



**DATAJET PERFORMANCE ANALYSIS IN
A CITRIX METAFRAME XP
ENVIRONMENT**



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1 What is a DataJet?

The TiGi DataJet is a data-throughput accelerator that is designed to optimize performance in application and database servers, as well as networked storage environments. Based on a unique open architecture that incorporates high-performance solid state technology, this easy-to-install device removes I/O bottlenecks and speeds up data-throughput within existing hardware by as much as 800%. As a result, the TiGi DataJet dramatically increases system performance and scalability for most any server regardless of OS or application environment.

2 Test Objective

This TiGi DataJet Performance Analysis was developed to measure performance changes in a "typical" Citrix MetaFrame XP server when the DataJet data-throughput accelerator was applied. The second objective of this test was to identify and compare the number of concurrent client sessions that can be connected to a single Metaframe server and maintain acceptable end-user performance with and without the DataJet.

3 Test Methodology

Each *Citrix Server Test Kit* (CSTK) scenario performed utilized Microsoft Excel, PowerPoint, and Access scripts supplied with the CSTK. The tests in this analysis were performed using scripts that simulated Power User interaction with a Metaframe XP server. During three separate comparison tests, we first ran the Power User scenario on a "typical" MetaFrame XP server to establish a baseline measurement. Then we added the DataJet to the same server to measure any performance and scalability changes. Extreme efforts were made to keep the tests fair, comparable and easy to replicate.

4 Conclusions from the Performance Analysis

Performance Monitor counters reveal where the bottleneck of a system is located. For our testing scenarios, a bottleneck can be defined as the factor that restricts a system from further performance or scalability. From the performance counter data, at 35 users, we learned that the TiGi DataJet accelerator nearly eliminated all disk queuing.

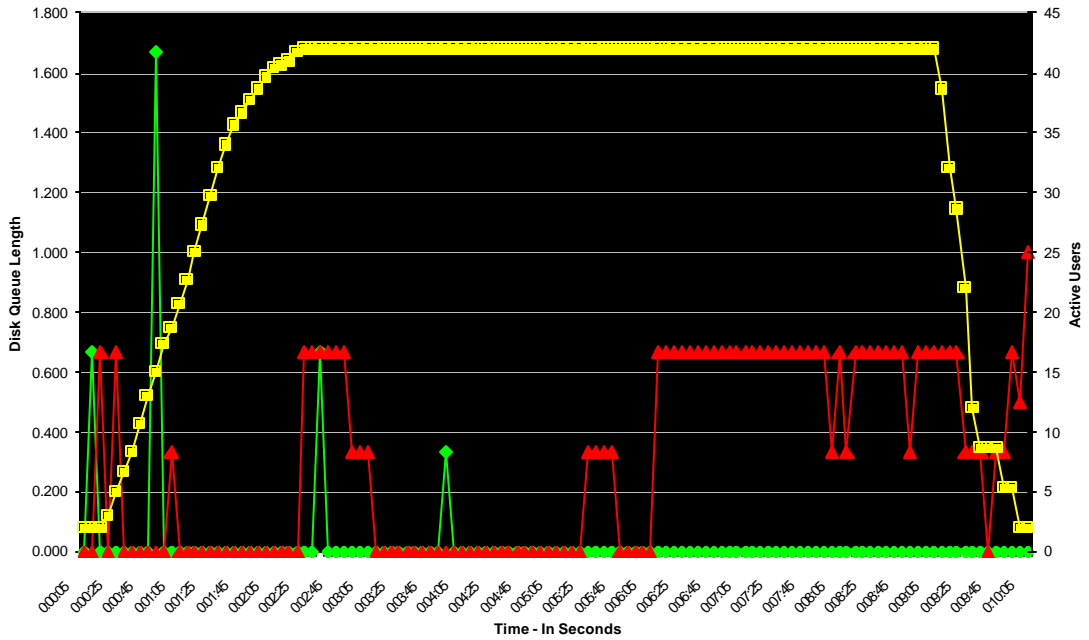
Also with the DataJet installed our testers were able to connect 65 users to the MetaFrame server and still maintain a high end user experience. Without the DataJet installed the test team was only able to scale the same server to 35 users before the end user experience was compromised. This represents an 86% increase in scalability when the DataJet was applied. In other comparison tests where higher powered CPUs were applied, we attained more than 100% increases in scalability with the DataJet – without any performance degradation.

What does this mean?

