NetApp

Technical Report

Bosch Video Recording solution with NetApp E-Series E2800 disk storage array

Solution architecture and storage best practices

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In partnership with

BOSCH

Abstract

The Bosch Video Recording solution brings revolutionary technology to the video surveillance industry by enabling smart cameras to write directly to network storage. The performance and reliability attributes provided by NetApp® E-Series storage enables the Bosch solution to scale from enterprises to entire smart cities. This report explains the solution and includes details of the components and best practice configuration guidance.

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Introduction

Bosch and NetApp jointly developed this video surveillance solution reference architecture to guide successful deployments with Bosch video management software and NetApp® E-Series storage. The architecture delivers a powerful and scalable video recording solution.

About NetApp

NetApp is the leader in cloud data services, empowering global organizations to change their world with data. Together with our partners, we are the only ones who can help you build your unique data fabric. Simplify hybrid multicloud and securely deliver the right data, services, and applications to the right people at the right time.

Overview of The Bosch Group

The Bosch Group is a leading global supplier of technology and services. It employs roughly 410,000 associates worldwide (as of December 31, 2018). The company generated sales of 78.5 billion euros in 2018. Its operations are divided into four business sectors: mobility solutions, industrial technology, consumer goods, and energy and building technology. As a leading Internet of Things (IoT) company, Bosch offers innovative solutions for smart homes, smart cities, connected mobility, and connected manufacturing. It uses its expertise in sensor technology, software, and services, and in its own IoT cloud, to offer its customers connected, cross-domain solutions from a single source. The Bosch Group's strategic objective is to deliver innovations for a connected life. Bosch improves quality of life worldwide with products and services that are innovative and spark enthusiasm. In short, Bosch creates technology that is "invented for life."

For more information, see www.bosch.com.

Bosch Security and Safety Systems

The Bosch Security and Safety Systems division is a leading global supplier of security, safety, and communications products, solutions, and services. Protecting lives, buildings, and assets is the division's aim. The product portfolio includes video surveillance, intrusion detection, fire detection, voice evacuation systems, and access control and management systems. Professional audio and conference systems for communication of voice, sound, and music complete the range. Bosch Security and Safety Systems develops and manufactures in its own plants across the world. For more information, see www.boschsecurity.com.

The Bosch and NetApp video surveillance alliance

Bosch Security and Safety Systems and NetApp formed a strategic global collaboration to capitalize on the rapid development of the IP video surveillance market. Under terms of their agreement, Bosch sells and supports cobranded NetApp storage devices as part of the Bosch video surveillance portfolio. To meet Bosch solution performance requirements, the NetApp performance engineering and NetApp Bosch technical account teams did extensive work to identify system configurations that meet those requirements.

Bosch pioneered the development of IP cameras and encoders that stream directly to RAID arrays or SANs. This award-winning, efficient approach to video recording is made possible with the use of the iSCSI storage standard.

Under terms of the collaboration, NetApp assists Bosch associates with presales support for the cobranded products. NetApp also delivers training and certification to Bosch technical support groups. As a NetApp authorized provider, Bosch provides customers with postsale technical support for the full solution, including tier 1 support for the storage devices. This level of integration provides a streamlined experience for customers during and after the sale of the cobranded products.

Why NetApp and Bosch?

- Global collaboration aligns leaders in storage and video surveillance.
- Agreements link engineering, sales, and support teams.
- Both companies are positioned for success in IT and security market segments.
- Bosch and NetApp have collaborated since 2006.
- Industry-leading enhancements for Bosch iSCSI cameras provide seamless operations.
- There is seamless integration with Bosch configuration management.
- Bosch support and sales personnel have been trained on NetApp technology.
- The two companies have proven stability and reliability.
- The Bosch and NetApp Video Recording solution provides a high-performance, flexible, scalable, and highly reliable storage management solution for IP network video recording.

Why choose the Bosch video surveillance solution?

- Bosch is a leading global full-video-surveillance solution provider.
- The solution enables a lower cost of ownership and ease of setup by reducing the footprint.
- The turnkey solution provides:
  - High performance and highly available storage from NetApp to support video surveillance–specific workloads and tight integration of cameras, recording applications, and storage infrastructure
  - Full integration with Bosch video management applications, the Bosch video management system (VMS), and the Bosch video client
  - A large global installed base resulting from collaboration between Bosch and NetApp since 2006
  - Certified recording solutions for third-party Genetec video management solutions and third-party cameras and encoders

Solution architecture

The Bosch VMS solution is designed to meet the needs of the video security market. It is a flexible second-generation IP network video recording technology solution that provides scalability, robustness, and reliability built on state-of-the-art, enterprise-grade IT components.

The Bosch and NetApp integrated video surveillance solution is described with various industry-standard and Bosch-specific acronyms. Table 1 provides a list of acronyms and a brief definition of each.

Table 1) Glossary of terms used in this document.

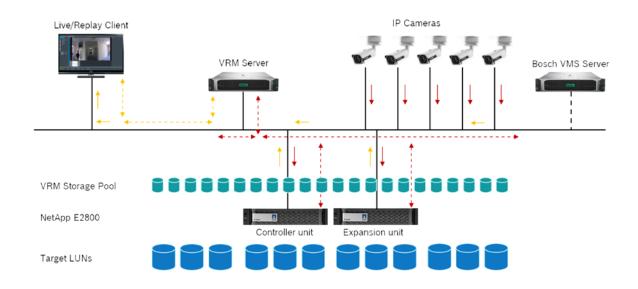| Term	Definition
VMS	Video management system
VRM	Video Recording Manager (refers to the management server)
VMS Configuration Client	GUI used to set up and manage the VRMs and underlying cameras and storage
iSCSI	Internet Small Computer Systems Interface
IP	Internet Protocol
LUN	Logical unit number
BVIP	Bosch Video over IP
HIC	Host interface card

Term	Definition
H.264/MPEG-4	ITU-T H.264: advanced video coding for generic audiovisual services
RAID	Redundant array of independent disks
NVR	Network video recorder
ANR	Automatic network replenishment
ATM/POS	Automatic teller machines/point of sale
FQDN	Fully qualified domain name
DNS	Domain name system
NTP	Network Time Protocol
ICMP	Internet Control Message Protocol

Bosch VMS solution architecture

The Bosch VMS solution integrates the Bosch VRM software, NetApp E-Series storage, and Bosch camera network in a tightly integrated package. The VMS solution consists of the VMS server, the VRM server, the Bosch Configuration Client, and the VRM monitor. The Bosch video client or the Bosch VMS operator client can also be used as a playback client. Figure 1 provides a high-level view of the integrated solution.

