SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECT312 – EMBEDDED SYSTEM DESIGN

III YEAR/ VI SEMESTER

1

UNIT 4 : EMBEDDED OPERATING SYSTEMS & MODELING

TOPIC :Embedded File Systems

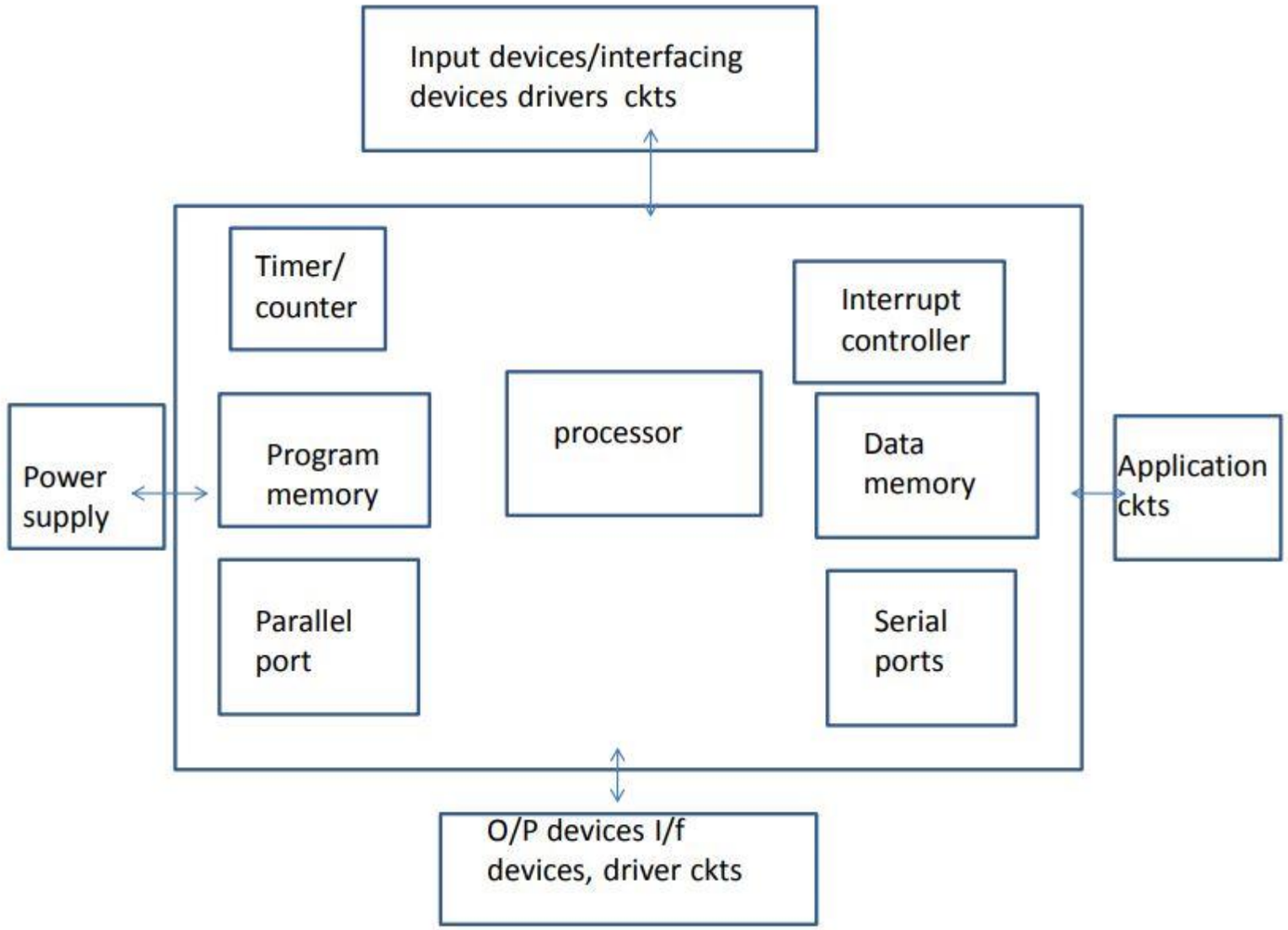
INTRODUCTION

- An embedded file system is a file system specifically designed to be used with embedded systems, which are typically resource-constrained devices such as microcontrollers, single-board computers, or other embedded hardware.

- Embedded file systems are optimized for efficient storage utilization, minimal memory footprint, and fast access speeds, making them suitable for devices with limited resources.

- These file systems often employ techniques such as wear leveling (for flash memory), compression, and minimal metadata overhead to maximize performance and reliability in embedded environments.

