Power Saving Cloud Archive:
Performance

The Power Saving Cloud Archive is a high-performance, low-cost, redundant, and robust NAS file server plus an archival storage solution. The Power Saving Cloud Archive (PSCA) uses open standards server and storage components combined with Cutting Edge's 5th generation EdgeWare OS built on a 64-bit Linux operating system. This combination allows the PSCA to attain a performance vs. price point that is significantly higher than other storage solutions. Open standards internal and external RAID systems, SAS/SATA/SSD disks, high-performance Intel processors, and multiple Intel gigabit and/or 10 gigabit Ethernet ports allow the PSCA to leverage high-quality low-cost components. The open standards approach provides greater cost efficiencies and quicker technology refresh cycles when compared to expensive proprietary hardware and software.

The PSCA provides high-performance network attached storage (CIFS) solution that can scale to the user's required throughput and storage capacity requirements.

The "magic" of the PSCA is the Long Term Storage Nodes (LTSN). LTSNs can be configured with either dual GbEthernet or dual 10GbEthernet ports to provide performance options to meet any throughput requirements. The ability of the PSCA NAS Server to dynamically power-up and add LTSNs as bandwidth or storage capacity requirements increase and then power down LTSNs as requirements lessen essentially moves any potential bottleneck to the existing public network infrastructure. The ability of an LTSN to power down when not in use and dynamically power on when needed in 30 seconds, creates an ultra-low-power high-performance solution previously not known in the storage industry.

The PSCA NAS Server may be configured with different drive options depending on the use case required. The PSCA NAS consists of at least two separate hardware RAID protected volumes. The first volume is the PSCA protected NAS CIFS share. The PSCA protected NAS share volume can have high-performance Solid State Drives (SSD), high-performance Serial-Attached SCSI drives (15K RPM SAS), or high-capacity SAS/Serial-ATA drives (7200 RPM SAS/SATA) depending on the user's access specification. The second volume is the fast PSCA database used to track files archived on the LTSNs. The PSCA database volume can have high-performance SSDs or 15K RPM SAS HDDs depending on the user's file types, sizes, and throughput requirements. Additional volumes may be configured for additional PSCA NAS CIFS shares, non-PSCA NAS CIFS shares, NFS exports, and volumes to be used as iSCSI or Fiber Channel Targets.

The LTSN is configured with twelve high-capacity 7200 RPM SATA drives in a RAID-6 volume. RAID 6 is used to maximize drive redundancy to ensure availability. The LTSN is available with 2TB or 3TB drives for a raw storage capacity of 24TB to 36TB.

Standard Configuration

The "standard" PSCA configuration consists of a PSCA NAS Server connected to the existing public network infrastructure with two 10GbEthernet ports and similarly with two 10GbEthernet ports to the PSCA Private Network (**Figure 1**).

