



# IBM MVS TCP/IP Performance Tuning Tips and Capacity Planning

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- The performance data discussed in this presentation was collected in dedicated system environments. Therefore, the results obtained in other configurations or operating system environments may vary.



# Presentation Overview

- CS/390 R7, R8, R10 & R12 Performance Summary
- IBM MVS TCP/IP CS/390 R4, R5, R6, R7, R8, R10 & R12 Performance Tuning
- TCP/IP OS/390 Unix System Services Performance Tuning
- FTP Performance Tuning / Capacity Planning
- Telnet Performance Tuning / Capacity Planning
- CICS Sockets TuningParms
- TCP/IP Tuning Performance Checklist

## CS/390 Release Info

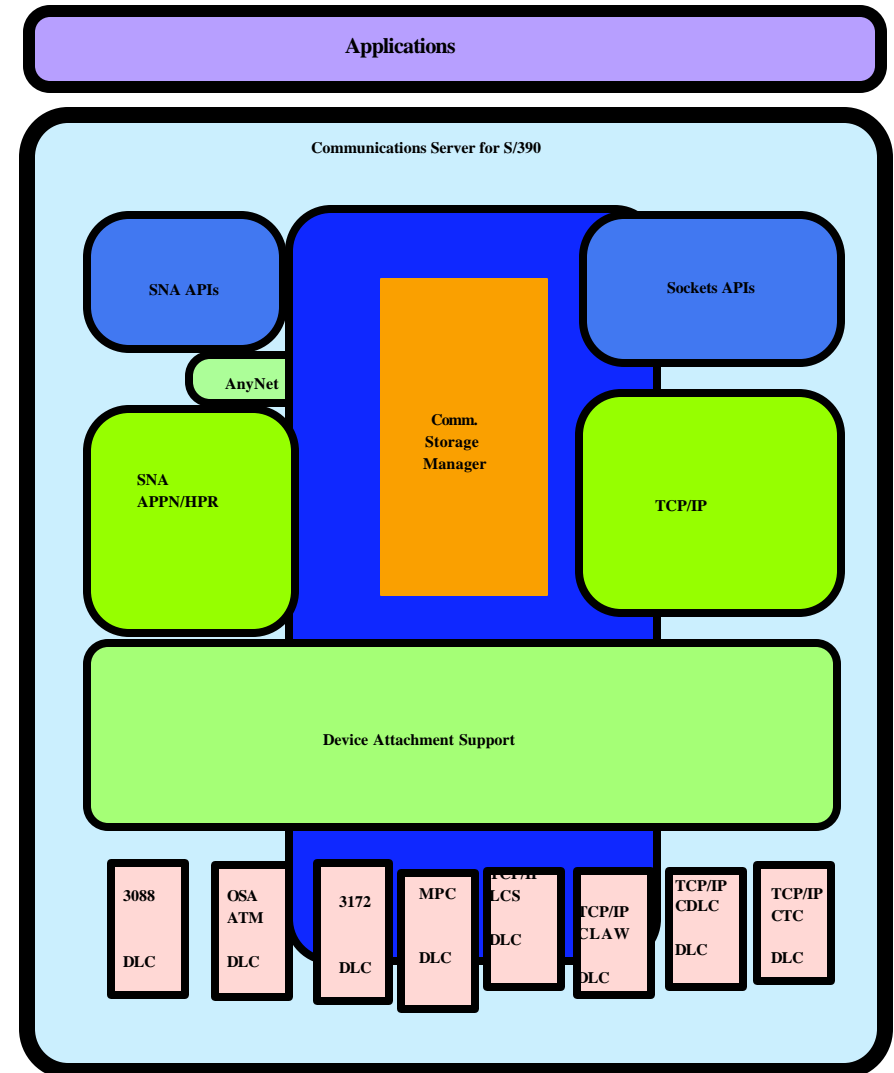
- Comm. Server for OS/390 (CS/390):  
Integral part of OS/390.
  - ▶ OS/390 R3 , CS/390 R3 (3/97): TCP/IP V3R2
  - ▶ OS/390 R4 , CS/390 R4 (9/97): TCP/IP V3R2  
& R4
  - ▶ OS/390 R5 , CS/390 R5 (3/98): R5
  - ▶ OS/390 R6 , CS/390 R6 (9/98): R6
  - ▶ OS/390 R7 , CS/390 R7 (3/99): R7
  - ▶ OS/390 R8 , CS/390 R8 (9/99): R8
  - ▶ OS/390 R9 , CS/390 R8 (3/00): R8
  - ▶ OS/390 R10, CS/390 R10 (9/00): R10
  - ▶ z/OS V1R1 , CS/390 R10 (3/01): R10
  - ▶ z/OS V1R2 , CS/390 R12 (10/01): R12

# Enterprise Class SNA and TCP/IP

## Comm. Server for OS/390

### Integrated Services

- Comm. Server for OS/390 provides:
  - ▶ Reliability of OS/390 system
  - ▶ High Availability
  - ▶ Capacity
  - ▶ Scalability
  
- Provide common services within the S/390 Communications Server
  - ▶ Storage Management
  - ▶ Device Attachment (with Data Link Controls)
  
- TCP/IP and SNA integration (e.g. TN3270)





# CS/390 R12 Performance Highlights

- HiperSockets
  - ▶ LPAR to LPAR communication via memory (same CEC)
  - ▶ Supported on IBM eServer zSeries 900 processors
  - ▶ Speed equivalent to cross addr space memory move
  - ▶ Up to 4 HiperSockets Lans per CEC
  - ▶ MTUs: 8KB, 16KB, 32KB, 56KB
  - ▶ Configure with IPCONFIG DYNAMICXCF stmt or manually configure
  
- Hipersockets Accelerator
  - ▶ Allow a single TCP/IP stack to act as a "router" for entire CEC
  - ▶ 'Accelerate' routing by bypassing entire TCP/IP stack
  - ▶ Reduces number of direct connections to external network
  - ▶ IPCONFIG IQDIOROUTING QDIOPRIORITY 3
  
- Full CLAW Packing
  - ▶ Pack multiple datagrams into a single claw channel frame
  - ▶ Pack up to 60 KB claw channel buffer
  - ▶ Prelim. TPUT Improvement: Inbound: +30 % Outbound: +65 %
  - ▶ R8 & R10: APAR PQ41205 (limited claw packing: 4KB)
  - ▶ Recommended for all customers using Cisco 7200/7500 (via claw)
  - ▶ MVS: DEVICE CLAW7500 CLAW HOST1 CISCO1  
PACKED 15 15 60K 60K
  - ▶ Router: CLAW EF73 80 48.1.1.1 HOST1 CISCO1 PACKED PACKED



# CS/390 R12 Performance Highlights

- TCP Protocol Configuration Options:
  - ▶ TCPTIMESTAMP  
TCPCONFIG TCPTIMESTAMP (default) or  
TCPCONFIG NOTCPTIMESTAMP
  - ▶ FINWAIT2  
TCPCONFIG FINWAIT2TIME 60 (60-3600 sec, default = 675)
  - ▶ Display current settings:  
D TCPIP,,NETSTAT,CONFIG
  
- TCP/IP Storage Management:
  - ▶ GLOBALCONFIG ECSALIMIT 250M POOLLIMIT 300M
  - ▶ Default is to set no storage limits
  - ▶ ECSALIMIT does not include ECSA CSM storage
  - ▶ POOLLIMIT is authorized private storage in TCP/IP Addr Space
  - ▶ D TCPIP,,STOR (Shows current storage limits)
  - ▶ 4 TCP/IP Storage Classes :
    - Normal: < 80 % of Storage Limit
    - Constrained: 80 % <= Constr < 90 %
    - Critical: 90 % <= Critical < 98 %
    - Exhausted: exhausted >= 98 %
  - ▶ Storage warning messages displayed on MVS console







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# CS/390 R12 Performance Highlights

- TCP/IP Performance Statistics:
  - ▶ D TCPIP,,NETSTAT,STATS
  - ▶ New MIB objects defined for SNMP
  - ▶ Displays IP, TCP, UDP, ICMP performance statistics
  
