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Resource Utilization Using PowerVC Based Auto-Provisioning

Pavan G Yajurvedi[1*], Vishwanath R. Hulipalled[2]

[1]M. Tech Part Time 6* semester Student, Computer Science & Engineering School of Computing & Information Technology REVA University, Bangalore, India
[2]Deputy Director, School of Computing & Information Technology, REVA University, Bangalore, India

**Corresponding Author: yajurvedipavan@gmail.com*

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Abstract— AIX regression test suite execution will take place on every weekly build, and this requires one or more lpars with pre-defined configurations need to be dedicated per job(eg: for specific function/feature/area). and each lpar needs a NIM installation.This model has a limitation of most of the H/W remains unutilized till next execution starts (due to dedicated H/W per job) and reconfigurations to improve utilization involves admin efforts.To address this limitation, we are going with new approach where Lpar/VMs will be created with required config on demand when there is a requirement, and it will be recycled (Memory, CPU, and Disks) immediately once the work is done in automated way with the help of PowerVC

Keywords— VMs. Mem, Proc, storage, PowerVC, HMC, LPAR, FSP

I. INTRODUCTION

PowerVC Virtualization Center is an advanced virtualization and cloud management offering, which is built on OpenStack, that provides simplified virtualization management and cloud deployments for AIX, IBMi, and Linux VMs running on Power Systems. PowerVC is designed to improve administrator productivity and simplify the cloud management of VMs on Power Systems servers. With PowerVC[1] , we can

- Create VMs and resize the VMs CPU and memory.
- Attach disk volumes or additional networks to those VMs.
- Import existing VMs and volumes so that they can be managed by PowerVC.
- Monitor the use of resources in your environment.
- Take snapshots of a VM or clone it.
- Migrate VMs while they are running (live migration between physical servers).
- Remote restart VMs in case of a server failure.
- Use advanced storage technologies such as vdisk mirroring or Global mirror.
- Improve resource usage to reduce capital expense and power consumption.
- Increase agility and execution to respond quickly to changing business requirements.
- Increase IT productivity and responsiveness.
- Simplify Power Systems virtualization management.
- Accelerate repeatable, error-free virtualization deployments.

PowerVC gives Power Systems clients the following advantages:

- It is deeply integrated with Power Systems.
- It provides virtualization management tools.
- It eases the integration of servers that are managed by PowerVM in automated IT environments, such as clouds.
- It is a building block of Infrastructure as a Service (IaaS), based on Power Systems.
- PowerVC integrated with other cloud management tool like Ansible, Terraform or OpenShift and can be integrated into orchestration tools like the Cloud Automation Manager (CAM), VMware vRealize or the SAP Landscape Management (LaMa).
- PowerVC provides also an easy exchange of VM images between private and public clouds

PowerVC[1] is an addition to the existing PowerVM set of enterprise virtualization technologies that provide virtualization management. It is based on open standards and integrates server management with storage and network management.

II. RELATED WORK

HMC is an appliance for planning, deploying, and managing Power Systems servers. It can be used to create and modify logical partitions, including dynamically adding and removing resources from a running partition. HMC allows you to configure and manage servers. One HMC can manage multiple servers, and dual HMCs can provide redundant support by managing the same system.

A local HMC is an HMC that is physically located close to the system it manages and is connected by either a private or public network. An HMC in a private network is a DHCP server for the service processors of the systems it manages. An HMC may also manage a system over an

open network, where the managed system's service processor IP address has been assigned manually using the Advanced System Management Interface (ASMI).

