



Information & Communications Technology

**ICT-TS-2020-HCI**

# **Technical Standards**

**HYPER-CONVERGED INFRASTRUCTURE  
(HCI) & ADD ON COMPONENTS**

# 1. Introduction

The components proposed to be supplied by the Contractor or Contractor shall be branded industry proven products. All supplies shall conform to the requirements of relevant International standards. The Contractor shall provide all the required components and services to fulfil the intent of the specification and to ensure the completeness, operation and maintainability of the system at no extra cost to the procuring entity.

The purpose of this Guide is to invite technically complete and commercially competitive proposals from reputed manufactures/authorized representatives for Supply, Installation, Configuration, commissioning and Maintenance of servers & add on components of Hyper Converged technology to build a Hyper-Converged Infrastructure as per Scope of work and Technical Specifications given in the relevant RFP, at Port Moresby and if required at DRS (currently in PPL HQ) or any other alternate site as per PPL's requirement on ongoing basis during the RFP period.

## 1.1 Objectives of the PPL HCI Network

The objectives of the PPL HCI Network project will be the following:

- To achieve e-governance commitment and bring ICT closer to the organisation.
- To provide efficient service management.
- To strengthen Disaster Management Capacity.
- To provide cost-effective ICT services to employees through PPL Power Stations and PPL Business Centres located throughout the country.
- To provide information with regard to schemes and programs of PPL on the Intranet.
- To support the digitalization of PPL processes
- To ensure delivery of services through effective partnership with experienced and proven Service Providers, to be selected through a competitive bidding process.
- To ensure speed, reliability and certainty of delivery of services through enforcement of a Service Level Agreement with the selected Partner.
- To enable the PPL Business units to focus on their core functions and responsibilities by enabling efficient and secure communication and exchange of Data, Voice and Video and reducing the time and cost of travel and thereby enhancing the overall productivity of the administrative machinery.
- To create the right governance and institutional mechanisms for implementation of the project to achieve sustained delivery of services and a network with maximum use of bandwidth.

## 2. Scope of Work

A Broad Scope of work will include but not restricted to the following:

- Supply, install, integrate and implementation of the proposed Hyper Converged Infrastructure, VMware virtualization software licenses as per the RFP to meet the requirement of PPL.
- Install and configure the HCI and VMware virtualization solution and provide support for the delivered components during the maintenance period as per the requirement of PPL.
- Supply updates and upgrades including new versions of all the software licenses supplied as part of this tender during the period of warranty.
- All the hardware, software quoted should be with THREE years back to back warranty with OEMs.
- MAF to be submitted along with the bid as per the MAF annexure.
- Delivery location: PPL, ICT Department, Head Office, Hohola, Port Moresby, Papua New Guinea, 121.
- PPL conducts periodic information security audit by third party or its own officials as per regulatory requirements. In case of any observation by the auditor or PPL own officials for up gradation of any software (including virtualization solution), firmware to mitigate the risk, bidder has to upgrade the software (including virtualization solution) of all equipment supplied by them.
- At PPL Datacentre site, entire solution is to be configured in High availability mode, adding to the existing cluster.
- All peripheral equipment to be supplied along with the solution.
- Any addition requirement regarding hardware and software, after awarding the contract will not be entertained by PPL. The bidder shall be responsible for the same. The cost of any additional hardware and software, if required, should be mentioned in the bill of material.
- Implementation of the entire project to be completed within six weeks from the date of delivery of hardware and software at the site.
- All claims for functional / technical delivery made by the bidders in their responses to the RFP shall be assumed as deliverable, within the quoted financials.
- In case of any damage to PPL property during equipment delivery and installation attributable to the bidder, bidder has to replace the damaged property at its own cost.
- Vendor has to maintain all the versions of HCI solution updated with latest versions after having discussion with PPL officials during the contract period.

# 3. Framework of the HCI CORE architecture

## 3.1 Current Workload

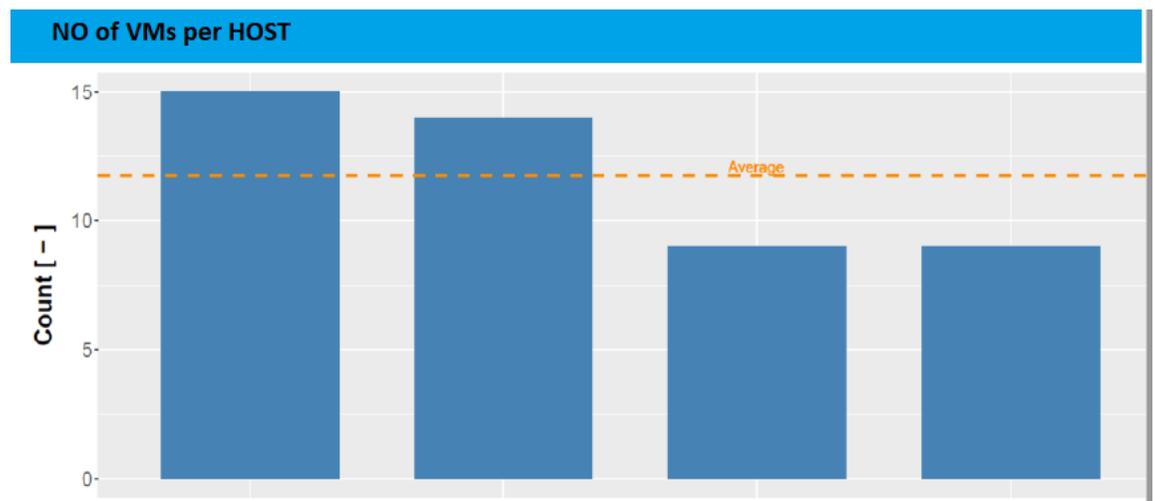
Hosts	CPU & Memory	Storage	VM Details	Average VM	Physical Util
Total Hosts: 4 Clusters: 1 Avg Cluster Size: 4.0	Total Sockets: 8 Total Cores: 80 Total RAM (TB): 1	Provisioned (TB): 17 Consumed (TB): 17 VM Disk: Thick/Thin	Total VMs: 47 vCPUs: 136 vRAM (TB): 1 VM/Physical: 12:1	vCPU: 2.9 vRAM (GB): 15 Used Storage (GB): 366	Avg CPU: 8% Avg RAM: 59% <i>* Point in time snapshot</i>