- Enterprise Extender Performance Improvements
  - ▶ Minimize route lookups
  - ▶ EE fastpath (Bypass IP layer, call IF layer)
  
- 64 bit real addressing support
  - ▶ Back most CSM data space above the 2 GB line
  - ▶ CSM displays are changed to support 64 bit
  - ▶ VTAM Option:
    - API64R=YES (64 bit backed storage can be passed to application)
    - NO (Forces a copy out of 64 bit backed storage before being given to application)
  
- IPSEC Performance Improvement
  - ▶ Previously, TCP connections using IPSEC were not able to take advantage of Path MTU Discovery.
  - ▶ Track negotiated MTU as part of PATH MTU discovery on a tunnel basis
  - ▶ Avoid calls to firewall code at IP layer



# CS/390 R10 Performance Highlights

- SAP Performance
  - ▶ 8.1 % ITR (Tran/CPU) Improvement in SAP Sales and Distribution (SD) Benchmark (vs CS/390 R8)
- Fastpath Local Sockets
  - ▶ 2 X increase in transactions/sec (vs CS/390 R8 Local Sockets)
  - ▶ 48 % or greater reduction in latency (vs CS/390 R8 Local Sockets)
- Route Lookup Enhancements
  - ▶ Up to 50 % CPU reduction when using CS/390 R10 as an intermediate router
- IP Security
  - ▶ 25 % reduction in Client CPU (vs CS/390 R8)
  - ▶ 10 % improvement in throughput (vs CS/390 R8)
- UNIX Select() Scalability & Performance Improvements
  - ▶ Response time of select() with 1000 file descriptors reduced to 1 ms from 60 ms.
  - ▶ In OS/390 R10 base, PTFed (OW44754) back to R8.
- FRCA-WebSphere responsibility passing
  - ▶ Dynamic passing of connection ownership between FRCA and WebSphere cache for persistent connections.



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# CS/390 R7 Performance Highlights

- Web Server Performance
  - ▶ 21,591 ops/sec running SpecWeb96 Benchmark (9672-YX6, G5 10 Way system)
  - ▶ Web Serving throughput improvement and CPU reduction using R7 Fast Response Cache Accelerator (FRCA) and DGW 5.1.
  - ▶ Up to 3.5 X throughput improvement (vs R6).
  
- LCS I/O Improvements (outbound data):
  - TN3270 : Reduces CPU up to 6 % (vs R6)
  - FTP Server: Avg. CPU reduction of 9 % (vs R6)
  - FTP Client: Avg. CPU reduction of 2 % (vs R6)
  
- Significant storage reduction compared to previous releases :
  - TN3270 (4000 to 32000 sessions):
    - Total Reduction of 40 to 120 MB
    - System CSA reduction of 7.9 to 60 MB
    - System SQA reduction of 30.4 to 31.3 MB



# CS/390 R7 Performance Highlights

- Inline buffer expansion of VTAM buffers improves TPUT and reduces CPU.
  - ▶ Up to 15 % TPUT increase & up to a 12 % CPU reduction for TN3270 (4,000 to 32,000 sessions) vs CS/390 V2R6.
- Path MTU Discovery :
  - ▶ Dynamically discovers minimum MTU of each hop in network.
  - ▶ Prevents fragmentation of datagrams.
  - ▶ Use IPCONFIG PATHMTUDISCOVERY parm in TCP/IP Profile.
- Accept\_and\_Receive socket call support
- Type of Service
- Enhanced Addressing for Session Managers:
  - ▶ Up to a 5 % TPUT increase and up to a 7 % CPU reduction for TN3270 (4,000 to 64,000 sessions) vs CS/390 V2R6.
  - ▶ Use ENHADDR=YES in VTAM Start options.
- 64,000 TN3270 sessions successfully tested
- New Queued Direct Input/Output (QDIO) channel cu design
- Gigabit Ethernet support with new OSA-Express adapters



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# CS/390 R7 Performance Highlights

## ■ OSA-Express - Gigabit Ethernet Performance:

Client: MVS Server: MVS

Application	OSA Express Gigabit Ethernet Throughput	OSA Express Gigabit Ethernet CPU	ESCON Channel Throughput	ESCON Channel CPU	Gigabit Ethernet / ESCON TPUT Ratio	Gigabit Ethernet / ESCON CPU Ratio
FTP (PUT) (MTU=1500)	30.44 MB/Sec	19.43 ms/MB	13.75 MB/Sec	22.69 ms/MB	2.21	0.85
FTP (GET) (MTU=1500)	27.95 MB/Sec	11.07 ms/MB	13.56 MB/Sec	12.72 ms/MB	2.06	0.87
FTP (PUT) (MTU=9000)	33.97 MB/Sec	12.16 ms/MB	14.05 MB/Sec	16.11 ms/MB	2.41	0.75
FTP (GET) (MTU=9000)	29.48 MB/Sec	8.11 ms/MB	13.84 MB/Sec	9.14 ms/MB	2.13	0.89
TN3270 (4000 u)	2487 tr/sec	0.6374 ms/tr	2522 tr/sec	0.6390 ms/tr	0.98	0.997
TN3270 (8000 u)	4036 tr/sec	0.7193 ms/tr	4121 tr/sec	0.7605 ms/tr	0.98	0.946
TN3270 (12000 u)	4949 tr/sec	0.7464 ms/tr	4601 tr/sec	0.8225 ms/tr	1.075	0.907
TN3270 (16000 u)	5215 tr/sec	0.7654 ms/tr	4716 tr/sec	0.8475 ms/tr	1.105	0.903

FTP Summary: 2.06 to 2.41 X (TPUT), 11 to 25 % CPU Reduction

TN3270 Summary: - 2 to + 10.5 % (TPUT), 0.3 to 9.7 % CPU Reduction





# IBM MVS TCP/IP Performance Comparison (CS/390 R10 & TCP/IP V3R2)

CS/390 R10 vs TCP/IP V3R2+ :

Application	TPUT	CPU	TPUT / CPU
Web Server	up to 8.2 X	- 93 %	up to 117 X
CICS Sockets	up to 1.95 X	- 46 %	up to 3.61 X
Telnet(TN3270)	up to +2 % (note 1)	- 48 %	up to 1.96 X
FTP Server	up to 1.27 X	- 48 %	up to 2.46 X
FTP Client	up to 1.31 X	- 63 %	up to 3.52 X

Note 1: Telnet transaction generator is time driven (with a think time between user transactions) so that transactions per second are approx. equal for all releases.



# IBM MVS TCP/IP CPU Performance Ratio

## Summary: (V3R2 GA, V3R2+, CS/390 R5, R6, R7, R8 & R10)

MVS CPU Ratio's:

Application	TCP/IP V3R2 GA	TCP/IP V3R2+	CS/390 R5 +	CS/390 R6 +	CS/390 R7+	CS/390 R8 (GA)	CS/390 R10 (GA)
Web Server	-----	1.00	0.30	0.26	0.07 (FRCA ON)	0.07 (FRCA ON)	0.07 (FRCA ON)
CICS Sockets	-----	1.00	0.61	0.58	0.57	0.55	0.54
Telnet (TN3270)	1.00	0.71	0.48	0.44	0.40 LCS	0.39	0.37
FTP Server	1.00	0.87	0.58	0.52	0.48 LCS	0.47 LCS	0.45
FTP Client	1.00	0.77	0.31	0.30	0.29 LCS	0.28 LCS	0.28

+ : means GA code + PTF 's



# IBM MVS TCP/IP CS/390 R4-R12 Performance Tuning

- Number of TCP/IP Buffers no longer specified in TCP Profile

- ▶ TCP/IP Buffers are dynamically allocated (CSM)

- TCP/IP Send / Receive Buffer Sizes:

Default Size = 16 KB

Override Send/Receive buffer size for all applications (TCP/IP Profile):

TCPCONFIG	TCPSEENDBFRSIZE	65535
	TCPRCVBUFRSIZE	65535
UDPCONFIG	UDPSEENDBFRSIZE	65535
	UDPRCVBUFRSIZE	65535
	NOUDPQUEUELIMIT	

Override Send Receive buffer size for one application:

Use setsockopt(SO\_SNDBUF) or setsockopt(SO\_RCVBUF) in application

- CSA/SQA Storage Usage (R7):

CSA : For TN3270 (4k to 64k users), need 18.8 to 262 MB additional

SQA : For TN3270 (4k to 64k users), need 0.2 to 1 MB additional

- CSA/SQA Storage Usage (R8):

CSA : For TN3270 (4k to 64k users), need 14.1 to 197 MB additional

SQA : For TN3270 (4k to 64k users), need 0.1 to 1.1 MB additional

- ▶ **Save 4.7 to 65 MB of System CSA storage with CS/390 V2R8 (vs R7).**

TCP/IP control blocks and data structures moved from System CSA storage to TCP/IP Address Space storage.





