FARSIGHT

嵌入式培训专家

Windows CE内核

华清远见

v Windows CE architecture

v Memory Model

v Process Model

v GWE System

v File System

v OAL

v Boot loader

v Device drivers

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Windows CE Architecture

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| Microsoft | OEM | ISV |

Applications

Embedded Shell

Windows CE Shell Services

Remote Connectivity

WIN32 APIs
COREDLL, WINSOCK, OLE, COMMCTRL, COMMDLG, WININET, TAPI

| Kernel Library | GWES | Device Manager | File Manager | IrDA | TCP/IP |

| OAL Bootloader | Drivers | Device drivers | File drivers | Network drivers |

OEM Hardware

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∨ Portable across supported processors

  Ø Kernel is portable as most of the operating system is written in C

∨ NK.EXE, COREDLL.DLL

  Ø NK.EXE contains Kernel code and Coredll.dll is the operating system core DLL module

∨ Saving system resources

  Ø CE loader is designed to save system resources by loading application pages as and when needed and by keeping only one physical copy of a DLL

∨ Demand paging

  Ø Loads virtual memory pages into physical memory when needed

∨ Multiple execute in place regions

  Ø Allows applications to execute code directly from read-only memory
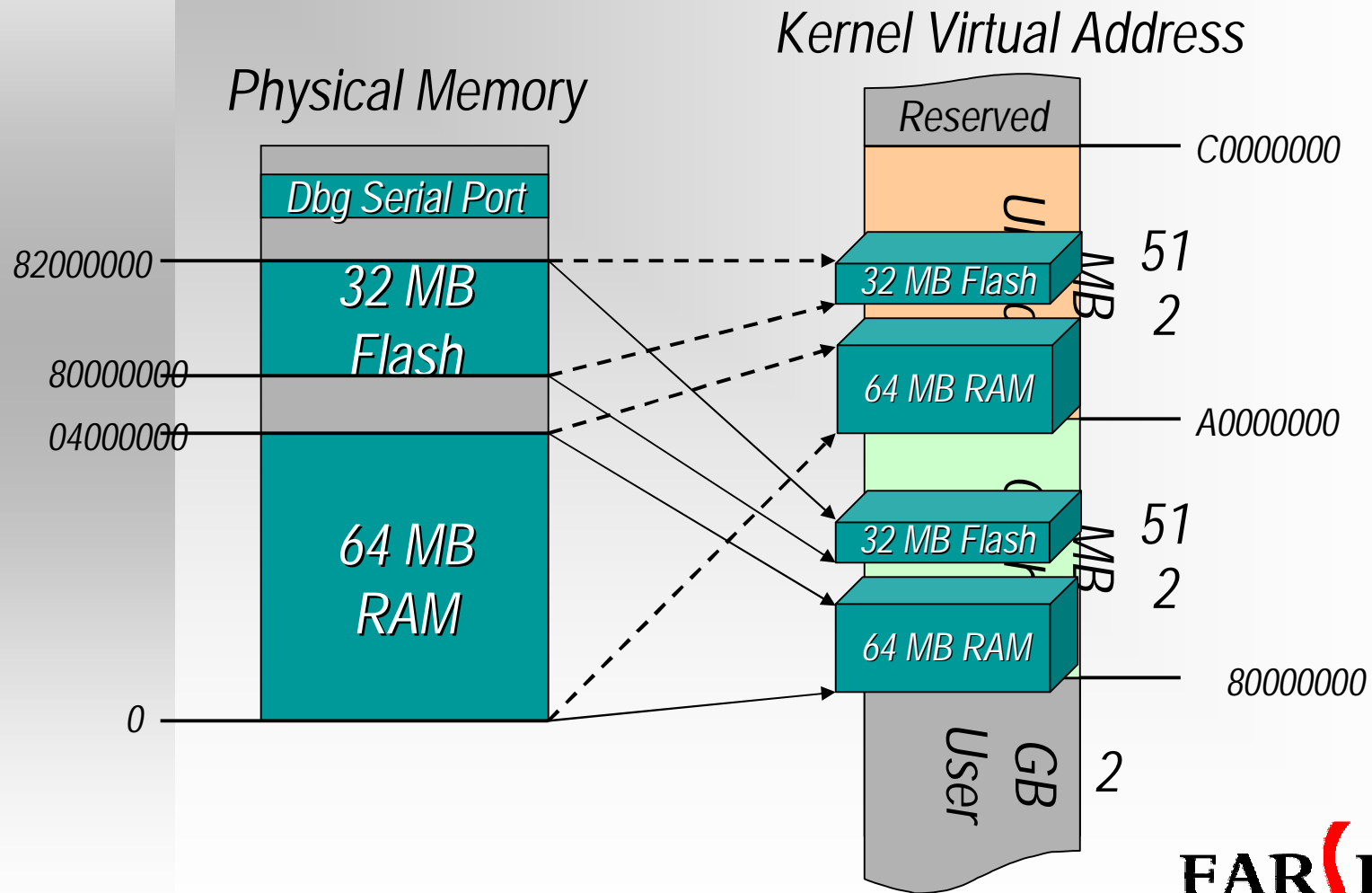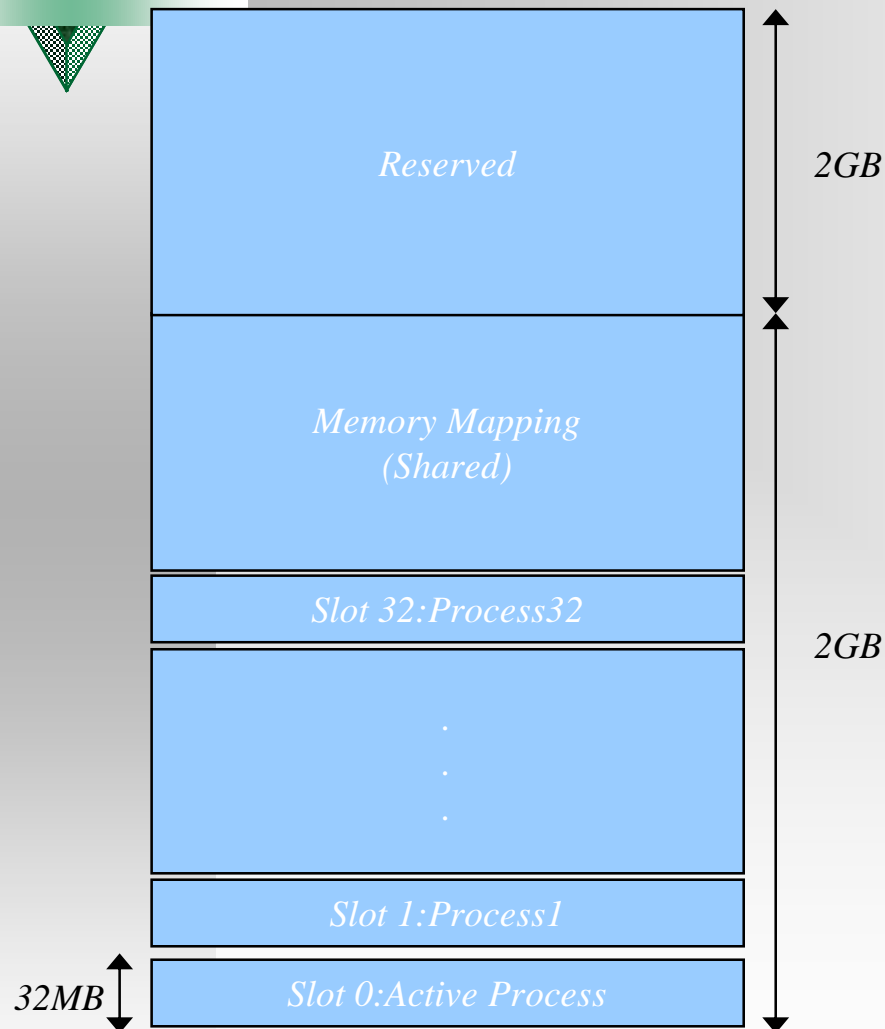
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∨ Physical Memory