The HMC based related work has been done on AIX test suite for various level of testing in past but HMC based test environment can not be fully used for hardware utilization as most of the resources are dedicated to each Jenkins job and can not be made free to use for other hardware resources, hence best hardware utilization can not be possible using HMC based environment.[2]

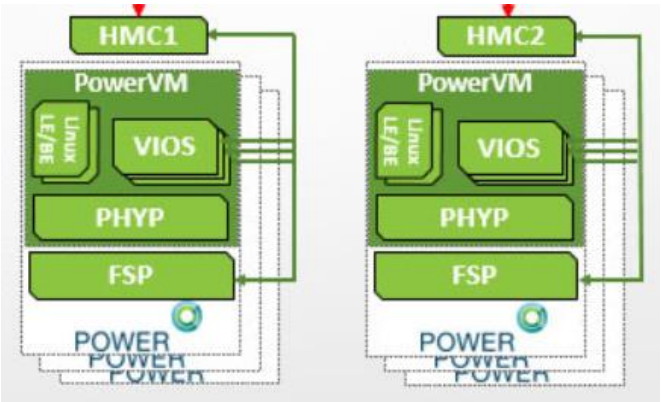

Figure 1

III. METHODOLOGY

OpenStack is a cloud operating system that controls large pools of compute, storage, and networking resources throughout a datacentre, all managed and provisioned through APIs with common authentication mechanisms.

A dashboard is also available, giving administrators control while empowering their users to provision resources through a web interface. Beyond standard infrastructure-as-a-service functionality, additional components provide orchestration, fault management and service management amongst other services to ensure high availability of user applications.

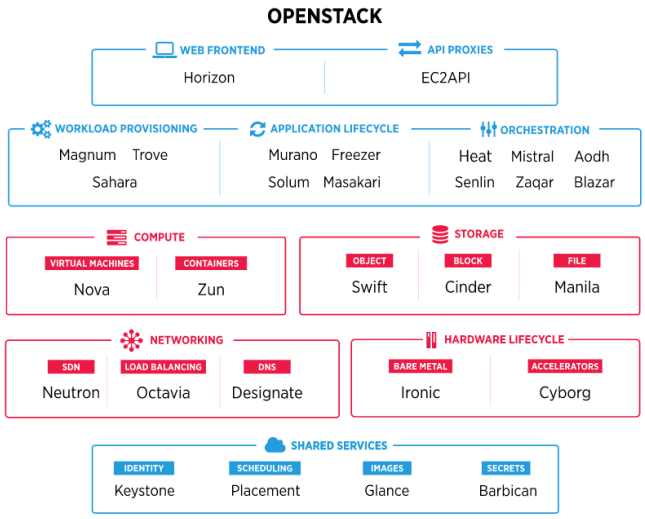

Figure 2

Power VC Functions and Advantages:
Why PowerVC? Why do you need another virtualization management offering? When more than 70% of IT budgets is spent on operations and maintenance, IT clients legitimately expect vendors to focus their new development efforts to reduce this cost and foster innovation within IT departments. PowerVC gives Power Systems clients the following advantages: It is deeply integrated with Power Systems. It provides virtualization management tools. It eases the integration of servers that are managed by PowerVM in automated IT environments, such as clouds. It is a building block of Infrastructure as a Service (IaaS), based on Power Systems. PowerVC integrated with other cloud management tool like Ansible, Terraform or OpenShift and can be integrated into orchestration tools like the Cloud Automation Manager (CAM), VMware vRealize or the SAP Landscape Management (LaMa).PowerVC provides also an easy exchange of VM images between private and public clouds PowerVC is an addition to the existing PowerVM set of enterprise virtualization technologies that provide virtualization management. It is based on open standards and integrates server management with storage and network management. Because PowerVC is based on the OpenStack initiative, Power Systems can be managed by tools that are compatible with OpenStack standards. When a system is controlled by PowerVC, it can be managed in one of three ways:By a system administrator using the PowerVC graphical user interface (GUI)By a system administrator that uses scripts containing the PowerVC Representational State Transfer (REST) application programming interfaces (APIs)By higher-level tools that call PowerVC by using standard OpenStack APIThe PowerVC offerings are positioned within the available solutions for Power Systems cloud as follows: PowerVC: Advanced Virtualization Management PowerVC for Private Cloud: Basic Cloud Cloud Automation Manager: Advanced Cloud VMware vRealize: Advanced CloudIt provides a systems management product that enterprise clients require to manage effectively the advanced features that are offered by premium hardware. It reduces resource use and manages workloads for performance and availability.

