

Washington Systems Center
1997 Benchmarking
Frequently Asked Questions
and Answers

Release 2.0 WSCFAQ.SAM

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Prepared by the IBM Networking Hardware Division

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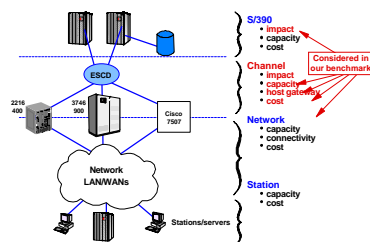
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Background:

In mid 1997, IBM Networking Hardware Division conducted a wide ranging series of enterprise scaleable benchmarking in the Washington Systems Center, Bethesda, Maryland. The IBM 3746-900, IBM 2216, and Cisco 7507 were tested. IBM engaged The Tolly Group to independently audit a series of tests which were designed to show the channel gateway performance of the tested implementations. The tests were completed in August, 1997.



In September, Cisco managers and engineers called upon Kevin Tolly, of The Tolly Group, to explore potential errors that Cisco felt had been made. Six specific objections were thoroughly investigated and Cisco was not able to find error.

IBM has made available the entire set of configurations, traces, and the full engineering report via the web: www.tolly.com.

Certainly Cisco can point to their market share in traditional router networks as evidence of reliable performance, but their strength in routing has not extended to the S/390 channel. - and our benchmark proves that Cisco doesn't have the enterprise scaleability to play in the big leagues.

Question 1: What kind of technical skills were used to support the Cisco Router?

Answer: The Washington Systems Center (WSC) fully staffed this initiative.

IBM took many steps to be fair in these tests. NHD contracted the services of the WSC because of the skills to master all the testing required. The WSC is a major center for the IBM Global Services organization. Located in Bethesda, Maryland, the WSC houses several groups, ranging from Business Recovery Services to the Networking team. It is a vast array of S/390 processors, DASD, Tape, and networking components.. The WSC provided highly skilled router and Cisco knowledgeable resources. WSC personnel were in dialogue with the Cisco Technical “ Tactical Assistance Center “ (TAC) throughout the tests. The WSC works with ISSC to implement customer solutions involving many different hardware vendors including Cisco. In addition, IBM employed the Tolly Group to audit and validate the test results.

The WSC team comprised skilled individuals in the following areas:

1. Cisco Router specialists who managed configurations, Cisco Technical Assistance Center (TAC) interface, planning and implementation of hardware and software.
2. VTAM/APPN/HPR specialists to perform detailed performance tuning and consultation with IBM VTAM support, configuration of all SNA workstations for both Netmarks and Communications Manager, and overall VTAM support.
3. MVS TCP/IP specialist to support S/390 and to ensure Netmarks IP workstations were configured and performing as designed.
4. IBM 2216 specialist.
5. IBM 3746 specialist.
6. Network Management specialist to ensure the capture of all relevant SNMP statistics.
7. MVS and TPNS specialist.
8. S/390 ESCON configuration specialist.
9. Performance and Analysis specialist (Network Performance Monitor)
10. S/390 environment specialist
11. NetView and Network Management specialist
12. Overall Project Leader.

Question 2: Was Cisco involved in tuning and optimizing the Cisco routers?

Answer 2: Cisco's TAC was frequently consulted with for advice on configuration and implementation items and for problem resolution throughout the project.

Cisco was consulted on many tuning, implementation, and problem items. All issues were addressed through Cisco's normal support structure. Cisco did not come on site. Every effort was taken to ensure that the Cisco router was configured for optimal operation. This included consultation with Cisco's worldwide support centers.

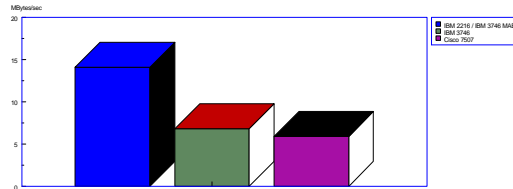
Question 3: Why did IBM use two channel adapter configurations for these tests? By configuring one Cisco Channel card with two ESCON connections, was this an "apples to apples" comparison?

