

Enterprise Class Director Architecture. Scalable to 1536 SAS/SATA drives.



The director class architecture has the flexibility to expand each of its components where they are needed within each system. Each individual 5U system consists of a Host Director, a Cache Module, a Disk Director, an X-Bar switch. Disk drives can be expanded in 2U twelve drive increments. Each 5U system can be expanded up to a total of 4.

Add components individually, in real time, non-disruptively!

Director Class Architecture

The Xanadu II is the industry's only system to provide true module expandability that allows for superior flexibility, performance and scalability in a director class solution.

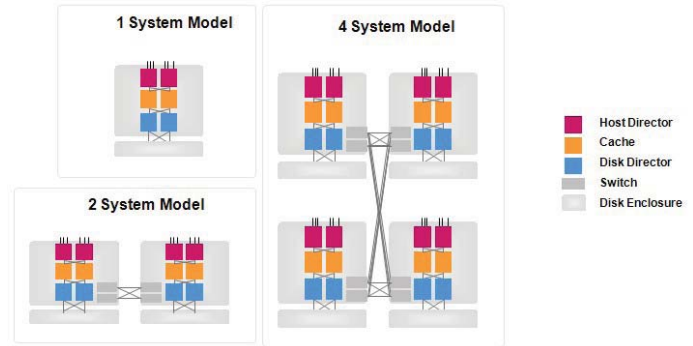


Xanadu II Overview:

- Modular 5U Chassis / 2U Disk Enclosure
- 4 to 16 4Gbps Host Interfaces
- 3 to 384 HDD
- Dual Redundant Cache from 8 to 32GB
- SAS or SATA drives
- High Speed X Bar Switch
- Complete redundancy
- Battery backup cache
- SATA Guard Parity Validation
- Self-Healing
- MAID Technology
- Dynamic Provisioning
- Full enterprise software suite available

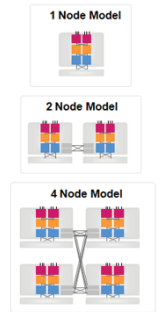
Scalable Capacity and Performance

- The Xanadu II single node supports up to 384 drives per module.
- Customers who start with a Xanadu but later discover they need more capacity than the Xanadu allows, can convert the Xanadu array to Xanadu II without losing or migrating data.
- Xanadu II will be available in single, dual or quad configurations supporting up to 1,536 SAS or SATA disk drives.
- Xanadu II can be upgraded in real-time from single to dual or quad, non-disruptively, so no data or up-time is ever lost.
- The high-speed X-bar switch architecture enables true multi-node operation, with performance scaling linearly with capacity.
- All models are managed through a common software package called StorageManager.



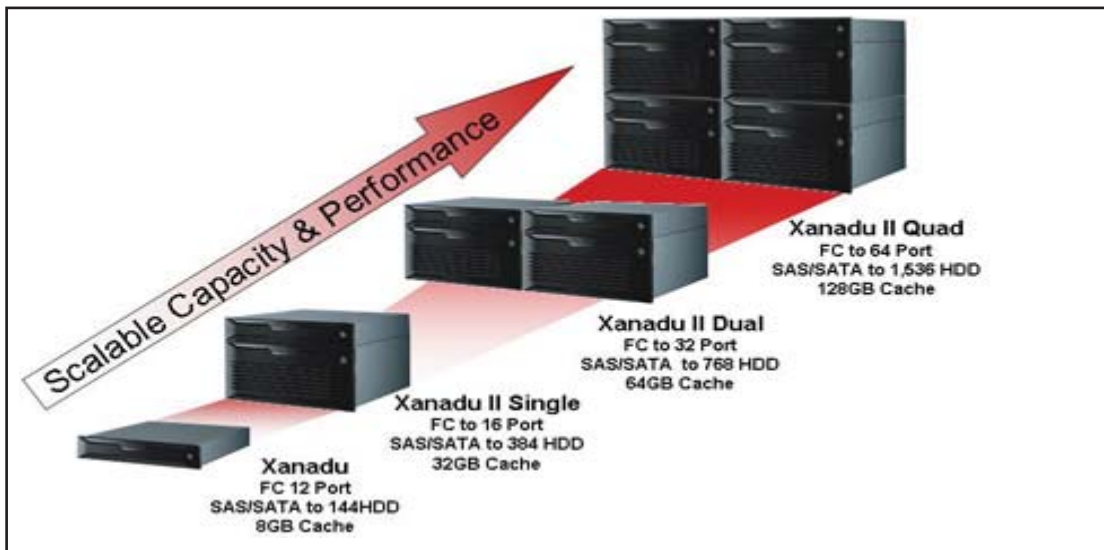
X-Bar Architecture True Multi-node Operation

