

Using TSAF to Connect Two VMs

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Using TSAF to Connect Two VMs

Introduction

In this document, I'll be describing how to connect two VMs using TSAF over a CTC link. First, I'll describe the process to connect to a guest VM using a virtual CTCA. I'll then show the changes necessary to connect over an external, "real", CTCA link using Hercules' CTCE.

Note for now, the CTCE section is very brief until we get further into the troubleshooting and debugging of the link. There's enough to recreate the existing problem, but not enough to create a full scenario yet.

For this documentation, the following applies:

JS07 is z/VM 4.4.0, with a CTC (virtual or real) at address 816 that connects to JS16.

JS16 is z/VM 6.3.0, with a CTC (virtual or real) at address 807 that connects to JS07.

Both images came with TSAF pre-installed and pre-existing directory entries.

To paraphrase an old cook book's recipe for Rabbit Stew, "first, get a rabbit." I'll assume you know how to "get the rabbit", that is that you have a VM running as a host and know how to bring up another VM under it as a guest and do basic VM administration. Therefore, I will only be discussing the parts of the process that apply directly to TSAF. If you have questions in this area, please ask and I'll help out as much as I can.

Since I grew up with MVS, I tend to assume everybody knows more about VM than I do. If I went too lightly over a subject, or you have questions about something I didn't cover, please let me know.

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Using TSAF to Connect Two VMs

TSAF over VCTCs

In this scenario, one VM (JS16) will be a host, supporting the other VM (JS07) as a guest. They will be connected via a virtual CTC.

Bring up the host

Initially, just IPL the host and leave the guest inactive.

Modify the user directory entry for TSAFVM

Log on to the host as the administrator (most likely MAINT) and examine the user directory. Ensure there is an entry for TSAF, assumed for these instructions to be named TSAFVM. If you don't have one, see the Appendix, section "USER DIRECT" for an example of entries from z/VM 4.4.0 and 6.3.0. Once your directory entry functionally matches what is listed in the Appendix, make sure you do a DIRECTXA command to implement it. Do not include any DEDICATEs for the CTC links.

There should be no changes needed to the directory entry for the guest VM for TSAF.

Modify TSAFVM's PROFILE EXEC

Access the mini-disk for TSAFVM so you can edit the PROFILE EXEC. If you created a new MDISK as part of the previous step, you may need to format it and copy the PROFILE EXEC listed in the Appendix to it. The following assumes you're starting with a file that matches the Appendix.

This is TSAFVM on the host, so we need to define the virtual CTCA 807 that will connect to the guest VM. After the "Trace O" statement in the PROFILE EXEC, add the following lines:

```
'CP DEFINE CTCA 807'  
'CP COUPLE 807 JS07 816'
```

When TSAFVM is started up, the first line will define the virtual CTCA at address 807. The second line will then attempt to couple that address with address 816 in the VM guest, JS07. Don't worry if you get errors when the guest VM is not up, we'll do the same thing in it so whichever VM comes up last will perform the couple.

Save the file and make sure to detach any links to TSAFVM's 191 disk. TSAFVM will need to access the disk R/W to be able to save the ATSLINKS FILE when links are added or deleted, so make sure MAINT does not have a link to it that might cause TSAFVM to only access it R/O. (Or just logoff MAINT to be sure.)

Bring up TSAFVM

At this point, TSAFVM on the host is ready to come up. You can log on to it or XAUTOLOG it. For this document, I will XAUTOLOG it.

Entering the "xautolog tsafvm" command on the Operator's console returns the following output. Four messages were returned to the Operator, about the autolog process and then messages from TSAFVM, prefixed with "TSAFVM :." were output.

