

# ORACLE SOLARIS 11 EXPRESS 2010.11

## WHAT'S NEW

### NEW FEATURE HIGHLIGHTS

- Oracle Solaris 10 Zones for business investment protection
- Built-in network virtualization and resource management for enhanced server workload consolidation
- Greatly reduced planned and unplanned downtime with new package management tools with safe system upgrade
- New optimizations and features designed to deliver proven scalability and reliability as an integrated component of Oracle's Exadata and Exalogic systems

*Oracle Solaris is the industry leading operating system for the enterprise. Oracle Solaris 11 Express 2010.11 raises the bar on the innovation introduced in Oracle Solaris 10, with a unique feature set that few other operating systems can offer. Oracle Solaris 11 Express 2010.11 has been tested and optimized for Oracle hardware and software, and is an integral part of Oracle's combined hardware and software portfolio.*

*Oracle Solaris 11 Express 2010.11 provides customers with the latest access to Oracle Solaris 11 technology, allowing developers, architects and administrators to test and deploy within an enterprise environments and greatly simplify their day to day operations. Oracle Solaris 11 Express 2010.11 has the reliability, availability, and serviceability that you'd expect from a leading enterprise operating system.*

*With new features such as network based package management tools to greatly decrease planned system downtime and provide for a completely safe system upgrade, built-in network virtualization and resource control management for an unprecedented level of flexibility for application consolidation, and on-disk ZFS encryption to provide the highest levels of security in your data center, Oracle Solaris 11 Express 2010.11 is the most exciting release of the Oracle Solaris platform to date. This document covers some of the new features included in Oracle Solaris 11 Express 2010.11.*

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## What's New for Administrators

### Installation

Oracle Solaris 11 Express 2010.11 introduces a new, modern software installation architecture, offering a number of installation choices - from a completely hands free automated network installation experience, to a graphical LiveCD or interactive text based installation for systems without a graphical display.

#### • Automated Install

The Automated Installer is a new technology to allow administrators to install multiple systems in parallel over the network in a hands free manner. Administrators can quickly create a network installation service to allow client machines to find an installation profile, or manifest, that matches the client's machine specifications. Once the client machine finds a match, it will then download a basic boot image and start installing software over the network from package repositories. The automated install images are also directly bootable, providing an easy way of installing Oracle Solaris 11 Express 2010.11 without setting up a network installation service - simply boot a system off the CD, specify an automated install manifest that exists on the network (or default to the one included in the media) and the system will automatically install itself from an IPS package repository. Oracle Solaris 11 Express 2010.11 also supports automated installations that install onto an iSCSI target on SPARC and x86 client systems.

#### • Interactive Text Install

The Oracle Solaris 11 Express 2010.11 text based interactive installer provides users with the opportunity of installing systems without a graphical display. The installer will step through a process similar to the graphical LiveCD, but only install a basic selection of software more suitable for server deployments. For example, it will not install components such as a graphical desktop environment, audio or wireless networking drivers.

It is also possible to install Oracle Solaris 11 Express 2010.11 to logical volumes defined within extended partitions. With this functionality you are still limited to a single Oracle Solaris partition, whether it is primary or logical. With the inclusion of the GNU Partition Editor on the Oracle Solaris 11 Express 2010.11 LiveCD, users can now resize, create or delete disk partitions and filesystems

prior to installing the operating system.

- **Distribution Constructor**

The distribution constructor is a command-line tool for building pre-configured, bootable customized Oracle Solaris 11 Express 2010.11 images. The tool takes a distribution constructor manifest file as input and outputs either an ISO image or virtual machine (VM) image that is based on the parameters specified in the configuration manifest, allowing administrators to create completely customizable golden images for use in their enterprise environment. The distribution constructor can also create USB bootable media for any of the ISO images (Automated Install, LiveCD or Interactive Text Install).

## Software and System Management

- **Boot Environments and Fast Reboot**

Boot environments in Oracle Solaris 11 Express 2010.11 represent a significant evolution of the Live Upgrade experience used in Oracle Solaris 10 and earlier releases with an out of the box configuration to allow for system updates to be applied in parallel on a live production system.

Solaris 11 boot environments are designed specifically for the ZFS filesystem, utilizing its fast snapshot and clone features to save a copy of the boot environment any time a software update to the system is performed. A snapshot is taken before any package is installed or updated, and if the update includes modifications to the system that will require a reboot to effect, then the snapshot is cloned to create a new boot environment; the package operations are then applied to the new boot environment. Once an administrator is satisfied that the update is ready to be used, the system can be rebooted into the new boot environment to activate it. In the event that an update turns out to be problematic for some reason, they can quickly activate a previous boot environment and reboot back into it to restore a prior state. ZFS filesystem snapshots and clones have low overhead and provide unprecedented flexibility for system management.

