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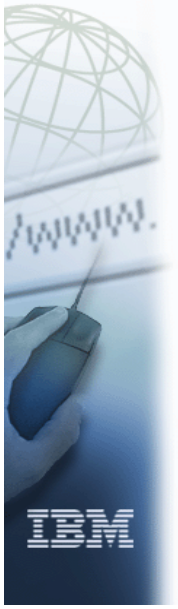

JES2 and JES3 Networking with TCP/IP

Redbooks

International Technical Support Organization

Trademarks

eNetwork	DFSMS/MVS	IMS	RACF
geoManager	DFSMSdfp	IMS/ESA	RMF
AD/Cycle	DFSMSdss	IP PrintWay	RS/6000
ADSTAR	DFSMShsm	IPDS	S/390
AFP	DFSMSrmm	Language Environment	S/390 Parallel Enterprise Server
APL2	DFSORT	Multiprise	SecureWay
APPN	Enterprise System 3090	MQSeries	StorWatch
BookManger	Enterprise System 4381	MVS/ESA	Sysplex Timer
BookMaster	Enterprise System 9000	Network Station	System/390
C/370	ES/3090	NetSpool	SystemView
CallPath	ES/4381	OfficeVision/MVS	SOM
CICS	ES/9000	Open Class	SOMobjects
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Domino (Lotus Development Corporation)
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Tivoli (Tivoli Systems Inc.)
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JES Networking Requirements

- Currently JES supports NJE over SNA and BSC networks
- TCP/IP is the standard for networking today
- VM (RSCS), AS/400, and VSE/POWER all have NJE over TCP/IP
- Solutions involving SNA over IP (such as Enterprise Extender) have fallen short due to
  - Performance (SNA architecture overhead)
  - Interoperability
- New way to send and receive data with:
  - TCP/IP (this is new support for JES in z/OS V1R7)

TCP/IP Protocol for NJE

- Supports established TCP/NJE protocol
- Enhancements to protocol is also included for:
  - IPv6 connections
  - Enhanced security (SSL/TLS)
  - Large LRECL SYSIN data streams up to 32K
- Overall better RAS characteristic is designed in
  - Fewer outages than current NJE
  - Better performance

Networking Via TCP/IP

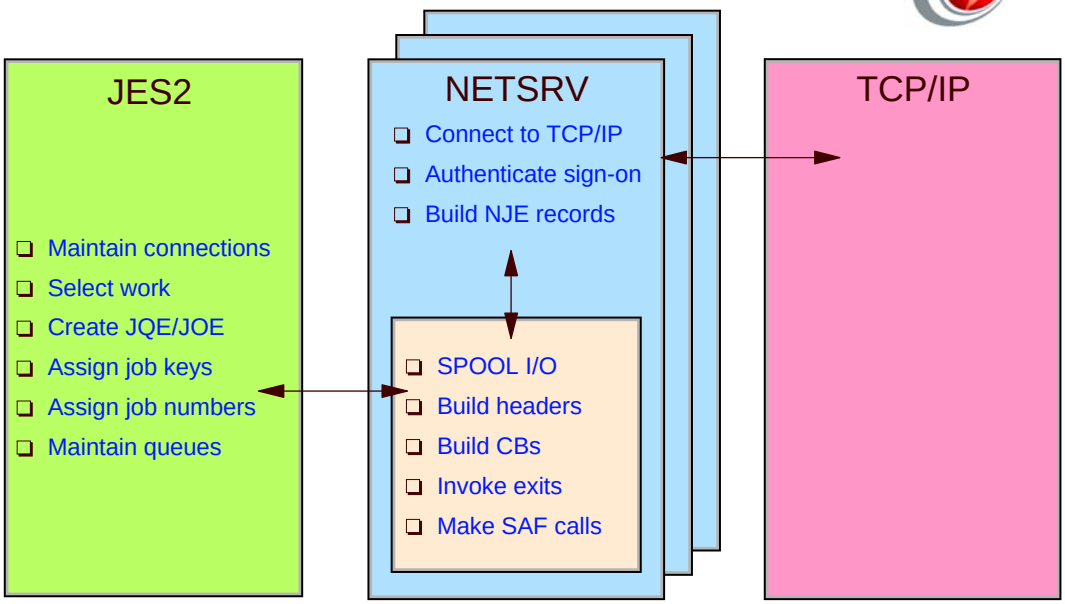
- To send data from one NJE node to another via TCP
  - A virtual circuit is established between the two nodes
    - A virtual circuit is a path between two applications over which TCP packets may be sent
    - An IP address is assigned to a system
    - Each TCP/IP service machine has an IP address

