Planning and Migrating to z/VM Single System Image (SSI)

Session 12361

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Topics

- What to think about before installing z/VM 6.2
- Configuring your SSI Cluster
  - CTCs
  - DASD
  - System Configuration file
  - User Directory
  - Persistent Data Record (PDR)
- Migrating to SSI

SSI Cluster Requirements

- Servers must be IBM System z10 or later (z/VM Version 6)
- Shared and non-shared DASD
  - 3390 volume required for the PDR
  - All volumes should be cabled to all members
    - Makes non-shared disks accessible to other members to fix configuration problems
- LPARs
  - 1-16 FICON CTC devices between LPARs
    - Provide direct ISFC links from each member to all other members
  - FICON channels to shared DASD
  - OSA access to the same LAN segments
  - FCP access to same storage area networks (SANs) with same storage access rights
- Shared system configuration file for all members
- Shared source directory containing user definitions for all members
- Capacity planning for each member of the SSI cluster
  - Ensure sufficient resources are available to contain shifting workload
    - Guests that will relocate
    - Guests that logon to different members

SSI Cluster Topography

1. **How many members in your cluster?**

2. **Production configuration**
   - How many CECs?
   - How many LPARS/CEC?
     - *Suggested configuration for 4-member cluster is 2 LPARs on each of 2 CECs*

3. **Test configuration**
   - VM guests?
   - LPARs?
   - Mixed?

4. **Virtual server (guest) distribution**
   - Each guest's “home" member?
   - Where can each guest be relocated?
   - *Distribute workload so each member has capacity to receive relocated guests*
     - CPU
     - Memory

Which Type of Installation Should I Choose?

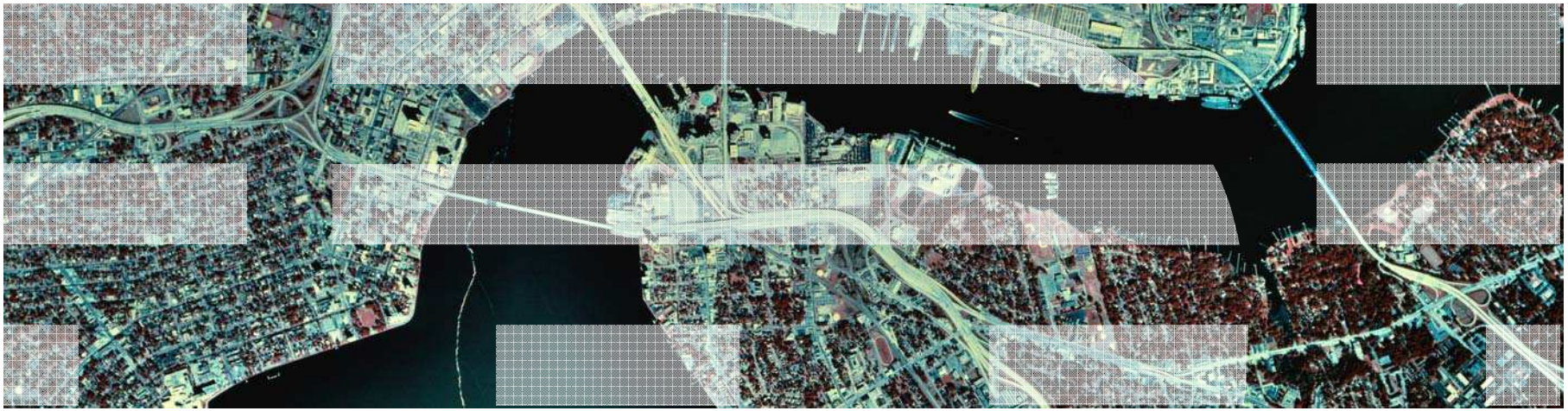
- **SSI Installation**
  - Single installation for multiple z/VM images
    - Can also install a single system configured as an SSI member
  - Installed and configured as an SSI cluster
    - Single source directory
    - Shared system configuration file
    - Creates Persistent Data Record (PDR) on Common volume

- **Non-SSI installation**
  - Single z/VM image
  - Can be converted to initial member of an SSI cluster later
  - Builds DASD layout, directory, and configuration file the same as SSI installation

- Both types of installation are different from previous releases of z/VM
  - Userids
  - Disks
  - Directory
  - System configuration file

- Review documented migration scenarios before deciding whether to do SSI or non-SSI install
    - "CP Planning and Administration"
  - SSI installation primarily for new or "from scratch" installs

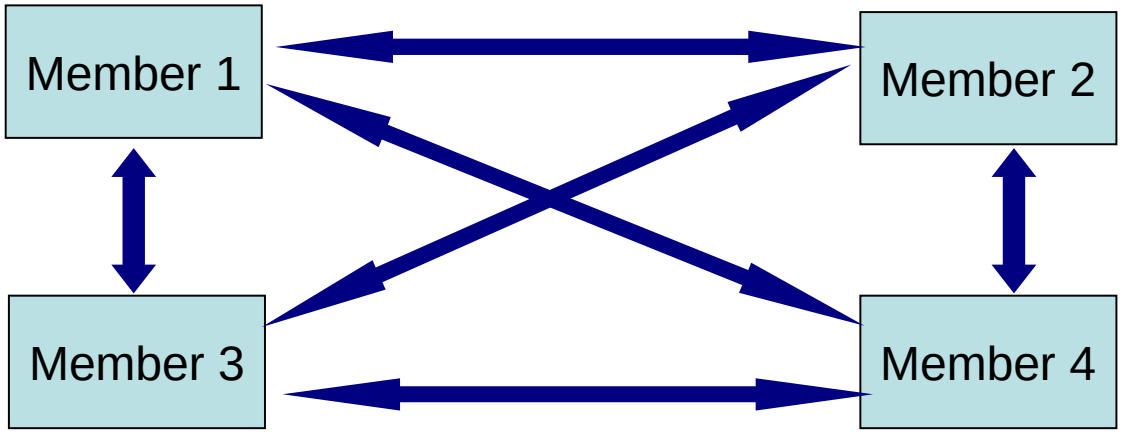
- "Getting Started with Linux on System z" book has been updated with SSI and LGR planning tips