The time to reboot on Oracle Solaris 11 Express 2010.11 is significantly faster by default, allowing tests to be skipped on SPARC systems and firmware and boot loader to be bypassed on x86 systems. Administrators can change this behavior by modifying the `config/fastreboot_default` SMF property in the `svc:/system/boot-config:default` service.

- **Image Packaging System**

Image Packaging System (IPS) is a new network based package management system included in Oracle Solaris 11 Express 2010.11. It provides a framework for complete software lifecycle management such as installation, upgrade and removal of software packages. Combined with the ZFS filesystem and boot environments, IPS offers completely safe system upgrade. Administrators can install software from network based package repositories with full automatic dependency checking for any additional libraries that might be required during a software package install.

IPS package repositories also provide the administrator an opportunity to greatly simplify software delivery with a completely centralized architecture for managing a selection of software, multiple versions of that software, and multiple different architectures. Administrators can control access to different software package repositories, and mirror existing repositories locally for network restricted deployment environments. For administrators wishing to construct a local package repository mirror of Oracle Solaris 11 Express 2010.11 visit the [Oracle Solaris 11 Express download site](#) or purchase the Oracle Solaris 11 Express media pack from the [Oracle Store](#).

IPS includes a number of command-line utilities including `pkg (1)` and graphical tools, Package Manager and Update Manager. Additionally, IPS provides a MIME association, `.p5i`, to allow for single click package installs. IPS also provides the ability to validate its consistency on a system and fix any software packages should any errors occur during that validation process.

IPS also provides an easy method of sending new software packages to a repository through a series of package transactions to add package content, package metadata and dependent system services upon installation to a publisher. Administrators can easily create and manage new package repositories and associating publishers for local software delivery in an enterprise environment.

In coordination with the Oracle Solaris 11 Express 2010.11 release, new repositories have been created, containing additional software packages. The new repositories can be added under the **File > Add Publisher** menu item in Package Manager, or using the `pkg set-publisher` command-line.

Publisher URI	Description
<a href="http://pkg.oracle.com/solaris/release">http://pkg.oracle.com/solaris/release</a>	The release repository is the default repository for Oracle Solaris 11 Express 2010.11. This repository will receive updates for each new release of the Oracle Solaris platform.
<a href="https://pkg.oracle.com/solaris/support">https://pkg.oracle.com/solaris/support</a>	The support repository is a repository providing the latest bug fixes and updates. Administrators will only be able to access this repository if they have a current <a href="#">support contract from Oracle</a> . For details on how to connect to the support repository, please see the <a href="#">Oracle Solaris 11 Express Support FAQ</a> .

While IPS packaging is the default system for Oracle Solaris 11 Express 2010.11, compatibility for older SVR4 software packages is preserved with continued access to `pkgadd` and related commands. The Oracle Solaris 10 `patchadd` command (and related commands) are not available on Oracle Solaris 11 Express 2010.11 as these have now been replaced with IPS package management tools.

• **Service Management Facility (SMF)**

Significant improvements have been made to the Service Management Facility (SMF) in Oracle Solaris 11 Express 2010.11. SMF provides the ability to view system-wide service status, manage services and their dependencies and automatically restore services should a failure occur. New to Oracle Solaris 11 Express 2010.11 is the ability to notify administrators of service state transitions and fault management events via SNMP traps or email messages.

With the introduction of the new installation and packaging technologies, SMF has become an important piece of the system configuration and software package installation architecture. System configuration profiles are passed to the client system during installation to be imported on first reboot, and then later applied by a set of SMF services that are responsible for particular system configuration areas. SMF services can also now be activated after the installation of a software package as an alternative to post-installation scripting.

**Virtualization**

**Oracle Solaris Zones**

• **Oracle Solaris 10 Zones**

Oracle Solaris 11 Express 2010.11 introduces the ability to run Oracle Solaris 10 environments inside a Solaris 10 Container running on top of Oracle Solaris 11 Express 2010.11. For users already running their applications either in zones or on bare metal on Oracle Solaris 10 systems, virtual-to-virtual (v2v) and physical-to-virtual (p2v) tools are provided to help this transition over to an Oracle Solaris 10 Container. An Oracle Solaris 10 Container can have a shared IP stack with the global zone, or an exclusive IP stack. Oracle Solaris 10 Zones provide a proven, tested and fully supported option for quick adoption of Oracle Solaris 11 Express 2010.11 allowing administrators to benefit immediately from all the new features available while providing an easy application migration path.

