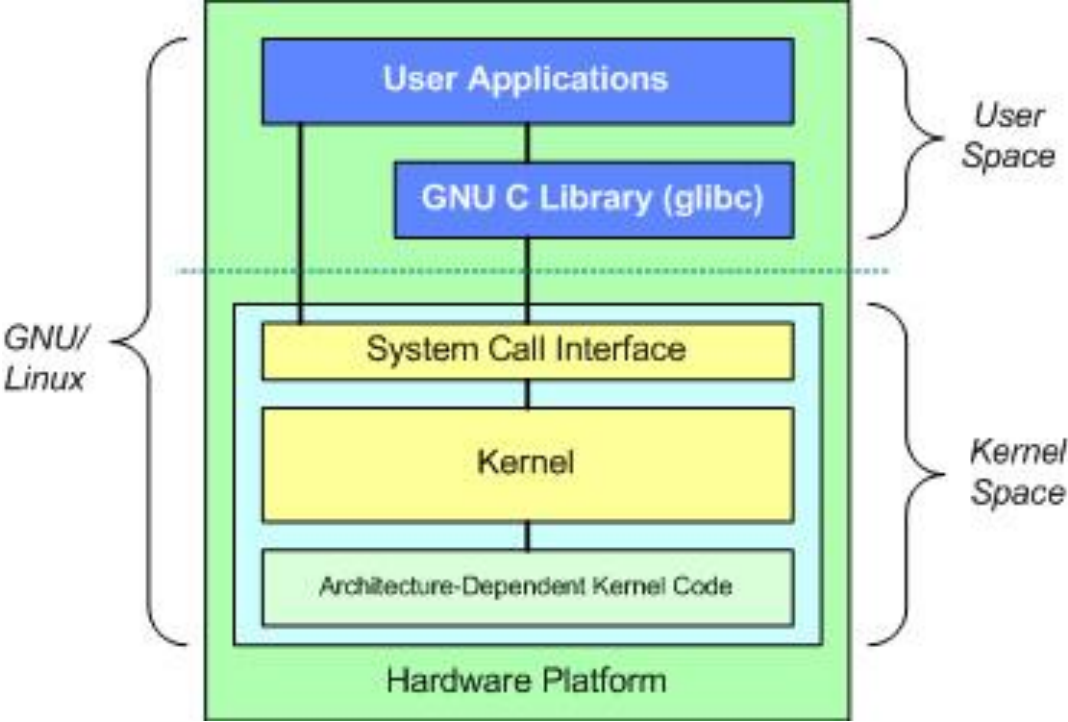


# Linux Kernel

Raju Alluri

# Linux Kernel Architecture - Process Space



# Linux Kernel Architecture - Process Spaces

- Need for different process spaces
- Privileged Operations
- Multi-user support
- Process isolation
- Resource Management

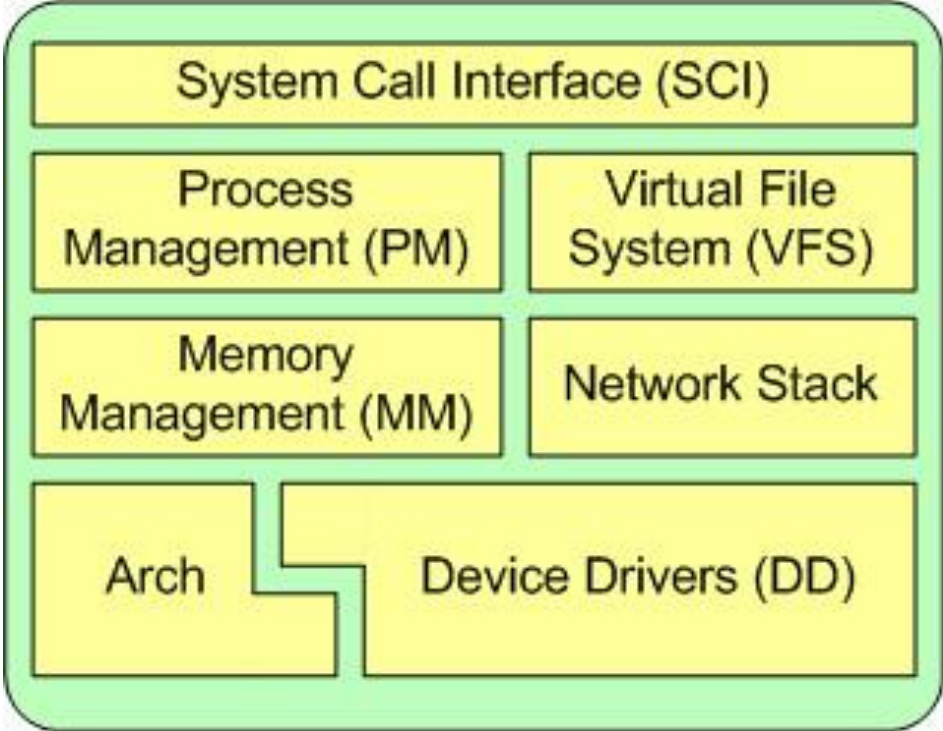
# Linux Kernel Architecture - User Space