# IBM MVS TCP/IP CS/390 R4-R12

## CSM Performance Tuning

### ■ CSM Storage Settings:

SYS1.PARMLIB (IVTPRM00):

Fixed MAX(x M)      Recommend 60 M  
ECSA MAX(y M)      Recommend 40 M

Display cmds:                      D NET,CSM      or  
   D NET,CSM,ownerid=all

### CSM Usage (R8 & R10):

Workload	# Users / Clients	TPUT (CS/390 R8)	MAX CSM (ECSA)	MAX CSM (Data Space)	Max CSM (FIXED)
Web Server (R8)	200	3123.8 c/s	3.44 MB	1.10 MB	4.71 MB
CICS Sockets	84	409 c/s	0.736 MB	1.96 MB	3.8 MB
TN3270 (Echo's)	4000	395.8 tr/sec	0.66 MB	3.63 MB	5.28 MB
	8000	794.5 tr/sec	3.42 MB	4.84 MB	11.38 MB
	16000	1529.6 tr/sec	4.84 MB	11.09 MB	17.35 MB
	32000	2626.7 tr/sec	12.53 MB	19.93 MB	34.12 MB
FTP Server	64000	3295.4 tr/sec	13.38 MB	28.15 MB	42.34 MB
	9 Inbound 9 Outbound	34270 KB/S 51870 KB/S	1.82 MB 6.3 MB	10.00 MB 6.29 MB	12.58 MB 13.65 MB

# IBM MVS TCP/IP CS/390 R4-R12

## VTAM Buffer Performance Tuning

### ■ VTAM Buffer Settings:

#### ▶ VTAM Start Options:

Set IOBUFF, LFBUFF, CRPLBUFF, TIBUFF and CRA4BUFF using application usage below as a guideline.

#### ▶ Display cmds:     D NET,BFRUSE,BUFFER=SHORT                           D NET,STORUSE

VTAM Buffer Max Usage (R8 & R10):

Work load	# Users / Clients	TPUT (CS/390 R8)	VTAM Buffer (IO00)	VTAM Buffer (LF00)	VTAM Buffer (CRPL)	VTAM Buffer (TI00)	VTAM Buffer (CRA4)
Web Server (R8)	200	3123.8 c/s	11	5	55	110	7
CICS Sockets	80	409 c/s	26	5	54	29	6
TN3270 (Echo's)	4000	395.8 tr/sec	94	4005	8007	156	45
	8000	794.5 tr/sec	168	8005	16007	211	60
	16000	1529.6 tr/sec	564	16005	32007	812	68
	32000	2626.7 tr/sec	1629	32005	64007	1358	68
	64000	3295.4 tr/sec	2209	64005	128007	2431	169
FTP Server	9 Inbound	34270 KB/S	20	4	2	4	4
	9 Outbound	51870 KB/S	20	4	2	4	4



# MVS TCP/IP and OS/390 Unix System Services Performance *Tuning*

- Follow the OS/390 Unix System Services performance tuning guidelines in the OS/390 Unix System Services Planning manual (SC28-1890) or WWW.
  - <http://www.s390.ibm.com/oe/bpxa1tun.html>
- Follow IBM MVS TCP/IP Performance checklist.
- Update your MVS TCP/IP Profile, TCPIP.DATA and FTP.DATA files.
- Estimate how many OS/390 Unix System Services users, processes, ptys, sockets and threads would be needed for your OS/390 Unix installation. Update your BPXPRMxx member in SYS1.PARMLIB.



## *MVS TCP/IP and OS/390 Unix System Services Performance Tuning (con't)*

- OS/390 R1-R3 :  
Estimate how many ASCH initiators would be needed for your Unix installation. Update your ASCHPMxx member in SYS1.PARMLIB.
- Spread OS/390 Unix user HFS datasets among many DASD volumes for optimal performance.
- Monitor your OS/390 Unix resources with RMF and/or system commands (DISPLAY ACTIVE, DISPLAY OMVS, DISPLAY ASCH, DISPLAY APPC, etc.).
- Adjust OS/390 Unix system parms to improve performance.

## *MVS TCP/IP and OS/390 Unix System Services Performance Tuning (BPXPRMxx)*

### **BPXPRM<sub>xx</sub> (SYS1.PARMLIB) Tuning:**

- Optimally set Max... parms.
  - ▶ Make sure MAXPROCSYS, MAXPROCUSER, MAXUIDS, MAXFILEPROC, MAXPTYs, MAXTHREADTASKS and MAXTHREADS are optimally set.
  - ▶ If these parms are not optimally set, your OS/390 Unix performance may be degraded. For more information, see the OS/390 Unix Services Planning manual (SC28-1890).
- Set MAXSOCKETS(n) to a high number to avoid shortage.
  - ▶ Make sure the MAXSOCKETS(n) parm for the AF\_INET domain is set high enough to avoid running out of OS/390 Unix sockets.
  - ▶ As an example, each OS/390 Unix telnet session would require 1 OS/390 Unix socket and each FTP session would require 1 OS/390 Unix socket. Once the MAXSOCKETS limit is reached, no more telnet, FTP sessions or other apps that require OS/390 Unix sockets would be allowed to start.



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## *FTP Tuning Summary*

- MVS CPU decreases as packet size (MTU) increases
- MVS throughput increases and MVS CPU decreases as Workstation window size increases
  - ▶ Recommended WS Window size = 64 KB
- MVS throughput increases and MVS CPU decreases as MVS TCP/IP TCP Window size increases
  - ▶ Recommended MVS Window size = 64 KB

Note: MVS FTP Server and Client sets its TCP send/receive buffers to 180 KB.

Thus, the MVS FTP Server and Client will use a 64 KB window size by default.

For other applications that send/receive large streams of data, make sure their TCP or UDP send/receive buffers are set to a minimum of 64 KB.

## *FTP Tuning Summary (continued)*

- For CLAW devices (Cisco Channel Attached Routers), set read and write buffers on CLAW Device statement (MVS TCP/IP Profile) to 50 (Default = 15) for improved performance.
- MVS throughput increases as MVS dataset blocksize increases.
  - ▶ Recommended DS blocksize = 1/2 DASD track.
- For best performance, keep CHKPTINT parm (in TCPIP.FTP.DATA) = 0.
- File System characteristics (Caching, file blksize, dasd speed, etc.) can greatly influence FTP performance (CPU & Throughput).