∨ Virtual Memory

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Physical Memory

Virtual Memory

Reserved

Memory Mapping
(Shared)

Slot 32:Process32

.
.
.

Slot 1:Process1

Slot 0:Active Process

2GB

2GB

32MB

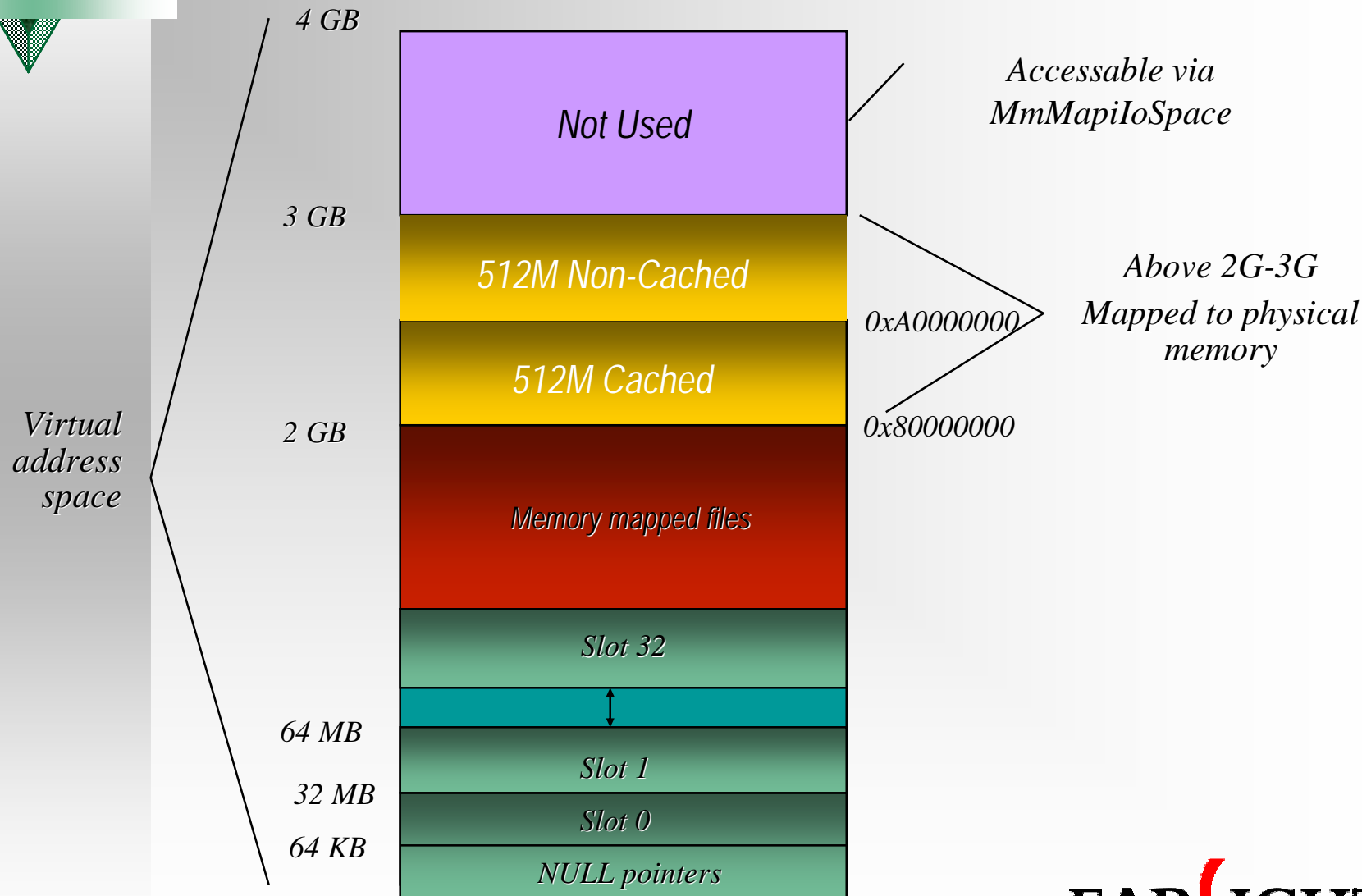- **v** Virtual memory management
  - **Ø** Windows CE .NET provides only one virtual address space of 4 GB for all the applications it uses
- **v** Using virtual memory
  - **Ø** Allocate large blocks of memory
  - **Ø** Does not fragment
  - **Ø** Windows CE .NET manages virtual memory in 64 KB blocks
- **v** Using the local heap
  - **Ø** Is a region of reserved virtual memory space that Windows CE .NET manages for your application
- **v** Using the stack
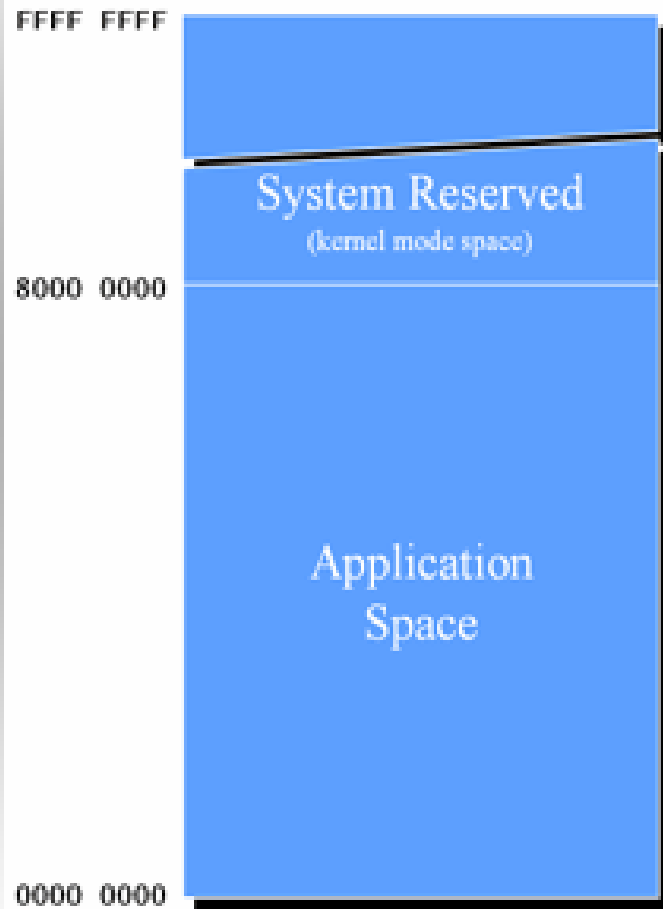 - **Ø** Is the storage area for variables that are referenced in a function

