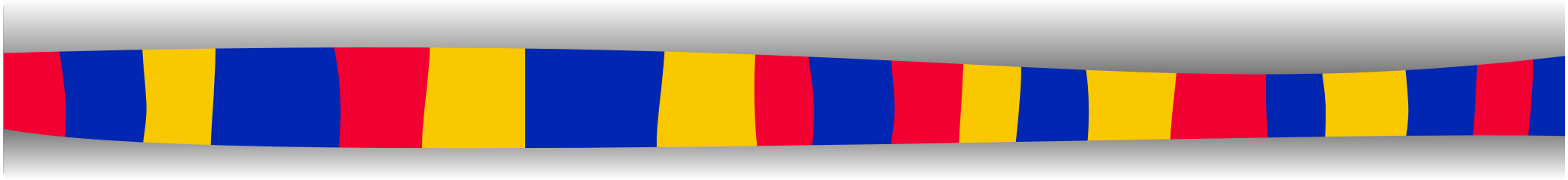
CISC 326

Game Architecture



Module 5: Examples of Architectures (Linux and Chrome)

Ahmed E. Hassan

Linux as a Case Study: Its Extracted Software Architecture

Paper By: Ivan T. Bowman, Richard C. Holt and Neil V. Brewster

Slides By: Jack ZhenMing Jiang

Outline

- Terminology
- Conceptual Architecture
- Concrete Architecture
- Conclusions

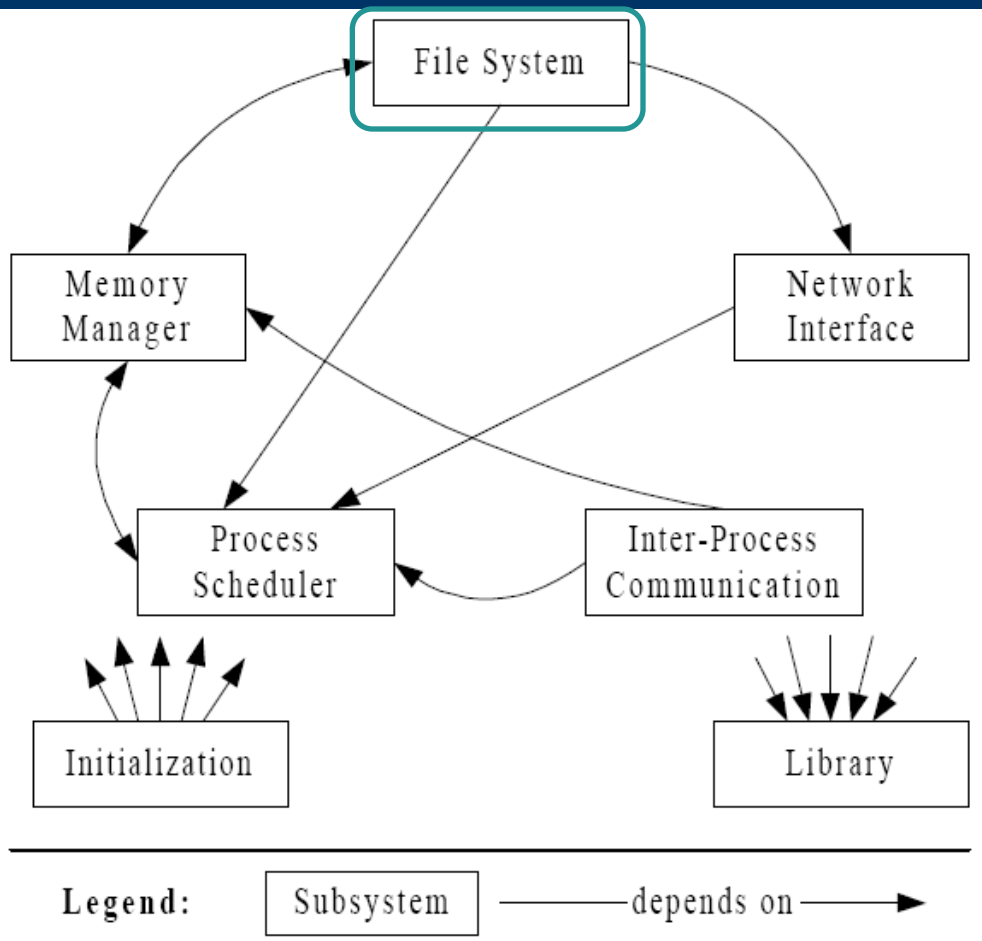
Terminology

- Conceptual Architecture
  - How developers think of a system; Relations meaningful to developers
  - Analogy: Blue Print of the House
  - By Reviewing Existing Documentation
  - Essential Relations
- Concrete Architecture
  - Relations that exists in a system
  - Analogy: Actual Architecture of the House
  - By Examining the Source Code
  - Implementation Specific Knowledge

