VM New User HOW-TO
Defining ESCON CTCs Between LPARs

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Introduction

Purpose of This Document

This document describes a cookbook example of how to define ESCON CTC connections between LPARs on a single system. These CTCs may be used for any VM or z/OS function that requires a point-to-point CTC connection between two applications such as RSCS, TCPIP, or TSAF/ISFC.

Intended Audience

This document is intended for system programmers and hardware administrators involved in setup of inter-LPAR communications.

Defining ESCON CTCs Between LPARs

Step By Step Example

The following is a step-by-step example of setting up a set of inter-LPAR ESCON-based CTC connections.

1. Read IBM document SB10-7034-00 (the *zSeries 900 ESCON Channel-to-Channel Reference*). Pay specific attention to the "MIF-to-MIF Configurations" section and examples.
2. Make a list of the LPARs which will need CTC connections to one or more LPARs (including to itself). For each LPAR in your list, specify each LPAR with which it must communicate.

   In this document, the example shown in figure Figure 1 will be used throughout to illustrate the configuration statements.

   In our example, the LPARs defined on the system are:

   - LPPROD (LPAR #1)
   - LPTEST (LPAR #2)
   - ZVM5 (#3)
   - DVLP (#4)

   Noting the LPAR numbers is important; the information is used in a later step.

   In our example, the following LPARs need connections to each other:

```
LPPROD -> LPTEST

LPTEST -> LPPROD, LPTEST, ZVM5, DVLP

ZVM5   -> LPTEST, ZVM5, DVLP

DVLP   -> LPTEST, ZVM5, DVLP
```

Figure 1. Example LPAR Connectivity List

3. List all of the point to point connections resulting from the list made in step 2, omitting any duplicates (where A connecting to B is simply a duplicate of B connecting to A).

   In our example, figure Figure 2 on page 4 shows an example of the list with the duplicate entries removed.

```
LPPROD ->  LPTEST
LPTEST ->  LPTEST
ZVM5   ->  LPTEST
LPTEST ->  DVLP
ZVM5   ->  ZVM5
ZVM5   ->  DVLP
DVLP   ->  DVLP
```

Figure 2. LPAR Connectivity List (Duplicates Removed)

Keep in mind that one end of a CTC can have multiple "other ends", defined by additional control units (CUs) on the source channel. Each CU is "connected" to a specific destination LPAR, so if one LPAR needs to communicate with several others (including itself), there will be a CU for each destination LPAR.

4. To prepare CUs for all required connections, sort the point to point list from the previous step, grouping the connections for each source with all required destinations.

   In each example pair in Figure 3 below, consider the first LPAR to be the source.

```
LPTEST -> LPPROD
LPTEST -> LPTEST
LPTEST -> ZVM5
LPTEST -> DVLP

ZVM5   -> ZVM5
ZVM5   -> DVLP

DVLP   -> DVLP
```

Figure 3. Sorted LPAR Connection List

5. Each end of an EMIF CTC is one CHPID, so we now assign a CHPID to each end of the connections we have listed.

   In our example:

Table 1. CHPID Assignment

CHPID 20	**CHPID 30**
LPTEST	LPPROD
LPTEST	LPTEST
LPTEST	ZVM5
LPTEST	DVLP
ZVM5	ZVM5
ZVM5	DVLP
DVLP	DVLP

6. Looking at the chart we just created in Table 1, we see that on each CHPID there will be several connections to the destination LPARs, i.e. several CUs. We can now add these to the chart.

   First we will look at the CHPID 20 side. All CTCs defined on CHPID 20 are connected to a CTC on CHPID 30, and the target LPAR is defined by the CU number. We define a CU for each of the destination LPARs. Several source partitions can use the same CU, in order to contact one destination LPAR (for example, LPTEST and ZVM5 both use CU203 to contact ZVM5).

   Expanding on Table 1 on page 4, we have:

Table 2. CHPID Assignment With CU Numbers (CHPID 20)

CHPID 20	**CU Num**	**to**	**CHPID 30**
LPTEST	CU201	to	LPPROD
LPTEST	CU202	to	LPTEST
LPTEST	CU203	to	ZVM5
LPTEST	CU204	to	DVLP
ZVM5	CU203	to	ZVM5
ZVM5	CU204	to	DVLP
DVLP	CU204	to	DVLP

7. Now we will define CUs on the other CHPID. This time, the LPAR in the CHPID 30 column is the "source", and the other column is the "destination". Again, each destination LPAR gets a different CU.