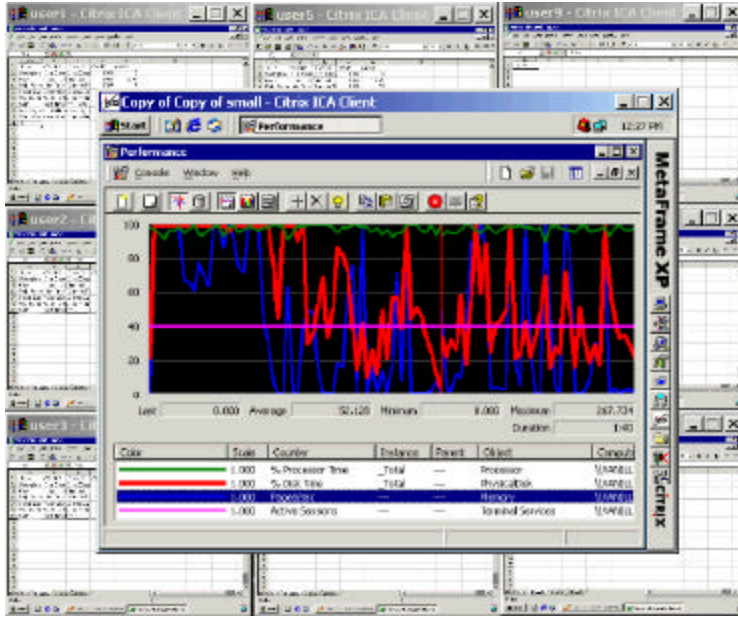
- The DataJet can dramatically improve performance and increase the numbers of concurrent users on an existing server.
- Administrators can deploy fewer servers in their data centers to support their existing customers. Organizations can free up additional hardware and reduce administration time.



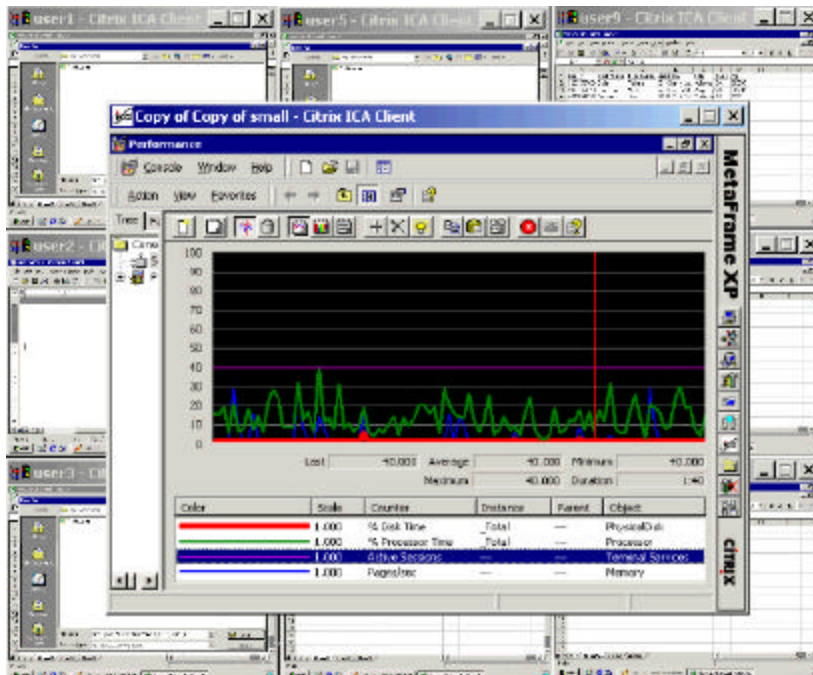
- Organizations can now consolidate I/O intensive applications. This key discovery could very well revolutionize the way many administrators approach their MetaFrame deployments. Generally, administrators configure their MetaFrame servers with applications that are connected to back-end databases. With a DataJet installed in a MetaFrame server, administrators can now configure applications and databases on the same server and still maintain remarkable end-user performance. This is what we call the "DataJet Effect"



This chart above demonstrates how the DataJet reduces the amount of disk queuing on a typical server configured for MetaFrame XP. Yellow lines indicate number of concurrent users connected to the server. Red lines indicate disk queuing without the DataJet installed. Green lines indicate disk queuing on a typical server with the TiGi DataJet accelerator installed.



The above chart demonstrates how a server without DataJet technology performs in a MetaFrame XP environment. The green line in this performance monitor graph represents processor time. The red line indicates disk time and the blue line indicates memory pages per second. The violet line indicates the number of connected users. As you can see from the graph, the processor time is consumed with 40 users at about 95%. (At just 35 users the performance is degraded to unacceptable levels). Now look at the chart below which shows the changes in processor utilization from the same 40 users when the DataJet is added.