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```
xautolog tsafvm
22:46:52 Command accepted
Ready; T=0.01/0.01 22:46:52
22:46:52 AUTO LOGON ***          TSAFVM  USERS = 2      BY OPERATOR
22:46:52 HCPCLS6056I XAUTOLOG information for TSAFVM: The IPL command is
verified by the IPL command processor.
TSAFVM  : z/VM V6.3.0    2018-10-18 11:59
TSAFVM  : CTCA 0807 DEFINED
TSAFVM  : HCPCPL045E JS07 not logged on
TSAFVM  : DMSACP723I D (193) R/O
TSAFVM  : 22:46:52 ATSC TL013I Trace area size is 40K
TSAFVM  : 22:46:52 ATSCAC006I TSAF link statistics and session accounting
records will be generated
TSAFVM  : 22:46:52 ATSLIN719W ATSLINKS FILE not found
TSAFVM  : 22:46:52 ATSMRZ518I RESET: collection now has size 1
TSAFVM  : 22:46:52 ATSCST001I Initialization is complete. The service level
is 0300.
TSAFVM  : 22:46:52 ATSMRX520I Synchronization is now NORMAL
```

The first TSAFVM message was from CMS's IPL process. The next two lines were caused by what we just edited into the PROFILE EXEC. CTCA 807 was defined and since the guest VM JS07 is not up yet, the couple command failed with the HCPCPL045E message. The "D" disk was accessed and then TSAF was started. The ATSLIN719W message details that the ATSLINKS FILE was not found; it will be created the first time TSAF is shut down with links added. The additional messages just describe the rest of the initialization process.

TSAFVM is now waiting for links to be added, which we'll do once we get the guest VM up.

Modify the guest VM's PROFILE EXEC

In preparation for bring up the guest VM, we need to make changes to its PROFILE EXEC to match what we did to TSAFVM's PROFILE EXEC, to bring up the other end of the VCTC link.

So, while logged on as the administrator, edit the PROFILE EXEC for the guest VM, in my case "JS07" and add the following lines:

```
CP DEFINE CTCA 816
CP COUPLE 816 TSAFVM 807
```

This is essentially the reverse of the lines we added to TSAFVM. Here, line 1 DEFINES the CTCA at address 816 and line 2 COUPLES that address to address 807 in TSAFVM. By having both VMs attempt the COUPLE, whichever one is the last to come up should be successful in establishing the CTC.

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Start the Guest VM

Now, you can start the guest VM, using whatever procedure you like. I have a dedicated Operator's console and XAUTOLOG the VM, so that's what I'll be documenting.

```
xautolog js07
23:10:12 Command accepted
Ready; T=0.01/0.01 23:10:12
23:10:12 AUTO LOGON *** JS07 USERS = 4 BY OPERATOR
23:10:12 HCPCLS6056I XAUTOLOG information for JS07: The IPL command is
verified by the IPL command processor.
JS07 : z/VM V6.3.0 2018-10-18 11:59
JS07 : CP DEFINE CTCA 816
JS07 : CTCA 0816 DEFINED
JS07 : CP COUPLE 816 TSAFVM 807
TSAFVM : CTCA 0807 COUPLED BY JS07 0816
JS07 : CTCA 0816 COUPLED TO TSAFVM 0807
JS07 : CP SET RUN ON
JS07 : CP IPL 123 LOADPARM CONS0700
```

As part of the startup messages for the VM, you can see that the CTCA at 816 was defined and successfully COUPLED with address 807 in TSAFVM.

Modify the USER DIRECT Entry for TSAFVM

As with the host VM, a USER DIRECT entry needs to exist for TSAFVM on the guest VM. In this entry, a DEDICATE statement also needs to exist, connecting to the address of the CTCA we created in the PROFILE EXEC for the guest VM. So, create an entry if necessary and then modify the entry to add a DEDICATE statement for the link address. For this example, add:

```
DEDICATE 816 816
```

Save it and do a DIRECTXA.

Prepare the TSAFVM VM

The PROFILE EXEC needs to be created for TSAFVM if it did not exist before. There will not be any DEFINES or COUPLES in this file, it will match what's in the Appendix.

Also, any ATSLINKS FILE can be erased so when we bring it up, it comes up clean.

When you're done, make sure to detach any links to the TSAFVM mini-disk, so it can have it R/W when it comes up.

Bring Up TSAFVM on the Guest VM

The next step is to start TSAFVM on the guest VM. Again, I'll use XAUTOLOG.

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```
xautolog tsafvm
```

```
23:28:23 Command accepted
Ready; T=0.01/0.01 23:28:23
23:28:23 AUTO LOGON ***          TSAFVM  USERS = 2      BY OPERATOR
23:28:23 HCPCLS6056I XAUTOLOG information for TSAFVM: The IPL command is
verified by the IPL command processor.
TSAFVM  : z/VM V4.4.0    2003-10-24 08:38
TSAFVM  : DMSACP723I D (193) R/O
TSAFVM  : 23:28:23 ATSCTL013I Trace area size is 40K
TSAFVM  : 23:28:23 ATSCAC006I TSAF link statistics and session accounting
records will be generated
TSAFVM  : 23:28:23 ATSLIN719W ATSLINKS FILE not found
TSAFVM  : 23:28:23 ATSMRZ518I RESET: collection now has size 1
TSAFVM  : 23:28:23 ATSCST001I Initialization is complete. The service level
is 0300.
TSAFVM  : 23:28:23 ATSMRX520I Synchronization is now NORMAL
```

