
Intelligent I/O Architecture

I₂O

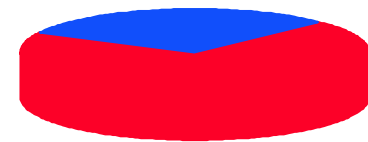
PCI Spring Developers' Conference and Expo

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I/O Dilemma

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- I/O Scalability is Limited
 - Performance
 - Connectivity
- Introduction of New I/O Technology
 - Slow to market
 - Development funds limited due to maintenance costs

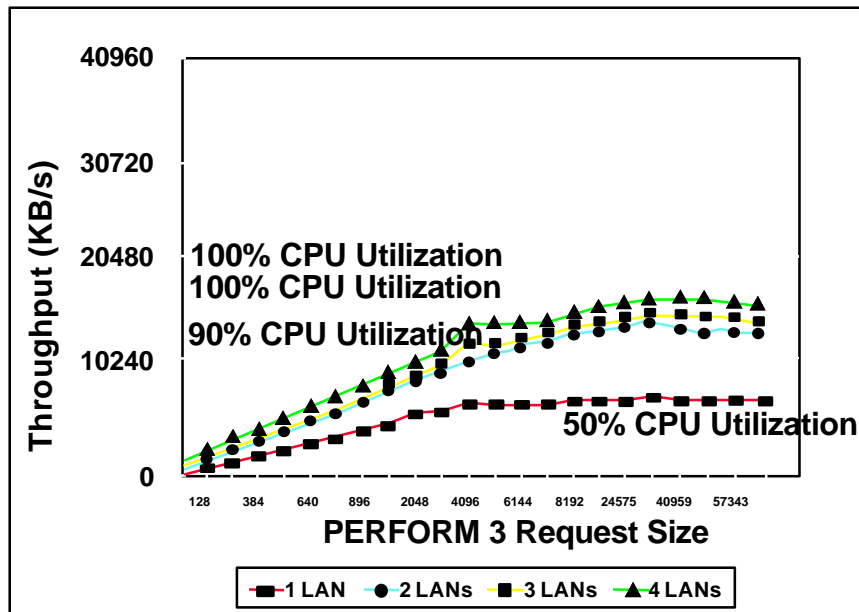


■ Maintenance
■ New Development

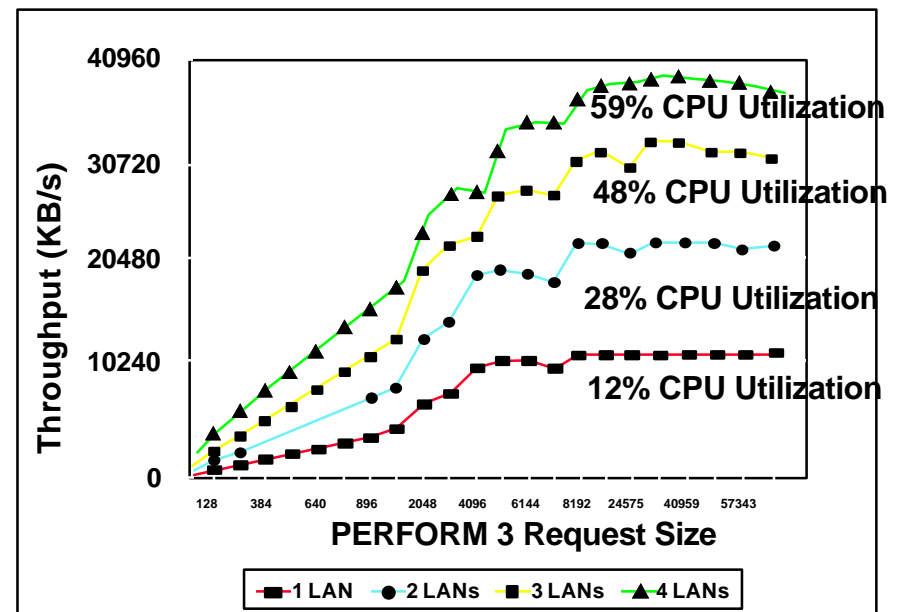
Intelligent I/O Performance Analysis for Fast Ethernet



