

Virtual Library Extension

Configuring the MSP Host Software for VLE

Version 1.2



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Preface

Audience

This guide is for StorageTek or customer personnel who are responsible for configuring theMSP host software for Oracle's StorageTek™ Virtual Library Extension (VLE).

What is Virtual Library Extension?

Oracle's StorageTek™ Virtual Library Extension (VLE) is back-end disk storage for VTSS. VLE provides:

- An additional storage tier in the VSM solution. VTVs can now migrate from VTSS to VLE to provide fast access to recent data. Additionally, VTVs can transition from VLE storage to tape media (MVCs) for long term archive. You can control how VTVs are migrated and archived via the existing HSC Management and Storage Classes, providing full backward compatibility with previous configurations.
- Back-end disk storage shared between multiple VTSS systems ensuring high-availability access to data.

Note – For VLE 1.1 and above, a “VLE” is a collection of nodes interconnected with a private network.

To VTCS, a VLE looks like a tape library except that the VTVs are stored in Virtual Multi-Volume Cartridges (VMVCs) on disk. With VLE, you can configure either a VLE and tape or a VLE only (for example, with Tapeless VSM configurations) back-end VTV storage solution. A VTSS can migrate VTVs to and recall them from a VLE, just as is done with a real tape library.

Caution –

- **Note that** if you have a VLE system, HSC/VTCS uses SMC communication services to communicate with the VLE. To ensure that these services are available during VTCS startup, Oracle recommends that you first issue the start command for HSC, then immediately issue the start command for SMC, while HSC is initializing.
- **Also note that** stopping SMC stops VTCS from sending messages to the VLE, which effectively stops data transfer. Therefore, you should ensure that VTCS activity is quiesced or VTCS is terminated before stopping SMC.
- You cannot use AT-TLS with the SMC HTTP server if you are using VLE.
- **Note that** in Tapeless VSM configurations, if you have only a single-node VLE attached to a specific VTSS and that VLE goes offline, you lose access to any VTVs migrated to the VLE that are not resident in the VTSS until the VLE comes back online.

The VLE solution consists of:

- Virtual Tape Storage Subsystem (VTSS) hardware and microcode.
- Virtual Tape Control Subsystem (VTCS) software and Storage Management Component (SMC).
- VLE hardware and software.

Single Node VLE Configuration

FIGURE 1-1 shows a single node VLE configuration.

