

IBM Storage Host Attachment Kit for Linux
Version 2.8.0

Release Notes



First Edition (June 2017)

This document edition applies to version 2.8.0 of the IBM Storage Host Attachment Kit for Linux software package. Newer document editions may be issued for the same version in order to add missing information, update information, or amend typographical errors. The edition is reset to "First Edition" for every newly released version.

© Copyright IBM Corporation 2009, 2017.

US Government Users Restricted Rights – Use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM Corp.

Contents

Overview	1
What's new in version 2.8.0	1
Compatibility and requirements	1
Supported Linux versions	2
Supported storage systems	2
Supported HBAs	3
Supported multipath I/O solutions	3
Required software on the host	3
Change log	4
Version 2.8.0 (June 2017)	4
Version 2.7.0 (December 2016)	4
Version 2.6.0 (April 2016)	5
Version 2.5.0 (September 2015)	5
Version 2.4.0 (March 2015)	6
Version 2.3.0 (August 2014)	6
Known issues	7
Related information and publications	11
Getting information, help, and service	12
Notices	13
Trademarks	14

Overview

The IBM® Storage Host Attachment Kit (HAK) for Linux is a software pack that simplifies the task of connecting a Linux host to the IBM storage systems.

The HAK provides a set of command-line interface (CLI) tools that help host administrators perform different host-side tasks, such as: detect any physically connected storage system (single system or multiple systems), detect storage volumes, define the host on the storage system, run diagnostics, and apply best practice native multipath connectivity configuration on the host.

You can download the IBM Storage Host Attachment Kit software package at any time from the IBM Fix Central website(www.ibm.com/support/fixcentral).

What's new in version 2.8.0

Version 2.8.0 adds integration with IBM HyperSwap solution, as introduced by the FlashSystem A9000 and A9000R storage systems (version 12.1).

General availability date: 9 June 2017

IBM HyperSwap

HyperSwap high availability is based on active-active pairing of storage systems per volume or per consistency group. Each volume or consistency group pair uses synchronous replication to keep both systems updated at all times. When certain conditions apply, an automatic and completely transparent failover is performed, so that the applications experience no downtime. As soon as the actual failure is recovered, the pair is automatically resynchronized.

As in other high availability solutions, HyperSwap requires a quorum witness component, to avoid split-brain situations. The IBM Spectrum Accelerate Family HyperSwap Quorum Witness is constantly monitoring the status of the related storage systems, and, if necessary, acts as a tiebreaker for conflict resolution.

The HyperSwap solution relies on Asymmetrical Logical Unit Access (ALUA) support to inform the host about the optimized paths to the storage system, and minimize I/O latency. HyperSwap does not require an external solution that provides an active-active solution, and no separate licensing.

Full description of the IBM HyperSwap® solution appears in the Product Overview of the IBM FlashSystem® A9000 and A9000R storage systems.

Compatibility and requirements

The IBM Storage Host Attachment Kit for Linux is compatible with different versions of the Linux operating system and the storage system, as well as with different HBAs and multipath solutions.

Certain software packages, patches, or drivers must be installed on the host, as detailed in the following subsections.

Note: This section applies to version 2.8.0. For information about the compatibility and requirements of a previous Host Attachment Kit version, refer to its relevant release notes. In addition, the HAK lifecycle and support matrix (www.ibm.com/support/knowledgecenter/SSEPRF/landing/css_lifecycle_support_matrix_hak.html) details the HAK lifecycle with compatible storage system microcode versions and supported operating system releases.

Supported Linux versions

Version 2.8.0 of the IBM Storage Host Attachment Kit for Linux supports different Linux versions and editions, as listed in the following table. All listed Linux releases support IBM HyperSwap solution.