# MVS CS/390 R12 FTP Server Performance (MTU=1500)

MVS FTP Server Performance:

2064-----OSAE-GbE-----Switch----- GbE---- 1 RISC/6000 WS

(4 CP LPAR)

(1 FTP Client)

z/OS V1R2

CS/390 R12

MTU/Pkt Size = 1500      Filesize = 20 MB

AIX rfc1323=0, AIX tcp\_sendspace=65536,

Using 1 DASD Bank ([Shark](#))

AIX tcp\_recvspace=65536

FTP Type	Lan	Total MVS CPU microsec / KB	TPUT 1 session (KB/Sec)
Bin Put/Get			
Bin Put	GBE	15.15	11201
Bin Get	GBE	8.0	9630
Average		11.58	10415

KB = 1024





# MVS CS/390 R10 FTP Server Performance (MTU=1500)

MVS FTP Server Performance:

9672-RX6-----OSAE-GbE-----Switch----- GbE---- 1 or 3 RISC/6000 WSs  
(4 CP LPAR) (1 or 9 (3/WS) FTP Clients)

OS/390 R10

CS/390 R10

MTU/Pkt Size = 1500

Filesize = 20 MB

AIX rfc1323=0, AIX tcp\_sendspace=65536,

Using 3 DASD Banks

AIX tcp\_recvspace=65536

FTP Type Bin/Ascii Put/Get	Lan	TCP+ VTAM+ FTP CPU microsec / KB	TPUT 1 session (KB/Sec)	TPUT 9 sessions (KB/Sec)
Bin Put	GBE	20.098	6520	34270
Bin Get	GBE	9.8311	7290	51870
Ascii Put	GBE	38.389	6470	36660
Ascii Get	GBE	20.801	6560	50940
Average		22.280	6710	43440

KB = 1024

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# MVS CS/390 R10 FTP Server Performance (MTU = 9000)

MVS FTP Server Performance:

9672-RX6----OSAE-GbE-----Switch-----GbE----- 1 or 3 RISC/6000 WSs  
(4 CP LPAR) (1 or 9 (3/WS) FTP Clients)

OS/390 R10

CS/390 R10

MTU/Pkt Size = 9000

Filesize = 20 MB

AIX rfc1323=0, AIX tcp\_sendspace=65536,

Used 3 DASD banks

AIX tcp\_recvspace=65536

FTP Type Bin/Ascii Put/Get	Lan	TCP+ VTAM+ FTP CPU (microsec / KB)	TPUT 1 session (KB/Sec)	TPUT 9 sessions (KB/Sec)
Bin Put	GBE	11.865	6280	35860
Bin Get	GBE	7.834	7570	57940
Ascii Put	GBE	30.881	6500	36410
Ascii Get	GBE	18.55	6710	53590
Average		17.285	6770	45950

KB = 1024

10 to 41 % (Avg 22 %) CPU Reduction vs MTU=1500

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# FTP Capacity Planning

## MVS CPU Requirements:

$$\begin{array}{rcccl}
 \text{Max KB} & & \text{CPU secs} & & \text{CPU secs} \\
 \text{-----} & * & \text{-----} & = & \text{-----} \\
 \text{Elap secs} & & \text{KB} & & \text{Elap secs}
 \end{array}$$

Example: (34270 KB/S, WS--> MVS, Bin Put, CS/390 R10, IBM OSAE-GBE)

$$\begin{array}{rcccl}
 34270 \text{ KB} & & .000020098 \text{ N1} & & .689 \text{ CPU secs} \\
 \text{-----} & * & \text{-----} & = & \text{-----} \\
 \text{Elap secs} & & \text{KB} & & \text{Elap secs}
 \end{array}$$

N1: MVS TCP/IP + VTAM + FTP Addr Spaces  
(9672-RX6 4 CP LPAR)

If the CPU secs/Elap sec ratio is greater than 1, one would need more than one processor (CS/390 R4 - R12).

# FTP Capacity Planning con't

MVS CPU Utilization:

$$\frac{\text{CPU secs/Elap Sec}}{\text{\# of processors}} * 100 \% = \text{CPU Util \%}$$

# of processors: Should be equal to the number of number of processors (CS/390 R4 - R12).

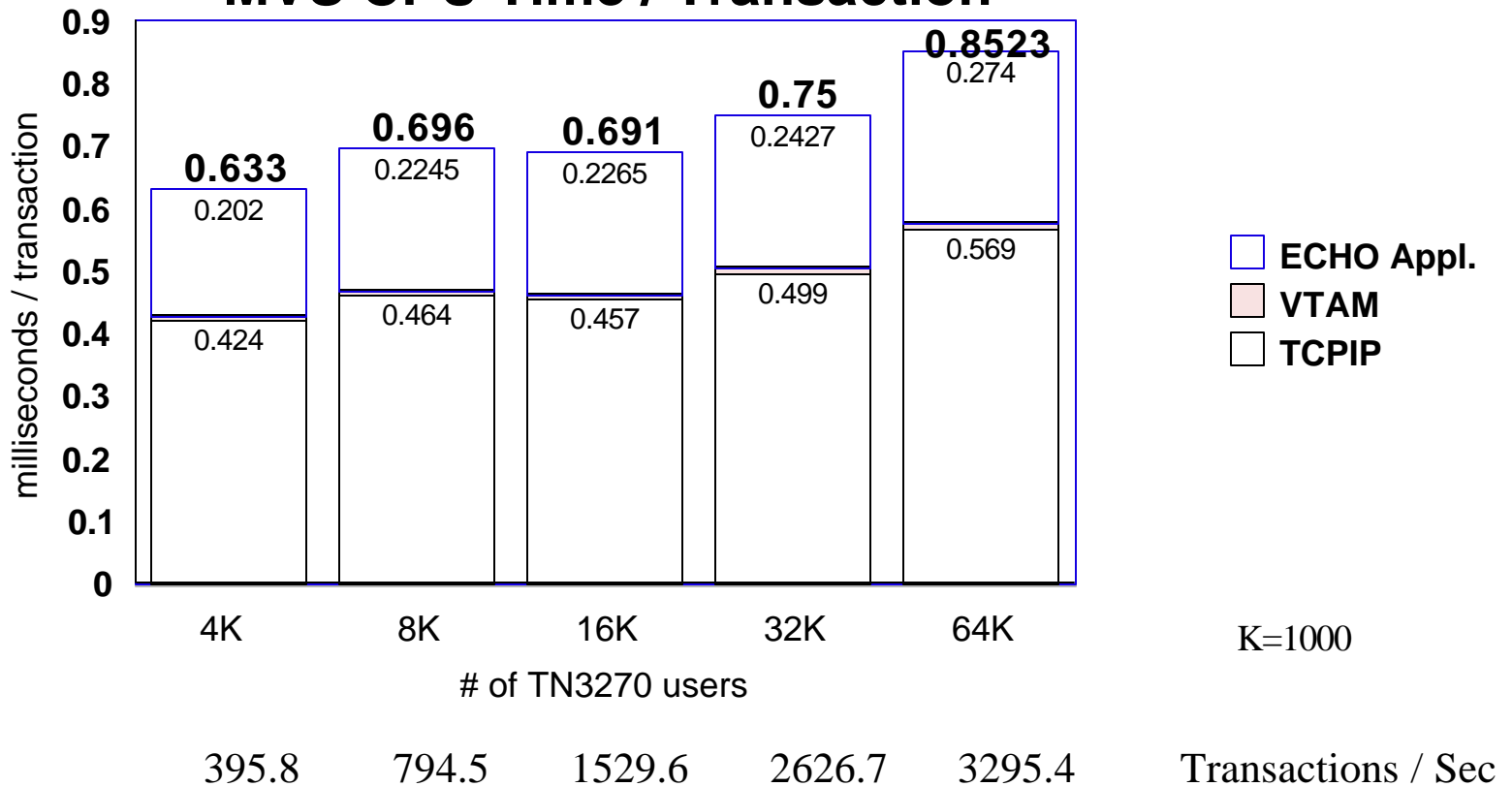
Example: (34270 KB/S, WS--> MVS, Bin Put, CS/390 R10, IBM OSAE-GBE)

$$\frac{0.689 \text{ CPU secs/Elap sec}}{4 \text{ processor}} * 100 \% = 17.23 \%$$

Thus, MVS TCP/IP's + VTAM's + FTP addr spaces CPU requirement for FTP Binary PUT would require 17.23 % of a four processor 9672-RX6 LPAR system. LSPR can be used to adjust for other processors types.

# Telnet(TN3270) CPU Time/Transaction (CS/390 R10)

## MVS CPU Time / Transaction



Transaction: 100 bytes in, 800 bytes out

Transaction rate: 6 / minute / user (10 sec Think Time)

9672-RX6 (3 CP LPAR), CS/390 V2R10, MPC+ over Channel to Channel (4)

MVS CPU (TCP/IP + VTAM + ECHO Application) / Transaction varies from 0.633 to 0.852 milliseconds when going from 4000 to 64000 TN3270 users.