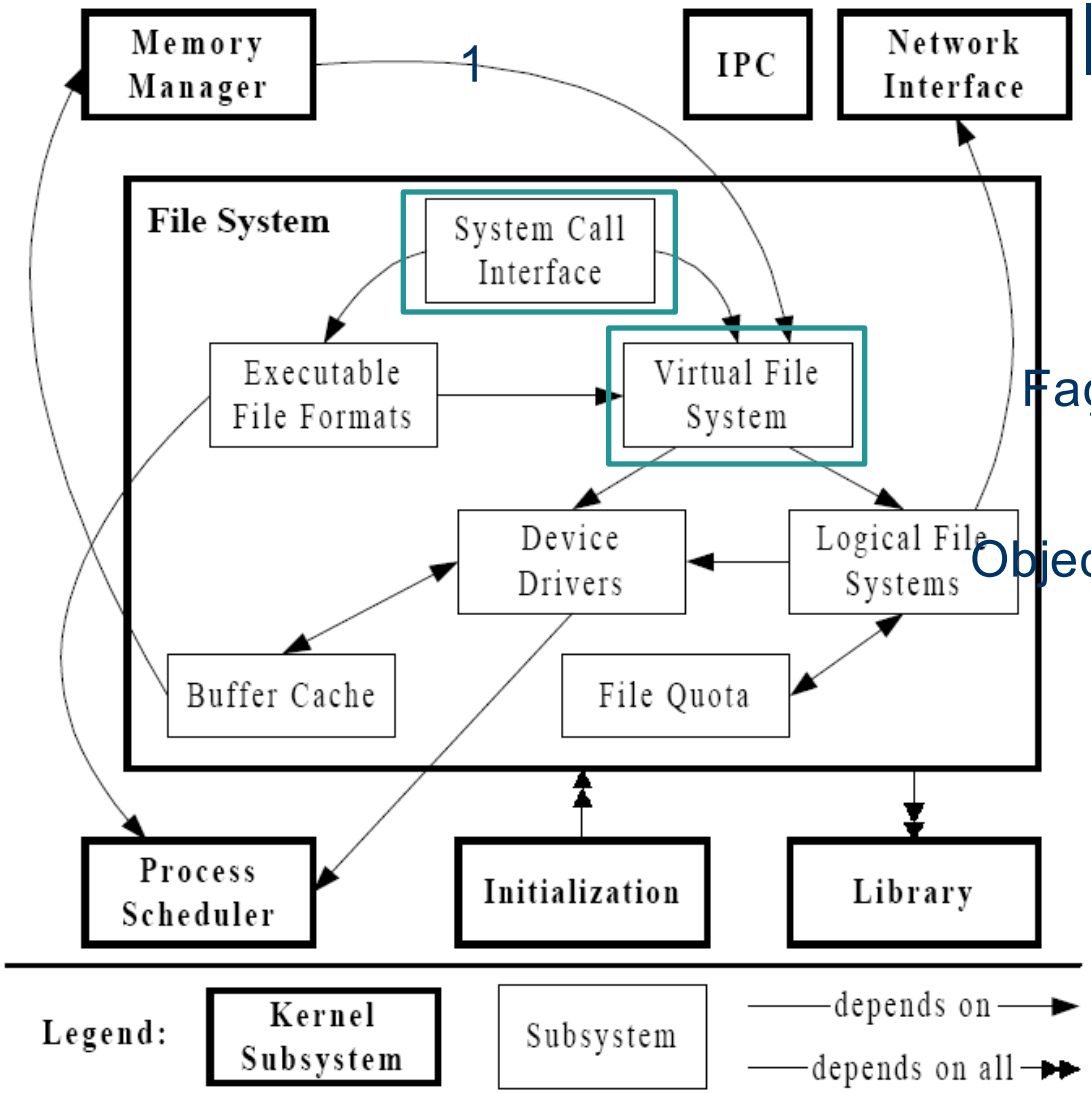
The Linux Kernel

- Responsible for process, memory, and hardware device management
  - Different from the Linux System
- Linux System: 10 KLOC in 1991 to 1.5 MLOC in 1998
- The studied Linux Kernel is 800 KLOC
- Open Source

