AIX Disaster Recovery with IBM Power Virtual Server

An IBM Systems Lab Services Tutorial

IBM Systems Lab Services

Infrastructure services to help you build the foundation of a smart enterprise.

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Chapter 1: Solution Overview

1.1 Introduction

Uptime is a key client expectation for AIX workloads. Across geographic locations, this is accomplished with a disaster recovery (DR) solution. <u>IBM Power Virtual Server</u> (PowerVS) meets that requirement by enabling clients to leverage DR solutions between two AIX Virtual Server Instances (VSIs) in separate IBM Cloud datacenters.

An important characteristic of DR solutions for PowerVS is that they are based on **logical or operating system-level replication**. Many Power Systems clients today use storage-based replication for disaster recovery (DR), which is not an option with PowerVS.

Replication solutions between two datacenters always involve prerequisite network configuration between them to allow the necessary data flow to occur securely. This also applies to DR with PowerVS, which requires specific networking steps in IBM Cloud before implementing the replication software itself.

This tutorial will provide step-by-step instructions to accomplish both phases of configuring DR for AIX workloads in PowerVS:

- 1. Performing the required network configuration.
- 2. Implementing the DR solution itself.

1.2 Use Cases

1.2.1 Geographic Logical Volume Manager (GLVM) Replication

In this situation, we use IBM AIX GLVM functionality to replicate data from one IBM Cloud location to another IBM Cloud location for DR purposes. This gives one the capability of recovering their application at a secondary IBM Cloud location should the primary IBM Cloud location be inaccessible for whatever reason.

1.2.2 Geographic Logical Volume Manager (GLVM) Replication with PowerHA

In this situation, we combine the IBM AIX GLVM functionality to replicate data from one IBM Cloud location to another IBM Cloud location with IBM PowerHA to provide a fully automated resiliency solution. This gives one the capability of automatically recovering their application at a secondary IBM Cloud location should the primary IBM Cloud location be inaccessible for whatever reason.

1.3 Solution Components and Requirements

1.3.1 Components

The following components will be required for these solutions:

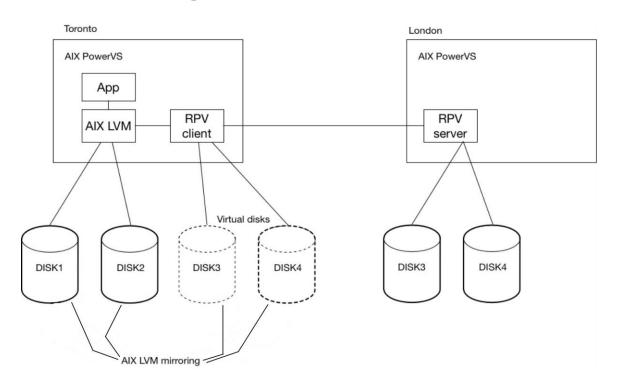
- 1. IBM Power Virtual Servers
- 2. Multiple IBM Cloud locations
- 3. IBM network setup between IBM Cloud locations
- 4. Storage assigned to appropriate VMs

1.3.2 Requirements

The following will be required for these solutions:

- 1. IBM Power Virtual Servers with AIX operating system at multiple IBM Cloud locations
- 2. IBM network setup between IBM Cloud locations
 - a. The network setup is described in the **Chapter 2:** Implementation section of this document
- 3. AIX GLVM installed on each AIX VM
 - *a.* AIX GLVM comes with AIX, so it is not an additional cost or license

- 4. For integration with IBM PowerHA, the IBM PowerHA Enterprise Edition software installed on each of the AIX VMs that will be part of this environment (high-availability cluster)
 - a. IBM PowerHA is a separately orderable product and requires an additional licensing



1.4 Solution Diagram

Figure 1.4.1 RPV server/client diagram with virtual drives

Chapter 2: Implementation

2.1 Base IBM Cloud PowerVSI and Networking setup

The following steps are required to implement IBM PowerVS VMs and setup the network between IBM Cloud locations:

- 1. Open an IBM Cloud account
- 2. Create two Power PowerVS location Services and a private subnet in each PowerVS location.
- 3. Provision AIX VSIs in each PowerVS location
- 4. Order Direct Link Connect Classic to connect each PowerVS location to IBM Cloud
- 5. Order two Vyatta Gateways one in each datacenter: Lon06 and Tor01 datacenters or your chosen datacenters to allow for PowerVS location-to-PowerVS location communication
- 6. Request a Generic Routing Encapsulation (GRE) tunnel to be provisioned at each PowerVS location.
- 7. Configure three GRE tunnels in the Vyatta Gateways. Two to connect Vyatta Gateway to the PowerVS location GRE tunnels created in Step 6 above and one across Vyatta Gateways to connect Vyatta-to-Vyatta. This will allow end-to-end PowerVS location to PowerVS location communication for the VSIs in the PowerVS locations and to the IBM Cloud VSIs and other services such as Cloud Object Storage (COS).

2.1.1 Open an IBM Cloud account

Login to <u>https://cloud.ibm.com</u> and follow the procedure to open an Internal to external account.

For internal accounts, you can use your IBM intranet ID and password. For external accounts you will need to provide a billing source such as a credit card.

2.1.2 Create PowerVS location Service and Subnet(s)

All Power VSIs are provisioned in what is called a PowerVS location. This is a separate datacenter adjacent to IBM Cloud datacenters. In order to setup your PowerVS location, you will setup a PowerVS location service in the IBM Cloud UI. The PowerVS location service is a service within IBM Cloud which allows you to provision Power AIX and IBM I VSIs. There is a limit of one PowerVS location service per datacenter in IBM Cloud. In our scenario we have created two PowerVS locations, one is Toronto and one in London datacenters.

Prior to provisioning Power VSI in the PowerVS location, you will need to create at least one subnet. You can have as many subnets as you require in each PowerVS location service on which you can provision your Power VSIs.

2.1.3 Provision AIX and IBM i VSIs in each PowerVS location

In each PowerVS location service you can create AIX or IBM i VSIs. The details are provided in the next section.

2.1.4 Order Direct Link Connect Classic to connect PowerVS location to IBM Cloud

You will need to order Direct Link (DL) Connect Classic to allow your Power VSIs to communication with Linux/Window VSIs in IBM Cloud and also with all other IBM Cloud services such as VMWare VMs, and Cloud Object Storage (COS). Ordering a DL may take 1-2 weeks to complete. There is no charge for this service as of June 2020.

2.1.5 Order two Vyatta Gateways, one in each datacenter

In order to setup communication between the two PowerVS location datacenters, you will need to use a Generic Routing Encapsulation (GRE) tunnels. GRE tunnels are provisioned on Vyatta Gateways so you will need to order one Vyatta Gateway in each PowerVS location.

We ordered one Vyatta in LON06 and the other in TOR01 datacenters where our PowerVS locations exists.

2.1.6 Request a Generic Routing Encapsulation (GRE) tunnel to be provisioned at each PowerVS location

You will need to open a support ticket with Power Systems and request that a GRE tunnel be provisioned in each PowerVS location. They will provision their end of the GRE tunnel and send you the information so you can continue and provision your end on the Vyatta Gateways. You will need to provide the subnets information in each PowerVS location in the ticket.

2.1.7 Configure three GRE tunnels in the Vyatta Gateways

After the support team finished configuring the GRE tunnel, you will need to configure your end of the GRE tunnel on the two Vyatta Gateways.

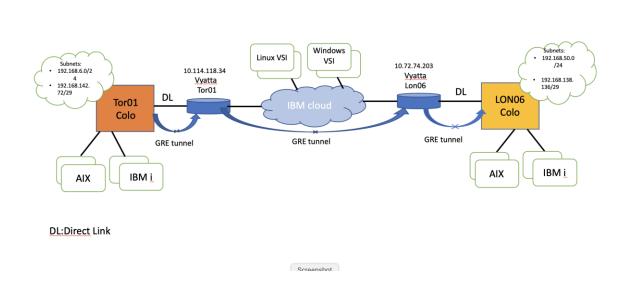
You will need three GRE tunnels

- 1. GRE tunnel on Vyatta to terminate the PowerVS location GRE in LON06
- 2. GRE tunnel on Vyatta to terminate the PowerVS location GRE in TOR01
- *3. GRE* tunnel across the two Vyatta gateways. One on each side.

2.1.8 Diagrams

The overall architecture of our deployment is shown in Figure 1.

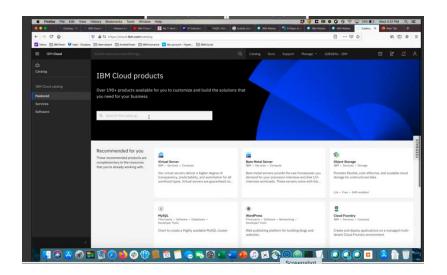
End-to-End PowerVS location Architecture



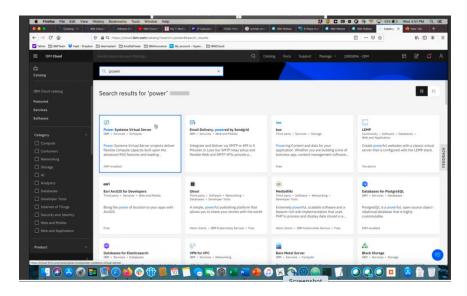
2.1.9 Create PowerVS location Services and Subnet(s)

You will need an IBM Cloud account to start this process.

Go to the main IBM Cloud UI page and click on "Catalog" on upper right side of the UI.



Search for "Power"



Select "Power System Virtual Servers".

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Your PowerVS location service will now appear under the Services tab.

You will repeat this process to create a second PowerVS location service. In our case we have two PowerVS location services, one in London and one in Toronto.

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Next you will need to click on the PowerVS location Service you created and provision a subnet to be used by your Power VSI servers.

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- 1. name for your subnet
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- *3.* The rest of the fields will be automatically populated based on the CIDR you provided.

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There should be a VLAN ID associated with the subnet.

At this point, you will need to open a Support Ticket with Power System to request that the subnet be configured to allow local communication between any Power VSI you create in this PowerVS location service. Provide your PowerVS location service location, and your subnet in the ticket.

Without this step, the Power VSI you create will not be able to ping between each other even if they are on same subnet in the same PowerVS location.

2.1.10 Provision AIX and IBM i VSIs in each PowerVS location

The procedure is similar for both AIX and IBM i VSI provisioning. Here is a procedure to create an AIX 7.2 VSI. The cost shown are monthly costs, but you are being charged hourly.

Go to the IBM Cloud Catalog and press the "IBM Cloud" on top left side of the UI.

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	IBMiProd-kb	192.168.6.118, 192.168.142.74	IBMi-74 Screenshot	1 cores	4 GB	Active	0		
	Items per page: 10 V 1-10 of 10 ite							of 1 🚽	Þ

Since we have already provisioned several VSIs, we see the list show above. If you are creating VSIs for the first time, your list will be empty.

Press "Create Instance" on upper right-hand side.

Resource list /					
Power Systems		onot01 @ Active Add tags 소		Details	Actions Y
Virtual server instances	Virtual serve	r instance creation		Summary	
Storage volumes Boot images Subnets	Virtual servers SSH key Boot image Profile Storage volumes Network interfaces	Create a new instance for Power System Strict Instance are consistent to the service defined in your resource list, liewy for an analysis of the service defined in your resource list, liewy Instance range Up group and the service defined in the service SSH bay Toy must add the SSH why to security context to your Power Stot add the service for new adventuation, the group age and the service defined in the service defined and the service defined and the service defined and the service defined and the service defined and the service defined and the service defined and the service defined and service defined and the service defined and the service defined and service defined and the service defined and the service defined and service defined and the service defined and the service defined and service defined and the service defined and the service defined and service defined and the service defined and the service defined and service defined and service defined and service defined and service defined and service defined and service defined and service defined and service de		LEM POWER9 5 emp 3 dis 3 dis Network interface Storage volume	\$1,289.5 9 \$0.0 \$0.0
		SSH keys Choose a SSH Key	New SSH key +	Total monthly cost*	\$1,289.5 estimate

This is where you provision AIX or IBM i VSIs.

Choose a name for your VSI, i.e., AIX-72-Tor01 and select how many VSIs you need to configure. The names of the VSI will be appended with a "-1", "-2" etc. if you select more than one VSI.

You may leave VM pruning and SSH key as is since the VSIs will have no passwords when you create them for the first time. You will need to create a password via the OS command.

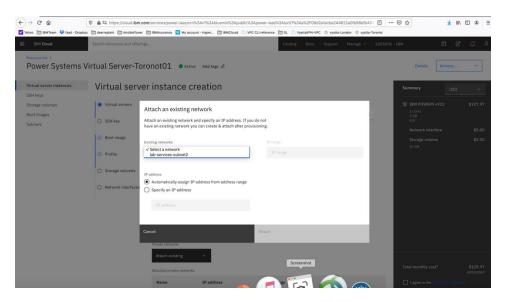
Scroll down to choose other options.

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Resource list / Power Systems	s Virtual Server-Tor	CONOTO1 Sective Add tag	B ℓ			Details	ctions Y
Virtual server instances	Virtual serve	er instance creatio	n		1	Summary	USD ~
SSH keys							
Storage volumes	Virtual servers	Boot image				I IBM POWER9	\$1,365.10
Boot images		Select from AIX, IBM i, or Linux boot ima				1 cores 2 GB	
Subnets	O SSH key	virtual machine (VM), you must first pure it and register with your Linux vendor aft				XIX	60.00
	O Boot image	purchasing and subscribing to Linux Operating system		Image		Network interface	\$0.00
		V AIX	1	Select an image		Storage volume	\$0.00
	O Profile	IBM i Linux - Client supplied subscript	lon	Select an image	· ·		
	O Storage volumes	Profile					
	O Network interfaces	Choose your machine type, processor, me	mory and cores.				
		Machine type Pr	rocessor				
		Choose a type 🗸 🤄	Dedicated 🔘 Shared uni	capped 🔘 Shared capped			
		Cores (CPUs)		Memory (GB)			
			1		•		
		Storage volumes Please select an image before creating an existing volumes after you provision the is				Total monthly cost*	\$1,365.10 estimated
				C.7		I agree to the Monte of	

Here you will choose the following options:

- Operating System AIX
- Image type: AIX 7.1 or 7.2, etc.
- Disk types: Type 1 or 3. Type 3 is a less expensive option which we selected.
- Machine type: S922 or E980. S922 is the cheater of the two which we selected.
- Processor: Dedicated or Shared or Shared Capped. We choose "shared" as its less expensive.
- Choose the number of cores and RAM you will need. The minimum core is "0.25".
- You can also attach additional volume to the VSI is you wish. We did not do that here and only used the root volume which is included.

Next you will scroll down to choose your subnet on which these VSIs will be provisioned. It is assumed you have already created one or more subnets prior to this step.



Click on the "Attached Existing" under networks.

Choose the subnet you wish to attach, and the press "Attach"

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IBM Cloud	Search resources and offering	Catalog Docs Support Manage V 2085896 - IBM	
Power Systems	Virtual Server-Tor	Donot01 • Active Add tags 2	Actions ~
/irtual server instances	Virtual serve	r instance creation Summary	USD
SH keys			
Storage volumes	Virtual servers	1 C 2 C III IBM POW	ER9 s922 \$137
Boot images	0.000	1 cores 2 GB AIX	
ubnets	 SSH key 	Storage volumes Network i	nterface \$0
	 Boot image 	Create and attach new storage volumes. You can attach existing volumes after you provision the instance. Storage vol	
	-	provision the instance. Storage vo	nume \$4
	 Profile 	New storage volume +	
	 Storage volumes 		
	 Network interfaces 	Network interfaces A public interfaces while metwork was a public VLAH to connect to your virtual server instance. Under private metworks, you acconnect to existing subsets to invoive on permises avoid/adu to the Could For sereta a new subnet you must go to the subset tab, your progress here will be served.	
		Public networks	
		Off Off	
		Private networks	
		Attach existing +	
		Attached private networks Screenshot Total monthly	cost* \$139
		Name IP address IP range CIDP	

Now check the box "I agree to the" And press "create Instance" in lower right-hand side.

Your VSI is now being provisioned.

2.1.11 Order Direct Link Connect Classic to connect PowerVS location to IBM Cloud

You will need to order Direct Link (DL) Connect Classic to allow your Power VSIs in the PowerVS location to communication with Linux/Window VSIs in IBM Cloud and also with all other IBM Cloud services such as Cloud Object Storage and VMware services. This process may take 1-2 weeks to complete.

There are several steps involved in completing DL ordering:

- Order Direct link connect classic service on IBM Cloud UI see steps below
- Next a support ticket will be created, and Support will send you a word document with questionnaires to be completed concerning various DL settings.
- Complete the questionnaires and upload it to support in the ticket.
- Support will then request that you create a new support ticket with the Power System so they can complete their side of the DL provisioning. Attach information about the DL in the original ticket to this ticket.
- The DL will be provisioned, and you will be notified when complete.
- You can now test connection to any Linux/Windows VSI you may have in IBM Cloud and other IBM Cloud services.

To start the DL order process, go to IBM Cloud UI and log in.

Choose "Catalog" from upper right-hand side, and search for "direct".

IBM Cloud				
atalog	Q direct	×		
3M Cloud catalog eatured ervices	Search results for 'direct' 7 results			82 **
oftware	5		5	5
Category	Direct Link Connect on Classic IBM - Services - Networking	Direct Link Dedicated 2.0 IBM - Services - Networking	Direct Link Dedicated Hosting on Classic IBM • Services • Networking	Direct Link Dedicated on Classic IBM - Services - Networking
Networking Analytics Web and Application	IBM Cloud Direct Link Connect offers private access to your IBM Cloud infrastructure and to any other clouds linked to your Network	This is the 2.0 version of this service. Connect directly to IBM Cloud through a single-tenant connection, using a dedicated circuit or cross IAM-enabled	Establish unparalleled network performance to and from your IBM Cloud platform resources, with customized support for your	Connect directly to IBM Cloud through a single-tenant connection, using a dedicated circuit or cross-connect, for unparalleled
	~	TYLI-GUEDRO		
	Direct Link Exchange on Classic IBM - Services - Networking	IBM Cognos Dashboard Embedded IBM - Services - Analytics	Voice Agent with Watson	
rovider ·	A IBM Cloud Direct Link Exchange offers multi- tenant connections to your IBM Cloud infrastructure, through your local IBM Cloud	Bring data to life directly from your application with this powerful and easy-to-use visualization service.	Create a cognitive voice agent that uses Watson services to speak directly with customers using natural language over the	
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Select "Direct Link Connect on Classic".

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Infrastructure	IBM Cloud Direct Link Connect offers private access to your IBM Cloud infrastructure and to any other clouds linked to your		
Provider IBM	Network Service Provider, through your local IBM Cloud datacenter. This option is perfect for creating multi-cloud		
Category	connectivity in a single environment. We connect customers to the IBM Cloud private network, using a shared bandwidth topology. As with all Direct Link products, you can add global routing that enables private network traffic to all IBM Cloud		
Networking	locations.		
Related links			
Docs Terms	Features		
	Fully Integrated Hybrid Environment		
	Whether your resources are in your datacenter or on the IBM Cloud, you can operate with the speed and security that your business requires.		
	Secure Dedicated Connectivity		
	Deploy your resources where you need them on IBM Cloud's secure network. You need not sacrifice performance quality for security and compliance.		
	Unmatched choice and investment protection Choose port speeds of 50, 100, 200, 500 Mtgs. 1 CBps. 2 Gbps. or 5 Gbps. As your needs change you can transition your speeds semissive.		
	Screenshot		
		Create	

Press "Create". There are no options to select.

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IBM Cloud		Search resources and offerings		Q Catalog	Docs Support Manage V 20	185896 - IBM	
Classic		IBM Cloud Direct Lin	k Connect			Order Di	rect Link Connect 🕀
Overview							
Devices	~	The table below shows the status of	IBM Cloud Direct Link Connect connection	ns provisioned for this accour	nt. Details of the connection can be di	splayed by clicking on the con	nection name. The
Storage	~	connections can be cancelled or del	eted depending on the connection status.				
Network	~	NAME	LINK SPEED	LOCATION	NETWORK PROVIDER	CONNECTION STATUS	Actions
Security	~						
Services	~		There are no Direct Links. To o	reate one, use the 'Order Di	irect Link Connect' button in the top	right.	
				Screen	ishot		

Now choose "Order Direct Link Connect" from top right-hand side.

○ IBM Cloud :: Create a Direct X ← → C ^a @	 Configure per a data (s. X) Security a later interpreter and a security a later integer. X Constances - Constitution (X. X) Constitution (X. X)<th>atartied with the IIII X [™] Direct Link Connect for Poor X + … ♡ ☆ IIN III ③ [™]</th>	atartied with the IIII X [™] Direct Link Connect for Poor X + … ♡ ☆ IIN III ③ [™]
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- Choose a "name" for the DL.
- Choose a location for the DL. This should be the same location as where you created your PowerVS location Service.
- Choose "link speed" under network provider menu.
- Choose "Local Routing (free)"

Global routing will require additional charges and will allow for easier PowerVS location-to-PowerVS location communication. You will also need to order a Vyatta Gateway Router to complete your Global routing option via use of a GRE tunnel. Support can help you with this further.

In our case, we decided to use Local Routing and then order a Vyatta Gateway in each PowerVS location and provision a GRE tunnel end-toend.

