HCL OneDB 2.0.1

JSON compatibility

Contents

Chapter 1. JSON compatibility

Applications that rely on JSON data can interact with the relational and non-relational data that is stored in HCL OneDB™ databases.

The HCL OneDB™ wire listener provides JSON access to HCL OneDB™ through its MongoDB API compatibility, its REST API, and its MQTT protocol, all of which allow application developers to write applications accessing HCL OneDB™ data from any of those paradigms.

In addition to the wire listener providing an API compatibility layer for MongoDB, REST, and MQTT, the HCL OneDB™ database server also provides built-in JSON and BSON (binary JSON) data types which can also be accessed directly through SQL.

About the HCL OneDB™ JSON compatibility

You can access and combine relational and JSON data into a single application by using the HCL OneDB™ JSON compatibility features.

Applications that rely on JSON data can interact with the relational and non-relational data that is stored in HCL OneDB™ databases by using the wire listener or the REST API. The HCL OneDB™ database server also provides built-in JSON and BSON (binary JSON) data types.

The JSON document format provides a way to transfer object information in a way that is language neutral, similar to XML. Language-neutral data transmission is a requirement for working in a web application environment, where data comes from various sources and software is written in various languages. With HCL OneDB™, you can choose which parts of your application data are better suited to unstructured, non-relational storage, and which parts are better suited in a traditional relational framework.

You have the following options for accessing relational tables, including time series tables, and JSON collections:

SQL API

You can insert, update, and query data relational tables through the SQL language and standard ODBC, JDBC, .NET, OData, and other clients.

You can access JSON collections through direct SQL access and the JDBC driver. You can use the SQL BSON processing functions to convert JSON collections to relational data types for use with ODBC, .NET, OData, and other clients.

For more information about accessing JSON data through SQL statements, see BSON and JSON built-in opaque data types and Manipulate BSON data with SQL statements on page 7.

MongoDB API

You can insert, update, and query data in relational tables and JSON collections through MongoDB APIs for Java™, JavaScript™, C++, C#, Python, and other clients.

For more information, see MongoDB API on page 60.

REST API

You can insert, update, and query data relational tables and JSON collections through the driverless REST API. You can run command documents that include MongoDB API commands or SQL queries. You can use the REST API to load time series data from sensor devices.

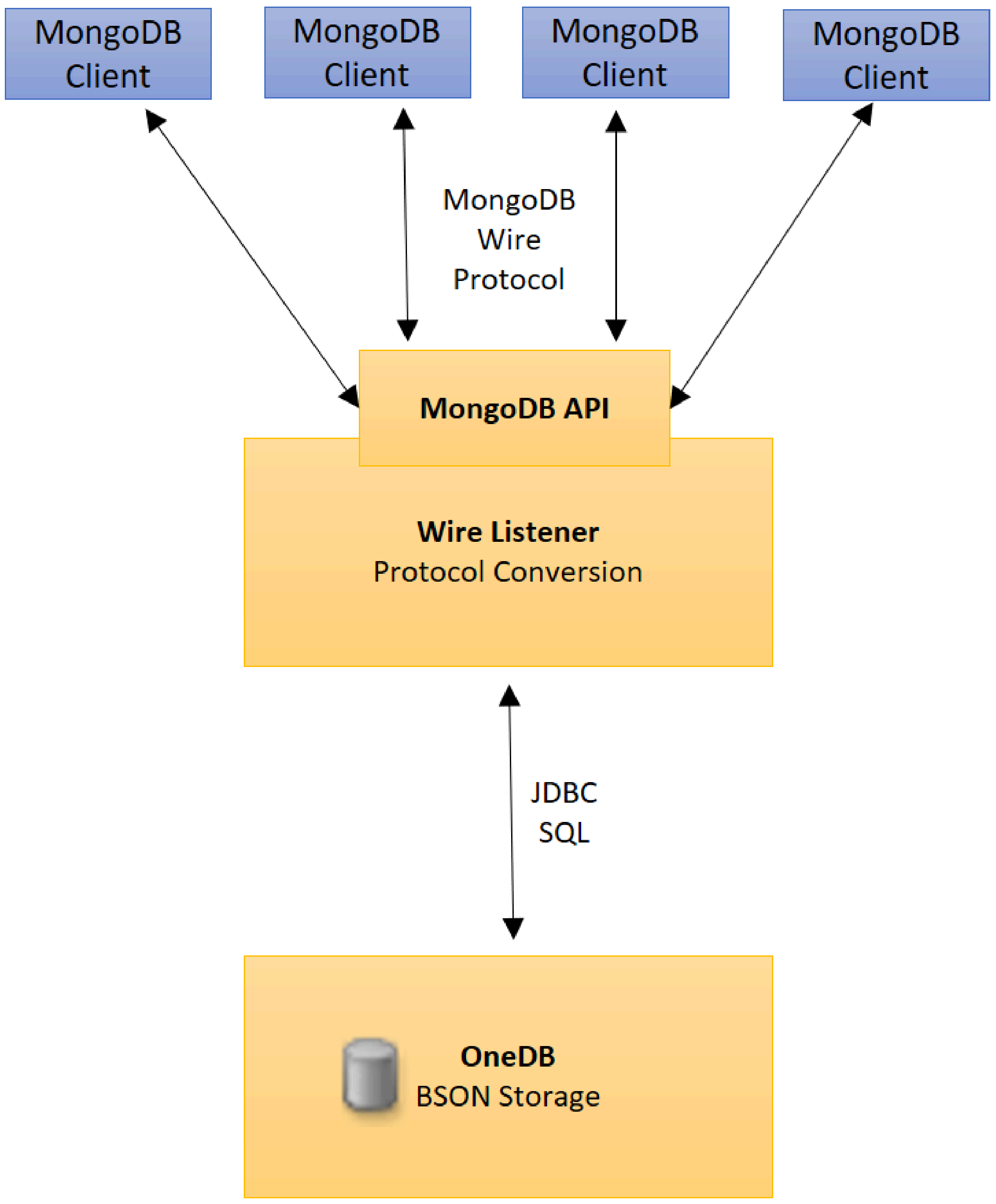
For more information, see the HCL OneDB REST API Guide.

You can enable dynamic scaling and high-availability for data-intensive applications by taking the following steps:

- Define a sharded cluster to easily add or remove servers as your requirements change.
- Use shard keys to distribute subsets of data across multiple servers in a sharded cluster.
- Query servers in a sharded cluster and return the consolidated results to the client application.
- Use secondary servers (similar to subordinates in MongoDB) in the sharded cluster to maximize availability and throughput. Secondary servers also have update capability.

You can choose to authenticate users through the wire listener or in the database server.

The following illustration shows the architecture of the wire listener and the database server.



Requirements for JSON compatibility

HCL OneDB™ JSON compatibility has specific software dependencies and database server requirements.

Java requirements

If you are using the wire listener for MongoDB access to your HCL OneDB™ data, you must use a supported Java™ runtime environment. Java version 1.8 is recommended.

MongoDB version

Informix JSON compatibility is based on MongoDB version 4.0 by default. You can configure the wire listener to use a different MongoDB API compatibility version by setting the mongo.api.version on page 23 parameter in the wire listener configuration file.

Database server requirements

JSON and BSON data is stored in sbspaces. You can specify the sbspace for JSON and BSON storage in the PUT clause of the INSERT statement when doing direct SQL access. However, you must set a default sbspace with the SBSPACENAME configuration parameter. When you insert JSON or BSON data that exceeds 4 K in size, the data is temporarily saved in the default sbspace for processing before being saved in the sbspace that you specified.

Support for dots in field names

Unlike MongoDB, which does not allow dots, (.), in JSON or BSON field names, HCL OneDB™ conforms to the JSON standard and allows dots. For example: {"user.fn" : "Jake"}. However, you cannot run a query or an operation directly on a field that has a dot in its name. In queries, a dot in between field names indicates a hierarchy.

Here the rules of using field names with dots in them with HCL OneDB™:

- You can insert a document that has a field name with a dot in it. You do not get an error.
- You cannot use a field name with a dot in it in a query or operation. HCL OneDB™ ignores the field. The query does not return the matching document. The operation does not affect the value of the field.
- You can return a document that includes a field name with a dot in it by querying on a field name in the same document that does not have a dot in it.

Allowing dots in field names is useful when you do not have control over the field names because your data comes from external sources, for example, the Google API. You still want to store those documents in your database, even though some fields might have dots in their names.

The following examples to illustrate how dots in field names work in HCL OneDB™. The table name is **tab1** and the column that contains JSON data is named **data**.

Suppose that you have the following document:

```
{user : {fn : "Bob", ln : "Smith"}, "user.fn" : "Jake"}
```

You run the following statement to update a field:

```
SELECT data::json FROM tab1 WHERE BSON_UPDATE(data, '$set : {"user.fn" :
      "John:}}');
```

The following document is returned:

```
{user : {fn : "John", ln : "Smith"}, "user.fn" : "Jake"}
```

The value of the **fn** field that is in a subdocument to the **user** field is updated. The value of the **user.fn** field is not updated, but the value is returned. You cannot update the value of a field with a dot in its name, but you can retrieve the value.

Suppose that you have the following document:

```
{"user.firstname" : "Jake"}
```

You run this query to return the value of the **user.firstname** field:

```
SELECT data::json FROM tab1 WHERE BSON_KEYS_EXIST(data,
      "user.firstname");
```

No documents are returned.

If you have documents where all the fields have dots in their names, you must run a query to return all documents in the database to see them: for example:

```
SELECT data::json FROM tab1;
```

Manipulate BSON data with SQL statements

As an alternative to using the MongoDB API, you can use HCL OneDB™ SQL to manipulate BSON data. However, if you plan to query JSON and BSON data through the wire listener, you must create your database objects, such as collections and indexes, through the wire listener. You can use SQL statements to query JSON and BSON data whether you created your database objects through the wire listener or with SQL statements.

You might have an existing application on relational tables that uses SQL to access the data, but you want to add BSON data to your database. You can create a table with a BSON column, insert the data, and manipulate the data with SQL statements. BSON documents that you insert through SQL statements or HCL OneDB™ utilities do not contain generated ObjectId field-value pairs or other MongoDB metadata.

Alternatively, you might use a MongoDB client for daily data processing, but need the querying capabilities of SQL for data analysis. For example, you can use SQL statements to join tables that have BSON columns with other tables based on BSON field values. You can create views that have columns of BSON field values. You can run warehouse queries on BSON data with . If you have time series data, you can use the corresponding specialized SQL routines to analyze the data.

You can use BSON processing functions to manipulate BSON data in SQL statements. The BSON value functions convert BSON field values to standard SQL data types, such as INTEGER and LVARCHAR. The BSON_GET function retrieves field-value pairs and the BSON_UPDATE function manipulates field-value pairs. You can convert all or part of a relational table to a BSON document with the genBSON function.

Example: Using SQL to query a collection

In the following example, a JSON collection table that is named **people** is created with **name** and **age** fields that are inserted by using the interactive JavaScript™ shell interface to MongoDB:

```
db.createCollection("people");
db.people.insert({"name":"Anne","age":31});
db.people.insert({"name":"Bob","age":39});
db.people.insert({"name":"Charlie","age":29});
```

For SQL statements, the table name is **people** and the BSON column name is **data**. When you create a collection through a MongoDB API command, the name of the BSON column is always set to **data**.

