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Enterprise Extender – the AnyNet alternative

In the last issue of TCP/SNA Update *(issue 42, June 2001), the article entitled 'SNA over TCP/IP' described the AnyNet suite of products, which enables multiple application programs to be transported over SNA or IP networks. This article looks at an alternative – Enterprise Extender (EE) – examining its benefits, and describing how recent enhancements have eliminated significant implementation problems.*

Businesses continue to rely on legacy applications residing on mainframes. Initially, access to these applications was through SNA networks. Today, however, application developers are unlikely to be familiar with VTAM, and newer applications are generally based on TCP/IP networks. Initially, businesses created and supported these SNA and TCP/IP networks separately, but network managers are now seeking ways to consolidate their SNA traffic onto the TCP/IP network. But it's not usually economically practical to convert existing SNA applications to TCP/IP-enabled applications, and, in many cases, conversion may even be technically impractical because of the lack of source code and/or adequate skills for the specific application.

For 3270-based applications, tn3270 can be a key part of the solution. Businesses could convert all their end-user desktops to be TCP/IP-based. These desktop users would then be able to access Web-based applications, new applications written for TCP/IP, and the existing SNA applications using terminal emulation. Desktop emulators come as stand-alone products (typically called fat clients) or are browser-based using Java clients downloaded to the desktop from a Web server. tn3270 servers can run outboard (a separate device) of the System/390 or be contained within it. Both approaches limit the SNA network path to the inside of the data centre. Many businesses use tn3270 to access those SNA applications from IP-based desktops.

It's often impossible or too expensive to convert all end devices to TCP/IP, especially older or specialized devices, such as ATMs requiring a SNA communications protocol (eg SDLC) or actual 3270 devices coax-attached to a 3274 terminal controller. This leaves the question of how to access non-3270-based applications, preserve the application

and endpoint investment, and converge onto a single IP network.

AnyNet was introduced in 1993 for VTAM, in 1994 for OS/2, and included within CS/390 V2R5 (and higher). AnyNet gained limited acceptance and by 1998 most of the offerings were withdrawn from marketing and service (in the US). In 1992, IBM's now defunct networking division invented DLSw as a way to transport SNA using its infamous 6611 routers. Although DLSw is non-proprietary (RFC 1795), implementations, such as Cisco's DLSw+, have additional features provided by proprietary extensions. All routing vendors incorporated a form of DLSw, and most customers use this as their method for accessing SNA applications across a TCP/IP network.

With CS/390 V2R7, IBM created Enterprise Extender as an alternative way to integrate SNA applications onto an IP network. EE is also an industry-standard solution defined by the APPN Implementer's Workshop (AIW) and the IETF (RFC 2353). EE is supported on a number of other IBM products, including Communications Server for OS/2 (CS/2) and CS/NT. Routing vendors continued to promote DLSw (it sold more routers), and EE did not initially gain widespread acceptance. However, DLSw has a number of limitations (see below), and, in 1999, Cisco announced that its routers would also provide the EE function as part of its SNA Switching Services (SNASw). This has sparked new IBM customer interest in EE.

DLSw LIMITATIONS

The key limitations of DLSw are shown below:

- DLSw is the encapsulation of SNA protocols within a TCP/IP 'package'. The package has a usable TCP/IP address that has been discovered by DLSw-capable routers. (Note that older routers may not be able to support DLSw or may require software upgrade.) At both the sending and receiving location, the routers terminate the SNA connection and locally acknowledge transmissions. Connection set-up and session maintenance is process-intensive, involving link-level acknowledgement, TCP retransmit, congestion control, protocol translation, and data store-and-forward. This is a significant router burden, and requires powerful data centre routers (branch office routers today are

generally powerful enough to be able to maintain their sessions).

- With DLSw, the data centre router, where termination and acknowledgement occurs, is a single point of failure. Should this router fail, even though an alternative path may exist, all SNA connections would be disrupted and would have to be re-established. Because Enterprise Extender does not terminate the session flow, it can take advantage of the inherent reroute capability of IP, maintain the connection, and switch to an alternative path without session disruption.

- Although most routers provide some form of prioritized queueing, it has been difficult to identify the priority at which a SNA packet should be sent. With DLSw, traffic prioritization is handled on a link basis, and multiple links must be defined to the same SNA device to support prioritization.

EE extends the reach of SNA applications and data across IP networks to IP-attached clients, and offers high levels of reliability, scalability, and control. EE provides SNA Class of Service support as well as non-disruptive path switching over an IP network. It provides this integration using standard IP technology, and, like AnyNet, requires no new hardware or software in the IP backbone network.

ENTERPRISE EXTENDER IN DETAIL

EE is an extension to High Performance Routing (HPR) technology that provides encapsulation of SNA application traffic within UDP frames by HPR-capable devices at the edges of an IP network. (UDP stands for Unreliable Data Protocol; however, the data transport end-points ensure reliable delivery.) To the IP network, the SNA traffic is UDP datagrams that get routed without hardware or software changes to the IP backbone. To the end user, the session is 'normal SNA' with predictable performance and high availability.

SNA evolved from the traditional subarea networks that dominated enterprise networks for 25+ years. APPN was an enhancement to SNA that supported the movement of logical units and routing change without coordinated system definition. HPR was an enhancement to APPN that supported non-disruptive session switching around failures. Before you discard EE for fear of venturing beyond subarea, I'd like

to point out that HPR is a simpler form of APPN.

HPR and TCP/IP have similarities – end stations ensure data integrity and intermediate devices forward traffic. With HPR, the intermediate – Automatic Network Routing (ANR) – node forwards packets, has no session awareness, and relies on the endpoints for error recovery. The HPR endpoint – Rapid Transport Protocol (RTP) – nodes provide end-to-end error recovery, non-disruptive rerouting, and selective retransmission of lost packets. Anyone familiar with TCP/IP networks will relate RTP to the TCP portion and ANR to the IP part of the stack.

ENTERPRISE EXTENDER ADVANTAGES

The RTP endpoint sees its interface with the UDP layer of the stack as just another data link control (DLC), and treats the IP connection as it would any SNA connection. This gives EE certain advantages:

- When errors are detected, there is a selective retransmission of lost packets only (ie not all subsequent packets too).

- EE requires less router processing. In similar network configurations, the same router can be up to ten times faster when using Enterprise Extender than when using DLSw.

- Non-disruptive reroute based on class of service requirements. HPR preserves the session without impact to the end user for planned and unplanned outages in the session path. If no alternative path is available, HPR can even be configured to preserve the session while the failing component is recovered.

- Enterprise Extender introduced an enhanced version of HPR's Adaptive Rate-Based (ARB) congestion control algorithm. The new proactive version, Responsive-Mode ARB, is more aggressive in using available bandwidth, and more tolerant of variations in network latency. Responsive-Mode ARB better allows EE traffic to coexist with native IP traffic in the backbone network.

- Prioritization. The SNA priority field is mapped to the IP precedence settings used by routing algorithms such as Cisco's Weight-Fair-Queuing. (Joint IBM and Cisco testing resulted in a white paper that showed, for a particular configuration, an improvement from 3 to 7 second response swings to a consistent

1-second response. See: ftp://ftp.software.ibm.com/software/ network/hostintegration/brochures/hostintegqos0300.pdf)

EE exploits an APPN connection mechanism where a shared transport facility can be represented as a Virtual Routing Node (VRN). With EE, a VRN can represent the IP network such that n number of OS/ 390 network connected servers define a single connection instead of defining n-1 partner links. These connections can be dynamically activated as needed.

EE provides an alternative for current SNA Network Interconnect (SNI) users. The APPN replacement for SNI is Extended Border Node (EBN), first shipped on VTAM in 1994. Unlike SNI, which requires a gateway NCP (on a 3745) at the network boundary, there's no gateway requirement between two EBNs. Since most enterprises generally connect to an IP network (eg Internet), EE can connect multiple enterprises using the existing IP connectivity.

OSA-Express provides an economical, high-speed method for System/390 server access. Direct memory access uses a set of priority queues shared with CS/390's TCP/IP stack to provide higher bandwidth and lower latency, and use less CPU. Because of this, the OSA-Express adapter doesn't support native SNA communication; however, SNA applications using EE can still benefit from this high-speed path.

When APPN was introduced, larger networks quickly became complex, requiring large numbers of network-nodes. When EE is used in conjunction with an IP wide area network, much simpler networks can be designed. A few data centre CS/390 images within each sysplex would be designated as network nodes – typically a Communications Management Controller (CMC), a CMC back-up, and one or two additional images to provide basic network node services. The remainder of the CS/390 images would be data hosts defined as end nodes. Branch routers (eg Cisco's SNASw routers) would be configured as Branch Extender (BX) nodes – nodes that present an end node image to the upstream hosts in the data centre, while providing network services for end nodes and clients in the branch. The result is a scalable design that greatly reduces the impact of APPN topology and search broadcast traffic (a potentially significant overhead).

HPR is a very scalable architecture (despite some early counter claims). Joint IBM and Cisco testing showed that thousands of EE flows could be terminated on a single System/390. 30,000 sessions, across 10,000 connections were set up and maintained – and the results were linear, suggesting that even larger networks could be built and supported (ftp://ftp.software.ibm.com/software/network/hostintegration/brochures/hostintegqos0300.pdf).

EE INHIBITORS ELIMINATED

Enterprise Extender has been available on IBM's Communications Server for OS/390 product since V2R7 (V2R6 via PTF). However, until recently, it has had several limitations that made migration very difficult. Before CS/390 V2R10, the first hop from an interchange node (ICN), for sessions from a subarea partner network crossing into the APPN network, could not be HPR. Sessions from applications on the ICN could enter the APPN network via HPR, but those entering the ICN from a cross-domain subarea partner (eg SNI partner) could not use HPR for the first hop. (There is one exception – if the interchange session from the ICN to an end node is via a single APPN hop, then HPR is allowed.)

With CS/390 V2R10, when an ICN receives a session initiation request for an interchange session, it examines the session path to determine whether HPR should be used. If HPR is necessary, the ICN ties the session via a one-hop pipe to the adjacent APPN partner node. Sessions for multi-hop APPN paths will use the one-hop pipe to the adjacent node, and then access a second HPR pipe for the remainder of the HPR-capable session path. Setting up back-to-back pipes in the adjacent node introduces a small performance hit and a single point of failure in the session path. However, you can now establish interchange sessions using HPR, thereby enabling all connection types (including EE) anywhere within the network. (Because this function enables customer migrations to EE, CS/390 has made it available for earlier releases (V2R6-V2R8) via an APAR (OW44611).)

Although V2R10 allows interchange sessions to enter the APPN network via HPR-capable connections, those connections cannot be over a connection-network (virtual routing node). IBM currently recommends the following to customers deploying EE with connection

network:

- Define the EE virtual routing node (VRN) at all end-nodes, branch extenders, and pure network nodes.

- Use only defined (ie non-VRN) connections at an ICN.

These recommendations don't require much definition beyond what's already required. The ICNs typically also function as network node servers (primary and back-up) for the end nodes and branch extenders, and connectivity between an EN (or a BX) and its network node server for the CP-CP session must be defined.

Even though Extended Border Nodes (EBN) removes the requirement for SNI, it forces all inter-network traffic through this potential bottleneck. Customers asked for a slicker solution and IBM responded in z/OS Communications Server V1 R2 (aka R12). Transmission groups directly connected to the destination (end-node) server can be established, bypassing the border node. The IP network, supporting EE and/or SNASw, is defined as a virtual node with a global CPNAME of IP. This enables Virtual Private Networks (VPNs) between networks to be established for TCP/IP and SNA application traffic.

SUMMARY

Having recently had the responsibility for the AnyNet product within CS/390, I know that AnyNet is no longer a strategic product to IBM – in fact, there are no planned enhancements to any of the AnyNet products.

Enterprise Extender is IBM's strategic approach to SNA/IP integration. It has numerous advantages over the widely accepted DLSw approach, including session prioritization and 'SNA-like' availability. And, although EE requires the implementation of HPR, IBM has corrected shortcomings that reduce the network definition complexity and improve performance. If you want to preserve your SNA application and end-device investment, I would recommend that you seriously consider Enterprise Extender as the way to transport SNA applications across an IP network.

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Simplistic monitor of VTAM's LUs

This article offers a rudimentary version of the sophisticated monitors that provide detailed information regarding activity on logical units controlled by VTAM. Initial values of the send and receive counts of each logical unit (LU) are preserved, and then the counts are again retrieved at six-second intervals, three times, and a delta is computed and stowed in a line of information that is transcribed for each active LU.

The send and receive counts are the reverse of those provided by VTAM for an LU in response to a D NET,ID=luname command. However, the counts agree with those provided by VTAM in response to a D NET,ID=imsappl command. Deltas for send and receive counts begin under the title SND1 and RCV1. Under the last portion of output generated by YANKO, they're listed under the titles SDLTA and RDLTA (I wasn't very consistent, was I?). Most titles are readily understood, but consult the source code for those that aren't.

In order to obtain send and receive counts, several control block chains anchored in VTAM's Communications Vector Table (ATCVT) were followed to where those counts are maintained. Send and receive counts are extracted from the Transmission Control Status Area (TCSA) of the Transmission Subsystem Parameter List (TSPL), a VTAM control block, to be sure.

CHAINS

The first chain processed by YANKO is the DEB chain anchored at ATCACDA in the ATCVT. This is the only chain used to obtain three delta counts. A Logical Unit Control Block (LUCB) is chained from each DEB, and from there to a Function Management Control Block (FMCB) extension that contains a network address. Each FMCB extension is searched until an address is found that matches the one in the Resource Definition Table Entry Prefix (RPRE) of the LU for which you want to obtain counts, or until you reach the end of the FMCB chain for that LUCB. Then it's on to the next DEB.

This is a lengthy and convoluted process (thank goodness for fast processors), but since IBM personnel are unwilling to share their

shortcut methods with their customers, I was stuck with doing it in this fashion. The FMCB extension points to the FMCB proper where the send and receive counts can be found in the TCSA. Normally, I can locate the information I need in VTAM's control blocks. However, there's no chart showing how the various control blocks can be accessed, so learning how to navigate them takes time.

The third chain processed is the CID Index Table that begins at label ATCCIT in the ATCVT. Only one delta is provided here. This chain will eventually become non-existent and will then need to be removed from YANKO.

I've saved the second chain that's processed by YANKO for last, because it's the one that caused me most exasperation. I failed to locate receive and send counts by following the chain of Session Information Blocks (SIB), anchored at label ATCSIBQ. IBM personnel stated that send and receive counts are available only from the PLU side of a session, and then only if the PLU is HOST-based, such as a VTAM APPL, and definitely not when the session is cross net or cross domain. I contended that the SEQNO presented in a VTAM trace on the SNA Summary (SSPRT) was analogous to the send and receive counts (close enough anyway) and would serve my purpose for seeking them. But, while they agreed in theory, they wouldn't help me locate counts, stating that the manner in which VTAM accesses the information in the TSPL is OCO. Since VTAM is visibly vanishing as I compose this article, I don't quite understand this reluctance – if anyone learns how to access the TSPL from the SIB chain before I do, please share this information through *TCP/SNA Update*.

(I should just mention that someone at IBM did provide me with the name of the fields that contain the send and receive counts, although in fact I'd already found this out while awaiting a response from him.)

NOTES

Because VTAM's environment is dynamic and extremely volatile, a few deltas may be in the X'FF00' - X'FFFF' range. Don't be alarmed. Extreme care was taken to ensure that the TSPL control block used to obtain send and receive counts corresponded to the LU at hand; however, within an eighteen-second period, an LU could have had one session end and another begin, thereby corrupting the initial

counts preserved for comparisons. Just discount such values. It may be noted that incremental deltas do continue to be valid afterwards.

Some of the information provided by YANKO is present only because it helped me to locate the information I wanted. For example, the ESTAE routine helped me solve more than a couple of S0C4 abends.

The last line of data will always contain the name of the active network, the name of the procedure used to initiate that network, and its network identifier.

YANKO must reside in an authorized library and have been bound with an authorization code of 1. For execution, it should have a region size of 210M. The only DD statement required for execution is one named SYSPRINT.