Table 3. CHPID Assignment With CU Numbers (CHPID 20 and 30)

CHPID 20	**CU Num**	**to**	**CHPID 30**	**CU Num**
LPTEST	CU201	to	LPPROD	CU301
LPTEST	CU202	to	LPTEST	CU301
LPTEST	CU203	to	ZVM5	CU301
LPTEST	CU204	to	DVLP	CU301
ZVM5	CU203	to	ZVM5	CU302
ZVM5	CU204	to	DVLP	CU302
DVLP	CU204	to	DVLP	CU303

8. When defining the CUs in IOCP, each one will have a CUADD value. The CUADD value must be specified as the LPAR number of the destination LPAR. (The LPAR number used as the CUADD is the value specified for the destination LPAR in the RESOURCE statement of the IOCP).

   In order for two CUs to communicate, two conditions must be met:

   a. Each CU must have a CUADD value which specifies the LPAR number of the opposite end, and

b. the unit addresses at each end must be the same.

Using one IODEVICE statement shared by 2 or more LPARs will give each LPAR its own devices with the same device numbers and unitaddress values. If preferred, separate IODEVICE statements may be used, with differing unitaddress values, giving more flexibility in number of devices defined, and device numbers chosen.

We can now add CUADD and UNITADDR to Table 3 on page 5, so that each CU has a CUNUMBR, a CUADD, and a UNITADDR range.[1]

Table 4. CHPID Assignment With CU Numbers and CUADD/UNITADDR (C/U) Values.

Line #	CHPID 20	CU Num	C/U Addr	CHPID 30	CU num	C/U Addr
1	LPTEST	CU201	CUADD=1 00-1F	LPPROD	CU301	CUADD=2 00-1F
2	LPTEST	CU202	CUADD=2 00-1F	LPTEST	CU301	CUADD=2 00-1F
3	LPTEST	CU203	CUADD=3 00-1F	ZVM5	CU301	CUADD=2 00-1F
4	LPTEST	CU204	CUADD=4 00-1F	DVLP	CU301	CUADD=2 00-1F
5	ZVM5	CU203	CUADD=3 00-1F	ZVM5	CU302	CUADD=3 00-1F
6	ZVM5	CU204	CUADD=4 00-1F	DVLP	CU302	CUADD=3 00-1F
7	DVLP	CU204	CUADD=4 00-1F	DVLP	CU303	CUADD=4 00-1F

9. Once we have the information we have collected in this table, we can proceed to actually coding IOCP statements. We need one CHPID statement for each end of the CTC we are connecting, one CTLUNIT statement for each CU defined on each CHPID, and one IODEVICE statement to define the CTC devices on each CTLUNIT. (As mentioned above, it is possible to use more than one IODEVICE statement per CU, to get more flexibility in device numbers, however this also requires using different UNITADDR values on the IODEVICE statements and defining more unit addresses in the CU).

   First we will define the CHPIDS:

```
CTC20   CHPID PATH=20,PCHID=xxx,TYPE=CNC,            *
         SHARED     CNC SIDE:   ALLOW ALL LPARS ACCESS
CTC30   CHPID PATH=30,PCHID=yyy,TYPE=CTC,            *
         SHARED     CTC SIDE:   ALLOW ALL LPARS ACCESS
```

Figure 4. IOCP Macros for CHPID Definitions

[1] Line numbers in table used for reference in following text.

After the CHPIDS are defined, we need one CTLUNIT statement for each target partition, and an IODEVICE statement for the devices that CU will use. We will define them in sets, first for CHPID 20:

```
* CU201: CHP20 LINE 1, TO CU301 (CHP30, LINE 1)
  CNTLUNIT CUNUMBR=201,PATH=20,UNITADD=((00,32)),     *
           CUADD=1,UNIT=SCTC
  IODEVICE ADDRESS=(200,32),UNITADD=00,CUNUMBR=(201), *
           UNIT=SCTC,PART=(LPTEST)
```

Figure 5. IOCP Macros for CTLUNIT and IODEVICE (CU201)

Note that the IODEVICE statement includes PART=(LPTEST), because according to our table of CTC connections, only the LPTEST partition connects to LPPROD (as signified by CUADD=1) from CU201.

Next, we define CU202:

```
* CU202: CHP20 LINE 2, TO CU301 (CHP30, LINE 2)
  CNTLUNIT CUNUMBR=202,PATH=20,UNITADD=((00,32)),     *
           CUADD=2,UNIT=SCTC
  IODEVICE ADDRESS=(230,32),UNITADD=00,CUNUMBR=(202), *
           UNIT=SCTC,PART=(LPTEST)
```

Figure 6. IOCP Macros for CTLUNIT and IODEVICE (CU202)

Again, only one partition is using CU202. Note that CU201 is already using all device numbers from 200 to 21F, so these numbers are not available. We continue with CU203 as:

```
* CU203: CHP20 LINE 3, TO CU301 (CHP30 LINE 3)
*              LINE 5     CU302 (CHP30 LINE 5)
  CNTLUNIT CUNUMBR=203,PATH=20,UNITADD=((00,32)),     *
           CUADD=3,UNIT=SCTC
  IODEVICE ADDRESS=(250,32),UNITADD=00,CUNUMBR=(203), *
           UNIT=SCTC,PART=(LPTEST,ZVM5)
```

Figure 7. IOCP Macros for CTLUNIT and IODEVICE (CU203)

CU203 is used (in our table, above) by two partitions, LPTEST and ZVM5. We code this in the IOCP by defining the IODEVICE statement with the PART= keyword listing both partitions.

