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Network Adapters for NFS at 10Gb and Beyond

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Overview

- Networking Issues at 10Gb and Beyond
  - Protocol Processing
  - Memory Bandwidth
- The Role of the Network Adapter
  - Standard NIC
  - TCP Offload Adapter
  - RDMA Adapter
  - NFS Acceleration Adapter
- Multi-Protocol Network Adapters
  - Flexible Solutions

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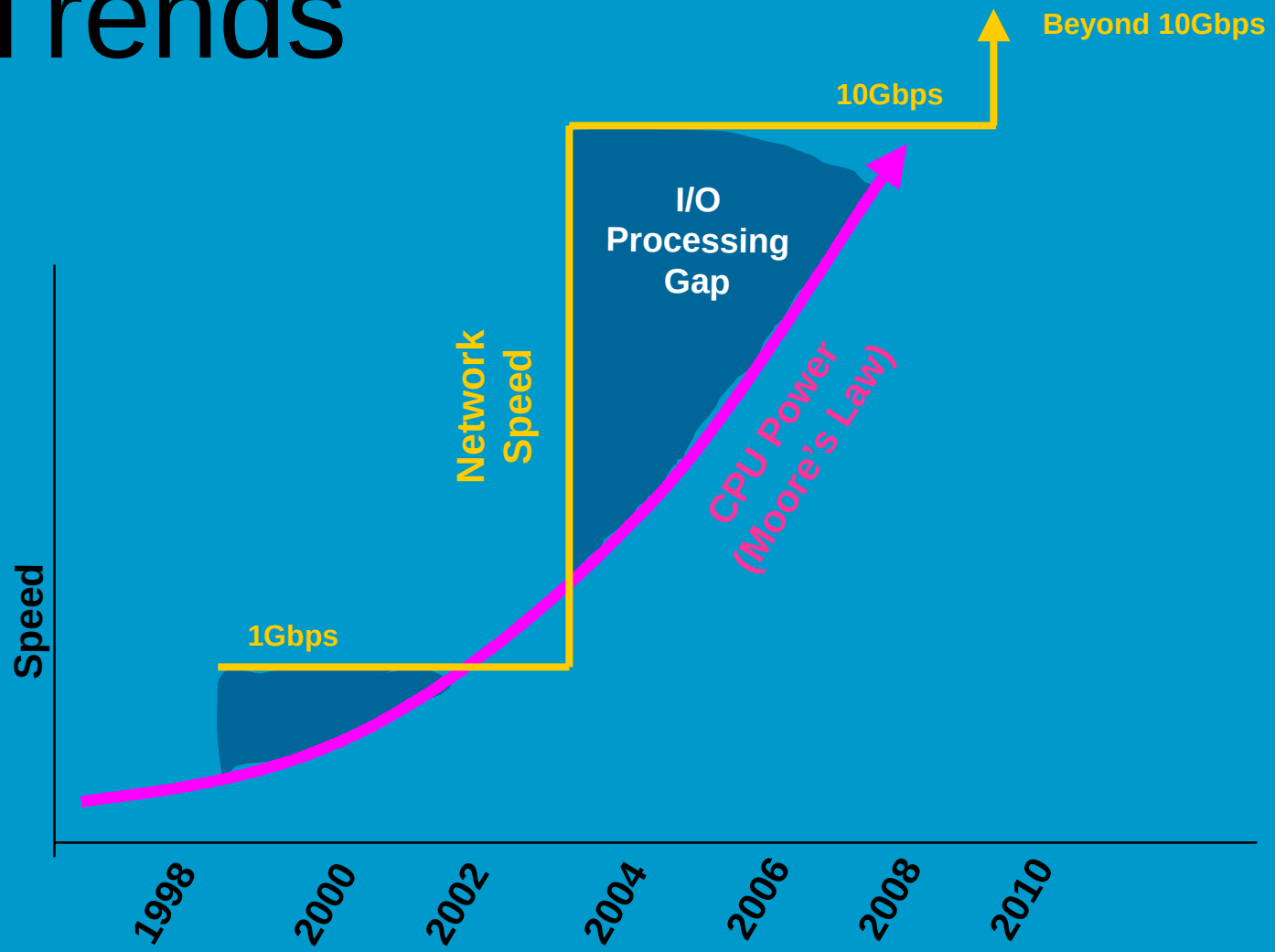
CPU and Network Trends



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10Gb Protocol Processing

- Requires a 10x Increase in I/O Processing
- Performance Limited by Host
  - Protocol Processing
  - Interrupts
  - Buffer Copies