The following statement selects the **name** and **age** fields with dot notation and displays the results in a readable format by casting the results to JSON:

```
> SELECT data.name::JSON, data.age::JSON FROM people;

(expression)  {"name":"Anne"}
(expression)  {"age":31}

(expression)  {"name":"Bob"}
(expression)  {"age":39}

(expression)  {"name":"Charlie"}
(expression)  {"age":29}

3 row(s) retrieved.
```

Wire listener

The wire listener is a mid-tier gateway server that enables communication between MongoDB clients and the HCL OneDB™ database server.

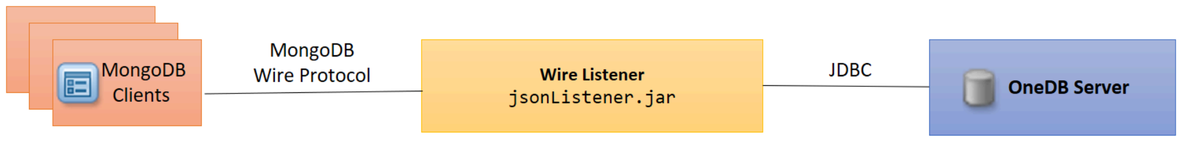
The wire listener is a Java™ application and is provided as an executable JAR file as part of the HCL OneDB™ APIs package. The JAR file provides access to the MongoDB API.

MongoDB API access

The wire listener implements the MongoDB Wire Protocol. This allows you to connect MongoDB applications and client drivers to the HCL OneDB™ database through the wire listener. The MongoDB applications send MongoDB operations and commands to the wire listener, which automatically translates those commands to SQL which it runs against the HCL OneDB™ database using JDBC.

You can use the MongoDB API to access HCL OneDB™ JSON/BSON collections, relational tables, or TimeSeries tables.

The wire listener configuration properties file on page 10 defines every operational characteristic. By default, when you create a database or a table through the wire listener, automatic location and fragmentation are enabled. Databases are stored in the dbspace that is chosen by the server. Tables are fragmented among dbspaces that are chosen by the server. More fragments are added when tables grow.



Configuring the wire listener for the first time

Before starting the wire listener, you must customize the wire listener configuration file.

Before you begin

The wire listener JAR file is included in the HCL OneDB™ APIs package.

To configure the wire listener for the first time:

1. Choose an authorized user.
   An authorized user is required in wire listener connections to the database server. The authorized user must have access to the databases and tables that are accessed through the wire listener.
   Choose from:
   - **Windows™:** Specify an operating system user.
   - **UNIX™ or Linux™**: Specify an operating system user or a database user. For example, here is the command to create a database user in UNIX™ or Linux™:

     ```
     CREATE USER userID WITH PASSWORD 'password' ACCOUNT unlock PROPERTIES
      USER daemon;
     ```
2. **Optional:** If you want to shard data by using wire listener commands, grant the user REPLICATION privilege by running the admin or task SQL administration API command with the grant admin argument.
   Example
   For example:

   ```
   EXECUTE FUNCTION task('grant admin','userID','replication');
   ```
3. Create a wire listener configuration with the `.properties` file extension. You can use the example properties file in the HCL OneDB™ APIs package as a template.
   For more information, see The wire listener configuration file on page 10.
4. Customize the wire listener configuration file to your needs.
   To include parameters in the wire listener, uncomment the row and customize the parameter. The **url** parameter is required. Specifiy the authorized user created in step 1 in the **url** string. All other wire listener configuration parameters are optional.

Tip: Review the defaults for the following properties and verify that they are appropriate for your environment: **mongo.api.version**, **authentication.enable**, **listener.port**, **listener.hostName**, and **listener.ssl.enable**.

5. If you are using a Dynamic Host Configuration Protocol (DHCP) on your IPv6 host, you must verify that the connection information between JDBC and HCL OneDB™ is compatible.

   For example, you can connect from the IPv6 host through an IPv4 connection by using the following steps:

   a. Add a server alias to the DBSERVERALIASES configuration parameter for the wire listener on the local host.

      Example

      For example: `lo_onedb`.

   b. Add an entry to the `sqlhosts` file for the database server alias to the loopback address `127.0.0.1`.

      Example

      For example:

      ```
      lo_onedb onsoctcp 127.0.0.1 9090
      ```

   c. In the wire listener configuration file, update the **url** entry with the wire listener alias.

      Example

      For example:

      ```
      url=jdbc:onedb://localhost:9090/sysmaster;
      ONEDB_SERVER=lo_onedb;
      ```

What to do next

Start the wire listener on page 41.

The wire listener configuration file

The wire listener is configured through a properties file. This properties file contains, among other things, settings for the connection between the wire listener and the database server.

A sample properties file is provided in the HCL OneDB™ APIs package. In the sample properties file, all of the parameters are commented out by default. To enable a parameter, you must uncomment the row and customize the parameter.

To modify the wire listener configuration file once the listener is started, you must first stop the wire listener, then update the configuration file and restart the wire listener for the changes to take affect.

Wire listener configuration properties

Important: The **url** parameter is required. All other parameters are optional.

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- Setup and configuration

- pool.lenient.return.enable on page 35
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- pool.semaphore.timeout on page 36
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- pool.size.maximum on page 38
- pool.type on page 38
- pool.typeMap.strategy on page 38
- response.documents.size.minimum on page 39

Required parameter

You must configure the **url** parameter before using the wire listener.

url

This required parameter specifies the host name, port number, user ID, and password that are used in connections to the database server.

You must specify the **sysmaster** database in the **url** parameter. That database is used for administrative purposes by the wire listener.

```
url = jdbc : onedb : // hostname : portnum / sysmaster ; [ USER = userid ; PASSWORD = password NONCE = value ]
```

You can include additional JDBC properties in the **url** parameter such as CONNECT_TIMEOUT, CONNECT_RETRIES, LOGINTIMEOUT, and IFX_SOC_TIMEOUT. For a list of HCL OneDB™ environment variables that are supported by the JDBC driver, see HCL OneDB™ environment variables with the HCL OneDB™ JDBC Driver on page .

hostname:portnum

The host name and port number of your computer. For example, `localhost:9090`.

USER=*userid*

This optional attribute specifies the user ID that is used in connections to the HCL OneDB™ database server. If you plan to use this connection to establish or modify collection shards by using the HCL OneDB™ sharding capability, the specified user must be granted the REPLICATION privilege group access.

If you do not specify the user ID and password, the JDBC driver uses operating system authentication and all wire listener actions are run by using the user ID and password of the operating system user who runs the wire listener start command.

PASSWORD=*password*

This optional attribute specifies the password for the specified user ID.

NONCE=*value*

This optional attribute specifies a 16-character value that consists of numbers and the letters a, b, c, d, e, and f. This property triggers password encoding when a pluggable authentication module is configured for the wire listener. Applicable only if the db.authentication parameter is set to onedb-mongodb-cr.

Setup and configuration

These parameters provide setup and configuration options.

documentIdAlgorithm

This optional parameter determines the algorithm that is used to generate the unique HCL OneDB™ identifier for the ID column that is the primary key on the collection table. The _id field of the document is used as the input to the algorithm. The default value is `documentIdAlgorithm=ObjectId`.

```
documentIdAlgorithm= { ObjectId | SHA-256 | SHA-512 }
```

ObjectId

Indicates that the string representation of the ObjectId is used if the _id field is of type ObjectId; otherwise, the MD5 algorithm is used to compute the hash of the contents of the _id field.

- The string representation of an ObjectId is the hexadecimal representation of the 12 bytes that comprise an ObjectId.
- The MD5 algorithm provides better performance than the secure hashing algorithms (SHA).

ObjectId is the default value and it is suitable for most situations.

Important: Use the default unless a unique constraint violation is reported even though all documents have a unique _id field. In that case, you might need to use a non-default algorithm, such as SHA-256 or SHA-512.

SHA-256

Indicates that the SHA-256 hashing algorithm is used to derive an identifier from the _id field.

SHA-512

Indicates that the SHA-512 hashing algorithm is used to derive an identifier from the _id field. This option generates the most unique values, but uses the most processor resources.

include

This optional parameter specifies the properties file to reference. The path can be absolute or relative.

```
include= properties_file
```

listener.onException

This optional parameter specifies an ordered list of actions to take if an exception occurs that is not handled by the processing layer.

```
listener.onException = { reply | closeSession | shutdownListener }
```

reply

When an unhandled exception occurs, reply with the exception message. This is the default value.

closeSession

When an unhandled exception occurs, close the session.

shutdownListener

When an unhandled exception occurs, shut down the wire listener.

listener.hostName

This optional parameter specifies the host name of the wire listener. The host name determines the network adapter or interface that the wire listener binds the server socket to.

Tip: If you enable the wire listener to be accessed by clients on remote hosts, turn on authentication by using the **authentication.enable** parameter.

```
listener.hostName= { localhost | hostname | * }
```

localhost

Bind the wire listener to the localhost address. The wire listener is not accessible from clients on remote machines. This is the default value.

hostname

The host name or IP address of host machine where the wire listener binds to.

*****

The wire listener can bind to all interfaces or addresses.

listener.port

This optional parameter specifies the port number to listen on for incoming connections from clients. This value can be overridden from the command line by using the **-port** argument. The default value is 27017.

Important: If you specify a port number that is less than 1024, the user that starts the wire listener might require additional operating system privileges.

`listener.port=` { **`27017`** | *port_number* }

listener.timezone

This parameter specifies the timezone of the listener java JVM. This will override any system or user configured default timezone. The timezone property affects the timezone of date values that are used outside of BSON documents.

Important: It is recommended that the listener timezone be set to UTC (or GMT). You should change this property only if you are using the listener to interact with relational tables that store dates in a timezone other than UTC/GMT.

Possible values: UTC, GMT, GMT+1, GMT+2, GMT-1, GMT-2, EST, CST, etc. Set this property to null to use the system's default timezone.

`listener.timezone` = { **`UTC`** | *timezone* }

response.documents.count.default

This optional parameter specifies the default number of documents in a single response to a query. The default value is 100.

`response.documents.count.default` = { **`100`** | *default_docs* }

response.documents.count.maximum

This optional parameter specifies the maximum number of documents in a single response to a query. The default value is 10000.

`response.documents.count.maximum=` { **`10000`** | *max_docs* }

response.documents.size.maximum

This optional parameter specifies the maximum size, in bytes, of all documents in a single response to a query. The default value is 1048576.

`response.documents.size.maximum=` { **`1048576`** | *max_size* }

sharding.enable

This optional parameter indicates whether to enable the use of commands and queries on sharded data.

`sharding.enable=` { **`false`** | `true` }

false

Do not enable the use of commands and queries on sharded data. This is the default value.

true

Enable the use of commands and queries on sharded data.

sharding.parallel.query.enable

This optional parameter indicates whether to enable the use of parallel sharded queries. Parallel sharded queries require that the SHARD_ID configuration parameter be set to unique IDs on all shard servers. The sharding.enable parameter must also be set to true.

```
sharding.parallel.query.enable = { false | true }
```

false

Do not enable parallel sharded queries. This is the default value.

true

Enable parallel sharded queries.