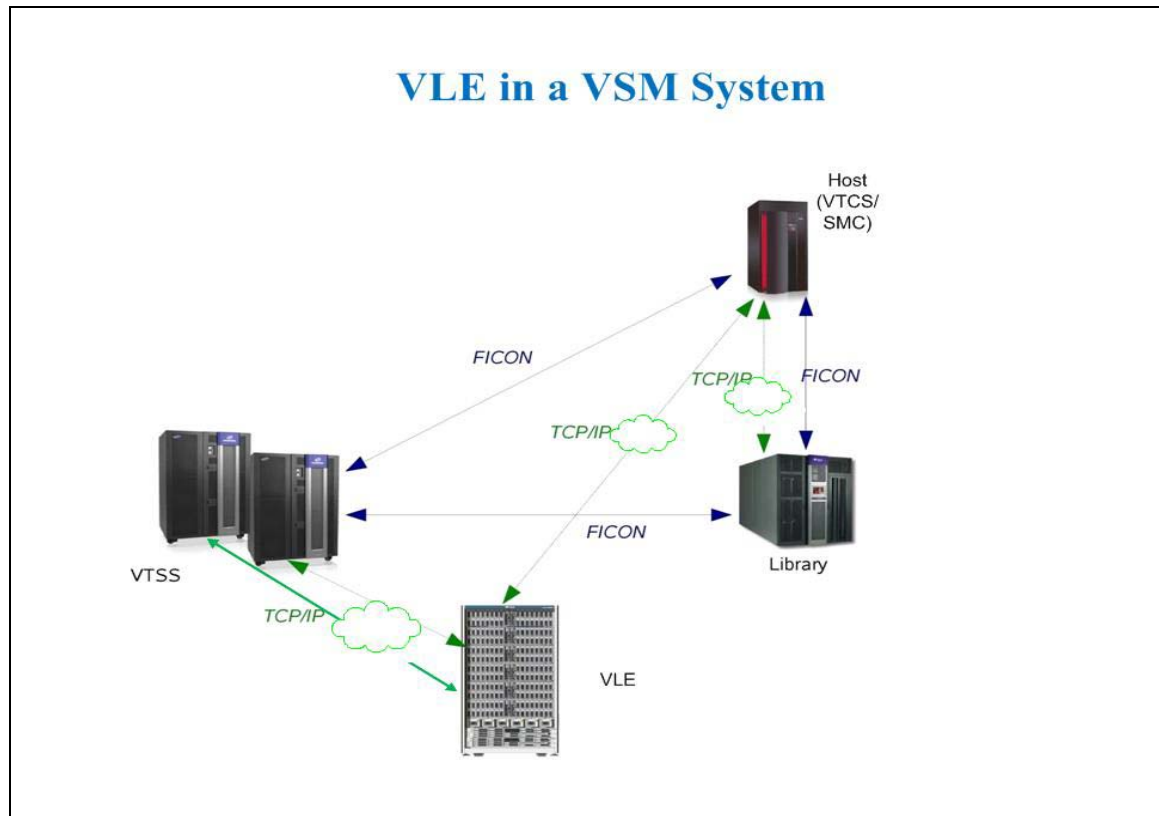


FIGURE 1-1 Single Node VLE in a VSM System

As FIGURE 1-1 shows:

- Multiple TCP/IP connections (between the VTSS's IFF3 card IP ports and the VLE's IP ports) are supported as follows:
 - A single VLE can connect up to 8 VTSSs, so VTSSs can share VLEs.
 - A single VTSS can connect to up to 4 VLEs to increase buffer space for heavy workloads.
- A single VTSS can be attached to:
 - Only RTDs
 - Only other VTSSs (clustered)
 - Only VLEs
 - Any combination of the above.
- TCP/IP is the only supported protocol for connections between the VLE and the VTSS and for connections between the VLE and hosts running SMC and VTCS.

Multi-Node VLE Systems

- Multi-node VLE systems **enable massive scaling of the VLE storage system**. You can construct *multi-node systems* that can consist of one to 64 nodes, with multiple nodes interconnected by a private network. A multi-node VLE appears to SMC/VTCS as a single VLE. A single VLE, therefore, can scale between 330 TB (for a single-node VLE with two JBODs) and 82.5 PB (for a fully populated 64-node VLE).

Note – These are effective capacities, assuming 4:1 compression.

Also note that VLE is **architected** for up to 64 nodes, but has only been **validated** for up to 7 nodes.

FIGURE 1-2 on page 10 shows a VLE multi-node complex, where the nodes are cross connected into a dedicated 10GE switch so that each node can access any other node in the complex.