SOURCE

```
TITLE 'YANKO - PRINT A NETWORK'S ACTIVE SESSIONS'
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*                                                                 *
*   THE PURPOSE OF THIS ROUTINE IS TO PRINT A SIMPLE VERSION OF   *
*   VTAM'S VIEW OF A NETWORK'S ACTIVE LOGICAL UNITS AS SEEN FROM THE *
*   PERSPECTIVE OF DEB'S, SIB'S, AND CIT'S.  A DELTA OF RECEIVE AND *
*   SEND COUNTS IS ALSO PROVIDED IN THE DEB AND CIT LISTINGS.     *
*   YANKO MUST RESIDE IN AN AUTHORIZED LIBRARY AND HAVE BEEN BOUND *
*   WITH AN AUTHORIZATION CODE OF ONE.                            *
*                                                                 *
*   EXECUTION OF YANKO REQUIRES A DD STATEMENT NAMED SYSPRINT.    *
*   A REGION SIZE OF 210M ON THE EXEC STATEMENT WOULD BE NICE.    *
*                                                                 *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
         SPACE
YANKO    CSECT
         SPACE
YANKO    AMODE 31
YANKO    RMODE 24
         SPACE
         PRINT NOGEN
         SPACE
         USING YANKO,R12          ESTABLISH YANKO ADDRESSABILITY
         USING PPHDSECT,R8        ESTABLISH PPHDSECT ADDRESSABILITY
         USING PSA,R0             ESTABLISH PSA ADDRESSABILITY
         SPACE
         LR    R12,R15            PRIME BASE REGISTER
         SPACE
         STORAGE OBTAIN,LENGTH=200000000,LOC=ANY NEED BUNCH OF STORAGE
```

```
        ST    R1,PPHGAREA          STOW ITS ADDRESS
        LR    R8,R1                PRIME BASE REGISTER FOR PPHDSECT
        SPACE 1
        MODESET MODE=SUP           PRETEND TO BE GEORGE
        MODESET EXTKEY=ZERO        WALK ANYWHERE
        SPACE
        ESAR  R1                   GET SECONDARY ASID OF THIS TASK
        ST    R1,PPHCASID          SAVE IT
        SPACE
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*         ESTABLISH RECOVERY ENVIRONMENT                          *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
        SPACE 1
        L     R3,=A(PATEXIT)       POINT TO STAE EXIT ROUTINE ADDRESS
        SPACE 1
        ESTAE (R3),PARAM=PATLIST   ESTABLISH STAE ENVIRONMENT
        SPACE 1
        LTR   R15,R15              TEST IF UNDER STAE'S AEGIS
        BE    PATGO                BRANCH IF SO
        SPACE 1
        WTO   '*** UNABLE TO ESTABLISH A STAE ENVIRONMENT ***'
        SPACE 1
        LA    R15,16               SET CATASTROPHIC ERROR CODE
        SVC   3                    TERMINATE
        EJECT
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*         LOCATE AND ESTABLISH ADDRESSABILITY TO NET'S ADDRESS SPACE   *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
        SPACE 1
PATGO   L     R7,PSAATCVT          ADDRESS OF VTAM'S VECTOR TABLE
        L     R9,ATCCONFT(R7)      ADDRESS OF VTAM CONFIGURATION TABLE
        MVC   PPHJNAME,CONIDENT(R9) SET THE NAME OF VTAM'S TASK
        SPACE 1
        L     R3,CVTPTR            ADDRESS OF CVT
        USING CVT,R3               ESTABLISH CVT ADDRESSABILITY
        L     R5,CVTASVT           FETCH ADDRESS OF ASVT
        DROP  R3                   FORGET CVT
        SPACE 1
        USING ASVT,R5              ESTABLISH ASVT ADDRESSABILITY
        L     R4,ASVTMAXU          MAXIMUM NUMBER OF ADDRESS SPACES
        SPACE 1
PATLOC  TM    ASVTENTY,ASVTAVAL    TEST IF ENTRY IS AVAILABLE
        BO    PATGRUVE             BRANCH IF SO
        L     R6,ASVTENTY          RETRIEVE ADDRESS OF ASCB
        USING ASCB,R6              ESTABLISH ASCB ADDRESSABILITY
        SPACE 1
        ICM   R1,15,ASCBJBNI       POINTER TO INITIATED JOBNAME
        BZ    PATJBNI              BRANCH IF NONEXISTENT
        SPACE 1
        CLC   Ø(8,R1),PPHJNAME     TEST IF CORRECT JOB
        BNE   PATGRUVE             BRANCH IF NOT
```

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        B    PATGOTIT             ELSE CONTINUE
        SPACE 1
PATJBNI ICM  R1,15,ASCBJBNS       POINTER TO START/MOUNT/LOGON TASK
        BZ   PATGRUVE             FORMAT IT
        SPACE 1
        CLC  Ø(8,R1),PPHJNAME     TEST IF CORRECT JOB
        BE   PATGOTIT             BRANCH IF SO
        SPACE 1
PATGRUVE LA  R5,4(R5)             NEXT ENTRY
        BCT  R4,PATLOC            LOOP POWER
        B    PPHDUST              ISSUE ERROR MESSAGE; RETURN TO DUST
        SPACE 1
PATGOTIT LH  R2,ASCBASID          OBTAIN ASID OF VTAM'S ADDRESS SPACE
        STH  R2,PPHVASID          STOW VTAM'S ASID
        LAM  R3,R3,PPHONE         INITIALIZE ACCESS REGISTER
        LAM  R4,R4,PPHONE         INITIALIZE ACCESS REGISTER
        LAM  R5,R5,PPHONE         INITIALIZE ACCESS REGISTER
        LAM  R2,R2,PPHONE         INITIALIZE ANOTHER ACCESS REGISTER
        SPACE 1
        LA   R1,1                 SET AUTHORIZATION
        AXSET AX=(R1)              INDEX TO ONE
        SSAR R2                   USE DATA IN VTAM'S ADDRESS SPACE
        SPACE 1
        SAC  512                  SET UNIVERSAL ACCESS MODE
        EJECT
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*        PROCESS VTAM'S DEB CHAIN                                 *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
        SPACE 1
PPHTYPE1 DS  ØH
        L    R5,ATCACDA(R7)       POINT TO FIRST DEB
        MVI  PPHCC,C' '
        MVC  PPHONLNM(PPHDLEN-1),PPHCC CLEAR OUTPUT AREA
PPGLOCLU DS  ØH
        SPACE
        CLI  Ø(R5),X'ØF'          TEST IF R15 POINTS TO A DEB
        BNE  PPGNXTDB             BRANCH IF NOT
        SPACE
        ICM  R4,15,ACDLUCBA(R5)   OBTAIN ADDRESS OF LUCB
        BE   PPGNXTDB             BRANCH IF UNAVAILABLE
        CLI  Ø(R4),X'52'          TEST IF ACTUALLY AN LUCB
        BNE  PPGNXTDB             BRANCH IF NOT
        SPACE
        ICM  R3,15,LUCRDTEA(R4)   OBTAIN ADDRESS OF APPL RDT ENTRY
        BE   PPGDOFMX             BRANCH IF UNAVAILABLE
        MVC  PPHONLNM,Ø(R3)       SAVE NAME
        SPACE
PPGDOFMX ICM R3,15,LUCFMCBA(R4)   FETCH ADDRESS OF FIRST FMCB XTENSION
        BE   PPGNXTDB             BRANCH IF UNAVAILABLE
        SPACE
PPGISDEB DS  ØH                   PROVIDE A TARGET FOR BRANCH INST
```

```
        MVC   PPHAPLNM,ACDUNTNM(R5) ALIAS NAME
        MVC   PPHLUNME,TSPNAME(R3) NAME OF SESSION PARTNER
        SPACE 1
        ST    R5,PPHHOLD          ADDRESS OF DEB
        UNPK  PPHDADDR(9),PPHHOLD(5) FORMAT ADDRESS
        TR    PPHDADDR(8),PPHTRANS-24Ø  OF RCC
        MVI   PPHDADDR+8,C' '     CLEAR THE TRASH
        SPACE 1
        UNPK  PPHNETAD,TSPNA(5,R3) DESTINATION'S NETWORK SUBAREA
        TR    PPHNETAD(8),PPHTRANS-24Ø
        MVI   PPHNETAD+8,C' '
        UNPK  PPHNETEL,TSPNA+4(3,R3) DESTINATION'S NETWORK ELEMENT
        TR    PPHNETEL(4),PPHTRANS-24Ø
        MVI   PPHNETEL+4,C' '
        SPACE
        UNPK  PPHPLUAD,TSPPLUSA(5,R3) PLU'S SUBAREA NUMBER
        TR    PPHPLUAD(8),PPHTRANS-24Ø
        MVI   PPHPLUAD+8,C' '
        UNPK  PPHPLUEL,TSPPLUEA(3,R3) PLU'S ELEMENT NUMBER
        TR    PPHPLUEL(4),PPHTRANS-24Ø
        MVI   PPHPLUEL+4,C' '
        SPACE
        UNPK  PPHSLUAD,TSPSLUSA(5,R3) SLU'S SUBAREA NUMBER
        TR    PPHSLUAD(8),PPHTRANS-24Ø
        MVI   PPHSLUAD+8,C' '
        UNPK  PPHSLUEL,TSPSLUEA(3,R3) SLU'S ELEMENT NUMBER
        TR    PPHSLUEL(4),PPHTRANS-24Ø
        MVI   PPHSLUEL+4,C' '
        SPACE
        LR    R1,R3               PRESERVE POINTER TO FMCB EXTENSION
        L     R3,TSPFMCBA(R3)    POINT TO FMCB
        CLI   TSPCBID(R3),FMTYPE  TEST IF FMCB
        BNE   PPGNXTDB            BRANCH IF NOT
        SPACE 1
        ST    R3,PPHHOLD          ADDRESS OF FMCB
        UNPK  PPHFADDR(9),PPHHOLD(5) FORMAT ADDRESS
        TR    PPHFADDR(8),PPHTRANS-24Ø  OF RCC
        MVI   PPHFADDR+8,C' '     CLEAR THE TRASH
        SPACE 1
        LA    R3,FMCTCSA(R3)      POINT TO TCSA
        SPACE
        MVC   PPHSND3(2),TSPSQCNT(R3) RETAIN CURRENT RECEIVE COUNT
        UNPK  PPHSEND,TSPSQCNT(3,R3) RECEIVE COUNT
        MVI   PPHSEND+4,C' '      CLEAR THE TRASH
        TR    PPHSEND(4),PPHTRANS-24Ø MAKE IT PRETTY
        SPACE
        MVC   PPHRCVD3(2),TSPSQRCV(R3) RETAIN CURRENT SEND COUNT
        UNPK  PPHRECV,TSPSQRCV(3,R3) SEND COUNT
        MVI   PPHRECV+4,C' '      CLEAR THE TRASH
        TR    PPHRECV(4),PPHTRANS-24Ø MAKE IT PRETTY
        SPACE
```

```
        LA      R8,PPHDLEN(R8)      NEXT SLOT IN ARRAY OF SAVED ENTRIES
        MVI     PPHCC,C' '
        MVC     PPHONLNM(PPHDLEN-1),PPHCC CLEAR OUTPUT AREA
        SPACE
        C       R1,LUCFMCBL(R4)     TEST IF LAST FMCB EXTENSION
        BE      PPGNXTDB            BRANCH IF SO
        SPACE
        LR      R3,R1
        ICM     R3,15,TSPNEXTA(R3)  RETRIEVE ADDRESS OF NEXT EXTENSION
        BNE     PPGISDEB            BRANCH IF AVAILABLE
        SPACE
PPGNXTDB ICM    R5,15,ACDDEB(R5)    FETCH ADDRESS OF NEXT DEB ON CHAIN
        BNE     PPGLOCLU            BRANCH IF AVAILABLE
        MVI     PPHCC,C'('          TERMINATE LIST OF DEB ENTRIES
        ST      R8,PPGHDEB          REMEMBER END OF DEB TRANSCRIPTIONS
        EJECT
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*         REPROCESS VTAM'S DEB CHAIN, AGAIN AND AGAIN                 *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
        SPACE
        BAS     R9,PPHTARRY         TARRY AWHILE
        LA      R6,PPHSND10         OFFSET TO FIRST DELTA
        BAS     R9,PPHCAROL         PROCESS IT
        SPACE
        BAS     R9,PPHTARRY         TARRY A LITTLE LONGER
        LA      R6,PPHSND20         OFFSET TO MIDDLE DELTA
        BAS     R9,PPHCAROL         PROCESS IT
        SPACE
        BAS     R9,PPHTARRY         TARRY HO!
        LA      R6,PPHSND30         OFFSET TO LAST DELTA
        BAS     R9,PPHCAROL         PROCESS IT
        B       PPGCBPIB            GO AND PROCESS SIB CHAIN
        EJECT
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*         LOCATE A DEB ASSOCIATED WITH A LOGICAL UNIT WHOSE          *
*         DESCRIPTION HAS BEEN PREVIOUSLY FORMATTED.                 *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
        SPACE 1
PPHCAROL DS     ØH
        L       R8,PPHGAREA         POINT TO FIRST LINE OF DATA
        C       R8,PPGHDEB          TEST IF ANY ENTRIES WERE FOUND
        BE      Ø(R9)               RETURN IF NOT
        SPACE
PPHCN01 L       R5,ATCACDA(R7)      POINT TO FIRST DEB
        SPACE 1
PPHCKDEB CLI    Ø(R5),X'ØF'         TEST IF R5 POINTS TO A DEB
        BNE     PPHNXTDB            BRANCH IF NOT
        SPACE
        ICM     R4,15,ACDLUCBA(R5)  OBTAIN ADDRESS OF LUCB
        BE      PPHNXTDB            BRANCH IF UNAVAILABLE
        CLI     Ø(R4),X'52'         TEST IF ACTUALLY AN LUCB
```