# Telnet (TN3270) Storage Utilization (CS/390 R10)

# of TN3270 Sessions	0	4000	8000	16000	32000	64000
TCP/IP Below	616 k	632 k	664 k	680 k	728 k	856 k
TCP/IP Above	5.844 m	5.900 m	6.004 m	6.060 m	6.22 m	6.644 m
TCP/IP LSQA /SWA/229/230 Below	188 k	212 k	212 k	212 k	228 k	248 k
TCP/IP LSQA /SWA/229/230 Above	<b>10.5 m</b>	<b>24.9 m</b>	<b>36.7 m</b>	<b>60.3 m</b>	<b>108 m</b>	<b>201 m</b>
CSM Data Space	0.520 m	3.624 m	4.844 m	11.088 m	19.924 m	28.148 m
System CSA Below	368 k	368 k	368 k	368 k	368 k	368 k
System CSA Above	<b>42.6 m</b>	<b>56.1 m</b>	<b>69.1 m</b>	<b>91.6 m</b>	<b>145 m</b>	<b>243 m</b>
System SQA Below	704 k	704 k	704 k	704 k	704 k	704 k
System SQA Above	10.7 m	11.1 m	11.1 m	11.3 m	11.5 m	11.8 m
Total Below	1.876 m	1.916 m	1.948 m	1.964 m	2.028 m	2.176 m
Total Above	70.164 m	101.624 m	127.748 m	180.348 m	290.644 m	490.592 m
Total	72.04 m	103.54 m	129.696 m	182.312 m	292.672 m	492.768 m
Delta Per User Total	0	7.88 k	7.21 k	6.89 k	6.90 k	6.57 k

Delta Per User Total: xxxxx TN3270 sess. - 0 TN3270 sess.

Storage usage of TCP/IP Addr Space and MVS System Storage (SQA, CSA) during TN3270 echoes (4000 to 64000 users) when using CS/390 R10.

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# TN3270 Capacity Planning

MVS CPU Requirements:

$$\frac{\# \text{ trans/user } \times \# \text{ users } \times \text{ CPU secs/tran}}{\# \text{ of Elap secs}} = \frac{\text{CPU secs}}{\text{Elap secs}}$$

Example: CS/390 R10, 4000 users, 6 tr/min/user

$$\frac{6 \text{ tr/u } \times 4000\text{u } \times 0.000633 \text{ CPU secs/tr}}{60 \text{ elap. sec}} = 0.253 \frac{\text{cpu sec}}{\text{elap sec}}$$

N1: MVS TCP/IP + VTAM + ECHO Application CPU  
(9672-RX6 3 CP LPAR)

If the CPU secs/Elap sec ratio is greater than 1, one would need more than one processor (CS/390 R4-R12).





# TN3270 Capacity Planning con't

MVS CPU Utilization:

$$\frac{\text{CPU secs/Elap Sec}}{\text{\# of processors}} * 100 \% = \text{CPU Util \%}$$

# of processors: Should be equal to the number of 390 processors.

Example: CS/390 R10, 4000 users, 6 tr/min/user

$$\frac{0.253 \text{ CPU secs/Elap sec}}{3 \text{ processors}} * 100 \% = 8.43 \%$$

Thus, the MVS TCP/IP + VTAM + Echo Application CPU requirement for 4000 TN3270 users would require 8.43 % of a three processor 9672-RX6 LPAR system. LSPR can be used to adjust for other processors types.



# MVS Telnet (TN3270) TuningParms (V3R1/V3R2/CS390 R5-R12)

- SCANINTERVAL:
  - ▶ Used to override the default scan time (120 secs). This time specifies the periodic time that the Telnet server would scan the entire list of TCP/IP connections.
- Timemark:
  - ▶ Used to specify how often the Telnet server will send an "are you there" probe to clients that appear to be inactive.
  - ▶ Clients who receive three consecutive probes without intervening activity are considered to be inactive.
- INACTIVE:
  - ▶ Used to specify how long a terminal can remain unused (no communication with the Telnet server) before it will be deemed inactive and disconnected by the server.
- DISABLESGA:
  - ▶ Permits the transmission of GO AHEAD by Telnet. Negotiated by both client and server. Using DISABLESGA increases the overhead for a full duplex terminal using a full duplex connection. Applies only to Linemode, not 3270 connections.  
Default is to suppress transmission of GO AHEAD.  
Recommendation is to use the default (Do not specify DISABLESGA).

# MVS CICS Sockets Tuning (V3R2/CS390 R5-R12)

- MVS dispatching priority of VTAM, TCP/IP, and other servers:
  - ▶ Recommendation: High to Low dispatching priority.
    - VTAM
    - TCP/IP
    - Routing Deemons
    - Other TCP/IP Servers/Applications
- SOMAXCONN: Maximum # of queued connections on a listening port.
  - ▶ Recommendation: Set to a large value (ie. 2048 or >) in MVS TCP/IP Profile. Default = 10.
- Registration / Deregistration with WLM:
  - ▶ Modifications to the Listener configuration to allow for up to three group names.
  - ▶ A listener can be defined to belong to one of the group names. These group names are used to register the CICS listener with the Workload Manager (WLM) so that a BIND-based Domain Name Service (DNS) can be used to balance requests across multiple hosts in a sysplex environment.
- Refer to OS/390 V2R8.0-V2R10.0 SecureWay Communications Server IP CICS Sockets Guide (SC31-8518-01) for more information.

# MVS CICS Sockets TuningParms (V3R2/CS390 R5-R12)

## ● CICS Sockets ConfigurationParms :

### ▶ EZAC CICS Transaction for CICS:

▶ TCPADDR : Set to TCP/IP proc name.

▶ NTASKS : Set slightly higher than the max number of concurrent CICS sockets connections. Default = 20.

NTASKS defines a pool of reusable subtasks.

Attached tasks are used for listeners and when the pool of reusable tasks is exhausted.

▶ DPRTY : Set to 0 to improve response time for CICS Sockets.

The difference between the dispatching priority of the subtasks and the attaching CICS task.

### ▶ EZAC CICS Transaction for CICS Listener(s):

▶ NUMSOCK : Set slightly higher than NTASKS.

One less than this number is the maximum number of concurrent GIVESOCKET requests that can be active.

Default value is 50.

▶ BACKLOG : Set to 40. Default = 20.

The number of unaccepted connections that can be queued to this listener.

▶ WLMGN1,2,3 : cicsocgr1 / cicsocgr2 / cicsocgr3

## IBM MVS TCP/IP Performance Checklist

- MVS dispatching priority of VTAM, TCP/IP, and other servers:
  - ▶ Recommendation: High to Low dispatching priority.
    - VTAM
    - TCP/IP
    - Routing Deemons
    - Other TCP/IP Servers/Applications
- Make sure client and server TCP Window size are equal
  - ▶ Recommendation: On MVS, use default window size of 32768 or 65535.  
On Client, set client window size to 32768 or 65535 (if allowed).
- Make sure client and server MTU/packet size are equal
  - ▶ Recommendation: For Ethernet lans use 1500,  
Token Ring lans use 1500 or 2000,  
FDDI lans use 4000 or 4352,  
CTC use 65527.



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## IBM MVS TCP/IP Performance *Checklist*

- Routers: Make sure buffers are set appropriately so that packets are not being dropped.
- 3172: Make sure Delay timer and Max. response length are set correctly for each Lan adapter
  - ▶ Recommendation: Delay Timer = 10 ms,  
Max. response length = 500 bytes
- 2216: Make sure Blk timer and Ack length are set correctly for each LCS or MPC+ definition.
  - ▶ Recommendation: Blk Timer = 5 ms,  
Ack Length = 10 bytes
- RS/6000 ESCON Attachment:
  - ▶ Recommendation: Use MPC (instead of CLAW) as Subchannel Type for improved performance.  
By using MPC, FTP throughput improved 61 % (outbound) or 92 % (inbound).