Configuring your SSI Cluster

CTC Connections

- Each member of an SSI cluster must have a direct ISFC connection to every other member (logical link)

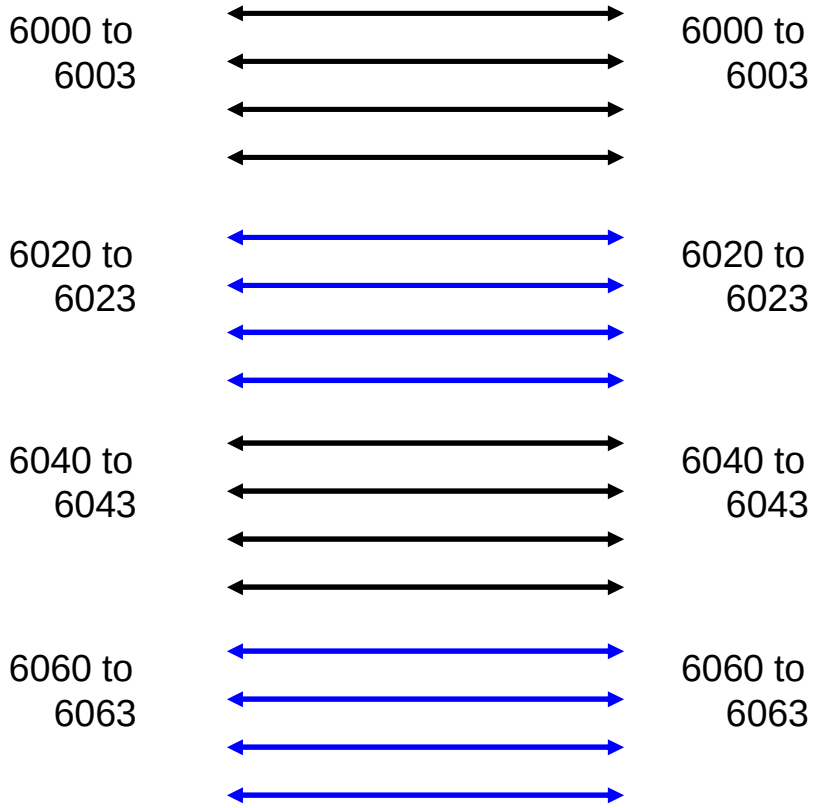


- Logical links are composed of 1-16 CTC connections
  - FICON channel paths
  - May be switched or unswitched
- Use multiple CTCs distributed on multiple FICON channel paths between each pair of members
  - Avoids write collisions that affect link performance
  - Avoids severing logical link if one channel path is disconnected or damaged
- *Recommended practice:* Use same real device number for same CTC on each member or have a numbering scheme

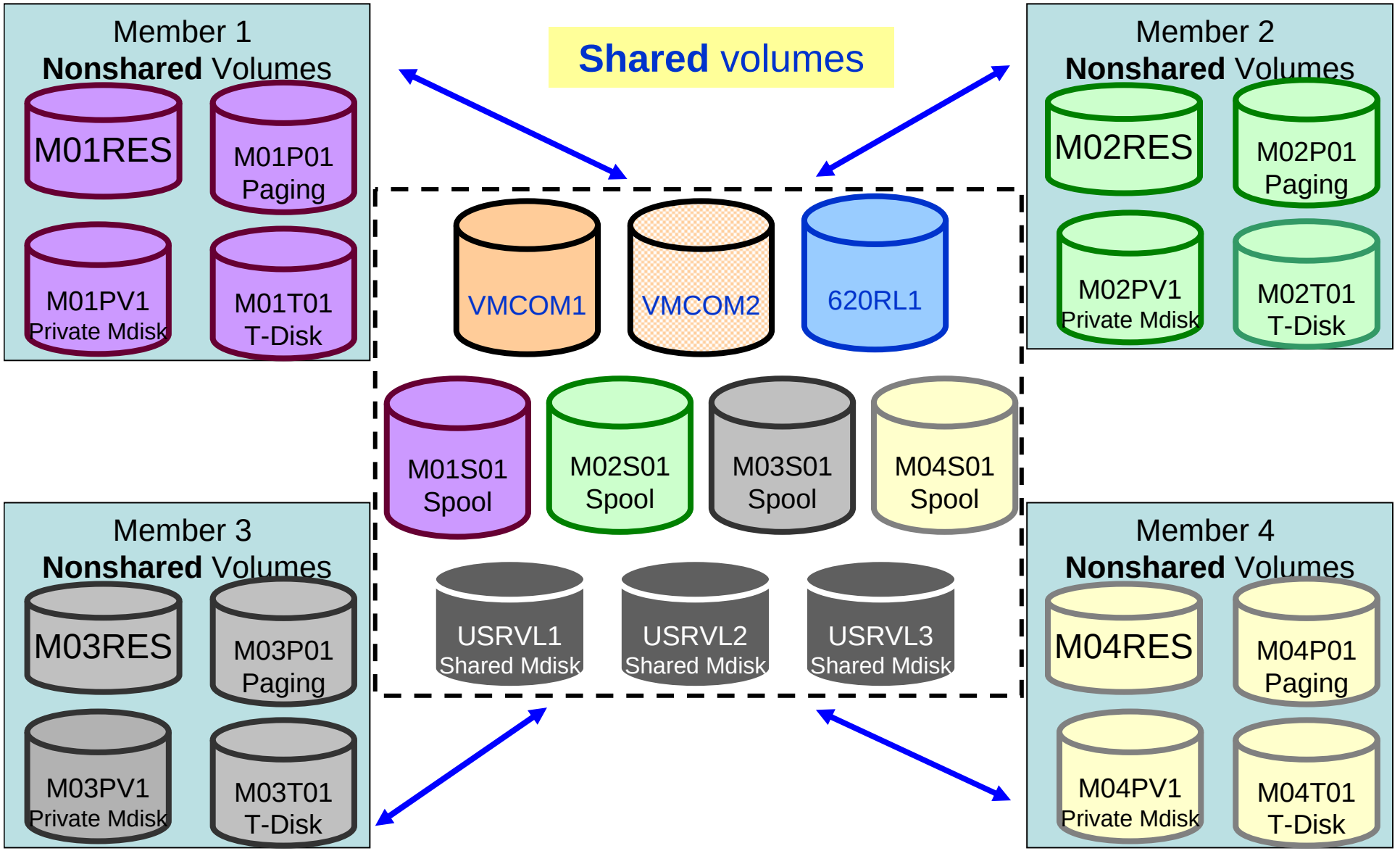
CTC Connections – How Many Do I Need?