VM Profile	VM Count	Total vCPU	Total RAM (GB)	Storage (TB)	Average vCPU	Average RAM(GB)	Average Storage Provisioned (GB)
STANDARD	41	102	365	8	3	9	193
OUTLIER	6	34	321	10	6	54	1,638

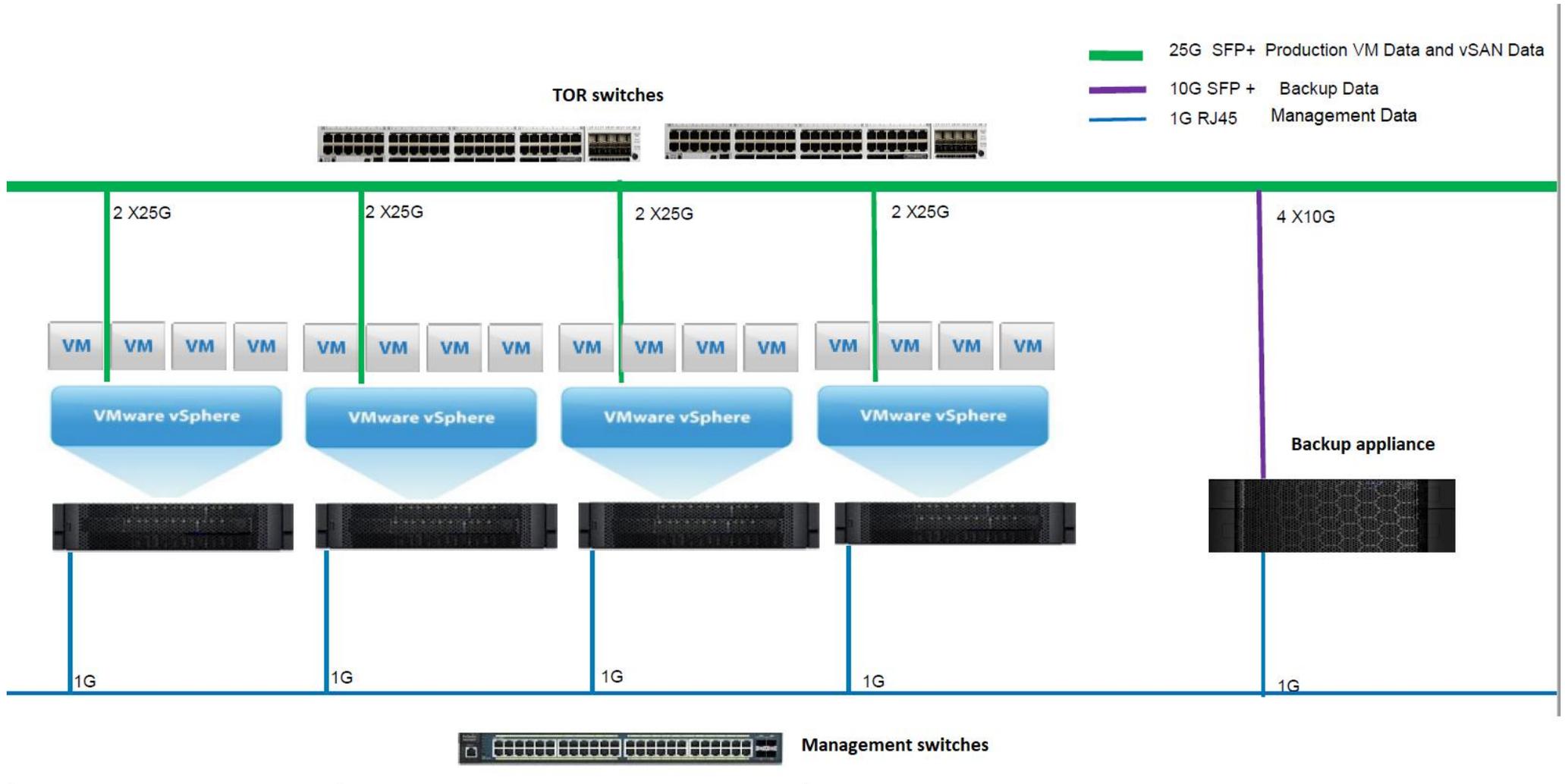
### VM Profiling

- Powered On VMs: 38  
Powered Off VMs: 9
- OS Versions: 7 derived OS types  
VM HW Versions: 0

