Spectra nTier Verde is network attached file based, long term IP video retention solution, that provides enterprise IP video storage for surveillance industry VMS recording servers, and network video recorders.
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Spectra nTier Verde IP video Surveillance Overview

Spectra nTier Verde advanced data integrity design, protects retained IP video after its creation, use, and its lifecycle. The ever expanding technology and use cases of IP cameras in the video security and surveillance market coupled with new regulations for retention terms, require a new class of storage. Spectra nTier Verde is the first disk product designed to meet the demands for enterprise video surveillance management systems.

By definition, enterprise video surveillance storage is designed to retain IP video data during the typically lengthy period between creation and initial use, and its deletion. This architecture is:

- Easy to install, use, and scale
- Affordable
- Dedicated to maintaining the integrity of IP video data

Spectra Logic has observed the need for IP video storage in the continuum of data protection and nTier Verde is the first disk product in this class of storage. It expands on the original goals of disk storage (i.e., rapid retrieval and familiar interface), to provide:

- Scalable capacity
  o Shared IP video storage resource
  o Expands to multiple petabytes
- Strong performance
  o IP video streaming sustained at the high levels
  o IP video low latency for fast search
- Ease of use
  o Easy to use tools, reduces project integration and time
- Affordability
  o High reliability and up time performance achieved through redundant design
- Data integrity confirmation and assurance
  o Operating and file system used in high performance compute environments

nTier Verde is a Network Attached Storage (NAS) system with NFS (Network File System) and CIFS (Common Interchange File System). As NAS, nTier Verde stores data affordably, is easy to, use, set-up and manage, and helps to ensure extremely high data integrity.

The nTier Verde system provides an easy-to-use and straightforward StrataView configuration interface that the customer uses to easily access the system’s data storage. The features supported in the product are designed for easy configuration and monitoring of system status.
Spectra nTier Verde Snapshot

- **4U Master Node**, with system controller and holds from 10 up to 35 SAS drives, deployed with 4 or 8TB disk drives
- **4U Expansion Node**, holds up to 44 SAS drives, deployed with 4 or 8TB disk drives, expansion node connects to the master node using external SAS cabling
  - The 4U master accepts up to 9 expansion nodes, for 1.7 / 3.4 PB (raw) configurations.

- **2U Master Node**, with system controller and holds from 6 up to 11 SAS drives, deployed with 4 or 8TB disk drives
  - The 2U master accepts one 4U single expansion node for a combined maximum of 55 drives.

- **Drives**
  - SAS
  - 4 or 8 TB raw
  - 7200 RPM
  - 2 million hour MTBF

**Physical Characteristics**
- **Dimensions:**
  - 4U nodes: 7” H x 19” W x 29.5” D
    - 178 mm H x 437 mm W x 699 mm D
  - 2U nodes: 3.5” H x 19” W x 27.5” D
    - 89 mm H x 483 mm W x 699 mm D
- **Weights (approximate):**
  - 4U master node with 35 drives: 120.2 lb. (54.5 kg);
  - 4U expansion node with 44 drives: 136.4 lb. (61.8 kg)
  - 2U master node with 11 drives: 57.7 lb. (26.2 kg)

**High-Availability Features**
- Redundant, hot-pluggable cooling system
- Redundant, power supplies, each with its own AC power connector and an LED to indicate status
- Hot-swap/spare drives
- Redundant Data On Module (DOM) drives for the operating system, logical volume manager and file system, NFS, CIFS, and SNMP servers, and the Spectra StrataView web interface

**Simple to Use**
- Buttons: Power on/off, system reset
- LEDs: power, hard drive activity, network activity (x2), system overheat, power fail

**Rapid Installation and Configuration**
- User can unpack, install, and have nTier Verde operational in 30 minutes or less.
**Spectra nTier Verde Snapshot**

**Interface**
- Graphical interface for ease of use. You can use the StrataView interface to manage nTier Verde through an Internet browser.
- Command line interface for flexibility

**Status Light Bar:** The Visual Status Beacon light bar in the front bezel provides an at-a-glance status of the array. The light bar changes color to indicate the status of the array. If an nTier Verde system is requires attention, the lit bar, or beacon, helps administrators identify the unit quickly. Customize these colors using StrataView.

**Access Protocols**
- CIFS – SMB 2
- NFS – NFS v3

**Network Monitoring and Configuration Support**
- DHCP
- SNMP
- SMTP
- NTP

**Data Transfer Specifications**
Full network bandwidth use in high-performance setup, using one of the following network data transfer connections from hosts to:

**4U nTier Verde system:**
- One 1 GigE port
- Aggregate of three 1 GigE ports - 3GigE throughput
- One 10 GigE port
- Aggregate of two 10 GigE ports – 20GigE throughput
- One 40 GigE port
- Aggregate of two 40 GigE ports – 80GigE throughput

**2U nTier Verde system:**
- One 1 GigE port
- Three 1 GigE ports (standard)
- One 10 GigE port (optional)
- Aggregate of two 10 GigE ports (optional) – 20GigE throughput
## Spectra nTier Verde Snapshot

### Additional 4U Master Node Ports
- 1 GigE port: StrataView management connection to the browser-based web interface (not used for data traffic)
- Adding expansion nodes requires an HBA card to be installed, which has SAS ports used to connect to one or two 4U expansion nodes

### Additional 2U Master Node Ports
- One 1 GigE port: StrataView management connection to the browser-based web interface (not used for data traffic)
  - Adding an expansion node requires an HBA card to be installed that has SAS ports used to connect to the 4U expansion node.

