

IBM eServer™

Sysplex: Network subplexing

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Background information - VTAM and TCP/IP Sysplex participation overview

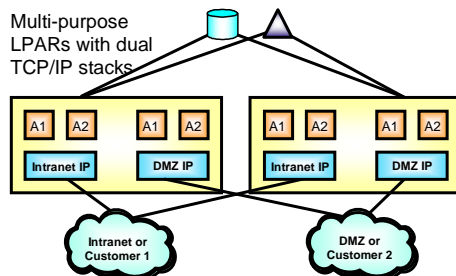
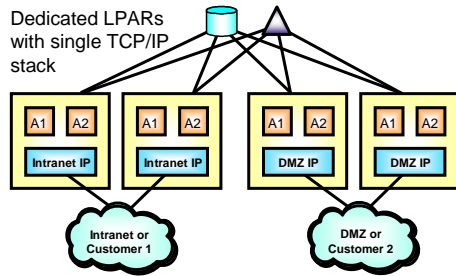
➤ **VTAM® participation in the Sysplex**

- Each VTAM in the Sysplex:
 - Joins ISTXCF and ISTCFS01 Sysplex messaging groups
 - Establishes Dynamic XCF Connectivity (controlled by XCFINIT start option)
 - Can access Generic Resource and MNPS coupling facility data structures (specified by STRGR & STRMNPS start options)

➤ **TCP/IP participation in the Sysplex**

- Each TCP/IP stack in the Sysplex:
 - Joins EZBTCPCS Sysplex messaging group
 - Exchanges IP address information - all stacks have awareness of IP addresses in all other stacks in the Sysplex
 - Coordinates DVIPA movement
 - Can be a Sysplex Distributor target and receive work from a Sysplex Distributor stack
 - Can access SWSA and Sysplexports coupling facility data structures
 - Sets up dynamic IP connectivity with other stacks in the Sysplex
 - Using Dynamic IUTSAMEH - if stacks are in the same LPAR
 - Using Dynamic HiperSockets™ (IQDIO) - if stacks are on the same CEC & use the same CHPID
 - Using VTAM's Dynamic XCF Connectivity

Is a network Sysplex always the same scope as a z/OS® Sysplex?



➤ How to control level of automatic connectivity

- XCF signaling (group name) - both IP and SNA
- IUTSAMEH (same host IP links inside an LPAR)
- HiperSockets (as enabled via IQDCHPID in VTAM)

➤ How to control level of IP and SNA resource awareness

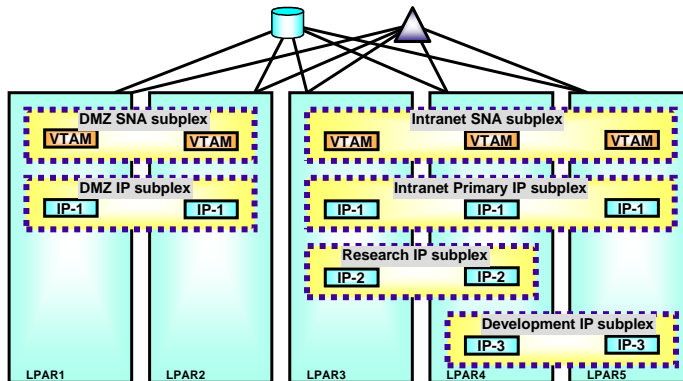
- Dynamic IP address discovery across the Sysplex
- VTAM generic resource and MNPS resource scope spans the full Sysplex

➤ How to control scope of IP workload balancing using Sysplex Distributor

- SD requires Dynamic XCF to be enabled, and Dynamic XCF will establish automatic IP connectivity to all stacks in the Sysplex that also have Dynamic XCF enabled

To support environments such as these, installations typically end up implementing complex resource controls and disabling many of the dynamic networking functions that are provided by TCP/IP and VTAM.