IBM Cloud	Search resources and offerings Q Catalog Docs Support Manage ~ 2085896	
Classic	Catalog / Offering Details /	
erview	📮 Create a IBM Cloud Direct Link Connect Connection	
vices ~	Direct Link Instance Name:	Order Summary USD
orage ~	labservices-directlinkconnect	1 Gbps Direct Link \$895.00 Connect
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curity ~	Toronto 1 👻	Total due per month: \$895 tax not inclu
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	IBM POWER VS	Prorated initial charge \$49
	Link Speed:	Total due now \$491 tax not inclu
	1000 Mbps	> Apply promo code
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	BGP ASN IBM ASN	Create
	64999 B 13884	Need Help? Contact IBM Cloud S
	Screenshot	

• Check the box to accept the offer and press "Create"

A support case will be opened with the information required.

Support - II) → C Vahoo 🖻	° û	guring and adding a :: X in Importing a boot image X A os.serve) A https://cloud.ibm.com/unifiedsupport/cases?number=CS180) derreplat AntibieTower I Minisurance V My account - Hyper.	8755	i in IBM (Publi 🗙 🚾 (1) P	PowerVS Networking Tur X	 Getting started with the ID × ♥ ☆ 	Direct Link Connect for Pose X	+
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R	Add comments here To maintain device sect	urity, please do not include any personal information, sensitive data		section 1000	Case resolutio			A

After this is complete, you will then be contacted by support and requested to complete and answer some questions in an attached document and send it back as attachment to the same ticket.

After this step is complete, support will request that you open a new IBM support ticket and address it to the Power System. Include the information in the original DL ticket. This new ticket will be sent to the PowerVS location support to configure their side of the DL connection.

This should be the last step before DL communication works. You can test your connection by pinging IBM Cloud Linux/Windows VSI from your Power VSIs and in reverse.

2.1.12 Order two Vyatta Gateways, one in each datacenter

In our scenarios we used two Vyatta Gateways, one in each PowerVS location to provide end-to-end PowerVS location-to-PowerVS location communication using GRE tunnels.

Login to IBM Cloud and click on the "Catalog", then search for Vyatta.

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Software Consulting	Gateway Appliance IBM - Services - Networking	Rd Databases for Redis IBM • Services • Databases	Pg Databases for PostgreSQL IBM • Services • Databases	Et Databases for etcd IBM • Services • Databases
ategory ^	Protect your cloud infrastructure and optimize its performance with a gateway appliance.	Redis is a blazingly fast, in-memory data structure store.	PostgreSQL is a powerful, open source object- relational database that is highly customizable.	etcd is a distributed reliable key-value store for the most critical data of a distributed system
		IAM-enabled	IAM-enabled	IAM-enabled
AI / Machine Learning Analytics Databases Developer Tools Logging and Monitoring	VSI Database Community + Software + Databases Configure a classic virtual server with PostgreeQL to provide scalability and	Es Databases for Elasticsearch IBM + Services + Databases Elasticsearch combines the power of a full text search engine with the indexing strengths of a	Mg Databases for MongoDB IBM + Services + Databases MongoDB is a JSON document store with a rich query and aggregation framework.	Knowledge Catalog IBM + Services + AI / Machine Learning Discover, catalog, and securely share enterprise data.
Integration Internet of Things Security	performance for your data workloads. Terratorm	3SON document database. IAM-enabled	IAM-enabled	Lite • Free • IAM-enabled
Product ^	Master Data Management	Mass Data Migration	Screenshot Sarket Data APIs	Cloud Pak for Data
	IBM - Services - Analytics IBM® Master Data Management (MDM) on Cloud helps businesses gain a trusted view of data in a hybrid computing environment.	IBM + Services + Storage A fast, simple, secure way to physically transfer terabytes to petabytes of IBM Cloud	Real time and reference market data	IBM + Software + Analytics An all-in-one cloud-native Data and AI platform in a box, providing a preconfigured, governed, and secure environment to collect

Select "Gateway Appliance" and click on it.

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Gateway appliance wy Agalances period and openance your cloud intrastructure. Create virtual readers, Trewalls, and private retwork devices, all with the custom parameters that you	View ATT VRA docs View Juniper vSRX docs reed. View Bring Your Own Appliance docs	Intel Xeon 5120 \$740.30 28 Cores, 2.20 GHz 32 GB RAM Virtual Router Appliance 18.x (up to 2) 210 CH 2
Create About		Gbps) Subscription Edition (64 Bit) LON06 - London (pod01)
Sateway Vendor		Add-ons
● AT&T vRouter		- 1 - Disk controller - Non-RAID \$
		2.00 TB SATA x 1
Gateway appliance		L Network interface \$3 1 Gbps Redundant Private Network
Hostname (D) Domain (D)		Uplinks
vyatta-labservices-LON IBM.cloud		Add-ons
High availability		Apply promo code
Location ()		Total due per month* \$79
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Select "AT&T vRouter". This is the Vyatta Gateway. You have other choices of Gateways, but we will use Vyatta.

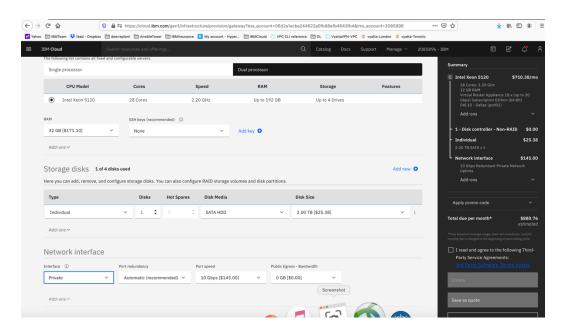
Provide a name for the Gateway and include the PowerVS location name in it so you can distinguish them later.

Select Location to match your PowerVS location.

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The following list contains all fixed and	d configurable servers.					Summary	
Single processor			Dual processor			Intel Xeon 5120	\$740.3
CPU Model	Cores	Speed	RAM	Storage	Features	28 Cores, 2.20 GHz 32 GB RAM Virtual Router Appliance 18.x Gbps) Subscription Edition (6	
 Intel Xeon 5120 	28 Cores	2.20 GHz	Up to 192 GB	Up to 4 Drives		LON06 - London (pod01) Add-ons	
RAM	SSH keys (recommende	- 0				27221270	
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		- 100 Ref. 100301 Fr.				 Individual 2.00 TB SATA x 1 	,
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Choose the following options:

- Uncheck the High Availability option unless you wish to order one which means you will order two Vyatta Gateways in each PowerVS location. We uncheck this option.
- Select the location by pressing on the arrow key in each location to find the exact datacenter where you PowerVS location are located.
- You may need to choose the POD if there are several PODs in the selected datacenter location.
- Select the CPU single or dual processor. We chose Single Processor.
- Select the amount of RAM you wish and add ssh keys if you like to login without password. This can be done later too.
- Choose Private network interface unless you wish to use the default which is public/private interface. We chose private network interface only.



Now check the box to agree with service agreement on the bottomright side and press "Create"

The Vyatta gateway is now being provisioned. This may take several hours.

You will need to do this process in each of the two PowerVS locations.

After the Vyatta Gateway is provisioned, you can see it listed under "Devices" where you can find your "Vyatta" and "root" user passwords.

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To log into the Vyatta gateway, use a browser and access it via the link:

https://<ip address of the Vyatta gateway>

user: Vyatta

password: as show under "devices" in IBM Cloud UI and password tab on the left.

		Manhanana analia lab	services-lon Logged in a		1 hours		
🔇 ΥΥΛΤΤΛ.		Dashboard Statiat	ics Configuration	Operat	lan		
Running: 1801q.09052048 on Intel 64bit			Aptime: 26m System To	ne: 17 Jun 2020 0	3:01 CDT		
Resource Usage	Interfaces *						
-	Name Description	IP Address	Status	In	Out		
CPU *: 0% >> Memory *: 0% of 30.38 GB	dp0bond0 *	10.72.74.203/26	IG FD	9.1 kbps	28.45 kbps		
Disk: 1% of 1.66 TB	dp0bond1 *		•	0 kbps	0 kbps		
System Information *	dp0s0 *		1G FD	1.33 kbps	28.23 kbps		
Domain name *: ibm.cloud DNS servers *: 10.0.80.11 via system >>	dp0s1 *		•	0 kbps	0 kbps		
Boot via : image	dp0s2 *		•				
Images : 1	dp0s3 *		•	0 kbps	0 kbps		
Routing *	8	Security *					
Name Status		Name Statur	E.				
MSDP * Peers: 0, Groups: 0, Mesh groups: 0		Firewall * State-	Policy: none, Rule-sets: 0/1	in use	30		
Static Route * Routes configured: 4, Routes in use	n: 4 >>				8		
Services *		Management * Name Status					
Name Status			it: 17 Jun 2020 02:27 by co	fot	39		
			0/2 connected, Root Login:		39		
			sessions: 0, Listen-addresse		39		
High Availability *	R	Sysiog * Global facil	lity/level: protocols/debug, a	il/notice	39		
Name Status							
VRRP * Groups confid: 0, Master: 0, Backup	p: 0, Fault: 0 »	Traffic Policy *					
		Name Status					
		QoS * 1 configure			39		
		Screen	shot				

Typically, you will use a command line to ssh to the Vyatta for further configuration. You will use the "Vyatta" user id to do the configurations.

2.1.13 Request a Generic Routing Encapsulation (GRE) tunnel to be provisioned at each PowerVS location

You will need to open a support ticket to Power Systems and request that a GRE tunnel be provisioned in each PowerVS location. You will need to provide information on the subnets you created in the PowerVS location. They will provision their end of the GRE tunnel and send you the information you will need so you can continue and provision your end of the GRE tunnel on the Vyatta Gateways.

Power Support team will send you the following information for your GRE tunnels after they complete their end of the GRE tunnel:

TOR01:

In Tor01 to POWERVS LOCATION GRE: Your destination should be 10.254.0.30 Your tunnel ip 172.20.8.1 Power-PowerVS location-Side: Tor01: interface Tunnel5 description IBM5-GRE vrf forwarding IBM5 ip address 172.20.8.2 255.255.255.252 keepalive 5 3 tunnel source 10.254.0.30 tunnel destination 10.114.118.34 tunnel vrf IBM5

LON06: In Lon06 to POWERVS LOCATION GRE: Your destination should be 10.254.0.26 Your tunnel ip 172.20.2.1 Power-PowerVS location-Side: Lon06: interface Tunnel4 description IBM3-GRE vrf forwarding IBM3 ip address 172.20.2.2 255.255.255.252 keepalive 5 3 tunnel source 10.254.0.26 tunnel destination 10.72.74.203 tunnel vrf IBM3

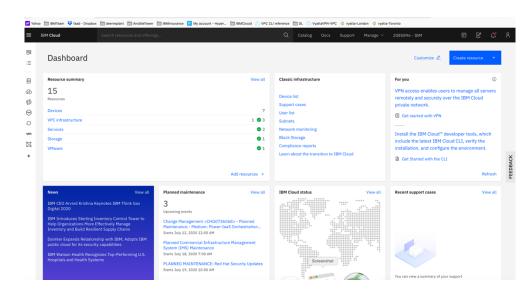
The items shown in Red is what you will need to configure your end of the GRE tunnel in each Vyatta Gateways.

- Note that your tunnel IP address is 172.20.2.1/30 where 255.255.255.252 translate to /30
- > Your tunnel destination IP is their tunnel source IP.
- > Your tunnel source IP is the IP address of the Vyatta gateway

Verify your Vyatta Gateway access.

The Vyatta Gateway address can be find in the IBM Cloud UI under Devices.

Login to IBM Cloud UI and press "IBM Cloud" on top left-hand side.



Click on "Devices"

Resource list								Creat	e resource
∨ Name	Ŷ	Group		Location		Offering	Status	Tags	
Q Filter by name or IP address		Filter by group or org	~	Filter	~	Q Filter	Q Filter	Filter	~
Devices (7)									
abservices-reverseproxy-ab.IBM	cloud	Classic Infrastructure		Toronto 01		Virtual Server	View status	-	
🔒 labservices-scenario1-centos-pri	vate-fg.IBM.cl	Classic Infrastructure		Toronto 01		Virtual Server	View status	-	
labservices-spectrumprotect-rhe Public: 169.48.5.242 / Private: 10.166.11	-ab.IBM.cloud	Classic Infrastructure		Toronto 01		Virtual Server	View status	-	
🔒 labservices-spectrumprotect-rhe	-ab2.IBM.cloud	Classic Infrastructure		Toronto 01		Virtual Server	View status	-	
🔒 vyatta-labservices-lon.ibm.cloud		Classic Infrastructure		London 06		Gateway Appliance	View status	-	
🚔 vyatta-labservices-tor.ibm.cloud		Classic Infrastructure		Toronto 01		Gateway Appliance	View status	-	
🚔 windows-fg.IBM.cloud		Classic Infrastructure		Dallas 05		Virtual Server	View status	-	
✓ VPC infrastructure (4+) (Error retrieving)	g data)								
 Clusters (0) 									
✓ Cloud Foundry apps (0)									
✓ Cloud Foundry services (0)									
 Services (2) 									
✓ Storage (1)									
 Network (0) 									

Choose the Vyatta system you like to configure:

- <u>vyatta-labservices-lon.ibm.cloud</u>
- <u>vyatta-labservices-tor.ibm.cloud</u>

LON06:

Click on the London Vyatta: vyatta-labservices-lon.ibm.cloud

erview sever details System details age Name vglata-labservices-lon.ibm.cloul d. OS ATT Virtual Router Appliance (rRouter 5600) 180.10 mote management Type Gateway nember Security Device Security Device Security Device toring Type Gateway nember Remote Mgint Carl Apped ATT2500 - Onboard naforing Gateway appliance Vjrtuzi Labservices-Ion. Remote Mgint Carl Apped ATT2500 - Onboard ar access ID 1374067 Remote Mgint Carl Apped ATT2500 - Onboard arge Sated OT72020, 10.391 PM Processor 2.2.2.0Hz Intel Xeno-Stylake (S120-00.DI) ModRy assords Sated OS Nate SuperMicro AUB-MATE Ketserk NA CB39UAG368A0194 Noter Koard SuperMicro AUB-MATE Intertion Nate Nate Dive Centroller Maiosard Onboard ModRy Setail # 0.01640 SuperMicro AUB-AST-SUB-STQ-MA Beckplane SuperMicro AUB-AST-SUB-STQ-MA Billing Monhy Sates Sates SuperMicro AUB-AST-SUB-STQ-MA Billing Service State Sates SuperMicro AUB-AST-SUB-STQ-MA	Server details Server details System details age Name vystts-labservices-lon.ibm.cloul d 55 ATT Virtual Router Appliance (rikouter Appliance (rikouter Appliance) mote management Type Gateway nember Security Device SogerVices ADM-TRM-692714 control Gateway appliance vystts-labservices-lon.ibm.cloul d Remote Mgm Cand Apped A27200-0100ad indring Gateway appliance vystts-labservices-lon.ibm.cloul d RAM Apped A27200-0100ad ar access ID 1374057 RAM Apped A57200-010bnd 37d, Modry arge Started 0172020.10.3919 AM Processor 2x 250Ht Intel Xeon-Stylake (S120-G0L0) Modry assords MFR Serial # CS194035880194 Network Cand SuperMicro 2W5753F-1A MFR Serial # CS194035880194 Metherboard SuperMicro 2W5753F-1A SuperMicro 2W5753F-1A Notes London 6 Bateplane SuperMicro 2W5753F-1A SuperMicro 2W5753F-1A Miles SuperMicro 2W5753F-1A Bateplane SuperMicro 2W5753F-1A SuperMicro 2W5753F-1A Massord SuperMicro		ervices-lon.ibm.clou	d Add tags ∠ ● Powered on	Connected			Actions 🔻
Space Name ystat-labervices-loo.ibm.cloud & OS ATT Virtual Router Appliance (Router Appliance Appliance Appliance Appliance Appliance Appliance Appliance A	By an and an analysis of the status	rview	Server details			System details		
Name Name Visital labeling visital	Name Value Value <thv< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th></thv<>							
Type Type <th< td=""><td>inport inport Section University Interior Section University Interior Section University Interior interior Gateway appliance valida Subscription Remote Vigine Cadid Aspeed A572500 interior Status ACTIVE RAM 2x 16GB Hyrix 16GB DDR4 2rk dB Modry raccess ID 1374067 Processor 2x 2 20112 Intel Xioon-Sinylake (S120-C01D) Modry age Reladed (J12/2020, 10.39.19 AM Processor 2x 2 2012 Intel Xioon-Sinylake (S120-C01D) Modry age Reladed (J12/2020, 10.39.19 AM Processor SuperHicro AC-UR-4XTF MER Serial # G3.90/AS38A0.194 Network Card SuperHicro AC-UR-4XTF Notes N/A & Notes SuperHicro BPN-5AS3-815-19. Reladed Information Backplance SuperHicro BPN-5AS3-81570-94 Serial # G3.00/AS38A0.194 Motherboard SuperHicro BPN-5AS3-81570-94 Billing Monthy Status SuperHicro BPN-5AS3-81570-94 Billing Series Settion SuperHicro BPN-5AS3-81570-94</td><td><u>ge</u></td><td>Name</td><td>vyatta-labservices-lon.ibm.cloud</td><td>2</td><td>os</td><td>ATT Virtual Router Appliance (vRou</td><td>er 5600) 1801q</td></th<>	inport inport Section University Interior Section University Interior Section University Interior interior Gateway appliance valida Subscription Remote Vigine Cadid Aspeed A572500 interior Status ACTIVE RAM 2x 16GB Hyrix 16GB DDR4 2rk dB Modry raccess ID 1374067 Processor 2x 2 20112 Intel Xioon-Sinylake (S120-C01D) Modry age Reladed (J12/2020, 10.39.19 AM Processor 2x 2 2012 Intel Xioon-Sinylake (S120-C01D) Modry age Reladed (J12/2020, 10.39.19 AM Processor SuperHicro AC-UR-4XTF MER Serial # G3.90/AS38A0.194 Network Card SuperHicro AC-UR-4XTF Notes N/A & Notes SuperHicro BPN-5AS3-815-19. Reladed Information Backplance SuperHicro BPN-5AS3-81570-94 Serial # G3.00/AS38A0.194 Motherboard SuperHicro BPN-5AS3-81570-94 Billing Monthy Status SuperHicro BPN-5AS3-81570-94 Billing Series Settion SuperHicro BPN-5AS3-81570-94	<u>ge</u>	Name	vyatta-labservices-lon.ibm.cloud	2	os	ATT Virtual Router Appliance (vRou	er 5600) 1801q
Intromy Status ACTIVE RAM 2.1.16B Hynk: 166B DDR4 2R-8 Modify raccess ID 1374067 Processor 2.2.2.2.0.1.1114 (S200–S0)42.Red Modify age Status 6/17/2020, 10.39.19 AM Processor 2.2.3.2.0.0.1.1144 (S200–S0)42.Red Modify age Releaded N/A Mover Sapply 2.5.0.00.1144.RT MRFR Serial # CS19UAG368.0194 Motherboard SuperMicro.0.144.RT News N.A. & Motherboard SuperMicro.0.0.144.RT Reso N.A. & Orlve Controller Mainbaard Onbaard Modify Statal London 6 Baloplane SuperMicro.0.0.144.RT Billing SuperMicro.0.0.144.RT SuperMicro.0.0.144.RT Billing SuperMicro.0.0.144.RT SuperMicro.0.0.144.RT Tasascitions SuperMicro.0.0.144.RT SuperMicro.0.0.144.RT	Introng Status ACTIVE RAM 2.16GB Hynix 16GB DDM 2/RxB Modify raccess ID 1374067 Processor 2.2.2.0Hz Hint Xicon-Skylake (S120-GDLD) Modify age Statute 6/17/2020.01.03.91.9 AM Processor 2.x.2.0Hz Hint Xicon-Skylake (S120-GDLD) Modify age Releaded N/A Network Sard SuperMicro PWS-751b-18 MrR Serial # G3.9U.03.0B.01.94 Motherboard SuperMicro DUF-R1.10 View details Notes N/A & Motherboard SuperMicro X11DPU-R1.10 View details Serial # London 6 Sakplane SuperMicro X11DPU-R3.10 View details Billing Northly Eastellane SuperMicro X11DPU-R3.3-815TO-N4 Transactions Series Statup Series Statup Series Statup	iote management	Туре	Gateway member		Security Device	SuperMicro AOM-TPM-9671H	
ID 1374067 Processor 2.x 2.2dHz Intel Xeon-Skytake (5120-00.1D) Modify Researce Started 0/72020.10.39.19.9M Power Supply 2.x SuperMicro PMS-7519-R1 Words Markade 0/12020.10.39.19.9M Power Supply 2.x SuperMicro PMS-7519-R1 Words Markade 0/14020 SuperMicro PMS-7519-R1 Model Markade C101/AG38A0194 Moters Cantol SuperMicro PMS-7519-R1 View details Notes C101/AG38A0194 Moters Cantoller Markade // Model SuperMicro PMS-7519-R1 View details Location Location Location SuperMicro PMS-853-81510-H4 SuperMicro PMS-853-81510-H4 Billing SuperMicro PMS-854-81510-H4 Backplane Line Location Line Location Tanactions SuperMicro PMS-854-81510-H4 Line Location Line Location Line Location	ID 1374067 Processor 2x 22GH2 Intel Xeon-Skylake (5120-GOLD) Modify Sep Started 6/17/2020, 10:919 AM Power Supply 2x SuperNicro PWS-751-1R words Reado N/A Network Kard SuperNicro PWS-751-1R MRR Serial # CB19UAG38A0194 Network Kard SuperNicro PWS-751-1R NA CB19UAG38A0194 Motherboard SuperNicro PWS-751-1R Nake N/A Motherboard SuperNicro PWS-751-1R Serial # Color 6 SuperNicro PWS-533-815T0-N4 SuperNicro PWS-533-815T0-N4 Biling SuperNicro PWS-533-815T0-N4 SuperNicro PWS-533-815T0-N4 Francetions SuperNicro PWS-533-815T0-N4 SuperNicro PWS-533-815T0-N4	irity	Gateway appliance	vyatta-labservices-lon		Remote Mgmt Card	Aspeed AST2500 - Onboard	
Started Started 6/17/2030, 10.3 9:19 AM Power Supply 2 x SuperMicro PWS-751P.1R More Reloaded N/A Network Card SuperMicro PWS-751P.1R words MFR CE1914/G368/0194 Network Card SuperMicro PWS-751P.1R Notes CE1914/G368/0194 Metwork Card SuperMicro PWS-751P.1R Network Card Location CE1914/G368/0194 Methode SuperMicro PWS-751P.1R Network Card Location Location Molthode Drive Centrolter Mainbard Onboard Modry Selat SL015/G-N4 Backplane SuperMicro PWS-SAS-815170-N4 Billing Monthly Tamaactions SuperMicro PWS-SAS-815170-N4	Started 6/17/2020, 10:39:19 AM Power Supply 2x SuperMicro PVSr/51P-1R Sper Relaaded NA Network Card SuperMicro AOC-UR-IAXTF Words MRF Serial # C819/UAG38A0194 Network Card SuperMicro AOC-UR-IAXTF Idea NA Notherboard SuperMicro ADI-UR-IAXTF Idea C819/UAG38A0194 Drive Carnoliter Maihbard Observer Idea Carlot Drive Carnoliter Maihbard Observer Idea Location Backplane SuperMicro BPA-SA3-815TQ-N4 Serial # SUDF6AN Backplane SuperMicro BPA-SA3-815TQ-N4 Billing Monthly Extreme SuperMicro BPA-SA3-815TQ-N4 SuperMicro BPA-SA3-815TQ-N4	toring	Status	ACTIVE		RAM	2x 16GB Hynix 16GB DDR4 2Rx8	lodify
Beloaded NA Network Card SuperMicro AOC-UR-I4XTF words MRB Serial # CE19UAG368A0194 Motherboard SuperMicro AOC-UR-I4XTF Nates N/A & Drive Centroller Mainbaard Onboard Modify Location Location Backplane SuperMicro BPN-SAS3-815TQ-N4 Billing Monthly State SuperMicro BPN-SAS3-815TQ-N4 Transactions Series Setup Setup Setup	ge Network Card SuperMicro ADC-UR-idXTF words MRR Serial # C810/UA368A0194 Motherboard SuperMicro ADC-UR-idXTF Notes N/A & Motherboard SuperMicro ADC-UR-idXTF Location Call Drive Controller Mainboard Onboard Modify Location Location Backplane SuperMicro BPN-SA3-815TQ-N4 Billing Monthly Tranactions Seried Setup	access	ID	1374067		Processor	2x 2.2GHz Intel Xeon-Skylake (512	0-GOLD) Modify
Relaaded N/A Network Card SuperMicro A0C-UR-iAXTF WarR Serial # CB19UAG368A0194 Motherboard SuperMicro A0D-UR-iAXTF Note DB10G368A0194 Motherboard SuperMicro A0D-UR-iAXTF Location NA & Motherboard SuperMicro A0D-UR-iAXTF Serial # London 6 Backplane SuperMicro BPN-SAS3-815TQ-N4 Billing Monthly Eactions SuperMicro BPN-SAS3-815TQ-N4 Transactions Serieus Settiop Settiop Settiop	Relaaded N/A Network Card SuperMicro ADC-UR-IAXTF MerR Serial # CS19UAGS801914 Motherboard SuperMicro ADC-UR-IAXTF Note CS19UAGS801914 Motherboard SuperMicro X11DFU+_FE110 View details Location N/A & Drive cannotizer Mainboard Obset/HodfV Serial # SL01F6AN Backplane SuperMicro BPN-SAS3-81STQ-N4 Billing Monthly Entrice Setup Fraid	ado	Started	6/17/2020, 10:39:19 AM		Power Supply	2x SuperMicro PWS-751P-1R	
MRR Serial # CE10/UAG38A0194 Motherboard SuperVince X11DPU+_R1.0 View details Notes N/A & Drive Controller Mainboard Onboard Modify Location London 6 Backplane SuperVince BPH-SAS3-81STQ-N4 Serial # S101F64N Balling Monthy Transactions Serior Situp Serior Situp	MRR Serial # C121UA0368A0194 Motherboard SuperMicro X11DPU-,R1.0 View details Notes N/A & Drive Controller Mainboard Onboard Modify Location London 6 Backplane SuperMicro BPN-SAS3-815TQ-N4 Serial # SL01F6N Balling Monthly Transactions Seriode Serial Series Serial Series Series		Reloaded	N/A		Network Card	SuperMicro AOC-UR+i4XTF	
Location London 6 Backplane SuperMicro BPN-SAS3-815TQ-N4 Serial # SUDE64N Billing Monthly Transactions Serial Setup	Location London 6 Backplane SuperMicro BPN-SAS3-81STQ-N4 Serial # SUD2F64N Billing Monthly Transactions Service Setup Filler Setup	words	MFR Serial #	C819UAG36BA0194		Motherboard	SuperMicro X11DPU+_R1.10 View	details
Serial # SL01F64N Billing Monthly Transactions Service Setup	Serial # SL01F64N Billing Monthly Transactions Service Stripp		Notes	N/A 🖉		Drive Controller	Mainboard Onboard Modify	
Billing Monthly Transactions Service Setup	Billing Monthly Transactions Service Setup		Location	London 6		Backplane	SuperMicro BPN-SAS3-815TQ-N4	
Transactions Service Setup	Transactions Service Setup		Serial #	SL01F64N				
			Billing	Monthly				
	Network details Orde		Transactions	Service Setup				
Network details Order			Network details					Order IPs
Status Redundancy Interface To Address VLAN Actions			 Active (1000Mbps) 	 Active 	private (eth0,eth2)	10.72.74.203/26 0	lon06.bcr01a.1227	1