Figure 1) Bosch VMS solution components.

The VMS solution comprises the components listed in Table 2.

Table 2) VMS components and associated definitions.

VMS solution Component	description
Disk storage array (DSA)	NetApp E-Series E2800 storage system in one of the two configurations shown in Figure 3 and Figure 4 or a combination of shelf configurations to meet requirements within the following guidelines:

VMS solution Component	description
	• E2800 systems cannot exceed 180 total drive slots. • Duplex controllers are required for DE460C shelf configurations. • The maximum number of shelves supported is eight: one controller-drive shelf and seven expansion shelves. Exception: When you use the DE460C, the configuration of three total shelves meets the maximum drive slot count limit (180).
Array firmware	Standard E-Series system firmware
Hard drives	One of the following configurations: • Up to 84 x 3.5" NL-SAS with 7 additional DE212C expansion chassis • Up to 180 x 3.5" NL-SAS with DE460C expansion chassis (For current supported disk configurations, refer to the Bosch product page and product datasheet.)
Volumes	Up to 254 LUNs configured as RAID 5, RAID 6; the DDP feature is available starting with Bosch VMS 10
Cameras	400 cameras per controller host interface port with a maximum of 800 IP cameras per storage system
Video Recording Manager (VRM)	Centrally manages direct-to-iSCSI recordings from Bosch IP cameras and encoders (for maximum number of channels and maximum net storage per VRM instance, refer to the Bosch product page)
VRM server	VRM server (running as a service)
VRM monitor	Displays overall system status information, including uptime, bit rate, and retention times Provides status information about recordings and storage
Bosch Configuration Client	Allows configuration of the iSCSI storage subsystem Allows configuration of recording parameters Includes schedules, data rates, frame rates, streams, and privileges Allows management of users and groups with privileges and roles Allows configuration of load-balancing parameters (bandwidth and iSCSI connections) per disk array (IP address)

VRM server

The VRM server manages configuration details and system settings and acts as a centralized orchestration service for the interaction of individual modules. The VRM server monitors the availability of all system components. If a failure occurs, the server creates alarm messages that are displayed in the VRM monitor or in the form of SNMP traps that you can retrieve with third-party systems.

VMS Configuration Client

The configuration client is used to configure the VRM system, including the recording management of the IP cameras and/or encoders, the iSCSI storage systems, and the user and alarm management.

The configuration client offers full integration with the E-Series storage by using the E-Series software development kit (SDK) interface. The client allows you to configure E-Series storage (that is, creating volume groups and volumes and allocating storage to the default host cluster) without using extra programs.

Note: To perform the initial installation and basic E-Series configuration steps, you should still use NetApp SANtricity® System Manager, the onboard, web-based E-Series management application. Initial configuration steps include setting the E-Series management IPs, configuring the DNS and NTP servers, and setting up system alerts.

VRM Monitor

The VRM monitor module monitors the VRM system. The web-based module is automatically installed with the VRM server and displays information about the connected IP cameras and encoders, the storage systems, and the recordings.

NetApp E2800 storage architecture

The DSA (disk storage array) E2800 is based on one 2U controller shelf with 12 internal 3.5", 7.2K RPM, NL-SAS, enterprise-grade HDDs or for large environments, the 4U, 60-drive shelf model. The controller unit is available as a standard simplex controller configuration or a standard duplex configuration for high-availability (HA) and extended performance requirements.

Note: The 4U, 60-drive shelf requires duplex controllers.

This storage system is a high-performance solution designed with robust flexibility that makes it a great fit for wide-ranging video surveillance and security analytics requirements. Its balanced performance is designed for supporting high-bandwidth and I/O-intensive workloads. The DSA E2812 disk shelf option with a standard 12-bay expansion unit (12 x 3.5", 7.2K, NL-SAS, enterprise HDDs) or a high-density 60-bay expansion unit (60 x 3.5", 7.2K, NL-SAS, enterprise HDDs) enables custom configurations. These configurations can be optimized for any midsize to extremely large enterprise environment. The DSA E2800's advanced protection features, and extensive diagnostic capabilities deliver high levels of availability and data integrity.
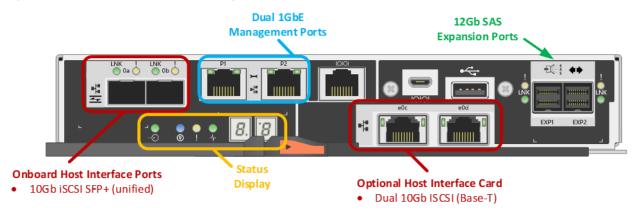
NetApp E-Series E2800 storage system

The NetApp E2800 array is an innovative block-level storage system that does not contain an onboard file system. Instead, it uses the file systems of the compute nodes that are attached to the storage system. This flexible and streamlined operating system approach delivers configurable performance for enterprise SAN storage environments. The E2800 storage system controllers support dual-core CPUs that deliver significantly higher performance than the earlier E2700 single core controllers. The shelf infrastructure is based on a 12Gb SAS3 infrastructure from the controllers to the drives as opposed to a 6Gb SAS2 infrastructure in the earlier system. The storage-specific management application, SANtricity System Manager, is now built into the controller OS and uses the onboard web servers on each E2800 controller canister for direct system management. The built-in web servers support Lightweight Directory Access Protocol (LDAP), role-based access control (RBAC), Secure Sockets Layer (SSL) certificates, or Security Assertion Markup Language (SAML) 2.0. With this support, the system easily meets the security standards in most environments.

The E2800 system provides application-driven storage for remote, branch, and large enterprises and is used for most video surveillance environments with fewer than 800 cameras per storage system. One example is the BVMS application, which enables Bosch cameras to use the E-Series built-in default host cluster. This application allows the cameras to access the E-Series storage without requiring that you configure each camera as a host server in SANtricity.

