



IBM Systems - iSeries
iSeries Access for Linux

Version 5 Release 4





IBM Systems - iSeries
iSeries Access for Linux

Version 5 Release 4

Note

Before using this information and the product it supports, read the information in “Notices,” on page 33.

Third Edition (February 2006)

This edition applies to version 5, release 4, modification 0 of iSeries Access for Linux (product number 5722-XL1) and to all subsequent releases and modifications until otherwise indicated in new editions. This version does not run on all reduced instruction set computer (RISC) models nor does it run on CISC models.

© Copyright International Business Machines Corporation 2004, 2006. All rights reserved.

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

Contents

iSeries Access for Linux	1
What's new.	1
Printable PDFs.	1
License information	2
Prerequisites for using iSeries Access for Linux	2
Install iSeries Access for Linux	3
Update iSeries Access for Linux	3
Uninstall iSeries Access for Linux	4
Security	4
5250 emulation	5
Prerequisites for using 5250 emulation.	6
Configure 5250 emulation	6
Troubleshoot 5250 emulation	18
5250 emulation FAQs	20
Open Database Connectivity.	20
Prerequisites for using ODBC	20
ODBC language considerations.	20
Restrictions when using ODBC with iSeries Access for Linux.	21
Configure an ODBC data source	22
ODBC examples.	24

Troubleshoot ODBC	24
ODBC FAQs	26
iSeries Access for Linux utilities	27
CWB COPWR - Change advanced communications settings	27
CWB MEDIC - Service information collection tool	27
CWB NLTBL - Download conversion tables	28
CWB PING - Test the connection to the server	28
CWB RUNSQL - Run batch SQL commands and procedures using an ODBC DSN	29
CWB TRC - Trace iSeries Access for Linux	30
RMT CMD - Run an iSeries batch/CL command	31
RMT ODBC - Run an iSeries batch/CL command using the ODBC driver	31
Code license and disclaimer information.	32

Appendix. Notices	33
Trademarks	35
Terms and conditions	35

iSeries Access for Linux

iSeries™ Access for Linux® (5722-XL1) is the latest offering in the iSeries Access (5722-XW1) family of products. It offers Linux-based access to iSeries servers. iSeries Access for Linux enables users to leverage business information, applications, and resources across an enterprise by extending the iSeries resources to the Linux client.

iSeries Access for Linux allows you to access the DB2 Universal Database™ (UDB) for iSeries using an ODBC driver, and to establish a 5250 session with an iSeries server, all from a Linux client.

iSeries Access for Linux is shipped with the iSeries Access for Web (5722-XH2) product and is available as a download by accessing the iSeries Access for Linux homepage (<http://www.ibm.com/eserver/iseries/access/linux/>).

Note: By using the code examples, you agree to the terms of the Code license and disclaimer information.


What's new

This topic highlights changes to iSeries Access for Linux.

iSeries Access for Linux provides the following new functions in version 1.10.

- Kerberos support
Kerberos is a security solution that provides authentication tools over the network to help secure your business information.
- Single signon support
Single signon uses Kerberos to help you simplify your local business environment, securely. Single signon support allows your users to enter a single password to access multiple systems, while ensuring the same security as entering multiple passwords for multiple systems.
- Bypass signon
Bypass signon uses password encryption to skip the 5250 signon screen.

iSeries Access for Linux information is new to the Information Center his release. It was previously documented on the iSeries Access for Linux Web site.

IBM® iSeries Access for Linux  (www.ibm.com/servers/eserver/iseries/access/linux/) provides the latest information about iSeries Access for Linux functions.

To find other information about what's new or changed this release, see the Memo to Users.

Printable PDFs

Use this to view and print a PDF of this information.

To view or download the PDF version of this document, select iSeries Access for Linux (about xxx KB).

You can view or download these related topics:

- iSeries Access for Windows® ODBC
- DB2 Universal Database for iSeries SQL Reference

Web sites


- IBM iSeries Access for Linux  (www.ibm.com/servers/eserver/series/access/linux/) Visit this site to learn more about iSeries Access for Linux.
- IBM iSeries Access  (www.ibm.com/servers/eserver/series/access/) This Web site has online product information for iSeries Access
- Linux on iSeries  (www.ibm.com/servers/eserver/series/linux/) Visit this site to learn more about Linux on iSeries.
- ODBC and the unixODBC project  (www.unixodbc.org/) This site provides information on the unixODBC Driver Manager. Among other things, there are links here to see what is fixed in a particular release and a spot to download the latest version of the unixODBC Driver Manager.
- Microsoft® Data Access and Storage Developer Center  (msdn.microsoft.com/data/default.aspx) This site gets you to information about the ODBC specification and examples on how to use it.
- IBM eserver iSeries support  (www.ibm.com/servers/eserver/support/series) Technical support and resources for iSeries and i5/OS™.

Saving PDF files

To save a PDF on your workstation for viewing or printing:

1. Right-click the PDF in your browser (right-click the link above).
2. Click the option that saves the PDF locally.
3. Navigate to the directory in which you want to save the PDF.
4. Click **Save**.

Downloading Adobe Reader

- 1 You need Adobe Reader installed on your system to view or print these PDFs. You can download a free copy from the Adobe Web site (www.adobe.com/products/acrobat/readstep.html) .

License information

IBM iSeries Access for Linux (5722-XL1) is a licensed program. The 5250 Display Emulation component requires an IBM iSeries Access Family (5722-XW1) license before you can use it.

For more information about iSeries Access Family license requirements, refer to the IBM International Program License Agreement included with the iSeries Access Family (5722-XW1).

Prerequisites for using iSeries Access for Linux

Use this information to learn about the iSeries server and Linux requirements for using iSeries Access for Linux.

iSeries server requirements for running iSeries Access for Linux

- Connections to iSeries servers running i5/OS, release V5R2 or V5R3, are supported. Using the product with earlier releases, may produce unexpected results.
- The QUSER user profile must be enabled. From an iSeries command line type the following:
DSPUSRPRF USRPRF(QUSER)
Press ENTER to display the status for QUSER.
Use the CHGUSRPRF command to change the profile if necessary.
- The host servers must be started. Type STRHOSTSVR and press ENTER to start the OS/400® host servers.

- TCP/IP must be started. To start TCP/IP, you must have the TCP/IP Connectivity Utilities (i5/OS licensed program 5722-TC1) installed on the server. For more information on host server options and TCP/IP, see the TCP/IP topic in the iSeries Information Center.

Linux requirements for running iSeries Access for Linux

- GNU C Library (GLibc 2.2)
- Red Hat package manager (RPM 3.0)
- Runtime environment (OpenMotif 2.0 or later for the 5250 emulator)
- unixODBC driver manager version 2.0.11 or later must be installed on the client. See the unixODBC Project web site for more information on the driver manager and to download the latest level of the driver manager.

Note: If you recompile the unixODBC driver manager, the `./configure --prefix` default is `/usr/local`. If you use this default, update your shared library (`/etc/ld.so.conf`) and executable paths to include it.

Recommended iSeries LPAR (Power PC[®]) and i386 Linux Distributions:

- SUSE LINUX Enterprise Server 8 and later
- Red Hat Enterprise Linux 3 and later

Install iSeries Access for Linux

To install iSeries Access for Linux, follow these steps.

1. Download the iSeries Access for Linux RPM package **iSeriesAccess-5.x.0-xx.xx.ppc.rpm**,
 - where *x* and *xx.xx* indicate the version level that is available for download.
2. Enter the following command on the Linux client:
 - `rpm -ivh iSeriesAccess-5.x.0-xx.xx.ppc.rpm`
3. Enter the actual name of the file that is downloaded in step 1.
 - For example: `iSeriesAccess-5.2.0-1.10.ppc.rpm`

Note:

1. Files are installed in the `/opt/ibm/iSeriesAccess` directory on your Linux client.
2. When iSeries Access for Linux is installed, the ODBC driver that was previously installed with the product is uninstalled.
3. The iSeries Access for Linux RPM package adds the ODBC driver to the list of ODBC drivers available through unixODBC.
4. The RPM package uses the following to complete the install task:
 - the unixODBC driver install program `odbcinst`
 - the iSeries Access for Linux ODBC Driver file `unixodbcregistration`
5. You can use the unixODBC `ODBCConfig` program to configure additional features of the ODBC Driver that is used by iSeries Access for Linux.
6. If the installation fails because of a dependency on `libodbcinst.so`, make sure you have the unixODBC driver manager installed. If the problem persists, run the installation command with the `--nodeps` parameter to stop dependency checking.

Update iSeries Access for Linux

Update iSeries Access for Linux

To update iSeries Access for Linux after an initial installation, enter the following command:

`rpm -Uvh iSeriesAccess-5.2.0-xx.xx.xxxx.rpm,`
where `xx.xx.xxxx` indicates the version level.

Uninstall iSeries Access for Linux

Uninstall iSeries Access for Linux

To uninstall iSeries Access for Linux, enter the following command:

```
rpm -ev iSeriesAccess
```

Note: If the `/opt/ibm/iSeriesAccess/conv_tables` directory is not removed during uninstall, because of downloaded conversion tables, you must manually remove the directory.

Security

Use this information to learn more about Kerberos, single signon, and secure sockets layer (SSL).

Kerberos

iSeries Access for Linux supports authenticating to the iSeries using Kerberos. To install and configure iSeries for Kerberos, see the Single signon topic, in the Security topic collection.