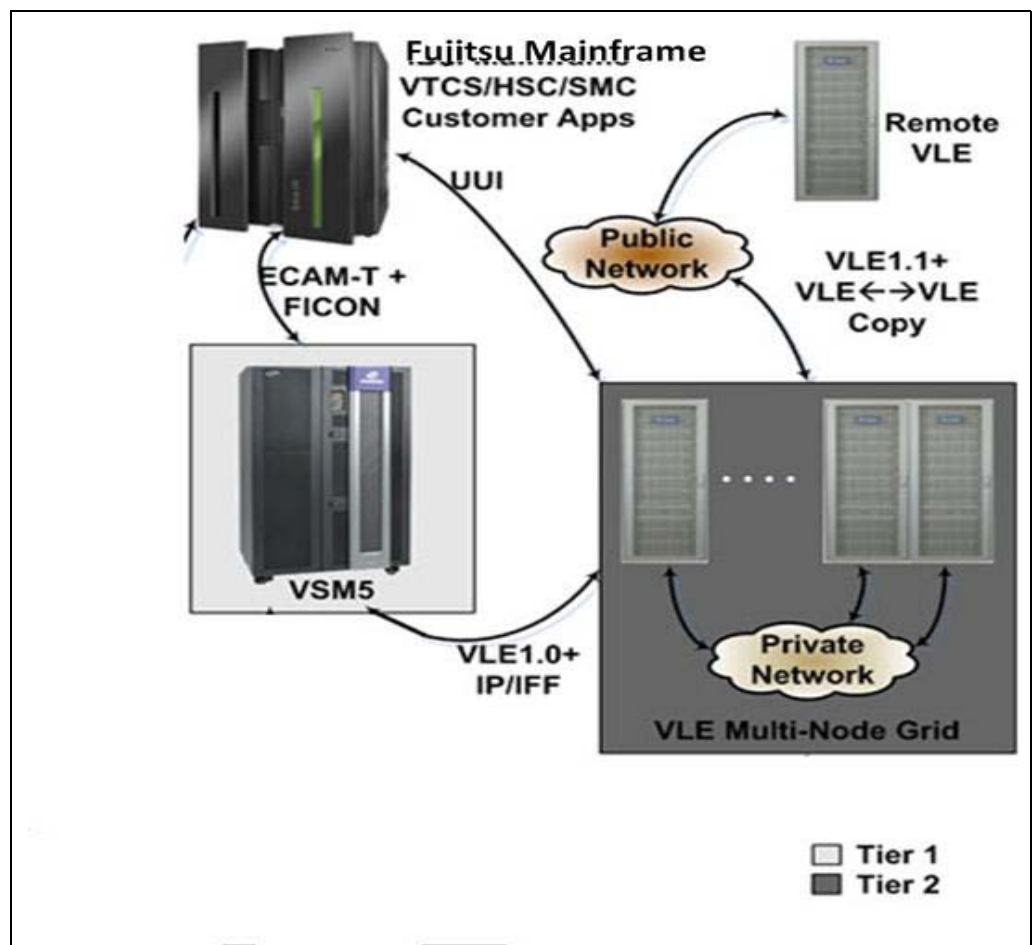


FIGURE 1-2 VLE Multi-Node Complex

VLE to VLE Data Transfer

The VLE storage system can manage data transfers independently of the VTSS, which frees VTSS resources for front-end (host) workload, which improves the overall VTSS through-put. For example:

- If your migration policies specify that there should be two VLE copies of a VTV (either in the same or separate VLEs), then the first migrate to a VLE will cause data to be transferred from the VTSS and all subsequent VLE migrates for the VTV may be achieved via a VLE to a VLE copy. This reduces the VTSS cycle times required to migrate all copies of a VTV.
- If your environment runs VLE 1.2 and VTCS 7.1, then you can use VTCS to define more VLE devices than there are VTSS to VLE paths via the `CONFIG STORMNGR VLEDEV` parameter as described [on page 22](#). If you use this addressing scheme, then the VTSS resources used to migrate all the VTV copies to VLE are reduced even further because the path from the VTSS to the target VLE is only reserved when the data transfer is direct from the VTSS to the VLE. For all VLE VRTD actions, a path from the VTSS is only reserved when VTSS data transfer is required.

What's New With VLE 1.2?

VLE 1.2 adds the following features:

- **Encryption**, which enables encryption of VMVCs written to the VLE system.
- **Deduplication**, which eliminates redundant data in a VLE complex.
Deduplication, which is controlled by a STORCLAS statement parameter, increases the effective VLE capacity and is performed by the VLE before the VTV is written to a VMVC.
- **Early Time To First Byte (ETTFB)**, also known as the concurrent tape recall/mount feature, which allows the VTSS to use a VTD to read data as it being recalled from VLE.
- **Frame Size Control**, which specifies the use of Jumbo frames on each copy link.

VLE Hardware and Software

The VLE, which is a factory-assembled unit in a Sun Rack II Model 1242, consists of the following hardware:

- A server built on a Sun Server X2-4 platform.
- Four 1GigE ports for a combination of SMC UUI connections and service connections.
- A service (ILOM) port.
- Four Quad-port 1GigE cards, which provide 16 ethernet ports for data transfer.
- J4410 JBODs in a ZFS RAID array, available in effective capacities of 330TB, 660TB, 990TB, or 1320TB (assuming a 4 to 1 compression ratio when the data is migrated to the VLE).
- Two dual-port 10GigE NIC cards per server, which are required for the internal network connections for VLEs with 3 or more nodes.

The VLE software consists of:

- Oracle Solaris 11 Operating System.
- ZFS file system and MySQL database.
- The VLE application software.

FIGURE 1-3 shows the VLE subsystem architecture.