- Application Programming Libraries
- System Calls
- Glibc
- Run using virtual memory addresses
  - More on this later

# Linux Kernel Architecture - Kernel Space

- System Call Interface
- Architecture independent kernel code
- Architecture dependent kernel code
- Use Physical Memory

# Kernel Architecture - Subsystems



# Kernel Subsystems

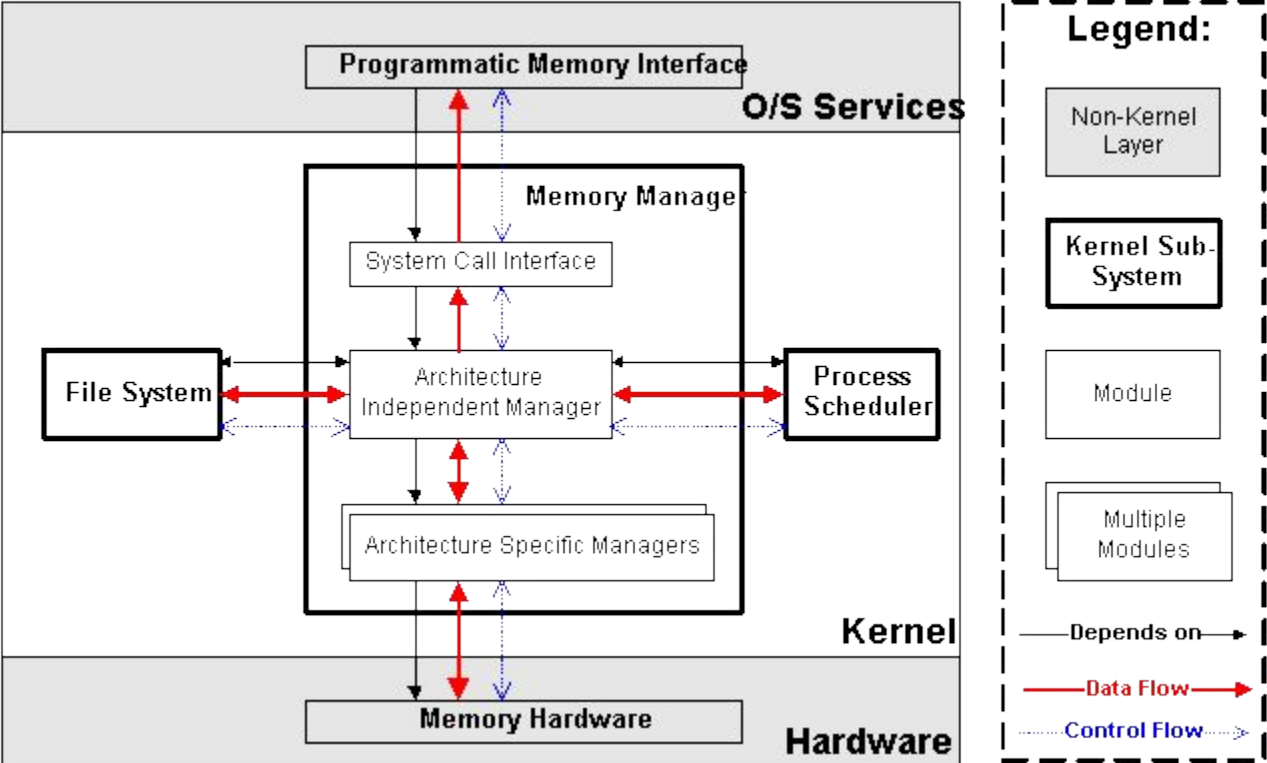
- Memory Management
- Process Management
- Virtual File System (VFS)
- Network
- Device Drivers
- Architecture-dependent code

