Setting Up HiveServer2

HiveServer2

HiveServer2 (HS2) is a server interface that enables remote clients to execute queries against Hive and retrieve the results (a more detailed intro here). The current implementation, based on Thrift RPC, is an improved version of HiveServer and supports multi-client concurrency and authentication. It is designed to provide better support for open API clients like JDBC and ODBC.

- The Thrift interface definition language (IDL) for HiveServer2 is available at https://github.com/apache/hive/blob/trunk/service/if/TCLIService.thrift.
- Thrift documentation is available at http://thrift.apache.org/docs/.

This document describes how to set up the server. How to use a client with this server is described in the HiveServer2 Clients document.

Version

Introduced in Hive version 0.11. See HIVE-2935.

How to Configure

Configuration Properties in the `hive-site.xml` File

hive.server2.thrift.min.worker.threads – Minimum number of worker threads, default 5.

hive.server2.thrift.max.worker.threads – Maximum number of worker threads, default 500.

hive.server2.thrift.port – TCP port number to listen on, default 10000.

hive.server2.thrift.bind.host – TCP interface to bind to.

See HiveServer2 in the Configuration Properties document for additional properties that can be set for HiveServer2.

Optional Environment Settings

HIVE_SERVER2_THRIFT_BIND_HOST – Optional TCP host interface to bind to. Overrides the configuration file setting.
HIVE_SERVER2_THRIFT_PORT – Optional TCP port number to listen on, default 10000. Overrides the configuration file setting.

Running in HTTP Mode

HiveServer2 provides support for sending Thrift RPC messages over HTTP transport (Hive 0.13 onward, see HIVE-4752). This is particularly useful to support a proxying intermediary between the client and the server (for example, for load balancing or security reasons). Currently, you can run HiveServer2 in either TCP mode or the HTTP mode, but not in both. For the corresponding JDBC URL check this link: HiveServer2 Clients -- JDBC Connection URLs. Use the following settings to enable and configure HTTP mode:

Setting	Default	Description
hive.server2.transport.mode	binary	Set to http to enable HTTP transport mode

hive.server2.thrift.http.port	10001	HTTP port number to listen on
hive.server2.thrift.http.max.worker.threads	500	Maximum worker threads in the server pool
hive.server2.thrift.http.min.worker.threads	5	Minimum worker threads in the server pool
hive.server2.thrift.http.path	cliservice	The service endpoint

Cookie Based Authentication

HIVE-9709 and HIVE-9710 introduced cookie based authentication for HiveServer2 in HTTP mode. The HiveServer2 parameters (hive.server2.thrift.http.cookie.*) associated with this change can be found here.

Optional Global Init File

A global init file can be placed in the configured hive.server2.global.init.file.location location (Hive 0.14 onward, see HIVE-5160, HIVE-7497, and HIVE-8138). This can be either the path to the init file itself, or a directory where an init file named ".hiverc" is expected.

The init file lists a set of commands that will run for users of this HiveServer2 instance, such as register a standard set of jars and functions.

Logging Configuration

HiveServer2 operation logs are available for Beeline clients (Hive 0.14 onward). These parameters configure logging:

- hive.server2.logging.operation.enabled
- hive.server2.logging.operation.log.location
- hive.server2.logging.operation.verbose (Hive 0.14 to 1.1)
- hive.server2.logging.operation.level (Hive 1.2 onward)

How to Start

```
$HIVE_HOME/bin/hiveserver2
```

OR

```
$HIVE_HOME/bin/hive --service hiveserver2
```

Usage Message

The `-H` or `--help` option displays a usage message, for example:

```
$HIVE_HOME/bin/hive --service hiveserver2 -H
Starting HiveServer2
usage: hiveserver2
 -H,--help                        Print help information
    --hiveconf <property=value>   Use value for given property
```

Authentication/Security Configuration

HiveServer2 supports Anonymous (no authentication) with and without SASL, Kerberos (GSSAPI), pass through LDAP, Pluggable Custom Authentication and Pluggable Authentication Modules (PAM, supported Hive 0.13 onwards).

Configuration

Authentication mode:

hive.server2.authentication – Authentication mode, default NONE. Options are NONE (uses plain SASL), NOSASL, KERBEROS, LDAP, PAM and CUSTOM.