Server performance with four PRO/100 adapters



Server performance with four intelligent PRO/100 Server Adapters

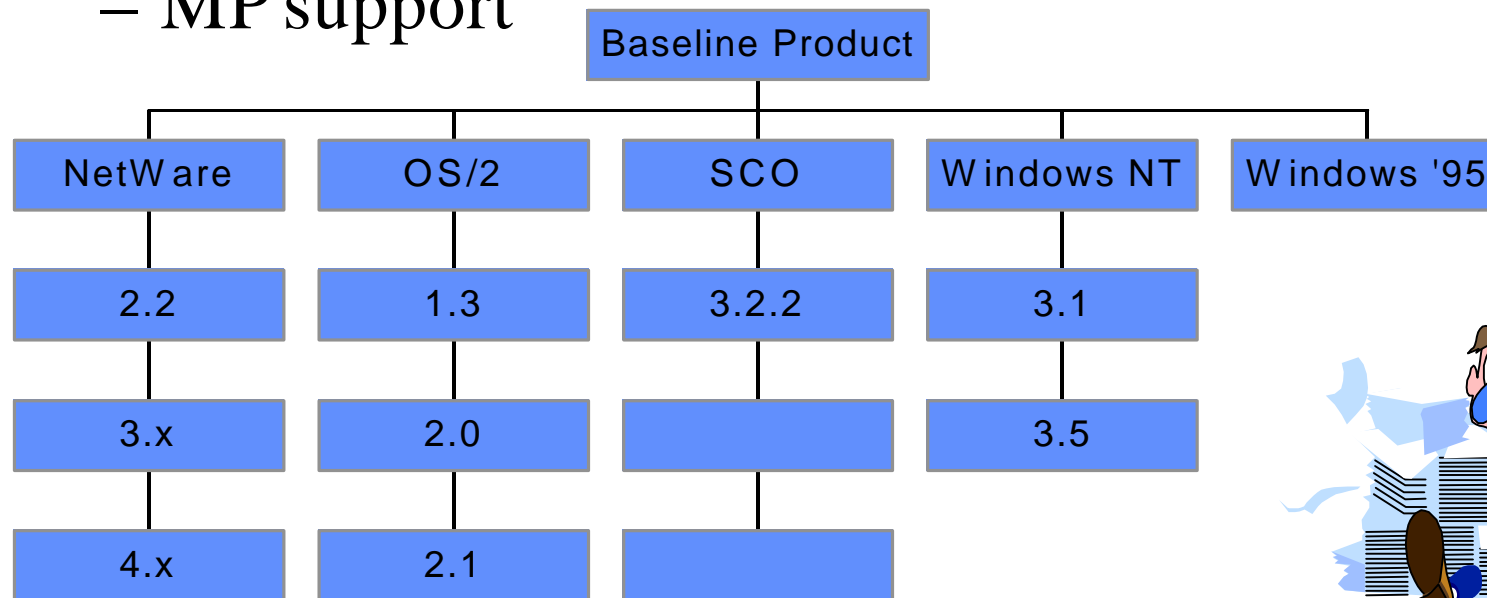


Source: Intel Benchmarks

I/O Dilemma

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- Device Driver Dilemma
 - Proliferation of network operating systems
 - MP support



Architecture Objectives

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- Create standard OS interface to system I/O
- Enable intelligent I/O devices
- Interoperability between I/O devices
- Enable Peer-to-Peer I/O Communication
- Enable rapid deployment of I/O technology
- Co-exist with legacy drivers

Create an industry standard I/O architecture.

Industry Benefits

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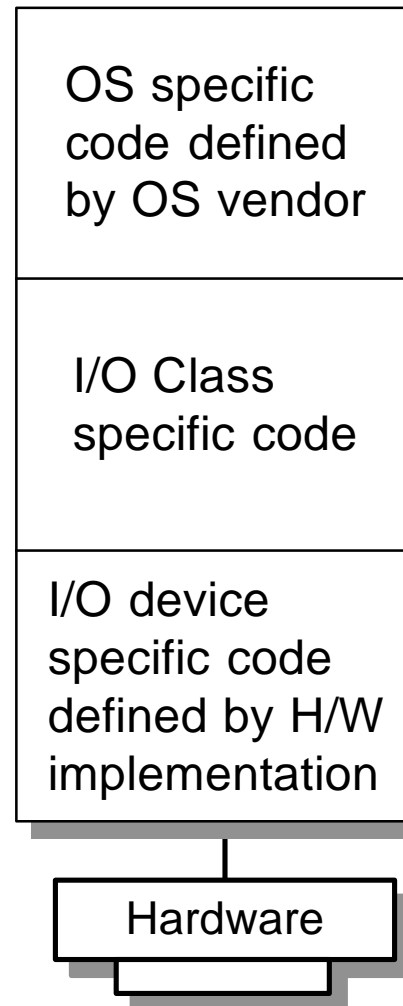
- Consistent driver model across multiple operating environments
 - Device firmware is OS & system independent
 - Enable a single binary image for a target execution environment
- Reduced device driver development costs
- Focus on introduction of new technology
- Reduced cost of intelligent I/O