Operating system	Architecture
Red Hat Enterprise Linux (RHEL) 6.4–6.8	x86, x64, POWER7 [®] /8 (if applicable)
Red Hat Enterprise Linux (RHEL) 7.0–7.3	x64, POWER7/8 (if applicable)
CentOS Linux 7.x	x64
SUSE Linux Enterprise Server (SLES) 11 SP3, SP4	x86, x64, POWER7/8 (if applicable)
SUSE Linux Enterprise Server (SLES) 12	x64, POWER7/8 (if applicable)
SUSE Linux Enterprise Server (SLES) 12 SP1, SP2	x64, POWER7/8 (if applicable)

Note: For details on Linux support on IBM Power Systems[™] servers, refer to IBM Knowledge Center.

Supported storage systems

Version 2.8.0 of the IBM Storage Host Attachment Kit for Linux supports different microcode versions of the IBM storage systems, as listed in the following table.

Storage system	Microcode version
IBM XIV [®] Storage System	10.2.4.x
	11.1.x, 11.2.x, 11.3.x, 11.4.x, 11.5.x, 11.6.x
IBM Spectrum Accelerate [™]	11.5.x
IBM FlashSystem A9000	12.0.x, 12.1.x
IBM FlashSystem A9000R	12.0.x, 12.1.x

Note:

- Newer microcode versions may also be compatible. When a newer microcode version becomes available, refer to the latest storage system release notes to check whether the new microcode version is also supported. In addition, the HAK lifecycle and support matrix (ibm.com/support/knowledgecenter/STJTAG/hsg/hak_lifecycle.dita) details the HAK lifecycle with compatible storage system microcode versions and supported operating system releases.
 - Version 2.8.0 adds support for IBM HyperSwap solution, as introduced by version 12.1 of the FlashSystem A9000 and A9000R storage systems. If HyperSwap support is required, use HAK version 2.8.0 or later.
-

Supported HBAs

The IBM Storage Host Attachment Kit for Linux supports different host bus adapter (HBA) brands and types.

For the latest support information and compatibility matrix, see the IBM System Storage® Interoperation Center website (www.ibm.com/systems/support/storage/config/ssic).

Important: For iSCSI connectivity, only iSCSI software initiators are supported. Hardware iSCSI HBAs are not supported.

Note: For best performance, install the latest firmware and drivers for the HBAs that are in use. The HBA vendor should provide the latest firmware and drivers.

Supported multipath I/O solutions

The IBM Storage Host Attachment Kit for Linux supports the following multipath solutions:

- Native Device Mapper-Multipath (DM-MP), including the device-mapper multipath switch (*dm-switch*) module.
- Veritas Dynamic Multipathing (DMP). For the details of the supported DMP versions and of the HyperSwap support with DMP, refer to the IBM System Storage Interoperation Center.

Important: Using more than one multipath I/O framework on the same host is not supported.

Required software on the host

Prior to running the IBM Storage Host Attachment Kit for Linux, depending on the installed Linux version (RHEL or SLES) and storage connectivity type (FC or iSCSI) – specific software packages must be installed on the host, as detailed in the following table.

Operating system	Connectivity type	Required software package
Red Hat Enterprise Linux (RHEL), CentOS Linux	Fibre Channel (FC)	<ul style="list-style-type: none">• device-mapper-multipath• sg3_utils
	iSCSI	<ul style="list-style-type: none">• device-mapper-multipath• sg3_utils• iscsi-initiator-utils
SUSE Linux Enterprise Server (SLES)	Fibre Channel (FC)	<ul style="list-style-type: none">• multipath-tools• sg3_utils
	iSCSI	<ul style="list-style-type: none">• multipath-tools• sg3_utils• open-iscsi

Change log

This section summarizes the changes made in different version releases of the IBM Storage Host Attachment Kit for Linux.

