Performance Brief for TCP/IP Offload Engine with the NC370T Multifunction Server Adapter using Microsoft® Windows Server™ 2003 Scalable Networking Pack

Executive Summary 2

Key Findings 2

Introduction 2

What's needed to run TOE 2

Chariot Test Methodology 3

Chariot Performance Data and Analysis 3

Data Protector Test Methodology 4

Performance Data and Analysis with HP Data Protector 4

Conclusion 5

For Further Information 5

Appendix A 6

System Disclosure 6

Test Disclosure 7

Executive Summary

This performance brief compares and contrasts the results of running an HP NC370T Multifunction Server Adapter without the benefit of TCP/IP Offload Engine (TOE) and then with TOE turned on. The results are first shown with a well-known networking test suite, Chariot, and then with an HP application, HP Data Protector.

Key Findings

Based on gathered performance data:

- For transmitted data using Chariot, TOE shows a 5% - 17% reduction in CPU utilization
- For received data using Chariot, TOE shows a 47% - 55% reduction in CPU utilization
- When TOE is tested with HP Data Protector, CPU utilization is reduced between 7% and 17%, depending on file size, with a 15% overall (mixed) reduction

Introduction

The Ethernet TCP/IP protocol is currently the de facto industry standard for high speed networking between LAN attached systems and the Internet. However, handling the TCP/IP stack sometimes slows down operations because the stack requires a server CPU to handle the processing overhead. TCP/IP Offload Engine seeks to remove this bottleneck by offloading the protocol stack to the network adapter, thereby freeing the host CPU for other duties.

The NC370T adapter is one in a family of HP multifunction networking products that support TOE on HP ProLiant servers. These multifunction networking products require that "TOE Chimney" be installed; TOE Chimney is one component of Microsoft Windows Server 2003 Scalable Networking Pack.

What's needed to run TOE

Figure 1: NC370T PCI-X Multifunction Gigabit Server Adapter

To implement TOE four separate elements are required: two from Microsoft and two from HP:

- Microsoft® Windows Server™ 2003, Service Pack 1, or later
- Microsoft Windows Server 2003 Scalable Networking Pack, available directly from Microsoft at www.microsoft.com/snp
- An HP ProLiant server with embedded multifunction network adapter or stand-alone NC-series multifunction server adapter. This Performance Brief uses the NC370T, described in the "ProLiant Ethernet Adapters" section at www.hp.com/servers/networking
- The HP networking driver that supports TOE Chimney. This driver is currently identified as "HP NC370x/371x/373x/374x/380x Multifunction Gigabit Server Adapter Driver for Windows Server 2003 version 2.6.2.0."

  The driver is available as release version NCDE 8.37 of the "HP Network Server Adapters and Upgrade Modules Software and Documentation" CD, in SmartStart version 7.51 (or later), and also from the Software and Driver Download page at www.hp.com.

Chariot Test Methodology

The devices tested were two HP NC370T Multifunction Gigabit server adapters installed in a ProLiant ML370 G4 connected to an Extreme Networks Summit 7i switch, with each NC370T using one VLAN (VLAN 130 and VLAN 140). Eight HP ProLiant DL380 G3 dual processor servers (dual NC7781 embedded NICs) were used as clients with one NC7781 connected via the Summit 7i to VLAN 130 and the second NC7781 connected via the Summit 7i to VLAN 140. In this way, a total of 16 different client ports (eight HP ProLiant DL380 G3 machines with two ports each) were connected to the SUT (via two NC370T adapters). In addition, a Chariot control console and a DHCP server were connected to each VLAN.

Chariot test runs were then conducted using the Chariot High Performance Test Script v6.20. Each test was run for 90 seconds and repeated three times to obtain an average value for the variables of interest. These values were then graphed accordingly.

Chariot Performance Data and Analysis

Test results for the HP NC370T running with TCP/IP Offload turned off and then with TCP/IP Offload turned on are summarized in the following graphs, which reflect both throughput and CPU utilization for the NC370T set to Gigabit speed. The test uses two ports.

Throughput is indicated by lines; higher is better. CPU utilization is indicated by bars; smaller is better.

Figure 2 shows the results for transmitted data, and Figure 3 shows the results for received data.

