

IBM eServer™

**Enterprise Extender and SNA: EE
Connectivity test**

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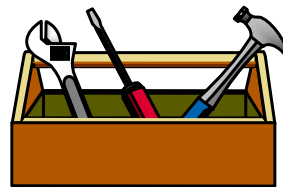
Diagnosing Enterprise Extender connectivity problems

➤ Diagnosing EE problems, at times may

- Be time consuming

- Require the use of various tools/traces:
 - VTAM® displays
 - D EE
 - D EEDIAG
 - TCP/IP displays
 - NETSTAT displays
 - VTAM VIT trace
 - TCP/IP traces
 - CTRACE
 - Packet trace
 - Sniffer traces

- Require the interaction of various groups
 - Data center support
 - Router/Firewall support



➤ Need an end-to-end diagnostic tool

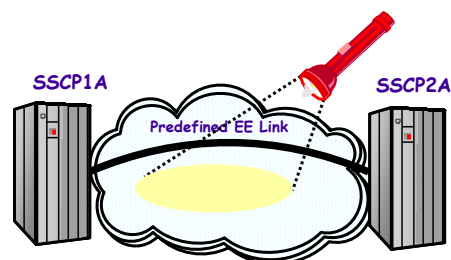
Sample EE connectivity failure

>V NET,DIAL,ID=SWPU1A2A

```
IST097I VARY ACCEPTED
..
IST1411I INOP GENERATED FOR LNIP1
IST1430I REASON FOR INOP IS XID OR LDLC COMMAND TIMEOUT
IST314I END
```

>V1R8 implements a new variation of the **DISPLAY EEDIAG** command

- D NET,EEDIAG,TEST=YES
 - Test existing EE connection or
 - Test a new EE connection which will not establish
- Provides end-to-end connectivity test
- Provides an EE equivalent to TCP/IP TRACERTE



New Enterprise Extender connectivity test command in V1R8

➤ EE connectivity test validates the following:

- 1 EE XCA major node active
- 2 IUTSAMEH connectivity is established
 - VTAM-to-TCP/IP communications path
- 3 Line availability
- 4 Hostname resolution capability when using hostname filters
- 5 EE partner reachability
 - IP routing exists to destination
 - Active interfaces/devices
 - Tests all 5 UDP ports (12000-12004)
 - Provides information about each IP hop
 - MULTIPATH support
 - Tests all active interfaces

```
>>-DISPLAY NET,EEDIAG---,TEST=YES-->

.-,LIST=SUMMARY-.
>+-----+
+-,LIST=SUMMARY-+
'-.LIST=DETAIL--'

.-,MAXTIME=60-----.
>+-----+
'-.MAXTIME=maxtime--'

>---| EEDIAG command filters|-----<
```

Enterprise Extender connectivity test - command syntax details

NOTES

EEDIAG Command Filters:

Limit the D EEDIAG command scope to one EE connection identified by LINE or PU name.

```
>>- ,ID=name-----><
```

name represents either an Enterprise Extender LINE or switched PU which has an active EE connection.

Limit the D EEDIAG command scope to EE connections identified by IPADDR.

```
>>--- ,IPADDR=--+local_ipaddr+-----><
|           '-,HOSTNAME=(,remote_hostname)-' |
+-(local_ipaddr)+-----+
|           '-,HOSTNAME=(,remote_hostname)-' |
+-(local_ipaddr,remote_ipaddr)-----+
'|-(,remote_ipaddr)-----'
```

Limit the D EEDIAG command scope to EE connections that are identified by HOSTNAME:

```
>>--- ,HOSTNAME=--+local_hostname+-----><
|           '-,IPADDR=(,remote_ipaddr)-' |
+-(local_hostname)+-----+
|           '-,IPADDR=(,remote_ipaddr)-' |
+-(local_hostname,remote_hostname)-----+
'|-(,remote_hostname)-----'
```

Enterprise Extender connectivity test - Firewall considerations

➤ EE connectivity test expects ICMP messages to be returned from intermediate hops