- 4 CTC devices per per FICON chpid
  - *provides most efficient ISFC data transfer*

- For large guests, relocation and quiesce times improve with more chpids
  - *Up to 4 chpid paths, with 4 CTCs each*
    - *Additional factors affect relocation and quiesce times*



DASD Planning – Non-Shared and Shared System Volumes



DASD Planning - CP Volume Ownership

- Link the full pack overlay for each CP-Owned volume
- Use **CPFMTXA** to add ownership information to each CP-Owned volume
  - Cluster name
  - System name of owning member

Volume	***Full Pack Overlay***	***Owner (CLUSTER.MEMBER)***
M01RES	**MAINT 123**	**MYCLUSTER.MEMBER1**
VMCOM1	**PMAINT 141**	**MYCLUSTER.NOSYS**
M01S01	**MAINT 122**	**MYCLUSTER.MEMBER1**
M01P01	**$PAGE$ A01**	**MYCLUSTER.MEMBER1**

- Ownership information may also be used on non-SSI systems
  - System name but no cluster name
  - Default on non-SSI installs

DASD Planning – Changes to the System Configuration

- CP_OWNED list shows CP_OWNED volumes for all systems:

```
/*****************************************************************/
/*                                          SYSRES  VOLUME       */
/*****************************************************************/

MEMBER1:  CP_Owned   Slot   1  M01RES
MEMBER2:  CP_Owned   Slot   1  M02RES
/*****************************************************************/
/*                                          COMMON VOLUME        */
/*****************************************************************/

    CP_Owned   Slot   5  VMCOM1
```

- The User_Volume_List is now split between shared and private volumes

```
/*****************************************************************/
/* Shared User Volumes                                           */
/*****************************************************************/
          User_Volume_List  620RL1 620RL2 USRVL1

/*****************************************************************/
/* User volumes for local minidisks                              */
/*****************************************************************/

MEMBER1:   User_Volume_List  M01W01 M01PV1
MEMBER2:   User_Volume_List  M02W01 M02PV1
```

Networks in an SSI

- All members should have identical network connectivity
  - Connected to same physical LAN segments
  - Connected to same SAN fabric

- Assign equivalence identifiers (EQIDs) to all network devices
  - Devices assigned same EQID on each member must be
    - same type
    - have the same capabilities
    - have connectivity to the same destinations

Networks in an SSI – Virtual Switches

- Define virtual switches with same name on each member
- For relocating guests:
  - Source and destination virtual switch guest NIC and port configurations must be equivalent
    - Port type
    - Authorizations (access, VLAN, promiscuous mode)
  - Source and destination virtual switches must be equivalent
    - Name and type
    - VLAN settings
    - Operational UPLINK port with matching EQID
    - Device and port numbers need not match, but connectivity to the same LAN segment is required

Networks in an SSI – MAC Addresses

- MAC address assignments are coordinated across an SSI cluster
  - VMLAN statement
    - MACPREFIX must be set to different value for each member
    - Default is 02-xx-xx where xx-xx is "system number" of member (e.g., 02-00-01 for member 1)
  - USERPREFIX must be set for SSI members
    - Must be identical for all members
    - Must not be equal to any member's MACPREFIX value
    - Default is 02-00-00
  - MACIDRANGE is ignored in an SSI cluster
    - Because MAC assignment is coordinated among members
  - Example:

```
VMSYS01: VMLAN MACPREFIX 021111 USERPREFIX 02AAAA
VMSYS02: VMLAN MACPREFIX 022222 USERPREFIX 02AAAA
VMSYS03: VMLAN MACPREFIX 023333 USERPREFIX 02AAAA
VMSYS04: VMLAN MACPREFIX 024444 USERPREFIX 02AAAA
```

Cluster and Member Configuration – SYSTEM CONFIG

- System_Identifier statements for each member:

```
System_Identifier LPAR LP01 MEMBER1
System_Identifier LPAR LP02 MEMBER2
```

- The new SSI statement:

```
SSI MYCLUSTR PDR_Volume VMCOM1 ,
 Slot 1 MEMBER1,
 Slot 2 MEMBER2
```

- System_Residence statements for each member:

```
MEMBER1:  System_Residence,
    Checkpoint  Volid M01RES    From CYL 21  For 9 ,
    Warmstart   Volid M01RES    From CYL 30  For 9
MEMBER2:  System_Residence,
    Checkpoint  Volid M02RES    From CYL 21  For 9 ,
    Warmstart   Volid M02RES    From CYL 30  For 9
```

Cluster and Member Configuration – Additional Steps

- Enable the SSI Feature

- Run CPSYNTAX:

```
cpsyntax sysnew config (system member1
CONFIGURATION FILE PROCESSING COMPLETE -- NO ERRORS ENCOUNTERED.
```

Shared Source Directory – Virtual Machine Definition Types

Single Configuration Virtual Machine (traditional)

USER statement

Same definitions and resources on all members

- May log on to any member
  - Only one member at a time
- General Workload
  - Guest Operating Systems
  - Service virtual machines requiring only one logon in the cluster

Multiconfiguration Virtual Machine (new)

IDENTITY statement

Definitions and resources common to all members

- May log on to multiple members at the same time (known by IDENTITY name)
- System support virtual machines
- Service virtual machines

SUBCONFIG statement for member 1

Definitions and resources unique to member 1

SUBCONFIG statement for member 2

Definitions and resources unique to member 2

Shared Source Directory – Global and Local disks

- For each guest you're turning into a multiconfiguration virtual machine, decide which disks should be global and which should be local
  - You may want to split existing disks into global and local.