Set following for KERBEROS mode:

hive.server2.authentication.kerberos.principal – Kerberos principal for server.

hive.server2.authentication.kerberos.keytab – Keytab for server principal.

Set following for LDAP mode:

hive.server2.authentication.ldap.url – LDAP URL (for example, ldap://hostname.com:389).

hive.server2.authentication.ldap.baseDN – LDAP base DN. (Optional for AD.)

hive.server2.authentication.ldap.Domain – LDAP domain. (Hive 0.12.0 and later.)

See User and Group Filter Support with LDAP Atn Provider in HiveServer2 for other LDAP configuration parameters in Hive 1.3.0 and later.

Set following for CUSTOM mode:

hive.server2.custom.authentication.class – Custom authentication class that implements the `org.apache.hive.service.auth.PasswdAuthenticationProvider` interface.

For PAM mode, see details in section on PAM below.

Impersonation

By default HiveServer2 performs the query processing as the user who submitted the query. But if the following parameter is set to false, the query will run as the user that the `hiveserver2` process runs as.

hive.server2.enable.doAs – Impersonate the connected user, default true.

To prevent memory leaks in unsecure mode, disable file system caches by setting the following parameters to true (see HIVE-4501):

fs.hdfs.impl.disable.cache – Disable HDFS filesystem cache, default false.

fs.file.impl.disable.cache – Disable local filesystem cache, default false.

Integrity/Confidentiality Protection

Integrity protection and confidentiality protection (beyond just the default of authentication) for communication between the Hive JDBC driver and HiveServer2 are enabled (Hive 0.12 onward, see HIVE-4911). You can use the SASL QOP property to configure this.

- This is only when Kerberos is used for the HS2 client (JDBC/ODBC application) authentication with HiveServer2.
- hive.server2.thrift.sasl.qop in `hive-site.xml` has to be set to one of the valid QOP values ('auth', 'auth-int' or 'auth-conf').

SSL Encryption

Support is provided for SSL encryption (Hive 0.13 onward, see HIVE-5351). To enable, set the following configurations in `hive-site.xml`:

hive.server2.use.SSL – Set this to true.

hive.server2.keystore.path – Set this to your keystore path.

hive.server2.keystore.password – Set this to your keystore password.

Note

When hive.server2.transport.mode is binary and hive.server2.authentication is KERBEROS, SSL encryption did not work until Hive 2.0. Set hive.server2.thrift.sasl.qop to auth-conf to enable encryption. See HIVE-14019 for details.

Setting up SSL with self-signed certificates

Use the following steps to create and verify self-signed SSL certificates for use with HiveServer2:

1. Create the self signed certificate and add it to a keystore file using: keytool -genkey -alias example.com -keyalg RSA -keystore keystore.jks -keysize 2048 Ensure the name used in the self signed certificate matches the hostname where HiveServer2 will run.
2. List the keystore entries to verify that the certificate was added. Note that a keystore can contain multiple such certificates: keytool -list -keystore keystore.jks
3. Export this certificate from keystore.jks to a certificate file: keytool -export -alias example.com -file example.com.crt -keystore keystore.jks

4. Add this certificate to the client's truststore to establish trust: keytool -import -trustcacerts -alias example.com -file example.com.crt -keystore truststore.jks
5. Verify that the certificate exists in truststore.jks: keytool -list -keystore truststore.jks
6. Then start HiveServer2, and try to connect with beeline using: jdbc:hive2://<host>:<port>/<database>;ssl=true;sslTrustStore=<path-to-truststore>;trustStorePassword=<truststore-password>

Selectively disabling SSL protocol versions

To disable specific SSL protocol versions, use the following steps:

1. Run openssl ciphers -v (or the corresponding command if not using openssl) to view all protocol versions.
2. In addition to 1, an additional step of going over the HiveServer2 logs may be required to see all the protocols that the node running HiveServer2 is supporting. For that, search for "SSL Server Socket Enabled Protocols:" in the HiveServer2 log file.
3. Add all the SSL protocols that need to be disabled to hive.ssl.protocol.blacklist. Ensure that the property in hiveserver2-site.xml does not override that in hive-site.xml.

Pluggable Authentication Modules (PAM)

Warning

JPAM library that is used to provide the PAM authentication mode can cause HiveServer2 to go down if a user's password has expired. This happens because of segfault/core dumps from native code invoked by JPAM. Some users have also reported crashes during logins in other cases as well. Use of LDAP or KERBEROS is recommended.