• **Boot Environments for Zones**

Boot environments are also integrated with Oracle Solaris Zones such that all non-global zone root filesystems are a ZFS dataset known as Zone Boot Environment datasets (ZBE). When a new boot environment is created by cloning an existing one, the base boot environment's zones are also cloned into the new boot environment.

Oracle Solaris Zones have been integrated with the new IPS package management tools in Oracle Solaris 11 Express 2010.11. Non-global zones require an active network connection for their creation and must be manually updated (using `zoneadm attach -u`) to stay in sync with the global zone. Sparse root zones are not supported in Oracle Solaris 11 Express 2010.11 at this time.

• **Monitoring a Zone**

The introduction of `zonestat` in Oracle Solaris 11 Express 2010.11 greatly facilitates the observation of system resources consumed by Oracle Solaris Zones. More specifically, administrators can observe memory and CPU utilization, utilization of resource control limits, total utilization and per-zone utilization break-down over specified time periods.

- **Delegated Administration**

With Oracle Solaris 11 Express the administration of Oracle Solaris Zones becomes much more flexible. You have the ability to delegate common zone administration tasks for specific zones to different administrators using Role-Based Access Control (RBAC). With delegated administration, for each zone, a user or set of users may be identified with the permissions to login, manage or clone that zone. These specific authorizations will be interpreted by the appropriate commands running in the global zone to allow access at the correct authorization level to the correct user.

## Storage

ZFS is the root filesystem on Oracle Solaris 11 Express 2010.11 offering a superior experience in terms of manageability, scalability and data integrity. ZFS presents a pooled storage model that completely eliminates the concept of volumes and the associated problems of partitions, provisioning, wasted bandwidth and stranded storage. Thousands of file systems can draw from a common storage pool, each one consuming only as much space as it actually needs. All operations are copy-on-write transactions ensuring that the on-disk state is always valid. Additionally, blocks are checksummed to prevent silent data corruption, allowing data to self-heal itself in replicated (mirrored or RAID) configurations. If one copy is damaged, ZFS detects it and uses another copy to repair it. ZFS is also at the heart of Oracle Solaris 11 Express 2010.11 software installation and management with the IPS packaging system, greatly reducing planned and unplanned downtime with safe system upgrade capability. UFS is no longer supported as a root filesystem.

- **Save space with ZFS**

Deduplication is a feature of modern storage platforms by which varying mechanisms are employed to reduce the amount of total data stored by eliminating and sharing common components. ZFS deduplication support has been added to Oracle Solaris 11 Express 2010.11. ZFS deduplication uses checksum based comparison of blocks with optional verification (for example with non-cryptographically secure checksums). Deduplication is performed across the entire ZFS storage pool; administrators can select if individual datasets have deduplication enabled or not. This is useful in mixed-mode environments in which some datasets have highly duplicated data (e.g. virtualized images, home directories, or email folders) and others are unique (e.g. databases). Deduplication can be used in combination with ZFS compression. However, when used in combination with ZFS encryption, deduplication of data can only occur within a single dataset or clone of that dataset as encrypted datasets by default have different data encryption keys.

- **ZFS Diff**

Support for listing the differences between ZFS snapshots has been added with Oracle Solaris 11 Express 2010.11. Users with the appropriate privilege can now view what file and directory level changes have occurred between snapshots, such as files or directories added, removed, modified or renamed in a later snapshot.

- **COMSTAR targets for iSER, SRP and FcoE**

COMSTAR (Common Multiprotocol SCSI Target) is the software framework that enables the ability to turn any Oracle Solaris host into a target device that can be accessed over a storage network. The COMSTAR framework makes it possible for all SCSI device types (tape, disk, and the like) to connect to a transport (such as Fibre Channel) with concurrent access to all logical unit numbers (LUN) and a single point of management. Support for a number of protocols has been added; iSCSI Extensions for RDMA (iSER) and SCSI RDMA Protocol (SRP) for hosts that include an InfiniBand Host Channel Adapter, iSCSI, and Fibre Channel over Ethernet (FCoE). Oracle Solaris DTrace probes have also been added to COMSTAR in the SCSI Target Mode Framework (STMF) and SCSI Block Device (SBD).

- **Greater Microsoft interoperability with fully integrated CIFS**

Oracle Solaris 11 Express 2010.11 includes fully integrated CIFS. The Common Internet File System (CIFS) also known as SMB, is the standard for Microsoft file sharing services. The Oracle Solaris CIFS service provides file sharing and MS-RPC administration services required for Windows like behavior for interoperability with CIFS clients, including many new features such as host-based access control which allows a CIFS server to restrict access to specific clients by IP address, ACLs (access control lists) on shares, and synchronization of client-side offline file caching during reconnection. Microsoft ACLs are also supported in ZFS.