Global	Local
•All instances have access	•Only one instance has access
•Usually R/O	•Usually R/W
•EXECs	•Log files
•Control files	•Work files

Shared Source Directory - New Layout

- IBM-supplied directory will be significantly different than in previous releases
  - Both SSI and non-SSI installations
  - Directory for non-SSI installations will be in "SSI-ready" format
    - Facilitate future SSI deployment
- Many of the IBM-supplied userids will be defined as multiconfiguration virtual machines
- Determine if any of your guests should be defined as multiconfiguration virtual machines
  - Most will be single-configuration virtual machines
  - Userids defined on SYSTEM_USERIDS statements will usually be multiconfiguration virtual machines
- Merge your user definitions into the IBM-supplied directory

Shared Source Directory - New MAINT Userids

MAINT	PMAINT	MAINT620
Multi Configuration Virtual Machine	***Single Configuration Virtual Machine***	***Single Configuration Virtual Machine***
Owns CF1, CF3 parm disks, 190, 193, 19D, 19E, 401, 402, 990 CMS disks	Owns CF0 parm disk, 2CC, 550, 551 disks	Owns the service disks (e.g., 490, 493, 49D) and the CF2 parm disk
Use for work on a particular member, such as attaching devices, or relocating guests	Use for updating the system config, or for SSI-wide work, e.g., defining relocation domains	Use for applying 6.2.0 service. The CF2 parm disk contains 6.2.0 CPLOAD modules.

Shared Source Directory - Minidisks for New MAINT Userids

Parm Disks *(Owner)*

- **CF0** ***(PMAINT) – Global disk***
  - Common system configuration file
- **CF1** ***(MAINT) -- Local disk***
  - Production CPLOAD MODULE
- **CF2** ***(MAINT620) – Local disk***
  - Used by SERVICE to hold test CPLOAD MODULE
- **CF3** ***(MAINT) – Local disk***
  - Backup of CF1

Full Pack Minidisks

- **MAINT**
  - 122 M01S01
  - 123 M01RES
  - 124 M01W01
- **MAINT620**
  - 131 620RL1
  - 132 620RL2
  - 133 620RL3
- **PMAINT**
  - 141 VMCOM1
  - 142 VMCOM2

Shared Source Directory - Multiconfiguration Virtual Machine Definition

```
IDENTITY MAINT    MAINTPAS     128M 1000M ABCDEFG

BUILD ON SSIMEMB1 USING SUBCONFIG MAINT-1
BUILD ON SSIMEMB2 USING SUBCONFIG MAINT-2
BUILD ON SSIMEMB3 USING SUBCONFIG MAINT-3
BUILD ON SSIMEMB4 USING SUBCONFIG MAINT-4

CONSOLE 009 3215 T
SPOOL 00C 2540 READER *
SPOOL 00D 2540 PUNCH  A
SPOOL 00E 1403 A
LINK    USER1     2CC 2CC RR
LINK    USER1     551 551 RR

SUBCONFIG MAINT-1
 MDISK 0191 3390 1000 20 MNTVL1 WR
 MDISK CF1  3390 100  20 M01RES RR
* END OF MAINT-1

SUBCONFIG MAINT-2
 MDISK 0191 3390 1000 20 MNTVL2 WR
 MDISK CF1  3390 100  20 M02RES RR
* END OF MAINT-2

SUBCONFIG MAINT-3
 MDISK 0191 3390 1000 20 MNTVL3 WR
 MDISK CF1  3390 100  20 M03RES RR
* END OF MAINT-3

SUBCONFIG MAINT-4
 MDISK 0191 3390 1000 20 MNTVL4 WR
 MDISK CF1  3390 100  20 M04RES RR
* END OF MAINT-4
```

These statements apply to all instances of MAINT on all members

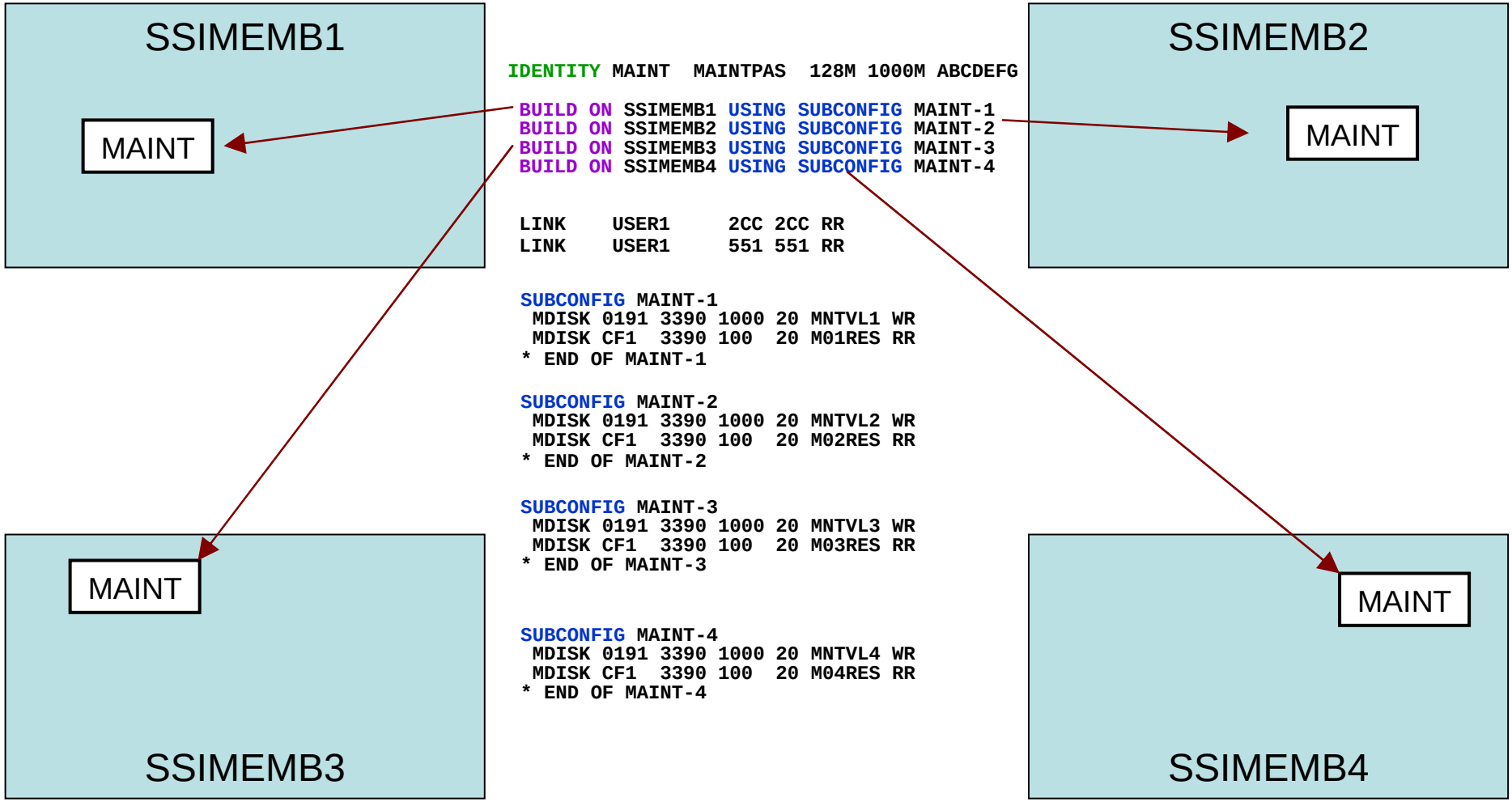
These statements only apply to MAINT on member SSIMEMB1

