

HXTT's HXTT Cobol Packages

Welcome to the HXTT Cobol pages

You should read carefully License, Introduction, and Components first. If you have JDBC programming experience and SQL92 knowledge, you can start easily your project after you know `com.hxtt.sql.cobol.CobolDriver` (the suitable JDBC driver class name) and `jdbc:cobol:///[DatabasePath]` (the correct embedded JDBC url) from [here](#). You will get up to date information relating to the HXTT Cobol, and look at current documentation from [here](#). JDBC 4.2 packages are for JDK 1.8.X. JDBC 4.1 packages are for JDK 1.7.X, and 1.8.X. JDBC 4.0 packages are for JDK 1.6.X, 1.7.X, and 1.8.X. JDBC 3.0 packages are for JDK 1.3.X, 1.4.X, 1.5.X, 1.6.X, 1.7.X, and 1.8.X. JDBC 2.0 packages are for JDK 1.2.X, and 1.3.X. JDBC 1.2 packages are for JDK 1.1.X, and Personal Java. For questions and general support, you should submit your request at [HXTT's technical support site](#).

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Chapter 1. Quick Start

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What Is the HXTT Cobol?

HXTT Cobol provides a type 4 JDBC driver for Cobol data files. It supports Cobol Copybook file, Cobol source program, FB record, VB record, ASCII encoding, EBCDIC encoding, and so on. It supports JDBC1.2, JDBC2.0, JDBC3.0, JDBC4.0, JDB4.1, and JDBC4.2. It supports Personal Java, JDK1.0.X, JDK1.1.X, JDK1.2.X, JDK1.3.X, JDK1.4.X, JDK1.5.X, JDK1.6.X, JDK1.7.X, and JDK1.8.X. It supports all transactions level of READ UNCOMMITTED, READ COMMITTED, REPEATABLE READ, and SERIALIZABLE. It supports JBuilder's Database Pilot, Oracle's JVM, JDeveloper 10G, Dreamweaver UltraDev, Dreamweaver ColdFusion, ObjectRelationalBridge, DBVisualizer, iSQL-Viewer, AquaDataStudio, Sunopsis, MySQL Migration Toolkit, Tomcat, vqServer, Hibernate, Squirrel SQL Client, Crystal Reports, Jisql, and DbEdit Database Utilites for Eclipse Platform. It supports XOPEN SQLState, RMI, Jini, JNDI, and serialization. It supports { UNION | INTERSECT | EXCEPT | MINUS } [ALL] query , INNER JOIN, FULL JOIN, LEFT JOIN, RIGHT JOIN, NATURAL JOIN, CROSS JOIN, self join, GROUP_CONCAT, multiple-row VALUES table, PIVOT table, UNPIVOT table, and subquery which includes single-row subquery, multirow subquery, multiple-column subquery, inline views, and correlated subquery. The current version of the HXTT Cobol packages are available [here](#):

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First, you need to download JDK1.8.X from <http://www.oracle.com> if you use Cobol JDBC 4.2 package(Cobol_JDBC42.jar). You can download JDK1.7.X or JDK1.8.X if you use Cobol JDBC 4.1 package(Cobol_JDBC41.jar). You can download JDK1.6.X, JDK1.7.X, or JDK1.8.X if you use Cobol JDBC 4.0 package(Cobol_JDBC40.jar). You can download JDK 1.3.X, 1.4.X, or JDK1.5.X if you use Cobol JDBC 3.0 package(Cobol_JDBC30.jar). You can download JDK1.2.X too if you use Cobol JDBC 2.0 package(Cobol_JDBC20.jar). You can download JDK1.1.X too if you use Cobol JDBC 1.2 package(Cobol_JDBC12.jar).

Secondly, please add Cobol_JDBC42.jar, Cobol_JDBC41.jar, Cobol_JDBC40.jar, Cobol_JDBC30.jar, Cobol_JDBC20.jar or Cobol_JDBC12.jar to your Java class path, for instance, "SET CLASSPATH=c:\javalib\Cobol_JDBC40.jar;%classpath%". You can also use "java -classpath c:\javalib\Cobol_JDBC40.jar yourCobolclass" to run your class. More information about classpath, please read the "Setting the Classpath" topic in file:///yourdriver/jdk1.6/docs/tooldocs/tools.html . You can use "java -classpath c:\javalib\Cobol_JDBC40.jar yourCobolclass" too.

Thirdly, you can use 'Class.forName("com.hxtt.sql.cobol.CobolDriver").newInstance();' or Class.forName("com.hxtt.sql.cobol.CobolDriver");' to load this driver.

Fourth, if you have used other JDBC driver, you only need to know the correct URL format for DriverManager.getConnection(url,"",""); You can find the Cobol URL format below. If you were a Java novice, please read also other Java examples code in [Cobol_JDBC42demo.zip](#), [Cobol_JDBC41demo.zip](#) or [Cobol_JDBC40demo.zip](#). Cobol URL format:

```
Embedded:
jdbc:cobol:[:///][DatabasePath][?prop1=value1[;prop2=value2]] (You can omit that
"///" characters sometimes)
For example:
"jdbc:cobol:/"
"jdbc:cobol:/c:/data" for Windows driver
"jdbc:cobol:///c:/data" for Windows driver
"jdbc:cobol:///usr/data" for unix or linux
"jdbc:cobol://///192.168.10.2/sharedir" for UNC path
```

```
                "jdbc:cobol:./data"
Remote Access (client/server mode):
  jdbc:cobol://host:port/[DatabasePath]
  For example: "jdbc:cobol://domain.com:3099/c:/data" if one CobolServer is
run on the 3099 port of domain.com
Compressed Database:(.ZIP, .JAR, .GZ, .TAR, .BZ2, .TGZ, .TAR.GZ, .TAR.BZ2)
  jdbc url format is the same as embedded url and remote url.
  For example:
    "jdbc:cobol:/c:/test/testcobol.zip"
Memory-only Database:
  jdbc:cobol:/memory/
URL Database:(http protocol, https protocol, ftp protocol, sftp protocol)
  jdbc:cobol:http://httpURL
  jdbc:cobol:https://httpsURL
  jdbc:cobol:ftp://ftpURL
  jdbc:cobol:sftp://sftpURL
  For example:
    "jdbc:cobol:http://www.hxtt.com/test" ///Note: FTP site's
user/password should be set in ftpURL, and cannot be set in JDBC connection property because
user/password JDBC connection property belongs to server/client connection.
    "jdbc:cobol:sftp://testa:123456@localhost"

SAMBA Database:(smb protocol)

jdbc:cobol:smb://[[[domain;]username[:password]@]server[:port]/[[share/[dir/]file]]][?
[param=value]]
  For example:
    "jdbc:cobol:smb://test1:123@100.100.13.94/cobolfiles".zone"
///Note: SAMBA user/password should be set in SMB URL, and cannot be set in JDBC connection
property because user/password JDBC connection property belongs to server/client connection.
Free JDBC url:(Warning: only use it for special project)
  jdbc:cobol:" or "jdbc:cobol:///". Then you can use some full UNC path names in SQL
to visit anywhere where your Java VM has right to access.
  For instance:
    select * from "\\amd2500\e$\cobolfiles\test;
    elect * from "\\amd2500\d$\cobolfiles".test;
    select * from ".".test;

HXTT Cobol supports seamlessly data mining on memory-only table, physical table, url
table, compressed table, SAMBA table in a sql. More details
is in Advanced Programming chapter.
```

Last, Cobol driver is a standard JDBC driver so that you will find most of valuable information at <file:///yourdrive/jdk1.6/docs/api/java/sql/package-frame.html> .

Cobol supports SQL-92. It supports { UNION | INTERSECT | EXCEPT | MINUS } [ALL] query , INNER JOIN, FULL JOIN, LEFT JOIN, RIGHT JOIN, NATURAL JOIN, CROSS JOIN, self join, GROUP_CONCAT, and subquery which includes single-row subquery, multirow subquery, multiple-column subquery, inline views, and correlated subquery. The major syntax is listed at [here](#).

Cobol driver will use index to speed up the query which contains some indexed expressions. Cobol supports utilizing index file for LIKE, BETWEEN, IN, DISTINCT, ORDER, and some OR operations.

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Introduction of HXTT Cobol Packages

HXTT Cobol contains the only type 4 JDBC(1.2, 2.0, 3.0, 4.0, 4.1, 4.2) driver packages for Cobol data files, which includes FB (fixed block) file, VB (variable block) file, FB sequential file, VB sequential file, FB relative file, IBM mainframe line sequential file, PC line sequential file, Open Cobol MVS VB file, Fujitsu NetCOBOL VB file, MicroFocus VB sequential file, MicroFocus VB relative file, AcuCobol relative file, and so on. It supports Cobol Copybook file, Cobol source program(free format, fixed format, Fujitsu-Siemens style, Tandem Non-stop style), ASCII encoding, EBCDIC encoding, transaction, embedded access, client/server mode, and remote access(map network drive, SAMBA protocol, HTTP protocol, HTTPS protocol, FTP protocol, SFTP protocol, and UNC path).

Trial version is for your evaluation only. If you want to use HXTT Cobol after a trial period, you should purchase a licensed copy from [here](#).

Differences between the trial version and the licensed version:

- The trial version of the driver is available to use free for a **30-day** trial period.
- The trial version of the driver allows executing not more than **50** queries once.
- SELECT queries return the first **100** rows in the result set.

Ordering benefits:

- Full version of HXTT Cobol without limitations
- Free technical support by forum and email
- Free online major and minor updates in the guarantee period

[Our Other JDBC Products](#)

[HXTT Access](#) - JDBC(1.2, 2.0, 3.0, 4.0, 4.1, 4.2) driver packages for Microsoft Access version from 95, 97, 2000, XP, 2002, 2003, 2007, 2010, 2013, to 2016

[HXTT DBF](#) - JDBC(1.2, 2.0, 3.0, 4.0, 4.1, 4.2) driver packages for Xbase database (dbase, Visual DBASE, SIx Driver, Alaska, SoftC, Codebase, Clipper, Foxbase, Foxpro, VFP, xHarbour, Halcyon, Apollo, Goldmine, and BDE)

[HXTT Excel](#) - JDBC(1.2, 2.0, 3.0, 4.0, 4.1, 4.2) driver packages for Microsoft Excel version from 95, 97, 98, 2000, 2001, 2002, 2003, 2004, 2007, 2010, 2013, to 2016.

[HXTT Paradox](#) - JDBC(1.2, 2.0, 3.0, 4.0, 4.1, 4.2) driver packages for Corel Paradox version from 3.0, 3.5, 4.x, 5.x, 7.x to 11.x

[HXTT PDF](#) - JDBC(4.0, 4.1, 4.2) driver packages for Portable Document Format (PDF) version from 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6 to 1.7

[HXTT Text\(CSV\)](#) - JDBC(1.2, 2.0, 3.0, 4.0, 4.1, 4.2) driver packages for raw data, flat text , CSV file, TSV file, PSV file, fixed-length, and variable-length binary file

[HXTT XML](#) - JDBC(1.2, 2.0, 3.0, 4.0, 4.1, 4.2) driver packages for XML data (XML1.0, XML1.1).

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Components of HXTT Cobol Packages

These components are included in the HXTT Cobol license descriptions :

Component	Description
Cobol Documentation	Development Documentation
Cobol JDBC 1.2 Package	JDBC 1.2 and Personal Java compliant driver, and a Database GUI manager for swing1.0.3.
Cobol JDBC 1.2 Embedded Package	JDBC 1.2 and Personal Java compliant driver without client/server mode support.
Cobol JDBC 1.2 Remote Access Package	The client side JDBC 1.2 and Personal Java compliant ultra light applet driver
Cobol JDBC 1.2 Driver's Demo	Demo Code for JDBC 1.2
Cobol JDBC 2.0 Package	JDBC 2.0 compliant driver, and a Database GUI manager.
Cobol JDBC 2.0 Embedded Package	JDBC 2.0 compliant driver without client/server mode support.
Cobol JDBC 2.0 Remote Access Package	The client side JDBC 2.0 compliant ultra light applet driver
Cobol JDBC 2.0 Driver's Demo	Demo Code for JDBC 2.0
Cobol JDBC 3.0 Package	JDBC 3.0 compliant driver, and a Database GUI manager.
Cobol JDBC 3.0 Embedded Package	JDBC 3.0 compliant driver without client/server mode support.
Cobol JDBC 3.0 Remote Access Package	The client side JDBC 3.0 compliant ultra light applet driver
Cobol JDBC 3.0 Driver's Demo	Demo Code for JDBC 3.0
HXTT JDBC 3.0 Common Package and Cobol JDBC 3.0 Core Package	You can use common package if you employ more than one of HXTT JDBC products.
Cobol JDBC 4.0 Package	JDBC 4.0 compliant driver, and a Database GUI manager.
Cobol JDBC 4.0 Embedded Package	JDBC 4.0 compliant driver without client/server mode support.
Cobol JDBC 4.0 Remote Access Package	The client side JDBC 4.0 compliant ultra light applet driver
Cobol JDBC 4.0 Driver's Demo	Demo Code for JDBC 4.0
HXTT JDBC 4.0 Common Package and Cobol JDBC 4.0 Core Package	You can use common package if you employ more than one of HXTT JDBC products.
Cobol JDBC 4.1 Package	JDBC 4.1 compliant driver, and a Database GUI manager.
Cobol JDBC 4.1 Embedded Package	JDBC 4.1 compliant driver without client/server mode support.
Cobol JDBC 4.1 Remote Access Package	The client side JDBC 4.1 compliant ultra light applet driver
Cobol JDBC 4.1 Driver's Demo	Demo Code for JDBC 4.1
HXTT JDBC 4.1 Common Package and Cobol JDBC 4.1 Core Package	You can use common package if you employ more than one of HXTT JDBC products.
Cobol JDBC 4.2 Package	JDBC 4.2 compliant driver, and a Database GUI manager.
Cobol JDBC 4.2 Embedded Package	JDBC 4.2 compliant driver without client/server mode support.
Cobol JDBC 4.2 Remote Access Package	The client side JDBC 4.2 compliant ultra light applet driver
Cobol JDBC 4.2 Driver's Demo	Demo Code for JDBC 4.2
HXTT JDBC 4.2 Common Package and Cobol JDBC 4.2 Core Package	You can use common package if you employ more than one of HXTT JDBC products.

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HXTT's JDBC Packages Documentation

Welcome to the HXTT Cobol v3.0 Documentation

Current documentation can be found [here](#). This documentation is not intended as a complete guide to JDBC programming, but should help to get you started. For more information, refer to the standard JDBC API documentation(supplied with Sun's JDK). Also, take a look at the examples included with the HXTT Cobol packages. The basic example is used here.

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FAQ for HXTT Cobol Packages of type 4 JDBC Driver for Cobol FB VB data file

The most recent version of this document can be viewed at [here](#).

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General Questions

1. How to know the detailed version information of HXTT Cobol package?

1st way: "java com.hxtt.sql.cobol.CobolDriver" will print that information.

2nd way: check that MANIFEST.MF file in jar file.

2. Can I use it in an iSeries OS/400 IBM machine that has Java 1.4 running in it?

The HXTT Cobol packages can run on any platform with Java VM, which includes Microsoft Windows, Novell Netware, OS2, UNIX, and LINUX. It supports Personal Java, JDK1.0.X, JDK1.1.X, JDK1.2.X, JDK1.3.X, JDK1.4.X, JDK1.5.X, JDK1.6.X, JDK1.7.X, and JDK1.8.X. It supports JDBC1.2, JDBC2.0, JDBC3.0, JDBC4.0, JDBC4.1, and JDBC4.2 now.

3. What is difference between the HXTT Cobol Package, Embedded Package, and Remote Access Package? Can I get some sample code to use the HXTT Cobol?

The HXTT Cobol supports Embedded and Remote Access. HXTT Cobol Package includes a Database GUI manager. If you're accessing the local data, you can use the HXTT Cobol Package or Embedded Package. If you're accessing the remote data, you can use the HXTT Cobol Package or Remote Access Package. There is no any difference for your code to use anyone of three packages. Please download the demo package from [here](#).

4. What causes the 'No suitable driver' SQLException?

This error usually occurs during a call to `DriverManager.getConnection()`. The cause can be failing to load the appropriate JDBC driver before calling `getConnection()`, or specifying an invalid JDBC URL that isn't recognized by your JDBC driver. If you're using a trial version, you will get "No suitable driver" SQLException, and "Evaluation period over" after using about 30 days. The HXTT Cobol driver's name is `com.hxtt.sql.cobol.CobolDriver`, and its JDBC URL:

Embedded:

`jdbc:cobol:[//][DatabasePath][?prop1=value1[:prop2=value2]]` (You can omit that "/" characters sometimes)

For example:

"jdbc:cobol:/"

"jdbc:cobol:c:/data"

"jdbc:cobol:///usr/data" for unix or linux:

"jdbc:cobol:./data"

Access by Cobol Server: Skip it if you don't use TCP, RMI or JINI.

`jdbc:cobol://host:port/[DatabasePath]`

For example: "jdbc:cobol://domain.com:3099/c:/data" if one CobolServer is run on the 3099 port of domain.com

5. How to setup Cobol url on the Novell Server?

Cobol driver can run on Novell server. You can use directly access or CobolServer to visit your data on Novell server. If your Cobol files is at `sys:/java/yourdata`, the direct URL should be:

`jdbc:cobol:///sys:/java/yourdata`

or
 jdbc:cobol:///java/yourdata

6. I got "java.io.IOException: Permission denied" sometimes for my SELECT query.

Please figure out what directory Java's java.io.tmpdir system property points to, and make sure that directory is writable by the user that runs your Java applications, otherwise you should set tmpdir property in Connection property to a writable directory. tmpdir property indicates whether set a temp directory, Default: the value of JVM's "java.io.tmpdir" property. If that value is incorrect, using the directory of JDBC url.

7. When I used jdbc:cobol:<DatabasePath>, the connection's schema was empty. "create catalog if not exists cobolfiles". What is Catalog?

Cobol's schema is always empty. You can use catalog to query subdirectory. Catalog means a directory, which contains some Cobol files.

8. Can HXTT Cobol support JDK 1.0.2?

Yeah. You need to download JDBC 1.22 from the Sun's JDBC download page and add JDBC1.22 into JDK 1.0.2. HXTT Cobol hasn't be tested on JDK1.0.X since we have not received such a complement request from our users. If you meet any problem, please let us know.

Applet Questions

1. I already configured the .java.policy for my applet, but I continue with problems of "access denied".

For instance, you're using "jdbc:cobol:/C:/test", and grant codeBase "file:/C:/test" in your policy file, but your applet is running from "D:\sample\CargaStatApplet.html". You should grant codeBase "file:/D:/sample", not "file:/c:/test".

2. http://localhost:8080/jdbcapplet.html, the applet started but returns a Classnotfound com.hxtt.sql.cobol.CobolDriver error in the gui list.

Please add a codebase tag. For instance, "<applet code="jdbcapplet.class" codebase="Cobol_Remote_Access_JDBC40.jar"></applet>". The Cobol_Remote_Access_JDBC40.jar should be at the same directory of jdbcapplet.html.

Remote Access Questions and Client/Server Mode Questions

1. Client/Server mode question: The data directory is not in the IBM machine where the Java program should run, but instead those Cobol files are in another machine with Windows operating system.

com.hxtt.sql.admin.Admin provides a GUI manger for [Cobol server](#). For instance, you wish to provide JDBC4.0 remote data access. Please use "java -cp yourdirectory/Cobol_JDBC40.jar com.hxtt.sql.admin.Admin" to start GUI manager, and add a url setting of "'jdbc:cobol://10.32.90.48:' + 8029 + '/' + databaseDirectory'" on your host of 10.32.90.48(just an IP sample), then click Start button. Third, you can use 'String url =

"jdbc:cobol://10.32.90.48:' + 8029 + '/' + databaseDirectory,'" to visit your Cobol database from your IBM machine. If you're running that GUI manager on "yourNT.com" host to visit "c:/database" directory, you can use "jdbc:cobol://yourNT.com:8029/c:/database" on your web application. jdbc:cobol://yourNT.com:8029/c:/database?user=oneuser&password=onpassword can provide a simply user/password verification for client/server mode. If you wish to write a secure Cobol server for some sensitive information, embedded encrypt/decrypt functions can help you.

2. Remote access through map network drive question: How to remote access Cobol data without CobolServer?

You can share your remote directory which contains your data files, then map it to a local driver.

For Windows: You can connect remote Cobol database by sharing the directory and map it to local drive. You should disable the OPLOCKS of your Samba/NT/2000 server. How to turn off opportunistic locking in windows on client and on server side? This is done by manipulating the following registry key:

For client side: oplocks.reg file

REGEDIT4

[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\MRXSmb\Parameters]

"OplocksDisabled"=dword:00000001

[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\LanmanWorkstation\Parameters]

"UseOpportunisticLocking"=dword:00000000

For server side: oplocksServer.reg
 REGEDIT4
 [HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\LanmanServer\Parameters]
 "EnableOplocks"=dword:00000000

You should put additional registry entry like e.g.

The following registry entries disable opportunistic locking and caching:

HKey_Local_Machine \ System \ CurrentControlSet \ Services \ LanmanServer \ Parameters \ EnableOpLocks must be set to 0.

HKey_Local_Machine \ System \ CurrentControlSet \ Services \ LanmanServer \ Parameters \ CachedOpenLimit must be set to 0.

HKey_Local_Machine \ System \ CurrentControlSet \ Services \ LanmanWorkStation \ Parameters \ UseOpportunisticLocking must be set to 0.

HKey_Local_Machine \ System \ CurrentControlSet \ Services \ LanmanWorkStation \ Parameters \ UtilizeNtCaching must be set to 0.

For Linux: You can use mounting. One user uses Samba to map NTFS partitions in Linux servers, and Cobol driver works normally like mapping any mount point in Linux.

For Novell: You can map NCP directory as driver or mount NCP directory.

3. Remote access through UNC path question: Can I setup only one datasource to access four servers for my Cold Fusion?

To access one unc path, you can use jdbc:cobol://PC17\c\$\values or jdbc:cobol://PC17\val.

To access four unc pathes in the same connection, you need to use a free JDBC url, "jdbc:cobol:/" or "jdbc:cobol:///".

Then you can use some full UNC path names in SQL to visit your four servers where your Java VM has right to access.. For instance:

```
select * from \\amd2500\e$\cobolfiles\test;
select * from "\\amd2500\d$\cobolfiles".test;
select * from ".".test;
```

4. Remote access through http/https/ftp protocol question: How to let my program to fetch data daily from our web host?

You need to use [url database](#), which supports http protocol, https protocol, ftp protocol, and sftp protocol.

5. Remote access through SAMBA protocol question: How to let my servlet on Linux to access over 300 hundred shared folders that all are on Windows boxes

You need to use [SAMBA table](#), which needn't to map or mount driver.

6. I can't get the [com.hxtt.sql.admin.Admin](#) running for internet --> intranet

HXTT Cobol supports port mapping and NAT route. Let HXTT Cobol listening a port on the database server, and modify your route table or NAT table to map an external port to that internal port. You can use "start java -Djava.security.policy=policy com.hxtt.sql.admin.Admin" to start GUI manager. You should add a remote url, for instance, jdbc:cobol://localhost:8029/d:/cobolfiles, and click Start button to start that server. Then on your internet client side, you can use jdbc:cobol://externalIP:8029/d:/cobolfiles to access your intranet host. externalIP means an external IP or domain name address of your gateway or database server.

BTW, except for TCPServer protocol, HXTT Cobol can use also RMIServer protocol. For instance, you have used

"start rmiregistry 1099 -J-Djava.security.policy=yourPolicyFile" to startup your rmi service. Then you can use jdbc:cobol://localhost:1099/d:/cobolfiles?serverType=RMIServer to let HXTT Cobol bind remote service in registry.

The key is use "java -Djava.security.policy=policy -Djava.rmi.server.hostname=externalIP com.hxtt.sql.admin.Admin RMISERVER 8029" to start your server. RMIServer protocol is slower much than the default TCPServer protocol.

7. I would like to start a server (TCP) from our application, instead of [DBAdmin](#). I need to be able to programmatically tell the application which profile to start.

Please read [Start/Stop Server Programmatically](#).

8. Is there a way to specify a file path in the url that will connect to a mapped drive in Windows 2000. ie drive \\gomer\pyle\db which is mapped to f drive on the server.

Cobol driver can work with mapped driver, and you should use "jdbc:cobol:/f:" to access your data.

Note: If you're using a database file through a UNC path or a mapped drive of Windows, there is a Windows Security restriction. If you run ColdFusion (Tomcat, or tanuki sw wrapper) as a service on Windows, it operates by default as System, and cannot access directories on a remote system or mapped drive; to resolve this issue, do not run ColdFusion (Tomcat, or tanuki sw wrapper) using the local system account.

9. When I click Start button to start a remote service, I get a security exception: access denied (java.net.SocketPermission 127.0.0.1:8029 connect,resolve)

You have to enable java.net.SocketPermission right in your policy file if you run a Cobol server. Please read

file:///yourdriver/jdk1.6/docs/guide/security/PolicyFiles.html for more information about policy file. It is unnecessary to know the specific content of a policy file, since you can use policy tool to create and maintain your policy files. Please read

file:///yourdriver/jdk1.6/docs/tooldocs/win32/policytool.html for policy tool.

10. How to start remote service as MS Windows service and Linux(Solaris) Daemon?

Please read [Run HXTT CobolServer as Windows Service or Linux\(Solaris\) Daemon](#).

11. How to start remote control when CobolServer is running as Windows service or Linux(Solaris) Daemon?

You can use "java com.hxtt.sql.admin.Admin TCPCLIENT [host:]port [remoteControlPassword]" to start your remote control.

SQL Questions

1. I need to use tables stored in a subdirectory.

table-name: [catalog.]tableName

For instance, you have many Cobol files on c:\data. You can use "jdbc:cobol:/c:/data" as JDBC url. Then you can use "select * from subdirectory1.table1" to visit table1 file at subdirectory1. For instance, "select tableAlias.* from "sales/2004/04".sale as tableAlias" can access sale table at "c:\data\sales\2004\04".

2. I can't use "select RIGHT from deldob"

RIGHT is a reserved SQL keyword. "variableName", [variableName] or {v 'variableName'} is used to quote those columns which use reserved keyword, so that you should use "RIGHT" or {v 'RIGHT'} to quote the RIGHT field, for instance, *select {v 'RIGHT'}, 'other' from states where "RIGHT"=32*. HXTT Cobol supports using DATE, TIME, TIMESTAMP, GROUP, ORDER, KEY, DESC, UPDATE directly in SQL, although they're reserved words too.

3. Can I get an example on how to do a query involving a boolean value. eg. " Select * from tableName where exported = true", where exported is a boolean column in a Cobol file.

Supports. You can use "select * from tableName where exported" too. All of NOT, AND, and OR operation are supported.

4. How to specify dates?

Please use SQL Escape Syntax, a date is specified in a JDBC SQL statement with the syntax {d `yyyy-mm-dd`} where yyyy-mm-dd provides the year, month, and date, e.g. 1996-02-28. There are analogous escape clauses for TIME and TIMESTAMP type: {t `hh:mm:ss`} and {ts `yyyy-mm-dd hh:mm:ss.f...`}. The fractional seconds (.f...) portion of the TIMESTAMP can be omitted. For instance, {d '1999-11-01'} and {ts '3999-03-24 00:59:23.22222'}. You can use PreparedStatement.setDate to set date columns too.

5. How to handle date range selection, e.g. SELECT * FROM CALLS WHERE START >= '2001-01-01' AND END <= '2002-01-01'

Although the HXTT Cobol supports "SELECT * FROM CALLS WHERE START >= '2001-01-01' AND END <= '2002-01-01'", but that sql syntax is unadvisable. Please use SQL Escape Syntax, {d `yyyy-mm-dd`} and {ts `yyyy-mm-dd hh:mm:ss.f...`}, for Date and timestamp type according to JDBC standard. You can learn more about Escape Syntax at file:///yourdriver/jdk1.6/docs/guide/jdbc/spec/jdbc-spec.frame11.html . You should use "select * from calls where start>={d '2001-01-01'} and end <={d '2002-01-01'}".

6. Can {d '2999-11-21'}={ts '2999-11-21 23:22:20.3335'} and {t '23:22:20'}={ts '1999-01-01 23:22:20.333'}? Supports.

7. I think this one is for use functions {fn abs(TEST.int1)}

You can use abs(TEST.int1) too. HXTT Cobol supports more than 230 functions.

8. Update table_name set (fieldname1=X, fieldname2=X2,) where primary_index='blah' throws a parse exception.

You should use "update table_name set fieldname1=X, fieldname2=X2, where primary_index='blah'".

9. How to delete all deleted records permanently?

"PACK TABLE [IF EXISTS] table_name" will pack database.

"TRUNCATE TABLE [IF EXISTS] table-name" will zap database.

Index Questions

1. How to rebuilding index in case of corrupted index?

REINDEX {ALL | indexFileName[,indexfileN2,...]} ON table-name

2. I receive 1 record back, however there should be 8 records returned. My SQL is "SELECT * FROM Schshift@brian WHERE PSCHED='0001092478'"

You should have a UNIQUE index restriction on your PSCHED column in your index file. You should use "CREATE INDEX PSCHED on Schshift (PSCHED)", not "CREATE INDEX PSCHED on Schshift (PSCHED UNIQUE)". Then you can get all ten records. Cobol driver will use index to speed up the query which contains some index expressions.

3. We tried to set a PRIMARY KEY constraint with: create unique index PROVA on PROVA (COD)

You should try "CREATE INDEX prova ON prova (cod PRIMARY KEY).

4. I have a table that lists an index using: STR(ClassLink,4,0)+STR(StuLink,5,0) as the column_name. I want to join it to another table that has an index that uses the same columns... What should the join statement look like in order to take advantage of the indexes?

For instance, you can use "select * from ACLS3295,AGRD3295 where STR(ACLS3295.ClassLink,4,0)+STR(ACLS3295.StuLink,5,0)='1234abcde' and STR(AGRD3295.ClassLink,4,0)+STR(AGRD3295.StuLink,5,0)='5678abcde'", or "select * from ACLS3295 as a,AGRD3295 as b where STR(a.ClassLink,4,0)+STR(a.StuLink,5,0)='1234abcde' and STR(b.ClassLink,4,0)+STR(b.StuLink,5,0)='5678abcde'".

Performance Questions

1. What is the most efficient method to insert records in a table, to use an updatable RecordSet or to use a PreparedStatement?

PreparedStatement is smally quicker than updatable RecordSet. An updatable RecordSet is quicker than PreparedStatement if you insert into more than 200 columns with constant values. It can only cope with constant values. PreparedStatement can cope with complicated expressions so that you can insert timestamp, function, ResultSet, and so on.

2. "select count(*) from table" are worked a long time for large tables.

You should use "select reccount() from table" to get the number of records. Count(*) sums always up all records except deleted row.

3. Are there any data row count, data volume, memory minimums, maximums imposed when using the HXTT Cobol?

No limitation. The HXTT Cobol supports to join query big databases with DISTINCT, GROUP BY, and ORDER BY.

4. > Is there a scenario possible where we store frequently accessed temporary data in memory-only tables (as a cache) and use these for query's* **_mixed_***with real HXTT Cobol tables?

`_memory_` is a special catalog name for memory-only database. Through `_memory_` catalog, memory-only database is visible for all applications in the same JVM. For instance, in an embedded connection, you can use create table `_memory_.abc` (a char(10));insert into `_memory_.abc` values(333);select * from `_memory_.abc`, test where `abc.a=test.b`;drop table `_memory_.abc`; to do the same things.

Concurrency Questions

1. Does HXTT Cobol support multi-user access?

The HXTT Cobol supports multi-user access, record lock, and table lock.

2. Is there any way to lock/unlock record programatically.

We have provided a `_LockFlag_` virtual column as row lock flag. You can know it from [Set Record Lock Manually](#).

Internationalization Questions

1. Can the HXTT Cobol support Czech MS - DOS 895?

The HXTT Cobol supports all codepage, multilingual collation sequence, and unicode character set. Cp895(Czech MS - DOS 895), Cp620(Polish MS - DOS 620) and Mazovia are extra supported although JVM doesn't support those.

2. Do you have a solution for character translation to the right encoding?

The HXTT Cobol supports CharacterEncoding. Please use `charSet` property.

```
//Default: null
//You can find a Supported Encodings list of files:///yourdriver/jdk1.2/docs/guide/internat/encoding.doc.html
//Extra supports:
// Cp895 is supported by HXTT Cobol driver. //Czech MS - DOS 895
// Cp620 is supported by HXTT Cobol driver. //Polish MS - DOS 620
// Mazovia is supported by HXTT Cobol driver. //Polish
Properties properties=new Properties();
properties.setProperty("charSet","sv_SE");
Connection con = DriverManager.getConnection(url,properties);
```

3. While reading encrypted data in a Cobol file using u'r parser in java. The data retrieved is different from the data in the Cobol file, certain characters are read as ? marks.(the encryption is done using ASCII values).

