

Power Virtual Server VTL Overview

DSI RESTORE VTL Solution Overview

The DSI RESTORE VTL solution on PowerVS is designed to follow a well-established architecture that is used by many IBM i customers today on-prem. Most IBM i customers today use some form of tape to backup up their solution and traditionally that is attached via Fibre Channel. These appliances are hardware solutions that integrate software, servers, and storage. For the PowerVS solution, it was decided to try to replicate the on-prem solution by providing a SW VTL appliance that can be dynamically provisioned in the IBM Cloud.

Sizing Considerations

As part of the solution there are considerations for compute, storage, and networking. The following is a general guideline: To get an accurate sizing, please contact DSI at IBMsizing@ynamicsolutions.com for sizing help.

The first sizing that needs to be determined is the amount of data that needs to be retained. There are a variety of methods to determine this, but it's recommended that if you are using the IBM i BRMS product that you use the reports that are built into the product. For more information see: [BRMS VTL Sizing Guidelines](#) After you size the amount of data that needs to be retained, you can calculate the repository size by dividing by a deduplication rate. A commonly used rate for sizing is 15:1. In this example, if you divide your data retained size by 15 you will get your repository size. This is the number that you will enter during the VTL creation for the 'Licensed repository capacity (TB)' field. The licensed repository capacity can be increased but is not allowed to be decreased.

The repository size influences several other sizing factors. The first is the machine type. Only a repository less than 400TB should go on the S922, if a bigger repository is needed it should go on the E980 systems. This is due to the memory requirements. For every TB of repository space, you need 2GB of memory and 32 GB of base memory.

The CPU requirements are guidelines for starting points. You may need to adjust depending on the VTL configuration and usage.

1 - 12 TB Repository = 2 CPU
13 - 72 TB Repository = 4 CPU
> 72 TB Repository = 8 CPU

When you deploy the VTL, it will only have the OS boot disk. The VTL requires 4 other types of disks to be assigned.

1. All VTLs require a 20 GB config drive.
2. An index drive of ~10% of the repository size
3. The landing space or tape space. This is specific to the usage of the VTL. This space must take into consideration all the current backups that could be run at a given time.
4. Repository space is where the backups are retained. This is the space needed after you consider deduplication and compression. There are two options for the repository space; it can be stored on the block storage in Power Virtual Server or it can utilize IBM Cloud Object Storage.

If you are going to use Cloud Object Storage (COS) for the repository you will need to connect your Power Virtual Server account to the IBM Cloud Classic Infrastructure through a proxy server. See this link on information on connecting to [COS over Direct Link](#).

For information on establishing a network connection to COS see this link on how to use [Cloud Connections](#). If Cloud Connections is not available, see how to establish a [Direct Link](#).

You have a choice of which tier to deploy the VTL. The tier will change the performance of the VTL saves and restores. It has been observed that tier3 storage can be in the 30-40% slower throughput than tier1. Actual differences may vary based on the type and size of objects being saved or restored.

The VTL also requires a console that runs on top of a Windows OS. The Windows OS instance needs network connectivity to the VTL and can be either on-prem or on IBM Cloud. It is recommended that the Windows VM has at least 2 vcpu and 8GB of memory.

DSI RESTORE VTL Networking Considerations

There is an option to configure the VTL to have a public facing IP, normally there is not a reason to do this.

Network interfaces
At least one private or public network is required.