These statements only apply to MAINT on member SSIMEMB2

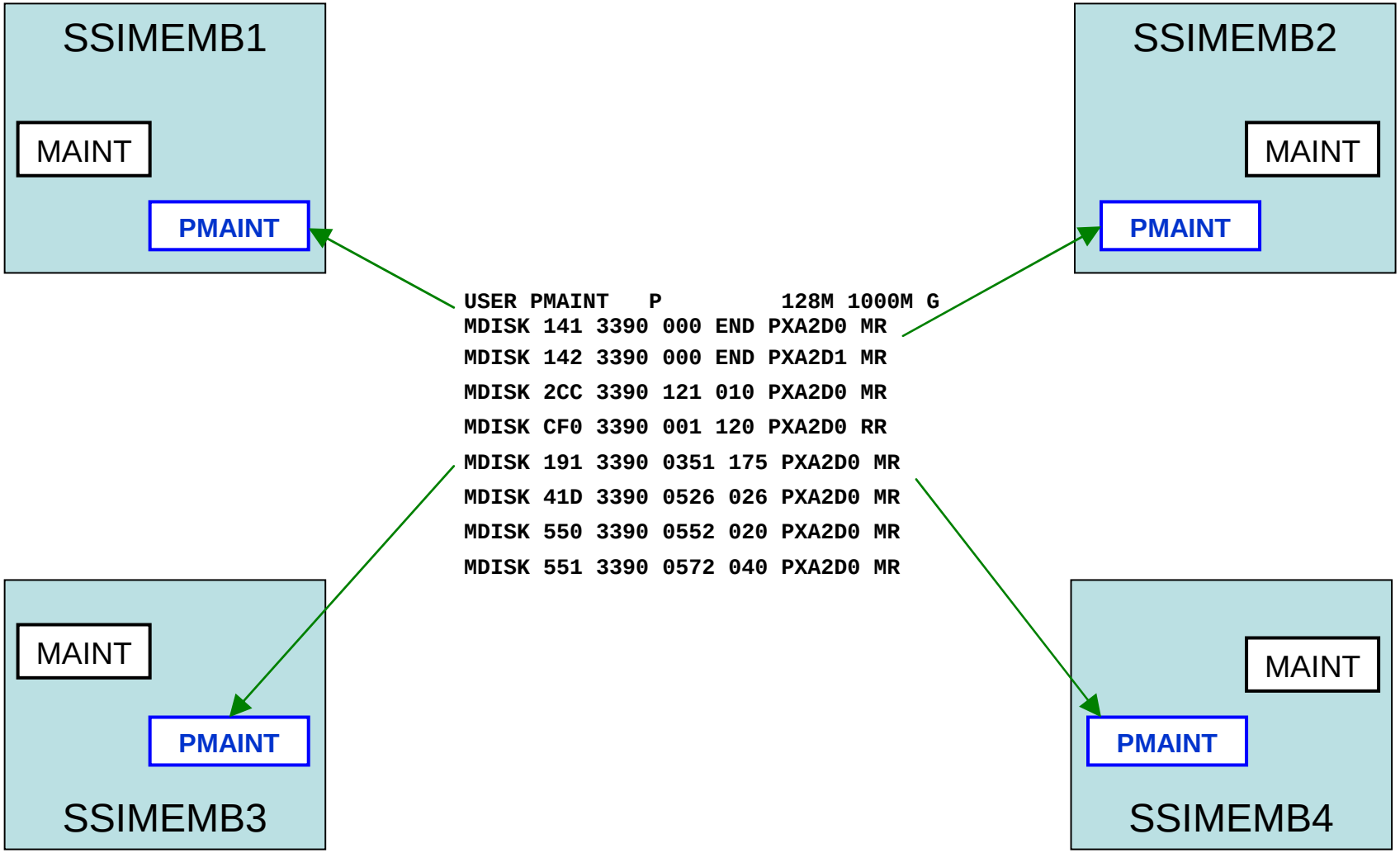
These statements only apply to MAINT on member SSIMEMB3

These statements only apply to MAINT on member SSIMEMB4

Shared Source Directory – Multiconfiguration Virtual Machines



Shared Source Directory – Single Configuration Virtual Machines



Shared Source Directory – "SSI-enable"

- New SSI keyword on the DIRECTORY statement, which can now take multiple volume names

```
23 DIRECTORY SSI 123 3390 M01RES M02RES M03RES M04RES
```

- In a 6.2.0 Non-SSI directory, all IDENTs have a Build statement with * instead of a member name
- In an SSI directory, this needs to be updated to a member name