Conceptual Architecture – Top Level



Conceptual Architecture – File System



Façade Pattern

Object Oriented Style

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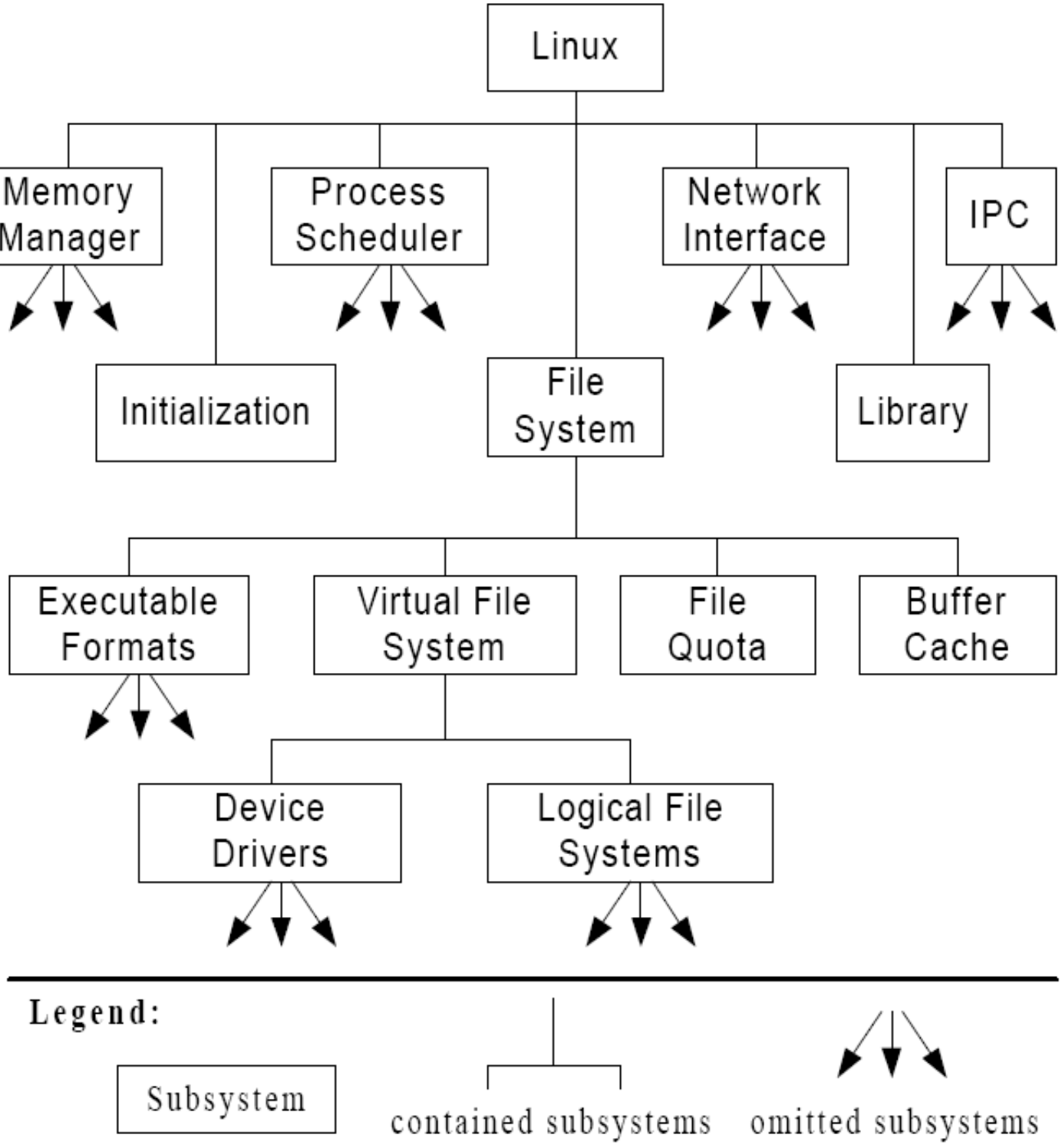