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## IBM MVS TCP/IP Performance Checklist

- FTP: BUFNO, EXTRATASKS and NCP parms are no longer used in CS/390 V2R5 and later releases.
- FTP: Use large dataset blocksizes on MVS
  - ▶ Recommendation: DS Blocksize = 1/2 DASD track  
(3380: approx. 23424 byt,  
3390/9334: approx. 28288 byt)
- TELNET: Check TIMEMARK, SCANINTERVAL, INACTIVE parms in MVS TCP/IP Profile (INTERNALCLIENTPARMS)
  - ▶ Recommendation: TIMEMARK = 10800 (3 hrs)  
SCANINTERVAL = 1800 (30 min)  
INACTIVE = 5400 (90 min)
- SOMAXCONN: Maximum # of queued connections on a listening port.
  - ▶ Recommendation: Set to a large value (ie. 2048 or >) in MVS TCP/IP Profile.  
Default = 10.





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## IBM MVS TCP/IP Performance *Checklist*

- Sockets: Use large msg sizes (> 1 KB) for better performance.
- Gateway Statement (MVS TCP/IP Profile):  
Use a numeric value for MVS Packet Size.  
(Do not use DEFAULTSIZE for Packet Size.)
- PTF's: Make sure have latest CS/390 (TCP/IP & VTAM) Performance PTF's.
- Traces: Make sure TCP/IP and all other traces are turned off for optimal performance.





# Summary

- CS/390 R12
  - ▶ HiperSockets: Fast LPAR to LPAR communication (same CEC)
  - ▶ HiperSockets Accelerator: Single stack acts as router for entire CEC
  - ▶ Full Claw Packing: Up to 60KB claw packing buffers
  - ▶ TCP/IP Storage Limits (ECSA & POOLLIMIT)
- CS/390 R10:
  - ▶ SAP Performance Improvements: 8.1 % ITR Improvement
  - ▶ Fastpath Local Sockets: 2X TPUT improv., 48 % latency reduction
  - ▶ Route Lookup improvements: Up to 50 % CPU reduction
  - ▶ IP Security: 10 % TPUT improv., 25 % Client CPU reduction
  - ▶ UNIX Select(): Significant Response time reduction
  - ▶ FRCA - Websphere Responsibility passing
- CS/390 R8:
  - ▶ Save 4.7 to 65 MB of System CSA storage with CS/390 V2R8 (vs R7).
- CS/390 R7:
  - ▶ Web Server Performance
    - 21,591 ops/sec (SpecWeb96 benchmark)
    - New Fast Response Cache Accelerator (FRCA) provides up to 3.5 X throughput improvement over CS/390 V2R6
  - ▶ New Queued Direct I/O (QDIO) + Gigabit Ethernet support (new OSA-Express adapter)
  - ▶ 64,000 TN3270 sessions successfully tested
  - ▶ TCP Application throughput increased (up to 7.9 X) and CPU reduced (43 to 93 %) for CS/390 R7 vs V3R2+
- Follow MVS TCP/IP Performance Checklist for optimal performance.





# Appendix



# MVS FRCA Configuration Params

- Following are the important configuration parms for Fast Response Cache Accelerator (FRCA):
- Parms are specified in the Webserver configuration file (/etc/httpd.conf).

EnableFRCA on	Enables FRCA
FRCACacheSize 8192	# of 4K Blocks
FRCACacheEntries 1024	max # of files to be cached
FRCAMaxFileSize 1000000000	max file size (bytes)
FRCAStackName TCPCS7	TCP/IP Proc name
FRCAWLMParms FRCAHTTP WEBFRCA WEBFRCA	

where FRCAHTTP = subsystem name (required)  
WEBFRCA = application environment name  
WEBFRCA = transaction class

FRCACacheOnly \*.gif  
FRCACacheOnly cacheable/\*.html  
or (mutually exclusive)  
FRCANoCaching dontcache/\*.html  
FRCANoCaching meeither/\*.html



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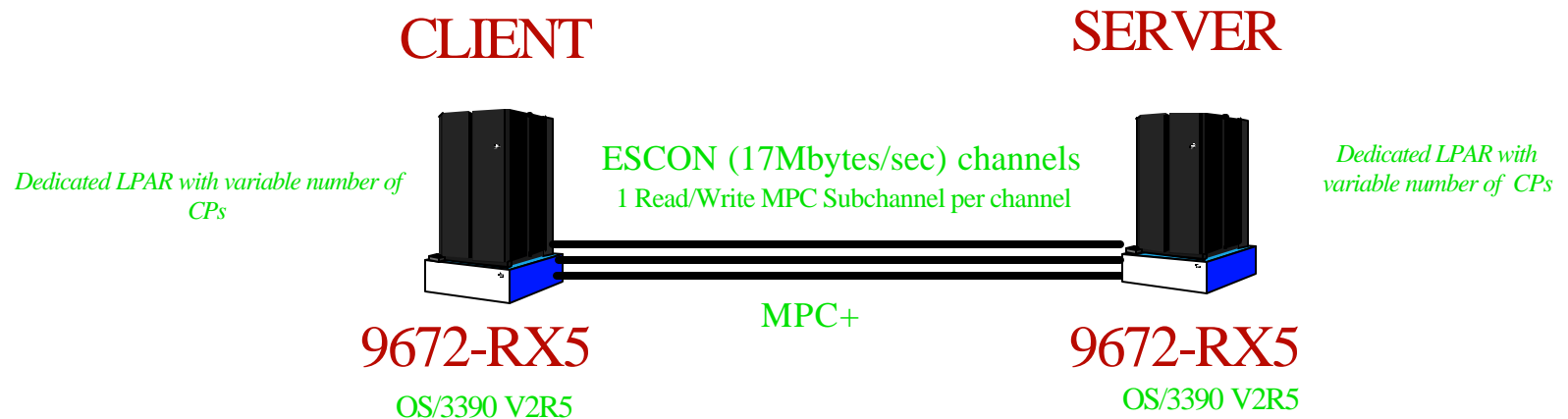
# MVS TCP/IP Configuration Files

- Following are the important configuration / tuning files for IBM MVS TCP/IP:
  - ▶ TCPIP.XXXXXXXXXX.TCPIP:
    - MVS TCP/IP Profile contains buffer definitions, Lan controller definitions, server ports, home IP addr, gateway statements, VTAM LU's. etc
  - ▶ TCPIP.TCPIP.DATA:
    - MVS TCP/IP DATA contains hostnames, domainorigin, nsinteraddr (name server), etc.
  - ▶ TCPIP.FTP.DATA:
    - MVS FTP DATA contains LRECL, BLOCKSIZES, RECFM, CHKPTINT, etc.



# MVS TCP/IP Scalability Overview

## Performance Testbed



## Tuning Parameters

### TCP/IP 3.2, OS/390 V2R5 & R6

- ▶ Tuning parameters chosen to correspond with typical network parameters  
... not to maximize performance
- ▶ MTU Size 1500 bytes
- ▶ Send/Recv Size 16384 bytes
- ▶ Socket buff size 65535 bytes

# Primitive Performance Workloads

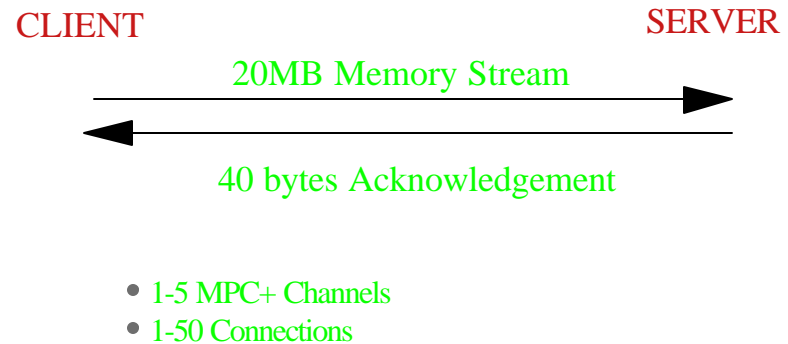
## PRIMITIVE WORKLOADS FOR TCP/IP

### Performance Objectives

- ▶ Throughput and CPU utilization
- ▶ Scalability
- ▶ Approximate modeling of application behavior