Non-SSI

```
165 IDENTITY MAINT MAINT 128M 1000M ABCDEFG
166  BUILD ON *        USING SUBCONFIG MAINT-1
```

SSI

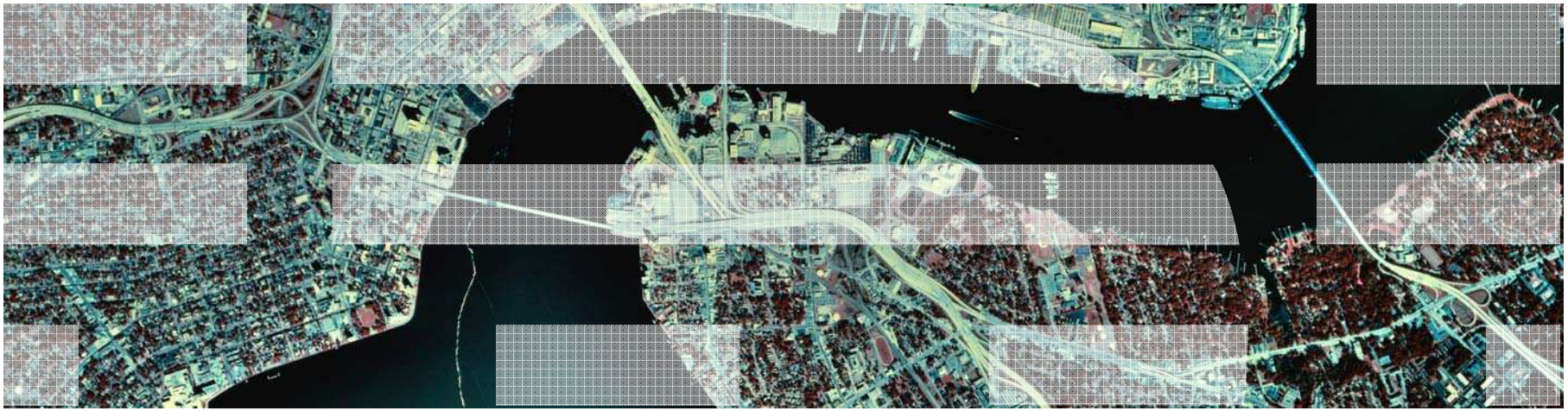
```
165 IDENTITY MAINT MAINT 128M 1000M ABCDEFG
166  BUILD ON MEMBER1 USING SUBCONFIG MAINT-1
```

Persistent Data Record (PDR) – Create and query

- **LINK** the fullpack overlay of *VMCOM1*, **PMAINT** *141*

```
formssi create 141 myclustr
HCPPDF6613R Device 0141 label is VMCOM1 - continue (Yes/No)?
yes
HCPPDF6614I Persistent Data Record created on device 0141
Ready; T=0.01/0.01 14:35:48

formssi display 141
HCPPDF6618I Persistent Data Record on device 0141 (label VMCOM1) is for
MYCLUSTR
HCPPDF6619I PDR                  state: Unlocked
HCPPDF6619I                time stamp: 09/23/11 14:35:48
HCPPDF6619I     cross-system timeouts: Enabled
Ready; T=0.01/0.01 14:35:54
```



Migrating to SSI

Use Case Scenarios

- Migration procedures for existing z/VM environments
  - Documented in CP Planning and Administration
    - Converting a z/VM System to a Single-Member z/VM SSI Cluster
    - Adding a Member to a z/VM SSI Cluster by Cloning an Existing Member
    - Combining Two Non-SSI z/VM Systems to Create a z/VM SSI Cluster
    - Moving a Second-Level z/VM SSI Cluster to First-Level
    - Converting a CSE Complex to a z/VM SSI Cluster
    - Decommissioning a Member of a z/VM SSI Cluster
- Review documented procedures before deciding whether to do SSI or non-SSI install

Migrating from a Non-SSI 6.2.0 system to a Single Member SSI

1. Prepare the New DASD Volumes
2. Update the System Configuration File
3. Update the User Directory
4. Manage the User Spool Files
5. Prepare the CP-Owned Volumes
6. Create the PDR
7. Modify the Startup Parameters for the VMPSFS File Pool
8. Shut Down and Cold Start
9. Load the Spool Files
10. Change the User Directory to SSI-Enabled

Adding a Second Member to Create a Two-member Cluster

1. Format the new member's volumes
2. Create the new member's services' configurations
3. Copy the member-specific volumes
4. Update the user directory
5. Update the shared system configuration
6. Enable the existing member to access the new member
7. IPL the new member
8. Update the Product Inventory Table
9. Build the saved segments
10. **XAUTOLOG AUTOLOG1** and check MEMBER2

Defining New Members to Active Ones

1. Active members stay up while new members are added
2. On one existing member the **`SET SSI SLOT n MEMBERNAME`** is issued
3. All existing members must **`ACTIVATE ISLINK`** to the new member
4. The new member joins the SSI cluster when it is IPLed
   - Provided the SYSTEM CONFIG and PDR configurations match

```
11:44:53 HCPFCA2706I Link MEMBER2 activated by user SYSTEM.
11:44:53 HCPKCL2714I Link device 0083 added to link MEMBER2.
11:44:53 HCPKCL2714I Link device 0063 added to link MEMBER2.
11:44:53 HCPKCL2714I Link device 0073 added to link MEMBER2.
11:44:53 HCPKCL2714I Link device 0053 added to link MEMBER2.
11:44:54 HCPALN2702I Link MEMBER2 came up.
11:44:54 HCPACQ2704I Node MEMBER2 added to collection.
11:44:54 HCPPLM1697I The state of SSI system MEMBER2 has changed from DOWN to JO
NING
11:44:54 HCPPLM1698I The mode of the SSI cluster is IN-FLUX
11:44:54 HCPPLM1697I The state of SSI system MEMBER2 has changed from JOINING to
JOINED
11:44:54 HCPPLM1698I The mode of the SSI cluster is IN-FLUX
11:44:54 HCPXHC1147I Spool synchronization with member MEMBER2 initiated.
11:44:54 HCPXHC1147I Spool synchronization with member MEMBER2 completed.
11:44:54 HCPPLM1698I The mode of the SSI cluster is STABLE
```

Summary

- SSI is a new way to deploy z/VM images and resources
  - Benefit from clustering and virtual server mobility
  - Disk layouts are different
  - IBM-supplied userids are defined differently
  - USER DIRECT and SYSTEM CONFIG are different