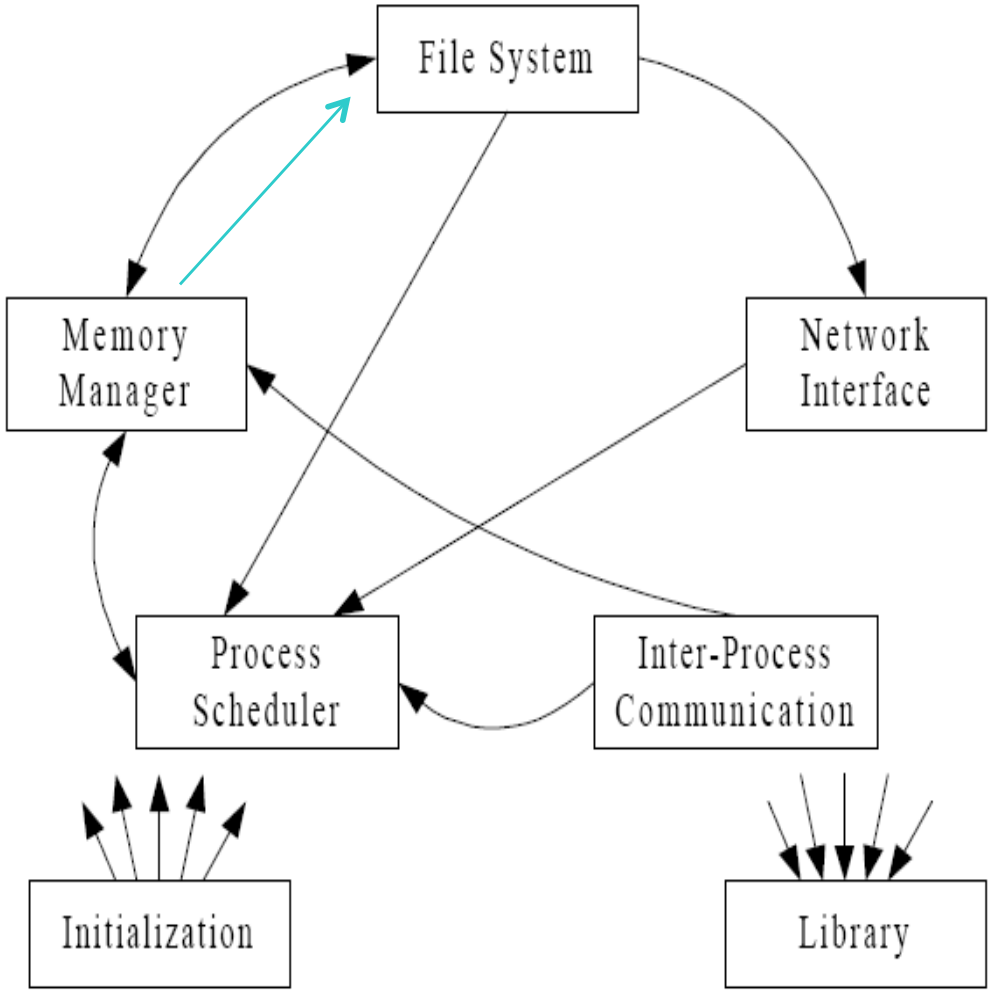
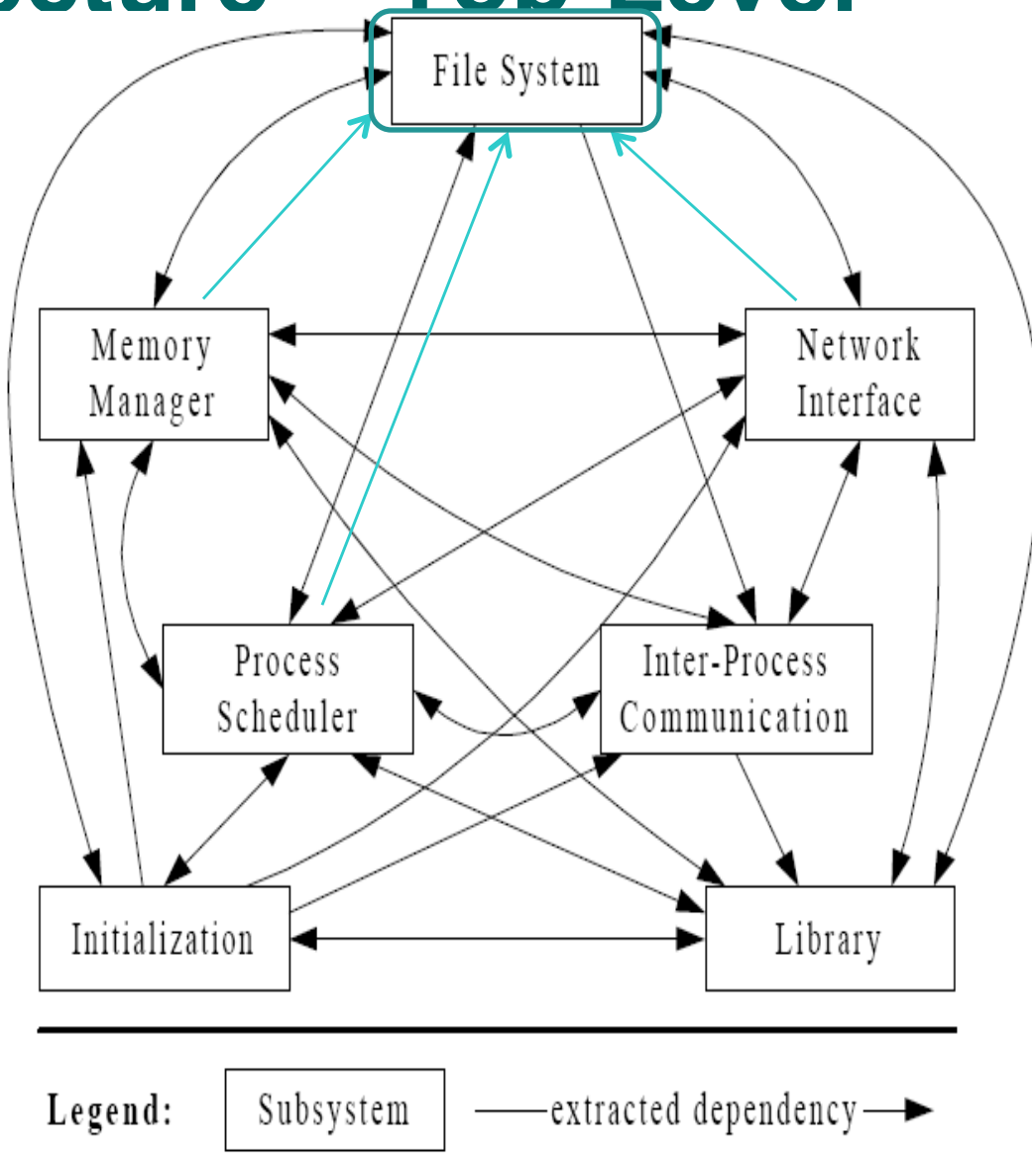
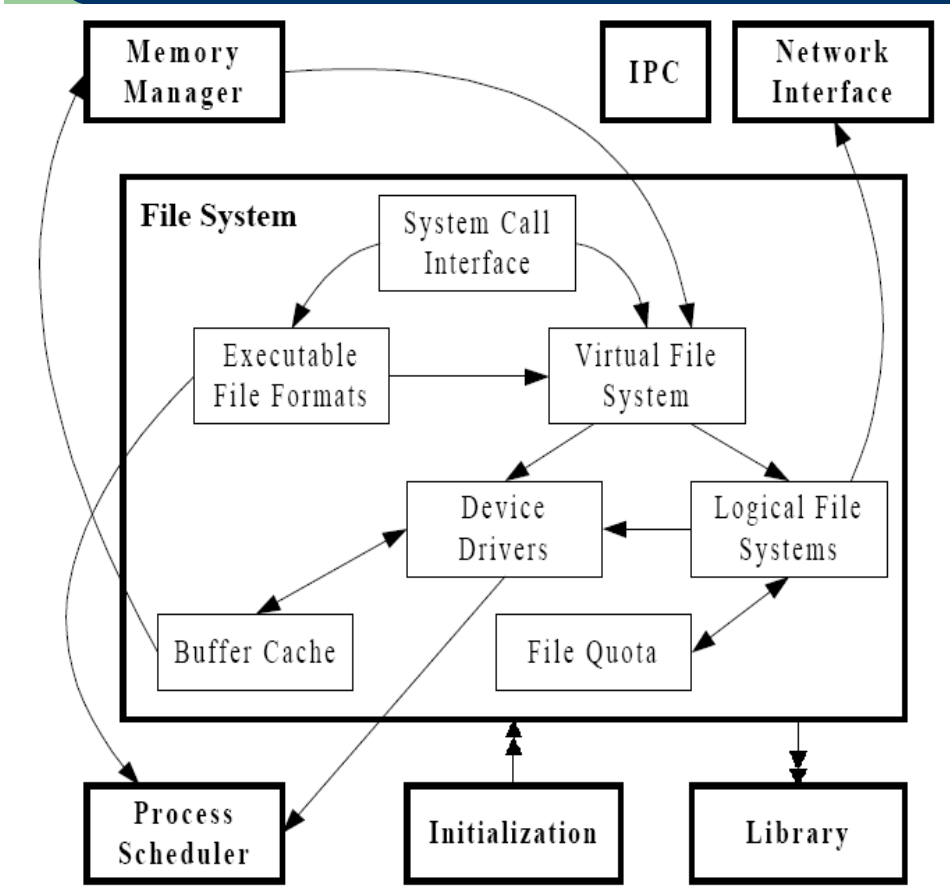