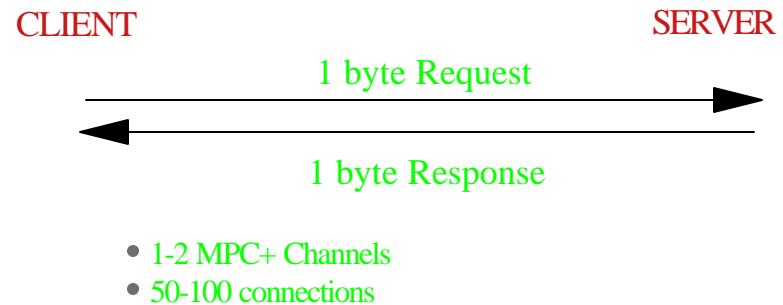
### Stream Workload

- FTP
- Bulk data transfers applications such as ADSM, DB/2



### RR Workload

- TN3270

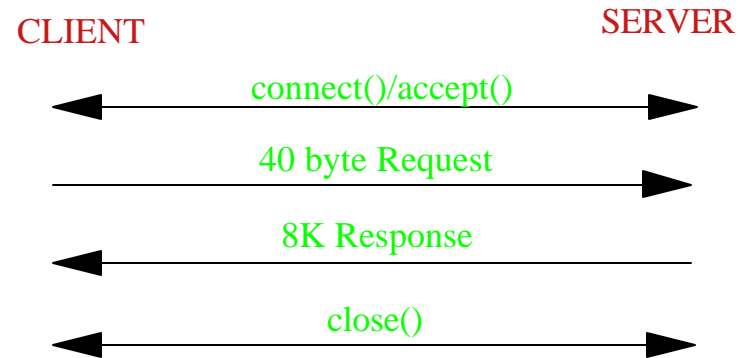


# Primitive Performance Workloads

## PRIMITIVE WORKLOADS FOR TCP/IP

### ☛ Connect-Request-Response (CRR) Workload

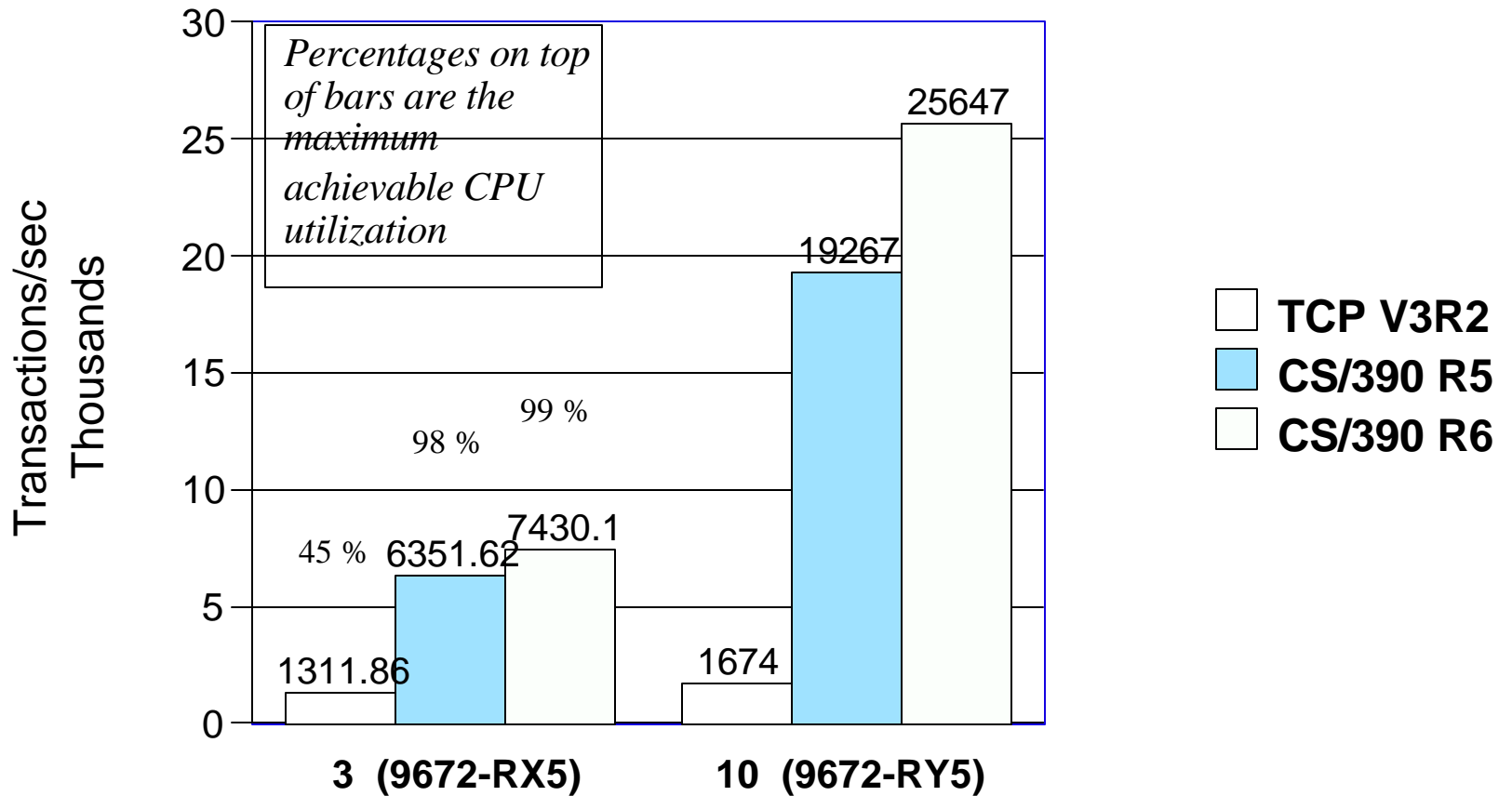
- Static Web Serving



- 2-4 MPC+ Channels
- 40-100 Connections

# MVS TCP/IP RR Scalability (CS/390 R5 & R6 vs V3R2)

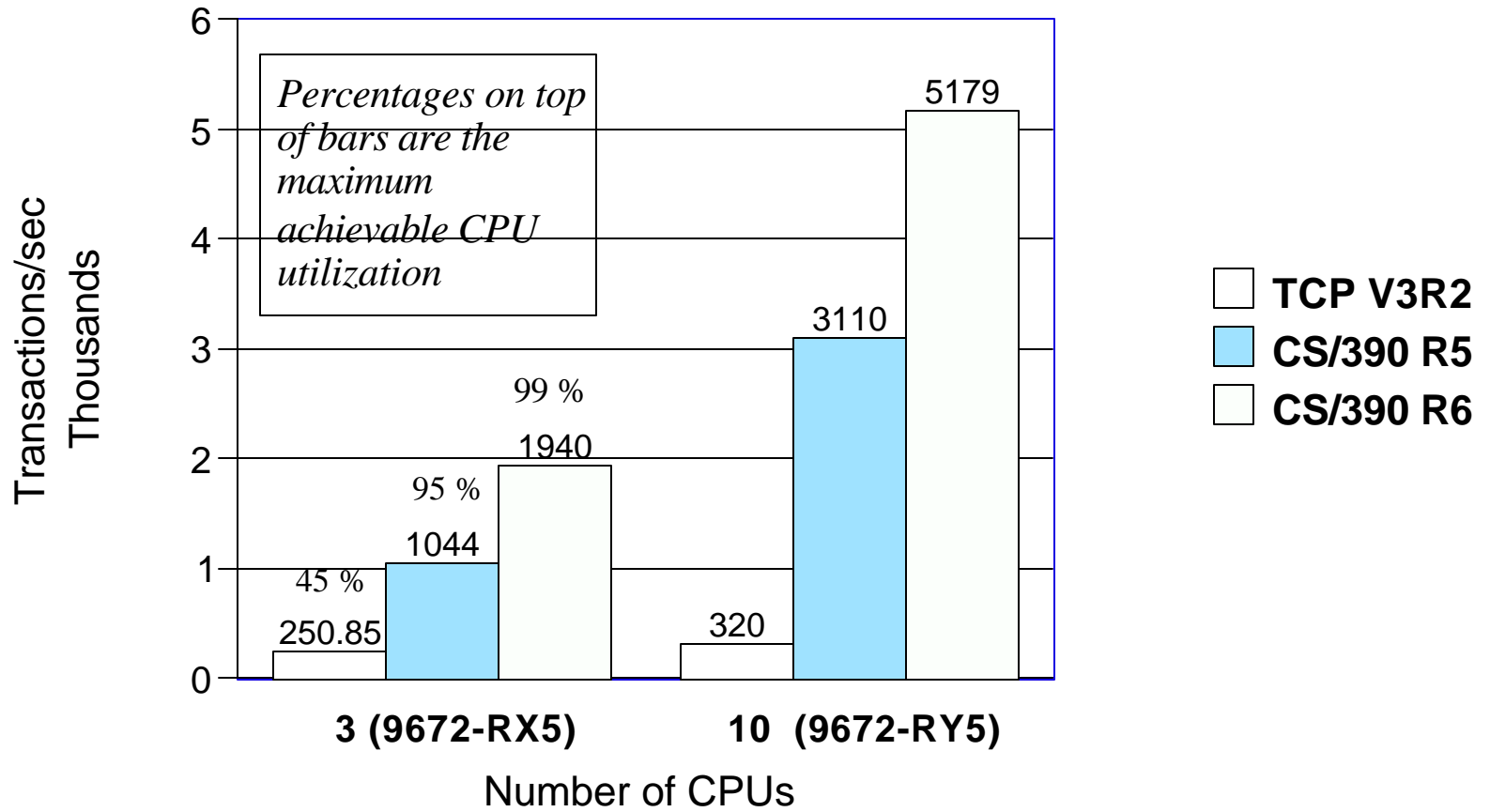
RR Workload (TCP Sockets)



