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Host-Based Routing Using Peer DMA

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Host-Based Forwarding

Benefits

- Programmability
- Commodity Platforms and Network Interfaces
- Network Interface Cards track technology advances
- NICs precede line cards (if line cards exist at all).

Example uses in Research

- in testbeds DARTnet and successor CAIRN
- Active Networks.
- ATOMIC project supporting Myrinet LAN at ISI



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Problems

Latency

- Store and forward copying

Bandwidth

- bus limited backplane

CPU load

- interrupts



DMA into host RAM

- cycles to manage transfers (PIO more than DMA)



Solution: Forwarding using Peer DMA

Two approaches:

- packet on NIC
- data on NIC, copy header to host

Results:



Peer DMA NIC-to-NIC

- UDP thoughput up by 45%
- CPU pegged for small packet sizes and multiple sources
- Relieves CPU load by 35% for 2 sources
- Max packet per sec. 12,000 @ 128 byte packet sizes
- Worse for TO-Host traffic



Implications for NIC

NIC design

- support DMA
- sufficient shared memory for packet storage
- Co-processor available on NIC?

Packet issues

- Fragmentation not required or trivial
- Packet data not utilized by CPU (not so in Active Nets)

Host issues

- I/O subsystem supporting DMA



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Future Work?

Processing

- How much involvement is needed by Host CPU?
- How much can be done on NIC?

Buffers

- Is buffering required for send and receive on NICs?

Integration

- How to integrate Peer DMA forwarding with TO-Host data?
- Implications for early demux NIC architectures? (APIC)





Throughput Comparison of Three Driver Types





HEADER-COPY Packet Rate Throughput



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Improvement in Throughput of Peer DMA over Standard Driver