### Boot Drives
Two dedicated mirrored boot drives for the operating system, logical volume manager and file system, NFS, CIFS, and SNMP servers, and the Spectra StrataView web interface
- NTier Verde 4U uses Dual Data On Module (DOM)
- NTier Verde 2U uses Dual 2.5 inch disk drives

### Monitoring
- Hardware status
- System messages
- Remote access
- SNMP client support
- Email notification when issues arise
  - Log collection

### Support
- 1-year warranty for hardware and software
- AutoSupport feature
- Recovery from failed drives with efficient automatic rebuilds
- On-site professional services available
- Support service options:
  - Next Business Day
  - Next Business Day On-Site
  - Same Business Day On-Site
- Four-Hour On-Site

### Assisted Self Maintenance (ASM)
(ASM) is an optional support program that stores nTier Verde components at the customer’s site that data center staff can replace in minutes. NTier Verde user-replaceable, on-site components include:
- System drive
- Power supplies
- Fans
- 10 GigE Ethernet card
- 40 GigE Ethernet card
<table>
<thead>
<tr>
<th><strong>Spectra nTier Verde Snapshot</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Additional features</strong> supported in nTier Verde disk systems:</td>
</tr>
<tr>
<td>• <strong>Data integrity</strong> – Advanced checksums protect against undetected errors and result in a much better bit error rate than traditional disk</td>
</tr>
<tr>
<td>• <strong>Mirroring, Double and Triple parity</strong> – In addition to striping across multiple disks, and mirroring (making a second copy of all data disks), nTier Verde supplies double- and triple-parity options, allowing 2 or 3 drive failures per parity group without data loss. This enhances reliability when working with large data sets.</td>
</tr>
<tr>
<td>• <strong>Thin provisioning</strong> – nTier Verde lets you increase storage efficiency by virtualizing available space and allocating it as required. You can make better use of existing capacity, handling data growth as needed.</td>
</tr>
<tr>
<td>• <strong>Compression</strong> – You can configure compression at the volume level.</td>
</tr>
<tr>
<td>• <strong>Snapshots</strong> – Snapshots, or point-in-time copies of a volume, let you restore a volume to the state it was in when the snapshot was created. A snapshot only consumes the space of the changed blocks, which makes them very space-efficient. Snapshots can be generated automatically (hourly, daily, or weekly); snapshots can also be created on demand.</td>
</tr>
<tr>
<td>• <strong>On-demand integrity check</strong> - nTier Verde feature an on-demand data integrity check for data drives configured in one or multiple storage pools. The check scans the drives for data corruption and corrects any errors found.</td>
</tr>
<tr>
<td>• <strong>Intelligent rebuilds</strong> – Instead of rebuilding an entire failed drive, nTier Verde rebuilds only the portion of the drive that held data, potentially saving hours on rebuilds.</td>
</tr>
<tr>
<td>• <strong>Redundant power</strong> – Each nTier Verde node ships with two high-efficiency redundant power supplies.</td>
</tr>
<tr>
<td>• <strong>Performance monitoring</strong> – The StrataView interface lets you view the performance of pools, drives, CPUs, and the network.</td>
</tr>
<tr>
<td>• <strong>Global spare drives</strong> – A drive that is not configured in a storage pool acts as a global spare drive. If a drive failure occurs on the nTier Verde, the array immediately activates a global spare. When the failed drive is replaced, the replacement drive acts as the global spare. Spectra Logic recommends having one or more spare drives in your array to permit immediate rebuilds of a pool in the case of data drive failure.</td>
</tr>
<tr>
<td>• <strong>Hot-swappable data drives</strong> – nTier Verde’s drives are shipped on drive sleds that allow the drives to be replaced quickly, without tools, by on-site data center staff.</td>
</tr>
<tr>
<td>• <strong>AutoSupport</strong> – Automatically contact mail recipients upon generation of messages. Also generate logs for Spectra Logic Technical Support.</td>
</tr>
</tbody>
</table>
4U nTier Verde Network Connectivity

The 4U nTier Verde master node provides GigE, 10 GigE, 40 GigE connectors, a data management port, SAS ports, and power connectors. The rear side of the unit provides ready access to 12 drive bays and the two power supplies. Note that a master node can be configured with additional SAS ports that permit the master to control a maximum of 9 expansion nodes.

When configuring the 4U nTier Verde system, use one of the following methods to connect to the data network:

- 1 GigE – uses one of the three 1 GigE data ports
- 3 GigE – uses the aggregate of the three 1 GigE ports
- 10 GigE- uses one of the two 10 GigE ports
- 20 GigE – uses the aggregate of the two 10 GigE ports
- 40 GigE- uses one of the two 40 GigE ports
- 80 GigE – uses the aggregate of the two 40 10 GigE ports

4U nTier Verde: Example Network Diagram

The following diagram shows an example environment with the nTier Verde system used in an architecture supporting data transfer and data management networks.

