High-performance IP Forwarding Using Host Interface Peering

Joe Touch, touch@isi.edu
Anne Hutton, hutton@isi.edu
Simon Walton, simonw@isi.edu
Stephen Suryaputra, surya@isi.edu
USC/ISI Computer Networks Division

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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

Problems

Latency
- Store and forward copying

Bandwidth
- bus limited backplane

CPU load
- interrupts
- 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:
- UDP throughput up by over 40%
- 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 (PIO)

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 utilised by CPU (not so in Active Nets)

Host issues
- I/O subsystem supporting DMA
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)