EMBEDDED SYSTEMS



FILE SYSTEMS

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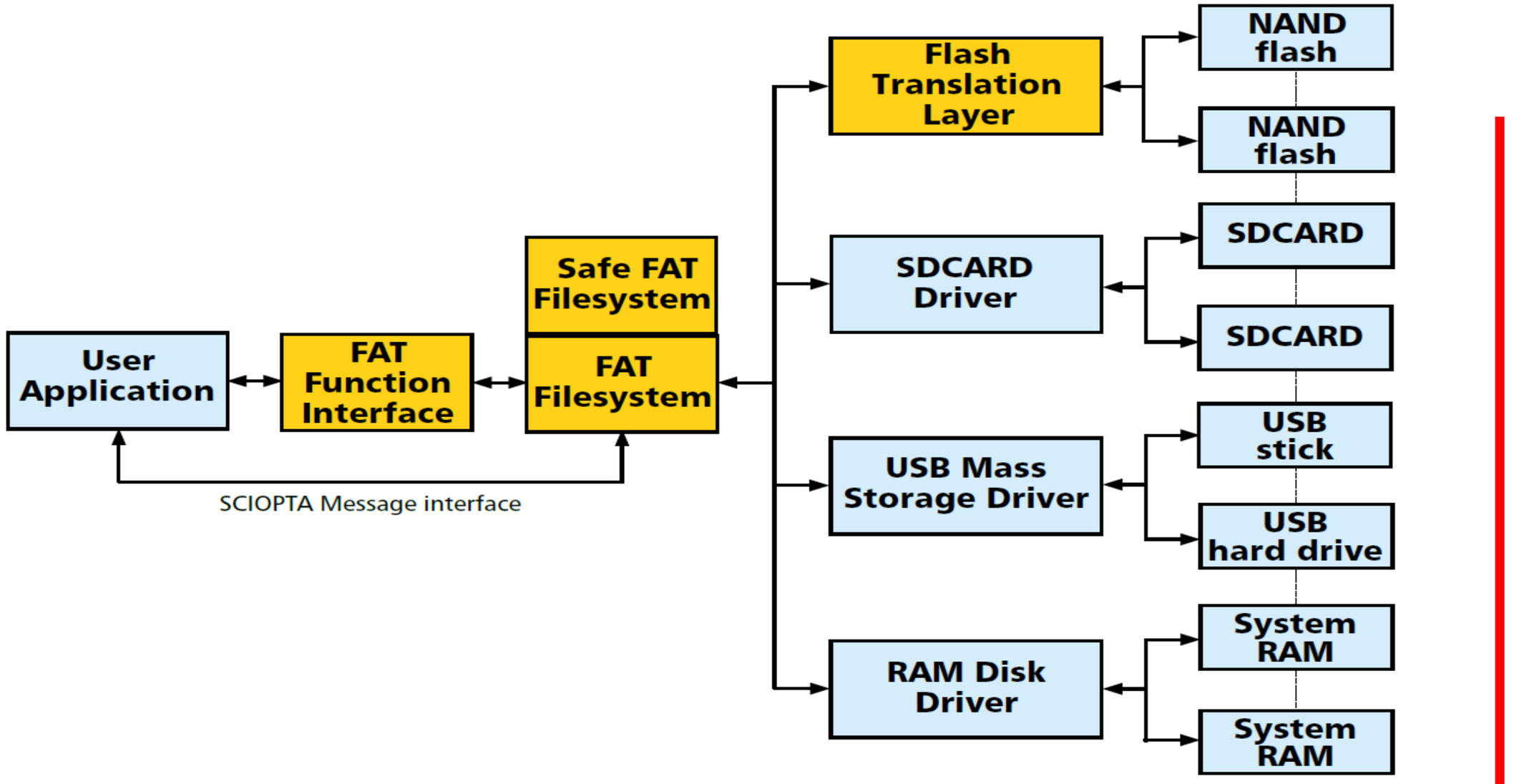
REQUIREMENTS

- Minimal footprint
- Wear leveling support
- Real time performance
- Compatability with flash memory
- Power failure resilence

TYPES OF EMBEDDED FILE SYSTEMS

- **YAFFS (Yet Another Flash File System):** YAFFS is a file system optimized for NAND flash memory, commonly used in embedded systems. It provides wear leveling, bad block management, and power-failure resilience. YAFFS is designed for high performance and reliability in embedded applications.
- **FAT (File Allocation Table):** FAT is a widely used file system originally developed for floppy disks and later adopted for use with flash memory storage devices. It is simple, lightweight, and supported by many operating systems and embedded platforms. FAT file systems include variants like FAT12, FAT16, and FAT32, with FAT32 being the most common in embedded systems.