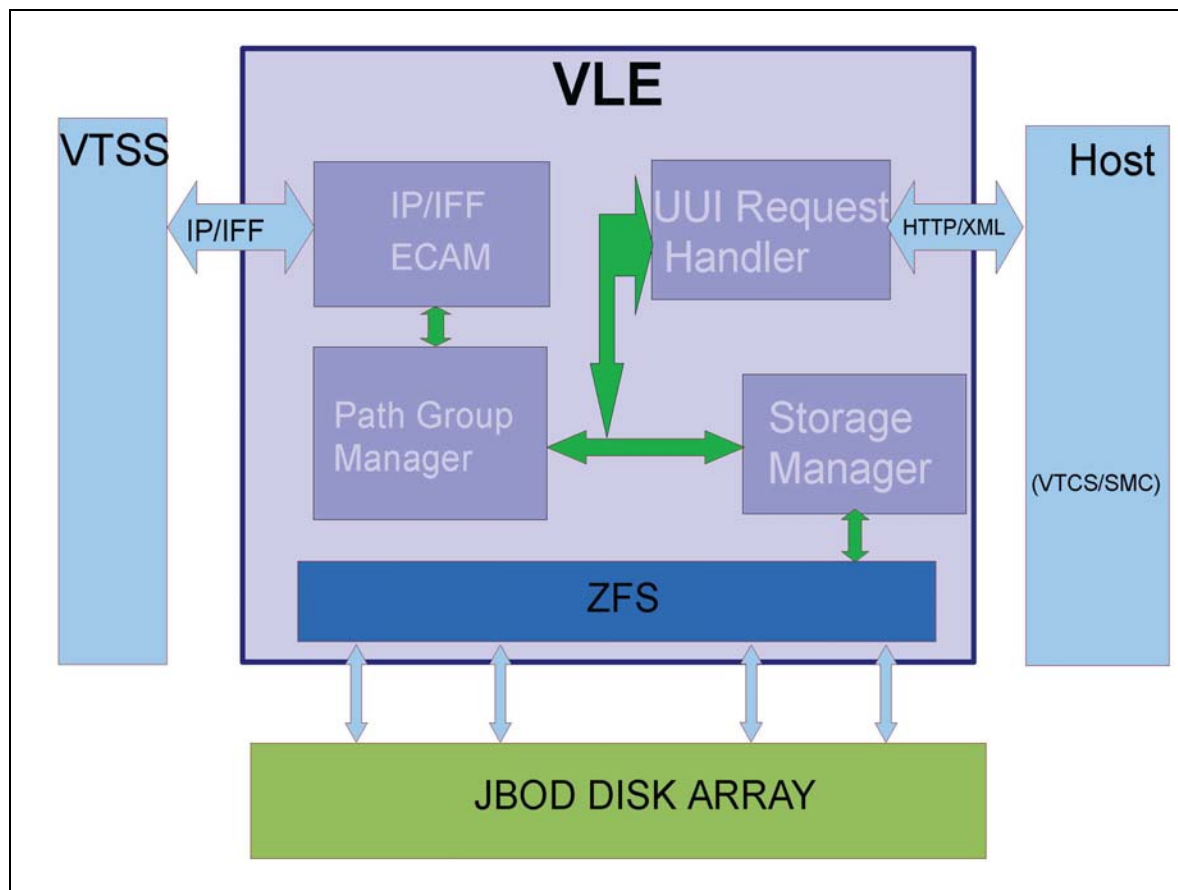


FIGURE 1-3 VLE Subsystem Architecture

As [FIGURE 1-3 on page 13](#) shows, the VLE application software is comprised of:

- HTTP/XML is the data protocol for host to VLE communications.
- The Universal User Interface (UII) Request Handler, which processes UII requests from and produces responses to Storage Management Component (SMC) and Virtual Tape Control Software (VTCS). The UII Request Handler determines which VLE components are used to service a request.

UII Request Handler calls:

- The PathGroup Manager to schedule VTV migrates and recalls. The PathGroup Manager manages all Path Groups, where each Path Group manages a single VTV data transfer between the VTSS and the VLE.
- The Storage Manager to schedule all report generation.
- The VLE Storage Manager component manages the VMVC/VTV data and meta data on the VLE. The VLE Storage Manager stores VTV data on and retrieves it from the ZFS on the JBOD array.
- TCP/IP/IFF is the data protocol for host to VLE communications, where the IP/IFF/ECAM component handles communications between the VTSS and the VLE.

Configuring the MSP Host Software

This chapter provides the MSP host software configuration for VLE as described in the following sections:

- [“Key Configuration Values” on page 16](#)
- [“MSP Host Software Configuration Tasks” on page 19](#)

Note – Support for VLE 1.2 is provided in ELS/MSP 7.1 base.