Version 2.8.0 (June 2017)

Version 2.8.0 adds integration with IBM HyperSwap solution, as introduced by the FlashSystem A9000 and A9000R storage systems (version 12.1). Additional changes in version 2.8.0:

Ticket ID	Description
HA-261963*	Enhancement: Added support for Veritas Dynamic Multipathing version 7.x.
HA-261976*	Enhancement: The HAK multipath configuration has been updated to support the IBM HyperSwap solution.
HA-261979*	Enhancement: The <code>xiv_devlist</code> command output indicates the HyperSwap mode of the volume (stretched or regular).
HA-261987*	Enhancement: The <code>xiv_devlist</code> command output displays the name of the remote storage system in the IBM HyperSwap solution.
HA-261965*	Fixed: The <code>xiv_host_profiler</code> command with the <code>--set-password</code> and <code>--storage</code> arguments fails due to discrepancy between the <code>--storage</code> value and the system serial number of the storage system itself. This update requires resetting the current password.
HA-261968*	Fixed: HAK fails to add the WWPN wildcard of the FlashSystem A9000/A9000R storage systems to the <code>multipath.conf</code> blacklist exception section. This occurs, when a BFS (Boot from SAN) host is attached, using the <code>xiv_attach</code> , <code>xiv_iscsi_admin</code> or <code>xiv_fc_admin</code> commands.

* Applies to all supported operating systems.

Version 2.7.0 (December 2016)

Version 2.7.0 improved security by adding ability to set passwords for hosts, accessing storage systems. Additional changes in version 2.7.0:

Ticket ID	Description
HA-261894*	Change: Added support for RHEL 6.8
HA-62994*	Fixed: The <code>xiv_devlist</code> command output displays the current HAK version with uppercase <code>-V</code> .
HA-261877*	Fixed: Error messages generated, when invalid LDAP credentials are supplied, may be overly general without specifying the exact reason for host attachment failure.

* Applies to all supported operating systems.

Version 2.6.0 (April 2016)

Version 2.6.0 added support for IBM FlashSystem A9000 and IBM FlashSystem A9000R storage systems with microcode 12.0. In addition, this version introduced support for RHEL 7.2, SLES 12 and SLES 12 SP1, including Linux support on IBM Power Systems servers.

Additional changes and fixes in version 2.6.0:

Ticket ID	Description
HA-261809*	Change: The xiv_syslist command output displays all supported storage system types.
HA-261811*	Change: The xiv_devlist command output displays all supported storage system types.
HA-261816*	Fixed: When running the xiv_attach command, scanning for FC-connected storage systems is performed, even if the user chooses not to complete it.
HA-261859*	Fixed: A general exception may occur during the xiv_iscsi_admin , xiv_fc_admin or xiv_attach command execution.
HA-261869*	Fixed: If during new iSCSI target discovery an IP address is unreachable on a single storage systems, the error message appears for all connected devices.

* Applies to all supported operating systems.

Version 2.5.0 (September 2015)

Version 2.5.0 added support for XIV microcode version 11.6.x, IBM Spectrum Accelerate 11.5.1.x, and RHEL 7.1. In addition, this version introduced the host-side acceleration (HSA) for improved iSCSI communication between Spectrum Accelerate and a host.

Additional enhancements, changes and fixes in version 2.5.0:

Ticket ID	Description
HA-261623	Enhancement: Provisions for enabling and configuring the HSA are added to the xiv_attach and xiv_iscsi_admin commands. For more information, refer to the user guide.
HA-261629*	Change: The -L option of the xiv_iscsi_admin and xiv_fc_admin commands is deprecated. Only the xiv_syslist -L command can be used for listing the attached storage systems, as detailed in HA-204578. For more information, refer to the user guide.
HA-261657	Fixed: After upgrading from RHEL 5.x to 6.x, the xiv_devlist command may fail, when it is run by a host installed on an HP server.

* Applies to all supported operating systems.

Version 2.4.0 (March 2015)

Version 2.4.0 added support for XIV microcode version 11.5.1 and IBM Spectrum Accelerate 11.5.0.b, and included the following enhancement and fix.

Ticket ID	Description
HA-261509	Enhancement: This new feature allows the host administrator to automatically discover and connect to new, already-attached iSCSI ports. For more information, refer to the user guide.
HA-261551	Fixed: Syntax <code>-m --no-native-mp</code> has changed to <code>-m IGNORE</code> .