PowerVC Requirements:
This section describes the necessary software and hardware components to implement PowerVC to manage AIX.

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Hardware and software information
The following information provides a consolidated view of the hardware and software requirements for both PowerVC and PowerVC for Private Cloud. PowerVC management host and managed hosts The PowerVC architecture supports a single management host for each managed domain. It is not possible to configure redundant PowerVC management hosts that control the same objects. The VM that hosts the PowerVC management host should be dedicated to this function. No other software or application should be installed on this VM. However, you can install software for the management of this VM, such

as monitoring agents and data collection tools for audit or security
Hardware and OS requirements

Table 1

Host type	Supported Hardware	Supported operating systems
IBM PowerVC management server	▸ ppc64le (Power8 and above) ▸ x86_64 Note: Support for PowerVC installation on ppc64 architecture is being withdrawn.	▸ Power Platform: Red Hat Enterprise Linux 8.2 and Red Hat Enterprise Linux 8.3; SLES15 SP1 and SLES15 SP2 ▸ x86_64 Platform: Red Hat Enterprise Linux 8.2 and Red Hat Enterprise Linux 8.3

In the table, the meaning of the processor capacity row depends on the type of host that is used as the PowerVC management host:If the PowerVC management host is PowerVM, processor capacity refers to either the number of processor units of entitled capacity for shared processors, or the number of dedicated processors.If the PowerVC management host is x86, processor capacity refers to the number of physical cores

Resource requirements for 5 hosts, 2 storage providers and 2 fabric

Table 2

Item	Minimum	Recommended				
Number of VMs		Up to 500	501-1000	1001-2000	2001-3000	3001-6000
Processor capacity	1	2	4	8	8	12
Virtual CPUs	2	2	4	8	8	12
Memory and swap space (GB)	22	32	35	40	45	55
Disk used (GB)	80	100	120	140	160	180

Supported AIX operating systems and its version for VMs on the managed hosts

Table 3

Operating system	Little Endian (LE) or Big Endian (BE)	Version
AIX	BE	7.1 TL0, SP0 7.2 TL0, SP0

Approaches:

- To address this limitation, we are going with new approach where Lpar/VMs will be created with required config on demand when there is a requirement and it will be recycled (Memory, CPU, and Disks) immediately once the work is done in automated way with the help of PowerVC.
- Whenever there is a weekly build available for testing, a job(Jenkins) will get triggered and it will install a lpar and capture the AIX image, the captured image will be stored in PowerVC repository.
- When there is a request for a lpar with specific configuration/flavour and lpar will get deployed/created on fly.
- Deployment of VM is quite easy and less time consuming when compared to create+install.
- Since the image is deployed as lpar instead of installation, this reduces load on NIM server and on network traffic.
- As the VM gets created and deleted on demand, it improves resource(CPU and Memory) utilization.
- Allows testing in various configurations (Dedicated, Shared,. VSCSI, VFC).
- It caters requirements of various teams of interested (FVT, AIX Dev, L3, and ISST/ART).

Module Design:
Comparison of Existing Model v/s Proposed Model

In the Proposed model, the PowerVC version connects to multiple HMCs and intern HMC can be connected to Flexible service processor (FSP) and VIOS. PowerVC also connects to SAN and FC switch. Hence new proposed PowerVC model has all build in models connected and easily accessible and manageable from end user and have high efficiency in managing the hard ware resources.