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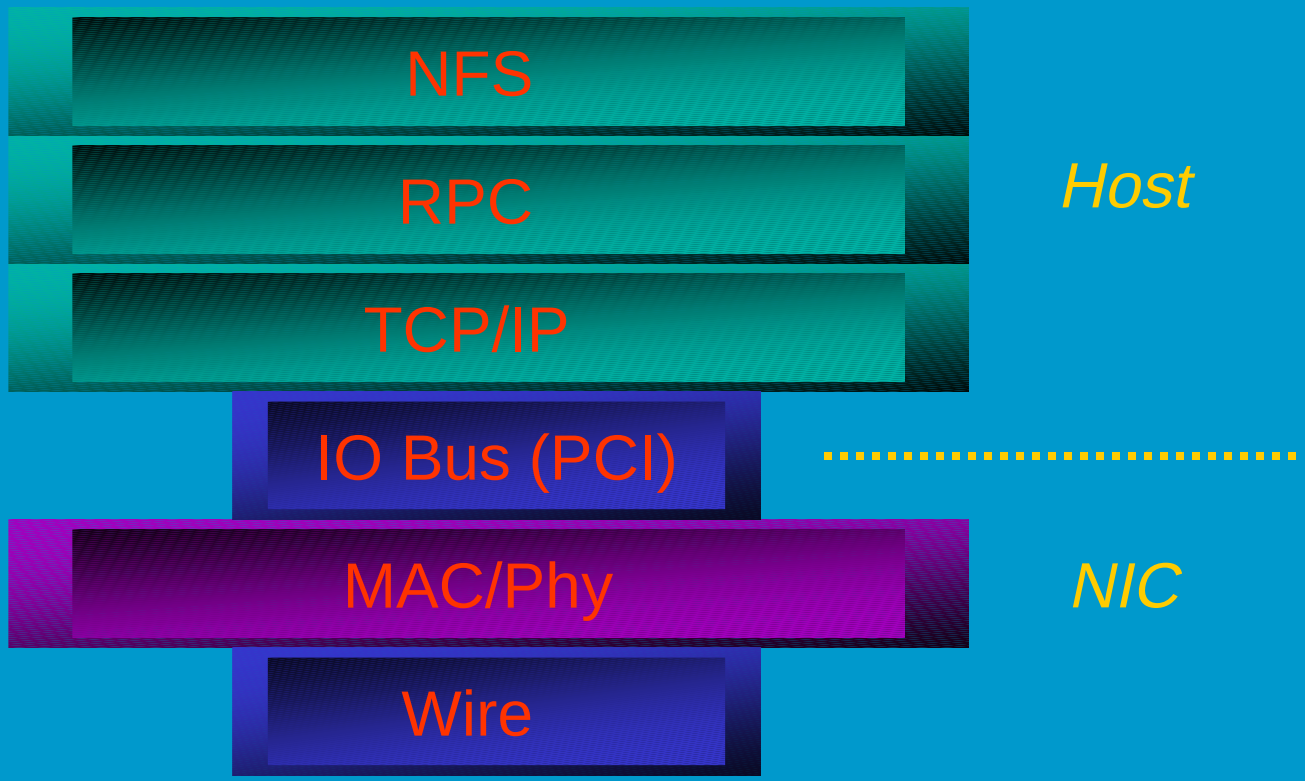
Standard NIC



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Standard NIC

- Will not Allow 10Gb Performance
  - TCP Processing on Host
  - Buffer Copy on Receive
- Overloaded Host CPU and Memory
  - Poor Application Performance