```
        BNE    PPHNXTDB             BRANCH IF NOT
        SPACE
        ICM    R3,15,LUCFMCBA(R4)   FETCH ADDRESS OF FIRST FMCB XTENSION
        BE     PPHNXTDB             BRANCH IF UNAVAILABLE
        EJECT
****************************************************************
*     ENSURE THAT AN ENTRY TRULY MATCHES ONE BEING PROCESSED    *
****************************************************************
        SPACE
PPHISDEB DS    ØH                   PROVIDE A TARGET FOR BRANCH INST
        LR     R2,R3                PRESERVE POINTER TO FMCB EXTENSION
        CLC    PPHLUNME,TSPNAME(R3) TEST IF NAMES OF PARTNERS MATCH
        BNE    PPHLUCK              BRANCH IF NOT
        SPACE 1
        UNPK   PPGFSM(9),TSPNA(5,R3) DESTINATION'S NETWORK SUBAREA
        TR     PPGFSM(8),PPHTRANS-24Ø MAKE SUBAREA LEGIBLE
        CLC    PPGFSM(8),PPHNETAD   TEST IS SAME NETWORK SUBAREA
        BNE    PPHLUCK              BRANCH IF NOT
        SPACE 1
        UNPK   PPGFSM(5),TSPNA+4(3,R3) DESTINATION'S NETWORK ELEMENT
        TR     PPGFSM(4),PPHTRANS-24Ø MAKE ELEMENT LEGIBLE
        CLC    PPGFSM(4),PPHNETEL   TEST IS SAME NETWORK ELEMENT
        BNE    PPHLUCK              BRANCH IF NOT
        SPACE
        UNPK   PPGFSM(9),TSPPLUSA(5,R3) PLU'S SUBAREA NUMBER
        TR     PPGFSM(8),PPHTRANS-24Ø CONVERT TO EBCDIC
        CLC    PPGFSM(8),PPHPLUAD   TEST IS SAME SUBAREA NUMBER
        BNE    PPHLUCK              BRANCH IF NOT
        SPACE
        UNPK   PPGFSM(5),TSPPLUEA(3,R3) PLU'S ELEMENT NUMBER
        TR     PPGFSM(4),PPHTRANS-24Ø CONVERT TO EBCDIC
        CLC    PPGFSM(4),PPHPLUEL   TEST IS SAME ELEMENT NUMBER
        BNE    PPHLUCK              BRANCH IF NOT
        SPACE
        UNPK   PPGFSM(9),TSPSLUSA(5,R3) SLU'S SUBAREA NUMBER
        TR     PPGFSM(8),PPHTRANS-24Ø TRANSLATE TO EBCDIC
        CLC    PPGFSM(8),PPHSLUAD   TEST IS SAME SUBAREA NUMBER
        BNE    PPHLUCK              BRANCH IF NOT
        SPACE
        UNPK   PPGFSM(5),TSPSLUEA(3,R3) SLU'S ELEMENT NUMBER
        TR     PPGFSM(4),PPHTRANS-24Ø TRANSLATE EXTERNAL DEC TO EBCDIC
        CLC    PPGFSM(4),PPHSLUEL   TEST IS SAME SUBAREA NUMBER
        BNE    PPHLUCK              BRANCH IF NOT
        EJECT
****************************************************************
*       COMPUTE DELTA FOR SEND AND RECEIVE COUNTS               *
****************************************************************
        SPACE
        LA     R1,Ø(R6,R8)          POINT TO PROPER COUNT
        L      R3,TSPFMCBA(R3)      POINT TO FMCB
        CLI    TSPCBID(R3),FMTYPE   TEST IF FMCB
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        BNE    PPHNXTDB
        LA     R3,FMCTCSA(R3)      POINT TO TCSA
        SPACE
        SR     R14,R14             ZERO A WORK REGISTER
        LR     R15,R14             CLEAR ANOTHER VOLATILE REGISTER
        SPACE
        CLC    PPHSND3(6),=CL6' '  TEST IF LU MISSD DURING AN ITERATION
        BE     PPHLUCK             BRANCH IF SO
        SPACE
        ICM    R14,3,TSPSQRCV(R3)  FETCH CURRENT RECEIVE COUNT
        CLC    TSPSQRCV(2,R3),PPHRCVD3 IF CURRENT IS HIGHER THAN FORMER
        BNL    PPHRLESS                  THEN BRANCH
        O      R14,=XL4'ØØØ1ØØØØ'          ELSE ENSURE THAT IT IS
        SPACE
PPHRLESS ICM   R15,3,PPHRCVD3      FETCH PREVIOUS RECEIVE COUNT
        SR     R14,R15             COMPUTE CHANGE
        STCM   R14,3,PPHHOLD       STOW VALUE COMPUTED
        UNPK   5(5,R1),PPHHOLD(3)  CONVERT RECEIVE COUNT TO EBCDIC
        MVI    9(R1),C' '          CLEAR THE TRASH
        TR     5(4,R1),PPHTRANS-24Ø MAKE IT PRETTY
        SPACE
        SR     R14,R14             ZERO A WORK REGISTER
        LR     R15,R14             CLEAR ANOTHER VOLATILE REGISTER
        SPACE
        ICM    R14,3,TSPSQCNT(R3)  FETCH CURRENT SEND COUNT
        CLC    TSPSQCNT(2,R3),PPHSND3 IF CURRENT IS HIGHER THAN FORMER
        BNL    PPHSLESS                  THEN BRANCH
        O      R14,=XL4'ØØØ1ØØØØ'          ELSE ENSURE THAT IT IS
PPHSLESS ICM   R15,3,PPHSND3       FETCH PREVIOUS SEND COUNT
        SR     R14,R15             COMPUTE CHANGE
        STCM   R14,3,PPHHOLD       STOW VALUE COMPUTED
        UNPK   Ø(5,R1),PPHHOLD(3)  CONVERT SEND COUNT TO EBCDIC
        MVI    4(R1),C' '          CLEAR THE TRASH
        TR     Ø(4,R1),PPHTRANS-24Ø MAKE IT PRETTY
        SPACE
        LA     R8,PPHDLEN(R8)      POINT TO NEXT ENTRY
        CLI    PPHCC,C'('          TEST IF END OF CHAIN
        BNE    PPHCNO1             IF NOT PROCESS NEXT LINE-ENTRY
        B      Ø(R9)                ELSE RETURN TO CALLER
        EJECT
PPHLUCK  C     R2,LUCFMCBL(R4)     TEST IF LAST FMCB EXTENSION
        BE     PPHNXTDB            BRANCH IF SO
        SPACE
        LR     R3,R2               SET ADDRESS OF FMCB EXTENSION
        ICM    R3,15,TSPNEXTA(R3)  RETRIEVE ADDRESS OF NEXT EXTENSION
        BNE    PPHISDEB            BRANCH IF AVAILABLE
        SPACE
PPHNXTDB ICM   R5,15,ACDDEB(R5)    FETCH ADDRESS OF NEXT DEB ON CHAIN
        BNE    PPHCKDEB            BRANCH IF AVAILABLE
        SPACE
PPHENDEB DS    ØH                  PROVIDE A TARGET FOR B INSTRUCTION
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        CLI    PPHCC,C'('           TEST IF END OF CHAIN
        BE     Ø(R9)                IF SO, RETURN TO CALLER
        SPACE
        MVI    PPHSND3,C' '         CLEAR THE TRASH
        MVC    PPHSND3+1(8),PPHSND3 FROM SEND AND RECEIVE DELTAS
        LA     R8,PPHDLEN(R8)       POINT TO NEXT ENTRY
        B      PPHCNO1              AND PROCESS IT
        EJECT
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*         PROCESS CHAIN OF SESSION INFORMATION BLOCKS          *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
        SPACE
PPGCBPIB L      R5,ATCSIBQ(R7)      POINT TO FIRST SIB
        SPACE
        DROP   R8                   FORGET PPHDSECT
        USING  PPGDSECT,R8          ESTABLISH PPGDSECT ADDRESSABILITY
        SPACE
PPGSIBLP CLI   SIBCBID(R5),SIBCBTYP TEST IF THIS IS AN SIB CONTROL BLK
        BNE    PPGSIBER             BRANCH IF NOT
        SPACE
        CLI    PPGSIBSW,Ø           TEST IF DATA PRESENT
        BE     PPGETPLU             BRANCH IF NOT
        MVI    PPGSIBSW,Ø           RESET SWITCH
        LA     R8,PPHDLEN(R8)       NEXT SLOT IN ARRAY OF SAVED ENTRIES
        MVI    PPGCC,C' '
        MVC    PPGSRNID(PPHDLEN-1),PPGCC CLEAR OUTPUT AREA
        SPACE
PPGETPLU ICM   R3,15,SIBBPPTR(R5)   POINT TO PLU RESOURCE INFORMATION
        BE     PPGKSSIB             BRANCH IF NOT AVAILABLE
        MVI    PPGSIBSW,1           INDICATE THAT DATA IS PRESENT
        SPACE
        UNPK   PPGP1ADR,SIBPCID(5,R5) FIRST-HALF OF LU'S PCID
        TR     PPGP1ADR(8),PPHTRANS-24Ø
        MVI    PPGP1ADR+8,C' '
        UNPK   PPGP2ADR,SIBPCID+4(5,R5) SECOND-HALF OF LU'S PCID
        TR     PPGP2ADR(8),PPHTRANS-24Ø
        MVI    PPGP2ADR+8,C' '
        SPACE
        MVC    PPGSALNM,SIBRALNM(R3) RESOURCE'S NAME IN SESS PART NETWK
        MVC    PPGSRNID,SIBRNID(R3)  NETWORK ID ASSOCIATED WITH LU
        ICM    R4,15,SIBRRSRC(R3)   ADDRESS OF RESOURCE'S RDTE
        BE     PPGKSSIB             BRANCH IF NONE
        CLI    RPRNAME(R3),C'A'     TEST IF TRULY A NAME
        BL     PPGKSSIB             BRANCH IF NOT
        MVC    PPGSNAME,RPRNAME(R3) PLU'S RDTE NAME
        EJECT
PPGKSSIB ICM   R3,15,SIBBSPTR(R5)   POINT TO SLU RESOURCE INFORMATION
        BE     PPGNSIB              BRANCH IF NONEXISTENT
        MVI    PPGSIBSW,1           INDICATE THAT DATA IS PRESENT
        MVC    PPGSSLNM(8),SIBRALNM(R3) RESOURCE'S NAM IN SESS PART NWK
        MVC    PPGSSNID(8),SIBRNID(R3)  NETWORK ID ASSOCIATED WITH LU
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        SPACE
        UNPK  PPGSSUBA,SIBRSUBA(5,R3) FORMAT LU'S SUBAREA ADDRESS
        TR    PPGSSUBA(8),PPHTRANS-24Ø MAKE IT PRETTY
        MVI   PPGSSUBA+8,C' '        REMOVE THE GARBAGE
        SPACE
        UNPK  PPGSSUBE(5),SIBRELMA(3,R3) FORMAT LU'S ELEMENT ADDRESS
        TR    PPGSSUBE(4),PPHTRANS-24Ø MAKE IT LEGIBLE
        MVI   PPGSSUBE+4,C' '        RECYCLE THE TRASH
        SPACE
        ST    R5,PPHHOLD            ADDRESS OF SIB
        UNPK  PPGSSBAD,PPHHOLD(5) FORMAT ADDRESS
        TR    PPGSSBAD(8),PPHTRANS-24Ø  OF SIB
        MVI   PPGSSBAD+8,C' '        CLEAR THE TRASH
        SPACE
        ICM   R4,15,SIBRRSRC(R3)  ADDRESS OF RESOURCE'S RDTE
        BE    PPGNSIB              BRANCH IF NONE
        CLI   RPRNAME(R3),C'A'     TEST IF TRULY A NAME
        BL    PPGNSIB              BRANCH IF NOT
        MVC   PPGSPNME(8),RPRNAME(R3) PLU'S RDTE NAME
        SPACE
PPGNSIB ICM   R5,15,SIBBFWD(R5)    FETCH POINTER TO NEXT SIB
        BNE   PPGSIBLP
        EJECT
***********************************************************************
*       RUN THE CIT CHAIN                                             *
***********************************************************************
        SPACE
        DROP  R8                    FORGET PPGDSECT
        USING PPLDSECT,R8           ESTABLISH PPGLSECT ADDRESSABILITY
        SPACE
PPGSIBER LA   R8,PPHDLEN(R8)        NEXT SLOT IN ARRAY OF SAVED ENTRIES
        ST    R8,PPHSAVIT           REMEMBER FIRST OF MANY CIC ENTRIES
        MVI   PPLCC,C' '
        MVC   PPLLUNME(PPHDLEN-1),PPLCC CLEAR OUTPUT AREA
        SPACE
        MVI   PPLCC,C')'            TERMINATE LIST OF SIB ENTRIES
        L     R5,ATCCIT(R7)         ADDRESS OF CID INDEX TABLE
PPGCITFM LA   R4,X'2Ø'(R5)          POINT TO FIRST ENTRY
        SPACE
PPHCITFM CLC  Ø(4,R4),4(R4)         TEST IF ENTRIES ARE TWINS
        BE    PPGSAME               BRANCH IF SO
        SPACE
        LA    R8,PPHDLEN(R8)        NEXT SLOT IN ARRAY OF SAVED ENTRIES
        MVI   PPLCC,C' '
        MVC   PPLLUNME(PPHDLEN-1),PPLCC CLEAR OUTPUT AREA
        SPACE
        UNPK  PPLVRBLK(9),Ø(5,R4)   FORMAT ADDRESS
        TR    PPLVRBLK(8),PPHTRANS-24Ø  OF VRBLK
        MVI   PPLVRBLK+8,C' '       CLEAR THE TRASH
        SPACE
        UNPK  PPLFMCB(9),4(5,R4)    FORMAT ADDRESS
```

```
          TR     PPLFMCB(8),PPHTRANS-24Ø  OF FMCB
          MVI    PPLFMCB+8,C' '       CLEAR THE TRASH
          SPACE
          L      R3,4(R4)             POINT TO FMCB
          TM     4(R4),CITFMCBX       TEST IF FMCB EXTENSION
          BNO    PPPHIPPS             BRANCH IF NOT
          SPACE
          L      R3,TSPFMCBA(R3)      POINT TO FMCB
PPPHIPPS  CLI    TSPCBID(R3),FMTYPE   TEST IF FMCB
          BNE    PPGSAME              BRANCH IF NOT
          SPACE
          LA     R3,FMCTCSA(R3)       POINT TO TCSA
          SPACE
          UNPK   PPLSEND,TSPSQCNT(3,R3) RECEIVE COUNT
          MVC    PPLSEND+4(2),TSPSQCNT(R3) STOW BINARY RECEIVE COUNT
          TR     PPLSEND(4),PPHTRANS-24Ø MAKE IT PRETTY
          SPACE
          UNPK   PPLRECV,TSPSQRCV(3,R3) SEND COUNT
          MVC    PPLRECV+4(2),TSPSQRCV(R3) STOW BINARY SEND COUNT
          TR     PPLRECV(4),PPHTRANS-24Ø MAKE IT PRETTY
          EJECT
****************************************************************
*         FORMAT THE NETWORK ADDRESS OF RESOURCE'S PLU AND SLU  *
****************************************************************
          SPACE 1
          L      R3,4(R4)             POINT TO FMCB
          L      R3,4(R3)             POINT TO FMCB EXTENSION
          SPACE
          MVC    PPLLUNME,TSPNAME(R3) NAME OF SESSION PARTNER
          UNPK   PPLPLUAD,TSPPLUSA(5,R3) PLU'S SUBAREA NUMBER
          TR     PPLPLUAD(8),PPHTRANS-24Ø TO EBCDIC
          MVI    PPLPLUAD+8,C' '      DON'T WANT ANY TRASH AROUND HERE
          UNPK   PPLPLUEL,TSPPLUEA(3,R3) PLU'S ELEMENT NUMBER
          TR     PPLPLUEL(4),PPHTRANS-24Ø  TO EBCDIC
          MVI    PPLPLUEL+4,C' '      SO LONG TRASH
          SPACE
          UNPK   PPLSLUAD,TSPSLUSA(5,R3) SLU'S SUBAREA NUMBER
          TR     PPLSLUAD(8),PPHTRANS-24Ø TO EBCDIC
          MVI    PPLSLUAD+8,C' '      GARBAGE TO OBLIVION
          UNPK   PPLSLUEL,TSPSLUEA(3,R3) SLU'S ELEMENT NUMBER
          TR     PPLSLUEL(4),PPHTRANS-24Ø  TO EBCDIC
          MVI    PPLSLUEL+4,C' '      TAKE OUT THE GARBAGE
          SPACE 2
****************************************************************
*         PROCESS ENTIRE CIT INDEX TABLE                       *
****************************************************************
          SPACE 1
PPGSAME   CLC    12(4,R4),=F'Ø'       TEST IF LAST ENTRY
          BE     PPGCITNX             BRANCH IF SO
          LA     R4,X'1Ø'(R4)         POINT TO NEXT ENTRY
          B      PPHCITFM             LOOP POWER
```

```
         SPACE
PPGCITNX ICM   R5,15,16(R5)        POINT TO NEXT CIT
         BNE   PPGCITFM            BRANCH IF ONE IS AVAILABLE
         EJECT
*****************************************************************
*         FORMAT THE NETWORK ADDRESS OF THIS HOST; INCLUDE       *
*         ITS NETWORK IDENTIFIER AND VTAM'S NAME IN THE SAME     *
*         INFORMATIVE MESSAGE, THEN TERMINATE ENTRIES.           *
*****************************************************************
         SPACE
         LA    R8,PPHDLEN(R8)      NEXT SLOT IN ARRAY OF SAVED ENTRIES
         MVI   PPLCC,C' '          INITIAL BLANK
         MVC   PPLLUNME(PPHDLEN-1),PPLCC CLEAR OUTPUT AREA
         MVI   PPLCC,C'Ø'          DOUBLE SPACE
         SPACE
         L     R9,ATCCONFT(R7)     ADDRESS OF VTAM CONFIGURATION TABLE
         MVC   PPLSEND(8),CONIDENT(R9) SET THE NAME OF VTAM'S TASK
         MVC   PPLLUNME,ATCNETID(R7) THIS HOST'S NETWORK IDENTIFIER
         UNPK  PPLPLUAD,ATCHOSTA(5,R7) HOST'S NETWORK SUBAREA
         TR    PPLPLUAD(8),PPHTRANS-24Ø TO EBCDIC
         MVI   PPLPLUAD+8,C' '     LESS TRASH
         UNPK  PPLPLUEL,ATCHOSTE(3,R7) HOST'S NETWORK ELEMENT
         TR    PPLPLUEL(4),PPHTRANS-24Ø TO EBCDIC
         MVI   PPLPLUEL+4,C' '     END OF TRASH
         LA    R8,PPHDLEN(R8)      NEXT SLOT IN ARRAY OF SAVED ENTRIES
         SPACE
         MVI   PPLCC,X'FF'         TERMINATE LIST
         EJECT
*********************************************************************
*         PROCESS THE CIT CHAIN, AGAIN.                              *
*********************************************************************
         SPACE
         BAS   R9,PPHTARRY         A PAUSE FOR THE CAUSE
         SPACE
         L     R8,PPHSAVIT         FETCH ADDRESS OF FIRST CIT PROCESSED
         SPACE
PPGCAROL L     R5,ATCCIT(R7)       ADDRESS OF CID INDEX TABLE
PPLCBP   LA    R4,X'2Ø'(R5)        POINT TO FIRST ENTRY
         SR    R1,R1               CLEAR A VOLATILE REGISTER
         SPACE
PPCPITFM CLC   Ø(4,R4),4(R4)       TEST IF ENTRIES ARE TWINS
         BE    PPGCPME             BRANCH IF SO
         SPACE
         L     R2,4(R4)            POINT TO FMCB
         LR    R3,R2               PRESERVE ADDRESS OF FMCB
         TM    4(R4),X'8Ø'         TEST IF FMCB EXTENSION
         BO    PPLCAROL            BRANCH IF SO
         CLI   TSPCBID(R2),FMTYPE  TEST IF FMCB
         BNE   PPGCPME             BRANCH IF NOT
         L     R3,4(R2)            POINT TO FMCB EXTENSION
         SPACE
```