High Availability

These parameters provide configuration options for ensuring high availability and transaction survivability to your MongoDB applications in case of a database server failover.

failover.retry.enable

Enables the listener to automatically retry client requests if a possible server failover is detected.

In the case of a server failover, the wire listener can be automatically rerouted by the Connection Manager to the new primary in the high-availability cluster, or to any other online server in the cluster, depending on how the service level agreement rules are configured. In such a scenario, you may choose to enable the wire listener to monitor for failover error codes from the server. If such a failure is detected, the wire listener will attempt to automatically reconnect through the Connection Manager to another server in the cluster and retry the client operations there. The wire listener will only return an error to the client application if it cannot establish a new connection to the cluster. This automatic retry provides seamless high availability to MongoDB client applications with the wire listener and the Connection Manager automatically handling the rerouting of client operations in the event of a database server failover.

If `failover.retry.enable` is set to `true`, the url property must point to a OneDB Connection Manager.

```
failover.retry.enable = { false | true }
```

true

Enable automatic retry of client requests if a possible server failover is detected.

false

Disable automatic retry of client requests.

failover.retry.delay

This optional parameter specifies the delay in milliseconds that the wire listener waits before trying to reestablish a connection after a failover error code is received from the database server. This parameter only takes effect if `failover.retry.enable=true`.

`failover.retry.delay` = { **`10000`** | *milliseconds* }

failover.retry.errorCodes

This optional parameter specifies the list of database server error codes that will be considered an indication of a possible failover.

If `failover.retry.enable` is set to `true`, this list provides the list of error codes that will trigger the wire listener to attempt to reestablish a connection from the Connection Manager and retry the client request again. This parameter only takes effect if `failover.retry.enable=true`.

`failover.retry.errorCodes` = { **`[-908, -930, -931, -404, -1803, -25582, -27002, -27009, -79716, -79730, -79735]`** | *list of error codes* }

failover.retry.maxRetries

This optional parameter specifies the maximum number of times the wire listener will retry an client request after a potential failover error is received from the database server.

If the wire listener is connected to a Connection Manager that can automatically reroute the wire listener when a server failover occurs, this `failover.retry.maxRetries` parameter controls how many times the wire listener will attempt to reestablish a connection and retry the client operation that failed. This parameter only takes effect if `failover.retry.enable=true`.

`failover.retry.maxRetries` = { **`12`** | *number of retries* }

Command and operation configuration

These parameters provide configuration options for JSON commands and operations.

collection.onedb.options

This optional parameter specifies which table options for shadow columns or auditing to use when creating a JSON collection.

`collection.onedb.options` = [{ [{ | " **`audit`** " | " **`crcols`** " | " **`erkey`** " | " **`replcheck`** " | " **`vercols`** " }] }]

audit

Use the AUDIT option of the CREATE TABLE statement to create a table to be included in the set of tables that are audited at the row level if selective row-level is enabled.

crcols

Use the CRCOLS option of the CREATE TABLE statement to create two shadow columns that Enterprise Replication uses for conflict resolution.

erkey

Use the ERKEY option of the CREATE TABLE statement to create the ERKEY shadow columns that Enterprise Replication uses for a replication key.

replcheck

Use the REPLCHECK option of the CREATE TABLE statement to create the **ifx_replcheck** shadow column that Enterprise Replication uses for consistency checking.

vercols

Use the VERCOLS option of the CREATE TABLE statement to create two shadow columns that HCL OneDB™ uses to support update operations on secondary servers.

command.listDatabases.sizeStrategy

This optional parameter specifies a strategy for calculating the size of your database when the MongoDB listDatabases command is run. The listDatabases command estimates the size of all collections and collection indexes for each database. However, relational tables and indexes are excluded from this size calculation.

Important: The MongoDB listDatabases command performs expensive and CPU-intensive computations on the size of each database in the database server instance. You can decrease the expense by using the **command.listDatabases.sizeStrategy** parameter.

```
command.listDatabases.sizeStrategy={{estimate|{ estimate:n}|compute|none|perDatabaseSpace}}
```

estimate

Estimate the size of the database by sampling documents in every collection. This is the default value. This strategy is the equivalent of {estimate: 1000}, which takes a sample size of 0.1% of the documents in every collection. This is the default value.

```
command.listDatabases.sizeStrategy=estimate
```

estimate: *n*

Estimate the size of the database by sampling one document for every *n* documents in every collection. The following example estimates the collection size by using sample size of 0.5% or 1/200th of the documents:

```
command.listDatabases.sizeStrategy={estimate:200}
```

compute

Compute the exact size of the database.

```
command.listDatabases.sizeStrategy=compute
```

none

List the databases but do not compute the size. The database size is listed as 0.

```
command.listDatabases.sizeStrategy=none
```

perDatabaseSpace

Calculate the size of a database by adding the sizes for all dbspaces, sbspaces, and blobspaces that are assigned to the tenant database.

Important: The **perDatabaseSpace** option applies only to tenant databases that are created by the multi-tenancy feature.

update.client.strategy

This optional parameter specifies the method that is used by the wire listener to send updates to the database server. When the wire listener does the update processing, it queries the server for the existing document and then updates the document.

```
update.client.strategy={{updatableCursor|deleteInsert}}
```

updatableCursor

Updates are sent to the database server by using an updatable cursor. This is the default value.

deleteInsert

The original document is deleted when the updated document is inserted.

Important: If the collection is sharded, you must use this method.

update.mode

This optional parameter determines where document updates are processed. The default value is `update.mode=mixed`.

```
update.mode={{mixed|client}}
```

client

Use the wire listener to process updates. You must use this mode if you enable sharding and want to allow the updating of shard key field values.

mixed

Attempt to process updates on the database server first, then fallback to the wire listener. This is the default value.

Database resource management

These parameters provide database resource management options.

database.buffer.enable

Prerequisite: `database.log.enable=true`

This optional parameter indicates whether to enable buffered logging when you create a database by using the wire listener.

```
database.buffer.enable = { true | false }
```

true

Enable buffered logging.

false

Do not enable buffered logging. This is the default value.

database.create.enable

This optional parameter indicates whether to enable the automatic creation of a database, if a database does not exist.

```
database.create.enable = { true | false }
```

true

If a database does not exist, create a database. This is the default value.

false

If a database does not exist, do not create a database. With this option, you can access only existing databases.

database.dbspace

Prerequisite: `dbspace.strategy=fixed`

This optional parameter specifies the name of the dbspace databases that are created. The default value is `database.dbspace=rootdbs`.

```
database.dbspace = { rootdbs | dbspace_name }
```

database.locale.default

This optional parameter specifies the default locale to use when a database is created by using the wire listener. The default value is en_US.utf8.

```
database.locale.default = { en_US.utf8 | locale }
```

database.log.enable

This optional parameter indicates whether to create databases that are enabled for logging.

```
database.log.enable = { true | false }
```

true

Create databases that are enabled for logging. This is the default value. Use the **database.buffer.enable** parameter to enable buffered logging.

false

Do not create databases that are enabled for logging.

database.onException.errorCodes

A JSON document describing what actions to take on specific database error codes. Each action should be followed by an array of the database's integer error codes that should trigger the specified action.

closePools

Error codes that should trigger the listener to close the existing connection pools.

disposeOfConnections

Error codes that indicate the current connection is stale and should be disposed of.

removeCollectionFromCache

Error codes that indicate that the listener's currently cached information about the collection is stale and should be refreshed.

reprepareStatement

Error codes that indicate that the prepared statement should be re-prepared.

retryStatement

Error codes that indicate that an insert, update, delete or query statement should be retried once before the error/result is returned to the client.

These lists of error codes are the default values for each statement, and can be changed or added as you desire. For example:

```
database.onException.errorCodes={
    "closePools":[-79716, -79730, -79735],
    "disposeOfConnection":[-349, -79716, -79730, -79735],
    "removeCollectionFromCache":[-710, -206],
    "reprepareStatement":[-208, -267, -285, -79716],
    "retryStatement":[]
}
```

dbspace.strategy

This optional parameter specifies the strategy to use when determining the location of new databases, tables, and indexes.

```
dbspace.strategy = { autolocate | fixed }
```

autolocate

The database server automatically determines the dbspace for the new databases, tables, and indexes. This is the default value.

fixed

Use a specific dbspace, as specified by the **database.dbspace** property.

fragment.count

This optional parameter specifies the number of fragments to use when creating a collection. If you specify 0, the database server determines the number of fragments to create. If you specify a *fragment_num* greater than 0, that number of fragments are created when the collection is created. The default value is 0.

```
fragment.count = { 0 | fragment_num }
```

jdbc.afterNewConnectionCreation

This optional parameter specifies one or more SQL commands to run after a new connection to the database is created.

```
jdbc.afterNewConnectionCreation = [ " sql_command " ]
```

MongoDB compatibility

These parameters provide options for MongoDB compatibility.

compatible.maxBsonObjectSize.enable

This optional parameter indicates whether the maximum BSON object size is compatible with MongoDB.

Tip: If you insert a BSON document by using an SQL operation, HCL OneDB™ supports a maximum document size of 2 GB.

```
compatible.maxBsonObjectSize.enable = { false | true }
```

false

Use a maximum document size of 256 MB with the wire listener. This is the default value.

true

Use a maximum document size of 16 MB. The maximum document size for MongoDB is 16 MB.

mongo.api.version

This optional parameter specifies the MongoDB API version with which the wire listener is compatible. The version affects authentication methods as well as MongoDB commands.

```
mongo.api.version = { 4.0 | 4.2 }
```

Note: 4.0 is the default value.

update.one.enable

This optional parameter indicates whether to enable support for updating a single JSON document.

Important: The **update.one.enable** parameter applies to JSON collections only. For relational tables, the MongoDB multi-parameter is ignored and all documents that meet the query criteria are updated.

```
update.one.enable = { false | true }
```

false

All collection updates are treated as multiple JSON document updates. This is the default value.

With the `update.one.enable=false` setting, the MongoDB **db.collection.update** multi-parameter is ignored and all documents that meet the query criteria are updated.

true

Allow updates on collections to a single document or multiple documents.

With the `update.one.enable=true` setting, the MongoDB **db.collection.update** multi-parameter is accepted. The **db.collection.update** multi-parameter controls whether you can update a single document or multiple documents.

Performance

These parameters provide performance options for databases and collections.

delete.preparedStatement.cache.enable

This optional parameter indicates whether to cache prepared statements that delete documents for reuse.

```
delete.preparedStatement.cache.enable = { true | false }
```

true

Use a prepared statement cache for statements that delete documents. This is the default value.

false

Do not use a prepared statement cache for statements that delete documents. A new statement is prepared for each query.

insert.batch.enable

If multiple documents are sent as a part of a single INSERT statement, this optional parameter indicates whether to batch document inserts operations into collections.

```
insert.batch.enable = { true | false }
```

true

Batch document inserts into collections by using JDBC batch calls to perform the insert operations. This is the default value.

false

Do not batch document insert operations into collections.

insert.batch.queue.enable

This optional parameter indicates whether to queue INSERT statements into larger batches. You can improve insert performance by queuing INSERT statements, however, there is decreased durability.