## Networking

The networking stack in Oracle Solaris 11 Express 2010.11 has undergone significant re-architecture to unify, simplify and enhance the observability and interoperability of network interfaces and features. The introduction of a new network driver framework, GLDv3, provides VLAN, link

aggregation and the ability to support MAC layers other than Ethernet (IP tunnels, Wi-Fi, Infiniband) providing flexible network administration with `dladm(1M)`. Enhancements to `dladm` also include the ability to allow links to be renamed, including non-GLDv3 links, and set properties for NIC drivers using a common command.

- **Network virtualization and resource management**

Oracle Solaris 11 Express 2010.11 introduces built-in network virtualization and resource management providing more effective sharing of network resources and enhancing the ability to consolidate server workloads. Using the basic building blocks of Virtual Network Interface Controllers (VNICs), virtual switches and interconnects, Virtual LANs (VLANs), and routing and firewall functionality, it is possible to consolidate an entire distributed computing environment on a single system for prototyping, testing and deployment scenarios without the restriction of physical network devices attached to the system.

Network resource management allows organizations to meet quality of service goals for networking. These management capabilities allow setting bandwidth limits on NICs/VNICs, and assigning CPU resource limits for servicing the NICs/VNICs. This enables organizations to create OS-enforced network sharing policies.

The new architecture has many features to allow it to work more effectively with the latest generation of intelligent NICs while still maintaining compatibility with older NICs. Highlights of the new architecture include the ability to shift from interrupt-driven to polling in high volume traffic meaning more efficient handling of network traffic, the ability to offer Quality of Service capabilities without adding any additional overhead and the ability to mitigate the effects of a denial of service attack by dealing with packets at the NIC level.

The power and flexibility of built-in network virtualization has been tightly integrated with Oracle Solaris Zones, allowing each non-global zone to have its own exclusive IP stack using VNICs without the limitation of dedicating a physical network interface (NIC) to a zone. In addition, this capacity is also extended to Oracle Solaris 10 Zones.

- **IP Observability**

Oracle Solaris 11 Express 2010.11 improves the area of IP observability, allowing the developer or administrator to use common packet sniffing tools such as `wireshark(1)` and `snoop(1M)` to view all IP traffic sent on real and virtual paths. Now all traffic can be observed at the IP layer, including to and from an Oracle Solaris Zone. In addition, Oracle Solaris 11 Express includes `dlstat(1M)`, a tool to provide runtime statistics for data links allowing administrators to get a better understanding of how well their networks are performing.

- **IP Multipathing**

IP Multipathing (IPMP) provides transparent redundancy for IP level communications between the application running on a system, and the first router in the communication path to the outside world. IPMP allows creating multiple paths to that first router so that port, NIC, cable or switch failures will not impact any connections. For high availability applications IPMP will assign one of the interfaces to the IP address and continually monitor the underlying interfaces to ensure a connection is maintained. If IPMP detects that the IP interface being used has failed it will use an alternate working IP interface. Applications do not need to be aware they are running on a system managed by IPMP. For Oracle Solaris 11 Express 2010.11, IPMP has undergone a significant re-architecture to improve network administration and network observability.

- **Network Auto-Magic**

Network Auto-Magic (NWAM) simplifies and automates network configuration on Oracle Solaris 11 Express 2010.11. NWAM allows users to automatically discover and connect to networks depending on their network conditions and profiles i.e., whether they are connected through a wired ethernet cable, or connecting wirelessly on their laptop. NWAM is the default behavior on all installations of the Oracle Solaris 11 Express 2010.11.

- **New Sockets Architecture**

The socket implementation has been re-written for Oracle Solaris 11 Express 2010.11 and no longer uses STREAMS. Historically Oracle Solaris has supported streams-based sockets, and with the move to the new architecture there are significant performance improvements along with a simplified developer interface for adding new socket types.

- **Load Balancing**

Oracle Solaris 11 Express 2010.11 includes an integrated L3/L4 load balancer. This capability can be complimentary to existing higher layer load balancing solutions from different ISVs. The addition includes stateless DSR and NAT operation modes on a variety of load balancing algorithms, a command-line and configuration API to configure various features as well as view statistics and other configuration details.

**• Link Protection**

In many virtualized setups today, it is common for the host administrator to grant exclusive access of a physical link or a Virtual NIC to a guest VM. This enables guests to benefit from traffic isolation and improved performance. The downside is that guests are allowed to generate any type of packet, even harmful ones, to the network. Link protection is a new mechanism for preventing potentially malicious or misbehaving guest VMs from sending harmful packets to the network. This feature provides protection against these basic threats: IP, DHCP, MAC and L2 frame spoofing. Unlike a traditional firewall, link protection does not support inbound filtering or customizable filtering rules. For users with such requirements, a firewall should be used instead such as Oracle Solaris IP Filter, `ipf(1M)`.

