

# EonStor DS High Density Storage: Key Design Features and Hybrid Connectivity Benefits

White Paper

## ***Abstract***

This white paper introduces the key design features and advantages of high density EonStor DS storage systems that utilize hybrid host interfaces, namely Fibre Channel and iSCSI. Hybrid interfaces increase connectivity and enable the application of multiple data transfer standards and protocols on a consolidated system, delivering a gain in efficiency and utility: for example the implementation of SAN tiering and more accessible remote replication.



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## EonStor DS

EonStor DS is Infortrend's entry-level family of storage solutions. Featuring advanced hardware design and comprehensive data services at affordable price points, EonStor DS systems are ideal solutions for small and medium businesses (SMBs).

EonStor DS systems provide excellent data protection to ensure the highest data availability for storage area network (SAN) and direct attached storage (DAS) configurations. Combined with modular architecture, thin provisioning, easy and intuitive management, and exceptional price-performance ratios, the EonStor DS family offers price-conscious businesses a decisive competitive edge by helping IT efficiency keep up with growing storage needs.

For more information about Infortrend EonStor DS storage systems, please visit [www.infortrend.com](http://www.infortrend.com).





## [EonStor DS High Density Solutions: Introduction](#)

Infotrend EonStor DS 3048R/3060R (dual redundant controllers) and EonStor DS 3048G/3060G (single controller) models are high density storage solutions featuring a 4U form factor that accommodates 48 and 60 drive bays, respectively.

The solutions offer hybrid connectivity with 8Gb/s or 16Gb/s Fibre Channel, 1Gb/s or 10Gbs iSCSI, and 6Gb/s or 12Gb/s SAS with 1GbE iSCSI onboard in a single enclosure. This configuration allows users to deploy cost effective remote replication via the iSCSI ports or implement SAN tiering, assigning mission-critical applications to FC SAN and secondary applications to IP SAN.

As with all EonStor DS systems, high density solutions offer advanced data services to help users get even more out of storage systems. Standard services include snapshot and volume copy/mirror, and available features cover remote replication. These help users effectively protect their data and implement comprehensive disaster recovery plans. Thin provisioning enables dynamic capacity provisioning to optimize storage resource utilization.





## **High Density Features**

High density EonStor DS systems offer extremely large storage capacities, reducing the required amount of floor space, lowering power consumption and simplifying management.

### ***Extremely Large Capacity***

48 and 60 drive slots in a 4U form factor offer extreme capacities. Traditional 2U 12-bay systems need 8U to 10U rack space to reach the same number of disk drives that high density solutions achieve in only a 4U form factor.

With high density solutions supporting drive capacities of 6TB and above, a single 60-bay enclosure can accommodate 360TB or more. In addition, the solution can be further expanded with 48-bay/60-bay expansion enclosures (JBODs) to achieve a maximum of 336/360 drives.

### ***Reduced Floor Space and Power Consumption***

By cutting the space required to accommodate 48 and 60 disk drives by half or even more as mentioned above, companies can optimize the use of their datacenter space. Maintaining datacenters requires large amounts of power and extensive cooling, and by limiting the size of their datacenters companies can attain significant electricity and cooling savings.

### ***Simplified Storage Management***

By storing more data in a single system instead of having data spread out over multiple hardware systems, management can be simplified. IT administrators can manage their data through a single interface and deal with a single set of hardware components instead of having to monitor multiple enclosures, possibly from different vendors.

### ***Reduced Costs***

The above mentioned features lead to considerable cost savings. Less power consumption and cooling equipment lower electrical power costs, while simplified management lowers human resource costs. The competitive prices of high density solutions further contribute to cost advantages.

