Agena's cloud gateway

Revision history

Revision	Author	Date	Description
0.75	Jyoti Ranjan	15-June-2019	Investigation and evaluation based recommendation for Agena Cloud Gateway Storage System. It is assumed that KVM hypervisor cluster is used to realize the gateway.
0.85	Jyoti Ranjan	18-June-2019	Updated with vSAN details if we chose ESX for Agena Cloud Gateway. Also, indicated the recommended configuration can be used for compute infrastructure as well.
1.0	Jyoti Ranjan	20-June-2019	Used point based system to objectify evaluation of Agena Cloud Gateway. The scope is enlarged to consider generic gateway's requirement instead of focusing only on storage aspect.

Overview

GreenLake Hybrid Cloud (GLHC) cloud platform is a flagship cloud solution provided by HPE. Gemini is one of the product line up which aims to support **VMaaS** (VM as a Service) and **CaaS** (Container as a Service) in private cloud space with the robustness, simplicity, scalability and pay-as-you go model. The cloud gateway and VMaaS platform including physical infrastructure to create IaaS layer is owned and managed by HPE. Managing and operating the VMaaS cloud life-cycle remotely requires a set of services running on-premises. In order to run these set of services , we need to come up with the choice of physical infra definition, hypervisor stack including compute, network and storage options. Consideration to be given for optimization in terms of number of nodes / resources used within the rack, cost of the option chosen, license requirement etc, as it is mainly the control / management plane. The cloud gateway aims to run on set of management applications layered over very small foot print of physical hardware which can serve the cloud gateway requirement standalone as well as shared storage for the application being part of gateway. It is worth to mention that the discussion is not intended to provide storage use case for end user consuming private cloud as it will need to be solved differently. The shared storage helps to deploy many applications (like high availability solution) which is need by it. At the same time it will be good to define a storage system which can scale along with compute as well as network aspects of cloud (preferred path) gateway, if required. Also, it has to be aligned with hardware eco-system with the goal to lower TCO (total cost of ownership). As we know, the storage requirement is different user cases. For e.g. storage requirement for Agena cloud gateway, Backup for Agena cloud gateway, Agena VMaaS cloud and Backup for Agena VMaaS cloud are going to be different. So, usage of one storage system for all the purpose might not result in effective storage solution and can result into higher TCO or lower performance or high maintainability, which is very important for private cloud space especially in multi-tenant environment. The document focus on Agena cloud gateway and its storage requirement.

Requirement(s), Constraint(s) and Assumption(s)

Requirements	• Need a shared storage system for Agena cloud gateway: VMaaS and CaaS (preferred) • Low foot print in terms of physical hardware. • Limited capacity in stead of ever-growing storage capacity. The required capacity can be reasonably predicted with reasonable accuracy. • Lower total cost of ownership (TCO)

Constraint(s)	• Leverage physical server used to form a compute cluster in stead of independent need of storage system (preferred)

Assumptions	1. The design of Agena cloud gateway as of today is not defined completely but there is clarity on choices we need to consider along with how services will be deployed on the cloud gateway. As of now the following assumptions have been made.
	  • Choices of hypervisor: KVM, ESX and HyperV (no Xen etc).
	  • Management applications will be deployed as virtual machine or appliances. Services within
	  • Some services deployed as appliance might have its own HA while some might rely on high availability of VM.
	2. Only block storage is needed. No need of supportability of file and object storage.
	3. Maintainability is not utmost priority as IaaS layer will be owned and managed by HPE. So, there is levy in terms of technical expertise needed to manage infrastructure.
	4. No specific requirement on storage protocol. It is fine to have RBD or iSCSI or other storage protocol till storage requirement is met.

Choices under consideration

The section evaluates the Agena's cloud gateway. The prime consideration of gateway choices are:

1. Hypervisor
2. Shared storage system for hypervisor
3. Networking support

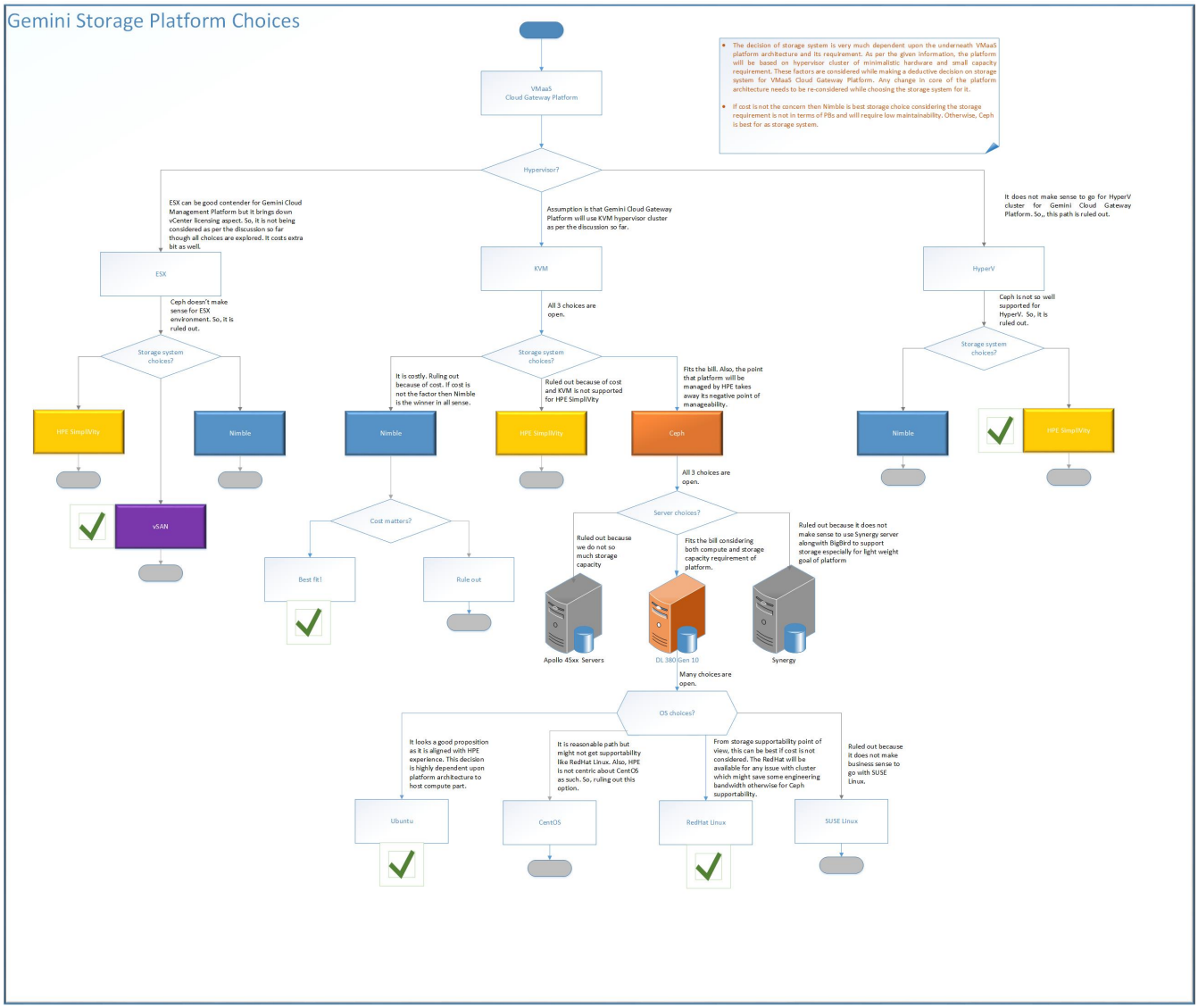
Among the three, networking support is very much tied to hypervisor selection and henceforth it is not discussed in expanded manner. On the other hand, there can be multiple shared storage system choices for a given hypervisor. For e.g HPE SimpliVity, vSAN and Nimble can be storage system choices for ESX hypervisor based cloud gateway. And hence, a detailed diagnosis of storage configuration is needed. It is worth to mention that the parameter will vary greatly if the storage system needs to be built of PB and is meant for user applications or for other purposes like backup etc. So, the reader is requested to keep this view point in mind. So, consider this section as why some of the combination of hypervisor and storage system are being considered and which parameters have critical influence in decision making system

Storage aspect	**HPE Nimble**	**HPE SimpliVity**	**Ceph**	**vSAN**
Compute hardware requirement	No extra hardware, comes with built-in hardware box	• 3 Physical servers with plenty of storage disk • DL 380 should serve the purpose	• 3 physical servers with plenty of storage disks • DL 380 should serve the purpose	• 3 physical servers with plenty of storage disks. Recommendation is for 4 servers for better manageability and performance. • DL 380 should serve the purpose
Minimal compute hardware requirement	No extra hardware, comes with built-in hardware box	• One physical server (not recommended, only for PoC)	• One physical server (not recommended, only for PoC)	• One physical server (not recommended, only for PoC)
Specific host hardware requirement	No specific requirement	• PCIe Accelerator Card	• At least SSD per compute node for journal disk (recommended)	• At least ne SSD per compute node for caching disk
Network requirement	• Separate network for control and data path • At least two NIC (recommended) for storage. Each NIC forms its own VLAN.	• One NIC	• Depends • Separate public and cluster network (recommended). It will require at two NIC used to create two different VLAN.	• Depends • Separate public and cluster network (recommended). It will require at two NIC used to create two different VLAN.