- Just as the IP traceroute function does

➤ Firewall configurations may have limited diagnostic output

- Firewalls may be configured to block ICMP messages
 - Intermediate hops past firewall will appear as non-responsive
 - Minimally configure firewall to allow ICMP "Time Exceeded"
 - IPv4: ICMP Message Type 11
 - IPv6: ICMPv6 Message Type 3
- Firewalls may be configured to block UDP traffic
 - Firewalls must allow UDP traffic for EE UDP ports 12000 - 12004
 - Test probe response may route through firewall
 - Probe response is not an ICMP message, it is a UDP datagram

Enterprise Extender connectivity test - Firewalls - notes

NOTES

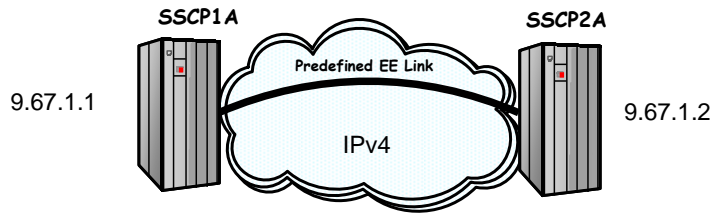
➤ Enterprise Extender connections which route through firewalls may have limited diagnostic output. The EE connectivity test requires that ICMP messages be returned to diagnostic probe commands which are sent to each hop in the EE route. If firewalls are configured such that ICMP messages are blocked, the output will look as though each hop past the firewall is nonresponsive to the test probe. In some case, the EE connectivity test will time out due to the maximum time allowed for the test to be performed (MAXTIME). In other cases, if the test probe reaches the EE partner and the partner supports the EE connectivity test, the diagnostic output will validate partner reachability and should provide the number of hops to the partner node. For the EE connectivity test to yield usable results when firewalls are being employed, then minimally the firewalls must be configured to allow ICMP "time exceeded" error messages to be returned.

➤ Modern firewalls allow filtering of ICMP messages based on the message type. This allows you the flexibility to only open up the firewalls for specific ICMP messages in order to have the EE connectivity test function. Allowing all ICMP messages to pass through firewalls may allow the EE connectivity test to provide more diagnostic information. To allow the EE connectivity test to provide you with the more diagnostic information, open your firewalls to allow the following ICMP messages to be returned:

IPv4 protocol: Type 3 - "Destination Unreachable"
Type 4 - " Source Quench"
Type 11 - " Time Exceeded"
Type 12 - " Parameter Problem"

IPv6 protocol: Type 1 - "Destination Unreachable"
Type 2 - " Packet too big"
Type 3 - " Time Exceeded"
Type 4 - " Parameter Problem"

Example #1 - Successful single hop EE connectivity test - SSCP1A definitions



```

XCAIP  VBUILD TYPE=XCA
PORTIP  PORT  MEDIUM=HPRIP,
          LIVTIME=( 25,3600),
          SRQTIME=15,
          SRQRETRY=3
*
GPIP    GROUP DIAL=YES,
          ANSWER=ON,
          ISTATUS=INACTIVE,
          IPADDR=9.67.1.1,
          CALL=INOUT
LNIP1   LINE
PUIP1   PU
LNIP2   LINE
PUIP2   PU
  
```

```

TOIP2A  VBUILD TYPE=SWNET
*
SWP1A2A PU  ADDR=01,
            CFCP=YES,
            CPNAME=SSCP2A,
            CONNTYPE=APPN,
            NETID=NETA,
            PUTYPE=2
PATH1A2A PATH GRPNM=GPIP,
            IPADDR=9.67.1.2
  
