The What and How of JES3 NJE

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JES3

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Objective

- **Session abstract:**
  - The speaker will cover the what and how of NJE for JES3. He will look at how NJE is defined, differences between the protocols, and how NJE is managed in JES3.

- This presentation was requested based upon a similar JES2 presentation last SHARE (repeated this SHARE):
  - "What Are All These JES2 NJE Options? (The A-Zs of NJE)" – Tom Wasik
  - Intent was to review NJE definitions in JES2 as some people may not be familiar with how NJE is defined.
  - We try to do the same for JES3!

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Network Job Entry (NJE)

- NJE provides the ability to transmit a unit of work from one node (a JESplex) to another node:
  - Pre-execution Jobs (**SYSIN**)
  - Output datasets (**SYSOUT**)
  - Operator commands and messages via nodal message record (**NMR**)
- NJE functions:
  - **Transmit** – A node packages the NJE transfer unit and transmits it to another node.
  - **Receive** – A node recognizes the NJE transfer unit, receives it, and stores it.
  - **Store-and-Forward** – A node accepts the NJE transfer unit, stores it, and schedules it to be forwarded to another node.

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NJE nodes

- A node is a JESplex that is defined in a network.
  - Each node must be identified by a unique NJE node name.
- Types of nodes:
  - **Originating Node** – The node where the user submitted the request to transmit the data to another node.
  - **Intermediate Node** – A node that lies in the path of either the originating and execution nodes, or execution and destination nodes.
  - **Target Node** – The node where the user submitted request is received to be processed or executed:
    - **Destination Node** – Receives and processes a SYSOUT job or a message in an NMR.
    - **Execution Node** – Receives and executes a job or a command in an NMR.

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NMR = Nodal Message Record

Networking Protocols

- A networking protocol is the means by which a complex can participate in a job entry network.
- Protocols are rules that direct the logical structure, formats, and operational sequences for transmitting information through networks and controlling the network configuration and operation.
- JES3 supports three protocols:
  - Binary Synchronous Communication (BSC)
  - Systems Network Architecture (SNA)
  - Transmission Control Protocol/Internet Protocol (TCP/IP)

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JES3 node terminology

- A node is either a home node or a remote node.
  - Depends upon your point of reference!
  - Home node – your node.
  - Remote node – other nodes in the network.
- Two kinds of remote nodes:
  - Directly-connected – is *adjacent* to your node, and is connected through direct BSC, SNA, or TCP/IP links.
  - Indirectly-connected – is *not adjacent* to your node, but is connected to your node through one or more other nodes.
- You must define the home node and all remote nodes with which the home node will communicate.
 - NJERMT initialization statement.

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JES3 node terminology

- If NODE1 is the home node:
  - NODE2 is a directly connected remote node.
  - NODE3 is an indirectly connected remote node.
- If NODE2 is the home node:
  - NODE1 and NODE3 are directly connected remote nodes.
- If NODE3 is the home node:
  - NODE2 is a directly connected remote node.
  - NODE1 is an indirectly connected remote node.

NODE1 — NODE2 — NODE3

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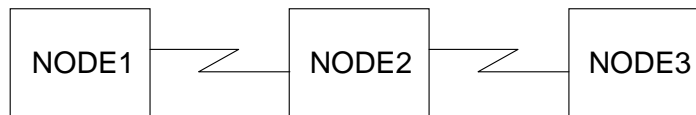
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Store-and-Forward

- Store-and-Forward occurs for indirectly connected nodes.
  - All nodes between the home node and the indirectly connected node must accept the NJE transfer, store it, and then forward to the next node.
  - Different protocols may be used between each connection.
- Store-and-Forward can be inefficient and time consuming.
- Consider including initialization parameters that would allow the remote node to become directly-connected at some future time.
  - By doing so during initialization, you need only use the *F,NJE command to change the communication path from indirect to direct.

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Note: When defining an indirectly-connected remote node, you may want to include parameters that would allow this node to become directly-connected at some future time. By doing so during initialization, you need only use the *F,NJE command to change the communication path from indirect to direct.

NJE

- JES3 specific items
  - Only one protocol can be used for a link between nodes.

  - Links and protocols to remote nodes are explicitly defined to JES3 via the initialization stream.

  - Allowed to specify the parameters for different protocols,
    - But can only use one protocol at a time for an active link.