To install and configure Linux for Kerberos, see one of the many “How To’s” available on the Internet. For example: www.linux.com/howtos/Kerberos-Infrastructure-HOWTO/client-configure.shtml

Note: Most Linux distributions have at least one (Heimdal and MIT) version of Kerberos 5 included with them. However, some distributions neglect to create a symbolic link for the Kerberos shared library (Heimdal `/usr/lib/libgssapi.so` or MIT `/usr/lib/libgssapi_krb5.so`). iSeries Access for Linux dynamically loads the Kerberos shared library by that name and if a symbolic link to that name is not available, you get the following error: CWBSY1015 - Kerberos not available on this version of the operating system.

To use Kerberos with iSeries Access for Linux, you must first authenticate to your Kerberos domain using the `kinit` command or by setting up your initial Linux login to authenticate with the pluggable authentication module (PAM) Kerberos plugin. After successful authentication, you should be able to do a `klist -f` to see the status of your Kerberos tickets.

For any iSeries Access function, you can use `*kerberos` in place of the iSeries user profile to use your Kerberos tickets. Any password will be ignored in this case. For example:
`/opt/ibm/iSeriesAccess/bin/rmtcmd CRTLIB Test /system:iSeriesSystemName /user:*kerberos.`

The Kerberos principle name will be based upon the fully qualified TCP/IP name received from the reverse lookup of the TCP/IP address. If you use a hosts file to resolve TCP/IP addresses, be sure to include the fully qualified TCP/IP system name. For example: `1.2.3.4 MyiSseries.MyDomain.com MyiSeries.`

Single signon

The `ibm5250` emulator supports Kerberos and single signon. Using either command line options or the `setup5250` configuration utility you can enable this security support.

Secure sockets layer

For enabling iSeries Access for Linux to use secure sockets layer (SSL) support, OpenSSL and stunnel must be installed and configured. An example stunnel configuration file (`/opt/ibm/iSeriesAccess/doc/iSeriesAccess.stunnel.config`) is provided to get you started.

Related reference

Single signon

“Command line emulator options” on page 6

Learn about command line options for iSeries Access for Linux 5250 emulator.

5250 emulation

The 5250 emulator provides function equivalent to an IBM 5250 terminal. The emulator also provides extended 5250 terminal functions similar to those provided by the PC/5250 emulator.

The emulator supports the following functions:

- Customizable multi-session support (up to 99)
- Customizable menu bar/pull downs
- Scalable fonts
- Maximize window support
- Remember initial window placement and font
- Saving a desktop file for window placement and font if initial geometry is not defined.
- On-line help
- Keyboard remapping
- Session level color mapping
- Record/playback
- User-customizable pop-up and pull down keypads
- Auto-start of playback file
- Auto-logon
- Copy/cut/paste
- 24x80 and 27x132 screen size support
- Dynamic window management for screen size changes (27x132)
- Settable 5250 display names
- Kerberos/Single Signon support
- Screen print to PostScript printers (parallel, serial, remote)
- Monochrome, grey scale, and color image/fax viewing and printing; 3489 emulation
- DP mode (normal 5250 mode) support of primary and foreground color extended attributes
- Easily changed Enter/Field Exit key locations
- Customizable automatic Help key on operator error
- Fixed hot spots
- Hot spot highlighting option
- Cursor style options: block/underscore and blink/no blink
- Rule line
- Row/column indicator
- Shift and Caps Lock indicators
- Customizable window title
- Column separator customization
- Type-ahead customization
- Session ID to identify a session (similar to PCOMM session short name)
- Automatic, customizable, communication error recovery
- Auto-disconnect option after specified inactivity time

Note: By default, the iSeries Access for Linux 5250 emulator shares the same process for multiple sessions used on a Linux client, defined as a system with a single Linux user, using one Linux userid. To enable multiple users or thin clients, use the `ibm5250 -STAND_ALONE` command line option. This option allows multiple thin clients, Virtual Network Computing (VNC), and Linux Terminal Server Project (LSTP) users to easily use the 5250 emulator.

For information on using the 5250 emulator with iSeries Access for Linux, see the following topics:

Prerequisites for using 5250 emulation

You must meet the following prerequisite requirements to use the iSeries Access for Linux 5250 emulator.

- iSeries Access: The 5250 Emulator is designed to be Linux distribution independent. The dependencies on the Linux distribution are glibc 2.2 and openmotif 2.*. The distribution must also support installing an rpm created with rpm 3.0.
- For version 1.10, monospaced fixed width 75 dpi fonts are required and should be included by default when you install X. To get more font choices, install 100 dpi fonts. For prior versions, 75 and 100 dpi fonts are required to be installed and configured for scalability.
- Using the 5250 emulator in iSeries Access for Linux requires the iSeries Access Family (5722- XW1) license on the iSeries server. One 5722-XW1 user license is used for each unique client or userid that is connecting to the iSeries server. One userid may start multiple emulator sessions to the same iSeries server and only one 5722-XW1 license will be used on the server.

You can use either the command line option or a global preference (`setup5250`) to configure the userid and password on a connection. The configuration values, from the one that you choose, are used to obtain the 5722-XW1 license. If both global values and connection command line values are configured, command line values take precedence.

Related tasks

“Install iSeries Access for Linux” on page 3
To install iSeries Access for Linux, follow these steps.

Configure 5250 emulation

You can configure the 5250 emulator installed with iSeries Access for Linux RPM.

Select from the following for information on configuring your emulator:

Command line emulator options

Learn about command line options for iSeries Access for Linux 5250 emulator.

The format of the command line to invoke a 5250 emulator session is:

```
ibm5250 iSeries_system_name optional_parameters
```

where:

- `ibm5250` is the application name and is case sensitive.
- `iSeries_system_name` specifies the name of the server with which the 5250 emulation session communicates. The name is a host name or an IP address. The user is prompted when this field is not specified.
- `optional_parameters` specifies optional parameters.

The two main command line entries for configuring the iSeries Access for Linux emulator are:

1. **ibm5250** - This application invokes the 5250 emulator and displays a graphical user interface (GUI) for entering the system name, userid, and password. This information is used to obtain a 5722-XW1 license and initiate a 5250 session. Type `ibm5250 --help` to see command line options.
2. **setup5250** - This is the setup program that is used to configure global values that are applied to all 5250 sessions, userid's, and multiple connections. Once the initial 5250 program is started, reference

the online help text for additional configuration options. The setup5250 program also allows for the creation and launching of customized ibm5250 sessions.

You can use the following case sensitive, optional parameters on the 5250 command line:

- `-title` Case sensitive title text follows this parameter. If the title text contains a space, the title text must be within double quotes. The title text is displayed in the 5250 session window overriding the 5250 window title text resource value. Title text is truncated if longer than thirty characters. When the 5250 session dialogue (menu pull down) is used to start another 5250 session, the same title is used.
- `-TITLE_OPTION` is followed by one of the following: `TEXT_AND_SESSION_ID` (default), `TEXT_ONLY`, `SESSION_ID_ONLY`, `TEXT_HOST_AND_SESSIONID`, or `TEXT_AND_HOST`.
- `-wide` Either *enable* or *disable* should follow and are case sensitive. This parameter enables or disables 27x132 support. The default is *enable*.
- `-image` Either *enable* or *disable* should follow and are case sensitive. This parameter enables or disables image/fax viewing. The default is *enable*.
- `-LARGEST_IMAGE` A 3 or 4 digit numeric parameter follows which indicates the maximum source image/fax size which is displayed. The parameter indicates the number of thousands of bytes that are accepted. The 5250 emulator has a default value of 400, displaying an image or fax up to 400,000 bytes in size. This parameter is undocumented in help text.
- `-LANGID` A 5 digit parameter follows which contains the locale that is used. The `-LANGID` overrides the Linux environment variable `$LANG` and determines the conversions that are used on the OS400 data stream. The emulator window decorations are determined by the `$LANG` or `-LANGID` value of the first emulator session that is started.
- `-geometry` Window width, window height, x offset, and y offset follow (`WWxWH+Xoffset+Yoffset`). The 5250 window is placed according to these values. The window size parameters are adjusted as necessary to fit the font that fills the window. `-geometry 9999x9999+0+0` provides the maximized window, using the largest font that fits a particular monitor resolution.
- `-p` or `-PLAYBACK` A case sensitive file name of a 5250 playback file follows. This function enables autologon so users are not required to reenter their userid's and passwords. This function also enables starting a playback file, which allows users to display a specific iSeries server screen. The playback file is from the user's playback directory or a default playback file.
- `-keypad` or `-KEYPAD` Use this parameter to start a popup keypad window when the 5250 emulator session starts. A case sensitive popup keypad file name follows. Specify multiple `-keypad` command line options to start multiple popup keypad windows. The keypad file is from your keypad directory or from the default keypad file.
- `-KEYFILE` Use this parameter to specify a user-named keyboard remapping file that is used for the 5250 emulator session. A case sensitive keyboard remapping file name follows, including the keyboard type file extension.
- `-DISPLAY_NAME` is followed by one parameter. The following rules apply to i5/OS 5250 session names:
 - Each active 5250 session must have a unique session name.
 - The first character must be an alpha character.
 - All characters must be alpha, numeric, a period, or an underscore.
 - All alpha characters must be upper case.
 - Session names must be 2 to 10 characters in length.
- `-SESSION_ID` is followed by an ID for the 5250 session. The session ID text is upper or lower case and up to 20 characters in length. If there is a space in the session ID text, the session ID text must be enclosed within double quotes.

Note: `+n` is also supported where `n` is a numeric digit between 1 and 99. No spaces are allowed between the text and `+n`.

- `-EURO`, `-Euro`, `-euro`, and `-NOEURO` specify whether or not the European monetary symbol is used. This command line option is ignored for languages that do not support the Euro symbol.