Under the "Network Details" you will see your Vyatta Gateway IP address:

Your credentials are under the "password" menu on the left-hand side. Click on the icon next to the password to see it unencrypted.

Rest of Rest out of the rest of the rest of Rest out of Rest	IBM Cloud	Search resources and offerings	م	Catalog Docs Si	upport Manage ~ 20	085896 - IBM	5 C 4
Bits on heips task users and their passwords. Action of the set on their devices. Action of the set on the s			vered on 🛛 e Connected				Actions *
Sensor Disman Passwort Lat Modified Notes Actions accurity Nitual Router Appliance (Router S600) vyata lp3050 50 0/17/020 Click to elds 1 homitoring router Appliance (Router S600) not not 0/17/020 Click to elds 1 kera cess vitual Router Appliance (Router S600) not not 0/17/020 Click to elds 1	ases	This tool helps track users and their passwords.					Add credentials
Konstroling Instrument of particular Appliance (rRouter 5600) root Instrument of particular Appliance (Software	Username	Password	Last Modified	Notes	Actions
Virtual Router Appliance (rRouter 5600) root • • • • • • • • • • • • • • • •	ecurity	Virtual Router Appliance (vRouter 5600)	vyatta	lzsKnsD5 Ø	6/17/2020	Click to edit	1
longe		Virtual Router Appliance (vRouter 5600)	root		6/17/2020	Click to edit	I.
asswords							
	asswords						
				(1) (1) (1) (1) (1) (1) (1) (1) (1) (1)			
				Screenshot			
Screenhot							

Open a browser and login to the Vyatta Gateway using:

userID: Vyatta Password: as show in the GUI <u>https://10.72.74.203</u> ssh vyatta@10.72.74.203 Note: Prior to login to a 10.x.x.x private IPs in IBM Cloud you will need to start your MotionPro Plus VPN access. This will give you access to IBM Cloud private IPs.

\mathbb{Q}	νύλττλ.		
	You have been	logged out due to inactivity. Please login again:	
	Username	vyattaj	
	Password		
		LOGIN	
Contact Us	02017 AT&T intellectual Property. All Rights Reserved.		

Login with the userID and password.

/			Hostname:	vyatta-labservices-ic	in Logged in a	:: vyatta Help	logout
🔘 νυλττλ. 🧹							
			Dashboard	Statistics	Configuration	Operat	tion
Running: 1801q.09052048 on Intel 64bit				Uptime: 16d 22h 3i	im System Ti	me: 04 Jul 2020 0	1:11 CDT
Resource Usage	Interfaces *						
	Name	Description	IP Address		Status	In	Out
CPU *: 0% >> Memory *: 0% of 30.38 GB	dp0bond0 *	0.00 (100	10.72.74.203/26		1G FD	8.45 kbps	27.16 kbps
Disk: 1% of 1.66 TB	dp0bond1 *				•	0 kbps	0 kbps
System Information *	dp0s0 *				1G FD	1.88 kbps	15.99 kbps
Domain name *: Ibm.cloud DNS servers *: 10.0.80.11 via system >>>	dp0s1 *				•	0 kbps	0 kbps
Boot via : image Images : 1	dp0s2 *				•		
	dp0s3 *				•	0 kbps	0 kbps
Routing *			Security *				\$
Name Status			Name	Status			
MSDP * Peers: 0, Groups: 0, Mesh group		39	Fireval	 State-Policy: no 	ne, Rule-sets: 0/1	in use	39
Static Route * Routes configured: 6, Routes in a	use: 6	39	Management *				
Services *		*		Status			
Name Status				Last commit: 30 Jun	2020 06:51 by ye	ita	20
				CLI users: 0/2 conne	cted, Root Login:	enabled	30
			SSH *	Connected sessions:	0, Listen-addresse	s: all:	30
High Availability *		*	Syslog *	Slobal facility/level:	all/notice, protoco	s/debug	30
Name Status							
VRRP Groups conf'd: 0, Master: 0, Bac	kup: 0, Fault: 0	39	Traffic Policy *				8
				Status			
			Qo5 ¥	L configured			39
Contact Us 62017 A7&T Intellectual Property. All Rights Re				Screenshot			

Now that you have verified you access to the Vyatta Gateways, you will need to now access it via ssh to continue your GRE tunnel provisioning.

2.1.14 Setup PowerVS location GRE tunnels in the Vyatta Gateways

The following references may help in configuring GRE tunnels:

https://cloud.ibm.com/docs/virtual-router-appliance?topic=solutiontutorials-configuring-IPSEC-VPN

https://docs.huihoo.com/vyatta/6.5/Vyatta-Tunnels 6.5R1 v01.pdf

Open a command window on your Mac/Window.

Note: Prior to login to a 10.x.x.x private IPs in IBM Cloud you will need to start your MotionPro Plus VPN access.

Setup GRE PowerVS location Tunnel in LON06:

userID: Vyatta Password: as show in the GUI ssh <u>vyatta@10.72.74.203</u> ssh to LON06 Vyatta Gateway.

The default interactive shell is now zsh. To update your account to use zsh, please run `chsh -s /bin/zsh`. For more details, please visit https://support.apple.com/kb/HT208050. Faads-MacBook-Pro:~ faadghoraishi\$ Faads-MacBook-Pro:~ faadghoraishi\$ ssh vyatta@10.72.74.203 Welcome to AT&T vRouter 5600 Welcome to AT&T vRouter Version: 1801q Description: AT&T vRouter 5600 1801q Linux vyatta-labservices-lon 4.9.0-trunk-vyatta-amd64 #1 SMP Debian 4.9.124-0vyatta2+2.1 (2018-09-05) x86_64 Last login: Tue Jun 30 00:58:24 2020 from 10.1.232.20 vyatta@vyatta-labservices-lon:-\$ We are using the information provided by support for LON06 GRE.

In Lon06 to POWERVS LOCATION GRE: Your destination should be 10.254.0.26 Your tunnel ip 172.20.2.1 Power-PowerVS location-Side: Lon06: interface Tunnel4 description IBM3-GRE vrf forwarding IBM3 ip address 172.20.2.2 255.255.255.252 (172.20.2.2/30) keepalive 5 3 tunnel source 10.254.0.26 tunnel destination 10.72.74.203 tunnel vrf IBM3

Run the following commands:

We have chosen to call our tunnel "tun0" on the Vyatta Gateway.

\succ	coni	figure			
\succ	set	interfaces	tunnel	tun0	address 172.20.2.1/30
\succ	set	interfaces	tunnel	tun0	local-ip 10.72.74.203
\succ	set	interfaces	tunnel	tun0	remote-ip 10.254.0.26
\succ	set	interfaces	tunnel	tun0	encapsulation gre
\succ	set	interfaces	tunnel	tun0	mtu 1300
\succ	com	nit			
\triangleright	exi	t			

```
vyatta@vyatta-labservices-lon:~$ configure
[edit]
vyatta@vyatta-labservices-lon# set interfaces tunnel tun0 address 172.20.2.1/30
[edit]
vyatta@vyatta-labservices-lon# set interfaces tunnel tun0 encapsulation gre
[edit]
vyatta@vyatta-labservices-lon# set interfaces tunnel tun0 mtu 1300
[edit]
vyatta@vyatta-labservices-lon# set interfaces tunnel tun0 local-ip 10.72.74.203
[edit]
vyatta@vyatta-labservices-lon# set interfaces tunnel tun0 remote-ip 10.254.0.26
[edit]
vyatta@vyatta-labservices-lon# commit
[edit]
vyatta@vyatta-labservices-lon# show interfaces tunnel
tunnel tun0 {
       address 172.20.2.1/30
       encapsulation gre
       local-ip 10.72.74.203
       mtu 1300
       remote-ip 10.254.0.26
}
[edit]
vyatta@vyatta-labservices-lon# show interfaces tunnel tun0
tunnel tun0 {
       address 172.20.2.1/30
       encapsulation gre
       local-ip 10.72.74.203
       mtu 1300
                 10.254.0.26
         emote-ip
```

You can verify that your GRE tunnel is setup by running the following commands:

- ➢ configure
- ▹ show interfaces tunnel
- > Or to get more info:
- > Show interface tunnel tun0
- ▶ exit

2.1.15 Setup GRE PowerVS location Tunnel in TOR01:

userID: Vyatta Password: as show in the GUI ssh vyatta@10.114.118.34 ssh to Tor01 Vyatta Gateway.

aads-MacBook-Pro:~ faadghoraishi\$ ssh vyatta@10.114.118.34 Welcome to AT&T vRouter 5600

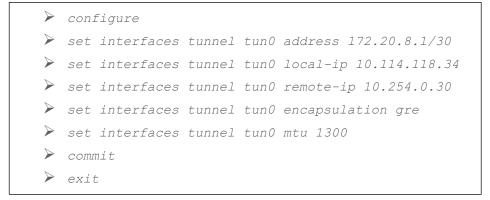
Welcome to AT&T vRouter Version: 1801q Description: AT&T vRouter 5600 1801q Linux vyatta-labservices-1 4.9.0-trunk-vyatta-amd64 #1 SMP Debian 4.9.124-0vyatta2+2.1 (2018-09-05) x86_64 Last login: Tue Jun 30 07:58:37 2020 from 10.1.232.20

vyatta@vyatta-labservices-1:~\$

In Tor01 to POWERVS LOCATION GRE: Your destination should be 10.254.0.30 Your tunnel ip 172.20.8.1 Power-PowerVS location-Side: Tor01: interface Tunnel5 description IBM5-GRE vrf forwarding IBM5 ip address 172.20.8.2 255.255.255.252 keepalive 5 3 tunnel source 10.254.0.30 tunnel destination 10.114.118.34 tunnel vrf IBM5

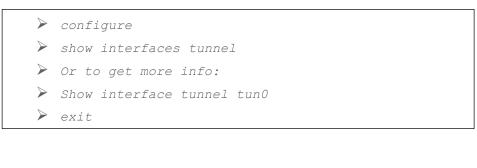
Run the following commands:

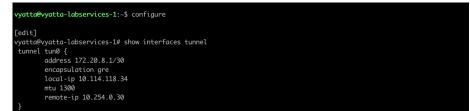
We have chosen to call our tunnel "tun0" in the Vyatta Gateway same as the other Vyatta Gateway.



vyatta@vyatta-labservices-1# configure vbash: configure: command not found [edit] vyatta@vyatta-labservices-1# set interfaces tunnel tun0 address 172.20.8.1/30 [edit] vyatta@vyatta-labservices-1# set interfaces tunnel tun0 encapsulation gre [edit] vyatta@vyatta-labservices-1# set interfaces tunnel tun0 mtu 1300 [edit] vyatta@vyatta-labservices-1# set interfaces tunnel tun0 local-ip 10.114.118.34 [edit] vyatta@vyatta-labservices-1# set interfaces tunnel tun0 remote-ip 10.254.0.30 [edit] vyatta@vyatta-labservices-1# commit [edit]

To show the status:





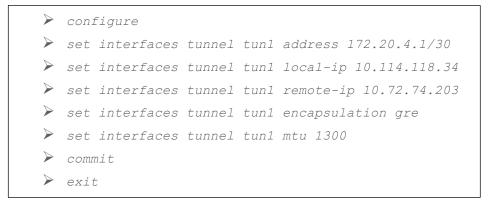
2.1.16 Setup GRE tunnel between Two Vyatta Gateways

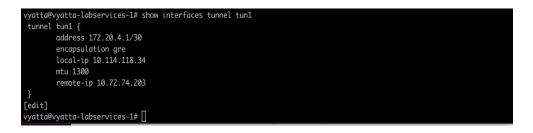
In this section you will setup a new tunnel in each of the two Vyatta gateways to allow for cross Vyatta connection via a GRE tunnel.

In this case we choose the tunnel address and tunnel source and destination IPs. The tunnel address can be any IP subnet you choose. We named our tunnel "tun1" in both Vyatta Gateways. We have selected a similar IP as the ones used in the PowerVS location GRE tunnels. We choose a CIDR of /30 since we only need two IP address, one in Tor01 and one in Lon06.

- In Lon06 Vyatta the GRE Vyatta-to-Vyatta tunnel address is 172.20.4.1/30
- In Tor01 Vyatta the GRE Vyatta-to-Vyatta tunnel address is 172.20.4.2/30
- Your tunnel destination IP is the IP address of the Vyatta gateway in each location
- Your tunnel source IP is the IP address of the Vyatta gateway in each location
- We call the tunnels tun1 in both locations

TOR01 GRE Configuration:





LON06 GRE Configuration:

```
configure
set interfaces tunnel tun1 address 172.20.4.2/30
set interfaces tunnel tun1 remote-ip 10.114.118.34
set interfaces tunnel tun1 local-ip 10.72.74.203
set interfaces tunnel tun1 encapsulation gre
set interfaces tunnel tun1 mtu 1300
commit
exit
```



The final steps needed is to setup static routes in each Vyatta to point the subnets for our PowerVS location to the right tunnels.

2.1.17 Setup GRE tunnel between Two Vyatta Gateways

Find the subnets you created in each PowerVS location in TOR01 and LON06 by accessing the services in the IBM Cloud UI for each PowerVS location.

(←) → ℃ ŵ	A 23 https://cloud.ibm.com/se	rvices/power-iaas/crn%	3Av1%3Abluemix%	i3Apublic%3Apower-iaas%3Ator01%3Aa	%2F06d2i	1ecba24	44622	aOfb88	efb484	F (⊡ ☆		<u>↓</u> II\ □	: ≣
Yahoo 🛅 IBMTeam <table-cell-rows> faad - Dropbo</table-cell-rows>	deerreplant 🗎 AnsibleTower 🛅 🗷	Minsurance 🚻 My accou	t - Hyper 🛅 IBMC	llouid 💍 VPC CLI reference 🛅 DL 💍 Vya	ttaVPN-VPC	Ø vyatt	ta-Londo	on Ø	vyatta-Tor	onto				
	Search resources and offerings			Catalog							вм			් ද
Resource list / Power Systems V	/irtual Server-Toron	ot01 • Active	Add tags 🖉								De	tails		×
Virtual server instances SSH keys	Subnets Learn more about <u>configuring</u>	and adding a private ne	twork subnet.								Loc CIE IP			8.6.254
Storage volumes					Q		0	reate s	ubnet	· +	VLA	S Servers 127. AN ID 234	0.0.1	
Boot images Subnets	Subnets	Туре	Location	IP ranges	VLAN ID							e Private		
	public-192_168_142_72-29- VLAN_2005	Public	tor01	192.168.142.74-192.168.142.78	2005						0	ė.		
	lab-services-subnet2	Private	tor01	192.168.6.102-192.168.6.254	234			L		Û				
	Items per page: 10 ~	1-2 of 2 items				1	~ 0	of 1		1				
(←) → ⊂ @				%3Apublic%3Apower-iaas%3Alon06%3Aa%						… ⊠ ☆		± ₩/ 0	⊡ ⊛ ≡	
Yahoo 🛅 IBMTeam 😲 faac	Search resources and offering		ount - Hyper 🛅 IBM	Clouid 🗢 VPC CLI reference 🛅 DL 🍮 Vyattali Catalog D			ndon < Manaş			96 - IBM		• 6	<u>م</u> 8	
Resource list /														
Power Syste	ms Virtual Server- LO	NDON06	Add tags a	2							Details		×	
Virtual server instances	Subnets Learn more about configu	ring and adding a private	network subnet.								Location CIDR 192	168.50.0/24		
SSH keys Storage volumes					Q	0	Create	subnet	+		ranges DNS Server	2.168.50.3-192.1 s 127.0.0.1	68.50.254	
Boot images	Subnets	Туре	Location	IP ranges	VLAN						VLAN ID 2 Type Priva			
Subnets					ID					- I -	Actions			
	public-192_168_138_13 VLAN_2013	Public	lon06	192.168.138.138-192.168.138.142	2013		e		÷	L	C 🗄			
	london-colo-subnet1	Private	lon06	192.168.50.3-192.168.50.254	234	4.11		4	ġ.					
	Items per page: 10 V	1-2 of 2 items				1 V	071	4	P					

The static routes in LON06 will need to point to the subnets in TOR01 and vis versa.