  - Parameters and protocol used for a link often can be modified.
    - Be aware that some modifications may not be saved across restarts.

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Binary Synchronous Communication (BSC)

- BSC protocol used between nodes with a physical link.
  - Typically channel-to-channel (CTC) adapters.
  - Can also be dial-up telephone lines.

- CTC connection protocols are identical to BSC communications.
  - z196 and z114 are the last System z servers to support ESCON channels which includes Basic mode CTC used by both JESes for BSC CTC.

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BSC lines

- DEVICE,DTYPE=NJELINE,…
  - Defines a BSC line or CTC connection between two nodes.

- DEVICE,DTYPE=NJELINE,JNAME=LINE2, JUNIT=(C06,SY1,TP)
  - JNAME= specifies the name of the line.
    - Used in NJERMT statement for the home node.
  - JUNIT= specifies information about the BSC line or CTC connection for the global such as device number and which mains have access.
    - Need to define access for each main that can be the global.

- Bottom line: On the global, this associates a line name with a device address for a physical link.

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Examples

The following example defines a BSC line named LINE1.

DEVICE,DTYPE=NJELINE,JNAME=LINE1,JUNIT=(207,SY1,TP)

The following example defines three BSC lines named LINEA123, LINEA124, and LINEA125 that can be accessed from all mains:

DEVICE,DTYPE=NJELINE,JNAME=LINE,JUNIT=(A123,*ALL,TP,ON),NUMDEV=3

BSC nodes

- NJERMT,NAME=NODE1,HOME=YES,…
  - Defines NODE1 as the home node for this main.

- NJERMT,NAME=NODE2,TYPE=BSC,CTC=YES, LINE=LINE2,…
  - Defines NODE2 as a remote node, directly connected, using BSC protocol, CTC connection, using LINE2.
  - Using CTC=NO indicates that this dial-up telephone line.

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For a complete list of optional parameters that can be specified for a BSC remote node, see:

z/OS JES3 Initialization and Tuning Guide

Chapter 11 – JES3 Networking

Table 50 - Parameter Requirements for the NJERMT Statement.

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BSC nodes

- NJERMT,NAME=NODE3,PATH=NODE2,…
  - Defines NODE3 as a remote node, indirectly connected via NODE2.
  - Connection to NODE2 is still BSC, but connection from NODE2 to NODE3 can be anything and may even be routed through one or mode additional nodes/protocols.

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Start BSC networking

- *CALL,NJE,NAME=*nodename*,LINE=*lname*
  - Required after initialization to start NJE/BSC communication on line *lname* that directly connects to remote node *nodename.*

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BSC multiple lines

- Multiple lines can be started between nodes.
  - Allows more work to be sent concurrently.

- NJERMT,NAME=NODE2,TYPE=BSC,CTC=YES, LINE=LINE2,MAXLINES=3
  - MAXLINES allows up to 3 lines to NODE2 to be concurrently used.
  - *CALL,NJE,NAME=NODE2 will start NJE communication using LINE2.
  - *CALL,NJE,NAME=NODE2,LINE=LINE2A will start NJE communication using LINE2A.
    - LINE2A must have been previously defined with DEVICE.

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BSC interleaving data

- Concurrent data streams can be transmitted on one line.
  - Streams for a job and a SYSOUT transmission are interleaved.
  - Consider using interleaving only when the SYSOUT streams are large compared to the size of the job streams.

- NJERMT,NAME=NODE2,TYPE=BSC,CTC=YES, LINE=LINE2,MAXLINES=3,STREAM=2
  - STREAM=2 allows concurrent transmissions on each line.

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BSC logical senders

- JES3 creates and names logical senders.
  - One (STREAM=1) or two (STREAM=2) per line started to a directly connected node.

- *INQUIRY,NJE,NAME=NODE2,SNDR
  - Command used to display the name and status of the logical senders defined to the node.

- *VARY,*lsender*,[ON | OFF]
  - Vary a node online or offline by varying each logical sender online or offline.

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BSC buffers

- NJERMT BFSIZ= parameter specifies the communication buffer size.
  - Limit of spool buffer size (BUFFER statement) minus 44.
  - Must match BFSIZ= parameter specified at the remote node!

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BSC considerations

- Interleaving streams only goes so far.
  - An interleaved stream will take longer to complete transmission.
  - SYSOUT streams are not interleaved.
  - Once a large SYSOUT stream starts, smaller SYSOUT streams wait.