The DSA E2800 controllers are preconfigured with two optical 10Gb iSCSI ports on the base host interface ports and two RJ-45 10GBASE-T iSCSI ports in the optional host interface card slot. Figure 2 shows a close-up of the DSA E2800 controller with the various interface ports labeled.

Note: Optical ports require OM4 optical cable.

Figure 2) NetApp E2800 controller configured for Bosch DSA E-Series.

Note: Although the NetApp E-Series E2800 supports multiple host interface options, the Bosch VMS integrated DSA E2800 solution supports one configuration, shown in Figure 2.

Figure 3 shows detailed views of the 2RU DSA E2812 storage system with the bezel removed to show the drive slots.

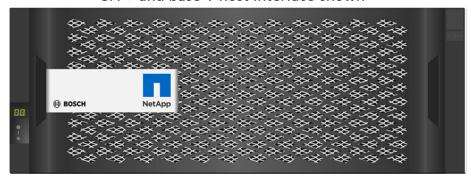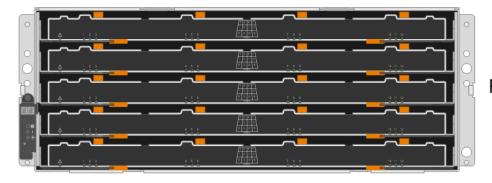**Figure 3) DSA E-Series E2812, 12-drive, 2RU shelf model.**

The DSA E2860 60-drive 4RU system is shown in Figure 4. This shelf configuration is used for larger, more complex environments that need to scale to large capacities and is particularly well suited for environments where long retention is mandatory.

Figure 4) DSA E-Series E2860, 60-drive, 4RU shelf model.

Bosch DSA E2860
DE460C shelf 10Gb iSCSI
SFP+ and base-T host interface shown

Front View

Front View
(bezel off)

Rear View

E-Series storage systems use enterprise-grade hardware and offer excellent flexibility with the various hardware options. But the system's hidden value comes from over 20 years of innovative software features that provide the built-in reliability and availability required to support life-safety and other enterprise workloads. For example, NetApp drive management features are purpose-built to manage modern large-capacity NL-SAS drives. And E-Series storage systems support link and controller failover using asymmetric logical unit access (ALUA), an industry-standard method of managing multiple paths between HA storage systems and compute nodes.

E-Series systems also support industry-standard automatic fault recovery by using hot spare drives with RAID 5 and RAID 6, and built-in reserve capacity with the Dynamic Disk Pools (DDP) feature. The RAID choices provide various levels of automatic protection from drive failures. However, only DDP provides

protection from more than two failed drives while providing significantly faster drive rebuild times compared with other RAID choices. For example, pools of 60 or more drives can recover from a failed drive in less than half the time of standard RAID. Table 3 defines the data protection choices available with the Bosch DSA E-Series.

Table 3) Description of E-Series RAID and DDP characteristics used in the Bosch integrated solution.

RAID type or DDP	Data protection
RAID 5	RAID 5 volume group characteristics include: • One-drive failure protection for volumes in a RAID 5 volume group. • If a second drive fails while a first failed drive is still in a failed state (even if the drive is being rebuilt), data on associated volumes is lost. • 12 total drives maximum are supported in a RAID 5 volume group that uses the Bosch VMS. However, this maximum can vary according to the total number of drives and the number of global hot spare drives configured. • Full-stripe write acceleration feature is supported.
RAID 6	RAID 6 volume group characteristics include: • Two-drive failure protection for volumes in a volume group. • If a third drive fails while the first two failed drives are still in a failed state (even if the drives are being rebuilt), data on associated volumes is lost. • 12 total drives maximum are supported in a RAID 6 volume group that uses the Bosch VMS. However, this maximum can vary according to the total number of drives and the number of global hot spare drives configured. • Full-stripe write acceleration feature is supported.
DDP	DDP characteristics (available with BVMS 10) include: • The BVMS Configuration Client supports one pool. • Two-drive failure protection for volumes in a pool, just like RAID 6. • If a third drive fails while critical segments on the first failed drive are still being moved, data on associated volumes is lost. • If a third drive fails after critical segments on the first failed drive are moved, all volume data in the pool is protected. • Drive failures can continue in this manner until the reserve capacity in the pool is exhausted. **Note:** Critical segments are segments of data from the same volume that reside on a single drive in a pool. If a drive fails, these segments are moved first.

For physical drive management, E-Series relies on a multiprong approach to managing failed drives and data integrity. For example, the SANtricity drive monitor and data evacuator feature monitors the telemetry on each drive in a system. If the drive stops communicating, the SANtricity OS automatically tries to power-cycle and reset the drive. If the drive recovers but still indicates an issue, the OS automatically starts to evacuate the data to a hot spare drive or (with DDP) reserve capacity. If the drive fails before the data evacuation is complete, the drive rebuild process picks up where the data evacuation stopped. This behavior is automatic; no user intervention is required. This feature combined with DDP saves time associated with drive recovery.

In addition to advanced fault management, an E-Series controller protects the integrity of data on incoming writes and then continuously scans the system to preserve data integrity over the retention period. For duplex controller configurations, the system further protects incoming data by cache-mirroring the incoming write to the peer controller. With this mirrored copy, you have two sources to compare against when data is written to the drives.

This multiprong approach to managing large capacity drives and the data on them is just one of the built-in software innovations in the SANtricity OS that are automatic and require little human intervention.
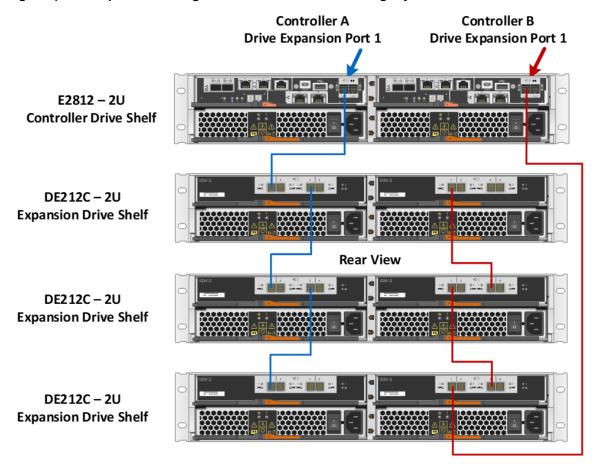
DE212C and DE460C expansion shelves

E-Series E2800 storage systems support capacity expansion to up to seven DE212C expansion shelves or up to two DE460C shelves in addition to the controller shelf. The expansion capacity can be installed from day one or can be hot-added nondisruptively one shelf at a time, up to the maximum number of shelves supported.