Public networks
A public network uses a public VLAN to connect to your VM. [Learn about the available firewall ports.](#)

Off

If you choose to use the public IP, it will go through the default PowerVS firewall and only these ports will be open:

- 22 (SSH)
- 443 (HTTPS)
- 992 (IBM i5250 emulation SSL)
- ICMP traffic

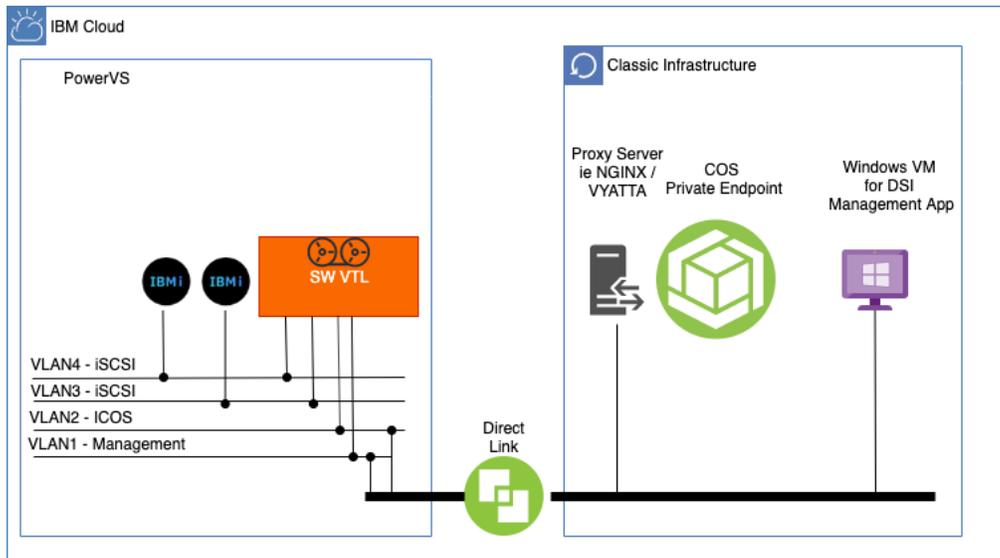
The following firewall ports are also open, typically used for IBM i logical partitions (LPARs):

- 2005
- 2007
- 2010
- 2012
- 9470
- 9475
- 9476

The VTL will communicate on private vlans within PowerVS. There are several options on how you want your traffic to flow.

Whether or not you use separate vlans to isolate the network traffic is up to your implementation, but the following network connectivity is required.

- 1) Network connectivity between the VTL and a windows machine for VTL management
- 2) (Optional) Network connectivity between the VTL and COS for repository access
- 3) (Optional) Network connectivity between the VTL and another VTL in another site for DR
- 4) Network connectivity between the VTL and IBM i for iSCSI traffic (option to put each client on different vlans)



For the network connectivity 1-3 you will need to use Direct Link to bridge that traffic to the classic infrastructure side of IBM Cloud. For the iSCSI traffic that is used to save and restore the data, that traffic can stay local to the PowerVS side of IBM Cloud. When sending data from the VTL to COS, an appliance must be used to forward the traffic to COS. Typically, this is either a Vyatta or NGINX server running on the IBM Cloud Classic side.

The DSI Restore VTL appliance requires a Java based application to be run a Windows machine. This GUI is used by an admin to manage and monitor the VTL. Some of the actions include creating tape libraries, drives and tapes, managing the connectivity to hosts, managing the connectivity to COS. The management UI itself has no access to the data stored on the VTL.

Reference:

Full details on the management UI see [DSI Virtual Tape Library User Guide](#).

VTL Deploy using the IBM Cloud UI

VTL name	VM pinning ⓘ
<input type="text"/>	None ▾
Image	Storage tier ⓘ
VTL-DSI-RESTORE-V6-00c 	Select storage tier ▾

Start by giving the VTL a name. This is what the hostname of the VTL should be set to. If the hostname is set to the IP address, change the hostname using the VTL management UI. If you change the hostname to something different from the VTL management UI, that change will not be reflected in the PowerVS UI.

The storage tier is set here. The base storage tier is what will be used for all volumes that are attached to the VTL.