- -port or -PORT allows a 5250 session to use a port number other than the default. For non-SSL telnet, the default port number is 23. A 1 to 4 digit port number follows the command line option.
- -INACTIVITY is followed by a numeric parameter from 0 to 9999. This option specifies whether the telnet connection is disconnected or reconnected, after a specified time of inactivity. The default value is 0 which indicates that inactivity is not monitored.
- -BLOCK_COPY specifies that the 5250 emulator defaults to block copy, as opposed to linear copy, when marking an area for copy or cut. Block copy occurs by a double click of the mouse button while linear copy means pressing and dragging the primary mouse button to mark the desired area. If this option is not specified, linear copy is the default.
- -NO_COPY_PASTE specifies that the emulator does not allow copy, cut, or paste into or out of the emulator session.
- -SESSION_COPY_PASTE_ONLY specifies that the 5250 emulator only allows copy, cut, and paste within the emulator session.
- -COPY_PASTE specifies the emulator allows copy, cut, and paste into and out of the emulator session.
- -BROWSER_START specifies that the emulator code recognize a URL hot spot. This option defaults to unavailable because not all users have browser access. If this option is specified and the user clicks on a valid URL hot spot, the command specified in the system environment variable \$BROWSER is called with the URL passed as an option. The user must define the system variable \$BROWSER as the browser name that is used. A fully qualified name or a name found in the system path is specified. If the environment variable is not found or is not valid, a browser is not started.
- -RETRY_COUNT specifies whether to try to reconnect if a communication error occurs and the 5250 session is disconnected. A numeric parameter follows with a value between 0 and 9999. Zero indicates that any reconnect is attempted manually. One to 9999 indicates the number of automatic retries that are attempted. The default is 144.
- -RETRY_INTERVAL specifies the automatic retry count in seconds. A numeric parameter follows with a value from 1 to 9999; the default value is 300 (5 minutes).
- -NO_DESKTOP_FILE The emulator supports reading and writing a desktop file to remember the user's last window location and font size. This option disables the ability to read and write the desktop file.
- -debug or -DEBUG displays verbose messaging while the emulator runs.
- -trace or -TRACE traces Telnet activity between the emulator and host OS/400.
- -sso or -SSO bypasses the signon screen.
- -kerberos authentication used for getting a license and bypassing signon when used with the -sso parameter.
- -IBMCURLIB specifies the current library when used with the -sso parameter.
- -IBMIMENU specifies the initial menu when used with the -sso parameter.
- -IBMPROGRAM specifies the initial program when used with the -sso parameter.

X resources for your emulator

Use X resources to configure 5250 emulation available with iSeries Access for Linux.

The primary method to configure the Emulator is with X resources. There is command line support for a subset of the X resources. Values passed in on the command line take precedence over values set as X resources. For information on using the emulator X resources, see the following:

Color mapping:

The color mapping program supports 8, 16, and 24 bit color systems.

The basic color mapping program defines up to 10 different colors for each of the five default basic color schemes; all but two of the basic scheme colors (wheat background and light blue background) come

from the WEB color palette. The advanced color mapping program can define up to 22 unique colors for each session. Access to the color mapping program is controlled with a resource. See the following for valid resource values:

advanced

The user is allowed to remap their colors for 5250 emulation sessions. The user can use either basic color mapping or use advanced color mapping.

basic The user is allowed to use the basic portion of the colormapper program. Basic is the default resource setting. Basic color mapping allows the user to choose between five basic background and foreground color schemes.

disable

The user is not allowed to change the colors of the emulation sessions. The color map menu item in the Option menu is grayed out and can not be selected.

disable_and_hide

The user is not allowed to change the colors of their emulation sessions. The pull down menu is not displayed in the Option menu.

Each emulation session has a session name, determined at 5250 session initialization. The session name contains the name of the host that the session is connected to and a session number into that host (1-99). The session name enables the user to use multiple color maps for multiple 5250 emulation sessions.

Basic color mapping allows you to choose from the following default color schemes:

- black background
- light grey background
- dark grey background
- light background
- light blue background

Advanced color mapping allows the user to control the color of the following individual components of an emulator session (default color listed in parentheses):

1. 5250 menu bar foreground (black)
2. 5250 menu bar background (grey)
3. 5250 window background (black)
4. 5250 pushbutton background (dark grey)
5. 5250 blue text (blue)
6. 5250 green text (green)
7. 5250 pink text (pink)
8. 5250 red text (red)
9. 5250 turquoise text (turquoise)
10. 5250 white text (white)
11. 5250 yellow text (yellow)
12. 5250 cursor color (white)
13. 5250 mouse color (white)
14. 5250 rule line color (blue)
15. 5250 status line foreground (turquoise)
16. 5250 status line background (black)
17. 5250 monochrome image foreground (black)
18. 5250 monochrome image background (white)
19. Assist programs window background (grey)

20. Assist programs group box background (light grey)
21. Assist programs scrollable list/entry field background (off white)
22. Assist programs foreground (black)

If you create a new advanced color scheme and want to save the changes, the you will be prompted for a name of the color scheme. The color scheme name will be displayed when using basic color mapping. Blanks are allowed in the color map name.

A saved color map file immediately applies to the 5250 session the color mapping program was started from. Other emulator sessions must be exited and restarted to pick up the new colors.

Image/fax (3849 emulation):

5250 monochrome image/fax viewing and printing to PostScript printers is supported. 5250 color and grey scale JPEG and TIFF image viewing and printing is supported. Color PCX is supported.

A resource entry controls 5250 image/fax; the resource values are:

enable Allows you to display image/fax. Enable is the default resource value.

disable

Does not allow you to display image and fax.

5250 emulator image/fax supports the following:

- image/fax formats
- scrolling
- scaling
- rotation
- reverse
- trim magnify scaling

The maximum image/fax size is dynamic based on the following:

- The default size is 400,000 bytes of source (compressed) image/fax. The command line parameter `LARGEST_IMAGE` can increase or decrease the size of the maximum image/fax.
- The available memory of the system.
- The largest image/fax that the 3489 can display is 128K bytes. Applications may not send more than that to the emulator.

Image/fax printing is supported to PostScript printers.

Keyboard remapping:

The 5250 emulator includes a GUI keyboard remapping program for 5250 sessions.

Each 5250 session has a session name determined at 5250 session startup time. The session name contains the name of the iSeries partition the session is connecting to and a 5250 session number (1-99). The session name enables the user to use multiple keyboard maps for multiple 5250 emulation sessions.

The maximum file name length for a keyboard map file is 32 characters. Blanks are allowed in the name.

The saved keyboard map immediately applies to the 5250 session that was used to start the keyboard mapping program. Other emulator sessions must be exited and restarted to pick up the new keyboard map.

The keyboard map may be printed.

Miscellaneous preferences:

Launch the miscellaneous preferences menu through a pull down menu item under the Option menu. A resource entry controls the availability or unavailability of the miscellaneous preferences menu item.

Valid values for the reference are as follows:

enable Allows you to use 5250 miscellaneous preferences. Enable is the default value.

disable_and_hide

Does not allow you to use the 5250 miscellaneous preferences program and the menu item is not displayed.

At 5250 session initialization, the emulator checks to see if there is a Miscellaneous file in the user's directory (\$HOME/.iSeriesAccess/ibm_5250). If the file is not found, the internal defaults are used. The 5250 miscellaneous preferences are as follows:

- Cursor Style
- Cursor Blink
- Enter/Field Exit key locations
- Print key location
- Destructive Backspace key
- Hot spots
- Hot spots highlighting
- Paste start location
- Auto Help for operator error
- Operator error reset
- Keyboard buffering
- Large screen behavior
- Row column indicator
- Rule line key
- Rule line style
- Blue underscore

When a preference is modified, the change is temporarily applied to all 5250 sessions.

Popup/pull down keypads:

You can create keypads.

Valid resource values for the keypad resource entry are as follows:

enable Allows you to create, change, and user keypads. The default resource value is enable.

keypad_only

Allows you to use, but not create or change keypads. The keypad customization pull down choice is not displayed.

disable_and_hide

Does not allow you to use keypads. The two pull down keypad choices are not displayed.

The default keypad resource IBM5250*KeyPadPath: is typically followed by one or more full paths (directory and file name) to default keypad files. Multiple paths are separated by a comma. If the resource is followed by the character "0", there is no default keypad file for the user.

Each popup window has the following:

- A title that is a portion of the 5250 session title: the OS400 partition name or IP address and the session number. The window title is useful to tie the popup keypad window to the launching 5250 session window.
- Customized buttons that perform a keyboard action or playback file. You control the size and layout of the keypad buttons: for example, 1x4, 6x1, or 4x4. All keypad buttons are the same size.

The Customize Keypad program allows you to specify that the keypad functions should be available through a keypad pull down instead of a popup keypad window. If you select this choice, a Keypad menu bar choice is included in the main 5250 window. If you have:

- one pull down keypad file, selecting Keypad lists the buttons text as pull down choices.
- multiple pull down keypad files, selecting Keypad lists the pull down keypad files; select a keypad file displays a drop-down list with the button text as drop-down list choices.
- no pull down keypad files, the Keypad menu bar choice is not displayed.