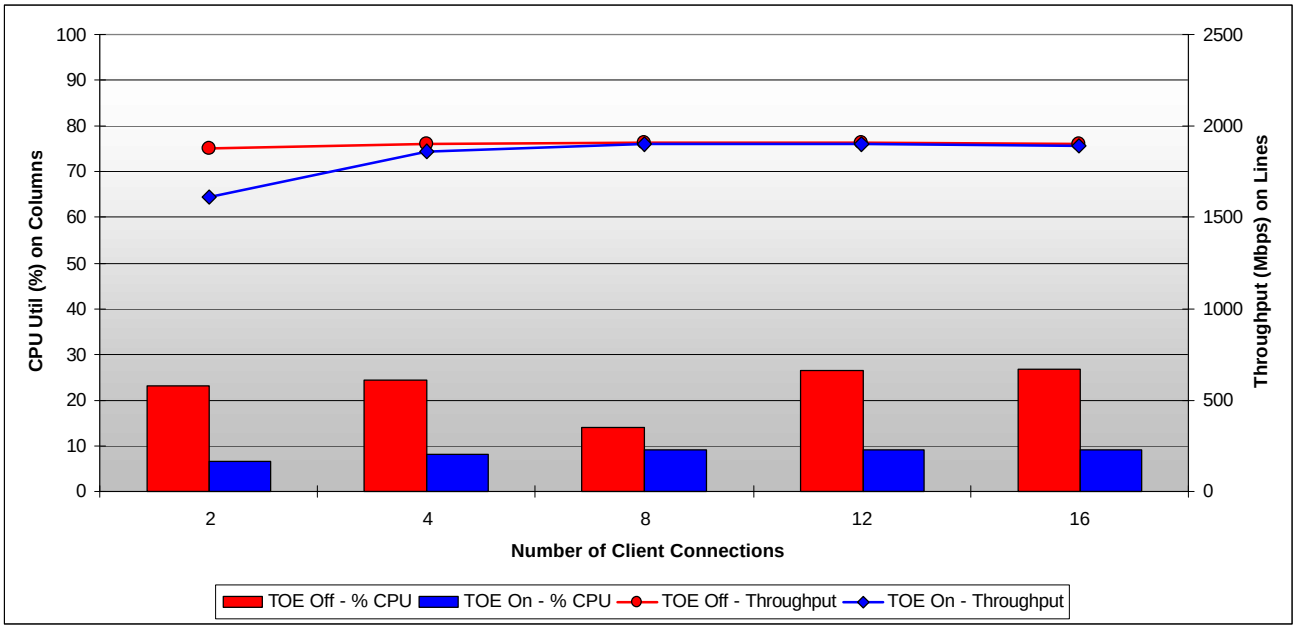

Figure 2: Transmit Throughput and CPU Utilization compared, not using TOE and using TOE