# Memory Management

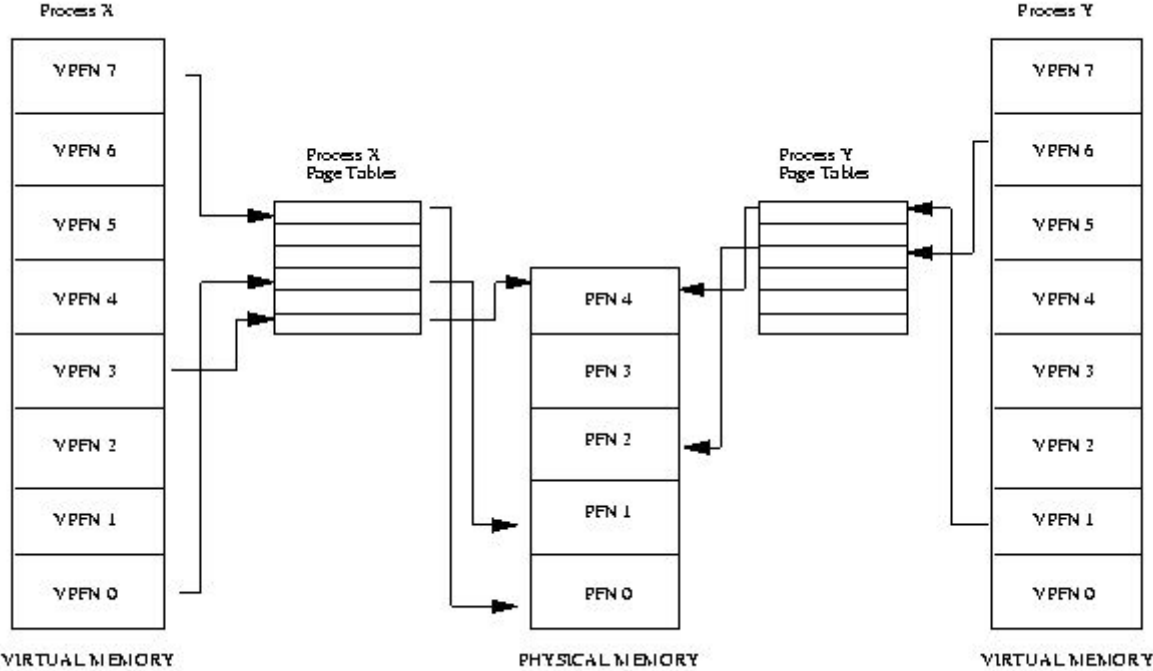
- Virtual Memory
- Physical Memory
- Pages
- Page Faults
- Page Frame Numbers (Virtual and absolute)
- Page Tables (per process)
  - Access Control, Validity, physical page frame numbers
- Full/partially used/empty pages
- File system
  - More later
- Process Scheduler
  - More later