Key Configuration Values

The following sections describes values required for software configuration that must match values that are typically already set in the hardware configuration and recorded in the `IP_and_VMVC_Configuration.xls` worksheet.

Subsystem Name

The subsystem name of the VLE, which is set by the VLE installation scripts, is specified in the following:

- Either the VTCS `CONFIG TAPEPLEX STORMNGR` parameter or the `CONFIG STORMNGR NAME` parameter.
- The VTCS `CONFIG RTD STORMNGR` parameter.
- The SMC `STORMNGR NAME` parameter.
- The SMC `SERVER STORMNGR` parameter.
- The HSC `STORCLAS STORMNGR` parameter.

VLE Data Port and VSM5 IFF3 Card Target IP Addresses

These IP addresses are initially set on the VSM5 DOP IFF IP Configuration Status panel and at the VLE GUI and the values must match. On the DOP panel, they are set as IP addresses with their equivalent *c:ip* addresses shown, which are required for the `CONFIG RTD IPIF` parameter.

IP Addresses of VLE Ports for Host (UI) Communication

These addresses are required for the `SMC SERVER IP` parameter.

VMVC Volsers

Required to define VMVCs to SMC/VTCS, method of definition depends on the software version, see [“Defining the VLE VMVCs to the MSP Host Software and Including VMVCs in an MVC Pool” on page 23.](#)

VMVC Reclamation Threshold

For more information, see [“Specifying the Reclamation Policy for VMVCs” on page 22.](#)

VTV Deduplication

The `STORCLAS DEDUP` parameter specifies whether VTV data migrated to VMVCs in the specified `STORMNGR` is deduplicated. For example:

```
STORCLAS NAME (VLEDEDUP) STORMNGR (VLE1) DEDUP (YES)
```

This `STORCLAS` statement specifies to deduplicate data in Storage Class `VLEDEDUP` that is migrated to `VLE1`. For more information, see *ELS 7.x Command, Control Statement, and Utility Reference*,

Deduplication increases effective VMVC capacity and is performed by the VLE before the VTV is written to a VMVC. Oracle recommends, therefore, that you initially enable deduplication, then monitor the results with the `SCRPT` report and fine tune deduplication as necessary

Early Time to First Byte (ETTFB)

ETTFB (also known as the concurrent tape recall/mount feature) allows host applications to read data while VTVs are being recalled from **either** VMVCs or RTDs. ETTFB is done by overlapping the VTV recall and mount phases, which allows the application to read the VTV data sooner. If the application attempts to read part of the VTV that has not been recalled, the application's I/O request is blocked until the required VTV data is been recalled. With ETTFB for VLE, application access to the first byte occurs in under a second, making the VLE a true extension of the VTSS. Therefore, VLE ETTFB is a good choice for applications that serially access the VTV data. VLE ETTFB is generally **not** a benefit for those applications that stack multiple files on a single VTV, including HSM and image management applications. In these types of applications, the desired data is usually not at the beginning of the VTV, but rather at some random location in the VTV.

ETTFB is disabled by default. You can globally enable ETTFB via the `CONFIG GLOBAL FASTRECL` parameter. If you globally enable ETTFB, you can disable it for individual VTSSs via the `CONFIG VTSS NOERLYMNT` parameter.

VTVs that have incurred a ETTFB recall error have an error flag set in their VTV record in the CDS. These VTVs are subsequently not selected for ETTFB. If you want to reset the error flag, do any of the following:

- Enter a `VTVMaint SCRATCH (ON)` command for the VTV.
- Migrate the VTV to a new MVC copy.
- Import the VTV.
- Create a new version of the VTV.
- Scratch the VTV.

MSP Host Software Configuration Tasks

Adding VLE to a VSM system requires the tasks described in the following sections:

- [“Satisfying the RACF Requirement”](#)
- [“Modifying the SMC SCMDS file” on page 20](#)
- [“Updating the VTCS CONFIG Deck to Define VLE” on page 21](#)
- [“Defining the VLE VMVCs to the MSP Host Software and Including VMVCs in an MVC Pool” on page 23](#)
- [“Updating the MSP Host Software Policies” on page 24](#)

Satisfying the RACF Requirement

To allow the VLE to communicate with SMC via a TCP/IP connection, RACF must be installed and active on the host where SMC is running.

