



TERMS OF REFERENCE FOR THE SUPPLY, DELIVERY, INSTALLATION, TRAINING, TESTING, AND COMMISSIONING OF BIG DATA CLUSTER STORAGE ENHANCEMENT

A. OBJECTIVE

With the rapid increase in data generated by weather satellites and real-time meteorological information, there is a continuous demand for additional storage capacity in the Weather Division (WD) and throughout PAGASA concerning data safekeeping and retrieval. Upgrading file storage systems can lead to faster data access and retrieval times, which are essential for maintaining operational efficiency and improving the WD user experience. Modern storage solutions often incorporate advanced security features, such as adaptive data protection techniques, including encryption and access controls, which are crucial for protecting sensitive information against cyber threats and data breaches.

Given concerns about possible backdoors or vulnerabilities in products from specific manufacturers, especially those associated with countries experiencing geopolitical tensions, assessing the track record and global reputation of the storage manufacturer/provider can impact procurement choices. PAGASA may evaluate local or international data storage providers that better align with the country's data security and compliance standards.

Enhancing and expanding file storage is about keeping up with data growth and improving overall performance, security, and operational efficiency. In conclusion, enhancing high-density, high-performance cluster file storage is vital for the safekeeping of the Weather Division (WD), which is facing the challenges of continuous data volume growth. By leveraging cutting-edge technologies and innovative storage system designs, WD can achieve efficient, reliable, and scalable solutions that meet its dynamic data storage needs.

B. APPROVED BUDGET FOR THE CONTRACT (ABC)

The Approved Budget for the Contract is **SEVENTY MILLION PESOS (Php70,000,000.00)** inclusive of VAT and all applicable government taxes.

C. DELIVERY PERIOD AND PLACE OF DELIVERY

The Winning Bidder shall deliver all hardware and software components including configurations, testing, and commissioning at PAGASA WFFC Building, Senator Miriam P. Defensor-Santiago Avenue, Quezon City within **ninety calendar days (90 c.d.)** commencing from the date of issuance of the Notice to Proceed (NTP).

D. TECHNICAL SPECIFICATIONS AND REQUIREMENTS

These specifications outline the requirements for the supply, delivery, installation, training, and commissioning of the Big Data Cluster Storage system. All design, materials, manufacturing techniques, and workmanship must adhere to the highest accepted international standards for this kind of system.

1. SYSTEM ARCHITECTURE

a) Storage system features:
1. Storage architecture must be a file-distributed storage (DFS), scale-out system that specifically manages files rather than blocks or objects.
2. With a minimum USABLE storage capacity of at least 3 Petabytes
3. Files or data are distributed across multiple servers or nodes, which can be located in different physical locations or data centers to provide data resiliency through disk or node-level distribution and must support replication technologies for site-to-site disaster recovery.
4. Users can access files as if they were located on a local file system, even though the files are spread across multiple nodes.
5. Storage expansion must be scale-out technology, by just adding nodes without disruptions to the running operation of the clustered nodes
6. DFS often includes data replication to ensure fault tolerance and data availability. If one node fails, the data can still be accessed from another node.
7. It can easily scale out by adding more nodes to the system, allowing for more storage capacity and improved performance.
8. Storage Operating System (OS) must be a file fabric software that is designed to provide scalable, high-performance file storage with features like data protection, erasure coding, and seamless integration with cloud services.
9. Centralized operation management and real-time analytics dashboard showing access control, usage monitoring, system health status, and firmware update management.
10. Uses Adaptive Data Protection to optimize data protection configurations as clusters grow, improving failure tolerance and storage utilization without impacting performance.
11. Integration with data security software features to enhance data security by protecting data from accidental or malicious deletion.
12. With advanced Erasure Coding to efficiently handle massive files, ensuring small files are managed as effectively as large ones.
13. With advanced data protection techniques such as erasure coding, replication, snapshots, and FIPS140-2 encryption to ensure data integrity and security.
14. Management GUI must be an intuitive self-management, with REST API for programmatic management, built-in real-time analytics for visibility and control, and directory-based capacity quotas
15. The real-time analytics dashboard must provide an intuitive cloud management experience, featuring access control, usage monitoring (to prevent bottlenecks), system health status, and firmware management.