- Basic mode CTC not supported with FICON.

- Consider using TCP/IP/NJE.

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Systems Network Architecture (SNA)

- SNA protocol provides a networking capability in combination with MVS/Bulk Data Transfer (MVS/BDT).

- Networking is established between nodes through MVS/BDT "sessions."
  - Established between channel-to-channel adapters, telephone lines, microwave links, or by satellite.
  - Virtual Telecommunication Access Method (VTAM) used to control the sessions between the nodes.
    - VTAM is the logical connection between the nodes.
    - Need to define BDT nodes to VTAM (APPL ids).
  - Nodes need to be defined in MVS/BDT and JES3.
    - Any changes must be made to both initialization streams.

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MVS/BDT sessions/nodes

- MVS/BDT sessions provide the method of transferring data between nodes for JES3 SNA/NJE and file-to-file (FTF) transactions.
  - MVS/BDT runs as a separate MVS secondary subsystem.
  - JES3 communicates with MVS/BDT via a shuttle BDT Subsystem Interface Data (BSID) area.

- An MVS/BDT home node to remote node session is used for NJE or FTF – never both.
  - Specified on MVS/BDT BDTNODE initialization statement with TYPE=NJE or TYPE=FTF.
  - We will be focusing on NJE unique specifications.

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A shuttle *BDT Subsystem Interface Data* (BSID) area is associated with each z/OS BDT address space that is defined in the complex. JES3 uses the shuttle to send requests to the specified z/OS BDT subsystem. The BSID contains a data area where JES3 places the request. To send a BSID to z/OS BDT, JES3 issues a JSERV macro TYPE=RESP. The subsystem communication routines that process the JSERV macro, place the BSID in the shuttle staging area and pass it through the subsystem interface to the specified z/OS BDT subsystem.

MVS/BDT sessions/nodes

- <u>SYSID</u>,<u>NAME</u>=*name*,<u>NJENAME</u>=*node-name*,…
  - MVS/BDT initialization statement which specifies the name of the home node for SNA NJE and FTF transfers
  - *node-name* is the NJE home node name and is used on the JES3 SYSID and NJERMT initialization statements for the home node.
  - *name* is the FTF home node name.

- <u>BDTNODE</u>,<u>N</u>=*remote-node-name*,<u>TYPE</u>=<u>NJE</u>,…
  - MVS/BDT initialization statement which defines the session between the home node and a remote node for SNA NJE transfers.
  - *remote-node-name* is used on the JES3 NJERMT initialization statements for remote nodes.

  Note: <u>*MVS/BDT statements and keywords*</u> *are underscored to distinguish from JES3 statements and keywords.*

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You must allocate a data set to contain the BDT initialization stream.

The initialization stream is run when the operator starts BDT.

See z/OS V1R7.0 BDT Installation.

SNA nodes

- SYSID,NAME=*nodename*
  - JES3 initialization statement which specifies the name of the default MVS/BDT node.
    - JES3 submits MVS/BDT commands and transactions to the MVS/BDT node defined by this statement unless otherwise specified on the command or transaction.

  - Used when BDTID= is not specified on JES3 NJERMT statement.

  - *nodename m*ust match one of the following from the MVS/BDT <u>SYSID</u> initialization statement:
    - <u>*node-name*</u> specified with <u>NJENAME=</u> if SNA NJE only.
    - <u>*name*</u> specified with <u>N=</u> if FTF with or without SNA NJE.

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<u>MVS/BDT statements and keywords</u> are underscored to distinguish from JES3 statements and keywords.

SNA nodes

- NJERMT,NAME=NODE1,HOME=YES,
  BDTID=*nodename,…*
  - Defines NODE1 as the home node for this main and the associated MVS/BDT node.
  - If BDTID is not used, JES3 sends transactions to the default MVS/BDT node that is named on the JES3 SYSID statement.
  - *nodename m*ust be the same as the *nodename* specified with NAME= on the JES3 SYSID initialization statement.

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SNA nodes

- NJERMT,NAME=NODE2,TYPE=SNA,…
  - Defines NODE2 as a remote node, directly connected, using SNA protocol.
  - NAME=*name* must be the same as the *remote-node-name* specified with N= on the MVS/BDT BDTNODE initialization statement with TYPE=NJE.