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Windows CE Address Space

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4 GB	Not Used	Accessable via MmMapiIoSpace
3 GB	512M Non-Cached	
	512M Cached	0xA0000000
2 GB	Memory mapped files	0x80000000
	Slot 32	
64 MB		
32 MB	Slot 1	
64 KB	Slot 0	
	NULL pointers	

Virtual address space

Above 2G-3G
Mapped to physical memory

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Windows XP Virtual Memory Space   **Windows CE Virtual Memory Space**

FFFF FFFF

System Reserved
(kernel mode space)

8000 0000

Application
Space

0000 0000

FFFF FFFF

System Reserved
(kernel mode space)

8000 0000

Large Memory Area
(memory mapped files)

4200 0000

Reserved

0400 0000

Active Process

0000 0000

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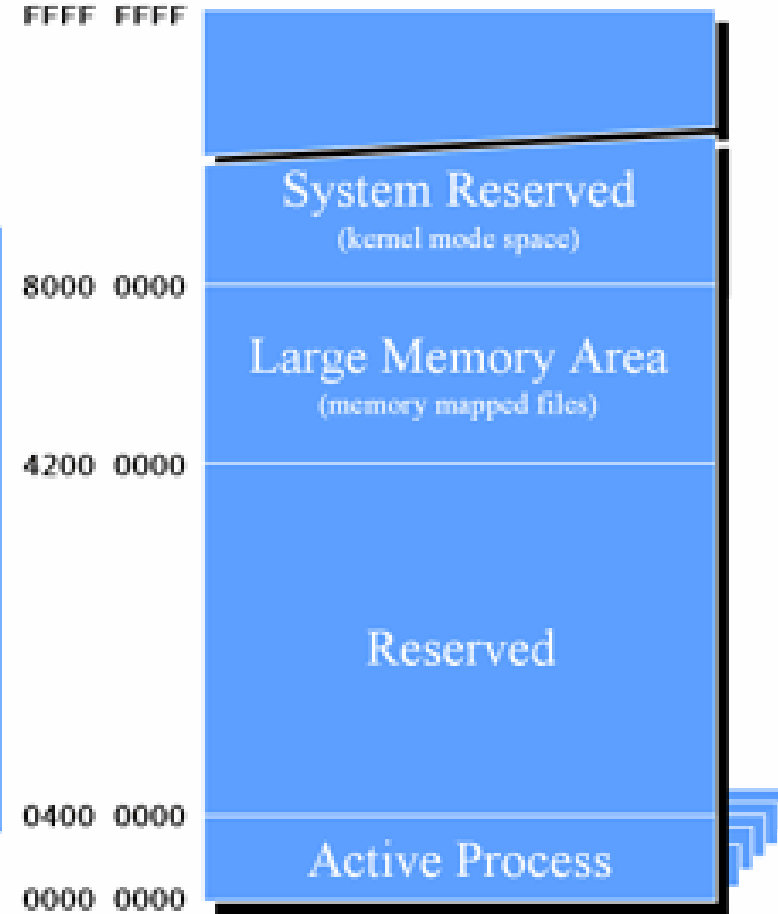
∨ The maximum number of simultaneous processes are limited 32 processes because:

- Ø It is the number of bits in a DWORD
- Ø It is a reasonable limit for most embedded devices, as using multi-thread is recommended over multi-processes