```


Example #1 (cont.) - Successful single hop EE connectivity test

➤ D NET,EEDIAG,TEST,ID=SWPU1A2A

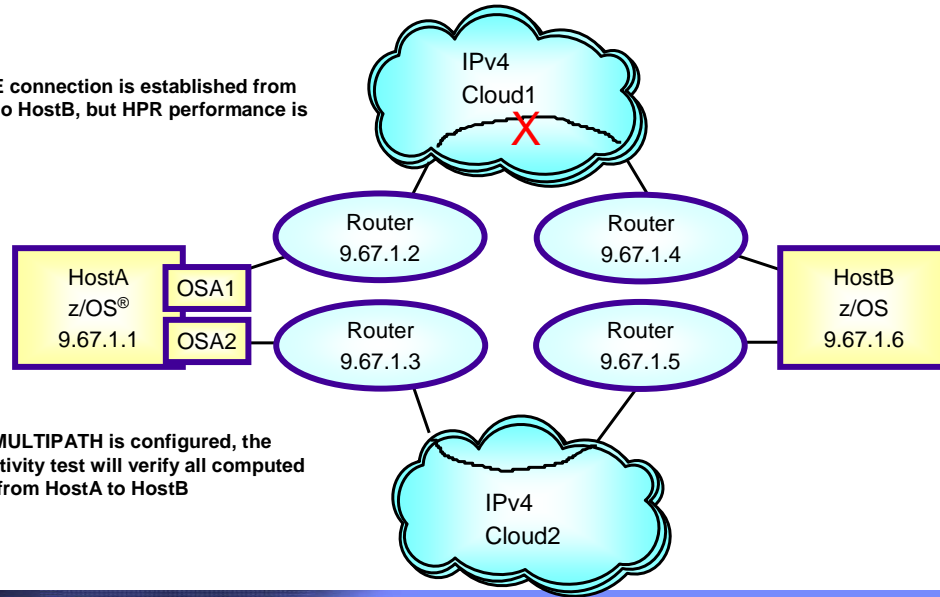
```
IST097I DISPLAY ACCEPTED
IST350I DISPLAY TYPE = EEDIAG
IST2119I ENTERPRISE EXTENDER DISPLAY CORRELATOR: EE00000A
IST2067I EEDIAG DISPLAY ISSUED ON 11/22/05 AT 21:07:27
IST1680I LOCAL IP ADDRESS 9.67.1.1
IST1680I REMOTE IP ADDRESS 9.67.1.2
IST2023I CONNECTED TO LINE LNIP2
IST2126I CONNECTIVITY TEST IN PROGRESS
IST314I END
.
.
```

Example #1 (cont.) - Successful single hop EE connectivity test

```
IST350I DISPLAY TYPE = EEDIAG
IST2130I ENTERPRISE EXTENDER CONNECTIVITY TEST INFORMATION
IST2119I ENTERPRISE EXTENDER DISPLAY CORRELATOR: EE00000A
IST2131I EEDIAG DISPLAY COMPLETED ON 11/22/05 AT 21:07:27
IST2132I LDLC PROBE VERSIONS: VTAM = V1          PARTNER = V1
IST1680I LOCAL IP ADDRESS 9.67.1.1
IST1680I REMOTE IP ADDRESS 9.67.1.2
IST924I -----
IST2133I INTFNAME: LTRLE1A          INTFTYPE: MPCPTP
IST2134I CONNECTIVITY SUCCESSFUL          PORT: 12000
IST2137I 1 9.67.1.2          RTT: 6
IST2134I CONNECTIVITY SUCCESSFUL          PORT: 12001
IST2137I 1 9.67.1.2          RTT: 6
IST2134I CONNECTIVITY SUCCESSFUL          PORT: 12002
IST2137I 1 9.67.1.2          RTT: 6
IST2134I CONNECTIVITY SUCCESSFUL          PORT: 12003
IST2137I 1 9.67.1.2          RTT: 6
IST2134I CONNECTIVITY SUCCESSFUL          PORT: 12004
IST2137I 1 9.67.1.2          RTT: 7
IST924I -----
IST2139I CONNECTIVITY TEST RESULTS DISPLAYED FOR 1 INTERFACES
IST314I END
.
```

Example #2 - EE connectivity test with MULTIPATH

➤ IPv4 EE connection is established from HostA to HostB, but HPR performance is poor



➤ When MULTIPATH is configured, the connectivity test will verify all computed routes from HostA to HostB

Example #2 (cont.) - EE connectivity test with MULTIPATH

> D NET,EEDIAG,TEST=YES,IPADDR=(9.67.1.1,9.67.1.6),LIST=DETAIL

```
IST097I DISPLAY ACCEPTED
IST350I DISPLAY TYPE = EEDIAG
IST2119I ENTERPRISE EXTENDER DISPLAY CORRELATOR: EE00000E
IST2067I EEDIAG DISPLAY ISSUED ON 10/04/05 AT 11:05:50
IST1680I LOCAL IP ADDRESS 9.67.1.1
IST1680I REMOTE IP ADDRESS 9.67.1.6
IST2023I CONNECTED TO LINE LN11
IST2126I CONNECTIVITY TEST IN PROGRESS
IST314I END
.
.
```