- NJERMT,NAME=NODE3,PATH=NODE2,…
  - Defines NODE3 as a remote node, indirectly connected via NODE2.
  - Connection to NODE2 is still SNA, but connection from NODE2 to NODE3 can be anything and may even be routed through one or mode additional nodes/protocols.

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MVS/BDT statements and keywords are underscored to distinguish from JES3 statements and keywords.

Start SNA networking

- No JES3 commands involved.
- Use MVS command START used to activate VTAM with a start procedure.
- Use MVS command START used to activate BDT with a start procedure.
- Use MVS command VARY NET,ACT,ID=… to activate the logical connection to a node.
- Use BDT command CALL SNA to activate the BDT SNA manager.
  - See *z/OS BDT Commands* for starting BDT and additional JES3 specific information.

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MVS/BDT statements and keywords are underscored to distinguish from JES3 statements and keywords.

SNA considerations

- BDT runs as a VTAM application program, requiring several VTAM definitions.
  - Did not try to cover the VTAM definitions required.

- BDT operates under the control of MVS and therefore must be defined as a secondary MVS subsystem.
  - Did not try to cover the IEFSSN*xx*, IEASYS*xx*, and IEAAPF*xx* definitions required.

- Last release of BDT was in 1996.

- Consider using TCP/IP/NJE.

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Transmission Control Protocol/Internet Protocol (TCP/IP)

- TCP/IP/NJE takes advantage of TCP/IP hardware-independent layered stack to establish connections over existing hardware protocols.
  - Ethernet and token ring for example.

- Networking is established between nodes through a separate Netserv address space.
  - Netserv makes all the communication interface calls to TCP/IP on behalf of the JES.
    - Sockets provide the logical connections between the nodes.
  - Netserv functionality is provided in the JES Common component, therefore it is the same in both JES3 and JES2.

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TCP/IP

- TCP/IP requires z/OS UNIX Systems Service and ACF/VTAM to be configured and active.
  - IP addresses, IP host names, port names, and special service names must be defined in TCP/IP in order to be used by JES3.

- TCP/IP/NJE uses the same record structure and data streams as BSC/NJE.
  - Communications are driven through a separate Netserv address space.
    - Analogous to BDT for SNA/NJE, but without BDT's unique configuration requirements.

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Network Server (Netserv)

- Netserv address space can run on a global or local main.
  - Can have multiple Netserv address spaces running simultaneously.
  - Can use the same IP address, but each must use a separate port.

- Communicates with JES to spool and de-spool jobs and data sets.

- JES3 NETSERV initialization statement implicitly defines the local TCP/IP socket used.
  - Note that this socket must be explicitly defined in JES2.

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Netserv

- NETSERV,NAME=*name*,HOSTNAME=*hostname*, PORT=*nnnnn*,SYSTEM=*sysname,…*
  - JES3 initialization statement which defines a Netserv address space identified by *name*.
  - Specifies the IP host name, or IP address, and port that the Netserv local socket will use to listen for incoming TCP/IP data.
    - Default is to listen over any IP address defined for the processor.
    - Each active Netserv must then use a different port.
  - Netserv address space will be started on main *sysname.*
    - Default is the global main.

- HOSTNAME, PORT, and SYSTEM can be set/modified before starting the Netserv address space.

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Socket

- JES3 SOCKET initialization statement defines usage of the foreign TCP/IP socket used to connect to the remote node.

- The socket only needs to be defined at the node where the connection can be initiated from (the client node).
  - Socket at the remote (the server node) is created by JES3 when a connection is made. This is an ephemeral (or server) socket.
  - Note that this socket must also be explicitly defined in JES2.

- Each socket runs as a subtask of the Netserv address space.
  - Socket name identifies the socket for inquiry and modify commands as well as JES3 processing of outbound and inbound data.

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JES3 refers to the socket used to initiate a connection as the client socket.

JES3 refers to the socket created on the remote when a connection is made as the server socket.

This is because when a TCP/IP connection is established, the node on which the connection is initiated is known to TCP/IP as a client and the responding node is known to TCP/IP as a server.

A client socket is sometimes referred to as an outbound socket and a server socket is sometimes referred to as an inbound socket though NJE communications across the active connection can be initiated at either node.