You can use `ResultSet.getBytes(int columnIndex)`, not `ResultSet.getString(int columnIndex)` and `ResultSet.getObject(int columnIndex)`, to get your encrypted data, since your encrypted data is binary stream.

4. When they insert accented characters, it comes out different at the Java end. There seem to be some character set conversion problems. Is there a way to solve that?

You can use `ResultSet.getBytes()` and `ResultSet.setBytes()` to avoid CharacterEncoding.

Interoperability Questions

1. How to set up HXTT Cobol with Tomcat4.1 as PoolableConnection?

This sample shows three PoolableConnections ways through Database Connection Pool (DBCP) Configurations and JNDI Resources(You should read [JNDI Datasource HOW-TO](#) and [JNDI Resources HOW-TO](#) also.):

In server.xml:

```
<Context path="" docBase="ROOT" debug="5" reloadable="true" crossContext="true">
  <Resource name="jdbc/testcobolPool1" auth="Container" type="javax.sql.DataSource"/>
    <ResourceParams name="jdbc/testCobolPool1">
      <parameter>
        <name>factory</name>
        <value>org.apache.commons.dbcp.BasicDataSourceFactory</value>
      </parameter>
      <parameter>
        <name>maxActive</name>
```

```

        <value>50</value>
    </parameter>

    <parameter>
        <name>maxIdle</name>
        <value>10</value>
    </parameter>

    <parameter>
        <name>maxWait</name>
        <value>10000</value>
    </parameter>

    <parameter>
        <name>username</name>
        <value></value>
    </parameter>

    <parameter>
        <name>password</name>
        <value></value>
    </parameter>

    <parameter>
        <name>driverClassName</name>
        <value>com.hxtt.sql.cobol.CobolDriver</value>
    </parameter>

    <parameter>
        <name>url</name>
        <value>jdbc:cobol:///d:/cobolfiles</value>
    </parameter>
</ResourceParams>

<Resource name="jdbc/testCobolPool2" auth="Container" type="com.hxtt.sql.HxttConnectionPoolDataSource"/>
  <ResourceParams name="jdbc/testCobolPool2">
    <parameter>
        <name>factory</name>
        <value>org.apache.naming.factory.BeanFactory</value>
    </parameter>

    <parameter>
        <name>url</name>
        <value>jdbc:cobol:///d:/cobolfiles</value>
    </parameter>

    <parameter><name>username</name><value></value></parameter>
    <parameter><name>password</name><value></value></parameter>
    <parameter><name>host</name><value></value></parameter>
    <parameter><name>port</name><value>8029</value></parameter>
  </ResourceParams>

<Resource name="jdbc/testCobolPool3" auth="Container" type="com.hxtt.sql.HxttConnectionPoolDataSource"/>
  <ResourceParams name="jdbc/testCobolPool3">
    <parameter>
        <name>factory</name>
        <value>com.hxtt.sql.HxttObjectFactory</value>
    </parameter>
    <parameter>
        <name>url</name>
        <value>jdbc:cobol:///d:/cobolfiles</value>
    </parameter>

    <parameter><name>username</name><value></value></parameter>
    <parameter><name>password</name><value></value></parameter>
    <parameter><name>host</name><value></value></parameter>
    <parameter><name>port</name><value>8029</value></parameter>
  </ResourceParams>
</Context>

```

Then you can use the below code to test those PoolableConnections:

```

Context initContext = new InitialContext();
Context envContext = (Context)initContext.lookup("java:/comp/env");

DataSource ds1 = (DataSource)envContext.lookup("jdbc/testCobolPool1");

```

```

Connection conn1 = ds1.getConnection();
out.println("testCobolPool1 OK:")<br/>");
Statement stmt1 = conn1.createStatement();
ResultSet rs1 = stmt1.executeQuery("select * from test");
if(rs1.next())
    out.println(rs1.getString(1)+":")<br/>");
rs1.close();
stmt1.close();
conn1.close();

```

```

DataSource ds2 = (DataSource)envContext.lookup("jdbc/testCobolPool2");
Connection conn2 = ds2.getConnection();
out.println("testCobolPool2 OK:")<br/>");
Statement stmt2 = conn2.createStatement();
ResultSet rs2 = stmt2.executeQuery("select * from test");
if(rs2.next())
    out.println(rs2.getString(1)+":")<br/>");
rs2.close();
stmt2.close();
conn2.close();

```

```

DataSource ds3 = (DataSource)envContext.lookup("jdbc/testCobolPool3");
Connection conn3 = ds3.getConnection();
out.println("testCobolPool3 OK:")<br/>");
Statement stmt3 = conn3.createStatement();
ResultSet rs3 = stmt3.executeQuery("select * from test");
if(rs3.next())
    out.println(rs3.getString(1)+":")<br/>");
rs3.close();
stmt3.close();
conn3.close();

```

If you use `org.apache.commons.dbcp.BasicDataSource`, but get "Cannot create PoolableConnectionFactory" Error, you should check your `commons-pool-1.x.jar` and `commons-dbcp-1.*.jar` file in `$TOMCAT/common/lib` directory to see whether two files have the same version. DBCP v1.2 requires Pool v1.2 so that you should update Pool v1.1 from the tomcat website.

If you wish to add more Connection property, you should use `connectionProperties`, for instance:

```

<parameter>
<name>connectionProperties</name>
<value>charSet=Cp737</value>
</parameter>

```

2. How to set up HXTT Cobol with vqServer 1.9.55 as web server?

The key is to use an absolute path as Java libraries' location, and restart vqServer after modified Java libraries.

For instance, your vqServer is installed at `C:\vqServer\`.

1. Please use `http://yourhost:9090/` to visit your administration server.
2. Click on Java libraries in the vqServer control centre menu (`http://yourhost:9090/admin?action=libraries&serial=14`)
- 3 Click New library (`http://yourhost:9090/admin?lib=New_library&action=edit`)
4. Enter `C:\vqServer\classes\Cobol_JDBC20.jar` as location value, Cobol Driver as Description value, then click OK button.
5. Please copy `Cobol_JDBC20.jar` into `C:\vqServer\classes` directory.
6. Please copy `ex01.class` into `C:\vqServer\servlets\servlets`
7. Stop and restart vqServer
8. Please use `http://yourhost/servlet/yourServlets` to get your result.

3. How to set up HXTT Cobol with Coldfusion MX 6.1 Application Server?

For instance,your Coldfusion MX is installed at `C:\CFusionMX\`, and wish to use `Cobol_JDBC30.jar`.

1. Please copy `Cobol_JDBC30.jar` into `C:/CFusionMX/wwwroot/WEB-INF/classes/`.
2. Use `http://yourhost:8500/CFIDE/administrator/index.cfm` to enter the CFMX Administrator.
3. Go to the "Java and JVM" of Server Settings, `http://yourhost:8500/CFIDE/administrator/settings/jvm.cfm` page, and enter the full path, `C:/CFusionMX/wwwroot/WEB-INF/classes/Cobol_JDBC30.jar`, in the Class Path. Then, click "Submit Changes".

4. Restart the CFMX Service.
5. Please go back to the administrator page, and go to the "Data Sources" of Data & Services, <http://yourhost:8500/CFIDE/administrator/datasources/index.cfm> page, and enter the name for the new datasource, for instance "CobolTest", and select "Other" for the driver. Then Click "Add".
6. Enter the datasource information. JDBC URL is always in the format jdbc:cobol:[//[host:port]]/[DatabasePath], for instance jdbc:cobol:/c:/data. You can set more connection properties in your JDBC URL, for instance: jdbc:cobol:/c:/data?delayedClose=15;maxCacheSize=6144;lockTimeout=2000; . Driver class is always com.hxtt.sql.cobol.CobolDriver. Driver name is used to identify the driver in the datasources view, and you can use Cobol. Username and password are not required. They can also be specified in the cfquery tag (but datasource verification will fail if you don't enter them). Description is not required.
7. Lastly, please press "Submit" to finalize the entered data.
8. You can find edit.cfm and edit_action.cfm sample in demo package.

4. HXTT Cobol with If you run ColdFusion (Tomcat, or alexandria sw and tanuki sw wrapper) on Windows 2000 and Windows XP Pro does not work on mapped drives.

Note: If you're using a database file through a UNC path or a mapped drive of Windows, there is a Windows Security restriction. If you run ColdFusion (Tomcat, or tanuki sw wrapper) as a service on Windows, it operates by default as System, and cannot access directories on a remote system or mapped drive; to resolve this issue, do not run ColdFusion (Tomcat, or tanuki sw wrapper) using the local system account.

The service(For instance, ColdFusion MX Application Server, ColdFusion MX 7 Application Server, or Apache Tomcat) built by ColdFusion (Tomcat, or tanuki sw wrapper) can not access the share directory at other machine by default. But you can do as follows to solve this problem:

1. Right click the service built by ColdFusion (Tomcat, or tanuki sw wrapper) in service manager, and click the property menu.
2. On the open window,select the login tab, click this account radio box, and click the browse button.
3. Select the administrator account(it seems that you should select the administrator account), input the correct password in the password textbox and confirm password textbox.
4. Restart this service, you can find this service can access the share directory at other machine.

5. How to resolve 'DataSet has no unique row identifiers.' issue in JBuilder's QueryDataSet?

You can use `_rowid_`, a virtual column to avoid that issue, For instance:

```
//...
queryDataSet = new QueryDataSet();
//...
queryDataSet.setMetaDataUpdate(MetaDataUpdate.ALL-MetaDataUpdate.ROWID-MetaDataUpdate.TABLENAME);

queryDataSet.setQuery(new QueryDescriptor(database, "select _rowid_,* from test", null, true,
Load.ALL));
queryDataSet.open();

queryDataSet.setTableName("test");
queryDataSet.setRowId("_rowid_", true);
//...
```

6. How to set HXTT Cobol with WebSphere Application Server?

You can download a pdf guide from [here](#).

7. How to set HXTT Cobol with Hibernate?

You should download support package and sample from [here](#).

8. How to set HXTT Cobol Data Source with Oracle Application Server 10G?

You should read guide at [Oracle Application Server 10G\(v10.1.3\)](#) and [Oracle Application Server 10G\(v10.1.2.02\)](#).

9. How to set HXTT Cobol Data Source with JBoss AS 7.0.2?

After downloading HXTT Cobol driver jar file. just move the HXTT Cobol driver jar file into Jboss 7 installation directory under standalone/deployments (jboss-as-web-7.0.2.Final/standalone/deployments).

Restart your jboss server

Then go to the url and type <http://localhost:8080/>

click Administration console.

In Jboss Administration console you can press Add button of Datasource Configurations. step 1/3 Datasource Attributes: enter datasource name(testcobol) and jndi name(testcobol) then click Next button. step 2/3 JDBC Driver: select HXTT Cobol driver jar file. click Next button. Step 3 Connection Settings: enter connection URL (jdbc:cobol:///data) , Username(null) and Password(null). finally click Done button.

10. How to set HXTT Cobol Data Source with Railo 3.3.1 Express?

After downloading HXTT Cobol driver jar file. just move the HXTT Cobol driver jar file into Railo 3 installation directory under /lib/ext/railo-server/context/library (railo-3.3.1.000//lib/ext/railo-server/context/library).

Restart your Railo server

Then go to the url and type <http://localhost:8888/>

click Railo Server Administrator (or type <http://localhost:8888/railo-context/admin/server.cfm>).

In Services - Datasource of Railo Server Administrator console, you can Create new datasource: step 1/2 Name: enter datasource name(testcobol) and Type(Other - JDBC driver) then click create button. step 2/2 enter Class(com.hxtt.sql.cobol.CobolDriver), DSN(jdbc:cobol:///data), Username(null) and Password(null). finally click create button.

11. Where's JDBC Connection Pool Templates for GlassFish?

MS Access template is at http://www.hxtt.com/test/microsoft_access_type4_datasource.xml

Cobol data file template is at http://www.hxtt.com/test/microsoft_access_type4_datasource.xml

MS Excel template is at http://www.hxtt.com/test/microsoft_excel_type4_datasource.xml

Corel Paradox template is at http://www.hxtt.com/test/paradox_type4_datasource.xml

Xbase template is at http://www.hxtt.com/test/dbf_type4_datasource.xml

CSV template is at http://www.hxtt.com/test/csv_type4_datasource.xml

Text template is at http://www.hxtt.com/test/text_type4_datasource.xml

PDF template is at http://www.hxtt.com/test/pdf_type4_datasource.xml

XML template is at http://www.hxtt.com/test/xml_type4_datasource.xml

12. How to set HXTT Cobol database in DBeaver?

1. Create a JDBC Data Source for HXTT Cobol Data

Open the DBeaver application, in the Databases menu, click the Driver Manager item. Click New to open the Create New Driver form.

In the Driver Name box, enter a user-friendly name for the driver, for instance, testCobol.

In the Class Name box, enter com.hxtt.sql.cobol.CobolDriver.

In the URL Template box, enter jdbc:cobol: .

In the Category box, enter Cobol.

In the Libraries panel, click Add File so that load the driver JAR (for instance, Cobol_JDBC40.jar) in DBeaver.

In the Open driver library dialog that appears, select the Cobol_JDBC40.jar file.

2. Create a Connection to HXTT Cobol Data

In the Databases menu, click New Connection item.

In the Create new connection wizard that results, select Cobol, then testCobol.

On the next page of the wizard, click the Driver properties tab.

Add new property, Property Name is database, Value is the path of your database file, for instance, d:/test/cobol .

Click Finish button.

13. How to set HXTT Cobol with Apache EmpireDB?

You should download support package from [here](#).

13. Does HXTT Cobol driver support XA connections ?

It provides an experimental com.hxtt.sql.HxttXADataSource .

14. How to set HXTT Cobol into my projects maven pom.xml.?

For instance,

Once you've downloaded the JAR just add it to your computer repository with:
 mvn install:install-file -DgroupId=com.hxtt.sql.cobol -DartifactId=coboljdbc4 \
 -Dversion=v3.0 -Dpackaging=jar -Dfile=Cobol_JDBC40.jar -DgeneratePom=true
 The last parameter for generating a POM will save you from pom.xml warnings.

Include the new dependency by modifying your project's pom.xml. Add the following dependency:

```
<dependency>
  <groupId>com.hxtt.sql.cobol</groupId>
  <artifactId>coboljdbc4</artifactId>
  <version>v3.0</version>
</dependency>
```

Save the pom.xml file and build the project to make sure no errors exist.

15. How to set HXTT Cobol Data Source with JBoss Application Server 4.0.1?

For instance,

```
<datasources>
<local-tx-datasource>
  <jndi-name>TestData</jndi-name>
  <connection-url>jdbc:cobol:///data</connection-url>
  <driver-class>com.hxtt.sql.cobol.CobolDriver</driver-class>
  <connection-property name="delayedClose">-1</connection-property>
  <user-name/>
  <password/>
  <min-pool-size>5</min-pool-size>
  <max-pool-size>20</max-pool-size>
  <idle-timeout-minutes>5</idle-timeout-minutes>
</local-tx-datasource>
</datasources>
```

16. How to set HXTT Cobol database dialect with EclipseLink of Glassfish?

You should download support package and sample from [here](#).

17. How to set HXTT Cobol database dialect with TopLink of Glassfish?

You should download support package and sample from [here](#).

18. How to set HXTT Cobol database in JasperSoft Studio?

1. right-click a project in the Project Explorer and select New > Data Adapter to open the Data Adapters Wizard.
2. In the DataAdapter File window, choose the project where you want to save the data adapter file. This should be the project that contains the report(s) you want to use with your data adapter.
3. Enter a file name for your adapter and click Next.
4. Select Database JDBC Connection as the data adapter type and click Next.
5. Enter a name for your adapter. This name is used when you select an adapter for a report.
6. Enter com.hxtt.sql.cobol.CobolDriver for JDBC Driver
7. Enter jdbc:cobol:/yourDatabasePath for JDBC Driver
8. Click Driver Classpath tab.
9. Click Add button to select the Cobol_JDBC40.jar file.
10. Click Finish to create the adapter.

The adapter is saved as an XML file in the project location you selected.

19. How to set HXTT Cobol database in Jasper Server?

First, copy the Driver to the JasperReports Server Classpath

Now you need to copy the driver (the Cobol_JDBC40.jar file) to the classpath of your application server to enable JasperServer to find it.

In general it's best to copy the driver to the application server's shared library location. Refer to your application server documentation for exact locations.

For example in a JasperServer Bundle install on windows this is located at: C:/Jaspersoft/jasperreports-server-cp-7.1.0/apache-tomcat/lib

After these modifications you will need to restart the application server for this settings to take effect. For information on restarting your server see Chapter 3 of the JasperReport Server Install Guide (is located on the /docs folder of your Jasper Server install path)

1. Log into JasperReport Server from your browser using the jasperadmin or superuser account (e.g.: <http://localhost:8080/jasperserver-pro>)
2. Go to View | Repository, Select a folder where you want to create your Data Source (e.g.: /Data Sources). Right click on the folder name in the repository view and from the context menu select called Add Resource and then click on Data Source. Now you are presented with a screen to enter the settings of your Data Source connection
3. Type choose JDBC Data Source. JDBC Driver option choose Other... .
4. JDBC Driver (required): enter com.hxtt.sql.cobol.CobolDriver
5. URL (required): enter jdbc:cobol:/yourDatabasePath .
6. Click Save button.
7. Data Source Name (required): enter a user-friendly name for the driver, for instance, testCobol.
8. Click Save button.

20. Where's the support package for MySQL Migration?

The support package for MySQL GUI Tools 5.0 is at http://www.hxtt.com/test/mysql_migration.zip.

The support package for MySQL Migration Toolkit v1.0.21 is at http://www.hxtt.com/test/mysql_migration1.0.21.zip.

The support package for MySQL Migration Toolkit v1.0.20 is at http://www.hxtt.com/test/mysql_migration1.0.20.zip.

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Released Version Log

Latest feature:

- 2018-10-22 supports aggregate function ARRAY_AGG([DISTINCT] expression), STRING_AGG([DISTINCT] expression[, delimiter]).
- 2018-10-07 provides dbo as a pseudo name for the current schema for JasperSoft tool. The old "." name can still be used too.
- 2018-09-20 supports JSON, JSONB, XML, and ARRAY.
- 2018-08-30 provides _CURRENT_ as a pseudo name for the current catalog for JasperSoft tool. The old "." name can still be used too.
- 2018-04-23 supports invalid compressed size for RM Cobol compressed index/data file.
- 2018-04-12 needn't to encode special character for http/https url.
- 2018-03-19 fixed a bug for binary search row id on JOIN table.
- 2018-02-20 provides more support for missed columns in XFD file.
- 2018-02-02 can split multivalue column into rows through special subquery table.
- 2018-01-17 provides sameColumnName_X_n format to support duplicated column name in CPY file.
- 2018-01-16 fixed a bug for array column value.

2017-08-02 Cobol v3.0 JDBC1.2 Package(1393KB) JDBC2.0 Package(1373KB) JDBC3.0 Package(1433KB) JDBC4.0 Package(1585KB) JDBC4.1 Package(1588KB) JDBC4.2 Package(1599KB)

- 2017-06-30 PreparedStatement.executeBatch supports RETURN_GENERATED_KEYS.
- 2016-09-30 provides Pseudo Table INFORMATION_PARSER.sql for SQL syntax analysis feature.
- 2016-08-08 add a special feature to allow more than one FD files on the same data file. For instance, you have an hotpreis.xfd and an hotpreis. Now you define a schluesseluebergabe.xfd, and a schluesseluebergabe.sel(which contains only one line: select schluesseluebergabe assign to hotpreis.) Then "select * from schluesseluebergabe" will use schluesseluebergabe.xfd to access hotpreis file. The limitation is you can NOT use two xfd files at the same file at the same time.
- 2016-06-21 supports compression format of AcuCobol Vision Version 5.
- 2016-06-16 will try to load all table informations in WORKING-STORAGE.CBL,FILE.CBL, and FILE-CONTROL.CBL, if set dir4fileDescription connection property.
- 2016-05-20 supports XFD version 3.
- 2016-04-26 quicken query speed for big AcuCobol Vision 3 file.
- 2016-04-22 provides ODBCTrimBehavior, caseInsensitive, emptyDecimalAsZero, and emptyStringAsNull connection property.
- 2016-03-23 provides refreshIntervalfor ftp/sftp protocol
- 2016-03-23 supports DatabaseMetaData.getTables for ftp/sftp protocol
- 2016-02-09 supports write AcuCobol Vision 3 file.
- 2016-02-04 supports escape character '\ in pattern for DatabaseMetaData.
- 2016-01-27 supports omitted filled column information for XFD version 4.
- 2016-01-21 AcuCobol data verification will ignore the invalid file size information from vutil.
- 2015-04-30 supports write sftp protocol data file.
- 2015-01-31 provides extra copybooksyntax (OCCURS n TIMES DEPENDING ON name = value) for variable-length file. For intance, 01 RIVER OCCURS 1 TIMES DEPENDING ON TYPE=2.
- 2015-01-31 supports column name contains parentheses in copybook.
- 2014-09-02 supports write ftp protocol data file.
- 2014-05-08 v5.2.001 supports JDBC 4.2.

2014-05-08 Cobol v2.1 JDBC1.2 Package(1363KB) JDBC2.0 Package(1344KB) JDBC3.0 Package(1403KB) JDBC4.0 Package(1527KB) JDBC4.1 Package(1531KB) JDBC4.2 Package(1541KB)

- 2014-05-08 v2.1.001 supports JDBC 4.2.
- 2013-11-19 fixed a value fetch bug on two dimension array column.
- 2013-10-09 supports NTLM Authentication for SAMBA url or SAMBA absolute path.
- 2013-09-11 provides dir4fileDescription connection property to assign a different directory for file descriptor. If file descriptor is at the same directory of data file, you needn't that connection property. The older FDDIR connection property is still supported.
- 2013-09-11 supports XFD (EXtended File Descriptor), which includes XML format(version 6) and text format(version 4 and 5).
- 2013-08-27 fixed an ArrayIndexOutOfBoundsException bug on system function since 2013-08-09.
- 2013-08-09 support update batch column list syntax. For instance, UPDATE "UIP_Target" SET ("key_string","key_int","data_string","data_int","data_decimal") = (SELECT COALESCE(DP3475."key_string", "UIP_Target"."key_string"),COALESCE(DP3475."key_int", "UIP_Target"."key_int"),COALESCE(DP3475."data_string", "UIP_Target"."data_string"),COALESCE(DP3475."data_int", "UIP_Target"."data_int"),COALESCE(DP3475."data_decimal", "UIP_Target"."data_decimal") FROM DP3475 WHERE "UIP_Target"."key_string"=DP3475."KEY208" AND "UIP_Target"."key_int"=DP3475."KEY572") WHERE EXISTS (SELECT 'X' FROM DP3475 WHERE "UIP_Target"."key_string"=DP3475."KEY208" AND "UIP_Target"."key_int"=DP3475."KEY572")
- 2013-08-02 fixed a cache bug for In subqueryTable expression which subqueryTable contains parameter since 2013-02-25.
- 2013-06-29 fixed a match partly bug on FULL OUTER JOIN.
- 2013-06-26 fixed a condition bug for where clause since 2013-06-23.
- 2013-06-07 will read correctly Packed Decimal arrays when OCCURS>1 .
- 2013-06-04 will use always charSet connection property.
- 2013-05-31 parses correctly an unknown AcuCobol VIX format 5 sample.
- 2013-05-30 will use charSet connection property if failed to detect automatically charSet of data file.
- 2013-05-30 supports string value for (NAME (QualifiedDataName | Literal))+ syntax .
- 2013-05-03 fixed a NullPointerException bug for date conversion function since 2013-04-11.
- 2013-05-02 fixed a bug for Union ALL with where-clause.
- 2013-04-28 v2.0.133 fixed an insert rowid bug when using transaction mode.
- 2013-04-11 ALFRED can read normally the modified AcuCobol VIX index file.
- 2013-04-06 LIKE/ILIKE supports complicated expression as string pattern.
- 2013-03-11 v2.0.117 allows omittance [CONSTRAINT constraint_name] for UNIQUE in constraint clause.
- 2013-03-07 provides how to install HXTT DB Server as system service on MS Windows 7, Windows 2008, and Vista for remote connection and remote control
- 2013-02-02 v2.0.106 fixed a bug for update AcuCobol VIX index file since v2.0.104.
- 2013-01-27 v2.0.105 can utilize index file for children columns on any level.
- 2013-01-13 v2.0.104 allows update AcuCobol VIX index file.
- 2012-12-13 v2.0.098 accepts '\0' as S token for AcuCobol COMP-3 data type.
- 2012-12-11 v2.0.097 provides SPLIT(expression,delimiter) function.
- 2012-11-14 v2.0.095 enables the support for Micro Focus indexed file format 3.
- 2012-11-09 v2.0.093 supports AES(128/192/256) for encrypt,decrypt,encode/decode function.
- 2012-10-23 v2.0.087 quicken IN on subquery with more than 100,000 data rows.
- 2012-10-20 v2.0.084 supports NUMBER[(n1[,n2])] for CREATE TABLE sql.
- 2012-10-04 v2.0.080 supports XML format for SELECT ... INTO OUTFILE syntax.
- 2012-10-01 v2.0.079 optimizes long varchar type of temporary index.
- 2012-09-27 v2.0.079 supports seamlessly sftp url database in jdbc url and sql.
- 2012-07-07 v2.0.064 supports CSV format for SELECT ... INTO OUTFILE syntax.
- 2012-06-14 v2.0.060 provides FDDIR connection property to assign a different file description

directory with data directory. tableName.fileDescriptionExtension can be used to match tableNameDDD.fileExtension data file. For instance, ABANA.FD can be used to match ABANA777.dat file.

- 2012-06-07 v2.0.057 fixed a join query bug since v2.0.051.
- 2012-05-16 v2.0.051 uses automatic temporary index to quicken join sql.
- 2012-05-13 v2.0.049 supports query on VIX index file of AcuCobol Vision Version 4.
- 2012-05-13 v2.0.049 supports compression format of AcuCobol Vision Version 4.
- 2012-05-10 v2.0.047 supports X2 variable of IDXFORMAT"4" for Micro Focus.
- 2012-05-09 v2.0.046 supports query on VIX index file of AcuCobol Vision Version 5.
- 2012-05-04 v2.0.045 supports " _ " to replace "-" in column name directly in SQL. For instance, Both of "Cod-Att-Tessera" and Cod_Att_Tessera can be used for "Cod-Att-Tessera" column.
- 2012-05-04 v2.0.045 supports " *> " following comment.
- 2012-02-25 v2.0.031 supports Statement.setQueryTimeout.
- 2012-02-18 v2.0.028 supports query on RM-Cobol RMKF index file.
- 2012-02-10 v2.0.026 supports query on SCHEMATA, TABLES, COLUMNS of INFORMATION_SCHEMA schema.
- 2012-01-06 v2.0.022 supports query on AcuCobol Vision Version 3.
- 2011-12-22 v2.0.021 supports IDXFORMAT"4" for Micro Focus.
- 2011-11-29 v2.0.015 skips system rows which mix with data rows for Micro Focus.
- 2011-11-28 v2.0.014 fixed a multi-row cache bug for Micro Focus Compression Routine CBLDC001 since v2.0.007.
- 2011-11-10 v2.0.007 supports Micro Focus Compression Routine CBLDC001.
- 2011-11-07 v2.0.006 provides five regular expression functions(REGEXP_COUNT, REGEXP_LIKE, REGEXP_REPLACE, REGEXP_INSTR, and REGEXP_SUBSTR)
- 2011-11-04 v2.0.005 optimizes speed for DISTINCTROW on multi tables.

2011-10-11 Cobol v2.0 JDBC1.2 Package(1133KB) JDBC2.0 Package(1118KB) JDBC3.0 Package(1164KB) JDBC4.0 Package(1269KB) JDBC4.1 Package(1273KB)

- v2.0.001 supports JDBC 4.1.
- v1.1.028 support one variable X3 version format of Micro Focus variable indexed file
- v1.1.028 will use aname.fileDescriptionExtension(cpy, 'fd', 'sel', 'cbl', and 'cob') to match anameNN.dat(which NN is a digit letter) if it failed to find file description
- v1.1.026 provides fileDescriptionExtension to indicate whether Cobol driver supports other extension beside 'cpy', 'fd', 'sel', 'cbl', and 'cob' as default file description extension. The supported formats include Cobol source code file, Copybook file, FD file, and SEL file.
- v1.1.020 supports PIVOT expression besides column.
- v1.1.019 supports [START WITH initial-condition] CONNECT BY [NOCYCLE] recurse-condition. level is a pseudo column that can be used in hierarchical queries.
- v1.1.002 supports CREATE VIEW and DROP VIEW.

2011-04-05 Cobol v1.1 JDBC1.2 Package(891KB) JDBC2.0 Package(927KB) JDBC3.0 Package(972KB) JDBC4.0 Package(1065KB)

- It supports AcuCobol relative file since v1.0.023.
- It supports MicroFocus VB sequential file, and MicroFocus VB relative file since v1.0.018.
- It parse COPY and REPLACE since v1.0.011.
- SELECT ... FOR UPDATE will lock all the selected rows for transaction until transaction commit or rollback even if you close that ResultSet since v1.0.010.
- SELECT ... FOR UPDATE will lock all the selected rows so that other users cannot lock or update

the rows until you close that ResultSet since v1.0.008.

2010-08-15 Cobol v1.0 JDBC1.2 Package(859KB) JDBC2.0 Package(895KB) JDBC3.0 Package(937KB)
JDBC4.0 Package(1026KB)

- supports create/query/update Cobol data file.
- supports retrieve record layout according Cobol Copybook file and Cobol source program.
- supports ASCII encoding (PC Cobol), and EBCDIC encoding (IBM mainframe).
- supports seamlessly url(http, ftp) database in jdbc url and sql.
- supports seamlessly memory-only database in jdbc url and sql for internal data processing, applets, or certain special applications.
- supports seamlessly files and directories in ZIP, GZIP, TAR and BZ2 file formats(.ZIP, .JAR, .TAR, .BZ2, .TGZ, .TAR.GZ, .TAR.BZ2) in jdbc url and sql.
- supports all of four transaction levels.
- supports CREATE DATABASE, CREATE CATALOG, CREATE TABLE, DROP TABLE, RENAME TABLE, SELECT, INSERT, UPDATE, and DELETE sql.
- Development Documentation is available.
- supports JDBC4.0, JDBC3.0, JDBC2.0 and JDBC1.2.

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Chapter 6. SQL Syntax

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Use ";" to separate multi sql statements. "reserved word" or {v 'reserved word'} is used to quote a column with reserved word name in SQL statement. The HXTT Cobol supports using DATE, TIME, TIMESTAMP, GROUP, ORDER, KEY, DESC, SEQUENCE, INCREMENT, MINVALUE, MAXVALUE, CACHE, CHECK, CYCLE, OTHER, SET, INT, UNIQUE, LEVEL, RELEASE, INDEX, TOP, PACK, CALL, CONNECT, START, PRIMARY, COMMENT, TRANSACTION, REFERENCES, and UPDATE directly in SQL, although they're reserved words too.

```
SELECT [ALL | DISTINCT [ ON ( expression [, ...] ) ] ] | DISTINCTROW [TOP n [PERCENT]] select_list [INTO
variable [, ...] | INTO OUTFILE 'outfileName'] FROM table_reference_list [WHERE condition_expression] [[START
WITH initial-condition] CONNECT BY [NOCYCLE] recurse-condition] [group_by_clause] [HAVING
condition_expression] [union_clause] [order_by_clause] [LIMIT [offset,] [limit] ] [FOR UPDATE]
```

`select_list`: { expression [[AS] columnAlias] | table.* | * } [...]

`table_reference_list`: {table_reference | table_join} [...]

`table_reference`: { { table_name | subquery | (table_join) | (VALUES expression[, ...]) AS
tableName(columnName[,...]) } [[AS] tableAlias] } [pivot_clause] [unpivot_clause]

`table_name`: { [catalog.]tableName } | {UNC path}

`table_join`: table_reference join_clause [join_clause,...]

`join_clause`: [NATURAL] { INNER | { [LEFT | RIGHT | FULL] [OUTER] } } JOIN table_reference [ON
condition_expression | USING(column1,column2,...)]

`condition_expression`: an expression which should return a boolean value.

`pivot_clause`: PIVOT (aggregate_function(value_column) FOR pivot_expr IN (column_list)) [AS] tableAlias

`unpivot_clause`: UNPIVOT (value_column FOR pivot_column IN (column_list)) [AS] tableAlias

`group_by_clause`: GROUP BY expression [...] [WITH ROLLUP | CUBE]

`union_clause`: { UNION | INTERSECT | EXCEPT | MINUS } [ALL] select_statement [union_clause ...]

