Changes to the ESX Service Console for ESX 4.0

ESX 4.0 Service Console

The intended audiences for this technical paper are a System Administrator who uses the service console for ESX 4.0, and a developer who has written software for ESX. Sections that pertain only to developers are located at the end of this document. This technical paper discusses incompatibilities between the ESX 3.5 service console and the ESX 4.0 service console. Included are suggestions of what you might do to upgrade your existing environments that depend on the ESX service console. This document also discusses how you might bridge the gap to support ESXi, which does not include a service console. And finally, if you are currently writing applications that run in the ESX service console, this document suggests some possible options you have for transitioning away from it.

The ESX 4.0 service console includes a 64-bit, 2.6-based Linux kernel and is compatible with Red Hat Enterprise Linux 5.2, CentOS version 5.2 , and equivalent Linux systems.

NOTE This document mentions the CIM Provider Development Kit (CIM PDK). VMware provides the CIM PDK exclusively for its qualified partners. For more information on VMware's partner programs, see http://www.vmware.com/partners/programs/, or contact your VMware representative.

This technical note contains the following topics:

New Features for ESX 4.0 Service Console

The ESX 4.0 service console introduces the following new features.

- "Support for Both 32-Bit and 64-Bit Applications" on page 2
- "64-Bit Driver Support" on page 2
- "Console Root File System is a VMDK File" on page 2
- "IPv6 Support" on page 2
- "Security Enhancement" on page 2
- "64-Bit Perl Environment" on page 2
- "Linux Standard Packages" on page 2

Support for Both 32-Bit and 64-Bit Applications

ESX 4.0 provides native support for 64-bit applications. ESX 4.0 also supports 32-bit applications through compatibility libraries.

64-Bit Driver Support

ESX 4.0 supports 64-bit device drivers only. All device drivers are `vmklinux` based drivers running in (and owned by) the `vmkernel`. ESX 4.0 does not require Linux device drivers, whereas ESX 3.5 required Linux drivers running in the service console. VMware enables partners to add VMware supported devices on the HCL through the IOVP program (http://www.vmware.com/partners/alliances/programs/co-dev/iovp.html).

Console Root File System is a VMDK File

ESX 4.0 stores the root file system in a VMDK file (VMware Virtual Disk Format).

IPv6 Support

All network interfaces fully support IPv6.

Security Enhancement

ESX 4.0 supports Address Space Layout Randomization (ASLR; http://en.wikipedia.org/wiki/Address_space_layout_randomization)

64-Bit Perl Environment

ESX 4.0 includes a 64-bit Perl environment to enable scripting.

Linux Standard Packages

The ESX 4.0 service console includes a subset of the packages typically found in a Linux environment. The ESX 4.0 service console does not include development packages such as: `gcc`, `make`, `rpm-build`, `*-devel`.

Support for Remote File Systems

The ESX 4.0 service console supports remote file systems that use either `samba` or `nfs` clients. To use these services, you must manually enable them.

VMware Configuration CLI Support (esxcfg-*)

The ESX 4.0 service console includes `esxcfg` commands to provide command line configuration of the ESX Server. ESX 4.0 extended some esxcfg commands to support new facilities such as IPv6.

Command-Line Utilities

ESX 4.0 changed the command-line utilities in numerous ways. These changes include new versions of `vihostupdate` and `esxcfg-mpath`. A new command, `esxcli`, is available from the ESX 4.0 service console as well as the vSphere CLI. Documentation for this command can be found in the *vSphere Command-Line Interface Installation and Reference Guide*. For more information on the vSphere CLI, see "vSphere Command-Line Interface" on page 5.

DMTF SMASH 2.0 Support

ESX 4.0 includes the DMTF-compliant CIM SMASH 2.0 infrastructure to support standards-based monitoring and configuration. Clients built with SMASH can communicate through CIM/XML or WS-MAN protocols to remotely monitor the ESX server.

Support for vmware-cmd

Service console support for `vmware-cmd` has changed since ESX 3.5. Table 1 shows the commands no longer supported in ESX 4.0.