Enable use of networking Sysplex functions in a Sysplex that is connected to multiple security areas



➤ Networking subplex scope:

- VTAM Generic Resources (GR) and Multi-Node Persistent Session (MNPS) resources
- Automatic connectivity - IP connectivity and VTAM connectivity over XCF (including dynamic IUTSAMEH and dynamic HiperSockets based on Dynamic XCF for IP)
 - HiperSockets VLANID support also added as part of this support
- IP stack IP address (including dynamic VIPA) awareness and visibility
- Dynamic VIPA movement candidates
- Sysplex Distributor target candidates

Networking Subplexing

Sysplex partitioning from a network perspective

- One SNA subplex per LPAR
- An IP subplex cannot span multiple SNA subplexes
- Different IP stacks in an LPAR may belong to different IP subplexes
- Standard RACF® controls for stack access and application access to z/OS resources need to be in place.

VTAM Subplexing

➤ **New VTAM Start Option:**

- XCFGRPID vv
-where vv is a number between 2 and 31

➤ **VTAM joins ISTXCFvv and ISTCFSvv Sysplex groups**

- If no XCFGRPID is specified, VTAM will join ISTXCF and ISTCFS01 - as before

➤ **STRGR and STRMNPS CF structure names are suffixed with vv**

- For example, if STRGR=ISTMYGR, VTAM will attempt to connect to structure ISTMYGRvv.
- If no XCFGRPID is specified, VTAM will connect to the names specified in STRGR and STRMNPS without any suffix - as before.

➤ **Structure names specified in STRGR and STRMNPS Start Options must not include the XCFGRPID suffix**

- The suffix will be automatically added by VTAM.

➤ **MNPS and GR structure names in the CFRM policy definition must include Subplex suffixes**

- If not, VTAM will not be able to connect to the structures.

➤ **An MNPS structure name in one Subplex must not appear to be an alternate MNPS structure in another subplex**

- Otherwise, VTAM nodes in different Subplexes may attempt to access the same MNPS structure.

➤ **All MNPS application recoveries must be within the same Subplex**

- You must specify your ARM policy so that a failed application is restarted on a VTAM node that is within the same Subplex (that is, specified the same XCFGRPID).

➤ **All resources that will share a Generic Resource name must reside within the same Subplex**

VTAM Subplexing - notes

NOTES

- Do not include the XCFGRPID suffix in the STRGR and STRMNPS Start Option names
 - E.G. If XCFGRPID=23, do not specify STRGR=ISTMYGENERIC23 and STRMNPS=ISTMYMNPS23. You specify STRGR=ISTMYGENERIC and STRMNPS=ISTMYMNPS. VTAM will append the suffix.
- Structure names in the CFRM policy must include the Subplex suffixes

```
DATA TYPE(CFRM) REPORT(YES)
DEFINE POLICY NAME(VTAMSAMP) REPLACE(YES)
  STRUCTURE NAME(ISTMYGENERIC23)
  SIZE(10000)
  INITSIZE(7000)
  PREPLIST(RALNSCF1,RALNSCF2)
  STRUCTURE NAME(ISTMYMNPS23)
  SIZE(25600)
  INITSIZE(12288)
  REBUILDPERCENT(30)
  PREPLIST(RALNSCF1,RALNSCF2)
```

- If VTAM1 has XCFGRPID=23, and VTAM2 has XCFGRPID=05, you should not specify STRMNPS=ISTMYMNPS on VTAM1 and STRMNPS=ISTMYMNPS23 on VTAM2
 - VTAM1 will attempt to connect to ISTMYMNPS23 and ISTMYMNPS2305 as an alternate structure, VTAM2 will connect to ISTMYMNPS2305 as its main MNPS structure. This will lead to unpredictable results.
- Similarly, if VTAM1 has XCFGRPID=23, and VTAM2 has no XCFGRPID specified, you should not specify STRMNPS=ISTMYMNPS on both nodes.
 - VTAM1 will attempt to connect to ISTMYMNPS23. VTAM2 will attempt to connect to ISTMYMNPS and ISTMYMNPS23 as an alternate structure.

VTAM Subplexing - notes

NOTES

- If an MNPS application in VTAM Subplex 23 fails and is restarted in a node in VTAM subplex 05, the recovering application will not have access to the MNPS structure from Subplex 23 and will not be able to recover the application's sessions.
- If a resource in VTAM Subplex 05 tries to share a Generic Resource name defined in Subplex 23, it will not have access to the Generic Resource structure in Subplex 23 to access the GR affinities.