Modifying the SMC SCMDS file

SMC manages all communication between VTCS and VLE, so SMC must know how to connect to the VLE server. You do so by adding an SMC `STORMNGR` statement for each VLE system plus one or more SMC `SERVER` statements that define the TCP/IP control paths for the VLE. For 7.0 and above, you may want to do this in your SMC CMDS file as shown in [CODE EXAMPLE 2-1](#).

```
TAPEPLEX NAME(TMSPA) LOCSUB(SLS0)
SERVER NAME(ALTSESV) TAPEPLEX(TMSPA) +
HOSTNAME(MSPX) PORT(8888)
STORMNGR NAME(VLE1)
SERVER NAME(VLESESV1) +
STORMNGR(VLE1) IP(192.168.1.10) PORT(60000)
```

CODE EXAMPLE 2-1 SMC Commands for VLE

[CODE EXAMPLE 2-1](#) contains:

- A `TAPEPLEX` statement, which defines a single TapePlex, `TMSPA`, with an HSC/VTCS running on the same MSP host (`SLS0`).
- A `SERVER` statement, which defines a backup HSC/VTCS subsystem (`ALTSESV`) running on another host.
- A `STORMNGR` command that defines a VLE (`VLE1`) .
- A second `SERVER` command that defines a UUI communication path to the VLE, where:
 - The server name is `VLESESV1`.
 - The `STORMNGR` parameter value is `VLE1` .
 - The `IP` parameter value is the VLE port IP address of 192.168.1.10 for UUI communications.
 - The `PORT` parameter value is 60000; this value is always used for the `SERVER PORT` parameter for SMC communication with a VLE.

Updating the VTCS CONFIG Deck to Define VLE

You must update VTCS CONFIG deck to define the VLE and the connectivity from the VTSS systems to the VLE. VTCS can drive VLE 1.2 as follows:

- **In this method**, the CONFIG TAPEPLEX statement defines the TapePlex that VTCS is running under and provides the list of defined VLEs on the CONFIG TAPEPLEX STORMNGR parameter as shown in [CODE EXAMPLE 2-2](#).

```
TAPEPLEX THISPLEX=TMSPA STORMNGR=VLE1
VTSS NAME=VTSS1 LOW=70 HIGH=80 MAXMIG=8 MINMIG=4 RETAIN=5
RTD  NAME=VL1RTD1 STORMNGR=VLE1 IPIF=0A:0
RTD  NAME=VL1RTD2 STORMNGR=VLE1 IPIF=0A:1
RTD  NAME=VL1RTD3 STORMNGR=VLE1 IPIF=0I:0
RTD  NAME=VL1RTD4 STORMNGR=VLE1 IPIF=0I:1
RTD  NAME=VL1RTD5 STORMNGR=VLE1 IPIF=1A:0
RTD  NAME=VL1RTD6 STORMNGR=VLE1 IPIF=1A:1
RTD  NAME=VL1RTD7 STORMNGR=VLE1 IPIF=1I:0
RTD  NAME=VL1RTD8 STORMNGR=VLE1 IPIF=1I:1
VTD  LOW=6900 HIGH=69FF
```

CODE EXAMPLE 2-2 VTCS 7.1 CONFIG TAPEPLEX Example

In [CODE EXAMPLE 2-2](#), note:

- The CONFIG TAPEPLEX statement, which defines TMSPA as the TapePlex that VTCS is running under and the names of all connected VLEs (which in this example is a single VLE called VLE1).
- The CONFIG RTD statements, which define a single VLE RTD for each path from the VTSS to the VLE. In this example, the CONFIG RTD statements for VTSS1 specify:
 - The connections to the defined VLEs (VLE1).
 - The IPIF value and an RTD name for each IFF target to VLE port connection.

- VTCS 7.1 can, of course, drive VLE 1.2 as described [on page 21](#). In this mode, however, the number of VLE RTD targets is limited by the number of paths from a VTSS. Additionally, the VLE RTDs are assigned to fixed VTSS paths. The path from a VTSS to the VLE is always reserved by VTCS regardless of whether any VTSS to VLE data transfer is occurring.

However, with VTCS 7.1, you can define a VLE with more VLE RTD targets than there are paths from the VTSS to the VLE, which means:

- The path from the VTSS to the VLE is **not** reserved unless a VTSS to VLE data transfer is required.
- More VLE RTD operations can occur simultaneously. For example, an audit of a VMVC does not require data transfer between the VTSS and the VLE.