We will configure both GREs to the PowerVS location and between Vyattas.

Run the following commands in each Vyatta Gateway after login in via ssh using the Vyatta userID:

in TOR01 Vyatta:

- ➤ configure
- > set protocols static route 192.168.6.0/24 next-hop 172.20.8.2
- > set protocols static route 192.168.50.0/24 next-hop 172.20.4.2
- ➤ commit
- ≻ exit

in LON06 Vyatta:

- ➤ configure
- > set protocols static route 192.168.50.0/24 next-hop 172.20.2.2
- *set protocols static route 192.168.6.0/24 next-hop 172.20.4.1*
- ➤ commit
- ≻ exit

At this point you should have end-to-end connectivity and be able to ping between your Power VSIs in each PowerVS location and also from the Power VSI to IBM Cloud services such as Linux/Windows VSI.

If you cannot ping the IBM Cloud VSIs from the PowerVS location VSIs, you will need to open a ticket to address this issue. Support needs to address this from their Cisco Router side.

2.2 Geographic Logical Volume Manager (GLVM) Replication

AIX Geographic Logical Volume Manager (GLVM) is a software-based technology for real time geographic data mirroring over standard TCP/IP networks. AIX GLVM can help protect your business from a disaster by mirroring your mission-critical data to a remote disaster recovery site.

Using AIX GLVM, we will mirror the data of an IBM Power Virtual Server image from one data center to another. We will then simulate a DR event and recover that data at the remote data center.

2.2.1 Basic Concepts

We will use a simple configuration to describe the basic concepts of GLVM. We will use an example configuration for this tutorial. Consider an IBM AIX image that is running a business application. All of the data resides on two disks, DISK1 and DISK2. Each disk contains exactly half of the data. In other words, there is only one copy of the data which spans both disks. This configuration is shown in the following diagram:

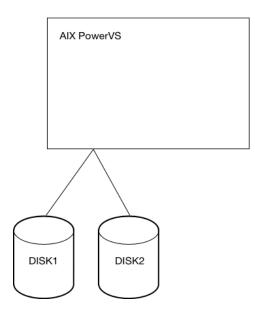


Figure 2.2.1.1 Typical AIX configuration

With only one copy of the data, a single storage failure would cause this environment to fail. To make this environment more redundant, we need to make a copy of the data.

AIX GLVM helps you to solve this problem by allowing a complete mirror to exist in a geographically distant location, the DR site. For this we will need two servers, one at the production site and another at the disaster recovery site and each site needs a complete mirror copy of the data. Both servers are connected by a TCP/IP network. This can be any type of TCP/IP network. The production and disaster recovery sites do not have to be on the same physical network. Routers and gateways between the two sites are allowed. For our example, the primary site will be in Toronto, CA and the DR site will be in London, UK. This is shown in the following diagram:

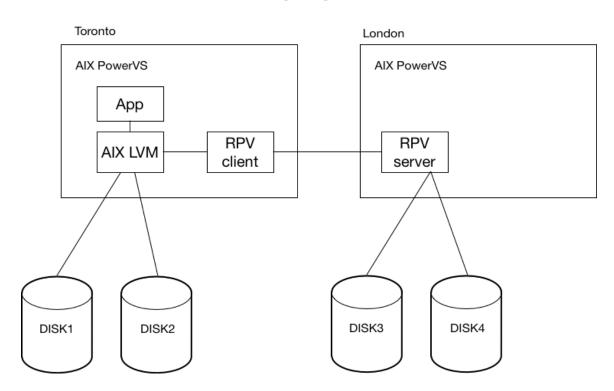


Figure 2.2.1.2 RPV server with disks

In this configuration, we can take the same volume group, containing the business application described earlier and stretch it across both sites. This is now a geographically mirrored volume group. In the above diagram, the volume group will be varied on at the primary site and no replication is occurring. The Remote Physical Volume (RPV) device driver will allow AIX LVM at the production site to access the disks at the disaster recovery site as if they were locally attached. This will be accomplished by defining disks DISK3 and DISK4 to the production site as remote physical volumes.

There are two components to the RPV device driver, the RPV client and the RPV server. The RPV client will reside on the production site. The RPV server will reside on the DR site. The RPV server will process read/write requests from a the remote RPV client. Both RPV cdevice driver components work together to enable AIX LVM at the production site to access the DR disk(s).

Here is how it will work:

• The RPV server will present a disk from the DR site to the RPV client on the production site

• The production site will see a virtual disk that acts like a real disk and any writes to that disk go from the production site to the DR site.

• The production site will see a virtual disk that acts like a real disk and any writes to that disk go from the production site to the DR site

• Because the production site now sees extra disks, we can use regular IBM LVM processes to copy data from the local production disks to the remote DR disks

At this point, if a disaster were to destroy the primary site, the DR site would contain a copy of that data.

See the following diagram.

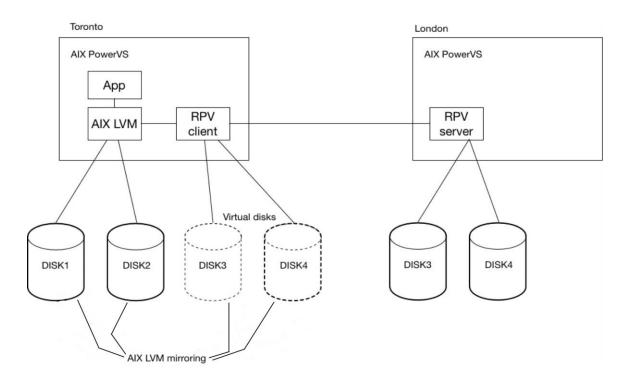


Figure 2.2.1.3 RPV server/client with virtual disks

In our example environment, we will create virtual disks in both directions. It was only drawn in one direction above for clarity.

2.2.2 Example environment

For our discussion, we will use the following configuration:

- Single AIX PowerVS in Toronto location
- Single AIX PowerVS in London location
- Storage (tier 3, 6-20GB LUNs) allocated to each AIX PowerVS
- Communication between IBM Cloud locations
- Setting LV strictness

2.2.3 Preparing for IBM AIX GLVM setup

For our discussion, we will use the following configuration:

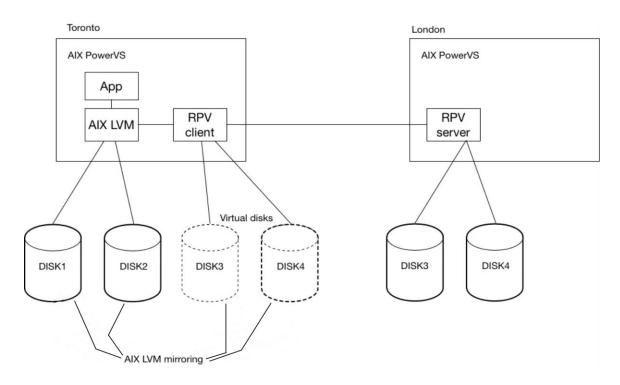


Figure 2.2.3.1 RPV server/client with virtual disks

In our example scenario, we have implemented an application with a couple of volume groups, dbvg and appvg. Those volume groups have 2 disk drives each.

We will prepare this environment for IBM GLVM replication by performing the following steps:

- Change or verify the volume groups are a scalable volume group
- Updating the volume groups so as to not vary on automatically at reboot time
- Updating the volume groups by turning off bad block relocation
- Updating volume groups by setting super strict mirror pools
- Defining mirror pools

2.2.4 Change or verify the volume groups are a scalable volume group

For our example, we did create the volume groups as scalable volume groups. This can be verified using the *lspv* and *readvgda* commands:

# lspv gre	p dbvg		
hdisk1	00c8d4403180f273	dbvg	active
hdisk2	00c8d4403180f319	dbvg	active
# readvgda h	disk2 grep type	<u> </u>	
	dvgda_type: svg		
type:	jfs2log		
type:	jfs2		
type:	jfs2		
type:	jfs2		
	jfs2		
type: #	· · · ·		

Figure 2.2.4.1 Using "readvgda" to find VG type

For our example, we did create the volume groups as scalable volume. If the volume groups were not scalable, they could be changed to scalable volume groups via the following command: chvg -G <VGNAME> where <VGNAME> is the name of the volume group. Note that the volume group needs to be varied off when this chvg command is executed.

2.2.5 Updating the volume groups so as to not vary on automatically at reboot time

We can update the volume group, so it does not automatically varyon at boot time using the following command: *chvg -a n <VGNAME>* where <VGNAME> is the name of the volume group. See the output of our command execution:

# chvg -an dbvg # chvg -a n appvg			
# lsvg dbvg			
VOLUMĒ GROŪP: 001733180f36e	dbvg	VG IDENTIFIER:	00c8d44000004b00000
VG STATE:	active	PP SIZE:	16 megabyte(s)
VG PERMISSION:	read/write	TOTAL PPs:	2550 (40800 megabyt
es)			
MAX LVs:	256	FREE PPs:	2037 (32592 megabyt
es)	-		E12 / 9209 magabutas
LVs:	5	USED PPs:	513 (8208 megabytes
, OPEN LVs:	5	QUORUM:	2 (Enabled)
TOTAL PVs:	2	VG DESCRIPTORS:	
STALE PVs:	Θ	STALE PPs:	0
ACTIVE PVs:	2	AUTO ON:	no
MAX PPs per VG:	32768	MAX PVs:	1024
LTG size (Dynamic):	512 kilobyte(s)	AUTO SYNC:	no
HOT SPARE:	no	BB POLICY:	relocatable
MIRROR POOL STRICT:	off		
PV RESTRICTION:	none	INFINITE RETRY:	no
DISK BLOCK SIZE:	512	CRITICAL VG:	no
FS SYNC OPTION:	no	CRITICAL PVs:	no
#			

Figure 2.2.5.1 Status of VG auto vary on field

Note the "AUTO ON: no" field on the lower right indicating this volume group will not automatically vary on at boot time.

2.2.6 Updating the volume groups by turning off bad block relocation

We can update the volume group so that black block relocation is disabled. By default, if a bad block is detected, that block is relocated to a different location on the disk. This would create dissimilar block maps between replicated LUNs, so it needs to be disabled.

Bad block relocation can be disabled via the following command: *chvg* -*b n* <*VGNAME*> where <*V*GNAME> is the name of the volume group. See the output of our command execution:

# chvg -b n dbvg # lsvg dbvg			
VOLUME GROUP: 001733180f36e	dbvg	VG IDENTIFIER:	00c8d44000004b00000
VG STATE: VG PERMISSION:	active read/write	PP SIZE: TOTAL PPs:	16 megabyte(s) 2550 (40800 megabyt
es) MAX LVs:	256	FREE PPs:	2037 (32592 megabyt
es) LVs:	5	USED PPs:	513 (8208 megabytes
) OPEN LVs: TOTAL PVs:	5 2	QUORUM: VG DESCRIPTORS:	2 (Enabled)
STALE PVs: ACTIVE PVs:	0	STALE PPs: AUTO ON:	0 no
MAX PPs per VG: LTG size (Dynamic):	32768	MAX PVs: AUTO SYNC:	1024 no
HOT SPARE: MIRROR POOL STRICT:	no	BB POLICY:	non-relocatable
PV RESTRICTION: DISK BLOCK SIZE:	none 512	INFINITE RETRY: CRITICAL VG:	no no
FS SYNC OPTION: #	no	CRITICAL PVs:	no

Figure 2.2.6.1 Status of VG relocatable field

Note the "BB POLICY: non-relocatable" field on the lower right indicating bad block relocation is disabled.

2.2.7 Updating volume groups by setting super strict mirror pools

As mentioned previously, it is critical that we can guarantee one copy of the data is local and a secondary copy of the data is remote. We can do this by setting super strict mirror pools.

Super strict mirror pools can be set via the following command: chvg - M s < VGNAME > where < VGNAME > is the name of the volume group. See the output of our command execution:

# chvg -M s dbvg			
# lsvg dbvg			
VOLUMĚ GROŬP:	dbvg	VG IDENTIFIER:	00c8d44000004b00000
001733180f36e	5		
VG STATE:	active	PP SIZE:	16 megabyte(s)
VG PERMISSION:	read/write	TOTAL PPs:	2550 (40800 megabyt
es)			
MAX LVs:	256	FREE PPs:	2037 (32592 megabyt
es)	_		
LVs:	5	USED PPs:	513 (8208 megabytes
)	-	0110D104	o (5 13 1)
OPEN LVs:	5	QUORUM:	2 (Enabled)
TOTAL PVs:	2	VG DESCRIPTORS:	-
STALE PVs:	0	STALE PPs:	Θ
ACTIVE PVs:	2	AUTO ON:	no
	32768	MAX PVs:	1024
LTG size (Dynamic):	-	AUTO SYNC:	no
HOT SPARE:	no	BB POLICY:	non-relocatable
MIRROR POOL STRICT:	•		
PV RESTRICTION:	none	INFINITE RETRY:	
DISK BLOCK SIZE:	512	CRITICAL VG:	no
FS SYNC OPTION:	no	CRITICAL PVs:	no
#			

Figure 2.2.7.1 Status of VG mirror pool strictness

Note the "MIRROR POOL STRICT: super" field on the lower left indicating super strict mirror pools is enabled.

2.2.8 Defining mirror pools

Once we define the volume group with super strict mirror pools, we need to define the mirror pools. Mirror pool names can follow any type of convention, so it is up to the customer to determine that naming convention. For our purposes, we will the location as part of the naming convention.

Mirror pools can be set by adding physical volumes to the mirror pool. In our case, we will use the following:

- Using "Ispv" to determine the disks for a VG: Ispv | grep dbvg

	grep dbvg		
hdisk1 ``	00c8d4403180f273	dbvg	active
hdisk2	00c8d4403180f319	dbvg	active
#			

Figure 2.2.8.1 Determining disks in a VG

- Using "chpv" to create the mirror pool and add the volumes to it:

chpv -p dbvg_tor01 hdisk1 hdisk2

chpv -p dbvg_tor01 hdisk1 hdisk2
0516-1010 chpv: Warning, the physical volume hdisk1 has open logical
volumes. Continuing with change.
0516-1010 chpv: Warning, the physical volume hdisk2 has open logical
volumes. Continuing with change.
#

Figure 2.2.8.2 Adding disks to a mirror pool

Using "Ismp" and "Ispv" to display the mirror pool information:
 "Ismp -A" dbvg and "Ispv -P"

# lsmp -A dbvg VOLUME GROUP:	dbvg	Mirror Pool Super Strict:	yes
MIRROR POOL: # lspv -P	dbvg_tor01	Mirroring Mode:	SYNC
Physical Volume	Volume Group	Mirror Pool	
hdisk0	None		
hdisk1	dbvg	dbvg tor01	
hdisk2	dbvg	dbvg_tor01	
hdisk3	rootvg	<u> </u>	
hdisk4	None		
hdisk5	appvg		
hdisk6	appvg		
#	11 5		

Figure 2.2.8.3 Displaying mirror pool information

In our example, we continue defining mirror pools for the second vg 'appvg' and end up with the following:

# lspv -P		
Physical Volume	Volume Group	Mirror Pool
hdisk0	None	
hdisk1	dbvg	dbvg tor01
hdisk2	dbvg	dbvg_tor01
hdisk3	rootvg	<u>j_</u>
hdisk4	None	
hdisk5	appvg	appvg_tor01
hdisk6	appvg	appvg_tor01
#		

Figure 2.2.8.4 Displaying mirror pool information

2.2.9 Setting LV strictness

The AIX LVs also have to be set to superstrict. We do this to every LV in the volume group. We use "lsvg -1 < VGNAME > " to display the LVs and then "chlv -s s <LVNAME>" to set the strictness.

pc-tor01-glvm-01a: / > # chlv -s s loglv00 pc-tor01-glvm-01a: / >

Figure 2.2.9.1 Changing LV strictness to superstrict

And

# lslv loglv00 more					
LOGICAL VOLUME:	loglv00	VOLUME GROUP:	dbvg		
LV IDENTIFIER:	00c8d44000004b0000001	733180f36e.1 PER	MISSION: read/writ		
e					
VG STATE:	active/complete	LV STATE:	closed/syncd		
TYPE:	jfs2log	WRITE VERIFY:	off		
MAX LPs:	512	PP SIZE:	16 megabyte(s)		
COPIES:	2	SCHED POLICY:	parallel		
LPs:	1	PPs:	2		
STALE PPs:	Θ	BB POLICY:	relocatable		
INTER-POLICY:	minimum	RELOCATABLE:	yes		
INTRA-POLICY:	middle	UPPER BOUND:	2		
MOUNT POINT:	N/A	LABEL:	_ None		
DEVICE UID:	0	DEVICE GID:	0		
DEVICE PERMISSIONS:	•	DEVICE GID.	0		
MIRROR WRITE CONSIST					
	EPARATE PV ?: yes (supe	rstrict)			
Serialize IO ?:	NO				
INFINITE RETRY:	no	PREFERRED READ:	0		
		FREFERRED READ:	0		
	DS_LVZ				
COPY 1 MIRROR POOL:					
COPY 2 MIRROR POOL:					
COPY 3 MIRROR POOL:	None				

Figure 2.2.9.2 Displaying LV strictness

Note the field "EACH LP COPY ON A SEPARATE PV ?" is "yes (superstrict).

We repeat this process for all LVs in all of the appropriate VGs.

2.2.10 Implementing AIX GLVM RPV servers and RPV clients

Now that the AIX volume groups have been readied for AIX GLVM, we can implement the AIX GLVM RPV servers and clients. As noted before, the RPV server presents a physical disk to the RPV client. The RPV client uses that to present a virtual disk to the AIX operating system. The operating system can use that virtual disk and store data in it. That data is actually being replicated to the remote RPV server instance and written to the physical volume at that remote location.

To mirror data from our Toronto PowerVS to London, we will setup an RPV server at our London PowerVS. That RPV server will present its physical volume to the RPV client instance at our Toronto PowerVS. The Toronto PowerVS, in turn, will present that volume as a virtual volume to the AIX operating system and we can start to use AIX LVM to replicate data between the different drives.

2.2.11 Implementing AIX GLVM RPV servers

Now that the AIX volume groups have been readied for AIX GLVM, we can implement the AIX GLVM RPV servers. The AIX GLVM RPV servers will exist on the DR site, the IBM Cloud London location for our example. We note the IP address of our PowerVS images at the Toronto and London locations:

- Toronto: 192.168.6.163
- London: 192.168.50.184

We log into our London PowerVS instance and make sure the LUNs we will be using have PVIDs on them:

- Checking hdisks we will make available, hdisk1, hdisk2, hdisk5, hdisk6

pc-lon06-glvm-01a:/ >						
# lspv						
hdisk0	none	None				
hdisk1	none	None				
hdisk2	none	None				
hdisk3	00f6db0af58e9775	rootvg	active			
hdisk4	none	None				
hdisk5	none	None				
hdisk6	none	None				
pc-lon06-gl	vm-01a:/ >					
#						

Figure 2.2.11.1 Determining available disks

- Adding PV ID's to hdisk1, hdisk2, hdisk5, hdisk6

hdisk1 char pc-lon06-gl # chdev -a hdisk2 char pc-lon06-gl # chdev -a hdisk5 char pc-lon06-gl	<pre>pv=yes -l hdisk1 ged .vm-01a:/ > pv=yes -l hdisk2 ged .vm-01a:/ > pv=yes -l hdisk5 ged .vm-01a:/ > pv=yes -l hdisk6 ged</pre>		
# lspv hdisk0 hdisk1 hdisk2 hdisk3 hdisk4 hdisk5 hdisk6 pc-lon06-gl	none 00c8cf803fb0193a 00c8cf803fb02116 00f6db0af58e9775 none 00c8cf803fb029cd 00c8cf803fb03444	None None rootvg None None None	active

Figure 2.2.11.2 Adding PVIDs to disks

- We verify that both RPV server and RPV client IP addresses are

on the /etc/hosts file

```
pc-lon06-glvm-01a:/ >
# hostent -S
127.0.0.1 loopback localhost # loopback (lo0) name/address
192.168.6.163 pc-tor01-glvm-01a
192.168.50.184 pc-lon06-glvm-01a
pc-lon06-glvm-01a:/ >
#
```

Figure 2.2.11.3 Verifying /etc/hosts entries

- We define the RPV site name by going into the SMIT menu 'rpvserver'

Move cursor to (Remote Phy desired item and pre	vsical Volume Servers ess Enter.	
Remote Physica List All Remote Add Remote Phy Change / Show Change Multip Remove Remote	•	te Name Configuration Servers 's /olume Server /olume Servers rvers	
F1=Help F9=Shell	F2=Refresh F10=Exit	F3=Cancel Enter=Do	F8=Image

Figure 2.2.11.4 Displaying primary RPV server SMIT panel

 Then select "Remote Physical Volume Server Site Name Configuration" -> "Define / Change / Show Remote Physical Volume Server Site Name" and enter the site name, london06, for our example.

Define /	Change / Show Rem	ote Physical Volum	e Server Site Name	
	lues in entry fiel making all desire			
* Remote Physical	Volume Server Sit	e Name	[Entry Fields] [london 06	
F1=Help Esc+5=Reset F9=Shell	F2=Refresh F6=Command F10=Exit	F3=Cancel F7=Edit Enter=Do	F4=List F8=Image	

Figure 2.2.11.5 Adding an RPV server site name

- Depress the Enter key and wait for SMIT to complete the process (no output will be given).
- IMPORTANT NOTE: The site name must be entered for each site even if only one site will have RPV servers
- Then we add the RPV servers by going to SMIT panel, smit rpvserver, then selecting "Add Remote Physical Volume Servers" where the available LUNs are presented. We will select hdisk1 for this example.