Disk storage requirement	No specific requirement	• Depends upon storage requirement. More disks per server we have, more disk storage we have. All disks have to be SSD.	• At least one SSD per compute • Depends upon storage requirement. More disks per server we have, more disk storage we have	• At least one SSD per compute • Depends upon storage requirement. More disks per server we have, more disk storage we have
Hyper-visor supportability	Hyper-visor agnotics	• ESX • KVM	• KVM	• ESX
Operating system supportability	• Linux flavors • Windows	• ESX • Window	• Ubuntu • RedHat CentOS • RedtHat Linux	• Build component of hypervisor. Tenant VM can have any OS.
Specific host software requirement other than what is needed to implement storage system	• Multi-path software if we are connecting device through more than one path	No	No	No
Can be used as hyper-converged storage system?	No	Yes	Yes	Yes
Storage capacity	Need to be figure out for minimal cost Nimble storage system	Depends upon storage configuration	Depends upon storage configuration	Depends upon storage configuration
Fault tolerance	RAID	RAID 10 mirroring	Replicas	RAID 10 mirroring
Storage protocol meaningful for gateway	iSCSI	NFS	RBD	Native VMDK storage protocol
Thin provisioning to leverage consume bits as you need	Yes	Yes	Yes	Native VMDK storage protocol
Availability	99.9999%	Need to be discovered	Not published. It significantly depends upon how well we manage the storage system.	TBD
Scalabiltiy	Vertically scalable	Vertically and Horizontally scalable	Vertically and Horizontally scalable	Vertically and Horizontally scalable
Performance	Very good	Very good	Good	Very good
Manageability	Easy	Easy	Moderate	Easy
Telemetry	Very good	Very good	Good	Easy
OpenStack compatibility	No	Yes	Yes (Very good)	Yes
Maintainability / Operation cost	Low	Low	Medium	Low
Purchase cost	$40K	• Varies based on the configuration we choose. Proposed model as per the author of the page 'DL 380 Gen 10 Performance 5', which costs around 5000$ per unit. • Extra cost for PCIe card • Extra cost for more number of disks to be attached to physical server • HPE SimpliVity (and vCenter) license. There is no point in going for HPE SimpliVity for HyperV support.	• Varies based on the configuration we choose as well as the deployment strategy we adopt for. For e.g. if we take support from RedHat then we might have to pay. As far as physical server alone is concerned, recommendation is to use 'DL 380 Gen 10 Performance 5', which costs around 5000$ per unit (by author of the page). • Extra cost for SSD disk • Extra cost for more number of disks to be attached to Ceph physical server	• Varies based on the configuration we choose. Proposed model as per the author of the page 'DL 380 Gen 10 Performance 5', which costs around 5000$ per unit. • Extra cost for more number of disks to be attached to physical server • Extra license for vSAN

Evaluation tree

The below diagram illustrates the various choices and reasoning behind it for its positioning for Agena cloud gateway's infrastructure.



Recommended infrastructure for cloud gateway

> ***Note:***
>
> *Although this paper talks about infrastructure related to storage system but it implicitly indicates what compute environment will be for Agena cloud gateway. For e.g. we can very well leverage hypervisor cluster formed with 3 DL 360 Gen10 servers to serve both compute and storage requirement. This goes with all choices where we go for hyper-converged model for cloud gateway. There is one exception if we decide to use Nimble. In that case, our gateway platform will be composed of following entities*
>
> - *3 DL Gen 10 servers to host compute infrastructure*
> - *Nimble array for shared storage system*
> - *iSCSI network to connect compute with storage system*
>
> *In other words, the proposed infrastructure recommends compute infrastructure as well implicitly.*