As before, we see 4 lines to the Operator describing the AUTOLOG processing. This is followed by the startup messages for TSAF.

Add the VCTC to Both TSAFs

We're now ready to add our VCTC to TSAF on both VMs. Since we're just brought up TSAF on the guest, let's add the CTC there first.

Links are added to TSAF using the "add link <ccuu>" command.

```
send tsafvm add link 816
```

```
Ready; T=0.01/0.01 23:31:48
TSAFVM  : 23:31:48 ATSLLM724I Link 0816 added
```

Now, on the host VM:

```
send tsafvm add link 807
```

```
Ready; T=0.01/0.01 23:32:41
TSAFVM  : 23:32:41 ATSLLM724I Link 0807 added
```

Within a few seconds, the following messages were generated:

```
TSAFVM  : 23:32:46 ATSLMN707I Link 0807 came up
TSAFVM  : 23:32:46 ATSMJK513I Attempting JOIN with node JS07 as the agent
TSAFVM  : 23:32:46 ATSMYC521I Collection is roughly synchronized
TSAFVM  : 23:32:47 ATSMYC520I Synchronization is now NORMAL
```

Looking back on the guest VM's console, we see the following:

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```
TSAFVM : 23:32:46 ATSMDO546I Quiesce broadcasts issued by JS07
TSAFVM : 23:32:46 ATSMDO515I JOIN in progress for node JS16, agent is JS07
TSAFVM : 23:32:46 ATSMYC521I Collection is roughly synchronized
TSAFVM : 23:32:47 ATSMYC520I Synchronization is now NORMAL
TSAFVM : 23:32:51 ATSLMN707I Link 0816 came up
```

Verify TSAF's Status

TSAF provides the QUERY command to display the status of various aspects of TSAF. It has several operands to specify what you want to look at.

Query

```
COLLECT
LINKS or LINK <ccuu>
RESOURCE
STATUS
```

QUERY COLLECT

“Q COLLECT” lists all the systems currently connected in the “collection”. This includes hosts that are directly connected as well as hosts reachable via a directly-connected peer.

```
send tsafvm q collect
TSAFVM : JS07      JS16
```

QUERY LINKS

“Q LINKS” will display all the defined links. Since we only have one link at this point, it is displayed:

```
send tsafvm q links
TSAFVM : Link: 0807
TSAFVM :      Type:          CTCA
TSAFVM :      Status:         up      Delay:          15
TSAFVM :      Neighbor: JS07      Neighbor State: ESTABLISHED
TSAFVM :
```

Adding a specific address to the command, i.e. “Q LINK <ccuu>” will display the status of a single link:

```
send tsafvm q link 807
TSAFVM : Link: 0807
TSAFVM :      Type:          CTCA
TSAFVM :      Status:         up      Delay:          15
TSAFVM :      Neighbor: JS07      Neighbor State: ESTABLISHED
TSAFVM :
```

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QUERY RESOURCE

“Q RESOURCE” can be used to display any resources registered with TSAF.