This parameter batches all INSERT statements, even a single INSERT statement. These batched INSERT statements are flushed at the interval that is specified by the **insert.batch.queue.flush.interval** parameter, unless another operation arrives on the same collection. If another operation arrives on the same collection, the batch inserts are immediately flushed to the database server before proceeding with the next operation.

```
insert.batch.queue.enable = { false | true }
```

false

Do not queue INSERT statements. This is the default.

true

Queue INSERT statements into larger batches. Use the **insert.batch.queue.flush.interval** parameter to specify the amount of time between insert queue flushes.

insert.batch.queue.flush.interval

Prerequisite: `insert.batch.queue.enable=true`

This optional parameter specifies the number of milliseconds between flushes of the insert queue to the database server. The default value is `insert.batch.queue.flush.interval=100`.

```
insert.batch.queue.flush.interval = { 100 | flush_interval_time }
```

index.cache.enable

This optional parameter indicates whether to enable index caching on collections. To write the most efficient queries, the wire listener must be aware of the existing BSON indexes on your collections.

```
index.cache.enable = { true | false }
```

true

Cache indexes on collections. This is the default value.

false

Do not cache indexes on collections. The wire listener queries the database for indexes each time a collection query is translated to SQL.

index.cache.update.interval

This optional parameter specifies the amount of time, in seconds, between updates to the index cache on a collection table. The default value is `index.cache.update.interval=120`.

```
index.cache.update.interval = { 120 | cache_update_interval }
```

insert.preparedStatement.cache.enable

This optional parameter indicates whether to cache the prepared statements that are used to insert documents.

```
insert.preparedStatement.cache.enable = { true | false }
```

true

Cache the prepared statements that are used to insert documents. This is the default value.

false

Do not cache the prepared statements that are used to insert documents.

preparedStatement.cache.enable

This optional parameter indicates whether to cache prepared statements for reuse.

```
preparedStatement.cache.enable = { true | false }
```

true

Use a prepared statement cache. This is the default value.

false

Do not use a prepared statement cache. A new statement is prepared for each query.

preparedStatement.cache.size

This optional parameter specifies the size of the least-recently used (LRU) map that is used to cache prepared statements. The default value is `preparedStatement.cache.size=20`.

```
preparedStatement.cache.enable = { 20 | LRU_size }
```

Security

The parameters provide security enablement options.

authentication.enable

This optional parameter indicates whether to enable user authentication.

You can choose to authenticate users through the wire listener or in the database server.

```
authentication.enable= { false | true }
```

false

Do not authenticate users. This is the default value.

true

Authenticate users. Use the **authentication.localhost.bypass.enable** parameter to control the type of authentication.

authentication.localhost.bypass.enable

Prerequisite: `authentication.enable=true`

If you connect from the localhost to the HCL OneDB™ **admin** database, and the **admin** database contains no users, this optional parameter indicates whether to grant full administrative access.

The HCL OneDB™ **admin** database is similar to the MongoDB admin database. The HCL OneDB™ **authentication.localhost.bypass.enable** parameter is similar to the MongoDB **enableLocalhostAuthBypass** parameter.

```
authentication.localhost.bypass.enable= { true | false }
```

true

Grant full administrative access to the user. This is the default value.

false

Do not grant full administrative access to the user.

command.blocklist

This optional parameter lists commands that are removed from the command registry and cannot be called. By default, the block list is empty.

```
command.blocklist = [ command ]
```

db.authentication

This optional parameter specifies the user authentication method. See User authentication with the wire listener on page 44 for more information.

```
db.authentication = { mongodb-scram | onedb-mongodb-cr }
```

mongdb-scram

Authenticate through the wire listener with the MongoDB SCRAM-SHA-256 algorithm. MongoDB SCRAM-SHA-256 authentication is only supported on Mongo listeners. This is the default value .

onedb-mongodb-cr

Authenticate through the database server with a pluggable authentication module (PAM) using the MongoDB Challenge Response (MONGODB-CR) authentication algorithm.

listener.admin.ipAddress

This optional parameter specifies the IP address for the administrative host. Must be a loopback IP address. The default value is 127.0.0.1.

Important: If you specify an address that is not a loopback IP address, an attacker might perform a remote privilege escalation and obtain administrative privileges without knowing a user password.

```
listener.admin.ipAddress = ip_address
```

listener.authentication.timeout

This optional parameter specifies the number of milliseconds that the wire listener waits for a client connection to authenticate. The default value is 0, which indicates that the wire listener waits indefinitely for client connections to authenticate.

```
listener.authentication.timeout = milliseconds
```

listener.ssl.algorithm

This optional parameter specifies the Service Provider Interface (SPI) for the KeyManagerFactory that is used to access the network encryption keystore. On an Oracle Java Virtual Machine (JVM), this value is typically SunX509. On an IBM JVM, this value is typically IbmX509. The default value is no SPI.

Important: Do not set this property if you are not familiar with Java Cryptography Extension (JCE).

```
listener.ssl.algorithm = SPI
```

listener.ssl.ciphers

This optional parameter specifies a list of Secure Sockets Layer (SSL) or Transport Layer Security (TLS) ciphers to use with network encryption. The default value is no ciphers, which means that the default list of enabled ciphers for the JVM are used.

Important: Do not set this property if you are not familiar with Java Cryptography Extension (JCE) and the implications of using multiple ciphers. Consult a security expert for advice.

`listener.ssl.ciphers` = *cipher*

You can include spaces between ciphers.

For example, you can set the following ciphers:

```
listener.ssl.ciphers=TLS_RSA_WITH_AES_128_CBC_SHA, TLS_RSA_WITH_AES_256_CBC_SHA,
TLS_EMPTY_RENEGOTIATION_INFO_SCSV
```

listener.ssl.enable

This optional parameter enables SSL or TLS network encryption on the socket for client connections. See Configuring SSL connections between the wire listener and client applications on page 48.

`listener.ssl.enable` = { **`false`** | **`true`** }

false

Disable network encryption. This is the default.

true

Allow network encryption.

listener.ssl.key.alias

This optional parameter specifies the alias, or identifier, of the entry into the keystore. The default value is no alias, which indicates that the keystore contains one entry. If the keystore contain more than one entry and a key password is needed to unlock the keystore, set this parameter to the alias of the entry that unlocks the keystore.

`listener.ssl.key.alias` = *alias*

This parameter is effective when the listener.ssl.enable parameter is set to true.

listener.ssl.key.password

This optional parameter specifies the password to unlock the entry into the keystore, which is identified by the listener.ssl.key.alias parameter. The default value is no password, which means to use the keystore password. If the entry into the keystore requires a password that is different from the keystore password, set this parameter to the entry password.

`listener.ssl.key.password` = *password*

This parameter is effective when the listener.ssl.enable parameter is set to true.

listener.ssl.keyStore.file

This optional parameter specifies the fully-qualified path and file name of the Java keystore file to use for network encryption. The default value is no file.

```
listener.ssl.keyStore.file = file_path
```

This parameter is effective when the listener.ssl.enable parameter is set to true.

listener.ssl.keyStore.password

This optional parameter specifies the password to unlock the Java keystore file for network encryption. The default value is no password.

```
listener.ssl.keyStore.password = password
```

This parameter is effective when the listener.ssl.enable parameter is set to true.

listener.ssl.keyStore.type

This optional property specifies the provider identifier for the network encryption keystore SPI. The default value is JKS.

Important: Do not set this property if you are not familiar with Java Cryptography Extension (JCE).

```
listener.ssl.keyStore.type = SPI
```

This parameter is effective when the listener.ssl.enable parameter is set to true.

listener.ssl.protocol

This optional parameter specifies the SSL or TLS protocols. The default value is TLS.

```
listener.ssl.protocol = protocol
```

This parameter is effective when the listener.ssl.enable parameter is set to true.

security.sql.passthrough

This optional parameter indicates whether to enable support for issuing SQL statements by using JSON documents.

```
security.sql.passthrough = { false | true }
```

false

Disable the ability to issue SQL statements by using the MongoDB API. This is the default.

true

Allow SQL statements to be issued by using the MongoDB API.

Wire listener resource management

These parameters provide wire listener resource management options.

cursor.idle.timeout

This optional parameter specifies the number of milliseconds that a cursor can be idle before it is closed. The default value is 30000. A positive integer value for *time* specifies the number of milliseconds before an idle timeout.

```
cursor.idle.timeout = { 30000 | time }
```

listener.connectionPool.closeDelay.time

This optional parameter specifies the amount of time to keep a connection pool open after the last client disconnects. When the existing connection pool is open, the next connection can connect faster by reusing the existing pool instead of creating a new connection pool. The default value is 0, which indicates that the connection pool is closed immediately after the last client disconnects. A positive integer value for *time* specifies the number of time units to keep the connection pool open. The unit of time is set by the **listener.connectionPool.closeDelay.timeUnit** parameter.

```
listener.connectionPool.closeDelay.time = { 0 | time }
```

listener.connectionPool.closeDelay.timeUnit

This optional parameter specifies the time unit for the **listener.connectionPool.closeDelay.time** parameter. The *unit* can be NANOSECONDS, MICROSECONDS, MILLISECONDS, SECONDS, MINUTES, HOURS, or DAYS. The default value is SECONDS.

```
listener.connectionPool.closeDelay.timeUnit = { SECONDS | unit }
```

listener.idle.timeout

This optional parameter specifies the amount of time, in milliseconds, that a client connection to the wire listener can idle before it is forcibly closed. You can use this parameter to close connections and free associated resources when clients are idle. The default value is 300000 milliseconds. The value of 0 indicates that client connections are never timed out.