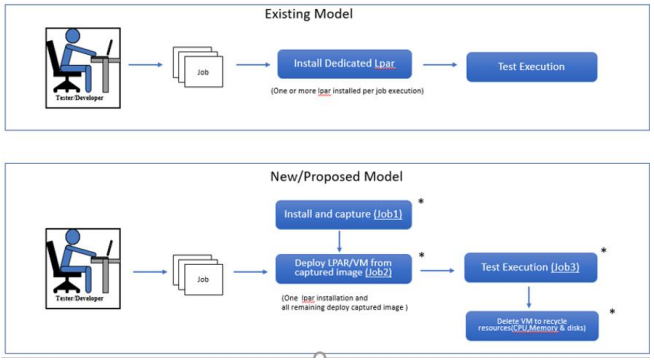


Figure 3

PowerVC Dashboard and GUI representation

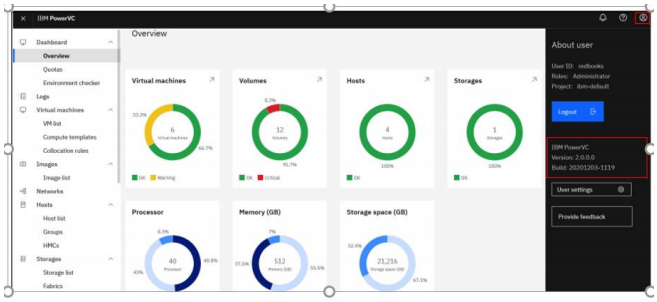


Figure 4

AIX virtual machines
To install VMs when your system runs on the AIX operating system, no additional setup is necessary. After the IP address is configured, an RMC connection is automatically created. The PowerVC, PowerVM, and the HMC rely on the the active RMC services. When these services are down, most of the concurrent and dynamic tasks cannot be run. Make sure the RMC status is active every time you change the VM dynamically.

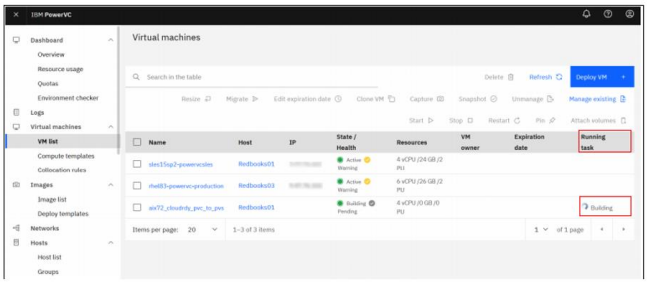


Figure 5

Functional highlights

The new PowerVC version 2.0.0 user interface provides an ease-of-work in terms of the behavioral patterns. Here is a glimpse of the functional highlights. The new user interface is developed asynchronous in most places. When you trigger any resource action, the UI notifies that the action is being processed initiate an Add host or Remove host operation, for any action on a virtual machine, the VM list displays the running task state on the VM list page

Compute Templates and Execution

A compute template provides a predefined compute configuration to use when you deploy a new VM. By default, PowerVC provides six compute templates with different sizes, from tiny to xxlarge and template setup with configuration

– Name of the template – Virtual processors – Processing units – Shared processor pool – Memory

Model Block Diagram:

PowerVC connected to HMC Hardware Management console which connects multiple server having multiple logical partitions, each logical partitions have different AIX images installed. Storage and SAN area can also connected through PowerVC.

Multiple VMs being created using POWER-VC[5][6] model and for each VMs the Jenkins configuration designed and required resources being assigned to each on VMs.

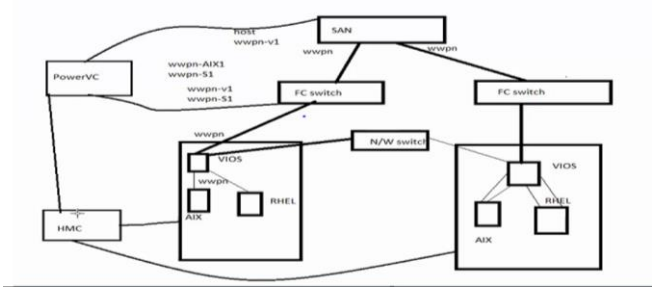


Figure 6

Implementation Method:

Implementation can be done using Ansible or Python programming. Ansible is an open source community project sponsored by Red Hat, it's the simplest way to automate IT. Ansible is the only automation language that can be used across entire IT teams from systems and network administrators to developers and managers.