**• Bridging and Tunneling**

Bridging is a general layer two (L2 or datalink) technology that is used to connect together separate L2 subnetworks, allowing communication between attached nodes as if only a single subnetwork were in use. Basic ethernet bridging support has been added to Oracle Solaris 11 Express 2010.11 using the Spanning Tree Protocol (STP, IEEE 802.1D-1998) and TRILL protocol.

IP tunneling functionality has been reimplemented in Oracle Solaris 11 Express 2010.11, delivering a generic LAN driver (`iptun`) that implements IP tunnel links atop which IP interfaces can be plumbed and managed through `dladm(1M)`. With this new architecture, tunnel links gain functionality common to other links, including link vanity naming, link-layer observability using transitional observability tools such as `wireshark(1)` and `snoop(1M)`, and the assignment of tunnel links to exclusive stack non-global zones.

**• InfiniBand support**

The InfiniBand networking stack has undergone some significant improvements in Oracle Solaris 11 Express 2010.11, including improved support for Sockets Direct Protocol (SDP) allowing the transparent redirection of TCP/IP usage to SDP and the efficiencies it brings, and the addition of the RDSv3 protocol providing better performance and observability for Oracle RAC databases. Enhancements to the InfiniBand networking stack are very much the heart of Oracle Solaris 11 Express 2010.11 on the Oracle Exadata Database Machine.

**Security****• ZFS Dataset Encryption**

Encrypted dataset support has been added to ZFS to protect against theft of physical storage, man-in-the-middle attacks on the SAN, and to provide dataset level secured deletion. Data is encrypted at the dataset level, allowing a mix of encrypted and unencrypted datasets in the same ZFS storage pool. A single dataset has a consistent policy only allowing for encryption to be set at dataset creation time. All data and file system metadata is encrypted with a comprehensive encryption key management facility to cover different key management strategies. Encrypted root pool is not supported at this time.

**• Root Account is a Role**

The traditional UNIX root account is now a role by default in Oracle Solaris 11 Express 2010.11. Authorized users can assume the root role using the command-line `sudo(1M)` utility rather than directly logging into a root user account. During installation, the first user account is assigned the root role. This feature extends Oracle Solaris Role Based Access Control (RBAC) and enables authorized non-root users to complete tasks and scripts with superuser privileges.

**• Labeled IPsec**

When labeled processes in a multilevel secure operating system, such as Oracle Solaris Trusted Extensions, communicate across system boundaries, their network traffic needs to be labeled and protected. Traditionally, this requirement is met by using physically separate network infrastructure to ensure that data belonging to different labeled domains stays in separate physical infrastructures. Labeled IPsec/IKE, new to Oracle Solaris 11 Express 2010.11, enables customers to reuse the same physical network infrastructure for labeled communications by transferring labeled data within separate labeled IPsec security associations, removing the need for redundant and expensive physical network infrastructure.

**• Trusted Platform Module**

A Trusted Platform Module (TPM) chip is a hardware device usually attached directly to the motherboard of a computing platform that is intended to provide protected storage and protected capabilities on an inexpensive component with restricted resources. Oracle Solaris 11 Express 2010.11 includes driver support for TPM as specified by the Trusted Computer Group (TCG) 1.2 specification for compliant TPM devices, a TSS software stack (and a PKCS#11 provider for the Oracle Solaris Cryptographic Framework) that uses TSS to provide mechanisms for doing

cryptographic operations on the secure device, and administrative tools for managing the TPM and PKCS11 provider.

- **Oracle Solaris Cryptographic Framework**

To meet more stringent government standards, the Oracle Solaris Cryptographic Framework now supports the NSA Suite B algorithms. Additionally, the new Oracle SPARC T3 processor now supports the AES CFB mode used by tablespace encryption features of the Oracle Database Advanced Security Option. This is closely related to the ability of the Oracle Solaris Cryptographic Framework to provide acceleration through on-board cryptographic mechanisms on both SPARC and Intel chips. The Oracle Solaris Cryptographic Framework also includes support for the Intel Advanced Encryption Standards – New Instructions (AES-NI).

To help with the complex task of managing keys, the Oracle Key Management System can now be used for AES key storage by using the new 'pkcs11\_kms' plugin for the Oracle Solaris Cryptographic Framework. This mechanism can be used by any PKCS#11-aware application.