Profile	
There is a core-to-vCPU ratio of 1:1. For shared processors, fractional cores round up to the nearest whole number. For example, 1.25 cores equal 2 vCPUs.	
<div style="border: 1px solid #ccc; padding: 5px; background-color: #f9f9f9;"><p>e980</p><p>✓ s922</p></div>	Licensed repository capacity (TB) ⓘ
	1 - +
	Must be between 1 and 419 TB on s922 machines. Cannot be decreased once created.
Core type	Memory (GiB)
<input checked="" type="radio"/> Shared uncapped <input type="radio"/> Shared capped <input type="radio"/> Dedicated	18 - +
Cores (Entitled CPUs)	Minimum: 18 GiB. Maximum availability on s922: 855 GiB.
2 - +	
Recommended: 2 cores. Minimum: 0.25 cores. Maximum availability on s922: 6 cores.	

You can deploy the VTL on either an S922 or e980. For a VTL that needs over ~400TB of repository space, the e980 is the only box that can support the amount of memory required.

The Licensed repository capacity is a software licensing metric only. It will determine the license key required for the repository space. Once the VTL is created, the process is started to generate the license key. A license key will be emailed to the IBM Cloud account owner's email. Once the VTL is created the Licensed repository capacity can only be increased. The software license charge metric is based on per month usage and is not pro-rated less than a month.

The core type can be any of the choices (Shared uncapped, Shared capped, or Dedicated). The most cost-effective choice is using Shared uncapped. If more performance is required Dedicated can be used.

Network interfaces

At least one private or public network is required.

Public networks

A public network uses a public VLAN to connect to your VM. [Learn about the available firewall ports.](#)

Off

The public network is not required for the VTL. The VTL will use the public network if it is there for the software registration but there are alternative methods if there is no public network. If the public network is set, you will need to add routes in the VTL for the VTL to connect to IBM Cloud Object Storage.

The screenshot shows the 'Network interfaces' configuration page in the IBM Cloud console. The page is divided into two main sections: 'Public networks' and 'Private networks'. The 'Public networks' section has a toggle switch set to 'Off'. Below this, there is a search bar and a table with columns for 'Name', 'IP address', 'IP range', and 'CIDR'. The table is currently empty, with a message stating 'No private networks attached'. At the bottom of the page, there is an 'SSH key' section with a dropdown menu to 'Choose a SSH Key' and a 'Create SSH key' button.

On the right side, a modal window titled 'Attach an existing network' is open. It features a search bar and a list of 'Existing networks' with options 'vlan4', 'vlan3', 'vlan1', and 'vlan2'. The 'vlan1' option is selected. Below the list, there are radio buttons for 'IP address' configuration: 'Automatically assign IP address from IP range' (selected) and 'Manually specify an IP address from IP range'. A text input field for 'Specified IP address' is visible. At the bottom of the modal, there are 'Cancel' and 'Attach' buttons.

The VTL uses the private networks for iSCSI traffic to the hosts and to communicate with IBM Classic services such as Cloud Object Storage. If you specify the networks at VTL create time, the IP addresses will be configured. If you add the networks after create time, you will have to go into the VTL console to configure the IP addresses. All networks should be configured before deduplication on the VTL is started.

vtlDemo2

[View details](#)

Licensed repository capacity
1 TB

Storage tier
Tier 1

Status
✔ Active

IP address
172.1.1.238

Cores
2

Memory
18 GiB

After the deploy of the VTL, you must wait for the status to become 'Active'. At this point click on the View details to add the additional storage for the VTL.

Attached volumes

At least one volume is required for Index space, Config, and Landing space. If not using COS, an additional volume is required for Repository. VTL must be in an Active state to create or attach volumes. Bootable volumes cannot be detached.

<input type="checkbox"/> Name	Size	Type	Shareable	Bootable	
<input type="checkbox"/> vtlDemo2-581470b1-00000f8f-boot-0	120 GB	Tier 1	Off	On	Detach
<input type="checkbox"/> vtlDemo2_cfg	20 GB	Tier 1	Off	Off	Detach
<input type="checkbox"/> vtlDemo2_Index	100 GB	Tier 1	Off	Off	Detach
<input type="checkbox"/> vtlDemo2_tapes	500 GB	Tier 1	Off	Off	Detach
<input type="checkbox"/> vtlDemo2_Repo	1 TB	Tier 1	Off	Off	Detach

Create volumes here for the config space, index, tapes, and optionally for the repository. See the sizing for exact volume sizes for the VTL.

