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Boosting data transfer over network with TOE

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Conventional TCP/IP implementation is becoming bottleneck to the dramatically increasing Internet traffic. Offloading network adapter while leaving TCP/IP control decisions to the host server guarantees high bandwidth, low latency

The online economy – particularly for e-business, entertainment, and collaboration – is dramatically increasing the servers. Most of this data is going through the TCP/IP stack and Ethernet controllers. Additionally, many IT organizations are moving computing (HPC), and database cluster networks to Ethernet. As a result, Ethernet controllers are experiencing heavy resources to process network packets. Because TCP/IP consumes a significant amount of host CPU processing cycles, resources available for other applications.

BOTTLENECK OF CONVENTIONAL TCP/IP MODEL

This situation can create a bottleneck for applications involving significant network traffic or limit the amount of CPU resources available for applications. Applications that exhibit this behavior include file-oriented storage, block-oriented storage, backups, database transactions, and high performance computing (HPC).

Is it possible to avoid network bottleneck, still keeping existing network infrastructure? Yes. TCP/IP offload engine

The TCP/IP Offload Engine (TOE) model is designed to improve data transfer performance over IP networks by relieving the host CPU. TOE allows the OS to offload all TCP/IP traffic to specialized hardware on the network adapter card. By relieving the host processor bottleneck, TOE can help deliver the performance benefits administrators expect from network links.

TOE components are incorporated into one of the printed circuit boards, such as the network interface card (NIC) or network adapter card.

HOW IS TOE BENEFICIAL?

TOE is cost-effective because it processes the TCP/IP stack on a high-speed network device that requires less processor resources than a performance CPU.

The manner in which TOE is implemented depends on the needs of the customer. Considerations include flexibility and scalability are optimized with ASIC implementation. Network flexibility is optimized with processor-based implementation.

Network performance improvements gained from TOE technology can be determined by measuring two parameters:

- 1) Increase in absolute network throughput
- 2) Reduction in system resources such as CPU utilization

TOE performance benefits vary with the type of applications being run. Applications with a small network packet size and high throughput applications with a large network packet size may not show significant network throughput improvements with TOE technology – thereby helping to keep CPU processing cycles available for other business-critical applications such as database transactions.

file server applications.

Applications that require extensive network utilization – such as network backups, network attached storage (NAS) the most from TOE technology.

TESTING THE IMPACT

Network throughput and CPU utilization are common ways to measure a network adapter's performance. Network throughput is the number of packets sent and received, while CPU utilization is the percentage of CPU capacity required to process the packets.

The ratio of network throughput to CPU utilization can be expressed as the performance efficiency (PE) index. The PE index is used for evaluating network adapters. For example, high PE indexes indicate high throughput with low CPU utilization, suggesting a more efficient adapter.

TOE-enabled network adapters are designed to achieve high throughput at small network packet sizes and low CPU utilization.

ADVANTAGES FOR MULTI-PORT SYSTEM

As the number of TOE-enabled ports in a system increases, network throughput can be expected to scale more efficiently than standard Layer 2 network adapters. At the same time, the CPU utilization can be expected to remain low enough to support other system tasks.

TOE can significantly benefit typical Web server environments in which connections are long lived, such as configuration management. TOE is the most reliable and cost effective solution to gain increased throughput and reduced CPU utilization in existing network environments.

Click here for the illustrations:

[Figure 1](#), [Figure 2](#), [Figure 3](#), [Figure 4](#)

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