Initialization Messages Display - Example

NOTES

➤ Example of the new/changed messages displayed by VTAM during initialization

```
S VTAMCS.NET
IEF695I START VTAMCS WITH JOBNAME VTAMCS IS ASSIGNED TO USER VTAMCS
, GROUP SYS1
$HASP373 VTAMCS STARTED
IEF403I VTAMCS - STARTED - TIME=16.39.52
IEF196I IEF237I 02AE ALLOCATED TO SYS00048
07 IST051A ENTER VTAM START PARAMETERS
R 07,LIST=1A,XCFGRPID=23
IEE600I REPLY TO 07 IS;LIST=1A,XCFGRPID=23
IST2158I VTAM HAS JOINED THE SYSPLEX GROUP ISTCFS23
IST093I ISTCDRDY ACTIVE
.
.
.
IST020I VTAM INITIALIZATION COMPLETE FOR CSV1R8
IST1349I COMPONENT ID IS 5695-11701-180
IST1348I VTAM STARTED AS INTERCHANGE NODE
IST2158I VTAM HAS JOINED THE SYSPLEX GROUP ISTXCF23
IST093I ISTLSXCF ACTIVE
IST1370I NETA.SSCP1A IS CONNECTED TO STRUCTURE ISTMNPS23
IST1370I NETA.SSCP1A IS CONNECTED TO STRUCTURE ISTGENERIC23
```


D NET,ID=VTAM Display - Example

NOTES

➤ Example of the new/changed messages displayed by D NET,ID=VTAM

```
D NET,ID=VTAM
IST097I DISPLAY ACCEPTED
IST075I NAME = VTAM, TYPE = CDRM 727
IST1046I CP NETA.SSCPIA ALSO EXISTS
IST486I STATUS= ACTIV, DESIRED STATE= ACTIV
IST599I REAL NAME = NETA.SSCPIA
IST815I AUTOMATIC RECOVERY IS SUPPORTED
IST231I CDRM MAJOR NODE = VTAMSEG
IST654I I/O TRACE = OFF, BUFFER TRACE = OFF
IST1500I STATE TRACE = OFF
IST476I CDRM TYPE = HOST GATEWAY CAPABLE
IST637I SUBAREA = 1 ELEMENT = 1 SSCPID = 1
IST388I DYNAMIC CDRSC DEFINITION SUPPORT = YES
IST171I ACTIVE SESSIONS = 0000000000, SESSION REQUESTS = 0000000000
IST924I -----
IST075I NAME = NETA.SSCPIA, TYPE = HOST CP
IST2159I XCF GROUP: ISTXCF23      CFS GROUP: ISTCFS23
IST2181I GR STRUCTURE NAME IS ISTGENERIC23
IST2181I MNPS STRUCTURE NAME IS ISTMNPS23
IST1046I SSCP NETA.SSCPIA ALSO EXISTS
```

TCP/IP Subplexing

➤ New TCP Profile parameters:

-GLOBALCONFIG statement:

- XCFGRPID tt - used to partition the TCP/IP sysplex groups into subplexes
 - tt is a numeric value between 2 and 31
- IQDVLANID nn - used to partition HiperSockets for Dynamic XCF connectivity into subplexes
 - nn is a numeric value between 1 and 4094
 - IQDVLANID support for HiperSockets requires a z890 GA2 or z990 GA2 hardware level.
- These values cannot be modified through Vary Obeyfile processing

➤ TCP will join Sysplex group EZBTvvtt, where vv is the VTAM subplex number mentioned earlier

➤ SWSA and Sysplexports structure names will be suffixed by vvtt

- EZBDVIPAvvtt and EZBEPORtvvtt
- For example, if the TCP/IP GLOBALCONFIG specified an XCFGRPID of 05 and the supporting VTAM was started with XCFGRPID=23, this stack would connect to EZBEPOR2305