Version 2.3.0 (August 2014)

Version 2.3.0 added support for XIV microcode version 11.5 and includes the following enhancements and fixes.

Ticket ID	Description
HA-250756*	Enhancement: The <code>--list (-L)</code> command option can be used with <code>xiv_diag</code> to display information that is to be gathered by the utility. For more information, refer to the user guide.
HA-261277	Enhancement: The <code>--clean</code> command option can be used with <code>xiv_fc_admin --rescan</code> or <code>xiv_iscsi_admin --rescan</code> to remove unreachable devices from the host. For more information, refer to the user guide.
HA-261361*	Enhancement: Added support for the XIV multi-tenancy feature, allowing work with different and separate storage domains that are defined on the same XIV storage system. This enhancement applies only to XIV microcode version 11.5 or later. For more information, refer to the user guide.
HA-261367	Enhancement: The <code>--no-native-mp (-M)</code> command option can be used with <code>xiv_fc_admin</code> and <code>xiv_iscsi_admin</code> to ignore the native multipath framework of the operating system when either the <code>-V</code> , <code>-C</code> , or <code>-R</code> option is used. For more information, refer to the user guide.
HA-22503	Fixed: On RHEL 6 and SLES 11, unmapped (or dead) LUNs are not removed from the <code>xiv_devlist</code> output after performing rescan.
HA-91689	Fixed: A host cannot be attached over iSCSI if it is already attached over FC.
HA-261223*	Fixed: A general error message appears when running <code>xiv_attach</code> , <code>xiv_fc_admin</code> , or <code>xiv_iscsi_admin</code> if non-English characters are used in the XIV credentials.

* Applies to all supported operating systems.

Known issues

This section details the known issues in version 2.8.0 of the IBM Storage Host Attachment Kit for Linux, along with possible solutions or workarounds (if available).

Ticket ID	Description
HA-11718	<p>Unmapped LUNs are not always removed after the rescan.</p> <p>In some of the early RHEL 5.x releases, multipathd (responsible for removing stale multipath maps) stops reacting to udev events.</p> <p>Red Hat provides a fix for multipath-tools and kpartx at the Red Hat Customer Portal website(rhn.redhat.com/errata/RHEA-2009-1377.html).</p>
HA-37888	<p>xiv_devlist does not identify LUN0.</p> <p>Currently there is no workaround or solution for this limitation.</p>
HA-65405	<p>xiv_attach shows 'Unknown type' for the Hitachi HBA driver.</p> <p>Currently there is no workaround or solution for this limitation .</p>
HA-100800	<p>Mapping the LUN0 volume causes errors.</p> <p>Due to the distinctive properties of the XIV LUN0 volume (on any storage pool), mapping it to the host causes numerous errors or performance problems.</p> <p>Accordingly, mapping the LUN0 volume is not supported.</p>
HA-101053	<p>When using xiv_attach over iSCSI on x86-based RHEL 6 or RHEL 5, a failure may occur on the last step in which the host is defined the XIV storage system. This applies to XIV microcode versions 10.2.4.x and 11.0.x.</p> <p>To resolve this issue, manually configure the host on the XIV system as follows:</p> <ol style="list-style-type: none">1. Use xiv_iscsi_admin -P to detect all iSCSI addresses of the host.2. Define a new host on the XIV system by using the XIV GUI or XCLI, and add this host the iSCSI posts that you found in the previous step.
HA-159609	<p>On RHEL 6.1 or earlier, when no volumes are mapped to the host, the iSCSI daemon does not start, and the configuration task of the iSCSI service fails.</p> <p>To resolve this issue, use RHEL 6.2 or later.</p>