Note: Any combination of shelf models cannot exceed 180 total drive slots even if the slots are not populated with drives.

The expansion shelf cabling allows a 12Gb SAS3 connection from the top down on the A-side of the system, and a 12Gb SAS3 connection from controller B to the last shelf and back to the first expansion shelf. This cabling method enables the seamless addition of a new expansion shelf to a running storage system. Figure 5 shows the cabling diagram for the DSA E2812 storage system.

Figure 5) Shelf expansion cabling for the Bosch DSA E2812 storage system.

Note: The drive expansion cabling for the DSA E2860 system is the same as for the DSA E2812. The primary difference between the various models is the orientation of the controllers. The DSA E2860 controllers are in a stacked configuration with controller A on the top. (In contrast, the DSA E2812 system uses a side-by-side configuration with controller A on the left side facing the rear of the shelf.) For more Bosch VMS with DSA E-Series installation instructions, see the [Bosch installation guide](#).

E2800 SANtricity OS

The SANtricity OS has several components bundled in one installation package, including the controller firmware, NVSRAM, and SANtricity System Manager application. The SANtricity management application runs on the controller onboard web servers. It provides complete system provisioning capabilities, event monitoring, audit log, and advanced security features (LDAP, RBAC, SSL certificates) without requiring a download of a Java-based application. The previous DSA E2700 did not have this embedded functionality or the new security features introduced with SANtricity System Manager.

SANtricity System Manager

SANtricity System Manager is a web-based storage management GUI that runs on E-Series controller web servers and acts as an API orchestration layer to communicate with E-Series controllers. The GUI supports most management functions, including:

- Hardware configuration and settings
- Application server setup (NTP, DNS, and so on)
- Security configuration
- Storage configuration

    Note: Storage configuration is generally not used because the Bosch VMS is integrated with SANtricity to offload and automate the storage configuration and LUN-mapping tasks.

- Performance monitoring
- System troubleshooting

Figure 6 shows the landing page and basic navigation choices with SANtricity System Manager.

Figure 6) SANtricity System Manager web-based GUI.

As shown, navigation links are along the left side:

- **Home.** This is the SANtricity System Manager landing page shown in Figure 6. Performance monitoring tasks and most basic storage configuration tasks can be executed from the Home page.
- **Storage.** On this tab, you can execute storage configuration tasks such as creating volume groups or pools, creating hosts or host clusters, creating volumes and mapping to hosts, or setting up mirroring.
- **Hardware.** You can view hardware status and change hardware-related settings such as management IPs or iSCSI port configuration.
- **Settings.** The Settings tab is used to configure or change systemwide or feature-specific settings such as:
  - Alerts, including email, SNMP, and syslog
  - Various settings, including naming the system, configuring iSCSI, changing host protocols, setting up drive security keys, and other systemwide settings
  - Access management to handle the role-based access accounts, set up directory services, configure SAML, or set up the audit log
  - Certificates, which can be managed for system controllers
- **Support.** Here you can perform support-related activities such as creating a support bundle, viewing the storage-array profile, viewing the event log, or executing upgrades.

  Note: All supported SANtricity System Manager Storage tab configuration capabilities needed for the Bosch video recording solution (creating volume groups, volumes, and so on) are built into the Bosch VMS Configuration Client interface. As a result, you shouldn't need to use SANtricity System Manager to provision or map the storage to Bosch cameras.

SANtricity limits and specifications

Table 4 provides a general list of system specifications. It isn't a complete list, but it clarifies some of the limits for the Bosch VMS integrated solution. For a complete list of system specifications, see the NetApp Hardware Universe tool for your configuration and software version.

Table 4) SANtricity software boundaries for DSA E2800 storage systems.

Components	Maximum
Storage hardware components	
Shelves (controller drive and expansion drive)	1 controller + 7 expansion shelves with 12 drive shelves, 1 controller + 2 expansion shelves when you use the 4U 60-drive shelf
Max drives: drive slot count	180
Logical components	
Volumes per partition	254
Volumes	254
Disk pools per system	1
Default Bosch recording volume size	2000GiB
Maximum supported Bosch recording volume size	64 TiB **Note:** Large volumes don't perform as well as small volumes.
Max number of iSCSI sessions per system	800

Note: DSA E-Series E2800 storage systems are configured specifically for the Bosch VMS application. As a result, some limits vary from the NetApp branded E2800 series system limits.

Bosch VMS solution

The Bosch Video Management System Solution provides a distributed network video recorder (NVR) solution, thus enabling the second generation of IP network video recording. The BVMS supports iSCSI-based storage systems and Bosch video-over-IP cameras and video encoders. The BVMS introduces the concept of a storage virtualization layer that uses VRMs. This abstraction layer enables VRMs to manage all the individual disk arrays in the entire system as a single virtual common pool of storage that is intelligently allocated as needed. The IP cameras and encoders record directly to the iSCSI storage and are managed only by VRMs. Therefore, the need for server hardware, operating systems, antivirus software, and the ongoing software patches and updates these systems require is greatly reduced. This technology makes installation, operation, and maintenance easier while reducing TCO.

Bosch VRM software provides virtualization and recording management services, enabling Bosch IP cameras to stream directly to NetApp network storage. The VRM pools all disks to allocate storage on demand and balance loading across your network, fully utilizing available storage and squeezing the maximum possible return from your investment.

The Bosch VRM's redundancy and automatic failover capabilities are combined with in-camera redundancy to deliver unmatched reliability. If a storage system fails, the VRM and/or individual cameras immediately redirect camera traffic. This concept combines and controls advanced video recording solution features in the application and eliminates the need for expensive intelligent storage capabilities such as mirroring, snapshots, and virtualization.

Benefits

The Bosch and NetApp video recording solution provides a high-performance, flexible, scalable, and highly reliable storage foundation for IP network video recording. The Bosch VMS solution offers many benefits. These benefits include huge cost savings through storage consolidation and harmonization, footprint reduction (cooling, power, space) with maximum storage scaling, and reduction of management overhead by using Bosch's management software.