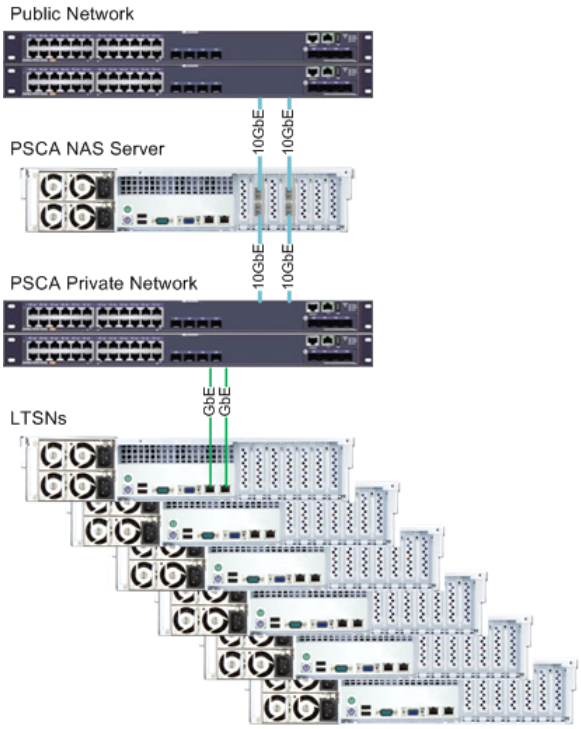

Figure 1: PSCA "standard" configuration

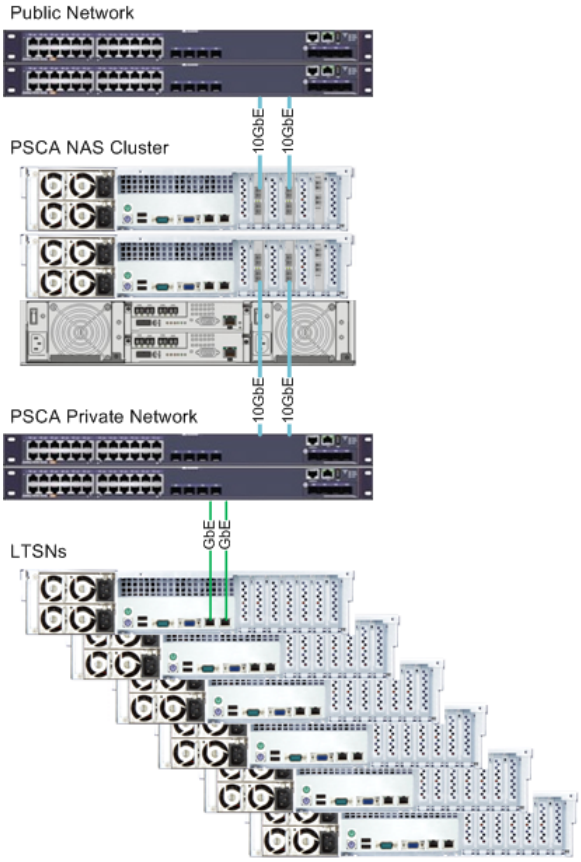

Figure 2: PSCA "standard" configuration with Failover-IP support

Each standard Long Term Storage Node has two GbEthernet ports providing up to 200MB/s bandwidth between the LTSN and the PSCA NAS Server. LTSNs have up to 30TB of software RAID-6 protected disk storage controlled by a dual core Intel 3.1GHz processor.

The two 10GbEthernet ports of the PSCA NAS Servers connected to the PSCA Private Network allows the PSCA solution to write and read data to as many as 10 LTSNs simultaneously with no expected loss of bandwidth. Each LTSN is capable of up to 200MB/s sustained write, read or mixed file transfers.

Writing Files

When a client on the public network writes a file to the PSCA NAS Server CIFS share, that file is immediately copied to an LTSN assigned to that share. When enough files have been written to the PSCA NAS Server share to fill the share, the oldest files are deleted from the share to make room for new files.

When enough files are written to the LTSN to reach capacity the LTSN switches to a reduced power state saving on power and cooling costs and a new LTSN powers on and seamlessly takes its place. This is transparent to the client who sees all files as available on the PSCA NAS share regardless of whether they are stored on the PSCA NAS share, a powered-on LTSN, or a suspended LTSN.

When writing files from the PSCA NAS Server to an LTSN the load is dynamically split between both back-end network paths. This provides a maximum bandwidth of 200MB/s between the PSCA NAS Server and one LTSN. As the load increases from clients on the public network to the PSCA NAS Server LTSNs are dynamically added as needed to keep up with the requirement for additional bandwidth. A "standard" PSCA NAS Server provides a maximum theoretical bandwidth of 2000MB/s between the PSCA NAS Server and ten LTSNs.

Reading Files

When a client on the public network reads a file the file is immediately available at the speed of the client's network interface, if the file still resides on the PSCA NAS Server. If the file has already been deleted from the PSCA NAS Server and resides on a powered-on LTSN the file is split between the two gigabit Ethernet paths and copied back to the PSCA NAS Server at up to 200MB/s per file and then is available to the client. If the LTSN is in the reduced power state the LTSN will dynamically power-on, which takes about 30 seconds, and then the file is copied back to the PSCA NAS Server.

High-Performance Configuration

The "high-performance" PSCA configuration is similar in design to the "standard" PSCA configuration. While the PSCA NAS Server remains unchanged there are three major differences in the design of the LTSN (**Figure 3**).