`order_by_clause`: ORDER BY expression [ASC|DESC] [...]

DISTINCT specifies that duplicate rows are discarded. A duplicate row is when each corresponding `select_list` column has the same value. **DISTINCT** has no effect on constant value, and pseudo columns(`_rowid_`).

expression: a complicated expression which can include parentheses, logical operator(NOT, AND, OR), positives/minus sign(+, -), arithmetical operator(+,-,*,/,%), string operator(|| (left string concat right string), +(left string concat right string), -(trim left string then concat rightstring), \$(check whether left string is contained in right string), comparison operator(>, >=, =, ==, <=, <, !=, <>), bitwise logical operator(&, |, ~, ^, <<, >>), [NOT] LIKE pattern {escape 'escape_character'},[NOT] ILIKE pattern {escape 'escape_character'}, IS [NOT] NULL, BETWEEN ... AND ..., [NOT] IN, [NOT] EXISTS, [ALL|ANY|SOME] (subquery), [NOT] CASE WHEN expr THEN result [WHEN expr THEN result ...] [ELSE expr] END, CASE expr WHEN compare_expr THEN result [WHEN compare_expr THEN result ...] [ELSE result] END, SQL Escape Syntax({d 'yyyy-mm-dd'}, {t 'hh:mm:ss'}, {ts 'yyyy-mm-dd hh:mm:ss.f...'}, {v 'reserved_word'}, {fn functionExpression}, {escape 'oneEscapeCharacter'}, {"varbinary" 'string'}), function(more than 200), aggregate function(MAX, MIN, AVG, COUNT, SUM, STD, STDDEV), constant(null, true, false, CURRENT_DATE, CURRENT_TIME, CURRENT_TIMESTAMP, date, time, timestamp, number, string), column, parameter(?), subquery(single-row subquery, multirow subquery, multiple-column subquery, inline views, correlated subquery) and so on.

"SELECT `select_list`" can be used to get some calculated values through an one-row ResultSet. Column can be used in all sql except for "SELECT `select_list`". Parameter(?) can only be used in PreparedStatement.

For instance:

```
select val('123.222')
SELECT top 8 percent * FROM data.sz9010;
select distinct top 10 * from test where not deleted() order by int1,char1 desc;
select int1,float1 from test where int1>0 group by int1,double1;
select distinct on (int1) int1,double1 from test;
select sum(int1),max(dec1),min(double1) from test;
SELECT SUM(apmast.fnamount), SUM(glcshi.fnadjamt),SUM(glcshi.fncashamt),SUM(glcshi.fndiscount)
```

```

FROM apmast, glcshi WHERE apmast.fcinvoice +apmast.fvendno = glcshi.fcinvoice + glcshi.fcnameid
AND apmast.fduedate between {d '1999-01-01'} AND {d '1999-11-30'} AND apmast.finvdate <= {d
'1999-11-30'};
SELECT cellID, columnID, reference, function, parameter FROM repLayout WHERE reportID = '1' AND
rowID = 0 ORDER BY columnID;
select distinct int1,double1 from test group by int1,double1,float1;
select distinct * from test where int1>0
select distinct int1,count(*),sum(int1) from brain.user group by int1
SELECT date1,time1,int1 FROM test where TIMESTAMPDIFF(SQL_TSI_YEAR,time1,{ts '3999-03-24
00:59:23.22222'})<-2000 and date1>{d '1900-01-01'} and date1>{d '1960-01-01'} and date1<{d '2000-01-
02'}+20;
select int1 as a,c+23 as b,a+b as c from test where a=1;
SELECT INT1,FLOAT1,A.* FROM TEST A WHERE {fn abs(-TEST.INT1)}>0 or a.float1<0 order by
int1 asc,currency1,double1*5+int1 desc;
select int1,count(*),sum(int1+count(*)),sum(int1)+int1 from test group by int1 having int1>10;
SELECT SCHOOLNUM, STULINK,CHGNUMBER, {v 'ABSENS$0101'}, {v 'ABSENS$0102'},
USERSTAMP, DATESTAMP, {v 'TIMESTAMP'},SEQUENCE FROM AATD2019 where {v
'ABSENS$0101'}='1234' ORDER BY SCHOOLNUM, STULINK, SEQUENCE;
select char1,char1 like 'Z%',char1 in('ZZAA','Z'),char1 between 'A' and 'ZZZ',char1 in('ZZAA','Z') or char1
between 'A' and 'Z',* from test where char1='Z';
select int1 from test where int1=(select distinct top 1 int1 from test where int1>0);
select int1 from test where int1 in(select int1 from test where not deleted());
select recno(),int1 from test where (recno(),int1) in(select top 2 recno(),int1 from test where int1>0);
select subquery.int1,recno('subquery') from (select top 2 recno(),int1 from test where int1>0) as subquery;
select subquery.int1,recno('test'),test.int1,recno('subquery') from (select top 2 recno(),int1 from test where
int1>0) as subquery, test where test.int1=subquery.int1;
ELECT INT1 FROM test as a WHERE EXISTS(SELECT 1 FROM test WHERE int1 >0);
SELECT INT1 FROM test as a WHERE int1>=all(SELECT int1 FROM test);
SELECT INT1 FROM test as a WHERE int1>=any(SELECT int1 FROM test);
SELECT INT1 FROM test as a WHERE int1>=some(SELECT int1 FROM test);
select int1,recno() from test where (int1,recno())>(3,5);
select int1,recno() from test where (recno(),int1)=(6,222);
SELECT * FROM (SELECT * FROM test WHERE int1 = 222 ) as a WHERE EXISTS(SELECT 1 FROM
test WHERE int1 >0);
select recno('a'),recno('b'),a.int1,a.char1,b.int1,b.char1 from test a, test as b where recno('a')=recno('b');
select a.int1,a.char1,b.int1,b.char1 from test a inner join test as b on a.int1=b.int1;
select a.int1,a.char1,b.int1,b.char1 from test a NATURAL inner join test as b on a.int1=b.int1;
select recno('a'),recno('b'),a.int1,a.char1,b.int1,b.char1 from test a left join test as b on a.int1=b.int1;
select a.int1,a.char1,b.int1,b.char1 from test a right join test as b on a.int1=b.int1;
select a.int1,a.char1,b.int1,b.char1 from test a full join test as b on a.int1=b.int1;
select recno('a'),recno('b'),a.int1,a.char1,b.int1,b.char1 from test a full join test as b on a.int1==b.int1 and
recno('a')!=recno('b');
SELECT * FROM test a LEFT JOIN (test b JOIN test c ON (b.int1 = c.int1)) as d ON (a.int1 = d.int1);
SELECT * FROM test a,test b,test c WHERE a.int1 = b.int1 AND b.int1 = c.int1;
SELECT * FROM test a NATURAL CROSS JOIN test b CROSS JOIN test c WHERE a.int1 = b.int1
AND b.int1 = c.int1;
SELECT * FROM test a LEFT JOIN (test b JOIN test c ON (b.int1 = c.int1)) on recno('a')=recno(2);
SELECT int1 FROM test where int1>0 UNION ALL select int1 from test where int1>3000 order by int1
desc
SELECT int1,* FROM test where int1>0 UNION select int1,* from test where int1>3000 order by int1
ELECT int1,* FROM test where int1>0 INTERSECT all select int1,* from test where int1>3000 order by
int1;
SELECT int1,* FROM test where int1>0 EXCEPT select int1,* from test where int1>3000 order by int1
desc

```

```

SELECT int1,* FROM test where int1>0 MINUS select int1,* from test where int1>3000 order by
int1,double1 desc;
select double1,sum(double1),int1 from test where int1>0 group by int1 having sum(double1)>0 and
double1>0;
select distinct l,a.int1,sum(a.int1) from test as a,test as b group by a.int1,B.int1
select a.int1,a.char1,b.int1,b.char1 from test a NATURAL inner join test as b
select * from (select 'ab5' as a) where a like '%[a-c][^ac][12345]'
select lpad(' ',2*(level-1)) || str(child) s from test_connect_by start with parent=0 connect by prior child =
parent;

```

```

INSERT INTO table_name [ [AS] tableAlias] [ ( column_identifier [,...] ) ] { VALUES ( expression [, ...] ) | VALUES
expression [, ...] | VALUES ( expression [, ...] ),... | SELECT query | ? }

```

```
column_identifier = columnName | "reserved_word" | {v 'reserved_word'}
```

Adds one or more new rows of data into a table. SQL doesn't permit that table1 is the same table as table2 when INSERT INTO table1 select * from table2, but the HXTT Cobol support such an unadvisable operation, for example, INSERT INTO test (INT1,DATE1) select distinct int1,date1 from test.

For instance:

```

INSERT INTO test (INT1,dec1,time1) VALUES(-1999,-222.33333,{ts '1333-11-30
22:22:22.999999999'});
INSERT INTO test ("INT1","DATE1") VALUES(1999.0111,{d '1996-10-21'});
INSERT INTO test ("INT1","DATE1") VALUES(1999.0111,{d '1996-10-21'}),(333,{d '2006-10-21'});
INSERT INTO test ("INT1") VALUES 1999.0111,333;
insert into ecode values('Maciej', 'Kowalski');
insert into test values (reccount()+1,'abc',date(),{ts '2003-12-18 19:42:17.88'});
INSERT INTO AATD2019 ({v 'ABSEN$0101'}) values('1234');
insert into test select * from test order by int1 asc;
insert into test select * from test order by int1 asc;

```

```

UPDATE table_name [ [AS] tableAlias] SET [column_identifier | (column_identifier,...) ] = expression [,...] [WHERE
condition_expression]

```

For instance:

```

update order set buyer=(SELECT name FROM user WHERE user.id = order.buyerid);
update test set int1=null where SequenceID=26;
update test set INT1=323232,DEC1=-DEC1 where FLOAT1=3.00 and INT1=222 and DEC1=3.00 and
DOUBLE1=34.0 and TIME1 is NULL and CHAR1='ZZAA' and CURRENCY1=0 and BOOLEAN1 is
NULL
update AATD2019 set {v 'ABSEN$0101'}='1234' where SequenceID=1;
update test set int1=3333555 where exists(SELECT 1 FROM test WHERE int1 = 222 ) and
SequenceID=3;
UPDATE "UIP_Target" SET ("key_string","key_int","data_string","data_int","data_decimal" ) =
(SELECT COALESCE(DP3475."key_string",
"UIP_Target"."key_string"),COALESCE(DP3475."key_int",
"UIP_Target"."key_int"),COALESCE(DP3475."data_string",
"UIP_Target"."data_string"),COALESCE(DP3475."data_int",
"UIP_Target"."data_int"),COALESCE(DP3475."data_decimal", "UIP_Target"."data_decimal") FROM
DP3475 WHERE "UIP_Target"."key_string"=DP3475."KEY208" AND
"UIP_Target"."key_int"=DP3475."KEY572");
UPDATE "UIP_Target" SET ("key_string","key_int","data_string","data_int","data_decimal" ) =
(SELECT COALESCE(DP3475."key_string",

```

```
"UIP_Target"."key_string"),COALESCE(DP3475."key_int",
"UIP_Target"."key_int"),COALESCE(DP3475."data_string",
"UIP_Target"."data_string"),COALESCE(DP3475."data_int",
"UIP_Target"."data_int"),COALESCE(DP3475."data_decimal", "UIP_Target"."data_decimal") FROM
DP3475 WHERE "UIP_Target"."key_string"=DP3475."KEY208" AND
"UIP_Target"."key_int"=DP3475."KEY572") WHERE EXISTS (SELECT 'X' FROM DP3475 WHERE
"UIP_Target"."key_string"=DP3475."KEY208" AND "UIP_Target"."key_int"=DP3475."KEY572")
UPDATE "UIP_Target" SET ("data_string","data_int","data_decimal" ) = (date(),789,44.5) WHERE
EXISTS (SELECT 'X' FROM DP3475 WHERE "UIP_Target"."key_string"=DP3475."KEY208" AND
"UIP_Target"."key_int"=DP3475."KEY572")
```

DELETE FROM table_name [[AS] tableAlias] [WHERE condition_expression]

Removes rows in a table according to condition_expression.

For instance:

```
delete from test where SequenceID=4;
```

CREATE CATALOG [IF NOT EXISTS] catalogName

Create a subdirectory to contain database files.

For instance:

```
create catalog if not exists data222;
```

CREATE DATABASE [IF NOT EXISTS] compressed-file-name ?

CREATE DATABASE [IF NOT EXISTS] compressed-file-name ?" sql can be used to create a database from any compressed java.io.InputStream object. Sample is [here](#).

DROP DATABASE [IF EXISTS] compressed-file-name

The DROP DATABASE statement is used to delete a database. IF that database doesn't exist without using IF EXIST, an SQLException will be thrown.

CREATE TABLE [IF NOT EXISTS] table_name [(column_identifier data_type [constraint] [,...] [, constraint_clause [,...]])] [[AS] SELECT query | ?]

data_type: CHAR(n) | CHARACTER(n) | VARCHAR[(n)] | BINARY (n) | VARBINARY (n) | NUMERIC(n1[,n2]) | DEC[IMAL](n1[,n2]) | INT[EGER] [AUTO_INCREMENT] | SMALLINT | FLOAT [(n)] | REAL | DOUBLE | BIT | BOOLEAN | DATE [(dateFormat)] | TIME [(dateFormat)] | TIMESTAMP [(dateFormat)] | LONGVARCHAR [(n)] | LONGVARBINARY [(n)] | JAVA_OBJECT [(n)] | CLOB | BLOB | OTHER(type_name [,n]) | NUMBER[(n1[,n2])]

n, n1,n2: positive integer, n2 can be 0

constraint: [NULL| NOT NULL] [UNIQUE] [DEFAULT expression] [PRIMARY KEY] [COMMENT 'string']

constraint_clause: [CONSTRAINT constraint_name] PRIMARY KEY (column1, column2, . column_n) | CONSTRAINT constraint_name FOREIGN KEY (column1, column2, ... column_n) REFERENCES parent_table (column1, column2, ... column_n) [ON DELETE CASCADE] [ON UPDATE CASCADE] | [CONSTRAINT constraint_name] UNIQUE (column1, column2, . column_n) | CONSTRAINT constraint_name CHECK (column_name condition)

Temporary table is only visible in the current connection.

The HXTT Cobol will create a Cobol Copybook file for Cobol's compatibility, and use PICTURE clause to describe the record layout.

SQL Data Types for Create Table

SQL Type	PIC string	Size in table	SQL Syntax	Java Type
CHARACTER	PIC 999 USAGE PACKED-DECIMAL	3	CHAR[ACTER]	char
CHAR	PIC X(n)	n	CHAR[ACTER] (n)	String
VARCHAR	PIC X(n)	n	VARCHAR (n)	String
LONGVARCHAR	PIC X(256)	256	LONGVARCHAR (n)	String, char[], java.sql.CLOB
	PIC X(n)	n		
NUMERIC	PIC -9(m).9(d) USAGE DISPLAY	n	NUMERIC [(n[,d])]	java.math.BigDecimal
DECIMAL	PIC -9(m).9(d) USAGE DISPLAY	n	DEC[IMAL] [(n[,d])]	java.math.BigDecimal
BIT	PIC 9 USAGE DISPLAY	1	BIT	boolean
TINYINT	PIC S999 USAGE BINARY	2	TINYINT	byte
SMALLINT	PIC S9(5) USAGE PACKED-DECIMAL	3	SMALLINT	short
INTEGER	PIC S9(9) USAGE BINARY	4	INT[EGER]	int
BIGINT	PIC S9(18) USAGE BINARY	8	BIGINT	long
REAL	PIC COMP-1	4	REAL	float
FLOAT	PIC COMP-2	8	FLOAT [(d)]	double
DOUBLE	PIC COMP-2	8	DOUBLE	double
BINARY	PIC X(n)	n	BINARY (n)	byte[]
VARBINARY	PIC X(n)	n	VARBINARY (n)	byte[]
LONGVARBINARY	PIC X(256)	256	LONGVARBINARY (n)	byte[], java.sql.BLOB
	PIC X(n)	n		
DATE	PIC A(10)	10	DATE	java.sql.Date
TIME	PIC A(8)	8	TIME	java.sql.Time
TIMESTAMP	PIC A(19)	19	TIMESTAMP	java.sql.Timestamp
BOOLEAN	PIC 9 USAGE DISPLAY	1	BOOLEAN	boolean
BLOB	Unavailing, map into PIC X(256)		BLOB	byte[], java.sql.BLOB, Object
CLOB	Unavailing, map into PIC X(256)		CLOB	String, char[], java.sql.CLOB
OTHER	PIC COMP-2	8	OTHER (Currency)	java.math.BigDecimal
JAVA_OBJECT	Unavailing, map into PIC X(256)		JAVA_OBJECT	byte[] or Object

JSON	Unavailing, map into PIC X(1024)		JSON	JavaScript Object Notation (JSON)
JSONB	Unavailing, map into PIC X(1024)		JSONB	JavaScript Object Notation (JSON)
XML	Unavailing, map into PIC X(1024)		XML	XML object
ARRAY	Unavailing, map into OCCURS n TIMES		ARRAY	Object[]

For instance:

`DROP TABLE [IF EXISTS] table_name`

Removes a table, and its indexes from the database. IF that table doesn't exist without using IF EXIST, an SQLException will be thrown.

For instance:

```
drop table if exists states;
```

`ALTER TABLE table_name alter_specification [...]`

alter_specification: {{ADD|MODIFY} column_identifier data_type [constraint]} | DROP column_identifier | RENAME column_identifier 1 TO column_identifier 2 | RENAME TO table_name2 | ADD constraint_clause

When some alter operations are in one ALTER sql, the HXTT Cobol will complete all RENAME column operations first, then do all ADD, MODIFY, AND DROP column operations at one time, and RENAME table is the last operation.

For instance:

```
alter table test rename int1 to int1;
alter table test rename int1 to int2, rename to test22;
alter table test22 rename to test;
alter table test add column1 int DEFAULT 3 NULL, drop clob1, modify double1 int;
```

`TRUNCATE TABLE [IF EXISTS] table_name`

Remove all table rows.

For instance:

```
truncate table test;
```

`PACK TABLE [IF EXISTS] table_name`

pack the table.

For instance:

```
pack table test;
```

`RENAME TABLE table_name TO table_name2`

Rename the table.

For instance:

```
RENAME table test to test1;
```

LOCK TABLE table_name

lock the table. Returns 1 if success, 0 if failed to lock a table.

For instance:

```
lock table test;
```

UNLOCK TABLE table_name

unlock the table. Returns 1 if success, 0 if failed to unlock a table.

For instance:

```
unlock table test;
```

CREATE [UNIQUE] INDEX [IF NOT EXISTS] indexName[(keylength)][,...] [OF indexFileName] ON tableName (expression [UNIQUE] [PRIMARY KEY] [ASC|DESC] [FOR expression][,...])

Create an index file which can contains one or more index expressions for a table. The HXTT Cobol will utilize index when condition_expression contains indexed expression.

For instance:

DROP INDEX [IF EXISTS] {ALL | indexName[,...]} [of indexFileName] ON table_name

Removes the specified index from the database.

For instance:

```
drop index all on test;
```

REINDEX {ALL | indexFileName[,...]} ON table_name

Rebuild the specified index.

For instance:

```
reindex all on test;
```

CREATE [OR REPLACE] [TEMP | TEMPORARY] VIEW table [(column_identifier [,...])] [AS] SELECT query

Creates a virtual table whose contents (columns and rows) are defined by a query. Temporary view is only visible in the current connection.

For instance:

```
create or replace temporary view abcv (aaa) select FEC_ANAL FROM ANALISIS;
```

DROP VIEW [IF EXISTS] table

Drop a virtual table.

For instance:

```
drop view if exists abcv;
```

```
CREATE SEQUENCE [IF NOT EXISTS] sequence_name [AS {INT|SMALLINT|TINYINT|BIGINT}] [START
[WITH] n] [INCREMENT [BY] n] [MINVALUE n | NO MINVALUE] [ MAXVALUE n | NO MAXVALUE ] [
CACHE n | NO CACHE] [ [ NO ] CYCLE ]
```

sequence_name: [catalog.]sequenceName

The optional clause START WITH n allows the sequence to begin anywhere. The default starting value is minvalue for ascending sequences and maxvalue for descending ones. The optional clause INCREMENT BY n specifies which value is added to the current sequence value to create a new value. A positive value will make an ascending sequence, a negative one a descending sequence. The default value is 1. The optional clause MINVALUE n determines the minimum value a sequence can generate. If this clause is not supplied or NO MINVALUE is specified, then defaults will be used. The defaults are 1 and -128(-32768,0x80000000,0x8000000000000000L) for ascending and descending sequences, respectively. The optional clause MAXVALUE n determines the maximum value for the sequence. If this clause is not supplied or NO MAXVALUE is specified, then default values will be used. The defaults are 127(32767,0x7fffffff,0x7fffffffL)and -1 for ascending and descending sequences, respectively. The optional clause CACHE cache specifies how many sequence numbers are to be preallocated and stored in memory for faster access. The minimum value is 1 (only one value can be generated at a time, i.e., no cache), and this is also the default. The maximum value for cache is 65535. The CYCLE option allows the sequence to wrap around when the maxvalue or minvalue has been reached by an ascending or descending sequence respectively. If the limit is reached, the next number generated will be the minvalue or maxvalue, respectively. If NO CYCLE is specified, any calls to nextval after the sequence has reached its maximum value will throw an exception. If neither CYCLE or NO CYCLE are specified, NO CYCLE is the default.

For instance:

```
create sequence if not exists userID start WITH 100 increment by 2 maxvalue 2000 cache 5 cycle;
```

```
DROP SEQUENCE [IF EXISTS] sequence_name
```

Removes a sequence from the database. IF that sequence doesn't exist without using IF EXIST, an SQLException will be thrown.

For instance:

```
drop sequence if exists userID;
```

```
ALTER SEQUENCE sequence_name [AS {INT|SMALLINT|TINYINT|BIGINT}] [RESTART [WITH] n]
[INCREMENT [BY] n] [MINVALUE n | NO MINVALUE] [ MAXVALUE n | NO MAXVALUE ] [ CACHE n | NO
CACHE] [ [ NO ] CYCLE ]
```

ALTER SEQUENCE changes the parameters of an existing sequence generator. Any parameter not specifically set in the ALTER SEQUENCE command retains its prior setting.

For instance:

```
alter sequence userID restart WITH 100 increment by 1 maxvalue 5000;
```

```
SET TRANSACTION transaction_mode [, ...]
```

transaction_mode: { ISOLATION LEVEL {READ UNCOMMITTED | READ COMMITTED | REPEATABLE READ | SERIALIZABLE } | { READ WRITE | READ ONLY } }

Sets the transaction characteristics of the current transaction. It effects any subsequent transactions in the same connection. `java.sql.Connection.setTransactionIsolation(int level)` and `java.sql.Connection.setReadOnly(boolean readOnly)` can do the same task.

For instance:

```
SET TRANSACTION ISOLATION LEVEL SERIALIZABLE;
```

```
START TRANSACTION [ transaction_mode [, ...] ]
```

Begins a new transaction block. `java.sql.Connection.setAutoCommit(false)`, `java.sql.Connection.setTransactionIsolation(int level)`, and `java.sql.Connection.setReadOnly(boolean readOnly)` can do the same task.

For instance:

```
START TRANSACTION;
```

```
COMMIT [WORK]
```

Terminates the current transaction and makes all changes under the transaction persistent. It commits the changes to the database. `java.sql.Connection.commit()` can do the same task.

For instance:

```
commit;
```

```
ROLLBACK [WORK] [ TO [ SAVEPOINT ] savepoint_name]
```

Without `savepoint_name`, terminates the current transaction and rescinds all changes made under the transaction. It rolls back the changes to the database. With `savepoint_name`, rolls back all commands that were executed after the savepoint was established. `java.sql.Connection.rollback()` can do the same task of `ROLLBACK [WORK] sql`.

For instance:

```
rollback;
```

```
SAVEPOINT savepoint_name
```

`SAVEPOINT` establishes a new savepoint within the current transaction. `java.sql.Connection.setSavepoint(String name)` and `java.sql.Connection.setSavepoint()` can do the same task.

For instance:

```
savepoint t1;
```

```
RELEASE SAVEPOINT savepoint_name
```

Destroys a savepoint previously defined in the current transaction. `java.sql.Connection.releaseSavepoint(Savepoint savepoint)` can do the same task.

For instance:

```
release savepoint t1;
```

```
{ [ ? = ] call procedure_name [ ( ? [, ? [, ... ] ] ) ] }
```

java.sql.CallableStatement can be used to call stored procedure.

For instance:

```
{call myview(?)};
```

Pseudo Tables

The INFORMATION_SCHEMA implementation include SCHEMATA, TABLES, COLUMNS, and DATABASES.

For instance,

```
SELECT TABLE_SCHEMA FROM INFORMATION_SCHEMA.SCHEMATA;
SELECT * FROM INFORMATION_SCHEMA.TABLES WHERE TABLE_TYPE='TABLE';
SELECT * FROM INFORMATION_SCHEMA.TABLES WHERE TABLE_TYPE='TABLE' AND
TABLE_SCHEMA='SCHEMA-NAME';
SELECT column_name,data_type,column_default,is_nullable FROM information_schema.tables AS t JOIN
information_schema.columns AS c ON t.table_catalog=c.table_catalog AND t.table_schem=c.table_schem AND
t.table_name=c.table_name WHERE t.table_name='TABLE-NAME';
SELECT column_name, data_type, character_maximum_length, numeric_precision, column_default, is_nullable
FROM information_schema.tables as t JOIN information_schema.columns AS c ON t.table_catalog=c.table_catalog
AND t.table_schem=c.table_schem AND t.table_name=c.table_name WHERE c.table_schema='TABLE-SCHEMA'
AND c.table_name='TABLE-NAME';
```

The INFORMATION_PARSER.sql provides SQL syntax analysis feature. For instance,

```
        sql = "SELECT * FROM INFORMATION_PARSER.sql WHERE SQL_COMMAND = ? and
OBJECT_TYPE='TABLE'";
        sql = "SELECT SQL_TYPE,OBJECT_TYPE,OBJECT_NAME FROM INFORMATION_PARSER.SQL WHERE
SQL_COMMAND= ?";

        pstmt = con.prepareStatement(sql);

        pstmt.setString(1, "select * from a.test out; SELECT efg,3+2 as dd FROM ABC;update a
set a=3;");
        //        pstmt.setString(1, "select EFG from a.test, test2 where test.b=test2.c");
        //        pstmt.setString(1, "select EFG from (select * from abc);select EFG from (select *
from abc) as o;");
        //        pstmt.setString(1, "select EFG from a.test left join test2 where test.b=test2.c;
SELECT A FROM B UNION SELECT C FROM D;");
        ResultSet rs = pstmt.executeQuery();
```

Pseudo Columns

rowid, is a pseudo column as primary key. A _rowid_ identifies a row in a table.

level is a pseudo column that can be used in hierarchical queries (start with .. connect by). For records that appear in the root, level is 1, for their (direct) children, level is 2 and so on.

Pseudo Variable

CURRENT_DATE is a pseudo variable which returns the current date.

CURRENT_TIME is a pseudo variable which returns the current time.

CURRENT_TIMESTAMP is a pseudo variable which returns the current timestamp.

CURRENT is a pseudo catalog(or schema name) which returns the current catalog (or schema).

Split Multivalue Column Into Rows

If each row has multiple multi value columns, a special subquery table can be used in special join sql. For instance,

```
select User,Role from aTable,(select split(aTable.Roles,',') as Role) AS bTable;
```

```
select User,Role,Year from aTable,(select split(aTable.Roles,',') as Role,split(aTable.Years,',') as Year) AS bTable;
```

```
DECLARE variable_name[,...] type [DEFAULT expression]
```

```
DECLARE var_name[,...] 'jsonText'
```

Variable is visible only in the same connection.

For instance:

```
DECLARE abc CHAR(20) DEFAULT 'Hello';
DECLARE x, y INT;
DECLARE _Page_Demo '{"size":"A4","rotate":0}';
select _Page_Demo; select _Page_Demo.size;
```

```
SET variable_name[.propertyName] = expression [,...]
```

expression can be a complicated expression. BTW, INTO variable[,...] clause of SELECT syntax can set selected columns directly into variables.

For instance:

```
SET x = 1+int(55.5),y=2;
SELECT name,id INTO x,y FROM table1 WHERE id=33;
SELECT date(),pi() INTO x,y;
SELECT id,data INTO x,y FROM test.t1 LIMIT 1;
set _Page_Demo.size='A2';
```

Comment Syntax

#one-line comment

--one-line comment

/*multiline comment*/

For instance:

```
select * /* column list */ from test;#This is a select sql.
```

SQL States

SQL State	Description
01001	Cursor operation conflict
01427	single-row subquery returns more than one row
01428	single-column subquery returns more than one column
01429	subquery returns mismatch column number
01436	CONNECT BY loop in user data
01430	single-row subquery returns none row
07006	Restricted data type attribute violation

08000	Connection exception
08003	Connection not open
08007	Connection failure during transaction
08S01	Remote database access failure
0A000	Feature not supported
0A001	Multiple server transactions
21S01	Insert value list does not match column list
22000	Data exception
22019	Invalid escape character
22023	Invalid parameter value
23000	Integrity constraint violation
24000	Invalid cursor state
25000	Invalid transaction state
26000	Invalid SQL statement name
28000	Access denied error
2A000	Direct SQL syntax error or access rule violation
2D000	Invalid transaction termination
2E000	Invalid connection name
34000	Invalid cursor name
34102	Invalid variable name
34103	Invalid function name
34104	Invalid index file name
3C000	Duplicate cursor name
3D000	Invalid catalog name
3F000	Invalid schema name
40000	Transaction rollback
42000	Syntax error or access violation
42001	Syntax error
42002	Access violation
42003	Statement has been closed
60000	System errors
99999	Catch all others
C0100	Unknown CodePageID
C0101	Unknown File Format
C0102	Unknown Table Version
C0103	Unknown Index Version
C0104	Corrupt Index File
C0105	Invalid Record Number
C0106	Convert dirty data into null value
S0001	Base table or view already exists

S0021	Index already exists
S0022	Column not found
S1002	Invalid column number
S1009	Invalid Argument value
S1T00	Timeout expired
HY008	Operation canceled

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Chapter 2. Installation

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System Requirements

HXTT Cobol packages include a Type 4 JDBC driver. Type 4 indicates that the driver is written in Pure Java, and communicates in the database system's own network protocol. Because of this, the driver is platform independent; once compiled, the driver can be used on any system. HXTT Cobol can run on any platforms with Java VM, which includes Microsoft Windows, Novell Netware, OS2, UNIX, and LINUX. HXTT Cobol supports Personal Java, JDK1.0.X, JDK1.1.X, JDK1.2.X, JDK1.3.X, JDK1.4.X, JDK1.5.X, JDK1.6.X, JDK1.7.X, JDK1.8.X, and JDK1.9.X. HXTT Cobol includes a database engine which can support multi-user access. It supports { UNION | INTERSECT | EXCEPT | MINUS } [ALL] query , INNER JOIN, FULL JOIN, LEFT JOIN, RIGHT JOIN, NATURAL JOIN, CROSS JOIN, and subquery which includes single-row subquery, multirow subquery, multiple-column subquery, inline views, and correlated subquery.

Setting the CLASSPATH

When java loads any class, it searches a list known as the classpath. This is a list of directories where classes are placed, or a list of jar files (archives containing classes and other resources) or both. HXTT Cobol driver is a Type 4 driver. You can do this in many different methods, but the most command are:

1. Setting the CLASSPATH environment variable.
2. putting it on the command line using the -cp parameter.
3. placing it in the JVM's lib/ext directory.
4. extract all files in jar file into the directory of your application.

You can know detailed information about "Setting the Classpath" from your JDK Tools and Utilities. Let's use JDBC4.0 package as a simple sample. To put Cobol_JDBC40.jar into your class path, you should use "export CLASSPATH=/usr/share/lib/Cobol_JDBC40.jar:\$CLASSPATH" on Solaris and Linux, and "SET CLASSPATH=\\javalib\Cobol_JDBC40.jar;%classpath%" on Windows.

Loading the Driver

Any source that uses JDBC needs to import the java.sql package by using " import java.sql.*;".

HXTT Cobol driver' name is **com.hxtt.sql.cobol.CobolDriver**, and you can uses it without involving hard coding the driver into your code. You do this by setting the jdbc.drivers system property. For example, for command line apps you can use:

```
java -Djdbc.drivers=com.hxtt.sql.cobol.CobolDriver yourApp
```

Then, the JVM upon startup will load the drivers automatically. Some applications (JBoss, Tomcat etc) support a .properties file which they use to save putting this on the command line.

The second method is the most common and involves you loading the driver yourself. It's simple:

```
Class.forName("com.hxtt.sql.cobol.CobolDriver");
```

From then on you can get connections from DriverManager.

