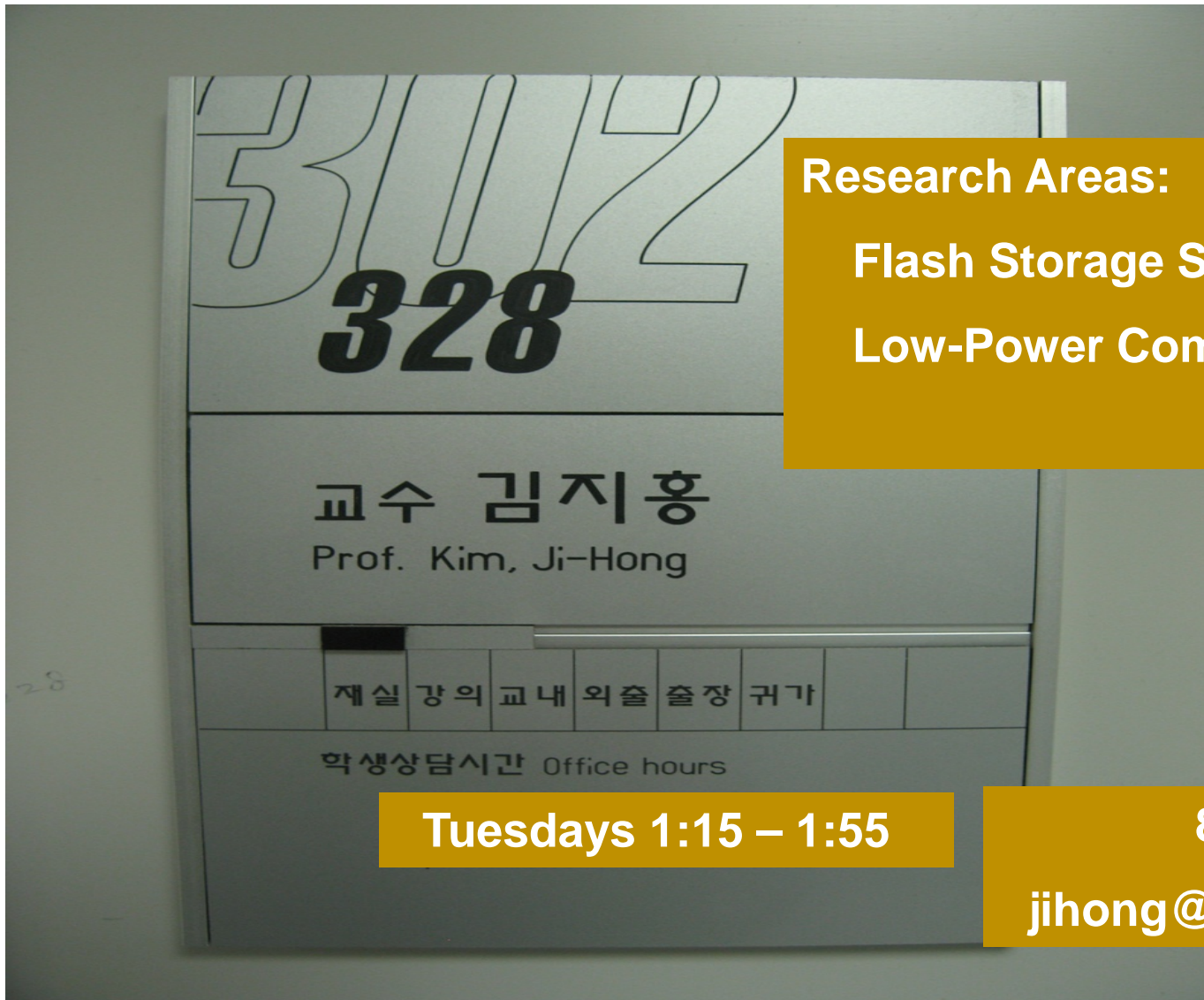# 4190.763(001)

내장형시스템특강

Flash-Aware Computing

Course Information

Instructor

Research Areas:

Flash Storage Systems

Low-Power Computing

Tuesdays 1:15 – 1:55

880-8792

jihong@davinci.snu.ac.kr

Today's Lecture

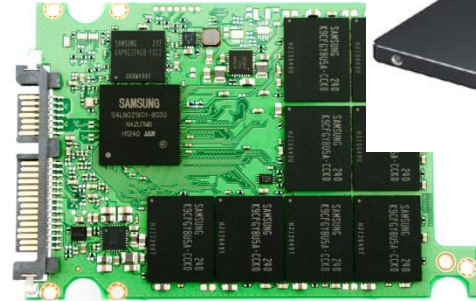- **Course Overview & Information**

Our Target: Flash Storage

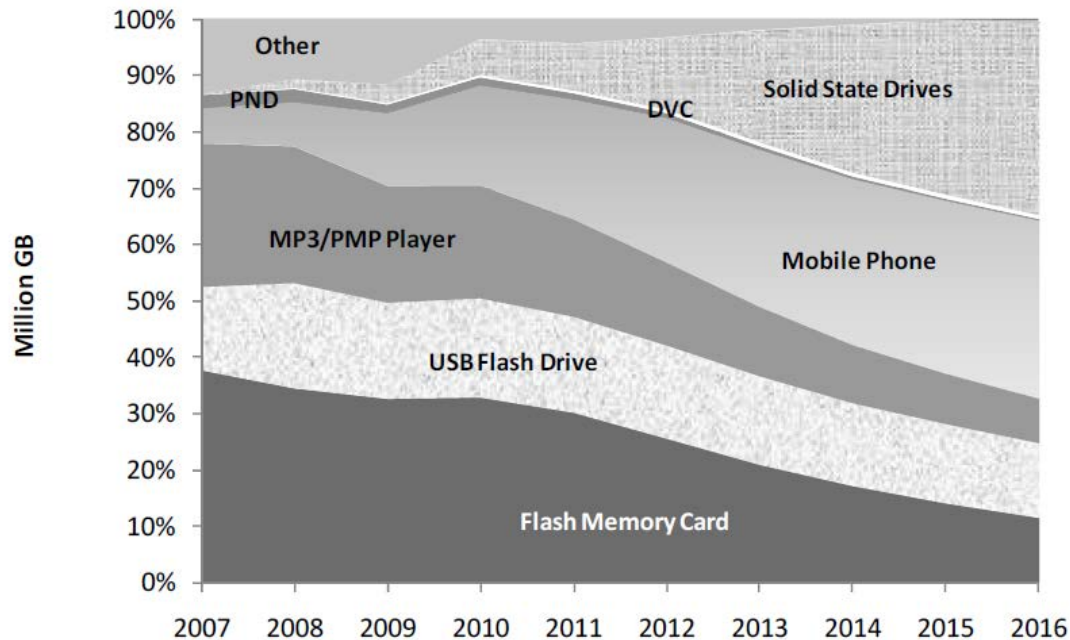- **Rapid Improvements in capacity/performance/price of NAND flash memory**
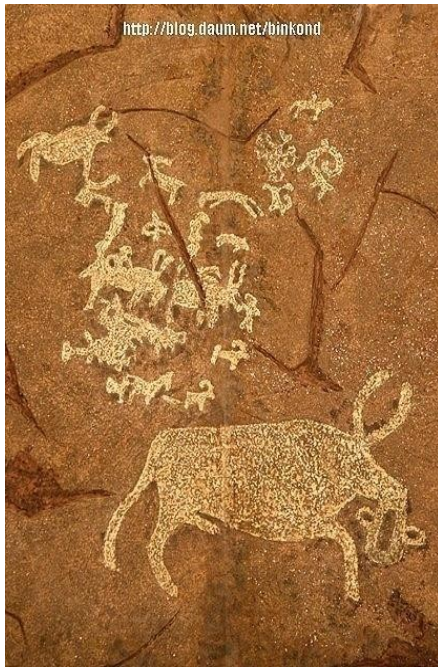
Performance   Price   Capacity