- The high-speed X-bar switch architecture enables true multi-node operation, with performance scaling linearly with capacity.
- Each system can be interconnected with up to 3 other systems by utilizing patented X-Bar technology.
- This results in a maximum scaled configuration of 128GB of cache 64 Fibre Channel ports and 1536 HDDs.



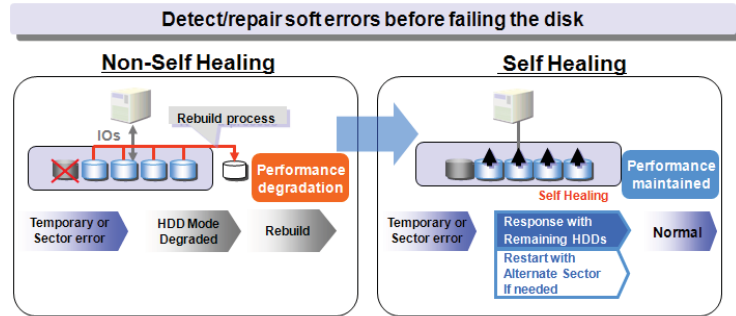
SATA Guard

- Recent large academic studies have identified the surprising frequency of silent read failures.
- Such errors result in corrupt data being provided by the disk array to the application without any notification.
- This "silent data corruption" includes misdirected writes, partial writes, and data path.
- The X2 IB Extended Data Integrity Feature detects and addresses silent data corruption, while also preventing parity pollution.



Failure Avoidance: Self Healing

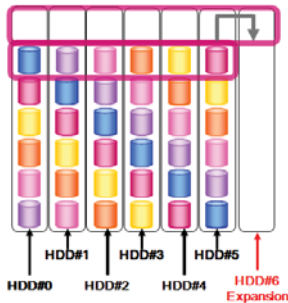
In traditional disk subsystem designs, sector errors would mark the disk drive as failed, initiating a RAID rebuild process. This process degrades performance and takes a long time to finish. It is also expensive as there may still be useful life in the disk drive.



Patented Phoenix Technology detects these errors but allows operation to continue with the other drives in the RAID group. If an alternative sector can be assigned, the drive is allowed to return to operation with the RAID group without having to do a complete rebuild. Phoenix technology allows performance to be maintained throughout the detection and repair process

Dynamic Provisioning

Traditionally, logical disks could only be managed in units of the physical sets of disks that made up the RAID. Users had to install a fixed number of disks even if they were not needed. The new dynamic provisioning function permits logical disk capacities to be changed dynamically to either expand or shrink. Physical disks can be added one at a time. The logical disks required can be managed efficiently, and the system is free from physical restrictions.



Features

- No data loss up to two disk failures
- Two modes: 4+PQ or 8+PQ
- LUNs spread across entire pool in data stripes similar to RAID-6
- Dynamically add HDD one by one
- Dynamically grow/shrink LUNs in pool
- Better performance than basic pool RAID-6

Dynamic Provisioning is a unique storage management and protection implementation which provides the power of RAID-6 data protection with the flexibility to manage capacity one drive at a time. RAID-6 has a higher capacity overhead than RAID-5, but can protect against data loss from two disk failures, which RAID-5 cannot.