If you have a keypad file, a dialogue box asks the user to select an existing keypad to change or create a new keypad. The customize keypad window allows you to do the following:

- Define keypad buttons: including button text and keypad actions or a playback file associated with the button. You can edit the keypad action areas. A list of keyboard actions and playback files are available for you to select.
- Change an Existing keypad button.
- Delete an existing keypad button.
- Move keypad buttons.
- Specify if the keypad is a popup keypad or pull down keypad.
- Set the row/column dimensions of a popup keypad window.
- Set the size of each button in a popup keypad window.
- A save pushbutton that allows the user to save this popup keypad. The user gives the keypad a file name. The maximum length of the file name is 32 characters and can contain blanks.
- A cancel pushbutton that cancels the customize window.
- A help pushbutton that launches popup keypad help text.
- Also, a separate keypad window shows the keypad under construction. For a pull down keypad, the keypad window is shown as one column wide.

Popup keypad windows will use the same foreground/background colors as the 5250 emulator menu bar of the session that launched the keypad window.

Record/playback:

The emulator supports record/playback capability (sometimes called keyboard macros) for 5250 sessions. Any recorded sequences are stored in a file in the user's directory.

You can start recording in one of the following two ways:

- Select the Record choice from the pull down menu.
- Press the Record key

Playback sequences are the same for all 5250 emulation sessions for a given user:

- Default playback files: Each playback sequence is stored in a separate file. The default playback resource IBM5250*PlayBackPath: is typically followed by one full path (directory and file name) or more to default playback files. Multiple paths are separated by a comma. If the resource is followed by a "0", there is no default playback file.

- When the user requests a playback, check if the playback file is in the user's playback directory:
iSeriesAccess: \$HOME/.iSeriesAccess/ibm_5250/P/

User accelerator keys take priority over default accelerator keys (if a match occurs).

An auto-logon playback file is specified on the startup file (-playback). The playback file is automatically started as soon as the first 5250 screen is received.

The 5250 emulator automatically pauses when the user presses a data key in a non-display entry field.

The maximum playback file size is 8K bytes.

The playback file name may contain blanks. If an accelerator key is specified, the accelerator key becomes an extension on the file name. For example if F4 is configured as an accelerator key the playback file name could be "playback file name".F4. If no accelerator key is specified, the playback file name does not have an extension.

An existing playback file can not be edited. To make changes to an existing file, a new recording needs to be done and then saved as the existing file name. The new recording will replace the previous recording.

A playback window is normally presented when playback is started. If the user selected Playback from the pull down menu or pressed the Playback key, the user selects a playback file to play. The playback window has two scrollable lists of playback files: the user's playback files and default playback files.

The record and playback program detects the following:

- Matching name found in the user's directory; user is asked to verify that this recording should overwrite the previous playback file.
- Playback requested but the default playback file not longer exists
- Accelerator key playback attempted, but no matching playback file

Screen print:

Screen print uses the default printer environment variable. If a printer other than the default printer is desired, that printer's name needs to be typed into the displayed lpr command.

Valid resource values are as follows:

enable Allows you to screen print. The Print menu bar choice is displayed on the menu bar. The default value is enable.

keyboard_only_local_print

The user is allowed to screen print using the Screen Print key on the keyboard. The Printer menu bar choice is not displayed to the user.

disable_and_hide

The user is not allowed to screen print. The Print menu bar choice is not displayed to the user and the Print Screen key is disabled.

The emulator creates a PostScript level 2 printer data stream.

User preference items include the following:

- Target printer will be the configured default system printer or the user may type another printer name.
- Portrait or landscape
- Image/fax or text print if image/ fax is on the screen
- Printer page size for image/fax printing

When the user selects the screen print, the following text formatting is done:

- Non-display date changes to blanks
- Attributes change to blanks
- Text assist characters (OV/editor) change to blanks
- ENPTUI characters change to their character equivalents
- DUP character is changed to an asterisk
- Underscore is printed:
 - Underscore is used for ASCII for underscored nulls.
 - Begin/end underscore commands are used for PostScript.
- Color, intensify (bold), reverse image, and column separators are not printed.

Session ID:

The session ID can be defined by a command line option or a resource.

The session ID can be a single value; for example "Smith". A set of session IDs can be defined; for example, Smith+n where n is 3 would make 3 session IDs available, "Smith1", "Smith2", and "Smith3".

Each 5250 session has a unique session ID. If a session ID is defined, it is used. If a session ID is not defined, default session IDs are defined, "A", "B", ..., "Z", "AA", "AB", ... If a user has one or more session IDs defined and already has 5250 sessions active using those session IDs, default session IDs are defined for subsequent 5250 sessions, starting with "A".

The 5250 session ID will be used by the following:

- 5250 window title: the default window title is the window title text, a colon, and the defined session ID. If a 5250 session has a default session ID, the target host system and session number continue to be used in the 5250 window title.
- The DeskTop file stores the user's last 5250 window locations and font size. If a 5250 session has a defined session ID, this is used in the DeskTop file. If a 5250 session has a default session ID, the target host system and session number are used in the DeskTop file instead.
- The 5250 jump key can jump between all 5250 windows. The jump action can also have a session number as a parameter; for example, if jump(3) is defined as the action for a key sequence, this key sequence jumps to the third 5250 window. The jump action also allows a session ID as a parameter, for example, jump("Smith").
- Color mapping allows a color map file to be stored for a specific 5250 session. If a 5250 session has a defined session ID, the session specific color mapping file applies to that session ID.
- Keyboard mapping allows a keyboard map file to be stored for a specific 5250 session. If a 5250 session has a defined session ID, the session specific keyboard map file applies to that session ID.

Languages for your emulator

Set emulator language variables.

The labels and help applications in the main emulator are translated and displayed based on the \$LANG system environment variable. The command line value -LANGID is also used to set the language.

The text for iSeries Access for Linux is stored in /opt/ibm/iSeriesAccess/mri/%locale%.

iSeries Access for Linux uses one of the locales listed in the table below to identify the language version of the server. It searches for a directory matching the entire locale, then searches for the first two characters of the locale. It defaults to the en_US directory when a match is not found.

The setup5250 program and associated help are not translated so they always display as English text. The On-line Help and GUI are translation enabled and translated unless otherwise noted in the following

table.

Language	Locale	Server language	Notes
Albanian	sq_SQ	2995	English only GUI and on-line help.
Bulgarian	bg_BG	2974	English only GUI and on-line help. Requires iconv patch to support Codepage 1025.
Chinese (Simplified) DBCS	zh_CN	2989	
Chinese (Traditional) DBCS	zh_TW	2987	
Croatian	sh_SH	2912	English only GUI and on-line help.
Czech	cs_CZ	2975	
Danish 2926	da_DA	2926	Partial GUI translation and English only on-line help.
Dutch (Belgium)	nl_BE	2963	
Dutch (Netherlands)	nl_NL	2923	
English	en_US	2924	
English (Belgium)	en_BE	2909	
Estonian	et_ET	2902	English only GUI and on-line help.
Finnish	fi_FI	2925	Partial GUI translation and English only on-line help.
French	fr_FR	2928	
French (Belgium)	fr_BE	2966	
French (Canada)	fr_CA	2981	
French (Switzerland)	fr_CH	2940	
German	de_DE	2929	
German (Switzerland)	de_CH	2939	
Greek	el_EL	2957	
Hungarian	hu_HU	2976	
Italian	it_IT	2932	
Italian (Switzerland)	it_CH	2942	
Japanese (Katakana) DBCS	ja_JP	2962	
Korean DBCS	ka_KR	2986	
Lao	lo_LO	2906	English only GUI and on-line help.
Latvian	lv_LV	2904	English only GUI and on-line help.
Lithuanian	lt_LT	2903	English only GUI and on-line help.
Macedonian	mk_MK	2913	English only GUI and on-line help.
Norwegian	no_NO	2933	Partial GUI translation and English only on-line help.
Polish	pl_PL	2978	English only GUI and on-line help.
Portuguese	pt_PT	2922	Partial GUI translation and English only on-line help.
Portuguese (Brazil)	pt_BR	2980	
Romanian	ro_RO	2992	English only GUI and on-line help.
Russian	ru_RU	2979	Requires iconv patch to support Codepage 1025.

Language	Locale	Server language	Notes
Serbian	sr_SR	2914	English only GUI and on-line help.
Slovakian	sk_SK	2994	
Slovenian	sl_SL	2911	English only GUI and on-line help.
Spanish	es_ES	2931	
Swedish	sv_SE	2937	Partial GUI translation and English only on-line help.
Turkish	tr_TR	2956	English only GUI and on-line help.

Emulator resources

Find information on resources for the 5250 emulator.