Table 1. vmware-cmd Commands No Longer Supported in ESX 4.0

Command Type	No Longer Supported in ESX 4.0
Server Operations	`getresource`, `setresource`
VM Operations	`getconnectedusers`, `setconfig`, `getresource`, `setresource`

Table 2 shows what commands are new to ESX 4.0 that were not supported in ESX 3.5.

Table 2. Additions to vmware-cmd for ESX 4.0

Command Type	New for ESX 4.0
Server Operations	`listvms`
VM Operations	`getid`

Features No Longer Supported in ESX 4.0 Service Console

The ESX 4.0 service console does not support the following legacy interfaces:

- "Service Console net-snmp No Longer Supported" on page 3
- "Support for /proc/vmware Nodes" on page 4
- "Migration from /proc to /sys File System" on page 4
- "Custom IPMI Drivers No Longer Supported" on page 5
- "Booting into linux or debug Mode No Longer Supported" on page 5
- "ESX 4.0 Service Console is Not a Development Environment" on page 5

Service Console net-snmp No Longer Supported

With ESX 4.0, VMware no longer actively supports, updates, or encourages the use of `net-snmp` in the service console. The SNMP agent built into the host agent provides MIB modules, which replace the `net-snmp` implementation for ESX/ESXi 4.0.

ESX 4.0 bundles `net-snmp-5.3.1-24.el5`, and `net-snmp-libs-5.3.1-24.el5`. The `net-snmp` and `net-snmp-libs` modules included for ESX/ESXi 4.0 are 64-bit versions and do not load legacy 32-bit shared libraries from previous `net-snmp` ESX implementations. All ESX related traps come from the SNMP host agent and not from `net-snmp` as in the past. While the host agent has been sending traps since ESX 3.0, the host agent used to use the UCD configuration file, but now uses its own configuration file. That is, it used to use `/etc/snmp/snmp_config`, but now uses `/etc/vmware/snmp.xml`. You can find the SNMP MIB modules at http://www.vmware.com/go/snmp-mib.Download the `vmware-esx.mibs.zip` file. The `VMWARE-VMINFO-MIB.mib` file contains the traps.

For more details, see the SNMP section in the vSphere 4.0 *Basic System Administration* guide (see http://www.vmware.com/pdf/vsphere4/r40/vsp_40_admin_guide.pdf).

VMware encourages partners and customers to use other VMware interfaces as integration points. For example, those found in the *VMware CIM Provider Development Kit Developer's Guide*.

VMware encourages partners and customers to use the vSphere Management Assistant (vMA) in place of installing an agent in the service console or accessing the service console remotely. vMA is an open virtual appliance that VMware provides to partners and customers as an environment for deploying agents and scripts used to manage and provision ESX hosts. The vMA interface offers an alternative to using ESX service console for such deployments. See *vSphere Management Assistant 4.0 Administrator's and Developer's Guide*.

To acquaint yourself with VMware developer software, see http://www.vmware.com/developer

For VMware developer documentation, see http://www.vmware.com/support/pubs/sdk_pubs.html.

Support for /proc/vmware Nodes

`/proc/vmware` nodes were deprecated in ESX 3.0. The ESX 4.0 service console removes many of the `/proc/vmware` nodes that were included in the ESX 3.5 service console. The removed `/proc/vmware` nodes include the following:

```
/proc/vmware/buddy/*
/proc/vmware/config/*
/proc/vmware/net/*
/proc/vmware/scsi/*
/proc/vmware/mem
/proc/vmware/sched/capacity
/proc/vmware/sched/cpu
/proc/vmware/sched/cpu-run-times
/proc/vmware/sched/cpu-state-counts
/proc/vmware/sched/cpu-state-times
/proc/vmware/sched/cpu-verbose
/proc/vmware/sched/events
/proc/vmware/sched/groups
/proc/vmware/sched/idle
```

and for each virtual machine (number *xxxx*):

```
/proc/vmware/vm/xxxx/cpu/run-stat-histo
/proc/vmware/vm/xxxx/cpu/status
/proc/vmware/vm/xxxx/cpu/wait-stat-histo
/proc/vmware/vm/xxxx/disk
```

NOTE Applications should retrieve data with commands from the vSphere API and the CIM APIs (SMASH and SMI-S) (http://www.vmware.com/developer) rather than from `/proc` nodes.