Networking with TCP/IP

- Commands to start/stop network devices similar to SNA
- NETSERVs can bind to all defined IP addresses or a specific address
- Supports multiple stacks, VIPA, sysplex distributor
- TLS/SSL support is available using the TCP/IP transparent TLS support

SNA	NJE/TCP	Description
LOGON	NETSERV	Represents a NJE/TCP address space
APPL	SOCKET	Maps an NJE node name to a TCP/IP address (either explicit or a name)
LINE	LINE	Logical connection

Address Spaces for TCP/IP NJE



- $S NETSRVnnn– Starts NETSRV address space
- Address space name is jesxSnnn

NETSRV Statement

NETSRV(nnn) SOCKET=,STACK=,
TRACEIO=(JES=NO,COMMON=NO,VERBOSE=NO)

nnn=(1-999)

- SOCKET= - points to SOCKET(xxxxxxxx) statement defining the local node's IP address and port
- STACK= - indicates a specific TCP/IP stack to use.
- TRACE =
  - JES=YES/NO – traces communication within JES (between JES and NETSRVx address space), and from JES to the common code
  - COMMON=YES/NO – traces events and communication within the common component (such as TCP/IP API calls)
  - VERBOSE=YES/NO – issues additional messages to console/SYSLOG for diagnostics on live system

SOCKET Statement

```
SOCKET(LOCAL) IPADDR=*LOCAL,PORT=,
SECURE=NO,LINE=0,NODE=2,REST=0,NETSRV=
```

- IPADDR= - the IP address associated with the socket definition
  - Can specify name (chicago.ibm.com), IPv4 or IPv6
  - *LOCAL indicates all IP addresses associated with this system
- PORT= - the port associated with the socket definition
  - Default is 175 if SECURE=NO, 2252 if SECURE=YES
- SECURE=YES/NO – whether to use SSL/TLS
- NODE= - the associated node
- LINE= - a dedicated line
- NETSRV= - the NETSRV to use when establishing a connection to this IP address/port
- REST= - the resistance associated with the socket

LINE Statement

- LINE statement
  - Maximum line number increased from 32767 to 65535
  - UNIT=TCP – defines line as TCP/IP line
  - TRACE =
    - JES=YES/NO – traces communication within JES2 (between JES2 and NETSRV address space), and from JES2 to the common code
    - COMMON=YES/NO – traces events and communication within the common component (such as TCP/IP API calls)
    - VERBOSE=YES/NO – issues additional messages to console/SYSLOG for diagnostics on live system

TCP/IP NJE Statements

NETSRV statement

```
NETSRV1     SOCKET=(LOCAL),STACK=,
              TRACEIO=(JES=NO,COMMON=NO,VERBOSE=NO)
```

SOCKET statement

```
SOCKET(LOCAL)      IPADDR=*LOCAL,PORTNAME=VMNET,
                   SECURE=NO,LINE=0,NODE=2,REST=0,
                   NETSRV=0
SOCKET(OTHER)      IPADDR=9.117.234.95,PORTNAME=VMNET,
                   SECURE=NO,LINE=0,NODE=82,REST=0,
                   NETSRV=0
```

LINE statement

```
LINE12      UNIT=TCP,STATUS=DRAINED,LOG=NO,
            PASSWORD=(NOTSET),REST=0,TRACEIO=(JES=NO,
            COMMON=NO,VERBOSE=NO),JRNUM=DEFAULT,
            JTNUM=DEFAULT,SRNUM=DEFAULT,STNUM=DEFAULT
```