16. Must support NFS, SMB, S3 API, FTP protocols
17. Shall have two 25GbE NIC ports for fast data transfer and connectivity
18. Connection between nodes and switch must be using the 25GbE SFP28 ports
19. Must support continuous asynchronous replication across the cluster
20. Can be configured with a mix of Large Form Factor (LFF) and Small Form Factor (SFF) drives to balance cost and performance.
21. Equipped with redundant, consistent, and reliable power supplies.
22. With flexible drive bays to support up to 28 LFF with 4 NVMe-capable SFF, 24 LFF with 12 NVMe-capable SFF, or 60 SFF hot-plug drive bays, or can support to 20 by 20TB per disk/node.
23. With a serviceable 2U or 1U (4-node) design to save data center space and allows for easy serviceability with hot-plug drives. All storage nodes, including storage switches, must be installed in a single 42U data cabinet.
b) Storage switch features:
1. Must be ideal for modern server and storage networks that provide fast, reliable, and cost-effective connectivity with predictable performance.
2. Must be a high port-density switch in a 1U form factor with 48 SFP28 25GbE ports and minimum of 6 QSFP28 100GbE ports, providing flexible connectivity options.
3. Must provide ultra-low latency of under 425 ns port-to-port.
4. Capable of forwarding 100% capacity wire-rate performance with zero packet loss across all ports concurrently at 25GbE and 100GbE speeds while transferring data across both Layer 2 and Layer 3 networks.
5. Must deliver predictable and consistent throughput of at least 3.0 Bpps processing capacity regardless of the transfer packet size.
6. Must deliver consistent throughput line rate across each port & packet size, ensuring reliable performance even under heavy workloads.
7. Must have 2 x 25GbE SFP28 connection per node to provide high throughput and redundant connectivity between nodes.
8. Must have separate frontend and backend connectivity of storage nodes to avoid bottlenecks during data reconstruction and dynamic storage tiering (DST) on frontend services.
9. Must support Remote Direct Memory Access (RDMA) and TCP Offload Engine (TOE) to improve transmission performance.
10. With flexible port configuration of various speeds, including 1, 10, 25, 40, 50, and 100 GbE, providing future-proofing for evolving network needs.
11. Must be bundled with any Linux Network Operating System (NOS) to simplify network management and provide robust performance.
12. The switch NOS must support centralized remote management for software updates, remote debugging, and system monitoring, along with additional features such as self-healing systems.

13. The switch NOS must have an object-oriented management tool that enables any APIs to tie into NOS management, including REST, gRPC, RestConf, NetConf, and OpenConfig.
14. Must be designed with efficient airflow to help maintain optimal operating temperatures in data centers.
15. Must have a Layer 3 (L3) features of IPv4/v6 routing suite including OSPFv2, OSPFv3, and BGPv4/v6; Virtual routing and forwarding (VRF) & VRF route leaking.
16. Must have a Layer 2 features of Bridge management
17. Must have system management features of in-service software upgrades; native Linux management tools, automated install and provisioning; snapshot and rollback of the entire system to eliminate risk from system updates.

2. HARDWARE INFRASTRUCTURE

a) HIGH-PERFORMANCE STORAGE NODES

Constitute at least **SIXTEEN (16) UNITS of 2U STORAGE NODES OR EQUIVALENT 1 U, 4 NODES DESIGN** to form a unified data storage system across multiple servers appearing as a single entity to users and applications. Each node must have at least:

1. 2 x Intel Xeon 4310 (2.1GHz/12C/120W) processors or better
2. 128GB DDR4 Smart Memory or equivalent
3. Redundant hot-swap power supply.
4. 24 x 10TB SATA LFF LP or a total raw capacity of 240TB
5. Ethernet interface of 25GbE SFP28 at least 2-ports
6. Each node must support up to 24x 10TB SATA Large Form Factor (LFF) hard disk drives (HDDs) for data storage, with options for additional Small Form Factor (SFF) drives.
7. Must have a 3-year warranty on parts and onsite support.