```
send tsafvm q resource
TSAFVM : No global resources identified
```

We don't currently have any global resources active that use TSAF. One of my goals is to get file sharing working in the collection, if I had that on one of the hosts in our scenario, we could see “SFSPool1” listed as a resource.

QUERY STATUS

“Q STATUS” displays status information about TSAF:

```
send tsafvm q status
TSAFVM : Local node id:                JS16
TSAFVM : Current collection time:      0002472B
TSAFVM : Collection ID:                JS07
TSAFVM : Last synchronous update time: 0000A13B
TSAFVM : Next scheduled sync time:    000E8DC7
TSAFVM : Sync period:                  7200 seconds
TSAFVM : Transmission Delay:           0080
TSAFVM : Maximum clock deviation:      0081
TSAFVM : Worst extra clock deviation:  00000001
TSAFVM : Atomic broadcast duration:    00000102
TSAFVM : Latest Manual adjustment to duration: 00000000
TSAFVM : Worst case diffusion hop count: 01
TSAFVM : Current checksum:             6CD33409
TSAFVM : Number of Nodes in collection: 02
TSAFVM : Highest bit in use for signatures: 02
TSAFVM : Current Node map:            C0000000
TSAFVM : 1)Processor node: JS07      CPU ID: FF01110728180000
TSAFVM : 2)Processor node: JS16      CPU ID: FF01111628180000
TSAFVM : 3)Processor node:           CPU ID: 4040404040404040
TSAFVM : 4)Processor node:           CPU ID: 4040404040404040
TSAFVM : 5)Processor node:           CPU ID: 4040404040404040
TSAFVM : 6)Processor node:           CPU ID: 4040404040404040
TSAFVM : 7)Processor node:           CPU ID: 4040404040404040
TSAFVM : 8)Processor node:           CPU ID: 4040404040404040
TSAFVM : Collection bitmap: C0000000 Base signature: 0000010100000000
```

Managing Links

The add and delete link commands allow you to manage the active links in your TSAF configuration.

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ADD LINK <CCUU>

The “ADD LINK <ccuu>” command lets you add a link to the TSAF configuration.

```
send tsafvm add link 807
Ready; T=0.01/0.01 00:24:01
TSAFVM : 00:24:01 ATSLLM724I Link 0807 added
```

Assuming the other end is already up and waiting, after a few seconds you’ll see:

```
TSAFVM : 00:24:12 ATSLMN707I Link 0807 came up
TSAFVM : 00:24:12 ATSMJK513I Attempting JOIN with node JS07 as the agent
TSAFVM : 00:24:17 ATSMYC521I Collection is roughly synchronized
TSAFVM : 00:24:19 ATSMYC520I Synchronization is now NORMAL
```

DELETE LINK <CCUU>

The “DELETE LINK <ccuu>” command lets you remove a command from the configuration.

```
send tsafvm delete link 807
TSAFVM : 00:15:42 ATSLLM713I Link 0807 deleted
Ready; T=0.01/0.01 00:15:42
```

After a few seconds on an active link, you’ll also see:

```
TSAFVM : 00:15:49 ATSMBN540I Node JS07 deleted from collection
```

Stopping and Restarting TSAF

Stopping TSAF gracefully is performed with the “STOP TSAF” command. Starting or restarting is uses the “RUNTSAF” command.

STOP TSAF

Use the “STOP TSAF” command to shut down TSAF.

```
send tsafvm stop tsaf
TSAFVM : 00:17:34 ATSC TL003I Termination is in progress
Ready; T=0.01/0.01 00:17:34
TSAFVM : Ready; T=0.34/0.57 00:17:34
00:17:34 HCPQCS150A User TSAFVM has issued a VM read
```

At this point, I can logoff the VM to complete shutting it down, or possibly make some configuration change and restart TSAF.

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RUNTSAF

“RUNTSAF” is how TSAF gets started in the TSAFVM VM. Thus, if you shut it down accidentally, or shut it down to make a configuration change, use the “RUNTSAF” command to restart it.

For example:

```
send tsafvm stop tsaf
TSAFVM : 00:17:34 ATSCCTL003I Termination is in progress
Ready; T=0.01/0.01 00:17:34
TSAFVM : Ready; T=0.34/0.57 00:17:34
00:17:34 HCPQCS150A User TSAFVM has issued a VM read

send tsafvm runtsaf
Ready; T=0.01/0.01 00:20:25
TSAFVM : 00:20:25 ATSCCTL013I Trace area size is 40K
TSAFVM : 00:20:26 ATSCAC006I TSAF link statistics and session accounting
records will be generated
TSAFVM : 00:20:26 ATSLIN719W ATSLINKS FILE not found
TSAFVM : 00:20:26 ATSMRZ518I RESET: collection now has size 1
TSAFVM : 00:20:26 ATSCST001I Initialization is complete. The service level
is 0300.
TSAFVM : 00:20:26 ATSMRX520I Synchronization is now NORMAL
```

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TSAF over CTCEs

In this scenario, both z/VMs will be running standalone and be connected to each other via a CTCE.

Prepare and start JS07

Starting with JS07, before IPLing, I added a statement to the Hercules configuration to provide the CTC.