Ticket ID	Description
HA-163935	<p>xiv_diag may hang when unreachable block devices are present.</p> <p>Regardless of this issue, the xiv_diag log file (<code>xiv_diag_results*.tar.gz</code>) is properly generated. To avoid this issue, remove all unreachable block devices before running xiv_diag. Also, due to a known issue in RHEL 6 (631009 (bugzilla.redhat.com/show_bug.cgi?id=631009)), you may need to use <code>multipath -f <mpath device></code> to clean up all multipath devices.</p>
HA-165868	<p>The user_friendly_names multipath parameter is automatically assigned with 'yes'.</p> <p>Workaround: If you want to use non-friendly names, manually change the parameter value to 'no'.</p>
HA-165914	<p>udev-related problems may occur on hosts that were upgraded from HAK versions earlier than 1.7.0.</p> <p>To resolve this issue, manually delete the udev rule in <code>/dev/udev/rules.d/44-ibm-xiv.rules</code>. You might need to reload the udev rules or reboot the host.</p> <p>Note: This workaround removes the <code>/dev/xiv</code> device tree, as in a clean HAK installation.</p>
HA-171098	<p>Due to a known issue in RHEL 6 (662433 (bugzilla.redhat.com/show_bug.cgi?id=662433)), hosts that use mapped volumes over iSCSI might freeze during an OS shutdown or reboot.</p> <p>If this occurs, power off and restart the host manually.</p> <p>To avoid this issue, upgrade to RHEL 6.3.</p>
HA-173095	<p>If the host is predefined on the XIV storage system without CHAP authentication, using CHAP credentials during the attachment procedure (xiv_attach) silently succeeds, but does not apply any CHAP authentication.</p> <p>Workaround: Ensure that the host is already defined on the XIV storage system with a CHAP name and secret.</p>
HA-227476	<p>If XIV volumes mapped to a host that regularly boots from SAN, deleting a WWPN associated with these volume mappings causes the server to hang.</p> <p>Currently there is no workaround or solution for this limitation.</p>

Ticket ID	Description
HA-251225	<p>The xiv_host_profiler and xiv_syslist utilities might not detect all connectivity parameters if the host uses HBAs manufactured by LSI. In such a case, the utilities would not be able to determine whether the host is connected to two or more XIV modules, and the xiv_host_profiler --analyze command will report that the host is not properly configured.</p> <p>Currently there is no workaround for this limitation, and you need to manually check whether the host is connected to at least two XIV modules (if LSI HBAs are used).</p>
HA-254724	<p>When running the xiv_host_profiler --create-scheduled-task command and no crontab file exists for the root user, a Linux message stating 'No crontab for root' is displayed.</p> <p>This is a one-time occurrence that has no impact on the creation of the scheduled task.</p>
HA-261163	<p>On RHEL 6 or SLES 11 SP3, xiv_devlist might hang after a volume is unmapped.</p> <p>To resolve this issue, restart the host.</p>
HA-261166	<p>"No Adapter Found" message might appear in some cases when using xiv_host_profiler --create or xiv_host_profiler --analyze, even though a host bus adapter is actually found.</p> <p>This has no impact on the created host profile or host analysis, and you can ignore this message.</p>
HA-261345	<p>On SLES 11 SP2, xiv_attach, xiv_iscsi_admin, and xiv_fc_admin and may hang when using the rescan (-R) option.</p> <p>To avoid this issue, upgrade to SLES 11 SP3.</p>
HA-261359	<p>On SLES 12.0, if one of the iSCSI ports on the storage system is unreachable, then iSCSI service fails to start and an error message is displayed.</p> <p>To avoid this issue, connect the iSCSI port, if it is disconnected, or disable the unreachable port. Then, log out of all the existing nodes. Alternatively, upgrade to SLES 12 SP1.</p>
HA-261402	<p>Running rescan with the --clean flag in RHEL 7.x environment (xiv_iscsi_admin -R --clean or xiv_fc_admin -R --clean) may take several minutes, depending on amount of multipath devices without existing paths.</p> <p>Currently there is no workaround or solution for this limitation.</p>
HA-261434	<p>On RHEL 7.0, the iSCSI service fails to start and an error message is displayed if one of the XIV iSCSI ports is unreachable.</p> <p>To resolve this issue, use RHEL 7.1 or later.</p>