# Memory Management



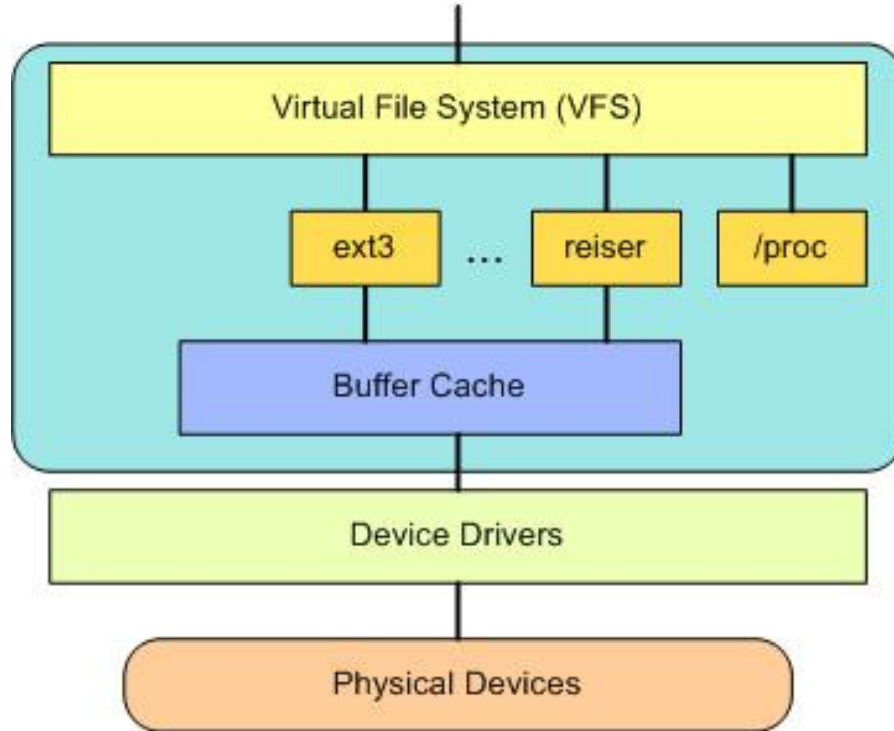
# Memory Management - Virtual Memory



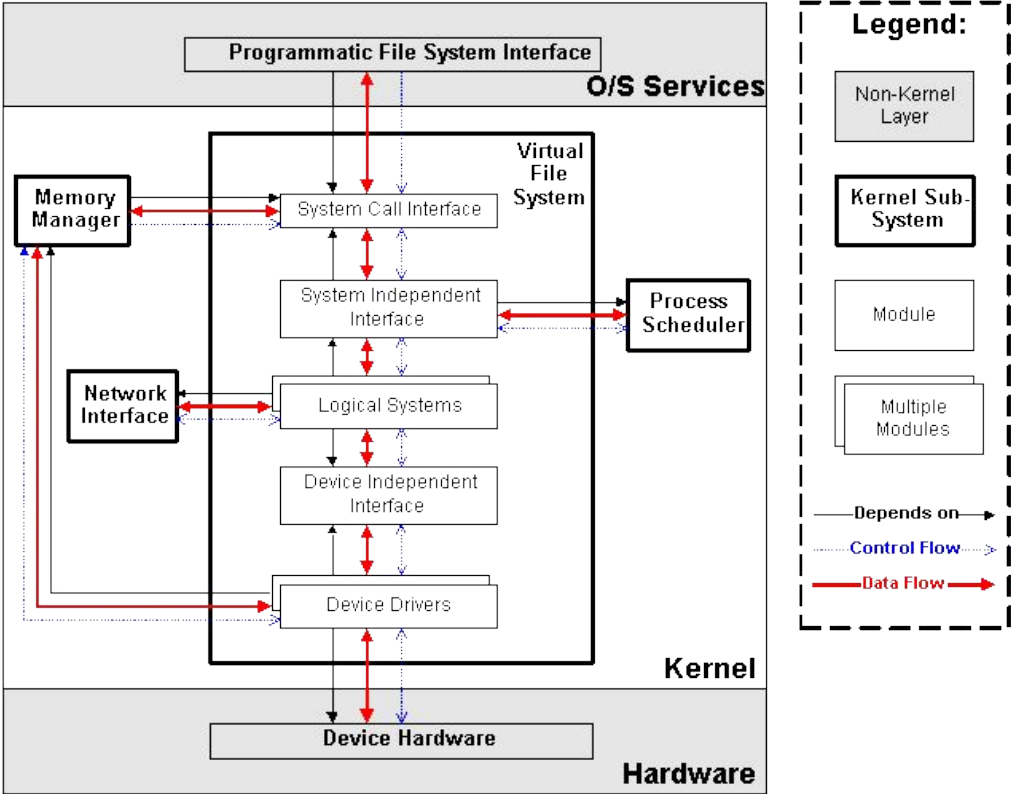
# File Systems

- The notion of “everything is in a file”
- Virtual File System
- Filesystem type (ext3, Reiser)
- Mount points and Superblocks
- Directories and Files
- Inodes