```
# CTC for TSAF
816 CTCE 38807 807=Hercules 38816 # link to JS16/807
```

I then IPLed normally.

Verify the USER DIRECT entry

Since JS07 was the guest VM in the previous scenario, the DEDICATE for the CTC link is already in the TSAFVM USER DIRECT entry.

Start TSAFVM

At this point, we're ready to bring up TSAF on JS07. I prefer to just XAUTOLOG it, however for this example, I'll be logging in to it to show an alternate means of access.

I log into TSAFVM and receive the following output:

```
LOGON TSAFVM
z/VM Version 4 Release 4.0, Service Level 0302 (64-bit),
built on IBM Virtualization Technology
There is no logmsg data
FILES:  NO RDR,  NO PRT,  NO PUN
LOGON AT 18:04:29 PST TUESDAY 03/05/24
z/VM V4.4.0    2003-10-24 08:38
DMSACP723I D (193) R/O
18:04:29 ATSCTL013I Trace area size is 40K
18:04:29 ATSCAC006I TSAF link statistics and session accounting records will
be generated
18:04:29 ATSLIN719W ATSLINKS FILE not found
18:04:29 ATSMRZ518I RESET: collection now has size 1
18:04:29 ATSCST001I Initialization is complete. The service level is 0300.
18:04:29 ATSMRX520I Synchronization is now NORMAL
```

Note the message I underlined shows that no ATSLINKS FILE existed when TSAF was brought up, so it did not start any links. I erased the one from the VCTC test so TSAF would come up clean. Not shown at this point, I did a "#CP DISC" and went back to SCIF commands from the console.

Add the link

To add a link, use the command "add link <ccuu>".

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```
send tsafvm add link 816
Ready; T=0.01/0.01 17:54:02
TSAFVM : 17:54:02 ATSL1Y795I Retry limit exceeded on unit 0816 SET_370_MODE
TSAFVM : 17:54:02 ATSL1Y708E An attempt to reset link 0816 has failed
TSAFVM : 17:54:02 ATSLLM724I Link 0816 added
TSAFVM : 17:54:02 ATSL1Y795I Retry limit exceeded on unit 0816 SET_370_MODE
TSAFVM : 17:54:02 ATSL1Y708E An attempt to reset link 0816 has failed
```

Note the underlined message, this indicates that the link has been added to the ATSLINKS FILE. If you start TSAFVM again, it will automatically restart this link.

Unfortunately, due to the current issue, this is as far as we'll get.

At this point about all I can do is "stop tsaf" or "delete link 816". Trying to query the link will just make TSAF unresponsive and it will have to be FORCED.

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Appendix

USER DIRECT

As listed in JS16, z/VM 6.3.0

```
IDENTITY TSAFVM   ZVM63       16M   16M G
  INCLUDE IBMDFLT
  BUILD ON * USING SUBCONFIG TSAFVM-1
* BUILD ON @@member2name USING SUBCONFIG TSAFVM-2
* BUILD ON @@member3name USING SUBCONFIG TSAFVM-3
* BUILD ON @@member4name USING SUBCONFIG TSAFVM-4
ACCOUNT 1 TSAFVM
OPTION MAXCONN 256 COMSRV DIAG98 ACCT CONCEAL
MACH ESA
IUCV ANY
IUCV ALLOW
IUCV *CRM
IPL CMS PARM AUTOOCR
CONSOLE 009 3215 T OPERATOR

SUBCONFIG TSAFVM-1
LINK MAINT 193 193 RR
MDISK 191 3390 1145 002 ZVMPK7 MR RTSAFOBJ WTSAFOBJ MTSAFOBJ
DEDICATE 807 807
```

As listed in JS07, z/VM 4.4.0

```
USER TSAFVM TSAFVM 16M 16M G
  INCLUDE IBMDFLT
ACCOUNT 1 TSAFVM
OPTION MAXCONN 256 COMSRV DIAG98 ACCT CONCEAL
MACH XA
IUCV ANY
IUCV ALLOW
IUCV *CRM
IPL CMS PARM AUTOOCR
CONSOLE 009 3215 T OPERATOR
LINK MAINT 193 193 RR
MDISK 191 3390 3336 002 440RES MR RTSAFOBJ WTSAFOBJ MTSAFOBJ
DEDICATE 816 816
```

The only changes I made from the supplied version was to add a DEDICATE statement for my links and modify the CONSOLE statement to include OPERATOR so I can control the VM from the console.