Ticket ID	Description
HA-261572	<p>On CentOS Linux 7.x and RHEL 7.x, running the xiv_syslist may fail with exception.</p> <p>To avoid this issue, install the PCI Utilities (<i>pciutils</i>) package .</p>
HA-261626	<p>LUNs with IDs higher than 255 mapped to a host over iSCSI may result in incorrect listing of the storage volumes, using the xiv_devlist command.</p> <p>To avoid this issue, do not use LUN IDs higher than 255.</p>
HA-261648	<p>Updating routing table on the device-mapper multipath switch (xiv_iscsi_admin -U) immediately after restoration of an iSCSI session may cause an execution error.</p> <p>To resolve this issue, rerun the routing table update.</p>
HA-261731	<p>On RHEL 7.x, unmapped LUNs remain associated with the host and continue to appear in the xiv_devlist output if the xiv_devlist command is run immediately after rescanning storage systems with the --clean argument (xiv_iscsi_admin -R --clean).</p> <p>To resolve this issue, run the xiv_iscsi_admin -R --clean command again.</p>
HA-261758	<p>When run under CentOS Linux, the xiv_host_profiler --analyze command declares the operating system as unsupported, producing an incorrect host configuration analysis.</p> <p>Currently there is no workaround or solution for this limitation.</p>
HA-261835	<p>When run on a VM under SLES11 SP4 in VMware environment, the xiv_fc_admin -R or xiv_iscsi_admin -R commands may fail with exception.</p> <p>To resolve this issue, configure the virtual machine to display local disk UUID. Then, remove the VMware disk device from black list in <code>multipath.conf</code> file.</p>
HA-261881	<p>Operating systems added in the HAK version 2.6.0 (SLES 12.x, RHEL 7.2 for x86/x64 and all Linux flavors for POWER7/8) appear as unsupported, when running the xiv_host_profiler command on host connected to a storage system with the 11.x microcode.</p> <p>Currently there is no workaround or solution for this limitation.</p>
HA-261885	<p>LUNs with IDs higher than 255 mapped to a host over iSCSI may result in faulty update of the routing table on the device-mapper multipath switch, using the xiv_iscsi_admin -U command.</p> <p>To avoid this issue, do not use LUN IDs higher than 255.</p>

Ticket ID	Description
HA-261930	<p>When running the xiv_devlist command on volumes during the Hyper-Scale Mobility process, the storage system serial number indicates either a source or a destination system. This may be confusing, when this command is used several times in a row, and each time a different storage system serial number is displayed.</p> <p>To resolve this issue, use XIV GUI or Hyper-Scale Manger to determine the Hyper-Scale Mobility state and correct serial numbers of the storage systems.</p>
HA-261995	<p>Abnormal behavior of the multipath service under SLES 12 SP1 has been identified. One of its possible effects is that the xiv_devlist command output can display individual device paths of a storage volume instead of a single multipath device.</p> <p>To avoid this issue, use SLES 12 SP2 or later.</p>
HA-262031	<p>If a host reboots after HyperSwap failover, the multipath routes to the storage system, originally configured as primary, remain available, but become inactive.</p> <p>Use one of the following procedures to resolve this issue:</p> <ul style="list-style-type: none"> • Procedure 1 <ol style="list-style-type: none"> 1. Identify the FlashSystem A9000 or A9000R block devices excluded by multipath service and manually delete them. 2. Run the xiv_fc_admin -R or xiv_iscsi_admin -R command to detect the connected storage systems. • Procedure 2 <ol style="list-style-type: none"> 1. Identify the FlashSystem A9000 or A9000R block devices excluded by multipath service (primary or secondary volume). 2. Unmap the volume from the storage system. 3. Run the xiv_fc_admin -R --clean or xiv_iscsi_admin -R --clean command to disassociate the unreachable storage systems from the host. This procedure runs a risk of removing other inactive multipath routes, which are not related to the FlashSystem A9000 or A9000R storage systems. 4. Remap the volume to the storage system. 5. Run the xiv_fc_admin -R or xiv_iscsi_admin -R command to detect the connected storage systems.