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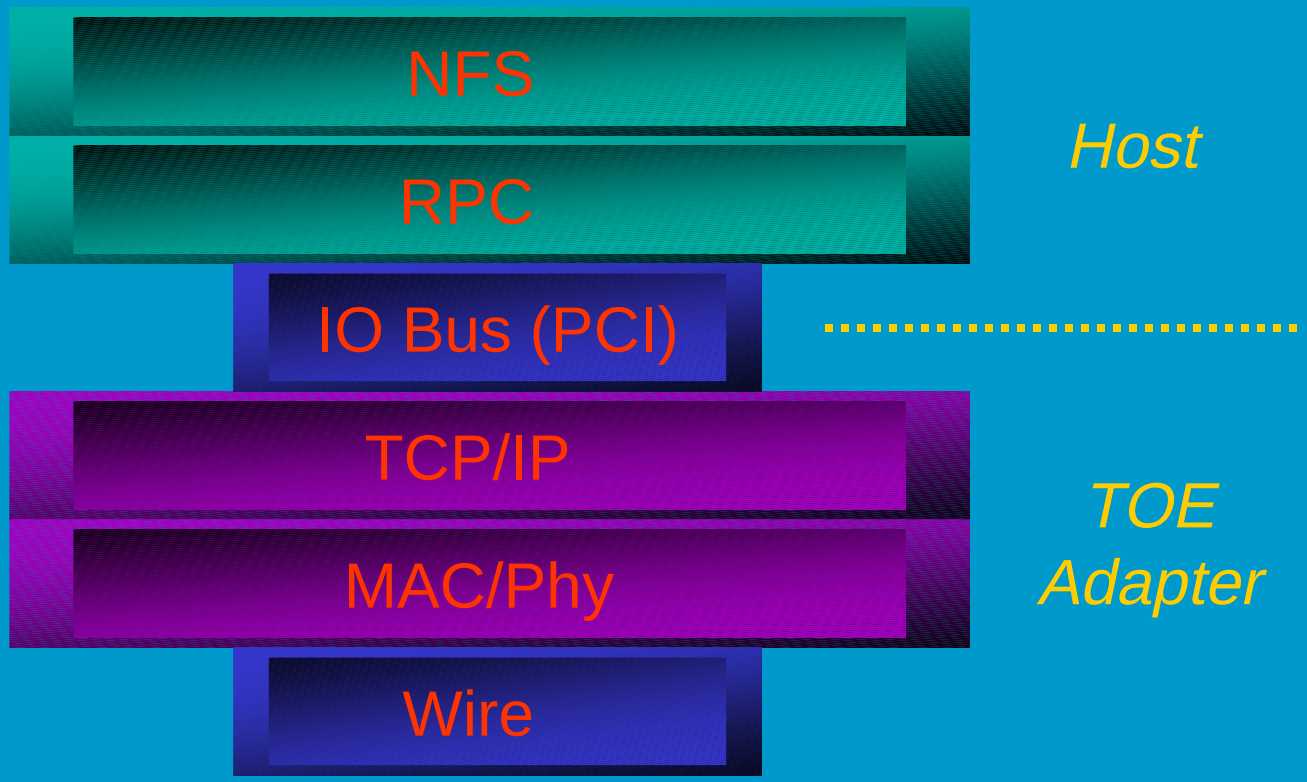
TCP Offload Adapter



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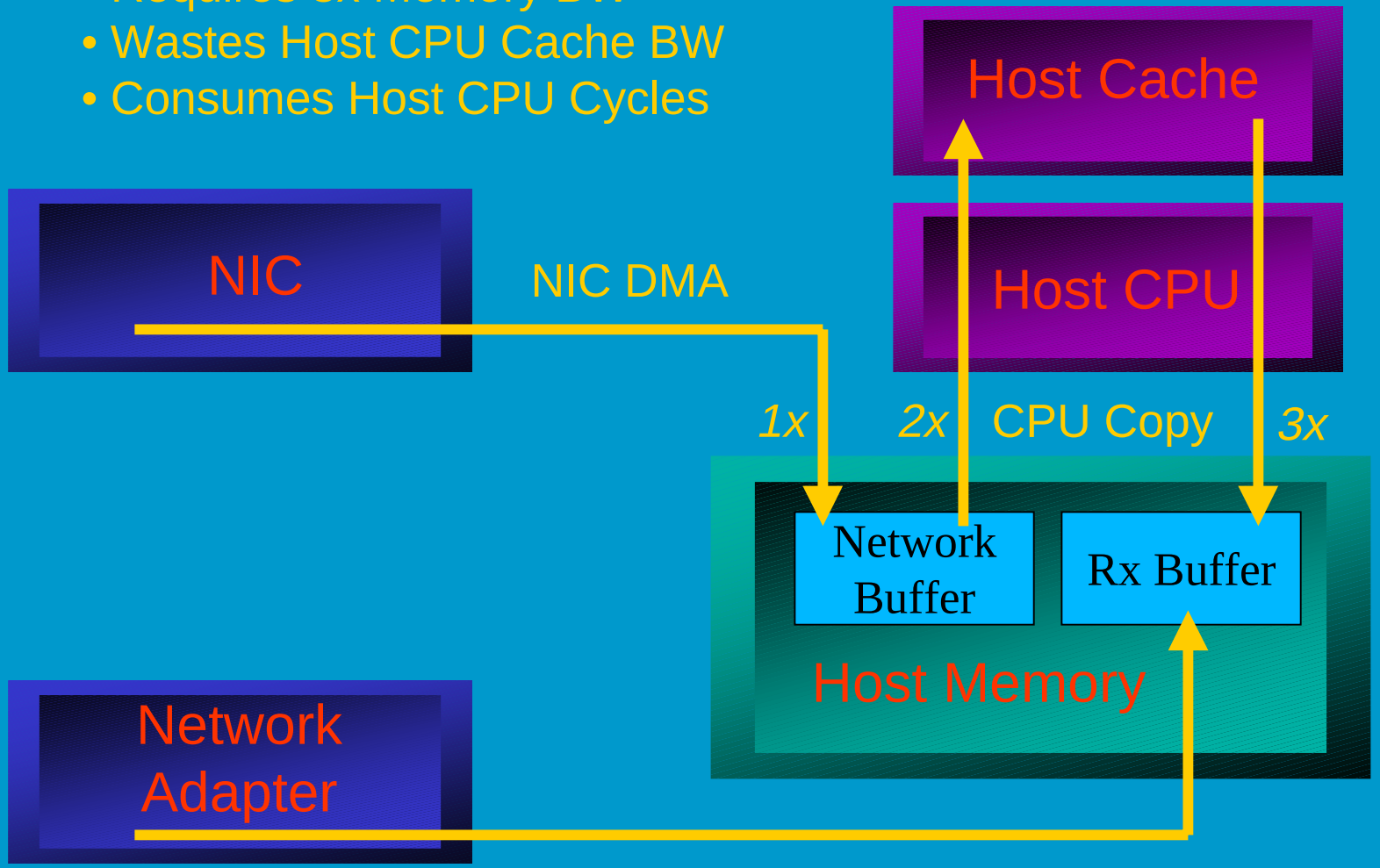
TCP Offload Adapter