Note: If Class.forName() throws ClassNotFoundException, you should check your classpath.

Connecting to the Database

After the driver has been registered with the DriverManager, you can obtain a Connection instance that is connected to a particular database by calling DriverManager.getConnection(). With JDBC, a database is represented by a URL (Uniform Resource Locator).

```

Embedded:
    jdbc:cobol:[///][DatabasePath][?prop1=value1[;prop2=value2]] (You can omit that
"//" characters sometimes)
    For example:
        "jdbc:cobol:/"
        "jdbc:cobol:/c:/data" for Windows driver
        "jdbc:cobol:///c:/data" for Windows driver
        "jdbc:cobol:///usr/data" for unix or linux
        "jdbc:cobol://192.168.10.2/sharedir" for UNC path
        "jdbc:cobol:/./data"
Remote Access (client/server mode):
    jdbc:cobol://host:port/[DatabasePath]
    For example: "jdbc:cobol://domain.com:3099/c:/data" if one CobolServer is
run on the 3099 port of domain.com
Compressed Database:(.ZIP, .JAR, .GZ, .TAR, .BZ2, .TGZ, .TAR.GZ, .TAR.BZ2)
    jdbc url format is the same as embedded url and remote url.
    For example:
        "jdbc:cobol:/c:/test/testcobol.zip
Memory-only Database:
    jdbc:cobol:/_memory_/
URL Database:(http protocol, https protocol, ftp protocol, sftp protocol)
    jdbc:cobol:http://httpURL
    jdbc:cobol:https://httpsURL
    jdbc:cobol:ftp://ftpURL
    jdbc:cobol:sftp://sftpURL
    For example:
        "jdbc:cobol:http://www.hxtt.com/test" //Note: FTP site's
user/password should be set in ftpURL, and cannot be set in JDBC connection property because
user/password JDBC connection property belongs to server/client connection.
        "jdbc:cobol:sftp://testa:123456@localhost"
SAMBA Database:(smb protocol)
jdbc:cobol:smb://[[[domain;]username[:password]@]server[:port]/[[share/[dir/]file]]][?
[param=value]]
    For example:
        "jdbc:cobol:smb://test1:123@100.100.13.94/cobolfiles/zone" //Note:
SAMBA user/password should be set in SMB url, and cannot be set in JDBC connection property because
user/password JDBC connection property belongs to server/client connection.
UNC path JDBC url:
    jdbc:cobol:/uncpath
    jdbc:cobol:///uncpath
    For example:
        "jdbc:cobol://PC17\c$\values"
        "jdbc:cobol://PC17\val"
Free JDBC url:(Warning: only use it for special project)
    jdbc:cobol:/" or "jdbc:cobol:///". Then you can use some full UNC path names in SQL
to visit anywhere where your Java VM has right to access.
    For instance:
        select * from \\amd2500\e$\cobolfiles\test;
        select * from "\\amd2500\d$\cobolfiles".test;
        select * from ".".test;

HXTT Cobol supports seamlessly data mining on memory-only table, physical table, url
table, compressed table, SAMBA table in a sql. More details
is in Advanced Programming chapter.
    
```

To connect, you need to get a Connection instance from JDBC. To do this, you use the DriverManager.getConnection() method:

```
Connection con = DriverManager.getConnection(url, properties);
```

There are a few different signatures for the getConnection() method. You should see the API documentation that comes with your JDK for more specific information on how to use them. You can specify additional properties to the JDBC driver by placing them in a java.util.Properties instance and passing that instance to the DriverManager when you connect.

Property Name	Definition	Default Value
---------------	------------	---------------

host	The remote host on which one CobolServer is running	null
port	The port on which one CobolServer is listening	null
serverType	The type of CobolServer on the remote host	null
user	The user to connect as	null
password	The password to use when connecting	null
charSet	To specify a Character Encoding Scheme other than the client default. You can find a Supported Encodings list of file:///c:/jdk1.2/docs/guide/internat/encoding.doc.html. Cp895(Czech MS - DOS 895), Cp620(Polish MS - DOS 620) and Mazovia are extra supported although JVM doesn't support those.	null
lockType	To specify a compatible lock for other applications. You needn't set that property now since there is no lock from other applications.	null
lockTimeout	To specify Cobol driver's timeout in milliseconds to wait until processes released record lock or table lock. 0 means a default value, and <0 means no wait.	1000
refreshInterval	To specify a refresh interval setting in seconds for FTP/SFTP database file which determines how long it to discard the content cache.	60
cryptType	To specify a crypt type for Table Encryption and Column Level Encryption. All new created table in this connection will become crypted table. You can use DES, TRIDES, BLOWFISH, and AES now.	null
cryptKey	To specify a crypt key. Without encrypt key, CREATE TABLE won't create crypted table.	null
storeCryptKey	Indicates whether crypt key is stored in crypted table. If stored, crypted table can be opened automatically in any connection without predefined crypt properites. If not stored, cryptd table can only be opened with the correct key, and none include us can help you in cracking your data without the correct key.	false
tmpdir	Indicates whether set a temp directory, Default: the value of JVM's "java.io.tmpdir" property. If that value is incorrect, using the directory of JDBC url. <u>_memory_</u> means large data in memory.	null
delayedClose	Indicates the delayed seconds for close transaction. That option is used to avoid frequent close/open table operations for following sqls. Automatic temporary index is disabled when delayedClose<=60s. You can use 0~120 seconds. Default: 3.	null
maxIdleTime	Indicates the max idle time in minute for remote connection. That option is mainly used to avoid closing automatically idle remote connection for connection pool. Embedded idle connectoin won't be closed automatically except for garbage collection. You can use 1~1440 minutes. Default: 30.	null
maxCacheSize	Indicates the max memory utilization for per table on automatic temporary index or matched result cache. You can use 16~65536 kilo bytes. Default: 1024.	null
fileExtension	To specify other suffix as default extension of Cobol data file.	DAT
fileDescriptionExtension	Indicates whether Cobol driver supports other extension beside 'cpy', 'fd', 'xfd', 'sel', 'cbl', and 'cob' as default file description extension. The supported formats include Cobol source code file, Copybook file, FD file, XFD (EXtended File Descriptor), and SEL file. You can use comma to assign more than one extension, for instance, cobolExtension=CBL,ECOB .	null

dir4fileDescription	To assign a different directory for file descriptor. If file descriptor is at the same directory of data file, you needn't that connection property.	null
dialect	To specify a default COBOL dialect. You can use RM, MF, Fujitsu, ACU, IBM, MVS, and CA.	null
width4SequenceNumberArea	In fixed format, the COBOL source format divides each COBOL source record into 72 columns. Sequence number area are column 1-6. You can use 0 if there's no sequence number area.	6
boundary4source	A COBOL source record can extend up to 80 columns in length. The contents of columns 73 to 80 are ignored by the COBOL system.	72
ignoreDirtyData	Indicates whether ignores all dirty data and return null value when failed to parse number value or date value. You can use the following code to know where's dirty data in your file. <pre> warnings=rs.getWarnings(); if(warnings!=null){ do{//SQState: C0106 Convert dirty data into null value System.out.println(warnings.getMessage()); System.out.println("Error Code:"+warnings.getErrorCode()); System.out.println("SQL State:"+warnings.getSQLState()); }while((warnings=warnings.getNextWarning())!=null); rs.clearWarnings(); } </pre>	false
locale	locale is used to specify a default local for parse. You can use CANADA, CANADA_FRENCH, CHINA, CHINESE, ENGLISH, FRANCE, FRENCH, GERMAN, GERMANY, ITALIAN, ITALY, JAPAN, JAPANESE, KOREA, KOREAN, PRC, ROOT, SIMPLIFIED_CHINESE, TAIWAN, TRADITIONAL_CHINESE, UK, or US.	null
dateFormat	dateFormat is used to specify a default parse sequence of date(Default: 'yyyy-MM-dd') format.	yyyy-MM-dd
timeFormat	timeFormat is used to specify a default parse sequence of time(Default: 'hh:mm:ss') format.	hh:mm:ss
timestampFormat	timestampFormat is used to specify a default parse sequence of timestamp(Default: 'yyyy-MM-dd hh:mm:ss') format.	yyyy-MM-dd hh:mm:ss
decimalFormat	decimalFormat is used to specify a default parse sequence of decimal number format.	null
decimalSeparator	decimalSeparator is used to specify a default character for decimal sign. Different for French, etc.	null
groupingSeparator	groupingSeparator is used to specify a default character for thousands separator. Different for French, etc.	null
ODBCTrimBehavior	Indicates whether works like MS Access ODBC driver to ignore tail space characters in condition expression. You can use null, true, false	false
caseInsensitive	Indicates whether is case insensitive for string comparison. You can use null, true, false	false
emptyDecimalAsZero	Indicates whether returns empty decimal as zero value. You can use null, true, false	false
emptyStringAsNull	Indicates whether returns empty string as null value. You can use null, true, false	true

When your code then tries to open a Connection, and you get a No driver available SQLException being thrown, this is probably caused by the driver not being in the class path, or the JDBC url not being correct.

To close the database connection, simply call the close() method to the Connection:

```
con.close();
```

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Chapter 3. Statement

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2. [Issuing a Query](#)
3. [Performing Updates](#)
4. [Creating and Modifying Database Objects](#)

Creating a Statement Instance

Once a Connection is established, it can be used to create Statements and PreparedStatement. Any time you want to issue SQL statements to the database, you require a Statement or PreparedStatement instance. To get a Statement object, you call the createStatement() method on the Connection object you have retrieved via the DriverManager.getConnection() method. Once you have a Statement object, you can execute a SELECT query by calling the executeQuery(String SQL) method with the SQL you want to use. To update data in the database use the executeUpdate(String SQL) method. This method returns the number of rows affected by the update statement. If you don't know ahead of time whether the SQL statement will be a SELECT or an UPDATE/INSERT, then you can use the execute(String SQL) method. This method will return true if the SQL query was a SELECT, or false if an UPDATE/INSERT/DELETE query. If the query was a SELECT query, you can retrieve the results by calling the getResultSet() method. If the query was an UPDATE/INSERT/DELETE query, you can retrieve the affected rows count by calling getUpdateCount() on the Statement instance. This is explained in the following sections.

Issuing a Query

A simple sample can illustrates more than some words:

```
String sql = "select * from test where int1>0";
Connection con = DriverManager.getConnection(url, "", "");

Statement stmt = con.createStatement();

ResultSet rs = stmt.executeQuery(sql);

ResultSetMetaData resultSetMetaData = rs.getMetaData();
int iNumCols = resultSetMetaData.getColumnCount();
for (int i = 1; i <= iNumCols; i++) {
    System.out.println(resultSetMetaData.getColumnLabel(i)
        + " " +
        resultSetMetaData.getColumnTypeName(i));
}

Object colval;
while (rs.next()) {
    for (int i = 1; i <= iNumCols; i++) {
        colval = rs.getObject(i);
        System.out.print(colval + " ");
    }
    System.out.println();
}

rs.close();
stmt.close();
con.close();
```

This example issues the same query as before but uses a PreparedStatement and a bind value in the query.

```
String sql = "select * from test where int1>?";
Connection con = DriverManager.getConnection(url, "", "");
PreparedStatement stmt = con.prepareStatement(sql);

stmt.setInt(1, 0);

ResultSet rs = stmt.executeQuery();
```

```

ResultSetMetaData resultSetMetaData = rs.getMetaData();
int iNumCols = resultSetMetaData.getColumnCount();
for (int i = 1; i <= iNumCols; i++) {
    System.out.println(resultSetMetaData.getColumnLabel(i)
        + " " +
        resultSetMetaData.getColumnTypeName(i));
}

Object colval;
while (rs.next()) {
    for (int i = 1; i <= iNumCols; i++) {
        colval = rs.getObject(i);
        System.out.print(colval + " ");
    }
    System.out.println();
}

rs.close();
stmt.close();
con.close();

```

You can use a single Statement instance as many times as you want. You could create one as soon as you open the connection and use it for the connection's lifetime. But you have to remember that only one ResultSet can exist per Statement or PreparedStatement at a given time. When you are done using the Statement or PreparedStatement, you should close it.

Before reading any values from ResultSet, you have to call next(). This returns true if there is a result, but more importantly, it prepares the row for processing. Under the JDBC specification, you should access a column only once. It is safest to stick to this rule, although the HXTT Cobol driver will allow you to access a column as many times as you want. You should close a ResultSet by calling close() once you have finished using it too. Once you make another query with the Statement used to create a ResultSet, the currently open ResultSet instance is closed automatically. The HXTT Cobol driver supports updatable result sets, but an updatable query can only span one table (i.e. no joins).

Performing Updates

To change data (perform an INSERT, UPDATE, or DELETE), you should use the executeUpdate() method. This method is similar to the method executeQuery() used to issue a SELECT statement, but it doesn't return a ResultSet; instead it returns the number of rows affected by the INSERT, UPDATE, or DELETE statement. This example will issue a simple UPDATE statement and print out the number of rows updated.

```

String sql="update test set boolean1=not boolean1 where recno()%5=0";

Connection con = DriverManager.getConnection(url, "", "");

Statement stmt=con.createStatement();

int updateCount=stmt.executeUpdate(sql);
System.out.println(sql+" : "+updateCount);

stmt.close();
con.close();

```

Creating and Modifying Database Objects

To create, modify or drop a database object like a table, index, or view, you should use the execute() method. This method is similar to the method executeUpdate(), but it doesn't return a result. This example will drop a table.

```

String sql="drop table test";

Connection con = DriverManager.getConnection(url, "", "");

Statement stmt=con.createStatement();

stmt.execute(sql);

```

```
stmt.close();  
con.close();
```

The HXTT Cobol driver can create, modify or drop a database object like a table, index, or view through `executeUpdate()`, but the returned result is unexpectable. For instance, dropping a table can return 0(dropped nothing), 1(only one table file), 2(two table files, or one table files and one index file), 3, 4, and so on. The returned result of `executeUpdate()` is valuable when it creates something with IF NOT EXISTS clause, or drops something with IF EXISTS clause. This example will drop a test table if that table exists.

```
String sql="drop table if exists test";  
Connection con = DriverManager.getConnection(url, "", "");  
Statement stmt=con.createStatement();  
boolean droppedFlag=stmt.executeUpdate(sql)!=0;  
stmt.close();  
con.close();
```

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Chapter 4. ResultSet

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2. [Providing Performance Hints](#)
3. [Performing Updates](#)
4. [Serializing ResultSet](#)

ResultSet Overview

A `ResultSet` is a Java object that contains the results of executing an SQL query. In other words, it contains the rows that satisfy the conditions of the query. The data stored in a `ResultSet` object is retrieved through a set of get methods that allows access to the various columns of the current row. The `ResultSet.next` method is used to move to the next row of the `ResultSet`, making it the current row.

A `ResultSet` object maintains a cursor, which points to its current row of data. The cursor moves down one row each time the method `next` is called. When a `ResultSet` object is first created, the cursor is positioned before the first row, so the first call to the `next` method puts the cursor on the first row, making it the current row. `ResultSet` rows can be retrieved in sequence from top to bottom as the cursor moves down one row with each successive call to the method `next`. A scrollable result set's cursor can move both forward and backward as well as to a particular row. The following methods move the cursor backward, to the first row, to the last row, to a particular row number, to a specified number of rows from the current row, and so on: `previous`, `first`, `last`, `absolute`, `relative`, `afterLast`, and `beforeFirst`. As with scrollability, making a `ResultSet` object updatable increases overhead and should be done only when necessary. That said, it is often more convenient to make updates programmatically, and that can only be done if a result set is made updatable.

The HXTT Cobol driver supports scrollable updatable result set.

Providing Performance Hints

The number of rows that should be fetched from the database each time new rows are needed. The number of rows to be fetched is called the fetch size, and it can be set by two different methods: `Statement.setFetchSize` and `ResultSet.setFetchSize`. The statement that creates a `ResultSet` object sets the default fetch size for that `ResultSet` object, using the `Statement` method `setFetchSize`. The following code fragment sets the fetch size for the `ResultSet` object `rs` to 10. Until the fetch size is changed, any result set created by the `Statement` object `stmt` will automatically have a fetch size of 10.

```
Statement stmt = con.createStatement();
stmt.setFetchSize(10);
ResultSet rs = stmt.executeQuery("SELECT * FROM test");
```

A result set can, at any time, change its default fetch size by setting a new fetch size with the `ResultSet` version of the method `setFetchSize`. Continuing from the previous code fragment, the following line of code changes the fetch size of `rs` to 50:

```
stmt.setFetchSize(50);
```

Normally the most efficient fetch size is already the default for the HXTT Cobol driver. The method `setFetchSize` simply allows a programmer to experiment to see if a certain fetch size is more efficient than the default for a particular application.

Performing Updates

A `ResultSet` object may be updated (have its rows modified, inserted, or deleted) programmatically if its concurrency type is `CONCUR_UPDATABLE`. The following example demonstrates show how to update, delete, and insert data.

```

PreparedStatement stmt = con.prepareStatement(
    "select int1,float1,clob1 from test where double1<=?",
    ResultSet.TYPE_SCROLL_SENSITIVE, ResultSet.CONCUR_UPDATABLE);

stmt.setFetchSize(12);

stmt.setDouble(1, 0);
ResultSet rs = stmt.executeQuery();

ResultSetMetaData resultSetMetaData = rs.getMetaData();
int iNumCols = resultSetMetaData.getColumnCount();
for (int i = 1; i <= iNumCols; i++) {
    System.out.println(resultSetMetaData.getColumnLabel(i));
}

Object colval;
while (rs.next()) {
    for (int i = 1; i <= iNumCols; i++) {
        colval = rs.getObject(i);
        System.out.print(colval + " ");
    }
    System.out.println();
}

rs.first();
rs.relative(5);
rs.updateString(3, "eeees333ee3");
rs.updateFloat("float1", 11111.2111f);
rs.updateRow();

rs.absolute(6);
rs.deleteRow();

rs.relative(-2);
rs.refreshRow();

rs.moveToInsertRow();
rs.updateInt(1, 10000);
rs.updateFloat(2, 1000000.0f);
rs.updateObject(3, "abc" + (new java.sql.Time(System.currentTimeMillis())));
rs.insertRow();
rs.moveToCurrentRow();

System.out.println("After be updated:");

rs.beforeFirst();
while (rs.next()) {
    for (int i = 1; i <= iNumCols; i++) {
        colval = rs.getObject(i);
        System.out.print(colval + " ");
    }
    System.out.println();
}

rs.close();
stmt.close();
con.close();

```

Serializing ResultSet

The HXTT Cobol driver's result set is `Serializable`.

```

// serialize the resultSet
java.io.FileOutputStream fileOutputStream = new java.io.FileOutputStream("testrs.tmp");
java.io.ObjectOutputStream objectOutputStream = new
java.io.ObjectOutputStream(fileOutputStream);
objectOutputStream.writeObject(rs);
objectOutputStream.flush();

rs.close();
rs = null;

// deserialize the resultSet

```

```
java.io.FileInputStream fileInputStream = new java.io.FileInputStream("testrs.tmp");
java.io.ObjectInputStream objectInputStream = new
java.io.ObjectInputStream(fileInputStream);
rs = (ResultSet) objectInputStream.readObject();
```

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Chapter 5. Advanced Programming

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Sending Very Large IN Parameters

The methods `setBytes`, `setString`, `setBinaryStream`, `setAsciiStream`, `setCharacterStream`, `setBlob`, and `setClob` are capable of sending unlimited amounts of data. The following code illustrates using a stream to send the contents of a file as an IN parameter.

```
String sql="update test SET clob1 = ?, blob1=? WHERE float1>=?*PI()%5 or float1=0";
java.sql.PreparedStatement pstmt = con.prepareStatement(sql);

java.io.File file = new java.io.File(dir+"/somechar.txt");
int fileLength =(int) file.length();
java.io.InputStream fin = new java.io.FileInputStream(file);
pstmt.setCharacterStream(1,new java.io.InputStreamReader(fin), fileLength);
pstmt.setObject(2, "A serialized class");
pstmt.setFloat(3,0);
pstmt.executeUpdate();
pstmt.close();
```

Set Record Lock Manually

`SELECT ... FOR UPDATE` will lock all the selected rows so that other users cannot lock or update the rows until you close that `ResultSet`. You can specify `FOR UPDATE` clause only in a top-level `SELECT` statement (not in subqueries).

`_LockFlag_` is a virtual column for row lock flag. You can use `"select _LockFlag_,* from yourTable"` to get an `Updatable ResultSet`, then use three functions below:

```
boolean ResultSet.setBoolean("_LockFlag_",true)//Lock the current row.
```

```
boolean ResultSet.setBoolean("_LockFlag_",false);//Unlock the current row.
```

```
boolean ResultSet.getBoolean("_LockFlag_");//indicates whether the current row has been locked by other process or application.
```

If `ResultSet.close()` is called, all pending record locks will be released automatically. `"update yourTable set _LockFlag_=true where condition"`, and `"update yourTable set _LockFlag_=false where condition"` can lock/unlock records too, but you have to take care of every record lock.

```
Connection connection1= DriverManager.getConnection("jdbc:DBF:/.",properties);
Statement stmt1 = connection1.createStatement(ResultSet.TYPE_SCROLL_INSENSITIVE,
        ResultSet.CONCUR_UPDATABLE);
stmt1.executeUpdate("CREATE TABLE IF NOT EXISTS testlock(int1 int,char1 varchar(100));"
        +"INSERT INTO testlock VALUES (1, 'DFDFDFDF')");
```

```

        +"INSERT INTO testlock VALUES (2, 'aaaa');"
        );

        ResultSet rs=stmt1.executeQuery("select _lockFlag_,* from testlock where int1=1");
//
//      ResultSet rs=stmt1.executeQuery("select recno(),_lockFlag_,* from testlock where
int1=1");

        rs.next();

        boolean lockResult=rs.getBoolean("_LockFlag_");//indicates whether the current row has
been locked by other process or application
        if(lockResult){
            System.out.println("Maybe other application has locked it!");
        }

        //Through moving the cursor of ResultSet, many rows can be locked at the same time.
        rs.updateBoolean("_LockFlag_",true);//Lock Row
        rs.updateRow();

        boolean isLockedResult=rs.getBoolean("_lockFlag_");//indicates whether the current row
has been locked by other process or application
        if(!isLockedResult){
            System.out.println("It's impossible since the current row is just locked!");
        }

        Connection connection2= DriverManager.getConnection("jdbc:DBF:/.",properties);
        Statement stmt2 = connection2.createStatement(ResultSet.TYPE_SCROLL_INSENSITIVE,
            ResultSet.CONCUR_UPDATABLE);
        if(true){//Whether show a wrong code block.
            try{
                int result = stmt2.executeUpdate(
                    "UPDATE testlock set int1=1 where int1=1");
                System.out.println("update count:" + result);
            }catch(SQLException e){
                System.out.println("update error:"+e);//lock error
            }

            rs.updateInt("int1",1);
            rs.updateRow();//Pass since it's locked by rs.
        }else{
            int result=stmt2.executeUpdate("UPDATE testlock set int1=1 where int1=1 and not
rowlocked()");
            System.out.println("update count:"+result);

            rs.updateInt("int1",1);
            rs.updateRow();//Pass since it's locked by rs.

            result= connection1.createStatement().executeUpdate("UPDATE testlock set int1=1
where int1=1");//Pass since it's a statement of the same connection.
            System.out.println("update count:"+result);

            rs.updateBoolean("_LockFlag_",false);////Unlock Row
            rs.updateRow();
            isLockedResult=rs.getBoolean("_lockFlag_");//indicates whether the current row has
been locked by other process or application
            if(isLockedResult){
                System.out.println("Falied to unlock the current row!");
            }

            result=stmt2.executeUpdate("UPDATE testlock set int1=1 where int1=1");
            //BTW, you can use "UPDATE testlock set int1=int1+1 where ..." in a multi-user. DBF
            will fetch the latest int1 value for calculation.
            System.out.println("update count:"+result);
        }

        rs.close();

        stmt2.close();
        connection2.close();

        stmt1.close();
        connection1.close();

```

Encryption

If you create table in a connection with crypt properties, those tables will become encrypted tables. You needn't take

care too much about encrypt/decrypt since it's a Table LEVEL Encryption.

```

        properties.setProperty("cryptType", "des");//To specify an crypt type for Table
Encryption and Column Level Encryption. All new created table in this connection will become
cryptd table. You can use DES, TRIDES, and BLOWFISH now. Deaful: null
        properties.setProperty("cryptKey", "123 myKey 456");//To specify an encrypt key.
Without encrypt key, CREATE TABLE won't create cryptd table.
        properties.setProperty("storeCryptKey", "true");//Indicates whether crypt key is stored
in cryptd table. If stored, cryptd table can be opened automatically in any connection without
predefined crypt properites. If not stored, cryptd table can only be opened with correct key.
Default: false

        Connection con = DriverManager.getConnection(url,properties);

```

You needn't encrypt/decrypt a total table sometimes, then you can used some crypt functions to protect your sensitive data:

ENCRYPT(content,cKey,cCryptMethod): Returns a cryptd byte[]. cCryptMethod should be 'DES', 'TRIDES', or 'BLOWFISH' now. ENCRYPT function is used for VARBINARY column.

DECRYPT(content,cKey,cCryptMethod): Returns a decrypted byte[]. cCryptMethod should be 'DES', 'TRIDES', or 'BLOWFISH' now.

ENCODE(content): Encodes a BASE64 encoding string.

DECODE(content): Returns a byte[] from a BASE64 string.

ENCODE(content,cKey,cCryptMethod): Crypts and encodes content. cCryptMethod should be 'DES', 'TRIDES', or 'BLOWFISH'. ENCRYPT function is used for VARCHAR column.

DECODE(content,cKey,cCryptMethod): Decodes and decrypts content. cCryptMethod should be 'DES', 'TRIDES', or 'BLOWFISH' now.

For instance:

```

select encode('adsdfsdf');
select decode(encode('adsdfsdf'))+";
select decode(encode('dfdfdf233','12345','trides'),'12345','trides')+':('
select decrypt(encrypt('25355','12345','trides'),'12345','trides')+':('
select decrypt(encrypt('25355','12345','des'),'12345','des')+':('
select decrypt(passwd,'12345','des') from test;
insert into users (user,passwd) values('abc',encode('abcpasswd','a key','trides'));
select count(*) from user where users=? and passwd=encode(?, 'a key','trides');
select count(*) from user where users=? and decode(passwd,'a key','trides')=?;

```

VARBINARY's Encrypted Data Column Length=Maximum length of the non-encrypted data + 1 byte + The number of bytes to the next 8-byte boundary. For instance, your data is 8 byte, you can use varbinary of 9 byte length (or binary of 8 byte) to stored the encrypted data. Your data is 12 byte, you can use varbinary of 17 byte length to stored the encrypted data. VARCHAR's Encrypted Data Column Length= (VARBINARY's Encrypted Data Column Length)*4/3. For instance, your data is 8 byte, you need 12 byte to stored the BASE64 encoding encrypted data.

Bulk Insert

"CREATE TABLE [IF NOT EXISTS] table-name [(column-identifier data-type [constraint] [...])] [AS] [SELECT query]", and "INSERT INTO table-name [(column-identifier [...])] SELECT query" can copy a table to another table or allow insert of multiple rows in one statement. For instance, "CREATE TABLE newtable select * from table1 where column1!=null order by column2;", and "insert into test (int1,char1) select id1,name1 from abc where id1>50 and value1>300". SQL doesn't permit that table1 is the same table as table2 when INSERT INTO table1 select * from table2, but the HXTT Cobol supports such an unadvisable operation, for instance,"insert into table1 select * from table1;".

Bulk Insert A ResultSet from any JDBC driver

The HXTT Cobol supports to insert data from other JDBC drivers. "CREATE TABLE [IF NOT EXISTS] table-name [(column-identifier data-type [constraint] [...])] ?", and "INSERT INTO table-name [(column-identifier [...])] ?" is for that purpose.

```

//rs is an open ResultSet from any JDBC driver.
String sql="insert into test ?;";

PreparedStatement pstmt = con.prepareStatement(sql);

pstmt.setObject(1,rs);//insert a resultSet into table test.
pstmt.executeUpdate();

pstmt.close();

sql="create table if not exists abcd ?;";
pstmt = con.prepareStatement(sql);

pstmt.setObject(1,rs);//insert a resultSet into a new table abcd
pstmt.executeUpdate();

pstmt.close();

```

Notes: If your `ResultSet.getType()==ResultSet.TYPE_FORWARD_ONLY`, and you have used `ResultSet.next()` to browsed some rows, you won't insert those browsed rows. Other conditions, all rows will be inserted.

BTW, the HXTT Cobol driver's result set is Serializable.

```

// serialize the resultSet
try {
    java.io.FileOutputStream fileOutputStream = new java.io.FileOutputStream("yourfile.tmp");
    java.io.ObjectOutputStream objectOutputStream = new
java.io.ObjectOutputStream(fileOutputStream);
    objectOutputStream.writeObject(rs);
    objectOutputStream.flush();
    objectOutputStream.close();
    fileOutputStream.close();
}
catch (Exception e) {
    System.out.println(e);
    e.printStackTrace();
    System.exit(1);
}

// deserialize the resultSet
try {
    java.io.FileInputStream fileInputStream = new java.io.FileInputStream("yourfile.tmp");
    java.io.ObjectInputStream objectInputStream = new
java.io.ObjectInputStream(fileInputStream);
    rs = (ResultSet) objectInputStream.readObject();
    objectInputStream.close();
    fileInputStream.close();
}
catch (Exception e) {
    System.out.println(e);
    e.printStackTrace();
    System.exit(1);
}

```

SELECT ... INTO OUTFILE Syntax

SELECT ... INTO OUTFILE writes the selected rows to a file. SELECT [ALL | DISTINCT [ON (expression [, ...])]] | DISTINCTROW [TOP n [PERCENT]] select_list [INTO variable [, ...] | INTO OUTFILE 'outfileName'] FROM table_reference_list [WHERE condition_expression] [[START WITH initial-condition] CONNECT BY [NOCYCLE] recurse-condition] [group_by_clause] [HAVING condition_expression] [union_clause] [order_by_clause] [LIMIT [offset,] [limit]] [FOR UPDATE]

'outfileName' support CSV and XML format. For instance:

```

SELECT * into OUTFILE 'A' FROM USER_PLANS; /* Default suffix: csv */
SELECT * into OUTFILE 'A.xml' FROM USER_PLANS; /* It will use XML format now. */
SELECT 'A"A' AS BB,12345 AS C,now() as e into OUTFILE 'b.CSV' ;
SELECT * into OUTFILE 'c.CSV' FROM USER_PLANS LEFT OUTER JOIN (SELECT * FROM

```

USER_FUNCTION_DESCRIPTIONS WHERE UFD_IS_PLAN='Y' AND UFD_LANG='EN')PLAN_DESC ON USER_PLANS.UPL_ID=PLAN_DESC.UFD_USF_ID WHERE UPL_UFL_ID=-1.0 ORDER BY UPL_NAME Because that SELECT ... INTO OUTFILE Syntax need to write file, so that it will throw SQLException if Connection.isReadOnly(). ResultSet.getRow() will show the number of rows exported to the file. The ResultSet object can be reused in code if it's not ResultSet.TYPE_FORWARD_ONLY type. Connection properties can be specified to produce a specific output format.