Resource	Function
IBM5250*27x132: enable or disable	27x132 enable/disable
IBM5250*ColumnSeperator: enable or disable	Column separators enable/disable
IBM5250*ImageView: enable or disable	Image/fax viewing enable/disable
IBM5250*Keymap: enable, disable, or disable_and_hide	Is user allowed to remap keyboard
IBM5250*Keymap101Path	Default 101 key map file
IBM5250*Keymap102Path	Default 102 key map file
IBM5250*KeymapPath	Default key map file
IBM5250*ColorMap: advanced, basic, disable, or disable_and_hide	Is user allowed to change colors
IBM5250*DefaultColorMapPath:	Default color map file
IBM5250*ColorMapPath:	Default color schemes
IBM5250*KeyPad: enable, disable, or disable_and_hide	Is the keypad function available
IBM5250*KeyPadPath	Default keypad files
IBM5250*PlayBack: enable, disable, or disable_and_hide	Are record and playback available
IBM5250*MiscPref: enable, disable, or disable_and_hide	Is Miscellaneous preferences available
IBM5250*LocalPrint: enable, disable, or keyboard_only_local_print	Is screen print available
IBM5250*Control: enable or disable	Is control menu displayed
IBM5250*Edit: enable or disable	Is edit menu displayed
IBM5250*Command: enable or disable	Is command menu displayed
IBM5250*Option: enable or disable	Is option menu displayed
IBM5250*Help: enable or disable	Is help menu displayed
IBM5250*FontMenu: enable, disable, or disable_no_resize_or_move	Is font menu list displayed
IBM5250*ChangeIPAddress: enable or disable	Can user change IP address for New 5250 session
IBM5250*BrowserStart: enable or disable	Hot spot browser start allowed
IBM5250*CORSOR_BLINK: ENABLE or DISABLE	Cursor blink
IBM5250*CORSOR_STYLE: BLOCK_INSERT_UNDERSCORE_REPLACE, UNDERSCORE_INSERT_BLOCK_REPLACE, BLOCK, or UNDERSCORE	Cursor style
IBM5250*DESTRUCTIVE_BACKSPACE: ENABLE or DISABLE	Destructive backspace

Resource	Function
IBM5250*ENTER_KEY: USE_DEFAULT, ENTER_ENTER_AND_RIGHT_CTRL_NEWLINE, ENTER_NEWLINE_AND_RIGHT_CTRL_ENTER, ENTER_ENTER_AND_RIGHT_CTRL_FIELD_EXIT, or ENTER_FIELD_EXIT_AND_RIGHT_CTRL_ENTER	Enter/New Line/Field Exit
IBM5250*ERROR_RESET_KEYS: RESET, CURSOR_MOVEMENT_ALSO, or MOST_KEYS	Error reset keys
IBM5250*KEYBOARD_BUFFERING: ENABLE, DISABLE, or USE_AS400_SETTING	Keyboard buffering
IBM5250*HOTSPOTS: DISABLE, ENABLE, SINGLE_CLICK, or DOUBLE_CLICK	Hotspots
IBM5250*HOTSPOT_HIGHLIGHTING: ENABLE or DISABLE	Hot spot highlighting
IBM5250*INPUT_ONLY_CURSOR_MOVEMENT: ENABLE or DISABLE	Input only cursor movement
IBM5250*INSERT_MODE: DEFAULT_OFF_AUTOMATIC RESET, DEFAULT_OFF_NO_AUTOMATIC RESET, or DEFAULT_ON_NO_AUTOMATIC_RESET	Insert mode
IBM5250*PASTE_LOCATION: AT_CURSOR or AT_MOUSE_POINTER	Paste location
IBM5250*PRINT_KEY: USE_DEFAULT, PRINT_IS_SCREEN_PRINT, or SHIFTED_PRINT_IS_SCREEN_PRINT	Print key
IBM5250*ROW_COLUMN_INDICATOR: ENABLE or DISABLE	Row column indicator
IBM5250*RULE_LINE: ENABLE_KEY_FOLLOW_CURSOR, ENABLE_KEY_FIXED, ENABLE_FOLLOW_CURSOR, or DISABLE	Rule Line
IBM5250*RULE_LINE_STYLE: BOTH or VERITCAL	Rule line style
IBM5250*AUTOMATIC_HELP: ENABLE or DISABLE	Automatic help on operator error
IBM5250*BLUE_UNDERSCORE: ENABLE or DISABLE	Blue underscore
IBM5250*LARGE_SCREEN_BEHAVIOR: USE_LAST_FONT, MOVE_WINDOW_AND_REDUCE_FONT_IF_NEEDED, REDUCE_FONT_ONLY, or REDUCE_FONT_AND_MOVE_WINDOW_IF_NEEDED	Large screen (27x132) behavior
IBM5250*COPY_PASTE_ACCESS: ENABLE or DISABLE	Copy paste access
IBM5250*DEFAULT_COPY_TYPE: LINEAR or BLOCK	Default copy type
IBM5250*DESKTOP_FUNCTION: ENABLE or DISABLE	Desktop file write allowed
IBM5250*SESSION_ID: 20 characters within double quotes, or 18 or 19 characters in double quotes with +n	Session ID
IBM5250*STAND_ALONE: True or False, emulator will not attach itself to another emulator session. Default value False.	
IBM5250*BYPASSSIGNON: Bypass the signon screen. Default value False	
IBM5250*KERBEROS: True or False, use Kerberos to get a licence and when IBM5250*BYPASSSIGNON = True, logon to host using Kerberos.	
IBM5250*IBMCURLIB: STRING, specify current host library. IBM5250*BYPASSSIGNON must be True.	

Resource	Function
IBM5250*IBMIMENU: STRING, specify initial host menu. IBM5250*BYPASSIGNON must be True.	
IBM5250*IBMCURLIB: STRING, specify initial program to run on the host. IBM5250*BYPASSIGNON must be True.	

Troubleshoot 5250 emulation

Use this information to help you understand, isolate, and resolve problems with your 5250 emulator.

5250 problem isolation

Use this information to isolate problems with your 5250 emulator.

Communications

Use the cwbping program to verify the connection between the Linux workstations and the iSeries server, and to verify the host servers are started.

Tracing and Logging

Once you verify your connection to the server, there see the following trace files for problem isolation:

- **History log.** The history log shows high-level communication, security and data conversion error messages. The History log is activated using the cwbttrc program.
- **Detail trace.** The detail trace shows low-level driver information and is intended for use in reporting problems to IBM. Detail trace is activated using the cwbttrc program.
- **Service information collection tool.** The service information collection tool is intended for use in reporting problems to IBM. The service information collection tool is activated using the cwbtmedic program.
- **ibm5250.** Adding the -debug flag to the ibm5250 command line will show detailed information for the emulator.
- **ibm5250.** Adding the -trace flag to the ibm5250 command line will trace the telnet activity between the emulator and host OS/400

Related reference

“Command line emulator options” on page 6

Learn about command line options for iSeries Access for Linux 5250 emulator.

“CWBMEDIC - Service information collection tool” on page 27

Use this command to gather service information for IBM.

“CWBPING - Test the connection to the server” on page 28

Use this command from a console prompt to determine if a connection can be successfully made to an iSeries system, or to help determine the cause of a connection failure.

“CWBTRC - Trace iSeries Access for Linux” on page 30

Use this command from a console prompt to configure tracing.

Font problems

Learn about some possible resolutions to font problems with the 5250 emulator.

Note: Troubleshooting applies to versions 1.8 and earlier.

To troubleshoot font problems use the following XFree86 utilities:

xfd -fn *fontname*

Use this utility to display the font.

xlsfonts

Use this to get a list of all available fonts from the font server.

xlsfonts -fn pattern

Use this to get a list of pattern available fonts from the font server.

Emulator will not start, font error indicated.

The emulator uses scalable 75 and 100 dpi fonts. If scalable fonts are not found an attempt to use a fixed font is made. Even if a fixed font is found and used, for proper full screen and size support, the X server should be configured to use scalable fonts.

For version 1.10, the emulator will run with the following:

- 75 dpi only installed (unscaled). An informational message is displayed on the command line screen informing the user that 100 dpi fonts are not installed. More font choices are available by installing the 100 dpi fonts.
- 100 and 75 dpi fonts installed (unscaled). An informational message is displayed on the command line screen informing the user that scalable fonts are not installed. More font choices are available by installing and configuring the scalable fonts.
- 100 and 75 dpi scaled fonts. No message is displayed.

The error returned should look similar to one of the following example messages:

- ```
*****Check your /etc/X11/XF86Config file*****
-b&h-lucidiatypewriter-medium-r-normal-sans-0-* scalable fonts are not available.
*****Using fixed fonts*****.
```
- ```
Check your /etc/X11/XF86Config file.
-b&h-lucidiatypewriter-medium-r-normal-sans-* fixed and scalable fonts are not available.
Session not starting.
```

For either of the above messages, 75 and 100 dpi fonts need to be made available. The default font server is configured usually in one of the following two ways:

- The X configuration file

The global XFree86Config or xorg.conf file is located in the /etc or /etc/X11 directories. You may also have .XF86Config or .XF86Config-4 (user config version) in your home directory.

If the following is in the X configuration file, the font server is configured here and is not configured to use 75 and 100 dpi scaled fonts.

```
FontPath "/usr/X11R6/lib/X11/fonts/75dpi:unscaled"
FontPath "/usr/X11R6/lib/X11/fonts/100dpi:unscaled"
```

To enable 75 and 100 dpi scalable fonts, remove :unscaled from the above two lines.

- Font server (xfs) config file

If the XF86Config file contains a single line similar to the following, then look for the file config in /etc/X11/fs directory:

```
FontPath "unix/:7100"
```

Similar to the steps above find the lines and remove the :unscaled from the lines for 75 and 100 dpi fonts. For example change:

```
catalogue = /usr/X11R6/lib/X11/fonts/korean,
/usr/X11R6/lib/X11/fonts/misc:unscaled,
/usr/X11R6/lib/X11/fonts/75dpi:unscaled,
/usr/X11R6/lib/X11/fonts/100dpi:unscaled,
```

to look like this:

```
catalogue = /usr/X11R6/lib/X11/fonts/korean,
/usr/X11R6/lib/X11/fonts/misc:unscaled,
/usr/X11R6/lib/X11/fonts/75dpi,
/usr/X11R6/lib/X11/fonts/100dpi,
```

5250 emulation FAQs

Find frequently asked questions about 5250 emulation for iSeries Access for Linux.

Can I have multiple users on a single Linux client?

By default, the iSeries Access for Linux 5250 emulator shares the same process for multiple sessions used on a Linux client, defined as a system with a single Linux user, using one Linux userid. To enable multiple users or thin clients, use the `ibm5250 -STAND_ALONE` command line option. This option allows multiple thin clients, Virtual Network Computing (VNC), and Linux Terminal Server Project (LSTP) users to easily use the 5250 emulator.