JES2 NJE NODE Statement Changes

- NJE node definitions are now MAS scope
  - Changes on one member reflected on others
  - Data is stored in the JES2 checkpoint
  - Applies to NAME=, SUBNET=, PATHMGR=, ENDNODE=, PRIVATE=, and DIRECT=
  - Init deck changes accepted when other members active
    - Warning message if incompatible, option to continue or terminate

JES2 Commands for NODEs

- Change node names when node is active (no restart)
  - $TNODE(nodename),NAME=newname
    - Indicates node is renamed, not redefined
  - Applies to local node name as well (was all-member warm start)
- Change maximum node number via command
  - $T NJEDEF,NODENUM= (was all member warm start)
  - Value can only be increased

NJE Security Changes

- Support for SSL/TLS to be included in NJE over TCP/IP
  - Application Transparent TLS support in Z/OS 1.7 (AT-TLS) used
    - All definitions for SSL/TLS are in TCP/IP policy definitions, not JES definitions
    - Future standards for TLS will automatically be supported
  - Only JES2 control is SECURE=YES/NO on SOCKET statement

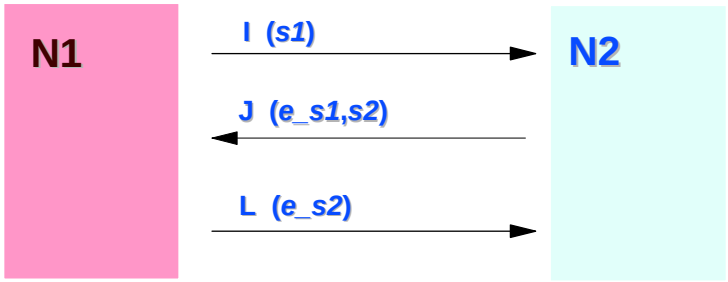
NJE Secure Signon

- Secure form of NJE sign-on now supported
  - Exchanges DES-encrypted passwords in I/J sign-on records
  - Controlled by SIGNON=SECURE|COMPAT on NODE statement
  - Uses APPCLU class in RACF/SAF
    - Entity is NJE.node1.node2
    - Uses SESSKEY associated with profile for encryption
  - Can be used by SNA or BSC nodes as well as TCP/IP

NJE Secure Signon

```
RDEFINE APPCLU NJE.N1.N2
    SESSION(SESSKEY(key))
    UACC(NONE)
SETROPTS CLASSACT(APPCLU)
```

```
RDEFINE APPCLU NJE.N2.N1
    SESSION(SESSKEY(key))
    UACC(NONE)
SETROPTS CLASSACT(APPCLU)
```



Commands for TCP/IP NJE

- $ADD NETSRVnnn – creates a new NETSRV device
- $T NETSRVnnn – change attributes of NETSRV
- $S NETSRVnnn– Starts NETSRV address space
  - Address space name is *jesx*S*nnn*
  - NETSRVnnn SOCKET= - defines IP addr/port of this node
- $P NETSRVnnn – Drains NETSRV address space
- $E NETSRVnnn – Resets connections in NETSRV address space
- $ADD SOCKET(*socket*) – Creates a new socket definition
- $T SOCKET(*socket*) – modify attributes of socket
  - $SN,S=*socket* – Start networking with specified socket
    - $SN,N=*nodename* – if NODE(*nodename*) LINE= points to TCP/IP line

Defining TCP/IP NJE with JES3

```
EJES510 USER-VAINI---/*F NETSERV,ADD=JES3NS
*F NETSERV,ADD=JES3NS
IAT8162 ADD    COMPLETE FOR NETSERV JES3NS
*I NETSERV=JES3NS
IAT8707 NETSERV INQUIRY RESPONSE 936
INFORMATION FOR NETSERV JES3NS
  SYSTEM=, HOST=, PORT=    0, STACK=, JTRACE=NO,
VTRACE=NO,
  ITRACE=NO, ACTIVE=NO
  SOCKETS DEFINED IN THIS NETSERV
  NONE
END OF NETSERV INQUIRY RESPONSE
```