```
         B     PPLCAROL => BRANCH REGARDLESS  ** REMOVE FOR DEBUG ** <=
         SPACE
         LRA   RØ,Ø(R3)              TEST FOR A VALID VIRTUAL ADDRESS
         SPACE
         BE    PPLCAROL            BRANCH IF SO
         SPACE
         ST    R2,PPHHOLD          ADDRESS OF FMCB
         UNPK  PPLFMCBX(9),PPHHOLD(5) FORMAT ADDRESS
         TR    PPLFMCBX(8),PPHTRANS-24Ø  OF FMCB
         MVI   PPLFMCBX+8,C' '     CLEAR THE TRASH
         ST    R5,PPHHOLD          ADDRESS OF CIT
         UNPK  PPLFMCBY(9),PPHHOLD(5) FORMAT ADDRESS
         TR    PPLFMCBY(8),PPHTRANS-24Ø  OF CIT
         MVI   PPLFMCBY+8,C' '     CLEAR THE TRASH
         ST    R4,PPHHOLD          ADDRESS OF CIT ENTRY
         UNPK  PPLFMCBZ(9),PPHHOLD(5) FORMAT ADDRESS
         TR    PPLFMCBZ(8),PPHTRANS-24Ø  OF CIT ENTRY
         MVI   PPLFMCBZ+8,C' '     CLEAR THE TRASH
         B     PPLPHIPP            PROCESS NEXT ENTRY
         EJECT
*****************************************************************
*    ENSURE THAT AN ENTRY TRULY MATCHES ONE BEING PROCESSED    *
*****************************************************************
         SPACE
PPLCAROL CLC   PPLLUNME,TSPNAME(R3) TEST IF KNOWN NAME OF SESS PARTNER
         BNE   PPGCPME             BRANCH IF NOT
         SPACE
         UNPK  PPGFSM(9),TSPPLUSA(5,R3) PLU'S SUBAREA NUMBER
         TR    PPGFSM(8),PPHTRANS-24Ø CONVERT TO EBCDIC
         CLC   PPGFSM(8),PPLPLUAD  TEST IS SAME SUBAREA NUMBER
         BNE   PPGCPME             BRANCH IF NOT
         SPACE
         UNPK  PPGFSM(5),TSPPLUEA(3,R3) PLU'S ELEMENT NUMBER
         TR    PPGFSM(4),PPHTRANS-24Ø CONVERT TO EBCDIC
         CLC   PPGFSM(4),PPLPLUEL  TEST IS SAME ELEMENT NUMBER
         BNE   PPGCPME             BRANCH IF NOT
         SPACE
         UNPK  PPGFSM(9),TSPSLUSA(5,R3) SLU'S SUBAREA NUMBER
         TR    PPGFSM(8),PPHTRANS-24Ø
         CLC   PPGFSM(4),PPLSLUAD  TEST IS SAME SUBAREA NUMBER
         BNE   PPGCPME             BRANCH IF NOT
         SPACE
         UNPK  PPGFSM(5),TSPSLUEA(3,R3) SLU'S ELEMENT NUMBER
         TR    PPGFSM(4),PPHTRANS-24Ø TRANSLATE EXTERNAL DEC TO EBCDIC
         CLC   PPGFSM(4),PPLSLUEL  TEST IS SAME SUBAREA NUMBER
         BNE   PPGCPME             BRANCH IF NOT
         EJECT
*****************************************************************
*        COMPUTE DELTA FOR SEND AND RECEIVE COUNTS             *
*****************************************************************
         SPACE
```

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          LA    R3,FMCTCSA(R2)       POINT TO TCSA
          SPACE
          SR    R14,R14              ZERO A WORK REGISTER
          LR    R15,R14              CLEAR ANOTHER VOLATILE REGISTER
          SPACE
          ICM   R14,3,TSPSQRCV(R3)  FETCH CURRENT RECEIVE COUNT
          CLC   TSPSQRCV(2,R3),PPLRECV+4 IF CURRENT IS > THAN FORMER CNT
          BNL   PPGRLESS                THEN BRANCH
          O     R14,=XL4'00010000'       ELSE ENSURE THAT IT IS
          SPACE
PPGRLESS  ICM   R15,3,PPLRECV+4      FETCH PREVIOUS RECEIVE COUNT
          MVI   PPLRECV+4,C' '       TAKE OUT THE GARBAGE
          SR    R14,R15              COMPUTE CHANGE
          STCM  R14,3,PPHHOLD        STOW VALUE COMPUTED
          UNPK  PPLDELTR,PPHHOLD(3) CONVERT RECEIVE COUNT TO EBCDIC
          MVI   PPLDELTR+4,C' '      CLEAR THE TRASH
          TR    PPLDELTR(4),PPHTRANS-240 MAKE IT PRETTY
          SPACE
          SR    R14,R14              ZERO A WORK REGISTER
          LR    R15,R14              CLEAR ANOTHER VOLATILE REGISTER
          SPACE
          ICM   R14,3,TSPSQCNT(R3)  FETCH CURRENT SEND COUNT
          CLC   TSPSQCNT(2,R3),PPLSEND+4 IF CURRENT IS > THAN FORMER CNT
          BNL   PPGSLESS                THEN BRANCH
          O     R14,=XL4'00010000'       ELSE ENSURE THAT IT IS
PPGSLESS  ICM   R15,3,PPLSEND+4      FETCH PREVIOUS SEND COUNT
          MVI   PPLSEND+4,C' '       TAKE OUT
          SR    R14,R15              COMPUTE CHANGE
          STCM  R14,3,PPHHOLD        STOW VALUE COMPUTED
          UNPK  PPLDELTS,PPHHOLD(3) CONVERT SEND COUNT TO EBCDIC
          MVI   PPLDELTS+4,C' '      CLEAR THE TRASH
          TR    PPLDELTS(4),PPHTRANS-240 MAKE IT PRETTY
          SPACE
          LA    R8,PPHDLEN(R8)       POINT TO NEXT ENTRY
          CLI   PPLCC,X'FF'          TEST IF END OF CHAIN
          BNE   PPGCAROL             BRANCH SO LONG AS WORK REMAINS
          B     PPHDUST              GO TRANSCRIBE DATA
          EJECT
*****************************************************************
*       PROCESS EVERY CIT ENTRY THEN PROCESS NEXT ONE UNTIL    *
*       EITHER A MATCHING ENTRY IS FOUND OF THE END OF THE     *
*       CIT INDEX TABLE IS ENCOUNTERED.  THEN PROCESS THE      *
*       NEXT ENTRY THAT IS TO BE TRANSCRIBED.                  *
*****************************************************************
          SPACE
PPGCPME   CLC   12(4,R4),=F'0'       TEST IF LAST ENTRY
          BE    PPPCITNX             BRANCH IF SO
          LA    R1,1(R1)             COUNT LOOPS
          LA    R4,X'10'(R4)         POINT TO NEXT ENTRY
          B     PPCPITFM             LOOP POWER
          SPACE
```

```
PPPCITNX ICM   R5,15,16(R5)          POINT TO NEXT CIT
         BNE   PPLCBP                BRANCH IF ONE IS AVAILABLE
         SPACE
PPLPHIPP CLI   PPLCC,X'FF'           TEST IF END OF CHAIN
         BE    PPHDUST               IF SO, TRANSCRIBE DATA
         MVI   PPLSEND+4,C' '        CLEAR THE TRASH
         MVI   PPLSEND+5,C' '         FROM SEND
         MVI   PPLRECV+5,C' '          AND RECEIVE
         MVI   PPLRECV+4,C' '           COUNT FIELDS
         LA    R8,PPHDLEN(R8)         ELSE POINT TO NEXT ENTRY
         B     PPGCAROL               AND PROCESS IT
         SPACE 1
         DROP  R8                    FORGET PPLDSECT
         USING PPHDSECT,R8           REMEMBER PPHDSECT?
         EJECT
****************************************************************
*        RETURN TO A NORMAL ENVIRONMENT FOR FURTHER DUTIES     *
****************************************************************
         SPACE
PPHDUST  L     R1,PPHCASID           OBTAIN ACTUAL SECONDARY ASID
         SSAR  R1                    SET SECONDARY TO CURRENT
         SPACE 1
         SAC   Ø                     ACCESS DATA ONLY WITHIN THIS ASID
         SPACE 1
         MODESET MODE=PROB           BECOME MORTAL ONCE AGAIN
         SPACE
         C     R8,PPHGAREA           TEST IF ABLE TO PERFORM AS DESIGNED
         BNE   PPHSCRIB              BRANCH IF SO
         WTO   '** NET NOT FOUND **'
         LA    R15,16                TERMINATE WITH PREJUDICE
         SVC   3                     RETURN TO NOTHINGNESS
         EJECT
****************************************************************
*        TRANSCRIBE FORMATTED DATA                            *
****************************************************************
         SPACE 1
PPHSCRIB LA    R1,PPHOPEN            SETUP FOR RE-ENTRY
         BSM   RØ,R1                 ENTER 24-BIT AMODE
PPHOPEN  OPEN  (PPHDCB,OUTPUT)       PREPARE DATA SET FOR USE
         L     R8,PPHGAREA           POINT TO INFORMATION-GRANARY(MY
*                                    TERM - IF YOU LIKE IT, USE IT!)
         SPACE 1
PPGTOP   LA    R6,58                 SET LINE COUNT
         BAS   R15,PPG24             ENTER
         SR    R1,R1                 CLEAR INDEX REGISTER
         IC    R1,PPHOTIT            FETCH OFFSET
         L     RØ,PPHATIT(R1)        POINT TO CORRECT TITLE FOR DATA
         PUT   PPHDCB,(Ø)            PRINT TITLE
         MVI   PPGFSM,C' '           SINGLE SPACE
         MVC   PPGFSM+1(PPHDLEN-1),PPGFSM  CLEAR LINE FOR PUT
         PUT   PPHDCB,PPGFSM         PRINT BLANK LINE
```

```
        BAS   R15,PPG31          ENTER 31-BIT AMODE
        SPACE
PPHPUT  CLI   PPHCC,X'FF'        TEST IF ALL DATA HAS BEEN PROCESSED
        BE    PPHCLOSE           BRANCH IF SO
        BCT   R6,PPGPUT          ENSURE THAT PAGES DON'T OVERFLOW
        B     PPGTOP
        SPACE
PPGPUT  MVC   PPGFSM(PPHDLEN),Ø(R8) MOVE DATA TO AREA IN 24-BIT AMODE
        SPACE
        CLI   PPHCC,C'('         TEST IF SIB CHAIN
        BNE   PPHCKRRN           BRANCH IF NOT
        MVI   PPHOTIT,4          USE SIB TITLES
        LA    R8,PPHDLEN(R8)     SET ADDRESS OF NEXT ENTRY
        B     PPGTOP             CONTINUE...
        SPACE
PPHCKRRN CLI  PPHCC,C')'         TEST IF CIT CHAIN
        BNE   PPHPUTX            BRANCH IF NOT
        MVI   PPHOTIT,8          USE CIT TITLES
        LA    R8,PPHDLEN(R8)     SET ADDRESS OF NEXT ENTRY
        B     PPGTOP             CONTINUE...
        SPACE
PPHPUTX BAS   R15,PPG24          ENTER 24-BIT AMODE
        PUT   PPHDCB,PPGFSM      TRANSCRIBE DATA
        BAS   R15,PPG31          ENTER 31-BIT AMODE
        LA    R8,PPHDLEN(R8)     SET ADDRESS OF NEXT ENTRY
        B     PPHPUT             LOOP POWER
        SPACE
PPHCLOSE BAS  R15,PPG24          ENTER 24-BIT AMODE
        CLOSE (PPHDCB)           CLEAN UP ENVIRONMENT
        SR    R15,R15            INDICATE SUCCESS
        SVC   3                  RETURN TO DUST
        EJECT
***************************************************************
*       SUBROUTINES USED TO SWITCH BETWEEN AMODES             *
***************************************************************
        SPACE
PPG24   LA    R15,Ø(R15)         CLEAR HI-ORDER BIT
        BSM   RØ,R15             RETURN IN 24-BIT AMODE
        SPACE
PPG31   O     R15,=X'8ØØØØØØØ'   SET HI-ORDER BIT
        BSM   RØ,R15             RETURN IN 31-BIT AMODE
        EJECT
*********************************************************************
*       REENTER NORMAL OPERATING MODE IN ORDER TO ISSUE AN STIMER   *
*********************************************************************
        SPACE
PPHTARRY L    R1,PPHCASID        OBTAIN ACTUAL SECONDARY ASID
        SSAR  R1                 SET SECONDARY TO CURRENT
        SPACE 1
        SAC   Ø                  ACCESS DATA ONLY WITHIN THIS ASID
        SPACE 1
```

```
*         MODESET MODE=PROB         BECOME MORTAL ONCE AGAIN
          SPACE
***********************************************************************
*         PAUSE SIX SECONDS FOR CHANGES IN SEND AND RECEIVE COUNTS    *
*         TO OCCUR, THEN REDO SCAN OF CHAIN ONCE AGAIN AND COMPUTE A   *
*         COUNT-DELTA FOR ENTRIES STILL IN EXISTENCE.                  *
***********************************************************************
          SPACE
          STIMER WAIT,BINTVL=CLAMTIME SLEEP...
          SPACE
***********************************************************************
*     RETURN TO ANYTHING-GOES MODE IN ORDER TO PROCESS CHAIN AGAIN    *
***********************************************************************
          SPACE
          LH    R2,PPHVASID          RETRIEVE VTAM'S ADDRESS SPACE IDENT
          SSAR  R2                   USE DATA IN VTAM'S ADDRESS SPACE
          SPACE 1
          SAC   512                  SET UNIVERSAL ACCESS MODE
          SPACE 1
          BR    R9                   RETURN TO CALLER
          EJECT
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*         CONSTANTS AND OTHER JUNK                                   *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
          SPACE 1
PPHJNAME DC    CL8'NET'             VTAM'S HANDLE
CONIDENT EQU   X'100'               OFFSET WITHIN CONFT TO VTAM'S JOB ID
          SPACE 1
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*         TITLE FOR DEBS' DATA                                       *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
          SPACE 1
PPHTITLE DC    C'1'
          DC    CL8'NAME'
          DC    C' '
          DC    CL9'APPL-NAME'
          DC    C' '
          DC    CL9'LU-NAME'
          SPACE 1
          DC    C' '
          DC    CL5'SEND'
          DC    CL5'RECV'
          SPACE 1
          DC    CL9'NET-ADR'
          DC    CL6'ELEM'
          DC    CL9'PLU-ADR'
          DC    CL6'ELEM'
          DC    CL9'SLU-ADR'
          DC    CL6'ELEM'
          DC    CL9'DEB-ADR'
          DC    CL9'FMCB-ADR'
```

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```
        DC    CL5'SND1'
        DC    CL5'RCV1'
        DC    CL5'SND2'
        DC    CL5'RCV2'
        DC    CL5'SND3'
        DC    CL5'RCV3'
        EJECT
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*         TITLE FOR SIBS' DATA                                   *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
        SPACE 1
PPGTITLE DC   C'1'
        DC    CL8'SIBRNID'
        DC    C' '
        DC    CL8'SIBRALNM'
        DC    C' '
        DC    CL8'RPRNAME'
        SPACE 1
        DC    C' '
        DC    CL8'SLURALNM'
        DC    C' '
        SPACE 1
        DC    CL9'SLURSUBA'
        DC    CL6'ELEM'
        DC    CL8'SLURNID'
        DC    C' '
        DC    CL8'PLU-NAME'
        DC    C' '
        DC    CL9'SIB-ADDR'
        DC    CL18'SESSION IDENTIFIER'
        DC    CL40' '
        EJECT
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*         TITLE FOR CITS' DATA                                   *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
        SPACE 1
PPLTITLE DC   C'1'
        DC    CL8'LU-NAME'
        DC    C' '
        SPACE 1
        DC    CL5'SEND'
        DC    CL5'SDLTA'
        DC    C' '
        DC    CL5'RECV'
        DC    CL5'RDLTA'
        DC    C' '
        SPACE 1
        DC    CL9'PLU-ADR'
        DC    CL5'ELEM'
        DC    CL9'SLU-ADR'
        DC    CL5'ELEM'
```

```
        DC    CL10'VRBLK-ADR'
        DC    CL10'FMCB-ADR'
        DC    CL60' '
        EJECT
PPGFSM  DS    CL133
        SPACE
PPHDCB  DCB LRECL=133,BLKSIZE=133,DSORG=PS,MACRF=PM,RECFM=FA,         C
        DDNAME=SYSPRINT
        SPACE
PPHOTIT DC    X'0'
        SPACE
CLAMTIME DC   F'600'              100 = ONE SECOND
        SPACE
PPHATIT DC    A(PPHTITLE)
        DC    A(PPGTITLE)
        DC    A(PPLTITLE)
PPHSAVIT DS   F
PPHGAREA DS   F
PPHCASID DS   F
PPHONE  DC    F'1'
PPGHDEB DS    F
PPHHOLD DS    F
PPHVASID DS   H
        SPACE
PPHTRANS DC   C'0123456789ABCDEF'
        EJECT
PPGSIBSW DC   X'01'
        SPACE 1
ATCSIBQ EQU   X'43C'
ATCHOSTA EQU  X'494'
ATCHOSTE EQU  X'498'
ATCNETID EQU  X'820'
        SPACE
RPRNAME EQU   0                   NAME OF RDTE ET AL
        SPACE
RCPSIBS EQU   X'6C'               PTR TO 1ST SIB ON SECONDRY SIB CHAIN
        SPACE
SIBBFWD EQU   X'30'               PTR TO THE NEXT SIB
SIBRSUBA EQU  X'42'
SIBRELMA EQU  X'46'
SIBRRSRC EQU  X'1C'               PTR TO THE RDTE
SIBBSPTR EQU  X'48'               PTR TO THE SLU RESOURCE INFORMATION
SIBCBTYP EQU  X'98'               CONTROL BLOCK CONSTANT FOR SIB
SIBBPPTR EQU  X'44'               PTR TO THE PLU RESOURCE INFORMATION
SIBRALNM EQU  8                   NAME OF RESRC FROM SESS PARTNR NETWK
SIBRNID EQU   16                  NAME OF NETWORK ASSOCIATED WITH LU
SIBPCID EQU   8                   ORIGINAL PCID FOR SESSION
SIBCBID EQU   0                   OFFSET TO SIB'S CONTROL BLOCK ID
        SPACE
CONVTHAA EQU  X'94'               POINTER TO VTAM RDT HEADER AREA
        SPACE
```

```
ATCCONFT EQU   X'44Ø'                POINTER TO VTAM CONFIG TABLE
ATCACDA  EQU   X'3C4'                POINTER TO FIRST FORWARD ACDEB
ATCCIT   EQU   X'93C'                POINTER TO CID INDEX TABLE - TEMP
CITFMCBX EQU   X'8Ø'                 INDICATION OF AN FMCB EXTENSION
         SPACE
LUCAPLEL EQU   2                     ELEMENT ADDRESS IN LUCB
LUCRDTEA EQU   X'2C'                 ADDRESS OF APPL'S RDT
LUCFMCBA EQU   X'3Ø'                 ADDRESS OF FIRST FMCB EXTENSION
LUCFMCBL EQU   X'34'                 ADDRESS OF LAST FMCB EXTENSION
         EJECT
ACDSAF   EQU   X'BØ'                 NETWORK ADDRESS IN DEB
ACDDEB   EQU   X'54'                 NEXT DEB ON DEB CHAIN
ACDLUCBA EQU   X'68'                 ADDRESS OF LUCB
ACDUNTNM EQU   X'88'                 UNINTERPRETED NAME OF LU
ACDRAFQH EQU   X'6C'                 HEAD OF FMCB QUEUE
         SPACE
TSPNA    EQU   Ø
TSPSQCNT EQU   Ø                     SQN.SEND.CNT - RECEIVE COUNT (TCSA)
TSPSQRCV EQU   8                     SQN.RCV.CNT  - SEND COUNT    (TCSA)
TSPDSAF  EQU   Ø                     DESTINATION SUBAREA
TSPCBID  EQU   Ø                     CONTROL BLOCK'S IDENTIFIER
FMTYPE   EQU   3                     CONTROL BLOCK IDENTIFIER FOR FMCB
TSPDEAF  EQU   4                     DESTINATION ELEMENT
TSPFMCBA EQU   X'ØC'                 ADDRESS OF FIRST FMCB
TSPPLUSA EQU   X'1Ø'                 SUBAREA OF PLU
TSPPLUEA EQU   X'14'                 PLU'S ELEMENT ADDRESS
TSPSLUSA EQU   X'16'                 SUBAREA NUMBER OF SLU
TSPSLUEA EQU   X'1A'                 SLU'S ELEMENT ADDRESS
TSPNEXTA EQU   X'1C'                 ADDRESS OF NEXT FMCB EXTENSION
TSPNAME  EQU   X'34'                 NAME OF SESSION PARTNER
         SPACE
FMCTCSA  EQU   X'A8'                 TRANSMISSION CONTROL STATUS AREA
         SPACE 3
         LTORG
         EJECT
***********************************************************************
*        GENERALIZED PROGRAM RECOVERY ROUTINE                        *
*                                                                    *
*        PERFORMS THE ERROR RECOVERY PROCESSING FOR ANY ROUTINE.     *
*        THIS ROUTINE IS INVOKED VIA THE ESTAE ERROR RECOVERY        *
*        MECHANISM IN THE EVENT OF AN ABEND CONDITION IN A ROUTINE.  *
*        THE PURPOSE OF THIS RECOVERY ROUTINE IS TO IDENTIFY THE OFF-*
*        SET OF AN ABEND WITHIN A CSECT THAT ISSUED THE CORRESPONDING*
*        ESTAE AND, WHEN REQUESTED, ATTEMPT TO RECOVER AT A SPECIFIC *
*        RETRY ADDRESS THAT WAS SPECIFIED IN PARAMETERS THAT WERE    *
*        PASSED TO THIS EXIT IN THE SDWA.                            *
*        IF NO PARAMETERS WERE SPECIFIED WHEN A RECOVERY ENVIRONMENT *
*        WAS ESTABLISHED, PERCOLATION CONTINUES WITHOUT AN ATTEMPT   *
*        TO RECOVER FROM ABEND CONDITIONS.                           *
*                                                                    *
*        REG       ENTRY VALUE                                       *
```