- Planning and thought required
  - CTC capacity and equipment
  - DASD resource sharing
  - Virtual networks
  - Single Configuration vs Multiconfiguration virtual machines

- New documentation to assist with
  - Migrating to an SSI cluster
  - Adding systems to your SSI cluster

More Information

z/VM 6.2 resources
http://www.vm.ibm.com/zvm620/

http://www.vm.ibm.com/events/

z/VM Single System Image Overview
http://www.vm.ibm.com/ssi/

Live Virtual Classes for z/VM and Linux
http://www.vm.ibm.com/education/lvc/

z/VM 6.2 Workshops
http://www.redbooks.ibm.com/cgi-bin/searchsite.cgi?query=Using+z/VM+v6.2+and+Linux

Redbooks
- An Introduction to z/VM SSI and LGR
  http://publib-b.boulder.ibm.com/redpieces/abstracts/sg248006.html?Open
- Using z/VM v 6.2 Single System Image (SSI) and Live Guest Relocation (LGR)
  http://publib-b.boulder.ibm.com/abstracts/sg248039.html?Open
- DB2 10 for Linux on System z Using z/VM v6.2, Single System Image Clusters and Live Guest Relocation
  http://www.redbooks.ibm.com/abstracts/sg248036.html?Open

Whitepaper
- z/VM Migration: Migrating the User Directory and RACF Environment
  http://public.dhe.ibm.com/common/ssi/ecm/en/zsw03246usen/ZSW03246USEN.PDF

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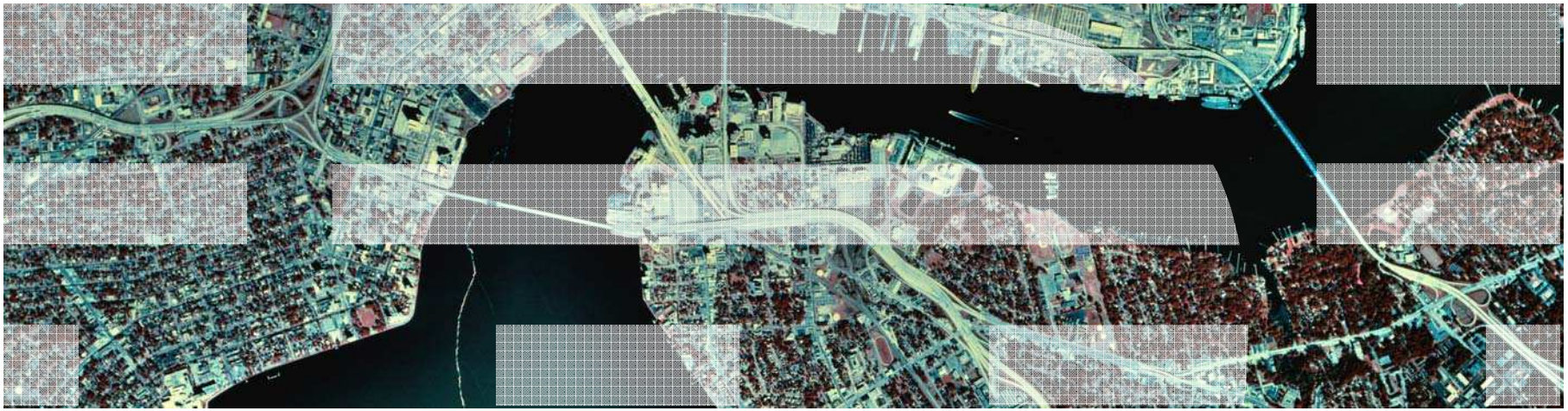
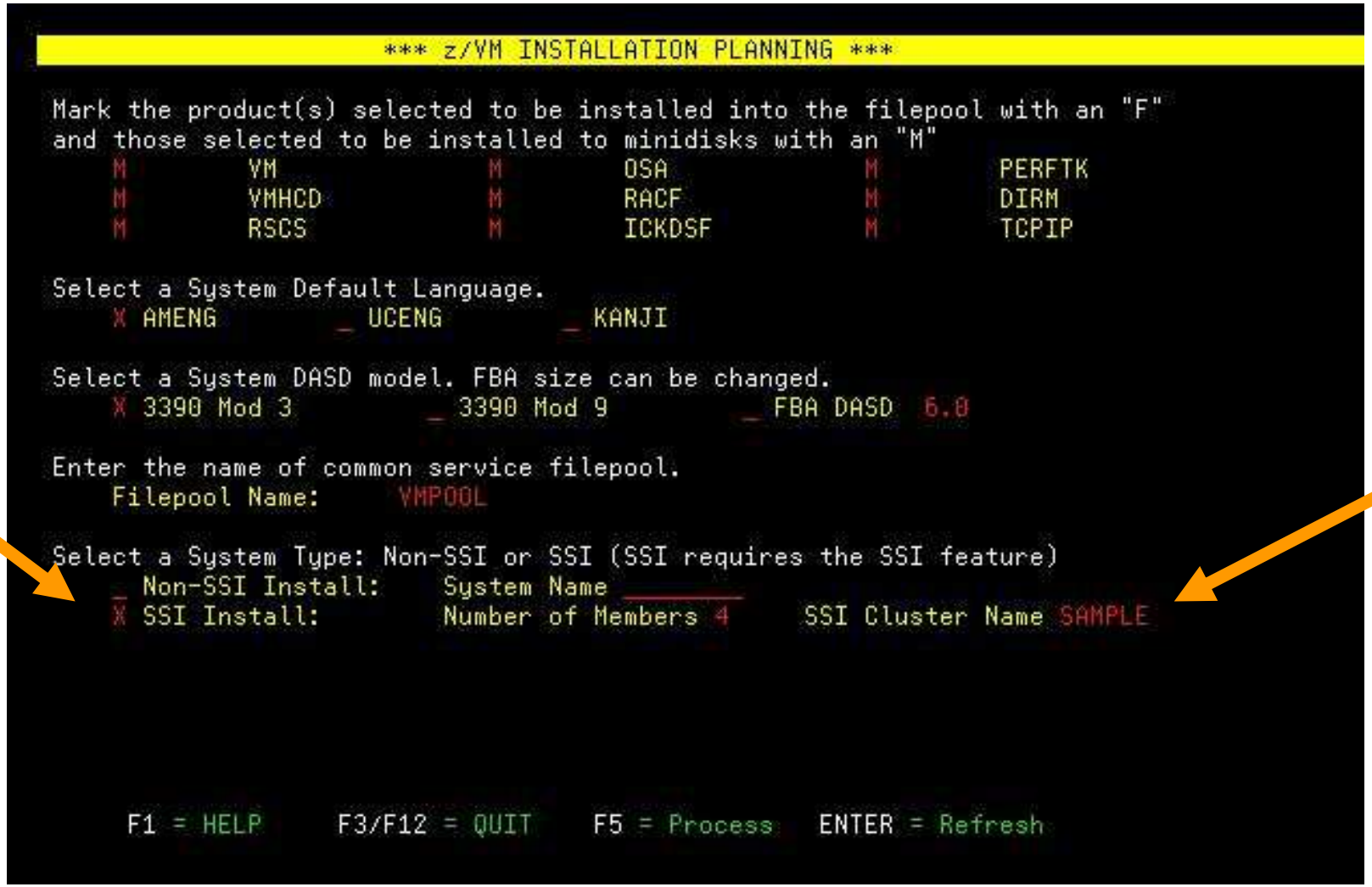