Answer 3: IBM selected two channel adapters to establish a baseline for benchmarking a "real world" enterprise network. Scaleable, enterprise networking testing required at least two channel adapters. Our experiences have shown that customer environments often call for two channel adapters to provide higher throughput, connection choices, and availability.

Many customer environments require maximum throughput comparisons and backup capabilities. Cisco offers a single CIP card with 2 ESCON connections as a standard model and this was selected for the Cisco 7507. The 2216 option comprised two ESCON cards. IBM deemed this to be a reasonable and representative configuration choice.

Question 4: Why are the performance numbers for the Cisco Channel Interface Processor (CIP) lower than the media speed 17 MBS ESCON connection?

IBM delivers superior performance for IP networks - more than twice that of Cisco as S/390 server gateway



Source: The Tolly Group, August 1997

- Tested using 2 channel adapters and 8 Token-Rings

IBM 2216 3746 Cisco 7507

Answer 4: These performance numbers are based on a sustained throughput supporting enterprise level numbers of servers, connections, client/server pairs, and SNA PUs and LUs.

The Tolly measurements showed Cisco's sustained performance with a given client/server pair. In additional testing at the WSC, Cisco's IP throughput seems greater with fewer client/server pairs, up to 16 servers. When the number of servers increased to the upward bound of the test, 48 servers, the throughput for the Cisco 7507 was unpredictable.

Thus, 17 Mbps is the media speed of the ESCON channel and not a statement about the actual achievable throughput.

Question 5: The Multi-access Enclosure (MAE) enhancement for the 3746 and the 2216 are, essentially, channel attached routers. What differentiates this from Cisco's approach to channel gateways?

Answer 5: IBM provides a choice to customers as to how to implement this new technology, with its high performance. The investment in 3745 and 3746 is preserved and extended with the addition of the MAE.

until
these IBM offerings....

Not ready for prime time....

- ✓ High overall costs
- ✓ Uncertain performance
- ✓ Questionable scalability
- ✓ Increasing complexity
- ✓ Forklift migration
- ✓ Requires multiple boxes
 - To support SNA/APPN and TCP/IP



IBM's MAE showed that the use of this new technology can offer higher throughput without compromising the high availability and reliability of the network that most 3745 customers have come to expect from their channel attached gateways.

Question 6: Why didn't IBM test IOS for S/390?

Answer 6: The test's focus was to verify the throughput at the ESCON connection level, not the capabilities of S/390. The MVS stack for TCP/IP was not evaluated and is not relevant.

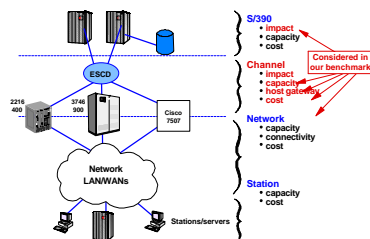
This benchmark tested channel gateway devices, and not the S/390 access methods.

Question 7: This test used Token Ring; why weren't Ethernet, fast Ethernet or FDDI tested?

Answer 7: The test was to verify scalability and throughput of Enterprise Server access. LAN topology was not relevant. This test was a test of ESCON and token ring.

Fact: This was a test of ESCON throughput using a token ring environment. This is relevant to many environments.

The LAN and WAN topologies were not part of this testing though they are part of the environment.. Token Ring was chosen because of its efficiencies in supporting an enterprise scalability test. The number of stations attached to rings and the number of rings per gateway was far more efficient. The configuration is directly comparable to many customer "real world" networks.



The focus of this benchmark was channel throughput, not campus throughput. It would have required significant more interfaces to load Ethernet LANs with the traffic volume of the token ring LANs. The result would have been more LANs, more interfaces, but negligible impact to the channel processing, which was the purpose of the test.