∨ Windows CE .NET uses the same loading and unloading mechanism as Windows NT

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∨ Windows CE 2.x

Ø Supported eight priorities – 0 to 7

Ø Use the SetThreadPriority(hThread, nPriority) function to set the priorities

∨ Windows CE 3.0 and higher

Ø Supports 256 Priorities – 0 (real-time) to 255

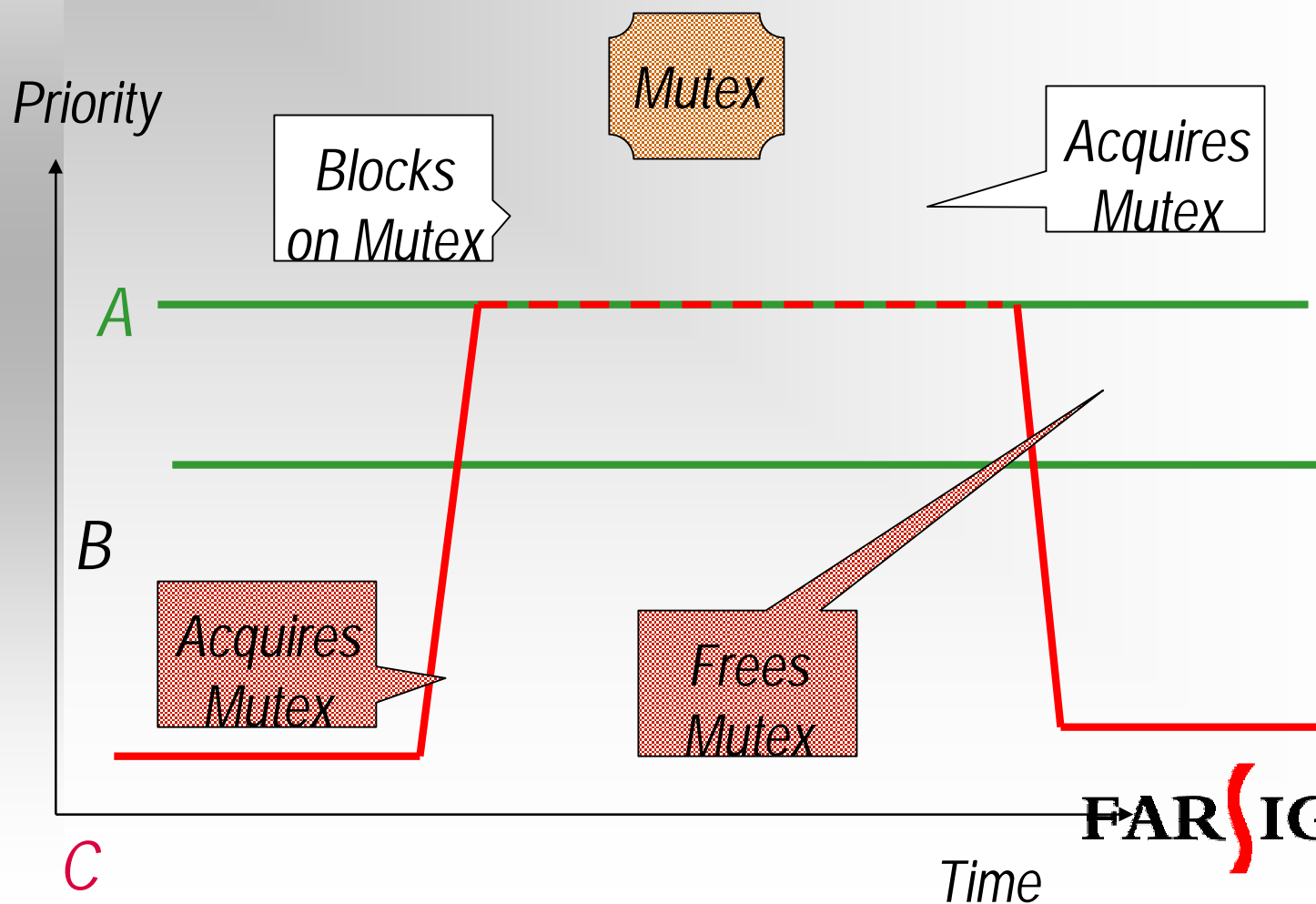Ø Uses CeSetThreadPriority(hThread, nPriority) function to set priorties

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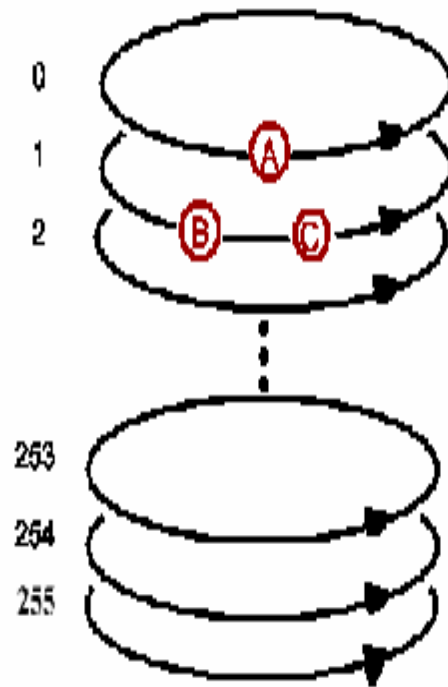
Thread Priority

- *Thread A is in the highest priority*
- *If at any point while thread A is running, thread B or C wake up*
- *If A is blocked, and both B and C are awake*
- *If thread A wakes up at any point during execution of any thread below its priority level*

Priority Inversion Handling

§ *The OEM should ensure that a priority inversion condition does NOT occur*

Priority

Mutex

Blocks
on Mutex

Acquires
Mutex

A

B

Acquires
Mutex

Frees
Mutex

C

Time

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∨ Graphics, Windowing, and Event Subsystem