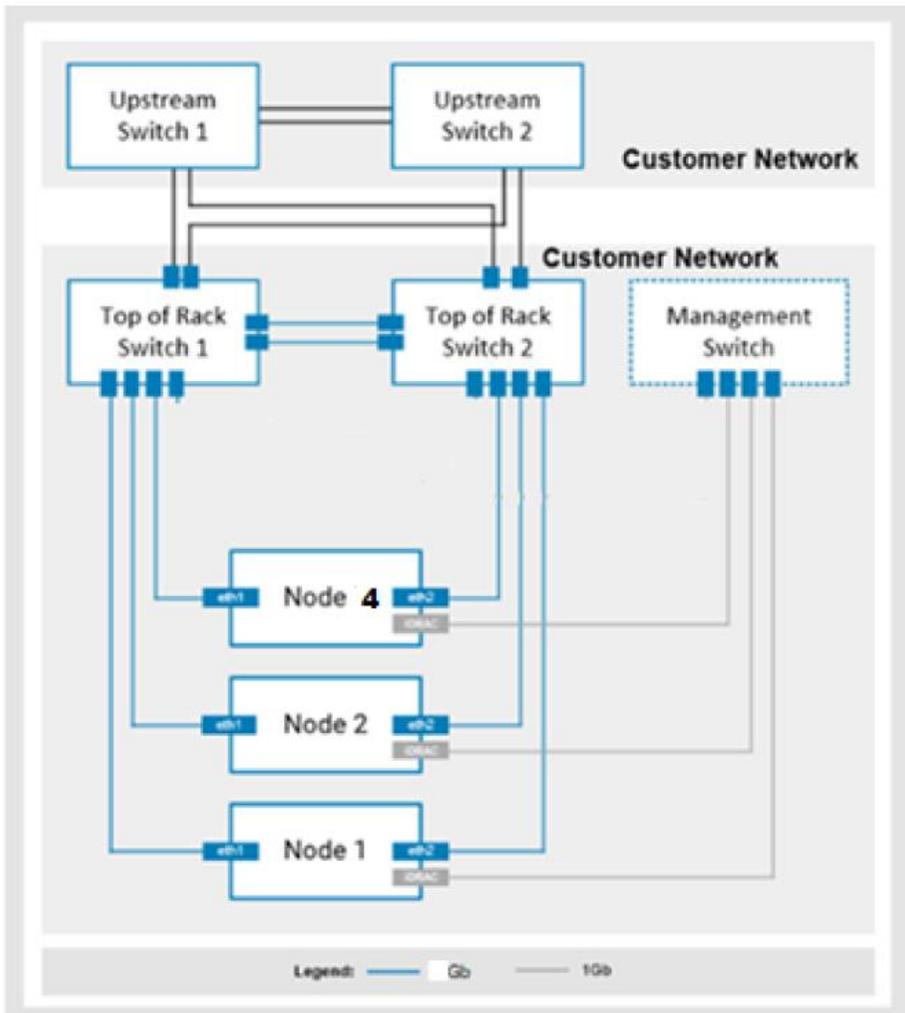
WINDOWS	LINUX	OTHER
Windows 10: 1 Server 2008 R2: 6 Server 2012: 16	CentOS: 1 Red Hat 6: 1 SUSE: 5	Other Linux: 1