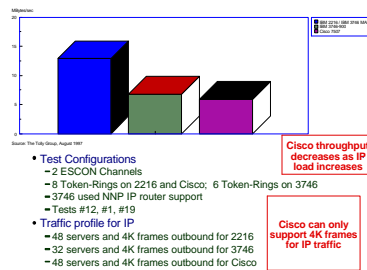
Question 8: Did IBM optimize its use of data message sizes for token ring and large messages? Many Customers use Ethernet and customer file transfers may vary between 1500-4000 bytes. Is this a "real world" test?

Answer 8: IBM tested many message sizes.

In so doing, we learned that Cisco does not consistently support 16K. The Tolly Group measures show equal message sizes for comparative purposes, in order to ensure an “apples to apples” view. The interactive SNA subarea tests used a series of typical SNA message sizes. When looking at IP transfers, we examined several increments ranging from 2K, 4K, 8K, and 16K. The IBM solution outperformed Cisco’s across a wide range of message sizes.

example

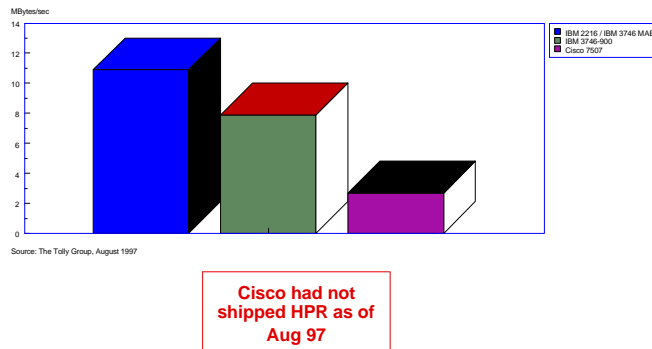
IBM 2216 3746 Cisco 7507



The test results are available in the reports published at www.tolly.com.

Question 9: Why didn't IBM test Cisco's HPR?

Answer 9: As of August 22nd, 1997, Cisco did not deliver HPR code to the WSC. The only alternative for APPN was to use the existing APPN ISR code. Cisco has announced its implementation as a channel protocol, Cisco MPC, and has not yet shipped this as a generally available product.

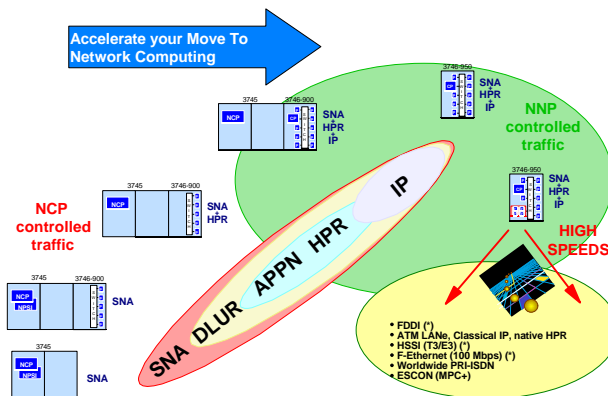


IBM 2216 3746 Cisco 7507

Question 10: What makes IBM's solution for server access evolutionary?

Answer 10: IBM offers solutions for S/390 access across a wide variety of products. The 374X family has evolved to include several new technologies since its introduction.

For the 3745 subarea customer, IBM is able to provide a clear road map that will enable them to migrate from a 3745 platform to a 3746 platform in an evolutionary manner. This road map supports multiprotocol applications, such as TCP/IP, SNA subarea, and APPN/HPR, along with high speed transport such as ATM, FDDI, and Frame Relay without significant disruption to the network operation or retraining of personnel. IBM's solutions provide consistent, high performance.



Question 11: IBM retained The Tolly Group to audit these tests. Can you view these tests as independent test results?