	F	Remote Physical Volume Se	ervers	
Move cur:	sor to desired ite	em and press Enter.		
	Physical Volume S ll Remote Physica	Server Site Name Configu l Volume Servers	ration	
		Physical Volume Identif:	iers	
Pres	ONE OR MORE items	d item and press F7. can be selected. ing all selections. Physical Volume Ide	entifier	
hd: hd:	isk2 000 isk5 000	c8cf803fb0193a c8cf803fb02116 c8cf803fb029cd c8cf803fb03444		
F1=H F7=S F1 Ente	elect	F2=Refresh F8=Image /=Find	F3=Cancel F10=Exit n=Find Next	

Figure 2.2.11.6 Adding PVs to an RPV server

- At this point, we add the client IP address to the "Remote Physical Volume Client Internet Address" field and depress the Enter key.

	Add Remote P	hysical Volume S	ervers	
	values in entry fiel ER making all desire			
* <u>Remote Physic</u> Configure Aut	me Identifiers al Volume Client Int omatically at System ices Immediately?		[Entry Fields] 00c8cf803fb0193a [<mark>192.168.6.163</mark> [no] [yes]	+ + +
F1=Help	F2=Refresh	F3=Cancel	F4=List	
Esc+5=Reset F9=Shell	F6=Command F10=Exit	F7=Edit Enter=Do	F8=Image	

Figure 2.2.11.7 Configuring RPV server

- The confirmation is displayed

COMMAND STATUS					
Command: <mark>OK</mark>	stdout: yes	stderr: no)		
Before command	completion, additiona	l instructions may	appear below.		
pvserver0 Avai	ilable				
F1=Help F8=Image n=Find Next	F2=Refresh F9=Shell	F3=Cancel F10=Exit	F6=Command /=Find		

Figure 2.2.11.8 Output of RPV server configuration

- Then we repeat this process for the rest of the LUNs we will be presenting to our Toronto PowerVS.

2.2.12 Implementing AIX GLVM RPV clients

With the RPV servers setup, we can proceed to the RPV client and configure them to see the remote LUNs. Again, the IP addresses of the dare:

- Toronto: 192.168.6.163
- London: 192.168.50.184

We log into our Toronto PowerVS instance proceed to the RPV client menu, smit rpvclient:

Remote Physical Volume Clients						
Move cursor to desired item and press Enter.						
List All Remote Physical Volume Clients						
Add Remote Physical Volume Clients Change / Show a Remote Physical Volume Client						
Change Multiple Remote Physical Volume Clients Remove Remote Physical Volume Clients						
Configure Defined Remote Physical Volume Clients						
F1=HelpF2=RefreshF3=CancelF8=ImageF9=ShellF10=ExitEnter=Do						

Figure 2.2.12.1 SMIT panel for RPV clients

- We select "Add Remote Physical Volume Clients", determine whether we are using IPv6 or not. The example does not use IPv6.

	Add Remote P	hysical Volume Clie	nts	
Type or select a Press Enter AFTE	value for the entr R making all desire	y field. d changes.		
* Does data mirr Version 6 (IPv	oring network use I	nternet Protocol	[Entry Fields] no	+
	<u>.</u>			
F1=Help Esc+5=Reset F9=Shell	F2=Refresh F6=Command F10=Exit	F3=Cancel F7=Edit Enter=Do	F4=List F8=Image	
Figure 2.2.12.	2 RPV client confi	guration, IPv6 co	nfirmation	
Then add the i	<i>IP address of the</i>	RPV server		
	Add Remote P	hysical Volume Clie	nts	
Type or select a Press Enter AFTE	a value for the entry R making all desire	y field. d changes.		
		a changes.	[Entry Fields]	
* Remote Physica	al Volume Server Int	ernet Address	192.168.50.184	+
F1=Help Esc+5=Reset F9=Shell	F2=Refresh F6=Command F10=Exit	F3=Cancel F7=Edit Enter=Do	F4=List F8=Image	•

Figure 2.2.12.3 RPV client configuration of RPV server IP

- And

_

		Add Remote Physical Volu	me Clients	
		e for the entry field. ing all desired changes.		
* R	emote Physical Vol	ume Server Internet Addres	[Entry Fields] s [192.168.50.184]	+
	Remo	te Physical Volume Local I	nternet Address	
	Move cursor to de	sired item and press Enter		
	192.168.6.163	pc-tor01-glvm-01a		
F1 Es F9	F1=Help F8=Image /=Find	F2=Refresh F10=Exit n=Find Next	F3=Cancel Enter=Do	

Figure 2.2.12.4 Selecting RPV server location from RPV client

- You will be presented with the available RPV servers which correspond to the LUNs that are being presented by the RPV server PowerVS instance.

	Add Remote Physical Volume Clients						
Ty Pr							
*	Move cursor to desired item and press F7. ONE OR MORE items can be selected. Press Enter AFTER making all selections.	ONE OR MORE items can be selected.					
	[MORE5] # pc-lon06-glvm-01a) # # Physical Volume Physical Volume Identifier #						
	# hdisk1 00c8cf803fb0193a00000000000000000000000000000000000						
F1 Es F9	s Enter=Do /=Find n=Find Next						

Figure 2.2.12.5 Selecting RPV server LUN from RPV client

- We select "hdisk1" and depress the Enter key bring up the

device parameter menu.

	Add Remote P	Physical Volume C	lients	
	alues in entry fiel R making all desire			
Press Enter AFTER making all desired changes. Remote Physical Volume Server Internet Address Remote Physical Volume Local Internet Address Physical Volume Identifiers I/O Timeout Interval (Seconds) Start New Devices Immediately? [yes]				
F1=Help Esc+5=Reset F9=Shell	F2=Refresh F6=Command F10=Exit	F3=Cancel F7=Edit Enter=Do	F4=List F8=Image	

Figure 2.2.12.6 Configuring RPV client parameters

- For our case, we select the default parameters and depress the Enter key bring up the results screen.

			COMM	AND STATUS		
Command	: OK	stde	out: yes	stde	rr: no	
Before	command	completion,	additional	instruction	s may appear	below.
disk7	Availabl	le				
					_	
F1=Help F8=Imag	e	F2=Ref F9=She		F3=Cancel F10=Exit		6=Command =Find
n=Find	Next					

Figure 2.2.12.7 RPV client configuration output

- We then repeat the same process for the remaining LUNs.
- Once completed, we note the new LUNs available on our Toronto PowerVS instance (hdisk7->hdisk10).

pc-tor01-glvm-01a: / >						
# lspv						
hdisk0	none	None				
hdisk1	00c8d4403180f273	dbvg	active			
hdisk2	00c8d4403180f319	dbvg	active			
hdisk3	00f6db0af58e9775	rootvg	active			
hdisk4	none	None				
hdisk5	00c8d44031815edd	appvg	active			
hdisk6	00c8d44031815f5a	appvg	active			
hdisk7	00c8cf803fb0193a	None				
hdisk8	00c8cf803fb02116	None				
hdisk9	00c8cf803fb029cd	None				
hdisk10	00c8cf803fb03444	None				
pc-tor01-glvm-01a: / >						
#						

Figure 2.2.12.8 Displaying addition of RPV client

- And also note that these LUNs are RPV clients by using the

"Isdev -Cc disk" command.

pc-tor01	l-glvm-01a: -Ccdisk	/ >						
# lsdev	-Ccdisk							
hdisk0	Available	C7-T1-01	MPIO	IBM	2076	FC	Disk	
hdisk1	Available	C7-T1-01	MPI0	IBM	2076	FC	Disk	
hdisk2	Available	C7-T1-01	MPI0	IBM	2076	FC	Disk	
hdisk3	Available	C7-T1-01	MPIO	IBM	2076	FC	Disk	
hdisk4	Available	C7-T1-01	MPI0	IBM	2076	FC	Disk	
hdisk5	Available	C7-T1-01	MPIO	IBM	2076	FC	Disk	
hdisk6	Available	C7-T1-01	MPIO	IBM	2076	FC	Disk	
hdisk7	Available		Remot	te Pł	hysica	al۱	/olume	Client
hdisk8	Available		Remot	te Pł	nysica	al۱	/olume	Client
hdisk9	Available							Client
	Available		Remot	te Pł	hysica	al۱	/olume	Client
pc-tor01	l-glvm-01a:	: / >						
#	Ĭ							

Figure 2.2.12.9 Display local and RPV client hdisks

2.2.13 Replicating data between sites using AIX LVM

With the RPV servers and clients defined, the virtual drives can now be used to replicate the data between sites.

In our example, we have a volume group "dbvg", which include the following LUNs: hdisk1, hdisk2

pc-tor01-glvm-01a	a:/>		
# lspv -P			
Physical Volume	Volume Group	Mirror Pool	
hdisk0	None		
hdisk1	dbvg	dbvg tor01	
hdisk2	dbvg	dbvg_tor01	
hdisk3	rootvg	5_	
hdisk4	None		
hdisk5	appvg	appvg_tor01	
hdisk6	appvg	appvg_tor01	
hdisk7	None		
hdisk8	None		
hdisk9	None		
hdisk10	None		
pc-tor01-glvm-01a	a:/>		

Figure 2.2.13.1 Displaying disks and associated mirror pools

- We will add the virtual disks, hdisk7 and hdisk8 to the volume group dbvg with a mirror pool name of dbvg_lon06 using the command: extendvg -p dbvg_lon06 dbvg hdisk7 hdisk8

pc-tor01-glvm-01a: /usr/sbin >									
pc-tor01-glvm-01a: /usr/sbin > # lspv -P Physical Volume Volume Group Mirror Pool									
Physical Volume	Volume Group	Mirror Pool							
hdisk0	None								
hdisk1	dbvg	dbvg tor01							
hdisk2	dbvg	dbvg_tor01							
hdisk3	rootvg								
hdisk4	None								
hdisk5	appvg	appvg tor01							
hdisk6	appvg	appvg_tor01							
hdisk7	dbvg	dbvg lon06							
hdisk8	dbvg	dbvg_lon06							

Figure 2.2.13.2 Extended a VG with new disk and mirror pool

- Note that hdisk7, hdisk8 (our virtual drives) are now part of the "dbvg" volume group and belong to a mirror pool named "dbvg_lon06"
- We then mirror our "dbvg" by mirror each of the LVs, such as fslv00, using the following command: mklvcopy -p copy1=dbvg_tor01 -p copy2=dbvg_lon06 fslv00 2
 The above command tells AIX to mirror the"fslv00" logical volume with copy 1 being in the "dbvg_tor01" mirror pool and copy 2 being in the "dbvg_lon06" making a total of 2 copies
- We verify the replication by using the "lsvg -l dbvg" command

# mklvcopy -p copy1=dbvg_tor01 -p copy2=dbvg_lon06 fslv00 2 pc-tor01-glvm-01a: /usr/sbin > # lsvg -l dbvg							
dbvg:	TYPE	L De	DDe	DVa		MOUNT DOTNT	
LV NAME	TYPE	LPs	PPs	PVs	LV STATE	MOUNT POINT	
loglv00	jfs2log	1	1	1	closed/syncd		
fslv00	jfs2	128	256	2	closed/stale	/data01	
fslv01	jfs2	128	128	1	closed/syncd	/data02	
fslv02	jfs2	128	128	1	closed/syncd	/data03	
fslv03	jfs2	128	128	1	closed/syncd	/data04	

Figure 2.2.13.3 Displaying multiple copies of fslv00 LV

- Note that the "fslv00" logical volume now has 2 copies and the state is "stale". The state will be updated in the near future.
- We proceed in mirroring the remaining LVs, loglv00, fslv01,

fslv02, fslv03. This is verified with the "lsvg -l dbvg" command.

pc-tor01-glvm-01a: / # lsvg -l dbvg dbvg:	′usr/sbin >					
	TYPE	LPs	PPs	PVs	LV STATE	MOUNT POINT
loglv00	jfs2log	1	2	2	closed/stale	N/A
fsĺv00	jfs2	128	256	2	closed/stale	/data01
fslv01	jfs2	128	256	2	closed/stale	/data02
fslv02	jfs2	128	256	2	closed/stale	/data03
fslv03	jfs2	128	256	2	closed/stale	/data04

Figure 2.2.13.4 Displaying multiple copies of all LVs in VG, dbvg

- Note that all LVs are now 2 copies (1 LP and 2 PPs) across 2 PVs and in stale status.
- To start the synchronization, simply execute the varyonvg command: varyonvg dbvg
- The synchronization will initiate which can be verified by running

the "*ps -ef* | *grep sync*" *command*

```
pc-tor01-glvm-01a: /usr/sbin >
# varyonvg dbvg
pc-tor01-glvm-01a: /usr/sbin >
  ps -ef | grep -i sync
                        1 0 Jul 11
                                         - 0:04 /usr/sbin/syncd 60
    root 3539314
    root 9306570 19792158 0 03:51:42 vty0 0:00 lresynclv -1 00c8d44000004b
00000001733180f36e
                                        vty0 0:00 /bin/ksh /usr/sbin/syncvg
    root 19792158
                        1
                           0 03:51:42
  dbvq
                                        vty0 0:00 grep -i sync
    root 22151544 7406072
                            0 03:51:48
```

Figure 2.2.13.5 Displaying VG synchronization processes

 Note the "Iresynclv" command is running which is what is synchronizing that volume group. - The progress can be checked by running the "lsvg -l dbvg"

CO	m	т	ar	าd

pc-tor01-glvm-01a: # lsvg -l dbvg	/usr/sbin >					
dbvg:						
LV NAME	TYPE	LPs	PPs	PVs	LV STATE	MOUNT POINT
loglv00	jfs2log	1	2	2	closed/syncd	N/A
fslv00	jfs2	128	256	2	open/stale	/data01
fslv01	jfs2	128	256	2	closed/stale	/data02
fslv02	jfs2	128	256	2	closed/stale	/data03
fslv03	jfs2	128	256	2	closed/stale	/data04

Figure 2.2.13.6 Displaying LV synchronization status

- Note that the LV, "loglv00", is now in syncd state which means is fully synchronized between all drives (local and remote) while the other LVs remain to be synchronized as those are still in "stale" state.
- The same process is repeated for the additional VG, appvg in our example.

2.2.14 Accessing the data in a DR event

The replication setup implemented in this scenario is a "true" DR setup. The implementation is purely one way, from the production site to the DR site.

In the event of a disaster, we will only have half of the storage for each of the volume groups.

We will simulate a DR event by shutting down the production PowerVS.

1 unsuccessful login attempt since last login. Last unsuccessful login: Tue Jul 21 17:33:46 CDT 2020 on /dev/vty0 Last login: Tue Jul 21 14:41:46 CDT 2020 on /dev/vty0 pc-tor01-glvm-01a: / > # shutdown -F SHUTDOWN PROGRAM Tue Jul 21 17:34:04 CDT 2020 Jul 21 2020 17:34:04 /usr/es/sbin/cluster/utilities/clstop : called with flags -f -y -s -N -S 0513-044 The clinfoES Subsystem was requested to stop. 0513-044 The clevmgrdES Subsystem was requested to stop. Running /etc/rc.d/rc2.d/Kcluster stop Quiescing cthags... Stopping IBM.ConfigRM... 0513-004 The Subsystem or Group, IBM.ConfigRM, is currently inoperative. Running /etc/rc.d/rc2.d/Ksshd stop 0513-044 The sshd Subsystem was requested to stop. Running /etc/rc.d/rc2.d/Kwpars stop Wait for '....Halt completed....' before stopping. Error reporting has stopped.

Figure 2.2.14.1 Shutting down production PowerVS

This results in the DR PowerVS being the only active image. We long into the DR PowerVS in London and note that we see only the local disks.

```
pc-lon06-glvm-01a:/ >
# lspv
hdisk0
                 00c8cf80601b4933
                                                      None
hdisk1
                 00c8cf803fb0193a
                                                      None
hdisk2
                 00c8cf803fb02116
                                                      None
hdisk3
                 00f6db0af58e9775
                                                      rootvq
                                                                      active
hdisk4
                 00c8cf8049bac9fa
                                                      caavg private
                                                                      active
hdisk5
                 00c8cf803fb029cd
                                                      None
hdisk6
                 00c8cf803fb03444
                                                      None
pc-lon06-glvm-01a:/ >
```

Figure 2.2.14.1 DR PowerVS storage

The process for accessing the data is to import the volume groups with the LUNs that are available. We note that hdisk1 and hdisk2 are associated with the "dbvg" volume group and hdisk5, hdisk6 are associated with the "appvg" volume group.

We import the "dbvg" volume group using "importvg -f -y dbvg -V 100 hdisk1" command. Note that the "-f" means we are forcing the import,

the "-V 100" flag means we are assigning the VG the major number of 100. In the following figure, note the error messages as they will be utilized when cleaning up the VG.

pc-lon06-glvm-01a:/ >	
# importvg -f -y dbvg -V 100 hdisk1	
PV Status: hdisk1 00c8cf803fb0193a	PVACTIVE
hdisk2 00c8cf803fb02116	PVACTIVE
00c8d4403180f273	NONAME
00c8d4403180f319	NONAME
varyonvg: Volume group dbvg is varied on.	
0516-510 synclvodm: Physical volume not found fo	
identifier 00c8d4403180f2730000000000000	0000.
0516-510 synclvodm: Physical volume not found fo	or physical volume
identifier 00c8d4403180f3190000000000000	0000.
0516-548 synclvodm: Partially successful with up	odating volume
group dbvg.	
dbvg	
0516-783 importvg: This imported volume group is	
Therefore, the volume group must be vari	ed on manually.

Figure 2.2.14.2 Importing a VG on the DR PowerVS

After importing the VG, we will vary it on so that the filesystems can be access. We utilize the "varyonvg -f -O dbvg" command. Note the "f" and "-O" flags are utilized to vary on the VG due the fact there is no quorum.

# varyonvg -0 dbvg		
0516-052 varyonvg: Volu	ime group cannot be v	/aried on without a
quorum. More ph	nysical volumes in th	ne group must be active.
Run diagnostics	on inactive PVs.	
pc-lon06-glvm-01a:/ >		
# varyonvg -f -0 dbvg		
PV Status: hdisk1	00c8cf803fb0193a	PVACTIVE
hdisk2	00c8cf803fb02116	PVACTIVE
	00c8d4403180f273	NONAME
	00c8d4403180f319	NONAME
varyonvg: Volume group	dbvg is varied on.	
pc-lon06-glvm-01a:/ >		

Figure 2.2.14.3 Varying on a VG without a quorum

At this point, we list the VG and note the filesystems are still there.

>					
TYPE	LPs	PPs	PVs	LV STATE	MOUNT POINT
jfs2log	1	2	2	closed/syncd	N/A
jfs2	128	256	2	closed/syncd	/data01
jfs2	128	256	2	closed/syncd	/data02
jfs2	128	256	2	closed/syncd	/data03
jfs2	128	256	2	closed/syncd	/data04
	TYPE jfs2log jfs2 jfs2 jfs2 jfs2	TYPE LPs jfs2log 1 jfs2 128 jfs2 128 jfs2 128 jfs2 128	TYPELPsPPsjfs2log12jfs2128256jfs2128256jfs2128256	TYPELPsPPsPVsjfs2log122jfs21282562jfs21282562jfs21282562	TYPELPsPPsPVsLVSTATEjfs2log122closed/syncdjfs21282562closed/syncdjfs21282562closed/syncdjfs21282562closed/syncd

Figure 2.2.14.4 Listing filesystems

We mount the filesystems so the data can be accessed.

pc-lon06-glvm-01a:/ >
mount /data01;mount /data02;mount /data03;mount /data04
pc-lon06-glvm-01a:/ >
#

Figure 2.2.14.5 Mounting filesystems

And

pc-lon06-glvm-	01a:/ >					
# df						
Filesystem	512-blocks	Free	%Used	Iused 9	%Iused	Mounted on
/dev/ĥd4	196608	105560	47%	3038	21%	/
/dev/hd2	4784128	330112	94%	40766	50%	/usr
/dev/hd9var	1966080	1533632	22%	1764	2%	/var
/dev/hd3	458752	453424	2%	55	1%	/tmp
/dev/hd1	65536	64792	2%	7	1%	/home
/dev/hdlladmin	262144	261384	- 1%	5	1%	₅ /admin
/proc	-	-	-	-	- /	proc
/dev/hd10opt	786432	85096	90%	11482	53%	/opt
/dev/livedump	524288	523552	1%	4	1%	/var/adm/ras/livedump
/dev/repo00	15335424	66280	100%	2534	25%	/usr/sys/inst.images
/dev/toolslv	2621440	452056	83%	12	1%	/tools
/ahafs	-	-	-	48	1% /	'aha
/dev/fslv00	4194304	4084024	3%	1016	1%	/data01
/dev/fslv01	4194304	3598480	15%	1945	1%	/data02
/dev/fslv02	4194304	4000328	5%	826	1%	/data03
/dev/fslv03	4194304	4193008	1%	4	1%	/data04
nc-lon06-dlvm-	$01a\cdot/>$					

Figure 2.2.14.6 Displaying mounted filesystems

We proceed with the remaining VG.

At this point, we can start the application and proceed with our recovery.