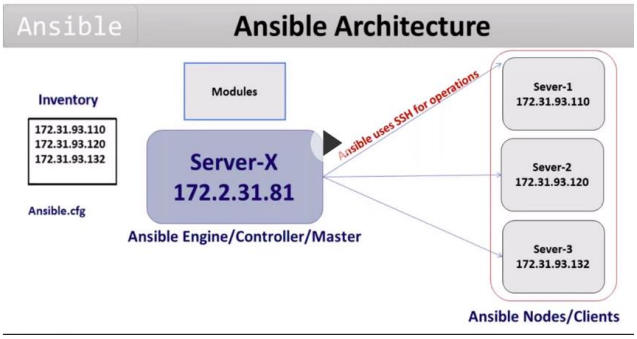


Figure 7

On Power VC the image deployments for logical partition:

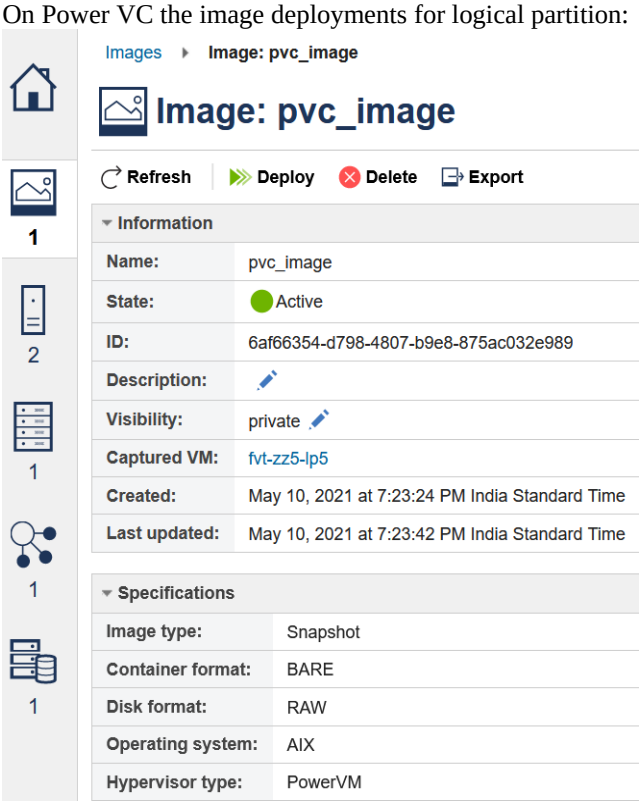


Figure 8

On Power VC Virtual Machine deployments display:

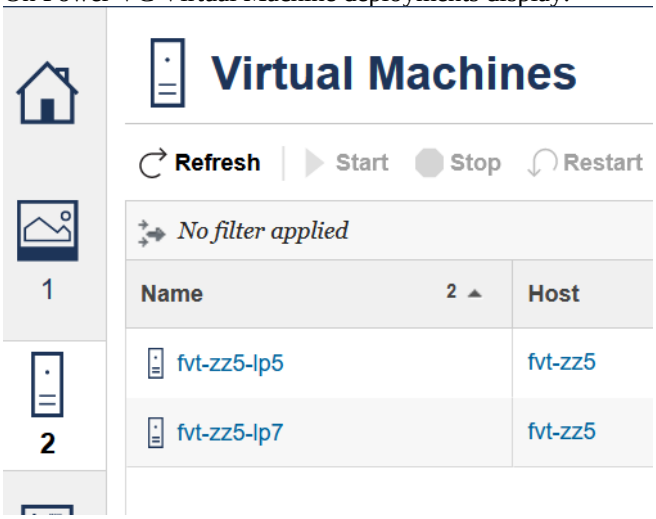


Figure 9

On Power VC Host HMC display :

