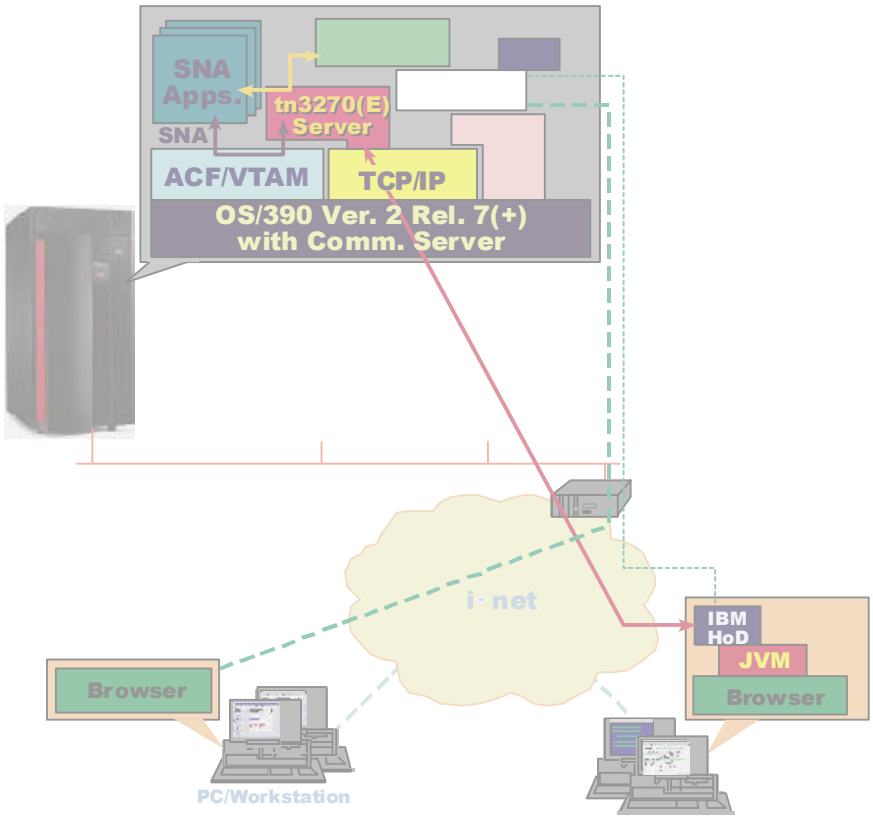
Choosing the Right Mission-Critical tn3270(E) Server

For OS/390 Customers who are Currently Not Using tn3270(E) Access

All tn3270(E) servers are not the same – and many claims about tn3270(E) servers are downright misleading, myopic and mystifying.

An Objective, Non-Commissioned White Paper



Developed *'pro bono publico'* by Anura ['SNA'] Gurugé

The author of: "SNA: Theory and Practice" (1984), "Reengineering IBM Networks" (1996) and "Integrating TCP/IP i•nets with IBM Data Centers" (1999)

Neither IBM, nor any other organization, paid for the development of this White Paper in hard or 'soft' money or goods.

August 2000

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Full Disclosure

I was not compensated by IBM or any one else for developing this White Paper. I also do not have a retainer agreement with IBM. I developed this White Paper because I do feel passionately about this pivotal issue.

I do own some IBM shares. However, I own 50 times (50x) more Cisco shares than I do IBM - and have been a Cisco shareholder (and even had some Cisco options as a result of their acquisition of Nashoba Networks) since at least 1994. I also own some Microsoft shares. So it would be difficult to argue that I am biased against Cisco or Microsoft – but especially Cisco.

Just in case you did not know, I am an ex-IBMer (1979) - and have made a reasonable living since 1980 being a Mr. SNA.

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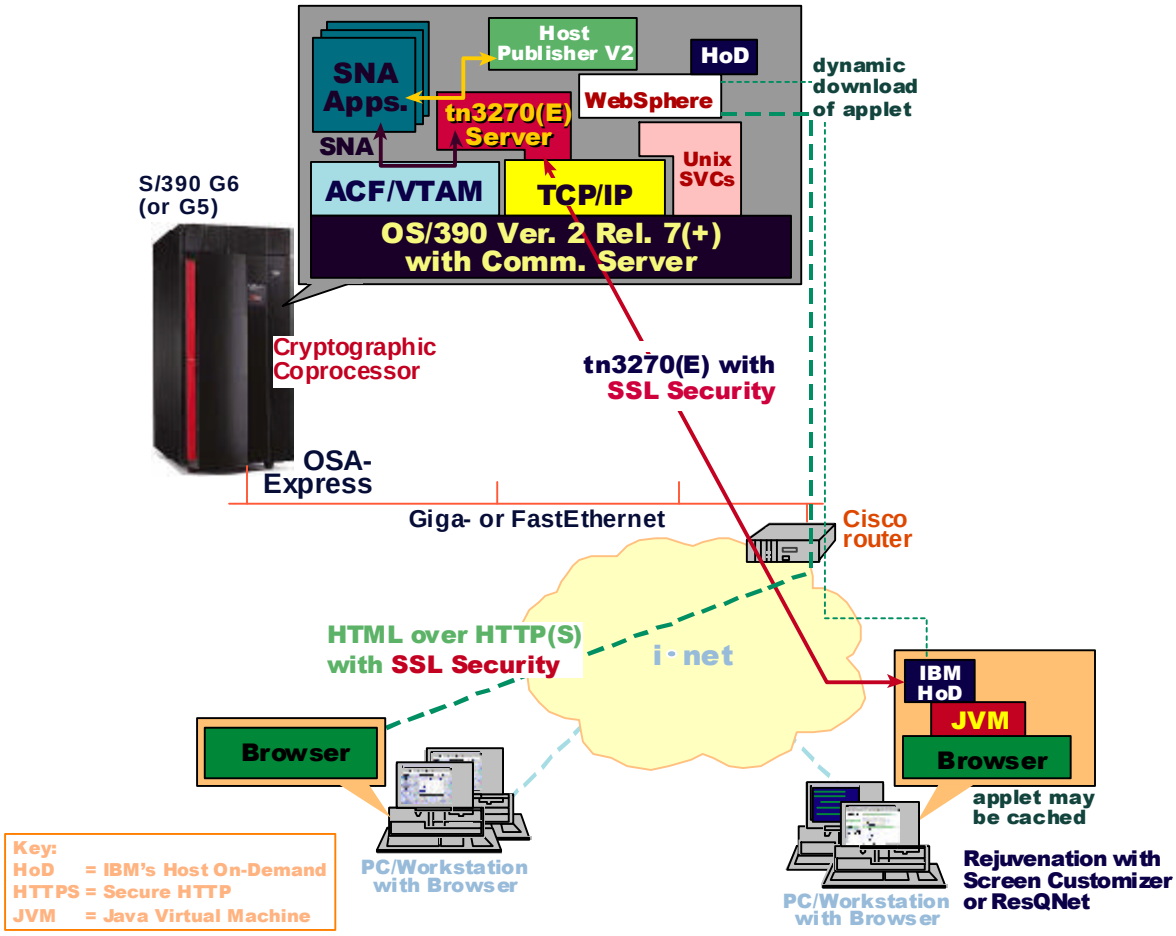
Expressly targeted at IBM mainframe customers who fit the following profile:

- **Have, or plan to have, a S/390 G5/G6 (or subsequent) mainframe**
- **Intend to use OS/390 Ver. 2 Rel. 6 (or greater)**
- **Have a need for 10,000 or more concurrent SNA mainframe sessions**
- **Currently do not have a large-scale tn3270 or tn3270(E) implementation**
- **Have evaluated the OSA-Express adapter**

The tn3270(E) server within Comm. Server for OS/390 outstrips all others when it comes to high-availability, hardware assisted security, speed, ease of implementation, manageability and scalability.

With the ongoing replacement of **SNA/APPN** enterprise backbones with **TCP/IP**-based networks, **tn3270(E)**, now a highly proven industry standard with a 15 year history, has become the preferred and accepted means for providing PC and workstation users with ready access to mainframe resident, mission-critical SNA applications. **[See Page 15 for a thumbnail sketch of tn3270(E).]** Choosing the right tn3270(E) server is imperative to the long-term success of any tn3270-based access scheme – particularly so when one has to accommodate 10,000 or more concurrent sessions, as is the case for most of you reading this document. Choosing the wrong tn3270(E) server can severely compromise security, routinely disrupt mission-critical operations, unnecessarily complicate network management, choke system throughput, increase network complexity, and curb future expansion. Opting for a non-optimum tn3720(E) server can thus be a very costly, highly visible, embarrassing and career limiting mistake.

If you have (or plan to have) an **IBM S/390 G5** (or greater) mainframe running **OS/390 Ver. 2 Rel. 6** (or greater), the best tn3270(E) server option for you is very obvious, straightforward and unmistakable. The tn3270(E) server available with IBM's **Communications Server for OS/390 (CS/390)** is indubitably the best, most strategic and safe tn3270(E) server solution for S/390 customers. No other tn3270(E) server can match it when it comes to: high-availability, hardware assisted end-to-end security, blazing performance, ease of implementation, network management visibility, scalability, or industrial-strength robustness. The overall superiority of the CS/390 tn3720(E) server compared to other offerings is thus incontrovertible … **Period**. **See page 6**.



The new paradigm for SNA mainframe access across TCP/IP networks -- leveraging the best and optimum technology

Minimizing Lost Opportunity Costs

'Phenomenal' is the only way to describe the fail-safe nature of the CS/390 tn3270(E) server in a Parallel Sysplex environment.

The CS/390 tn3270(E) server, interfaced to a TCP/IP network via an **OSA-Express** Fast/Gigabit Ethernet or 155Mbps ATM adapter with 'IP Assist' (IPA), is the new gold standard for 21st century, high-performance, ultra secure, mission-critical SNA/3270 access. Cost, intriguingly, is not really an issue or impediment with this solution. In the mid- to long-term [i.e. 3 to 4 year timeframe], the CS/390 solution will invariably prove to be considerably more cost effective, overall, than any other approach. For a start, this highly robust and resilient mainframe solution dramatically minimizes lost opportunity costs caused by software failures, sluggish response times, inoperative network interfaces and difficult to isolate client-side problems. In many cases, this reduction in lost opportunity costs alone is more than adequate cost justification for the CS/390 tn3270(E) server, whose 99.9%(+) 'up time' is comparable to **ACF/VTAM** or even OS/390 itself. In a **Parallel Sysplex** environment, 'phenomenal' might be the only way to describe the fail-safe availability of this tn3270(E) solution.

CS/390 tn3270(E) server, despite being the most feature-rich server on the market, is in reality a 'freebie'! If you have OS/390, you already have CS/390 installed – and with it the full tn3270(E) server which is an integral part of CS/390. So you do not have to go out and purchase this server. It is there, *gratis*, alongside your ACF/VTAM. [With OS/390, ACF/VTAM, the mainframe TCP/IP software and the tn3270(E) server are all packaged together within CS/390 – with CS/390 as a no-charge component of OS/390.] When reading the remainder of this document, you should always keep in mind that if you have OS/390 - you already have the CS/390 tn3270(E) server we are talking about.

Why pay $50,000(+) for a 'tn' server when you already have the best one around already on your system?

To get 30,000 concurrent sessions with tn3270(E) software for a **Cisco 7500/CIP** would cost you in excess **of $50,000**. Moreover the Cisco CIP, as yet, does not support Secure Sockets Layer (SSL) based end-to-end security – now the *de facto* standard for user authentication and data encryption vis-à-vis tn3270(E)-based SNA access. Microsoft's SNA Server, in addition to being severely deficient when it comes to scalability, also does not support SSL security. This is why I can unhesitatingly and with no compunctions, whatsoever, tell you that you that the CS/390 solution is the optimum choice for those of you who require a mission-critical, totally secure, high-capacity tn3270(E) solution – replete with multiple IP-centric host printing options. If you don't believe me and really want to duke it out, guns blazing at the hip, contact me at **guruge@cyberportal.net** or call **(603) 293-5855**, and I will do my best, free of charge, to allay your concerns and show you the light.

