Oracle Solaris Storage Software
Oracle Solaris 11 Express

Oracle Solaris 11

Oracle Solaris is the industry leading operating system for the enterprise. Oracle Solaris 11 raises the bar on the innovation introduced in Oracle Solaris 10 with a comprehensive set of storage virtualization and management features. With over 2,700 projects, 400 inventions, and support for over 11,000 applications, Oracle Solaris 11 has been tested and optimized as an integral part of the complete Oracle applications to disk stack.

Oracle Solaris Storage Software

Oracle's storage strategy is focused on tight integration and optimization of the enterprise stack – for both engineered systems like the Oracle Exadata Database Machine and the Oracle Sun ZFS Storage Appliance, and also for the core components of conventional computing environments. Here Oracle continues to provide best-of-breed storage technologies for customers who wish to architect, integrate and tune their business system IT stack.

To meet this challenge, Oracle Solaris 11 Express offers all of the core storage capabilities necessary in the enterprise datacenter.

Ease of Management and Extreme Data Integrity with ZFS

ZFS introduces a concept of pooled storage, the fundamental unit of which is the ZFS Storage Pool: This replaces the traditional storage volume that mapped a disk or disks to a single file system indefinitely. With ZFS you just add disks to the storage pool. Since all the storage is shared, there is no wasted space or bandwidth. Any number of file systems or raw volumes can be created within a ZFS Storage Pool. These file systems become administrative control points. ZFS provides a very simple administrative interface for managing storage and an extremely flexible storage virtualization model.

ZFS has an unparalleled data integrity model that ensures disk to application reliability. It is based on the principles that

• Everything is copy-on-write. Data is never overwritten in place. Because of this, on-disk state is always valid and there are no "windows of vulnerability."

• Everything is transactional: the related changes that represent the work that the user was asking the file system to do either succeed or fail as a whole. There's no need for journaling because all the information that the journal would have is represented is contained in these transactions.

• Everything is checksummed - enables the detection of data corruption regardless of where it occurs in the datapath. In a mirrored or RAID-Z pool configuration, damaged data is detected and a good data copy is used to repair it

Included Data Services

Oracle Solaris 11 provides a complete list of data services "out of the box" which require no additional purchase or license fees:

• Deduplication: a capacity optimization technology that eliminates duplicate copies of data. Dramatically

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improves storage efficiency, and reduces the cost of storage, network bandwidth, space, power and cooling.

• Compression: the encoding of data to reduce its storage requirement. ZFS provides a variety of compression algorithms to best suit the data. Compression works in tandem with deduplication to further minimize the data footprint.

• Encryption: ZFS provides on-disk encryption with built-in key management to create a secured, reliable and scalable environment for data storage. Encryption is enabled at file system create time and different encryption methods are available to each file system and ZFS pool.

• Snapshots and Clones: A snapshot is a read-only point-in-time copy of a file system. The copy-on-write design of ZFS makes them essentially "free" - They are space efficient and instantaneous, providing an invaluable part of backup strategies and synchronizing data between systems. Clones are writeable snapshots, ideal for storing many private copies of shared data for operations such as data migration, test and development, or backup.

• Replication. The ability to send and receive snapshots over the network provides ZFS with integrated asynchronous replication capability.

• Root & Boot: With Oracle Solaris 11 there is only one file system type to understand and manage. ZFS's features make it an excellent root file system with many management advantages such as snapshots and ZFS volumes for swap and dump areas, all contained within a single pool. The Oracle

Solaris 11 new installation and management features in the areas of upgrade and patching processes are tightly integrated to ZFS boot/root.

• Multipathing. The ability to resolve and map multiple paths to a LUN regardless of protocol (FC, SCSI, iSCSI etc) is built in to Oracle Solaris 11.

• Hybrid Storage Pools (HSPs). A unique feature of ZFS is the Hybrid Storage Pool (HSP). Using this technology, data is intelligently and automatically migrated between DRAM, Flash storage and disk. This enables the file system to continuously optimize storage performance and efficiency. It also simplifies storage management, transparently integrating hardware elements of different performance and cost as a single storage pool.

Reliability and Performance Across the Storage Network

• The CIFS or SMB protocol is the natural file sharing protocol in Microsoft Windows environments. Oracle Solaris 11 provides a CIFS server tightly integrated to ZFS to provide a filesharing for Microsoft Windows clients.

The Oracle Solaris CIFS client software enables Oracle Solaris 11systems to act as CIFS clients storing and retrieving files from Microsoft servers. Oracle Solaris clients access Windows-based files and directories through standard Oracle Solaris I/O interfaces.

• NFS or Network File System is the distributed file system of choice for general-purpose use in the datacenter. In

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Oracle Solaris, the network file system layer is tightly integrated with ZFS. NFS is well established and standards based, easy to set up and manage, and provides excellent performance. NFS is relatively inexpensive to implement as it uses existing network infrastructure.

• Targets and Initiators: Block storage devices comprise the bulk of the world's storage today. In fact many enterprise applications are written assuming block-based backing store. Oracle Solaris 11 provides a framework to handle multiple device types using multiple transports, such as iSCSI and Fibre Channel. The software allows Oracle Solaris to provide block-based storage over the network using ZFS as the backing store file system with its reliability and scalability benefits.

The Oracle Solaris 11 multiprotocol target software framework enables protocol plug-ins that can communicate in different standards for storage such as Fibre Channel, iSCSI, SAS, and can support any type of SCSI devices e.g. disk, tape, medium changer, etc. Its features include extensive LUN Masking and mapping functions; multipathing across different transport protocols; multiple parallel transfers per SCSI command; a scalable design approach and the ability to work with generic HBAs.

Whatever architectural approach to storage infrastructure is called for in the datacenter, Oracle Solaris 11 provides the tools to implement it. These tools are robust, tightly integrated and available out of the box and included in the base pricing.

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