Important: When set to a nonzero value, the wire listener socket that is used to communicate with a MongoDB client is forcibly closed after the specified time. To the client, the forcible closure appears as an unexpected disconnection from the server the next time there is an attempt to write to the socket.

```
listener.idle.timeout = { 300000 | idle_time }
```

listener.idle.timeout.minimum

This optional parameter specifies the lower threshold, in milliseconds, of the listener idle timeout, which is set by the low memory monitor. The default value is 10000 milliseconds. This property has no effect when the heap size is sufficiently large to not need a reduction in idle timeout.

```
listener.idle.timeout.minimum = { 10000 | idle_time }
```

This parameter is effective when the listener.memoryMonitor.enable parameter is set to true.

listener.input.buffer.size

This optional parameter specifies the size, in MB, of the input buffer for each wire listener socket. The default value is 8192 bytes.

```
listener.input.buffer.size = { 8192 | input_buffer_size }
```

listener.memoryMonitor.enable

This optional parameter enables the wire listener memory monitor. When memory usage for the wire listener is high, the memory monitor attempts to reduce resources, such as removing cached JDBC prepared statements, removing idle JDBC connections from the connection pools, and reducing the maximum size of responses.

```
listener.memoryMonitor.enable = { true | false }
```

true

Enable the memory monitor. This is the default.

false

Disable the memory monitor.

listener.memoryMonitor.allPoint

This optional parameter specifies the maximum percentage of heap usage before the memory monitor reduces resources. The default value is 80.

```
listener.memoryMonitor.allPoint = percentage
```

This parameter is effective when the listener.memoryMonitor.enable parameter is set to true.

listener.memoryMonitor.diagnosticPoint

This optional parameter specifies the percentage of heap usage before diagnostic information about memory usage is logged. The default value is 99.

```
listener.memoryMonitor.diagnosticPoint = percentage
```

This parameter is effective when the listener.memoryMonitor.enable parameter is set to true.

listener.memoryMonitor.zeroPoint

This optional parameter specifies the percentage of heap usage before the memory manager reduces resource usage to the lowest possible levels. The default value is 95.

```
listener.memoryMonitor.zeroPoint = percentage
```

This parameter is effective when the listener.memoryMonitor.enable parameter is set to true.

listener.output.buffer.size

This optional parameter specifies the size, in MB, of the output buffer for each listener socket. The default value is 8192 bytes.

```
listener.output.buffer.size = { 8192 | output_buffer_size }
```

listener.pool.admin.enable

This optional parameter enables a separate thread pool for connections from the administrative IP address, which is set by the listener.admin.ipAddress parameter. The default value is false. A separate thread pool ensures that administrative connections succeed even if the listener thread pool lacks available resources.

```
listener.pool.admin.enable = { false | true }
```

false

Prevents a separate thread pool. This is the default.

false

Creates a separate thread pool for administrative connections.

listener.pool.keepAliveTime

This optional parameter specifies the amount of time, in seconds, that threads above the core pool size are allowed to idle before they are removed from the wire listener JDBC connection pool. The default value is 60 seconds.

```
listener.pool.keepAliveTime = { 60 | thread_idle }
```

listener.pool.queue.size

This optional parameter specifies the number of requests to queue above the core wire listener pool size before expanding the pool size up to the maximum. A positive integer specifies the queue size to use before expanding the pool size up to the maximum.

```
listener.pool.queue.size = { 0 | -1 }
```

0

Do not allocate a queue size for tasks. All new sessions are either run on an available or new thread up to the maximum pool size, or are rejected if the maximum pool size is reached. This is the default value.

-1

Allocate an unlimited queue size for tasks.

listener.pool.size.core

This optional parameter specifies the maximum sustained size of the thread pool that listens for incoming connections from clients. The default value is 128.

```
listener.pool.size.core = { 128 | max_thread_size }
```

listener.pool.size.maximum

This optional parameter specifies the maximum peak size of the thread pool that listens for incoming connections from clients. The default value is 1024.

```
listener.pool.size.maximum = { 1024 | max_peak_thread_size }
```

listener.socket.accept.timeout

This optional parameter specifies the number of milliseconds that a server socket waits for an accept() function. The default value is 1024. The value of 0 indicates to wait indefinitely. The value of this parameter can affect how quickly the wire listener shuts down.

```
listener.socket.accept.timeout = milliseconds
```

listener.socket.read.timeout

This optional parameter specifies the number of milliseconds to block when calling a read() function on the socket input stream. The default value is 1024. A value of 0 might prevent the wire listener from shutting down because the threads that poll the socket might never unblock.

```
listener.socket.read.timeout = milliseconds
```

pool.connections.maximum

This optional parameter specifies the maximum number of active connections to a database. The default value is 50.

```
pool.connections.maximum = { 50 | max_active_connect }
```

pool.idle.timeout

This optional parameter specifies the minimum amount of time that an idle connection is in the idle pool before it is closed. The default value is 60 and the default time unit is seconds.

Important: Set the unit of time in the **pool.idle.timeunit** parameter. The default value is seconds.

```
pool.idle.timeout = { 60 | min_idle_pool }
```

pool.idle.timeunit

Prerequisite: `pool.idle.timeout=time`

This optional parameter specifies the unit of time that is used to scale the **pool.idle.timeout** parameter.

```
pool.idle.timeunit = { SECONDS | NANOSECONDS | MICROSECONDS | MILLISECONDS | MINUTES | HOURS | DAYS }
```

SECONDS

Use seconds as the unit of time. This is the default value.

NANOSECONDS

Use nanoseconds as the unit of time.

MICROSECONDS

Use microseconds as the unit of time.

MILLISECONDS

Use milliseconds as the unit of time.

MINUTES

Use minutes as the unit of time.

HOURS

Use hours as the unit of time.

DAYS

Use days as the unit of time.

pool.lenient.return.enable

This optional parameter suppresses the following checks on a connection that is being returned that might throw exceptions:

- An attempt to return a pooled connection that is already returned.
- An attempt to return a pooled connection that is owned by another pool.
- An attempt to return a pooled connection that is an incorrect type.

```
pool.lenient.return.enable = { false | true }
```

false

Connection checks are enabled. This is the default.

false

Connection checks are disabled.

pool.lenient.dispose.enable

This optional parameter suppresses the checks on a connection that is being disposed of that might throw exceptions.

```
pool.lenient.dispose.enable = { false | true }
```

false

Connection checks are enabled. This is the default.

false

Connection checks are disabled.

pool.semaphore.timeout

This optional parameter specifies the amount of time to wait to acquire a permit for a database connection. The default value is 5 and the default time unit is seconds.

Important: Set the unit of time in the **pool.semaphore.timeunit** parameter.

```
pool.semaphore.timeout = { 5 | wait_time }
```

pool.semaphore.timeunit

Prerequisite: `pool.semaphore.timeout=wait_time`

This optional parameter specifies the unit of time that is used to scale the **pool.semaphore.timeout** parameter.

```
pool.semaphore.timeunit = { SECONDS | NANOSECONDS | MICROSECONDS | MILLISECONDS | MINUTES | HOURS | DAYS }
```

SECONDS

Use seconds as the unit of time. This is the default value.

NANOSECONDS

Use nanoseconds as the unit of time.

MICROSECONDS

Use microseconds as the unit of time.

MILLISECONDS

Use milliseconds as the unit of time.

MINUTES

Use minutes as the unit of time.

HOURS

Use hours as the unit of time.

DAYS

Use days as the unit of time.

pool.service.interval

This optional parameter specifies the amount of time to wait between scans of the idle connection pool. The idle connection pool is scanned for connections that can be closed because they have exceeded their maximum idle time. The default value is 30.

Important: Set the unit of time in the **pool.service.timeunit** parameter.

```
pool.service.interval = { 30 | wait_time }
```

pool.service.threads

This optional parameter specifies the number of threads to use for the maintenance of connection pools that share a common service thread pool. The default value is 1.

```
pool.service.threads = number
```

pool.service.timeunit

Prerequisite: `pool.service.interval=wait_time`

This optional parameter specifies the unit of time that is used to scale the **pool.service.interval** parameter.

```
pool.service.timeunit = { SECONDS | NANOSECONDS | MICROSECONDS | MILLISECONDS | MINUTES | HOURS | DAYS }
```

SECONDS

Use seconds as the unit of time. This is the default value.

NANOSECONDS

Use nanoseconds as the unit of time.

MICROSECONDS

Use microseconds as the unit of time.

MILLISECONDS

Use milliseconds as the unit of time.

MINUTES

Use minutes as the unit of time.

HOURS

Use hours as the unit of time.

DAYS

Use days as the unit of time.

pool.size.initial

This optional parameter specifies the initial size of the idle connection pool. The default value is 0.

```
pool.size.initial = { 0 | idle_pool_initial_size }
```

pool.size.minimum

This optional parameter specifies the minimum size of the idle connection pool. The default value is 0.

```
pool.size.minimum = { 0 | idle_pool_min_size }
```

pool.size.maximum

This optional parameter specifies the maximum size of the idle connection pool. The default value is 50.

```
pool.size.maximum = { 50 | idle_pool_max_size }
```

pool.type

This optional parameter specifies the type of pool to use for JDBC connections. The available pool types are:

```
pool.type = { basic | none | advanced | perThread }
```

basic

Thread pool maintenance of idle threads is run each time that a connection is returned. This is the default value.

none

No thread pooling occurs. Use this type for debugging purposes.

advanced

Thread pool maintenance is run by a separate thread.

perThread

Each thread is allocated a connection for its exclusive use.

pool.typeMap.strategy

This optional parameter specifies the strategy to use for distribution and synchronization of the JDBC type map for each connection in the pool.

```
pool.typeMap.strategy = { copy | clone | share }
```

copy

Copy the connection pool type map for each connection. This is the default value.

clone

Clone the connection pool type map for each connection.

share

Share a single type map between all connections. You must use this strategy with a thread-safe type map.

response.documents.size.minimum

This optional parameter specifies the number of bytes for the lower threshold for the maximum response size, which is set by the response.documents.size.maximum parameter. The memory manager can reduce the response size to this size when resources are low. The default value is 65536 bytes.

```
response.documents.size.minimum = bytes
```

This parameter is effective when the listener.memoryMonitor.enable parameter is set to true.

Wire listener command line options

You can use command line options to control the wire listener.

Syntax

```
java -jar pathToListener -config properties_file { -start [ -port { 27017 | port_number } ] | -stop [ -wait { 10 | wait_time } ] } [ -version ] [ -buildInformation ]
```

```
>>-java-- -jar pathToListener---- -config properties_file-+------>

>--+- -start-+--------------------+-+-------------------------+-+-->
   |         '- -logfile--log_file-' |         .-27017-------. | |
   |                                 '- -port--+-port_number-+-' |
   '- -stop-+-----------------------+-------------------------------'
            |          .-10--------. |
            '- -wait--+-wait_time-+-'

>--+-----------+--+--------------------+----------------------><
   '- -version-'  '- -buildInformation-'
```

Argument	Purpose
-config *properties_file*	Specifies the name of the wire listener configuration file to run. This argument is required to start or stop the wire listener.
-start	Starts the wire listener. You must also specify the configuration file.
-stop	Stops the wire listener. You must also specify the configuration file. The **stop** command is similar to the MongoDB **shutdown** command.

Argument	**Purpose**
-logfile *log_file*	Specifies the name of the log file that is used. If this option is not specified, the log messages are sent to `std.out`. **Important:** From version 2.0.1.1 and newer **-loglevel** and **-logfile** command line options are ignored. Use the XML configuration file to specify log levels and log file locations.
-loglevel	Specifies the logging level. **error** Errors are sent to the log file. This is the default value. **warn** Errors and warnings are sent to the log file. **info** Informational messages, warnings, and errors are sent to the log file. **debug** Debug, informational messages, warnings, and errors are sent to the log file. **trace** Trace, debug, informational messages, warnings, and errors are sent to the log file. **Important:** From version 2.0.1.1 and newer **-loglevel** and **-logfile** command line options are ignored. Use the XML configuration file to specify log levels and log file locations.
-port *port_number*	Specifies the port number. If a port is specified on the command line, it overrides the port properties set in the wire listener configuration file. The default port is 27017.
-wait *wait_time*	Specifies the amount of time, in seconds, to wait for any active sessions to complete before the wire listener is stopped. The default is 10 seconds. To force an immediate shutdown, set the *wait_time* to 0 seconds.
-version	Prints the wire listener version.
-buildInformation	Prints the wire listener build information.