  Ø Graphic output: display and printer

  Ø User input: keyboard, stylus, and mouse

  Ø Window management: message routing

∨ Graphic Device Interface (GDI)

  Ø Is the drawing subsystem of GWES

  Ø Controls how text and graphics are displayed

  Ø Uses a device context to store drawing attributes for a specified device

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∨ The Filesys Module
- Ø Implements the object store
  - ü File systems
  - ü Registry
  - ü Property Database
- Ø Substitutes for a hard drive on an embedded drive
- Ø Resides in ROM, RAM, or both
- Ø Can have a maximum size of 256 MB

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The Filesys Module

∨ Storage manager
- Ø Is responsible for all external storage items, including all the file systems and block drivers

∨ Installable file systems
- Ø Can provide access to a floppy diskette, a hard drive, a flash file system on a PC Card, or to other external storage devices

∨ File-shadowing mechanism
- Ø Allows a file to be stored both in RAM and ROM.

∨ Differences from other Windows file systems
- Ø No letters assigned to file systems
- Ø No concept of current directory
- Ø No support for overlapped I/O
- Ø All files stored in RAM are automatically compressed
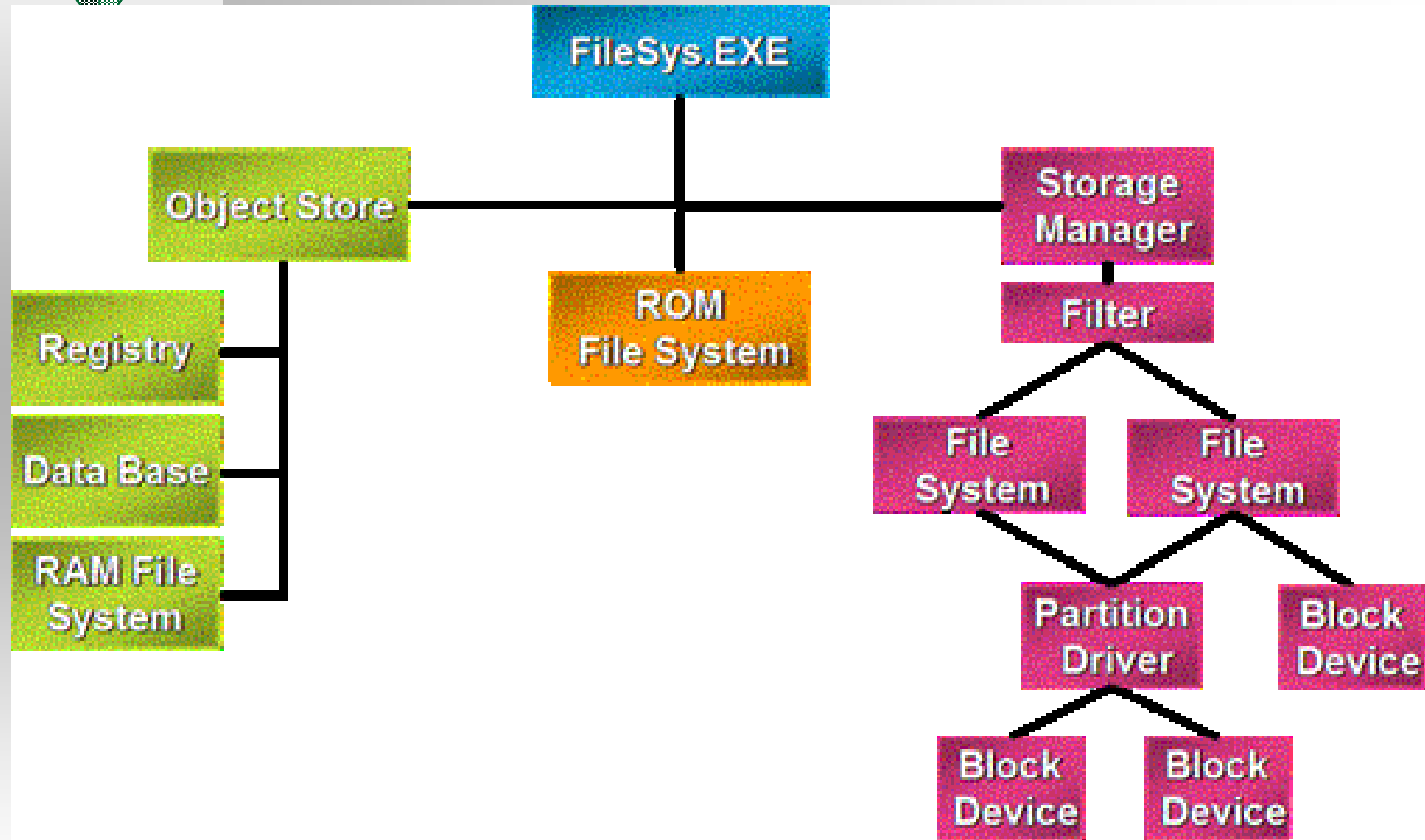
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The Filesys Module