Additional network configurations are possible; a few of these are illustrated in the following table.
### Connectivity Options

<table>
<thead>
<tr>
<th>Connectivity</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 GigE data transfer port</td>
<td>1 GigE management port</td>
</tr>
</tbody>
</table>

**Three 1 GigE data transfer ports aggregated to a single port with 3 GigE throughput (shown in diagram preceding this table)**
- 1 GigE management port

<table>
<thead>
<tr>
<th>Connectivity</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/40 GigE data transfer port</td>
<td>1 GigE management port</td>
</tr>
</tbody>
</table>

**Two 10/40 GigE data transfer ports aggregated to one port with 20/80 GigE throughput**
- 1 GigE management port
2U nTier Verde Master Node Connectivity
The 2U nTier Verde master node provides as a standard feature two 1 GigE data transfer ports, along with the 1 GigE StrataView management port, and optionally two 40 GigE data transfer ports. In additional, the 2U node includes dual power supplies and SAS ports.

Expansion Node Connectivity
The adjacent diagram shows the rear side of the nTier Verde expansion node, which provides SAS and two power connectors, the power supplies, and access to 21 disk bays.
Theory of Operations

Software Components

Two mirrored boot disks in the nTier Verde system are dedicated to the software necessary to run the system. These, along with the controller, manage the entire system.

**Master node operating and file system:** The nTier Verde master node has internal specialized dual boot disks (separate from the data disks) that support the unit’s operating system, integrating a logical volume manager and file system, used for data stored on the unit. The boot disks are mirrored, and control the structure and management of data storage. The nTier Verde operating system provides data verification to protect against corruption.

**SNMP Server:** The system accepts SNMP queries used by some network management applications, making it easy to track nTier Verde status in the context of the entire network.

**NFS and CIFS Servers:** The NFS and CIFS servers running on the nTier Verde node provide network file system access to host computers over an Ethernet network. Most major operating environments, including Microsoft Windows, Apple Macintosh, UNIX, and Linux, can access NFS/CIFS shares.

**StrataView:** The StrataView web interface provides browser-based configuration, management, and monitoring of the nTier Verde node. See the System Ease of Use with the StrataView Interface section for more information.

Pools, Protection, and Capacity

The nTier Verde system virtualizes disk storage to make it easy to configure and expand over time. To configure the system, select the parity level, capacity, and performance. StrataView uses these parameters to automatically build a storage pool, striping together one or more arrays of drives.

Note that as with all disk systems, your decisions result in trade-offs between capacity and performance. The greater the protection, the less storage capacity is available, and when capacity is optimized, protection levels are lower.
Example Case of Pools, Protection, and Arrays

The following figure illustrates the physical disks used in this example.

![Physical layer: 24 slots for data drives](image)

**Note:** Throughout this example, physical hard drives are shown for illustrative purposes only.

Virtualizing Disk using Pools

The first step in configuring nTier Verde is to create a storage pool. A storage pool is a virtualization of multiple disks; in other words, it’s a logical grouping of a set of physical drives. The pool is the location where volumes reside. Volumes are described in a later section.

In this example, the physical layer of 24 disks includes two disks that are set aside for other uses, leaving 22 disks for data storage. (Of the reserved slots, one is reserved for use by the system; the second slot stores a global hot spare drive.)

![Drive slot reserved for system use](image)

The preceding image shows a logical grouping of the 22 disk drives into two pools, Pool1 with 10 drives, and Pool2 with 12 drives. In this example, you have defined 2 large pools of disk rather than having to work with 22 individual physical disks. Note that physical hard drives are shown for illustrative purposes only, because a user specifies a drive count in the nTier Verde configuration, not specific, individual drives.

Set Level of Protection

After you’ve assigned a name and a number of disks to a pool, you set the level of protection the system will provide for data in each pool. The system uses this level of protection, along with some optimization choices, to further subdivide the number of disks in each pool into arrays. The system creates arrays automatically, simplifying setup while balancing protection, capacity, and performance.
The choices of protection (and optional lack of data rebuild within a set of disks) include:

- **Striping**: The data is striped across multiple disks without redundancy and without storing parity. In a stripe-only configuration, if you lose one disk, all data in the striped data set is lost. This may be appropriate for data that is intentionally short-lived. All of the disk capacity is available with this method of storage.
- **Mirroring**: This setup creates redundant data disks. In doing this, only half of the disk capacity is available. However, all data is available even with disk failure, and the failed drive can be rebuilt quickly using the global hot spare and the mirror of the failed drive.
- **Parity**: This is similar to setting RAID levels, with some notable improvements on RAID (see later section on nTier Verde Advantages). Parity information is a kind of metadata that systems use to rebuild data if a disk (or multiple disks, depending on the parity level) fails. The level of parity determines the number of drives that can fail without risking data loss.
  - **Single Parity**: One disk in each array can fail without putting data at risk—if a disk fails, all data can still be rebuilt.
  - **Double and Triple Parity**: Two disks in each array can fail without putting data at risk—all data can be rebuilt. With triple parity, up to three drives can fail out of the disks in an array without losing data.
  - **Note** that nTier Verde defaults to double parity level in configurations that can support this protection level, which ensures data protection while providing considerable capacity. Otherwise, the data protection level is set at single parity, also a robust protection choice.