Example #2 (cont.) - EE connectivity test with MULTIPATH

```

IST350I DISPLAY TYPE = EEDIAG
IST2130I ENTERPRISE EXTENDER CONNECTIVITY TEST INFORMATION
IST2119I ENTERPRISE EXTENDER DISPLAY CORRELATOR: EE00000E
IST2131I EEDIAG DISPLAY COMPLETED ON 10/04/05 AT 11:05:52
IST2132I LDLC PROBE VERSIONS: VTAM = V1 PARTNER = V1
IST1680I LOCAL IP ADDRESS 9.67.1.1
IST1680I REMOTE IP ADDRESS 9.67.1.6
IST924I -----
IST2133I INTFNAME: OSA1          INTFTYPE: OSAPDDI
IST2135I CONNECTIVITY UNSUCCESSFUL  SENSE: ***NA***  PORT: 12000
IST2137I   1 9.67.1.2              RTT: 2
IST2137I   2 9.67.1.21             D-1 RTT: 3
IST2135I CONNECTIVITY UNSUCCESSFUL  SENSE: ***NA***  PORT: 12001
IST2137I   1 9.67.1.2              RTT: 2
IST2137I   2 9.67.1.21             D-1 RTT: 3
IST2135I CONNECTIVITY UNSUCCESSFUL  SENSE: ***NA***  PORT: 12002
IST2137I   1 9.67.1.2              RTT: 2
IST2137I   2 9.67.1.21             D-1 RTT: 4
IST2135I CONNECTIVITY UNSUCCESSFUL  SENSE: ***NA***  PORT: 12003
IST2137I   1 9.67.1.2              RTT: 2
IST2137I   2 9.67.1.21             D-1 RTT: 4
IST2135I CONNECTIVITY UNSUCCESSFUL  SENSE: ***NA***  PORT: 12004
IST2137I   1 9.67.1.2              RTT: 2
IST2137I   2 9.67.1.21             D-1 RTT: 3

```

Example #2 (cont.) - OSA1 output description

NOTES

```
IST2137I hop ipv4address flags RTT: time
```

This message displays information gathered during the EE connectivity test over an IPv4 route using the OSA1 adaptor. Take the following IST2137I message from the previous display:

```
IST2137I 2 9.67.1.21 D-1 RTT: 3
```

2 is the TTL *hop* count used in the LDLC probe command.
9.67.1.21 is the source IPv4 address (*ipv4addr*) from the ICMP response.

In this case, the flags field (D-1 in this example) has a format of *t-ccc*.
Where *t* is a representative character of the ICMP message type returned in response to the LDLC probe and *ccc* represents the specific code associated with the ICMP message type.

The ICMP message type is displayed as one of the following:

D - "Destination Unreachable"	ICMP Type 3
P - "Parameter Problem"	ICMP Type 12
Q - "Source Quench"	ICMP Type 4

Hop 2 returned an ICMP message type 3 with a specific code of 1 in response to the EE probe. Message IST2137I indicates this by displaying the *flags* field as D-1. For a list of the ICMP types and codes, see Appendix E in the z/OS Communications Server: IP System Administrator's Commands, "ICMP/ICMPv6 types and codes".

time is the round trip time for the LDLC probe to be sent to the TTL hop, and for an ICMP response to be received. In this example, the round trip time is 3 milliseconds.

Example #2 (cont.) - EE connectivity test with MULTIPATH

```

IST924I -----
IST2133I INTFNAME: OSA2          INTFTYPE: OSAFDDI
IST2134I CONNECTIVITY SUCCESSFUL          PORT: 12000
IST2137I 1 9.67.1.3                RTT: 9
IST2137I 2 9.67.1.11               RTT: 14
IST2137I 3 9.67.1.12               RTT: 19
IST2137I 4 9.67.1.5                 RTT: 23
IST2137I 5 9.67.1.6                 RTT: 27
IST2134I CONNECTIVITY SUCCESSFUL          PORT: 12001
IST2137I 1 9.67.1.3                RTT: 8
IST2137I 2 9.67.1.11               RTT: 14
IST2137I 3 9.67.1.12               RTT: 17
IST2137I 4 9.67.1.5                 RTT: 21
IST2137I 5 9.67.1.6                 RTT: 25
.
.
IST2134I CONNECTIVITY SUCCESSFUL          PORT: 12004
IST2137I 1 9.67.1.3                RTT: 7
IST2137I 2 9.67.1.11               RTT: 11
IST2137I 3 9.67.1.12               RTT: 12
IST2137I 4 9.67.1.5                 RTT: 17
IST2137I 5 9.67.1.6                 RTT: 23
IST924I -----
IST2039I CONNECTIVITY TEST INFORMATION DISPLAYED FOR 2 INTERFACES
IST314I END