VTL Deploy using the IBM Cloud CLI

See this link to install the [IBM Cloud CLI and power-iass plugin](#).

The following is a working example; change these commands to suit your implementation:

1. Make sure you have configured the vlan networks that you intend to use on the VTL.

To list the existing networks use:

```
ibmcloud pi nets
```

```
      ID      Name Address  
8f475164-2ec8-4d67-9e81-cfeaa03d1f63  vlan1 /pcloud/v 1/cbud-instances/f682a8fb74564409ae2e9195460855ca/networks.8f475164-2ec8-4d67-9e81-cfeaa03d1f63
```

2. Create the VTL

First find the id of the VTL image you want to use

```
ibmcloud pi imglc
```

Use that image ID and the network ID(s) to create the VTL

```
vtlc vtlName --image <image id from imglc> --capacity 1 --memory 34 --processors 2 --processor-type shared --sys-type s922 --network <network id from nets> --storage-type tier3
```

3. Monitor for the status of the VTL

```
ibmcloud pi vtl 20a87524-24e6-4645-bdbc-665cb258740b
```

```
ID          20a87524-24e6-4645-bdbc-665cb258740b
Name        vtlTest
Capacity    1
CPU Cores   2
Memory      18
Processor Type  shared
Networks    8f475164-2ec8-4d67-9e81-cfeaa03d1f63
Disk Size   120
Volumes     47daadfc-8d47-42e7-befc-f6ae7ef826eb
Storage Type tier1
Pin Policy  none
Image       b48a168b-7f2e-4a9c-a7dc-92d3068178a0
Created     2021-10-07T03:25:48.000Z
Last Updated 2021-10-07T03:25:48.000Z
Status      ACTIVE
Progress    0
Address     Internal Address: 172.1.1.113, Mac Address: fa:62:24:de:65:20
Last Health Update 2021-10-07T19:00:40.443208
Health Reason
Health Status OK
```

Make sure the Status is 'ACTIVE' and the Health Status is 'OK' before attaching the volumes.

4. Create the disks that will make up the config, index, tapes/landing, and optionally the repository if you are putting the repository on PowerVS block storage. The volume must be the same tier as what you are going to deploy the base VTL on. Take note of the ID so it can be attached later to the VTL.

```
ibmcloud pi volc vtlTest_cfg --type tier1 --size 20 --affinity-policy affinity --affinity-volume <id of vtl boot vol>
```

```
ID          73d663d7-819e-42df-89d9-7c3de57f71a4
```

```
ibmcloud pi volc vtlTest_Index --type tier1 --size 100 --affinity-policy affinity --affinity-volume <id of vtl boot vol>
```

```
ID          a5d5c0c3-517c-4e8c-a06b-ab7af1adb941
```

```
ibmcloud pi volc vtlTest_Tapes --type tier1 --size 500 --affinity-policy affinity --affinity-volume <id of vtl boot vol>
```

```
ID          4c8a58c8-1f3f-4698-b311-a7fc1147a4b4
```

The Repository is optional on either the PowerVS storage or on COS. If using COS skip this volume creation for the repository. The COS configuration is done within the VTL.

```
ibmcloud pi volc vtlTest_Repo --type tier1 --size 1000 --affinity-policy affinity --affinity-volume <id of vtl boot vol>
```