Socket

- SOCKET,NAME=*name*,NETSERV=*ntsvname*,
  NODE=*nodename*,HOSTNAME=*hostname*,
  PORT=*nnnnn*,…
    - JES3 initialization statement which defines a socket task identified by *name* that will run under the Netserv address space *ntsvname*.
    - Specifies the node name, IP host name, or IP address, and port number of the remote node to which a connection will be initiated.
    - JES3 will dynamically create a socket definition on the remote node (server node) when the connection is established.

- NETSERV, NODE, HOSTNAME, and PORT can be set/modified before starting the socket to initiate a connection.

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PORT=

Specifies a port number that the socket will use, in combination with the host
name, to communicate with TCP/IP. The port must be a number from 0 to
65,535. A port of 0 indicates that when the socket starts a standard service
name of VMNET, VMNET will be used instead of a numeric port. The service
of VMNET corresponds to port 175. Although there is a corresponding port for
the service NJENET-SSL, it is recommended that you use the TLS=YES
parameter on the NJERMT statement or *MODIFY,NJE command instead.

TCP/IP nodes

- NJERMT,NAME=NODE1,HOME=YES,…
  - Defines NODE1 as the home node for this main.

- NJERMT,NAME=NODE2,TYPE=TCPIP,…
  - Defines NODE2 as a remote node, directly connected, using TCP/IP protocol.

- NJERMT,NAME=NODE3,PATH=NODE2,…
  - Defines NODE3 as a remote node, indirectly connected via NODE2.
  - Connection to NODE2 is still TCP/IP, but connection from NODE2 to NODE3 can be anything and may even be routed through one or mode additional nodes/protocols.
  - A TCP/IP direct connection to NODE3 would be easier/better!

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Start TCP/IP networking

- JES3 TCP/IP/NJE requires that TCP/IP be active.
- *CALL,TCP,NETSERV=*ntsvname*
  - Start the Netserv address space identified by *ntsvname.*
  - Local sockets under the Netserv are also started.
  - May need to start multiple Netservs if required for multiple sockets to a node.
- Start sockets one of two ways:
  - *START,TCP,NODE=*nodename*
    - Start communication with all sockets assigned to *nodename.*
  - *START,TCP,SOCKET=*sockname*
    - Start communication to a node via *sockname.*

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For *START,TCP,NODE=*nodename* JES3 internally issues *START,TCP,SOCKET=*sockname* for each socket defined for the node.

The ephemeral (server) socket

- When a connection request is accepted at the remote node (server node), JES3 will dynamically create a socket definition.
  - This is the ephemeral socket created for the connection.
  - It is assigned a unique socket name of @nnnnnnn, where nnnnnnn starts at 0000001.
  - You can use the socket name for *INQUIRY,SOCKET= command.
  - It is an active socket, so *MODIFY,SOCKET= command can only be used to set trace options for the socket.
  - JES3 deletes the socket definition when the connection ends.

- This a server socket definition because the node initiating a TCP/IP connection is known to TCP/IP as a client and the responding node is known to TCP/IP as a server.

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Home node (client) socket example

```
*I,NETSERV=JES3S1A
IAT8707 NETSERV INQUIRY RESPONSE
INFORMATION FOR NETSERV JES3S1A
  SYSTEM=SY1, HOST=9.57.1.227, PORT=  175, STACK=, JTRACE=NO,
  VTRACE=NO, ITRACE=NO, DSP JOBID=JOB00023, NETSERV JOBID=JOB00024,
  ACTIVE=YES
  SOCKETS DEFINED IN THIS NETSERV
  SOCKET    ACTIVE    NODE      SERVER
  S131A     YES       NODE3     NO
  S131B     NO        NODE3     NO
END OF NETSERV INQUIRY RESPONSE

*I,SOCKET=S131A
IAT8709 SOCKET INQUIRY RESPONSE
INFORMATION FOR SOCKET S131A
  NETSERV=JES3S1A, HOST=9.57.1.177, PORT=  175, NODE=NODE3,
  JTRACE=NO, VTRACE=NO, ITRACE=NO, ACTIVE=YES, SERVER=NO
END OF SOCKET INQUIRY RESPONSE
```

- Direct connection was initiated by NODE1 to NODE3.

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An inquiry of the Netserv on the home node (client socket - where the connection was initiated) shows:

•The Netserv JES3S1A is active on SY1, the IP address is 9.57.1.227, and it is listening on port 175.