- The software RAID-6 of the standard LTSN is replaced with a hardware RAID-6 managed by a 6Gb SAS/SATA PCI-E 2.0 hardware RAID controller
- The two Intel gigabit Ethernet network ports are replaced with two Intel 10 gigabit Ethernet ports
- The single 550 watt power supply is replaced with redundant 620 watt power supply

Each high-performance LTSN has a maximum throughput of 2000MB/s and an expected sustained throughput of 1200MB/s of write, read or mixed file transfers.

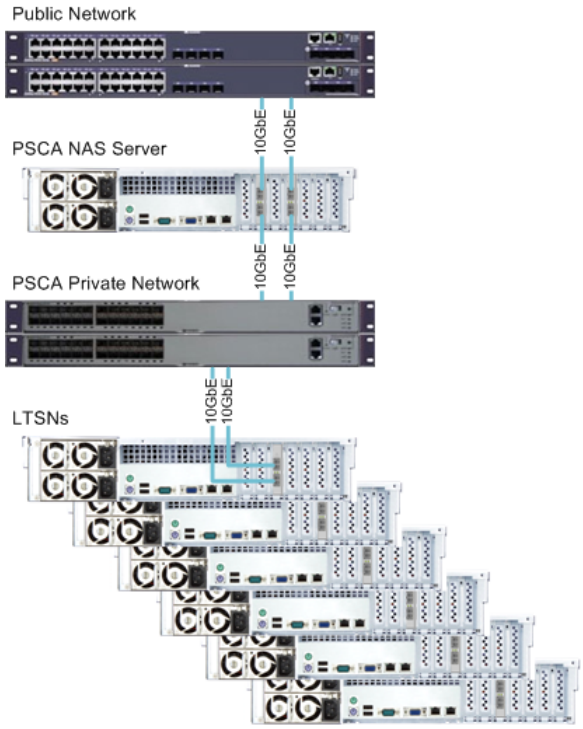

Figure 3: PSCA "high-performance" configuration

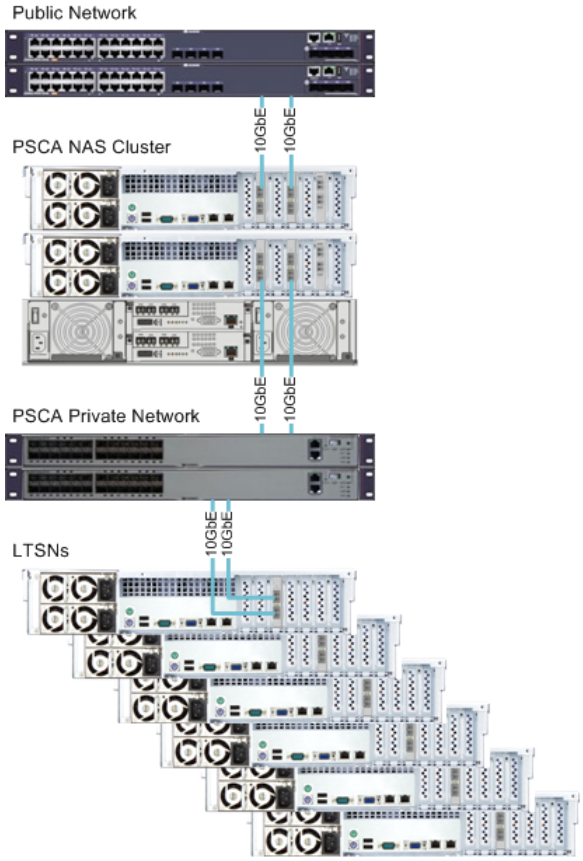

Figure 4: PSCA "high-performance" configuration with Failover-IP support

Writing Files

The high-performance PSCA solution process of writing files to the LTSN is the same as the standard configuration. Because of the higher bandwidth available between the PSCA NAS Server and the high-performance LTSN there is less need to power-on multiple LTSNs to archive files written to the PSCA NAS CIFS share. Although the high-performance LTSN uses slightly more power, ultimately it results in even greater power savings then in the standard configuration.

Reading Files

The high-performance PSCA solution process of reading files from the LTSN is again similar to that of the standard configuration. The added bandwidth provided by the 10 gigabit Ethernet ports improves reading performance of very large files.