FAT FILE SYSTEM



FLASH FILE SYSTEMS

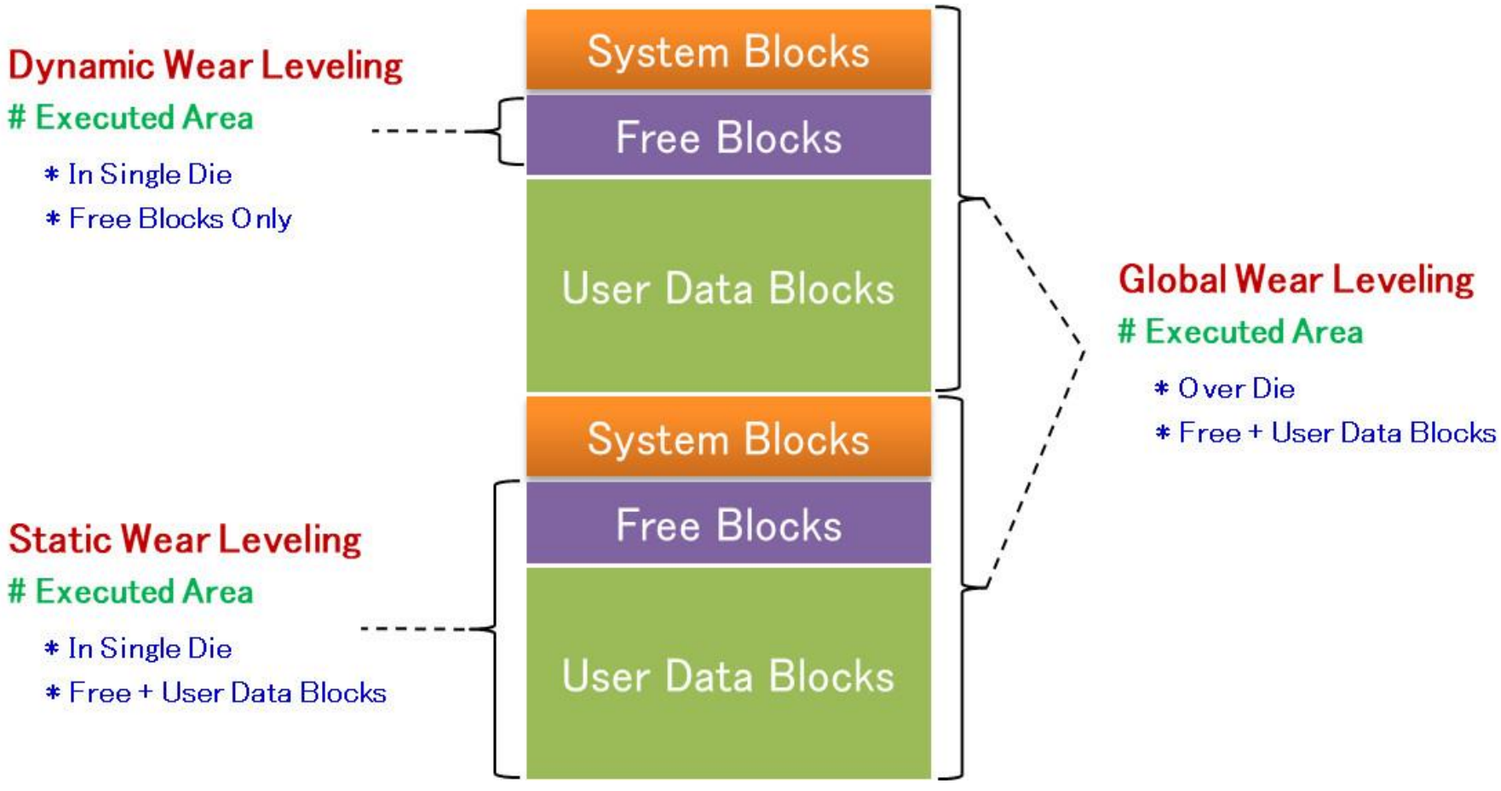
Flash file systems are specialized file systems designed specifically for flash memory-based storage devices, such as NAND and NOR flash memory. These file systems are optimized to address the unique characteristics and challenges associated with flash memory, including limited erase/write cycles, wear leveling, and efficient garbage collection.

- **JFFS2 (Journaling Flash File System 2):** JFFS2 is a Linux-based flash file system that provides wear leveling, compression, and journaling capabilities. It is designed to maximize the lifespan of flash memory by evenly distributing write/erase cycles across memory cells. JFFS2 supports NAND and NOR flash memory devices.
- **UBIFS (Unsorted Block Image File System):** UBIFS is a successor to JFFS2 and is also designed for use with Linux-based embedded systems. It is optimized for NAND flash memory devices and offers features such as wear leveling, compression, and fast mount times. UBIFS works in conjunction with the UBI (Unsorted Block Images) layer to manage flash memory storage efficiently.

CHALLENGES

- Limited Resource
- Flash Memory Wear
- Power Failure Resilience
- Real-Time Constraints
- Small Memory Footprint
- Fast Boot Times
- Customization and Configuration

WEAR LEVELING



POWER FAILURE RESILENCE

- Power failure resilience refers to the capability of a system or component to withstand sudden power interruptions or failures without losing data integrity or functionality.

- In computing, especially in systems like embedded devices, servers, and data storage systems, power failures are a common risk that can lead to data corruption, loss of work, or system instability.

- **Data Journaling:** Logging pending changes or transactions to a journal before committing them to disk. In the event of a power failure, the system can replay the journal to recover and complete the operations.

REAL TIME PERFOMANCE

Fax machine

Traffic Management

Security system

Television

Embedded Systems

Printer

Audio system

Ultra sound machine

Oven

THANK YOU