•The Netserv has job ID JOB00024 and the JES3 TCP DSP has job ID JOB00023.

•Socket S131A, used to initiate the connection to NODE3, is active. It is a client socket (not server).

•Second socket defined for NODE3, S131B, is not in use.

An inquiry of the client socket shows:

•The socket is for Netserv JES3S1A, is active, and is a client sockert (SERVER=NO).

•The socket is defined to connect to NODE3 using IP address 9.57.1.177 and port 175.connected to port 1025 on NODE1.

Remote node (server) socket example

```
*I,NETSERV=JES3S3A
IAT8707 NETSERV INQUIRY RESPONSE
INFORMATION FOR NETSERV JES3S3A
  SYSTEM=SY1, HOST=9.57.1.177, PORT=  175, STACK=, JTRACE=NO,
  VTRACE=NO, ITRACE=NO, DSP JOBID=JOB00016, NETSERV JOBID=JOB00017,
  ACTIVE=YES
  SOCKETS DEFINED IN THIS NETSERV
  SOCKET    ACTIVE    NODE     SERVER
  S313A     NO        NODE1    NO
  S313B     NO        NODE1    NO
  @0000001 YES        NODE1    YES
END OF NETSERV INQUIRY RESPONSE

*I,SOCKET=@0000001
IAT8709 SOCKET INQUIRY RESPONSE
INFORMATION FOR SOCKET @0000001
  NETSERV=JES3S3A, HOST=, PORT= 1025, NODE=NODE1, JTRACE=NO,
  VTRACE=NO, ITRACE=NO, ACTIVE=YES, SERVER=YES
END OF SOCKET INQUIRY RESPONSE
```

- Direct connection was initiated by NODE1 to NODE3.

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An inquiry of the Netserv on the remote node (server socket) shows:

- The Netserv JES3S3A is active on SY1, the IP address is 9.57.1.177, and it is listening on port 175.
- The Netserv has job ID JOB00017 and the JES3 TCP DSP has job ID JOB00016.
- The sockets S313A and S313B to NODE1 are not active. Connection to NODE1 not initiated here.
- Ephemeral socket @0000001 to NODE1 is active since connection initiated at NODE1.

An inquiry of the ephemeral socket (server socket) on the remote node shows:

- The ephemeral socket is for Netserv JES3S3A and is active.
- The socket is connected to port 1025 on NODE1. Note that the host name is blank.

JES3 calls this socket definition a server socket, because when a TCP/IP connection is established, the node on which the connection is initiated is known to TCP/IP as a client and the responding node is known to TCP/IP as a server.

NJE alias for a home node

- ALIAS= keyword on NJERMT initialization statement.
  - Used to define alternate names for the home node.
  - Can also influence how incoming SYSOUT destined for the alias is handled separately from how SYSOUT destined for the home node is handled.
    - XNAMEREQ, DEFCLASS, PRTDEF, PUNDEF, PRTTSO, and PRTXWRT are all valid keywords with ALIAS.

- NJERMT,NAME=NODE1,HOME=YES,…
  - Defines NODE1 as the home node for this main.
- NJERMT,ALIAS=ALIAS1,…
  - Defines ALIAS1 as an alternate name for NODE1.

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NJE alias path from a remote node

- NJERMT,NAME=ALIAS1,PATH=NODE1
  - Remote nodes must define the connection to an alias indirectly through the associated home node using the PATH keyword.

- In the remote node, NODE1 must have been defined either as an adjacent node:
  - NJERMT,NAME=NODE1,TYPE=TCPIP,…
  - NJERMT,NAME=ALIAS1,PATH=NODE1

- …or as an indirectly connected node (i.e. PATH= keyword used):
  - NJERMT,NAME=NODE1,PATH=NODE2
  - NJERMT,NAME=ALIAS1,PATH=NODE1

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NJE spool partition usage

- SPART= keyword on NJERMT initialization statement.
  - Used to specify a spool partition to be used to spool SYSIN and SYSOUT received from an NJE remote node.

- *MODIFY,NJE,*nodename*,SP=*spart*
  - Modifies the spool partition used to spool data from a remote node.

- *INQUIRY,NJE,*nodename*,SP
  - Displays the partition assigned to the remote node.