Abstract the I/O subsystem & improve system throughput

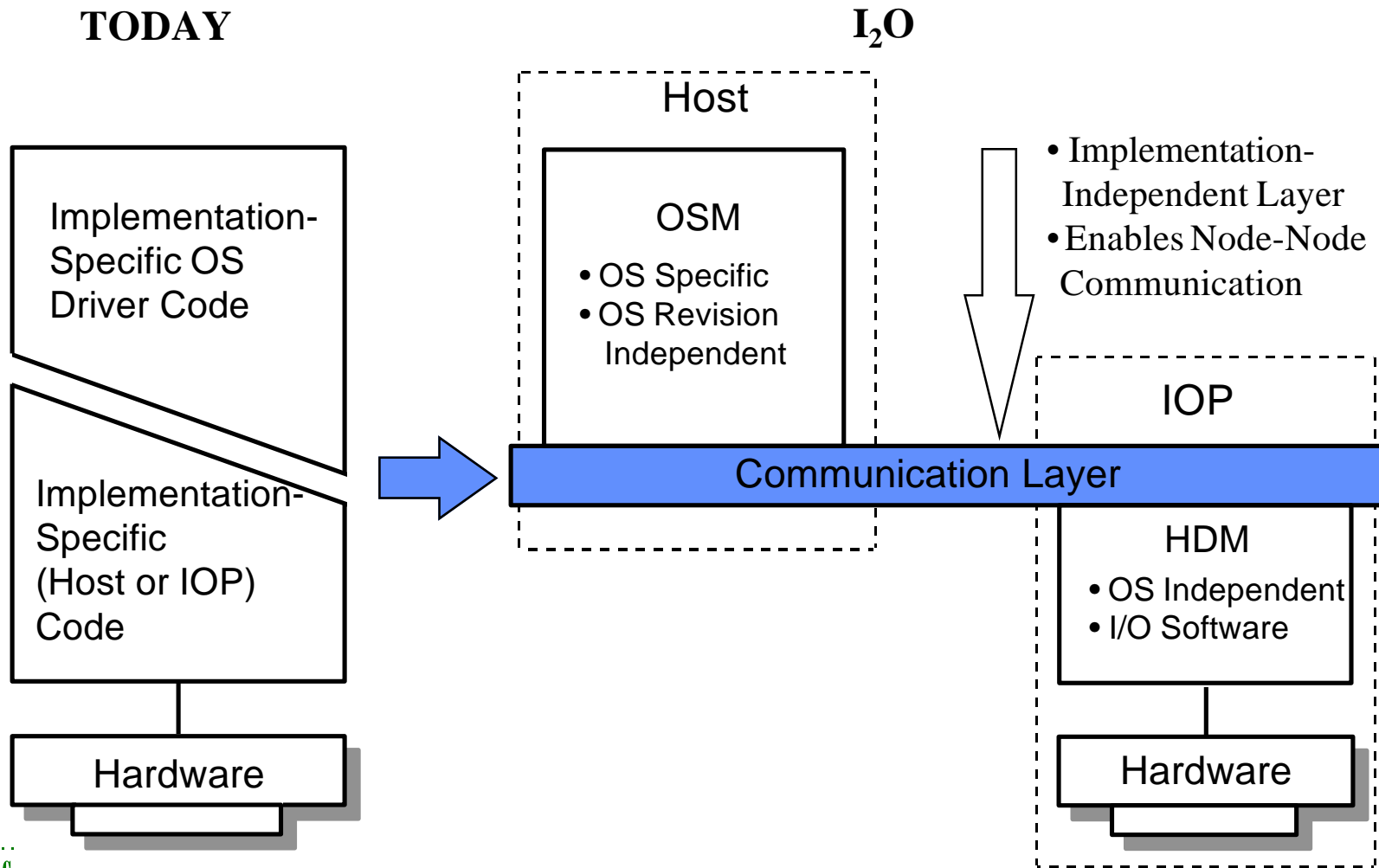
Typical I/O Device Driver

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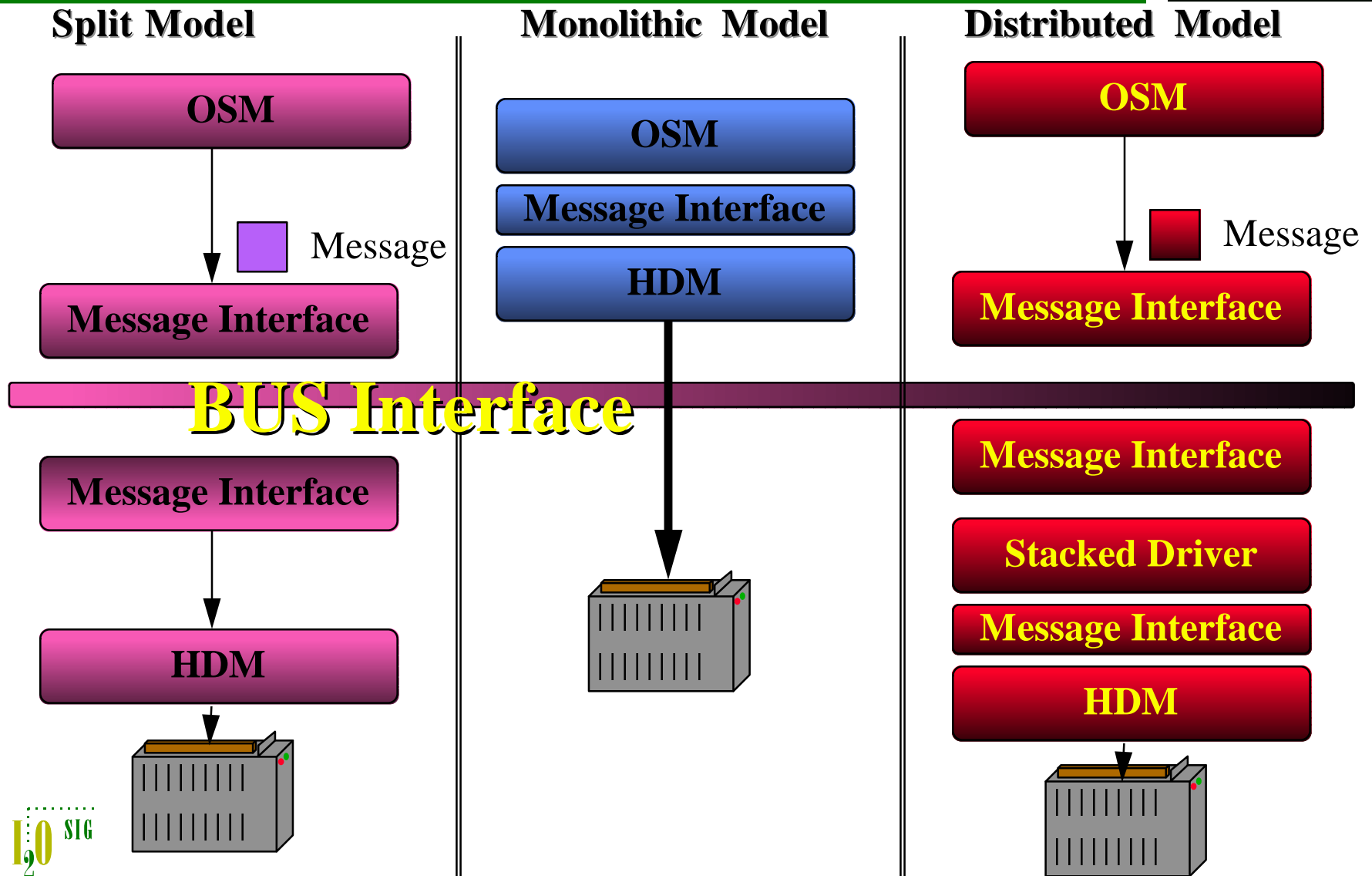
I₂O Split Driver Model

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Conceptual Overview

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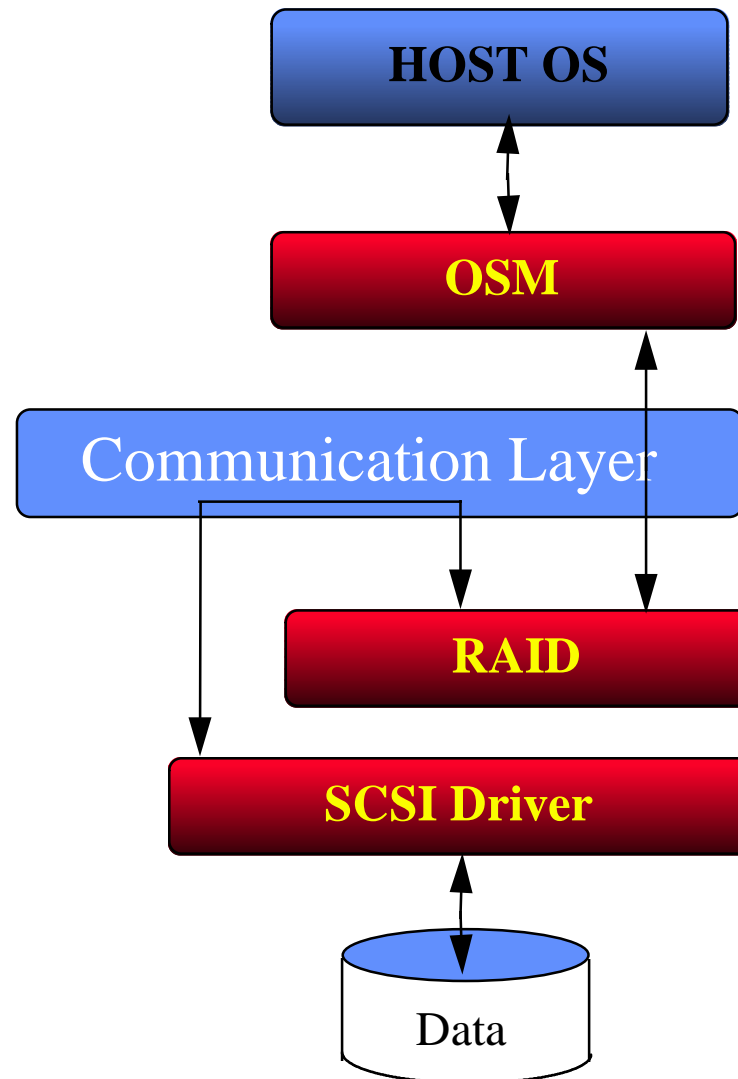