ID f38b18ab-9639-48cd-8afa-e4537ee49897

5. Attach the volumes to the VTL

```
ibmcloud pi volat 73d663d7-819e-42df-89d9-7c3de57f71a4 --instance 20a87524-24e6-4645-bdbc-665cb258740b
```

```
ibmcloud pi volat a5d5c0c3-517c-4e8c-a06b-ab7af1adb941 --instance 20a87524-24e6-4645-bdbc-665cb258740b
```

```
ibmcloud pi volat 4c8a58c8-1f3f-4698-b311-a7fc1147a4b4 --instance 20a87524-24e6-4645-bdbc-665cb258740b
```

```
ibmcloud pi volat f38b18ab-9639-48cd-8afa-e4537ee49897 --instance 20a87524-24e6-4645-bdbc-665cb258740b
```

DSI Restore Setup

After you have the VTL deployed, storage allocated, optional COS connectivity, and a Windows instance for the console, proceed to the document [‘Restore v6 Installation Guide for the IBM PowerVS Environment.pdf’](#) .

IBM i Configuration to connect to the VTL

IBM i uses iSCSI to connect to VTL; for the latest PTF list and SQL Services to configure iSCSI:

[IBM i iSCSI Configuration](#)

You can use SQL to configure iSCSI. The following is a couple of commands to show an example. These can be run from ACS or using interactive SQL ‘strsql’. For interactive SQL, remove the ‘;’ in the examples.

Use this command to get the IBM i client IQN to input into the VTL configuration.

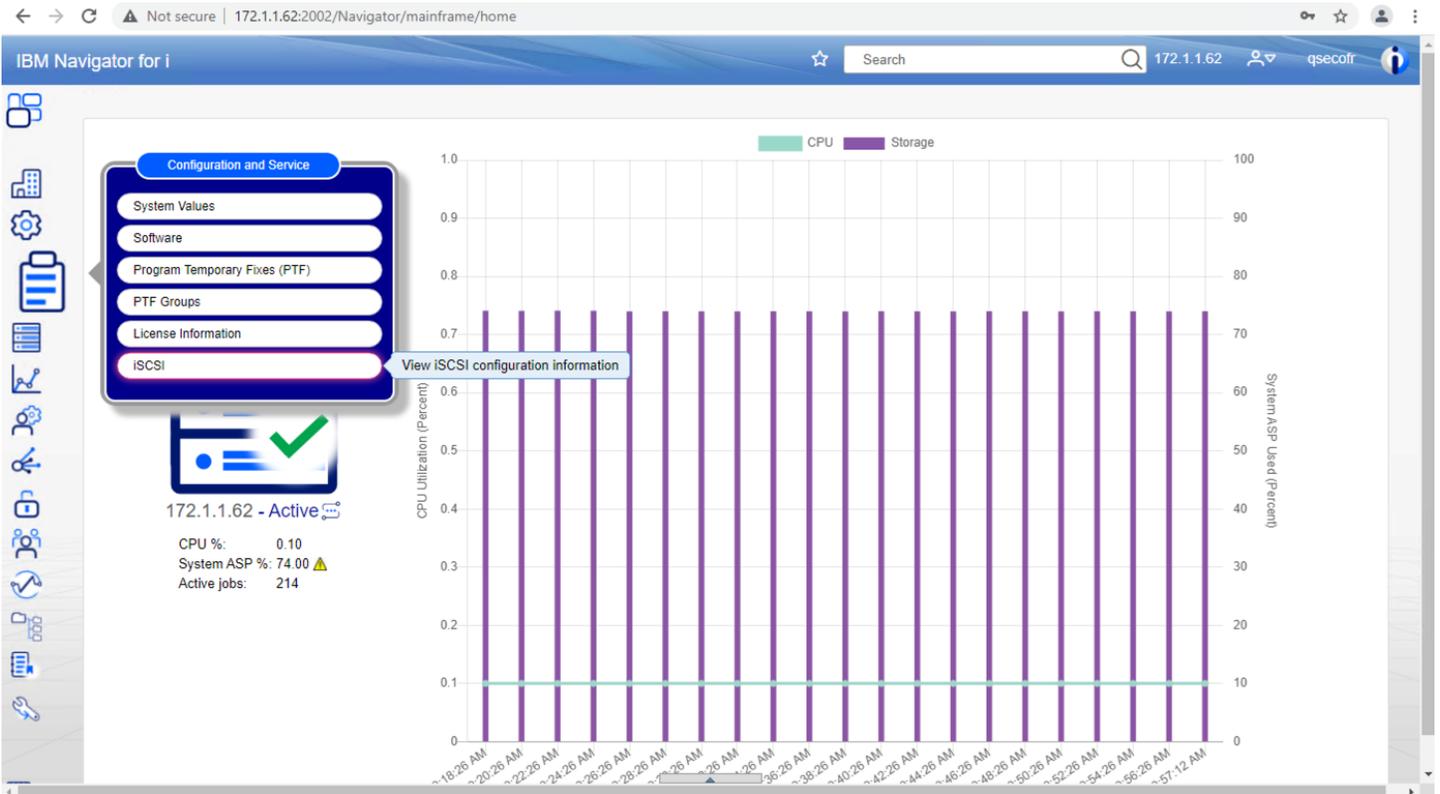
```
select * from table(qsys2.iscsi_info());
```