Scalability:	Number of CPUs	Receive 1 byte, Send 1 byte
CS/390 R5 / V3R2	4.84 X (3 CPUs)	11.51 X (10 CPUs)
CS/390 R6 / V3R2	5.66 X (3 CPUs)	15.32 X (10 CPUs)
CS/390 R6 / R5	1.17 X (3 CPUs)	1.33 X (10 CPUs)

# MVS TCP/IP CRR Scalability (CS/390 R5 & R6 vs V3R2)

Connection Request Response Workload (TCP Sockets)



Receive 40 bytes, Send 8192 bytes

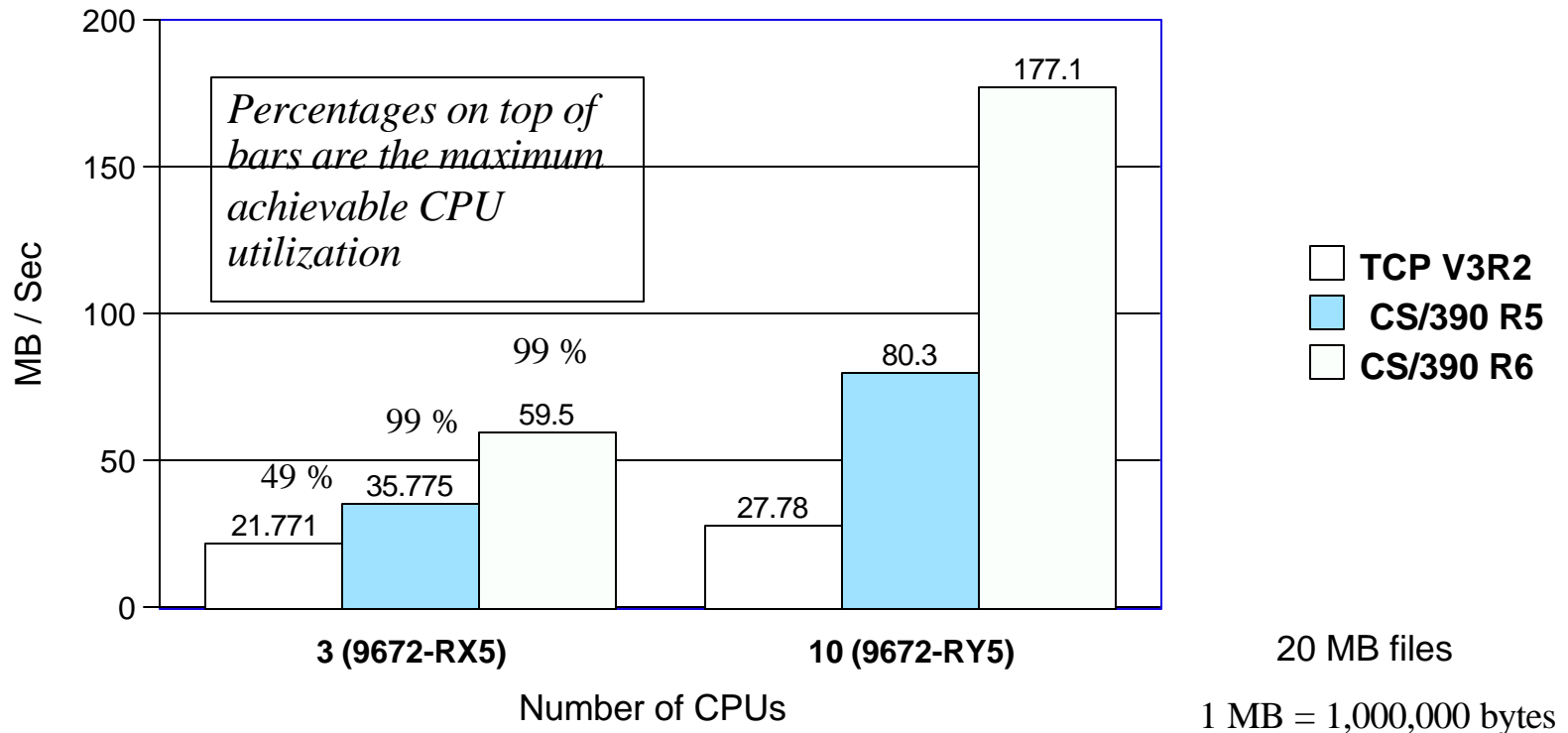
Scalability:

CS/390 R5 / V3R2	4.16 X (3 CPUs)	9.72 X (10 CPUs)
CS/390 R6 / V3R2	7.73 X (3 CPUs)	16.18 X (10 CPUs)
CS/390 R6 / R5	1.86 X (3 CPUs)	1.67 X (10 CPUs)



# MVS TCP/IP Streams Scalability (CS/390 R5 & R6 vs V3R2)

Streams Workload (TCP Sockets)



Scalability:

CS/390 R5 / V3R2	1.64 X (3 CPUs)	2.89 X (10 CPUs)
CS/390 R6 / V3R2	2.73 X (3 CPUs)	6.38 X (10 CPUs)
CS/390 R6 / R5	1.66 X (3 CPUs)	2.21 X (10 CPUs)

# MVS TCP/IP Performance References

- MVS TCP/IP Performance References:
  - ▶ ' IBM MVS TCP/IP Performance Tuning Tips and Capacity Planning ' presentation (Share 96, Session 3916, 03/01/2001)
  - ▶ CS/390 Performance Web Page:
    - <http://www.software.ibm.com/network/commserver/library/whitepapers/csos390.html>
    - [http://www.software.ibm.com/enetwork/commserver/library/whitepapers/white\\_csos390ip.html](http://www.software.ibm.com/enetwork/commserver/library/whitepapers/white_csos390ip.html)
  - ▶ CS/390 Hints and Tips page (Info APARS):
    - <http://www2.software.ibm.com/eNetwork/Tips.nsf/Tips?OpenView&Count=500>  
(--> Communications Server for OS/390 TCP/IP Services --> Communications Server for OS/390 Version 2.6--> Performance)
  - ▶ V3R2 Performance Web Page:
    - [http://www.software.ibm.com/network/commserver/library/whitepapers/white\\_tcpipmvs32perf.html](http://www.software.ibm.com/network/commserver/library/whitepapers/white_tcpipmvs32perf.html)
  - ▶ IBM TCP/IP Performance Tuning Guide:
    - MVS V3R2 Manual SC31-7188-02 (Third Edition, 3/97)
    - Also available for download from V3R2 Performance Web Page



# For More Information...



## URL

## Content

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