Bosch key benefits

- The setup is easy because of fewer hardware components.
- The pay-as-you-grow concept makes it easy to add extra storage without requiring a "balanced" upgrade; upgrades are not "unbalanced" when you add cameras or storage.
- There is automatic failover when there are more than two iSCSI targets and sufficient iSCSI sessions/bandwidth is available.
- The intelligence is located in the camera. With this camera-centric system, the decision about where to record is made in the camera.
- Every camera/encoder adds more computer power.
- Virtualization does not take place on physical hardware (server/storage).
- "Hot standby (N+1)" is not required.

Value for your money

Bosch's VMS software adds systemwide recording management for direct-to-iSCSI RAID storage. The software enables IP cameras and encoders to stream directly to the disk and distributes video to different arrays on the network. The VRM pools all disks on your system, allocates storage on demand, and balances video loading across your network. It makes full use of available space to maximize the return on your storage investment. You also gain added flexibility because you can easily add storage as your surveillance system grows.

Reliability

If an iSCSI disk array fails, the VRM immediately redirects camera traffic and helps prevent gaps in recording because of network outages.

Video storage arrays for ultimate flexibility and massive storage

The demand for storage capacity is growing at an unprecedented rate, fueled by increasing camera resolutions, longer data retention policies, and security through data replication. The Bosch range of video storage arrays is tailored to meet the unique demands of video surveillance and offers one of the highest levels of RAID redundancy.

Bosch and NetApp RAID 5 technology can deliver peace of mind about your video storage without compromise. A RAID 6 configuration can be used for greatly enhanced data protection against any two disk failure events. Starting with BVMS 10, the DDP option is available on the DSA E2800 to further enhance drive management with faster recovery from failed drive events and easy growth to existing pools.

Features of the Bosch VRM

The VRM offers systemwide recording, monitoring, and management of Bosch iSCSI storage, video servers, and cameras and acts like a traffic manager by distributing video across the storage devices.

Key features

- Uses second-generation IP NVR technology

- Replaces the dedicated NVR approach with the revolutionary concept of storage virtualization
- Enables:
  - Direct communication between the camera and the storage without involving a server
  - Camera-driven decisions about where to record
  - Automatic redundancy on storage and recording level; "hot standby (N+1)" configuration is not required
  - Automatic load balancing of bandwidth and connected cameras
  - The "pay-as-you-grow" concept; it is easy to add extra storage or cameras with an automatic balanced upgrade
  - Simultaneous recording of two camera streams with different recording qualities to physically separated locations
  - Integrated long-term video archiving

Storage failure handling with the VRM

- There is continuous recording even when traffic management fails.
- Each IP camera can independently stream to its current iSCSI targets.
- If an iSCSI drive or LUN fails, VRM provides access to another iSCSI drive.
- Data streams are reallocated to free storage targets.

VRM features

- Optimized storage utilization
- Failover for extra reliability
- Automatic load balancing between connected disk arrays with respect to the bandwidth and the number of iSCSI connections
- Configurable in accordance with the IP address
- Support for Bosch DSA disk arrays (NetApp portfolio systems)
- Improved logging functionality

Note: For VRM limits and compatibility to NetApp E-Series systems, check the VRM release notes and Bosch E2800 datasheets on the [Bosch product page](#).

Configuring the DSA E2800

There are two primary tasks required to successfully set up DSA E-Series systems. The first is the basic setup of the E-Series storage system, and the second is the integration with the Bosch VMS.
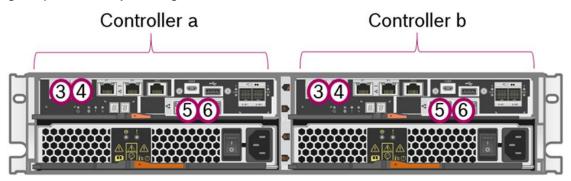
Initial E-Series configuration

The Bosch VMS is an end-to-end surveillance solution. As a result, much of the DSA E-Series configuration process is integrated into the Bosch VRM interface. To enable the Bosch integrated features to function, the following prerequisites must be met:

- The DSA E-Series was purchased through Bosch and has the Bosch branded submodel ID programmed into the system from the factory.
- The NetApp E-Series standard installation procedures provided in the quick installation guide shipped with the controller shelf have been completed. The storage system controller management ports (one per controller) are accessible to the VRM server.
- The storage system is in optimal status, and all installed drives are visible in the NetApp SANtricity System Manager GUI.

- The iSCSI IP addresses are set on the E-Series controller host interface ports as indicated in Figure 7. Use the ports designated 3 and 4 for 10Gb optical connectivity or the ports designated as 5 and 6 for 10GBASE-T connectivity.

  Note: Only one set of ports (3/4 or 5/6, depending on customer connectivity requirements) is used.

Figure 7) Bosch host port designation for the DSA E2800.

The BVMS architecture is designed for full path and controller redundancy through the capabilities of the VRM and the cameras combined with the built-in asymmetric dual-active controller capabilities of the NetApp E-Series storage system. The backup path mapping is specific to the Bosch integrated BVMS solution as follows:

- Controller A port 3 has a backup path pairing with controller B port 3.
- Controller B port 4 has a backup path pairing with controller A port 4.

Optionally:

- Controller A port 5 has a backup path pairing with controller B port 5.
- Controller B port 6 has a backup path pairing with controller A port 6.
- The VRM must be able to access two ports from each storage controller that is connected to the recording network. As shown in the diagram in Figure 7, ports 3/4 or ports 5/6 should be connected for each controller. For simplex controller configurations, the VRM load-balances the cameras across both iSCSI target IPs on the single controller. For duplex controller configurations, all four paths should be accessible to the BVMS Configuration Client before you discover the DSA E2800 system. For duplex, the VRM load-balances across the primary paths: controller A port 3 and controller B port 4, or controller A port 5 and controller B port 6.

All initial path configurations between cameras and DSA E-Series storage targets are directed by the VRM. After the VRM delivers the storage target (there must be at least one) or target list to cameras, the cameras use it to connect to a storage target. If one path becomes unavailable to a camera, the camera automatically switches to a designated available backup path. This approach allows the cameras to record, even in an HA mode, if the VRM goes offline. The E-Series controller-to-LUN ownership will function normally, including changing LUN ownership if an ALUA timer expires.