Defining TCP/IP NJE with JES3

```
*F NETSERV=JES3NS HOSTNAME=9.12.4.48
IAT8162 MODIFY COMPLETE FOR NETSERV
JES3NS

*I NETSERV=JES3NS
IAT8707 NETSERV INQUIRY RESPONSE 942
INFORMATION FOR NETSERV JES3NS
  SYSTEM=, HOST=9.12.4.48, PORT=    0, STACK=,
JTRACE=NO,
  VTRACE=NO, ITRACE=NO, ACTIVE=NO
  SOCKETS DEFINED IN THIS NETSERV
  NONE
END OF NETSERV INQUIRY RESPONSE
```


Defining TCP/IP NJE with JES3

```
*I NETSERV=JES3NS
IAT8707 NETSERV INQUIRY RESPONSE 112
INFORMATION FOR NETSERV JES3NS
  SYSTEM=SC65, HOST=9.12.4.48, PORT= 2345,
STACK=TCPIP, JTRACE=NO,
  VTRACE=NO, ITRACE=NO, ACTIVE=NO
  SOCKETS DEFINED IN THIS NETSERV
  NONE
END OF NETSERV INQUIRY RESPONSE
```

Defining TCP/IP NJE with JES3 - JES2 Node

```
*F NJE ADD=JES265 TYPE=TCPIP
IAT8460 NJERMT UPDATE COMPLETE. REQUEST HONORED.

*I NJE N=JES265
IAT8711 NODE INQUIRY RESPONSE 140
INFORMATION FOR NODE JES265
  TYPE=TCPIP, JOBTRANS=1, JOBRECV=1, OUTTRANS=1, OUTRECV=1,
  SECSIGNON=NO, TLS=NO, ACTIVE=NO, PWCNTL=SENDCLR
  SOCKETS DEFINED FOR THIS NODE
  NONE
END OF NODE INQUIRY RESPONSE

 *F SOCKET,ADD=J2SC65
 IAT8160 ADD    COMPLETE FOR SOCKET J2SC65

*F SOCKET=J2SC65,HOSTNAME=9.12.4.48
IAT8160 MODIFY COMPLETE FOR SOCKET J2SC65
```

..... add port and node .....

Defining TCP/IP NJE with JES3 - JES2 Node

```
*I SOCKET=J2SC65
IAT8709 SOCKET INQUIRY RESPONSE 545
INFORMATION FOR SOCKET J2SC65
  NETSERV=JES3NS, HOST=9.12.4.48, PORT= 2346,
NODE=J2SC65,
  JTRACE=NO, VTRACE=NO, ITRACE=NO,
ACTIVE=NO, SERVER=NO
END OF SOCKET INQUIRY RESPONSE
```

..... add port and node .....

Defining TCP/IP NJE with JES3 - JES2 Node

```
 *X TCP NETSERV=JES3NS
 IAT6306 JOB (JOB27751) IS TCP     , CALLED BY VAINI
 IAT6100 ( DEMSEL ) JOB IEESYSAS (JOB27752), PRTY=15, ID=STC
 ICH70001I STC      LAST ACCESS AT 07:18:19 ON THURSDAY, SEPTEMBER 8,
 2005
 IAT9301 TCP START SUCCESSFUL FOR SERVER JES3NS
 IEF403I IEESYSAS - STARTED - TIME=07.18.19 - ASID=00A1 - SC65
 IAZ0542I JES3NS IAZNJTCP for HBB7720 compiled Aug 11 2005 14:09:02
*IAZ0537I JES3NS NJETCP SERVER WAITING FOR WORK

 *S TCP SOCKET=J2SC65
*IAZ0537I JES3NS NJETCP SERVER WAITING FOR WORK
 IAZ0543I JES3NS TCP/IP connection with IP Addr: 9.12.4.48 Port: 2346
 Initiated
 IAZ0543I JES3NS TCP/IP connection with IP Addr: 9.12.4.48 Port: 2346
 Successful
*IAZ0537I NETSRV1 NJETCP SERVER WAITING FOR WORK
 IEF196I IAZ0537I NETSRV1 NJETCP SERVER WAITING FOR WORK
*IAZ0537I NETSRV1 NJETCP SERVER WAITING FOR WORK
```