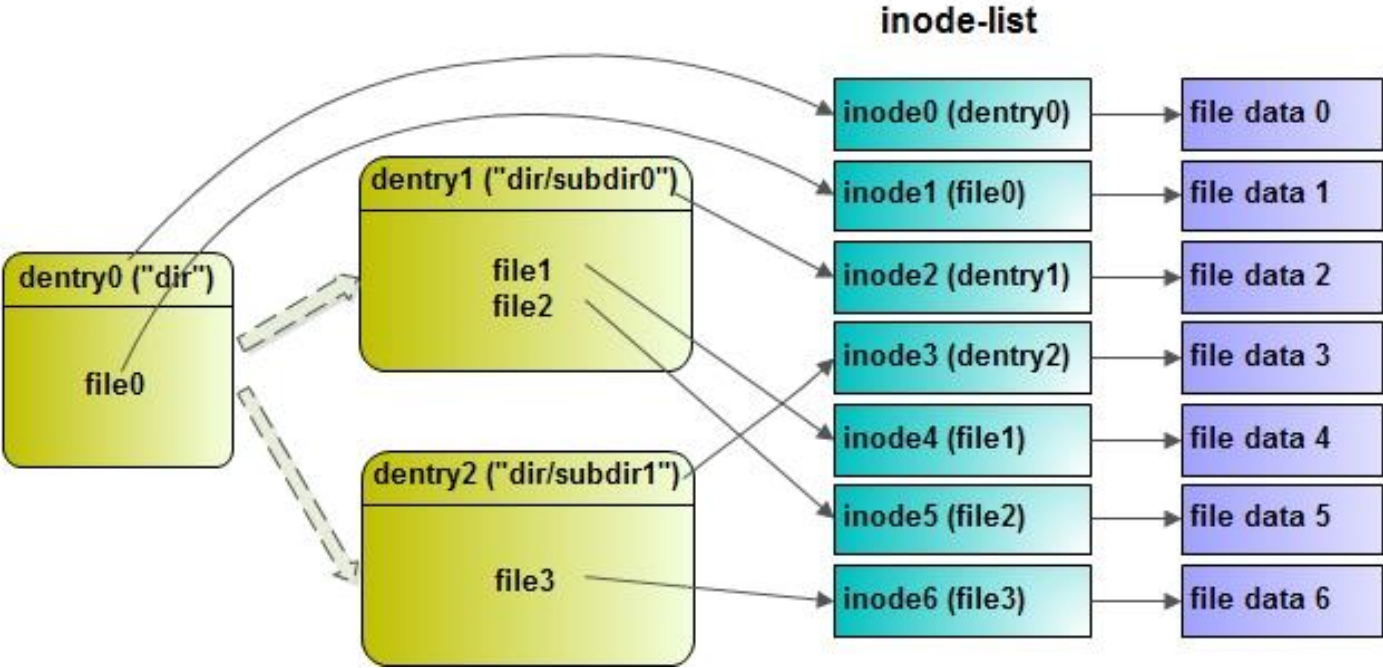
# VFS



# VFS - Architecture



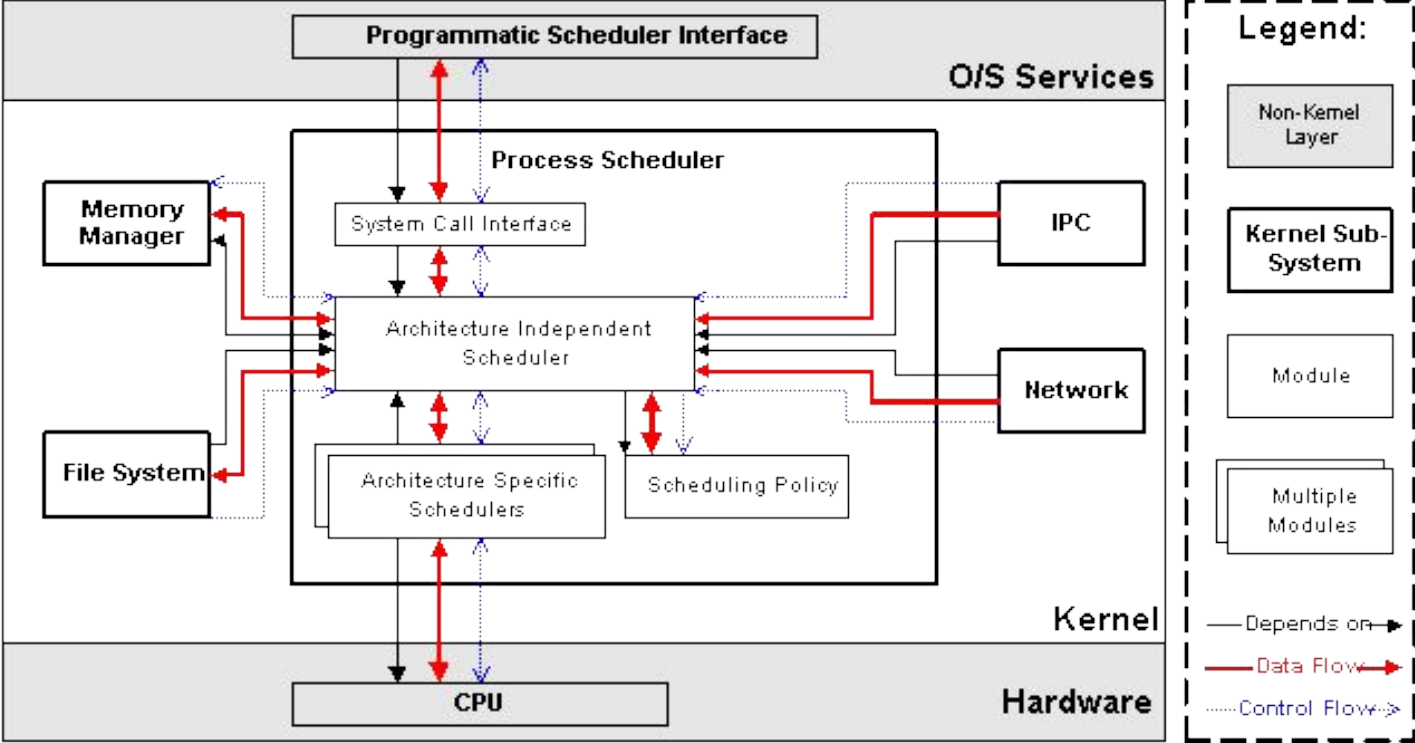
# VFS Structure - Directories, Files and Inodes