NAND Flash Applications Demand

Million GB

Other
PND
MP3/PMP Player
USB Flash Drive
Flash Memory Card
DVC
Solid State Drives
Mobile Phone

2007 2008 2009 2010 2011 2012 2013 2014 2015 2016

NAND Flash Memory

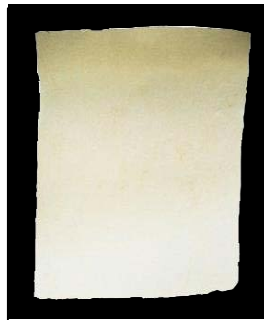- a **non-volatile computer storage** chip that can be electrically erased and reprogrammed

암각화 선사시대

木簡, 竹簡 (중국, 秦시대)

종이 (105년,채윤, 後漢)

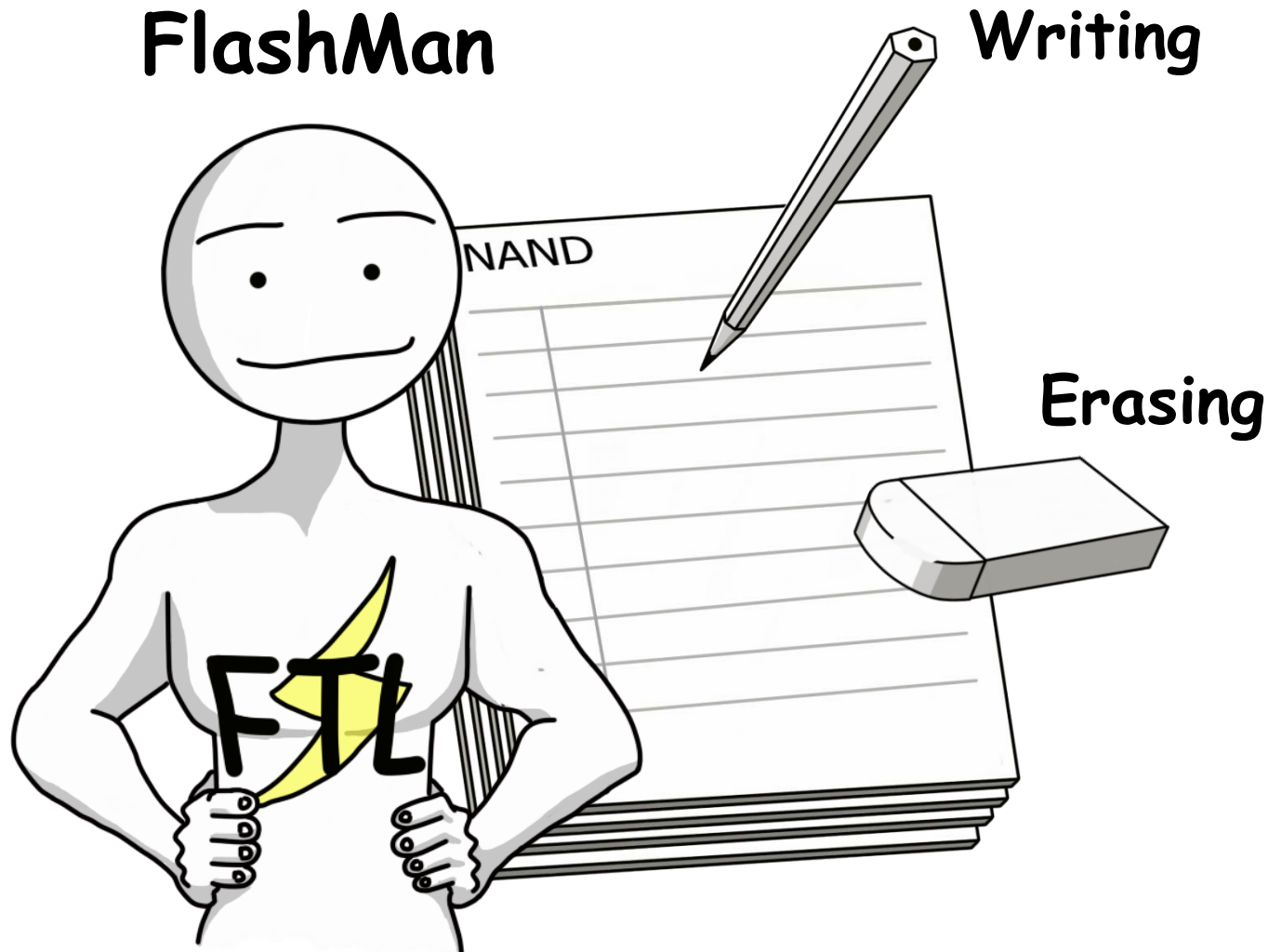Magnetic (1980~)