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Notes:

1. If you're running a VCTC link, comment out the DEDICATE statement in the host (but not the guest). The VCTC will be DEFINED in the TSAF PROFILE EXEC instead.
2. If you're starting from scratch with the directory entry, the MDISK does not need to be very big. They allocated 2 cylinders for it and that seems like overkill. In my operations so far, I've only seen two files on that disk and neither is very big. There is a PROFILE EXEC which controls the startup of TSAF and a file named ATSLINKS FILE which is created by TSAF and tracks the current link definitions. On one of my systems, they are both 1 4096-byte block, so in total, TSAF is using 9 blocks (3%) of the MDISK.

PROFILE EXEC

Please note: the first 5 characters are XEDIT sequence numbers so the comments could refer to a couple lines by statement number.

```
00001 /*****/
00002 /* */
00003 /* PROFILE EXEC for TSAF which */
00004 /* 1) access MAINT's 193 disk as D to gain access to */
00005 /* the TSAF executable module and message */
00006 /* repository */
00007 /* 2) allow the virtual timer for the TSAF virtual */
00008 /* machine to be updated during the virtual */
00009 /* processor run time and also during virtual */
00010 /* wait time */
00011 /* 3) allow the TSAF virtual machine to run while a */
00012 /* CP-initiated read is outstanding at the TSAF */
00013 /* console */
00014 /* 4) issue the SET LANGUAGE command to enable the */
00015 /* TSAF message repository */
00016 /* 5) issue the SET 370ACCOM ON command to allow */
00017 /* TSAF to run in an XA or XC virtual machine */
00018 /* 6) start execution of the RUNTSAF MODULE */
00019 /* */
00020 /* */
00021 /* Copyright - */
00022 /* */
00023 /* THIS MODULE IS "RESTRICTED MATERIALS OF IBM" */
00024 /* 5654-030 (C) COPYRIGHT IBM CORP. - 1992, 1995 */
00025 /* LICENSED MATERIALS - PROPERTY OF IBM */
00026 /* SEE COPYRIGHT INSTRUCTIONS, G120-2083 */
00027 /* ALL RIGHTS RESERVED. */
00028 /* */
00029 /* Status - VM/ESA Version 2, Release 1.0 */
00030 /* */
00031 /*****/
00032 Trace 0
```

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```
00033
00034
00035
00036
00037 'ACCESS 193 D'          /* access MAINT's 193 disk */
00038
00039 'CP SET RUN ON'        /* keep tsaf running      */
00040
00041 'SET LANGUAGE AMENG (ADD ATS USER' /* enable TSAF's message */
00042                          /* ... repository          */
00043
00044 'SET 370ACCOM ON'       /* allow TSAF to run in an */
00045                          /* XA or XC virtual machine*/
00046
00047 'CP SET TIMER REAL'     /* make the interval timer */
00048                          /* ... reflect real time   */
00049
00050 'RUNTSAF'              /* start TSAF execution    */
```

I discovered an error in the PROFILE EXEC. In the shipped version, “CP SET TIMER REAL” and “SET 370ACCOM ON” statements are included, however they are in the wrong sequence (SET TIMER REAL requires 370ACCOM be on). I had to edit the file and move them to the current locations at line 44 and 47.

Also, lines 34 and 35 will be created as part of the documented procedure for VCTC startup, so for now I have removed them. Just know that they are not needed as part of the CTCE startup procedure.

ATSLINKS FILE

```
0816      link added online
```

As I mentioned, ATSLINKS FILE tracks the links that have been added so TSAF can it restart them when it is brought up. This version of the file records a link I brought up recently (0816).

Just know that successfully adding a link records it in this file, you don't need to edit it manually. Also, the file can be deleted and TSAF will recreate it when new links are added.