# Process Management

- Processes
- Parent/child
- Process owner
- Init
- /proc
- Inter Process Communication (IPC)'s role in process management

# Process Management - Scheduler

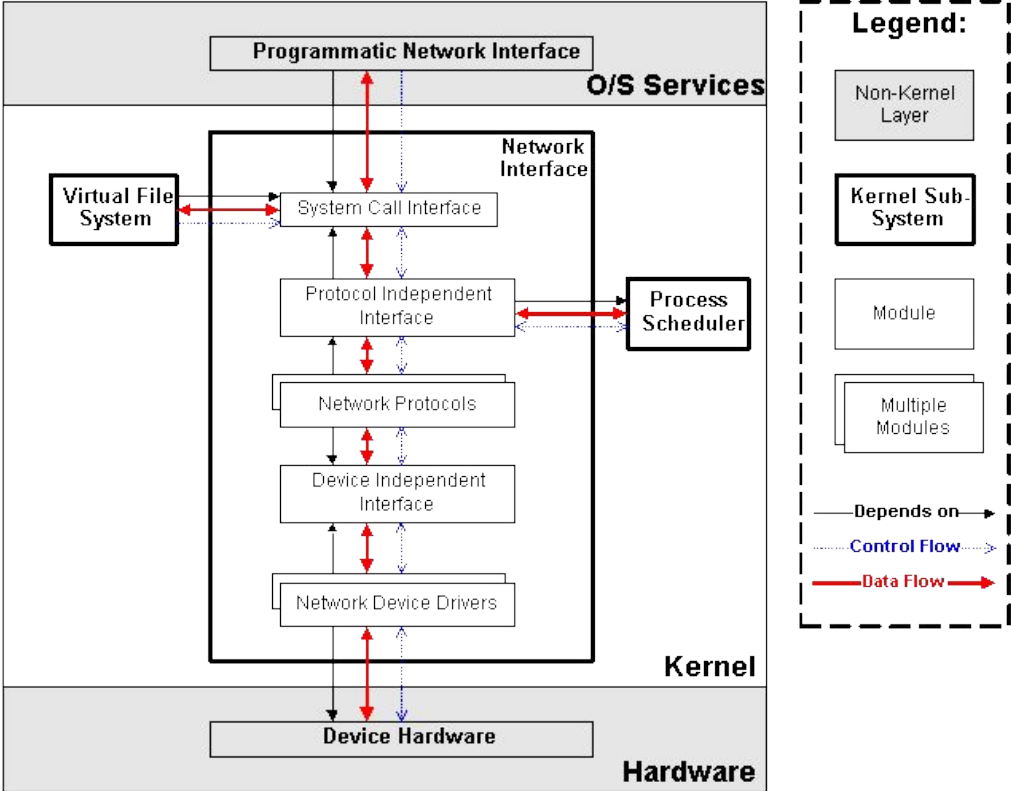




# Network

- Abstraction of implementation
  - Large set of network devices
  - Large set of network protocols
- Process management (via) scheduler
  - For processes waiting for network device response

# Network



# Interactive lab discussion

```
lsof
```

```
ps -aef | grep init | grep -v grep
```

```
df -ih
```

```
top
```

# Q&A

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