- **Trusted Extension Enhancements**

To enable greater flexibility and security, Trusted Extensions now enables per-label and per-user credentials allowing administrators to require a unique password for each label. This password is in addition to the session login password, and thus allowing administrators to set a per-zone encryption key for each label of every user's home directory. Trusted Extensions has also added support to explicitly set security labels on ZFS datasets ensuring that ZFS filesystems for a specific security label cannot be mounted on a zone of a different label, and thus inadvertently upgrade or downgrade the classification of data.

- **Secure by Default**

Oracle Solaris 11 Express 2010.11 provides a fully secure by default environment. With automatic secure by default, network services are disabled by default, or set to listen for local system communications only.

- **In-Kernel pexec, Forced and Basic Privileges.**

An In-Kernel pexec implementation, new to Oracle Solaris 11 Express 2010.11, is used to execute administrative commands requiring a higher privilege level. A new process flag is used to specify that all subsequent program executions are subject to RBAC policy. The flag is set at the first invocation of any of the complete set of profile shells (`pfsh(1)`, `pfcsch(1)`, `pfksh(1)`, `pfksh93(1)`, `pfbash(1)`, `pfctcsh(1)`, `pfzsh(1)`, `pfexec(1)`) and inherited by child processes. This feature eliminates the need to modify shell scripts to invoke pexec or profile shells. Another application of this feature is to limit the set of privileges given to programs with `setuid` to root. Processes that require the `setuid` mechanism traditionally ran with all privileges. Now they execute with only those privileges that are specified in their entry in the forced privileges rights profile, significantly reducing their potential to be an attack vector against the system. Additionally, Oracle Solaris 11 Express 2010.11 adds three new “basic” privileges (`file_read`, `file_write`, and `net_access`) beyond the five that exist in Oracle Solaris 10. These new privileges satisfy a long-standing customer need to restrict read, write and outbound network access.

## Platform Enhancements

Oracle Solaris 11 Express 2010.11 supports a wide range of hardware - from entry level systems to high end enterprise systems designed for mission critical environments and high levels of availability, capacity and virtualization. Scaling to thousands of threads and terabytes of memory, Oracle Solaris 11 Express 2010.11 is the best choice to take advantage of next generation systems either to scale up or scale out.

- **SPARC T3 support**

The SPARC T3 processor is the industry's first 16 core processor with 128 threads incorporated into a design that integrates all the key functions of a system into a single processor: computing, networking, security, and I/O. Oracle Solaris 11 Express 2010.11 supports the new SPARC T3 processor with a perfect match-up of the industry's most scalable system on a chip and the industry's most scalable operating system.

- **Nehalem support**

Oracle Solaris was one of the first platforms to fully support Intel's Xeon 5500 processor, codenamed 'Nehalem' (and subsequent generations of processors codenamed 'Nehalem-EX') with substantially increased performance, better power efficiency, improved reliability and cost effective virtualization for x64. Oracle Solaris 11 Express 2010.11 includes power awareness to the thread dispatcher, allowing threads to be scheduled according to the power state of the CPU. With Nehalem's support for deep idle CPU power management, known as deep C-state, Oracle Solaris 11 Express 2010.11 can dynamically place uninitialized CPUs into a state where they consume a fraction of the power that the CPU would use in normal operation. Oracle's continuing relationship

with Intel promises that Oracle Solaris 11 will be highly optimized for the latest Intel processors.

- **NUMA I/O**

Many modern systems are based on a NUMA (Non-Uniform Memory Access) architecture, where each CPU or set of CPUs is associated with its own physical memory and/o devices. For best I/O performance on these systems, the processing associated with a device should be performed close to that device, and the memory used by that device for DMA and PIO should be allocated close to that device as well. Oracle Solaris 11 Express 2010.11 adds support for a NUMA I/O architecture, which allows for operating system resources (kernel threads, interrupts, and memory) to be placed on physical resources according to the physical topology of the machine, specific high-level affinity requirements of I/O frameworks, actual load on the machine, as well as resource control and power management policies.

- **Dynamic Intimate Shared Memory Performance Improvements**

Significant integration work has been done in Oracle Solaris 11 Express 2010.11 to improve the performance of the Oracle Database stack for Oracle Solaris systems with large memory. Speed improvements to Intimate Shared Memory (ISM) and Dynamic Intimate Shared Memory (DISM) creation, locking and destruction have resulted in up to 8x start up performance improvement for the Oracle Database. Oracle Database uses DISM in its dynamic System Global Area (SGA) capability, which forms the part of the RAM shared by all processes belonging to a single Oracle Database instance.

- **Suspend and Resume to RAM**

Support for a limited number of platforms has been added in Oracle Solaris 11 Express 2010.11 to allow suspend and resume to RAM. Oracle Solaris continues to advance in the area of power management as energy efficiency in the datacenter becomes more important to drive costs down and increase utilization.