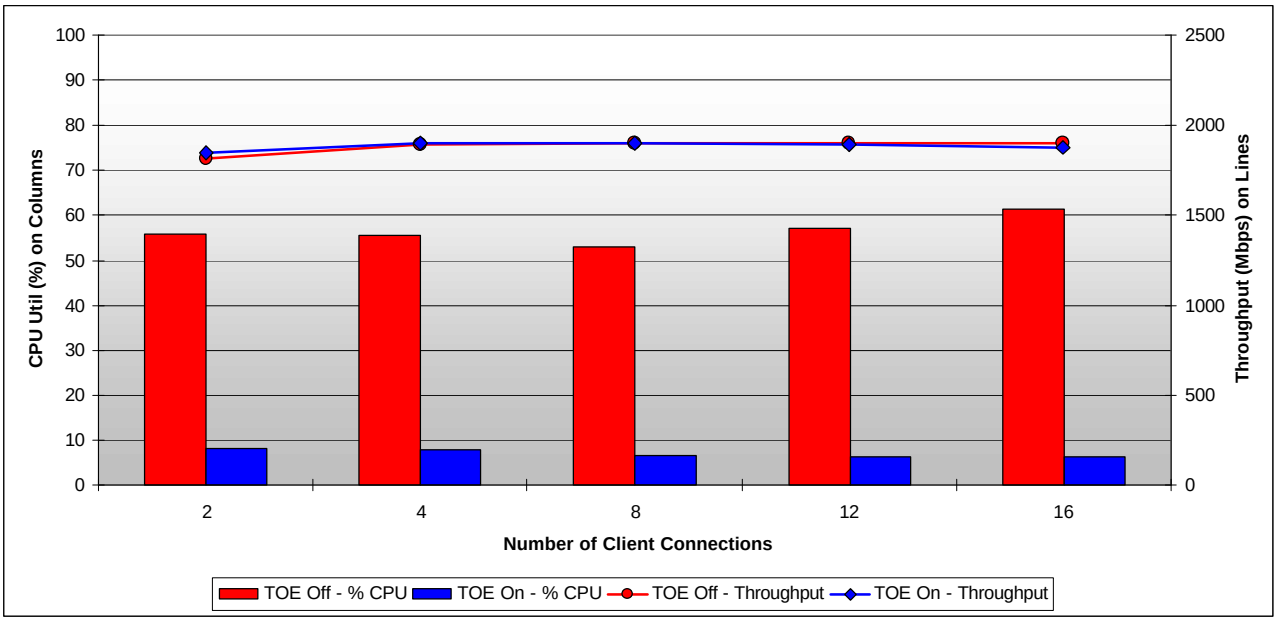

Figure 3: Receive Throughput and CPU Utilization compared, not using TOE and using TOE

Data Protector Test Methodology

The device tested was an HP NC370T Multifunction Gigabit server adapter installed in a ProLiant ML370 G4 connected to an Extreme Networks Summit 7i switch. Eight HP ProLiant DL380 G3 dual processor servers (NC7781 embedded NICs) were used as clients connected via the Summit 7i. Each ProLiant DL380 G3 server contained 5 15k RPM 18.2 GB U320 SCSI disk drives configured in a RAID 0 configuration. The SUT contained a HP Dual-Channel Ultra 320 64-bit / 133-MHz PCI-X HBA connected to an HP Storage Works Ultrium 960 tape drive. Using an HP utility called CreateData.exe, nested directories were created containing files of specific size only (8KB only – 128MB only) as well as a "mixed" directory containing an equal number of each type of file.

HP Data Protector software was installed on the SUT and backup jobs were executed for each specific file size, as well as the mixed group of files. The backup job was set to concurrently back up the same specific file size directory on each client to the Ultrium 960 tape drive. Throughput and CPU utilization were noted for each backup run conducted. Each folder was backed up three times and an average of throughput and CPU utilization was calculated for each. These results were then graphed accordingly.

Performance Data and Analysis with HP Data Protector

HP OpenView Storage Data Protector is software that manages backup and recovery from both disks and tapes. The software is designed to simplify and centralize backup and recovery operations by integrating a variety of techniques to eliminate backup windows. Data Protector scales from single server environments to the largest distributed enterprise infrastructures. For details about Data Protector, go to http://www.hp.com/go/dataprotector.

Figure 4 summarizes test results for the HP NC370T running with HP Data Protector, first with TOE turned off (in red) and then with TOE turned on (in blue).