Use this command to set the target of the VTL.

```
call qsys2.add_iscsi_target(target_name=>'targetIQN', target_host_name=>'hostname or ip');
```

With the PTF group IBM HTTP Server for i (SF99662) level 14 or newer you can use IBM i Navigator to do most of the configuration for iSCSI.

The direct URL is <http://<IP ADDR>:2002/Navigator/>. To access the iSCSI configuration, navigate to it from the Configuration and Service icon.

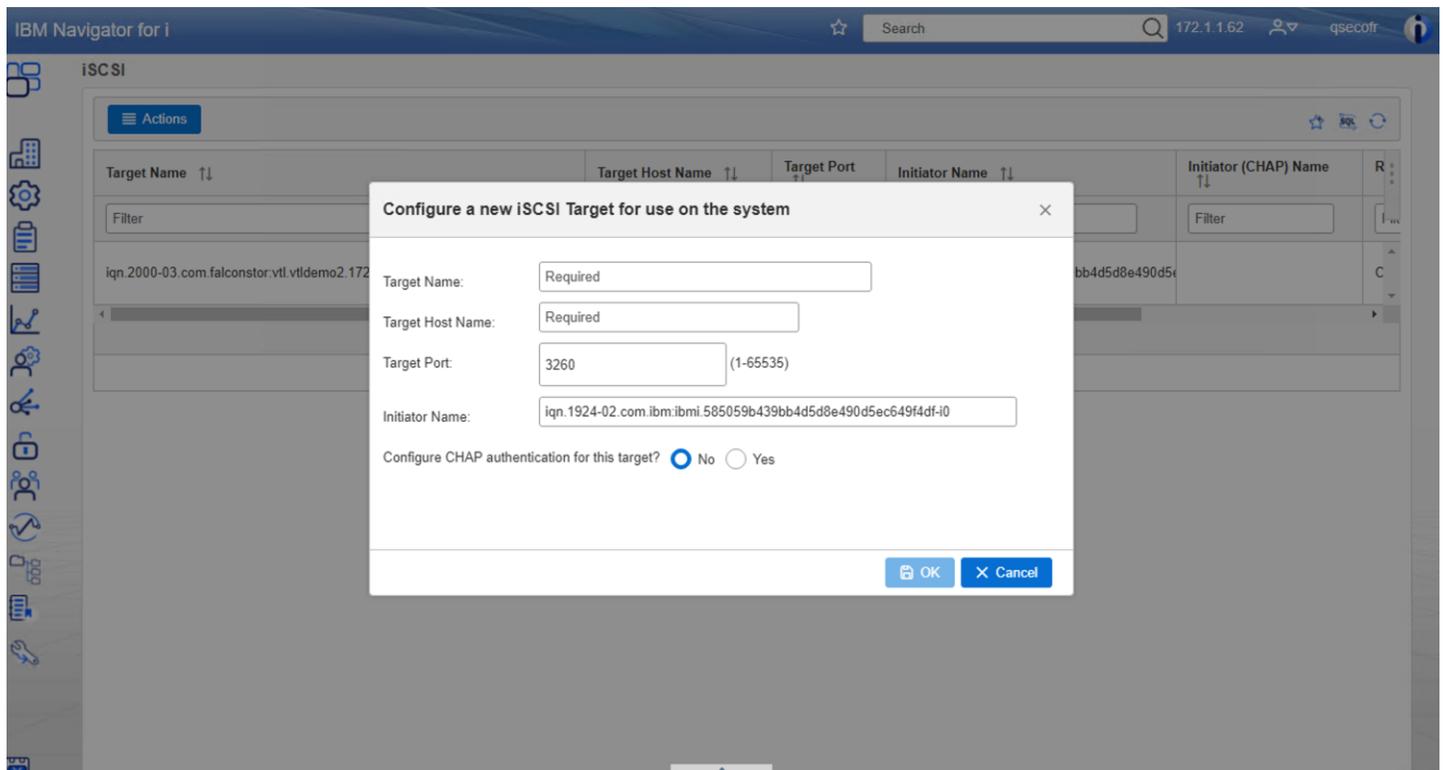


Click on Actions and Configure iSCSI Target

The 'iSCSI' configuration page shows a table with one row of data. The 'Actions' menu is open, showing options like 'Remove', 'Properties', 'Stop CHAP', and 'Configure iSCSI Target'. The table has columns for Target Host Name, Target Port, Initiator Name, and Initiator (CHAP) Name. The data row shows a target host at 172.1.1.238 on port 3260, with an initiator name starting with 'iqn.1924-02.com.ibm:ibmi.585059b439bb4d5d8e490d5e...'. The page also includes a pagination control showing 'Total Rows: 1'.

Item Actions	Target Host Name ↑↓	Target Port ↑↓	Initiator Name ↑↓	Initiator (CHAP) Name ↑↓
<ul style="list-style-type: none"> Remove Properties Stop CHAP Configure iSCSI Target Refresh 	emo2.172.1.1.62-30	172.1.1.238	3260	iqn.1924-02.com.ibm:ibmi.585059b439bb4d5d8e490d5e...

Input the Target Name and Target Host Name (or IP Address).



After the iSCSI configuration is done on the IBM i LPAR and there is a tape library and tapes assigned to the target port on the VTL side, re-IPL the virtual IOP associated with the iSCSI connection. An example of the SQL to re-IPL the IOP is below.