### nTier Verde Advantages

The nTier Verde system uses checksums, providing data integrity advantages not available in standard RAID configurations. One of the significant advantages is that the system prevents what’s called a write-hole in RAID. With RAID, data written to disks can be corrupted if a power loss occurs during the data write process.

With nTier Verde, the system does not overwrite existing data—it writes data to a new location. Further, until the parity information is created and the checksum is verified, the operation is not committed to the system as completed. This prevents a write and resulting restore error that can occur in RAID systems when a problem interferes with the system while data is being written to disk—in a RAID system, the data is committed as sent, without verifying the integrity of data.

### Balancing Capacity and Performance

Use a slider bar in the interface to balance performance, protection, and capacity. The selected protection and optimization levels determine how the disks in the pool are divided into sets of matching size, with each set referred to as an array. This gives flexibility when expanding a pool, since you add an array at a time. This also affects how much disk is available versus that used by parity for higher security.
For example, with triple parity, a pool of 18 disks can be automatically grouped as follows.
  - A single array of 18 disks
  - Two arrays of 9 disks
  - Three arrays of 6 disks

The system **never** subdivides the pool of 18 disks using an array size of five disks, because this grouping wastes capacity. NTier Verde will not configure a system so that one or more disks in an array cannot be used. Also, once a pool’s array size is defined, the size (number of disks in the array) can’t be changed. To expand the pool, add the number of disks used in the pool’s arrays (such as 6 disks per array). You can always create additional pools with alternate array sizes.

The nTier Verde system constrains array size in relationship to the selected protection level, to optimize the balance between performance, capacity, and protection.

The constraints are listed in the following table.

<table>
<thead>
<tr>
<th>Parity Level of Pool</th>
<th>Array Size/ Subset of Pool*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>*All arrays within a pool are the same size</td>
</tr>
</tbody>
</table>
| Double parity        | 4 to 16 disks per array, or entire pool = array  
  If the number of disks in the pool cannot be divided by a number in the specified range of 4-16, then all disks are used in a single array.  
  For example, a pool with 17 disks set to double parity uses one array of 17 disks. |
| Triple parity        | 6 to 18 disks per array, or entire pool = array  
  If the number of disks in the pool cannot be divided by a number in the specified range of 6 to 18, then the pool size equals the array size.  
  For example, a pool with 17 drives set to triple parity uses one array of 17 disks. |

The system configuration works with these parameters, which results in some disallowed array sizes. The following table shows some examples of permitted and disallowed array sizing.

**Examples of Array Sizing**

<table>
<thead>
<tr>
<th>Parity Level</th>
<th>Pool made up of 10 disks</th>
<th>Pool made up of 12 disks</th>
</tr>
</thead>
</table>
| Double parity—default value  
(4-16 disks per array or all disks in pool= array) | 10 disks per array - one array per pool  
5 disks per array - two arrays in the pool  
*Not allowed: 2 disks per array, because each double parity array must have at least 4 disks.* | 12 disks per array - one array per pool  
6 disks per array - two arrays in the pool  
4 disks per array - three arrays in the pool  
*Not allowed: 3 disks per array, because each double parity array must have at least 4 disks.* |
| Triple parity | 10 disks per array - one array per pool | 12 disks per array - one array per pool  
6 disks per array - two arrays in the pool |
<table>
<thead>
<tr>
<th>Parity Level</th>
<th>Pool made up of 10 disks</th>
<th>Pool made up of 12 disks</th>
</tr>
</thead>
<tbody>
<tr>
<td>(6-18 disks per array or all disks in pool=array)</td>
<td>Not allowed: 5 disks per array, because each triple parity array must have least 6 disks.</td>
<td>Not allowed: 4 disks per array, or 3 disks per array, because each triple parity array must have least 6 disks.</td>
</tr>
</tbody>
</table>

To continue with the earlier example: Pool1 is made up of ten disks, and is mirrored. Pool2 is made of 12 disks, and is protected using double parity. In this example, each pool is divided into arrays that work with the parity level assigned. (Note that this example is intended only to illustrate the principles behind nTier Verde configuration.)

### Considerations in Setting Protection Levels and Balancing Capacity and Performance

The number of disks per array is a result of setting the level and protection, and of balancing capacity and performance. At the same time, the number of disks per array has specific implications for your site. Consider the following when configuring the system:

- **Capacity**: With more disks in an array (larger array), the system uses fewer disks for parity so has greater capacity. At the same time, this sacrifices performance. Larger arrays aren’t read as fast as smaller arrays.
- **Speed** of data reads: With fewer disks in an array (smaller array), the data is read more quickly, enhancing performance. The tradeoff is that the increase in performance reduces overall capacity, because each additional array dedicates one or more disks to parity, which means that parity space is used for data protection rather than simple data storage.
- **Expansion**: The number of disks in an array is the base unit of expansion in a pool. That means that, if you have a single array of 30 disks, you can only expand the pool in increments of 30 disks. Alternately, if your system uses double parity and is set up so that each array has 5 disks, then you can add any multiple of 5 disks at a time to the pool. This ensures that all disks can be used.