Property Name	Definition	Default Value
charSet	To specify a Character Encoding Scheme other than the client default. You can find a Supported Encodings list of file:///c:/jdk1.2/docs/guide/internat/encoding.doc.html. Cp895(Czech MS - DOS 895), Cp620(Polish MS - DOS 620) and Mazovia are extra supported although JVM doesn't support those.	null
csvfileExtension	To specify other suffix as default csv file extension.	CSV
_CSV_Separator	To specify a character sequence used to separate the values of the fields. It supports escape processing so that you can use \t, \r, \u001A, \x32, and so on.	,
_CSV_EOL	To specify 1~2 character sequence to terminate one line. An end-of-line line sequence is any one of a line feed ('\n', 0x0A), a carriage return ('\r', 0x0D), or a carriage return followed immediately by a linefeed. In most occasions, you needn't to care that connection property, since HXTT CSV supports even to mix three styles in one file. For data update, HXTT CSV can detect automatically OS version and choose the suitable EOL style in UNIX-style, DOS-style, and Mac-style. If you wish to create unix-style file on Windows, then you need to assign that connection property. It supports escape processing so that you can use \t, \r, \u001A, \x32, and so on. For instance, your data file is using \$ as EOL, HXTT CSV can support that file.	null
_CSV_Quoter	To specify a character used to quote the string value. It supports escape processing so that you can use \t, \r, \u001A, \x32, and so on.	"
_CSV_Header	Indicates whether the first record of text file to consist of the names of the fields in the data following.	true
_CSV_Comment	To specify whether there're some comment lines before csv header and data rows. If you use n (integer values), the first n lines will be ingored as comment. If you use some paragraphs, these paragraphs will be used for csv file creation, the total line number of comment will be used for existent file.	null
locale	locale is used to specify a default local for parse. You can use CANADA, CANADA_FRENCH, CHINA, CHINESE, ENGLISH, FRANCE, FRENCH, GERMAN, GERMANY, ITALIAN, ITALY, JAPAN, JAPANESE, KOREA, KOREAN, PRC, ROOT, SIMPLIFIED_CHINESE, TAIWAN, TRADITIONAL_CHINESE, UK, or US.	null
dateFormat	dateFormat is used to specify a default parse sequence of date(Default: 'yyyy-MM-dd') format.	yyyy-MM-dd
timeFormat	timeFormat is used to specify a default parse sequence of time(Default: 'hh:mm:ss') format.	hh:mm:ss
timestampFormat	timestampFormat is used to specify a default parse sequence of timestamp(Default: 'yyyy-MM-dd hh:mm:ss') format.	yyyy-MM-dd hh:mm:ss
decimalFormat	decimalFormat is used to specify a default parse sequence of decimal number format.	null
decimalSeparator	decimalSeparator is used to specify a default character for decimal sign. Different for French, etc.	null
groupingSeparator	groupingSeparator is used to specify a default character for thousands separator. Different for French, etc.	null

RowSet

com.hxtt.sql.HxttRowSet can work with any descendent class of java.sql.DataSource. For instance:

```
import java.sql.*;
import java.util.Properties;

import com.hxtt.sql.HxttDataSource;
import com.hxtt.sql.HxttRowSet;

public class testRowSet{
    public static void main(String argv[]){
        try{
            Class.forName("com.hxtt.sql.cobol.CobolDriver").newInstance();

            HxttDataSource ds=new HxttDataSource();
            ds.setUrl("jdbc:cobol:/f:/cobolfiles");

            HxttRowSet rowSet=new HxttRowSet(ds);
            /*
            Another way:
            HxttRowSet rowSet=new HxttRowSet();
            rowSet.setDataSourceName(dsName);
            will use
                Context ctx = new InitialContext();
                return (DataSource) ctx.lookup(dataSourceName);
            to load the ds.
            */

            rowSet.setCommand("select * from test");

            rowSet.execute();

            ResultSetMetaData resultSetMetaData = rowSet.getMetaData();
            int iNumCols = resultSetMetaData.getColumnCount();
            for (int i = 1; i <= iNumCols; i++) {
                System.out.println(resultSetMetaData.
                    getColumnLabel(i)
                    + " " +
                    resultSetMetaData.getColumnTypeName(i));
            }

            rowSet.beforeFirst();
            while (rowSet.next()) {
                for (int i = 1; i <= iNumCols; i++) {
                    System.out.print(rowSet.getObject(i) + " ");
                }
                System.out.println();
            }

            rowSet.close();
        }
        catch( SQLException sqle )
        {
            do
            {
                System.out.println(sqle.getMessage());
                System.out.println("Error Code:"+sqle.getErrorCode());
                System.out.println("SQL State:"+sqle.getSQLState());
                sqle.printStackTrace();
            }while((sqle=sqle.getNextException())!=null);
        }
        catch( Exception e )
        {
            System.out.println(e.getMessage());
            e.printStackTrace();
        }
    }
}
```

PooledConnection

For instance:

```
com.hxtt.sql.HxttConnectionPoolDataSource pds=new
com.hxtt.sql.HxttConnectionPoolDataSource();
pds.setUrl("jdbc:cobol:/f:/cobolfiles");
javax.sql.PooledConnection pc=pds.getPooledConnection();
```

SSL Connection

SSL Connection has been provided since JDK1.4.X. To use SSL Connection, you should know how to use javax.net.ssl package first. With hxtt.socketclass=SSL **system** property, all of HXTT CobolServer's receiving connections in one JVM will become SSL connection. For client side, using hxtt.socketclass=SSL or hxtt.socketclass=null as **connection** property will overlay hxtt.socketclass **system** property so that it's possible that some connections are SSL encryption connection, but other connections are common connections or customer connections.

For instance, you can use java -Djavax.net.ssl.keyStore=yourKeyStore -

Djavax.net.ssl.keyStorePassword=yourKeyStorePassword -Djavax.net.ssl.trustStore=yourTruststore -

Djavax.net.ssl.trustStorePassword=yourTrustStorePassword -Dhxtt.socketclass=ssl -cp yourClassPath

com.hxtt.sql.admin.Admin to start a HXTT CobolServer with SSL Connection capability. If you wish to use HXTT CobolServer as Linux(Solaris) daemon or Windows Service without GUI, you should read [Run HXTT CobolServer as Windows Service or Linux\(Solaris\) Daemon](#) too.

java -Djavax.net.ssl.trustStore=yourTruststore -Djavax.net.ssl.trustStorePassword=yourTrustStorePassword -

Dhxtt.socketclass=ssl -cp yourClassPath yourApplication will let your application to use SSL for remote connection.

If you wish to write customer connection, please click [Customer Connection](#).

Run HXTT CobolServer as Windows Service or Linux(Solaris) Daemon

In Linux(Solaris), we assume that you save it to /jdbclib directory.

In Windows, we assume it is c:/ . You should have built the database server configuration by

com.hxtt.sql.admin.Admin program. It will create a file named

urlconfig.properties which locate on the user home directory.

For example, in Linux(Solaris), you build the database server configuration in root user, the urlconfig.properties will located

at /root directory if the root's home directory is /root; in windows, it will be the C:\Documents and

Settings\Administrator.

You should copy the file to other directory for the service program maybe not access the file. In Linux(Solaris), we assume you copy it

to /jdbclib;in windows,we assume it is c:/.

For Windows NT/2000/2003/XP system, you can use JavaService.exe([Here](#) to download, [here](#) is its forge) to register a window service to start the servers.

[Here](#) is a simple bat file to tell you how to register a service, you should change some options

accord your environment. After you download these two files, you can run the bat file to register and start the service at the Control Panel.

For Windows 7, Windows 2008, and Vista system, you can copy jsl64.exe([Here](#) to download, [here](#) is its home) and jsl64.ini([Here](#) to download) into somewhere on your disk.

Modify the jsl64.ini to reflect your desired settings. Specially the last line cmdline parameters.

Use Administrator Role to run jsl64.exe -install jsl64.ini

Start it in the NT service manager or by calling NET start "HXTTService"

In Linux(Solaris),you can use jsvc([Here](#) to download) as a daemon to start the servers for remote connection.

1.You should download the Apache common daemons package([Here](#) to download).

We assume that you save this two files to /commondaemon directory.

2.please run the follows command to enable the exec file property.

```
chmod +x /commondaemon/jsvc
```

Attention,the jsvc program has tested at RedHat 9.0 and Sun Open Desktop System 1.0.If it don't work at your enviroment,please download the jsvc source and make a binary program or tell us your environment.

3.run the follows command to know the default run level of your machine.

```
cat /etc/inittab | grep :initdefault
```

it's result will be as follows: id:3:initdefault

or

```
runlevel
```

it's result will be as follows:N 3

In common,the default run level should be 3 or 5.

4.Please download the [hxttjsvcserv](#) script to save it to /etc/init.d directory and run the follows command to enable the file exec-able bit mask .

```
chmod +x /etc/init.d/hxttjsvcserv
```

Attension ,if you don't put HXTT Cobol Package to /jdbclib directory or jsvc and commons-daemon.jar to /commondaemon directory,you should modify the

hxttjsvcserv file to fit your configuration.

BTW,the default user run this service is root,maybe you should changed it to another low right user.Please see the hxttjsvcserv for more detail information.

5.cd /etc/rcx.d (x is the run level,in some os,the rcx.d is not directly located in /etc directory,you can use find . -name rcx.d to find where is it)

At first you should list all the file for find the new service's running sequence number;

run the command

```
ls
```

You will see some files which starts with K or S,for example,S99local and K99local.

S99local is the run script file when start this machine.

K99local is the stop script file when shut down this machine.

local is the service name.K represent kill and S represent the start.

This two files all are a file linked to /etc/init.d/local.This is,when starting machine,OS will run local script with start parameter and when stopping with stop parameter.

99 is the run sequence number when start this machine.

For example,httpd service will start before this local service and stop after the local service for its start script file name is S15httpd and end script file name is K15httpd.

Find the max running sequence number,in my machine,it is 99,so the new service's running sequence number will be 100.

run the command to build this two file.

```
ln -s /etc/init.d/hxttjsvcserv S100hxttjsvcserv
```

```
ln -s /etc/init.d/hxttjsvcserv K100hxttjsvcserv
```

now you can run /etc/init.d/hxttjsvcserv start to start the service or reboot your machine to test if this service can auto start.

You can use "java com.hxtt.sql.admin.Admin TCPCLIENT [host:]port [remoteControlPassword]" to start your remote control when CobolServer is running as Windows service or Linux(Solaris) Daemon.

For Novell Netware OS console without GUI, you can also run directly com.hxtt.sql.admin.HxttService with above same parameters.

On LINUX and UNIX, if you got "Cannot connect to X11 window server. The environment variable DISPLAY is not set.", you should use -Djava.awt.headless=true to run Java in headless mode.

If startup using jsvc is not implemented on a specific operation system, you can also run directly

com.hxtt.sql.admin.HxttService with above same parameters on SCO OpenServer, OS/400, and so on.

How to Use Memory-only Table, Physical Table, Url table, Compressed table, SAMBA table in a SQL.

1. Compressed Database:(.ZIP, .JAR, .GZ, .TAR, .BZ2, .TGZ, .TAR.GZ, .TAR.BZ2)

jdbc url format is the same as embedded url and remote url. For example, "jdbc:cobol:/c:/test/testcobol.zip", then you can use select * from aTable to visit aTable table in testcobol.zip file.

No special requirement for sql. Both of the compressed file name and directory name in compressed file are also used as catalog name.

For TAR and BZ2 support, you should download [Apache's tarbz2.jar](#) package.

For case-insensitive sql compatibility, all name of directory and file in compressed file are case-insensitive too.

Compressed database is read-only, and all data modification won't be flushed into compressed file.

You can union compressed table in sql with the common table.

For instance, "jdbc:cobol:/c:/test", select * from "testcobol.zip/files/a.db"; select * from "b.tar.bz2/java"."test.dat";

2. Memory-only Database:

jdbc url: jdbc:cobol:/_memory_ /

No special requirement for sql.

Memory-only database is held commonly in memory, but it will be stored into temporary directory if its length exceeds 8MB limitation to avoid memory overburden.

memory is a special catalog name for memory-only database. Through _memory_ catalog, memory-only database is visible for all applications in the same JVM. For instance, in an embedded connection, you can use to do the same things.

You can use memory-only table in sql with the common table. For instance, select * from _memory_.abc, test;

Memory-only database is volatile, and you can't see your old data any more after restart a JVM.

3. URL Database:(http protocol, https protocol, ftp protocol, sftp protocol)

jdbc:cobol:http://httpURL

jdbc:cobol:https://httpsURL

jdbc:cobol:ftp://ftpURL

jdbc:cobol:sftp://sftpURL

For example, "jdbc:cobol:http://www.hxtt.com/test", then you can use "select * from aTable; ". Because All of http, https, ftp protocol, and sftp protocol are case-sensitive, you have to take care of your sql, and use proper table file suffix to avoid FileNotFoundException. //Note: FTP site's user/password should be set in ftpURL, and cannot be set in JDBC connection property because user/password JDBC connection property belongs to server/client connection.

Without URL database url, you can access url database in an embedded connection too. For instance, select * from "http://www.hxtt.com/test/b.tar/a.db"; select * from "http://www.hxtt.com/test/a.jsp?aaa=33"; select * from "sftp://testa:123456@localhost/a.db";

You can use url table in sql with the common table. For instance, select * from "http://www.hxtt.com/test/b.tar/a.db", aLocalTable;

URL database is read-only, and all data modification won't be flushed into URL content. If you're using a dial-up network, don't waste time to access too big URL database.

For https support in JDK 1.2.x and 1.3.x, you should download [JSSE 1.0.3](#) package.

For sftp support, you should download [JSch - Java Secure Channel Library](#) or [JSch for J2ME if you are using olderJDBC1.2 or JDBC2.0 package](#), which is developed by [Atsuhiko Yamanaka of JCraft, Inc.](#)

For ftp url, HXTT Cobol supports extra ftp mode=active|passive and detectsize=true|false parameters. For instance jdbc:cobol:ftp://username:apassword@127.0.0.1/test/abc.bin;mode=passive;detectsize=true", jdbc:cobol:ftp://192.168.1.1:5005/test/abc.bin;mode=active",

4. SAMBA Database:(smb protocol)

jdbc:cobol:smb://[[[domain;]username[:password]@]server[:port]/[[share/[dir/]file]]][?param=value]]

For example, "jdbc:cobol:smb://test1:123@100.100.13.94/cobolfiles", then you can use "select * from aTable; to visit table. Note: SAMBA user/password should be set in SMB URL, and cannot be set in JDBC connection property because user/password JDBC connection property belongs to server/client connection.

Without SAMBA database url, you can access SAMBA database in an embedded connection too. For instance, select * from "smb://test1:123@100.100.13.94/cobolfiles/zone.db"

You can use SAMBA table in sql with the common table. For instance, select * from

"smb://test1:123@100.100.13.94/cobolfiles/zone.db",aLocalTable

For SAMBA support, you should download [Java CIFS Client Library](#), which is developed by [Michael B. Allen](#).

HXTT Cobol supports seamlessly data mining on memory-only table, physical table, url table, compressed table, SAMBA table in a sql. A compressed database can be a URL database or SAMBA database at the same time. It's powerful, and you should ask for HXTT's support if you don't know how to use it for special purpose.

Create Table from any java.io.InputStream object

At [Bulk Insert A ResultSet from any JDBC driver](#), we discuss how to use "CREATE TABLE [IF NOT EXISTS] table-name [(column-identifier data-type [constraint] [...])] ?" to create a table from any JDBC ResultSet. In fact, that sql syntax can be used to copy and create a table from any java.io.InputStream object. Let's see a sample, which can create a physical table or a memory-only table from an HTTP stream.

```
package test.jdbc.cobol;

import java.net.URL;
import java.net.URLConnection;

import java.io.IOException;
import java.io.InputStream;
import java.sql.*;
import java.util.Properties;

public class testInputCreateTable{
    public static void main(String argv[]) {
        try {
            Class.forName("com.hxtt.sql.cobol.CobolDriver").newInstance();

            String url="jdbc:cobol:/// memory /";//Enabled it if you have not disk access right.
            // String url="jdbc:cobol://cobolfiles/";

            Properties properties=new Properties();
            properties.setProperty("tmpdir","_memory_");//Enabled it if you have not disk access
            right.
            properties.setProperty("delayedClose","-1");//Release database at once.
            Connection con = DriverManager.getConnection(url,properties);

            String sql;
            PreparedStatement pstmt;

            sql="create table testaaa ?";
            pstmt = con.prepareStatement(sql);

            URL httpurl=new URL("http://www.hxtt.com/test/abc.bin");

            URLConnection urlConnection=httpurl.openConnection();
            InputStream is=urlConnection.getInputStream();
            pstmt.setObject(1,is);//create a table from a HTTP stream
            pstmt.executeUpdate();

            pstmt.close();
            is.close();

            sql = "select * from testaaa";

            Statement stmt=con.createStatement();
            ResultSet rs = stmt.executeQuery(sql);

            ResultSetMetaData resultSetMetaData = rs.getMetaData();
            int iNumCols = resultSetMetaData.getColumnCount();
            for (int j = 1; j <= iNumCols; j++) {
                System.out.println(resultSetMetaData.getColumnLabel(j)
                    + " " + resultSetMetaData.getColumnTypeName(j)
                    + " " + resultSetMetaData.getColumnDisplaySize(j)
                );
            }
            Object colval;

            rs.beforeFirst();
            long ncount = 0;
            while (rs.next()) {
                ncount++;
            }
        }
    }
}
```

```

        for (int j = 1; j <= iNumCols; j++) {
            colval = rs.getObject(j);
            System.out.print(colval + " ");
        }
        System.out.println();
    }
    System.out.println("row count:"+ncount);

    rs.close();

    stmt.execute("drop table testaaa");//remove that testaaa table.

    stmt.close();

    con.close();
}
catch( SQLException sqle )
{
    do
    {
        System.out.println(sqle.getMessage());
        System.out.println("Error Code:"+sqle.getErrorCode());
        System.out.println("SQL State:"+sqle.getSQLState());
        sqle.printStackTrace();
    }while((sqle=sqle.getNextException())!=null);
}
catch (Exception e) {
    System.out.println(e.getMessage());
    e.printStackTrace();
}
}
}
}

```

Create Database from any compressed java.io.InputStream object

"CREATE DATABASE [IF NOT EXISTS] file-name ?" sql can be used to create a database from any compressed java.io.InputStream object. Let's see a sample, which can create a physical database or a memory-only database from a compressed HTTP stream.

```

package test.jdbc.cobol;

import java.net.URL;
import java.net.URLConnection;

import java.io.IOException;
import java.io.InputStream;
import java.sql.*;
import java.util.Properties;

public class testInputCreateDatabase{
    public static void main(String argv[]) {
        try {
            Class.forName("com.hxtt.sql.cobol.CobolDriver").newInstance();

            String url="jdbc:cobol:/// memory /";//Enabled it if you have not disk access right.
            // String url="jdbc:cobol:/7/cobolfiles/";

            Properties properties=new Properties();
            properties.setProperty("tmpdir","_memory_");//Enabled it if you have not disk access
            right.
            properties.setProperty("delayedClose","-1");//Release database at once.

            Connection con = DriverManager.getConnection(url,properties);

            String sql;
            PreparedStatement pstmt;

            sql="create database [testaaa.zip] ?";

            pstmt = con.prepareStatement(sql);

            URL httpurl=new URL("http://www.hxtt.com/test/cobolddb.zip");

            URLConnection urlConnection=httpurl.openConnection();
            InputStream is=urlConnection.getInputStream();
            pstmt.setObject(1,is);//create a table from a HTTP stream

```

```

pstmt.executeUpdate();

pstmt.close();
is.close();

sql = "select * from \"testaaa.zip\".abc";
sql = "select * from \"testaaa.zip\".abc";

Statement stmt=con.createStatement();
ResultSet rs = stmt.executeQuery(sql);

ResultSetMetaData resultSetMetaData = rs.getMetaData();
int iNumCols = resultSetMetaData.getColumnCount();
for (int j = 1; j <= iNumCols; j++) {
    System.out.println(resultSetMetaData.getColumnLabel(j)
        + " " + resultSetMetaData.getColumnTypeName(j)
        + " " + resultSetMetaData.getColumnDisplaySize(j)
    );
}
Object colval;

rs.beforeFirst();
long ncount = 0;
while (rs.next()) {
    ncount++;
    for (int j = 1; j <= iNumCols; j++) {
        colval = rs.getObject(j);
        System.out.print(colval + " ");
    }
    System.out.println();
}
System.out.println("row count:"+ncount);

rs.close();

stmt.execute("drop database \"testaaa.zip\"");//remove that testaaa database.

stmt.close();

con.close();
}
catch( SQLException sqle )
{
    do
    {
        System.out.println(sqle.getMessage());
        System.out.println("Error Code:"+sqle.getErrorCode());
        System.out.println("SQL State:"+sqle.getSQLState());
        sqle.printStackTrace();
    }while ((sqle=sqle.getNextException())!=null);
}
catch (Exception e) {
    System.out.println(e.getMessage());
    e.printStackTrace();
}
}
}

```

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Transaction Processing

Index:

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2. [Isolation Levels](#)
3. [Performance Hints](#)

Commit Mode

There are two modes for managing transactions within JDBC:

- auto-commit
- manual-commit

`java.sql.Connection.setAutoCommit(boolean autoCommit)` is used to switch between the two modes. If a connection is in auto-commit mode, then all its SQL statements will be executed and committed as individual transactions. Otherwise, its SQL statements are grouped into transactions that are terminated by a call to either the method `java.sql.Connection.commit` or the method `java.sql.Connection.rollback`. By default, new connections are in auto-commit mode. After an application turns auto-commit off, a transaction is started. The transaction continues until either the `java.sql.Connection.commit` method, `COMMIT [WORK]` sql, the `java.sql.Connection.rollback` method, or `ROLLBACK [WORK]` sql is called; after that a new transaction is automatically started.

Calling the commit method ends the transaction. At that stage, HXTT Cobol checks whether the transaction is valid and raises an exception if a conflict is identified. If a conflict is encountered, your application should determine how to continue, for example whether to automatically retry the transaction or inform the user of the failure. A request to rollback a transaction causes HXTT Cobol to discard any changes made since the start of the transaction and to end the transaction.

```
connection.setAutoCommit(false); // Explicit transaction handling
Statement stmt = connection.createStatement();

// Loop until transaction successful (or max retry exceeded)
for(int count=0;; count++) {
    stmt.executeUpdate(yourSQL);
    try{
        connection.commit(); // Commit transaction
        break;
    }catch(SQLException sqe) {
        // Check commit error
        if(sqe.getSQLState().equals("40000")) {
            //You can use sqe.getNextException() to know more information

            // Check number of times the transaction has been attempted
            if (count<3) {
                continue;
            }
        }
        throw sqe;
    }
}
```

Isolation Levels

An isolation level represents a particular locking strategy employed in the HXTT Cobol to improve data consistency. The higher the isolation level, the more locking or snapshot involved, and the more time users may spend waiting for data to be freed by another user. The isolation level provided by the HXTT Cobol determines whether a transaction will encounter the following behaviors in data consistency:

- dirty read: A row changed by one transaction can be read by another transaction before any changes in that row have been committed. For instance, User 1 modifies a row. User 2 reads the same row before User 1 commits.

User 1 performs a rollback. User 2 has read a row that has never really existed in the database. User 2 may base decisions on false data.

- non-repeatable read: Where one transaction reads a row, a second transaction alters the row, and the first transaction rereads the row, getting different values the second time (a "non-repeatable read"). For instance, User 1 reads a row but does not commit. User 2 modifies or deletes the same row and then commits. User 1 rereads the row and finds it has changed (or has been deleted).
- phantom read: When one transaction reads all rows that satisfy a WHERE condition, a second transaction inserts a row that satisfies that WHERE condition, and the first transaction rereads for the same condition, retrieving the additional "phantom" row in the second read. For instance, User 1 uses a search condition to read a set of rows but does not commit. User 2 inserts one or more rows that satisfy this search condition, then commits. User 1 rereads the rows using the search condition and discovers rows that were not present before.

Isolation Levels and Data Consistency Definition

Isolation Level	Dirty Read	Non-repeatable Read	Phantom Read
None	Yes	Yes	Yes
Read uncommitted	Yes	Yes	Yes
Read committed	No	Yes	Yes
Repeatable read	No	No	Yes
Serializable	No	No	No

HXTT Cobol supports all isolation levels.

Performance Hints

- With auto-commit mode, all operations will be done in TRANSACTION NONE level with concurrent support.
- READ UNCOMMITTED level is always faster than three other transaction levels if you don't do many roolback operations.
- Under REPEATABLE READ or SERIALIZABLE mode, the default CLOSE_CURSORS_AT_COMMIT for ResultSet holdability is faster than HOLD_CURSORS_OVER_COMMIT.

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DBAdmin is intergrated enviroment for start,stop,test,manage and monitor the HXTT database software! DBAdmin is contained in the all hxtt java database software package ,you can download the package from [here](#) for test use! How to start this DBAdmin program?

For example,if you have download the HXTT Cobol 3.0 package whose filename is Cobol_JDBC30.jar and save it to c disk,you can run it by

```
java -classpath c:/Cobol_JDBC30.jar com.hxtt.sql.admin.Admin
```

you will see this window!

In default ,this program will product a file named urlconfig.properties locate in user.home enviroment variable.

You can assign the hxtt.urlconfig environment variable to assign the urlconfig.properties path.For example,

```
java -classpath c:/Cobol_JDBC30.jar -Dhxtt.urlconfig=c:/urlconfig.properties
com.hxtt.sql.admin.Admin
```

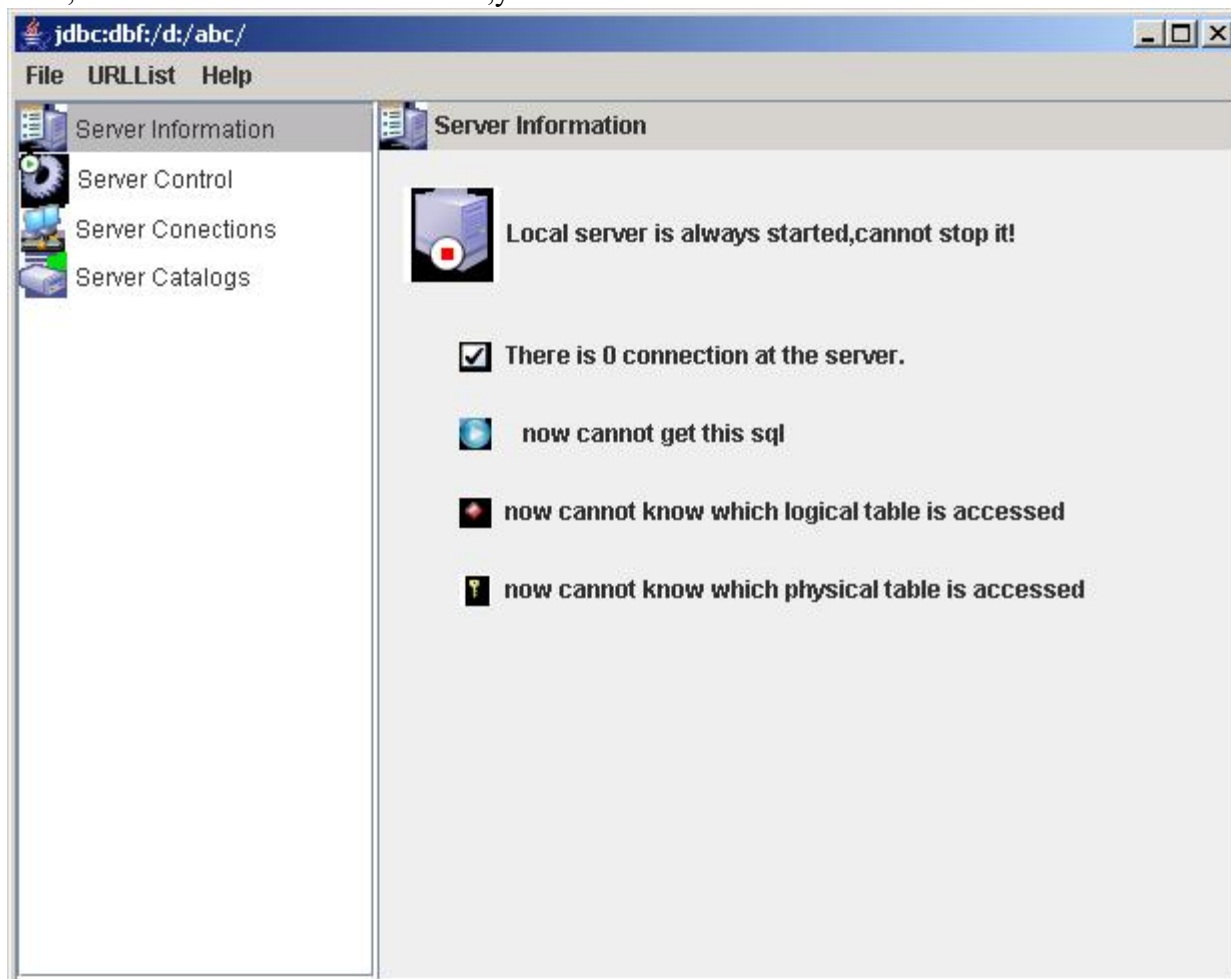


This left list is the configed url list,click a url in this list ,you can see this url config information at the right window!

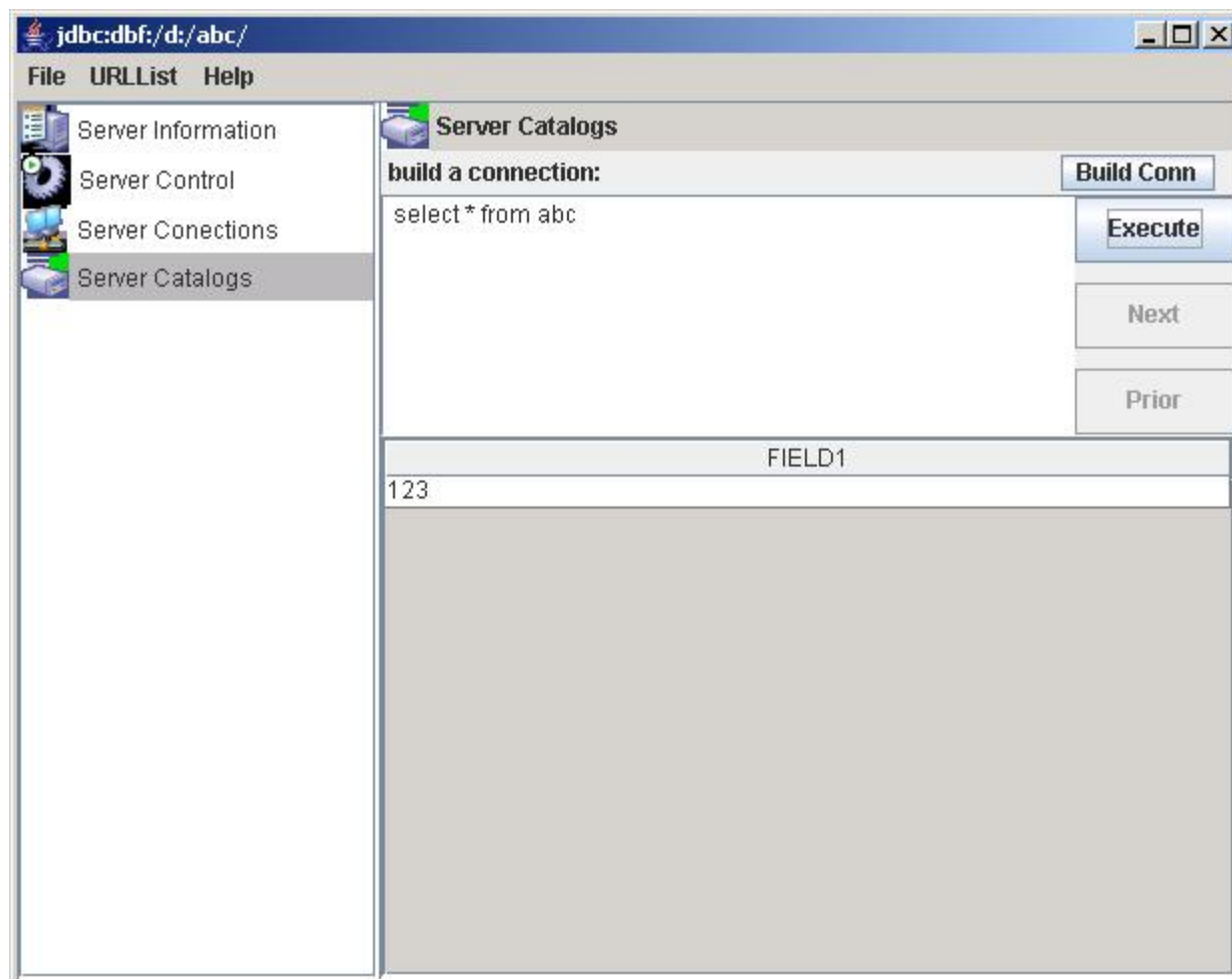


This url name is used to represented this url config information; this url information text is this url information for start,stop,manage and monotor url information, this url information must be a correct embedded jdbc url or remote jdbc url(this sample describes only an embedded url service, if you wish to access remote, you should use remote url service, for instance,

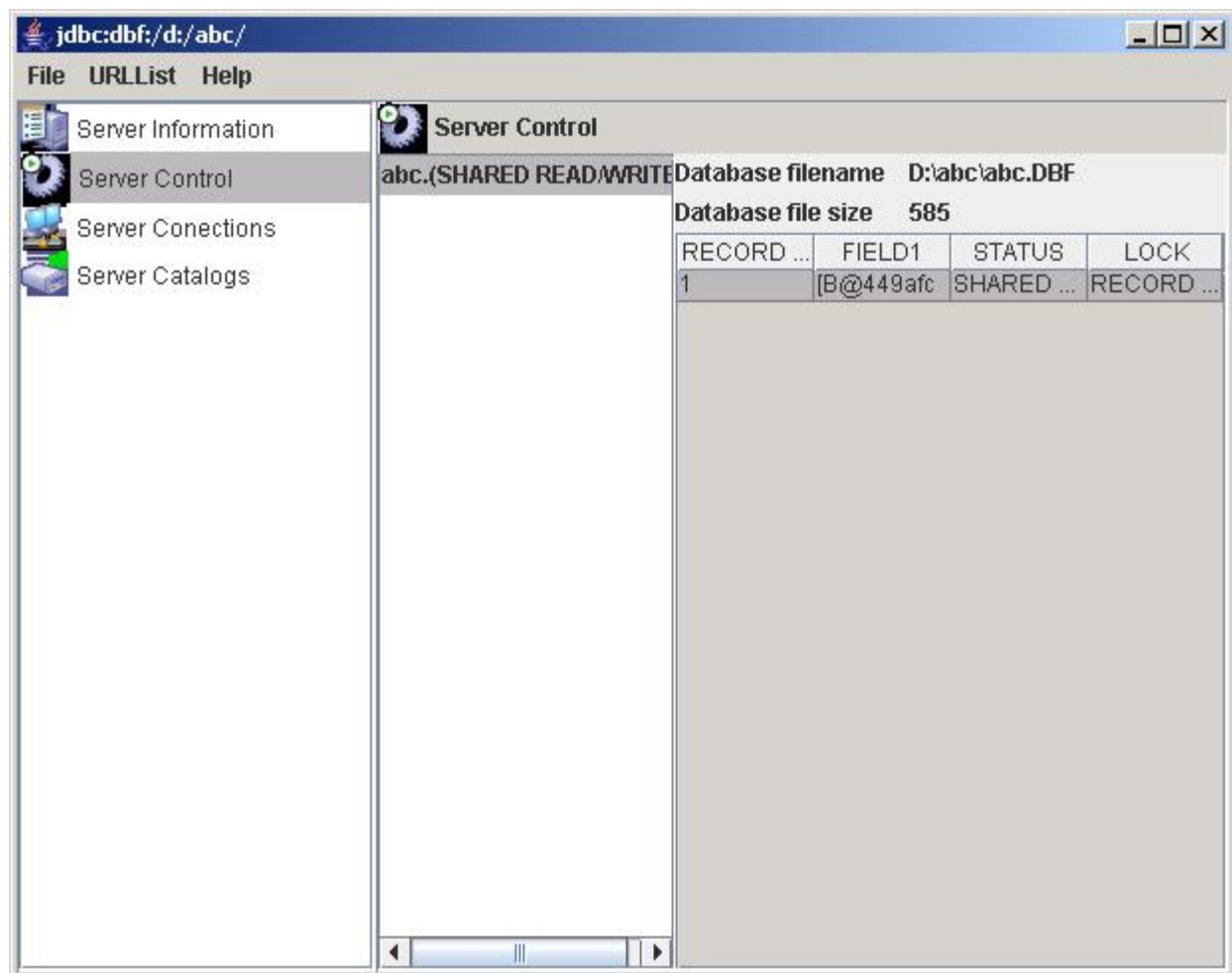
jdbc:cobol://localhost:3099//usr/datadir); this auto start is used to assign if this remote url start when this dbadmin program start,it is general used to start the hxtt java database server after start the rmi service ! this log information is used to assign if log this server access information to a disk file ; Click this View Monitor button,you can view the select url monitor window!