v Registry

- Ø Provides a common repository for system settings, application data, and user preferences
- Ø Resides in RAM, if not present in RAM, the registry can be reloaded from persistent storage or rebuilt from ROM
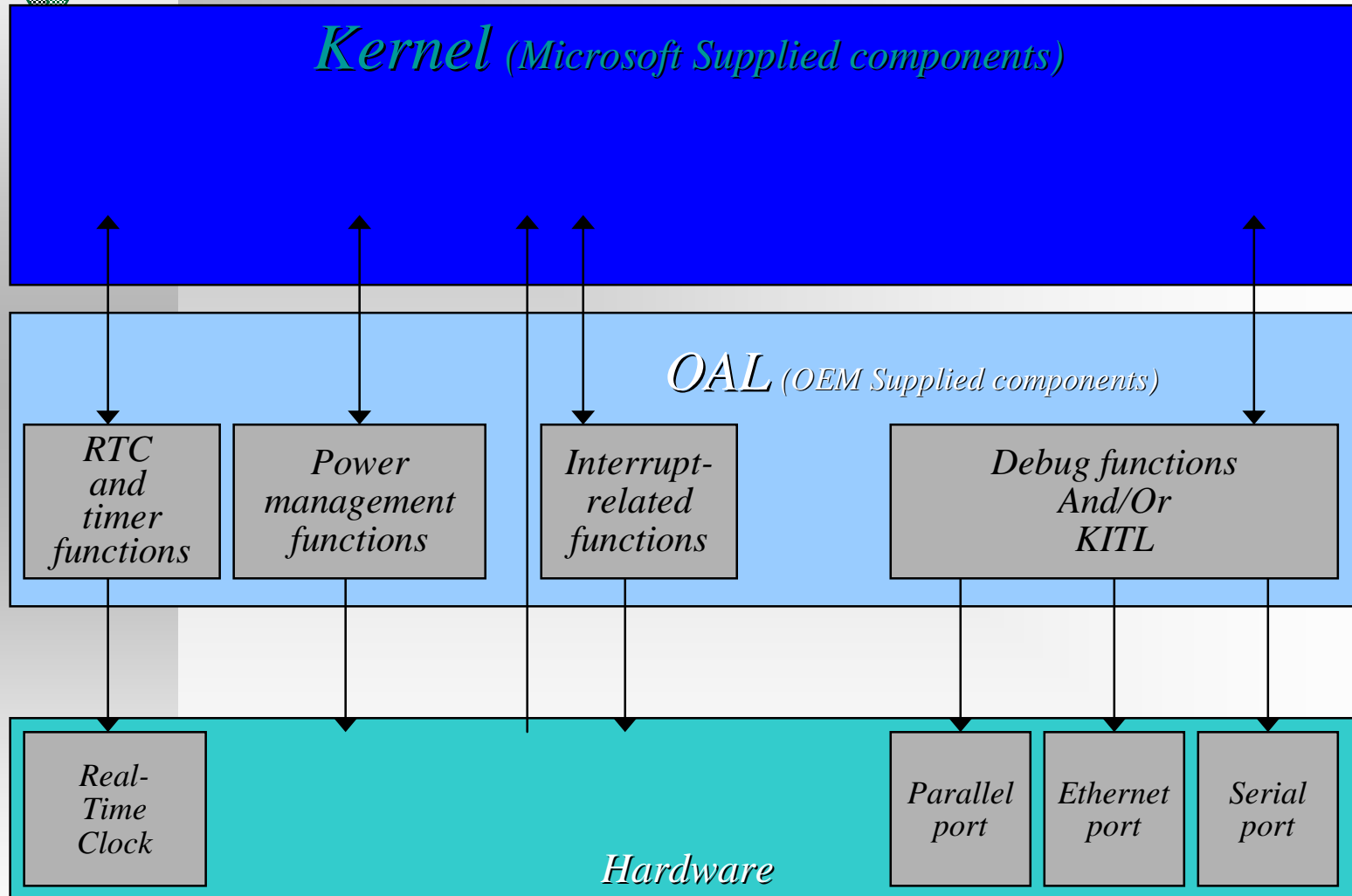- Ø Registry functions specific to Windows CE