- TCP/IP Processing on Adapter
  - Not Just TCP Assist
- Eliminates Host TCP Processing Requirements
- But…
  - Still Requires Buffer Copy on Receive

Direct Data Placement

Buffer Copy

- Requires 3x Memory BW
- Wastes Host CPU Cache BW
- Consumes Host CPU Cycles



Network Adapter Direct Data Placement (DDP)

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Memory BW Requirements

Wire Speed	Network BW (MB/sec)	Memory BW (MB/sec)
1 Gb/sec	125	375
10 Gb/sec	1,250	3,750

Memory BW = 3x Network BW due to Buffer Copy

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Zero Copy Receive with Remote DMA (RDMA)

- Direct Data Placement in Receive Data Buffer
- Requires 1/3 the Memory BW
- Eliminates Host CPU Copy Overhead

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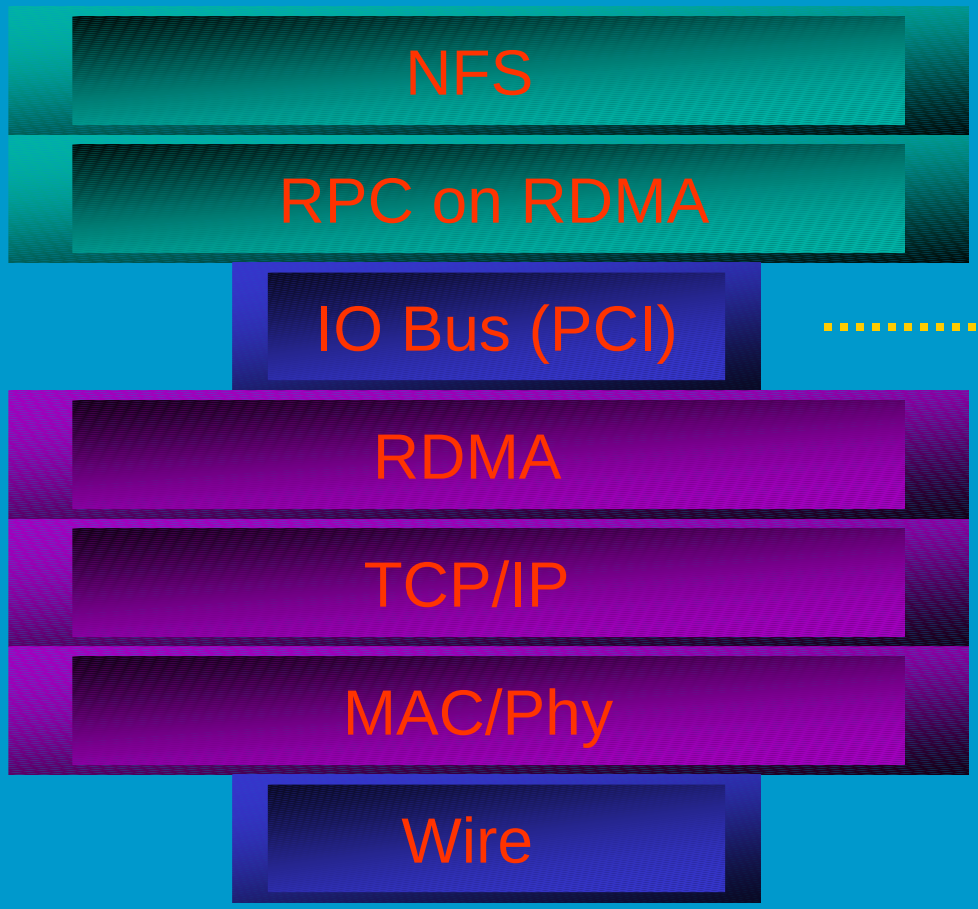
RDMA Adapter