Don't let the MIPS 'thing' mislead you

The use of mainframe cycles, in the end, is the key cost related issue that most agonize about when it comes to opting for the CS/390 tn3270(E) server. In reality, however, this is a non-issue for multiple reasons, including the vital lost opportunity cost minimization discussed above. The irrefutable ongoing benefits of the CS/390 approach [e.g. security, performance, manageability, scalability] will always outweigh the perceived costs of its mainframe resource consumption. As a first cut, rationalize the true cost issues involved here along the lines of the following automotive analogy.

original source: BMW

Turn off that stereo!
Haven't you heard that gas is expensive?

Gas costs, of late, have been exceptionally steep. You could improve your gas mileage, most likely unperceptibly, by not using your car stereo given that it most certainly does consume energy – the exact amount being dictated by its power output rating and the number of speakers that are being driven. The next, more dramatic step, when it comes to improving mileage (in addition to never exceeding 45mph) is to stop using the air conditioner, irrespective of how hot and oppressive it might be. Most, fortunately, don't resort to such draconian measures to save a few bucks each time they fill up – even if they are driving an SUV that does 9mpg. Well, trying

to economize on mainframe cycle usage vis-à-vis the CS/390 tn3270(E) server kind of falls into the same category. It is all about costs versus benefit. Refer to **pages 6 – 13** for a full list of the features that make the CS/390 tn3270(E) stand head-and-shoulders above the other pretenders.

To begin with, today's mainframe cycles, especially so with the G5/G6 machines, are no longer that costly. In reality, when one factors in true processing power, taking into account instruction set versatility, the true costs of today's mainframe MIPS (or BIPS in the case of the G6 machines) are very much in line with other systems [e.g. RISC processor-based Unix servers]. So the hackneyed chestnut about *'expensive mainframe MIPS'* no longer rings true. Then there is the issue as to how much MIPS the tn3270(E) server will actually consume. This will obviously depend on multiple factors – key among these being the number of active sessions in play, the transaction volume across these active sessions and the encryption methodology [e.g. length of encryption key, the number of cryptographic co-processors in use, etc.].

RULE-OF-THUMB: determine the MIPS currently being used by ACF/VTAM. Activating the CS/390 tn3270(E) server will most likely add another 20%

One way to quantify and characterize the MIPS usage of the CS/390 tn3270(E) server is to look at it as an increment to the MIPS currently being used by ACF/VTAM to sustain your SNA/APPN network. [Remember that you will still need ACF/VTAM, in addition to the tn3270(E) server, to run your SNA applications and to provide SNA network services to enable 3270-based access.] *As a general rule-of-thumb, activating the CS/390 tn3270(E) server to handle all of your SNA/3270 access will increase the amount of MIPS being used by the co-resident ACF/VTAM on that mainframe by 20%* to 30%. This relatively small increase in MIPS should be easy to cost justify when you weigh it against the benefits of this mainframe-centric approach. The guaranteed reduction in lost opportunity costs, which in some of your cases could easily be in the millions of dollars per year range, alone should be enough of a pay-back.

It's MIPS vs. Mission-Criticality

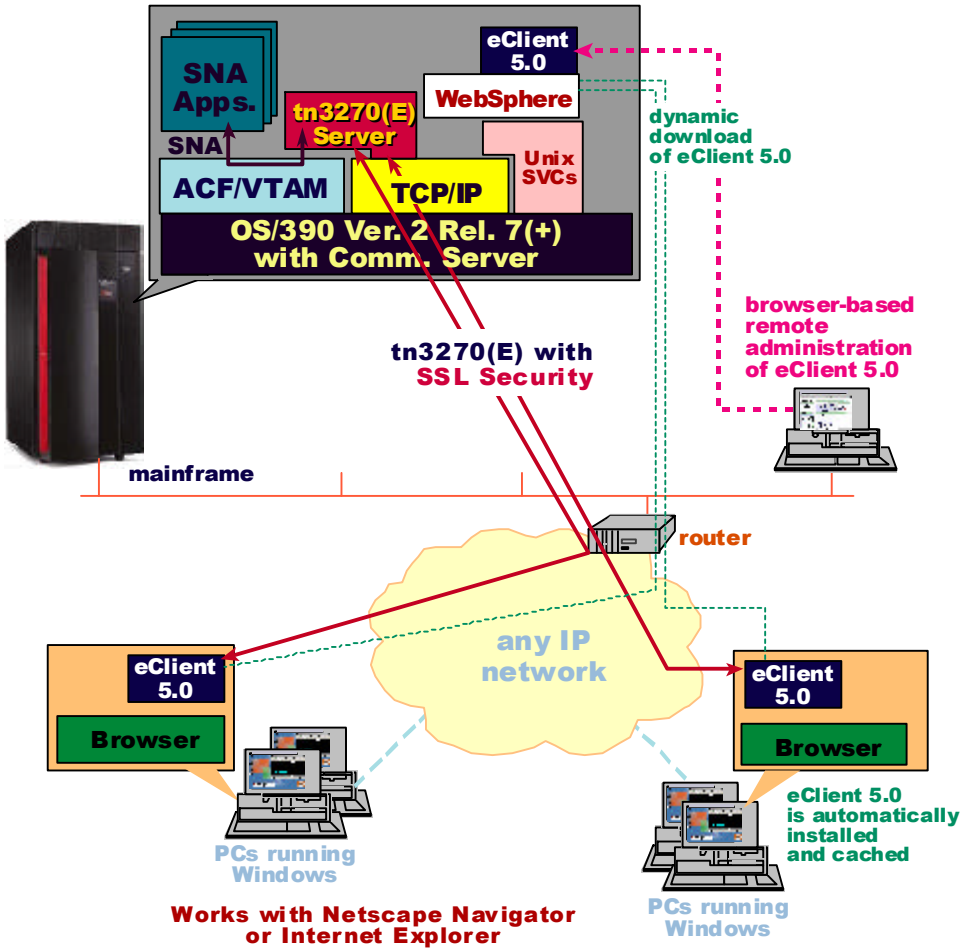
The MIPS consumption by the tn3270(E) server, viewed as a percentage of the overall MIPS being used by a mainframe, is likely to be very small – most likely in single digits. A mainframe-based tn3270(E) server requires TCP/IP on the mainframe since the TCP/IP-to-SNA conversions are now being performed on the mainframe. The TCP/IP software will also consume mainframe cycles. It is, however, wrong to add the TCP/IP related 'burden' to the tn3270(E) server related discussion since TCP/IP is going to become a mandatory prerequisite for future mainframe operation. Many of you, whether you realize it or not, probably already have TCP/IP running on your mainframes. I reckon that about 70% of OS/390 customers already have TCP/IP on their mainframes. If you are in the minority that doesn't have TCP/IP, then the chances are that it won't be long before you end up siding with the rest since TCP/IP really is inheriting the world.