Support is provided for PAM (Hive 0.13 onward, see HIVE-6466). To configure PAM:

- Download the JPAM native library for the relevant architecture.
- Unzip and copy libjpam.so to a directory (<libjmap-directory>) on the system.
- Add the directory to the LD_LIBRARY_PATH environment variable like so: `export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:<libjmap-directory>`
- For some PAM modules, you'll have to ensure that your `/etc/shadow` and `/etc/login.defs` files are readable by the user running the HiveServer2 process.

Finally, set the following configurations in `hive-site.xml`:

hive.server2.authentication – Set this to PAM.

hive.server2.authentication.pam.services – Set this to a list of comma-separated PAM services that will be used. Note that a file with the same name as the PAM service must exist in /etc/pam.d.

Setting up HiveServer2 job credential provider

Starting Hive 2.2.0 onwards (see HIVE-14822) Hiveserver2 supports job specific hadoop credential provider for MR and Spark jobs. When using encrypted passwords via the Hadoop Credential Provider, HiveServer2 needs to forward enough information to the job configuration so that jobs launched across cluster can read those secrets. Additionally, HiveServer2 may have secrets that the job should not have such as the Hive Metastore database password. If your job needs to access such secrets, like S3 credentials, then you can configure them using the configuration steps below:

1. Create a job-specific keystore using Hadoop Credential Provider API at a secure location in HDFS. This keystore should contain the encrypted key /value pairs of the configurations needed by jobs. Eg: in case of S3 credentials the keystore should contain fs.s3a.secret.key and fs.s3a.access.key with their corresponding values.
2. The password to decrypt the keystore should be set as a HiveServer2 environment variable called HIVE_JOB_CREDSTORE_PASSWORD
3. Set hive.server2.job.credential.provider.path to URL pointing to the type and location of keystore created in (1) above. If there is no job-specific keystore, HiveServer2 will use the one set using hadoop.credential.provider.path in core-site.xml if available.
4. If the password using environment variable set in step 2 is not provided, HiveServer2 will use HADOOP_CREDSTORE_PASSWORD environment variable if available.
5. HiveServer2 will now modify the job configuration of the jobs launched using MR or Spark execution engines to include the job credential provider so that job tasks can access the encrypted keystore with the secrets.

hive.server2.job.credential.provider.path – Set this to your job-specific hadoop credential provider. Eg: jceks://hdfs/user/hive/secret/jobcreds.jceks.

HIVE_JOB_CREDSTORE_PASSWORD – Set this HiveServer2 environment variable to your job specific Hadoop credential provider password set above.

Scratch Directory Management

HiveServer2 allows the configuration of various aspects of scratch directories, which are used by Hive to store temporary output and plans.

Configuration Properties

The following are the properties that can be configured related to scratch directories:

- hive.scratchdir.lock
- hive.exec.scratchdir

- hive.scratch.dir.permission
- hive.start.cleanup.scratchdir

ClearDanglingScratchDir Tool

The tool **cleardanglingscratchdir** can be run to clean up any dangling scratch directories that might be left over from improper shutdowns of Hive, such as when a virtual machine restarts and leaves no chance for Hive to run the shutdown hook.

```
hive --service cleardanglingscratchdir [-r] [-v] [-s scratchdir]
    -r           dry-run mode, which produces a list on console
        -v           verbose mode, which prints extra debugging information
        -s           if you are using non-standard scratch directory
```

The tool tests if a scratch directory is in use, and if not, will remove it. This relies on HDFS write locks to detect if a scratch directory is in use. An HDFS client opens an HDFS file (`$scratchdir/inuse.lck`) for writing and only closes it at the time that the session is closed. **cleardanglingscratchdir** will try to open `$scratchdir/inuse.lck` for writing to test if the corresponding HiveCli/HiveServer2 is still running. If the lock is in use, the scratch directory will not be cleared. If the lock is available, the scratch directory will be cleared. Note that it might take NameNode up to 10 minutes to reclaim the lease on scratch file locks from a dead HiveCli/HiveServer2, at which point **cleardanglingscratchdir** will be able to remove it if run again**.**