### Define Pool Availability to System Network/Protocols

The next step in configuring nTier Verde is to define the logical subsets of each pool. These are referred to as volumes. The volumes contain a file system and a share. Volumes are associated with pools, independent of array size.
**Thin Provisioning**

The nTier Verde system uses thin provisioning, so that space on the system is allocated only at the point of data writes. If a minimum value for a volume has been defined, then that space is allocated specifically to the volume and cannot be used by another volume. You can also set a maximum value. Only the minimum value is allocated specifically to the volume; the space beyond the minimum and up to the maximum value is not specifically assigned to that volume until the write occurs.

**Oversubscribing**

The possible size of each volume is limited only by the size of the pool. Further, the sum of the volumes sizes can be larger than the space available in the pool. This is referred to as oversubscribing the space.

The examples illustrated in this section show volumes that are sized so that together they use more space than is physically available. This lets the system allocate space only as data is written. This feature reduces the need for manual intervention. In this example, Pool2 has been divided into three volumes, whose aggregate capacity is larger than the size of Pool2. The volumes are ExecVol, EngVol, and SupportVol.

For example, if the SupportVol needs space that the other two volumes have not yet claimed but that are within the maximum set for the volume, SupportVol can expand without requiring the intervention of a system administrator. The nTier Verde system notifies you if the space available within a pool is low, so you can, for example, expand the pool, delete some data from the pool, or create a new pool for the data. Further note that although you can remove data from a pool, the pool size remains the same—pool size does not decrease.

**Assign Access to Volumes**

With the pool, arrays, and volumes configured, you can now define how the nTier Verde connects to your network, using mount point or shares that a network can access. The system’s graphical interface makes it easy to configure the data network connection.

After this is set up, you can share the volume with the network by using the NFS or CIFS service on the nTier Verde system. Volumes are associated with either CIFS or NFS, never both. Once the system is configured, use your network data mover to write data to and read data from your nTier Verde system.
IP Video Surveillance nTier Verde Configurations

In storing data after its creation the requirements of the storage vary, depending on the site. The following outlines possible cases where you may use nTier Verde.

**Long term retention IP video surveillance:** In a video surveillance environment a high percentage of the time IP video is written, reading IP video back for searches happen infrequently. The nTier Verde file system typically writes IP video data as received from the VMS recording server in a sequential process. As the nTier Verde fills with IP video, the VMS recording server shall begin to delete the oldest IP video, allowing the most recent IP video to be recorded to it. The nTier Verde file system manages fragmentation of IP video and insures the video streaming performance is maintained over the lifecycle of the IP video.

- Single VMS recording server example. An nTier Verde master node connects via its network interface and provides a NFS/CIFS share for the location of the IP video to be retained.

- Multiple VMS recording server example. An nTier Verde master node connects to each recording server via an IP network and provides a common NFS/CIFS share for the location of the IP video to be retained.
• Multiple VMS recording servers with scaled nTier master and expansion nodes example. An nTier Verde connects to each recording server via an IP network and provides a common NFS/CIFS share for the location of the IP video to be retained. Using the external SAS interface, expansion nodes are added with up to 44 disk drives in each to address long term IP video retention. Up to nine expansion nodes can be attached to a single master node.

• Multiple VMS recording servers with IP video streaming that exceeds 4800 Mbps (CIFS). Attaching two nTier master nodes example. An nTier Verde master node connects to each recording server via an IP network and provides each VMS recording server a common NFS/CIFS share for the location of the IP video to be retained. Using two nTier Verde master nodes 9600 Mbps (CIFS) IP video streaming can be obtained.
IP Video Surveillance Storage Calculations

Spectra provides a VS Verde storage calculation tool to determine the amount of formatted capacity required in order to provide the retention term that’s required. The VS Verde storage calculator allows the user to input camera (amount, frames per second, resolution, compression, motion, recording hours, and days of retention). The VS Verde calculator using a medium level of video quality. The result is an approximation of the capacity requirements, after project implementation the amount a real IP video being generated daily will need to be confirmed and retention term revised. If additional storage is required, adding more array’s and or expansion modules to the nTier Verde is easily performed.

Below is the output from the VS Verde storage calculator showing the recommended configuration addressing the surveillance project needs.

<table>
<thead>
<tr>
<th>Spectra VS Verde Calculator V8.2 05/27/15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Name:</td>
</tr>
<tr>
<td>Date:</td>
</tr>
<tr>
<td>Spectra Representative:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Select Project Requirements</th>
<th>Pool 1</th>
<th>Pool 2</th>
<th>Pool 3</th>
<th>Pool 4</th>
<th>Pool 5</th>
<th>Pool 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Cameras:</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Camera Resolution:</td>
<td>2M</td>
<td>1080P</td>
<td>720P</td>
<td>CIF</td>
<td>CIF</td>
<td>CIF</td>
</tr>
<tr>
<td>Camera Frames Per Second:</td>
<td>12</td>
<td>30</td>
<td>30</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Camera Video Compression:</td>
<td>H.264</td>
<td>H.264</td>
<td>H.264</td>
<td>H.264</td>
<td>H.264</td>
<td>H.264</td>
</tr>
<tr>
<td>Percentage of Recording/Motion:</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hours of Recording Per Day:</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Retention Period Specified &quot;Days&quot;:</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bandwidth Per Camera Pool:</td>
<td>221.4</td>
<td>498.0</td>
<td>220.8</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Camera&quot;KB&quot; Frame Size Selected:</td>
<td>46.1</td>
<td>41.5</td>
<td>18.4</td>
<td>2.2</td>
<td>2.2</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Total Camera Bandwidth "Mbps" 940.2
Retention Capacity Required "TB" 305