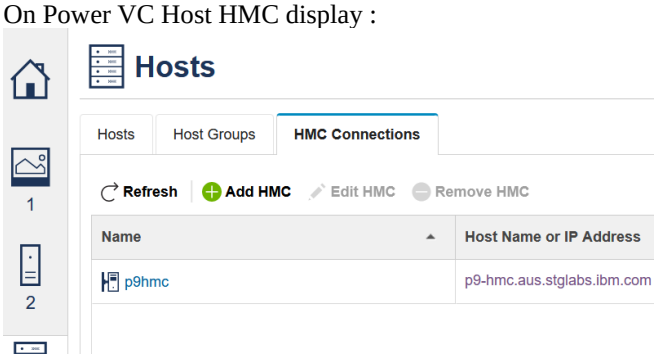


Figure 10

On Power VC Network connectivity display :

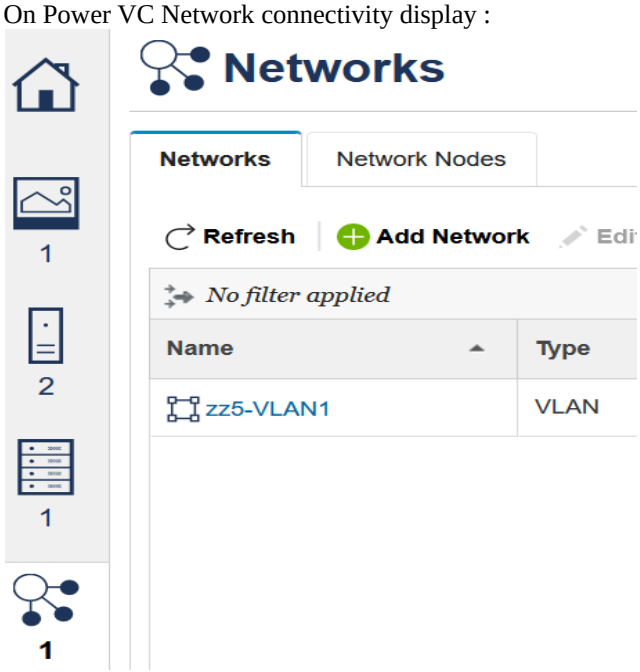


Figure 11

On power VC Storage display :

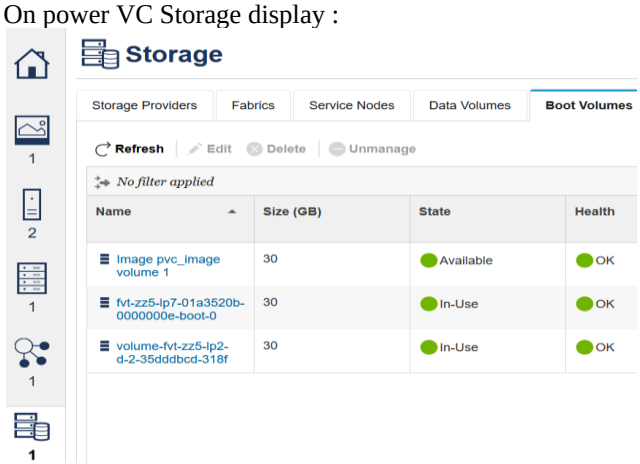
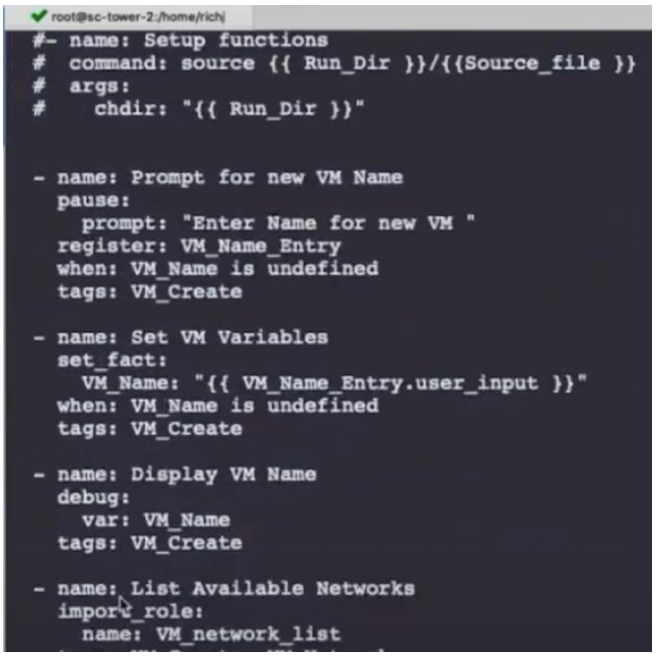