Open Database Connectivity

For information on using Open Database Connectivity (ODBC) with iSeries Access for Linux, see the following topics.

Related reference

iSeries Access for Windows ODBC

Version and release changes in the ODBC driver behavior

Prerequisites for using ODBC

You must meet the following prerequisites to use ODBC with iSeries Access for Linux.

There are only two requirements for using the ODBC driver on your Linux client:

- iSeries Access for Linux must be installed.
- unixODBC driver manager must be installed.

ODBC language considerations

The ODBC Driver in iSeries Access for Linux handles many types of data conversions.

The character code page conversions involve using conversion tables and the `iconv` interfaces. Some of the conversion tables are shipped with the driver, others are downloaded from the server when needed. `iconv` is a library shipped with Linux that also handles character data conversions.

Coded Character Set Identifiers (CCSID)

The ODBC Driver in iSeries Access for Linux uses a pair (to and from) of Coded Character Set Identifiers (CCSID) to convert character data. The conversion uses a conversion table or the `iconv` interfaces.

Conversion Tables

Conversion tables are stored in `/opt/ibm/iSeriesAccess/conv_tables` and use the following naming convention:

```
<4 byte hex number of FROM CCSID><4 byte hex number of TO CCSID>.tbl
```

For example, the conversation table for 819 to 500 is `033301f4.tbl`.

Many conversion tables are shipped with the iSeries Access ODBC Driver. Additional conversion tables are downloaded from the server when they are needed. You can also download conversion tables using the `CWBNLTBL` utility.

ODBC Application Character Set

The ODBC application character set is defined by the current locale's character set. To find out the current locale, use the following command:

```
locale
```

To find out the current mapping between the current locale's character set and the CCSID that is used, use the following command:

```
/opt/ibm/iSeriesAccess/bin/cwbnltbl
```

Overriding the Character Set CCSID Mappings

To change or the add character set CCSID mapping, add the following lines to the \$HOME/.iSeriesAccess/cwb_userprefs.ini configuration file.

```
[CWB_CURRUSER\Software\IBM\Client Access Express\CurrentVersion\NLS] CCSID-  
CODESET=attr_str:939,IBM939,819,IBM819
```

The above example creates mappings for CCSID 939 to character set "IBM939" and for CCSID 819 to character set "IBM819".

List of Available Locales

To list the available locales, use the following command:

```
locale -a
```

List of Available Iconv Character Sets

To list the available iconv character sets, use the following command:

```
iconv -l
```

How to Investigate Conversion Problems

Most conversion problems are logged in the History Log. To turn on history logging, use the following command:

```
/opt/ibm/iSeriesAccess/bin/cwbtrc /hl:1
```

(Refer to CWBTRC for more about the trace utility.)

The history log output is in \$HOME/.iSeriesAccess/cwbhistory-<application name- "\$HOME/.iSeriesAccess/cwbhistory".csv. Use either a text editor or a spread sheet to view the contents of the history log.

Restrictions when using ODBC with iSeries Access for Linux

Learn about restrictions for using the ODBC driver with iSeries Access for Linux.

The following table describes the restrictions when using ODBC with iSeries Access for Linux.

Table 1. ODBC restrictions.

Restriction	Reason
MTS is not supported.	This depends on Microsoft Windows-specific components which are not available on Linux. Note: Open XA Transaction API's are supported.

Table 1. ODBC restrictions. (continued)

Restriction	Reason
APIs that display a graphical user interface are not supported.	The API call completes but displaying the GUI fails.
Translation DLLs	Translation DLLs are not currently supported. Attempts to use them are ignored.
DSN connection option for user ID /password prompting via a sign-on dialog is not supported.	Graphical user interfaces are not ported to Linux.
DSN option for customizing package settings for an application is not supported.	Only the simple implementation of package settings is ported to Linux.
See Unsupported Connection String Keywords for other DSN options that are not supported in Linux.	These keywords correspond with options that are not supported.
Secure Sockets Layer (SSL) component	The SSL component is not included with iSeries Access for Linux. You can use a common SSL tunnel or Socks server.
Connection Timeout	The connection timeout option is not supported with the Linux driver.

Configure an ODBC data source

Use this information to configure an ODBC data source.

Choose a method to configure a data source:

Use GUI to configure an ODBC data source

Use the ODBC data source GUI to create and configure a data source.

The following instructions describe how to set required and frequently used options to create and configure your ODBC data source, using the ODBC data source graphical user interface(GUI).

1. Open the Data Source Administrator that comes with the unixODBC driver manager by typing the following at the command prompt:
 - `ODBCConfig`
2. Decide the type of data source name (DSN) to create.
 - A user data source is only accessible by the user who creates it.
 - A system data source is created using root authority but is accessible by any user on server.
3. Choose one of the following:
 - Click **Add...** to create a new data source, then continue with the next step.
 - Click **Configure...** to configure a data source that already exists, then go to step 5.
4. Select an ODBC driver from this screen, exercising caution to avoid the **Add**, **Remove**, and **Configure** buttons, which apply to adding, removing, or configuring a driver. If you accidentally click one of these buttons, close the window and repeat this step.
 - Click **iSeries Access ODBC Driver**.
 - Click **OK**.
 - Optionally resize the window that is displayed.
5. Set the required and optional fields.
 - Fill in the required Name field with your data source name.
 - Fill in the required System field with your system name.
 - Complete other optional fields on the GUI. Manually configure any connection options that are not supported on the GUI, however, see Connection String Keywords and Values and manual configuration information before manually configuring connection options.

6. Click the check mark in the upper-left corner of the window to save the configuration.

Manually configure an ODBC data source

Learn how to manually configure data source options that can not be set on the GUI.

The ODBC data source graphical user interface(GUI) contains a subset of the most commonly used connection options. Additional connection options are specified by the connecting application or by editing the `.odbc.ini` file.

It is strongly recommended that you reference the Connection string keywords topic before manually configuring connection options.

Use the following steps to add connection options to the `.odbc.ini` file:

1. Open the `.odbc.ini` file on your workstation using a text editor.
 - For user data sources, this file is in the root directory of the user who created the data source. For example, the file for user `"exampleUser"` is `/home/exampleUser/.odbc.ini`.
 - For system data sources, `.odbc.ini` is located in `/etc/odbc.ini` or `/usr/local/etc/odbc.ini` depending on how you installed the unixODBC driver manager.
2. If there are multiple ODBC data sources in the `.odbc.ini` file, locate the section in the file that contains the data source, that is the target for the additional connection options you are configuring.
3. Add a new row after the last entry in the data source and enter the new connection option and its value.
 - The syntax is `keyword = value`.
 - For example, if you want to change the date format from its default of 5 (yyyy-mm-dd or *ISO), to 1 (mm/dd/yy or *MDY), you would add `DFT = 1` in the new row.
4. Repeat step 3 to add additional connection options to the data source.
5. Save the `.odbc.ini` file.

```
[iSeriesDSN]
Description = iSeries Access ODBC Driver DSN for iSeries
Driver = iSeries Access ODBC Driver
System = iSeriesSystemName
UserID =
Password =
Naming = 0
DefaultLibraries = QGPL
Database =
ConnectionType = 0
CommitMode = 2
ExtendedDynamic = 0
DefaultPkgLibrary = QGPL
DefaultPackage = A/DEFAULT(IBM),2,0,1,0,512
AllowDataCompression = 1
LibraryView = 0
AllowUnsupportedChar = 0
ForceTranslation = 0
Trace = 0
```

Figure 1. An example of a `.odbc.ini` file DSN entry

Note:

1. Do not add multiple entries for the same connection option to the same section for a specific data source. This can lead to unpredictable behavior.
2. After manually editing the registry you can use `ODBCConfig` to configure your data source.

Note: Older versions of the unixODBC driver manager removed manually added options from the `odbc.ini` file when `ODBCConfig` was used to configure the data source. If you experience this problem, a newer version of the unixODBC driver manager is needed.

- Options specified by the application in the connection string override any options specified in the `.odbc.ini` file.

Related reference

Connection string keywords

ODBC examples

Find examples of using ODBC with iSeries Access for Linux.

IBM grants you a nonexclusive copyright license to use all programming code examples from which you can generate similar function tailored to your own specific needs.

SUBJECT TO ANY STATUTORY WARRANTIES WHICH CANNOT BE EXCLUDED, IBM, ITS PROGRAM DEVELOPERS AND SUPPLIERS MAKE NO WARRANTIES OR CONDITIONS EITHER EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT, REGARDING THE PROGRAM OR TECHNICAL SUPPORT, IF ANY.

UNDER NO CIRCUMSTANCES IS IBM, ITS PROGRAM DEVELOPERS OR SUPPLIERS LIABLE FOR ANY OF THE FOLLOWING, EVEN IF INFORMED OF THEIR POSSIBILITY:

- LOSS OF, OR DAMAGE TO, DATA;
- DIRECT, SPECIAL, INCIDENTAL, OR INDIRECT DAMAGES, OR FOR ANY ECONOMIC CONSEQUENTIAL DAMAGES; OR
- LOST PROFITS, BUSINESS, REVENUE, GOODWILL, OR ANTICIPATED SAVINGS.

SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF DIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, SO SOME OR ALL OF THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU.

Example: PHP and the ODBC driver

See how the Apache Software Foundation's web server, PHP, and the ODBC Driver in iSeries Access for Linux can work together to access database data on an iSeries server.

Instructions for setting up PHP and Apache are in the Redpiece Linux Integration with OS/400 on the IBM eServer™ iSeries Server, (SG24-6551). Read section 2.6 Three-tier application setup using PHP and Apache. Additional instructions are in `index.html` or `index.php` in the download file.