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NJE console

- *CALL,NJECONS
  - JES3 command to start JES3 networking console Dynamic Service Program (DSP).
  - Required before commands or messages can be sent to or received from nodes in the NJE network.
    - The DSP processes the NMRs which contain commands or messages.

- NJECONS,CLASS=*msgdest*
  - JES3 initialization statement that defines the message class used by JES3 when sending an inbound network message to an MCS console.
    - Specify MCS routing code or JES3 destination class.
    - Default is CLASS=108 (JES3 destination class S12).

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NMR = Nodal Message Record

NJE consoles

NJE consoles provide a remote node the capability to inquire on and control work that has arrived from the NJE network. There are no physical JES3 NJE consoles, but instead the NJE console support provides a way for performing command association between a requestor on a remote node and console operations on the JES3 node.

The NJE console services processor (NJECONS) maintains a queue for pending network commands. A console is established for the pending NJE command instance by invoking JESXCF. The command is then issued. When a response is issued for the command, it is routed to JESXCF which in turn notifies this DSP that a command response is available. The responses are retrieved from JESXCF, NJE command response entries are created and routed back to their origin.

MCS console routing code

You can define the message destination to which JES3 is to send network messages. To do this, code the message destination on the CLASS parameter on the NJECONS statement. The message destination can be specified as a JES3 destination class or as an MVS routing code. If you do not specify a message destination, JES3 sends all network messages to class S12 (the routing equivalent of S12 is 108).

A console receiving the routing code or the routing code equivalent of the destination class will receive network messages.

NJE reader

- *CALL,NJERDR
  - JES3 command to start an NJE reader DSP.
  - Required to receive inbound SNA/NJE job and SYSOUT streams for processing or printing by JES3.
  - Not required for BSC/NJE or TCP/IP/NJE.

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NJE dynamic changes

- Networking node definitions can be dynamically added, deleted, or changed using the *MODIFY,NJE command.

- Any additions or modifications are subject to the same prerequisites as defined for NJERMT statements:
  - DEVICE statements.
  - BDT node definitions.
  - TCP/IP and NETSERV definitions.

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NJE dynamic changes

- Initialization statement parameters are used for JES3 cold start, warm start, and hot start with refresh.
  - Dynamic modifications may not be used for these JES3 restarts.

- State of Netserv depends on the JES3 start type.
  - JES3 checkpoint contains Netserv state information that includes previous modifications.
  - Cold start = Initialization statements are used for the Netserv state.
  - Warm start = Initialization statements are used for the Netserv state.
  - Hot start = Checkpoint data is used for the Netserv state.
  - Hot start with refresh depends upon whether or not the Netserv was active at the time of the start:
    - Active = Checkpoint data is used for the Netserv state.
    - Inactive = Initialization statements are used for the Netserv state.

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NJE connection status

- Current networking node status can be displayed using the *INQUIRY,NJE command.
  - *I,NJE results in messages indicating the status of BSC connections to each directly connected remote node.
  - Using NAME=*nodename* results in messages specific to the type of node: home, remote, or alias, and the type of protocol.

- Current Netserv status can be displayed using the *INQUIRY,NETSERV command.
  - Can inquire about all or specific Netservs.

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Stopping BSC/NJE

- *CANCEL,*lname*
  - Stops communication on a BSC line as soon as current activity completes.
  - Sign-off record is sent to the remote node.

- *CANCEL,*lname*,I
  - Immediately stops communication on a BSC line including current activity.
  - Appears to the remote node that the line has stopped abnormally.

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Stopping SNA/NJE

- *CANCEL,NJERDR
  - Stops the JES3 NJE reader DSP from processing inbound SNA/NJE network streams.
  - Recall the NJERDR is used only for SNA/NJE.

- If more than one NJE reader DSP was started, then need to stop the job number of the DSP:
  - *INQUIRY,NJERDR to get a list of NJE reader DSPs.
  - *CANCEL,J=*jobno* to cancel a specific NJE reader DSP.

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Stopping SNA/BDT networking

- No JES3 commands involved.
- Use BDT command <u>CANCEL SNA</u> to stop a BDT session to a node.
  - See *z/OS BDT Commands* for stopping BDT and additional JES3 spcific information.

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MVS/BDT statements and keywords are underscored to distinguish from JES3 statements and keywords.