TCP/IP Subplexing - continued

- **SWSA and Sysplexports structure names in the CFRM policy definition must include Subplex suffixes**
 - If not, VTAM (acting on behalf of the TCP/IP stacks) will not be able to connect to the structures.
- **Dynamic/automatic connectivity between TCP/IP stacks in different Subplexes will be blocked for:**
 - Dynamic XCF
 - IUTSAMEH when used by Dynamic XCF
 - HiperSockets when used by Dynamic XCF (using the IQDVLANID value)
 - TCP/IP stacks that specify the same IQDVLANID value (GLOBALCONFIG) must specify the same XCFGRPID value, if they are on the same CEC using the same CHPID
 - TCP/IP stacks in the default Subplex must specify an IQDVLANID value, if they are on the same CEC using the same CHPID as stacks in other Subplexes
- **Connectivity between TCP/IP stacks in different Subplexes will not be blocked for:**
 - Static XCF
 - User-defined IUTSAMEH
 - User-defined Hipersockets
 - Any other external network interface
- **You must not restart VTAM with a different XCFGRPID while TCP/IP stacks are running**
 - You must stop and restart the TCP/IP stacks so they can pick up the new VTAM XCFGRPID suffix.

TCP/IP Subplex Configuration - XCFGRPID parameter

NOTES

- TCP/IP subplexes are defined by the Sysplex group name that each TCP/IP stack joins at initialization.
- The TCP/IP group name is determined by the new VTAM Start Option XCFGRPID and by the new TCP Profile parameter XCFGRPID on the GLOBALCONFIG statement.
- GLOBALCONFIG syntax for XCFGRPID:


```
>>-GLOBALCONFig---+-----+-----><
                    '-XCFGRPID=---tt-----'
```
- **tt** is a number between 2 and 31, inclusive. If one character is specified, it will be padded on the left with a 0. XCFGRPID can only be specified in the initial profile.
- TCP/IP will join group EZBTvvtt, where vv is the VTAM XCFGRPID, and tt is the TCP/IP XCFGRPID.
 - If a VTAM XCFGRPID is specified, but no TCP/IP XCFGRPID is specified, TCP/IP will join EZBTvvCS
 - If a VTAM XCFGRPID is not specified, but a TCP/IP XCFGRPID is specified, TCP/IP will join EZBTCPtt
 - If both a VTAM XCFGRPID and a TCP/IP XCFGRPID are not specified, TCP/IP will join EZBTCPCS
- TCP structures for SWSA and Sysplexports will be suffixed by both the VTAM XCFGRPID and the TCP XCFGRPID. The SWSA structure name will be EZBDVIPAvvtt. The Sysplexports structure name will be EZBEPORtvvtt.
 - If a VTAM XCFGRPID is specified, but no TCP/IP XCFGRPID is specified, the structure names will be EZBDVIPAvv and EZBEPORtvv
 - If a VTAM XCFGRPID is not specified, but a TCP/IP XCFGRPID is specified, the structure names will be EZBDVIPA01tt and EZBEPORt01tt
 - If both a VTAM XCFGRPID and a TCP/IP XCFGRPID are not specified, the structure names will be EZBDVIPA and EZBEPOR

TCP/IP Subplex Configuration - GLOBALCONFIG IQDVLANID parameter

NOTES

➤ If Hipersockets is supported on this system for Dynamic XCF connectivity, the IQDVLANID parameter, on the GLOBALCONFIG statement, must be specified if XCFGRPID is specified. The value specified is a VLAN id used when iQDIO (HiperSockets) connectivity is used for DynamicXCF support. It is used to partition connectivity across HiperSockets.

➤ Stacks on the same CEC using the same HiperSockets CHPID which use the same VLAN ID can establish communications over HiperSockets. Stacks on the same CEC using the same HiperSockets CHPID which use different VLAN IDs cannot.

➤ GLOBALCONFIG syntax for IQDVLANID:

```
>>-GLOBALCONFig-----+-----<<
          '-IQDVLANid---nn-----'
```

➤ nn is a number in the range 1-4094. IQDVLANID can only be specified in the initial profile.

➤ IQDVLANID support for HiperSockets requires a z890 GA2 or z990 GA2 hardware level.