You need TPC/IP on the mainframe for **FTP**-based file transfers, **WebSphere** powered e-business applications and for tn3270(E). So mainframe TCP/IP will soon be like ACF/VTAM. It is always going to be there on the mainframe and there is no point wasting your time or energy arguing whether it should or should not be there. *The good news is that by using the IPA feature of the OSA-Express, you can perceptibly reduce the MIPS being used to perform TCP/IP related functions.* The bottom line here is that the CS/390 tn3270(E) server is NOT a resource hog. For what it buys you, its usage of mainframe cycles is not

There is a reason why you still run your mission-critical applications on mainframes. Well, that is the same reason why you also need to run your mission-critical 'tn' server on a mainframe.

excessive and is easy to justify. Those of you with G5/G6 machines are also unlikely to be facing a MIPS shortage that would preclude you from activating the CS/390 tn3720(E) server. If MIPS are tight, this might be the time to explore the **"Capacity Upgrade on Demand" (CuoD)** feature of G5/G6 machines. Discussions that I have had indicate that any upgrades required just to accommodate the tn3270(E) server, when correctly apportioned, is likely to be in the $50,000 to $100,000 range. But put this into perspective. You don't have to pay for the tn3270(E) server. You already have it. It will cost you $50,000(+) just to get a 30,000 session tn3270(E) server offering from Cisco – and that approach won't give you the security, scalability, availability or the performance of the mainframe solution.

This MIPS issue can also be reconciled and rationalized in a different way. Cut to the chase, it really boils down to the perennial issue of mainframe versus another type of server [e.g. Windows NT]. You have the latest mainframe technology and still run your mission-critical applications on mainframes because you understand and appreciate that no other server can match a good ol' '390' when it comes to availability, scalability, performance, capacity and manageability.



The CS/390 tn3270(E) server works well with 3rd party tn3270(E) clients - in this instance Zephyr's popular e-Client browser plug-in

Others may argue, misguidedly, that NT or Linux servers are less expensive. But you, fortunately, have not been swayed when it comes to your mission-critical applications. You, fortunately, know which side the bread is buttered on.

Well, your tn3270(E) server is as mission-critical as your applications. If it is down or performing erratically, access to your mission-critical applications will be compromised. There is no *'ifs, ands, or buts'* about that. The only mission-critical tn3270(E) server on the market is the CS/390 tn3270(E) server. Consequently, any bickering about increases in MIPS usage, in the end, is kind of futile. Do you want a mission-critical solution or have you already found a another job?

The Undeniable Advantages of the CS/390 tn3270(E) Server

Now with the cost issue firmly behind us, it is time to enumerate, succinctly but incisively, the undeniable advantages of the CS/390 tn3270(E) server relative to other servers such as Cisco's tn3270(E) software for the 7500/CIP and the **7200/CPA**, Microsoft's **SNA Server**, and OpenConnect's **OC://WebConnect SNA Access Server**. Just some of the key advantages of the IBM mainframe approach, grouped together by category, are as follows:

SECURITY

When it comes to watertight security and security options, the exceptional superiority of the CS/390 tn3270(E) server, compared to other servers, is an open-and-shut case .

1. **SSL**-based user authentication and end-to-end data encryption using the latest 156- to 1024-bit bit encryption algorithms. While a few other tn3270(E) servers [e.g. Attachmate's SNA gateway 2.0] now support SSL-based encryption, IBM's CS is the only tn3270(E) server that can also perform user authentication and validation using digital certificates to preclude unauthorized access to the mainframe.
2. Tight integration with **RACF** to maximize access control integrity and to eliminate the need to duplicate user authentication definitions on less secure platforms.
3. Hardware assistance from the CMOS and PCI bus-based S/390 **cryptographic co-processors**, with both user authentication and end-to-end data encryption/deencryption to optimize response times and scalability – while minimizing overall CPU cycle usage.
4. Ability to use **IPSec**-centric, Virtual Private Networking (**VPN**) security on an end-to-end basis, or just on certain network hops – either by itself or in conjunction with end-to-end SSL security.

HIGH AVAILABILITY

1. The CS/390 tn3270(E) server can be used with OS/390's **Virtual IP Address (VIPA)** to ensure unparalleled fault tolerancy, transparent 'fail-over' and automatic 'primary owner' recovery. With dynamic VIPA, a CS/390 tn3270(E) server handling 32,000 client sessions can totally recover the entire workload in under 2.5 minutes! Without VIPA such a recovery could take at least 3 to 4 times longer. A non-OS/390 tn3270(E) server could not come anywhere close to being able to offer this level of robust, industrial-strength fault tolerance and recovery.

2. Full support for TCP/IP **Domain Name Server (DNS)** name-to-address resolution functionality coupled with OS/390's peerless Work Load Manager (WLM) capability guarantees controlled and quick 'fail-over' capability – with or without Parallel Sysplex and VIPA. OS/390 customers should never lose sight of the fact that they have the world's best load balancing, 'fail-over', processor clustering and fault masking technology. The CS/390 tn3270(E) server has been engineered from ground-up to be a tightly integrated component of OS/390 and as such have total and transparent access to all of OS/390's renowned and unparalleled high-availability features - including full support for both Sysplex and Parallel Sysplex mode operation.

3. *Rapid takeover* of 'active' tn3270(E) connections by backup CS/390 tn3270(E) servers, via a reset scheme invoked by the backup server. This obviates the need to wait several minutes before the connection times out. This takeover mechanism can reduce connection activation time by as much as 60%.