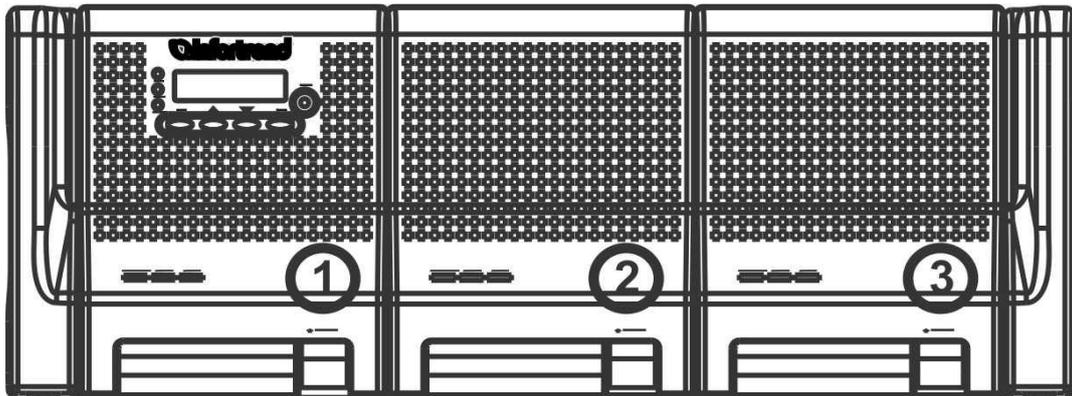


## Innovative Drawer Design

Accommodating a large number of drives in a 4U form factor requires special design features to ensure that systems are easy to use and maintain and have access to reliable power supply and cooling.

### ***Three Drawers Accommodate Disk Drives***

Systems feature three drawers that accommodate 16/20 disk drives each, for a total of 48/60 drive bays.



Take the EonStor DS 3048 for example: when viewed from the top, the first drawer on the left contains drive bays 1-16, the second drawer in the middle contains drive bays 17-32, and the third drawer on the right contains drive bays 33-48. The diagram below shows drive bay numbering:

#### **Rear panel**

1	5	9	13	17	21	25	29	33	37	41	45
2	6	10	14	18	22	26	30	34	38	42	46
3	7	11	15	19	23	27	31	35	39	43	47
4	8	12	16	20	24	28	32	36	40	44	48

#### **Front panel**

These drawers can be opened and closed while the system is online, making it easy to replace disk drives when necessary. When one of the drawers is pulled out from the enclosure, the other two drawers are not affected in any way.



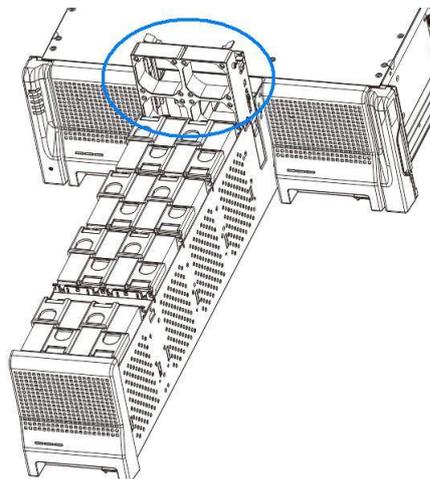
Each drawer is connected to the backplane with a power cable and signal cable in a flexible manner so that power and data signals are not interrupted when a drawer is pulled out. Disk drives in a drawer that is pulled out can continue to serve I/O requests. Disk drives are hot-swappable, meaning they can be replaced while the system is online.

Disk drives are installed into brackets, which are then installed into drawers. To optimize use of available space, high density solutions adopt a vertical design for these brackets. To install or remove disk drives, users can simply open one of the drawers and use handles on drive brackets to insert drives into the system or pull them out, as shown below.



### ***Drawer Cooling***

Each drawer has its own cooling fan module at the back, as shown in the figure below. These cooling fan modules contain four fans each. Fans pull in air through the convection holes on the front panel. This air cools hard drives and other internal components in the system, and exits at the back.