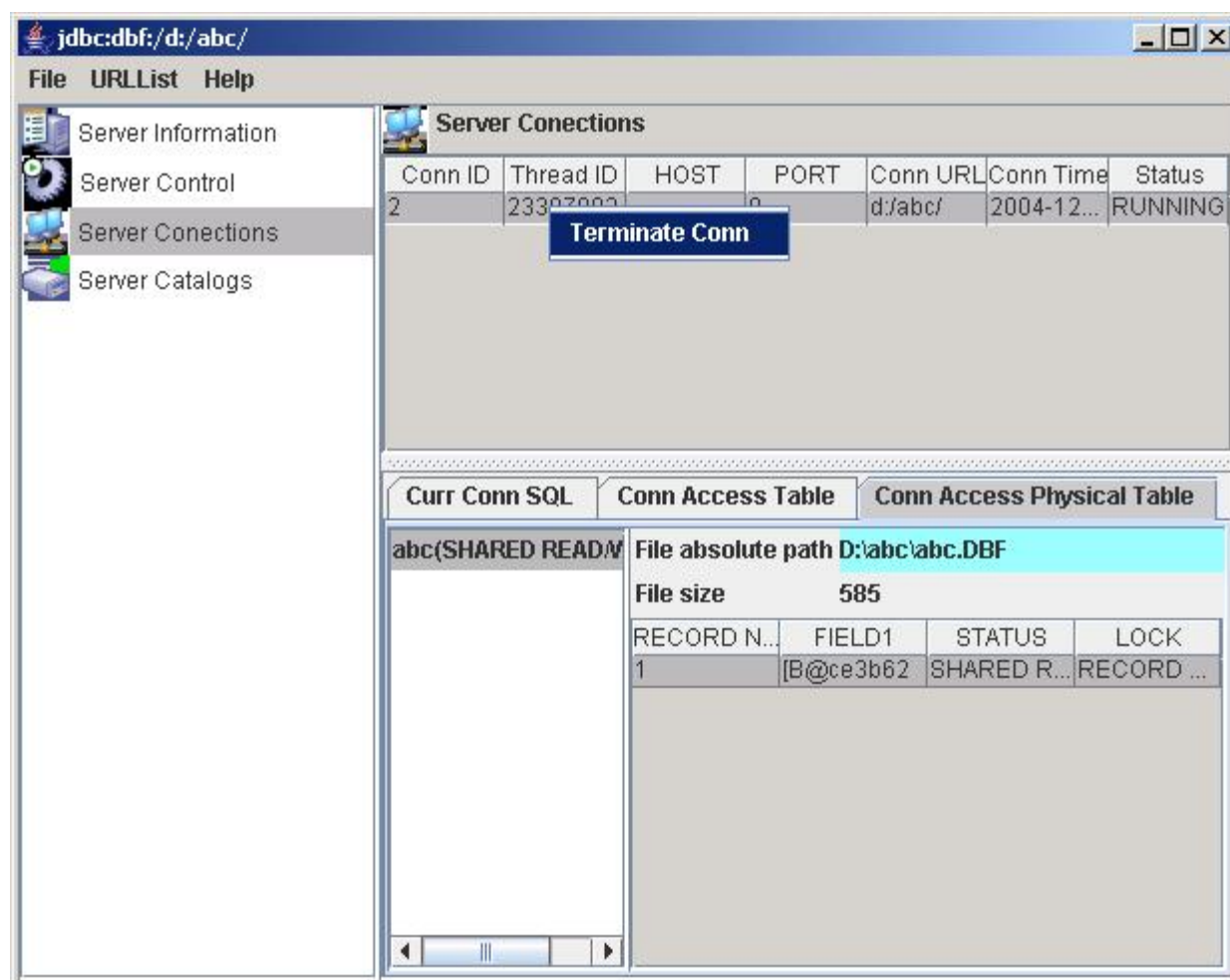
This Server Information item in the left list is used to show the general information about this selected url! If the server have not started,you can click the right image to start this server, after start this server,you can see four item at this left list! This Server Catalogs is used to build a connection and execute some sql at the server,you can see the result at this right-bottom window!



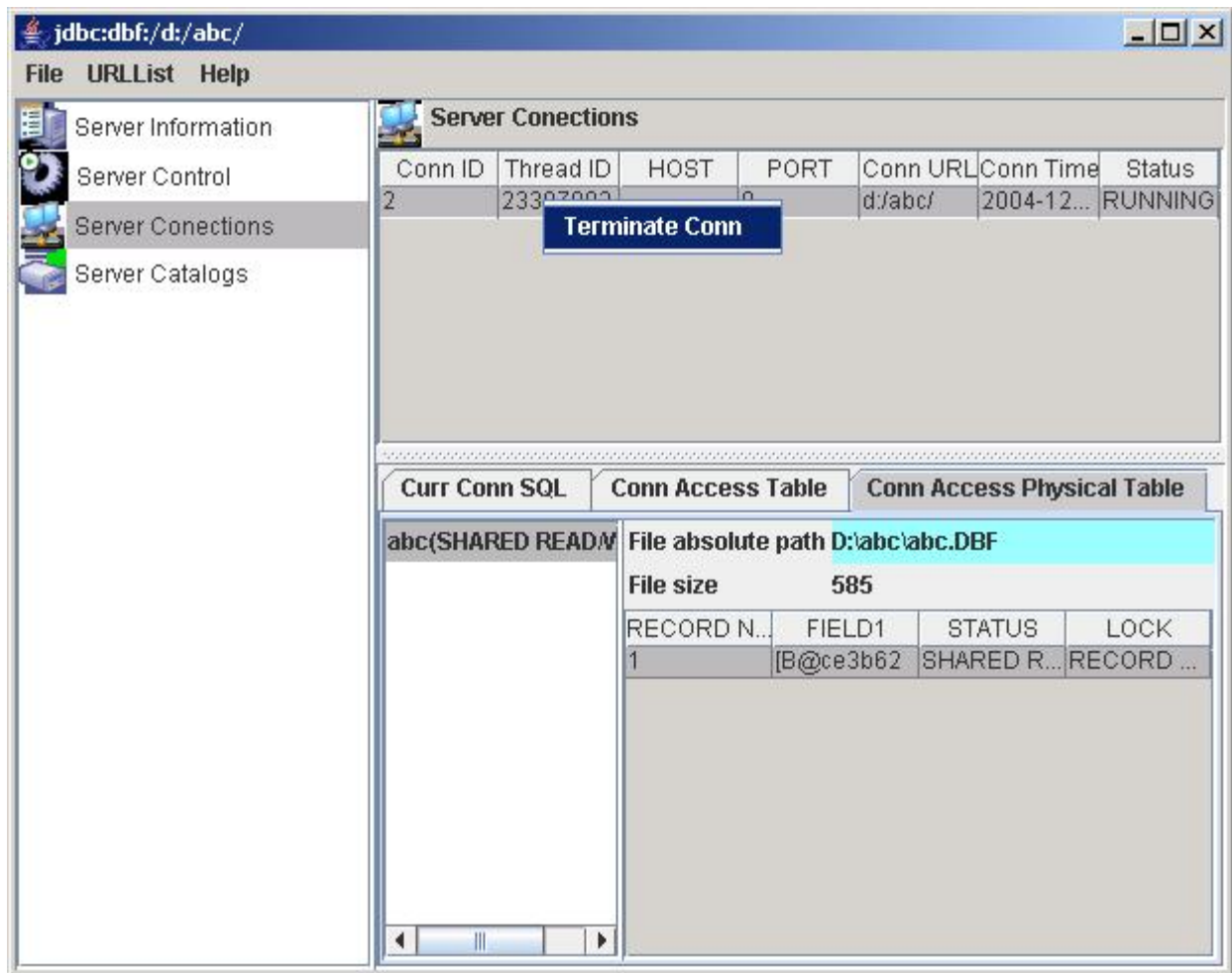
This Server Controls is used to monitor the physical file which is now accessed by the server! ❓❓



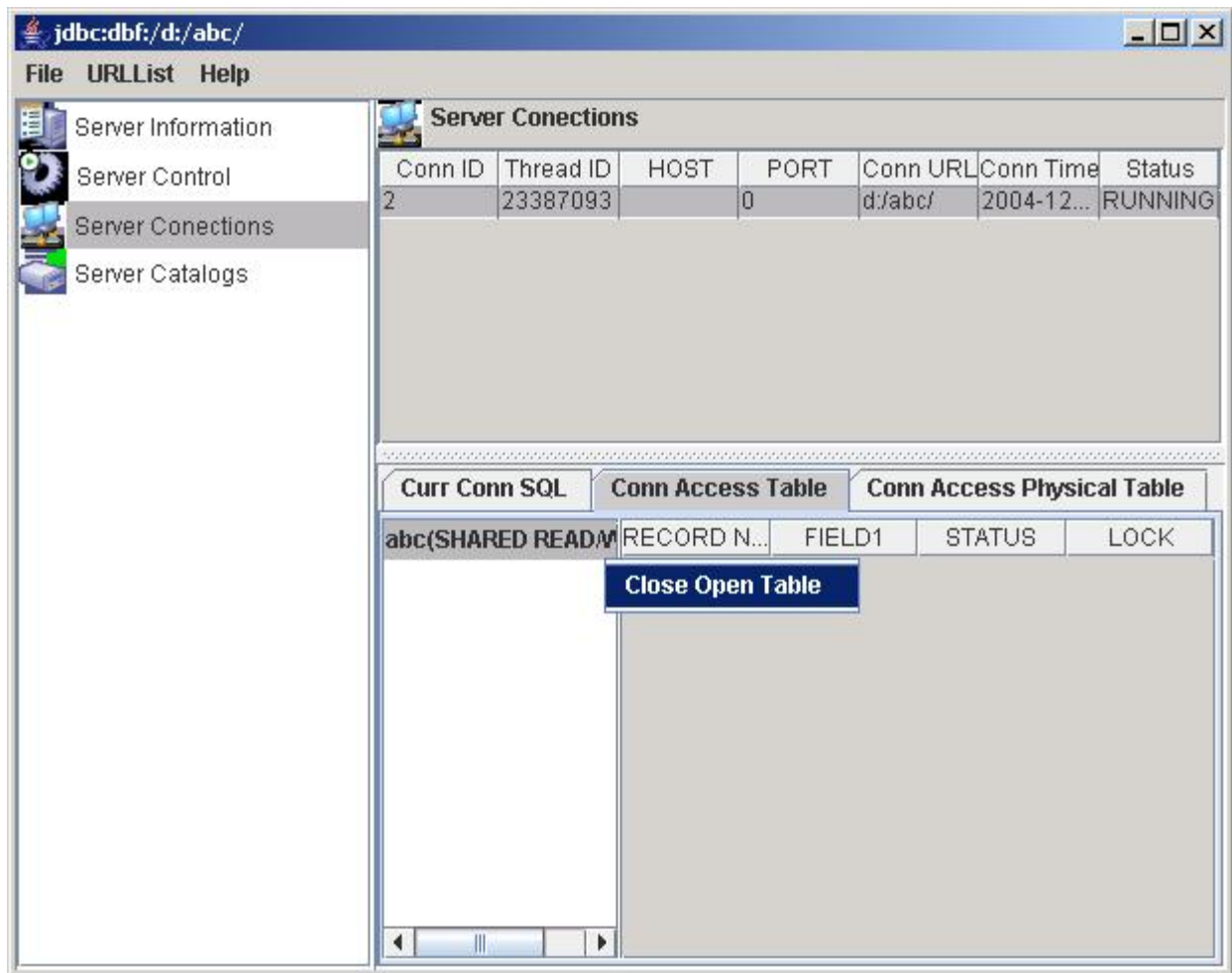
This Server Connections is used to monitor the current connections connected this server and their activity. There are a connection list at the right top window to show the current connections! At the right bottom window, there are three tabpanes! The first is used to show the current sql sentence executed by the selected connection ; this second is used to show the logical table accessed by the selected connection; this third is used to show the physical table accessed by the selected connection;



At the connections list,select a connection and right-click mouse ,you can close a connection at the popup menu!



At the accessed logical table list ,select a item and right click mouse,you can close the this logical table opened by this selected connection!



At the accessed physical table list ,select a item and right click mouse,you can close the physical table ,but you should be careful,because this operation will close the physical table no matter this table is accessed by other connection!

The screenshot shows the jdbadmin application window with the following components:

- Menu:** File, URLList, Help
- Left Panel:** Server Information, Server Control, Server Conections (selected), Server Catalogs
- Server Conections Table:**

Conn ID	Thread ID	HOST	PORT	Conn URL	Conn Time	Status
2	23387093		0	d:/abc/	2004-12...	RUNNING
- Table Tabs:** Curr Conn SQL, Conn Access Table, Conn Access Physical Table
- Physical Table View:**

abc(SHARED READM File absolute path D:\abc\abc.DBF

Close Physical Table

RECORD N...	FIELD1	STATUS	LOCK
1	[B@ce3b62	SHARED R...	RECORD ...

It a physical table is locked a lot of records and you can only release some records locks,you should select a item at the physical table record locks list and right click mouse,click the close menu to release the selected record lock,and redo this step to release other record lock until you don't want to do so.

The screenshot shows the jdbadmin application window with the following components:

- Window Title:** jdbadmin:dbf:/d:/abc/
- Menu Bar:** File URLList Help
- Left Panel:** Server Information, Server Control, Server Connections (selected), Server Catalogs
- Server Connections Table:**

Conn ID	Thread ID	HOST	PORT	Conn URL	Conn Time	Status
2	23387093		0	d:/abc/	2004-12-...	RUNNING
4	23387093		0	d:/abc/	2004-12-...	RUNNING
- Bottom Panel:**
 - Tabbed Interface:** Curr Conn SQL, Conn Access Table, Conn Access Physical Table
 - Current Selection:** abc(SHARED READM)
 - File Information:** File absolute path D:\abc\abc.DBF, File size 585
 - Table:**

RECORD NU...	FIELD1	STATUS	LOCK
1	IB@1 d6bf7	SHARED RE...	RECORD 1 S...
 - Action:** Release Select Record Lock

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Chapter 7. Scalar Functions and Aggregate Functions

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Mathematical Functions

1. ABS(x): the absolute value
2. BITAND(x, y): returns the result of performing a bitwise AND on x and y.
3. BIT_COUNT(x): returns the number of bits of x.
4. CEIL(x), CEILING(x): the smallest integer that is not less than x
5. DEGREES(x): converts radians to degrees
6. EXP(x): exponential, e(2.718...) raised to the power of x
7. FLOOR(x): the largest integer not greater than argument x
8. INT(x) : truncates x to nearest integer
9. LOG(x), LN(x): the natural logarithm
10. LOG(b,x): returns the logarithm of X for an arbitrary base B
11. LOG10(x): the base 10 logarithm
12. LOG2(X): the base 2 logarithm
13. LN(x): the natural logarithm
14. MOD(y, x): the remainder of y/x, you can use y%x too.
15. PI(): pi constant, 3.14159265358979323846.
16. POW(x, y), POWER(x, y): x raised to the power of y
17. RADIANS(x): converts degrees to radians
18. RAND([seed]): a random value between 0.0 and 1.0
19. ROUND(x [,y]): rounds x to nearest integer without y, or round x to y digits after the decimal point.
20. SIGN(x): returns -1 if x is smaller than 0, 0 if x==0 and 1 if x is bigger than 0.
21. SQRT(x): the square root
22. TRUNC(x[,y]), TRUNCATE(x[,y]): truncates x to nearest integer without y, truncates x to y digits after the decimal point

Trigonometric Functions

1. ACOS(x): the inverse cosine of an angle
2. ASIN(x): the inverse sine of an angle
3. ATAN(x), ATN(x): the inverse tangent of an angle
4. ATAN2(x, y): the inverse tangent of x/y
5. COS(x): the cosine of an angle
6. COT(x): the cotangent of an angle
7. SIN(x): the sine of an angle
8. TAN(x): the tangent of an angle

String Functions

1. ALLTRIM(string1): removes all leading and trailing blanks in string1
2. ASC(string1), ASCII(string1): the ASCII code of the leftmost character of the argument
3. AT(cSearchExpression, cExpressionSearched [, nOccurrence]): returns the beginning numeric position of the first occurrence of a character expression or memo field within another character expression or memo field, counting from the leftmost character. If the character expression isn't found, AT() returns 0.
4. ATC(cSearchExpression, cExpressionSearched [, nOccurrence]): returns the beginning numeric position of the first occurrence of a character expression or memo field within another character expression or memo field, counting from the leftmost character. If the character expression isn't found, RAT() returns 0. It is case insensitive.
5. BIN(number1): returns a string representation of the binary value of number1, where number1 is a integer(TINYINT, SMALLINT, INT, or BIGINT) number. Returns NULL if N is NULL.
6. BIT_LENGTH(string1): the length of the string str in bits
7. CHAR_LENGTH(string1), CHARACTER_LENGTH(string1): the number of characters in string1
8. CHAR(integer), CHR(integer): a character with the given ASCII code
9. CHAR(integer1,...): interprets the arguments as integers and returns a string consisting of the characters given by the unicode values of those integers. NULL values are skipped.

10. CHRTRAN(cSearchedExpression, cSearchExpression, cReplacementExpression): Replaces each character in a character expression that matches a character in a second character expression with the corresponding character in a third character expression. CHRTRAN() translates the character expression cSearchedExpression using the translation expressions cSearchExpression and cReplacementExpression and returns the resulting character string. If a character in cSearchExpression is found in cSearchedExpression, the character in cSearchedExpression is replaced by a character from cReplacementExpression that's in the same position in cReplacementExpression as the respective character in cSearchExpression. If cReplacementExpression has fewer characters than cSearchExpression, the additional characters in cSearchExpression are deleted from cSearchedExpression. If cReplacementExpression has more characters than cSearchExpression, the additional characters in cReplacementExpression are ignored.
11. CONCAT(string1, string2): string concatenation, you can use string1+string2 too.
12. CONCAT(string1, string2,...): returns the string that results from concatenating the arguments. NULL values are skipped.
13. CONCAT_WS(separator,string1, string2,...): returns the string that results from concatenating the arguments. The first argument is the separator for the rest of the arguments. The separator is added between the strings to be concatenated. If the separator is NULL, the result is NULL. The function skips any NULL values after the separator argument.
14. CONV(number1,base): returns a string representation of the first argument in the radix specified by the second argument. The minimum base is 2 and the maximum base is 36.
15. DIFFERENCE(string1, string2): the difference between the sound of string1 and string2
16. HEX(number1): returns a string representation of the hexadecimal value of number1, where number1 is a integer(TINYINT, SMALLINT, INT, or BIGINT) number. Returns NULL if N is NULL.
17. INITCAP(string1): converts first letter of each word (whitespace-separated) to upper case
18. INSERT(string1, start1, length1, string2): a string where length1 number of characters beginning at start1 has been replaced by string2
19. INSTR(string1, string2 [,start1]): the first index (>0:left location, 0:not found) where string2 is found in string1, starting at start1
20. INSTR(start1, string1, string2): (Compatible purpose) the first index (>0:left location, 0:not found) where string2 is found in string1, starting at start1.
21. LCASE(string1): converts string1 to lower case
22. LEFT(string1, count1): the leftmost count1 of characters of string1
23. LENGTH(string1), LEN(string1): the number of characters in string1
24. LOCATE(string1, string2 [,start1]): the first index (>0:left location, 0:not found) where string1 is found in string2, starting at start1
25. LOWER(string1): converts string1 to lower case
26. LPAD(string1, length1 [, cPadCharacter]): returns a string from an expression, padded with character(a space by default) to a specified length on the left. If the string is already longer than length then it is truncated (on the right).
27. LTRIM(string1): removes all leading blanks in string1
28. MID(string1 FROM start1 [FOR length1]), MID(string1, start1 [,length1]): extracts the substring starting at start1 with length length1. MID is a synonym for SUBSTRING.
29. OCT(number1): returns a string representation of the octal value of number1, where number1 is a integer(TINYINT, SMALLINT, INT, or BIGINT) number. Returns NULL if N is NULL.
30. OCTET_LENGTH(string1): the number of octets (8-bit bytes) needed to represent the string1.
31. PADC(string1, length1 [, cPadCharacter]): returns a string from an expression, padded with character(a space by default) to a specified length on both sides. If the string is already longer than length then it is truncated (on the right).
32. PADL(string1, length1 [, cPadCharacter]): returns a string from an expression, padded with character(a space by default) to a specified length on the left. If the string is already longer than length then it is truncated (on the right).
33. PADR(string1, length1 [, cPadCharacter]): returns a string from an expression, padded with character(a space by default) to a specified length on the right. If the string is already longer than length then it is truncated (on the right).
34. RAT(cSearchExpression, cExpressionSearched [, nOccurrence]): returns the beginning numeric position of the last (rightmost) occurrence of a character expression or memo field within another character expression or memo field, counting from the rightmost character. If the character expression isn't found, RAT() returns 0.
35. RATC(cSearchExpression, cExpressionSearched [, nOccurrence]): returns the beginning numeric position of the last (rightmost) occurrence of a character expression or memo field within another character expression or memo field, counting from the rightmost character. If the character expression isn't found, RATC() returns 0. It is case insensitive.
36. POSITION(s1 IN s2), POSITION(substr,str): location of specified substring
37. PROPER(STRING1) : returns from a character expression a string capitalized as appropriate for proper names.
38. REPEAT(string1, count1): repeats string1 count1 times
39. REPLICATE(string1, count1): same as REPEAT(string1,count1)
40. REPLACE(string1, string2, string3): replaces all occurrences in string1 of substring string2 with substring string3.
41. RIGHT(string1, count1): the rightmost count1 of characters of string1
42. RPAD(string1, length1 [, cPadCharacter]): returns a string from an expression, padded with character(a space by default) to a specified length on the right. If the string is already longer than length then it is truncated (on the right).
43. RTRIM(string1): removes all trailing blanks in string1
44. SOUNDEX(string1): a four character code representing the sound of string1
45. SPACE(nSpaces): returns a character string composed of a specified number of spaces.
46. SPLIT(string1, string2): split string1 according to delimiter string2, and return an String[] object (Types.ARRAY). Special SPLIT(expression,"") will return strings which contains only Letter and Digit. Special SPLIT(expression,null) will split string into length=1 strings, which is only Letter or Digit.
47. STRCAT(string1, string2): string concatenation, you can use string1+string2 too,same as CONCAT.
48. STRCAT(string1, string2,...): returns the string that results from concatenating the arguments, NULL values are skipped,same as CONCAT.
49. STRCMP(expr1,expr2): returns 0 if the strings are the same, -1 if the first argument is smaller than the second, and 1 otherwise.
50. STRCONV(expr1 [, charsetName]): returns a string by decoding the specified array of bytes using the specified charset. Cp895(Czech MS - DOS 895), Cp620(Polish MS - DOS 620) and Mazovia are extra supported although JVM doesn't support those. The omitted charsetName is 'ISO8859_1'.
51. STRTRAN(cSearched, cSearchFor [, cReplacement][, nStartOccurrence] [, nNumberOfOccurrences]): searches a character expression or memo field for occurrences of a second character expression or memo field, and then replaces each occurrence with a third character expression or

- memo field.
52. STUFF(cExpression, nStartReplacement, nCharactersReplaced, cReplacement): returns a string created by replacing a specified number of characters in a character expression with another character expression. cExpression specifies the string expression in which the replacement occurs. nStartReplacement specifies the position in cExpression where the replacement begins. nCharactersReplaced specifies the number of characters to be replaced. If nCharactersReplaced is 0, the replacement string cReplacement is inserted into cExpression. cReplacement specifies the replacement string expression. If cReplacement is the empty string, the number of characters specified by nCharactersReplaced are removed from cExpression.
 53. SUBSTR(string1, start1 [,length1]): extracts the substring starting at start1 with length length1
 54. SUBSTRING(string1 FROM start1 [FOR length1]), SUBSTRING(string1, start1 [,length1]): extracts the substring starting at start1 with length length1
 55. TRANSLATE(string1, string2, string3): any character in string1 that matches a character in the string2 is replaced by the corresponding character in the string3.
 56. TRIM([[BOTH | LEADING | TRAILING] [removedstring1] FROM] string1): remove the removedstring1 (a space by default) from the start/end/both ends of the string1.
 57. UCASE(string1): converts string1 to upper case
 58. UPPER(string1): converts string1 to upper case
 59. CHARMIRR(string1 [,IDontMirrorSpaces]): mirrors string1 at character level. string1 is the string that should be mirrored. If IDontMirrorSpaces equal to true, spaces at the end of string1 will not be mirrored but kept at the end. IDontMirrorSpaces's default value is false, which means to mirror the whole string.
 60. REVERSE(string1[,IDontMirrorSpaces]): mirrors string1 at byte level.

Date/Time Functions

1. ADDTIME(expr,expr2): adds expr2 to expr and returns the result. expr is a date or timestamp expression, and expr2 is a time expression.
2. CDOW(date) Returns the day-of-the-week(Sunday,Monday, Tuesday, Wednesday, Thursday, Friday,Saturday) from a given date,
3. CMONTH(date) the name of the month
4. CURDATE(): the current date
5. CURTIME(): the current time
6. DATE(): the current date
7. DATE(expr): extracts the date part of the date or timestamp expression expr.
8. DATETIME(): the current timestamp
9. DATESERIAL(year,month,day): returns a date value representing a specified year, month, and day.
10. DATE_ADD(date,INTERVAL expr type), DATE_SUB(date,INTERVAL expr type), ADDDATE(date,INTERVAL expr type), SUBDATE(date,INTERVAL expr type). For instance, SELECT DATE_ADD(date1,INTERVAL hour(now()+1 HOUR), adddate(date1,interval 3 hour) FROM test;

type Value	Expected expr Format
MICROSECOND[S]	MICROSECONDS
MILLISECOND[S]	MILLISECONDS
SECOND	SECONDS
MINUTE	MINUTES
HOUR	HOURS
DAY	DAYS
WEEK	WEEKS
MONTH	MONTHS
QUARTER	QUARTERS
YEAR	YEARS
DECADE	DECADES
CENTURY	CENTURYS
MILLENNIUM	MILLENNIUMS
SECOND_MICROSECOND	'SECONDS.MICROSECONDS'
MINUTE_MICROSECOND	'MINUTES.MICROSECONDS'
MINUTE_SECOND	'MINUTES:SECONDS'
HOUR_MICROSECOND	'HOURS.MICROSECONDS'
HOUR_SECOND	'HOURS:MINUTES:SECONDS'
HOUR_MINUTE	'HOURS:MINUTES'
DAY_MICROSECOND	'DAYS.MICROSECONDS'
DAY_SECOND	'DAYS HOURS:MINUTES:SECONDS'
DAY_MINUTE	'DAYS HOURS:MINUTES'
DAY_HOUR	'DAYS HOURS'
YEAR_MONTH	'YEARS-MONTHS'

11. DATEDIFF(expr,expr2): returns the number of days between the start date expr and the end date expr2. expr and expr2 are date or date-and-time expressions. Only the date parts of the values are used in the calculation.
12. DATEADD(INTERVAL, expr, date), DATEDIFF (INTERVAL, date1, date2), DATEPART (INTERVAL, date) For instance, SELECT DateAdd('m', 3, date1) FROM test;

INTERVAL Value	Expected expr Format
yyyy	Year
q	Quarter
m	Month
y	Day of the year
d	Day
w	Weekday
ww	Week
h	Hour
n	Minute
s	Second

13. DAY(date1), DAYOFMONTH(date1): the day of the month (1-31)
14. DAYNAME(date1): the name of the day
15. DAYOFWEEK(date1): the day of the week (1 means Sunday)
16. DAYOFYEAR(date1): the day of the year (1-366)
17. EXTRACT(type FROM expr): extracts parts from the date.

type Value	Expected Result
MICROSECOND[S]	MILLISECOND*1000
MILLISECOND[S]	indicates the millisecond within the second.
SECOND	indicates the second within the minute
MINUTE	MINUTES
HOUR	HOURS
DAY	DAYS
MONTH	MONTHS
QUARTER	QUARTERS
YEAR	YEARS
DECADE	DECADES
CENTURY	CENTURYS
MILLENNIUM	MILLENNIUMS
DOW	indicates the day of the week, SUNDAY, MONDAY, TUESDAY, WEDNESDAY, THURSDAY, FRIDAY, and SATURDAY(1~7).
DOY	indicates the day number within the year. The first day of the year has value 1.
WEEK,WOM	indicates the ordinal number of the day of the week within the current month.
WOY	indicates the ordinal number of the day of the week within the current year.
EPOCH	the current time as UTC milliseconds from the epoch(1970-01-01 00:00:00).

18. DOW(date1) get the day of the week, SUNDAY, MONDAY, TUESDAY, WEDNESDAY, THURSDAY, FRIDAY, and SATURDAY(1~7)
19. FROM_DAYS(expr1): given a day number expr1, returns a DATE value.
20. GOMONTH(expr1,numMonths) : give a date,return the date before or after a number months
21. HOUR(time1): the hour (0-23)
22. LAST_DAY(date1): takes a date or timestamp value and returns the corresponding date for the last day of the month.
23. MINUTE(time1): the minute (0-59)
24. MILLISECOND(time1): the milliseconds from the time or timestamp expression time1.
25. MICROSECOND(time1): the microseconds from the time or timestamp expression time1.
26. MONTH(time1): the month (1-12)
27. MONTHNAME(date1): the name of the month
28. NOW(): the current date and time as a timestamp
29. QUARTER(date1): the quarter (1-4)
30. SECOND(time1): the second (0-59)
31. SEC(time1) (Compatible purpose): the second (0-59)
32. SUBTIME(expr,expr2): subtracts expr2 from expr and returns the result. expr is a date or timestamp expression, and expr2 is a time expression.