B. HIGH PORT DENSITY STORAGE SWITCH:

Must have at least **TWO UNITS of 1U STORAGE SWITCH** to provide ultra-low latency connectivity between nodes, redundancy, and high availability.

- b) With at least 48 x 25GbE SFP28 ports and at least 6 x 100 Gb QSFP28 ports.
- c) The 48 SFP28 with at least 6 QSFP28 ports must deliver predictable performance and zero packet loss at line rate across each port and packet size.
- d) With aggregate switch bandwidth of at least 4.0 Terabit per second (Tbps).
- e) With flexible port configuration of various speeds: 1, 10, 25, 40, 50, 100GbE
- f) Supports media types of QSFP28, SFP28, SFP+, SFP.
- g) Management software must be NVIDIA® Cumulus Linux® or similar.
- h) Native Linux management tools like OpenSSH, SCP, and FTPS.
- i) Form factor: 1U chassis with dual power supplies and at least four fan trays
- j) Must have a 3-year warranty on parts and onsite support.

c) SYSTEM ACCESSORIES

Must include **ONE LOT of SYSTEM ACCESSORIES** to provide a reliable connection between nodes for the efficient performance of cluster storage. Below cable accessories are the minimum requirements for connectivity between nodes:

1. 25GE SFP28 SR 30m XCVR or equivalent (32 sets)
2. Premier Flex LC/LC OM4 2f 15m or equivalent (36 sets)
3. 10G SFP+ SR Transceiver or equivalent (4 sets)
4. QSFP/SFP+ Adaptor Kit or equivalent (4 sets)
5. Other needed cables, transceiver modules, and accessories

d) MULTI-PURPOSE HIGH-END LAPTOP (2 units)

1. 17.3 UHD 120Hz display or higher
2. Intel Core i9 13950HX Processor or higher
3. Memory 16GB RAM
4. Hard disk 1TB SSD
5. Graphics 8GB GB
6. I/O Ports (RJ45 LAN port
7. HDMI 2.1, USB 3.2 Gen 2 Type-C & Thunderbolt 4 support DisplayPort)
8. With Windows 11 & latest Microsoft Office (1-time license)
9. With an optical mouse and backpack for the laptop
10. With complete accessories and 1-year standard warranty.

E. ADDITIONAL REQUIREMENT

ISO certifications are crucial in data storage as they establish standardized protocols that ensure data integrity, security, and operational efficiency. Therefore, the Manufacturer or the product offered must have at least 1 relevant global certifications and compliance:

ISO 9001 – ensures consistent delivery of high-quality products and services while continually improving processes.

Adhering to this internationally recognized standard, the manufacturer can enhance the credibility of their product, and assure clients that their sensitive information is managed and stored appropriately.

F. ELECTRICAL AND DATA NETWORKING

Since the new cluster storage system will be installed at the newly established modular data center, the system's uplink network will be integrated into the modular data center's ethernet facility. Also, it shall be accessible to users in the WFFC building. Furthermore, the power requirements of the new cluster system will be fitted to the electrical power facility of the data center. The Winning Bidder will cover all expenses related to the installation of necessary networking and electrical peripherals, accessories, modules, and cables. Therefore, Prospective Bidders are encouraged to conduct an ocular visit to the modular data center at the PAGASA WFFC compound, where the equipment will be installed.

G. TRAINING/TECHNOLOGY TRANSFER

To provide knowledge and proficiency, the Winning Bidder must provide comprehensive, advanced training for at least eight (8) personnel for three (3) days, who will be tasked to manage, monitor, and maintain the new big data cluster storage system. The participants, recommended by WD, must have a basic knowledge of maintaining high-density, cluster storage systems. The trainor/s must be brand-certified professionals and must have a solid background in operating and maintaining the offered high-density, cluster storage systems. The workshop sessions shall be conducted face-to-face environment. The Winning Bidder must provide the participants with training materials and meals (and transportation if conducted outside the PAGASA office).