Example

Examples

In this example, the wire listener is started :

```
java -jar onedb-wire-listener.jar -config onedb-wire-listener.properties -start
```

In this example, port 6388 is specified:

```
java -jar onedb-wire-listener.jar
-config onedb-wire-listener.properties
-port 6388 -start
```

In this example, the wire listener is paused 10 seconds before the wire listener is stopped:

```
java -jar onedb-wire-listener.jar
-config onedb-wire-listener.properties
-wait 10 -stop
```

In this example, the wire listener version is printed:

```
java -jar onedb-wire-listener.jar -version
```

In this example, the wire listener build information is printed:

```
java -jar onedb-wire-listener.jar -buildInformation
```

Starting the wire listener

You can start the wire listener for the MongoDB API by using the start command.

Before you begin

- Stop all wire listeners that are currently running.
- If you plan to customize the Logback logger or another custom Simple Logging Facade for Java (SLF4J) logger, you must configure the logger before starting the wire listener.
- Configuring the wire listener for the first time on page 9
- Requirements for JSON compatibility on page 5

To start the wire listener, run the wire listener command with the -start option.
Example
For example:

```
java -jar onedb-wire-listener.jar
-config onedb-wire-listener.properties -start
```

Results

The wire listener starts.

Example

Example

In the following example, the wire listener is started with the configuration file specified as `onedb-mongo.properties`, the log file specified as `onedb-mongo.log`, and the log level specified as info:

```
java -jar onedb-wire-listener.jar
-config onedb-mongo.properties
-logfile onedb-mongo.log
-loglevel info -start
```

Here is the output from starting the wire listener:

```
starting mongo listener on port 27017
```

Stopping the wire listener

You can stop the wire listener by terminating the java process or by using the **stop** command.

About this task

You must stop the wire listener before you modify any configuration settings.

You can stop the wire listener at any time by terminating the java process that is running the wire listener.

You can also stop the wire listener by running the **stop** command with the configuration file specified. This stop command only works if **authentication.enable=true** or **authentication.localhost.bypass.enable=true**.

To run the stop command for a MongoDB listener.

```
java -jar onedb-wire-listener.jar -config
 onedb-wire-listener.properties -stop
```

Important: You must specify the **-config** argument to stop the wire listener from the command line.

Results

The wire listener is stopped.

Wire listener logging

The wire listener can output informational messages, warnings, and errors as well as debug and trace information to a log.

The default logging mechanism for the wire listener is Log4j. Log4j uses a configuration file to customize the level, style and target location for log messages. You can customize the logging output to fit your needs or to provide diagnostics for a technical support representative.

Below is a generic example log4j2.xml file which allows you control logging for the Wire Listener using the Java system properties specified in the table.

-Dlog4j2.configurationFile	Specify the location of the XML configuration file
-Dapp.logtarget	Specify 'console' or 'file'

-Dapp.logfile	If logtarget is 'file' give a file path here
-Dapp.loglevel	Specify the log level of the application
-Djdbc.loglevel	Specifiy the log level of the underlying JDBC driver

```
<?xml version="1.0" encoding="UTF-8"?>
<!--
 Generic Log4j2 configuration file that gives custom
 levels for JDBC and the application itself
-->
<Configuration monitorInterval="30" status="WARN">
  <Properties>
    <Property name="lgtarget">$${sys:app.logtarget:-console}</Property>
    <Property name="lgfile">$${sys:app.logfile:-app.log}</Property>
    <Property name="app">$${sys:app.loglevel:-info}</Property>
    <Property name="jdbc">$${sys:jdbc.loglevel:-error}</Property>
    <Property name="pattern">%d{yyyy-MM-dd HH:mm:ss.SSS} | %-5level | %t | %c{1} | %method | %marker
 | %msg%n</Property>
  </Properties>
  <Appenders>
    <Routing name="Router">
      <Routes pattern="${lgtarget}">
        <Route ref="Console" key="console" />
        <Route ref="File" key="file" />
      </Routes>
    </Routing>
    <Console name="Console">
      <PatternLayout pattern="${pattern}" />
    </Console>
    <File name="File" fileName="${lgfile}">
      <PatternLayout pattern="${pattern}" />
    </File>
  </Appenders>
  <Loggers>
    <!-- JDBC Driver packages -->
    <Logger name="com.informix" level="${jdbc}" />
    <Logger name="com.onedb.jdbc" level="${jdbc}" />
    <Logger name="com.onedb.jdbcx" level="${jdbc}" />
    <!-- Disable arcs/hikari logging except for errors -->
    <Logger name="com.informix.arcs" level="error" />
    <Logger name="com.zaxxer.hikari" level="warn" />

    <Root level="${app}">
      <AppenderRef ref="Router"/>
    </Root>
  </Loggers>
</Configuration>
```

Important: From version 2.0.1.1 and newer **-loglevel** and **-logfile** command line options are ignored. Use the XML configuration file to specify log levels and log file locations.

User authentication with the wire listener

When connecting to the wire listener, you can authenticate users directly with the database server or through the wire listener with MongoDB SCRAM-SHA-256 authentication.

You can use the following types of authentication methods with the wire listener:

SCRAM-SHA-256 two-step authentication

The wire listener authenticates users with the MongoDB SCRAM-SHA-256 authentication method outside of the HCL OneDB™ database server environment. You create users with the MongoDB API create user commands. User information and privileges are stored in the **system.users** collection in the **admin** database. Clients connect to the wire listener as MongoDB users and the wire listener authenticates the users. The wire listener connects to the database server as the user that is specified by the **url** parameter in the wire listener configuration file. The database server cannot access MongoDB user account information.

Database server authentication with a PAM (UNIX, Linux)

The PAM implements the MONGODB-CR challenge-response method. The wire listener connects to the database server using the user and password that is provided by clients and the database server authenticates the user through PAM. The database server controls all user accounts and privileges. You can audit user activities and configure fine-grained access control.

When connecting to the wire listener with MongoDB client drivers, you will need to specify that the authentication mechanism used as `MONGODB-CR`. For most Mongo drivers, you do this by specifying `authMechanism=MONGODB-CR` in the MongoDB url. Check the documentation for your MongoDB client driver for more information.

Which type of authentication that you can use depends on the type of client and the mongo.api.version on page 23 specified in your wire listener configuration file.

MongoDB clients

Table 1. Authentication types for the MongoDB API

Authentication type	Supported	Details
SCRAM-SHA-256	Yes	Follow the instructions on page 45 for configuring MongoDB authentication.
HCL OneDB™ user password	No	Database server authentication with a user and password is not supported for MongoDB clients because of the way MongoDB drivers hash the password.

Table 1. Authentication types for the MongoDB API (continued)

Authentication type	Supported	Details
PAM (MONGODB-CR)	Yes	Follow the instructions on page 45 for configuring database server authentication with PAM.

Configuring MongoDB authentication

You can configure the wire listener to use MongoDB authentication.

To configure MongoDB SCRAM-SHA-256 authentication:

1. Set the following parameters in the wire listener configuration file:
    - Enable authentication: Set authentication.enable=true.
    - Specify MongoDB authentication: Set db.authentication=mongodb-scram.
    - Set the MongoDB version: Set mongo.api.version to the version that you want.
    - Optional. Require authetntication even from clients on the localhost: Set the authentication.localhost.bypass.enable=false
    - Optional. Specify the authentication timeout period: Set the listener.authentication.timeout parameter to the number of milliseconds for authentication timeout.
2. Restart the wire listener.

Adding MongoDB users

To add the initial MongoDB authorized users:

1. Start the wire listener with authentication turned off: Set authentication.enable=false in the wire listener configuration file.
2. Add users by running the createUser command through any MongoDB client.
3. Turn on authentication: Set authentication.enable=true in the wire listener configuration file.
4. Restart the wire listener.

Configuring database server authentication with PAM (UNIX™, Linux™)

You can configure the database server to authenticate wire listener users with a pluggable authentication module (PAM).

About this task

You create a user for the wire listener for PAM connections. The wire listener uses the PAM user to look up system catalog-related information before sending client connection requests to the database server for authentication. The database server authenticates the client users through PAM.

To configure PAM authentication for MongoDB clients:

1. Set the **IFMXMONGOAUTH** environment variable.

   Example

   For example:

```
setenv IFMXMONGOAUTH 1
```

2. Create a PAM service file that is named `/etc/pam.d/pam_mongo` and has the following contents:

   ```
   auth    required $ONEDB_HOME/lib/pam_mongo.so file=mongohash
   account required $ONEDB_HOME/lib/pam_mongo.so
   ```

   Replace *$ONEDB_HOME* with the value of the **$ONEDB_HOME** environment variable.
3. On AIX® 64-bit computers, create a symbolic link that is named 64 that points to the `lib` directory by running the following commands:

   ```
   cd $ONEDB_HOME/lib
   ln -s . 64
   ```

4. Edit the `sqlhosts` file to add a connection that uses PAM. Include the s=4 option. Specify the PAM service `pam_mongo` with the pam_serv option. Specify the password authentication mode with the pamauth option.
   For example:

   ```
   ol_onedb onsoctcp myhost 40000 s=4,pam_serv=pam_mongo,pamauth=password
   ```

5. Enable connections from mapped users by setting the USERMAPPING configuration parameter to BASIC or ADMIN in the `onconfig` file.
6. Set up mapping to an operating system user that has no privileges.
   Example
   For example, on a typical Linux™ system, the user **nobody** is appropriate. Add the following line to the `/etc/onedb/allowed.surrogates` file:

   ```
   users:nobody
   ```

7. Restart the database server.
8. Create a PAM user for the wire listener. The user must be internally authenticated and map to the user **nobody**.
   Example
   For example, create a user that is named **mongo** by running the following SQL in the **sysmaster** database:

   ```
   CREATE USER 'mongo' WITH PASSWORD 'aPassword'
        PROPERTIES USER 'nobody';
   GRANT CONNECT TO 'mongo';
   ```

9. Verify the creation of the user by running the following statement:
   Example

   ```
   SELECT * FROM sysuser:sysmongousers
           WHERE username='mongo';
   ```

   The result of the query shows the user and hashed password:

   ```
   username   mongo
   hashed_password  bbb8f9630d5c6e094b9aedd945893faf
   ```

10. Set the following parameters in the wire listener configuration file:
    - Enable authentication: Set authentication.enable=true.
    - Specify PAM authentication: Set db.authentication=onedb-mongodb-cr.
    - Optional. Specify the authentication timeout period: Set the listener.authentication.timeout parameter to the number of milliseconds for authentication timeout.

  - Specify the mapped user and password for connections and specify to encode and hash the password: Set the url parameter. Include the NONCE property set to any 16 character string that contains only the digits 0-9 and the lower-case characters a-f (extended grep: [0-9a-f]{16}). For example:

    ```
    url=jdbc:onedb://10.168.8.135:40000/sysmaster;USER=mongo;
         PASSWORD=aPassword;NONCE=0123456789abcdef
    ```

11. Restart the wire listener.
12. Create users that the database server authenticates with PAM by running the SQL statement CREATE USER.