- **Improved hardware support**

Oracle Solaris 11 Express 2010.11 includes much improved hardware support with a number of driver additions across a variety of areas, from networking (Ethernet, WiFi, InfiniBand, Fibre Channel) to storage. As new drivers get developed, support for Oracle Solaris Fault Management Architecture (FMA) is also added allowing fine-grained fault isolation for hardware components and ensuring continuous service. Recent additions to the FMA framework include a generic topology enumeration framework for platform independence, a generic hotplug framework for any hotpluggable bus and migration functionality in a virtualization environment through virtual hotplug. For a full list of platforms and supported hardware components, refer to the hardware compatibility list for Oracle Solaris 11 Express 2010.11.

## What's new for Users

- **Enhanced Desktop Environment**

Oracle Solaris 11 Express 2010.11 includes GNOME 2.30, an intuitive easy to use desktop environment and the Firefox 3.6.10 web browser, among a variety of other software included in the network package repository. Additional software can be browsed and installed using the Package Manager. Should your system support it, switch on Visual Effects in the Appearance preferences to turn on Compiz, the compositing window manager that can take advantage of 3D graphics hardware for some stunning effects.

- **Command-line Familiarity**

To ease familiarity with other operating systems, Oracle Solaris 11 Express 2010.11 uses the `bash(1)` shell as the default interactive shell for users and `ksh93(1)` as the system shell. `/usr/gnu/bin` is also in the default command path containing many popular GNU commands.

- **Graphical Boot**

New with Oracle Solaris 11 Express 2010.11 is a graphical boot display. Users can switch from the graphical boot screen to the text boot screen by pressing any key when the system boots a few seconds after the graphical boot screen appears. The ability to switch to the text boot screen can be used if you suspect that the system startup is not proceeding normally. The text screen might contain informational messages or a request for user input. Users can also switch between boot environments prior to rebooting in the GNOME desktop restart dialog.

- **CUPS Printing**

The Common UNIX Printing System (CUPS) has been selected as the default print service on Oracle Solaris 11 Express 2010.11, replacing the LP print service. CUPS support includes a web and

graphical interface to manage your printing environment. A system that is running CUPS becomes a host that can accept print requests from client systems, process those requests, and then send them to the appropriate printer. To facilitate CUPS support, a new print-service command has been introduced that provides a mechanism for switching between CUPS print service and the LP print service, including 2 new SMF services.

Additionally, Oracle Solaris 11 Express 2010.11 provides the ability to automatically discover locally attached or network attached printers.

- **Time Slider Snapshot Management**

Time Slider provides the ability for users to quickly take ZFS snapshots of their home directories automatically and manually as needed. Snapshots can be viewed graphically over time with ZFS snapshot file manager integration to identify accidentally modified or deleted files.

- **Virtual Console Terminals**

Oracle Solaris 11 Express 2010.11 supports switching between X session and virtual console terminals. This service can be enabled by starting the `svc:/system/vtdaemon:default` and `svc:/system/console-login:vt*` services in SMF. Once turned on, users can switch between sessions using hotkeys `Alt + Ctrl + F#`.

- **New Sound System**

The Boomer audio subsystem is a new framework for supporting audio devices in Oracle Solaris 11 Express 2010.11. It has been designed to support current and future generation multimedia audio applications and devices. Boomer includes support for a number of new devices, expanding both device and platform support for audio. Boomer also supplies the Open Sound System API which has been made popular on Linux and FreeBSD, ensuring that many multimedia applications can be supported on Oracle Solaris much more easily. A new Device Driver Interface for audio device drivers ensures that writing a new device driver or porting one from another operating system can be done with only a modest amount of effort. Oracle Solaris 11 Express 2010.11 supports a wide range of audio, including Via 82C686, Creative Audigy LS, Creative SBP16X, ESS Technology Solo-1 AudioDrive PCI, and Creative EMU10K based audio devices.

- **Removable Media Enhancements**

The user experience for removable media has been improved with Oracle Solaris 11 Express 2010.11, replacing the legacy volume management daemon framework in Oracle Solaris 10. The new framework uses a combination of Hardware Abstraction Layer (HAL) and D-Bus message passing system used in popular Linux distributions to include various aspects such as hotplug, device discovery, content recognition as well as improving usability, scalability and performance across all layers of the software stack from the device drivers to the desktop application environment.

- **Command Assistant**

Accessing the right command-line information from managed content such as Oracle Solaris books and man pages can often be complex. Command Assistant is a new tool for Oracle Solaris users to get Oracle managed content easier and more accurate, enhancing the end user experience. Command Assistant can be added to the desktop panel using the Add to Panel > Command Assistant dialog.