### 3.2 Schematic representation of a HCI Core Failover Architect Diagram.



### 3.3 Physical Network Setup and required ports per DC/DR



#### PR Site

##### Per Switch port requirement (ToR)

4X 25 Gb SFP+ & 2 X 10G SFP+

##### Management Switch Ports

5 X 1Gb RJ45

#### DR Site

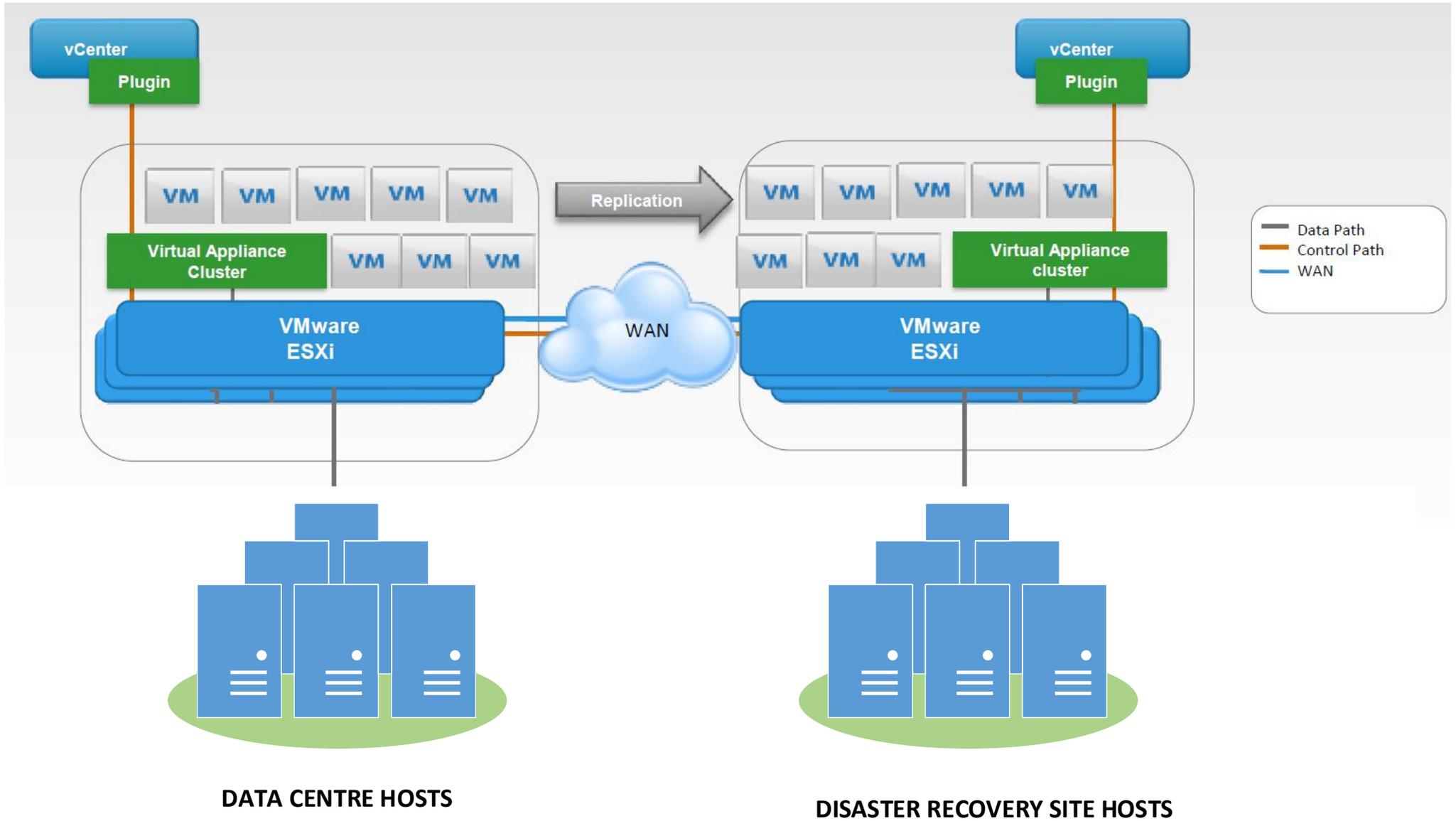
##### Per Switch port requirement (ToR)

4X 25 Gb SFP+ & 2 X 10G SFP

##### Management Switch Ports

5 X 1Gb RJ45

### 3.4 Asynchronous Replication



## 4. Technical Specifications

### 4.1 Hyper Converged Infrastructure Specification

#### Features

- The proposed Hyper Converged Infrastructure can be designed for on-premise or minimum specification for Infrastructure-as-a-Service.
- The proposed solution should be a Hyper Converged infrastructure which should come preinstalled with all software required to meet the requirement mentioned in RFP including SDS (Software Defined Storage), replication with management and associated hypervisor. It should include all hardware and software necessary to ensure high availability mode of operation. The proposed hyper converged system should have Single Management Console to manage integrated Compute, Storage, Hypervisor & Cluster. All nodes must be HCI nodes.
- Technology must be software defined and the solution should provide enterprise-class storage services using latest x86 server infrastructures without dependence on a separate Storage Area Network & associated component such as SAN Switches & HBAs
- The storage solution with the HCI should either have inbuilt software defined storage capability integrated within the Hypervisor kernel itself or should use a virtual storage controller architecture.
- Hypervisor layer should directly sit on the bare metal server hardware with no dependence on a general-purpose OS for greater reliability and security. It should be Industry Standard software and no special purpose software is allowed.
- The HCI solution should be able to scale by adding additional nodes to the cluster at a later point of time to handle compute, Memory & Storage requirements. Solution should support cluster expansion with zero down time.
- Data compression, deduplication, erasure coding techniques should be available with licenses in the Software Defined Storage (SDS) layer for use without additional cost.
- The HCI solution must ensure High Availability and it should in no way affect/degrade the production services & usable resources to the end user application hence HCI solution should be proposed in N+1 configuration, even if one node fails, the remaining nodes should provide user application the specified number of usable physical cores, usable RAM & usable storage capacity as mentioned. There should not be any Data Loss in any case.
- The HCI solution should provide seamless upgrade for Firmware, Hypervisor, Storage OS, SDS software, BIOS and other such functions which are required in the HCI platform. The upgrade should be online and should not mandate any kind of OEM engagement
- The HCI solution should support 3rd party Enterprise Backup Solution of all leading OEM's.
- The HCI Solution should provide a backup catalogue to allow any Virtual Server to be recovered to any specific point-in-time.
- The HCI solution must provide the following Disaster Recovery features and all licenses should be included from day
- The solution must provide a simple failover operation
- The solution must allow creation of a Run book to automate recovery of Virtual Servers
- The HCI solution should have feature failback process to Primary data centre.
- The HCI solution should support to connect external storage devices (like NAS/ SAN etc.) and should be useable as part of the HCI Solution, for the purpose of Backup.
- HCI solution should provide High Availability & It should support features like snapshots & cloning of individual virtual machines.
- HCI solution should support live migration of running virtual machines from one physical node to another with zero downtime, continuous service availability, and complete transaction integrity transparent to users.