2.2.15 Cleaning up mirrors after a DR event

While the application and data was successfully brought up in the previous section, there remains some activities to clean up LV mirrors. After mount the filesystems and starting the application, the data will be marked "stale" due to the fact there are no mirror physical volumes. This can be displayed via the "lsvg -l dbvg" command for the "dbvg" volume group.

pc-lon06-glvm-01a:/ # lsvg -l dbvg dbvg:	>		-			
	TYPE	LPs	PPs	PVs	LV STATE	MOUNT POINT
	jfs2log	1	2	2	open/stale	N/A
fsľv00	jfs2	128	256	2	open/stale	/data01
fslv01	jfs2	128	256	2	open/stale	/data02
fslv02	jfs2	128	256	2	open/stale	/data03
fslv03	jfs2	128	256	2	open/stale	/data04

Figure 2.2.15.1 Displaying stale data

This can be cleaned up by removing the copy from the previously existing drives.

We recall that when we imported the volume group, there were some PVs missing.

pc-lon06-glvm-0						
# varyonvg -f -	0 dbvg					
PV Status:	hdisk1	00c8cf803fb0193a	PVACTIVE			
	hdisk2	00c8cf803fb02116	PVACTIVE			
		00c8d4403180f273	NONAME			
		00c8d4403180f319	NONAME			
varyonvg: Volume group dbvg is varied on.						
pc-ĺon06‑glvm‑01aː/ >						

Figure 2.2.15.2 Importing "dbvg" volume group

We take note of the PVIDs that are missing. We proceed cleaning up the LVs by removing the "stale" copy using the "rmlvcopy <LVNAME> 1 <PVID>" as shown in the following diagram.

pc-lon06-glvm-01a:/ > # rmlvcopy fslv00 1 00c8d4403180f319 pc-lon06-glvm-01a:/ > #

Figure 2.2.15.3 Removing "stale" LV copies

We note that the LV is now no longer stale as there is only one copy.

pc-lon06-glvm-01a:/ # lsvg -l dbvg dbvg:	>					
LV ŇAME	TYPE	LPs	PPs	PVs	LV STATE	MOUNT POINT
loglv00	jfs2log	1	1	1	open/syncd	N/A
fsĺv00	jfs2	128	128	1	open/syncd	/data01
fslv01	jfs2	128	256	2	open/stale	/data02
fslv02	jfs2	128	256	2	open/stale	/data03
fslv03	jfs2	128	256	2	open/stale	/data04
nc-lon06-alvm-01a·/	5					

Figure 2.2.15.4 Displaying LV, "fslv00", has one copy

We proceed with all the LVs until it is all cleaned up as shown in the figure below.

pc-lon06-glvm-01a:/	/ >					
# lsvg -l dbvg						
dbvg:						
LV NAME	TYPE	LPs	PPs	PVs	LV STATE	MOUNT POINT
loglv00	jfs2log	1	1	1	open/syncd	N/A
fslv00	jfs2	128	128	1	open/syncd	/data01
fslv01	jfs2	128	128	1	open/syncd	/data02
fslv02	jfs2	128	128	1	open/syncd	/data03
fslv03	jfs2	128	128	1	open/syncd	/data04
nc longe alum 01a.	/ 5					

Figure 2.2.15.5 Displaying LV are "cleaned up" with only one copy

2.3 Geographic Logical Volume Manager (GLVM) Replication with PowerHA

While AIX GLVM provides a method of replicating an application's data to a DR site, it does not provide a method of automatically detecting a failure and bringing up the DR site. Integrating AIX GLVM with IBM PowerHA Enterprise Edition (EE) will provide that automation.

IBM PowerHA technology provides high availability, business continuity and disaster recovery. It enables the deployment of an HA solution that addresses both storage and high availability requirements with one integrated configuration.

In our configuration, we will build a simple 2 node cluster where one node is our PowerVS instance in the Toronto location and the second node is our PowerVS instance in London.

We will build the IBM PowerHA cluster configuration with a single resource group which will contain the volume groups, dbvg and appvg. For simplicity, there will be no other resources on that resource group such as IP addresses or application controllers.

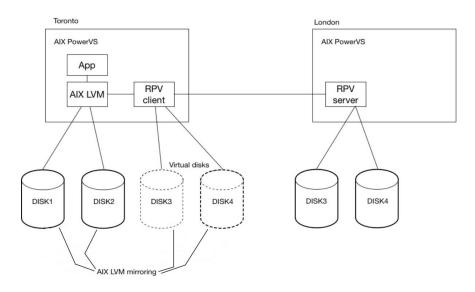
For examples of more complex PowerHA cluster, there are many resources listed in "Chapter 4: Additional resources".

2.3.1 Preparing AIX GLVM for IBM PowerHA EE

With the AIX GLVM only setup, we had the RPV servers only on the DR site. In essence, it was a one-way replication from the primary site to the DR site. Data did not flow from the DR site to the primary site.

With IBM PowerHA, we will need to have the ability of the data to be replicated in either directions. For that to occur, we will need to create RPV servers on the primary site so that the DR site can see those drives as virtual drives using the RPV clients on the DR site PowerVS. In that scenario, PowerHA will be managing which site is operational and control the RPV server/client activation and deactivation.

The starting state of the AIX GLVM-only replication looks like this diagram.





Note that in the above diagram, only the London location PowerVS have RPV servers. We will add RPV servers to the Toronto PowerVS and RPV clients to the London PowerVS in order to present the drives from Toronto to London.

The final AIX GLVM configuration will look like the following diagram.

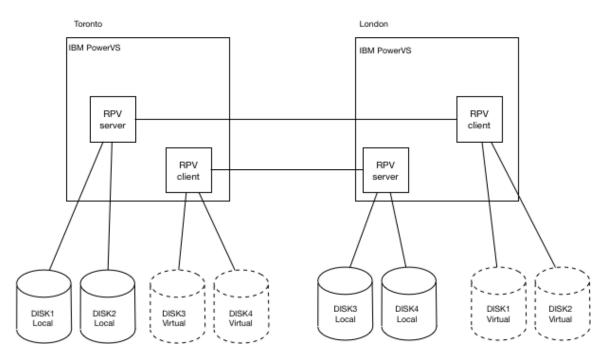


Figure 2.3.1.2 AIX GLVM replication in both directions

We proceed with the following steps

- Determine for which drives to create RPV servers
- Bring the VGs offline
- Create the RPV servers on the primary location
- Create the RPV clients on the DR location
- Verify the configuration
- Import all VGs to remote PowerVS

2.3.2 Update VGs to enhanced concurrent capable

PowerHA requires all of the shared VGs to be enhanced concurrent capable. The VGs can be updated to enhanced concurrent capable with the "chvg -C <VGNAME>" command. See the following diagram.

```
pc-lon06-glvm-01a:/ >
# chvg -C dbvg
```

Figure 2.3.2.1 Change VG to concurrent capable

VOLUME GROUP: 80f36e	dbvg	VG IDENTIFIER:	00c8d44000004b000000017331
VG STATE:	active	PP SIZE:	16 megabyte(s)
VG PERMISSION:	read/write	TOTAL PPs:	5100 (81600 megabytes)
MAX LVs:	256	FREE PPs:	4074 (65184 megabytes)
LVs:	5	USED PPs:	1026 (16416 megabytes)
OPEN LVs:	0	QUORUM:	3 (Enabled)
TOTAL PVs:	4	VG DESCRIPTORS:	4
STALE PVs:	0	STALE PPs:	Θ
ACTIVE PVs:	4	AUTO ON:	no
Concurrent:	Enhanced-Capable	Auto-Concurrent	: Disabled
VG Mode:	Non-Concurrent		
MAX PPs per VG:	32768	MAX PVs:	1024
LTG size (Dynamic):	-		no
HOT SPARE:	no	BB POLICY:	non-relocatable
MIRROR POOL STRICT:			
PV RESTRICTION:	none	INFINITE RETRY:	no
DISK BLOCK SIZE:	512	CRITICAL VG:	no
FS SYNC OPTION:	no	CRITICAL PVs:	no

Figure 2.3.2.2 Showing Enhanced-Capable field

Note in the above diagram the VG has the "Concurrent" field as "Enhanced-Capable".

2.3.3 Change filesystems to not automount

For PowerHA to manage the filesystems, they must not automatically mount. We change those filesystems using the "chfs -A no <FILESYSTEM>" command. See the following.

for i in 123;do chfs -A no /appfs\$i;done
pc-lon06-glvm-01a:/ >
lsfs sed 's/ //g'
Name Nodename Mount Pt VFS Size Options Auto Accounting
/dev/hd4 / jfs2 196608 yes no
/dev/hd1 /home jfs2 65536 yes no
/dev/hd2 /usr jfs2 4784128 yes no
/dev/hd9var /var jts2 1966080 yes no
/dev/hd3 /tmp jfs2 458752 yes no
/dev/hdlladmin /admin jfs2 262144 yes no
/proc /proc procfs yes no
/dev/hd10opt /opt jfs2 786432 yes no
/dev/livedump /var/adm/ras/livedump jfs2 524288 yes no
/dev/repo00 /usr/sys/inst.images jfs2 15335424 rw yes no
/dev/toolslv /tools jfs2 2621440 rw yes no
/dev/toolslv /tools jfs2 2621440 rw yes no /dev/fslv00 /data01 jfs2 4194304 rw no no
/dev/tslv01 /data02 1ts2 4194304 rW no no
/dev/fslv02 /data03 jfs2 4194304 rw no no
/dev/fslv03 /data04 jfs2 4194304 rw no no
/dev/fslv07 /appfs1 jfs2 6291456 rw no no
/dev/fslv05 /appfs2 jfs2 6291456 rw no no
/dev/fslv06 /appfs3 jfs2 6291456 rw no no

Figure 2.3.3.1 Changing filesystems to not automount

2.3.4 Determine for which drives to create RPV servers

We note the VGs and the VG drives.

```
pc-tor01-glvm-01a: /tools >
# lsvg -p dbvg | sed 's/ //g'
dbvg:
PV ŇAME
             PV STATE
                           TOTAL PPs FREE PPs FREE DISTRIBUTION
hdisk1
             active
                         1275
                                  1018
                                          127..126..255..255..255
                                  1019
                         1275
                                          127..127..255..255..255
hdisk2
             active
                         1275
                                  1018
                                          127..126..255..255..255
hdisk7
            active
hdisk8
                         1275
                                  1019
                                          127..127..255..255..255
            active
pc-tor01-glvm-01a: /tools >
# lsvg -p appvg | sed 's/ //g'
appvg:
PV NAME
             PV STATE
                           TOTAL PPs FREE PPs FREE DISTRIBUTION
hdisk5
            active
                         1275
                                  1082
                                          255..62..255..255..255
hdisk6
             active
                         1275
                                  891
                                          63..63..255..255..255
hdisk9
             active
                         1275
                                  1082
                                          255..62..255..255..255
                                   891
                                           63..63..255..255..255
hdisk10
             active
                          1275
```

Figure 2.3.4.1 VGs and their disk drives

We also note the local drives versus the RPV client drives.

pc-tor01	L-glvm-01a:	/tools :	>					
# lsdev	-Ccdisk	,						
hdisk0	Available	C7-T1-01	MPIO	IBM	2076	FC	Disk	
hdisk1	Available	C7-T1-01	MPI0	IBM	2076	FC	Disk	
hdisk2	Available	C7-T1-01	MPIO	IBM	2076	FC	Disk	
hdisk3	Available	C7-T1-01	MPI0	IBM	2076	FC	Disk	
hdisk4	Available	C7-T1-01	MPIO	IBM	2076	FC	Disk	
hdisk5	Available	C7-T1-01	MPIO	IBM	2076	FC	Disk	
hdisk6	Available	C7-T1-01	MPI0	IBM	2076	FC	Disk	
hdisk7	Available							Client
hdisk8	Available		Remot	te Ph	iysica	al۱	/olume	Client
hdisk9	Available		Remot	te Ph	nysica	al۱	/olume	Client
hdisk10	Available		Remot	te Ph	nysica	al۱	/olume	Client
pc-tor01	L-glvm-01a:	/tools >	>					

Figure 2.3.1.3.2 Determining local versus remote drives

Given the above, we determine that hdisk1, hdisk2 and hdisk5, hdisk6 will need to have RPV servers.

2.3.5 Bring the VGs offline

For safety, we vary off the volume groups dbvg, appvg.

```
pc-tor01-glvm-01a: /tools >
# varyoffvg dbvg
pc-tor01-glvm-01a: /tools >
# varyoffvg appvg
pc-tor01-glvm-01a: /tools >
```

Figure 2.3.5.1 VGs being brought offline

2.3.6 Create the RPV servers on the primary location

We proceed as previously to create those RPV servers for those drives using "smitty rpvserver -> Add Remote Physical Volume Servers". We select the appropriate drive.

	Remote Physical Vol	ume Servers				
Move cursor to desired item and press Enter.						
Remote Physical Volume List All Remote Physica		nfiguration				
Add Remote Physical Vo Change / Show a Remote	lume Servers	vor				
	Physical Volume Id	entifiers				
Move cursor to desire	ed item and press F7 s can be selected.					
Press Enter AFTER ma						
# Physical Volume	Physical Volu	me Identifier				
# hdisk5 00	0c8d44031815edd					
hdisk6 00						
F1=Help	F2=Refresh	F3=Cancel				
F7=Select F1 Enter=Do	F8=Image /=Find	F10=Exit n=Find Next				
F9						

Figure 2.3.6.1 Selecting RPV server drive

We select the appropriate drive and proceed to the RPV parameters screen where we add the IP address.

	Add Remote P	hysical Volume S	ervers	
	alues in entry fiel R making all desire			
Configure Auto	e Identifiers l Volume Client Int matically at System ces Immediately?		[Entry Fields] 00c8d44031815edd [192.168.50.184 [no] [yes]	+ + +
F1=Help Esc+5=Reset	F2=Refresh F6=Command	F3=Cancel F7=Edit	F4=List F8=Image	
F9=Shell	F10=Exit	Enter=Do	, o=image	

Figure 2.3.6.2 Configuring RPV server parameters

And, resulting in the configured rpvserver. We repeat this process for all appropriate drives.

	COMMAND STATUS						
Command: <mark>OK</mark>	stdout: yes	stderr: no	0				
Before command	completion, addition	al instructions may	appear below.				
pvserver2 Avai	llable						
F1=Help F8=Image n=Find Next	F2=Refresh F9=Shell	F3=Cancel F10=Exit	F6=Command /=Find				

Figure 2.3.6.3 Configured RPV server

2.3.7 Create the RPV clients on the DR location

We proceed as previously to create those RPV clients for those drives using "smitty rpvserver -> Add Remote Physical Volume Clients". We select the appropriate IPv6 option.

	Add Remote P	hysical Volume Cli	ents	
	Add Relibite P	Tysical volume cti	encs	
Type or select a Press Enter AFTEF	value for the entr R making all desire	y field. d changes.		
	oring network use I	nternet Protocol	[Entry Fields] o	+
Version 6 (IPv6	5)?			
F1=Help Fcc.5=Pocot	F2=Refresh	F3=Cancel	F4=List	
Esc+5=Reset F9=Shell	F6=Command F10=Exit	F7=Edit Enter=Do	F8=Image	

Figure 2.3.7.1 Selecting RPV client IPv6 option

We then select the RPV server IP address.

		Add Remote Physical Volu	ume Clients	
		ue for the entry field. king all desired changes.		
			[Entry Fields]	
* 8	emote Physical Vol	lume Server Internet Addres	ss []	+
	Remo	ote Physical Volume Server	Internet Address	
	Move cursor to de	esired item and press Enter	.	
	192.168.6.163	pc-tor01-glvm-01a		
F1	F1=Help F8=Image	F2=Refresh F10=Exit	F3=Cancel Enter=Do	
Es	/=Find	n=Find Next		
Es F9	/=Find	n=Find Next		

Figure 2.3.7.2 Selecting RPV server address

Then we select the drive the RPV client is to access.

	Ad	ld Remote Physical V	olume Clients	
Ty Pr	Rer	note Physical Volume	Server Disks	
*	Move cursor to desire ONE OR MORE items Press Enter AFTER mal	s can be selected.		
	[MORE3] # (The physical vo # on the host named # pc-tor01-glvm-01a # # Physical Volume	-)	-	
	<pre># hdisk5 hdisk6 [BOTTOM]</pre>		edd00000000000000000 f5a000000000000000000	
F1 Es F9	F1=Help F7=Select Enter=Do	F2=Refresh F8=Image /=Find	F3=Cancel F10=Exit n=Find Next	

Figure 2.3.7.3 Select RPV client drive is to access

Lastly, we are presented with the RPV client parameters menu. For our example, we will leave parameters as default.

	Add Remote P	Physical Volume C	lients	
	alues in entry fiel R making all desire			
Remote Physica Physical Volum I/O Timeout In	l Volume Server Int l Volume Local Inte e Identifiers terval (Seconds) ces Immediately?		[Entry Fields] 192.168.6.163 192.168.50.184 00c8d44031815edd00000> [80] [yes]	> +
F1=Help Esc+5=Reset F9=Shell	F2=Refresh F6=Command F10=Exit	F3=Cancel F7=Edit Enter=Do	F4=List F8=Image	

Figure 2.3.7.4 RPV client parameters

We proceed with the additional RPV client configurations.

2.3.8 Verify the configuration

We can verify the RPV client configuration using the "Isdev -Cc disk" command as shown below.

pc-lon00	5-glvm-01a:	:/ >						
# lsdev	-Čcdisk							
hdisk0	Available	C4-T1-01	MPIO	IBM	2076	FC	Disk	
hdisk1	Available	C4-T1-01	MPIO	IBM	2076	FC	Disk	
hdisk2	Available	C4-T1-01	MPIO	IBM	2076	FC	Disk	
hdisk3	Available	C4-T1-01	MPI0	IBM	2076	FC	Disk	
hdisk4	Available	C4-T1-01	MPIO	IBM	2076	FC	Disk	
hdisk5	Available	C4-T1-01	MPIO	IBM	2076	FC	Disk	
hdisk6	Available	C4-T1-01	MPIO	IBM	2076	FC	Disk	
hdisk7	Available		Remot	te Ph	nysica	al ۱	/olume	Client
hdisk8	Available		Remot	te Pł	nysica	al ۱	/olume	Client
hdisk9	Available		Remot	te Pł	nysica	al ۱	/olume	Client
	Available		Remot	te Pł	nysica	al ۱	/olume	Client
pc-lon06	5-glvm-01a:	:/ >			-			

Figure 2.3.8.1 Displaying RPV clients

Note the hdisks, hdisk7 to hdisk10, are shown as "Available" and are "Remove Physical Volume Client".

2.3.9 Import all VGs to remote PowerVS

Once we verify that RPV servers, clients are defined, working and synchronized, we can import the VGs to the remaining PowerVS. All VGs that will be part of the PowerHA resource group must be available on all nodes.

We display the importvg command, "importvg -y appvg -V 101 hdisk9" setting the major number as 101 and reading the VG information from hdisk9. We repeat the similar command for "dbvg".

```
pc-lon06-glvm-01a:/ >
# importvg -y appvg -V 101 hdisk9
appvg
```

Figure 2.3.9.1 Importing VGs to London PowerVS

2.3.10 Installing IBM PowerHA EE

The IBM PowerHA Enterprise Edition filesets will need to be installed on all AIX PowerVS instances that will be part of the cluster.

In our example, we placed the PowerHA EE filesets in a filesystem named "/tools". We "cd" to that directory and execute "smitty install_latest". Since we are in that directory, we can enter "." As the "INPUT device".

	Ins	tall Software		
Type or select a Press Enter AFTEF	value for the entr making all desire	y field.		
* INPUT device /	directory for soft	ware	[Entry Fields]	+
F1=Help Esc+5=Reset F9=Shell	F2=Refresh F6=Command F10=Exit	F3=Cancel F7=Edit Enter=Do	F4=List F8=Image	

Figure 2.3.10.1 Directory of AIX PowerHA software location

The following filesets will be installed:

- cluster.adt.es
- cluster.doc.en_US.assist
- cluster.doc.en_US.es
- cluster.doc.en_US.glvm
- cluster.es.client
- cluster.es.cspoc
- cluster.es.genxd
- cluster.es.server
- cluster.license
- cluster.man.en_US.es
- cluster.xd.base
- cluster.xd.glvm
- cluster.xd.license

Note that there are many more additional packages that do not apply such as those for EMC, Hitachi. Also note that there may be additional packages that may apply to your configuration such as the Smart Assists. Selected the minimum packages for AIX GLVM.

	Install Software	
Ту		
Pr	SOFTWARE to install	
[T * *	Move cursor to desired item and press F7. Use arrow keys to scroll. ONE OR MORE items can be selected. Press Enter AFTER making all selections.	
	[MORE100] > cluster.xd.base ALL + 7.2.4.0 PowerHA SystemMirror Enterprise Edition - Base Support.	
	<pre>> cluster.xd.glvm ALL + 7.2.4.0 PowerHA SystemMirror Enterprise Edition GLVM RPV Support</pre>	
[M	<pre>> cluster.xd.license ALL + 7.2.4.0 PowerHA SystemMirror Enterprise Edition License Agreement [BOTTOM]</pre>	
F1 Es F9	F1=HelpF2=RefreshF3=CancelF7=SelectF8=ImageF10=ExitEnter=Do/=Findn=Find Next	

Figure 2.3.10.2 Selecting PowerHA packages to install

We verify that "ACCEPT new license agreements?" field is set to "yes".

	Ins	tall Software		
	lues in entry fiel making all desire			
COMMIT software SAVE replaced f AUTOMATICALLY i EXTEND file sys OVERWRITE same VERIFY install Include corresp DETAILED output Process multipl ACCEPT new lice	install operation updates? iles? nstall requisite s tems if space need or newer versions? and check file siz onding LANGUAGE fi ? e volumes?	oftware? led? 	[Entry Fields] [cluster.adt.es no yes no yes yes no no yes no yes no yes no] > + + + + + + + + + + + + + + + + + +
F1=Help Esc+5=Reset F9=Shell	F2=Refresh F6=Command F10=Fxit	F3=Cancel F7=Edit Fnter=Do	F4=List F8=Image	

Figure 2.3.10.3 Verifying "ACCEPT new license agreements?" is "yes"

After proceeding, we verify the installation is completed successfully by scrolling through the SMIT output.

