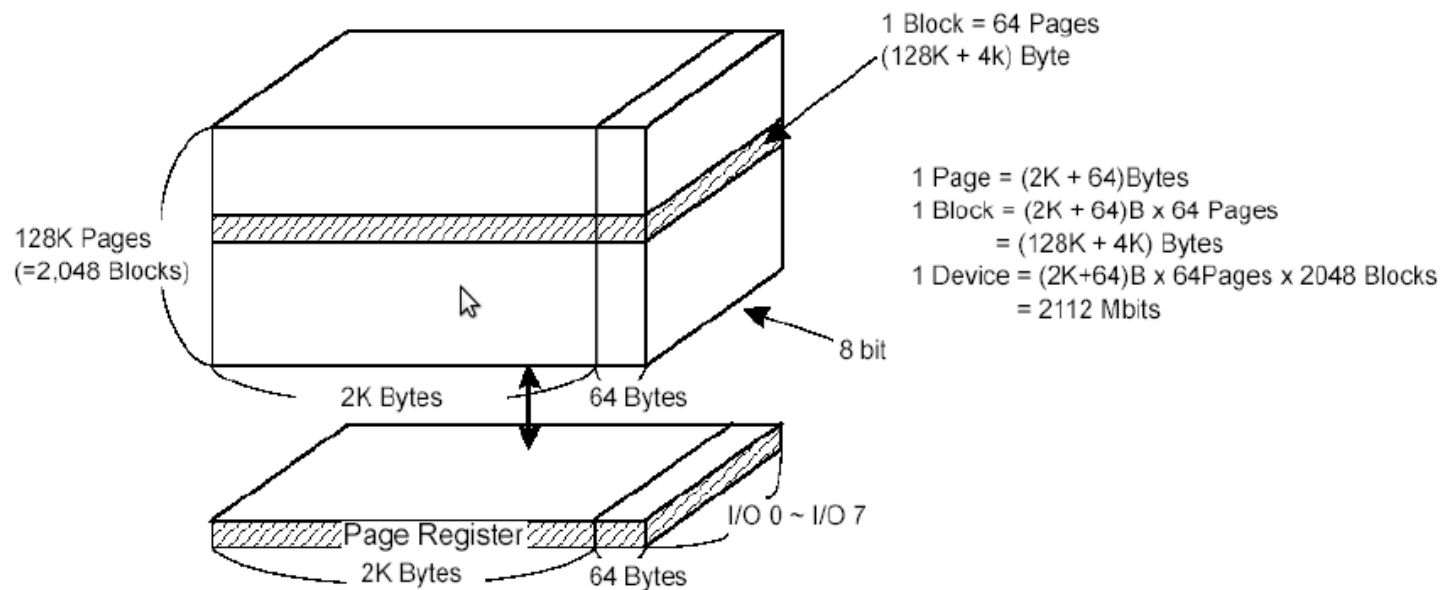
NAND flash is unreliable devices

Nandflash Model -- Operations

- Erase a block (0 -> 1)
- Write a page (1 -> 0)
- Read a page (page size = main area + spare area)
- ECC calculation
- ECC correction

Nand Software Stack in Ucore

User App
Syscall
VFS
Yaffs2-VFS glue layer
Yaffs2 Logic
MTD (memory technology layer)
Nand Controller Driver

Nand Controller Driver

- Chip specific
- Contains several commands:
  - Write addr
  - Write a word
  - Read a word
  - Some controller has a hw ECC controller

MTD

- manages partitions on a nandflash chip
- Organizes OOB area (spare area) layout
- Provides interfaces to read/write a page and erase a block
- Mark/Check a bad block

Implementation in Ucore

- Device driver implemented in arch/arm/mach-xxx
- MTD layer defined in fs/mtd-nand.h, but its implementation is machine-dependent
  - (see source code)

YAFFS2

- YAFFS stands for Yet Another Flash File System. YAFFS is the first file system that has been designed, from the ground up, for NAND storage.

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- In 2002 Aleph One set out to identify file system options for using NAND Flash as a file system. Various file systems available at the time were evaluated and all were found lacking in one way or another. The need for a suitable NAND storage file system was identified and YAFFS was designed to fill that need.

YAFFS2 Features

- Linux-compatible VFS interface
- POSIX interface
- Wear Leveling Algorithm
- Bad block handling

YAFFS2-Ucore VFS glue layer

- Ucore's VFS is not compatible with Linux's, so I have to rewrite all code for this layer.

- Placed in fs/yaffs2_direct/yaffs_vfs.[hc]

- Generally speaking, functions in this layer map inode requests to yaffs_obj object manipulation.

- FS mount/unmount methods are also implemented in this file.

Special Features supported by Nandflash Software Stack in Ucore

- HW ECC
- RAM simulated disk for YAFFS/VFS debugging in QEMU

- Demo~