```

Example #2 (cont.) - OSA2 output description

NOTES

```
IST2137I  hop  ipv4address      flags  RTT:  time
```

This message displays information gathered during the EE connectivity test over an IPv4 route using the OSA2 adaptor. Take the following IST2137I message from the previous display:

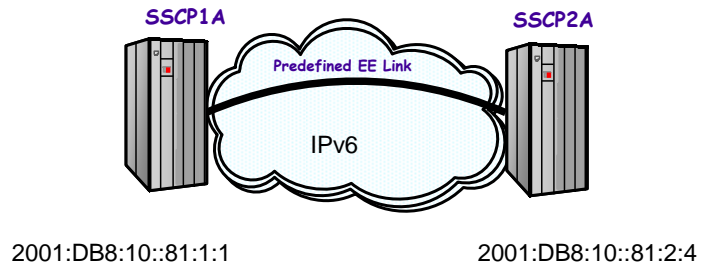
```
IST2137I  5  9.67.1.6              RTT:  27
```

5 is the TTL *hop* count used in the LDLC probe command. In this case, the EE connectivity test was successful over each of the 5 EE ports. Each IST2137I message indicating it was a 5 hop route to reach the EE partner with an IPv4 address of 9.67.1.6.

In this case, the flags field is blank as there were not any probe retries or any unexpected ICMP messages returned.

time is the round trip time for the LDLC probe to be sent to the TTL hop, and for the LDLC probe response (UDP datagram) to be received from the EE partner. In this example, the round trip time is 27 milliseconds.

Example #3 - EE IPv6 connectivity test with timeout



- IPv6 EE connection cannot be established from SSCP1A to SSCP2A
- z/OS CS release on SSCP2A is pre-V1R8 level without the EE LDLC probe command support

Example #3 (cont.) - EE IPv6 connectivity test with timeout

➤ D NET,EEDIAG,TEST=YES,,HN=(IP.SSCP1AV6,IP.SSCP2AV6),LIST=DETAIL

```
IST097I DISPLAY ACCEPTED
IST350I DISPLAY TYPE = EEDIAG
IST2119I ENTERPRISE EXTENDER DISPLAY CORRELATOR: EE00001F
IST2067I EEDIAG DISPLAY ISSUED ON 11/23/05 AT 08:15:30
IST2120I HOSTNAME RESOLUTION IN PROGRESS
IST314I END
```

```
IST350I DISPLAY TYPE = EEDIAG
IST2119I ENTERPRISE EXTENDER DISPLAY CORRELATOR: EE00001F
IST2121I HOSTNAME RESOLUTION COMPLETE
IST1680I LOCAL IP ADDRESS 2001:DB8:10::81:1:1
IST1910I LOCAL HOSTNAME IP.SSCP1AV6
IST1680I REMOTE IP ADDRESS 2001:DB8:10::81:2:4
IST1909I REMOTE HOSTNAME IP.SSCP2AV6
IST2023I CONNECTED TO LINE LNEE6000
IST2126I CONNECTIVITY TEST IN PROGRESS
IST314I END
```