JES2 Node

```
$T LNE(*)
$HASP880 LINE1 311
$HASP880 LINE1    UNIT=TCP,STATUS=DRAINED,LOG=NO,
$HASP880          PASSWORD=(NOTSET),REST=0,
$HASP880          TRACEIO=(JES=NO,COMMON=NO,
$HASP880          VERBOSE=NO),JRNUM=1,JTNUM=1,SRNUM=7,
$HASP880          STNUM=7
 $T NODE(*)
 $HASP826 NODE(1) 314
 $HASP826 NODE(1)   NAME=J2SC65,STATUS=(OWNNODE),
 $HASP826            AUTH=(DEVICE=YES,JOB=YES,NET=NO,
 $HASP826           SYSTEM=YES),TRANSMIT=BOTH,
 $HASP826           RECEIVE=BOTH,HOLD=NONE,PENCRYPT=NO,
 $HASP826           SIGNON=COMPAT,DIRECT=NO,ENDNODE=NO,
 $HASP826           REST=0,SENTREST=ACCEPT,COMPACT=0,
 $HASP826           LINE=0,LOGMODE=,LOGON=0,
 $HASP826           PASSWORD=(VERIFY=(NOTSET),
 $HASP826           SEND=(NOTSET)),PATHMGR=YES,
 $HASP826           PRIVATE=NO,SUBNET=LOCAL,TRACE=YES,
 $HASP826           NETSRV=0
```

JES2 Node

```
$ADD  SOCKET('tojes3'),IPADDR=9.12.4.48,PORT=2345,NODE=WTSCPLX4
$HASP897 SOCKET(TOJES3) 416
$HASP897 SOCKET(TOJES3)   STATUS=INACTIVE,
$HASP897                  IPADDR=9.12.4.48,PORT=2345,
$HASP897                  SECURE=NO,LINE=0,NODE=3,
$HASP897                  REST=0,NETSRV=0

$T  NETSRV(1),SOCKET=LOCAL
$HASP898 NETSRV1 437
$HASP898 NETSRV1    STATUS=DRAINED,SOCKET=LOCAL,STACK=,
$HASP898          TRACEIO=(JES=NO,COMMON=NO,
$HASP898          VERBOSE=NO)

@S NETSRV(1)
```

..... address space starts .....

JES2 Node Starting

```
IEF403I IEESYSAS - STARTED - TIME=07.08.32 - ASID=009F - SC65
IAZ0542I NETSRV1 IAZNJTCP for HBB7720 compiled Aug 11 2005 14:
IEF196I IAZ0542I NETSRV1 IAZNJTCP for HBB7720 compiled Aug 11
IEF196I 14:09:02
```

JES2 Commands for TCP/IP NJE

- $ADD NETSRVnnn – creates a new NETSRV device (1-999)
  - $T NETSRVnnn – change attributes of NETSRV
  - $S NETSRVnnn– Starts NETSRV address space
- Address space name is jesxSnnn
- NETSRVnnn SOCKET= - defines IP addr/port of this node
  - $P NETSRVnnn – Drains NETSRV address space
  - $E NETSRVnnn – Resets connections in NETSRV address space
- $D NETSRVnnn – Display attributes of NETSRV
  - ASID – displays the ASID of the NETSRV, if active
  - NAME – displays address space name
  - SESSIONS – displays list of all SOCKETs connected to this NETSRV

Define NJE TCP/IP Connections

```
NODE1 NAME=POK
NODE2 NAME=WSC
SOCKET(POK)
IPADDR=*LOCAL,
NODE=1,PORT=175
SOCKET(PARIS)
IPADDR=9.117.234.235,
NODE=2,PORT=175
NETSRV1 SOCKET=POK
LINE1 UNIT=TCP
```

```
NODE1 NAME=POK
NODE2 NAME=WSC
SOCKET(POK)
IPADDR=9.117.234.57,
NODE=1,PORT=175
SOCKET(WSC)
IPADDR=*LOCAL,
NODE=2,PORT=175
NETSRV1 SOCKET=WSC
LINE1 UNIT=TCP
```

JES2 and JES3 TCP/IP Availability

- JES2 - March 31, 2006
- JES3 - ?????

Documentation

- Documentation is in NJE formats and protocols

http://publibfp.boulder.ibm.com/cgi-bin/bookmgr/BOOKS/iea1m503/6.5