### ***Why Three Drawers?***

Different options exist for the design of high density storage solutions, as evidenced by the variety of designs available on the market. EonStor DS solutions adopt a three-drawer design to enhance and improve the user experience. The following factors make a three-drawer design the best possible option:

- Compared to products offering access to drives by opening the enclosure from the top, the horizontal drawer design is much more user friendly. As high density systems are mostly installed into racks, having the opening on top of the system requires users to remove the whole system from the rack when disk drives need to be replaced. Multiple people have to be involved. In a drawer design, the system does not need to be removed from the rack and drive replacements can be completed by a single person.
- Cabling in a three-drawer design is much less complex than in a single-drawer design. In a single-drawer design, each time the drawer is pulled out a large set of cables has to slide out as well, increasing the potential for cabling mishaps. In a three-drawer design, cabling is simplified. Each drawer has its own cabling, consisting of a power cable and a data signal cable. When pulling out a drawer, only one set of cables is moved, minimizing cabling issues.
- In a design featuring a larger number of drawers, for example five or six, system performance is compromised, as bandwidth is divided across the large number of drawers and cannot be fully optimized. Three drawers offer a balance between user friendly maintenance and system performance.
- Material costs in a three-drawer design are relatively low, leading to attractive price points for customers. Combined with the above mentioned factors, a three-drawer design offers the best cost efficiency.



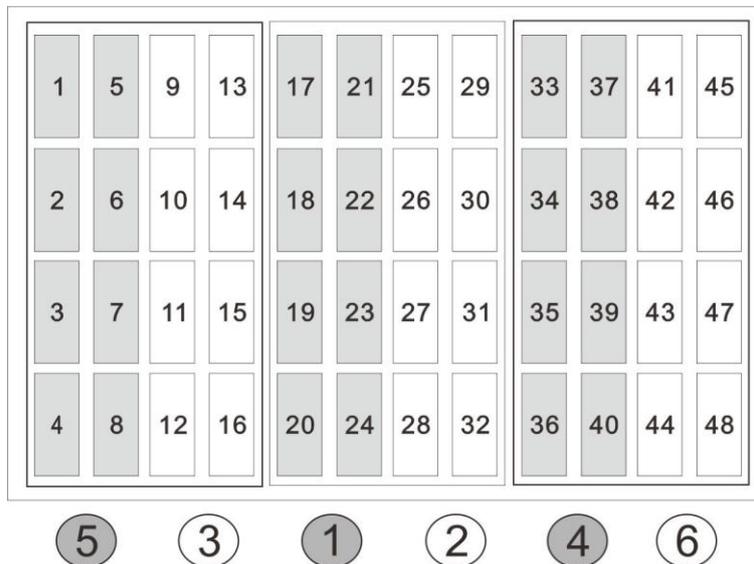
## Disk Drive Installation and Logical Drive Deployment

### ***Disk Drive Installation***

Due to the weight of EonStor DS high density solutions, it is strongly recommended that hard drives are installed after the enclosure has been rack-mounted. If drives are installed before rack-mounting the enclosure, it might become too heavy to handle properly.

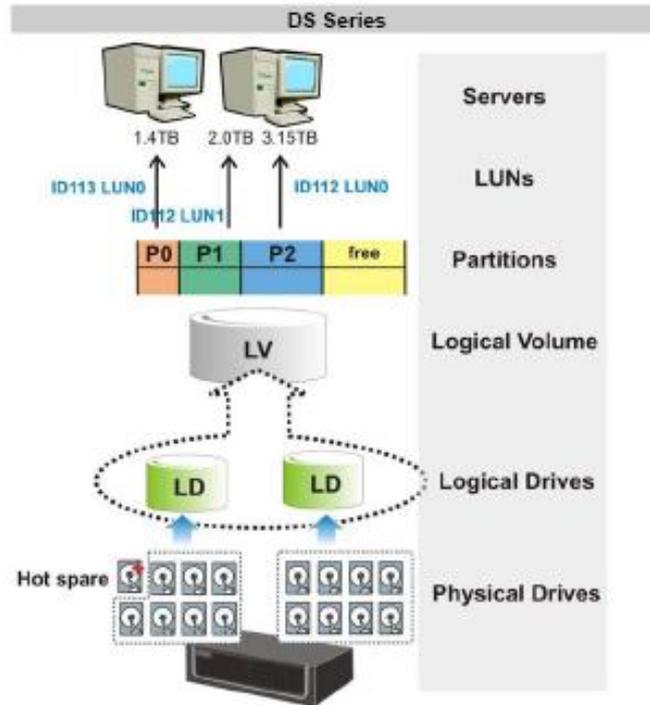
With the EonStor DS 3048 as an example, we recommend installing eight hard drives per set when configuring high density solutions. It is also recommended to install hard drives according to the following sequence, as shown in the diagram below:

- First set: hard drive positions 17-24
- Second set: hard drive positions 25-32
- Third set: hard drive positions 9-16
- Fourth set: hard drive positions 33-40
- Fifth set: hard drive positions 1-8
- Sixth set: hard drive positions 41-48



### ***Logical Drive Deployment***

Logical drives (LDs) are a collection of physical drives and form a basic building block in partitioning storage capacity for use by host applications, as shown in the figure below.



On EonStor DS high density solutions, the drawer design adds extra variables to LD deployment. In particular, LDs should not exceed the size of one drawer, i.e. 16 or 20 disk drives.

Another important element in determining optimal LD size is potential recovery time following disk drive failure. The time that LDs need to rebuild and regenerate parity following disk drive failure can be calculated based on the following: 1TB of storage capacity requires 1.5 hours of rebuild time.

The following table offers an overview of system recovery time according to different capacities of individual disk drives installed in the storage system:

Recovery Time (1TB=1.5 hours rebuild time)			
LD Size / Disk Drive Capacity	4 Drives	8 Drives	16 Drives
1TB	6 hours	12 hours	24 hours
2TB	12 hours	24 hours	48 hours
3TB	18 hours	36 hours	72 hours



This table provides recovery indicators to be considered together with particular application characteristics. Ideally, LD recovery can take place off-peak, for example a 12-hour nighttime period or a 48-hour period during the weekend.

Based on specific environments, users can choose the size of LDs they wish to deploy. A general recommendation for EonStor DS high density systems is to deploy 8-drive LDs, as they offer an optimal balance between potential recovery time, RAID protection, and capacity management.



## **Hybrid Connectivity Benefits**

### ***Cost Effective Remote Replication***

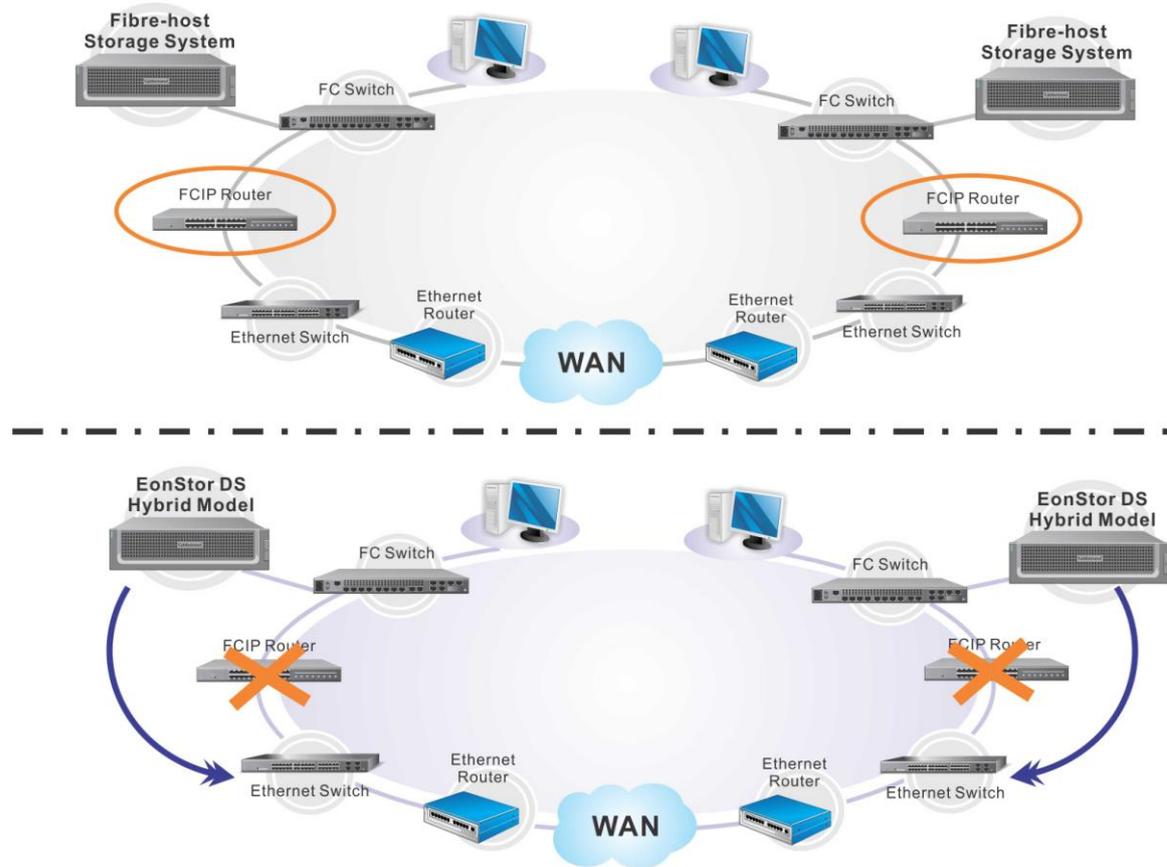
EonStor DS high density storage solutions support data replication, which can be conducted either in synchronous mode or asynchronous mode. Hybrid FC/iSCSI, variable speed iSCSI/iSCSI and SAS/iSCSI connectivity offers more options when planning data replication.