```
*         RØ          CODE EXPLAINING TYPE I/O PROCESSING PERFORMED      *
*                     Ø    - I/O QUIESCED AND RESTORABLE                 *
*                     4    - I/O HALTED AND NOT RESTORABLE               *
*                     8    - NO I/O AT TIME OF ABEND                     *
*                     12   - SDWA STORAGE UNAVAILABLE                    *
*                            R1  -  ABEND COMPLETION CODE                *
*                            R2  -  ADDR OF ESTAE PARM LIST OR Ø         *
*                     16   - NO I/O PROCESSING PERFORMED                 *
*         R1          POINTER TO SDWA                                    *
*                     FIRST WORD POINTS TO ESTAE PARM LIST               *
*         R13         POINTER TO 72-BYTE SAVE AREA ADDRESS               *
*         R14         RETURN ADDRESS                                     *
*         R15         ENTRY ADDRESS                                      *
*********************************************************************
          EJECT
          DROP  R12     ========> FORGET BASE REGISTER OF PROGRAM <======
          DS    ØF                    ALIGN RECOVERY RTN ON INTEGRAL BNDRY
          USING PSA,RØ                ESTABLISH PSA ADDRESSABILITY
          USING *,R15
          SPACE 1
PATEXIT   DS    ØH                    ESTAE ERROR RECOVERY
          SPACE 1
          SAC   Ø                     ENSURE OPERATING IN PRIMARY MODE
          C     RØ,=F'12'             SDWA AVAILABLE?
          BE    Ø(R14)      RETURN IF NOT - IMPLIES CONTINUE WITH ABEND
          SPACE 1
          ST    R14,12(R13)           SAVE RETURN ADDRESS
          L     R14,Ø(R1)             RETRY ADDRESS
          TM    Ø(R14),X'8Ø'          TEST IF RE-ENTRY
          L     R14,12(R13)           RESTORE RETURN ADDRESS
          BO    PATSTAE               BRANCH IF NOT
          SVC   3                     BACK TO DUST
          SPACE 1
PATSTAE   BAKR  R14,RØ                SAVE ENVIRONMENT AT ENTRY
          SPACE 1
          LR    R12,R15               SET BASE REGISTER
          DROP  R15                   FORGET INITIAL TEMPORARY BASE
          USING PATEXIT,R12           ESTABLISH  ADDRESSABILITY
          SPACE 1
          USING SDWA,R5               ESTABLISH SDWA ADDRESSABILITY
          LR    R5,R1                 ADDRESS OF SDWA
          SPACE 1
          MVC   PATCNAME,SDWANAME     SDWA
          MVC   PATSDWA,Ø(R1)         SDWA
          SPACE 1
          L     RØ,PATESIZE           SIZE OF WORK AREA
          GETMAIN R,LV=(Ø)            OBTAIN WORK AREA
          LR    R2,R1                 POINT TO IT
          EJECT
          USING PATDSECT,R2           ESTABLISH BASE
          MVC   PATGPRS(4*16),SDWAGRSV REGISTERS AT TIME OF ABEND
```

```
        L     R9,SDWASR13         POINT TO SAVE AREA AT TIME OF ERROR
        MVC   PATEWTO(PATWTOL),PATWTO INITIALIZE WORK AREA
        SPACE
        UNPK  PATDLPSW(9),SDWAEC1(5)  LEFT HALF OF EC PSW
        MVI   PATDLPSW+8,C' '
        TR    PATDLPSW,PATRANS-24Ø
        SPACE
        UNPK  PATDRPSW(9),SDWANXT1(5) RIGHT HALF OF EC PSW
        MVI   PATDRPSW+8,C' '
        TR    PATDRPSW,PATRANS-24Ø
        SPACE 1
        L     RØ,SDWANXT1         TERMINATION ADDRESS
        N     RØ,PAT7FFF          CLEAR 31-AMODE BIT
        ST    RØ,PATGILL          SAVE INSTRUCTION ADDRESS
        L     R4,PSATOLD          CURRENT TCB ADDRESS
        BAS   R8,PATMLOC          LOCATE FAILING MODULE
        SPACE 3
        L     R4,PSATOLD          CURRENT TCB ADDRESS
        USING TCB,R4              ESTABLISH TCB ADDRESSABILITY
        L     R8,TCBRBP           POINT TO AN RB
        DROP  R4                  FORGET TCB
        USING RBBASIC,R8          ESTABLISH RB ADDRESSABILITY
PATNXTRB N     R8,PATØFFF          CLEAR THE TRASH
        LR    R11,R8              PRESERVE ADDRESS OF RB
        L     R8,RBLINK           FETCH ADDRESS OF NEXT RB
        CR    R4,R8               TEST IF MISSING RB
        BNE   PATNXTRB            BRANCH IF NOT
        LR    R8,R11              SET ADDRESS OF RB
        SPACE 1
        L     RØ,RBOPSWA          FETCH RIGHT HALF OF PSW
        N     RØ,PAT7FFF          CLEAR 31-AMODE BIT
        ST    RØ,PATGILL          USE IT AS FAILING INSTRUCTION ADDRES
        BAS   R8,PATMLOC          LOCATE FAILING MODULE
        SPACE 1
        LR    R8,R11              RESTORE ADDRESS OF RB
        L     R3,RBCDE            POINT TO CONTENTS DIRECTORY ENTRY
        N     R3,PATØFFF          CLEAR OPTIONS
        B     PHCDNAME            ENTER COMMON CODE
        DROP  R8                  FORGET RB
        EJECT
***********************************************************************
*       LOCATE MODULE CONTAINING FAILING INSTRUCTION                  *
***********************************************************************
        SPACE 1
PATMLOC L     R4,PSATOLD          CURRENT TCB ADDRESS
        USING TCB,R4              ESTABLISH TCB ADDRESSABILITY
        SPACE 1
        L     R3,TCBJPQ           ADDR OF LAST CDE IN JOB PACK AREA Q
        SPACE 1
        MVC   PATDPGM,=CL8'UNKNOWN' SET CONSTANT IN WTO AREA
        MVC   PATDEP,=CL8'UNKNOWN' SET CONSTANT IN WTO AREA
```

```
             MVC    PATDOFF,=CL8'UNKNOWN' SET CONSTANT IN WTO AREA
             USING  CDENTRY,R3            ESTABLISH CDE ADDRESSABILITY
             TM     CDATTR,CDMIN          TEST IF MINOR CDE
             BO     PGNXTCDE              BRANCH IF NOT
             SPACE 1
PATGETXL     L      R7,CDXLMJP            ADDR OF EXTENT LIST OF THIS MODULE
             USING  XTLST,R7              ESTABLISH XTLST ADDRESSABILITY
             CLC    PATGILL,XTLMSBAD      COULD BLOCK CONTAIN FAILING INST?
             BL     PGNXTCDE              BRANCH IF NOT
             SPACE 1
             L      RØ,PATGILL            TERMINATION ADDRESS
             S      RØ,XTLMSBAD           COMPUTE OFFSET INTO BLOCK
             CLM    RØ,7,XTLMSBLN         TEST IF OFFSET WITHIN BLOCK
             BL     PATOK                 BRANCH IF SO
             SPACE 1
PGNXTCDE     ICM    R3,15,CDCHAIN         NEXT CDE ON CHAIN
             BE     Ø(R8)                 AT END RETURN
             TM     CDATTR,CDMIN          TEST IF MINOR CDE
             BNO    PATGETXL              BRANCH IF NOT
             B      PGNXTCDE              ELSE TRY TRY AGAIN
             SPACE 1
PATOK        ST     RØ,PATGILL            SAVE OFFSET
             MVI    PATGILL,Ø             CLEAR TRASH
             UNPK   PATDOFF(9),PATGILL(5)
             MVI    PATDOFF+8,C' '
             TR     PATDOFF,PATRANS-24Ø
PHCDNAME     MVC    PATDPGM,CDNAME        MODULE ACTIVE AT TIME OF ABEND
             SPACE 1
             L      R15,CDENTPT           FETCH ADDRESS OF ENTRY POINT
             CLC    Ø(3,R15),=XL3'47FØFØ' TEST IF MODULE CONFORMS
             BNE    PATRADIC              BRANCH IF A RADICAL
             CLI    4(R15),Ø              TEST IF LENGTH IS ZERO
             BE     PATRADIC              BRANCH IF SO
             MVC    PATDEP,=CL8' '        BLANK AREA
             SR     R14,R14               CLEAR WORK REGISTER
             IC     R14,4(R15)            OBTAIN LENGTH OF ENTRY POINT NAME
             CH     R14,=H'9'             TEST IF NAME EXCEEDS EIGHT BYTES
             BL     *+8                   BRANCH IF NOT
             LA     R14,8                 LIMIT LENGTH TO EIGHT BYTES
             BCTR   R14,RØ                REDUCE BY ONE FOR MOVE
             EX     R14,PATMVEP           MOVE NAME OF ENTRY POINT TO WTO AREA
             EJECT
PATRADIC     CLI    SDWACMPC+2,X'ØØ'      TEST IF USER ABEND
             BNE    PATDOUSR              BRANCH IF SO
             TM     SDWACMPC+1,X'ØF'      TEST IF USER ABEND
             BNZ    PATDOUSR              BRANCH IF SO
             UNPK   PATDCODE+1(5),SDWACMPC(3) ASSUME SYSTEM ABEND
             MVI    PATDCODE+4,C' '
             MVI    PATDCODE+5,C' '
             TR     PATDCODE+1(3),PATRANS-24Ø
             B      PATXWTO
```

```
         SPACE 1
         SPACE 1
PATDOUSR L     R1,SDWACMPF         FETCH USER ABEND CODE
         N     R1,PATØØ3F          CLEAR HI-ORDER TRASH
         CVD   R1,PPHTWICE         THENCE TO PACKED DECIMAL
         UNPK  PATDCODE,PPHTWICE+5(3) ASSUME USER ABEND
         MVI   PATDCODE,C'U'       SHOW USER ABEND
         OI    PATDCODE+4,24Ø      FILL FINAL CHARACTER FOR TRANSLATION
         MVI   PATDCODE+5,C' '     REMOVE GARBAGE
         TR    PATDCODE+1(4),PATRANS-24Ø EVERYTHING TO UPER CASE EBCDIC
         SPACE 1
PATXWTO  WTO   MF=(E,PATEWTO)
         EJECT
*******************************************************************
*        FORMAT GENERAL PURPOSE REGISTERS AT ENTRY TO ABEND       *
*******************************************************************
         SPACE 1
         MVI   PATEWTO+4,C' '      REMOVE TRASH
         MVC   PATEWTO+5(PATWTOL-5),PATEWTO+4 FROM WORK AREA
         LA    R3,PATGPRC-9        POINT TO CONSTANTS - 9
         LA    R7,SDWAGRSV         POINT TO REGISTERS AT ENTRY TO ABEND
         LA    R8,4               SET LOOP COUNT
PATPGPRS LA    R3,9(R3)            NEXT CONSTANT
         MVC   PATEWTO+4(9),Ø(R3)  CONSTANT TO WTO AREA
         LA    R4,4               SET LOOP COUNT
         LA    R6,PATEWTO+14       POINT TO REGISTER AREA
PATUNPKG UNPK  Ø(9,R6),Ø(5,R7)     CONVERT REGISTER CONTENTS
         TR    Ø(8,R6),PATRANS-24Ø  TO EBCDIC
         MVI   8(R6),C' '          CLEAR TRASH FROM WTO
         LA    R6,1Ø(R6)           NEXT OUTPUT LOCATION
         LA    R7,4(R7)            NEXT GENERAL PURPOSE REGISTER
         BCT   R4,PATUNPKG         LOOP POWER
         WTO   MF=(E,PATEWTO)      DISPLAY FORMATTED DATA
         BCT   R8,PATPGPRS         DISPLAY GENERAL PURPOSE REGISTERS
         SPACE 1
         L     RØ,PATESIZE         SIZE OF AREA TO BE RELEASED
         SPACE 1
         STORAGE RELEASE,ADDR=(2),LENGTH=(Ø)
         SPACE 1
         ICM   R6,15,SDWAPARM      ADDRESS OF ESTAE PARAMETER LIST
         BE    PATABEND            IF NONE, CONTINUE WITH TERMINATION
         NI    Ø(R6),255-X'8Ø'     CLEAR RETRY INDICATOR
         ICM   R6,15,Ø(R6)         RETRY ADDRESS
         BE    PATABEND            IF NONE, CONTINUE WITH TERMINATION
         SPACE 1
         SETRP WKAREA=(R5),RETADDR=(R6),RC=4  RETRY ONCE
         SPACE 1
         SR    R15,R15             SET RETURN CODE
         PR    R14                 RETURN TO DUST
         SPACE 2
PATABEND SETRP WKAREA=(R5),RC=Ø    ABEND
```

```
         SPACE 1
         SR    R15,R15              SET RETURN CODE
         PR    R14                  RETURN TO DUST
         EJECT
****************************************************************
*         CONSTANTS AND EQUATES                               *
****************************************************************
         SPACE 1
PPHTWICE DS    D
PAT7FFF  DC    X'7FFFFFFF'
PATØFFF  DC    X'ØØFFFFFF'
PATØØ3F  DC    X'ØØØØØFFF'
PATMVEP  MVC   PATDEP(*-*),5(R15)  **** EXECUTE ONLY ****
PATSDWA  DC    XL256'ØØ'
         DC  CL8'JOHNSLUV'
PATCNAME DC  CL8' '
         SPACE 1
PATSIZE  DC    A(18*4)
PATESIZE DC    A(PATDSIZE)
PATWTO   WTO  ' ABEND STAP  IN PGM LLEWWOP  AT EP HP      OFFSET PATTYL
             H   PSW - SNIKWAH   ENNA           ',MF=L
PATWTOL  EQU  *-PATWTO
PATRANS  DC    C'Ø123456789ABCDEF'
         SPACE 3
PATLIST  DC    X'8Ø',AL3(Ø) <===== PLACE ADDRESS OF RETRY ROUTINE HERE
         SPACE
PATGPRC  DC    CL9'GPR  Ø-3'
         DC    CL9'GPR  4-7'
         DC    CL9'GPR  8-11'
         DC    CL9'GPR 12-15'
         SPACE 2
         LTORG
         EJECT
PATDSECT DSECT
PATGILL  DS    2F
PATGPRS  DS    16F
PATEWTO  DS    (PATWTOL)C
         ORG   PATEWTO+4
         DC    C' ABEND '
PATDCODE DC    CL5'UØØØØ'
         DC    C' IN PGM '
PATDPGM  DC    CL8' '
         DC    C' AT EP '
PATDEP   DC    CL8' '
         DC    C' OFFSET '
PATDOFF  DC    CL8' '
         DC    C' PSW - '
PATDLPSW DC    CL8' '
         DC    C' '
PATDRPSW DC    CL8' '
         DC    C' '
```

```
          ORG
PATDSIZE EQU   ((((*-PATGILL)+7)/8)*8)
          EJECT
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*          DSECT FOR DEBS' DATA                                   *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
          SPACE 1
PPHDSECT DSECT
          SPACE 1
PPHCC    DS    C
PPHONLNM DS    CL8
         DS    C
PPHAPLNM DS    CL8
         DS    2C
PPHLUNME DS    CL8
         DS    2C
          SPACE 1
PPHSEND  DS    CL5
PPHRECV  DS    CL5
PPHNETAD DS    CL9
PPHNETEL DS    CL5
         DS    C
PPHPLUAD DS    CL9
PPHPLUEL DS    CL5
         DS    C
PPHSLUAD DS    CL9
PPHSLUEL DS    CL5
         DS    C
PPHDADDR DS    CL9
PPHFADDR DS    CL9
PPHSND1  DS    CL5
PPHRCVD1 DS    CL5
PPHSND2  DS    CL5
PPHRCVD2 DS    CL5
PPHSND3  DS    CL5
PPHRCVD3 DS    CL5
         DS    ØF
PPHDLEN  EQU   *-PPHCC
PPHSND1O EQU   PPHSND1-PPHCC
PPHSND2O EQU   PPHSND2-PPHCC
PPHSND3O EQU   PPHSND3-PPHCC
          EJECT
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*          DSECT FOR SIBS' DATA                                   *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
          SPACE 1
PPGDSECT DSECT
          SPACE 1
PPGCC    DS    C
PPGSRNID DS    CL8'SIBRNID'
         DS    C' '
```