## What's new for Developers

Compatibility is at the heart of Oracle Solaris development with over 20 years of engineering to ensure absolute binary and source compatibility guarantees for developers writing to the Oracle Solaris platform.

- **New Oracle Solaris DTrace Providers**

Oracle Solaris DTrace is a comprehensive dynamic tracing framework that allows administrators and developers to observe a live running system in a production environment to tune and troubleshoot it in a secure and safe manner. A number of new Oracle Solaris DTrace providers have been added to Oracle Solaris 11 Express 2010.11 giving a greater degree of observability, particularly in the network stack. The `cpc` provider allows administrators to connect to CPU events such as TLB misses or L2 cache misses to the cause of the event on a system-wide basis. The `tcp`, `udp` and `ip` providers allows administrators to trace the TCP, UDP and IPv4/IPv6 network protocols. The `iscsi` provider allows administrators to trace iSCSI activity. Oracle Solaris DTrace offers much more than any other operating system can provide for system observability.

- **New Developer Tools**

A number of popular developer tools have been added to the package repository for the Oracle Solaris 11 Express release, including `git (1)`, the distributed version control system. Oracle Solaris Studio continues to be the #1 development platform providing the highest performance C, C++, and Fortran compilers for the Oracle Solaris operating system allowing developers to optimize applications for Oracle hardware.

- **Measuring and Fixing Latency**

A port of Intel's LatencyTOP has been made to Oracle Solaris 11 Express 2010.11 and included in the network package repository. Through innovative use of Oracle Solaris DTrace, latencies on the system can now be measured and fixed.

- **libc Linux and BSD Familiarity**

A number of new routines have been added to the Oracle Solaris C library to improve familiarity with Linux and BSD operating systems and helping developers port their applications across to the Oracle Solaris platform. A few such examples of routines added in Oracle Solaris 11 Express 2010.11 are `asprintf()`, `vsprintf()`, `getline()`, `strdupa()`, and `strndup()`. Applications using the `printf()` string interface on a `NULL` string will no longer segfault.

## Internationalization

Like previous Oracle Solaris releases, users from around the world can enjoy Oracle Solaris 11 Express 2010.11 with support for many different languages and locales.

- **Input Methods and Keyboard Layout**

Next generation input method framework iBus (Intelligent Input Bus) has been available as an alternative Input Method framework with a new `ibus-xkbc` IM engine which supports `xkeyboard-config` based keyboard layout emulation and virtual keyboard functions (that have been supported by the current IM framework of `IIMF`). Users can easily switch IM framework through a new GUI, `imf-selector` (System > Preferences > Input Method).

A new version of `xkeyboard-config` (v1.9) has been added to Oracle Solaris 11 Express 2010.11, including several bug fixes and new configuration components. This version includes new keyboard layout symbols for several countries and regions of the world, more variants for existing and new keyboard layouts, support for additional models of physical keyboards, and updated geometries and keycodes that are 100% compatible with other Linux distributions and widely accepted by various user communities in the world.

- **New Fonts**

Oracle Solaris 11 Express 2010.11 significantly improves the choice of TrueType fonts available with the system. There are updated and newly added font families to support the many locales and languages covered by this release.

- **Locales and Languages**

Oracle Solaris 11 Express 2010.11 supports over 200 locales. Languages supported include: Afrikaans, Albanian, Arabic, Armenian, Assamese, Azerbaijani, Bengali, Belarusian, Bosnian, Bulgarian, Catalan, Chinese – Simplified, Chinese – Traditional, Croatian, Czech, Danish, Dutch, English, Estonian, Finnish, French, German, Greek, Georgian, Gujarati, Hebrew, Hindi, Hungarian, Icelandic, Indonesian, Italian, Japanese, Kannada, Kashmiri, Kazakh, Kirghiz, Korean, Kurdish, Lithuanian, Latvian, Macedonian, Malay, Malayalam, Maltese, Marathi, Norwegian Bokmal, Norwegian Nynorsk, Oriya (Indian), Punjabi (Indian), Polish, Portugese, Portugese – Brazil, Romanian, Russian, Sanskrit, Serbian, Slovak, Slovenian, Spanish, Swedish, Tamil, Telugu, Thai, Turkish, Ukrainian, and Vietnamese.

The locale data has been updated to Common Locale Data Repository (CLDR) 1.7.1 This update improves locale data quality and ensures consistency of locale data.

Locales which support translated messages are: Japanese, Chinese – Simplified, Chinese – Traditional, Korean, French, German, Italian, Spanish and Portugese – Brazil.

## Contact Us

For more information about Oracle Solaris 11 Express 2010.11, visit [oracle.com](http://oracle.com) or call +1.800.ORACLE1 to speak to an Oracle representative.



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