    If you have existing MongoDB users, you must re-create those users in the database server.

Encryption for wire listener communications

You can use Secure Sockets Layer (SSL) protocol to encrypt communication for the wire listener.

You can encrypt wire listener communications in one or both of the following ways:

- Configure SSL connections between the wire listener and the database server.
- Configure SSL connections between the wire listener and all client applications.

If you configure SSL communication for both the database server and client applications, you can use the same or different keystore files on the wire listener for each type of connection.

Configuring SSL connections between the wire listener and the database server

You can encrypt the connections between the wire listener and the database server with the Secure Sockets Layer (SSL) protocol.

Before you begin

You must have SSL configured for the database server. See Configuring a server instance for secure sockets layer connections on page .

About this task

The wire listener must use the same public key certificate file as the database server.

To configure SSL connections between the wire listener and the database server:

1. Use the keytool utility that comes with your Java runtime environment to import a client-side keystore database and add the public key certificate to the keystore:

   ```
   C:\work>keytool -importcert -file server_keystore_file -keystore client_keystore_name
   ```

   The *server_keystore_file* is the name of the server key certificate file.

2. Edit the wire listener properties file to update the url property to use the SSL port that you configured for the database server and add the `SSLCONNECTION=true` property to the end of the URL.
3. Start the listener with the javax.net.ssl.trustStore and javax.net.ssl.trustStorePassword system properties set:

```
java -Djavax.net.ssl.trustStore="client_keystore_path"
-Djavax.net.ssl.trustStorePassword="password" -jar jsonListener.jar
-config jsonListener.properties -logfile jsonListener.log -start
```

The *client_keystore_path* is the full path and file name of the client keystore file. The *password* is the keystore password.

Configuring SSL connections between the wire listener and client applications

You can encrypt the connections between the wire listener and the client applications with the Secure Sockets Layer (SSL) protocol.

About this task

All client applications must use the same public key certificate file as the wire listener.

To configure SSL connections between the wire listener and client applications:

1. Create a keystore and certificate for the wire listener.
   Use the method that best fits your type of client application and programming language. For example, you can use OpenSSL or the Java keytool utility.
2. Edit the wire listener properties file to configure the wire listener SSL properties and restart the listener.
   Set the following SSL properties:
    - Set the **listener.ssl.enable** parameter to `true` to enable SSL.
    - Set the **listener.ssl.keyStore.file** parameter to the path of the keystore file.
    - Set the **listener.ssl.keyStore.password** parameter to the password to unlock the keystore file.
    - Set the **listener.ssl.key.alias** parameter to the alias or identifier of the keystore entry. If the keystore contains only one entry, this parameter does not need to be set.
    - Set the **listener.ssl.key.password** parameter to the password to unlock the entry from the keystore. If this parameter is not set, the listener uses the **listener.ssl.keyStore.password** parameter.
    - Set **listener.ssl.keyStore.type** parameter if the keystore is not of type JKS (Java keystore).
3. Configure client applications to connect to the listener over SSL.

High availability support in the wire listener

The wire listener provides high availability support.

To provide high availability for MongoDB client applications, use a high-availability cluster configuration for your HCL OneDB™ database servers. For each database server in the cluster, run a wire listener that is directly connected to that database server. Each wire listener must be on the same computer as the database server that it is connected to and all wire listeners must run on the port 27017. For more information, see http://docs.mongodb.org/meta-driver/latest/legacy/connect-driver-to-replica-set/.

To provide high availability between the wire listener and the HCL OneDB™ database server, use one of the following methods:

- Route the connection between the wire listener and the database server through the Connection Manager.
- Configure the **url** parameter in the wire listener configuration file to use one of the OneDB® JDBC Driver methods of connecting to a high-availability cluster. For more information, see Dynamically reading the HCL OneDB™ sqlhosts file on page or Properties for connecting directly to an HDR pair of servers on page .

JSON data sharding

You can shard data with HCL OneDB™. Documents from a collection or rows from a table can be sharded across a cluster of database servers, reducing the number of documents or rows and the size of the index for the database of each server. When you shard data across multiple database servers, you also distribute performance across hardware. As your database grows in size, you can scale up by adding more shard servers to your shard cluster.

Documents or rows that are inserted on a shard server are distributed to the appropriate shard servers in a shard cluster based on the sharding schema. Queries on a sharded table automatically retrieve data from all relevant shard servers in a shard cluster. When data is sharded based on a field or column that specifies certain segmentation characteristics, queries can skip shard servers that do not contain relevant data.

A shard cluster of HCL OneDB™ database servers is a special form of Enterprise Replication. You can create a shard cluster with Enterprise Replication commands or with MongoDB commands.

HCL OneDB™ shard cluster architecture is very flexible:

- Shard servers can run on different hardware and operating systems.
- Shard servers can run different version of HCL OneDB™. For example, you can upgrade HCL OneDB™ on shard servers individually.
- Shard servers can have high-availability secondary servers from which users can query the sharded table.

To start sharding data:

1. Prepare shard servers for sharding.
2. Create a shard cluster.
3. Define a schema for sharding data against an existing table.

Preparing shard servers

You must prepare shard servers before you can shard data.

To set up shard servers:

1. On each shard server, set the SHARD_ID configuration parameter to a positive integer value that is unique in the shard cluster by running the following command:

   ```
   onmode -wf SHARD_ID=unique_positive_integer
   ```

   If the SHARD_ID configuration parameter is already set to a positive integer, you can change the value by editing the `onconfig` file and then restarting the database server. You can also set the SHARD_MEM configuration parameter to customize the number of memory pools that are used during shard queries.

2. Specify trusted hosts information for all shard servers.
   On each shard server, run the SQL administration API task() or admin() function with the cdr add trustedhost argument and include the appropriate host values for all the other shard servers. You must be a Database Server Administrator (DBSA) to run these functions.
3. On each shard server, edit the wire listener configuration file:
   a. Set the **sharding.enable** parameter to `true`.
   b. Set the **sharding.query.parallel.enable** parameter to `true`.
   c. Set the **update.client.strategy** parameter to `deleteInsert`.
   d. If you want to allow shard key field values to be updated, set the **update.mode** parameter to `client`. If you do not want to allow the updating of shard key field values, you can leave the setting of the **update.mode** parameter as the default value of `mixed`.
   e. Set the **USER** attribute in the **url** parameter to a user who has the REPLICATION privilege. Otherwise, see Configuring the wire listener for the first time on page 9 for instructions.
4. On each shard server, restart the wire listener.

What to do next

When applications that do not use the wire listener connect to shard servers, enable sharded queries to run against data across all shard servers by setting the USE_SHARDING session environment variable:

```
SET ENVIRONMENT USE_SHARDING ON;
```

For applications that use the wire listener with **sharding.enable**=`true`, this environment variable is set automatically by the wire listener.

Creating a shard cluster with MongoDB commands

You create a shard cluster by adding shard servers with the MongoDB shell command `sh.addShard` command or the `db.runCommand` command with the `addShard` syntax.

Before you begin

The shard servers must be prepared for sharding. See Preparing shard servers on page 49.

To create a shard cluster from the MongoDB shell:

1. Run the `mongo` command to start the MongoDB shell.
2. Run one of the following commands with the host name and port that is specified for the HCL OneDB™ server that you want to add. The specified port must run the HCL OneDB™ network-based listener, for example the **onsoctcp** protocol.
   a. Run the `sh.addShard` command.
   b. Run the `db.runCommand` with the `addShard` command syntax. You can include the fully qualified domain name of the server instead of the host name. You can specify multiple servers.

Results

A shard cluster is created with the specified shard servers. Each shard server is set up with Enterprise Replication and assigned an Enterprise Replication group name in its `sqlhosts` file. The default Enterprise Replication group name for a database server is the database server name with a suffix of `g_`. For example, the default Enterprise Replication group name for a database server that is named **myserver** is **g_myserver**.

Example

Examples

Add a server to a shard cluster with addShard

The following command adds the database server that is at port **9202** of **myhost2.hcl.com** to a shard cluster:

```
> sh.addShard("myhost2.hcl.com:9202")
```

Add a server to a shard cluster with db.runCommand and addShard

The following command adds the database server that is at port **9204** of **myhost4.hcl.com** to a shard cluster.

```
> db.runCommand({"addShard":"myhost4.hcl.com:9204"})
```

Add multiple servers to a shard cluster

This example adds the database servers that are at port **9205** of **myhost5.hcl.com**, port **9206** of **myhost6.hcl.com**, and port **9207** of **myhost7.hcl.com** to a shard cluster.

```
> db.runCommand({"addShard":["myhost5.hcl.com:9205",
    "myhost6.hcl.com:9206","myhost7.hcl.com:9207"]})
```

Shard-cluster definitions for distributing data

A cluster of shard servers uses a definition to distribute data across shard servers.

You must create a shard-cluster definition to distribute data across the shard servers. The definition contains the following information:

- The HCL OneDB™ Enterprise Replication group name of each participating shard server.
- The name of the database and collection or table that is distributed across the shard servers of a shard cluster.
- The field or column that is used as a shard key for distributing data. Shard key values determine which shard server a document or row is stored on.
- The sharding method by which documents or rows are distributed to specific shard servers. The sharding method is either a hash-based or expression-based.

Defining a sharding schema with a hash algorithm

The shardCollection command in the MongoDB shell creates a definition for distributing data across the database servers of a shard cluster.

To create a shard-cluster definition that uses a hash algorithm for distributing data across database servers:

1. Run the `mongo` command.
   Result
   The command starts the MongoDB shell.
2. Run the shardCollection command.

There are two ways to run the command:

Choose from:

- Run the `sh.shardCollection` MongoDB command. For example:

```
> sh.shardCollection("database1.collection1",
   {customer_name:"hashed"})
```

- Run the `db.runCommand` from the MongoDB shell, with `shardCollection` command syntax. For example:

```
> db.runCommand({"shardCollection":"database2.collection_2",
          key:{customer_name:"hashed"}})
```

The `shardCollection` command syntax for using a hash algorithm is shown in the following diagram:

db.runCommand ({"**shardCollection**":" *database* . { *collection* | *table* } ", **key**:{ { *field* | *column* } :"**hashed**"}})

Element	Description	Restrictions
database	The name of the database that contains the collection that is distributed across database servers.	The database must exist.
collection	The name of the collection that is distributed across database servers.	The collection must exist.
column	The shard key that is used to distribute data across the database servers of a shard cluster.	The column must exist. Composite shard keys are not supported.
field	The shard key that is used to distribute data across the database servers of a shard cluster.	The field must exist. Composite shard keys are not supported.
table	The name of the table that is distributed across database servers.	The table must exist.

3. For optimal query performance, connect to the wire listener and run the MongoDB ensureIndex command on the shard key of each of a cluster's shard servers. The ensureIndex command ensures that an index for the collection or table is created on the shard server.

Results

The name of a shard-cluster definition that is created by a shardCollection command that is run through the wire listener is:

sh_*database*_ { *collection* | *table* }

Example

Example

The following command defines a shard cluster that uses a hash algorithm on the shard key value **year** to distribute data across multiple database servers.

```
> sh.shardCollection("mydatabase.mytable",{year:"hashed"})
```

The name of the created shard-cluster definition is **sh_mydatabase_mytable**.