Ultra-High-Performance Configuration

The "ultra-high-performance" PSCA configuration is similar in design to the "high-performance" PSCA configuration. While the LTSN remains unchanged the major change is in the PSCA NAS Server. The PSCA NAS Server is available with additional bonded 10 gigabit Ethernet ports to allow even greater bandwidth between the PSCA NAS Server and both the public and PSCA private networks (**Figure 5**).

The "ultra-high-performance" PSCA configuration can provides the user a significant improvement in available bandwidth over the standard configuration while requiring a small increase in power of just a few percentage points.

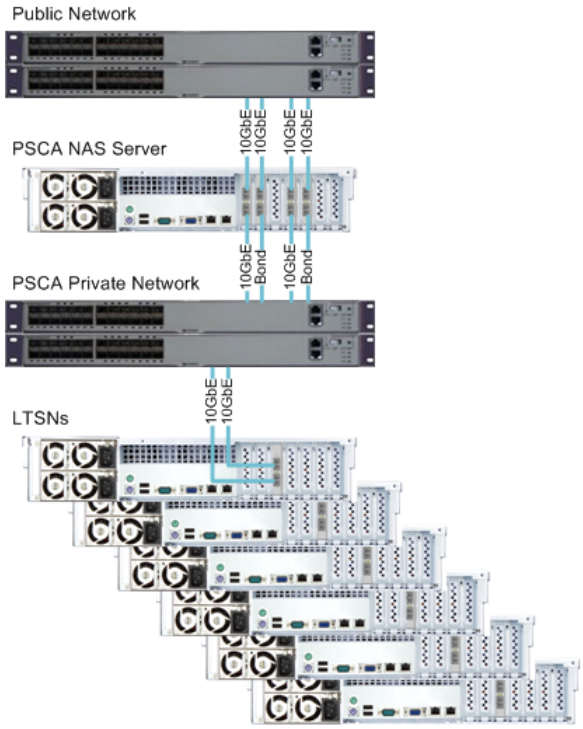

Figure 5: PSCA "ultra-high-performance" configuration

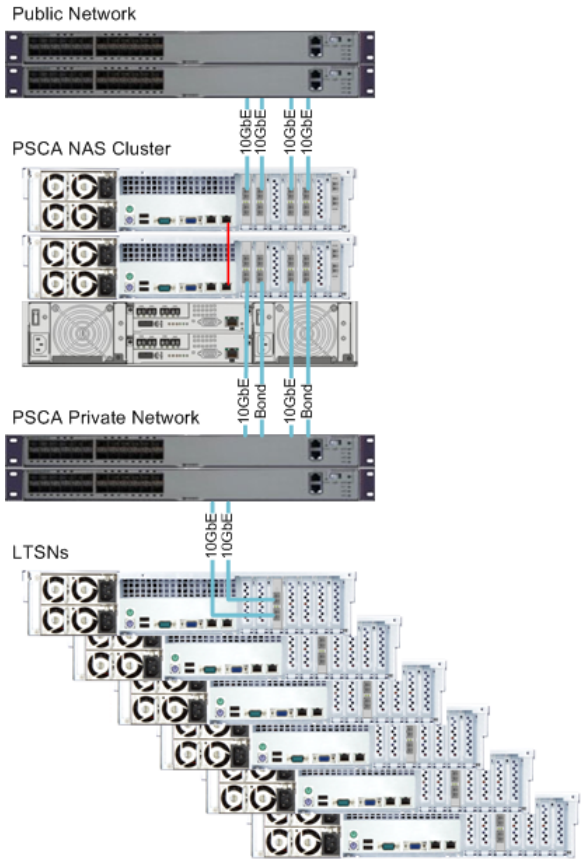

Figure 6: PSCA "high-performance" configuration with Failover-IP support

Writing Files

The ultra-high-performance PSCA process of writing files to the LTSN is the same as the standard configuration. Because of the higher bandwidth available between the PSCA NAS Server with bonded 10 gigabit Ethernet and the high-performance LTSN there is improved bandwidth available to handle additional clients and increases write access requirements.

Reading Files

The ultra-high-performance PSCA process of reading files from the LTSN is again similar to that of the standard configuration. The added bandwidth provided with the bonded 10 gigabit Ethernet ports provides improved reading performance across additional clients and larger files.