Verde HDD Storage Requirement (Assumes RAID 6 Configuration)

<table>
<thead>
<tr>
<th>Select Verde Disk Model (4TB or 8TB)?</th>
<th>8</th>
</tr>
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<tbody>
<tr>
<td>Number of Storage Disk Drives Required</td>
<td>48</td>
</tr>
<tr>
<td>Number of Parity Disk Drives Required</td>
<td>12</td>
</tr>
<tr>
<td>Number of Hot Spare Disk Drives Added</td>
<td>2</td>
</tr>
<tr>
<td>Total Number of Disk Drives Required</td>
<td>62</td>
</tr>
<tr>
<td>Number of Disk Drive Arrays</td>
<td>6</td>
</tr>
<tr>
<td>Number of Disk Drive (Data/Parity) Per Array</td>
<td>11</td>
</tr>
</tbody>
</table>
System Ease of Use with the StrataView Interface

The nTier Verde system has a simple interface that is extremely easy to use in configuring, managing, and monitoring system status. The system interface is password-protected, and lets you remotely monitor and manage the system. The initial screen, the dashboard, shows system and performance data. Navigate easily between this screen and the menu bar options that include Configuration, Status, and Support screens.

The dashboard provides an overview of configured storage pools, volumes, and shares, which are the logical components used to interact with the data storage capacity provided by the nTier Verde system.

StrataView Status Bar

StrataView provides the status of the system at a glance, providing component status and information about any messages that require attention. The status bar, at the bottom of every screen, provides the following:
- Icons that indicate hardware status at a glance
- Severity, date, and time of the most recent warning or error message
- Controls for rebooting and shutting down an array

Visual Status Beacon

The Visual Status Beacon light bar in the front bezel provides an at-a-glance status of the system. The light bar changes color to indicate the status. If an nTier Verde system requires attention, the blue bar helps to administrators identify the unit quickly.

Scalability: The Modular Design of Spectra Storage Systems

Spectra Logic’s storage systems, including nTier Verde disk, are designed with modular media and components that let users add or swap drives and replace components stored on-site as needed, most with no downtime.

Modular Expansion: Scaling the Spectra System

To scale the nTier Verde system to meet your site’s evolving storage requirements, you can easily add capacity and performance by adding an expansion node. The expansion node connects to the master node using external SAS cabling. NTier Verde 4U supports up to 9 expansion nodes. NTier Verde 2U supports a single expansion node.

On the 4U nTier Verde, the operating system data is stored on dedicated mirrored operating system (boot) drives. These drives are Data on Module (DOM) drives, distinct from the maximum of 35 data
storage drives available on the master node and up to 44 data storage drives per expansion node. An operating system drive is included with the Assisted Self-Maintenance (ASM) support option. See the next section for more information on ASM.

Drive storage bays:

<table>
<thead>
<tr>
<th></th>
<th>Total Drive Bays</th>
<th>Front Drive Bay Access</th>
<th>Back Drive Bay Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>4U master node</td>
<td>35</td>
<td>23</td>
<td>12</td>
</tr>
<tr>
<td>2U master node</td>
<td>11</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>Expansion node*</td>
<td>44</td>
<td>23</td>
<td>21</td>
</tr>
</tbody>
</table>

*All expansion nodes are 4U

The drive sleds slide into bays in the system and lock in place. Use the handle on the drive sled to remove and insert a sled, and the latch to lock the inserted drive sled.

When fewer than the full complement of data storage drives are installed, empty drive sleds are installed in the unused drive bays to prevent contaminants from entering the enclosure and to maintain proper air flow. To add a drive, order one from Spectra Logic, then insert the data disk into the bay. You may then use the nTier Verde StrataView graphical interface to add the drives to a pool or to create a new pool.

**Modular Design: On-Site, Swappable Components**

Spectra Logic designs products so that major components are optionally customer-replaceable, so that customers who would prefer to maintain their system can do so with user-installable on-site spare components. With Spectra Logic's Assisted Self-Maintenance (ASM) support options, spare components are placed at your facility, ready to be installed by your IT staff in your data storage environment, without tools and in less than three minutes.

Spectra disk systems are the only ones in the industry that are available with on-site, user-replaceable components that include:

- System drive
- Power supplies
- Fans
- 10/40 GigE Ethernet cards

**Data Integrity**

Advanced checksums used by nTier Verde software protect against undetected errors and result in a much better bit error rate than traditional disk systems. NTier Verde continually checks data written to data disks and verifies its integrity using these methods:

**Multi-Level Error Correction Codes (ECC)**—Spectra NTier Verde disk performs checksums on every 128K block of data. The block’s checksum is stored in a pointer to the data block rather than with the data block, adding a layer of protection between the corrective mechanism and the data itself. If the checksums don’t match, then Spectra NTier Verde disk identifies an accurate copy of that data, or rebuilds an accurate copy using parity.
**Internal Data Handling**—Data is never overwritten by updated versions of itself. Instead, the data remains on disk and a second copy is created.