Related information and publications

You can find additional information and publications related to the IBM Storage Host Attachment Kit for Linux on the following websites.

- IBM Knowledge Center (ibm.com/support/knowledgecenter)
- IBM XIV Storage System on IBM Knowledge Center (ibm.com/support/knowledgecenter/STJTAG)

- IBM Spectrum Accelerate on IBM Knowledge Center (ibm.com/support/knowledgecenter/STZSWD)
- IBM FlashSystem A9000 on IBM Knowledge Center (ibm.com/support/knowledgecenter/STJKMM)
- IBM FlashSystem A9000R on IBM Knowledge Center (ibm.com/support/knowledgecenter/STJKN5)
- IBM Power Systems software website for AIX®(www.ibm.com/systems/power/software/aix)
- IBM System p website(www.ibm.com/systems/p)
- IBM Flash Storage and Solutions marketing website (ibm.com/systems/storage/flash)

Getting information, help, and service

If you need help, service, technical assistance, or want more information about IBM products, you can find various sources to assist you. You can view the following websites to get information about IBM products and services and to find the latest technical information and support.

- IBM website (ibm.com®)
- IBM Support Portal website (ibm.com/support/entry/portal/support?brandind=Hardware~System_Storage)
- IBM Directory of Worldwide Contacts website (ibm.com/planetwide)

Use the Directory of Worldwide Contacts to find the appropriate phone number for initiating voice call support. Select the Software option, when using voice response system.

When asked, provide your Internal Customer Number (ICN) and/or the serial number of the storage system that requires support. Your call will then be routed to the relevant support team, to whom you can provide the specifics of your problem.

Notices

These legal notices pertain to the information in this IBM Storage product documentation.

This information was developed for products and services offered in the US. This material may be available from IBM in other languages. However, you may be required to own a copy of the product or product version in that language in order to access it.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not grant you any license to these patents. You can send license inquiries, in writing, to:

*IBM Director of Licensing
IBM Corporation
North Castle Drive, MD-NC119
Armonk, NY 10504-1785
USA*

For license inquiries regarding double-byte character set (DBCS) information, contact the IBM Intellectual Property Department in your country or send inquiries, in writing, to:

*Intellectual Property Licensing
Legal and Intellectual Property Law
IBM Japan Ltd.
19-21, Nihonbashi-Hakozakicho, Chuo-ku
Tokyo 103-8510, Japan*

INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product and use of those Web sites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Licensees of this program who wish to have information about it for the purpose of enabling: (i) the exchange of information between independently created programs and other programs (including this one) and (ii) the mutual use of the information which has been exchanged, should contact:

*IBM Director of Licensing
IBM Corporation
North Castle Drive, MD-NC119
Armonk, NY 10504-1785
USA*

Such information may be available, subject to appropriate terms and conditions, including in some cases, payment of a fee.

The licensed program described in this document and all licensed material available for it are provided by IBM under terms of the IBM Customer Agreement, IBM International Program License Agreement or any equivalent agreement between us.

The performance data discussed herein is presented as derived under specific operating conditions. Actual results may vary.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

All statements regarding IBM's future direction or intent are subject to change or withdrawal without notice, and represent goals and objectives only.

Trademarks

IBM, the IBM logo, and ibm.com are trademarks or registered trademarks of International Business Machines Corp., registered in many jurisdictions worldwide. Other product and service names might be trademarks of IBM or other companies. A current list of IBM trademarks is available on the Copyright and trademark information website (www.ibm.com/legal/us/en/copytrade.shtml).

Linux is a trademark of Linus Torvalds in the United States, other countries, or both.

Veritas is a trademark or registered trademark of Symantec Corporation in the United States and other countries.

Other product and service names might be trademarks of IBM or other companies.



Printed in USA