	COMMA	AND STATUS		
Command: <mark>OK</mark>	stdout: yes	stderr: n	0	
Before command compl	etion, additional	instructions may	appear belo	w.
[MORE470] luster.msg.en_US.gl cluster.msg.en_US.es cluster.es.genxd.rte cluster.es.genxd.cmd cluster.es.genxd.rte cluster.msg.en_US.ge File /etc/environmen File /etc/group has File /etc/jroup has File /etc/services h	.server 7.2.4.0 7.2.4.0 7.2.4.0 7.2.4.0 7.2.4.0 s 7.2.4.0 nxd 7.2.4.0 t has been modified been modified. s been modified.	USR USR USR ROOT ROOT USR	APPLY APPLY APPLY APPLY APPLY APPLY	
[MORE4]				
	F2=Refresh F9=Shell	F3=Cancel F10=Exit	F6=Com /=Find	

Figure 2.3.10.4 Verifying installation output

Repeat the process for all cluster PowerVS.

2.3.11 Configuring PowerHA EE

As mentioned previously, we will configure a very simple PowerHA cluster with:

- two nodes (one Toronto PowerVS, one London PowerVS)
- single resource group (we will call this RG01)
- no service IP
- no application controllers
- two VGs (dbvg, datavg)

2.3.12 Verify /etc/cluster/rhosts entries

The file, /etc/cluster/rhosts, contains entries that are used for communication purposes. These entries correspond to the hostname of each of the PowerVS nodes. For our purposes, the file looks like this.

```
pc-tor01-glvm-01a: / >
# cat /etc/cluster/rhosts
pc-tor01-glvm-01a
pc-lon06-glvm-01a
pc-tor01-glvm-01a: / >
```

Figure 2.3.12.1 /etc/cluster/rhosts entries

That is assuming those entries are also located in the /etc/hosts file as shown below.

```
pc-tor01-glvm-01a: / >
# hostent -S
127.0.0.1 loopback localhost
192.168.6.163 pc-tor01-glvm-01a tor01
192.168.50.184 pc-lon06-glvm-01a lon06
```

```
# loopback (lo0) name/address
```

Figure 2.3.12.2 /etc/hosts entries

After changing the /etc/cluster/rhosts file, the daemon, clcomd, needs to be refreshed. This is done with the "stopsrc -s clcomd;startsrc -s clcomd" command as shown.

```
pc-tor01-glvm-01a: / >
# stopsrc -s clcomd;startsrc -s clcomd
0513-044 The clcomd Subsystem was requested to stop.
0513-059 The clcomd Subsystem has been started. Subsystem PID is 7930116.
```

Figure 2.3.12.3 Restarting "clcomd" daemon

Lastly, the communication between PowerVS images can be verified with the "cl_rsh" command. In this example, we add the "cl_rsh" directory to the PATH variable before executing the "cl_rsh" command.

```
pc-tor01-glvm-01a: / >
# export PATH=$PATH:/usr/es/sbin/cluster/utilities
pc-tor01-glvm-01a: / >
# cl_rsh pc-lon06-glvm-01a date
Fri Jul 17 22:41:00 CDT 2020
nc-tor01-glvm-01a: / >
```

Figure 2.3.12.4 Using "cl_rsh" to verify communications

2.3.13 Determine the PowerHA repository disk(s)

In our example configuration, we only have two VGs, dbvg and appvg. Any of the other LUNs can be used as repository disks. We note those drives on each of the PowerVS images.

pc-tor01-gl	pc-tor01-glvm-01a: / >					
#lspv						
hdisk0	none	None				
hdisk1	00c8d4403180f273	dbvg				
hdisk2	00c8d4403180f319	dbvg				
hdisk3	00f6db0af58e9775	rootvg	active			
hdisk4	none	None				
hdisk5	00c8d44031815edd	appvg				
hdisk6	00c8d44031815f5a	appvg				
hdisk7	00c8cf803fb0193a	dbvg				
hdisk8	00c8cf803fb02116	dbvg				
hdisk9	00c8cf803fb029cd	appvg				
hdisk10	00c8cf803fb03444	appvg				

Figure 2.3.13.1 Displaying Toronto available disks (hdisk0, hdisk4)

	pc-lon06-glvm-01a:/ >							
# lspv								
hdisk0	none	None						
hdisk1	00c8cf803fb0193a	None						
hdisk2	00c8cf803fb02116	None						
hdisk3	00f6db0af58e9775	rootvg	active					
hdisk4	00c8cf8049bac9fa	None						
hdisk5	00c8cf803fb029cd	None						
hdisk6	00c8cf803fb03444	None						
hdisk7	00c8d4403180f273	dbvg						
hdisk8	00c8d4403180f319	dbvg						
hdisk9	00c8d44031815edd	None						
hdisk10	00c8d44031815f5a	None						
nc-lon06-dl	nc long f dlw glass / >							

Figure 2.3.13.2 Displaying London available disks (hdisk0, hdisk4)

For our purposes, we will select "hdisk4" on each of our PowerVS images.

2.3.14 Configure PowerHA topology

We begin the PowerHA configuration by executing "smitty sysmirror -> Cluster Nodes and Networks -> Multi Site Cluster Deployment -> Setup a Cluster, Nodes and Networks". We name the cluster "tor01lon06", set the site 1 name to "toronto01", the site 2 name to "london06". We select the "New Nodes" by pressing "F4" and selecting the appropriate node name.

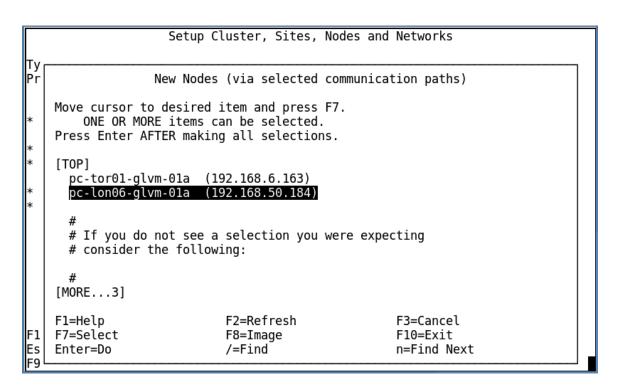


Figure 2.3.14.1 Select "New Nodes" in base PowerHA configuration

This leads to the following menu where we select the "Cluster Type" of "Linked Cluster".

	Setup Cluster, S	Sites, Nodes and	Networks	
	alues in entry field R making all desired			
* Cluster Name			[Entry Fields] [<mark>tor01lon06</mark>]	
* Site 1 Name * New Nodes (via	selected communica	tion paths)	[<mark>toronto01</mark>] [pc-tor01-glvm-01a]	+
* Site 2 Name * New Nodes (via	selected communica	tion paths)	[london06] [pc-lon06-glvm-01a]	+
Cluster Type			[Linked Cluster]	+
F1=Help Esc+5=Reset F9=Shell	F2=Refresh F6=Command F10=Exit	F3=Cancel F7=Edit Enter=Do	F4=List F8=Image	

Figure 2.3.14.2 Configuring PowerHA nodes, sites, cluster type

The result should be the gathering of cluster data as shown in the following diagram.

	Setup Cluster, S	Sites, Nodes and	Networks	
	alues in entry fielo R making all desireo			
* Cluster Name			[Entry Fields] [tor01lon06]	
* Site 1 Name * New Nodes (via	selected communicat	ion paths)	[<mark>toronto01</mark>] [pc-tor01-glvm-01a]	+
* Site 2 Name * New Nodes (via	selected communicat	ion paths)	[london06] [pc-lon06-glvm-01a]	+
Cluster Type			[Linked Cluster]	+
F1=Help Esc+5=Reset F9=Shell	F2=Refresh F6=Command F10=Exit	F3=Cancel F7=Edit Enter=Do	F4=List F8=Image	

Figure 2.3.14.3 Output of base cluster configuration

2.3.15 Configure PowerHA repository disks

We proceed to configuring the PowerHA repository disks by executing "smitty sysmirror -> Cluster Nodes and Networks -> Multi Site Cluster Deployment -> Define the Repository Disk and Cluster IP Address". We proceed to selecting the "Repository Disk" for each of the sites by pressing the "F4" key on those fields.

Multi Site	with Linked Clusters Co	nfiguration			
Type or select values in entry fields. Press Enter AFTER making all desired changes.					
uster Name artbeat Mechanism		[Entry Fields] tor01lon06 Unicast	+		
te Name pository Disk te Multicast Address		toronto01 [] []	+		
	Repository Disk				
Move cursor to desired :	item and press Enter.				
hdisk0 (00c8d440601a6595) on all nodes at site toronto01 hdisk4 (00c8d440601a64c7) on all nodes at site toronto01					
F1=Help F8=Image /=Find	F2=Refresh F10=Exit n=Find Next	F3=Cancel Enter=Do			
	or select values in en s Enter AFTER making al uster Name artbeat Mechanism te Name bository Disk te Multicast Address Move cursor to desired hdisk0 (00c8d440601a6 hdisk4 (00c8d440601a6	or select values in entry fields. s Enter AFTER making all desired changes. uster Name artbeat Mechanism te Name <u>bository Disk</u> te Multicast Address Repository Disk Move cursor to desired item and press Enter. hdisk0 (00c8d440601a6595) on all nodes at site hdisk4 (00c8d440601a64c7) on all nodes at site F1=Help F2=Refresh F8=Image F10=Exit	s Enter AFTER making all desired changes. [Entry Fields] tor01lon06 Unicast te Name te Name toronto01 [] te Multicast Address [] Repository Disk Move cursor to desired item and press Enter. hdisk0 (00c8d440601a6595) on all nodes at site toronto01 hdisk4 (00c8d440601a64c7) on all nodes at site toronto01 F1=Help F2=Refresh F3=Cancel Enter=Do		

Figure 2.3.15.1 Selecting repository disks

We repeat this process until all of the repository disks are selected.

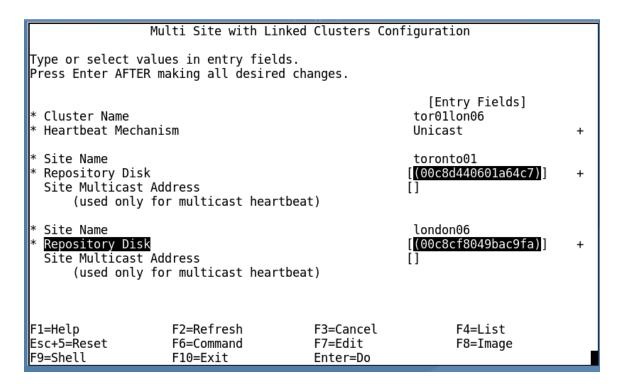


Figure 2.3.15.2 Defining repository disks

The resulting output should look similar to this diagram.

	CON	MAND STATUS			
Command: <mark>OK</mark>	stdout: yes	stderr: n	0		
Before command (completion, additiona	al instructions may	appear below.		
To view the comp "clmgr query rep Successfully add To view the comp "clmgr query rep Initial site con to complete the repository disks	[TOP] uccessfully added a primary repository disk. To view the complete configuration of repository disks use: "clmgr query repository" or "clmgr view report repository" Successfully added a primary repository disk. To view the complete configuration of repository disks use: "clmgr query repository" or "clmgr view report repository" Initial site configuration has been saved. You can now go on to complete the rest of the configuration, including adding backup repository disks (recommended), custom event notifications, resource groups and applications, etc.				
Vhen you have entered all the basic information you can then use [MORE3]					
F1=Help F8=Image n=Find Next	F2=Refresh F9=Shell	F3=Cancel F10=Exit	F6=Command /=Find		

Figure 2.3.15.3 Output of defining repository disks

2.3.16 Perform initial PowerHA verification

After defining the repository disks, we can perform the initial PowerHA verification. Before performing this, note that there is no CAA volume group.

pc-tor01-gl	pc-tor01-glvm-01a: / >					
#lspv						
hdisk0	00c8d440601a6595	None				
hdisk1	00c8d4403180f273	dbvg				
hdisk2	00c8d4403180f319	dbvg				
hdisk3	00f6db0af58e9775	rootvg	active			
hdisk4	00c8d440601a64c7	None				
hdisk5	00c8d44031815edd	appvg				
hdisk6	00c8d44031815f5a	appvg				
hdisk7	00c8cf803fb0193a	dbvg				
hdisk8	00c8cf803fb02116	dbvg				
hdisk9	00c8cf803fb029cd	appvg				
hdisk10	00c8cf803fb03444	appvg				

Figure 2.3.16.1 VGs before initial PowerHA verification

We proceed with the initial PowerHA verification by executing "smitty sysmirror -> Cluster Nodes and Networks -> Verify and Synchronize Cluster Configuration". This will present a verification screen.

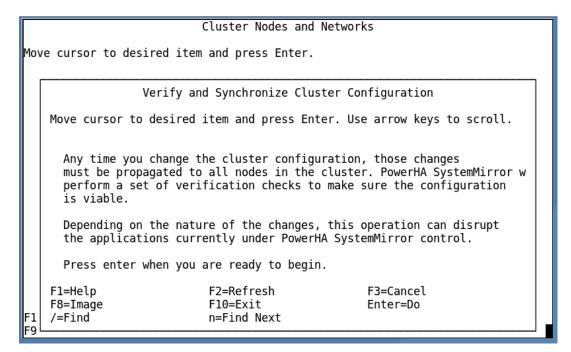


Figure 2.3.16.2 Enter to begin PowerHA verification

The resulting output should look something like the following.

COMMAND STATUS Command: OK stdout: yes stderr: no Before command completion, additional instructions may appear below. [T0P] Verification to be performed on the following: Cluster Topology Cluster Resources Verification will interactively correct verification errors. Retrieving data from available cluster nodes. This could take a few minutes. Start data collection on node pc-lon06-glvm-01a Start data collection on node pc-tor01-glvm-01a [MORE...153] F1=Help F2=Refresh F3=Cancel F6=Command F8=Image F9=Shell F10=Exit /=Find n=Find Next

Figure 2.3.16.3 Output of PowerHA verification

If PowerHA verification was successful, there should now be an additional volume group, "caavg_private", on each PowerVS instance.

pc-tor01-gl	pc-tor01-glvm-01a: / >						
# lspv							
hdisk0	00c8d440601a6595	None					
hdisk1	00c8d4403180f273	dbvg					
hdisk2	00c8d4403180f319	dbvg					
hdisk3	00f6db0af58e9775	rootvg	active				
hdisk4	00c8d440601a64c7	caavg private	active				
hdisk5	00c8d44031815edd	appvg					
hdisk6	00c8d44031815f5a	appvg					
hdisk7	00c8cf803fb0193a	dbvg					
hdisk8	00c8cf803fb02116	dbvg					
hdisk9	00c8cf803fb029cd	appvg					
hdisk10	00c8cf803fb03444	appvg					

Figure 2.3.16.4 "caavg_private" VG at Toronto PowerVS

pc-lon06-glvm-01a:/ > # lspv | grep caa hdisk4 00c8cf8049bac9fa pc-lon06-glvm-01a:/ >

caavg_private active

Figure 2.3.16.5 "caavg_private" VG at London PowerVS

2.3.17 Defining an XD_data network

AIX GLVM can use a couple of specific networks, XD_data and XD_ip. These networks have these characteristics

- XD_data An IP-based network used by geographically mirrored volume groups in a PowerHA SystemMirror cluster for transferring the data between the RPV devices.
- XD_ip An IP-based network used for participation in RSCT protocols, heartbeating, and client communication.

PowerHA builds the default IP networks without configuring either XD_data or XD_ip networks. We will need to create the XD_data network and add the interfaces to it

To create the XD_data network, execute "smitty sysmirror -> Cluster Nodes and Networks -> Manage Networks and Network Interfaces -> Networks -> Add a Network", then select "XD_data".

	Networks					
	NELWOIKS					
love cursor to desired item and press Enter.						
dd a Network						
nange/Show a Network emove a Network						
	Select a Network Type					
Move cursor to desired item and press Enter.						
XD_data						
	F2-Defreeb	E2-Concol				
F1=Help F8=Image	F10=Exit	F3=Cancel Enter=Do				
/=Find	n=Find Next					
	dd a Network hange/Show a Network emove a Network Move cursor to desired XD_data XD_ip ether F1=Help F8=Image	Anange/Show a Network emove a Network Select a Network Type Move cursor to desired item and press Enter. XD_data XD_ip ether F1=Help F2=Refresh F8=Image F10=Exit				

Figure 2.3.17.1 Selecting the XD_data network

Then verify the netmask is the same as the network interfaces.

	Ac	ld a Network		
Type or select values in entry fields. Press Enter AFTER making all desired changes.				
* Network Name * Network Type * Netmask(IPv4)/ * Network attrik * Unstable Thres * Unstable Peric	shold	,	[Entry Fields] [et_XD_data_01] XD_data [255.255.255.0] public [3] [60]	+ #
F1=Help Esc+5=Reset F9=Shell	F2=Refresh F6=Command F10=Exit	F3=Cancel F7=Edit Enter=Do	F4=List F8=Image	

Figure 2.3.17.2 XD_data network parameters

2.3.18 Moving network interfaces to XD_data network

In order to utilize the XD_data network that was created for the AIX GLVM replication, the network interfaces have to be moved to that network. Execute "smitty sysmirror -> Cluster Nodes and Networks -> Manage Networks and Network Interfaces -> Network Interfaces -> Change/Show a Network Interface", we select a network interface. Here, we select "en0" at "pc-lon06-glvm-01a"

Г Network Interfaces Show certificate Move cursor to desired item and press Enter. Add a Network Interface Select one or more network interfaces to change/show Move cursor to desired item and press Enter. Use arrow keys to scroll. # Node / Network IP Address Interface/Device IP Label/Device Path # # pc-lon06-glvm-01a / net_ether_01 en0 pc-lon06-glvm-01a 192.168.50 # pc-tor01-glvm-01a / net_ether_03 pc-tor01-glvm-01a en0 192.168.6. F1=Help F2=Refresh F3=Cancel F8=Image F10=Exit Enter=Do /=Find n=Find Next

Figure 2.3.18.1 Selecting a network interface

We then get the following menu where we can select the network the interface is on.

	Change /Show	, a Natuark Intari	face			
	Change/Show a Network Interface					
	alues in entry fiel R making all desire					
Node Name Network Interf IP Label/Addre Network Type * <mark>Network Name</mark>			[Entry Fields] pc-lon06-glvm-01a en0 pc-lon06-glvm-01a ether [et_ether_01]	+		
F1=Help Esc+5=Reset F9=Shell	F2=Refresh F6=Command F10=Exit	F3=Cancel F7=Edit Enter=Do	F4=List F8=Image			

Figure 2.3.18.2 Changing "Network Name" from "net_ether_01"

We change the network name to the XD_data network that we created in the previous step.

	Change/Show a Network Interface					
Type or select val Press Enter AFTER						
Node Name Network Interfac IP Label/Address Network Type * <mark>Network Name</mark>	-		[Entry Fields] pc-lon06-glvm-01a en0 pc-lon06-glvm-01a ether [n <mark>et_XD_data_01</mark>]	+		
F1=Help Esc+5=Reset F9=Shell	F2=Refresh F6=Command F10=Exit	F3=Cancel F7=Edit Enter=Do	F4=List F8=Image			



We get a confirmation menu and proceed to the rest of the interfaces.

2.3.19 Defining PowerHA resource group

As mentioned previously, the example configuration will include a single resource group. We define this resource group by executing "smitty sysmirror -> Cluster Applications and Resources -> Resource Groups -> Add a Resource Group". On this menu, we give it a resource group name, RG01 for our example, as well as the participating nodes. We change the "Inter-Site Management Policy" to "Prefer Primary Site". Lastly we select the "Fallback Policy" to "Never Fallback".

	Add a Resou	irce Group (extend	ded)
Type or select va Press Enter AFTER			
* Resource Group I	Name		[Entry Fields] [<mark>RG01</mark>]
	gement Policy odes from Primary odes from Secondar		[Prefer Primary Site] + [pc-tor01-glvm-01a] + [pc-lon06-glvm-01a] +
Startup Policy Fallover Policy Fallback Policy			Online On Home Node O> + Fallover To Next Prio> + N <mark>ever Fallback</mark> +
F1=Help	F2=Refresh	F3=Cancel	F4=List
Esc+5=Reset F9=Shell	F6=Command F10=Exit	F7=Edit Enter=Do	F8=Image

Figure 2.3.19.1 Define a PowerHA resource group

A successfully defined resource group should give the SMIT output similar to this.

			COMM/	AND STATUS		
Command	: OK	stde	out: no	stder	r: no	
Before	command	completion,	additional	instructions	may appear	below.
F1=Help		E2-Pof	resh	F3=Cancel	E	6=Command
F1=netp F8=Imag n=Find	e	F9=She		F10=Exit		=Find

Figure 2.3.19.2 Successfully defined a resource group

2.3.20 Adding resources to the PowerHA resource group

The example configuration will only include the VGs that are being replicated as the resources of the PowerHA resource group defined in the previous step. Again, for more complex PowerHA configuration, review the resources described in section "Chapter 4: Additional Resources".

To add resources to the resource group, execute "smitty sysmirror - > Cluster Applications and Resources -> Resource Groups -> Change/Show Resources and Attributes for a Resource Group". Select the appropriate resource group, "RG01" in our example.