Note: Note: The NetApp AutoSupport® feature is enabled by default in SANtricity 11.50.2 and 11.60.2. This feature monitors the health of a storage array and automatically sends health reports to NetApp technical support. In case of a problem with the disk array, NetApp forwards the information to the Bosch support team. If the system is not registered, the customer cannot be traced to provide support for the automatically reported issue.

To prevent this there are two options:

1. Make sure that your system hardware is registered. For this see chapter 2.1 of the Bosch installation guide.

2. Disable the AutoSupport feature following below steps in the NetApp SANtricity System Manager GUI:

   a. Select Support > Support Center > AutoSupport tab

   b. Select Enable/Disable AutoSupport Features

   c. Select Disable AutoSupport

   d. Click Save

Deployment procedures

Deploying the E2800 system with the Bosch VRM involves the following tasks:

- Install the DSA E2800 storage system by using the [installation procedures provided on the NetApp Support site](). The procedures include the following tasks:

  – Install the shelf-mounting hardware.

  – Install the shelves.

  – Cable the system for power, network, and drive expansion when required.

  – Power on the system; power on expansion shelves first if the system has more than one shelf.

- Use SANtricity System Manager:

  – To set the DSA E2800 system administrator password

  – To set the controller management port IPs

  – To run the setup wizard and configure email alerts

  – To configure NTP and DNS servers

  – To optionally set up SSL certificates, LDAP, RBAC, and the audit log

  – To configure the iSCSI host ports on the E-Series

- Use the Bosch VMS Configuration Client:

  – To add the storage system to the Bosch VRM

  – To provision the E-Series storage into volume groups or a pool and then into volumes

  Note: If you're using volumes larger than 2000GiB, you must set the flag to use larger volumes at the pool level of the BVMS Configuration Client.

  – To map the E-Series volumes to the E-Series default host cluster

  – To add cameras to the E-Series recording targets

Installing the storage system

The steps to install the E-Series storage system in the 12-drive shelf are in the [DE212C E-Series quick installation guide](), and the steps for the 60-drive shelf are in the [DE460C E-Series quick installation guide](). These guides ship with the E-Series controller shelf and are available on the NetApp Support site. The procedure includes setting the system administrator account password and management IP address for each controller. This password is also used by the Bosch VMS Configuration Client to discover the DSA E2800 system.
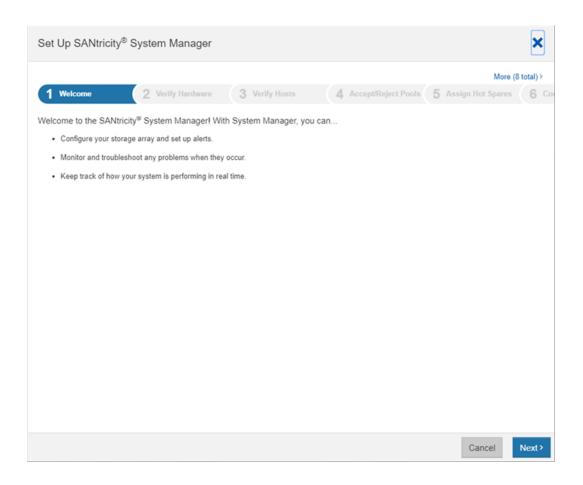
Note: Review the requirements in the site planning guide for the DE460C shelf before you try to install the system. The DE460C requires dual 208-240 VAC power sources and the new data center 1280mm deep rack. The DE212C shelf uses 120–240 VAC and fits in a standard rack.

Setting up email alerts, NTP, and DNS

When you log in to an E-Series storage system for the first time, the built-in SANtricity System Manager setup wizard automatically starts. The wizard can be used to set up several features of the storage system, but for Bosch implementations, you should use it only to set up email alerts. The other wizard settings should be bypassed or not used. From there, use SANtricity System Manager to complete the basic storage system configuration.

Note: This configuration is the standard one required for all E-Series installations and is usually done by some form of professional services. As a result, planning for NTP, DNS, management port IPs, and so on is essential so that the installation can be completed in one visit.
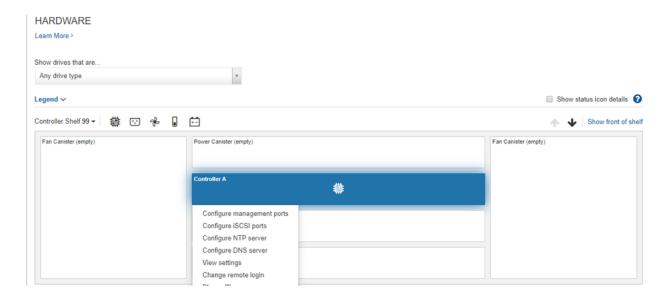
1. The first time you log in to SANtricity System Manager, you are automatically directed to the setup wizard. The wizard helps you can configure your storage system, including hardware shelf order, hosts, applications, workloads, pools, and volumes. For the BVMS implementation, skip the steps to create a pool or set aside hot spare drives, because you will perform these steps later in the procedure. Use the wizard only to set up email alerts.
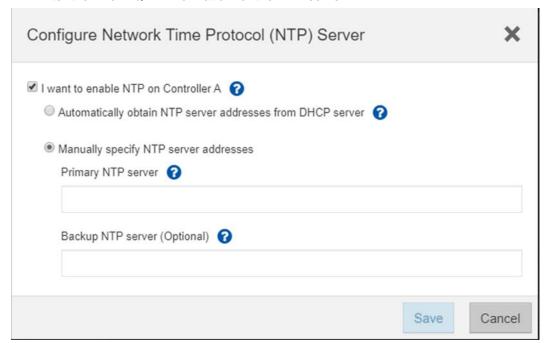
2. Use SANtricity System Manager and navigate to the Hardware tab. Select the link to show the back of the shelf.
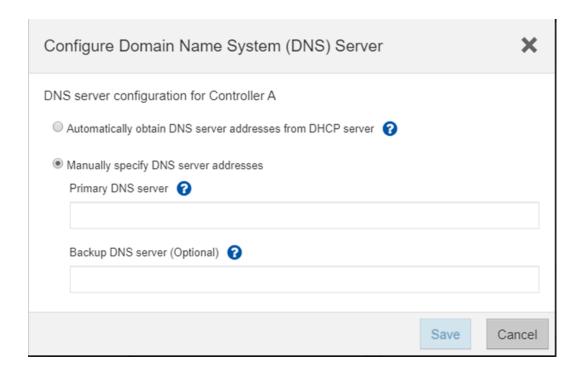