As shown in [CODE EXAMPLE 2-3](#), the VLEs are defined via a CONFIG STORMNGR statement, **not** the CONFIG TAPEPLEX STORMNGR parameter. The CONFIG STORMNGR statement specifies the VLEs that VTCS connects to. Additionally, for each VLE, the CONFIG STORMNGR VLEDEV parameter defines the number and the names of the RTD devices that the VLE emulates. The more devices defined (up to the maximum of 96 devices per VLE), the greater the level of concurrent activities VTCS can schedule on the VLEs.

```
TAPEPLEX THISPLEX=TMSPC
STORMNGR NAME=VLE1 VLEDEV (S000-S05F)
STORMNGR NAME=VLE2 VLEDEV (S000-S05F)
VTSS NAME=VTSS1 LOW=70 HIGH=80 MAXMIG=8 MINMIG=4 RETAIN=5
RTD NAME=VL1RTD1 STORMNGR=VLE1 IPIF=0A:0
RTD NAME=VL1RTD2 STORMNGR=VLE1 IPIF=0A:1
RTD NAME=VL1RTD3 STORMNGR=VLE1 IPIF=0I:0
RTD NAME=VL1RTD4 STORMNGR=VLE1 IPIF=0I:1
RTD NAME=VL1RTD5 STORMNGR=VLE2 IPIF=1A:0
RTD NAME=VL1RTD6 STORMNGR=VLE2 IPIF=1A:1
RTD NAME=VL1RTD7 STORMNGR=VLE2 IPIF=1I:0
RTD NAME=VL1RTD8 STORMNGR=VLE2 IPIF=1I:1
VTD LOW=6900 HIGH=69FF
```

CODE EXAMPLE 2-3 VTCS 7.1 CONFIG STORMNGR Example

Specifying the Reclamation Policy for VMVCs

VLE MVC media (VMVCs) is subject to fragmentation and must be reclaimed just like real MVCs. The VMVC reclaim process, however, uses far fewer resources than a standard reclaim. The reclaim threshold for a VMVC is specified via the CONFIG RECLAIM VLTHRES parameter. The lower that you set VLTHRES, the more frequent VTCS will run reclaim on the VMVCs and the greater the effective capacity of the VMVCs (less fragmentation).

Defining the VLE VMVCs to the MSP Host Software and Including VMVCs in an MVC Pool

VMVC volsers must be defined both to the MSP host software and to the VLE. The VMVCs are defined to the VLE as part of the VLE configuration. The following sections tell how to define the VMVCs to the MSP host software.

▼ Creating VMVC Volume Pools (7.1 and Above)

1. Code HSC POOLPARM/VOLPARM statements to define the VMVC pools.

For example, to define two separate pools for VLE1 and VLE2:

```
POOLPARM NAME (LEPOOL1) TYPE (MVC)
VOLPARM VOLSER (VL0000-VL880)
```

```
POOLPARM NAME (LEPOOL2) TYPE (MVC)
VOLPARM VOLSER (VL2000-VL2880)
```

2. Run SET VOLPARM to validate the POOLPARM/VOLPARM statements.

```
SET VOLPARM APPLY (NO)
```

APPLY (NO) validates the statements without loading them. If you like the results, go to [Step 3](#). Otherwise, rework your volume definitions, rerun this step, and if the definitions are valid, then go to [Step 3](#).

3. Run SET VOLPARM to load the POOLPARM/VOLPARM statements.

```
SET VOLPARM APPLY (YES)
```

Updating the MSP Host Software Policies

The following sections tell how to update the MSP host software policies to direct data to the VLE system.

Creating Storage and Management Classes for VLE

Management Classes specify *how* VTCS manages VTVs. The HSC MGMTclas control statement defines a Management Class and its attributes. For example, the DELSCR parameter of the MGMTclas statement specifies whether VTCS deletes scratched VTVs from the VTSS. Management Classes can also point to *Storage Classes*, which specify *where* migrated VTVs reside. The HSC STORclas control statement defines a Storage Class and its attributes.