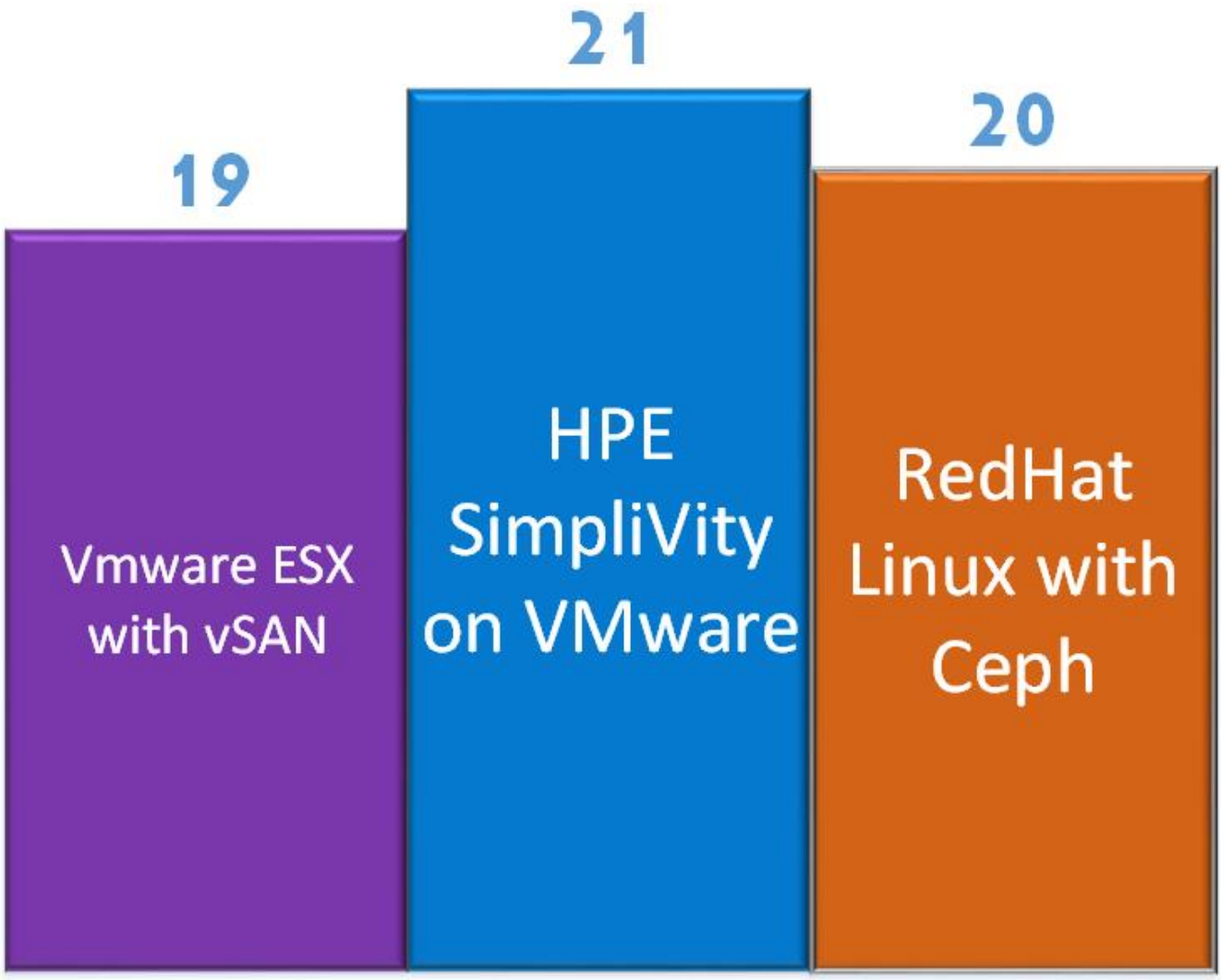
Considering the various factor including the cost, appliances needing shared storage, low maintainability, ease of operation etc, the following 3 has come out of contender for storage system of platform gateway:

- ESX with vSAN
- HPE SimpliVity for Vmware
- Ceph for RedHat Linux Enterprise edition

To make the objective discussion, the point based system is used to rank the above 3 choices based on the parameter which is of importance for decision making. These parameters not only technical evaluation but is based on other aspects of ease of use, business sense, branding etc. The 3 point of rating system is used: 1 - Low value, 2 - Good value and 3 - High value. Here is evaluation matrix-based on 3 point rating system:

	ESX with vSAN	HPE SimpliVity on ESX	Ceph for RedHat Linux Enterprise Edition
Minimal hardware footprint	3	3	3
Belong to HPE or Opensource family of product(s) - helps in branding instead of telling ourselves as VMware shop	0	3	1
Simplified high availability of hypervisor cluster	3	3	2
Supports native services running on baremetal as well as appliances (do we need?)	0	0	3
Ease of day-zero deployment	2	3	1
Ease of maintainability (day-n) post deployment including bug resolution, customer support etc	3	3	1
Available storage capacity with minimal configuration	~3	~3	~3
OpenStack compatibility	2	2	3
Cost including physical infrastructure and licensing	3	1	3
Total	**19**	**21**	**20**

So the winner is HPE SimpliVity on ESX by marginal points as depicted below.



Ranks based on point based evaluation

System configuration

Here is recommended hardware specification for each choices of Agena cloud gateway with more focused on storage system.

Storage system	ESX with vSAN	HPE SimpliVity on ESX	Ceph

Hardware configuration	• 3 DL 380 Gen 10 Performance 5 servers • 192 GB (6 x 32GB) Memory. • 1 NVMe disk per DL 380 Gen 10 server • 8-12 LFF SAS/SATA disk per DL 380 Gen 10 server (varies on specific storage capacity requirement) • HPE Smart Array P408i-a SR Ge 10 Ctrlr • 2 NIC to separate management and storage traffic	• 3 DL 380 Gen 10 Performance 5 servers • 192 GB (6 x 32GB) Memory. • 8-12 SSD disk per DL 380 Gen 10 server (varies on specific storage capacity requirement) • HPE Smart Array P408i-a SR Ge 10 Ctrlr • 2 NIC to separate management and storage traffic (to be confirmed)	• 3 DL 380 Gen 10 Performance 5 servers • 192 GB (6 x 32GB) Memory. • 2 NVMe disk per DL 380 Gen 10 server • 8-12 LFF SAS/SATA disk per DL 380 Gen 10 server (varies on specific storage capacity requirement) • HPE Smart Array P408i-a SR Ge 10 Ctrlr • 2 NIC to separate public and cluster network
Operating system and hyper-visor	ESX	ESX	• Operating system : RedHat Linux (preferred). Next preference will be ubuntu. • Hypervisor: KVM
Raw storage capacity	• Varies with the number of disk we use but will be sufficient for gateway requirement.	• Varies with the number of disk we use but will be sufficient for gateway requirement.	• Varies with the number of disk we use for OSD.
Usable storage capacity	• 50% because of RAID 10	• 50% because of RAID 10	• 1/3 of raw storage capacity
Storage configuration	• Present VMDK volume to appliance	• Present VMDK volume to appliance	• Use RBD to present volume to Virtual Machine • Use thing provisioning • Use R10 volume created from two NVMe disk for journaling • Use ceph tool for manageability • Create separate pool for specific storage purpose • Do not use to launch instance directly on Ceph cluster (not recommended because of performance)
Licensing	• Need vCenter license • Need ESX hypervisor license • Need vSAN license	• Need vCenter license • Need ESX hypervisor license • Need HPE SimpliVity license	• Need RedHat Linux Enterprise edition license • Need RHEA or RedHat Enterprise Linux High Availability license

Quick note on DL 380 vs. DL 360 Gen 10 servers

Above recommendation is made using DL 380 servers because of its proven and availability of technical references. However, this section captures its comparison with DL 360 if cost and real state consumption is a critical aspect to be looked after for. Based on below points, it is recommended to go for DL 380 Gen 10 servers.

Aspects	DL 360 Gen 10	DL 380 Gen 10	Authors comment
CPU	4-28 core	4-28 core	-
Storage capacity	Good	Very good	Having a higher storage capacity per node gives us ability to vertically scale storage requirement if we add more and more services.
Network controller	1 Gb	1 x 4 Gb	it is one critical aspects as high network bandwidth will help to deal with heavy traffic system as we are going to use hyper converged storage system - typically more chattier over network. Also, physical isolation of network can be achieved
Form factor	1 U	2 U	Considering that we are recommending for 3 physical servers, we are not going to get much saving because of low form factor of DL 360. We can place at max one extra DL 380s.

Conclusion

Go for HPE SimpliVity on VMware if we are OK to go with ESX hypervisor. Otherwise, Ceph storage system deployed on RedHat Linux Enterprise Edition is another alternate of we are looking for KVM hypervisor. It does not make sense to go for HyperV considering various reason.