Stopping TCP/IP/NJE communications

- *CANCEL,TCP,SOCKET=*sockname*[,I]
  - Stops all communications to a remote node on socket *sockname*.
    - Can specify the ephemeral (server) socket.
  - Remote node notified that this session is ending.
  - Socket is marked inactive.
    - Client socket at the remote node is marked inactive.
    - Server socket at remote node is marked inactive and deleted.
  - Active transmission and reception activity allowed to complete unless "I" parameter is included.

- *CANCEL,TCP,NODE=*nodename*[,I]
  - All sockets use to communicate to the remote node *nodename* are cancelled.

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Stopping TCP/IP/NJE communications

- *CANCEL,*ntsvname*,NODE=*nodename*[,I]
  - Stops all communications to remote node *nodename* by the Netserv address space *ntsvname*.
  - Remote node notified that session is ending.
  - Cancels all sockets used to communicate to the remote node.
  - Active transmission and reception activity allowed to complete unless "I" parameter is included.

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Stopping Netserv

- *CANCEL,*ntsvname*
  - Cancels the Netserv address space *ntsvname* and the associated JES3 TCP DSP.
  - Remote node notified that session is ending.
  - Cancels all sockets used to communicate to the remote node.

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SDSF panels

- SDSF V1.13 support panels for JES3.
  - Shows all information and eliminates the need to directly use JES commands.
- LINE Lines
  - Display information about JES lines and their associated transmitters and receivers.
- NODE Nodes
  - Display information about JES nodes.
- NC Network connections
  - Shows information about JES networking connections to an adjacent node.
- NS Network servers
  - Shows information about JES server-type networking devices on the node.

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See *z/OS V1R13.0 SDSF Operation and Customization* for more information on these an many other SDSF panels added for JES3.

More JES3 NJE stuff?

- Absolutely. We've only scratched the surface.
- There are a number of items that could not be included:
  - Many more NJERMT initialization statement options – some related to specific protocols.
  - Specifying and controlling the routing of jobs and SYSOUT.
  - Several JES3 installation exits that enable you to monitor NJE activity, supplement checking, inspect or modify header records, and collect accounting information.
  - And probably more than I am not aware of!

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References

- z/OS V1R13.0 publications are available at
  http://www-03.ibm.com/systems/z/os/zos/bkserv/r13pdf/

- *z/OS V1R13.0 JES3 Commands* (SA22-7540-11)
  - Chapters 4 through 7 on "Controlling…" along with command descriptions.
- *z/OS V1R13.0 JES3 Initialization and Tuning Guide* (SA22-7549-10)
  - **Chapter 11. JES3 Networking**
- *Network Job Entry (NJE) Formats and Protocols* (SA22-7539-02)
- *z/OS BDT Commands* (SA22-7512-02)
- *z/OS V1R13.0 SDSF Operation and Customization* (SA22-7670-15)
- *ABCs of z/OS System Programming - Volume 13* (SG24-7717-01)
  - http://www.redbooks.ibm.com/abstracts/sg247717.html

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System z Social Media Channels

- **Top Facebook pages related to System z:**
  - **IBM System z**
  - **IBM Academic Initiative System z**
  - **IBM Master the Mainframe Contest**
  - **IBM Destination z**
  - **Millennial Mainframer**
  - **IBM Smarter Computing**

- **Top LinkedIn groups related to System z:**
  - **System z Advocates**
  - **SAP on System z**
  - **IBM Mainframe- Unofficial Group**
  - **IBM System z Events**
  - **Mainframe Experts Network**
  - **System z Linux**
  - **Enterprise Systems**
  - **Mainframe Security Gurus**

- **Twitter profiles related to System z:**
  - **IBM System z**
  - **IBM System z Events**
  - **IBM DB2 on System z**
  - **Millennial Mainframer**
  - **Destination z**
  - **IBM Smarter Computing**

- **YouTube accounts related to System z:**
  - **IBM System z**
  - **Destination z**
  - **IBM Smarter Computing**

- **Top System z blogs to check out:**
  - **Mainframe Insights**
  - **Smarter Computing**
  - **Millennial Mainframer**
  - **Mainframe & Hybrid Computing**
  - **The Mainframe Blog**
  - **Mainframe Watch Belgium**
  - **Mainframe Update**
  - **Enterprise Systems Media Blog**
  - **Dancing Dinosaur**
  - **DB2 for z/OS**
  - **IBM Destination z**
  - **DB2utor**

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Thank You!

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