Requirements: a Linux machine running PHP under the Apache web server, the unixODBC driver manager, and the ODBC Driver in iSeries Access for Linux. PHP must have unixODBC driver manager support compiled in.

<http://www.ibm.com/servers/eserver/iseriess/linux/odbc/guide/phpdemo.tar>

Troubleshoot ODBC

Use this information to help you understand, isolate, and resolve problems with ODBC.

ODBC problem isolation

Use this information to isolate problems with ODBC.

Communications

Use the cwbping program to verify the connection between the Linux workstations and the iSeries server, and to verify the host servers are started.

Tracing and Logging

Once you verify your connection to the server, there see the following trace files for problem isolation:

- **SQL log.** The unixODBC sql.log will show the input and output parameters for ODBC API calls made. The sql.log is activated using the unixODBC ODBCConfig program. From the Advanced tab, you can enable sql tracing and configure the location of the log file.
- **History log.** The history log will show high-level communication, security and data conversion error messages. The History log is activated using the cwbtrc program.
- **Detail trace.** The detail trace will show low-level driver information and is intended for use in reporting problems to IBM. Detail trace is activated using the cwbtrc program.
- **Service information collection tool.** The service information collection tool is intended for use in reporting problems to IBM. The service information collection tool is activated using the cwbmedic program.

Related reference

“CWBMEDIC - Service information collection tool” on page 27

Use this command to gather service information for IBM.

“CWBPING - Test the connection to the server” on page 28

Use this command from a console prompt to determine if a connection can be successfully made to an iSeries system, or to help determine the cause of a connection failure.

“CWBTRC - Trace iSeries Access for Linux” on page 30

Use this command from a console prompt to configure tracing.

Error messages

When an error occurs, the ODBC Driver in iSeries Access for Linux returns the SQLSTATE (an ODBC error code) and an error message. The driver obtains this information both from errors that are detected by the driver and from errors that are returned by the iSeries server.

For errors that occur in the data source, the ODBC Driver in iSeries Access for Linux maps the returned native error to the appropriate SQLSTATE. When both the driver and the driver manager detect an error, they generate the appropriate SQLSTATE. The ODBC Driver in iSeries Access for Linux returns an error message based on the message returned by the iSeries server.

For errors that are detected within the ODBC Driver, the driver returns an error message based on the text associated with the SQLSTATE. These error messages are translated messages. Error message files and the help text for error messages found in the underlying components of the iSeries Access product are shipped in the /opt/ibm/iSeriesAccess/doc directory.

Error message format

Error messages have the following format:

```
[vendor][ODBC-component][data-source]
```

```
error-message
```

The prefixes in brackets ([]) identify the source of the error. When the error occurs in the data source, the [vendor] and [ODBC-component] prefixes identify the vendor and name of the ODBC component that received the error from the data source. The following table shows the values of these prefixes returned by iSeries ODBC Driver for Linux:

Error Source	Value	
Driver Manager	[unixODBC] [Driver Manager]	
ODBC Driver in iSeries Access for Linux	unixODBC] [IBM] [iSeries Access ODBC Driver]	
NLS messages	[unixODBC] [IBM] [iSeries Access ODBC Driver] Column #: NLS error message number NLS error message text See the message prefix table below to find second level help text.	
Communication and Security	unixODBC] [IBM] [iSeries Access ODBC Driver] Communications link failure. comm rc=xxxx - (message text) xxxx is the error number in decimal, not hexadecimal, format. Message text describing the nature of your error appears with the error number. See the message prefix table below to find second level help text.	
DB2® UDB for iSeries	[unixODBC] [IBM] [iSeries Access ODBC Driver] [DB2 UDB] Server error message To view error message text for DB2 UDB for iSeries errors:	
	For errors that begin with:	Use this OS/400 command
	SQL	DSPMSGD RANGE(SQLxxxx) MSGF(QSQLMSG)
	IWS or PWS	DSPMSGD RANGE(ZZZxxxx) MSGF(QIWS/QIWSMSG) ZZZ is either IWS or PWS

For other prefixes that may be seen through the ODBC Driver in iSeries Access for Linux, see the following table:

Message Prefix	Message File	Description
CWB####	cwber.html	Base error messages
CWBCO####	cwbcoer.html	Communication error messages
CWBNL####	cwbnlr.html	Conversion error messages
CWBSY####	cwbsyer.html	Security error messages
CWBRC####	cwbrcer.html	Remote Command error messages
CWBLM####	cwblmer.html	License error messages

ODBC FAQs

Find frequently asked questions about ODBC for iSeries Access for Linux.

What are the differences between the ODBC driver in iSeries Access for Linux and the ODBC driver in iSeries Access for Windows?

The following table describes some of the differences between the ODBC driver in iSeries Access for Linux and the ODBC driver in iSeries Access for Windows:

Table 2. Differences between iSeries Access for Linux ODBC driver and iSeries Access for Windows ODBC driver.

Function	Linux ODBC	Windows ODBC
The driver	The driver is an ODBC 3.5 ANSI driver with the ability to store and process Unicode data. An ANSI driver does not support Unicode strings passed as arguments to the APIs. Applications passing Unicode strings on APIs will work because the unixODBC driver manager maps calls these calls to the ANSI driver's narrow interfaces.	The driver is an ODBC 3.5 Unicode driver. A Unicode driver accepts Unicode strings as arguments to the APIs.
Signon	To sign on you must specify a user ID and password when calling the connection API or have the user ID and password entered into the DSN. The ODBC driver will not prompt for iSeries user IDs or passwords. User ID and password updates must be done through a telnet session with the iSeries.	The user has sign on options that control which user ID and password to use when connecting. When connecting, cached passwords might be used. If a user's password has expired a dialog is displayed to allow a user to change it.
Binding a parameter or column	When binding a parameter or a column with SQL_C_WCHAR as the C type, wchar_t buffers should not be passed in. The driver manager and driver both handle the SQL_C_WCHAR data type as a 2 byte UCS-2 string.	When binding a parameter or a column with SQL_C_WCHAR as the C type, wchar_t buffers should be passed in. The driver manager and driver both handle the SQL_C_WCHAR data type as a 2 byte UCS-2 string.

iSeries Access for Linux utilities

The following utilities are included with iSeries Access for Linux and are shipped in /opt/ibm/iSeriesAccess/bin.

Use the following links for more information on the iSeries Access for Linux utilities:

CWBCOPWR - Change advanced communications settings

Use this command to change the advanced communications settings of iSeries Access for Linux.

See cwbcopwr.html for details

CWBMEDIC - Service information collection tool

Use this command to gather service information for IBM.

Syntax

cwbmedic

Parameters

There are no parameters.

This command creates a .tgz file in the user's home directory. If requested, please send this file to IBM Service for analysis.

Examples

- To run the command, enter `cwbmedic .`
- To view the contents of this file, enter the following commands:

```
tar xvzf /home/username/cwbmedic.tgz
cat cwbmedic.out
```

CWBNLTBL - Download conversion tables

Use this command from a console prompt to download conversion tables.

Syntax

```
cwbnltbl [source-code-page] [target-code-page] [system] [userid] [password]
```

Parameters

- source-code-page = source code page for the table
- target-code-page = target code page for the table
- system = iSeries system to download the table from.

Note: If a connection to the iSeries is necessary, the user ID and password must also be specified.

- userid = iSeries user ID
- password = iSeries password

The tables share a common location on the workstation `/opt/ibm/iSeriesAccess/conv_tables`. Many conversions tables are already shipped with the product. The product also uses iconv conversion where necessary. Use the History Log to look for conversion information.

Examples

- To download the 819 to 13488 conversion table from the iSeries if necessary, run `cwbnltbl 819 13488 myiSeriesSystem myiSeriesuserid myiSeriesPwd`
- To show the current locale charset and its code-page mapping, run `cwbnltbl`

CWBPING - Test the connection to the server

Use this command from a console prompt to determine if a connection can be successfully made to an iSeries system, or to help determine the cause of a connection failure.

CWBPING checks of the status of the host servers on the iSeries system. The name of the communications provider is shown, as well as the result of connecting to each of the host socket servers. To see detailed messages, use the `(/v)` verbose option.

Syntax

```
cwbping system [/v] [/pl:#] [/al:#] [/serv:name] [/port:#] [/user:userid] [/password:password]
[/all]
```

Parameters

- system = name of the server
- /v = verbose output
- /pl:# = port mode (0 = Server services file, 1 = Local services file, 2 = Standard port)

Note: If the `/port:#` is specified, the port mode is ignored.

- /al:# = address mode
 - 0 = Always use gethostbyname
 - 1 = Lookup after 1 hour
 - 2 = Lookup after 1 day

- 3 = Lookup after 1 week
- 4 = Never use gethostbyname, use configured IP address
- 5 = Lookup once after each PC restart

Note: If the system name is specified in IP Address form (x.x.x.x) the address mode will be ignored.

- /serv:name = name of the service to connect to (i.e. /serv:telnet or /serv:ftp)

Note: Any TCP/IP service name can be used. For example, see CWBCO1003 or your local services file.

- /port:# = port number to connect to in decimal (i.e. /port:23 or /port:21)

Note: Any TCP/IP port number can be used. For example, see CWBCO1003 or your local services file

- /user:userid = iSeries user ID to use only if the server requires security on startup
- /password:password = iSeries password to use only if the server requires security on startup
- /all = verify all possible servers, by default only common servers are verified.