Answer 11: Yes, IBM retained The Tolly Group specifically to provide an independent validation of the test results.

The Tolly Group has been employed by many vendors, including Cisco, to provide the same thing that IBM was looking for: independent validation of legitimate, consistent test results. These results are published in the Tolly web site at www.tolly.com.

Question 12: Are these test results indicative of the performance of these products?

Answer 12: Yes, these tests are repeatable and show the sustained performance of these products in an enterprise environment.

Answer 12: In auditing these tests, the Tolly Group verified the methodologies employed. The lower IP throughput of the Cisco 7507 has been highly visible. In order to ensure the accuracy of these results, the tests were run many times. Traffic message sizes, configurations, implementation, and software levels were checked and rechecked. In our final analysis, it appears that increasing numbers of client/server pairs resulted in lessening throughput for the Cisco 7507, indicating that as the number of servers increased the throughput was unpredictable. The Tolly Group and IBM verified that software levels, configurations, channels, and all components were performing correctly.

Question 13: What was done to ensure that the Cisco 7507 was correctly configured for these tests?

Answer 13: The equipment, its configuration, and implementation were verified through Cisco's Technical Assistance Center and verified by the Tolly Group.

IBM deployed Cisco's fastest router that supports ESCON Channels, added maximum memory, added a new faster RSP4 route switch processor, and upgraded software as specifically directed by Cisco. To ensure fairness, the Tolly Group confirmed that the configuration parameters were correct. To ensure optimal performance, configuration options were tested and the Cisco configuration was reviewed by the Cisco Technical Assistance Center. The channel configurations were checked and verified, S/390 Channel utilization was checked and verified. Finally, the tests were run multiple times to ensure that they were statistically valid and scientifically measured.

After the announcement of these results, Cisco's engineers contacted the Tolly Group and queried them regarding items, such as, configuration of CLAW for channel program protocol, the use of single and double ESCON connections, supporting configuration information, and the correct configuration of message sizes in TCP/IP. IBM authorized the release of information to Cisco so that the Tolly Group could answer those queries. The Tolly Group answered those queries showing that these methodologies are fair and correct.

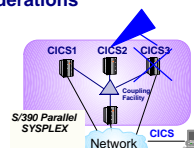
Question 14: A number of the benchmarking tests were for SNA APPN. How applicable is this to customer environments?

Answer 14: The value of APPN and HPR is being increasingly understood by our customers and is a significant option for future migration.

It is of special interest to our customers implementing Parallel Sysplex environment for 24 X 7 availability. We have also tested the performance in the subarea environment. As expected, IBM excelled in delivering high performance in every traffic category, including TCP/IP.

Sysplex Considerations

- Improved scalability
- Improved availability
- Improved access
- 24x7x365 objective
- Significantly reduced costs



Question 15. Cisco and IBM do not use the same channel protocols. In these benchmarking, MPC+, a new channel protocol for APPN/HPR was tested. Are these tests comparable?

Answer 15: IBM supports the largest array of channel protocols in the industry. We invented every one of these channel protocols and continue to control their implementation and evolution.