```
CALL QSYS2.CHANGE_IOP(IOP=>'ISCSI', OPTION=>'IPL')
```

You can also re-IPL the IOP from SST.



Choose option 1 to 'Start a service tool'

```
Start a Service Tool

Warning: Incorrect use of this service tool can cause damage
to data in this system. Contact your service representative
for assistance.

Select one of the following:

  1. Product activity log
  2. Trace Licensed Internal Code
  3. Work with communications trace
  4. Display/Alter/Dump
  5. Licensed Internal Code log
  6. Main storage dump manager
  7. Hardware service manager

Selection
  7

F3=Exit      F12=Cancel      F16=SST menu

MA  F                                                    21/007
```

Option 7 'Hardware service manager'

```
Hardware Service Manager

Attention: This utility is provided for service representative use only.

System unit . . . . . : 9080-M9S 21-EAEB7
Release . . . . . : V7R4M0

Select one of the following:
  1. Packaging hardware resources (systems, frames, cards,...)
  2. Logical hardware resources (buses, IOPs, controllers,...)
  3. Locate resource by resource name
  4. Failed and non-reporting hardware resources
  5. System power control network (SPCN)
  6. Work with service action log
  7. Display label location work sheet
  8. Device Concurrent Maintenance
  9. Work with resources containing cache battery packs

Selection
  2_

F3=Exit      F6=Print configuration      F9=Display card gap information
F10=Display resources requiring attention      F12=Cancel
```