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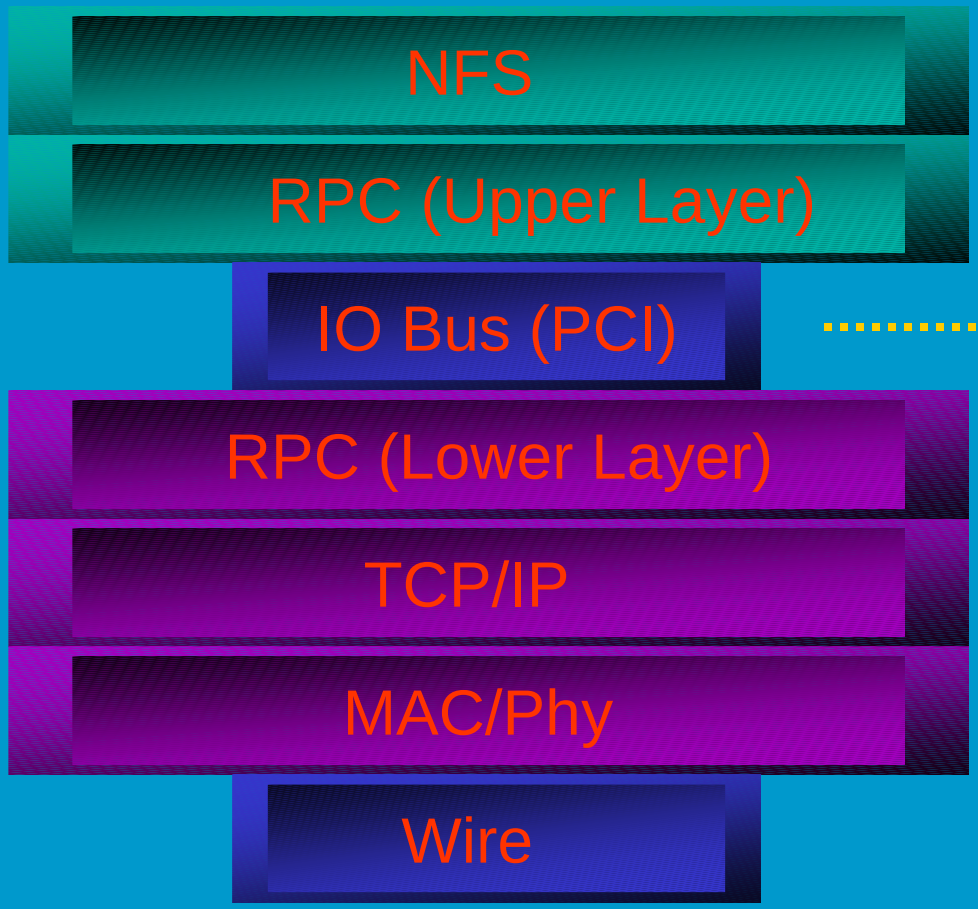
RDMA Adapter

- Modified RPC Layer Supports RDMA Protocol
- Transparent to Applications
- High Performance
  - Zero Copy Receives
  - TCP Protocol Offload
- Requires a New Transport Protocol
  - RDMA Protocol Supported by Server and Client