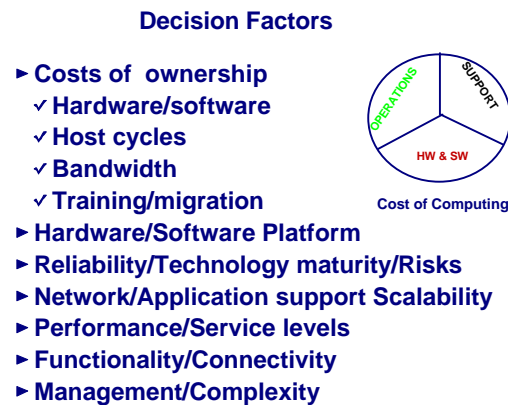
The 3746 uses CDLC, LCS, LSA, and MPC+. These various alternatives give customers the most options based on their specific needs. Currently, MPC+ is used only for APPN/HPR traffic, but in the next release of TCP/IP, MPC+ will also provide support for TCP and UDP. This means that the customer will get the benefits of MPC+ in either SNA or TCP or a mixed environment. Cisco does not support MPC+ - they have announced their version of MPC, called CMPC, but that is only for SNA traffic and not for TCP/IP. Further, it is not yet available from Cisco. Our Comm Server development folk rewrote the MPC code to provide MPC+ - it is completely different code, providing increased performance and availability. Cisco cannot even supply the earlier generation of MPC. As OS/390 and Comm Server/390 become more prevalent, we will see more customers using the latest levels of the code, and hence MPC+ will become very attractive indeed. You can expect up to 60% savings in host cycles, compared to Cisco, when using MPC+. The CDLC protocol continues to be used for the NCP support. We tested NCP during the benchmark, and it continues to provide excellent SNA support and superb offloading of host MVS/VTAM cycles compared to Cisco - up to 70% savings compared to the Cisco S/390 utilization.

We also tested LCS and LSA which are the protocols used today on the 3172. We tested LCS on the 2216 for IP support and LSA on the 2216 for SNA passthrough supports. Both these protocols are used by customers today on the 2216. They are both applicable to the MAE as well. So, we actually tested all the current methods of channel communications, and not just MPC+.

Channel Access Protocol Support

Protocol / Function	IBM Channel Access	Cisco Channel Access
TCP/IP	LCS	CLAW
DLSw SNA end systems	LSA	LSA
APPN: - ISR - HPR	LSA MPC+	LSA MPC (Not yet GA)
SNA LAN Gateway - Token Ring - Ethernet - ATM TR LANE - ATM EN LANE	LSA LSA LSA LSA	

Question 16. What is the benefit of the 3746 MAE over other implementations, such as the Cisco gateway?



Answer 16: The customer’s investment is protected and extended by the addition of the 3746 MAE. The implementation of the MAE is not just technology bolted on to the 3746; rather, it is an extension to the useful life of the 374X family, a measure of “lasting value.”

The MAE technology provides a smooth migration path for 3746 users, enhancing both performance and connectivity. Adding the MAE will bring the total number of processors on the 3746 to 23. Each 3746 processor (including the MAE) is controlled and managed by the Network Node Processor (NNP). All 3746 processors, including the MAE, will be managed and controlled as one system image and one router image for both APPN and IP. All management and configuration will be handled by CCM on the 3746. The MAE gives customers the scalability and performance they require in today's combined SNA and IP networks.

On 9 September 1997, IBM announced that the MAE will be enhanced to provide improved IP performance, up to three times current levels. Attaching the MAE to the 3746 gives the customer additional flexibility in using any of the processors on the MAE or 3746. Based on customer needs, they may use either the ESCON processor on the 3746 or the MAE, or the parallel channel on the 3745. IBM believes this wide range of flexibility gives customers the most scalability.

As a high speed processor attachment, maximum S/390 throughput can be achieved using the MAE ESCON processor and MPC+.

Question 17: Why did IBM test the Cisco 7507 and not the 7513 ? Most customers adding a Cisco CIP do so on the 7513. The 7513 is a higher speed channel attached router.

Answer 17: The 7507 and 7513 are identical in all aspects, except the number of processor slots and the higher list price of the 7513. The 7507 has 5 slots and the 7513 has 11 slots. The IBM benchmarks were done for performance throughput and not LAN connectivity. Using a 7513 would produce the same results. IBM had both a 7507 and 7513 available for use in these tests. We chose the 7507 for shipment to the WSC because we did not need the additional slots in these tests.

Question 18: Why have you discussed two sets of results - those endorsed by Tolly and those produced by the WSC? Why didn't Tolly audit all our results?

Answer 18: The decision is based on efficient use of resources, time and money. IBM chose these tests for auditing in order to deliver verified results to show the enterprise scalability of these server access gateways for S/390.