Layered Architecture

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*Layered architecture
promotes stackable drivers*

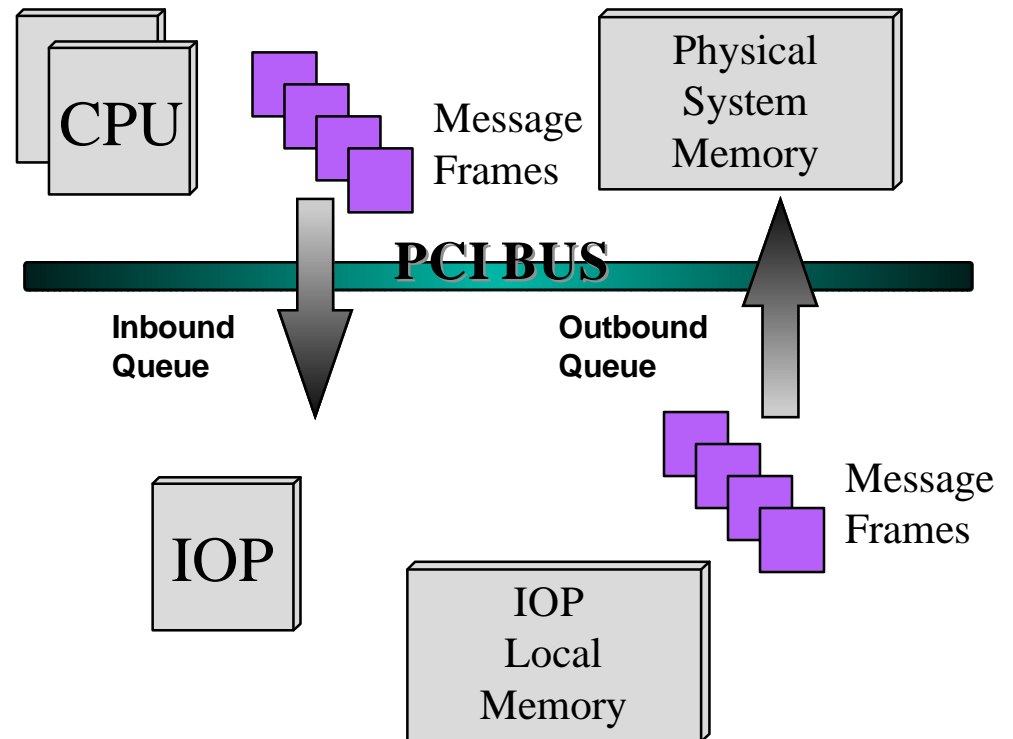
*Value-add at multiple
levels*



I₂O Message Interface

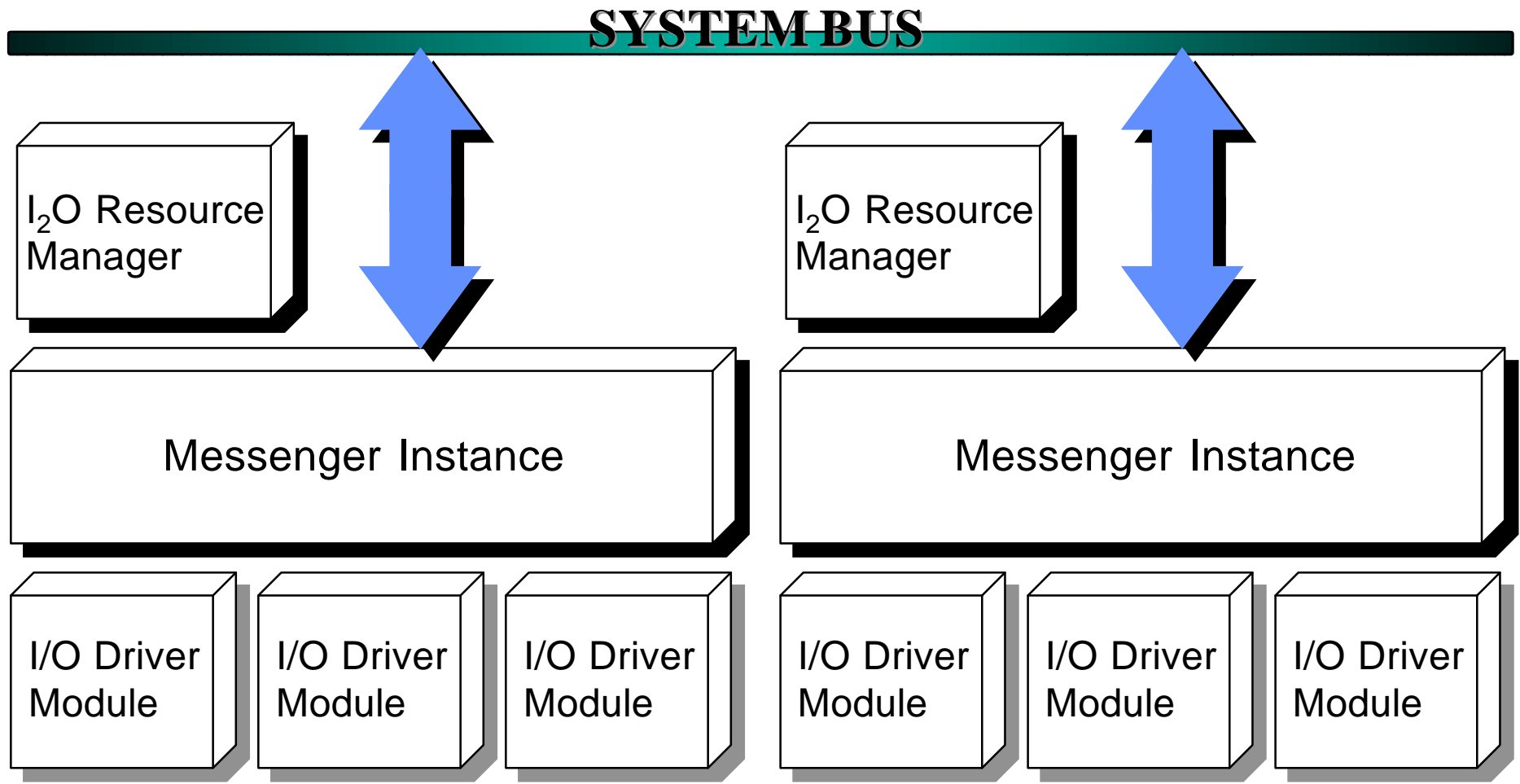
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- Allows OS to *batch* I/O requests
 - Eliminates CPU stall during I/O transactions
 - Increases system TPS
- Consistent hardware interface
 - Simplified software model for I₂O driver
 - OS support becomes pervasive
 - Narrows requirements for compliance