4. The CS/390 tn3270(E) server has a unique *'Fast Reconnect'* capability for tn3270(E) clients that explicitly specify the SNA LU name that they want to 'bind to' as a part of their connection establishment dialog. In such 'explicit LU name bind' scenarios, connection recovery, following a local network outage [e.g. a router failure], could be delayed since the tn3270(E) server would interpret the new connection request from the client as an attempt to connect to an already allocated LU. This is due to the fact that the server would be waiting for a time-out to find out about the connection failure, whereas the client would have received local notification in less time. The new 'Fast Reconnect' feature expedites the reconnect process by using a 'time-mark' request that is sent to the original client to determine whether the new connection is from that same client or from another.

It is ludicrous to even think, albeit even fleetingly, that any other 'tn' server could come close to matching the high-availability characteristics of the CS/390 'tn' server – even if you are not using Parallel Sysplex.

5. Preservation of the **LU-LU session** between the SNA application and the CS/390 tn3270(E) server in the event of a TCP/IP connection failure with the client – in order to greatly expedite reconnection time and moreover to eliminate the use of CPU cycles to reestablish the SNA LU-LU session. [Available with CS/390 Ver. 2 Rel. 10.]

6. The new *"autologon"* feature, available with CS/390 Ver. 2 Rel. 10, provides total support for the DEFAULTAPPL feature in tn3270(E) and thus minimizes client 'outages'. When the DEFAULTAPPL parameter is defined for a 'tn' client, the server will try and automatically connect that client to the specified mainframe application each time the client establishes a connection with the 'tn' server. In the past, if the application was temporarily inactive, the autologon request would fail and the client would be unceremoniously disconnected. Such disconnects could be disruptive, especially if the requisite application is in the process of being activated. With the new autologon support, automatic connection requests will be automatically queued, for a pre-specified amount of time, awaiting the activation of the subject application.

BLISTERING PERFORMANCE

1. The TCP/IP stack and the tn3270(E) server, as of CS/390 Ver. 2 Rel. 6, are considerably faster and more scalable than their predecessors, with each new release striving to outdo the previous one. If the last time you looked at a mainframe-based tn3270(E) server was 3 to 5 years ago [i.e. c. 1996 – 1997], you have to go back and look at how much has changed since then. The

TCP/IP stack shipping with OS/390 Ver. 2 Rel. 8 can handle three times more transactions per second than the stack available with OS/390 Ver. 1 Rel. 3. Around 1997 most people thought that a mainframe tn3270(E) server could handle 20,000 concurrent sessions. Today that number is 65,000. So don't go by what you heard or saw a few years ago. This is a whole new and considerably faster paced ball game.


source: GM

2. OSA-Express adapter, which is directly attached to the 2.66Gbps **Self-Timed Interconnect (STI)** bus of G5/G6 machines, working in conjunction with the ultra-optimized **'Queued Direct I/O' (QDIO)** access mechanism that permits direct network-to-memory transfers with the minimum of buffer manipulation, is uncontrovertibly the fastest way to realize network-to-mainframe I/O. OSA-Express, in marked contrast to the **ESCON II** channel with their top speed of 17MBytes/sec [136Mbps], works in full-duplex mode. It also supports 9,000 byte JUMBO Ethernet frames to optimize data transfer efficiency by eliminating the need to segment all Ethernet oriented LAN traffic into 1,500 byte frames. Consequently, an OSA-Express with a Gigabit Ethernet interface, running in full-duplex mode [i.e. 1Gbps in each direction] is 6 to 8 times faster than an ESCON II channel running at full-steam. Since the STI bus runs at 2.66Gbps, the 2Gbps network traffic does not have to be 'throttled' at any point. Any tn3270(E) server that relies on ESCON II for its mainframe data transfers just cannot compete with CS/390 tn3270(E) server, coupled with an OSA-Express adapter, for sheer blistering performance and split-second response times.

The OSA-Express Adapter with a full-duplex Gigabit Ethernet interface connected to a bridge/router or switch gives you 6 to 8 times the throughput of a 17Mbytes/sec. ESCON II channel.

3. The OSA-Express' TCP/IP 'off-load' IPA feature expedites TCP/IP-based data transfers to/from the mainframe and furthermore eliminates CPU cycles being used to perform network service functions. QDIO and IPA only works with TCP/IP traffic. There is no QDIO, the grease that makes OSA-Express go even faster, for SNA/APPN or HPR traffic. So an outboard tn3270(E) server [e.g. a Cisco 7200/CPA tn3270(E) server Fast Ethernet attached to an OSA-Express adapter, rather than being ESCON attached] cannot enjoy the same OSA-Express performance benefits as a mainframe resident server – since the outboard server has to use SNA/APPN to communicate with the mainframe, rather than TCP/IP. [The only other way to get around this would be to encapsulate the SNA/HPR within IP, per Enterprise Extender. In this scenario, however, that adds unnecessary encapsulation overhead.]

4. The CS/390 tn3270(E) server, depending on the configuration of the G5/G6 machine, could call upon up to 12 mainframe CPUs to process its workload. A Cisco CIP/CPA or a 4-way Pentium III box running NT is not even in the same league when it comes to processing power potency.

5. The cryptographic coprocessor hardware assist feature greatly expedites user authentication and data encryption/deencryption. With today's 156- to 168-byte encryption keys trying to do encryption just with software is a laborious, slow and resource intense operation. S/390's have the most powerful and extensive cryptographic coprocessor capabilities on the market to facilitate

encryption. The performance and scalability of the non-mainframe SSL-capable tn3270(E) solutions are severely impacted when cryptography is invoked. Cisco plans to offer SSL support on the CIP/CPA tn3270(E) servers towards the end of 2000. They are, however, already trying to reset customer expectations by openly stating that SSL support will indeed impact scalability.