```
PPGSALNM DS    CL8'SIBRALNM'
         DS    C' '
PPGSNAME DS    CL8'RPRNAME'
         SPACE 1
         DS    C' '
PPGSSLNM DS    CL8'SLURALNM'
         DS    C' '
         SPACE 1
PPGSSUBA DS    CL9'SLURSUBA'
PPGSSUBE DS    CL6'ELEM'
PPGSSNID DS    CL8'SLURNID'
         DS    C' '
PPGSPNME DS    CL8'PLU-NAME'
         DS    C' '
PPGSSBAD DS    CL9'SIB-ADDR'
PPGP1ADR DS    CL9
PPGP2ADR DS    CL9
         EJECT
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*        DSECT FOR CITS' DATA                                    *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
         SPACE 1
PPLDSECT DSECT
         SPACE 1
PPLCC    DS    C
PPLLUNME DS    CL8'LU-NAME'
         DS    C' '
         SPACE 1
PPLSEND  DS    CL5'SEND'
PPLDELTS DS    CL5'SDLTA'
         DS    C' '
PPLRECV  DS    CL5'RECV'
PPLDELTR DS    CL5'RDLTA'
         DS    C' '
         SPACE 1
PPLPLUAD DS    CL9'PLU-ADR'
PPLPLUEL DS    CL5'ELEM'
PPLSLUAD DS    CL9'SLU-ADR'
PPLSLUEL DS    CL5'ELEM'
PPLFMCBZ EQU   *
PPLVRBLK DS    CL10'VRBLK-ADR'
PPLFMCB  DS    CL10'FMCB-ADR'
PPLFMCBX DS    CL10'FMCB-ADR'
PPLFMCBY DS    CL10'FMCB-ADR'
         TITLE 'ESA CONTROL BLOCKS'
****************************************************
*        GENERATE REQUIRED OS CONTROL BLOCKS       *
****************************************************
         SPACE 1
         IKJTCB                    TASK CONTROL BLOCK
         SPACE 1
```

```
        IHAXTLST                  EXTENT LIST
        SPACE 1
        IHARB                     REQUEST BLOCK
        SPACE 1
        IHACDE                    CONTENTS DIRECTORY ENTRY
        SPACE 1
        IHASDWA                   SYSTEM DIAGNOSTIC WORK AREA
        SPACE 1
        IHAPSA                    PREFIXED SAVE AREA(LOW CORE)
        SPACE
        IHAASCB                   ADDRESS SPACE CONTROL BLOCK
        SPACE
        IHAASVT                   ADDRESS SPACE VECTOR TABLE
        SPACE
        CVT    DSECT=YES          ANCHOR AFTER ANCHOR
        SPACE
        YREGS                     EQUATES OF GENERAL PURPOSE REGISTERS
        SPACE
        END
```

IBM's Web Services and dynamic e-business

The Web services initiative unveiled by IBM on 14 May 2001 is a bold attempt to add some much needed formal structure and consistency to future e-business applications through the provision of a key set of vital backbone services based on open Internet standards. The express goal of these Web services is to facilitate the development of e-applications, for e-business, that can readily synthesize data from multiple disparate sources – from within the Web or external to the Web. The initial five Internet standards that together constitute the current base of IBM Web services are as follows:

1   *Universal Description Discovery and Integration (UDDI)* scheme, (backed by IBM, Microsoft, Ariba, SAP, Oracle, Sun, HP, Compaq, and about another 280 companies), which enables businesses to describe themselves in a standard and consistent manner. UDDI is, in effect, a universal, Web-centric product and service advertising and syndicating mechanism.

2   *Simple Object Access Protocol (SOAP)*, a World-Wide Web Consortium (W3C) standard now in Version 1.2, is a simple and

lightweight mechanism for exchanging structured and typed information between peers in a decentralized, distributed environment using the Extensible Markup Language (XML) standard – where XML is now the universal format for describing and exchanging structured documents and data on the Web. SOAP thus provides a peer-to-peer protocol for facilitating inter-company communications in the context of Web services – for example, conveying UDDI requests and responses.

3   *Web Services Description Language (WSDL)* is an XML derivative for describing network services as a set of endpoints that function by exchanging messages containing either document- or procedure-oriented information. With WSDL, these operations and messages are described abstractly in an implementation-independent manner and are then bound to a concrete network protocol (eg SOAP) and message format to define an endpoint. WSDL can also be used with HTTP and MIME.

4   *Java 2 Enterprise Edition (J2EE)*, the platform-independent middleware infrastructure that represents the top of the range of the three Java technology bundles available from Sun, and the one explicitly targeted at developers of enterprise-class, server-side applications.

5   *XML*, the increasingly popular and strategic standard, whose schema provide a powerful and consistent means for defining the structure, content, and semantics of e-business-related documents and data. XML schemas is today's preferred means for expressing shared vocabularies and allowing machines to carry out rules made by people in order to automatically process e-business transactions on a peer-to-peer, b2b basis. XML, as seen above, is also the underlying fabric of UDDI and WSDL.

UDDI, SOAP, WSDL, and J2EE are described in more detail later in this article.

AN ARCHITECTURE FOR E-BUSINESS

Anyone who remembers IBM's Open Blueprint of the early 1990s or the Systems Applications Architecture (SAA) that pre-dated it will immediately recognize where IBM is going with this Web services

initiative. The fact is that cogent architectures (or frameworks) are a sure way of winning customer following and keeping account control; Web services, though based entirely on open industry standards, is IBM's way of providing a convincing architectural basis for future e-business applications. So, think of Web services as SAA for e-business. In the same spirit as SAA, Web services, in theory, will be platform-, operating system-, and application-independent, and permit any-to-any integration and collaboration.

"Dynamic e-business", a phrase introduced by IBM at the Web services unveiling, is essentially an umbrella marketing term to describe Web services empowered e-business. Dynamic e-business should be thought of as e-business made possible via new e-applications that actually use the key backbone functionality provided by Web services. The relationship between Web services and dynamic e-business is therefore comparable to that between the SNA LU 6.2 architecture and IBM's market-speak term Advanced Program-to-Program Communications (APPC), which referred to anything that was based on LU 6.2.

Computer and networking architectures, though always valuable design props, are of little practical use unless the services they refer to are readily available within robust and reliable product implementations. WebSphere, IBM's strategic infrastructure foundation for all Web-centric endeavours, will undoubtedly be the premier platform offering pragmatic implementations of Web services. So think of WebSphere as playing ACF/VTAM's role with regard to SNA when it comes to Web services.

The three initial WebSphere products that will support Web services are WebSphere Application Services 4.0, WebSphere Studio, and WebSphere Business Integrator.

UDDI

Unveiled last September, UDDI is a cross-industry initiative to accelerate and broaden Web-based b2b integration and commerce. Its goal is to create a platform-independent, Web-centric open framework for describing services, discovering businesses, and integrating business services; ie machine readable 'yellow pages' for e-business. UDDI is thus the mechanism that will enable businesses to quickly,

easily, and dynamically find and transact with one another, over the Web, using their preferred applications.

Part of the growing success of UDDI is that it leverages proven and popular WWW Consortium (W3C) and Internet Engineering Task Force (IETF) standards such as XML, HTTP, and Domain Name System (DNS) protocols. In addition, cross-platform programming features are satisfied through the adoption of early versions of the proposed SOAP (which itself is based on the XML protocol messaging specifications described at www.w3c.org).

Before UDDI, there was no industry-wide, accepted approach, let alone a standard, that businesses could use to reach their customers and partners and provide them with information about their products and Web services. There was also no mechanism whereby they could cleanly integrate each other's systems and processes.

UDDI attempts to fix some of the problems that have slowed down the wide-scale adoption of b2b e-business. Companies can benefit from UDDI irrespective of their size, because the goals of UDDI are broad and pertinent and the specifications are platform-independent and comprehensive. What's more, UDDI is not specific to any particular industry; it's a true cross-industry initiative that can benefit any industry, world-wide, offering any type of product or service.

Companies can already register their products and services using UDDI through the uddi.org Web site. Registration enables a company to publicly list key information about its offerings. There's also the option to list a catalogue of products, services, and guidelines for business engagement. Registered companies at uddi.org will be displayed in searches conducted by potential buyers. Once a match is found, b2b integration will be significantly easier and more dynamic for companies transacting business with each other in this manner.

The second version (V2) of the UDDI specification was made available by UDDI.org on 18 June 2001. Key new features include:

- The ability to accurately describe complex organizations in terms of representative, real-world organizational structures that include business units, departments, divisions, and subsidiaries.

- Enhanced support for global trading and internationalization in

the form of support for multiple languages offering companies the option of describing their business and services in more than one language.

- The inclusion of additional categories and identification schemes, including industry-specific categories (eg chemical and pharmaceutical), to give companies more flexibility and freedom to describe their business. These new categories can be validated during registration through third parties such as industry associations.

- The availability of richer searching options to facilitate complex searches. You can now search the UDDI registry for e-business-related products and services you're looking for using more expressive query parameters spanning more fields and involving more complex combinations of fields.

SOAP

SOAP is a simple and lightweight peer-to-peer, platform-independent mechanism for exchanging data in a decentralized and distributed Web-centric environment. SOAP does not in itself define any application semantics such as a programming model or any implementation-specific guidelines. Instead, it specifies a simple mechanism for expressing application semantics through the provision of a modular packaging model and an encoding mechanism for encoding application defined data. This abstract, implementation-neutral specification allows SOAP to be used in a variety of networking systems ranging from those relying on messaging systems (eg MQSeries) to Unix systems that prefer remote procedure calls (RPCs).

SOAP has four separately defined components:

- *SOAP envelope*. This is the top element of the XML document representing the SOAP message. This envelope defines an overall framework for expressing what's in a message, who (ie which process) at the receiving end should deal with it, and whether the request contained in the message is optional or mandatory.

- *SOAP encoding rules*. The SOAP encoding scheme is based on a simple type system similar to that used by programming

languages and databases. A SOAP encoding type is either a simple (scalar) type or a compound type constructed as a composite of several parts, each with its own type. The SOAP encoding rules thus define a serialization mechanism that can be used to exchange instances of application-defined data types in a platform-independent manner.

- *SOAP binding*. SOAP bindings are the conventions for encapsulating a SOAP message within or on top of another protocol (ie the underlying protocol) for the purpose of transmitting these messages between peers using SOAP envelopes. Typical SOAP bindings include carrying a SOAP message within an HTTP message, or simply on top of TCP.

- *SOAP RPC representation scheme*. This scheme specifies how RPC functionality, in terms of RPC invocations and responses, can be represented and implemented within the context of XML.

WSDL

In much the same way as HTML enables us to describe the format of Web pages, WSDL offers a way to describe contemporary Web-oriented communications protocols and messaging schemes. WSDL, as such, is an XML-based grammar for describing communications environments in terms of a set of communication endpoints that can exchange messages between them. The goal of WSDL is to ensure that automated processes (eg e-business applications running on client PCs) can automatically determine the exact networking capabilities of remote systems without human intervention or prior definitions.

A WSDL document (or WSDL schema) describing a communications set-up will define the available services as collections of network endpoints, or ports. The key WSDL constructs, according to the current WSDL specification available at www.w3.org, are as follows:

- *WSDL types*. A container for data type definitions using some type system.

- *Message*. An abstract, typed definition of the data being communicated.

- *Operation*. An abstract description of an action supported by the service.

- *Port type*. An abstract set of operations supported by one or more endpoints.

- *Binding*. A concrete protocol and data format specification for a particular port type.

- *Port*. A single endpoint defined as a combination of a binding and a network address.

- *Service*. A collection of related endpoints.

J2EE AND CONTAINERS

Today's Java, especially on the server side, is more about containers than Java Virtual Machines (JVMs). According to Java, a container is a runtime environment that provides common services for the Java components that run in that container. Decoupling the services and putting them in the container means that Java application developers no longer have to concern themselves with how they obtain critical system functions such as security. Instead they can expect the container – or, to be more precise, the platform-specific implementation of the container – to deliver the required services at runtime.

This decoupling is also true to Java's fundamental platform-independence. With this approach, application developers can focus on writing platform-independent problem solving code without having to worry about how they tap into platform-specific services.

The Java programming model for enterprises defines three container-driven Java components:

- *Java Server Pages*. Similar to Microsoft's Active Server Pages (ASPs) and geared at enhancing the functionality of Web output by extending server-side presentation logic.

- *Java Servlets*. Server side Java code to add functionality or control the flow of software execution.

- *Enterprise JavaBeans*. The object-oriented technology ideally suited for creating reusable business logic components (including capturing and representing host transactions from existing host applications) and permitting interaction with non-Java resources and systems.

J2EE, in essence, consists of these three container-driven Java components combined with a set of key system level services, as well as a series of connectors to facilitate direct access to certain 'back-end' systems. The programming model for J2EE is flexible and extensible enough to permit any practical combination of containers, services. and 'back-end' connectors to be synthesized together to create an e-business application – whether based on a standalone, client/server (ie 2-tier) or fully distributed model.

WEBSPHERE APPLICATION SERVER VERSION 4 AND WEB SERVICES

Initially, the flagship product that will showcase all five of the Web services technologies will be Version 4 of the WebSphere Application Server (WAS) which has been available since 30 June 2001 for NT, Windows 2000, IBM AIX, Sun Solaris, UP-UX, and Red Hat Linux platforms. WebSphere Application Server Version 4 for z/OS and OS/390, which has been generally available as of April 2001, does not currently support UDDI, SOAP, and WSDL.

Although Web services are the undoubted highlight of WAS Version 4, they are not the only capabilities included in this new release. An overriding objective of WAS Version 4, including WAS Version 4 for z/OS and OS/390, is to deliver an industrial-strength Enterprise JavaBeans (EJB) production environment that is fully J2EE compliant. WAS Version 4 is first and foremost a top-end, cross-platform Java server with all of IBM's clout and support behind it. In the case of mainframes, WAS Version 4 is very much a tightly integrated enterprise Java server that takes full advantage of the unsurpassed high-availability, workload balancing, and scalability characteristics available with today's parallel sysplex systems. No other platform can come close to a mainframe when it comes to these crucial characteristics – with a top-end Sun Unix server still likely to have an order of magnitude shortfall in up-time over a year compared to that of a System/390 running OS/390. So, to Sun's chagrin, the most reliable and scalable platform to run high-end enterprise-class Java applications has to be a mainframe rather than one of its much-vaunted Unix boxes!

WAS includes the Java Software Development Kit (SDK) 1.3.0, which supports:

- Servlets and JavaServer Pages (JSPs) that conform to the J2EE V1.2 specifications.

- EJBs compliant with J2EE specifications.

- CORBA components consistent with the WebSphere platform programming model.

- Applications written to the Java 2 API level.

As well as EJB, WAS Version 4, in line with the original WebSphere goals, supports the OMG's CORBA at the 2.1 specification level. With both CORBA and EJB, IBM is giving you total freedom as to what type of object technology you want to use when it comes to developing new e-applications.

In addition to the standard UDDI functionality, WAS Version 4 will also be able to interface with a public UDDI registry. Access to a public UDDI registry will facilitate interoperability and information sharing across the corporate world, independent of platform and software dependencies. Consequently, companies using WebSphere can now easily transform new and existing business processes into Web services-based applications that can be easily 'advertised' and subsequently shared among other enterprises, including business partners and customers using the power and reach of UDDI.

WebSphere Application Server Version 4 is also credited with being able to connect and interoperate with the largest number of business applications in the industry. Application types supported include SAP, PeopleSoft, CICS, and IMS. Special emphasis has also been given to ensuring that this Application Server can handle ultra-high volume transactions without significant degradation in performance and response times. There's a new cacheing capability that supposedly increases application speed by 200% to 300% in high-volume scenarios. The performance and throughput of the 'back-end' host application connectors have also been optimized and improved.

OTHER IBM PRODUCTS SUPPORTING WEB SERVICES

While the Application Server Version 4 is the linchpin of this IBM Web services initiative, it's just one of the WebSphere components that will play an active part in making this technology real. IBM has

already included Web services capabilities in two other components: WebSphere Business Integrator and WebSphere Studio.

WebSphere Business Integrator permits companies to easily create, execute, and manage business processes that span disparate applications, enterprises, and people using a consistent methodology. It also ensures that you can monitor and manage these processes and their underlying operational infrastructure as a complete system independent of the platforms involved.

WebSphere Business Integrator is a total, integrated solution for enterprises, service providers, and system integrators that enables them to design, develop, and deploy adaptive business processes that can execute across multiple disparate internal business systems and interface with external business systems for b2b interactions. It also offers a mechanism for realizing a common and consistent management view of business activities that is adaptable to changes in business practices. Version 2.1 of the WebSphere Business-to-Business Integrator is currently available on NT servers, with AIX and Solaris versions to start shipping in the future.

Within the context of Web services, IBM will position WebSphere Business Integrator as the means for enabling companies to integrate and manage the 'flow' of Web services applications. WebSphere Business Integrator will use MQSeries, IBM's message queuing-based middleware solution for transaction processing, as the basis for interfacing with SOAP. IBM will use MQSeries to deliver SOAP messages from one Web services application to another, linking the applications together and managing their interaction.

WebSphere Studio is IBM's top-of-the-line design and development tool for multi-platform Web application creation and sustenance. It's an easy-to-use design tool that expedites application development and minimizes the development effort involved in creating, managing, and debugging Web applications. IBM claims that it's the first tool in the industry that permits the visual layout of dynamic Web pages using technologies such as Dynamic HTML (DHTML) and JavaServer Pages (JSPs). In addition, WebSphere Studio, which relies extensively on wizards for generating database-driven output pages, supports HTML and JavaScript. It also includes a JSP debugger – which according to IBM is another industry first. Studio can also automatically

update and correct Web links when the Web page content changes. Developers also have the option of integrating their favourite content creation tools into the design and development environment provided by the studio.

A new beta test release of the Studio (July 2001) enables companies to 'publish' Web services applications for existing and potential trading partners via a UDDI Registry. The general release of this software is scheduled for September 2001.

Next to the WebSphere products, the other IBM offering that will offer the most amount of Web services support, at least in the short-term, will be the Lotus Domino Application Server. The highly respected collaboration, workflow, and messaging capabilities of this Application Server will now be extended so that they support SOAP and WSDL. This support for SOAP and WSDL will permit external entities to gain access to selected applications being hosted by the Domino Application Server using these industry standards.

Within the context of Web services, the Tivoli offerings provide for overall management and policy enforcement support. The SecureWay Policy Director, for example, permits developers to add security policy into dynamic e-business applications using a consistent and proven paradigm that has been popular with WebSphere developers for the last couple of years. Similarly, the Tivoli Manager for WebSphere Application Server will enable the new Web services capable Version 4 Application Server to be managed, from a single point of control, using familiar and popular processes and procedures.

BOTTOM LINE

After the ignominious collapse of the 'dot.com' culture and the on-going global economic slowdown, many corporations have been forced to re-evaluate their e-business goals, expectations, and schedules. Many, quite rightly, are concerned that e-business might not live up to all that has been claimed for it. Web services, and UDDI in particular, set out to show how e-business, in the future, can be more pervasive, penetrative, and expeditious. Web services also has the potential to significantly reduce the cost of e-application development by ensuring that developers have ready access to key services in the form of open standards, via proven products like

WebSphere, rather than having to create some of this functionality themselves. Web services is therefore a win-win proposition all round, with no real downside. E-business needed this type of architectural framework and impetus, from IBM, the uncontested doyen of such initiatives, to get it over the current slump and back into true contention.

Anura Gurugé
Strategic Consultant (USA) © Xephon 2001

Monitoring host sites

There are many reasons why you might want to monitor the availability of a TCP/IP-accessible resource, especially host sites and Web sites. For example, you might be responsible for supporting it, investigating a user complaint of poor service on a site, or keeping an eye on your ISP's reliability.

THE ORIGINAL NEED

My need originally arose as I watched a partner repeatedly caught unawares as customers complained about their Web sites being down. He needed to know first, since he built and now maintains and supports their Web sites. I needed to know because I was the one who selected and negotiated with the ISP that hosted the Web sites.

But it soon became clear that the broader need went beyond just Web sites, and included the monitoring of:

- tn3270e access to mainframes.

- ftp access to both the mainframe and those Web sites, since ftp is currently the only way to maintain the Web pages and other components on those sites.

- The mail servers that send and receive e-mail.

I had never investigated this area, but it seemed fairly likely that comprehensive network management products from the likes of Tivoli would not have overlooked such necessary functionality. But

I had no idea whether affordable stand-alone software was available to do what I wanted: to run in the background and raise an alert on my workstation whenever any of a fairly lengthy list of sites was down.

THE SHAREWARE SEARCH

I decided to do a shareware search, selecting appropriate categories and doing searches by keyword on both ZDNet and TUCOWS. After sifting through the 500+ shareware products that were listed, I identified 16 that looked as if they might provide alerts whenever a site went down. Only two were freeware, and these moved immediately to the top of my list.

The freeware products were Active Server Watcher (ASW) and Web Supervisor. But it seemed pretty clear from the description of Web Supervisor on both ZDNet and the vendor's Web site that it could only monitor Web sites, not tn3270e and other types of host connection. This was a shame, because it promised a very comprehensive check of Web sites, beyond the rudimentary ping.

ACTIVE SERVER WATCHER (ASW)

I was quickly disappointed with ASW, as it seemed to have the same limitation as Web Supervisor – any site to be tested had to be expressed in terms of an http:// URL. But an inspired wild guess (ASW has no documentation or Help files) overcame this by adding a port number to the URL, allowing the testing of tn3270e and ftp through the telnet (23) and ftp (21) port numbers.

Complete details of the installation and evaluation process for ASW can be found in 'Active Server Watcher in action', which immediately follows in this issue. But if ASW does not meet your needs, Figure 1 lists the other 15 shareware products that were identified as possibles in the initial sweep. The list includes the registration price, vendor's Web site URL, and details of where I found each.

YOU MAY ALREADY OWN IT

Of course, the cheapest software is the software you already have. Not only is it free, but there should be no learning curve since you're using

- SPIS WebWatch – $40/£28 – ZDNet
  http://www.spis.co.nz/Webcentr/Webwatch.htm
- IPCheck – $50/£35 – ZDNet
  http://www.web-server-tools.com/tools/IPCheck_2/ipcheck_2.htm
- ITutils WebCheck – $30/£21 – ZDNet
  http://www.itutils.com/webcheck
- Alert LinkRunner – $40/£28 – ZDNet
  http://www.alertbookmarks.com/lr
- CyberSpyder Link Test – $35/£25 – ZDNet
  http://www.cyberspyder.com/cslnkts1.html
- Web Supervisor – free – ZDNet
  http://www.neurostock.com/websupervisor
- Site/C – $20/£14 – ZDNet
  http://www.locutuscodeware.com/sitec.htm
- InfoLink Link Checker – $50/£35 – ZDNet
  http://www.biggbyte.com/infolink
- Alchemy Network Monitor – $200/£140 – TUCOWS
  http://www.deksoftware.com/alchemy
- Eye in the Sky – $25/£18 – TUCOWS
  http://www.8th-wonder.net
- Host Monitor – $35/£25 – TUCOWS
  http://www.ks-soft.net/hostmon.eng

Figure 1: Other possibilities

it already. Or at least, that's the theory. Here are the pros and cons for using unused functionality that already exists in existing software, versus acquiring a stand-alone product ('single-purpose software' below) that does little or nothing more than what you want to do:

- If you plan to put it into production and have operations or rotating shifts of support staff responsible for it, using existing software they are familiar with will be easier for them.

- For personnel with no experience with the existing software, single-purpose software generally has less of a learning curve than the all-encompassing existing software.

- Single-purpose software avoids the problem of finding the functionality you need in an all-encompassing product with hundreds of features.

- You may discover that the functionality is only available in an expensive add-on to the existing software.

For the purposes of this discussion, two good examples of all-encompassing products are Tivoli NetView and Tivoli NetView for OS/390. For more information, see:

> http://www.tivoli.com/products/index/netview

> http://www.tivoli.com/products/index/netview_390

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Active Server Watcher in action

The selection of Active Server Watcher (ASW) is described in the preceding article in this issue, 'Monitoring Host Sites'. I was looking for software that would alert me whenever I was at my workstation and any of a specified list of host and Web sites was down.

To begin installing and testing ASW, I located the vendor's Web site—SmartLine at http://www.ntutility.com. (I avoid downloading shareware from sites like ZDNet and TUCOWS because they often don't have the most up-to-date version, although, in this case, ZDNet, TUCOWS, and the vendor's site all had the same version (1.0).)

DOWNLOAD AND INSTALL

When I clicked the Company Name in ZDNet, ASW was listed on a page with other SmartLine freeware at http://www.ntutility.com/freeware.html. The download was 471KB in a zipped file named asw.zip. It contained five files, including setup.exe, readme.txt, and software.txt.

There were no known problems or other last minute information in the readme file, and software.txt described some of the company's other products. I used WinZip 8.0 to extract all five files to the same directory where I had stored the asw.zip file: C:\Program Files\Install\Active Server Watcher.

When I double-clicked on setup.exe, the first dialogue box advertised MindVision's Installer VISE, but also listed a Web site and an e-mail address for ASW support. The Web site listed was http://www.protect-me.com, but the home page contents were the same as ntutility.com.

After a succession of dialogue boxes, including Welcome, Important Notes, and the licence agreement, I was able to accept the default Destination Directory or choose my own. Likewise with the Program Folder (Start menu). Finally, a Ready to Install dialogue box confirmed my Destination Directory and Program Folder choices. A few seconds later and the files had been copied, the new program folder opened, and a Finished dialogue box was displayed, confirming that installation was complete. By default, the Active Server Watcher Home Page box was checked off.

GETTING STARTED AND ADDING THE FIRST SITE

After you hit the Close button, your default Web browser starts up and displays the ntutility.com home page. If you look quickly, or have a dial-up connection, you'll see an Internet Options dialogue box. If you miss it, you'll see it when you shut down both your browser and the ASW program folder. Otherwise, if you don't close the ASW program folder and double-click on the Active Server Watcher icon inside the folder, nothing will happen, as the Internet Options dialogue box is hiding behind the folder.

There are two choices in the Internet Options dialogue box:

- I am connecting to the Internet through the LAN.

- I am connecting to the Internet through the Dial-Up.

It wasn't clear whether LAN is the default, or whether ASW was smart enough to determine that I had a LAN-type Internet connection.

'Autodetect connections (please select connections you are using to connect to the Internet):' was greyed out, but 'The list is empty!' was not. I clicked on the word OK, which immediately turned into a button and brought up the ASW window. The same empty list message appeared, this time in the left half of the window labelled Resources. Everything on the right side of the window was greyed out. Only the dark red word Add at the bottom of the window, the dark red plus sign

to the left of Add, and File, Options and '?' in the menu bar were not greyed out.

When I moved the mouse over Add, it turned bright red and became a button. The empty list message disappeared under Resources, and an icon appeared in the list with a box and cursor to the right of it. I typed a Web site URL beginning with http:// and hit Enter. The right side of the window was no longer greyed out, and Check Resource Now! was now in red at the bottom. Just above it was 'Check resource every 30 min'. I changed this to 5 minutes so that I would know quickly when an outage occurred on this site.

The rest of the right side was in an area labelled 'If resource becomes unavailable:'. 'Retry 0 times before run action(s)' was just below it, and I changed the zero to one. The rest of the 'If unavailable' area was an Actions subarea containing:

• Display message check box, with a check mark in it by default.

• Scrollable list of messages, initially with 'Resource is unavailable'.

• Unchecked check box: Bring this dialogue to top.

• Unchecked check box: Write to log file.

• Greyed out asw.log just below it.

• Unchecked check box: Run external file.

• Empty grey box just below it.

CHECKING SITE STATUS

When I clicked the Check Resource Now! button, nothing happened, because the Web site was up. Although this initially seemed quite reasonable, as I gained more experience with ASW it became quite annoying. Tests on sites where the operation times out often take quite a while to respond, especially with multiple retries, so you're never sure if you've waited long enough.

Next, I added a second Web site, which was actually a domain name that was still available for registration, so there could not be a Web site behind it. I set it to retry 5 times before displaying a message, and to check every 30 minutes, and hit the Check Resource Now! button. In

just 5 seconds, it did all six checks and displayed an Active Server
Watcher dialogue box:

```
Resource is unavailable

Resource name: http://www.newname.com
The server name or address could not be resolved
Status: 12007
```

ASW also worked well with trapped 404s, where sites display an
alternative page indicating the page is not found, displaying the
following ASW Resource Unavailable dialogue box:

```
Resource name: http://www.zdnet.com/aaa
Object not found
Status: 404
```

Even relatively obscure availability problems are precisely reported:

```
Resource name: http://cnnfn.cnn.com/techwatch
The connection with this page's server was lost.
Status: 12031
```

Of course, the downside of freeware is that corners get cut, and in this
case documentation is the weak point. I wanted to check an external
Internet tn3270e connection on an OS/390 system, but wasn't sure
how to a code the URL.

Rather than a Help menu bar item, there was simply a question mark,
offering the choice of 'SmartLine Home Page' or 'About'. There's no
user manual in the ASW program folder, and nothing more on the Web
site than the one paragraph description of the product that I read
initially. The Support page provides links to FAQs, but just for the
non-free products. And the only two discussion fora are for their
commercial products.

I therefore went back to the Add operation. The tn3270e site also had
ftp access on the same IP address, so I tried an ftp:// in front. As soon
as I hit Enter, I got an error dialogue box:

```
Error: can only use URLs beginning with http://
```

I checked with a Web browser and found that the IP address with
http:// in front of it didn't work. So I wasn't surprised when I added
it to ASW and got the Resource Unavailable dialogue box:

```
Resource name: http://222.111.57.22
```

```
The operation timed out
Status: 12002
```

The http-only error message above is quite literally correct. You must enter the complete URL, with the preceding http://. Even www.site.com will not work.

On a whim, I specified port numbers and confirmed that they actually have an effect. A valid site with :80 appended to the URL continued to work. But, with :23, indicating the telnet port on a site with no telnet access, it failed as it should:

```
A connection with the server could not be established
Status: 12029
```

I then checked my ISP's ftp site, which will also bring up a Web page if you enter the site name with http:// in front of it in your Web browser. Port 21 is ftp. In ASW:

- http://telusplanet.net worked

- http://telusplanet.net:80 worked

- http://telusplanet.net:23 failed

- http://telusplanet.net:21 worked.

Next, I checked the mainframe site that I used for testing, which has tn3270e and ftp access, but no Web access. In ASW:

- http://222.111.57.22 failed

- http://222.111.57.22:80 failed

- http://222.111.57.22:23 worked

- http://222.111.57.22:21 worked.

Mail servers can also be checked in this way. To determine the current URLs and port numbers for the mail servers you're using for e-mail, check your e-mail software configuration. In Outlook 2000:

- From the menu bar, select Tools-Accounts.

- Be sure your e-mail service is selected.

- Push the Properties button.

- Click the Servers tab.

- Write down the incoming and outgoing mail server URLs.

- Click the Advanced tab.

- Write down the Server Port Numbers for the incoming and outgoing mail.

MAIL SERVER TIMEOUTS

The practicality of effectively monitoring mail servers in this way is open to question. Unlike e-commerce Web sites, where ten-second outages may mean a lot of lost customers, mail servers routinely take a long time to respond. Even though my ISP prides itself on high service levels, it still recommends that e-mail clients be set to one minute mail server timeouts.

Before long, I was getting lots of Resource unavailable messages on both mail servers. I soon discovered that ASW uses a 15 second timeout, and that there was no way to change this value. At first glance, a Retry setting of three would seem to be the equivalent of my ISP's recommended one minute timeout. Except, of course, that giving up after 15 seconds, even if you try four times in a row, is not the same as patiently waiting 60 seconds. Especially on mail servers.

Additional testing indicated that the maximum value allowed by ASW for retries is 10. This may well be the best value to use when checking mail servers – surely at least one of 11 tries over a three-minute period should get a response within 15 seconds.

WEB SITE COMPONENTS

So far, all my tests had been on domain name or numeric IP addresses. But what about specific pages on a Web site, rather than just the home page?

- http://www.sitename.com/status.htm works

- http://www.sitename.com/test.gif fails

For the .gif, ASW's dialogue box read (in part):

```
Got unknown status code
Status: 406
```

The definition for code 406 (see http://www.ietf.org/rfc/rfc2068.txt) is 'not acceptable'. I realized that ASW probably sends Accept Headers specifying what type of content is allowable, and that does not include graphics files. I therefore tested the following file types: .txt , .asp, .jsp, and .cgi worked, but .jpg, .wav, .bmp, .mp3, .zip, and .ram failed.

An obvious pattern was emerging: ASW can check availability of Web pages but not components of Web pages. There are other shareware products that do this, and in any case it's not what I'd selected ASW for in the first place.

One troublesome area that ASW does not handle is audio/video (a/v) streaming servers. Not only will ASW not check that a server is streaming properly, but it cannot even check that the components, typically a/v file and meta-file pointing to it, are present.

Even the less obvious URLs all work correctly. Here are four examples:

- Default file within a folder – http://cnnfn.cnn.com/techwatch/

- Same, without the final slash – http://cnnfn.cnn.com/techwatch

- cgi coding – http://www.reelradio.com/comment/comment.cgi?general~General+Comments~../index.html

- Invalid cgi coding – http://www.reelradio.com/comment/comment.cgi?general~General+Comments

ASW didn't detect the error in the last cgi coding, probably because it's trapped by the Web site and produces an Illegal Usage! Web page.

STACKED ERROR MESSAGES

With the Display message option, even if you don't respond (by hitting the OK button) to the first 'Resource is unavailable' dialogue box, ASW continues checking and you continue to get messages for any other resources that are unavailable. In fact, if you wait long enough, you'll get a second dialogue box for the same resource, as ASW continues cycling through, checking all resources at the 'Check resource every *nn* min. interval' set for each resource you define.

To put this in perspective, even if you stick with the 30 minute check interval, and just one resource fails as soon as you go home, if you leave your workstation on all night, you'll be greeted with around thirty dialogue boxes on your screen the next morning.

This situation can really get out of hand if the workstation's Internet connection fails. I didn't test a dial-up connection, which may be handled differently, but when I pulled the workstation's LAN cable from the local hub, through which it connects to the Internet, ASW 'Resource Unavailable' dialogue boxes began piling up almost immediately. A similar situation would presumably occur during those bouts of slow Internet response that occur from time to time, as timeouts occur on ASW's attempts to contact each URL in the Resources list. Remember, ASW sets the timeout value to 15 seconds.

AUTOMATIC HIBERNATION

One solution to this glut of dialogue boxes when you're away is to use Power Management to shut down the workstation after a specified period of inactivity. I tested Hibernation in Windows 2000 and was quite surprised to find that Power Management doesn't consider ASW's operation as 'activity', whether or not any messages were generated by Display message actions in ASW.

LOG FILES

As mentioned earlier, you can write to a log file instead. Fields within each log record are separated by tabs and each log record is separated from the next by a single line feed.

Simply remove the check mark from the Display message box, click to put a check mark in the Write to log file box, and specify a file name in the field just below. The default is asw.log, but that means it will be stored in C:\Program Files\Active Server Watcher. You can change it, but, since there is no Browse button, it does mean a lot of typing if you're running Windows NT or 2000 and you want it in a My Documents folder. For example, to store it in the Administrator's ASW folder, you would have to type:

```
C:\Documents and Settings\Administrator\My Documents\ASW\asw.log
```

If your typing isn't good, you can use Windows Explorer to Copy and Paste the folder path from the Properties of the ASW folder.

PER ENTRY SETTINGS

Settings are made individually for each URL you want to check. If your list of 'Resources to monitor' grows beyond a very few, it becomes clear that this flexibility comes at a price. If you suddenly find that you must change the Retry value for all entries, you must select each URL on the Resources list individually and make the changes one at a time. Even if you make the decision before building the Resources list, you cannot change the ASW default, and must still change the value for each entry as you create each Resources list URL.

The flexibility, however, is useful. You can have several log files, perhaps even one for each URL you're checking. However, it's worth pointing out that Win 2000 Server would probably be a better place for this kind of continuous monitoring application. (Although my testing was done on a Windows 2000 Professional client workstation, I have no reason to believe that ASW would not run on Win 2000 Server.)

MULTIPLE ACTIONS

Beyond making different action, frequency of checking, and retry choices for each URL, you can also specify multiple actions for a single URL just by checking off more than one Actions box. By specifying no actions, you can temporarily disable an entry without deleting it and re-adding it later. It is, however, unclear whether ASW would actually stop checking the URL, or just stop reporting any negative results.

Additional flexibility is provided by the fact that you can create multiple Resources list entries for the same URL and specify different parameters for each. For example, you might want to:

- Write to three log files, say a master log, a site log, and a log for each URL.

- Perform different actions with different checking intervals.

RUN BATCH FILES

Another option in the Actions area is *Run external file*. Again, the default location is the folder where ASW was installed, by default:

C:\Program Files\Active Server Watcher

A full path to a batch file can be specified. There is no Browse button, but you can capture the path in the clipboard using the Copy and Paste technique from Properties on the batch file. Unless you begin your batch file with a CD (change directory) command, your batch file will run, and create any output files it generates, in the ASW install folder, even if the batch file is located elsewhere.

If you want to see the results in a Command Prompt session, you will have to insert a batch Pause command. Otherwise, unless the batch file takes a while to run, the session will appear only for a fraction of a second. At least, that's the default operation of batch files in Windows 2000. As with the Display message option, if you don't respond to the Pause before the interval specified in 'Check resource every *nn* minutes', you could end up with a screenful of Command Prompt sessions to greet you on your return.

EXECUTE PROGRAMS

You can also run executable files. You can specify just the file name, without a path, if the file is in one of the default paths like C:\WINNT\System32. For example, in Win 2000, specifying any of the following in the Run external file field will produce the same results:

- calc

- calc.exe

- C:\WINNT\System32\calc.exe

- - \WINNT\System32\calc.exe

- ..\..\WINNT\System32\calc.exe

Technically, this means that a (very) few batch commands can be run directly by entering them in the Run external file box:

- Only batch commands that are also executable files.

- No parameters are allowed, not even parameters separated from the command by only a slash and no blanks.

Simple commands like pause and dir are part of command.com and are not executable files in their own right. chkntfs is an executable file but gives an error message when specified without parameters.

VBSCRIPT AND JSCRIPT

If Visual Basic Scripting (VBScript) support is installed – it comes standard with Windows 2000 – you can also specify a .vbs file in ASW's 'Run external file' box. To test it, the following one line hw.vbs file was created in the ASW install directory (to simplify testing):

MsgBox "Hello World"

First, it was tested by double-clicking on the file in Windows Explorer. As you might guess, it generates a dialogue box labelled VBScript with the message "Hello World" and an OK button. At first, it appeared not to work in ASW until I noticed a VBScript button in the task bar at the bottom of the screen. ASW's dialogue box was overlaying the VBScript dialogue box and making it impossible to view until either ASW was minimized or ASW's Always on Top option was turned off. This and other ASW options are described below.

With a little imagination, the 'Run external file' action offers the ability to do almost anything when a host or Web site becomes unavailable. However, some knowledge of one or more of the following is required: batch files, VBScript, JScript, or any programming language or other tool that produces an .exe or other executable file.

RESTORING AND MINIMIZING, OPTIONS, SHUT DOWN AND RESTART

The fourth of the Actions, 'Bring this dialogue to top' requires some ingenuity to test, as pushing the Check Resource Now! button does nothing, whether or not the Resource is available. You need to Set

Check resource every 0 min (yes, zero minutes), and then minimize ASW.

There's one big problem with this option, however. If you have more than one entry in the Resources list, there's no easy way to tell which entry triggered the alert. Whatever entry was highlighted when you minimized ASW is still highlighted. About the only thing you can do at this point is to temporarily turn Display Message on, and push the Check Resource Now! button.

Back to minimizing for a moment. The minimize and exit buttons in the upper left corner of the ASW window always do the same thing. By default, ASW will look like it exited, but it has an Earth globe icon in the system tray, with an animated magnifying glass slowly moving over the surface.

This behaviour is known as Hide When Minimized. Since there's no button in the task bar at the bottom of the screen, as you would expect for a minimized application, you must double click on the icon in the system tray to bring the ASW window back to the desktop. Normal minimizing behaviour can be set from the menu bar, by selecting Options-Hide When Minimized to remove the check mark from the left of the option. You will see two other check marks and a final option that leads you to the first dialogue box you saw when the product originally started:

- Enable Watcher

- Always on Top

- Internet Options...

'Enable Watcher' allows you to stop ASW from automatically cycling through and checking each item on the Resources list for availability as specified in the 'Check resource every *nn* min.' box of each item. If you watch the ASW globe icon in the system tray carefully, you'll see the magnifying glass change to a red dot.

If you would prefer to shut down ASW completely, right-click on the ASW globe icon in the system tray, and select Close from the pop-up menu. You'll also see an option to turn Enable Watcher back on (or off if it was on). Whenever ASW is started, either automatically at Windows start-up, or manually from the Start menu, Enable Watcher

is set back on. This means that, if you want to disable ASW for an extended period, you must either uninstall it or know how to stop programs from inserting themselves into the system tray at start-up.

One final point: the ASW globe icon returns to the system tray each time you reboot or logon. And, unless you change the default Enable Watcher option, ASW begins monitoring.

ONE BUG

Despite all this testing, I only uncovered one bug. 'Resource unavailable' dialogue boxes for my mail servers kept appearing even after:

- Removing the check marks from all Actions for each mail server URL in the Resources list.

- Deleting the Resources list entries for the mail server URLs.

A reboot eliminated the problem, although the two mail server entries reappeared, with no Actions check marked, even though I had previously deleted both entries. With hindsight, I realize I should have tried changing the Enable Watcher option in the Options menu bar drop-down menu before resorting to a reboot.

Because this behaviour (bug) was observed on two separate workstations where ASW was installed, you're likely to encounter it. It appears to be triggered by large numbers of changes to list entry parameters, after which most changes do not take effect.

SUMMARY

If you have reliable Internet service and can live without documentation, Active Server Watcher provides a good way to be notified whenever you're at your workstation and any host, Web site, or perhaps mail server you're interested in goes down. And, although I didn't test it in that environment, there's no reason why ASW couldn't be run on a server to provide constant monitoring.

Finally, here are a few usage tips:

- Append a colon and a port number to the URL to check telnet, ftp, mail, and other types of non-Web access.

- The standard port numbers are 21 for ftp, 23 for tn3270e and other telnet connections, 25 for outgoing SMTP mail servers, and 110 for incoming POP3 mail servers.

- Remove all Action check marks to temporarily suspend outage reporting for a site.

- All sites to be checked must be specified with URLs beginning with http://

- Web pages, not components, can be checked.

- Set Retry to one or more for sites where momentary outages or long response times are common and you don't wish to know about them.

- Repeat any URLs in the Resources list where you wish to specify different actions with different Retry and/or 'Check resource every *nn* min' settings.

- Remember that a single site down for an extended period can create a large number of dialogue boxes on the desktop if Display Message is specified as an Action and the workstation is left unattended and running for long periods of time.

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The top ten sources of TCP/SNA-related information

Over recent years, our *Information points – reviews* have looked at many sources of TCP/SNA-related information. This article summarizes the ten most valuable.

IBM MANUALS ON THE INTERNET

IBM offers thousands of its manuals, including many TCP/SNA-related publications, on the Internet at no cost for Web viewing and/or downloading. Although originally only in a browser-based simulation of BookManager, many are now (also or exclusively) being offered in Adobe Acrobat (.pdf) format.

z/OS – http://www.ibm.com/servers/eserver/zseries/zos/bkserv

Under the heading *z/OS elements and features publications*, click on the relevant version/release. Under the *z/OS elements and features bookshelf* heading, click on 'List – All bookshelves'. Look for, or use your browser's Find function to find the *z/OS IBM Communications Server* bookshelf and click on 'List books'.

OS/390 – http://www.ibm.com/servers/s390/os390/bkserv

Under the heading *OS/390 elements and features publications*, click on the relevant version/release. Under the *OS/390 elements and features bookshelf* heading:

- Version 2.10: click on 'List – All bookshelves'; look for, or use your browser's Find function to find, the *OS/390 IBM Communications Server bookshelf* and click on 'List books'.

- Version 2.8-9: click on 'List – All bookshelves'; look for *OS/390 SecureWay Communications Server bookshelf* and click on 'List books'.

- Version 2.5-7: click on 'List – All bookshelves'; look for *OS/390 eNetwork Communications Server bookshelf* and click on 'List books'.

- Version 1.2-2.4: click on 'List – All bookshelves'; look for *Communication Server for OS/390 bookshelf* and click on 'List books'.

- Version 1.1: click on 'List – All books'; not all manuals are available on-line.

MVS/ESA – http://www.ibm.com/servers/s390/os390/bkserv/mvs.html

Under the heading *MVS/ESA Applications: Q-Z (Disc 6) bookshelf*, click on 'List – All bookshelves'. Find the relevant version/release of *TCP/IP for MVS* or *VTAM* and click on 'List books'.

VM – http://www.vm.ibm.com/library

Under the heading *z/VM, VM/ESA, and VM-related product documentation*, click on 'Product publications'. Click on System/390 bookserver under the *VM Library in BookManager format* heading. Look for, or use your browser's Find function to find, the bookshelf for the relevant version/release of *TCP/IP for MVS* or *VTAM* and click on 'List books'. The *z/VM bookshelf* also contains the old, but still useful, *VM/ESA V2R1.0 Connectivity* manual.

VSE – http://www.ibm.com/servers/eserver/zseries/os/vse/library/library.htm

Under the heading *VSE related documentation*, click on 'VSE product manuals' on the on-line book server. Find the relevant version of VSE and click on the *Search – Titles, names or doc numbers* link, then enter TCP, SNA, or any other keyword, and hit the Find button.

3270 and network hardware – http://www.ibm.com/servers/s390/os390/bkserv/hw

For specific hardware products, find the specific bookshelf and click 'List books'. Otherwise, click List books in the first bookshelf, *Hardware collection*, and search for the manual(s) of interest.

REDBOOKS – http://www.redbooks.ibm.com

Redbooks have always provided an outlet for less formal material

than manuals, and much of it is extremely valuable. Many of them are essentially detailed diaries of IBM projects, at both customer and IBM sites, with some effort made to remove installation-specific information in the sample code and the text. Others are based on technical presentations. A more recent trend, exemplified by the five-volume *ABCs of System Programming*, is to provide the type of textbooks you would expect to find in a computer bookstore.

You can do a direct search by keyword and find over 90 matches for SNA. Or you can click on *Redbooks Online* on the left sidebar. There, you'll find a more comprehensive search capability. The right sidebar provides access to a dozen *Redbook Portals* by subject area, from where you can list all the red books on one page, most recent first, or just the 15 most popular. These portals also provide access to Redpieces, Redpapers, and Residencies. Redpieces are redbooks in progress. Redpapers do not qualify as redbooks for one reason or another, and are only available on-line. Residencies list the future openings to be a member of the team that creates a specific redbook.

IBM zSERIES NETWORKING HOME PAGE – http://www.ibm.com/servers/eserver/zseries/networking

The left sidebar allows you to drill down to a broad range of mainframe networking information for VSE, z/VM, and z/OS environments. *Products*, for example, is where you will find Communications Server for z/OS.

IDG.NET – http://www.idg.net/content/channel_content/net_theme.html

The Networking and Communications channel of IDG.net is divided into five categories: News, Products, How-to, Books, and Research.

Books merely lists relevant *for Dummies* and other IDG books for sale. But the rest of the categories provide information from IDC Research, Network World Fusion, and other IDG publications, and the IDG News Service.

TECHREPUBLIC – http://www.techrepublic.com

To serve its two million members, TechRepublic catalogues a huge

amount of computing information both on and off the site. The number of links that lead you to books you have to buy or product marketing labelled as Research ('White Paper') can be frustrating, but the good stuff makes it all worthwhile. There are also *Discussions* and a *Technical Q&A* where members offer each other *TechRepublic Points* for answers to their questions.

Even for casual reading, *Search* and *Advanced Search* are usually the preferred method of navigation.

INTERNET PROTOCOLS – http://www.rfc-editor.org

Internet standards are defined by the Internet Engineering Task Force (IETF) and documented in Request For Comments (RFCs). They range from ftp commands to tn3270e protocol. RFCs began in 1969 as a series of notes on the Internet (then ARPANET) and cover a lot more than standards. They range from best practices to humour.

The RFC Editor is responsible for publishing all RFCs, a process that includes final editorial review and providing on-line search capabilities. From his home page, click on 'RFC Search and Retrieval' for a number of ways to find and retrieve RFCs.

XEPHON IS LIBRARY – http://www.xephon.com/is_library.html

Click the *IS Library* button in the left sidebar for free access to 200 articles extracted from Xephon Reports, including some on TCP/IP, SNA, VTAM, and other network topics. Members of Xephon's Corporate Licence scheme have access, without additional charge, to all 400+ articles. They are divided into five categories: Business and IT strategies, New technologies and applications, Data centre management, System/390, and Other systems.

Click on an article title to have an Adobe Acrobat (.pdf) version e-mailed to you; free registration is required the first time. To locate titles of interest on this page, select text anywhere on the right side of the page and then use your browser's Find function to search the titles. Alternatively, you can use the 'Search Site' function on the left sidebar to list both articles and Update journal pages.

EXTREMETECH – http://discuss.extremetech.com/extremetech/messages/?topfolder=6

As the site's name implies, this site will appeal most to the extreme fringes, though perhaps not the Overclocking crowd who install their own cooling system just so they can run their processor faster than it is rated to run. But this little corner seems to have found an active networking discussion group. Click on *Networking and Wireless* in the left sidebar to see an expanded view of discussion topics.

OPEN DIRECTORY PROJECT

http://dmoz.org/Computers/Data_Communications

http://dmoz.org/Computers/Software/Networking

http://dmoz.org/Computers/Software/Communications

http://dmoz.org/Computers/Internet/Protocols/Transmission_Protocols

Like Yahoo!, the Open Directory Project uses human beings to create a hierarchy of pages of links to a very large number of Web sites. Unlike Yahoo!, these people are volunteer editors, and the directory can be incorporated at no charge into other search engines and services. And it is, most notably by Google and AOL.

Subcategories are listed first, which you click to drill down, and any links to Web sites are listed next. Links are listed alphabetically except for any 'Editor's Choice' sites, which appear first.

YAHOO! – http://dir.yahoo.com/Computers_and_Internet/Communications_and_Networking

In response to the automated approach of search engines, Yahoo! pioneered the use of human beings to build menu-based navigation through the chaos that is the Internet. Scroll down to the *Categories and Site Listings* sections. A category is another Yahoo! page that covers a subtopic. Site listings are links to Web sites that cover multiple subtopics or none at all.

Jon E Pearkins
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Contributing to *TCP/SNA Update*

In addition to *TCP/SNA Update*, the Xephon family of *Update* publications now includes *CICS Update*, *MVS Update*, *VSAM Update*, *DB2 Update*, *RACF Update*, *AIX Update*, *Domino Update*, *MQ Update, NT Update*, *Oracle Update*, and *TSO/ISPF Update*. Although the articles published are of a very high standard, the vast majority are not written by professional writers, and we rely heavily on our readers themselves taking the time and trouble to share their experiences with others. Many have discovered that writing an article is not the daunting task that it might appear to be at first glance.

They have found that the effort needed to pass on valuable information to others is more than offset by our generous terms and conditions and the recognition they gain from their fellow professionals. Often, just a few hundred words are sufficient to describe a problem and the steps taken to solve it.

If you have ever experienced any difficulties, or made an interesting discovery, you could receive a cash payment, a free subscription to any of our *Updates*, or a credit against any of Xephon's wide range of products and services, simply by telling us all about it.

More information about contributing an article to a Xephon Update, and an explanation of the terms and conditions under which we publish articles, can be found at www.xephon.com/nfc. Alternatively, please write to the editor, Fiona Hewitt, at any of the addresses shown on page 2, or e-mail her at fionah@xephon.com

TCP/SNA news

IBM has made a number of announcements, including the following:

1   Enhancements to the 3746 Multiprotocol Controller, which consolidates IP, SNA, and APPN/HPR routing over the same media, with better network management functions, new capabilities in IP, APPN, HPR and dependent LU environments, and support for more LU-LU user sessions and SSCP-LU control sessions controlled by the Network Node Processor.

2   ACF/NCP V7R8.1 and ACF/SSP V4R8.1 with network management and serviceability enhancements, and the NTuneNCP tuning feature as an integrated component. This is designed to simplify installation and makes it easier to propagate network monitoring tools into SNA networks.

3   V4.0 of CICS Transaction Gateway, enabling gateway/server communication over TCP/IP, TCP62, SNA LU6.2, and memory-based protocols.

4   V2.1 of Everyplace Wireless Gateway for Multiplatforms, to help extend existing applications to mobile devices over wireless and wireline networks. It can be configured as a remote access gateway providing TCP/IP connectivity with support for strong encryption, data compression, and data optimizations to different client devices over different network types.

5   Enhancements to its performance management, testing, and scalability services. Specific functions include Web mining for Web site quality and consistency, Web site stress analysis, Web site usage analysis, TCP/IP network performance analysis, and server and database analysis.

URLs:
http://www.ibm.com
http://www.networking.ibm.com
http://www.ibm.com/software/ts/cics
http://www.software.ibm.com
http://www.ibm.com

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Tivoli has announced V1R5 of its Business Systems Manager (TBSM) enterprise system management product, including, amongst other new features, an expanded NetView interface with APPN SNA resource autodiscovery and management.
URL: http://www.tivoli.com/products

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Quattro software has begun shipping its SysChecker, which, amongst other things, can check whether TCP/IP interfaces are running correctly.
URL: http://www.quattrosoftware.co.uk

* * *

HP has launched its Storage on Ethernet (SoE) initiative, to provide SANs through an Ethernet and TCP/IP connection. The first products will ship by the end of the year.
URL: http://www.hp.com

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