TCP/IP Subplex Configuration - CF structure definitions

NOTES

- Structure names in the CFRM policy must include the Subplex suffixes

```
DATA TYPE(CFRM) REPORT(YES)
DEFINE POLICY NAME(VTAMSAMP) REPLACE(YES)
  STRUCTURE NAME(EZBDVIPA2311)
    SIZE(50000)
    INITSIZE(15000)
    REBUILDPERCENT(20)
    PREFLIST(RALNSCF2,RALNSCF1)
  STRUCTURE NAME(EZBEPOR2311)
    SIZE(10000)
    INITSIZE(5000)
    REBUILDPERCENT(20)
    PREFLIST(RALNSCF2,RALNSCF1)
```

TCP/IP Subplex Configuration - HiperSockets usage by dynamic XCF

NOTES

➤ Connectivity isolation across Hipersockets

- TCP/IP stacks in the same Subplex that share the same CEC and specify the same HiperSockets CHPID must specify the same value on the IQDVLANID parameter.
- TCP/IP stacks in different Subplexes that share the same CEC and specify the same HiperSockets CHPID must specify different values on the IQDVLANID parameter.
- TCP/IP stacks in the default Subplex (i.e. no XCFGRPID parameter specified) that share the same CEC and specify the same HiperSockets CHPID as stacks in other Subplexes must specify an IQDVLANID value that is different from those used in the other Subplexes.
- If Subplexing is not being used within the Sysplex, the IQDVLANID parameter on the GLOBALCONFIG statement should not be specified.
- If TCP1, TCP2, TCP3, and TCP4 are on the same CEC using the same CHPID, and TCP1 and TCP2 are in the same Subplex (e.g. both specified XCFGRPID 11), they must both specify the same IQDVLANID (e.g. IQDVLANID 2000). If TCP3 is in a different Subplex (e.g. XCFGRPID 02), it must not specify the same IQDVLANID as TCP1 and TCP2 (e.g. IQDVLANID 305). If TCP4 is in the default Subplex (no XCFGRPID specified), it must specify an IQDVLANID that is different from those specified by TCP1, TCP2 and TCP3 (e.g. IQDVLANID 16).

- **If a TCP/IP stack that specifies XCFGRPID=11 in its TCP Profile is started on a VTAM node with XCFGRPID=23, it will join group EZBT2311. If you then stop VTAM and restart it with an XCFGRPID=05, VTAM will establish connectivity with other nodes in Subplex 05, but TCP/IP will still be using group EZBT2311. You must stop the TCP/IP stack and restart it to cause it to join EZBT0511.**

TCP/IP Message Display Example - Initialization

NOTES

➤ Example of the new message displayed by TCP/IP during initialization

```
S TCPCS1
IEF695I START TCPCS1 WITH JOBNAME TCPCS1 IS ASSIGNED TO USER TCPCS
, GROUP SYS1
$HASP373 TCPCS1 STARTED
IEF403I TCPCS1 - STARTED - TIME=15.31.32
.
.
.
EZZ0641I IP FORWARDING NOFWDMULTIPATH SUPPORT IS ENABLED
EZZ0350I SYSPLEX ROUTING SUPPORT IS ENABLED
EZZ0351I SOURCEVIPA SUPPORT IS DISABLED
EZZ0632I MULTIPATH PERPACKET SUPPORT IS ENABLED
EZZ0624I DYNAMIC XCF DEFINITIONS ARE ENABLED
EZZ4202I Z/OS UNIX - TCP/IP CONNECTION ESTABLISHED FOR TCPCS1
EZD1176I TCPCS1 HAS SUCCESSFULLY JOINED THE TCP/IP SYSPLEX GROUP EZBT2305
EZB6473I TCP/IP STACK FUNCTIONS INITIALIZATION COMPLETE.
```