For a list of protocols you can use to access these APIs, see "VMware Protocols for Communicating with ESX/ESXi" on page 6.

Migration from /proc to /sys File System

With the migration to the 2.6 Linux kernel, the ESX 4.0 service console has largely replaced `/proc` with `/sys` file system. Programs that used `/proc` on 2.4 kernels might have to switch to `/sys` file system. The ESX 4.0 service console makes no VMware-specific changes to files in other nodes under `/proc`. Device-specific `proc` nodes (for example, `/proc/megaraid/`) still exist.

The ESX 4.0 service console does not support driver specific `sys` file system nodes. For example: you cannot create `/sys/module/qla2xxx/ql2xintrdelaytimer` on the ESX 4.0 service console.

The core kernel does create sys file system nodes that it registers on behalf of a driver. For example: the core kernel creates /sys/class/scsi_host/host9/proc_name on the ESX 4.0 service console on behalf of the underlying host bus adaptor driver.

Custom IPMI Drivers No Longer Supported

The ESX 4.0 service console no longer supports custom IPMI drivers outside of the vmkernel.

The vmkernel includes an IPMI driver. To insert a driver in the vmkernel, you use the DDK. To have access to the DDK, you must join the IO Vendor Program (IOVP) as described at the following URL:

http://www.vmware.com/partners/alliances/programs/co-dev/iovp.html

Booting into linux or debug Mode No Longer Supported

The ESX 4.0 service console no longer supports booting into linux or debug mode from the boot menu. In earlier versions, for debugging, it was possible to start regular Linux (linux mode), or a debug-build ESX system (debug mode) from the boot menu.

The ESX 4.0 service console provides only one alternative startup option, Troubleshooting mode. This mode loads a troubleshooting shell, booting up ESX with a known, good vmkernel, and a simplified configuration. The simplified configuration has a limited set of drivers and capabilities.

ESX 4.0 Service Console is Not a Development Environment

The ESX 3.x service console served as both a deployment environment and a development environment.

The ESX 4.0 service console is a deployment environment, not a development environment. The ESX 4.0 version does not include Linux development packages and libraries, such as gcc, make, rpm-build, and *-devel.

Use an Enterprise Linux distribution, such as Red Hat Enterprise Linux 5.2 or CentOS 5.2, when developing code for the ESX 4.0 service console.

Transitioning Away from ESX Service Console

To replace the service console for your ESX/ESXi 4.0 applications, VMware supplies the following software tools that you can use:

- "vSphere Command-Line Interface" on page 5
- "vSphere Management Assistant" on page 6
- "Virtual Appliances" on page 6
- "VMware Protocols for Communicating with ESX/ESXi" on page 6

vSphere Command-Line Interface

The vSphere Command-Line Interface (vSphere CLI) command set allows you to run common system administration commands against ESX/ESXi systems from any machine with network access to those systems. You can also run most vSphere CLI commands against a vCenter Server system and target any ESX/ESXi system that vCenter Server system manages. vSphere CLI commands are especially useful for ESXi hosts because ESXi does not include a service console.

You might have used scripts with corresponding service console commands starting with an esxcfg prefix to manage ESX 3.x hosts. To facilitate easy migration from ESX 3.x to ESX/ESXi, the commands with the esxcfg prefix are available as vSphere CLI commands.

Find more information about vSphere CLI at the following URL:

http://communities/vmwre.com/community/developer/vsphere_cli

KB article 1008194, *vSphere CLI and Service Console Parity Issues*, can be found at the following URL:

http://kb.vmware.com/kb/1008194

vSphere Management Assistant

The vSphere Management Assistant (vMA) allows administrators and developers to manage ESX and ESXi systems using scripts and agents. vMA is a virtual machine that includes prepackaged software, a logging component, and an authentication component that supports non interactive login. You can use vMA to perform most of the tasks commonly performed in the ESX service console.