Option 2 'Logical hardware resources'

Logical Hardware Resources

Select one of the following:

- 1. System bus resources
- 2. Processor resources
- 3. Main storage resources
- 4. High-speed link resources

Selection

1

F3=Exit

F6=Print configuration

F12=Cancel

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Option 1 'System bus resources'

Logical Hardware Resources on System Bus

System bus(es) to work with *ALL *ALL, *SPD, *PCI, 1-9999
Subset by *ALL *ALL, *STG, *WS, *CMN, *CRP

Type options, press Enter.

2=Change detail 4=Remove 5=Display detail 6=I/O debug

7=Display system information

8=Associated packaging resource(s) 9=Resources associated with IOP

Opt	Description	Type-Model	Status	Resource Name
-	Virtual IOP	6B25-001	Operational	CMB11
-	Virtual Bus Exp Adapter	-	Operational	BCC03
-	Virtual System Bus	-	Operational	LB02
<u>6</u>	Virtual IOP	298A-001	Operational	CMB02

Bottom

F3=Exit F5=Refresh F6=Print F8=Include non-reporting resources
F9=Failed resources F10=Non-reporting resources
F11=Display serial/part numbers F12=Cancel

MA

F

03/044

Find the Virtual IOP with a Type-Model of 298A-001 and take option 6

```

Select IOP Debug Function

Resource name . . . . . : CMB02
Dump type . . . . . : Normal

Select one of the following:

1. Read/Write I/O processor data
2. Dump I/O processor data
3. Reset I/O processor
4. IPL I/O processor
5. Enable I/O processor trace
6. Disable I/O processor trace

Selection
4

F3=Exit      F12=Cancel
F8=Disable I/O processor reset      F9=Disable I/O processor IPL

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```

Take Option 4 to 'IPL I/O processor'. After this is complete you should see tape library and drive resources. Take F12 to back out.

```

Logical Hardware Resources on System Bus

System bus(es) to work with . . . . . *ALL *ALL, *SPD, *PCI, 1-9999
Subset by . . . . . *ALL *ALL, *STG, *WS, *CMN, *CRP

Type options, press Enter.
2=Change detail      4=Remove      5=Display detail      6=I/O debug
7=Display system information
8=Associated packaging resource(s)      9=Resources associated with IOP

Opt Description                Type-Model  Status      Resource
-   Virtual IOP                 6B25-001   Operational CMB11
-   Virtual Bus Exp Adapter      -          Operational BCC03
-   Virtual System Bus           -          Operational LB02
9 Virtual IOP                     298A-001   Operational CMB02

Bottom

F3=Exit      F5=Refresh      F6=Print      F8=Include non-reporting resources
F9=Failed resources      F10=Non-reporting resources
F11=Display serial/part numbers      F12=Cancel

MA  F 03/044

```

Take option 9 to display the resources associated with IOP on the 298A-001 IOP

Logical Hardware Resources Associated with IOP

Type options, press Enter.

2=Change detail 4=Remove 5=Display detail 6=I/O debug
7=Verify 8=Associated packaging resource(s)

Opt	Description	Type-Model	Status	Resource Name
-	Virtual IOP	298A-001	Operational	CMB02
-	Virtual Storage IOA	298A-001	Operational	DC02
-	Tape Library	3584-402	Operational	TAPMLB01
-	Tape Unit	3580-007	Operational	TAP03
-	Tape Unit	3580-007	Operational	TAP01
-	Tape Unit	3580-007	Operational	TAP05
-	Tape Unit	3580-007	Operational	TAP06
-	Tape Unit	3580-007	Operational	TAP04
-	Tape Unit	3580-007	Operational	TAP02

F3=Exit F5=Refresh F6=Print F8=Include non-reporting resources
F9=Failed resources F10=Non-reporting resources
F11=Display serial/part numbers F12=Cancel