Example #3 (cont.) - EE IPv6 connectivity test with timeout

```

IST350I DISPLAY TYPE = EEDIAG
IST2130I ENTERPRISE EXTENDER CONNECTIVITY TEST INFORMATION
IST2119I ENTERPRISE EXTENDER DISPLAY CORRELATOR: EE00001F
IST2131I EEDIAG DISPLAY COMPLETED ON 11/23/05 AT 08:16:30
IST2132I LDLC PROBE VERSIONS: VTAM = V1          PARTNER = UNKNOWN
IST1680I LOCAL IP ADDRESS 2001:DB8:10::81:1:1
IST1680I REMOTE IP ADDRESS 2001:DB8:10::81:2:4
IST924I -----
IST2133I INTFNAME: MPC6221          INTFTYPE: MPCPTP6
IST2135I CONNECTIVITY UNSUCCESSFUL  SENSE: ***NA***  PORT: 12000
IST2136I CONNECTIVITY TEST ENDED - MAXIMUM TIME LIMIT EXCEEDED
IST2138I 1 *                          (3)  RTT: *N/A*
IST2138I 7 *                          (2)  RTT: *N/A*
IST2135I CONNECTIVITY UNSUCCESSFUL  SENSE: ***NA***  PORT: 12001
IST2136I CONNECTIVITY TEST ENDED - MAXIMUM TIME LIMIT EXCEEDED
IST2138I 1 *                          (3)  RTT: *N/A*
IST2138I 7 *                          (2)  RTT: *N/A*
.
IST2135I CONNECTIVITY UNSUCCESSFUL  SENSE: ***NA***  PORT: 12004
IST2136I CONNECTIVITY TEST ENDED - MAXIMUM TIME LIMIT EXCEEDED
IST2138I 1 *                          (3)  RTT: *N/A*
IST2138I 7 *                          (2)  RTT: *N/A*
IST924I -----
IST2139I CONNECTIVITY TEST RESULTS DISPLAYED FOR 1 INTERFACES
IST314I END

```

Example #3 (cont.) - Timeout example description

IST2138I *hop ipv6address* *flags* RTT: *time*
 This message displays information gathered during the EE connectivity test over an IPv6 route using interface MPC6221. Take the following IST2138I messages from the previous display:

```
IST2138I 1 *           (3) RTT: *N/A*
IST2138I 7 *           (2) RTT: *N/A*
```

NOTES

hop is the TTL hop count used in the LDLC probe command. To reduce repetitive information in the detailed display, when a TTL hop is unresponsive to the LDLC probe, IST2138I is only displayed for the first unresponsive hop and the last unresponsive hop. In these cases, all hops in between were also unresponsive to the LDLC probe command. In this example, it is really only a one hop route to the partner node. The EE test command makes 3 attempts for each TTL hop. When no response is received after the third attempt, the TTL hop count is incremented by 1, and the process repeats. In our case, the 60 second MAXTIME limit allowed the EE test to increment the TTL hop count to 7.

ipv6addr is the source IPv6 address from the ICMPv6 response. In this case, the source IPv6 address is displayed as * since the TTL hop did not respond to the LDLC probes.

flags is an optional field. In this case the flags field has the format of (a). Where a represents the number LDLC probe attempts, if more than one. In our examples above, 3 probe attempts were made for hop 1 through hop 6. The MAXTIME expired, only allowing us to make 2 probe attempts for hop 7. In all, 20 LDLC probe attempts were issued across each port to test for EE connectivity.

time is the round trip time for the LDLC probe to be sent to the TTL hop, and for an ICMPv6 response or an LDLC probe response to be received. In this case, the round trip time displays as *N/A* since no response was received to the probes.

EE connectivity test support - new MAXEETST start option

➤ New start option - MAXEETST

- Governs the number of concurrent EE connectivity tests that are allowed
 - Specifies the maximum number of Enterprise Extender connectivity tests (D NET,EEDIAG,TEST=YES command) which are allowed to run concurrently. When this maximum is reached, all subsequent EE connectivity tests are rejected until some of the previous test commands complete processing. If the current value of the MAXEETST is not appropriate for your system, you can modify the MAXEETST value by using the MODIFY VTAMOPTS command.
- Once maximum limit is exceeded, new EE connectivity test requests are rejected
 - IST2144I CONNECTIVITY TEST REJECTED - MAXEETST LIMIT EXCEEDED
- Can be modified

```

.-MAXEETST=500-----
>>+-----+-----><
'-MAXEETST=max_ee_connectivity_tests-----'

range:          1-1000

```

Things to think about

- **EE Test requires an available line for each connection to be tested.**
 - May need to increase number of defined lines to accommodate the number of concurrent tests

- **MAXEETST start option**
 - Default is 500
 - May want to limit number of concurrent tests due to line availability

- **EE Test probe "responder" support**
 - z/OS Communications Server below V1R8 level
 - Requires PTF for TCP/IP APAR PK17858
 - PTFs available for V1R4, V1R5, V1R6 and V1R7
 - Distributed platforms
 - See z/OS New Function Summary manual



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