Completing the CHPID 20 definitions, we code:

```
* CU204: CHP20 LINE 4, TO CU301 (CHP30 LINE 4)
*              LINE 6     CU302 (CHP30 LINE 6)
*              LINE 7     CU303 (CHP30 LINE 7)
  CNTLUNIT CUNUMBR=204,PATH=20,UNITADD=((00,32)),     *
           CUADD=4,UNIT=SCTC
  IODEVICE ADDRESS=(280,32),UNITADD=00,CUNUMBR=(204), *
           UNIT=SCTC,PART=(LPTEST,ZVM5,DVLP)
```

Figure 8. IOCP Macros for CTLUNIT and IODEVICE (CU204)

10. The second CHPID needs its own definitions, also as defined in Table 4 on page 6 above:

```
* CU301: CHP30 LINE 1, TO CU201 (CHP20 LINE 1)
*              LINE 2     CU202 (CHP20 LINE 2)
*              LINE 3     CU203 (CHP20 LINE 3)
*              LINE 4     CU204 (CHP20 LINE 4)
  CNTLUNIT CUNUMBR=301,PATH=30,UNITADD=((00,32)),     *
           CUADD=2,UNIT=SCTC
  IODEVICE ADDRESS=(300,32),UNITADD=00,CUNUMBR=(301), *
           UNIT=SCTC,PART=(LPPROD,LPTEST,ZVM5,DVLP)
```

Figure 9. IOCP Macros for CTLUNIT and IODEVICE (CU301)

As we saw in Table 4 on page 6, there are four LPARs using CU301 to communicate with LPTEST (CUADD=2).

We continue with CU302:

```
* CU302: CHP30 LINE 5, TO CU203 (CHP20 LINE 5)
*              LINE 6     CU204 (CHP20 LINE 6)
  CNTLUNIT CUNUMBR=302,PATH=30,UNITADD=((00,32)),     *
           CUADD=3,UNIT=SCTC
  IODEVICE ADDRESS=(330,32),UNITADD=00,CUNUMBR=(302), *
      UNIT=SCTC,PART=(ZVM5,DVLP)
```

Figure 10. IOCP Macros for CTLUNIT and IODEVICE (CU302)

And finally, CU303:

```
* CU303: CHP30 LINE 7, TO CU204 (CHP20 LINE 7)
  CNTLUNIT CUNUMBR=303,PATH=30,UNITADD=((00,32)),     *
           CUADD=4,UNIT=SCTC
  IODEVICE ADDRESS=(380,32),UNITADD=00,CUNUMBR=(303), *
      UNIT=SCTC,PART=(DVLP)
```

Figure 11. IOCP Macros for CTLUNIT and IODEVICE (CU303)

11. At this point we have completed our definitions of all of the connections in our table. Since each line defined a needed connection between a given LPAR and another (or itself), our IOCP definitions now enable those connections.

    The result of our example definitions is:

Table 5. LPAR and Device Connections Defined by Example IOCP

Line #	**LPAR**	**Device**	**to**	**LPAR**	**Device**
1	LPTEST	200-21F	to	LPPROD	300-31F
2	LPTEST	230-24F	to	LPTEST	300-31F
3	LPTEST	250-26F	to	ZVM5	300-31F
4	LPTEST	280-29F	to	DVLP	300-31F
5	ZVM5	250-26F	to	ZVM5	330-34F
6	ZVM5	280-29F	to	DVLP	330-34F
7	DVLP	280-29F	to	DVLP	380-39F

Conclusion

As we stated earlier, each ESCON CTC is:

- between two CUs where each is defined with the CUADD of the destination partition it should connect to, and
- the individual devices connected are those with identical unit addreses.

Consulting the IBM documentation, particularly SB10-7034 (*zSeries 900 ESCON Channel-to-Channel Reference*) is recommended to understand this topic further.

Acknowledgements

When I recently was faced with the need to set up CTC connections between various LPARs, including loopback to the same LPAR, I found very quickly that my intuitive solution was a total failure.

I asked for assistance on the VMESA-L Internet discussion group, where the wonderful community of VM system programmers quickly put me on the right track. I would like to express my gratitude to this group, its members and administrators, for all of the help I have received over the years.

It is my pleasure and privilege to share my new understanding of ESCON CTCs with the community at large.

I also thank David Boyes for volunteering to convert my writeup into this nicely formatted document.

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