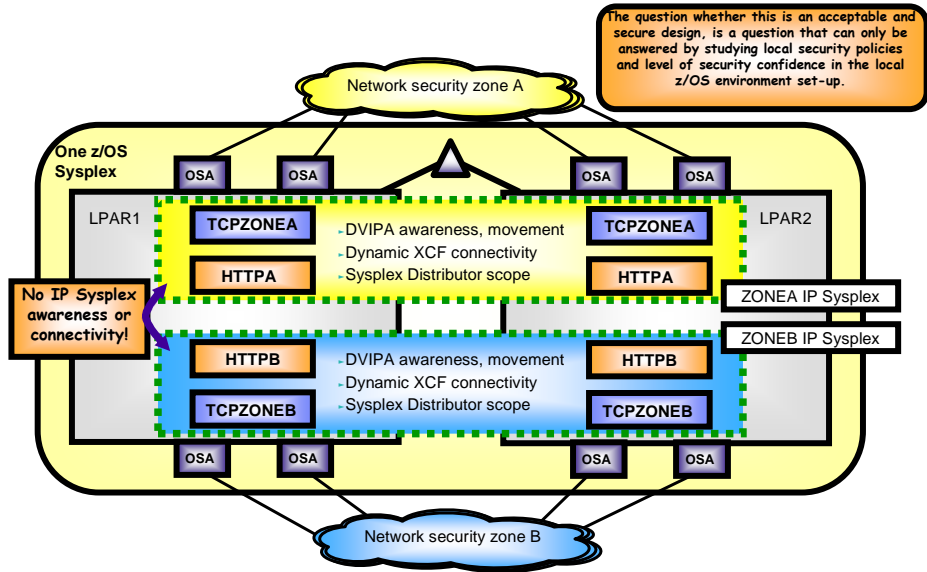

TCP/IP Message Display Example - D TCPIP,,SYSPLEX,GROUP

NOTES

➤ Example of the new message displayed by TCP/IP when D TCPIP,,SYSPLEX,GROUP is issued

```
d tcpip,tcps1,sysplex,group
EZZ8270I SYSPLEX GROUP FOR TCPCS1  AT MVS165  IS EZBT2305
```

Example of LPARs connected to multiple security zones



HiperSockets VLANID Configuration

- **HiperSockets VLANID support can be used by Dynamic XCF's HiperSockets support and by user-defined HiperSockets interfaces**
 - A VLAN ID is a number in the range 1-4094.
 - VLANID support for HiperSockets requires a z890 GA2 or z990 GA2 hardware level or later
- **VLANID to be used by Dynamic XCF is specified on the GLOBALCONFIG statement - option IQDVLANID**
- **User-defined HiperSockets interfaces can specify VLAN ids on the LINK or the INTERFACE statements to partition HiperSockets connectivity**
 - On the LINK and/or INTERFACE statements for HiperSockets devices
 - VLANID nn
 - nn is a numeric value between 1 and 4094
 - VLANID support for HiperSockets requires a z890 GA2 or z990 GA2 hardware level.
 - HiperSockets allows a stack to specify only one VLAN ID when the interface is used for both IPv4 and IPv6. If you specify a different VLAN ID value on a LINK and INTERFACE definition for the same CHPID, the second statement will be rejected.