6. The CS/390 tn3270(E) server is tightly integrated with the OS/390 Service Policy Agent to ensure strict enforcement of Quality of Service (QoS) based traffic and service priority. The OS/390 Service Policy Agent uses the standard 'Differentiated Services Field' in outbound IP datagrams to determine priority. Routers, in particular Cisco routers, also support this same 'Differentiated Services Field' and priority mechanism to deliver QoS-based data interchange. The OS/390 QoS works in conjunction with router support for QoS to obtain genuine, uncompromised end-to-end QoS. A router-only scheme that ends at the mainframe channel connection is not adequate, since slow priority traffic [e.g. FTP file transfer] could repeatedly get ahead of high-priority traffic [e.g. interactive tn3270(E) transactions] across the channel, delaying the delivery of the high-priority traffic. The CS/390 tn3270(E) server's ability to work with the OS/390 Server Policy Agent, and thus enforce QoS on an end-to-end basis, means that it can always guarantee that interactive tn3270(E) traffic will have precedence over lower-priority traffic on a client-to-mainframe basis – in both directions. Using QoS in this manner not only palpably improves response times but also guarantees consistent and predictable response times. This scheme obviates wild swings in response times caused by low-priority traffic getting in the way. A joint study, conducted by IBM and Cisco of the CS/390 tn3270(E) server using Cisco routers within the network, showed a four fold improvement in response times when this QoS feature was activated.

EASE OF IMPLEMENTATION

1. No other tn3270(E) server can come anywhere close to the CS/390 tn3270(E) server when it comes to ease of implementation and activation. The main reason, for this is that in marked contrast to outboard servers which have to be defined to ACF/VTAM as external SNA Type 2/2.1 nodes with PUs and LUs, the CS/390 server is defined to ACF/VTAM as a co-resident SNA application. Consequently, there are no PUs or LUs to be defined. The CS/390 tn3270(E) represents LUs like all other SNA applications by dynamically opening **Access Control Blocks (ACBs)**. **Check next page**.

   Using OS/390 'application cloning support' and 'model' statements, the entire downstream population of tn3270(E) clients can be typically defined to a CS/390 tn3270(E) server in around 20 – 50 lines of definition. Model statements with 'wild cards' [i.e. "*" or "?"] can be used to represent large groups of clients with the same characteristics. This scheme does not require the use and administration of ACF/VTAM EXIT routines as is the case with Dynamic Definition of Dependent LU (DDDLU)-based schemes supported by a few outboard tn3270(E) servers. The Cisco scheme, despite supporting DDDLU, requires an inordinate amount of router-specific PU definitions. The CS/390 scheme would generally reduce the 'tn' definition effort by 60 – 90%! If I was in your shoes, I would opt for the CS/390 solution just to avoid having to do all of the tedious and error-prone definitions required by the other servers.

To just say that the CS/390 'tn' server minimizes implementation time, effort and complexity is a gross understatement! Refer to the definition requirements on the next page to really see how easy it is.

The full set of definitions required to support a 10,000(+) tn3270(E) client population – with four different types of terminal characteristics

```
*********************************************************************
* TN3270 APPLICATION MODEL                                          *
*********************************************************************
TN3270   VBUILD TYPE=APPL
*
TCPM*    APPL  AUTH=NVPACE,                                         *
           EAS=1,                                                   *
           MODETAB=ISTINCLM,                                        *
           PARSESS=NO,                                              *
           SESSLIM=YES

;
; *******************************************************************
; PORT statements
; *******************************************************************
PORT
   23  TCP INTCLIEN           ; TELNET SERVER
   623 TCP OMVS               ; OMVS TELNET
;
; *******************************************************************
; TelNet parameters
; *******************************************************************
TELNETPARMS
  INACTIVE 0
  TIMEMARK 600
ENDTELNETPARMS
;
;
;

; *******************************************************************
; VTAM statements
; *******************************************************************
BEGINVTAM
;
;
;                            !TN3270     !TN3270E    !
; Telnet Device Type   !LOGMODE !LOGMODE  ! Comment
; --------------------+--------+---------+----------------------
  TelnetDevice 3278-2-E NSX32702,SNX32702 ; 24 line screen
  TelnetDevice 3278-3-E NSX32702,SNX32703 ; 32 line screen
  TelnetDevice 3278-4-E NSX32702,SNX32704 ; 48 line screen
  TelnetDevice 3278-5-E NSX32702,SNX32705 ; 132 column screen
;
  DEFAULTLUS
    TCPM0000..TCPM9999
  ENDDEFAULTLUS
  MSG07
  USSTCP EZBTPUST
;  DEFAULTAPPL TSO
;  LINEMODEAPPL TSO
  ALLOWAPPL *
ENDVTAM
```

MANAGEABILITY

1. The CS/390 tn3270(E) server provides total visibility of the 'tn' clients' TCP/IP properties – including IP address, IP port and DNS name. Thus correlating the IP characteristics of a 'tn' client with the SNA LU name it is currently using is a piece of cake. The reverse mapping is also available. When using the CS/390 server, ACF/VTAM commands, e.g. D NET,ID=luname, will display DNS names or lists of LUs associated with IP addresses to help operators quickly identify client side problems.

2. The Tivoli Application Monitor, as of CS/390 Ver. 2 Rel. 8, will provide a centralized, Sysplex-wide view of all of the active CS/390 tn3270(E) servers so that operators can see and manage all of the servers as a whole.

SCALABILITY

1. As of Ver. 2 Rel. 7, each CS/390 tn3270(E) server can support up to **65,536** [i.e. 64K] concurrent sessions per TCP/IP stack – and you can have up to 8 TCP/IP stacks per **LPAR**. Thus, with 8 TCP/IP stacks active you could have upwards of 500,000 concurrent sessions per LPAR – all talking to a single ACF/VTAM. [Note that you can only have one ACF/VTAM per LPAR.] No other tn3270(E) server can come close … PERIOD.

   The true scalability of outboard tn3270(E) servers, including those on the Cisco 7500/CIP or 7200/CPA, contrary to their misleading marketing claims, are restricted by ACF/VTAM's element addressing conventions. With the dismantling of SNA subarea networks, IBM 3745/3746 communications controllers are being displaced by more contemporary network interfaces; e.g. OSA-Express, OSA-2, IBM 2216-400 and CIP/CPA-attached Cisco bridge/routers. None of these devices, however, contain implementations of an SNA (Type 4) Subarea Node – as did the 37xxs. This generally means that the only subarea nodes now left within the SNA 'network' are your mainframes with ACF/VTAM. This lack of subarea nodes curtails the overall number of SNA network addresses available within the network since SNA addressing consists of a <subarea node address> concatenated with an <element address relative to that subarea>.