- Dashboard to manage and provision virtual machines, network, storage, monitor performance and manage events & alerts. It should also contain a dashboard for monitoring & generate reports.
- The HCI solution should have a single management console for managing compute, Network, Storage and Clustering. The HCI Solution should be able to give insight of underlying infrastructure like compute, storage and network.
- In the event of a node failure, virtual machines should automatically run on another node.
- HCI solution should include Redundant 10G switches providing minimum 48 ports (referred as TOR Switch') with minimum 4 uplink ports of 10G & 2 uplink ports of 40G per switch.
- All the required cables & modules for connecting all HCI nodes to HCI switch should be configured with redundancy in order to ensure HA.
- Bidder must quote appropriate license to enable and meet mentioned features in the infrastructure automation architecture.
- All licenses required for Memory and Storage upgradation with-in the provided solution should be included from Day-1
- HCI solution has to integrate with active directory (AD) /open LDAP to allow importing existing users and groups in addition to creation of local users.
- HCI solution should include an application and infrastructure performance management tool quoted as part of the solution to improve operations and provide insight deep infrastructure performance.
- HCI solution should be capable of increasing the resources such as (RAM, CPU and storage) online.
- HCI solution should have the capability to connect to any public cloud.
- Solution should support with Active-Active stretch cluster for RPO=0. Should have redundancy within site and across site without any extra cost to the Bank.
- The proposed HCI solution must have capability to provide 80% of the IOPS of respective node to any single VM.
- The proposed solution should be a Hyper Converged appliance that comes preinstalled with various software including SDS, replication with management and associated hypervisor. It should include all hardware and software necessary to ensure high availability mode of operation. The proposed hyper converged system should have Single Management Console to manage integrated Compute, Storage and Hypervisor. All nodes must be HCI nodes.
- Technology must be software defined and the solution should provide enterprise-class storage services using latest x86 server infrastructures without dependence on a separate Storage Area Network & associated component such as SAN Switches & HBAs
- The proposed Server Nodes, appliance, Hypervisor software & HCI software should be leader in Gartner/Forrester latest Report. Should be in top 5 in the Gartner Quadrant.
- The storage solution with the HCI should either have inbuilt software defined storage capability integrated within the Hypervisor kernel itself or should use a virtual storage controller architecture.
- Hypervisor software shall provide a Hypervisor layer that sits directly on the bare metal server hardware with no dependence on a general-purpose OS for greater reliability and security. It should be Industry Standard software and no special purpose software is allowed. Proposed Hypervisor software should be in the latest MQ of Gartner
- The HCI solution should be able to scale by support of adding additional nodes to the cluster at a later point of time to handle compute, Memory & Storage requirements. Solution should support cluster expansion with zero down time.
- Data compression/deduplication/erasure coding techniques should be available with licenses (if applicable) in the Software Defined Storage (SDS) layer for use without additional cost.
- HCI solution should include Redundant 10G switches providing minimum 32 ports (referred as 'HCI Switch') with minimum 4\*10G ports for uplinks per switch.
- All the required cables & modules for connecting all HCI nodes to HCI switch in redundant fashion to be supplied from day one.

## 4.2 Minimum Hardware Specification – X86

No	MINIMUM TECHNICAL SPECIFICATION (FOR EACH NODE)	
	Make & Model	LENOVO/NUTANIX/CISCO/DELL/HPE/FUJITSU
1.	Form Factor	The Proposed Server OEM should be in Leaders Quadrant in Latest report of Gartner Modular Servers Max. 2U rack mounted with sliding rails
2.	Each CPU Configuration (Each node must have 2 CPU of same configuration)	Intel Xeon Scalable (GOLD 6200 series with latest Gen) Processors with Minimum dual x 12 Core, Minimum Base frequency 2.40GHz, Minimum Turbo Boost frequency 3.6 GHz,
3.	Memory slots	Minimum 24 DDR4 DIMM slots RDIMMS supporting speeds of min 2666 MHz.
4.	Memory configured	Each Node in Cluster :- 576 GB
5.	Disks Supported	Minimum of 8 x SAS/SATA/SSD 2 x 1.6 TB SSD (Cache) 6 x 4 TB HDD
6.	Disks Requirement	<ul style="list-style-type: none"> <li>RAM 64GB-3,072GB</li> <li>Cache SSD 400GB - 1.6TB SAS 800GB-1.6TB NVMe</li> <li>Flash Storage 1.92TB-76.8TB SAS or SATA</li> <li>Drive Bays 24 x 2.5"</li> <li>Max disk groups 4</li> </ul>
8.	I/O slots	<ul style="list-style-type: none"> <li>Minimum of 4 x PCIe Gen 3 Slots</li> </ul>
9.	Ethernet ports	4x1 GbE RJ45/1GbE iDRAC9 (Optional), 2x25 GbE SFP28, 1 Dedicated Management port (optional)
10.	Interface Ports	Minimum of 1 x VGA/Video Port, 2 x USB2.0/USB3.0 dedicated Management Ports
11.	Certification and Compliances	Microsoft Windows Server, Hyper-V, VMWare, Red Hat Enterprise Linux (RHEL), Acropolis Hypervisor etc.
12.	Power Supply	Platinum rated dual redundant Power Supply
13.	Power & Temperature	Real- time power meter, graphing, thresholds, alerts & Temperature monitoring & graphing through Central Management Console of HCI Solution.
14.	Alert	Should provide predictive failure monitoring & proactive alerts of actual or impending component failure for fan, power supply, memory, CPU, RAID, NIC, HDD
15.	Configuration & Management (optional)	Real-time out-of-band hardware performance monitoring & alerting Agent free monitoring, driver updates & configuration, power monitoring & capping, RAID management, external storage management, monitoring of FC, HBA & CNA & system health Out-of-band hardware & firmware inventory Virtual IO management / state less computing system.
16.	LCD/LED panel (Optional)	Should display system ID, status information and system error conditions in different colours or status LED/LCD available to indicate health of the machine.
17.	HTML5 support	HTML5 support for virtual console & virtual media without using Java or ActiveX plugins