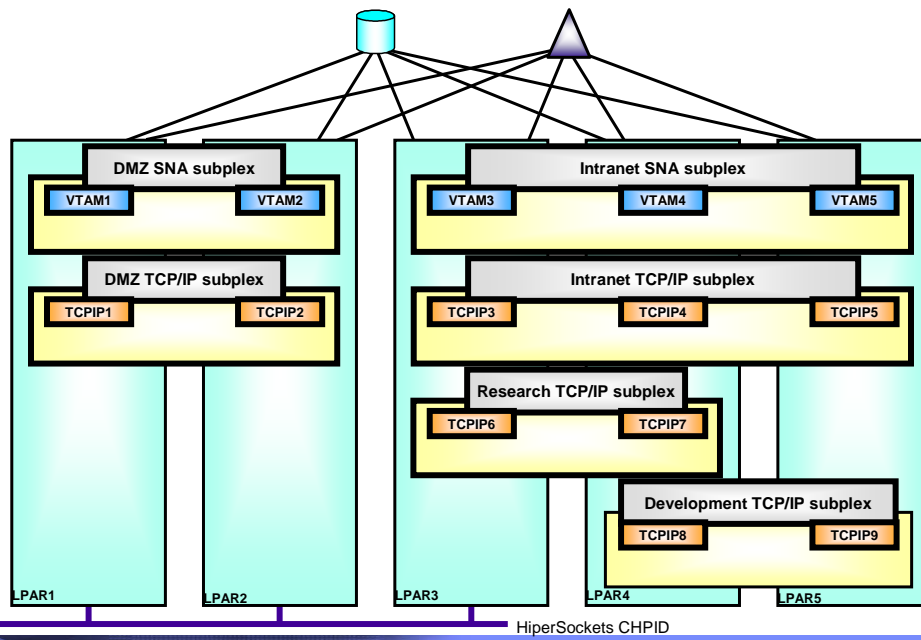
Pre-V1R8 nodes in the Sysplex

- **If you have network subplexing established in your Sysplex, any pre-V1R8 nodes in the Sysplex will be treated as being in the default Network Subplex**
 - For VTAM, the default Network Subplex is the one that joins Sysplex groups ISTXCF and ISTCFS01
 - For TCP/IP, the default Network Subplex is the one that joins Sysplex group EZBTCPCS
- **The pre-V1R8 nodes will only be able to establish dynamic connectivity to other nodes within the default Network Subplex.**
- **Dynamic connectivity (and the other TCP/IP and VTAM Sysplex functions that are scoped by Subplexing) will be blocked between these nodes and nodes in other Network Subplexes.**
- **Any pre-V1R8 TCP/IP stacks that set up dynamic HiperSockets connectivity will do so without an IQDVLANID.**
 - This effectively defaults the VLAN id to 0.
 - A VLAN id of 0 means that this HiperSockets access point can connect to (and exchange data with) any other HiperSockets access point, regardless of the IQDVLANID value specified on that other stack.
 - Full subplexing isolation will not be possible with this configuration.
 - Separate HiperSockets CHPIDs should be used for pre V1R9 stacks.

Things to think about

- **At this time, sysplex distributor is the only recommend method for distributing workload within a networking subplex.**
 - z/OS Load Balancing Advisor currently includes no explicit support for network subplexing - as of z/OS V1R8

Planning for Network Subplexing - plan the topology



Planning for Network Subplexing - Define group IDs and structure names

➤ Determine how many Network Subplexes will be needed

- Assign a unique VTAM XCFGRPID for each anticipated VTAM Subplex in the Sysplex
 - VTAM1 & VTAM2: Default (No XCFGRPID start option specified)
 - VTAM3, VTAM4, & VTAM5: XCFGRPID=21

- Determine what GR and MNPS structures each VTAM Subplex will require
 - Default VTAM Subplex: ISTDZMGR & ISTDZMNPS
 - VTAM Subplex 21: ISTGR21 & ISTMNPS21

- Assign a unique TCP/IP XCFGRPID for each anticipated TCP/IP Subplex in the Sysplex
 - TCPIP1 & TCPIP2: Default (No XCFGRPID parameter specified)
 - TCPIP3, TCPIP4, & TCPIP5: XCFGRPID 02
 - TCPIP6 & TCPIP7: XCFGRPID 03
 - TCPIP8 & TCPIP9: XCFGRPID 04

- Determine what SWSA and Sysplexports structures each TCP/IP Subplex will require
 - Default TCP/IP Subplex: EZBDVIPA & EZBEPOR
 - TCP/IP Subplex 02: EZBDVIPA2102 & EZBEPOR2102
 - TCP/IP Subplex 03: EZBDVIPA2103 & EZBEPOR2103
 - TCP/IP Subplex 04: EZBDVIPA2104 & EZBEPOR2104