   ACF/VTAM addressing precludes outboard 'tn' servers from being able to realistically support more than 40,000 concurrent sessions per LPAR. Dismiss any claims to the contrary.

   SNA addressing only allocates 16-bits (i.e. 2 Bytes) for element address. [q.v. TH FID4 Bytes 18 & 19 for destination address and Bytes 20 & 21 for origin address – where FID4's, which are used between subarea nodes, have the longest SNA address fields.] 2^{16} is 64K. Thus the maximum number of outboard SNA addresses a given ACF/VTAM can support is 64K. And you can only have one ACF/VTAM per LPAR.

   Consequently, irrespective of what Cisco or Microsoft claims, an outboard tn3270(E) server cannot have access to more than 64K addresses – and thus concurrent sessions - unless of course you have a magic ring that allows you to easily circumvent laws of physics and the number of discrete states that can be represented by a single bit. Furthermore, having access to 64K element addresses also does not mean you can use all of them to represent downstream 'tn' clients. For a start you need a portion of these addresses to represent the mainframe application LUs – the so called Primary LUs (PLUs). Then you need others to identify downstream PUs [keeping in mind that your

typical outboard tn3270(E) server emulates an SNA Type 2 node and as such needs a separate PU for each batch of 255 LUs] and the LINES that these PUs are attached to. The bottom line here is that an outboard tn3270(E) server [e.g. Cisco CIP/CPA] is unlikely to be able to support more than 30,000 – 40,000 concurrent sessions due to lack of SNA addressing – let alone other factors such as lack of processing power and memory.

Cisco claims to be able to support up to 30,000 concurrent sessions per CIP. That is OK. Two CIPs, however, will not give you 60,000 concurrent sessions to the same ACF/VTAM – because you would have run out of addresses. You could, with luck and a tail wind, possibly squeeze 40K concurrent sessions from a two-CIP configuration – which by the way will set you back a minimum of $100K. You can use one CIP to act as a back-up for another or use multiple CIPs talking to separate LPARs [which kind of defeats the objective because then you split up your network] – but whatever Cisco tells you, you can't get around the 40K (or so) limit imposed by SNA element addressing restrictions.

Microsoft's SNA Server only supports 30,000 concurrent sessions in your dreams - or are those nightmares?

This 40K limit is not even an issue with any of the other outboard tn3270(E) servers because none of them can in reality come close to these on a per server basis. Microsoft's SNA Server does not support 30,000 concurrent sessions! If you really believe that we should talk – and I will do my best to find you a good therapist in your area. I have yet to find anybody outside Microsoft that has seen SNA Server supporting more than 5,000 sessions. Some Unix based servers, in particular OpenConnects OC://WebConnect SNA Access Server, will support around 20,000 concurrent sessions. But there is a rather large gap between 20K and 40K – and even bigger gulf between 20K and 64K.

The CS/390 tn3720(E) server, as a mainframe resident SNA application, gives you the most bang for your buck when it comes to the 64K of element addresses you have at your disposal. For a start, because it is a mainframe resident SNA application that interacts directly with ACF/VTAM using ACBs, it can use the Enhanced Addressing available with ACF/VTAM Ver. 4 Rel. 2. With Enhanced Addressing you can use certain bits in the subarea address to extend your element address range. However, such enhanced addresses can only be used to identify mainframe resident PLUs. Since the CS/390 tn3270(E) server is also a *bona fide* SNA application vis-à-vis ACF/VTAM, as opposed to a Type 2 node, no PUs or LINES need to be defined. This eliminates the need for unnecessary element addresses for these 'overhead' components.

Hence, the CS/390 tn3270(E) server's ability to give you up to 64K concurrent sessions per TCP/IP stack. [The CA/Sterling Software/Interlink TCPaccess tn3270 server, though mainframe resident, currently only supports around 25,000 concurrent sessions per stack. It also does not support SSL-based security. It is thus a non starter in this field.] So from now on if you hear Cisco, Microsoft or OpenConnect tell you that they can give you 40K (or more) concurrent sessions to a single ACF/VTAM – from one tn3270(E) server – just chalk it up to an amusing out-of-body experience and go and have a tall latté and reflect on the foibles of mankind.

2. Outboard tn3270(E) servers just don't have the raw processing power, or the memory, at their disposal to compete with the capacity, performance and scalability of a CS/390 tn3270(E) server running on a G5/G6 machine.

3. The extensive S/390 cryptographic co-processor capability, with the CMOS- and PCI bus-based co-processors, ensures that the CS/390 tn320(E) server can easily outstrip other servers when it comes to performance and scalability in secure environments

The Other Servers are in a Different, and Lower, League

CS/390 tn3270(E) is the only viable mainframe resident tn3270(E) server on the market. The CA/Sterling Software/Interlink server lacks SSL-support and currently only supports around 25K concurrent sessions. These two vital factors alone rule it out of contention – even without us having to get into other issues such as lack of tight integration with the OS/390 Work Load Manager or Service Policy Agent.

Outboard tn3270(E) servers, as you must have seen from our discussion above, are no match for the CS/390 tn3270(E) server. At this juncture I am assuming that you know better than to even think of deploying small tn3270(E) servers, on a departmental, campus or regional basis, downstream of your TCP/IP backbone. Let me use a famous Thomas Watson Sr. expression: "THINK". The output of a tn3270(E) server, whether you like it or not, is unadulterated SNA. That is the nature of the beast. If you put such a server downstream of your TCP/IP backbone, you are immediately confronted with this little issue of trying to ship SNA traffic across your TCP/IP backbone to/from this 'tn' server. Yes, you can use **Data Link Switching (DLSw)** or **Enterprise Extender** (a.k.a SNASwitch in Cisco-speak) to achieve this. But why? Are you a closet masochist? Remember, TCP/IP is inheriting the world. Simplify your life. If you can achieve your goals by using TCP/IP traffic across that TCP/IP backbone, don't screw things up by unnecessarily introducing SNA downstream just because you still dream fondly of looking through 18" tall listings of ACF/NCP definitions. I have been there. That is why my middle name is "SNA". But you have to get with the times and adhere to the program. So downstream tn3270(E) servers is a non-negotiable issue.