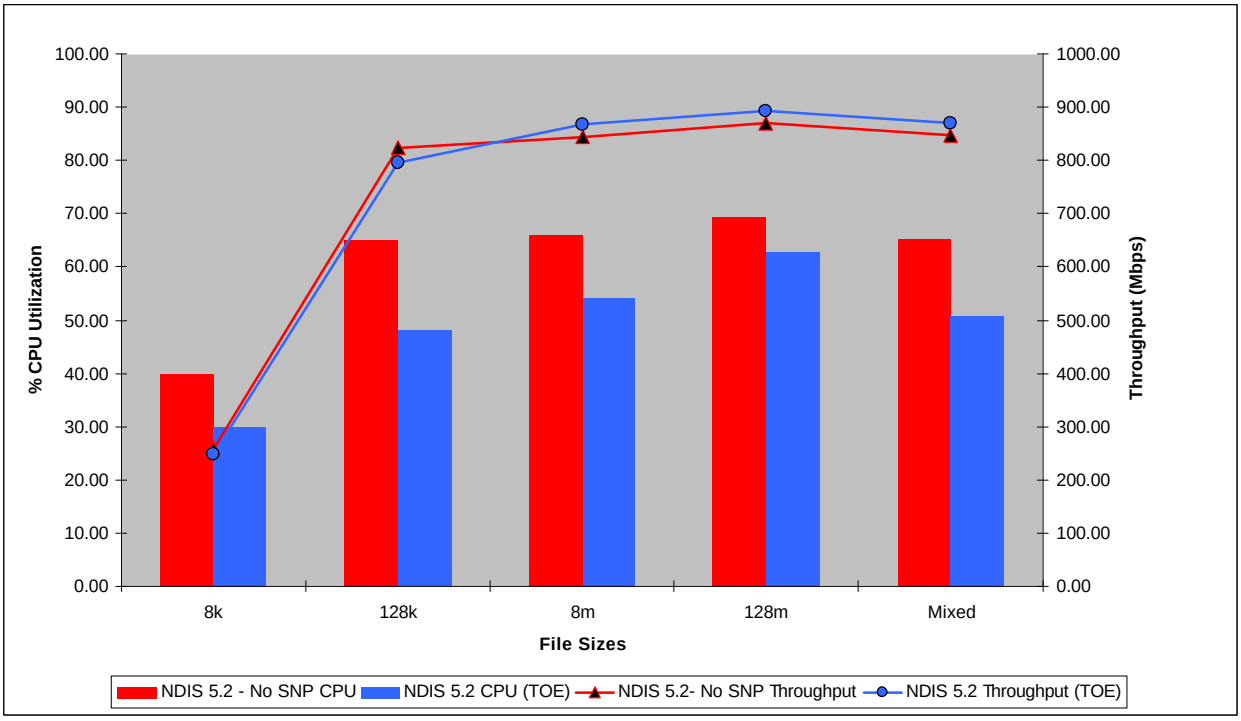

Figure 4: Throughput and CPU Utilization with NC370T and HP Data Protector using TOE

Conclusion

These test results show that the primary customer benefit of running TOE is lower host CPU utilization. By shifting the TCP/IP protocol overhead from the host to the adapter, ProLiant servers become more efficient, allowing them to support more user sessions and to handle applications with lower latency.

Throughput is slightly improved when TOE is used with HP Data Protector; otherwise, the presence of TOE has negligible impact on networking throughput.

The test results also reveal that TOE is of greatest benefit with large packets, such as those associated with backup, streaming media, and storage workloads. It is in these areas where bottlenecks are most likely to occur, and this is where TOE helps to improve network communications and optimize application performance.

For Further Information

For additional details about HP products mentioned in this technology brief, refer to:

Resource Description	Web address
HP ProLiant and BladeSystem servers	www.hp.com/go/proliant
HP Networking Products	www.hp.com/servers/networking
HP Multifunction Server Adapters	www.hp.com/go/multifunction-nics

Appendix A

System Disclosure

Server Disclosure	
Server_Model_Name	HP ProLiant ML370 G4
Num_of_CPU_Cores	2
Server_CPU_Type	Intel, Dual-Core
CPU_Core_Freq (GHz)	3.4
CPU_Cache_Size	2048
Server_Memory_Size (MB)	1024
Server_OS_Ver	Windows Server 2003, Ent. Ed. SP1, Scalable Networking Pack ver. 5.2.3790.2670
NIC_Model_Name	HP NC370T Multifunction Gigabit Server Adapter
NIC_Chipset	BCM57086,vA3
NIC_PCI_Type_Width_Freq	PCI-X, 2.5GHz
NIC_SoftwareDriver	BCM v2.6.12

Client Disclosure	
Client Model Name/Num	HP ProLiant DL380 G3
Client CPU Type	Pentium Xeon
Number of CPUs	2
CPU Core Freq (GHz)	2.4
Memory Size (MB)	512
Client O/S Version	Windows Server 2003, Ent. Ed.
Client O/S Tuning	none
Client NIC Model	HP NC7781
Client NIC Speed	1000Base-T
NIC Driver Version	7.40.0
NIC Special Tuning	none

Switch Disclosure	
Switch Mfg	Extreme Networks
Switch Model	Summit 7i
SUT Port Blade	1000Base-T Gigabit Copper
SUT Port Speed	1000Base-T
SUT Port Options	Port VLAN 140 / VLAN 130
Client Port Blade	1000Base-T Gigabit Copper
Client Port Speed	1000Base-T
Client Port Options	Port VLAN 140 / VLAN 130

Test Disclosure

Benchmark Disclosure	
Benchmark Mfg	Ixia
Benchmark Name	Chariot
Benchmark Version	6
Controller Script(s)	High Performance Script, Long Asynch. Tcp Connections
SUT Application	Chariot Performance Endpoint v6.2
SUT Workload Description	smMix = Uniform(128B-4KB), MedMix = Uniform(4KB-32KB), & HiPerf = 64KB Buffer Size Transfers: Transmit, Receive, & Bi-directional
Client Application	Chariot Performance Endpoint v6.0
Client Workload Description	SmMix = Uniform(128B-4KB), MedMix = Uniform(4KB-32KB), & HiPerf = 64KB Buffer Transfers: Transmit, Receive, & Bi-directional
Measurements	Network Throughput, SUT CPU Utilization, and Response Time