Additional Information

INSTPLAN - Select Installation Type



INSTPLAN - SSI Installation

Select first or second level and identify SSI member systems

```
                    *** z/VM INSTALLATION PLANNING PANEL 3 ***


SSI Cluster Name:    SAMPLE

After installation is complete, the SSI cluster will be IPLed:

X    First-Level
_    Second-Level

SSI Member Name(s):

SLOT #      MEMBER NAME     IPL LPAR/USERID
======      ============    ================
  1          MEMBER1          LPAR1
  2          MEMBER2          LPAR2
  3          MEMBER3          LPAR3
  4          MEMBER4          LPAR4



     F1 = HELP    F3/F12 = QUIT    F5 = Process    ENTER = Refresh
```

INSTPLAN - SSI Installation (cont.)

Define CP-Owned and Release volumes for all members

```
                *** z/VM INSTALLATION VOLUME DEFINITION ***

          TYPE      LABEL       ADDRESS                    FORMAT (Y/N)
         =======   ========    =========                   ============
         COMMON    VMCOM1        2000                           Y
         COMMON2   VMCOM2        2001
         RELVOL    620RL1        2002
         RELVOL2   620RL2        2003

          TYPE      LABEL       ADDRESS          TYPE      LABEL       ADDRESS
         =======   ========    =========        =======   ========    =========
MEMBER1                                    MEMBER2
         RES       M01RES        3000              RES       M02RES        4000
         SPOOL     M01S01        3001              SPOOL     M02S01        4001
         PAGE      M01P01        3002              PAGE      M02P01        4002
         WORK      M01W01        3003              WORK      M02W01        4003
MEMBER3                                    MEMBER4
         RES       M03RES        5000              RES       M04RES        6000
         SPOOL     M03S01        5001              SPOOL     M04S01        6001
         PAGE      M03P01        5002              PAGE      M04P01        6002
         WORK      M03W01        5003              WORK      M04W01        6003


          F1 = HELP       F3/F12 = QUIT       F5 = Process       ENTER = Refresh
```

INSTPLAN - SSI Installation (cont.)

Define Common Volume and CTC Device addresses

```
              *** z/VM INSTALLATION FIRST-LEVEL CONFIGURATION ***

Real addresses for the common volume on each member LPAR:

  VOLUME     DASD       MEMBER1     MEMBER2     MEMBER3     MEMBER4
   TYPE      LABEL      ADDRESS     ADDRESS     ADDRESS     ADDRESS
  =======   ========   =========   =========   =========   =========
   COMMON    VMCOM1       2000        2000        2000        2000

CTC device addresses:

  From: MEMBER1                          From: MEMBER2
        To: MEMBER1      N/A                   To: MEMBER1  0100 0101
        To: MEMBER2  0100 0101                 To: MEMBER2      N/A
        To: MEMBER3  0300 0301                 To: MEMBER3  0310 0311
        To: MEMBER4  0400 0401                 To: MEMBER4  0410 0411

  From: MEMBER3                          From: MEMBER4
        To: MEMBER1  0300 0301                 To: MEMBER1  0400 0401
        To: MEMBER2  0310 0311                 To: MEMBER2  0410 0411
        To: MEMBER3      N/A                   To: MEMBER3  0320 0321
        To: MEMBER4  0320 0321                 To: MEMBER4      N/A

     F1 = HELP      F3/F12 = QUIT     F5 = Process     ENTER = Refresh
```

INSTPLAN - Non-SSI Installation

Identify CP-Owned and Release volumes

CTC Connections – Defining in the IOCP

```
*
CHPID PATH=(CSS(0,1),4A),PCHID=222,TYPE=FC,SHARED   SX*FC4 11/LG04/D3
CHPID PATH=(CSS(0,1),4E),PCHID=282,TYPE=FC,SHARED   SX*FC4 16/LG02/D3
**************************************************
*** CHPID 4A SX FICON CTC                        ***
**************************************************
*
 CNTLUNIT CUNUMBR=0C00,PATH=((CSS(0),4A)),UNIT=FCTC,                    *
               UNITADD=((00,8)),CUADD=7
 IODEVICE ADDRESS=(0C00,8),CUNUMBR=(0C00),UNIT=FCTC,UNITADD=00,         *
               PART=((CSS(0),TEST7,TESTC))
*
**************************************************
*** CHPID 4E SX FICON CTC                        ***
**************************************************
*
 CNTLUNIT CUNUMBR=0D00,PATH=((CSS(0),4E)),UNIT=FCTC,                    *
               UNITADD=((00,8)),CUADD=C
 IODEVICE ADDRESS=(0D00,8),CUNUMBR=(0D00),UNIT=FCTC,UNITADD=00,         *
               PART=((CSS(0),TEST7,TESTC))
```