Linux
Memory Manager
Process Scheduler
Network Interface
IPC
Initialization
File System
Library
Executable Formats
Virtual File System
File Quota
Buffer Cache
Device Drivers
Logical File Systems
Legend:
Subsystem
contained subsystems
omitted subsystems

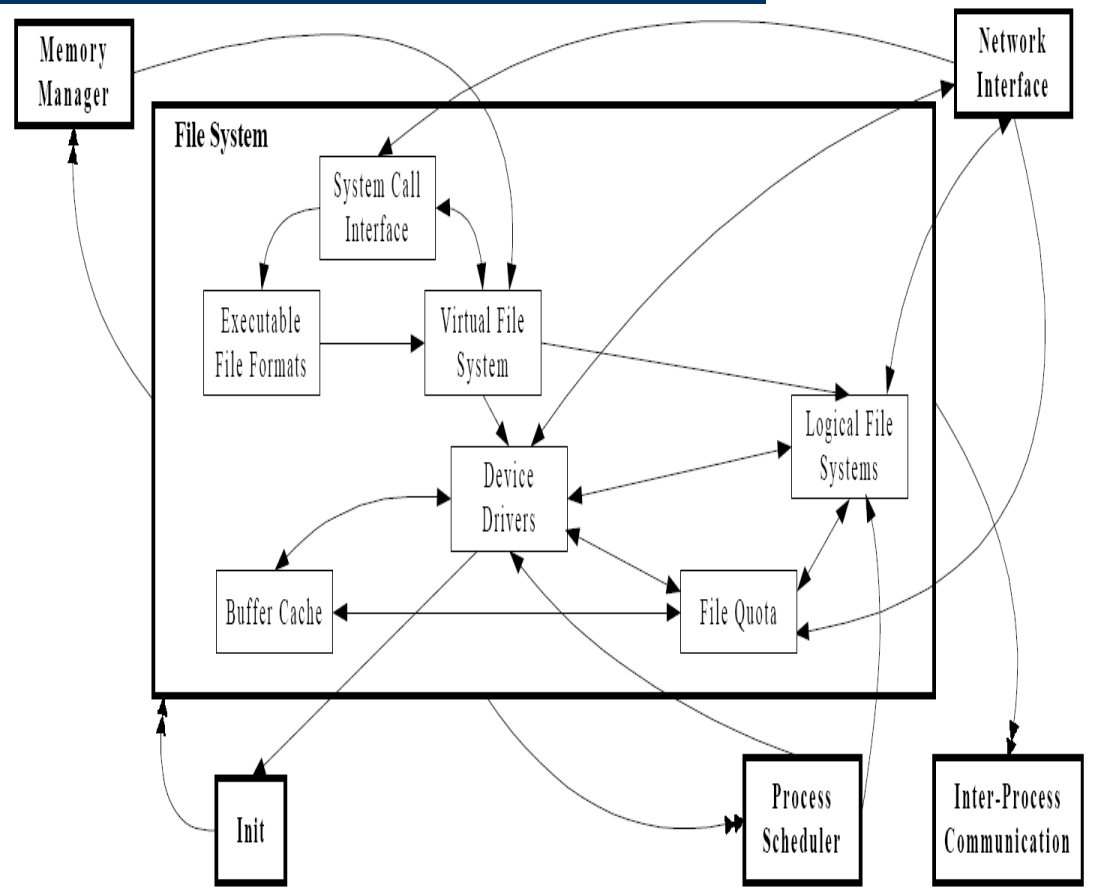
Concrete Architecture – Top Level



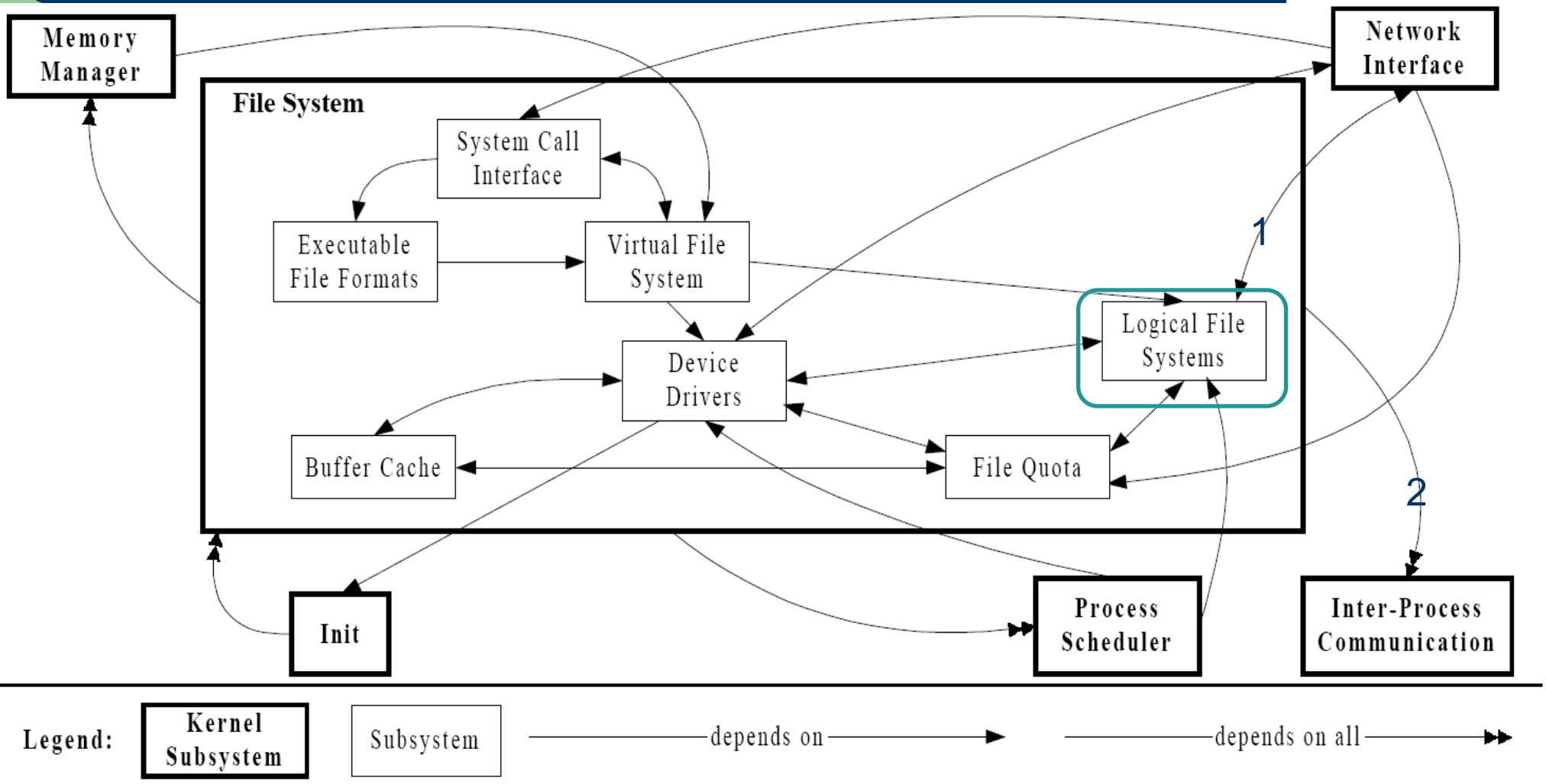


Concrete Architecture – File System

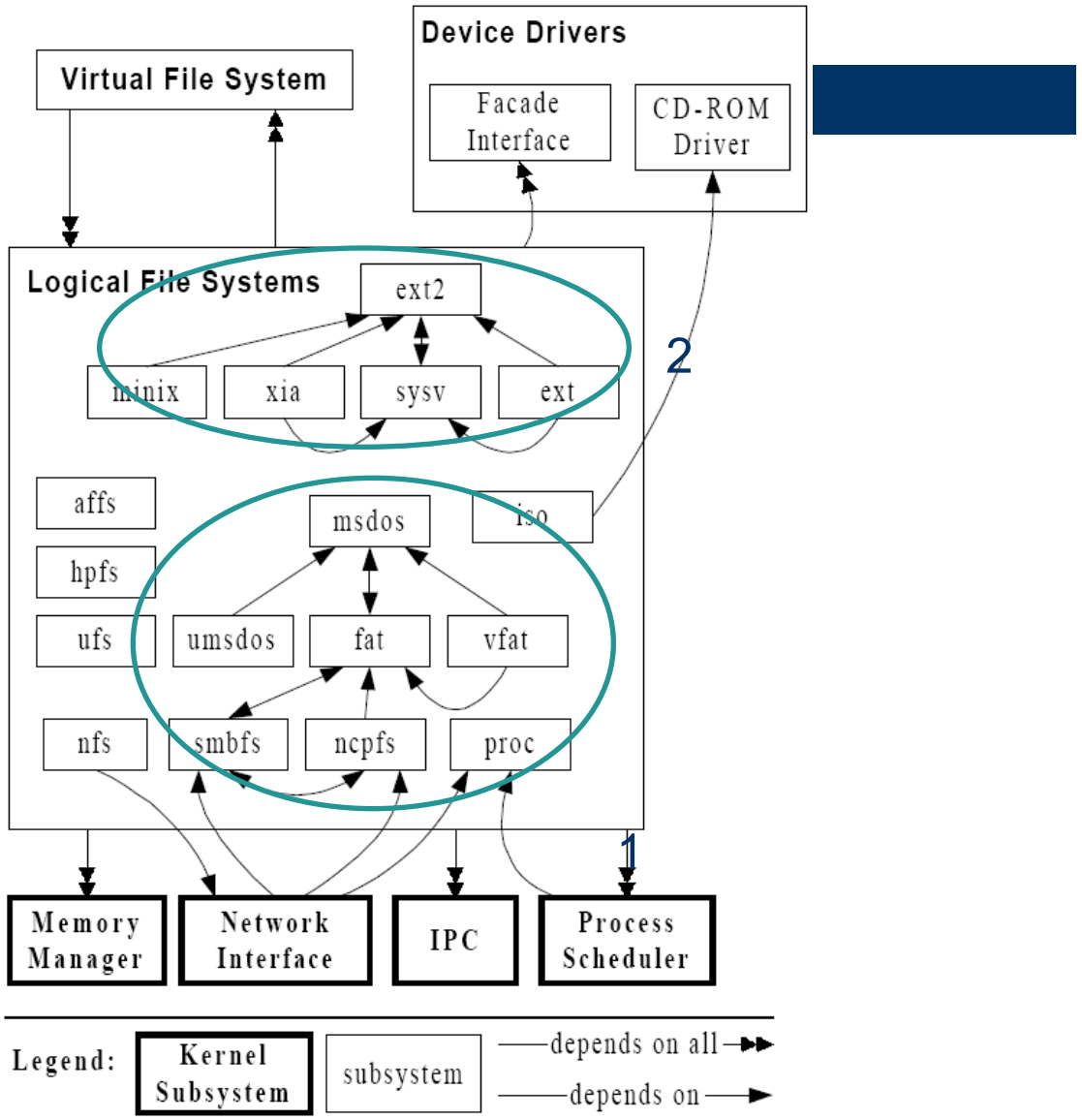




Concrete Architecture – File System



Concrete Architecture – Logical File System



Why Conceptual Architecture and Concrete Architecture Not Match?

- Missing Relations in Conceptual Architecture
- More Functionalities
  - For example, Process Scheduler
- Use Different Mechanisms
- Improve Efficiency by Bypassing Existing Interfaces
- Exist for Developer Expediency
  - “The read-only stuff doesn’t really belong here, but any other place is probably as bad and I don’t want to create yet another include file.”

What To Do Next?

- Restructure to Remove Unexpected Dependencies
  - Header Files
  - Lower Coupling
- Refine Conceptual Architecture
  - Not Hinder System Understanding

Conclusions

- Conceptual and Concrete Architecture for the Linux Kernel
- Similar Work Needs to Be Done for the Firefox Report
- Sample Reports:
  - Conceptual Architecture: http://plg.uwaterloo.ca/~itbowman/CS746G/a1/
  - Concrete Architecture: http://plg.uwaterloo.ca/~itbowman/CS746G/a2/