v Property Database

- Ø Provides a lightweight database management system
- Ø Accessible using a new set of Win32 API functions specific to Windows CE
- Ø Data stored in a flat model
- Ø Accessible to ActiveX Data Objects for Windows CE (ADOCE)
- Ø Supports multiple volumes on installable file systems
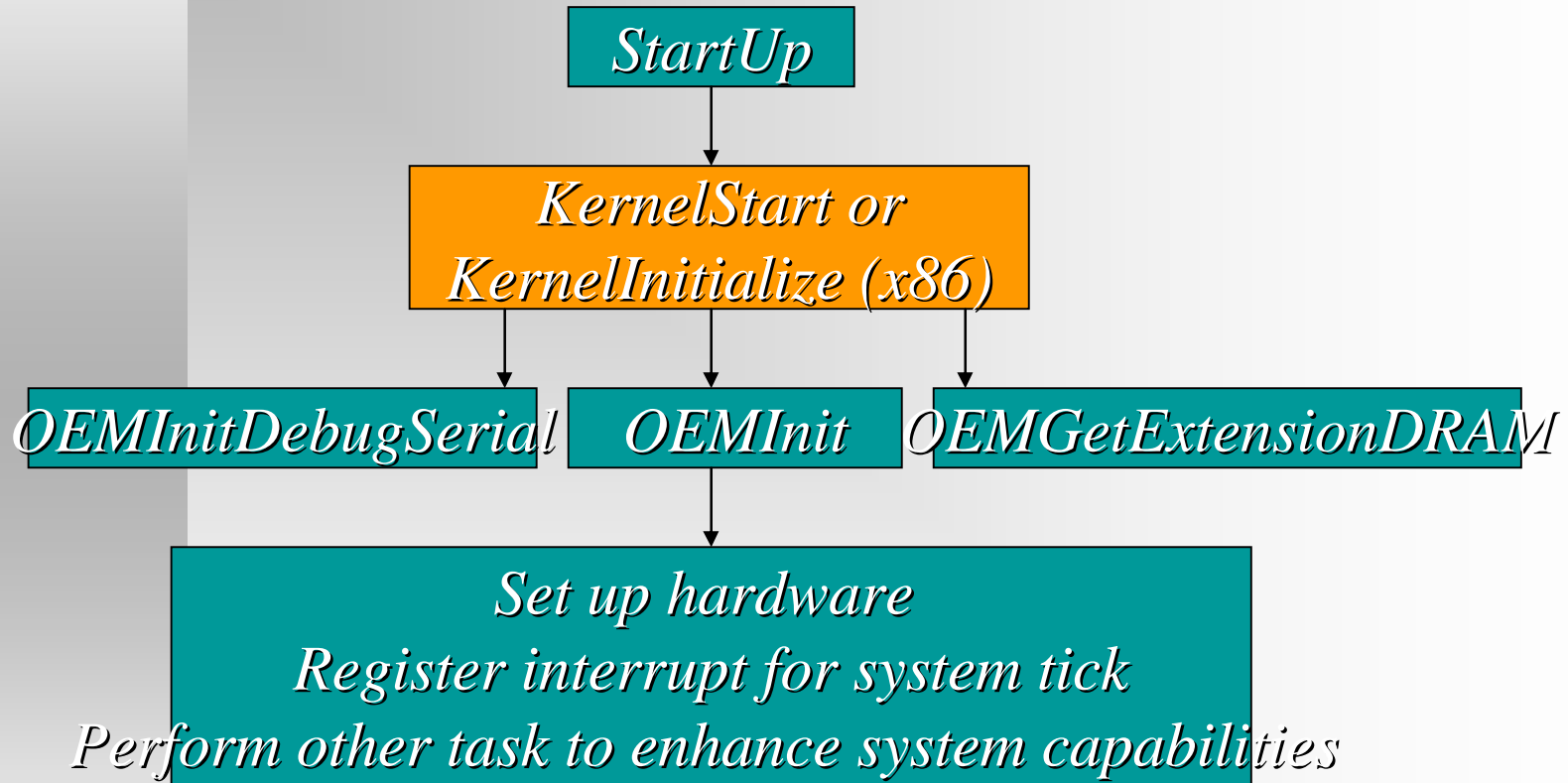
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FileSys.EXE

Object Store

Registry

Data Base

RAM File System

ROM File System

Storage Manager

Filter

File System

File System

Partition Driver

Block Device

Block Device

Block Device

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Operating System Boot Sequence

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StartUp

↓

KernelStart or
KernelInitialize (x86)

↓   ↓   ↓

OEMInitDebugSerial   OEMInit   OEMGetExtensionDRAM

↓

Set up hardware
Register interrupt for system tick
Perform other task to enhance system capabilities

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Role of the Boot Loader

| *Initializes the target device*

- *Memory and interrupt controller*
- *Setting up the clocks and MMU*

| *Controls the boot process*

- *Directly boot an existing flash RAM image*
- *Clear RAM before downloading*
- *Memory read/write test*

| *Downloads the Windows CE image to RAM or flash RAM using:*

- *Parallel port*
- *Ethernet port*

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