33. SYSDATE(): the current date and time as a timestamp. Asynonym for NOW().
34. TIME(): returns the current system time in 24-hour, eight-character string (hh:mm:ss) format.
35. TIME(expr): extracts the time part of the time or timestamp expression expr.
36. TIMEDIFF(expr,expr2) returns the time between the start time expr and the end time expr2. Only the time parts of the values are used in the calculation.
37. TIMESERIAL(hour,minute,second): returns a Time value representing a specified hour, minute, and second.
38. TIMESTAMP(expr): returns the date or timestamp expression expr as a timestamp value.
39. TIMESTAMPADD(interval, count, timestamp1): adds the integer expression count to the date or timestamp expression timestamp1. interval can be SQL_TSI_FRAC_SECOND, SQL_TSI_SECOND, SQL_TSI_MINUTE, SQL_TSI_HOUR, SQL_TSI_DAY, SQL_TSI_WEEK, SQL_TSI_MONTH, SQL_TSI_QUARTER, SQL_TSI_YEAR, FRAC_SECOND, SECOND, MINUTE, HOUR, DAY, WEEK, MONTH, QUARTER, or YEAR.
40. TIMESTAMPDIF(interval, timestamp1, timestamp2): returns the integer difference between the date or timestamp expressions timestamp1 and timestamp2 (timestamp2-timestamp1). interval can be SQL_TSI_FRAC_SECOND, SQL_TSI_SECOND, SQL_TSI_MINUTE, SQL_TSI_HOUR, SQL_TSI_DAY, SQL_TSI_WEEK, SQL_TSI_MONTH, SQL_TSI_QUARTER, SQL_TSI_YEAR, FRAC_SECOND, SECOND, MINUTE, HOUR, DAY, WEEK, MONTH, QUARTER, or YEAR.
41. TO_DAYS(date1): given a date date1, returns a day number.
42. WEEK(date1), WEEKOFYEAR(date1): the week of this year (1-53)
43. YEAR(date1): the year

Boolean Functions

1. BETWEEN(expression1,expression2,expression3) : determines whether the value of an expression1 lies between the expression2 and expression3, return true or false.
2. EMPTY(expression): determines whether an expression evaluates to empty or null. The expression you include can be a string, numeric, date, or logical expression. EMPTY() returns true, when a string is empty string, spaces, tabs, carriage returns, linefeeds, or any combination of these, numeric value equals to 0, and logical expression is false.
3. ISBLANK(expression): determines whether an expression evaluates to empty or null. The expression you include can be a string, numeric, date, or logical expression. ISBLANK() returns true, when a string is empty string or spaces, numeric value equals to null, and logical expression is null.
4. ISALPHA(expression): determines whether the leftmost character in a character expression is alphabetic.
5. ISDATE(expression): determines whether an expression can be converted to a date value.
6. ISDIGIT(expression): determines whether the leftmost character of the specified character expression is a digit (0 through 9).
7. ISDIGITS(expression): determines whether a string contains only digits(0 through 9).
8. ISNULL(expression): determines whether an expression evaluates to null. The expression you include can be a string, numeric, date, or logical expression. If expression is NULL, ISNULL() returns true, otherwise it returns false.
9. ISNUMERIC(expression): determines whether an expression can be converted to a number value.

System Functions

1. DATABASE(): the name of the database of this connection
2. USER(): the user name of this connection
3. DELETED([cTableAlias | nWorkArea]): returns a logical value that indicates whether the current record is marked for deletion.
4. RECCOUNT([cTableAlias | nWorkArea]): returns the number of records, which includes all deleted records.
5. RECNO([cTableAlias | nWorkArea]): returns the current record number in the current or specified table. nWorkArea specifies the work area number for a table open in another work area. cTableAlias specifies the table alias for a table open in another work area.
6. ROWLOCKED([cTableAlias | nWorkArea]): indicates whether the current row has been locked by process or application.
7. TABLELOCKED(cTableName): indicates whether a table has been locked by process or application. For instance, select tablelocked('test').

Conversion Functions

1. CAST(expression AS data_type): converts value1 to another data type data_type. data_type may be SQL_BIGINT(Types.BIGINT), SQL_BINARY(Types.BINARY), SQL_BIT(Types.BIT), SQL_CHAR(Types.CHAR), SQL_DATE(Types.DATE), SQL_DECIMAL(Types.DECIMAL), SQL_DOUBLE(Types.DOUBLE), SQL_FLOAT(Types.FLOAT), SQL_INTEGER(Types.INTEGER), SQL_LONGVARBINARY(Types.LONGVARBINARY), SQL_LONGVARCHAR(Types.LONGVARCHAR), SQL_REAL(Types.REAL), SQL_SMALLINT(Types.SMALLINT), SQL_TIME(Types.TIME), SQL_TIMESTAMP(Types.TIMESTAMP), SQL_TINYINT(Types.TINYINT), SQL_VARBINARY(Types.VARBINARY), SQL_VARCHAR(Types.VARCHAR), BIGINT(Types.BIGINT), BINARY(Types.BINARY), BIT(Types.BIT), CHAR(Types.CHAR), DATE(Types.DATE), DECIMAL(Types.DECIMAL), DOUBLE(Types.DOUBLE), FLOAT(Types.FLOAT), INTEGER(Types.INTEGER), INT(Types.INTEGER), LONGVARBINARY(Types.LONGVARBINARY), LONGVARCHAR(Types.LONGVARCHAR), NUMERIC (Types.NUMERIC), REAL(Types.REAL), SMALLINT(Types.SMALLINT), TIME(Types.TIME), TIMESTAMP(Types.TIMESTAMP), TINYINT(Types.TINYINT), VARBINARY(Types.VARBINARY), VARCHAR(Types.VARCHAR), JSON, and jsonb. For instance, cast('456' AS SQL_INTEGER),cast('123.456' AS DECIMAL(12,5)), and cast('2004-12-23' as sql_date).
2. CONVERT(value1, SQLtype1): converts value1 to another data type SQLtype1. SQLtype1 may be SQL_BIGINT(Types.BIGINT), SQL_BINARY(Types.BINARY), SQL_BIT(Types.BIT), SQL_CHAR(Types.CHAR), SQL_DATE(Types.DATE), SQL_DECIMAL(Types.DECIMAL), SQL_DOUBLE(Types.DOUBLE), SQL_FLOAT(Types.FLOAT), SQL_INTEGER(Types.INTEGER), INT(Types.INTEGER), SQL_LONGVARBINARY(Types.LONGVARBINARY), SQL_LONGVARCHAR(Types.LONGVARCHAR), SQL_REAL(Types.REAL), SQL_SMALLINT(Types.SMALLINT), SQL_TIME(Types.TIME), SQL_TIMESTAMP(Types.TIMESTAMP), SQL_TINYINT(Types.TINYINT), SQL_VARBINARY(Types.VARBINARY), SQL_VARCHAR(Types.VARCHAR), JSON, and jsonb. value1 may be any complicated expression. For instance, CONVERT("123",SQL_INTEGER).
3. CBOOL(expression): returns a Boolean value from an expression.

4. CBYTE(expression): returns a Byte value from an expression.
5. CCUR(expression): returns a Currency value with four decimal digits of precision to the right of the decimal from an expression.
6. CDATE(expression,pattern): returns a Date value according a pattern from an expression. For instance, CDATE('21111947','ddMMyyyy').
7. CDBL(expression): returns a Double value from an expression.
8. CINT(expression): returns an Integer value from an expression.
9. CLNG(expression): returns a Long value from an expression.
10. CSNG(expression): returns a Float value from an expression.
11. CSTR(expression): returns a String value from an expression.
12. CTOD(cExpression): converts a string expression to a date expression.
13. CTOT(cExpression): returns a timestamp value from a string expression.
14. DTOC(date1 | timestamp1[, 1]): returns a string from a date or timestamp expression.
15. DTOT(dDateExpression): returns a timestamp value from a date expression.
16. LTOC(bExpression): returns a string value(T,F, or ' ') from a logical expression.
17. DTOS(date1 | timestamp1): returns a string in a yyymmdd format from a specified date or timestamp expression.
18. DTOS(date1 | timestamp1,pattern): returns a string according to a pattern format from a specified date or timestamp expression.
19. TTOC(tExpression [, 1 | 2]): converts a timestamp expression to a string value of a specified format.
20. TTOD(tExpression): returns a date value from a timestamp expression.
21. POSIXTOT(expression): returns a timestamp value from a POSIX timestamp value.
22. TTOPOSIX(tExpression): converts a timestamp expression to a POSIX timestamp value.
23. STR(nExpression [, nLength [, nDecimalPlaces]]): Returns the character equivalent of a specified numeric expression. nExpression specifies the numeric expression STR() evaluates. nLength specifies the length of the character string STR() returns. The length includes one character for the decimal point and one character for each digit to the right of the decimal point. nDecimalPlaces specifies the number of decimal places in the character string STR() returns. If you specify fewer decimal places than are in nExpression, the extra digits are truncated. STR() pads the character string it returns with leading spaces if you specify a length larger than the number of digits to the left of the decimal point. STR() returns a string of asterisks, indicating numeric overflow, if you specify a length less than the number of digits to the left of the decimal point. If nLength is omitted, nLength defaults to 10 characters.
24. STRZERO(nExpression, nLength[, nDecimals]): convert a numeric expression to a string padded with leading zeros.
25. VAL(string1): returns a numeric value from a string1 composed of numbers.
26. COLLATE(string1[,collation]): For multilingual sort in ORDER BY clause. Now collation can be 'DUTCH', 'GERMAN', 'ICELAND', 'SPANISH', 'RUSSIAN', 'CZECH', 'GREEK', 'SLOVAK', 'POLISH', 'TURKISH', 'HUNGARY', CP850, CP852, CP866, CROATIAN, HEBREW, SWEDISH, and 'MAZOVIA'. Without collation parameter, COLLATE function will try to utilize charSet property in Connection properties.
27. PasToJava(str): get a Java string from a Pascal-style string
28. JavaToPas(str): get a Pascal-style string from a Java string
29. PasToJava(str): get a null-terminated string from a Pascal-style string
30. CToPas(str): get a Pascal-style string from a null-terminated string
31. CToJava(str): get a Java string from a null-terminated string
32. JavaToC(str): get a null-terminated from a Java string
33. BToInt_LE(binary): get int value from bytes with little-endian.
34. BToInt_BE(binary): get int value from bytes with big-endian.
35. IntToB_LE(binary): get bytes with little-endian from int value.
36. IntToB_BE(binary): get bytes with big-endian from int value.
37. BToShort_LE(binary): get short value from bytes with little-endian.
38. BToShort_BE(binary): get short value from bytes with big-endian.
39. ShortToB_LE(binary): get bytes with little-endian from short value.
40. ShortToB_BE(binary): get bytes with big-endian from short value.
41. BToLong_LE(binary): get long value from bytes with little-endian.
42. BToLong_BE(binary): get long value from bytes with big-endian.
43. LongToB_LE(binary): get bytes with little-endian from long value.
44. LongToB_BE(binary): get bytes with big-endian from long value.
45. GetNumber(str[, defaultValue]): return a number value(int, long, double) according to str. If failed to parse, return defaultValue(null is omitted value).
46. GetInt(str[, defaultValue]): return an int value according to str. If failed to parse, return defaultValue(null is omitted value).
47. GetLong(str[, defaultValue]): return a long value according to str. If failed to parse, return defaultValue(null is omitted value).
48. GetDouble(str[, defaultValue]): return a double value according to str. If failed to parse, return defaultValue(null is omitted value).

Security Functions

1. COMPRESS(content) : Return a compressed byte[]
2. UNCOMPRESS(compressedBytes) : Return an uncompressed byte[], please don't use it for non-compressed data
3. ENCRYPT(content,cKey,cCryptMethod): Returns a crypted byte[]. cCryptMethod should be 'DES', 'TRIDES', 'BLOWFISH', or 'AES' now. ENCRYPT function is used for VARBINARY column.
Data Encryption Standard (DES) algorithm, adopted by the U.S. government in 1977, is a block cipher that transforms 64-bit data blocks under a 56-bit secret key, by means of permutation and substitution. It is officially described in FIPS PUB 46. The DES algorithm is used for many applications within the government and in the private sector.
Triple-DES is an improvement over DES. It uses three DES keys k1, k2 and k3. A message is encrypted with k1 first, then decrypted with k2 and encrypted again with k3 (DESencryptiondecryptionencryption). This increases security as the key length effectively increases from 56 to 112 or 168 (two or three keys may be used in TriDES). The DES key size is 128 or 192 bit and block size 64 bit.
Blowfish is a keyed, symmetric block cipher, designed in 1993 by Bruce Schneier and included in a large number of cipher suites and encryption products. Blowfish has a 64-bit block size and a variable key length from 32 bits up to 448 bits. It is a 16-round Feistel cipher and

uses large key-dependent S-boxes.

The Advanced Encryption Standard (AES) is a specification for the encryption of electronic data established by the U.S. National Institute of Standards and Technology (NIST) in 2001. Originally called Rijndael, the cipher was developed by two Belgian cryptographers, Joan Daemen and Vincent Rijmen, who submitted to the AES selection process. The algorithm described by AES is a symmetric-key algorithm, meaning the same key is used for both encrypting and decrypting the data. AES is a variant of Rijndael which has a fixed block size of 128 bits, and a key size of 128, 192, or 256 bits.

4. DECRYPT(content,cKey,cCryptMethod): Returns a decrypted byte[]. cCryptMethod should be 'DES', 'TRIDES', 'BLOWFISH', or 'AES' now.
5. ENCODE(content): Encodes a BASE64 encoding string.
6. DECODE(content): Returns a byte[] from a BASE64 string.
7. ENCODE(content,cKey,cCryptMethod): Crypts and encodes content. cCryptMethod should be 'DES', 'TRIDES', 'BLOWFISH', or 'AES'. ENCRYPT function is used for VARCHAR column.
8. DECODE(content,cKey,cCryptMethod): Decodes and decrypts content. cCryptMethod should be 'DES', 'TRIDES', 'BLOWFISH', or 'AES' now.
9. MD5(string1): Calculates a MD5(Message-Digest Algorithm 5) checksum for the string1.
10. SHA1(string1): Calculates a SHA-1(Secure Hash Algorithm 1) hash for the string1.
11. Crypt3(word[, salt]): Returns a hashed string of 13 printable ASCII characters, with the first two characters represent the salt. It can be used to accept typed passwords from the user, or attempting to crack Unix passwords with a dictionary.

Sequence Functions

1. NEXTVAL(cSequenceName): advances sequence and returns new value.
2. CURRVAL(cSequenceName): returns value most recently obtained with nextval.

Regular Expression Functions

Function	Argument Type	Return Type	Description
REGEXP_LIKE(expression,pattern[,match_parameter])	<p>expression is a string expression that serves as the search value.</p> <p>pattern is the regular expression. For a listing of the operators you can specify in pattern, refer to java.util.regex.Matcher.Pattern.</p> <p>match_parameter is a text literal that lets you change the default matching behavior of the function. You can specify one or more of the following values for match_parameter:</p> <p>'i' specifies case-insensitive matching.</p> <p>'c' specifies case-sensitive matching.</p> <p>'n' allows the period (.), which is the match-any-character wildcard character, to match the newline character. If you omit this parameter, then the period does not match the newline character.</p> <p>'m' treats the source string as multiple lines. HXTT Cobol interprets ^ and \$ as the start and end, respectively, of any line anywhere in the source string, rather than only at the start or end of the entire source string. If you omit this parameter, then HXTT Cobol treats the source string as a single line.</p> <p>'x' ignores whitespace characters. By default, whitespace characters match themselves. If you specify multiple contradictory values, then HXTT Cobol uses the last value. For example, if you specify 'ic', then HXTT Cobol uses case-sensitive matching. If you specify a character other than those shown above, then HXTT Cobol will ignore it.</p> <p>If you omit match_parameter, then:</p> <p>The default case sensitivity is determined by the value of the caseInsensitive connection property.</p> <p>A period (.) does not match the newline character.</p> <p>The source string is treated as a single line.</p>	return true if it find one subsequence matches the pattern.	REGEXP_LIKE is similar to the LIKE condition, except REGEXP_LIKE performs regular expression matching instead of the simple pattern matching performed by LIKE. This condition evaluates strings using characters as defined by the charSet connection property.
	<p>source_expression is a string expression that serves as the search value.</p> <p>pattern is the regular expression. IFor a listing of the operators you can specify in pattern, refer</p>		

```
REGEXP_REPLACE(source_expression,pattern[,
cReplacement[, nStartOccurrence [,
nNumberOfOccurrences[,match_parameter]]])
```

to java.util.regex.Matcher.Pattern.
cReplacement may contain references to subsequences captured during the previous match: Each occurrence of \$g will be replaced by the result of evaluating group(g). The first number after the \$ is always treated as part of the group reference. Subsequent numbers are incorporated into g if they would form a legal group reference. Only the numerals '0' through '9' are considered as potential components of the group reference. If the second group matched the string "foo", for example, then passing the replacement string "\$2bar" would cause "foobar" to be appended to the string buffer. A dollar sign (\$) may be included as a literal in the replacement string by preceding it with a backslash (\\$).

nStartOccurrence is a positive integer indicating the character of source_expression where HXTT Cobol should begin the search. The default is 1, meaning that HXTT Cobol begins the search at the first character of source_expression.

nNumberOfOccurrences is a nonnegative integer indicating the occurrence of the replace operation:

If you specify 0, then HXTT Cobol replaces all occurrences of the match.

If you specify a positive integer n, then HXTT Cobol replaces the nth occurrence.

If occurrence is greater than 1, then the database searches for the second occurrence beginning with the first character following the first occurrence of pattern, and so forth. This behavior is different from the INSTR function, which begins its search for the second occurrence at the second character of the first occurrence.

match_parameter is a text literal that lets you change the default matching behavior of the function. You can specify one or more of the following values for match_parameter:

'i' specifies case-insensitive matching.

'c' specifies case-sensitive matching.

'n' allows the period (.), which is the match-any-character wildcard character, to match the newline character. If you omit this parameter, then the period does not match the newline character.

'm' treats the source string as multiple lines. HXTT Cobol interprets ^ and \$ as the start and end, respectively, of any line anywhere in the source string, rather than only at the start or end of the entire source string. If you omit this parameter, then HXTT Cobol treats the source string as a single line.

'x' ignores whitespace characters. By default, whitespace characters match themselves.

If you specify multiple contradictory values, then HXTT Cobol uses the last value. For example, if you specify 'ic', then HXTT Cobol uses case-sensitive matching. If you specify a character other than those shown above, then HXTT Cobol will ignore it.

If you omit match_parameter, then:

The default case sensitivity is determined by the value of the caseInsensitive connection property.

A period (.) does not match the newline character.

searches a character expression for occurrences of a pattern, and then replaces each occurrence with a third pattern expression.

REGEXP_REPLACE extends the functionality of the STRTRAN function by letting you search a string for a regular expression pattern. By default, the function returns source_expression with every occurrence of the regular expression pattern replaced with replace_string. The string returned is in the same character set as source_expression.

<p>REGEXP_INSTR(source_expression,pattern[,nStartOccurrence [,nNumberOfOccurrences[,return_option,[match_parameter[,subexpr]]]]])</p>	<p>The source string is treated as a single line.</p> <p>source_expression is a string expression that serves as the search value.</p> <p>pattern is the regular expression. For a listing of the operators you can specify in pattern, refer to java.util.regex.Matcher.Pattern.</p> <p>nStartOccurrence is a positive integer indicating the character of source_expression where HXTT Cobol should begin the search. The default is 1, meaning that HXTT Cobol begins the search at the first character of source_expression.</p> <p>nNumberOfOccurrences is a nonnegative integer indicating the occurrence of the replace operation:</p> <p>If you specify 0, then HXTT Cobol replaces all occurrences of the match.</p> <p>If you specify a positive integer n, then HXTT Cobol replaces the nth occurrence.</p> <p>If occurrence is greater than 1, then the database searches for the second occurrence beginning with the first character following the first occurrence of pattern, and so forth. This behavior is different from the INSTR function, which begins its search for the second occurrence at the second character of the first occurrence.</p> <p>return_option lets you specify what HXTT Cobol should return in relation to the occurrence:</p> <p>If you specify 0, then HXTT Cobol returns the position of the first character of the occurrence. This is the default.</p> <p>If you specify 1, then HXTT Cobol returns the position of the character following the occurrence.</p> <p>match_parameter is a text literal that lets you change the default matching behavior of the function. You can specify one or more of the following values for match_parameter:</p> <p>'i' specifies case-insensitive matching.</p> <p>'c' specifies case-sensitive matching.</p> <p>'n' allows the period (.), which is the match-any-character wildcard character, to match the newline character. If you omit this parameter, then the period does not match the newline character.</p> <p>'m' treats the source string as multiple lines. HXTT Cobol interprets ^ and \$ as the start and end, respectively, of any line anywhere in the source string, rather than only at the start or end of the entire source string. If you omit this parameter, then HXTT Cobol treats the source string as a single line.</p> <p>'x' ignores whitespace characters. By default, whitespace characters match themselves.</p> <p>If you specify multiple contradictory values, then HXTT Cobol uses the last value. For example, if you specify 'ic', then HXTT Cobol uses case-sensitive matching. If you specify a character other than those shown above, then HXTT Cobol will ignore it.</p> <p>If you omit match_parameter, then:</p> <p>The default case sensitivity is determined by the value of the caseInsensitive connection property.</p> <p>A period (.) does not match the newline character.</p> <p>The source string is treated as a single line. For</p>	<p>returns the position of the first character of the occurrence or the character following the occurrence.</p>	<p>REGEXP_INSTR extends the functionality of the INSTR function by letting you search a string for a regular expression pattern. It returns an integer indicating the beginning or ending position of the matched substring, depending on the value of the return_option argument. If no match is found, then the function returns 0.</p>
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	<p>a pattern with subexpressions, the subexpr is a fragment of pattern enclosed in parentheses. Subexpressions can be nested. Subexpressions are numbered in order in which their left parentheses appear in pattern. For example, consider the following expression: 0123(((abc)(de)fghi)45(678)</p> <p>This expression has five subexpressions in the following order: "abcdefghi" followed by "abcdef", "abc", "de" and "678".</p> <p>If subexpr is zero, then the position of the entire substring that matches the pattern is returned. If subexpr is greater than zero, then the position of the substring fragment that corresponds to subexpression number subexpr in the matched substring is returned. If pattern does not have at least subexpr subexpressions, the function returns zero. The default value for subexpr is zero.</p>		
<p>REGEXP_SUBSTR (source_expression,pattern[, nStartOccurrence [, nNumberOfOccurrences[,match_parameter[,subexpr]]])</p>	<p>source_expression is a string expression that serves as the search value.</p> <p>pattern is the regular expression. For a listing of the operators you can specify in pattern, refer to java.util.regex.Matcher.Pattern.</p> <p>nStartOccurrence is a positive integer indicating the character of source_expression where HXTT Cobol should begin the search. The default is 1, meaning that HXTT Cobol begins the search at the first character of source_expression.</p> <p>nNumberOfOccurrences is a nonnegative integer indicating the occurrence of the replace operation:</p> <p>If you specify 0, then HXTT Cobol replaces all occurrences of the match.</p> <p>If you specify a positive integer n, then HXTT Cobol replaces the nth occurrence.</p> <p>If occurrence is greater than 1, then the database searches for the second occurrence beginning with the first character following the first occurrence of pattern, and so forth. This behavior is different from the INSTR function, which begins its search for the second occurrence at the second character of the first occurrence.</p> <p>match_parameter is a text literal that lets you change the default matching behavior of the function. You can specify one or more of the following values for match_parameter:</p> <ul style="list-style-type: none"> 'i' specifies case-insensitive matching. 'c' specifies case-sensitive matching. 'n' allows the period (.), which is the match-any-character wildcard character, to match the newline character. If you omit this parameter, then the period does not match the newline character. 'm' treats the source string as multiple lines. HXTT Cobol interprets ^ and \$ as the start and end, respectively, of any line anywhere in the source string, rather than only at the start or end of the entire source string. If you omit this parameter, then HXTT Cobol treats the source string as a single line. 'x' ignores whitespace characters. By default, whitespace characters match themselves. <p>If you specify multiple contradictory values, then HXTT Cobol uses the last value. For example, if you specify 'ic', then HXTT Cobol uses case-sensitive matching. If you specify a</p>	<p>returns the substring of the occurrence.</p>	<p>REGEXP_SUBSTR extends the functionality of the SUBSTR function by letting you search a string for a regular expression pattern. It returns the substring itself. This function is useful if you need the contents of a match string but not its position in the source string.</p>

	<p>character other than those shown above, then HXTT Cobol will ignore it.</p> <p>If you omit <code>match_parameter</code>, then: The default case sensitivity is determined by the value of the <code>caseInsensitive</code> connection property.</p> <p>A period (.) does not match the newline character.</p> <p>The source string is treated as a single line.</p> <p>For a pattern with subexpressions, the <code>subexpr</code> is a fragment of pattern enclosed in parentheses. Subexpressions can be nested. Subexpressions are numbered in order in which their left parentheses appear in pattern. For example, consider the following expression: 0123(((abc)(de)f)ghi)45(678)</p> <p>This expression has five subexpressions in the following order: "abcdefghi" followed by "abcdef", "abc", "de" and "678".</p> <p>If <code>subexpr</code> is zero, then the position of the entire substring that matches the pattern is returned. If <code>subexpr</code> is greater than zero, then the position of the substring fragment that corresponds to subexpression number <code>subexpr</code> in the matched substring is returned. If pattern does not have at least <code>subexpr</code> subexpressions, the function returns zero. The default value for <code>subexpr</code> is zero.</p>		
<p><code>REGEXP_COUNT(source_expression,pattern[,nStartOccurrence[,match_parameter]])</code></p>	<p><code>source_expression</code> is a string expression that serves as the search value.</p> <p><code>pattern</code> is the regular expression. For a listing of the operators you can specify in pattern, refer to <code>java.util.regex.Matcher.Pattern</code>.</p> <p><code>nStartOccurrence</code> is a positive integer indicating the character of <code>source_expression</code> where HXTT Cobol should begin the search. The default is 1, meaning that HXTT Cobol begins the search at the first character of <code>source_expression</code>.</p> <p><code>match_parameter</code> is a text literal that lets you change the default matching behavior of the function. You can specify one or more of the following values for <code>match_parameter</code>: 'i' specifies case-insensitive matching. 'c' specifies case-sensitive matching. 'n' allows the period (.), which is the match-any-character wildcard character, to match the newline character. If you omit this parameter, then the period does not match the newline character. 'm' treats the source string as multiple lines. HXTT Cobol interprets ^ and \$ as the start and end, respectively, of any line anywhere in the source string, rather than only at the start or end of the entire source string. If you omit this parameter, then HXTT Cobol treats the source string as a single line. 'x' ignores whitespace characters. By default, whitespace characters match themselves.</p> <p>If you specify multiple contradictory values, then HXTT Cobol uses the last value. For example, if you specify 'ic', then HXTT Cobol uses case-sensitive matching. If you specify a character other than those shown above, then HXTT Cobol will ignore it.</p> <p>If you omit <code>match_parameter</code>, then: The default case sensitivity is determined by the value of the <code>caseInsensitive</code> connection property.</p>	<p>returns the number of times a pattern occurs in a source string.</p>	<p><code>REGEXP_COUNT</code> returns the number of times a pattern occurs in a source string. It returns an integer indicating the number of occurrences of pattern. If no match is found, then the function returns 0.</p>

A period (.) does not match the newline character.
The source string is treated as a single line.

Miscellaneous Functions

Function	Argument Type	Return Type	Description
DECODE(expression , search , result [, search , result]... [, default])	expression is the value to compare. search is the value that is compared against expression. result is the value returned, if expression is equal to search. default is optional. If no matches are found, the decode will return default. If default is omitted, then the decode statement will return null (if no matches are found).	same as argument type	The decode function has the functionality of an IF-THEN-ELSE statement.
GREATEST(expression1,expression2[,...]) MAX(expression1,expression2[,...])	any numeric, string, date/time, or boolean type	same as argument type	maximum value of all expressions
LEAST(expression1,expression2[,...]) MIN(expression1,expression2[,...])	any numeric, string, date/time, or boolean type	same as argument type	minimum value of all expressions
IF(IExpression, eExpression1, eExpression2) IIF(IExpression, eExpression1, eExpression2)	IExpression specifies the logical expression that IF()/IIF() evaluates.	Returns one of two values depending on the value of a logical expression.	If IExpression evaluates to true , eExpression1 is returned. If IExpression evaluates to false, eExpression2 is returned.
NVL(expression, value) IFNULL(expression, value)	any numeric, string, date/time, or boolean type	Returns one of two values depending on whether expression is null.	If expression evaluates to null , value is returned. Otherwise, expression is returned.
INLIST(eExpression1, eExpression2 [, eExpression3 ...])	eExpression1 specifies the expression INLIST() searches for in the set of expressions. eExpression2 [, eExpression3 ...] specifies the set of expressions to search. You must include at least one expression (eExpression2), and can include up to 24 expressions (eExpression2, eExpression3, and so on).	Determines whether an expression matches another expression in a set of expressions.	All the expressions in the set of expressions must be of the same data type.
COALESCE(value [, ...])	any numeric, string, date/time, or boolean type	the type of the first of its arguments that is not null	returns the first of its arguments that is not null
	numberExpression must		Returns value1Expression if numberExpression = 1, value2Expression

<p>ELT(numberExpression,value1Expression,[value2Expression,...])</p>	<p>be a integer type,value expression can be any type</p>	<p>Returns value depending on the numberExpression,value1Expression,...valuexExpression</p>	<p>if numberExpression = 2, and so on. Returns NULL if N is less than 1 or greater than the number of arguments.</p>												
<p>INTERVAL(expression,expr1,expr2,...,exprn)</p>	<p>any numeric, string, date/time, or boolean type</p>	<p>integer value</p>	<p>returns 0 if expression< expr1, 1 if expression< expr2 and so on or -1 if expressionN is NULL. If expression>exprn, returns n.</p>												
<p>TRANSFER (expression, search_1, result_1) TRANSFER (expression, search_1, result_1, search_2, result_2) TRANSFER (expression, search_1, result_1, search_2, result_2, ..., search_n, result_n) TRANSFER (expression, search_1, result_1, default) TRANSFER (expression, search_1, result_1, search_2, result_2, default) TRANSFER (expression, search_1, result_1, search_2, result_2, ..., search_n, result_n, default)</p>	<p>any numeric, string, date/time, or boolean type,or null</p>	<p>Returns value depending on the expression,search_x,result_x and default</p>	<p>TRANSFER compares expression to the search_x expressions and, if matches, returns result_x. If not, returns default, or, if default is left out, return null .</p>												
	<p>expression specifies the character, currency, date, or numeric expression to format. formatcode specifies one format code that determine how the expression is formatted. The following table lists the available format codes</p> <table border="1" data-bbox="573 1234 821 1999"> <thead> <tr> <th>Format Code</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>@C</td> <td>CR is appended to positive currency or numeric values to indicate a credit.</td> </tr> <tr> <td>@D</td> <td>act as DTOS function.</td> </tr> <tr> <td>@E</td> <td>act as DTOS function.</td> </tr> <tr> <td>@T</td> <td>leading and trailing spaces are trimmed from character values.</td> </tr> <tr> <td>@X</td> <td>db is appended to negative currency or numeric values to indicate a debit.</td> </tr> </tbody> </table>	Format Code	Description	@C	CR is appended to positive currency or numeric values to indicate a credit.	@D	act as DTOS function.	@E	act as DTOS function.	@T	leading and trailing spaces are trimmed from character values.	@X	db is appended to negative currency or numeric values to indicate a debit.		
Format Code	Description														
@C	CR is appended to positive currency or numeric values to indicate a credit.														
@D	act as DTOS function.														
@E	act as DTOS function.														
@T	leading and trailing spaces are trimmed from character values.														
@X	db is appended to negative currency or numeric values to indicate a debit.														

TRANSFORM(expression [, formatcodes])

@Z

if 0, currency or numeric values are converted to spaces.

@(

encloses negative currency or numeric values in parentheses.

@^

converts currency or numeric values to scientific notation.

@0

converts numeric or currency values to their hexadecimal equivalents. The numeric or currency value must be positive and less than 4,294,967,296.

!

converts a character to uppercase.

adds the current currency symbol specified by SET CURRENCY to currency and numeric values. By default, the symbol is placed immediately before or after the value.

\$

However, the currency symbol and its placement (specified with SET CURRENCY), the separator character (specified with SET SEPARATOR) and the decimal character (specified with SET POINT) can all be changed.

return the formatted string

returns a character string from an expression in a format determined by a format code

	X	specifies the width of character values. For example, if cFormatCodes is XX? 2 characters are returned.
	Y	converts logical true (.T.) and false (.F.) values to Y and N, respectively.
	@!	converts a string to uppercase.