Figure 12

Psuedo Code for implementing VMs virtual machine on Power VC display:



```
#- name: Setup functions
#  command: source {{ Run_Dir }}/{{Source_file }}
#  args:
#    chdir: "{{ Run_Dir }}"


- name: Prompt for new VM Name
  pause:
    prompt: "Enter Name for new VM "
  register: VM_Name_Entry
  when: VM_Name is undefined
  tags: VM_Create

- name: Set VM Variables
  set_fact:
    VM_Name: "{{ VM_Name_Entry.user_input }}"
  when: VM_Name is undefined
  tags: VM_Create

- name: Display VM Name
  debug:
    var: VM_Name
  tags: VM_Create

- name: List Available Networks
  import_role:
    name: VM_network_list
```

Figure 13

Configuration using Jenkins:
Jenkins Job parameters are configured on VMs as mentioned below.

Figure 14

IV. Results and Discussion

In the PowerVC UI model, the user can navigate to the overview sub-menus, which shows utilization statistics such as virtual machines, volumes, hosts, storage, processor, to name a few. Also, the UI displays additional graphs with respect to processor, memory, and storage space.

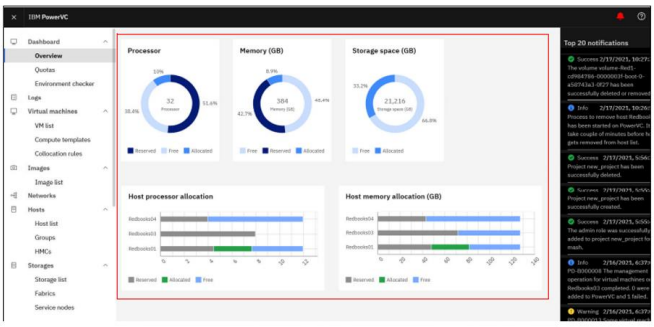


Figure 15

The PoerVC GUI displays the hardware resources utilized for any execution and the utilization can be compared with other test execution best results can be obtained.

V. CONCLUSION AND FUTURE SCOPE

In this paper we have discussed the solution to use PoweVC which helps in best way for hardware utilization with adding benefits. The PowerVM system will be managed by an OpenStack-based cloud controller such as the PowerVC

Our automation procedure simplifies various manual steps and provides benefits for the proposed model are as mentioned below.

There is no requirement of predefined Lpars which eliminates multiple configuration and reconfigurations which in turn helps in less admin work.

Various test configs possible with PowerVC model. eg: vscsi,vnic, veth, vnic.

PowerVC model reduces dependency of NIM server for installing AIX releases, and reduces load on Network and increase the availability of execution by reducing deploy time.

Many Use Cases are identified for the proposed model targeted for use in following areas:

- AIX CT/Auto regression
- CI/Extended unit testing by Dev and L3 team
- ISST/ART lab testing.
- LKU FVT
- AIX BAT testing

Future Enhancements will be possible with proposed model as a enhancements.

- Scalability and extending to multiple CECs
- Currently works for virtual adapter and to be extended for Physical adapters (with few additional scripts)
- Integrating with Ansible playbook for further optimization

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