Optical Disk (1990~)

Silicon (2002 ~)

NAND Flash Memory is like Sheets of Paper

FlashMan

Writing

NAND

Erasing

FTL

Illustrated by Jisung Park, Seoul National University

Writing Letters and Erasing Paper
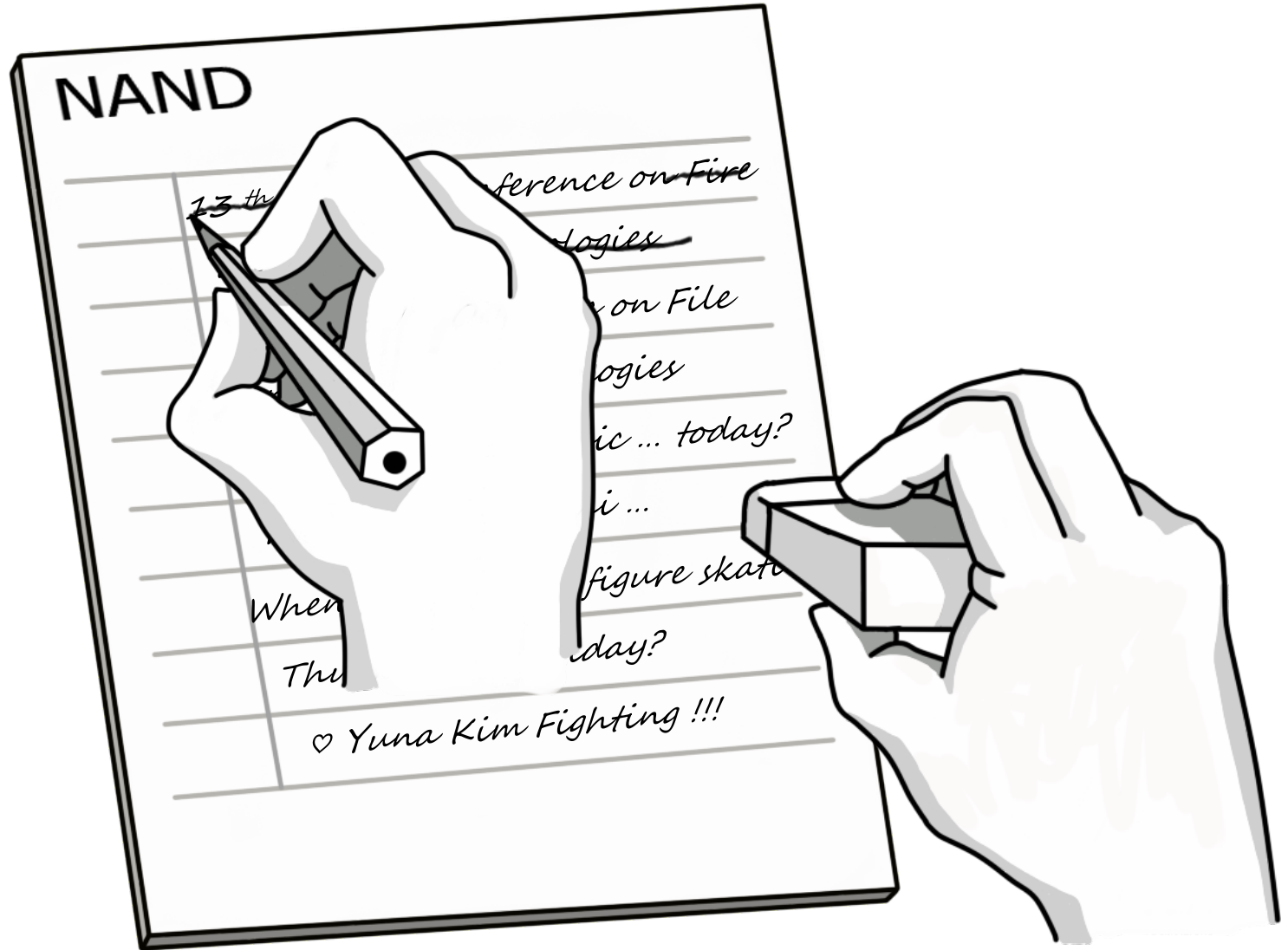
Flash-Aware Computing (FAC)