The WSC ran many tests in addition to the Tolly audited tests.. There was not time nor the budget to audit every test and so the most important tests were chosen for audit by the Tolly Group. It is important to also note the difference in methodologies: Tolly tested for sustainable, repeatable results; whereas the WSC was looking for the maximum achievable performance regardless of number of connections, message size, etc. These approaches are different because the objectives were different.

Question 19: Has Cisco licensed MPC or MPC+?

Answer 19: Cisco has not, as of this writing, licensed MPC. There are companies who have. Cisco is not among them. MPC+ has not been licensed to anyone. IBM makes decisions about the licensing of these technologies based on the overall needs of its S/390, software, and networking businesses.

Cisco has announced Cisco MPC and was not able to ship this implementation to IBM, as of August 22nd, 1997, for these benchmark tests.

Question 20: How do these benchmark results compare with IBM's prior testing?

Answer 20: The testing completed in the past on prior releases of hardware, such as the Cisco 7000, are of historical interest. The current benchmarking is based on the latest and most current levels of hardware and software.

Comparisons of APPN, packet speeds, and other capabilities tested in previous benchmarks have become dated with these results.

Question 21: There are those who would quote packets per second for IP and APPN throughput on Cisco 75XX as being much higher than these benchmarks. Any comments?

Answer 21: The IBM benchmark was audited and validated by the Tolly Group. The data, methodology, and results are public, documented, and repeatable. Comparisons based on of raw packets per second have not proven to be meaningful indicators of performance for S/390 connectivity.

Question 22: Why didn't IBM test the Cisco 7507's TN3270e functions?

Answer 22: The Cisco 7507's new RSP4 processor did not support running TN3270e until after the Tolly audited tests were completed. IBM received the code drop from Cisco in August and in fact installed and initialized this code. The code was received too late to be tested in this project. IBM's TN3270e server has been previewed but has not shipped as on October 1997.

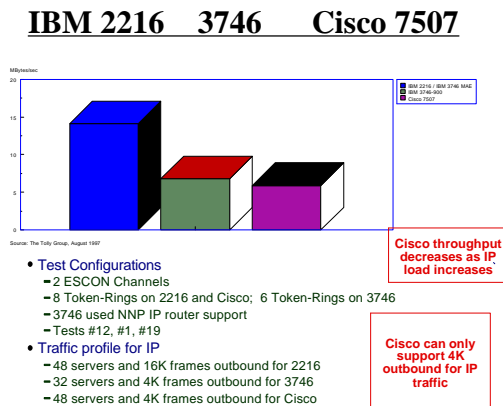
IBM is interested in future tests to compare this function with the 2216's TN3270e functions. Claims that a CIP2 card can support 16,000 LUs, 720 transactions/second, or IP of 18 MB/sec are not substantiated.

Question 23: Has IBM stated that the use of the CIP will increase CPU MIPs 47%?

Answer 23: NO. IBM has an accurate formula, that states the exact impact to VTAM. A good working number is a 47% increase in VTAM's impact on the CPU. This can range from 3% to over 30% impact on the CPU, depending on configuration parameters. This impact is the result of using SNA passthrough (XCA), as implemented by either Cisco's 7507 or IBM's 2216, rather than NCP.

Question 24: Can you comment on the possibility that the Cisco CIP2 support 18MB / second peak and sustain 9 MB/sec. on one ESCON connection?

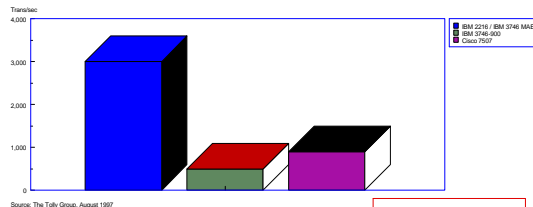
Answer 24: The audited performance of the Cisco 7507 has been documented as much less. Our own internal momentary peak performance measures of the Cisco 7507 fell far short of 18 MB/sec.