1. LASTNVL(column): returns the current value for a particular column. When a null value is encountered, it will try to return the nearest non-null value of prior rows in the specified table. That function is useful when data are stored by using suppression of repeated data.
2. LASTEVL(column): returns the current value for a particular column. When an empty value is encountered, it will try to return the nearest non-empty value of prior rows in the specified table. That function is useful when data are stored by using suppression of repeated data. It means empty value when it is a null value, or a string is empty string, spaces, tabs, carriage returns, linefeeds, or any combination of these, numeric value equals to 0, and logical expression is false.

Aggregate Functions

1. ARRAY_AGG([DISTINCT] expression): returns an array for input values, including null.
2. AVG([DISTINCT] expression): the average (arithmetic mean) of all input values.
3. COUNT(*): the number of input values.
4. COUNT([DISTINCT] expression): the number of input values for which the value of expression is not null.
5. FIRST(expression): the value of a specified field in the first record, respectively, of the result set returned by a query. Because records are usually returned in no particular order (unless the query includes an ORDER BY clause), the records returned by this functions will be arbitrary.
6. GROUP_CONCAT([DISTINCT] expr_list [order_by_clause] [SEPARATOR str_val]): returns a string result with the concatenated non-NULL values from a group. It returns NULL if there are no non-NULL values. SEPARATOR is followed by the string value that should be inserted between values of result. The default is a comma (','). You can eliminate the separator altogether by specifying SEPARATOR ". The result will be truncated to the maximum length of 8192 sometimes.
7. GROUPING(expression): returns a value of 1 when the expression is added by either the CUBE or ROLLUP operator, or 0 when the expression is not the result of CUBE or ROLLUP. It is used to distinguish the null values that are returned by CUBE and ROLLUP from standard null values. The NULL returned as the result of a CUBE or ROLLUP operation is a special use of NULL.
8. LAST(expression): the value of a specified field in the last record, respectively, of the result set returned by a query. Because records are usually returned in no particular order (unless the query includes an ORDER BY clause), the records returned by this functions will be arbitrary.
9. MAX(expression): the maximum value of expression across all input values.
10. MIN(expression): the minimum value of expression across all input values.
11. STD(expression): the sample standard deviation of the input values.
12. STDDEV(expression): the sample standard deviation of the input values.
13. STRING_AGG([DISTINCT] expression[, delimiter]): returns a string for input values, separated by delimiter.
14. SUM([DISTINCT] expression): the sum of expression across all input values.
15. XMLAGG(expr [order_by_clause]): Returns a collection of XML fragments. Any arguments that return null are dropped from the result.

Chapter 9. OpenAPI Programming

Index:

1. [Extend SQL functions](#)
2. [Create/Remove/Start/Stop Server Programmatically with/without GUI manager](#)
3. [Customer Connection](#)

Extend SQL functions

HXTT Cobol supports more than 250 SQL functions. Please email us if you wish to complement some new SQL functions. HXTT Cobol supports also user-defined SQL functions, and you should use only this feature to provide special SQL functions in your project.

First, you need to implement `com.hxtt.sql.ExtendedFunctionInterface`.

```
public interface ExtendedFunctionInterface {
    /**
     * Used to verify whether functionName is supported, and has a correct parameter count.
     * @param functionName the name of function
     * @param parameters the parameter list of function, which can be null
     * @return value
     * @throws SQLException if has an incorrect parameter number
     */
    public boolean isExtendedFunction(String functionName, Object[] parameters) throws SQLException;

    /**
     * Used to evaluate function value.
     * @param functionName the name of function
     * @param values the value list of function, which can be null
     * @return value
     * @throws SQLException if failed to calculate the function
     */
    public Object evaluate(String functionName, Object[] values) throws SQLException;

    /**
     * Used to get the SQL type of the value that is expected to be returned when evaluate() is
     * called.
     * @param functionName
     * @return the SQL type or Types.NULL if functionName is supported
     */
    public int getType(String functionName);

    /**
     * Used to get the SQL types of the parameter values that are expected to be returned when
     * evaluate() is called.
     * return null if function hasn't any parameter, or you wish to use the default SQL types.
     * use Types.NULL for that specific parameter if you wish to get the default SQL type.
     * @param functionName
     * @return the SQL type list or null if functionName is supported
     */
    public int[] getParameterTypes(String functionName);

    /**
     * Used to estimate the maximum number of characters that should be contained in a String
     * returned by evaluate(String functionName, Object[] values).
     * Zero is returned if this value object does not represent Types.VARCHAR, Types.BINARY,
     * Types.LONGVARCHAR, or Types.LONGBINARY.
     * @param functionName
     * @return maximum size
     * @throws SQLException if functionName is supported
     */
    public int estimateValueSize(String functionName) throws SQLException;
}
```

Let us see a sample:

```
import com.hxtt.sql.ExtendedFunctionInterface;
import java.sql.SQLException;
import java.sql.Types;

/**
 * Show how to complement some sql functions.
 * This sample complements toString(value) and random() for demo purpose
 */
```

```

*/
public class Functions implements ExtendedFunctionInterface {
    public Functions() {
    }

    /**
     * Used to verify whether functionName is supported, and has a correct parameter count.
     * @param functionName the name of function
     * @param parameters the parameter list of function, which can be null
     * @return value
     * @throws SQLException if has an incorrect parameter number
     */
    public boolean isExtendedFunction(String functionName, Object[] parameters) throws SQLException {
        if (functionName.equalsIgnoreCase("tostring")) {
            if (parameters != null && parameters.length == 1) {
                return true;
            }
            else {
                throw new SQLException("Invalid parameter value in tostring function");
            }
        }
        else if (functionName.equalsIgnoreCase("random")) {
            if (parameters == null) {
                return true;
            }
            else {
                throw new SQLException("Invalid parameter value in random function");
            }
        }
        return false;
    }

    /**
     * Used to evaluate function value.
     * @param functionName the name of function
     * @param values the value list of function, which can be null
     * @return value
     * @throws SQLException if failed to calculate the function
     */
    public Object evaluate(String functionName, Object[] values) throws SQLException {
        if (functionName.equalsIgnoreCase("tostring")) {
            return values[0] + "";
        }
        else if (functionName.equalsIgnoreCase("random")) {
            return new Double(Math.random());
        }
        throw new SQLException("Inner Error:");
    }

    /**
     * Used to get the SQL type of the value that is expected to be returned when evaluate() is
     called.
     * @param functionName
     * @return the SQL type or Types.NULL if functionName is supported
     */
    public int getType(String functionName) {
        if (functionName.equalsIgnoreCase("tostring")) {
            return Types.VARCHAR;
        }
        else if (functionName.equalsIgnoreCase("random")) {
            return Types.DOUBLE;
        }
        return Types.NULL;
    }

    /**
     * Used to get the SQL types of the parameter values that are expected to be returned when
     evaluate() is called.
     * return null if function hasn't any parameter, or you wish to use the default SQL types.
     * use Types.NULL for that specific parameter if you wish to get the default SQL type.
     * @param functionName
     * @return the SQL type list or null if functionName is supported
     */
    public int[] getParameterTypes(String functionName) {
        if (functionName.equalsIgnoreCase("tostring")) {
            return new int[] {
                Types.VARCHAR;
            }
        }
        return null;
    }
}

```

```

/**
 * Used to estimate the maximum number of characters that should be contained in a String
 * returned by evaluate(String functionName,Object[] values).
 * Zero is returned if this value object does not represent Types.VARCHAR, Types.BINARY,
 * Types.LONGVARCHAR, or Types.LONGBINARY.
 * @param functionName
 * @return maximum size
 * @throws SQLException if functionName is supported
 */
public int estimateValueSize(String functionName) throws SQLException {
    if (functionName.equalsIgnoreCase("tostring")) {
        return 20;
    }
    else if (functionName.equalsIgnoreCase("random")) {
        return 8;
    }
    return 10;
}
}

```

Then you can use *com.hxtt.sql.OpenAPI.registerExtendedFunction("Functions");* to register Functions class. Then you can use those user-defined functions in SQL. For instance, "select abs(random()),tostring(date) from test;".

Create/Remove/Start/Stop Server Programmatically

If you wish to create,remove,start a GUI server for remote connections from your application, you can call four functions of com.hxtt.sql.admin.Admin class:

```

public String createServer(String serverConfigName,String serverConfigURL,boolean serverAutoStart,boolean
isServerLog,String serverLogFilePath) throws Exception
public void removeServer(String serverName)
public void startServer(String serverName)throws SQLException
public void stopServer(String serverName)throws SQLException

```

For instance:

```

try {
    com.hxtt.sql.admin.Admin admin = new com.hxtt.sql.admin.Admin();
    admin.show();//It can be invisible too.

    String createResult =
admin.createServer("test1","jdbc:cobol://192.168.1.1:1027/mnt/cobolfiles",true,true,"/tmp/test1.log");

    if (createResult!=null)
        System.out.println("Failure to create this server for " + createResult);

    admin.startServer("test1");
    admin.stopServer("test1");
    admin.stopServer("test4");
    admin.removeServer("test1");
}
catch (SQLException e) {
    System.out.println(e.getMessage());
}

```

On LINUX and UNIX, if you got "Cannot connect to X11 window server. The environment variable DISPLAY is not set.", you should use -Djava.awt.headless=true to run Java in headless mode. On OS/400, if you got still a java.awt.HeadlessException thrown with -Djava.awt.headless=true, you should read [Run HXTT CobolServer as Windows Service or Linux\(Solaris\) Daemon](#) to consider running directly com.hxtt.sql.admin.HxttService. If you wish Create/Remove/Start/Stop Server Programmatically without GUI or invisible GUI, call four same functions of com.hxtt.sql.admin.HxttService class:

```

public String createServer(String serverConfigName,String serverConfigURL,boolean serverAutoStart,boolean
isServerLog,String serverLogFilePath) throws Exception

```

```

public void removeServer(String serverName)
public void startServer(String serverName)throws SQLException
public void stopServer(String serverName)throws SQLException

```

For instance:

```

    try {
        com.hxtt.sql.admin.HxttService admin = new com.hxtt.sql.admin.HxttService();

        String createResult =
admin.createServer("test1", "jdbc:cobol://192.168.1.1:1027/mnt/cobolfiles", true, true, "/tmp/test1.log");

        if (createResult!=null)
            System.out.println("Failure to create this server for " + createResult);

        admin.startServer("test1");

        admin.stopServer("test1");

        admin.stopServer("test4");

        admin.removeServer("test1");

    }
    catch (SQLException e) {
        System.out.println(e.getMessage());
    }

```

Customer Connection

First, let us know the relation of TCP/IP connection and java.sql.Connection. java.sql.Connection objects can share TCP/IP connection. The max number of alive TCP/IP connections between one client and one server is 20, but maybe more than 1000 alive java.sql.Connection objects are using those 20 TCP/IP connections. One java.sql.Connection object maybe build 0, 1, or more than one TCP/IP connections too.

If you haven't read [SSL Connection](#), please read.

To construct your customer connection, you need to implement two interface(com.hxtt.sql.common.SocketLayer and com.hxtt.sql.common.ServerSocketLayer). For SocketLayer, you should have one construction method(public YourSocketLayer(String host, int port)throws IOException). For ServerSocketLayer, you should have one construction method(public YourServerSocketLayer(int port, int backlog, InetAddress bindAddr) throws IOException). Then you can use:

```
java -Dhxtt.socketclass=yourPackage.YourServerSocketLayer -cp yourClassPath com.hxtt.sql.admin.Admin
```

Or

```
java -Dhxtt.socketclass=yourPackage.YourSocketLayer -cp yourClassPath com.hxtt.sql.admin.Admin
```

Or

```
java -Dhxtt.socketclass=yourPackage.YourServerSocketLayer -cp yourClassPath yourApplication
```

Or

```
java -Dhxtt.socketclass=yourPackage.YourSocketLayer -cp yourClassPath yourApplication
```

hxtt.socketclass can be used for client connection property too. The class name should be yourPackage.*Socket* and yourPackage.*ServerSocket* so that HXTT CobolServer can guess the other class name according to one class name. com.hxtt.sql.common.SocketLayer and com.hxtt.sql.common.ServerSocketLayer are pasted below. A simple sample for ip filter, id verification, and XOR encrypt/decrypt, is showed below too. To keep code neat, there's no remark since you can find all functions in java.net.Socket or java.net.ServerSocket. If you need help, please email us.

```

/***** SocketLayer.java *****/
package com.hxtt.sql.common;

import java.io.IOException;
import java.net.SocketException;
import java.net.InetAddress;

public interface SocketLayer {
    public boolean isClosed();
    public void close() throws IOException;

```

```

public void write(byte b[], int off, int len) throws IOException;
public void flush() throws IOException;

public int read(byte b[], int off, int len) throws IOException;

public int getSoTimeout() throws SocketException;
public void setSoTimeout(int timeout) throws SocketException;

public InetAddress getLocalAddress();
public int getLocalPort();

public InetAddress getInetAddress();
public int getPort();
}

/***** ServerSocketLayer.java *****/
package com.hxtt.sql.common;

import java.net.Socket;
import java.io.IOException;
import java.net.SocketException;

public interface ServerSocketLayer{
    public boolean isClosed();
    public void close() throws IOException;

    public SocketLayer accept() throws IOException;

    public void setSoTimeout(int timeout) throws SocketException;
}

/***** XorSocketLayer.java *****/
package demo;

import java.net.Socket;
import java.io.OutputStream;
import java.io.InputStream;
import java.io.IOException;

import java.net.SocketException;
import java.net.InetAddress;

import com.hxtt.sql.common.SocketLayer;

public class XorSocketLayer implements SocketLayer{
    private Socket socket;
    private InputStream in;
    private OutputStream out;

    public XorSocketLayer(String host, int port) throws IOException {
        Socket socket=new java.net.Socket(host, port);

        //just a check demo
        try{
            check(socket);
        }catch(IOException ioe){
            socket.close();
            throw ioe;
        }

        init(socket);
    }

    private void check(Socket socket) throws IOException{
        if(socket.getInetAddress().getHostAddress().startsWith("192.168.10")
            || socket.getInetAddress().getHostAddress().startsWith("127.0.0.1")){
            socket.getOutputStream().write("1234".getBytes("ISO8859_1"));
        }else{
            throw new IOException("Prevent logon based upon IP address");
        }
    }

    protected XorSocketLayer(Socket socket) throws IOException {
        init(socket);
    }

    private void init(Socket socket) throws IOException{
        this.socket = socket;
        try{
            in = socket.getInputStream();

```

```

        out = socket.getOutputStream();
    }catch(IOException ioe){
        socket.close();
        throw ioe;
    }
}

public boolean isClosed() {
    //Valid for JDK1.4.X
    return socket.isClosed();
//    return false;//For older JDK1.3.X, JDK1.2.X,...
}

public void close() throws IOException{
    out = null;
    in = null;
    socket.close();
}

public void write(byte b[], int off, int len) throws IOException{
    for(int i=0;i< len;i++){
        out.write( (b[off+i] ^ pattern) & 0xFF);
    }
}

public void flush() throws IOException {
    out.flush();
}

private static final byte pattern=(byte)0x21;

public int read(byte b[], int off, int len) throws IOException {
    int numBytes = in.read(b, off, len);

    if (numBytes <= 0)
        return numBytes;

    for (int i = 0; i < numBytes; i++) {
        b[off + i] = (byte) ( (b[off + i] ^ pattern) & 0xFF);
    }

    return numBytes;
}

public int getSoTimeout() throws SocketException{
    return socket.getSoTimeout();
}

public void setSoTimeout(int timeout) throws SocketException{
    socket.setSoTimeout(timeout);
}

public InetAddress getLocalAddress(){
    return socket.getLocalAddress();
}

public int getLocalPort(){
    return socket.getLocalPort();
}

public InetAddress getInetAddress(){
    return socket.getInetAddress();
}

public int getPort(){
    return socket.getPort();
}

}

/***** XorServerSocketLayer.java *****/
package demo;

import java.io.*;
import java.net.*;

import com.hxtt.sql.common.SocketLayer;
import com.hxtt.sql.common.ServerSocketLayer;

public class XorServerSocketLayer implements ServerSocketLayer {
    private ServerSocket serverSocket;

```

```
public XorServerSocketLayer(int port, int backlog, InetAddress bindAddr) throws IOException {
    this.serverSocket=new ServerSocket(port, backlog, bindAddr);
}

public boolean isClosed(){
    return serverSocket.getLocalPort()<=0;
}

public void close() throws IOException{
    serverSocket.close();
}

public SocketLayer accept() throws IOException {
    Socket socket=serverSocket.accept();

    //just a check demo
    try{
        check(socket);
    }catch(IOException ioe){
        socket.close();
        throw ioe;
    }

    return new XorSocketLayer(socket);
}

private void check(Socket socket)throws IOException{
    if(socket.getInetAddress().getHostAddress().startsWith("192.168.10")
        || socket.getInetAddress().getHostAddress().startsWith("127.0.0.1")
        ){
        byte[] id=new byte[4];
        int count=socket.getInputStream().read(id);
        if(count!=id.length || !"1234".equals(new String(id))){
            throw new IOException("Prevent logon based upon id");
        }
    }else{
        throw new IOException("Prevent logon based upon IP address");
    }
}

public void setSoTimeout(int timeout) throws SocketException {
    serverSocket.setSoTimeout(timeout);
}
}
```

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Chapter 10. JavaScript Object Notation (JSON) Support

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1. [json and jsonb Operators](#)
2. [JSON Functions](#)
3. [JSON sample](#)

json and jsonb Operators

Operator	Right Operand Type	Description	Example	Example Result
->	int	Get JSON array element (indexed from zero, negative integers count from the end)	cast(['{"a":"foo"}, {"b":"bar"}, {"c":"baz"}] as json)->2	{"c":"baz"}
->	text	Get JSON object field by key	cast('{"a": {"b":"foo"}}' as json)->'a'	{"b":"foo"}
->>	int	Get JSON array element as text	cast('[1,2,3] as json)->>2	3
->>	text	Get JSON object field as text	cast('{"a":1,"b":2}' as json)->>'b'	2
#>	text[]	Get JSON object at specified path	cast('{"a": {"b": {"c": "foo"}}}' as json)#>'a,b'	{"c": "foo"}
#>>	text[]	Get JSON object at specified path as text	cast('{"a":[1,2,3],"b":[4,5,6]}' as json)#>>'a,2'	3

JSON Functions

1. CAST(expression AS data_type): converts expression to another data type (json and jsonb). For instance, cast(['guia","test"] as json), cast('33.56' as json), and cast(['{"a":"foo"}, {"b":"bar"}, {"c":"baz"}] as jsonb).
2. CONVERT(expression, data_type): converts expression to another data type (json and jsonb). For instance, convert(['guia","test"], json), convert('null',json), and convert(['{"a":"foo"}, {"b":"bar"}, {"c":"baz"}] , json).
3. to_json(expression): Returns the value as json. Arrays and composites are converted (recursively) to arrays and objects; otherwise, if there is a cast from the type to json, the cast function will be used to perform the conversion; otherwise, a scalar value is produced. For any scalar type other than a number, a Boolean, or a null value, the text representation will be used, in such a fashion that it is a valid json or jsonb value.
4. to_jsonb(expression): Returns the value as jsonb.
5. jsonb_set(jsonObject, path, new_value[, create_missing_Flag]): Returns the value with the section designated by path replaced by new_value, or with new_value added if create_missing_Flag is true (default is true) and the item designated by path does not exist.

JSON sample

```

DECLARE v_json_obj json default '{"a":"foo"}, {"b":"bar"}, {"c":"baz"}';
select v_json_obj, v_json_obj->2;

set v_json_obj=to_json(true);
select v_json_obj;

select cast(['{"a":"foo"}, {"b":"bar"}, {"c":"baz"}] as json)->2 # output {"c":"baz"}
select cast(['{"a":"foo"}, {"b":"bar"}, {"c":"baz"}] as jsonb)->2 # maybe output {"c":"baz"}

select cast('{"a": {"b":"foo"}, "c":{"a": "aaa"}}' as json)->'a' # output {"b":"foo"}

select cast(['{"a":"foo"}, {"b":"bar"}, {"c":"baz"}] as json)->>2 # output {"c":"baz"}
select cast('{"a": {"b":"foo"}, "c":{"a": "aaa"}}' as json)->>'a' # output {"b":"foo"}

select cast('{"a": {"b":{"c": "foo"}}}' as json)#> 'a,b' # output {"c": "foo"}

```

```
select cast('{"a": {"b":{"c": "foo"}}}' as json)#>> '{a,b}' # output {"c": "foo"}
```

```
SELECT cast('{"bar": "baz", "balance":      7.77, "active":false}' as json);  
SELECT cast('{"bar": "baz", "balance":      7.77, "active":false}' as jsonb);
```

```
SELECT convert('null', json);  
SELECT cast('33.56' as json);  
SELECT cast('"abcdef"' as json);  
SELECT convert('["guia","test"]', json);  
SELECT cast(null as json);
```

```
select to_json('Fred said "Hi."');  
select to_json(true);
```

```
select to_jsonb(true);
```

```
select jsonb_set(' [{"f1":1,"f2":null},2]', '{0,f3}', '[2,3,4]');
```

```
select jsonb_set(' [{"f1":1,"f2":null},2,null,3]', '{0,f1}', '[2,3,4]', false);
```

```
create table if not exists testjson (jdoc jsonb);  
insert into testjson values('["guia","test"]');insert into testjson values('{"name": "Angel  
Back","company": "Tom Cat","is_active": true,"tags": ["gui","test"]}');  
select * from testjson;  
select jdoc->'name' from testjson where jdoc->'company'='Tom Cat';
```

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Chapter 11. XML Support

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1. [Declaration of XML Types](#)
2. [XML Functions](#)
3. [XML sample](#)

Declaration of XML Types

```
DECLARE v_xml_obj xml default '<?xml version="1.1"?><foo/>';
select v_xml_obj;
```

```
set v_xml_obj=xmlattributes('tom' as name);
select v_xml_obj;
```

```
CREATE TABLE if not exists ademo (
    item          varchar(16),
    xmlDemo xml
);
```

XML Functions

1. XMLPARSE ({ DOCUMENT | CONTENT } string1): Returns a value of type xml. If string1 resolves to null, then the function returns null. If you specify DOCUMENT, then string1 must resolve to a singly rooted XML document. If you specify CONTENT, then string1 must resolve to a valid XML value.
2. XMLSERIALIZE ({ DOCUMENT | CONTENT } value_expr [[AS] type]): Returns a string or LOB containing the contents of value_expr. If you specify DOCUMENT, then the value_expr must be a valid XML document. If you specify CONTENT, then the value_expr need not be a singly rooted XML document. However it must be valid XML content. The data type specified can be a string type (VARCHAR) or CLOB . The default is CLOB.
3. XMLCOMMENT(string1): Returns an XML comment with the specified text as content. The text cannot contain "--" or end with a "-" so that the resulting construct is a valid XML comment. If the argument is null, the result is null.
4. XMLELEMENT([NAME] name [, XMLATTRIBUTES(value [[AS] atname] [, ...])] [, content, ...]): Returns an XML element with the given name, attributes, and content.
5. XMLATTRIBUTES(value [[AS] atname] [, ...]): Returns attribute values.
6. XMLFOREST(value [[AS] elementname] [, ...]): Returns an XML fragment that is the concatenation of these converted arguments.
7. XMLCONCAT(expr[,...]): Returns an XML content fragment. Null values are omitted; the result is only null if there are no nonnull arguments.
8. XMLPI(NAME name [, value_expr]): Return an XML processing instruction using name and optionally the evaluated result of value_expr. A processing instruction is commonly used to provide to an application information that is associated with all or part of an XML document. The application uses the processing instruction to determine how best to process the XML document. The optional value_expr must resolve to a string. If you omit value_expr, then a zero-length string is the default. The value returned by the function takes this form: Name cannot specify xml in any case combination for identifier, and cannot contain the consecutive characters ?>.
9. XMLAGG(expr [order_by_clause]): Returns a collection of XML fragments. Any arguments that return null are dropped from the result.

XML sample

```
select xmlcomment('hello');
select xmlcomment('<!--hello-->');
```

```
select xmlattributes('tom' as name);
```

```
SELECT xmlelement(name cat);
```

```

SELECT xmlelement(name cat, xmlattributes('tom' as name));
SELECT xmlelement(name cat, xmlattributes('tom' as name), 'Tom is ', 'ca', 't');
SELECT xmlelement(name "cat$tom", xmlattributes('Demo for invalid XML name' as "a&b"));
SELECT xmlelement(name cat, xmlattributes('tom' as name), 'Tom is ', 'ca', 't');
SELECT xmlelement(name cat, xmlattributes('tom' as name), xmlelement(name abc), xmlcomment('test'),
xmlelement(name xyz));
SELECT XMLELEMENT("test", XMLELEMENT("test1", XMLATTRIBUTES(1 "test1 attribute"), NULL),
XMLELEMENT("test2", XMLATTRIBUTES(' "test2_attribute"), ''), XMLELEMENT("test3", XMLATTRIBUTES(NULL
"test3_attribute")), ':');
SELECT XMLELEMENT("TEST", '123', XMLELEMENT("AA", XMLATTRIBUTES('1235678' "test attribute"),
XMLELEMENT("BB", XMLATTRIBUTES('z' "attr", NULL "Go"), 'XXX'), XMLELEMENT("CC", 'XX')),
'qwe');
SELECT XMLCONCAT(XMLELEMENT("First", 'John'), XMLELEMENT("Last", 'Morgan')) AS "Name";
SELECT xmlconcat('<abc/>', '<bar>foo</bar>');
SELECT xmlconcat('<?xml version="1.1"?><foo/>', '<?xml version="1.1" standalone="no"?><bar/>');
drop table if exists departments ;
create table if not exists departments(id int, name varchar(24));
insert into departments (id,name) values(0,null);
insert into departments (id,name) values(101,'Accounting');
drop table if exists employees;
create table if not exists employees(id int auto_increment, firstName varchar(24), lastName
varchar(24), salary numeric(12,2), dept_id int);
insert into employees (firstName,lastName) values ('Susan', 'Baer');
insert into employees (firstName,lastName,salary,dept_id) values ('William', 'Mavris', 20000, 101);
SELECT XMLCONCAT(XMLELEMENT("First", e.firstName), XMLELEMENT("Last", e.lastName)) AS "Result"
FROM employees e WHERE e.id <10;
SELECT XMLELEMENT("Emp", XMLATTRIBUTES(e.id AS "ID", e.lastname), XMLELEMENT("Dept", e.dept_id),
XMLELEMENT("Salary", e.salary)) AS "Emp Element" from employees e WHERE e.id = 1;
SELECT XMLELEMENT("Emp", XMLFOREST(e.id, e.lastname, e.salary, 'Just a demo' as comment)) "Emp
Element" FROM employees e WHERE e.id = 2;
SELECT XMLELEMENT("Emp", XMLATTRIBUTES(employees.id, employees.lastname), XMLELEMENT("Dept",
XMLATTRIBUTES(employees.dept_id, (SELECT d.name FROM departments d WHERE d.id = employees.dept_id)
as "Dept name")), XMLELEMENT("salary", employees.salary)) AS "Emp Element" FROM employees WHERE
employees.id = 2;
SELECT xmlforest('abc' AS foo, 123 AS bar);
SELECT xmlforest(table_name, column_name) FROM information_schema.columns WHERE table_name ilike
'e%';
SELECT xmlpi(name php, 'echo "hello world";');
SELECT XMLPI(NAME "Order analysisComp", 'imported, reconfigured, disassembled?') AS "XMLPI";
SELECT XMLPARSE(CONTENT '123 ' ) AS PO ;
SELECT XMLPARSE(CONTENT '<purchaseOrder>123</purchaseOrder>');
SELECT XMLPARSE(CONTENT '123 <purchaseOrder poNo="12435"> <customerName>Tom Cat</customerName>
<itemNo>9876</itemNo> </purchaseOrder>' ) AS PO ;
SELECT XMLPARSE (DOCUMENT '<?xml version="1.0"?><book><title>Manual</title><chapter>...</chapter>
</book>');
SELECT XMLPARSE (CONTENT 'abc<foo>bar</foo><bar>foo</bar>');
SELECT XMLPARSE (CONTENT 'abc<foo>bar</foo><bar>foo</bar>' as varchar);
SELECT XMLSERIALIZE(CONTENT '<Owner>Tom</Owner>');
/*SELECT XMLSERIALIZE(CONTENT '<Owner>Tom/Owner>');*/
SELECT XMLELEMENT("Department", XMLAGG(XMLELEMENT("Employee", e.id||' '||e.lastname) ORDER BY
lastname)) as "Dept_list" FROM employees e WHERE e.dept_id <= 300;
INSERT INTO book2018 (xmlDemo) values(xmlelement(name cat, xmlattributes('tom' as name), 'Tom is
', 'ca', 't'));
select xmlDemo from book2018 where xmlDemo!=null;

```

Chapter 12. Array Support

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Declaration of Array Types

An array data type is named by appending square brackets ([]) to the data type name of the array elements, and all the elements are of the same data type. The array subscript numbers are written within square brackets. It uses a one-based numbering convention for arrays, that is, an array of n elements starts with array[1] and ends with array[n].

```
DECLARE v_pay_by_month decimal(12,2)[12];
set v_pay_by_month[2]=123.45;
select v_pay_by_month[2] as feb;
select v_pay_by_month;
```

```
CREATE TABLE if not exists book2018 (
    item          varchar(16),
    pay_by_month  decimal(12,2)[12],
    schedule      longvarchar[][]
);
```

Array Functions

1. CAST(expression AS array): converts expression to array. For instance, cast('{20000, 25000, 25000, 25000}' as array).
2. CONVERT(expression, data_type): converts expression to another data type (json and jsonb). For instance, convert('{{"breakfast", "consulting"}, {"meeting", "lunch"}}', array).
3. to_array(expression): Returns the value as array. For instance, to_array('{{"breakfast", "consulting"}, {"meeting", "lunch"}}').
4. array_assign(anyArrayElement,expression): Returns an array with supplied value. For instance, array_assign(to_array('{{"breakfast", "consulting"}, {"meeting", "lunch"}}')[2],to_array('{{"lunch", "meeting"}}').
5. array_ndims(anyArrayElement): Returns the number of dimensions of the array.
6. SPLIT(string1, string2): split string1 according to delimiter string2, and return an String[] object (Types.ARRAY). Special SPLIT(expression,"") will return strings which contains only Letter and Digit. Special SPLIT(expression,null) will split string into length=1 strings, which is only Letter or Digit.

Array sample

```
SELECT cast('{20000, 25000, 25000, 25000}' as array);
SELECT convert('{{"breakfast", "consulting"}, {"meeting", "lunch"}}', array);
select to_array('{{"meeting", "lunch"}, {"training", "presentation"}}');

select to_array('{{"meeting", "lunch"}, {"training", "presentation"}}')[1][2];

select array_assign(to_array('{{"breakfast", "consulting"}, {"meeting", "lunch"}}')
[2],to_array('{{"lunch", "meeting"}}');
```

```
drop table if exists book2018;
CREATE TABLE book2018 (    item          varchar(16),    pay_quarter  int[4], pay_month
DECIMAL(12,2)[12],    schedule      longvarchar[][2],comment java_object[],flags
boolean[2],tempVars varchar(10)[2],tempDemo array, xmlDemo xml);
INSERT INTO book2018 (item,pay_quarter,schedule) VALUES ('Bill',    '{10000, 20000, 25000,
10000}',    '{{"meeting", "lunch"}, {"training", "presentation"}}');
INSERT INTO book2018 (item,pay_month,schedule) VALUES ('Bill',    '{100.003, 200.106, 250.50,
10000,100.00, 200.10, 250.50, 10000,100.00, 200.10, 250.50, 62000}',    '{{"meeting", "lunch"},
{"training", "presentation"}}');
INSERT INTO book2018 (item,pay_quarter,schedule) VALUES ('Carol','{20000,20000, 25000, 25000}',
('{{"breakfast", "consulting"}, {"meeting", "lunch"}}');
```

```
*INSERT INTO book2018 (item,pay_quarter,schedule) VALUES ('Carol','{20000, 25000, 25000}',
'{"breakfast", "consulting"}, {"meeting", "lunch"}');
*INSERT INTO book2018 (item,pay_quarter,schedule) VALUES ('Carol','{20000, 25000, 25000,20000}',
'{"breakfast", "consulting"}, {"meeting"}');
INSERT INTO book2018 (tempVars) VALUES ('{"breakfast", "consulting abc"}');

select * from book2018;

SELECT item,pay_month[11],* FROM book2018 WHERE pay_quarter[1] !=pay_quarter[2];
UPDATE book2018 SET pay_quarter = '{25000,25000,27000,27000}' WHERE item = 'Carol';
select pay_quarter from ".".book2018 WHERE item = 'Carol';

UPDATE book2018 SET pay_quarter[4] = 300 WHERE item = 'Carol';
select pay_quarter from _current_.book2018 WHERE item = 'Carol';
SELECT item,pay_month[11],* FROM book2018 WHERE pay_quarter[1] !=pay_quarter[2];
```

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