18.	Server Security	Should provide effective protection, reliable detection & rapid recovery using: Secure default passwords Persistent event logging including user activity Secure alerting Automatic BIOS recovery Rapid OS recovery
19.	Compliance justification	All the compliance should be justified with page numbers highlighted with markers and Book marks.
20.	Warranty	5 Years 24/7Warranty Support with 4 Hours Response Time for both Hardware and Software. Bidder should provide L1/L2 Onsite Support for proposed servers including hardware and software components Back-aligns support with respective to OEM mandatorily during warranty period and during AMC period (Bidder must provide documentary proof)
21	End of Life	All the products quoted should be of the latest generation and End of Life should not be announced for the products and components being quoted.

## 4.3 Hypervisor - Technical Specifications

### Features

- The bidder shall propose Support & Subscription services from the direct OEM support 24x7x365 with unlimited incident support and including the unlimited upgrades and updates.
- The bidder shall propose Hypervisor technology from vendors placed in the leaders quadrant in the Gartner 'Magic Quadrant for x86 Server Hypervisor' report
- The bidder shall propose to use the existing hypervisor license in the data centre and renew the subscription for the same, if feasible (or) shall propose a solution with new hypervisor license
- Hypervisor software shall provide a Hypervisor layer that sits directly on the quoted hardware with no dependence on a general-purpose OS for greater reliability and security
- Hypervisor software shall allow heterogeneous support for guest Operating systems like Windows client, Windows Server, Linux (at least Red Hat, SUSE, Ubuntu, CentOS)
- Hypervisor software shall allow taking point-in-time snapshots of the virtual machines to be able to revert back to an older state if required
- Hypervisor software should have the ability to avoid allocating all storage space upfront. Full monitoring capabilities and alerts to prevent from accidentally running out of physical storage space should be there.
- Hypervisor software should support live Virtual Machine migration between different generations of CPUs in the same cluster and without the need for shared storage option.
- Hypervisor software shall have High Availability capabilities for the virtual machines if in case one server/Node fails all the Virtual machines running on that server shall be able to migrate to another physical server running same Hypervisor software.
- Hypervisor software should have the provision to provide zero downtime, zero data loss and continuous availability for the applications running in virtual machines in the event of physical host failure.
- Hypervisor software should provide integration of 3rd party endpoint security to secure the virtual machines with offloaded antivirus, antimalware solutions with/without the need for agents inside the virtual machines.
- Hypervisor software should allow configuring each virtual machine with one or more virtual NICs. Each of those network interfaces can have its own IP address and even its own MAC address, must support NIC teaming for load sharing and redundancy.
- Hypervisor software shall allow creating virtual switches that connect virtual Machines
- Hypervisor software shall support configurations of 802.1q VLANs which are compatible with standard VLAN implementations from other vendors
- Hypervisor software should allow dynamic adjustment of the teaming algorithm so that the load is always balanced across a team of physical network adapters
- Hypervisor software should provide solution to automate and simplify the task of managing hypervisor installation, configuration and upgrade on multiple physical servers.
- Hypervisor software should support for increasing capacity by adding CPU, Memory or any other devices to virtual machines on an as needed basis without any disruption in working VMs running windows and Linux operating system.
- It should provide the ability to set constraints that restrict placement of a virtual machine to a subset of hosts in a cluster and to keep virtual machines paired or separated.
- Hypervisor software shall continuously monitor utilization across virtual machines and should intelligently allocate available resources among virtual machines
- Hypervisor software should provide enhanced visibility into storage throughput and latency of hosts and virtual machines that can help in troubleshooting storage performance issues.

- Hypervisor software shall be able to dynamically allocate and balance computing capacity across collections of hardware resources aggregated into one unified resource pool with optional control over movement of virtual machines like restricting VMs to run on selected physical hosts.
- Hypervisor software should provide proactive High availability capability that utilizes server health information and migrates VMs from degraded hosts before problem occurs
- Hypervisor software should provide HCI/VM level encryption protects unauthorized data access.
- It should support hardware as well as non-hardware accelerated 3D graphics to run Basic 3D applications in virtual machines.
- The solution should provide an option to easily deploy and manage big data solutions like Hadoop& VDI on the Hypervisor platform.