Question 25: Cisco's 7507 is rated at 250,000 to 1,000,000 packets per second, often sited at 880,000 PPS. The IBM 2216 is rated at about 85,000 PPS. How, then, does IBM claim its 2216 is more than twice as fast for IP?

Answer 25: The real and effective throughput of the IBM 2216 in delivering data to the S/390, in IP file transfers, was tested, audited, and verified to be over twice that of the Cisco 7507. This causes IBM to question the validity of packets per second as a measure of performance and throughput.

Question 26: Comment on the SNA batch performance, wherein the IBM 2216 was 70% faster than the Cisco 7507 (in CSNA mode).



- Test Configurations
 - 2 ESCON Channels
 - 6 Token-Rings in all configurations
 - 2216 and Cisco used Passthrough; 3746 used NCP(on single CCU)
 - Tests #13, #4, #20
- Traffic Profile SNA-1 with 128B/128B messages
 - 1160 PUs/4416 LUs for 2216
 - 1160 PUs/4570 LUs for 3746
 - 240 PUs/619 LUs for Cisco*

* Have to slow down activation rate on Cisco to get SNA PUs and sessions up

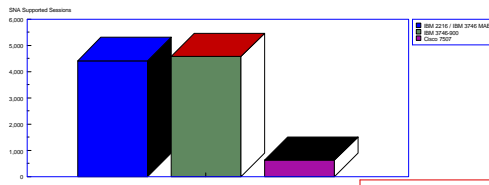
IBM 2216 3746 Cisco 7507

Answer 26: The test was audited and verified by the Tolly Group - see www.tolly.com.

Question 27: Cisco may question the number of transactions per second achieved by the Cisco 7507 (900 TPS), which was less than 1/3 of the IBM 2216 (3000 TPS). Comments?

Answer 27: The test was audited and verified by the Tolly Group. Many message sizes were tested and the Cisco 7507 performed at about 1/3 of the 2216's capability consistently.

IBM 2216 3746 Cisco 7507



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* Have to slow down activation rate on Cisco to get SNA PUs and sessions up

Question 28: Does this WSC benchmarking position the 2216 against the Cisco 75xx as a high end router?

Answer 28: The IBM 2216 outperformed the Cisco 7507 as a channel gateway and is the superior performer in that environment. The IBM 2216, when combined with IBM's switched virtual network family, meets the needs of customers' networks.

Question 29: Cisco offers a CIP2 card which supports 2 connections which may be ESCON or Parallel channel. Did you test both connections of a CIP2 card?

Answer 29: Our tests showed that there is not a linear increase in throughput when using both connections of the CIP2 card. The Tolly Group has published the traces which showed that both Channel ESCON connections were operational and traffic was flowing on both.

Question 30: When will IBM deliver functions such as TN3270e server, HSSI, Fast Ethernet FDDI, parallel channel and other functions?

Answer 30: The next few months will bring many great enhancements for the IBM 2216 and 2210 family.

Question 31: Was Cisco invited to participate in this testing?

Answer 31: IBM Networking commissioned the Washington Systems Center to provide the testing environment and The Tolly Group to audit the tests. IBM networking did not ask or invite Cisco to plan or implement the testing. The IBM WSC and The Tolly Group did call upon Cisco's technical support on a variety of items. IBM used Cisco's Tactical Assistance Center for support of this benchmark. IBM did not call upon Cisco's marketing or sales organizations to give advise or counsel.

Question 32: Is it true that Cisco challenged IBM to a benchmark?

Answer 32: Cisco has written to IBM, and blind carbon copied a trade press editor with a challenge to essentially dispense with this WSC benchmark and engage in a new benchmark. IBM's response was to offer Cisco the data, traces, and engineering reports for this benchmark so that Cisco can better understand this initiative. This material is available at www.tolly.com.