**Copy on Write**—With Spectra nTier Verde disk, data writes precede and are completed as a step separate from parity writes, so if power is lost between the copy and the parity write, data is not silently corrupted.

**On-demand integrity check** - nTier Verde feature an on-demand data integrity check for configured data drives. The check scans the drives for data corruption and corrects any errors found.

**Management and Reporting Features**
Spectra nTier Verde’s many built-in management and reporting features simplify its management and monitoring. The graphical interface, shown in an earlier section and in following sections, increases system ease of use.

**Command Line Interface**
The command line interface provides an alternate method of accessing the nTier Verde system, duplicating the functions available through the graphical interface. System administrators may use SSH to remotely access and manage the nTier Verde system using commands and associated parameters.

For example, use the following command:

```
config mailrecipient delete --id=NTier VerdeEmail2
```

to delete the mail recipient with the id of NTier VerdeEmail2.

**SNMP Management Protocol**
The nTier Verde system supports SNMP (Simple Network Management Protocol), with a MIB (Management Information Base) available through the StrataView interface that can be used to communicate between the system and other servers on the network.

**Performance Monitoring**
The performance pane displays the performance of
- Pools
- Drives
- CPUs
- Network

**System Messages**
The nTier Verde system provides ready access to error messages, including flagged messages that may require attention.
**Hardware Status**

Through a web browser from any location, you can use the StrataView interface to check hardware status. From the interface’s main dashboard, select hardware then select the component you are checking on. You can check status of data drives, fans, power supplies, and the system. The system screen provides information about processors, memory, and the boot drives.

**Network Configuration**

The system displays information about the configuration of the network, including all network connections and status of each, DNS servers, and email configuration. This greatly simplifies remote management of the nTier Verde unit.
Support and Continuity Features

A set of system features help expedite issue resolution. These features help identify possible issues and let administrators address them before they interfere with ongoing system operations. NTier Verde also provides on-site repair options, and is backed by Spectra Logic’s around-the-clock support.

The following are some of the NTier Verde built-in support features.

AutoSupport Phone Home Feature

Spectra storage systems have an AutoSupport feature that can be configured to automatically create and send e-mail messages about issues or problems to designated e-mail users, including Spectra Logic Technical Support.

Paired Recovery

NTier Verde is designed with a modern, highly reliable single controller design. Typical deployments of the system do not require the complexity or expense of traditional high-availability disk storage solutions. In cases where users need a method that helps sites quickly recover from a system failure, NTier Verde offers ColdPair and HotPair recovery options.

The ColdPair option for NTier Verde lets users quickly and economically recover from a master node failure. This involves storing on-site a spare master node without any data drives. In the case of a master node failure, the customer can rapidly bring the system back up using the spare master node by following these steps: make sure the original NTier Verde system is powered off, move cables and data drives to the ColdPair chassis, then power up the ColdPair node. The system reads all configuration data from the migrated disks, as the disks store Replicated System Configuration (RSC). All pools, volumes, shares and data typically come on-line in less than 30 minutes.

In an upcoming StrataView release, the HotPair option will be available, automating recovery. HotPair setup is configured with two master nodes and one or more expansion nodes. The master nodes do not contain data drives, but instead operate as pure disk controllers. Both master nodes are connected to all expansion nodes via SAS and to each other through Ethernet and serial cables. One master is active, the other is passive. Configuration information is sent from the active to passive node, and the passive node monitors the heartbeat of the active master. If the active master fails, the passive master takes over. While data access is affected during the recovery, the system does recover and return to serving data with no administrator intervention.

Hot-Swappable Hard Drives

Hard drives in the NTier Verde are on drive sleds that can be pulled out easily. With this, a failed drive can be replaced with a new one without requiring tools, and without requiring downtime.
Intelligent Rebuilds
When a drive fails, instead of rebuilding the entire drive, nTier Verde rebuilds only the portion of the drive that held data, potentially saving hours on rebuilds.

Redundant Power
Each nTier Verde master node and expansion node ships with two redundant, high-efficiency power supplies.

Parity
In addition to the more typical double-parity option, nTier Verde offers a single parity and a triple parity option. With triple parity, data is safe even if three drives fail. This greatly enhances protection and availability when working with large data sets.

SpectraGuard Support and Warranty Overview
The Spectra nTier Verde disk system has a warranty that extends one year from the date of shipment from the factory. This warranty includes a SpectraGuard Next-Business-Day service contract. The following service options are also available to customers purchasing a Spectra data storage system.

SpectraGuard Next Business Day Service
Customers requiring assistance and replacement parts during regular business hours for equipment with non-mission critical data can take advantage of the Next Business Day support package. On verification that the nTier Verde system requires repair, a part is shipped for delivery and customer installation the next business day.

SpectraGuard Next Business Day On-Site Service
• Access to a SpectraGuard technical support representative on any business day (not including evenings, weekends, or holidays) from 8:00 a.m. to 5:00 p.m. (customer local time).
• A service visit from a field service representative, upon verification that the unit has malfunctioned. If Spectra Logic is notified by 4:00 p.m. (customer local time), a field service representative will be dispatched that day for arrival the following business day before 12 noon.