In a Xanadu Dynamically Provisioned pool, the number of drives participating in a RAID-6 pool is not fixed and can be dynamically expanded as capacity requirements dictate.

Traditional RAID implementations can be expand only in full multiples of the RAID group size. Dynamic Provisioning does this by maintaining RAID-6-like parity protection in data stripes rather than full disk drives. When a logical disk is defined, it spreads the stripes across all drives in the pool. Disk drives can be added to the pool at any time, one at a time, without reformatting the raid group or moving any data files. When a new disk drive is dynamically added to the pool, some of the strip stripes from each of the logical disks are moved to the new disk drive. The next time a logical unit is allocated, it will be spread across all drives in the dynamic pool.

Performance in a dynamic pool should be better than in traditional, fixed-sized pools because all the drives in the pool are available to service I/O requests, not just the number of drives in a traditional RAID group.

MAID: PowerConsaver

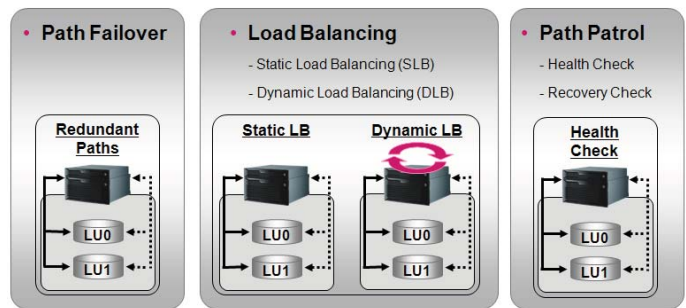
Massive Arrays of Idle Disks: Power down inactive disks – lower power and cooling

| | |
|--|--|
| Level 1 – Manual Mode (current release) | Using CLI scripting, disks can be stopped and started on demand or periodically. |
| Level 2 – Automatic Mode (future release) | Controller monitors disk activity. If no access within specified time, disk is stopped, then restarted when new access is requested. |
| Level 3 – Application Mode (future release) | Detailed setting of the stop/start conditions can be set through the application. |

30-60% energy savings in secondary storage applications

High Availability: PathManager

Xanadu's PathManager software provides a convenient combination of path failover and load balancing across multiple Fibre Channel paths between the host and the array. Should one path fail, all data traffic will be rerouted over the alternate path to continue operation uninterrupted. PathManager provides two types of load balancing. Static load balance directs traffic to specific logical disks to follow specific paths. Dynamic load balancing spreads traffic to all logical disks across all available paths. Path Patrol periodically checks paths to ensure that they are still available, and also periodically checks failed paths to detect when they have been restored.



The Xanadu comes with a full range of enterprise-class software options for storage management, data protection, performance management, conservation, compliance, and high availability. Each of these software solutions will be described individually on subsequent slides. All software options are available on all models.

Xanadu Enterprise Software

| Objective | Xanadu Storage Software | Function | Xanadu | Xanadu II |
|-------------------|------------------------------|---------------------------------|--------|-----------|
| Simple operation | StorageManager (ISM) | Storage & Access Control | Y | Y |
| | DynamicDataReplication (DDR) | Replication within same array | Y | Y |
| Data Protection | RemoteDataReplication (RDR) | Replication between arrays (FC) | Y | Y |
| | DynamicSnapVolume (DSV) | On-demand snapshots | Y | Y |
| | PerformanceMonitor | Performance monitoring & alerts | Y | Y |
| Performance | PerformanceNavigator | Analysis of data over time | Y | Y |
| | PerformanceOptimizer | Automates performance tuning | Y | Y |
| | Conservation | PowerConsaver | MAID | Y |
| Compliance | VolumeProtector | WORM | Y | Y |
| High Availability | PathManager | Multi-pathing and failover | Y | Y |