NFS Acceleration Adapter



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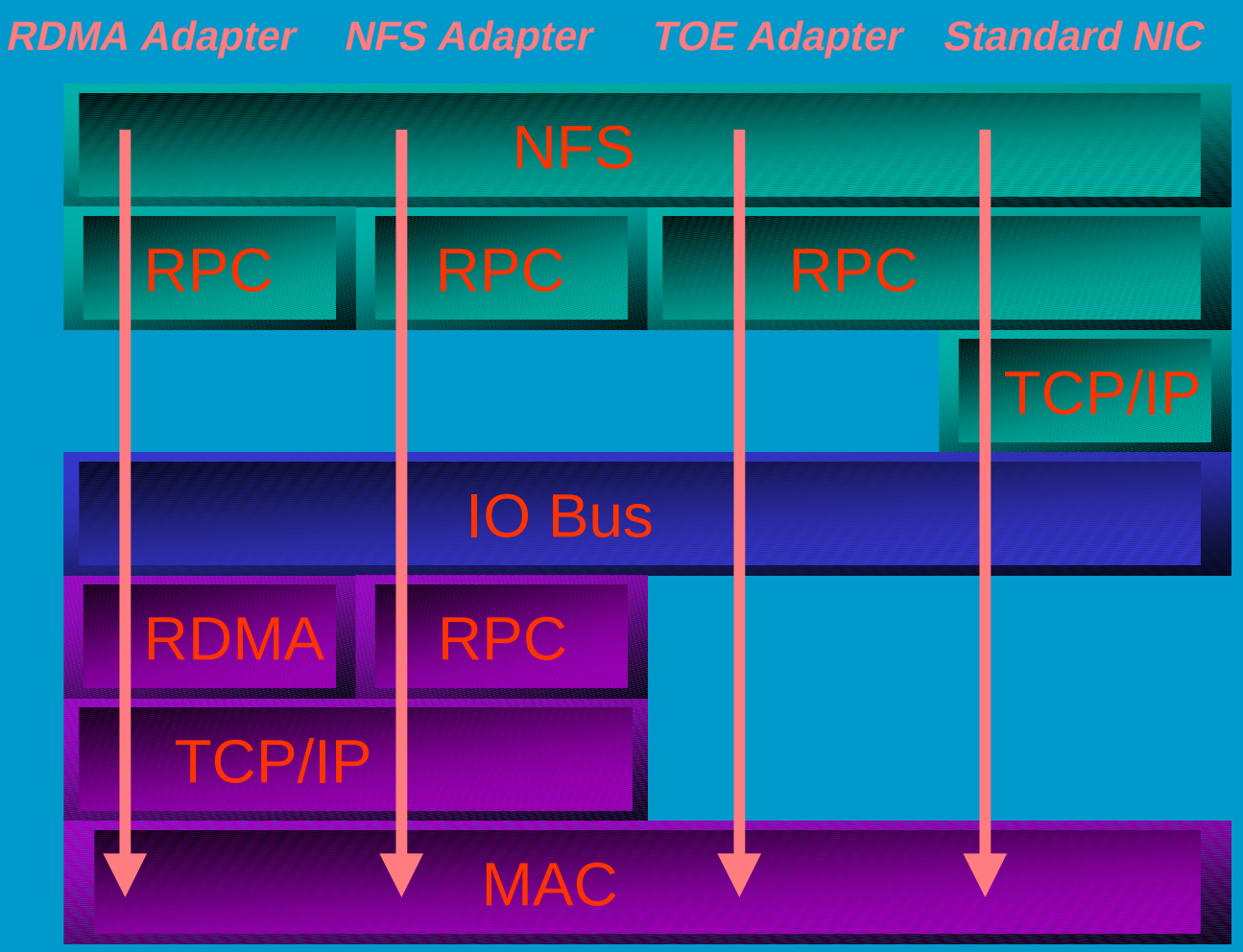
NFS Acceleration Adapter

- Modified RPC Layer
- Direct Data Placement
- Transparent to Applications
- High Performance
  - Zero Copy Receives
  - TCP Protocol Offload
- No New Protocols
  - Single Ended: Client or Server can Implement Independently

Multi-protocol Adapter



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Multi-Protocol Adapter

- Intelligent Network Adapter Supports Multiple Protocols
  - Standard NIC Mode
  - TCP Offload
  - NFS Acceleration
  - RDMA

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Summary

- Standard NICs will not Support 10Gb Performance
- Intelligent Network Adapters Needed
  - TCP Protocol Offload
  - Zero Copy Receive via Direct Data Placement
- Multi-Protocol Adapters Provide Flexible Solutions