Web UI for HiveServer2

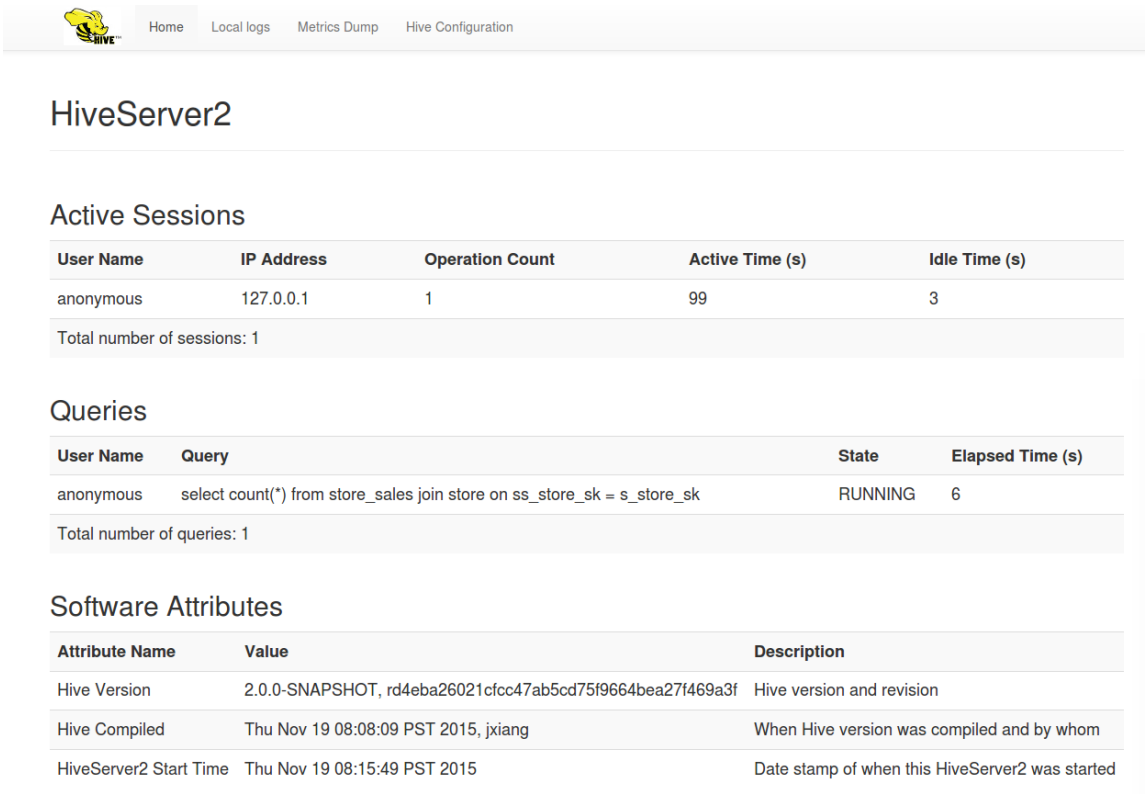
Version

Introduced in Hive 2.0.0. See HIVE-12338 and its sub-tasks.

A Web User Interface (UI) for HiveServer2 provides configuration, logging, metrics and active session information. The Web UI is available at port 10002 (127.0.0.1:10002) by default.

- Configuration properties for the Web UI can be customized in hive-site.xml, including hive.server2.webui.host, hive.server2.webui.port, hive.server2.webui.max.threads, and others.
- Hive Metrics can by viewed by using the "Metrics Dump" tab.
- Logs can be viewed by using the "Local logs" tab.

The interface is currently under development with HIVE-12338.



Python Client Driver

A Python client driver for HiveServer2 is available at https://github.com/BradRuderman/pyhs2 (thanks, Brad). It includes all the required packages such as SASL and Thrift wrappers.

The driver has been certified for use with Python 2.6 and newer.

To use the pyhs2 driver:

```
pip install pyhs2
```

and then:

```
import pyhs2

with pyhs2.connect(host='localhost',
                   port=10000,
                   authMechanism="PLAIN",
                   user='root',
                   password='test',
                   database='default') as conn:
    with conn.cursor() as cur:
            #Show databases
            print cur.getDatabases()

            #Execute query
        cur.execute("select * from table")

        #Return column info from query
        print cur.getSchema()

        #Fetch table results
        for i in cur.fetch():
            print i
```

You can discuss this driver on the user@hive.apache.org mailing list.

Ruby Client Driver

A Ruby client driver is available on github at https://github.com/forward3d/rbhive.