3. Click Controller A to display the drop-down menu and select Configure NTP Server.

HARDWARE
Learn More >

Show drives that are...
Any drive type

Legend ∨   ☐ Show status icon details ❓

Controller Shelf 99 ▾   ⬚ ⬚ ✦ 🔋 ⬚   ⬆ ⬇ | Show front of shelf

Fan Canister (empty)	Power Canister (empty)	Fan Canister (empty)
	Controller A ⬚	
	Configure management ports	
	Configure iSCSI ports	
	Configure NTP server	
	Configure DNS server	
	View settings	
	Change remote login	

4.   Enter the IP or FQDN information for the NTP server.

Configure Network Time Protocol (NTP) Server   ✕

☑ I want to enable NTP on Controller A   ❓

   ○ Automatically obtain NTP server addresses from DHCP server   ❓

   ◉ Manually specify NTP server addresses
      Primary NTP server   ❓

      [   ]

      Backup NTP server (Optional)   ❓

      [   ]

                                                [Save] [Cancel]

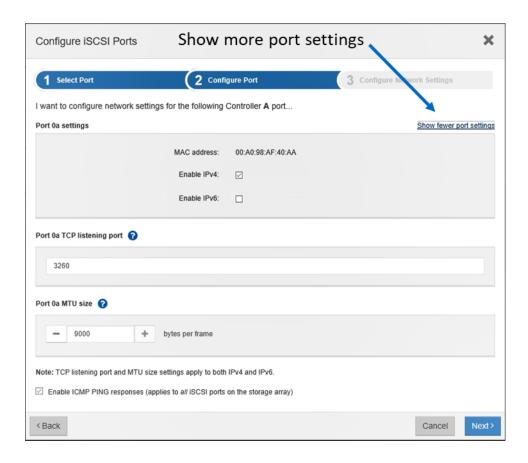5.   Repeat step 3, but select Configure DNS Server. Then enter the information to connect to the DNS server.

Configure Domain Name System (DNS) Server ✕

DNS server configuration for Controller A

   ○ Automatically obtain DNS server addresses from DHCP server ❓

   ◉ Manually specify DNS server addresses

      Primary DNS server ❓

      [   ]

      Backup DNS server (Optional) ❓

      [   ]

                                                  Save   Cancel

6. Repeat step 3 again and select Configure iSCSI Ports.

7. Select the first port to use for camera recording. In this example, the controller onboard ports 0a and 0b are used (the ports designated as 3 and 4 in the Bosch VMS installation guide and Figure 7). However, you should configure the ports specified in the build plan for each deployment.

> **Note:**   Port 0a (Bosch designated controller A port 3) is the primary I/O port on controller A. Port 0b is the Bosch designated backup path for controller B port 4 (NetApp designated controller B port 0b).

Configure iSCSI Ports ✕

1 Select Port   2 Configure Port   3 Configure Network Settings

I want to configure network settings for the following Controller **A** port...

| Port 0a | Link Status: Up ▾ |

What else do I need to do to configure or diagnose iSCSI?

                                              Cancel   Next >

8. Deselect the unused IP version, IPv4 or IPv6, and enter network information only for one or the other. You can also set jumbo frames and disable or enable ICMP ping from this window. Click Next.

Configure iSCSI Ports — Show more port settings

1 Select Port 2 Configure Port 3 Configure Network Settings

I want to configure network settings for the following Controller **A** port...

Port 0a settings — Show fewer port settings

MAC address: 00:A0:98:AF:40:AA
Enable IPv4: ☑
Enable IPv6: ☐

Port 0a TCP listening port

3260

Port 0a MTU size

− 9000 + bytes per frame

Note: TCP listening port and MTU size settings apply to both IPv4 and IPv6.

☑ Enable ICMP PING responses (applies to *all* iSCSI ports on the storage array)

< Back Cancel Next >

> **Note:** You can use ICMP ping to verify the network connection from the VMS server to the DSA E-Series E2800. But after confirmation, the best practice for security is to disable ICMP ping in your production environment.

9. Enter the iSCSI IP address, subnet mask, and (if required) the gateway address for the DSA E2800 port to access the camera network. Then Click Finish.

> **Note:** Clicking Finish causes the iSCSI port on the DSA E2800 to reset.

10. Repeat steps 6 through 9 for controller A port 0b (the port labeled port 4 in the Bosch VMS installation guide and Figure 7).

11. In the Hardware view, click controller B, and select Configure NTP Server to confirm the IP or FQDN information for the NTP server.

12. Repeat step 11 but select Configure DNS Server.

13. Repeat step 11 but select Configure iSCSI Ports.

14. Repeat steps 7 through 9 for controller B port 0a (this is Bosch designated port 3—the backup port for controller A port 0a).

15. Repeat steps 7 through 9 for controller B port 0b (this is Bosch designated port 4—the primary I/O recording path on controller B).

> **Note:** When iSCSI security is required, the BVMS VRM uses a single Challenge-Handshake Authentication Protocol (CHAP) password for all camera and storage target connections. Use SANtricity System Manager to set the CHAP password for the storage system. You can do this in the Settings tab's iSCSI settings section.

Setting up the Bosch VMS Configuration Client

1. On your Bosch VRM server, ping the storage system iSCSI IP addresses for the four ports planned for your deployment. For duplex systems, you must have IP connectivity to all four ports.

2. In the VMS Configuration Client, go to the Devices tab and expand the device tree.

3. Right-click VRM Devices and select Scan for VRM Devices.

4. Select the primary VRM with the network address that matches the address of the VRM where you want to add the DSA E-Series, and then select Next and Finish.

5. A pool should be automatically created under the VRM device you just added. If not, right-click the VRM device and select Add Pool.

   Note: When iSCSI security is required, the BVMS VRM uses a single CHAP password for all camera and storage target connections. Use SANtricity System Manager to set the CHAP password for the storage system. You can do this in the Settings tab's iSCSI settings section.

6. With the new pool selected, confirm that Recording Preferences Mode is set to Automatic.

Note: This specification sets the camera path failover mode to automatic. Automatic is the recommended setting for production environments. The alternative is Failover, but for that setting, the camera target paths must be manually set for each camera.