H. FACTORY ACCEPTANCE AND TRAINING

The Factory Acceptance Training (FAT) shall be attended, witnessed, and accepted by at least five (5) personnel from the Weather Division's top or middle management staff and key technical staff involved in storage. The activity shall be conducted within seven (7) calendar days including travel time at one of the manufacturer's factory sites, and the activity shall include Technology Trends and Innovation sessions. All related expenses, such as round-trip airfare, transportation, lodging/ accommodation, and daily allowances (based on UNDP rates) for each participant shall be shouldered by the winning bidder.

I. SYSTEM COMMISSIONING AND DOCUMENTATION

The Site Acceptance Test (SAT) will be carried out at the new modular data center located within the Weather and Flood Forecasting Center (WFFC) compound. The SAT aims to verify the operability and performance of the new Big Data Cluster System by the specifications and functional requirements outlined in this TOR. The Winning Bidder shall present, operate, and demonstrate the capabilities and performance of the newly commissioned system facility. A series of tests must be conducted by the Winning Bidder based on a checklist provided by the WD technical/end-user team for the system's functionalities and features. The SAT must be observed by middle or upper management staff from the WD, who, upon satisfactory completion of the SAT, will confirm that the system has been successfully commissioned.

Furthermore, the Winning Bidder shall provide installation, operations, and maintenance manuals for the end user. The manuals shall also include the system configuration of the server nodes, switches, and routers. Additionally, it shall contain, among other things, complete and detailed schematic diagrams, theory of operations, calibration, and maintenance procedures. All other hardware and software requirements shall also be turned over to PAGASA before the issuance of the Final Inspection and Acceptance report. Furthermore, the Winning Bidder shall provide a comprehensive list of deliverables and installation materials. Two (2) supervisory personnel from the PAGASA project and Inspection Committee shall oversee and support the acceptance procedure, as well as the signing of the site acceptance certificate. This process, including the signing, will take place following the testing and commissioning of the deliverable items.

J. PROFESSIONAL SERVICES and SYSTEM DOCUMENTATION

The Winning Bidder shall provide installation, operations, and maintenance manuals to the end user. The manuals shall also include the system configuration of the server nodes, switches, and routers. It shall also contain among others the complete and detailed schematic diagrams, theory of operations, calibration, and maintenance procedures. All other hardware and software requirements shall also be turned over to PAGASA before the issuance of the Final Inspection and Acceptance report. In addition, the Winning Bidder shall provide a complete list of deliverables and installation materials. (**SEE ANNEX A-1**)

K. SERVICE LEVEL AGREEMENT

Three (3) Years Warranty with Preventive and Remedial Services

A 3-year warranty with preventive and remedial services is required on all delivered goods and shall take effect upon issuance of the Certificate of Final Acceptance. Said warranty shall include, as follows:

1. The winning bidder must warrant that if any improvements are announced for the proposed product or its components between the submission of proposals and the implementation date, the Service Provider will deliver and install the improved product or components at the PAGASA without affecting the contract amount.
2. PAGASA should be entitled to receive all applicable software version updates (including operating systems and bundled software), security patches, and feature packs at no additional cost.
3. The Service Provider shall provide onsite technical support on all delivered products and their components.
4. The Service Provider shall utilize experienced and trained technicians or technical support personnel under its supervision in rendering the required remedial service. Hence, the winning Supplier is required to provide a list of support personnel with detailed resumes on experience and training
5. Spare parts shall be available 24 x 7 to replace defective units or parts.
6. Support services shall be available 7 x 24 x 4
7. Service units shall be provided if a technical issue has not been resolved within 48 hours.
8. All technical support shall be available locally. Technical support from abroad shall be allowed if it can meet the required SLA for support.
9. The winning bidder must have Helpdesk System Support to handle PAGASA technical support requests, providing a ticket for each issue and issuing status reports until resolution. The Helpdesk System Support must be operational 24/7, including holidays, and should provide notification options for technical assistance via email and telephone/smartphone.
10. Within four (4) hours upon receipt of a request for support, either through phone, email, or in writing, the Service Provider shall address the problem by making a phone call to the concerned PAGASA unit. If the problem persists, the Service Provider shall address the problem onsite.