The vSphere CLI is included in vMA.

Find more information about vMA at the following URL: http://www.vmware.com/go/vma/

Virtual Appliances

If you decide to package your applications in your own custom virtual appliance, rather than putting them in vMA, use VMware Studio to build the appliances.

http://communities.vmware.com/community/vmtn/vam/studio

VMware Protocols for Communicating with ESX/ESXi

Your software solutions originally written to run in the ESX service console might require modification to use a network-based protocol for communicating with ESX/ESXi.

The VMware protocols for this include the following:

- vSphere API, which can be accessed using the following:
  - vSphere Command-Line Interface
  - vSphere SDK for Perl
  - vSphere Web Services SDK
  - vSphere SDK for Java - Tech Preview
  - vSphere PowerCLI (Windows only)
- CIM Storage Management API and CIM SMASH/Server Management API, which can be accessed using the following:
  - CIM SDK
  - vSphere SDK for Perl

Access these products at the following VMware web site: http://www.vmware.com/developer/

Packages Installed with ESX 4.0 Service Console

To list the packages in the ESX 4.0 service console standard distribution, from the service console command line, run the following command:

```
rpm –qa
```

Developer Information

The material in this part of the technical paper pertains primarily to developers and includes the following topics:

- "Bridging the Gap to ESXi in the Absence of Service Console" on page 7
- "VMware Virtual Disk Development Kit" on page 7
- "vStorage APIs for Data Protection (VADP)" on page 7

Bridging the Gap to ESXi in the Absence of Service Console

There are tools that you can use to create management applications for ESXi 4.0 without service console.

VMware CIM SMASH/Server Management API

The VMware CIM APIs provide a CIM interface for developers building management applications. With the CIM SMASH/Server Management API (formerly the CIM SMASH API), developers can use CIM-compliant applications to monitor and manage the health of server systems running ESX 4.0 and ESXi 4.0.

The following URL points to the current release of the API:

http://www.vmware.com/support/developer/cim-sdk/4.0/smash/

VMware CIM Provider Development Kit

Independent hardware vendors, who provide a management interface to hardware for ESX/ESXi, must write CIM providers in addition to drivers. To create CIM providers, you need the VMware CIM PDK that is available only to members of the IO Vendor Program (IOVP). Use the following URL to obtain information about the IOVP:

http://www.vmware.com/partners/alliances/programs/co-dev/iovp.html

VMware Virtual Disk Development Kit

If you write storage solutions for deployment outside of the ESX service console, you can use the vSphere API along with VMware Virtual Disk Development Kit (VDDK).

The VDDK is a collection of C libraries, code samples, utilities, and documentation to help you create or access VMware virtual disk storage.

The kit includes:

- The Virtual Disk library, a set of C function calls to manipulate VMware Virtual Disk Format VMDK files. (ESX 4.0 stores the root file system in a VMDK file.)
- C++ code samples that you can build with either Microsoft Visual Studio or the GNU C compiler.
- Virtual Disk Manager utility to manipulate offline VMDK files on Windows or Linux (clone, create, relocate, rename, extend, shrink, or defragment).
- DiskMount utility to access files and file systems in virtual disks on Windows or Linux.
- Documentation about the Virtual Disk library and the command-line utilities.

Find the current VDDK documentation and software at the following URL:

http://communities.vmware.com/community/developer/vddk

vStorage APIs for Data Protection (VADP)

vStorage APIs for Data Protection (formerly VMware Consolidated Backup API) is part of VMware vSphere and contains various tools for creating backup solutions deployed outside of the service console. In addition to other vSphere documentation, see the technical note, *Designing Backup Solutions for VMware vSphere*, at the following location:

http://vmware.com/support/developer/vddk/vcb_vsphere_backup.pdf