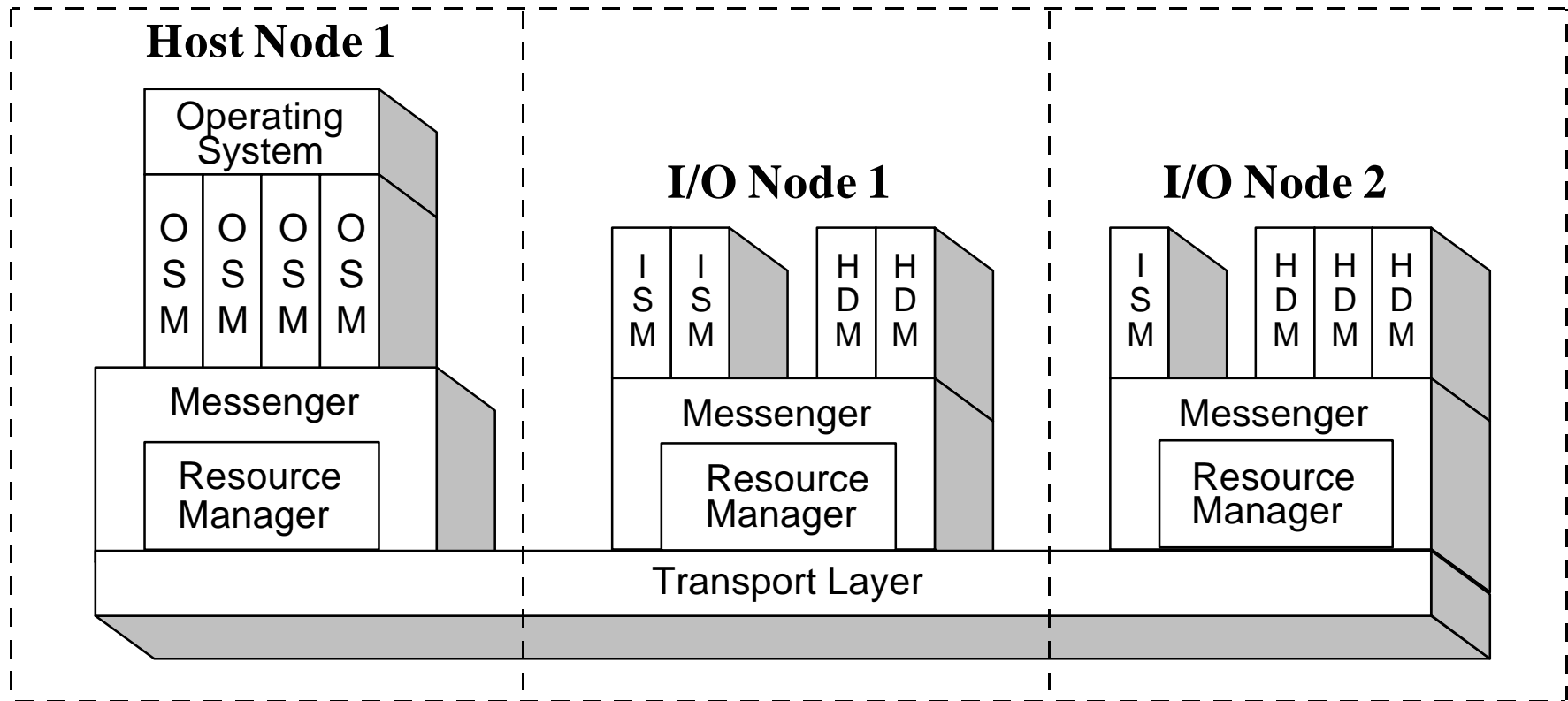
Communication Service Model

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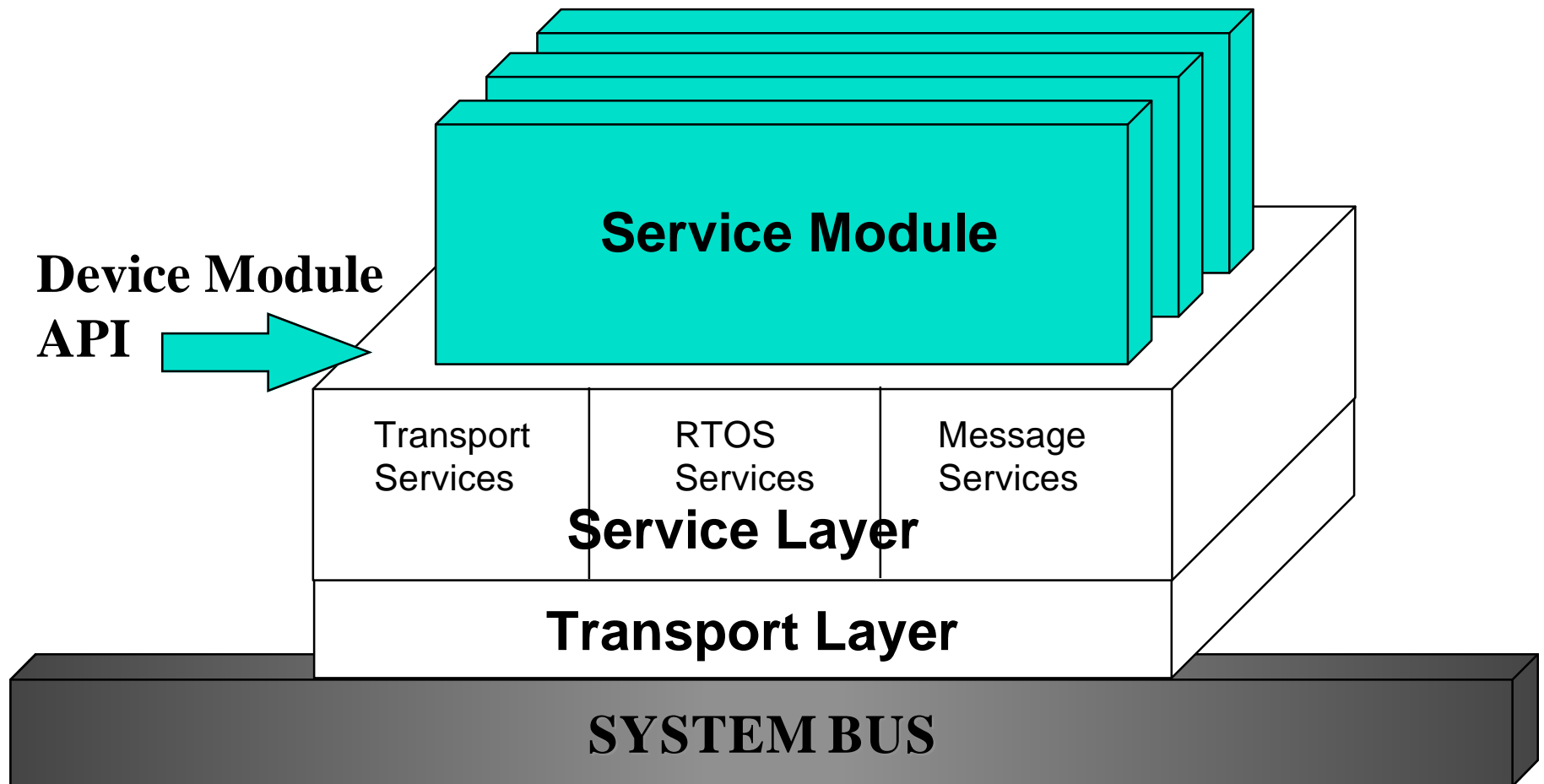