Question 33: Any comments on the claim that the high switching and packets per second capability of the 75xx family, especially compared to the 2216?

Answer 33: IBM is pleased that customers are considering the 2216 as a robust router. The facts are that when it comes to delivering throughput on an ESCON channel, the 2216 does a superior job. Measurements of adapter to adapter packets per second are not relevant to S/390 capacity measures.

Question 34: Comment on the statement that HPR from Cisco is available and that the WSC should have used this.

Answer 34: Cisco did not provide HPR code as of August 22, 1997 to the WSC.

Question 35: Can you compare the port density, number of LAN connections, and total size of the 2216 with the Cisco 7500? Additionally, the 7500 has far greater backplane, switching, routing, and other capabilities, according to Cisco. Comments?

Answer 35: IBM designed the 2216 to provide a robust and complementary Switched Virtual Network (SVN) solution. Customers are moving toward lower cost, higher performing switched infrastructures. However, since both the 2216 and Cisco 75xx perform S/390 channel gateway functions, we sought to establish their relative performance. The facts are that the 2216 outperformed the Cisco 75xx router for this function.

Question 36: Does the mechanical drive of the IBM 2216, used to store configurations, impact MTBF?

Answer 36: The technology of the IBM 2216 is world class in every respect. The hard disk is designed for high MTBF and it allows for better troubleshooting, as it stores trace data. The high performance disk is used at startup and not for steady state operation.

Answer 37: How does the architecture of the 75xx and the CIP compare to the 2216?

Answer 37: The Cisco 75xx employs a route switch processor (RSP4) which has its own memory and processor. It uses a CIP2 card which also has its own memory and processor. The IBM 2216 uses a PowerPC processor and ESCON adapter(s) to provide equivalent function. The positive results of the benchmark, wherein the 2216 outperformed the 7507, confirm the quality of the 2216's design.

Question 38: Cisco has announced that it is certified to support IBM 's TPF environment. IBM's TPF announced that the Cisco 75xx is its choice as a TCP/IP gateway. Comments?

Answer 38: NHD acknowledges this IBM - Cisco OEM relationship. NHD supports TPF's TCP/IP stack, which is still dependent on offload, via the 3172. TPF has not announced an intention to migrate to the new TCP/IP stack, rewritten to eliminate the need for offload. The strategic NS and NH products, the OS/390 and Comm Server platforms, have moved to this new stack. The new stack gives great flexibility in the support of parallel Sysplex environments, the support of IP and HPR across ESCON channels, and many performance and functional enhancements. The current announced 2216 plans do not include that capability. This should not be construed to mean anything beyond TPF's TCP/IP implementation.

Question 39: Is the IBM 2216-400 to be compared to the Cisco 4700 or 7500?

Answer 39: While IBM would position the 2216 as a mid-range router, similar to the Cisco 4700, the Tolly Reports clearly show that the IBM 2216's performance surpasses Cisco's 7500 series router as a S/390 gateway.

Question 40: Does the Cisco CIP2 or the 2216 replace the role of the Front End Processor (FEP)?

Answer 40: No, especially given the documented performance of the 3746 in these tests. The WSC testing on the value of NCP, the 3746's role in APPN migration (ISR), and its ability to integrate the new high performance 2216 technology as a component (MAE), are just a few of the reasons that the 3746 continues to provide lasting value.

Question 41: Often Cisco implementations use peering routers to handle the workload of functions, such as data link switching or distributed LU server/requestor functions. Any comments?

Answer 41: These benchmarks did not address the use of peering routers. However, peering routers represent an implementations that often accompany a Cisco S/390 gateway. In our testing, we encountered significant capacity constraints, such as slow PU activation and instability of active LUs, that define a clear need for distributing function to peering routers.

Question 42: Can you use this data to extrapolate the one channel or multiple channel throughput of these products?

Answer 42: Extrapolation is not recommended. NO.