Add the storage system to Bosch VRM

After you complete the prerequisites, you can discover the DSA E-Series by using the Bosch VRM and the VMS Configuration Client. This process includes the following functions:

- Discovering the storage system by using the E-Series controller A out-of-band management port IP
- Provisioning multiple RAID 5 or RAID 6 volume groups; or with BVMS 10 and later, a pool from all available drives in the system
- Creating up to 254 volumes (depending on the available capacity) or optionally creating larger volumes

   Note: This functionality is based on administrator entries in the Configuration Client combined with built-in VRM logic. For more information, see the Bosch product page.

- Mapping the volumes to the E-Series default host cluster

Because the cameras have built-in iSCSI initiators, they can access the DSA E-Series default host cluster without being specifically defined in the E-Series management application. As a result, the cameras can connect and disconnect as needed, and they can redirect to a backup storage port when the primary storage port is not available.

Note: More installation instructions are available in the Bosch VMS installation guide.

To initiate connectivity from the BVMS Configuration Client:

1. Navigate to the Devices tab.
2. In the tree view on the left, select the desired VRM, and expand that device.
3. Select the desired pool, and right-click to display the context menu.
4. Select Add DSA E-Series Device to open the wizard.

5. Enter the management IP address of controller A in the Management Address box, and enter the storage system administrator password in the Password box.
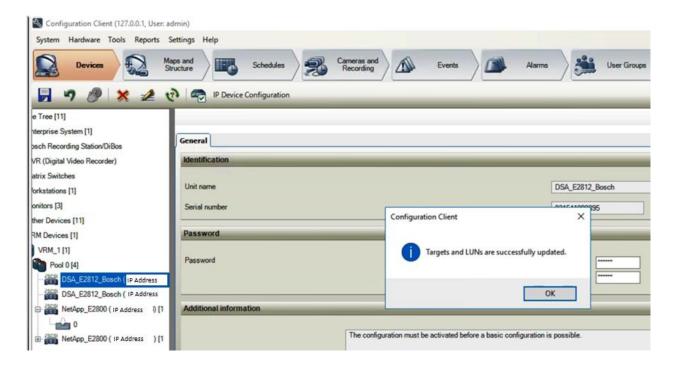
6. Click Connect to start the discovery process. If the process is successful, the window populates with the host interface port information for both controllers and the management port address for the second controller in a duplex system.

Add DSA E-Series Device

Connection

Name	DSA_E2812_Bosch
Management address	DSA E-Series Cont. A mgmt. IP
Password	••••••••••

Controller

DSA E-Series type	DSA E2800 Full Duplex
Network address iSCSI Ch 5	Cont. A port 0c IP address
Network address iSCSI Ch 6 backup channel	Cont. A port 0d IP address

2nd Controller

Management address	DSA E-Series Cont. B mgmt. IP
Network address iSCSI Ch 5 backup channel	Cont. B port 0c IP address
Network address iSCSI Ch 6	Cont. B port 0d IP address

Successfully connected to DSA E-Series device.

[Connect] [OK] [Cancel]

Note: In this example, the primary recording ports are controller A port 0c (port 5 from Figure 7) and controller B port 0d (port 6 from Figure 7). Controller B port 0c and controller A port 0d are the backup ports for the primary recording paths.

7. Click OK.

8. To save the new iSCSI targets, select Save. Then select Activate to update all workstations and devices with the new configuration.

9. With one of your storage controllers highlighted, select the Basic Configuration tab. Specify the LUN size and number of target spare disks, and select a RAID choice (RAID 5, 6, or DDP). Then click Initialize. A new window opens to display the progress of the LUN creation.

10. When the process is completed, right-click each of the controllers and select Scan Target. A number 0 should appear under the controllers. Click Save at the top-left corner.

11. Select the number 0 under each controller. The associated LUNs for the given path to the storage system should be listed here. Select the boxes under Format for each LUN and click Format LUN.

12. Click Save at the top-left corner.

Summary

The Bosch VMS solution provides a high-performance, flexible, scalable, and highly reliable direct-to-iSCSI storage management solution for IP network video recording. The solution combines the following features:

*   **Optimal performance.** Optimal performance is obtained by using intelligent addressing on a block level, which also allows load balancing of video recording to all available storage blocks on any storage array in the system.

*   **Load balancing.** The solution performs load balancing for bandwidth and number of iSCSI connections and is configurable per IP address (iSCSI target).

*   **Logical virtualization.** The VRM virtualization layer allows you to scale storage beyond the physical limits of a single storage subsystem. This logical abstraction layer means that each camera can use any storage space it needs, rather than an allocated, arbitrary, discrete chunk ahead of time. You can also adjust retention times of video data.

*   **Fast recording and retrieval.** The VRM provides fast and flexible retrieval through a search database of recordings and metadata. Metadata is a form of data that describes other data such as events, ATM/POS information, and video content analysis data. The metadata is recorded with the video data and provides a fast and an efficient way for the search engine, in the playback client, to

quickly locate specified video clips. The database also tracks the location of recording blocks. If this database is lost, the VRM can re-create the database by reading the stored metadata, thus providing a self-healing capability.

- **Distributed storage.** The VRM provides redundant management of metadata that significantly enhances overall reliability and availability. With redundancy for storage provisioning and a failover design for the central recording management service, there is no single point of failure. Also, unlike NVR systems, the VRM scales without requiring more PCs. This capability greatly reduces the risk of system failure.

VRM iSCSI recording architectures

Figure 8 shows a small VRM iSCSI recording architecture.

Figure 8) Concept drawing of basic Bosch VRM solution.

Figure 9 shows a large-scale VRM architecture.

Figure 9) Large-scale Bosch video recording architecture.

Where to find additional information

To learn more about the information that is described in this document, review the following websites:

- Bosch Worldwide
  https://www.bosch.com/
- Bosch Media Service
  https://www.bosch-presse.de/pressportal/de/en/news/
- Bosch Security Systems Worldwide
  https://www.boschsecurity.com/xc/en/
- NetApp E-Series documentation
  https://mysupport.netapp.com/info/web/ECMP1658252.html

Refer to the [Interoperability Matrix Tool (IMT)](#) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer's installation in accordance with published specifications.

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