I₂O Software Architecture

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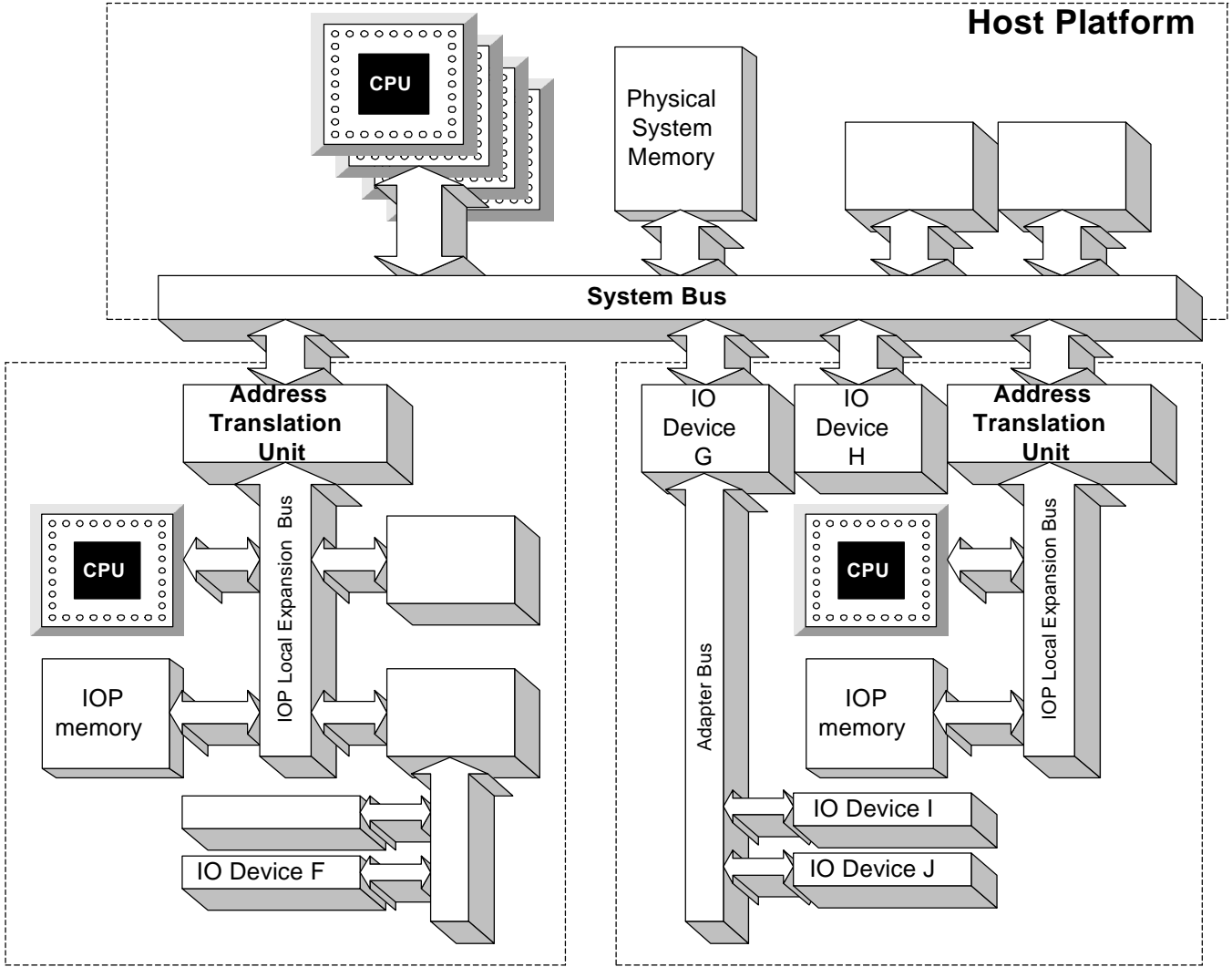
I₂O Message Service Model