You specify the VLE system as the destination for migrated VTVs via the STORCLAS STORMNGR keyword. For example:

```
STOR NAME (VLOCAL) STORMNGR (VLESERV1) DEDUP (YES)
STOR NAME (VREMOTE) STORMNGR (VLESERV2) DEDUP (YES)
```

The preceding statements define a “local” Storage Class (VLOCAL) on the VLESERV1 and a “remote” Storage Class (VREMOTE) on the on the VLESERV2. As these STORCLAS statements specify, all migrations to Storage Class VLOCAL or VREMOTE must go to the specified VLEs. Also note that deduplication is specified for both Storage Classes.

You can be less restrictive than this if desired. For example, if you define an MVCPOOL that contains both VMVCs and MVCs you can set up the migration policies to migrate to a VLE but if the VLE becomes full or not available, to continue to migrate to real tape media (MVCs). For example the MVC pool DR is defined as follows:

```
POOLPARM NAME (DR) TYPE (MVC)
VOLPARM VOLSER (VL0000-VL0100)
VOLPARM VOLSER (ACS000-ACS099)
```

Pool DR, therefore, contains both MVCs and VMVCs. A Storage Class that specifies pool DR will migrate first to VMVCs and only use MVCs if VMVCs are not available. For example:

```
STOR NAME (DRCLASS) MVCPOOL (DR) DEDUP (YES)
```

This method is valuable if you have a configuration where both an ACS and a VLE are connected to the VTSS systems.

Next, to specify migration to VLE, you specify the VLE Storage Classes you defined via the MGMTCLAS MIGPOL parameter. For example:

```
MGMT NAME (M1) MIGPOL (VLOCAL, VREMOTE)
MGMT NAME (M2) MIGPOL (DRCLASS)
```

Management Class M1 migrates one VTV copy to the “remote” VLE, one copy to the “local” VLE. Management Class M2 migrates a single VTV copy to the Storage Class that points to the “mixed” MVC pool that contains both MVCs and VMVCs.

Note – In addition to directing migration to a VLE also consider:

1. You can use the ARCHAge and ARCHPol parameters of the MGMTclas statement to set an Archive Policy for VTVs in a Management Class. When the VTV's age exceeds the ARCHAge value, the VTV is eligible for archive per the Storage Class(es) specified on the ARCHPol parameter. You can use Archive Policies to archive (move) VTVs from VMVCs to MVCs as the VTVs age. For more information, see *Managing HSC and VTCS*.
2. You can use STORSEL statements to cause VTCS to preference recalls from VLE media. For more information, see *Managing HSC and VTCS*.
3. If you are running at ELS 7.0 or above, you can use HSC MIGRSEL and MIGRVTV to fine tune migration to VLE. Using these statements, you can cause migration of data in a Management Class to start to one Storage Class before another. This method is typically used to ensure that a critical DR copy is made as soon as possible. For more information, see *Configuring HSC and VTCS*
4. On a VLE 1.1 and above system, if multiple VLEs are connected to each other and to the VTSS, **by default**, VTCS preferences VLE to VLE connections to make multiple VTV copies. In a DR scenario, for example, where you have a "local" and a "remote" VLE, you typically want the remote copy made as quickly as possible (using VTSS to VLE connections) and the local copy using VLE to VLE connections. The local copy, by default, uses VLE to VLE TCP/IP connections. You use the STORCLAS FROMLST parameter to specify VTSS to VLE connections for the "remote" copy. For example:

```
STOR NAME (VREMOTE) STORMNGR (VLE2) FROMLST (VTSSA1,VTSSA2)
```

In this example, for Storage Class VREMOTE, migrations to VLE2 come from either VTSSA1 or VTSSA2, thus using VTSS to VLE connections for the "remote" copy.

Routing Data to VLE

To route data to VLE, first create an SMC POLICY command that specifies a VLE Management Class. Next, create SMC TAPEREQ statements that route the desired workload to the SMC VLE policy. For example

```
POLICY NAME (VLEWORK) MEDIA (VIRTUAL) MGMT (VLECLASS)  
TAPEREQ DSN (VLETEST.***) POLICY (VLEMIGR)
```

The preceding example assigns the VLEWORK policy to all tape datasets with an HLQ of VLETEST.

Ensure that your SMC Started task JCL includes the TISPAPPL DD statement. This statement points to a member of a PDS containing a single statement which is TCPAPPLNAME=STKHAPPL. This statement is used to control the TISP APPL that SMC uses for its TCP/IP socket services, and must be defined in the VTAM-G TISP TAPPL NODESET.