Planning for Network Subplexing - HiperSockets VLAN IDs and CFRM policies

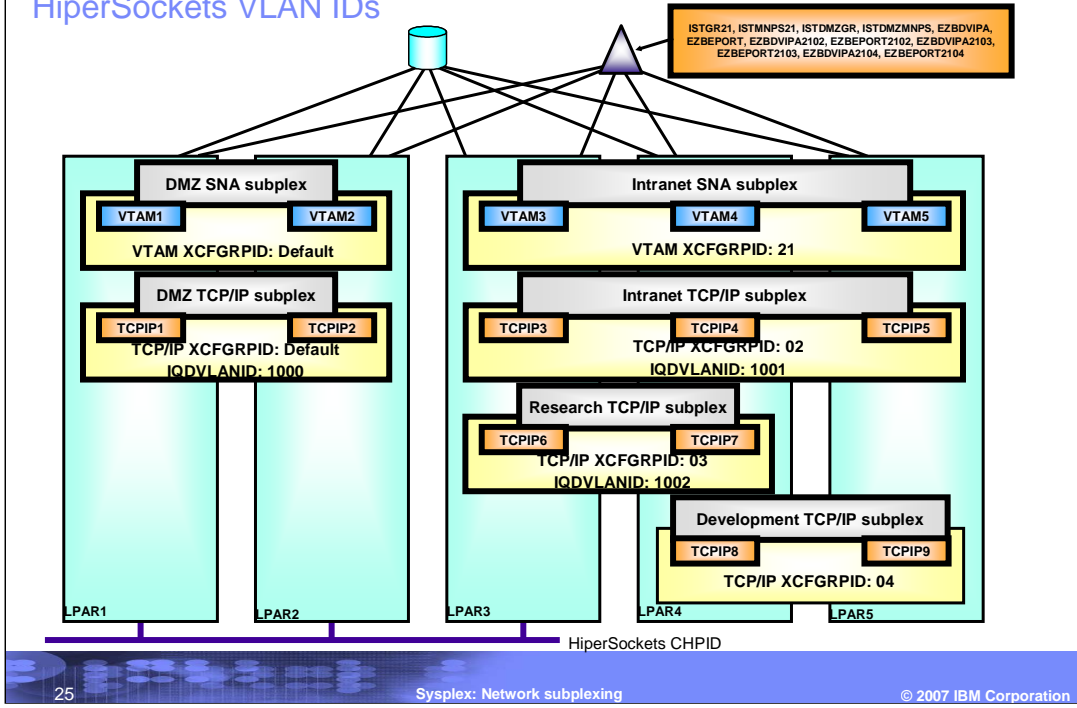
➤ If you will have multiple TCP/IP Subplexes with accessibility to the same HiperSockets LAN

- Ensure all the systems that will be using HiperSockets are at the V1R8 level (and at the appropriate hardware level)
- Assign a unique IQDVLANID value for each such TCP/IP Subplex to each TCP/IP stack with common HiperSockets access. Also, assign a unique IQDVLANID value to stacks in the default Subplex (i.e. no XCFGRPIDs specified).
 - Default TCP/IP Subplex, Stacks TCPIP1 & TCPIP2: IQDVLANID 1000
 - TCP/IP Subplex 02, Stack TCPIP3: IQDVLANID 1001
 - TCP/IP Subplex 03, Stack TCPIP6: IQDVLANID 1002

➤ Create a CFRM policy that defines all the needed GR, MNPS, SWSA, and Sysplexports structures that will be used in the Sysplex, including their assigned XCFGRPIDs suffixes

- Define, in the CFRM policy: ISTGR21, ISTMNPS21, ISTDZGR, ISTDZMNPS, EZBDVIPA, EZBEPOR, EZBDVIPA2102, EZBEPOR2102, EZBDVIPA2103, EZBEPOR2103, EZBDVIPA2104, EZBEPOR2104

Planning for Network Subplexing - topology with group IDs and HiperSockets VLAN IDs



Setting up Network Subplexes in a Sysplex

➤ Activate the CFRM policy

➤ For each VTAM in the Sysplex that will need a VTAM XCFGRPID or that supports TCP/IP stacks that need a TCP/IP XCFGRPID or IQDVLANID

- If the VTAM node needs an XCFGRPID, stop the VTAM node

- For each TCP/IP stack on that VTAM node that will need a TCP/IP XCFGRPID or IQDVLANID
 - Stop the TCP/IP stack

 - Change the TCP/IP profile GLOBALCONFIG statement to specify the XCFGRPID value for that stack

 - If the stack requires a IQDVLANID, change the TCP/IP profile GLOBALCONFIG statement to specify the IQDVLANID value for that stack

 - Restart the TCP/IP stack

- If the VTAM node was stopped, restart the VTAM node specifying the XCFGRPID Start Option with the value assigned to the Subplex this VTAM node will belong to

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