## 4.4 Hypervisor Management Software - Technical Specifications

### Features

- Hypervisor management software console shall provide a single view of all virtual machines, allow monitoring of system availability and performance and automated notifications with email alerts.
- The Hypervisor management software should provide the core administration interface as a single Web based interface. This interface should be flexible and robust and should simplify the hypervisor control through shortcut navigation, custom tagging, enhanced scalability, and the ability to manage from anywhere with Internet Explorer, Firefox, Google Chrome, Opera enabled devices.
- The management software should provide means to perform quick, as-needed deployment of additional hypervisor hosts.
- The Hypervisor should have capability to simplify host deployment and compliance by creating virtual machines from configuration templates.
- Power, storage related and OS cluster related information has to initiate from the relevant sources and can be integrated through RESTful APIs.
- Hypervisor management software console shall provide reports for performance and utilization of Virtual Machines. It shall co-exist and integrate with leading systems management vendors.
- Hypervisor management software console shall provide capability to monitor and analyse virtual machines, and server utilization and availability with detailed performance graphs.
- Hypervisor management software console shall maintain a record of significant configuration changes and the administrator who initiated them.
- Hypervisor management software console shall provide the Manageability of the complete inventory of virtual machines, and physical servers with greater visibility into object relationships.
- Hypervisor management software should provide a global search function to access the entire inventory of multiple instances of Hypervisor management server, including virtual machines, hosts, data stores and networks, anywhere from within Hypervisor management server.
- Hypervisor management software should support user role and permission assignment (RBAC).
- Hypervisor management software should allow to deploy and export virtual machines, virtual appliances in Open Virtual Machine Format (OVF).
- Hypervisor management software should allow reliable and non-disruptive migrations for Physical/ Virtual machines running Windows and Linux operating systems to virtual environment.
- Hypervisor management software should include provision for automated host patch management with no VM downtime.
- Hypervisor management software should be able to integrate into existing standard SPSD systems.
- The management solution for hypervisor should provide Single-Sign-On capability which should dramatically simplify administration by allowing users to log in once to access all instances or layers of management without the need for further authentication

## 4.5 Software Defined Storage – Technical Specifications

### Features

- The proposed solution shall provide software-based enterprise class storage services on commodity x86 servers
- Shared Storage created by clustering server attached traditional magnetic Disks or Flash Disks (like SSDs, NVMeS etc.)
- Can be configured using either Hybrid or All-Flash Storage
- Should provide upgrade path from Hybrid to All-Flash with same set of compatible hardware no disruptively. (in case of Hybrid)
- Should provide high-resilient shared storage capacity for Virtual environment
- Should be integrated with Hypervisor within or outside kernel and No additional VM/Appliance/hardware/software should be required to install.
- Should support all Hypervisor functions like HA, live migration of running virtual machines from one physical server to another with zero downtime, continuous service availability, and complete transaction integrity.
- Should be compatible with Disaster Recovery solutions
- Should support server side read/write caching to reduce storage latency
- Should support snapshots and clones in a Virtual environment
- The software defined storage solution should support Data Locality.
- Should be Hardware independent to provide flexibility of choosing hardware from any server manufacturer.
- Should support non-disruptive Scale-Up (Upgrade by inserting drives in existing empty drive slots) & Scale-Out (Upgrade by adding nodes) upgrades to grow capacity and/or performance whenever required.
- Direct OEM 24x7x365 days AMC & ATS with unlimited incident support and 30mins or less response time including the unlimited upgrades and updates.
- The solution should provide a single unified management console for the management of the entire environment including virtualized environment as well as software defined storage environment. This would simplify the manageability of the entire solution.
- Provide granular VM-Centric controls for managing storage service levels
- Automated self-re-balancing capabilities to align with defined Storage service levels
- The solution should deliver zero data loss capability in case of disk, host, network or rack failure
- The solution should support Online Analytics on Health and provide predictive alerts
- The solution should be able to use hypervisor/VM based replication to asynchronously replicate VMs across sites based on configurable schedules of up to 5 minutes RPO

## 4.6 TOR Switch – Technical Specification

No	Part NO	Description (Minimum)
1	Minimum Ports	48 x 10GBASE-T ports and 4 uplink ports of 10G & 2 uplink ports of 40G
2	Software	latest Version
3	Accessory Kit	3K/9K Fixed Accessory Kit
4	Fan	3K/9K Single Fan, port side intake airflow
5	Power Supply Unit	Nexus NEBs AC 500W PSU - Port Side Intake
6	Power Cord	AC Power Cord - 250V, 10A , Australia
7	Lan License	LAN Enterprise License
8	Optical Cable	100GBASE QSFP Active Optical Cable, 5 meters
9	Adapter	QSFP to SFP10G adapter
10	SFP Module	10GBASE-LR SFP Module
11	Other	Any other software/ Hardware needed to run the cluster

## 4.7 RACK – Technical Specification

### Features

- All the relevant product brochures and manuals must be submitted
- RACK should be same make as that of server/node make i.e. OEM make
- Standard 42U 800mmW/1000mmD fully perforated front & back door and side panels, holes should be evenly distributed from top to bottom to permit adequate airflow (equivalent to 64 percent open areas for ventilation), preferably black Color.
- Should have 42U of vertical mounting space and the servers, KVM and Monitor Console should fit into the rack and necessary rack mount plates/kits to be provided.
- Rack doors should having locking arrangements both front panel and rear panel
- Adequate clearance between the installed rack component and the side panels of the rack
- 1 x Earthing Kit, One number Cable Manager Horizontal 1U
- The bidder should provide 2 (two) nos. Power Distribution Units (PDU) - PDU should have a 32A MCB, a neon Indicator, 16 x IEC C13 Sockets (5 A / 15 A) and at least 3.0 meter cable for connection to the external power source
- Castors (One set of 4) , One number Stationary Shelf , 1 x Keyboard tray rotary with slides , 2 x mounting hardware (Each Pack of 10)
- 1 x Temperature Indication Unit
- 2 x Cat6 24 port 1 RU Jack Panel for Rack
- The bidder should terminate the Jack Panel and its necessary components using Cable Manager
- The bidder shall have to mount new servers/nodes in the rack and will have to provide the rack mounting kit accordingly
- Compliance to EIA-310-D. The bidder has to supply Rack design diagram
- Appropriate Cables for connecting Keyboard, Monitor, Mouse etc. to be provided
- Supporting 1000 Kgs load. Bottom cover with knock out holes for cable entry to be provided
- Three pairs of horizontal support shall be fitted on both right and left sides
- Fans to be mounted on Rear Door / Roof
- Copper based Electrical Grounding / Earthing Strip