One of the main benefits of hybrid connectivity is that users are able to implement highly cost effective remote data replication via iSCSI ports on the system.

Traditionally, protocol converters or FC/IP routers are required when users want to replicate data sets from an FC-host storage system onto another FC-host storage system at a remote site over Ethernet. One router needs to be installed at the local site, while a second one needs to be installed at the remote site. These FC/IP routers require significant investments, with average prices of approximately US\$9,000 per router.

Remote replication can be implemented via the iSCSI ports of EonStor DS high density storage solutions, which can be directly connected to the IP network. This allows users to skip the protocol conversion step described above and directly send data over Ethernet to the remote site. In this way, users do not need to separately buy two FCIP routers, amounting to cost savings US\$18,000 on average.

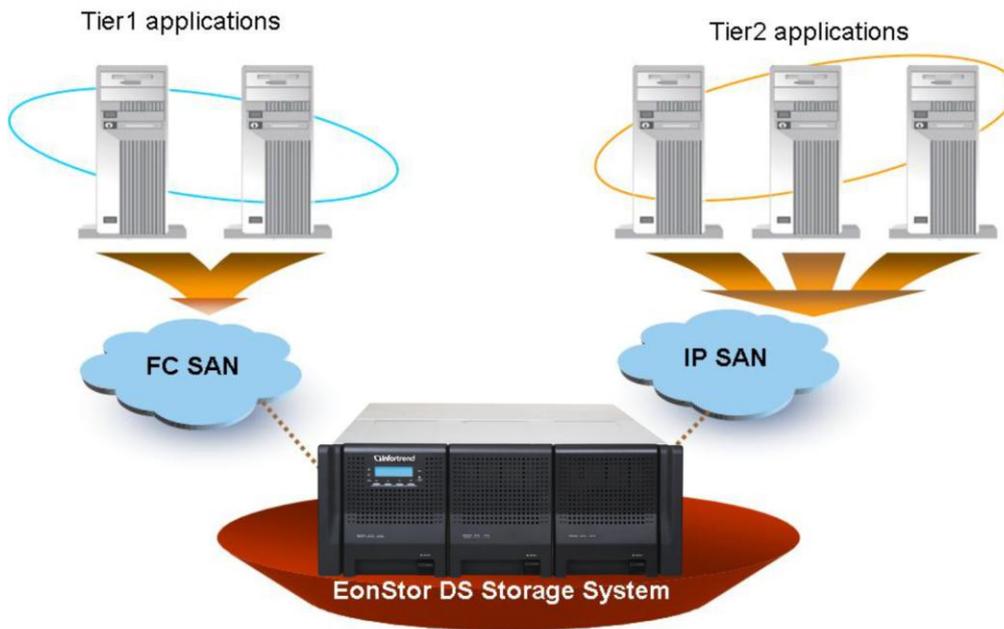
The figure below shows two remote replication setups: one using FC-only systems and one using hybrid connectivity.