SpectraGuard Same Business Day On-Site Service
• Provides round-the-clock telephone access to a technical support representative, 24 hours a day, 7 days a week, and 365 days a year.

SpectraGuard Four-Hour On-Site Service
• 4-hour on-site service, 5 days a week, from 8:00 a.m. to 5:00 p.m. (customer local time).
• 24 x 7 x 365 telephone access to a SpectraGuard technical representative (includes evenings, weekends, and holidays).
• Upon verification that the unit has malfunctioned, a field service representative is dispatched to the site within four hours of the dispatch request.

Professional Services
Spectra Logic’s professional services group offers additional on-site services for prevention, maintenance, and site-specific consulting. These services include:
• Preventive maintenance
• Customized training
• Optimization services
• Media migration support
• Security assessment and consulting
• System consolidation
• Backup and disaster-recovery consulting
• System relocation and reintegration services

Assisted Self-Maintenance Support Options
The Assisted Self-Maintenance option is available to customers purchasing a Spectra nTier Verde disk system and can be purchased to supplement the on-site service options above. Refer to the Modular Design: On-Site, Swappable Components section for details.
## Specifications

### Environmental Specifications

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<tr>
<th>Description</th>
<th>Values</th>
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<tbody>
<tr>
<td>Temperature range - operating environment</td>
<td>10° C to 35° C</td>
</tr>
<tr>
<td></td>
<td>50° F to 95° F</td>
</tr>
<tr>
<td>Temperature range – environment when storing &amp; shipping</td>
<td>-40° C to 70° C</td>
</tr>
<tr>
<td></td>
<td>-40° F to 158° F</td>
</tr>
<tr>
<td>Relative humidity - operating environment</td>
<td>8%-90% (non-condensing)</td>
</tr>
<tr>
<td>Relative humidity – environment when storing &amp; shipping</td>
<td>5%- 95% (non-condensing)</td>
</tr>
<tr>
<td>Altitude - operating environment</td>
<td>Sea level to 3,048 meters</td>
</tr>
<tr>
<td></td>
<td>Sea level to 10,000 feet</td>
</tr>
<tr>
<td>Altitude – environment when storing &amp; shipping</td>
<td>Sea level to 12,000 meters</td>
</tr>
<tr>
<td></td>
<td>Sea level to 39,370 feet</td>
</tr>
<tr>
<td>Maximum wet bulb temperature - operating environment</td>
<td>29° C</td>
</tr>
<tr>
<td>Maximum wet bulb temperature–environment when storing &amp; shipping</td>
<td>35° C</td>
</tr>
<tr>
<td></td>
<td>84° F</td>
</tr>
<tr>
<td></td>
<td>95° F</td>
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### Power

<table>
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<tr>
<th>Unit</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>4.2 amps (4U master)</td>
</tr>
<tr>
<td></td>
<td>4 amps (2U master)</td>
</tr>
<tr>
<td></td>
<td>4.5 amps (expansion)</td>
</tr>
<tr>
<td>Input frequency</td>
<td>50-60 Hz</td>
</tr>
<tr>
<td>NTier Verde 4U Master Input voltage</td>
<td>100-140 VAC, 12-8 A, 1,000 W maximum</td>
</tr>
<tr>
<td></td>
<td>180-240 VAC, 8-6 A, 1,280 W maximum</td>
</tr>
<tr>
<td>NTier Verde 2U Master Input voltage</td>
<td>180-240 VAC, 11-4.5 A, 920 W maximum</td>
</tr>
<tr>
<td>NTier Verde Expansion Input voltage</td>
<td>100-140 VAC, 13.5-9.5 A, 1,100 W maximum</td>
</tr>
<tr>
<td></td>
<td>180-240 VAC, 9.5-7 A, 1,400 W maximum</td>
</tr>
</tbody>
</table>
### Data Storage

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive type</td>
<td>7200 RPM SAS</td>
</tr>
<tr>
<td>Single drive capacity, native</td>
<td>4 or 8 TB</td>
</tr>
</tbody>
</table>

System capacity options:
- **4U Master Node**
  - Minimum – 10 drives
  - Maximum -35 drives
- **2U Master Node**
  - Minimum – 6 drives
  - Maximum -11 drives
- **Expansion Node**
  - Minimum – 10 drives
  - Maximum - 44 drives

### System

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU</td>
<td>2 multi-core processors</td>
</tr>
<tr>
<td>System disk drives</td>
<td>NTier Verde 4U – Two solid-state 64 GB DOMs</td>
</tr>
<tr>
<td></td>
<td>NTier Verde 2U – Two 2.5&quot; spinning disks</td>
</tr>
<tr>
<td>Memory</td>
<td>32 GB (4 x 8 GB DIMMs)</td>
</tr>
<tr>
<td>Interface connections</td>
<td>• 4 integrated Gigabit Ethernet ports</td>
</tr>
<tr>
<td></td>
<td>• 1 dual-port 10 Gigabit Ethernet NIC</td>
</tr>
<tr>
<td></td>
<td>• 1 dual-port 40 Gigabit Ethernet NIC (option)</td>
</tr>
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