I₂O



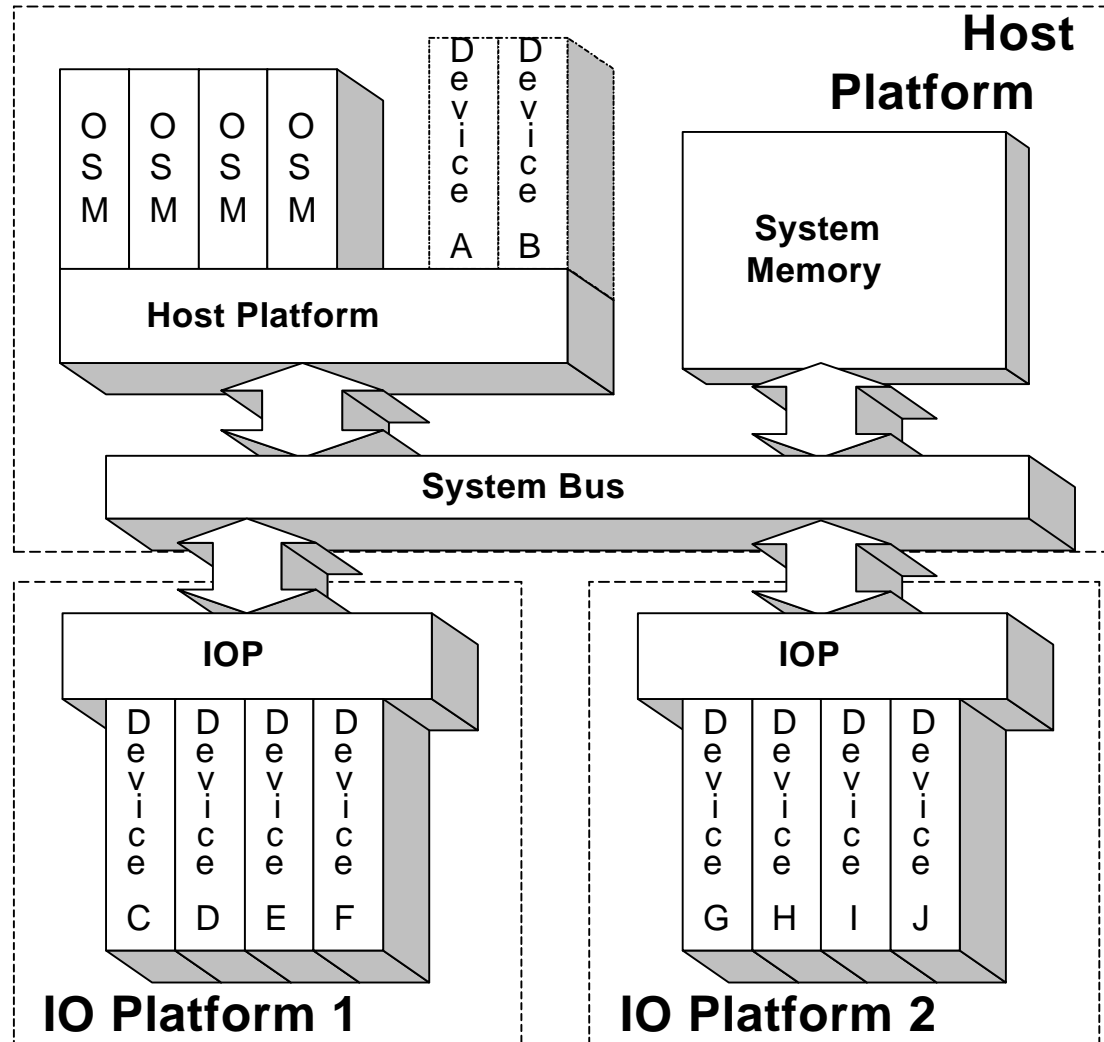
I₂O System Model - Physical View

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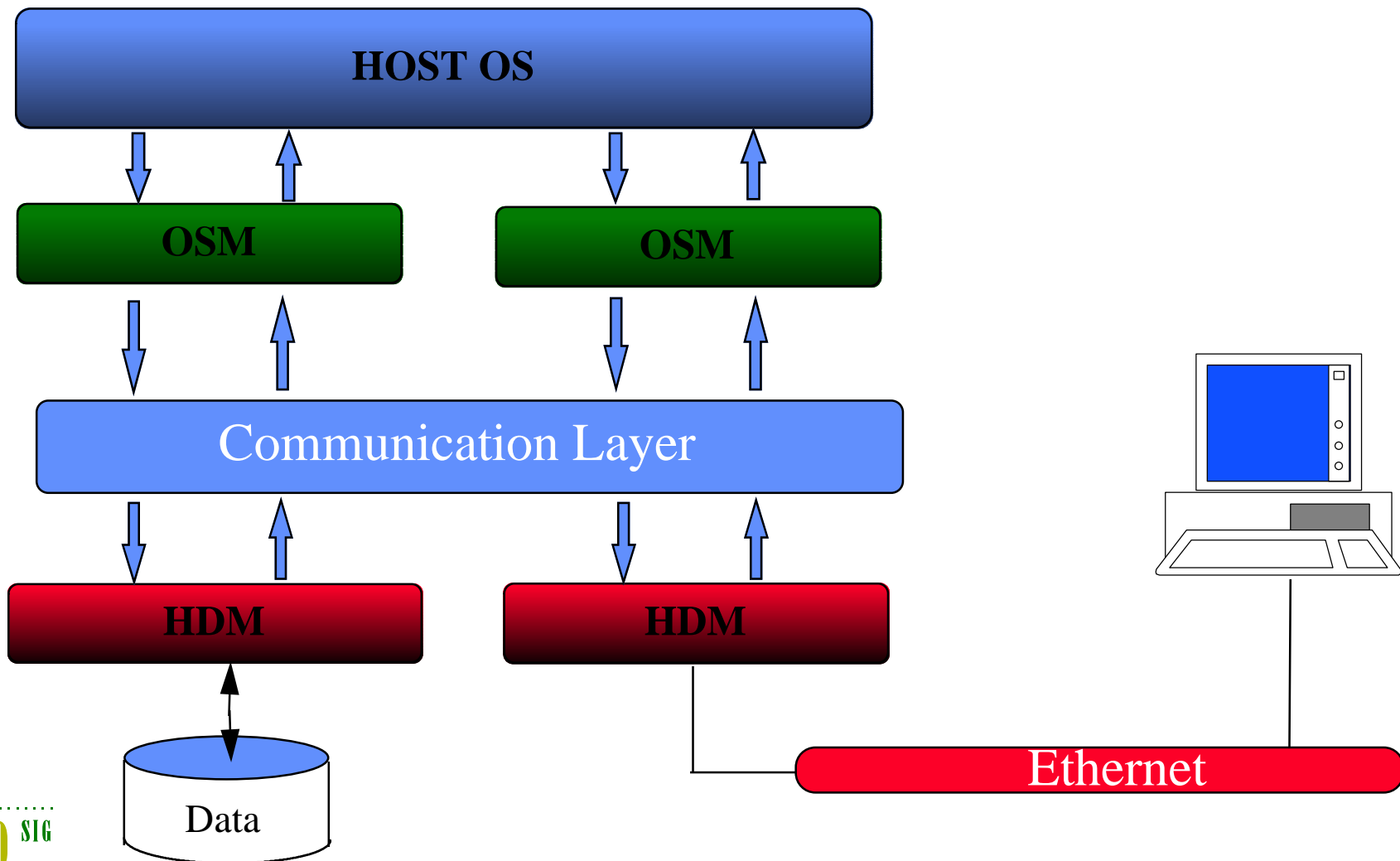
I₂O System Model - Logical View