In the performance monitor graph on the previous page there is a significant performance enhancement on the same server configuration with the DataJet data-throughput accelerator installed. The red line indicates the systems disk time. The green line indicates processor time. Purple line indicates number of concurrent users and the blue line indicates memory pages per second. The performance monitor graph confirms that when the DataJet is installed administrators can achieve significant performance and at the same time increase the number of users per server. These results are achieved because the CPU is no longer bogged down with requests for information that it is generally looking for on the hard drive -- such as paging files, profile information or general operating system requests. The DataJet eliminates these I/O intensive processes by having the data stored within the DataJet's solid state technology -- which is memory that is as fast as RAM.

5 Testing Procedures and Performance Test

5.1 Testing Scenarios

5.1.1 Typical server configured for Citrix MetaFrame XP

- **(Scenario 1) All data and OS on standard technology**
- **(Scenario 2) Profile data stored on DataJet / All other data and stored on standard technology.**
- **(Scenario 3) Profile and Page data stored DataJet / All other data and OS stored on standard technology**
- **(Scenario 4) All data and OS stored on DataJet**

5.2 Test Procedure

A standard test begins by launching ten to fifteen individual ICA desktop sessions to the MetaFrame XP Server being tested. Once an individual client machine and all of its sessions have successfully established a connection, the sessions begin to run a Power User script. Found in the CSTK. In this analysis the client sessions have been configured in the CSTK to be staggered by three seconds so that the sessions are not running in parallel. All test iterations were timed in ten-minute intervals. During that time all client sessions will login upon launching the test and logout one minute before the test ends. Performance counters are captured during the test at five-second intervals. In each test scenario the first iteration of the test for each group of designated users the profiles were created to simulate a true enterprise environment and provide more information on I/O performance for comparison. Detail on these counters are defined and explained in the Performance Counter section of this document. Once the iteration has completed the client machines were reconfigured adding more sessions for each consecutive iteration. All performance values captured are compared to a calibration value obtained from our initial benchmark test on a "Typical server hardware configuration for a Citrix MetaFrame server" without a DataJet installed.

5.3 Test equipment and configurations

5.3.1 Typical server configured for Citrix MetaFrame XP

5.3.2 Hardware configuration

Dual Intel Pentium P750

1 - GB PC100 RAM

1 - 9.19 GB SCSI HDD, Speed = 7200 rpm, Seek time 5.9ms (*Used in scenarios 1 – 3*)

1 – 2 GB TiGi DataJet (*Used in scenarios 2-4*)

5.3.3 Software configuration

Windows 2000 Server SP3

Citrix Metaframe XP SP2

Citrix Metaframe Feature Release 2

Citrix Server Test Kit Version 2.1

Microsoft Office 2000 (Excel, Word, and Access)

5.4 Client Configurations

5.4.1 Hardware Configurations

Pentium P3 600

256k Cache,

128 MB RAM to 256 MB RAM

9 GIG HDD

5.4.2 Software Configurations

Windows 2000 SP3

Windows XP

CSTK Launcher

Citrix ICA Win32 Full PN Client Version 6.31.1051

5.5 Server Tuning Parameters

All test runs were done without any performance changes or enhancements to each server's operating system. These configurations were essentially "clean out-of-the-box installation".

The server's hardware was manipulated for some tests to observe any performance or scalability differences that basic tuning parameters may have affected.

5.6 Installation Steps

If you would like to replicate the test performed in this document additional information can be found in Appendix "A" of this document.

6 Summary

Based on the testing process and the data captured during the test we can conclude:

- TiGi has the right data-throughput acceleration solution to efficiently grow and scale today's enterprise MetaFrame XP environments.
- TiGi DataJet can improve system scalability in a Citrix MetaFrame XP Server by 50% to 100% or more.
- TiGi DataJet offers a unique solution to solving chronic Server I/O and deployment bottlenecks.

- Administrators can now support more users per server and have the opportunity to free up additional servers for other deployments or solutions.
- TiGi DataJet liberates MetaFrame XP environments by allowing administrators to now deploy applications and I/O intensive databases on the same server. In the past this technique was considered a challenge having applications users and data competing for a server's precious resources.
- TiGi DataJet does not require special software, drivers or hardware. This means that the DataJet can be seamlessly integrate into existing environments.
- TiGi's DataJet data-throughput accelerator is a hardware-based solution. Using the DataJet provides new opportunities to improve performance not only in MetaFrame XP / Terminal Server deployments but almost all "I/O performance challenged deployments" across the data center.