Remote replication without (above) and with (below) hybrid connectivity

### ***SAN Tiering***

If users do not require remote replication, hybrid connectivity enables users to deploy both FC and IP SAN and take advantage of consolidated SAN tiering. SAN tiering means that a single storage system can meet service level requirements as FC SAN and IP SAN.



The following table provides general guidance for how to deploy applications. These general principles can help users increase SAN efficiency and improve productivity.

<b>Application characteristics suited to FC SAN deployment</b>	<b>Application characteristics suited to IP SAN deployment</b>
Mission-critical applications	Non mission-critical applications
High performance applications	Low performance applications
No significant cost considerations	Significant cost considerations
High data security demands	Low data security demands
High reliability demands	Low reliability demands



## **Solution Applications**

The high density and large capacities of EonStor DS solutions, as well as their cost advantages, generate significant benefits in many different application environments. In particular, data archiving and HPC are two areas in which the solutions stand out.

### ***Data Archiving***

The large capacities offered by EonStor DS high density solutions are ideal for data archiving. Companies often deploy one storage system set to serve current applications and another set to store archived data. The large capacities, excellent reliability, and cost efficiency of EonStor DS high density systems make them ideal choices for data archiving, helping users maintain access to older data through a single enclosure to serve their own business needs and comply with a growing number of laws and regulations mandating long term data retention.

In addition, cost advantages make it affordable for companies to maintain archived data on disk systems instead of often-used tape storage. If data is stored on tape storage systems, normally a significant amount of time and management effort is needed to retrieve data. In addition, tape tends to degrade over time, creating potential issues for long term data storage. By storing archived data on disk-based storage systems, users can enjoy instant access to archived data in case the need arises, and ensure extended data retention with the reliability of disk drives.

### ***High Performance Computing (HPC)***

HPC is another area in which EonStor DS high density solutions excel. HPC applications are characterized by the high frequency with which data is created and the large overall amount of generated data. EonStor DS systems are ideally positioned to accommodate these characteristics.

With four 8Gb/s Fibre Channel (FC) ports per controller (eight 8Gb/s FC ports on dual controller models), EonStor DS solutions offer large bandwidth to efficiently transmit massive amounts of data to and from storage arrays. HPC generates large amounts of data, and the capacity advantages of EonStor DS solutions helps users easily manage these data amounts. If a single system is not sufficient, expansion enclosures (JBODs) can help users expand capacity up to 360 disk drives.



In addition, HPC applications require extremely reliable hardware to ensure applications can operate without any downtime and with the highest data availability. EonStor DS solutions offer high reliability and availability with a large number of features:

- Redundant, reliable hardware components: redundant power supplies, cooling modules, controllers (on dual controller models) and others make solutions highly fault-tolerant. Even if one component fails, systems can still operate with redundant parts until the faulty component is replaced
- RAID technology: offers protection against up to two simultaneous drive failures
- Advanced data services: by default these include snapshot and volume copy/mirror, with support for remote replication to offer an added layer of protection
  - Snapshot offers space-efficient differential copies of data to enable quick recovery to any point-in-time in the event of system or human errors
  - Volume copy/mirror helps users deploy full data copies on systems
  - Remote replication offers the ability to deploy full data copies at remote sites to guard against major accidents or disasters at a primary storage site (see also the previous section on hybrid FC/iSCSI connectivity).