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Communication Model

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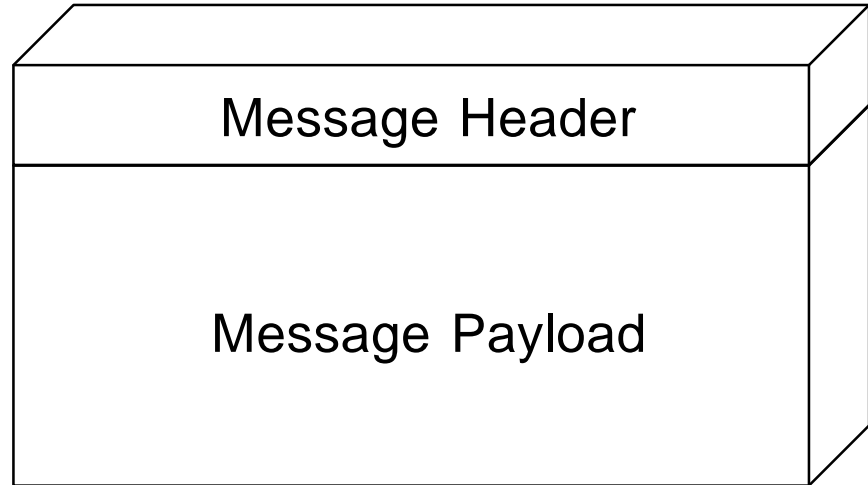


I₂O Message Frame

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Two primary parts:
fixed size header &
variable-size payload.

Two basic categories:
request messages &
reply messages.



I₂O Message Types

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- Utility Messages
 - common across all I/O classes
 - provide basic level of functionality for negotiation & configuration
- Base Messages
 - typically describe I/O requests or services requests
- Private Messages
 - allow for extensions to the base set of messages within an I/O class

I₂O Class Definitions

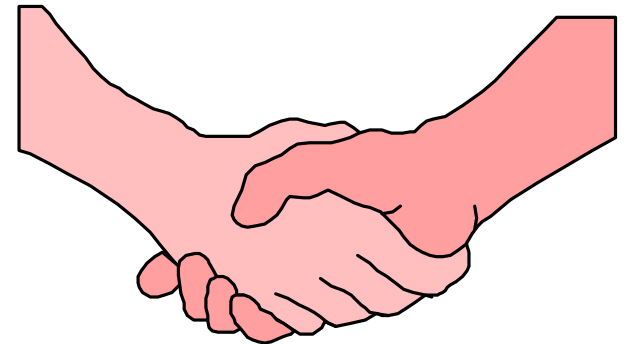
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- Executive Class - Used to communicate between Messenger Instances
- Block Storage - Abstraction of block storage device: hard disk drive, CD ROM, etc.
- LAN - Abstraction of LAN port: ethernet, token ring, etc.
- SCSI Peripheral - Abstraction of SCSI device
- SCSI Adapter - exposes an interface to the host bus adapter

Industry Partnership

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- Take Advantage of Industry Expertise
 - NOS Vendors
 - I/O Adapter Vendors
 - System Integration Vendors
- Develop the Specification
 - Create an Open Architecture
 - Validate with a Proof-of-Concept Platform
- Form a Special Interest Group



I₂O SIG Membership



Steering Committee

Members

Compaq
HP
Intel
Microsoft
NetFrame
Novell
Symbios Logic
3Com



Contributing Members

Accelerate Technologies SMC
Adaptec SysKonnnect
AMI Tandem
Dell The Santa Cruz Operation
DPT Topmax
Harris & Jeffries Tricord
ISI V3 Semiconductor
Mylex Corp Veritas Software
PLX Western Digital
SCO Wind River Systems
Xpoint Technologies

I₂O SIG Information

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<http://www.I2OSIG.org>



Associate Members

Acer America
Annabooks
Cyclone Microsystems
Fore Systems
ICP Vortex
Siemens Nixdorf

I₂O Initiative Overview

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- Multiple Levels of I₂O SIG Participation
 - Steering Committee (*includes 3 elected members*)
 - Contributing Member (*1 company/1 vote*)
 - Associate Member (*no vote*)
- Establish Working Committees *
 - Participation limited to Contributing Members
 - Multiple participation allowed
- Specify Compliance Requirements *

* At the discretion of the Steering Committee

I₂O SIG Working Committees

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- Clustering/Fault Tolerance
- Peer-to-Peer
- Server Management
- Fibre Channel
- Certification
- ATM/WAN
- 64 Bit
- Storage/RAID
- Marketing/Public Relations
- IRTOS

Summary

I₂O

- I₂O Architecture is a solution to I/O standardization and performance bottlenecks
- I₂O Architecture is not dependent on a single microprocessor or bus architecture
- I₂O Architecture defined by proven leaders from all segments of the server and I/O industry
- Membership of the I₂O SIG is growing to address new technologies