7 Appendix A

7.1 Server operating system and software installation procedure

7.1.1 Windows 2000 Server

- Insert the Windows 2000 Server CD in your CD drive.
- Power on the system.
- When prompted, press any key to boot from the Windows 2000 CD.
- When prompted to install additional or OEM drivers, press the **F6** key to install the SCSI card drivers.
- Press **S** to specify additional drivers.
- Select the SCSI adapter from the list.
- Select the CD-ROM drivers from the list provided by Windows
 - 2000-Advanced Server.
- Follow the directions in the *Microsoft Windows 2000 Server Installation Guide* to complete the installation.
- When installation is complete, ensure that the latest Microsoft service pack is installed. For this test SP3 was used.
- **Accessories and Utilities**
 - Accessibility Wizard - REMOVE
 - Accessories – INSTALL
 - Communications – REMOVE
 - Games – REMOVE
 - Multimedia - REMOVE
- Certificate Server – REMOVE
- Indexing Services – REMOVE
- IIS – REMOVE
- Management and Monitoring Tools
 - Connection Manager Components – REMOVE
 - Network Monitor Tools – INSTALL
 - SNMP – REMOVE
- Message Queuing Service – REMOVE
- Networking Services – REMOVE
- Other Network File and Print Services – REMOVE

- Remote Storage – REMOVE
- Script Debugger – REMOVE
- Terminal Services – INSTALL
- Terminal Server Licensing – REMOVE
- Windows Media Services – REMOVE

7.1.2 Citrix MetaFrame XP FR2 Installation Procedure

- On the first screen, select “Application Server Mode”
- On the next screen, select “Permissions compatible with Windows 2000 Users”

Please refer to the Metaframe XP Application Server for Windows Feature Release 2 Administrators Guide and Service Pack 2 / Feature Release 2 Read me documents for information on this procedure. The documents can be located at <http://www.citrix.com/support> select the product documentation hyperlink.

7.1.3 Microsoft Office 2000 Installation Procedure

- **Microsoft Word**
 - Help – REMOVE
 - Wizards and Templates – REMOVE
 - Address Book – REMOVE
 - Text with Layout Converter – REMOVE
 - Page Border Art - REMOVE
- **Microsoft Excel**
 - Help – REMOVE
 - Spreadsheet Templates – REMOVE
 - Add-Ins – REMOVE
 - Sample Files – REMOVE
 - Quattro Pro 5.0 Converter – REMOVE
 - Microsoft Map – REMOVE
- **Microsoft Power Point**
 - Presentation Broadcasting – REMOVE
 - Help – REMOVE
 - Tutorial – REMOVE
 - Design Templates – REMOVE
 - Content Templates – REMOVE
 - Presentation Translators – REMOVE
 - Animation Sound Effects – REMOVE
 - GENIGRAPHICS Wizard – REMOVE
 - Pack and Go Wizard - REMOVE
- **Microsoft Outlook for Windows** - REMOVE
- **Microsoft Access**
 - Help - REMOVE
 - Typical Wizards - REMOVE
 - Additional Wizards – REMOVE
 - Sample Databases – REMOVE
 - Snapshot Viewer – REMOVE
 - Database Replication – REMOVE
 - Calendar Control – REMOVE



- Client Server Visual Design Tools – REMOVE
- **Microsoft Front Page for Windows** – REMOVE
- **Office Tools** – REMOVE
- **Converters and Filter** – ALL FROM COMPUTER

Select "Do not Customize Outlook profile and account info"
 Select "Do not install IE 5"

7.1.4 Citrix ICA Client installation Procedure

All client machines that participated in this test were configured with the **Full Program Neighborhood Version 6.31.1051** of the Citrix ICA client. For additional information on this process please refer to the **ICA Win32 Clients Administrator's Guide** for step-by-step instructions for installing the ICA Win32 Client.

7.2 Performance Monitor Counters and Measurements leveraged

The table below contains all performance counters used during the testing.