	Resource Group)5				
Move cursor to desired	Move cursor to desired item and press Enter.					
Add a Resource Group	l Delicies for a Decour					
Change/Show Resources	d Policies for a Resources and Attributes for a P					
	oup Run-Time Policies					
	/ Node or Resource Group					
Verify and Synchronia	ze Cluster Configuration	1				
Change/Show	Resources and Attribute	es for a Resource Group				
Move cursor to des	ired item and press Ente	er.				
RG01						
F1=Help F2=Refresh F3=Cancel						
F8=Image F1 /=Find	F10=Exit n=Find Next	Enter=Do				
F9						

Figure 2.3.20.1 Selecting RG to add resources

On the resource group fields, enter the appropriate VGs on the "Volume Groups" field by pressing "F4".

	Change/Show All Resources and Attributes for a Resource Group					
	Type or select values in entry fields. Press Enter AFTER making all desired changes.					
] F	Resource Group Name Inter-site Manageme Participating Nodes	nt Policy	[Entry Fields] RG01 ignore pc-tor01-glvm-01a pc-lon06-glvm-01a			
		Volume Groups				
	Move cursor to desired item and press F7. ONE OR MORE items can be selected. Press Enter AFTER making all selections.					
[M	> dbvg > <mark>appvg</mark>					
F1 Es F9	F1=Help F7=Select Enter=Do	F2=Refresh F8=Image /=Find	F3=Cancel F10=Exit n=Find Next			

Figure 2.3.20.2 Selecting VGs to add to resource group

In our example, we will leave the other fields as default including the "Service IP labels/Addresses" and "Application Controller Name" fields.

Change/	Show All Resources	and Attributes for	or a Resource Group	
	alues in entry fie R making all desire			
Participating	Name agement Policy Nodes from Primary Nodes from Seconda		[Entry Fields] RG01 ignore pc-tor01-glvm-01a pc-lon06-glvm-01a	
Startup Policy Fallover Policy Fallback Policy			Online On Home Node Fallover To Next Pri Never Fallback	-
Service IP Labels/Addresses Application Controller Name			[] []	+ +
Volume Groups [MORE30]			[d <mark>bvg appvg</mark>]	+
F1=Help Esc+5=Reset F9=Shell	F2=Refresh F6=Command F10=Exit	F3=Cancel F7=Edit Enter=Do	F4=List F8=Image	

Figure 2.3.20.3 Adding VGs to resource group RG01

A successful modification should result in a similar screen to this.

	COMM	IAND STATUS	
Command: <mark>OK</mark>	stdout: no	stderr: no	D
Before command	completion, additional	instructions may	appear below.
F1=Help F8=Image n=Find Next	F2=Refresh F9=Shell	F3=Cancel F10=Exit	F6=Command /=Find

Figure 2.3.20.4 Successful RG change

2.3.21 Perform an additional PowerHA verification

We proceed with an additional PowerHA verification by executing "smitty sysmirror -> Cluster Nodes and Networks -> Verify and Synchronize Cluster Configuration". This will present a verification screen.

Cluster Nodes and Networks Move cursor to desired item and press Enter. Verify and Synchronize Cluster Configuration Move cursor to desired item and press Enter. Use arrow keys to scroll. Any time you change the cluster configuration, those changes must be propagated to all nodes in the cluster. PowerHA SystemMirror w perform a set of verification checks to make sure the configuration is viable. Depending on the nature of the changes, this operation can disrupt the applications currently under PowerHA SystemMirror control. Press enter when you are ready to begin. F3=Cancel F1=Help F2=Refresh F8=Image F10=Exit Enter=Do /=Find n=Find Next FQ

Figure 2.3.21.1 Enter to begin PowerHA verification

The resulting output should look something like the following.

	CON	IMAND STATUS	
Command: <mark>OK</mark>	stdout: yes	stderr: n	0
Before comma	and completion, additiona	al instructions may	appear below.
[TOP]			
Clus	n to be performed on the ster Topology ster Resources	following:	
Verificatio	n will interactively corn	rect verification e	rrors.
Retrieving (data from available clust	ter nodes. This co	uld take a few minutes.
	rt data collection on noc rt data collection on noc]		
F1=Help F8=Image n=Find Next	F2=Refresh F9=Shell	F3=Cancel F10=Exit	F6=Command /=Find

Figure 2.3.21.2 Output of PowerHA verification

2.3.22 Starting PowerHA EE

Once PowerHA EE is fully configured, we can start the cluster by starting cluster services. For our example, we start PowerHA by executing "smitty clstart" and change the fields "Startup Cluster Information Daemon" to "true" and "Automatically correct errors found during cluster start?" to "Yes".

	Start	Cluster Services		
Type or select val Press Enter AFTER	ues in entry fiel making all desire	ds. ed changes.		
Start Cluster Se * Manage Resource BROADCAST messag Startup Cluster Ignore verificat	e at startup? Information Daemo	nodes on?	[Entry Fields] now [pc-tor01-glvm-01a] Automatically false true false Yes	+ + + + + +
F1=Help Esc+5=Reset F9=Shell	F2=Refresh F6=Command F10=Exit	F3=Cancel F7=Edit Enter=Do	F4=List F8=Image	

Figure 2.3.22.1 Starting PowerHA services on primary node

The output of this command should be similar to the following screen.

COMMAND STATUS Command: OK stdout: yes stderr: no Before command completion, additional instructions may appear below. [TOP] Verifying Cluster Configuration Prior to Starting Cluster Services. Verifying Cluster Configuration Prior to Starting Cluster Services. There are no active cluster nodes to verify against. Verifying node(s): pc-tor01-glvm-01a requested to start WARNING: No backup repository disk is UP and not already part of a VG for nodes WARNING: For PowerHA SystemMirror to perform monitoring over a network at least two interfaces that reside on separate nodes must be defined to a [MORE...37] F2=Refresh F3=Cancel F6=Command F1=Help F9=Shell F10=Exit /=Find F8=Image n=Find Next

Figure 2.3.22.2 Output of starting PowerHA services

We repeat this process for all cluster nodes.

2.3.23 Verifying PowerHA EE is operating normally

After starting PowerHA EE on all nodes, the AIX GLVM resources, dbvg and appvg, should be on the appropriate node. We log into the primary PowerVS and perform a "df" command.

# df					
Filesystem	512-blocks	Free	%Used	Iused	%Iused Mounted on
/dev/hd4	196608	105208	47%	3073	21% /
/dev/hd2	4784128	329872	94%	40770	50% /usr
/dev/hd9var	1966080	1646824	17%	1783	1% /var
/dev/hd3	458752	453696	2%	52	1% /tmp
/dev/hd1	65536	64784	2%	8	1% /home
/dev/hdlladmir	n 262144	261384	1%	5	5 1%/admin
/proc	-	-	-	-	- /proc
/dev/hd10opt	786432	85096	90%	11482	53% /opt
/dev/livedump	524288	523016	1%	5	1% /var/adm/ras/livedump
/dev/repo00	15335424	66288	100%	2533	25% /usr/sys/inst.images
/ahafs	-	-	-	51	1% /aha
/dev/lv00	2621440	889232	67%	23	1% /tools
/dev/loop0	553760	Θ	100%	138440	100% /mnt
/dev/fslv07	6291456	5758640	9%	2092	1% /appfsl
/dev/fslv05	6291456	5313400	16%	3292	1% /appfs2
/dev/fslv06	6291456	4922056	22%	4189	1% /appfs3
/dev/fslv00	4194304	4084024	3%	1016	1% /data01
/dev/fslv01	4194304	3598480	15%	1945	1% /data02
/dev/fslv02	4194304	4000328	5%	826	1% /data03
/dev/fslv03	4194304	4193008	1%	4	1% /data04

Figure 2.3.23.1 Displaying shared VG mounted filesystems

Note on the above figure that the "dbvg" and "appvg" filesystems are mounted. An additional PowerHA command to display resource status"

• clmgr q RG <RGNAME>

```
pc-tor01-glvm-01a: / >
# clmgr q rg RG01 | head -15
NAME="RG01"
CURRENT NODE="pc-tor01-glvm-01a"
NODES="pc-tor01-glvm-01a"
STATE="ONLINE"
CURRENT_SECONDARY_NODE="pc-lon06-glvm-01a"
SECONDARYNODES="pc-lon06.glvm-01a
SECONDARY_STATE="ONLINE SECONDARY"
TYPE="non-concurrent"
APPLICATIONS="
STARTUP="0HN"
FALLOVER="FNPN"
FALLBACK="NFB"
NODE PRIORITY POLICY="default"
NODE_PRIORITY_POLICY_SCRIPT=""
NODE PRIORITY POLICY TIMEOUT=""
```

Figure 2.3.23.2 Displaying resource group status

The above figure shows the resource group "RG01" being "ONLINE" on node "pc-tor01-glvm-01a" with secondary being "pc-lon06-glvm-01a".

The "clmgr q cluster" command also displays the cluster status. The figure below shows that the cluster is in "STABLE" status.

```
r01-glvm-01a: / >
# clmgr q cluster | head -15
CLUSTER NAME="tor01lon06"
CLUSTER_ID="1372642113"
STATE="STABLE"
TYPE="LC"
HEARTBEAT TYPE="UNICAST"
VERSION="7.2.4.0"
VERSION NUMBER="20"
EDITION="ENTERPRISE"
UNSYNCED_CHANGES="false"
FC SYNC INTERVAL="10"
RG_SETTLING_TIME="0"
RG DIST POLICY="node"
MAX_EVENT_TIME="180"
MAX RG PROCESSING TIME="180"
TEMP HOSTNAME="disallow"
pc-<u>tor01-glvm-</u>01a: / >
```

Figure 2.3.23.3 Querying the cluster status

2.3.24 Testing PowerHA

Once the cluster status is "STABLE" and all nodes are online and the RG is also online, we can perform a failover test.

For our scenario, we will simply reboot the primary node, pc-tor01glvm-01a, using the "reboot -q" command. Note that we cannot use the "shutdown" command as PowerHA has a "hook" into the "shutdown" command and will know that was performed intentionally. Since PowerHA assumes a "shutdown" command is executed intentionally, it will not failover to the next available node. That is the reason we use the "reboot -q" command.

Again, before rebooting the primary node, pc-tor01-glvm-01a, we check to see the VGs are operational.

pc-tor01-glvm-01a: / > # lsvg -o grep -E "db app";df grep -E "appfs data"							
dbvg	-r1-r	, .	-1				
appvg							
/dev/fslv07	6291456	5758640	9%	2092	1% /appfs1		
/dev/fslv05	6291456	5313400	16%	3292	1% /appfs2		
/dev/fslv06	6291456	4922056	22%	4189	1% /appfs3		
/dev/fslv00	4194304	4084024	3%	1016	1% /data01		
/dev/fslv01	4194304	3598480	15%	1945	1% /data02		
/dev/fslv02	4194304	4000328	5%	826	1% /data03		
/dev/fslv03	4194304	4193008	1%	4	1% /data04		

Figure 2.3.24.1 VGs operational at primary node

We also verify that the VGs are not operational on the standby node, pc-lon06-glvm-01a.

pc-lon06-gl # lsvg -o	.vm-01a:/	>					
# lsvg -o	grep -E	"db	app";df	grep	- E	"appfs	data"
1 00 1							

Figure 2.3.24.2 VGs not operational at standby node

On the primary node, we execute the "reboot -q" command.

On the standby node, we watch that the node reacts by monitoring the "hacmp.out" log file using the command "tail -f /var/hacmp/log/hacmp.out".

+RG01:clvaryonvg(169.302):appvg[updatefs:600] clodmget -q 'name = fslv07 and att ribute = type and value = raw' -f value -n CuAt +RG01:clvaryonvg(169.305):appvg[updatefs:600] [[-n '']] +RG01:clvaryonvg(169.305):appvg[updatefs:605] : Skip logical volumes for which g etlvcb fails +RG01:clvaryonvg(169.305):appvg[updatefs:607] /usr/sbin/getlvcb -f fslv07 +RG01:clvaryonvg(174.037):appvg[updatefs:607] fs_info=vfs='jfs2:log=/dev/loglv01 :options=rw:account=false:mountguard=yes ' +RG01:clvaryonvg(174.037):appvg[updatefs:608] typeset -i cmd_rc +RG01:clvaryonvg(174.037):appvg[updatefs:608] typeset -i cmd_rc +RG01:clvaryonvg(174.037):appvg[updatefs:608] typeset -i cmd_rc +RG01:clvaryonvg(174.037):appvg[updatefs:615] : Skip logical volumes not associa ted with file systems +RG01:clvaryonvg(174.037):appvg[updatefs:618] [[-z vfs='jfs2:log=/dev/loglv01:o ptions=rw:account=false:mountguard=yes ']] +RG01:clvaryonvg(174.037):appvg[updatefs:618] [[vfs='jfs2:log=/dev/loglv01:o ptions=rw:account=false:mountguard=yes ']] +RG01:clvaryonvg(174.037):appvg[updatefs:618] [[vfs='jfs2:log=/dev/loglv01:opti ons=rw:account=false:mountguard=yes ']] +RG01:clvaryonvg(174.037):appvg[updatefs:623] : Label and file system type from LVCB on disk for fslv07 +RG01:clvaryonvg(174.038):appvg[updatefs:625] getlvcb -T -A fslv07 +RG01:clvaryonvg(174.038):appvg[updatefs:625] getlvcb -T -A fslv07 +RG01:clvaryonvg(174.041):appvg[updatefs:625] gerep -w 'label =|type =' +RG01:clvaryonvg(174.044):appvg[updatefs:625] paste -s -

Figure 2.3.24.3 Watching "hacmp.out" on standby node

Eventually, PowerHA on the standby node finishes acquiring the resources and we can confirm that by looking at the status of the VGs status and the mounted filesystems.

pc.lon06.glvm.01a:/ >								
# lsvg -o grep -E "db app";df grep -E "appfs data"								
dbvg								
appvg								
/dev/fslv07	6291456	5758640	9%	2092	1% /appfs1			
/dev/fslv05	6291456	5313400	16%	3292	1% /appfs2			
/dev/fslv06	6291456	4922056	22%	4189	1% /appfs3			
/dev/fslv00	4194304	4084024	3%	1016	1% /data01			
/dev/fslv01	4194304	3598480	15%	1945	1% /data02			
/dev/fslv02	4194304	4000328	5%	826	1% /data03			
/dev/fslv03	4194304	4193008	1%	4	1% /data04			

Figure 2.3.24.4 Displaying resources at DR node after failover

Chapter 3: Troubleshooting

The following are some possible problems and resolutions.

3.1 ioctl call failed

When attempting to manipulate disks, you may receive errors that indicate "ioctl call failed" such as the figure below.

pc-tor01-glvm-01a: / >
extendvg -f -p appvg_lon06 appvg hdisk9 hdisk10
0516-1395 extendvg: The physical volume hdisk9, is not supported.
0516-1395 extendvg: The physical volume hdisk10, is not supported.
0516-1941 extendvg: ioctl call failed on hdisk9.
0516-1941 extendvg: ioctl call failed on hdisk10.
0516-792 extendvg: Unable to extend volume group.

Figure 3.1.1 ioctl call failed error

This may indicate the RPV server is not operational on the remote location. Log into the remote location PowerVS and verify the RPV server is operational.

Here we log into our remote PowerVS and restart the RPV servers.

pc-lon06-glvm-01a:/ >				
# lsdev -Čcrpvserver				
rpvserver0 Available	Remote	Physical	Volume	Server
rpvserver1 Available	Remote	Physical	Volume	Server
rpvserver2 Defined	Remote	Physical	Volume	Server
rpvserver3 Defined	Remote	Physical	Volume	Server
pc-lon06-glvm-01a:/ >		-		
# mkdev -l rpvserver2				
rpvserver2 Available				
pc-lon06-glvm-01a:/ >				
# mkdev -l rpvserver3				
rpvserver3 Available				
pc-lon06-glvm-01a:/ > #				
#				

Figure 3.1.2 Changing "Defined" RPV servers to "Available"

3.2 Resuming a failed RPV client

If an RPV client has "failed" such as when we try to use it when the RPV server is down, it will stay in that "failed" state until it is resumed. In our example above (section 3.1), hdisk9 and hdisk10 failed due to the RPV server being down. The RPV servers were restarted and the RPV clients hdisk9 and hdisk10 still failed with the same message.

```
pc-tor01-glvm-01a: / >
# extendvg -f -p appvg_lon06 appvg hdisk9 hdisk10
0516-1395 extendvg: The physical volume hdisk9, is not supported.
0516-1395 extendvg: The physical volume hdisk10, is not supported.
0516-1941 extendvg: ioctl call failed on hdisk9.
0516-1941 extendvg: ioctl call failed on hdisk10.
0516-792 extendvg: Unable to extend volume group.
```

Figure 3.2.1 ioctl call failed error

Taking those two drives and updating them to "resume", we are able to utilized them after the "resume" is processed.

```
pc-tor01-glvm-01a: / >
# chdev -a resume=yes -l hdisk9
hdisk9 changed
pc-tor01-glvm-01a: / >
# chdev -a resume=yes -l hdisk10
hdisk10 changed
pc-tor01-glvm-01a: / >
# extendvg -f -p appvg_lon06 appvg hdisk9 hdisk10
pc-tor01-glvm-01a: / >
#
```

Figure 3.2.2 Resuming RPV clients with chdev command

3.3 When configuring RPV server, available disks are not displayed

An RPV server can only be configured when a disk has a PVID configured. If the PVID is not configured, the RPV configuration panel will not display the drive.

Say we have the following drives as shown on the following diagram.

pc-lon06-glvm-01a:/ >					
# lspv					
hdisk0	none	None			
hdisk1	00c8cf803fb0193a	None			
hdisk2	00c8cf803fb02116	None			
hdisk3	00f6db0af58e9775	rootvg	active		
hdisk4	none	None			
hdisk5	00c8cf803fb029cd	None			
hdisk6	00c8cf803fb03444	None			
pc-lon06-gl	vm-01a:/ >				

Figure 3.3.1 Displaying available drives

We see that hdisk4 is available and want to setup an RPV server with that disk. We go into the SMIT panel to add that RPV server (smitty rpvserver->Add Remote Physical Volume Servers and receive the following message "There are no items of this type".

	Remote Physical Volume Servers					
Mov	love cursor to desired item and press Enter.					
	Remote Physical Volume Server Site Name Configuration List All Remote Physical Volume Servers Add Remote Physical Volume Servers Change / Show a Remote Physical Volume Server Change Multiple Remote Physical Volume Servers Remove Remote Physical Volume Servers Configure Defined Remote Physical Volume Servers					
	ERROR MESSAGE					
	Press Enter or Cancel to return to the application.					
	1800-051 There are no items of this type.					
F1 F9	F1=Help F8=Image	F2=Refresh F10=Exit	F3=Cancel Enter=Do			

Figure 3.3.2 SMIT does not find any available drives for an RPV server

We exit the SMIT panel and add a PVID to hdisk4 using the "chdev -a pv=yes -l hdisk4" command and note that the PVID has been assigned to that drive.

pc-lon06-glvm-01a:/ >						
# chdev -a pv=yes -l hdisk4						
	hdisk4 changed					
pc-lon06-gl						
# lspv						
hdisk0	none	None				
hdisk1	00c8cf803fb0193a	None				
hdisk2	00c8cf803fb02116	None				
hdisk3	00f6db0af58e9775	rootva	active			
hdisk4	00c8cf8049bac9fa	None				
hdisk5	00c8cf803fb029cd	None				
hdisk6	00c8cf803fb03444	None				
pc-lon06-glv	pc-lon06-glvm-01a:/ >					

Figure 3.3.3 Displaying new PVID on hdisk4

When we go back to the RPV server panel and try to select a drive to assign to an RPV server, we now get the following.

Ir			_		
	Remote Physical Volume Servers				
love cursor to desired item and press Enter.					
Remote Physical Volume Server Site Name Configuration List All Remote Physical Volume Servers Add Remote Physical Volume Servers Change / Show a Remote Physical Volume Server Change Multiple Remote Physical Volume Servers					
	Physical Volume Ide	ntifiers			
	esired item and press F7.				
	tems can be selected.				
Press Enter AFTER making all selections.					
# Dhysical Valu	# Dhuries] Malume Dhuries] Malume Identified				
# Physical Volt	<pre># Physical Volume Physical Volume Identifier #</pre>				
hdisk4	00c8cf8049bac9fa				
F1=Help	F2=Refresh	F3=Cancel			
F7=Select	F8=Image	F10=Exit			
F1 Enter=Do	/=Find	n=Find Next			
F9					

Figure 3.3.4 Displaying available disks for an RPV server

We note that hdisk4 is now available as it now has a PVID configured. We can proceed to configuring the RPV server.

Chapter 4: Additional Resources

4.1 AIX Geographic Logical Volume Manager (GLVM) resources

AIX Geographic Logical Volume Manager (GLVM) is a software-based technology for real time geographic data mirroring over standard TCP/IP networks. Listed below are some additional resources.

- <u>https://www.ibm.com/support/knowledgecenter/en/SSPHQG 7.</u> 2/glvm/ha_glvm_glvm.html
- <u>https://www.ibm.com/support/knowledgecenter/SSPHQG 7.2/gl</u> <u>vm/hacmpgeolvm_pdf.pdf</u>

4.2 IBM PowerHA resources

AIX Geographic Logical Volume Manager (GLVM) is a software-based technology for real time geographic data mirroring over standard

- <u>https://www.ibm.com/support/knowledgecenter/SSPHQG_7.2/gl</u> <u>vm/ha_glvm_plan_glvm_mirror.htm</u>
- http://www.redbooks.ibm.com/redbooks/pdfs/sg248434.pdf

4.3 Other resources

- IBM Cloud Power Virtual Server offering:
 - https://cloud.ibm.com/docs/power-iaas?topic=power-iaasgetting-started