## 4.8 Backup Storage – 50TB useable capacity SAS drives

No.	Attribute	Specification
1	Form Factor	2U12 LFF controller enclosure 2U rack mount.
2	Controller configuration	Dual active-active controller configuration with automatic load balancing.
3	RAID levels	RAID 0, 1, 3, 5, 6, and 10; Dynamic Disk Pools.
4	Controller cache	16 GB per system (8 GB per controller). Cache mirroring between the controllers. Flash-backed cache protection (includes battery for destaging to flash).
5	Drive bays	Should support Intermix of 2U24 SFF and 2U12 LFF enclosures
6	Drive technology	12 Gb SAS and NL SAS HDDs, 12 Gb SAS SSDs.
7	Drive expansion connectivity	Should support Intermix of HDDs and SSDs within a system 2x 12 Gb SAS x4 (Mini-SAS HD SFF-8644) expansion ports on each of two controllers in the controller closure for the attachment of the expansion enclosures 4x 12 Gb SAS x4 (Mini-SAS HD SFF-8644) expansion ports on each of two I/O modules in the expansion enclosure for the attachment to the controller enclosure and daisy chaining of the expansion enclosures.
8	Drives	Should support SSD, SAS, NL SAS Drives
9	Storage capacity	Scalable up to minimum 1PB200 TB
10	Host connectivity	<ul style="list-style-type: none"> <li>• Base ports (per controller enclosure with two controllers):</li> <li>• 4x 10 Gb iSCSI (DAC or SW fibre optics, LC) or 8/16 Gb FC (SW fibre optics, LC) SFP+ host ports (2 ports per controller)</li> <li>• Optional additional ports on host interface cards (per controller enclosure with two controllers):</li> <li>• 4x 12 Gb SAS host ports (Mini-SAS HD, SFF-8644) (2 ports per controller)</li> <li>• 4x 1/10 Gb iSCSI RJ-45 host ports (2 ports per controller)</li> </ul>
11	Host operating systems	Microsoft Windows Server 2012 R2 and 2016; Red Hat Enterprise Linux (RHEL) 7; SUSE Linux Enterprise Server (SLES) 12; VMware vSphere 6.0 and 6.5.
12	Standard software features	Dynamic Disk Pools, SSD read cache, snapshots (up to 128 targets), volume copy, thin provisioning (DDP only), and data assurance.
13	Optional software features	Snapshots (up to 512 targets), asynchronous mirroring.
14	Performance*	<ul style="list-style-type: none"> <li>• Minimum 100 000 random read IOPS (4 KB blocks).</li> <li>• Minimum 35 000 random write IOPS (4 KB blocks).</li> <li>• Minimum 3 GBps sequential read throughput (64 KB blocks).</li> <li>• Minimum 0.9 GBps sequential write throughput (64 KB blocks).</li> </ul>
15	Cooling	Redundant cooling with the fans that are built into power supplies.
16	Power supply	Two redundant hot-swap 913 W (100 - 240 V) Platinum AC power supplies.
17	Hot-swap parts	Controllers, I/O modules, drives, power supplies, and SFP+ transceivers.

18	Management ports	<ul style="list-style-type: none"> <li>• 1x 1 GbE port (UTP, RJ-45) per controller for out-of-band management.</li> <li>• 2x Serial console ports (RJ-45 and Micro-USB) for system configuration.</li> <li>• In-band management via I/O path.</li> </ul>
19	Management interfaces	System Manager web-based GUI; SAN Manager standalone GUI; SSH CLI; Serial console CLI; SMI-S Provider; SNMP, email, and syslog alerts;
20	Security features	Secure Socket Layer (SSL), Secure Shell (SSH), user level security, role-based access control (RBAC), and AD/ LDAP authentication.
21	Hardware warranty	5 years onsite support with 4 hours response time for both hardware and software

## 4.9 Backup Management System

### Specification

- Solution should provide a backup catalog to allow any Virtual Server to be recovered to any specific point in time; Data recovery process should be simple with an RTO in minutes
- Backup Window: Daily incremental, Week Differential and Monthly Full Backup
- Retention Policy: 90 Days
- Solution provider should supply 50TB NAS Storage for Backup purpose and should to expandable to 200 TB at any point of time and brand should as server brand

## 4.10 Software Licenses

### Specification

- Hypervisor & SDS licenses should be perpetual on the supplied appliance.
- Hypervisor & SDS licenses should keep on working post end of OEM support.
- Backup software license should be either TB based or processor based perpetual license

## 4.11 Integration and Commissioning

### Specification

- Integration shall include the hardware installation as well as software installation and configuration of all the modules and requisite dependencies for ready launch of sample virtual machine from templates.
- All existing virtual machines should be migrated to new setup without any failover and downtime.