What ever you do, don't even think about putting a 'tn' server downstream of your TCP/IP backbone.

So your only other option to the CS/390 one is a data center resident server – either the channel-attached or LAN-attached. The Cisco CIP/CPA are the best known, and most aggressively marketed, channel-attached servers. But the CIP/CPA currently lacks SSL security. Its scalability, as you now know, isn't nearly as good as Cisco likes to claim. Then there is the cost. The CIP tn3270(E) server has never been an inexpensive solution. If you are still agitating about MIPS usage, work out how much the Cisco approach is going to cost you and amortize that against your mainframe costs. Especially with the cost/performance advantages provided by the OSA-Express, the Cisco approach is now passé. To get around the OSA-Express, Cisco it appears is telling people like you to buy a CIP or a CPA – and the expensive tn3270(E) software – and then NOT channel-attach the bridge/router. Instead they expect you to connect the CIP/CPA bridge/router to the mainframe via Fast or Gigabit Ethernet through the OSA-Express. Aahh! You have just paid for a channel-attach module – which is now just going to be used as a processor to run the tn3270(E) server. If you buy that let me know. You will no doubt be willing to consider

putting one of those cutesy VW bugs in your den so that you can use its CD player as your hi-tech entertainment unit.

This brings us to Microsoft's SNA Server. Simply and delicately put, this is now a technologically out-of-date product. It has no SSL security, let alone features like Enterprise Extender. It also does not scale. If you really want an NT based 'tn' server, to satisfy some obscure penance that you feel obliged to fulfill, try out IBM's CS/NT. That at least will give you all the necessary features. But even this IBM NT scheme will not scale to support the 30,000 or so concurrent sessions you want – unless you are willing to deploy vast server farms. At this juncture start thinking high-availability, performance, manageability and, above all, mission-criticality. Mickey mouse vs. industrial strength.

Bottom Line

The bottom line here is very simple and straightforward. If you are an OS/390 customer and have a need to support 10,000 (or more) concurrent 'tn' sessions, you need a proven, mission-critical, scalable and industrial strength 'tn' server. In reality there is only one server on the market that will truly meet your needs – ***the CS/390 tn3270(E) server***. It is brought to you by the same people who gave you ACF/VTAM. The only germane line of argument you can use against it is that it uses mainframe MIPS. It has no other negatives – and you know that. The MIPS argument, in the end, becomes flawed when you weigh it against the advantages of the CS/390 tn3270(E) server. The high-availability, throughput and manageability of this IBM solution, without doubt, minimizes lost opportunity costs. That alone is justification enough given that you are dealing with mission-critical applications. With all other schemes, the hidden costs [e.g. limited scalability] and lost opportunity costs will, over time, haunt you and make you regret making the wrong choice. If you are still having doubts, call me at (603) 293-5855 or send an e-mail to: **guruge@cybperortal.net**. I will, at no charge, try to help you. Choosing the best tn3270(E) server for your enterprise is an important and strategic decision. Don't get swayed by misleading claims or distracted by non issues. Right now, the best tn3270(E) server that fits your profile is the CS/390 tn3270(E) server. PERIOD.

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Acronyms

CS/390	Communications Server for OS/390
DDDLU	Dynamic Definition of Dependent LUs
DLSw	Data Link Switching
DNS	TCP/IP Domain Name Server
G5/G6	Generation 5/Generation 6 S/390 mainframes
IPA	OSA-Express IP Assist
LPAR	Logical Partition
LU	SNA Logical Unit
MIPS	Millions of Instructions per Second. BIPS – Billions, with G6 machines
OSA	Open Systems Adapter
PU	SNA Physical Unit
SSL	Secure Sockets layer
VIPA	Virtual IP Addressing

Thumbnail Sketch of tn3270(E)

Tn3270(E) is a hugely popular industry standard. It is specified in the form of a series of **Internet Engineering Task Force (IETF)** Requests for Comment (RFC) documents – with **RFC 2355** and **RFC 1647** currently being the most germane. Go to **www.ietf.org** to obtain these RFCs. Tn3270(E), and its older version tn3270, at present, are being used daily, in production mode, by over 12 million users, around the world, through a variety of schemes including full-function, 'fat-clients' [e.g. Attachmate's **EXTRA!** and IBM's **PComm**]; browser-invoked, Java-based 'thin-clients' [e.g. IBM's **Host On-Demand**], and 'on-the-fly' 3270-to-HTML conversion à la Eicon's **Aviva Web-to-Host Server** where the HTML gateway gains host access via tn3270.

Tn3270 is a 'split-stack', client-server mechanism that is essentially a variant of a traditional, c.1990 SNA PU-Controller Gateway such as Novell's **NetWare for SAA**. It works by having a TCP/IP-client that performs 3270 emulation, using standard 3270 data streams [including extended data stream for 7-color and highlighting) - that is exchanged via TCP/IP - with a tn3270(E) Server component. This server includes multiple full-function SNA nodes and looks to a mainframe as if it is group of SNA Type 2 nodes (à la 3174s), each with one PU and up to 255 LUs.

The 'E' notation in the context of tn3270(E) refers to enhanced mode operation which supports printing, status notification, LU assignment by name, positive/negative responses, SYSREQ and ATTN key support and SNA BIND transmittal.

About the Author

Anura Gurugé is an Independent Technical Consultant who specializes in all aspects of contemporary IBM networking. He has first hand, in-depth experience in Web-to-host, SNA/APPN/HPR/AnyNet, Frame Relay, Token-Ring switching, ATM, System Management, and *x*DSL technologies. He was actively involved with the Token-Ring switching pioneer Nashoba Networks, which was acquired by Cisco Systems in 1996. He is the author of *"Integrating TCP/IP i·nets with IBM Data Centers"* [pp 420, 1999], *"Reengineering IBM Networks"* [pp 600; 1996], the best selling "*SNA: Theory and Practice*" [pp 570; 1984]. He co-edits Auerbach's handbooks on: "*Communications Systems Management*" and "*Web-to-Host Integration*". In addition, he has published over 270 articles. In a career spanning 24 years, he has held senior technical and marketing roles in IBM, ITT, Northern Telecom, Wang and BBN. He can be contacted at (603) 293-5855 or guruge@cyberportal.net.