Examples

To check the status of the host servers on the iSeries system named System1 with address 9.12.103.14:
 cwbping System1

or cwbping

9.12.103.14 /v

CWBRUNSQL - Run batch SQL commands and procedures using an ODBC DSN

Use this command to run batch SQL commands and procedures using an ODBC DSN.

Syntax

```
cwbrunsql [/DSN:<ODBC DSN="">] [/I:<fileName>]
```

Parameters

- [/DSN:<ODBC DSN="">] = Use the specified ODBC DSN.
- [/I:<fileName>] = Use the specified file name.
- [/SYSTEM:<system>] = Use the specified system name. Can be used in place of (or in addition to) DSN.
- [/USER:<userID>] = Use the specified userid.
- [/PASSWORD:<password>] = Use the specified password.
- [/DFTLIB:<library>] = Use the specified default library.
- [/Z] = No banners.

Example

A file named myfile.sql contains the following:

```
CREATE TABLE QGPL.MYTABLE (COL1 INT, COL2 CHAR(10));
INSERT INTO QGPL.MYTABLE VALUES ( 1, 'ABC' );
INSERT INTO QGPL.MYTABLE VALUES ( 2, 'DEF' );
INSERT INTO QGPL.MYTABLE SET COL2= 'XXX' WHERE COL1=2;
SELECT * FROM QGPL.MYTABLE;
```

Note that each SQL statement is separated by a semicolon. To run this .sql file, enter the following, where *myODBCDSN* is the name of the ODBC Data Source.

```
cwbrunsql /DSN:myODBCDSN /I:myfile.sql
```

CWBTRC - Trace iSeries Access for Linux

Use this command from a console prompt to configure tracing.

Syntax

```
cwbtrc [/DT:0-1] [/DPATH:path] [/DWRAP:0-4000] [/DFLTR:0-1] [/DTICK:0-1] [/DFRMT:0-1] [/HL:0-1]
[/HPATH:path] [/HWRAP:0-4000] [/HFLTR:0-1] [/HTICK:0-1]
```

Parameters

Note: Defaults shown in bold.

- /DT:0-1 = turn detail trace **off/on**
- /DPATH:path = detail trace path, default is \$HOME/.iSeriesODBC
- /DWRAP:0-4000 = detail trace wrap size (MB), default is 1. An <EOF> symbol will be placed after the last record.
- /DFLTR:0-1 = detail trace filter **off/on**
- /DCOMP:abc,abc = filter component list. Where components are: Configuration, Communication, Comm-API, Comm-SPI, Comm-System, Comm-Base, License Management, NLS, ODBC, ODBC-Error, Emulator Remote Command, Service, Security.
- /DTICK:0-1 = **timestamp** or tick count in trace entries
- /DFRMT:0-1 = limit tcp hex data **off/on**
- /HL:0-1 = turn history log **off/on**
- /HPATH:path = history log path, default is \$HOME/.iSeriesODBC /HWRAP:0-4000 = history log wrap size (MB), default is 1. An <EOF> symbol will be placed after the last record.
- /HFLTR:0-1 = history log filter **off/on**
- /HCOMP:abc,abc = filter component list. Where components are: Configuration, Communication, Comm-API, Comm-SPI, Comm-System, Comm-Base, License Management, NLS, ODBC, ODBC-Error, Emulator Remote Command, Service, Security.
- /HTICK:0-1 = **timestamp** or tick count in traces entry

Running CWBTRC without any parameters will show the command syntax and the current status of each parameter.

The output from CWBTRC will have the following naming convention:

```
cwbdetail-<process name>-pid.csv
```

```
cwbhistory-<process name>-pid.csv
```

The output files will be in semicolon separated record format, suitable for input into spreadsheets for viewing.

Examples

The following command will turn on detail trace and allow it to grow to a 10 mg file before wrapping. It will also turn on history logging.

```
cwbtrc /dt:1 /dwrap:10 /hl:1
```

The following command will turn on history log and change the path to /usr/traces

```
cwbtrc /hl:1 /hpath:/usr/traces
```

RMTCMD - Run an iSeries batch/CL command

Use this command from a console prompt to run a single iSeries command or a group of iSeries commands.

Syntax

To run a single command:

```
rmtcmd [command]
```

To run a group of commands

```
rmtcmd [/I:fileName]
```

Parameters

- /system:systemName = iSeries system name
- /user:userName = iSeries user profile
- /password:password = iSeries user profile password
- /Q = no error prompts
- /Z = no banners

Examples

- To run command foo on iSeries system bigblue, run:

```
rmtcmd foo /system:bigblue /user:UserProfile /password:UserPassword
```
- To run a groups of command listed in a file, run:

```
rmtcmd /i:foocmds.txt /system:bigblue /user:UserProfile /password:UserPassword
```

RMTODBC - Run an iSeries batch/CL command using the ODBC driver

Use this command from a console prompt to run a single iSeries command or a group of iSeries commands.

Syntax

To run a single command:

```
rmtodbc [command]
```

To run a group of commands:

```
rmtodbc [/I:fileName]
```

Parameters

- /system:systemName = iSeries system name
- /dsn:dsnName = ODBC DataSource name
- /user:userName = iSeries user profile
- /password:password = iSeries user profile password
- /Q = no error prompts
- /Z = no banners

Examples

- To run command foo on iSeries system bigblue, run:

```
rmtodbc foo /system:bigblue /user:UserProfile /password:UserPassword
```
- To run a groups of command listed in a file, run:

```
rmtodbc /i:foocmds.txt /system:bigblue /user:UserProfile /password:UserPassword
```

Code license and disclaimer information

IBM grants you a nonexclusive copyright license to use all programming code examples from which you can generate similar function tailored to your own specific needs.

| SUBJECT TO ANY STATUTORY WARRANTIES WHICH CANNOT BE EXCLUDED, IBM, ITS
| PROGRAM DEVELOPERS AND SUPPLIERS MAKE NO WARRANTIES OR CONDITIONS EITHER
| EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR
| CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND
| NON-INFRINGEMENT, REGARDING THE PROGRAM OR TECHNICAL SUPPORT, IF ANY.

| UNDER NO CIRCUMSTANCES IS IBM, ITS PROGRAM DEVELOPERS OR SUPPLIERS LIABLE FOR
| ANY OF THE FOLLOWING, EVEN IF INFORMED OF THEIR POSSIBILITY:

- | 1. LOSS OF, OR DAMAGE TO, DATA;
- | 2. DIRECT, SPECIAL, INCIDENTAL, OR INDIRECT DAMAGES, OR FOR ANY ECONOMIC
| CONSEQUENTIAL DAMAGES; OR
- | 3. LOST PROFITS, BUSINESS, REVENUE, GOODWILL, OR ANTICIPATED SAVINGS.

| SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF DIRECT,
| INCIDENTAL, OR CONSEQUENTIAL DAMAGES, SO SOME OR ALL OF THE ABOVE LIMITATIONS
| OR EXCLUSIONS MAY NOT APPLY TO YOU.

Appendix. Notices

This information was developed for products and services offered in the U.S.A.

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
Armonk, NY 10504-1785
U.S.A.

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

IBM World Trade Asia Corporation
Licensing
2-31 Roppongi 3-chome, Minato-ku
Tokyo 106-0032, Japan

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law: 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 Corporation

Software Interoperability Coordinator, Department YBWA
3605 Highway 52 N
Rochester, MN 55901
U.S.A.

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 information and all licensed material available for it are provided by IBM under terms of the IBM Customer Agreement, IBM International Program License Agreement, IBM License Agreement for Machine Code, or any equivalent agreement between us.

Any performance data contained herein was determined in a controlled environment. Therefore, the results obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurements may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

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.

All IBM prices shown are IBM's suggested retail prices, are current and are subject to change without notice. Dealer prices may vary.

This information is for planning purposes only. The information herein is subject to change before the products described become available.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs.

Each copy or any portion of these sample programs or any derivative work, must include a copyright notice as follows:

© (your company name) (year). Portions of this code are derived from IBM Corp. Sample Programs. © Copyright IBM Corp. _enter the year or years_. All rights reserved.

If you are viewing this information softcopy, the photographs and color illustrations may not appear.

Trademarks

The following terms are trademarks of International Business Machines Corporation in the United States, other countries, or both:

AS/400
DB2
DB2 Universal Database
eServer
i5/OS
IBM
iSeries
OS/400
Power PC

Microsoft, and Windows are trademarks of Microsoft Corporation in the United States, other countries, or both.

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

Other company, product, and service names may be trademarks or service marks of others.

Terms and conditions

Permissions for the use of these publications is granted subject to the following terms and conditions.

Personal Use: You may reproduce these publications for your personal, noncommercial use provided that all proprietary notices are preserved. You may not distribute, display or make derivative works of these publications, or any portion thereof, without the express consent of IBM.

Commercial Use: You may reproduce, distribute and display these publications solely within your enterprise provided that all proprietary notices are preserved. You may not make derivative works of these publications, or reproduce, distribute or display these publications or any portion thereof outside your enterprise, without the express consent of IBM.

Except as expressly granted in this permission, no other permissions, licenses or rights are granted, either express or implied, to the publications or any information, data, software or other intellectual property contained therein.

IBM reserves the right to withdraw the permissions granted herein whenever, in its discretion, the use of the publications is detrimental to its interest or, as determined by IBM, the above instructions are not being properly followed.

You may not download, export or re-export this information except in full compliance with all applicable laws and regulations, including all United States export laws and regulations.

IBM MAKES NO GUARANTEE ABOUT THE CONTENT OF THESE PUBLICATIONS. THE PUBLICATIONS ARE PROVIDED "AS-IS" AND WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT, AND FITNESS FOR A PARTICULAR PURPOSE.



Printed in USA