Processor: %ProcessorTime_Total Instance	% Processor Time is the percentage of time that the processor is executing a non-Idle thread. This counter was designed as a primary indicator of processor activity. It is calculated by measuring the time that the processor spends executing the thread of the Idle process in each sample interval, and subtracting that value from 100%. (Each processor has an Idle thread, which consumes cycles when no other threads are ready to run).
System: Processor Queue Length	Processor Queue Length is the number of threads in the processor queue. There is a single queue for processor time even on computers with multiple processors. Unlike the disk counters, this counter counts ready threads only,
Terminal Services: Active Sessions	Number of active Terminal Services sessions.
Memory: Available Bytes	Available Bytes is the amount of physical memory available to processes running on the computer, in bytes.
Memory: Pages/Sec	Pages/sec is the number of pages read from or written to disk to resolve hard page faults. (Hard page faults occur when a process requires code or data that is not in its working set or elsewhere in physical memory, and must be retrieved from disk). This counter was designed as a primary indicator of the kinds of faults that cause system-wide delays.
Memory: Pages Reads/sec	Page Reads/sec is the number of times the disk was read to resolve hard page faults. (Hard page faults occur when a process requires code or data that is not in its working set or elsewhere in physical memory, and must be retrieved from disk).

Memory: Page Writes/sec	Page Writes/sec is the number of times pages were written to disk to free up space in physical memory.
Memory: Paging File %Usage	Percentage of page file utilized by computer.
Memory: Pool Paged Bytes	Pool Paged Bytes is the number of bytes in the paged pool, an area of system memory (physical memory used by the operating system) for objects that can be written to disk when they are not being used.
Memory: Pool Nonpaged Bytes	Pool Nonpaged Bytes is the number of bytes in the nonpaged pool, an area of system memory (physical memory used by the operating system) for objects that cannot be written to disk, but must remain in physical memory as long as they are allocated.
Physical Disk: % Disk Read Time	The % Disk Read Time counter is the percentage of elapsed time that the selected disk drive is busy servicing read requests.
Physical Disk: % Disk Time	% Disk Time is the percentage of elapsed time that the selected disk drive is busy servicing read or write requests.
Physical Disk: % Disk Write Time	% Disk Write Time is the percentage of elapsed time that the selected disk drive is busy servicing write requests.
Physical Disk: % Idle Time	% Idle Time reports the percentage of time during the sample interval that the disk was idle.
Physical Disk: Avg. Disk Bytes/Read	Avg. Disk Bytes/Read is the average number of bytes transferred from the disk during read operations.
Physical Disk: Avg. Disk Bytes/Transfer	Avg. Disk Bytes/Transfer is the average number of bytes transferred to or from the disk during write or read operations.
Physical Disk: Avg. Disk Bytes/Write	Avg. Disk Bytes/Write is the average number of bytes transferred to the disk during write operations.
Physical Disk: Avg. Disk Queue Length	Avg. Disk Queue Length is the average number of both read and write requests that were queued for the selected disk during the sample interval.
Physical Disk: Avg. Disk Read Queue Length	Avg. Disk Read Queue Length is the average number of read requests that were queued for the selected disk during the sample interval.
Physical Disk: Avg. Disk sec/Read	Avg. Disk sec/Read is the average time in seconds of a read of data from the disk.
Physical Disk: Avg. Disk sec/Transfer	Avg. Disk sec/Transfer is the time in seconds of the average disk transfer
Physical Disk: Avg. Disk sec/Write	Avg. Disk sec/Write is the average time in seconds of a write of data to the disk.
Physical Disk: Avg. Disk Write Queue Length	Avg. Disk Write Queue Length is the average numbers of write requests that were queued for the selected disk during the sample interval.



About TiGi

TiGi products dramatically increase scalability and performance of application server or networked storage environments. Our data-throughput accelerator products remove I/O bottlenecks and increase data response time by as much as 800%. With a unique open architecture design, TiGi products can be quickly configured to any server or storage system, enabling you to deliver a substantially better computing experience to users while adding years to the life of your current technology investments.

TiGi Corporation is headquartered in Northern Virginia, with field offices in Illinois, North Carolina and New York. Founded in July 2000, TiGi spent its initial two years developing its data-throughput accelerator products which were initiated to meet the high-speed computational requirements of the United States government. TiGi maintains an ongoing relationship with the world-renowned Naval Research Lab (NRL), considered among the top IT research centers in the world.

TiGi has brought together a seasoned management team with diverse backgrounds in science, engineering, marketing, sales and finance that span the commercial, government and academic sectors. Its executive team has held leadership positions at Merrill Lynch, Digital Equipment, Harris Corporation, AT&T, Citrix Systems, NASA and The Pentagon.

Contact Information

TiGi Corporation

8000 Towers Crescent Dr.
Suite 100
Vienna, VA 22182

Toll Free: 1-800-515-1581
Office: 703-462-2550
Fax: 703-462-2559
e-mail: info@tigicorp.com

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