- **Cross-layer optimizations**

- **Two directions**
  - **Device-Aware** System Design
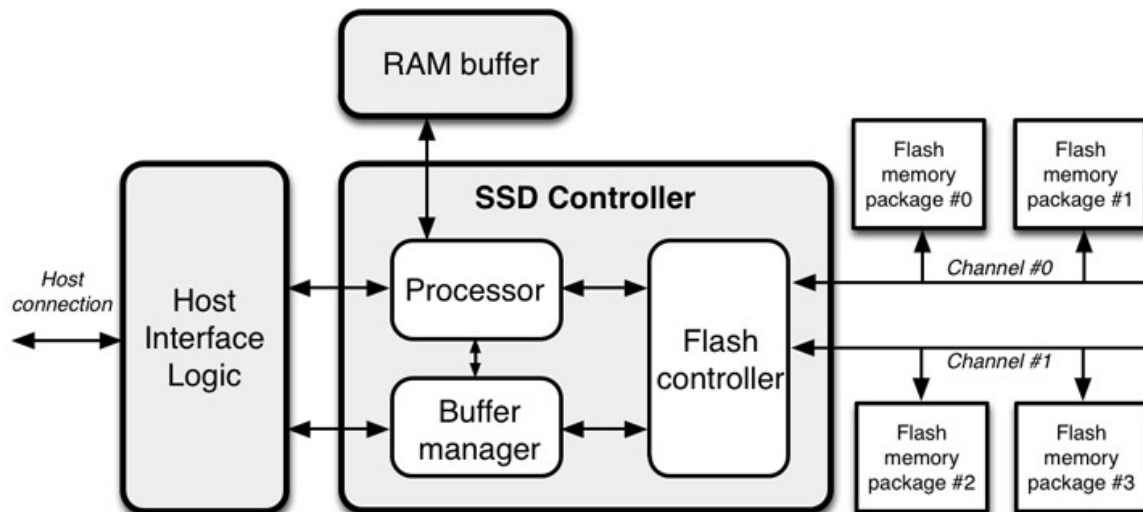 - **System-Aware** Device Design

Course Overview

- **Part 1: Lectures on key components of flash storage**

- **Part 2: Paper study on recent topics in flash storage systems**

- **No prior knowledge/exposure to Flash required.**

Part 1: Key Components of SSD

- **NAND Flash Basics/(ECC?)**

- **Flash Translation Layers**

- **SSD Architecture**

- **Flash-Aware OS/File System Issues**

- **Host/App-Managed Flash Issues**

Architecture of a solid-state drive

At Least:

Undergraduate-level Familiarity with

Computer Architecture &

Operating Systems

Evaluation (Tentative)

Assignments **30%**	
Final Exam (Closed) **40%**	**Attendance** **-5%**
Group Activity **30%**	

Linux I/O Stack Diagram

System Call (open, read, write …)

Direct I/O

VFS (Virtual File System)

yaffs2 **EXT4** **FAT** **…**

Page Cache

Block I/O Layer

I/O Scheduler

cfq **deadline** **noop**

BIOs (Block I/O)

Linux Kernel

SCSI layer

/dev/sda **/dev/sdb** **…**

HDD **SSD** **DVD**

Any Questions??