Defining a sharding schema with an expression

The MongoDB shell `db.runCommand` command with `shardCollection` command syntax creates a definition for distributing data across the database servers of a shard cluster.

To create a shard-cluster definition that uses an expression for distributing data across database servers:

1. Run the `mongo` command.

   Result

   The command starts the MongoDB shell.
2. Run the `db.runCommand` from the MongoDB shell, with `shardCollection` command syntax.

   The `shardCollection` command syntax for using an expression is shown in the following diagram:

   ```
   db.runCommand ({"shardCollection":" database. { collection | table } ", key:{ { column | field } :1},expressions :{
   "ER_group_name":expression " "ER_group_name ":"remainder" })
   ```

Element	Description	Restrictions
collection	The name of the collection that is distributed across database servers.	The collection must exist.
column	The shard key that is used to distribute data across the database servers of a shard cluster.	The column must exist. Composite shard keys are not supported.
database	The name of the database that contains the collection that is distributed across database servers.	The database must exist.
ER_group_name	The Enterprise Replication group name of a database server that receives copied data. The default Enterprise Replication group name for a database server is the database server's name prepended with `g_`. For example, the default Enterprise Replication group name for a database server that is named **myserver** is **g_myserver**.	None.

Element	Description	Restrictions
expression	The expression that is used to select documents by shard key value.	None.
field	The shard key that is used to distribute data across the database servers of a shard cluster.	The field must exist. Composite shard keys are not supported.
remainder	Specifies a database server that receives documents with shard key values that are not selected by expressions. The remainder expression is required.	
table	The name of the table that is distributed across database servers.	The table must exist.

3. For optimal query performance, connect to the wire listener and run the MongoDB ensureIndex command on the shard key of each of a cluster's shard servers. The ensureIndex command ensures that an index is created for the collection or table on the shard server.

Results

The name of a shard-cluster definition that is created by a shardCollection command that is run through the wire listener is:

```
sh_database_ { collection  | table }
```

Example

Examples

Define a shard cluster that uses an expression to distribute data across multiple database servers

The following command defines a shard cluster that uses an expression on the field value **state** for distributing **collection1** across multiple database servers.

```
> db.runCommand({"shardCollection":"database1.collection1",
   key:{state:1},expressions:{"g_shard_server_1":"in ('KS','MO')",
   "g_shard_server_2":"in ('CA','WA')","g_shard_server_3":"remainder"}})
```

The name of the created shard-cluster definition is **sh_database1_collection1**.

- Inserted documents with **KS** and **MO** values in the **state** field are sent to **g_shard_server_1**.
- Inserted documents with **CA** and **WA** values in the **state** field are sent to **g_shard_server_2**.
- All inserted documents that do not have **KS**, **MO**, **CA**, or **WA** values in the **state** field are sent to **g_shard_server_3**.

Define a shard cluster that uses an expression to distribute data across multiple database servers

The following command defines a shard cluster that uses an expression on the column value **animal** for distributing **table2** across multiple database servers.

```
> db.runCommand({"shardCollection":"database1.table2",
   key:{animal:1},expressions:{"g_shard_server_1":"in ('dog','coyote')",
   "g_shard_server_2":"in ('cat')","g_shard_server_3":"in ('rat')",
   "g_shard_server_4":"remainder"}})
```

The name of the created shard-cluster definition is **sh_database2_table2**.

- Inserted rows with **dog** or **coyote** values in the **animal** column are sent to **g_shard_server_1**.
- Inserted rows with **cat** values in the **animal** column are sent to **g_shard_server_2**.
- Inserted rows with **rat data** values in the **animal** column are sent to **g_shard_server_3**.
- All inserted rows that do not have **dog**, **coyote**, **cat**, or **rat** values in the **animal** column are sent to **g_shard_server_4**.

Define a shard cluster that uses an expression to distribute collections across multiple database servers

The following command defines a shard cluster that uses an expression on the field value **year** for distributing **collection3** across multiple database servers.

```
> db.runCommand({"shardCollection":"database1.collection3",
   key:{year:1},expressions:{"g_shard_server_1":"between 1980 and 1989",
   "g_shard_server_2":"between 1990 and 1999",
   "g_shard_server_3":"between 2000 and 2009",
   "g_shard_server_4":"remainder"}})
```

The name of the created shard-cluster definition is **sh_database3_collection3**.

- Inserted documents with values of **1980** to **1989** in the **year** field are sent to **g_shard_server_1**.
- Inserted documents with values of **1990** to **1999** in the **year** field are sent to **g_shard_server_2**.
- Inserted documents with values of **1980** to **1989** in the **year** field are sent to **g_shard_server_3**.
- Inserted documents with values below **1980** or above **2009** in the **year** field are sent to **g_shard_server_4**.

Shard cluster management

You can display information about shard cluster participants and about the shard cache on each shard server. You can add or remove shard servers from a shard cluster.

To display information about shard cluster participants, run the db.runCommand from the MongoDB shell, with listShard command syntax.

To display information about shard caches, run the onstat -g shard command.

Add a shard server

To add a shard server to the shard cluster, prepare the new shard server and add it to the shard cluster with the `addShard` command. Make sure to add the trusted host information for the new shard server to the existing shard servers.

Remove a shard server

To remove a shard server, run the `db.runCommand` from the MongoDB shell, with `removeShard` command syntax.

Change the sharding definition

After you add or remove a shard server, you might need to update the sharding definition:

- A definition that uses a hash algorithm to shard data is modified automatically.
- You must modify a sharding definition that uses an expression by running the `changeShardCollection` command.

When you change the sharding definition, existing data on shard servers is redistributed to match the new definition.

Changing the definition for a shard cluster

The `db.runCommand` command with `changeShardCollection` command syntax changes the definition for a shard cluster.

Before you begin

If the shard cluster uses an expression for distributing data across multiple database servers, you must add database servers to a shard cluster and remove database servers from a shard cluster by running the `changeShardCollection` command. If the shard-cluster definition uses a hash algorithm, database servers are automatically added to the shard cluster when you run the `sh.addShard` MongoDB shell command.

If you change a shard-cluster definition to include a new shard server, that server must first be added to a shard cluster by running the `db.runCommand` command with `addShard` command syntax.

When a shard-cluster definition changes, existing data on shard servers is redistributed to match the new definition.

About this task

The following steps apply to changing the definition for shard cluster that uses an expression for distributing documents in a collection across multiple database servers.

To change the definition for a shard cluster:

1. Run the mongo command.
   Result
   The command starts the MongoDB shell.
2. Change the shard-cluster definition by running the changeShardCollection command. You must redefine all expressions for all shard servers, not just newly added or changed shard servers.

```
db.runCommand ({"changeShardCollection":" database. { collection | table } ", expressions:{ "ER_group_name":" expression" ,"ER_group_name":" remainder" })
```

Element	Description	Restrictions
collection	The name of the collection that is distributed across database servers.	The collection must exist.
database	The name of the database that contains the collection that is distributed across database servers.	The database must exist.
ER_group_name	The Enterprise Replication group name of a database server that receives copied data. The default Enterprise Replication group name for a database server is the database server's name prepended with `g_`. For example, the default Enterprise Replication group name for a database server that is named **myserver** is **g_myserver**.	None.
expression	The expression that is used to select documents by shard key value.	None.
remainder	The database server that receives documents with shard key values that are not selected by expressions.	
table	The name of the table that is distributed across database servers.	The table must exist.

3. For optimal query performance, connect to the wire listener and run the MongoDB ensureIndex command on the shard key each of a cluster's shard servers. The ensureIndex command ensures that an index for the collection or table is created on the shard server.

Example

Example

You have a shard cluster that is composed of three database servers, and the shard cluster is defined by the following command:

```
> db.runCommand({"shardCollection":"database1.collection1",
   expressions:{"g_shard_server_1":"in ('KS','MO')",
   "g_shard_server_2":"in ('CA','WA')","g_shard_server_3":"remainder"})
```

To add **g_shard_server_4** and **g_shard_server_5** to the shard cluster and change where data is sent to, run the following command:

```
> db.runCommand({"changeShardCollection":"database1.collection1",
   expressions:{"g_shard_server_1":"in ('KS','MO')",
   "g_shard_server_2":"in ('TX','OK')","g_shard_server_3":"in ('CA','WA')",
   "g_shard_server_4":"in ('OR','ID')","g_shard_server_5":"remainder"})
```

The new shard cluster contains five database servers:

- Inserted documents with a **state** field value of `KS` or `MO` are sent to **g_shard_server_1**.
- Inserted documents with a **state** field value of `TX` or `OK` are sent to **g_shard_server_2**.
- Inserted documents with a **state** field value of `CA` or `WA` are sent to **g_shard_server_3**.
- Inserted documents with a **state** field value of `OR` or `ID` are sent to **g_shard_server_4**.
- Inserted documents with a **state** field value that is not in the expression are sent to **g_shard_server_5**.

To then remove **g_shard_server_2** and change where the data that was on **g_shard_server_2** is sent to, run the following command:

```
> db.runCommand({"changeShardCollection":"database1.collection1",
   expressions:{"g_shard_server_1":"in ('KS','MO')",
   "g_shard_server_3":"in ('TX','CA','WA')",
   "g_shard_server_4":"in ('OK','OR','ID')",
   "g_shard_server_5":"remainder"})
```

The new shard cluster contains four database servers.

- Inserted documents with a **state** field value of `TX` are now sent to **g_shard_server_3**.
- Inserted documents with a **state** field value of `OK` are now sent to **g_shard_server_4**.

Existing data on shard servers is redistributed to match the new definition.

Viewing shard-cluster participants

Run the db.runCommand MongoDB shell command with listShards syntax to list the Enterprise Replication group names, hosts, and port numbers of all shard servers in a shard cluster.

1. Run the mongo command.
   Result
   The command starts the MongoDB shell.
2. Run the listShards command:
   Example
   ```
   db.runCommand({listShards:1})
   ```

Results

The listShards command produces output in the following structure:

```
{
        "serverUsed" : "server_host/IP_address",
        "shards" : [
                {
                        "_id" : "ER_group_name_1",
                        "host" : "host_1:port_1"
                },
                {
                        "_id" : "ER_group_name_2",
                        "host" : "host_2:port_2"
```

```
                },
                {
                        "_id" : "ER_group_name_x",
                        "host" : "host_x:port_x"
                }
        ],
        "ok" : 1
}
```

ER_group_name

The Enterprise Replication group name of a shard server.

host

The host for a shard-cluster participant. The host can be a localhost name or a full domain name.

IP_address

The IP address of the database server that the listener is connected to.

port

The port number that a shard-cluster participant uses to communicate with other shard-cluster participants.

server_host

The host for the database server that the listener is connected to. The host can be a localhost name or a full domain name.

Example

Example

For this example, you have a shard cluster defined by the following command:

```
prompt> db.runCommand({"addShard":["myhost1.ibm.com:9201",
   "myhost2.ibm.com:9202","myhost3.ibm.com:9203",
   "myhost4.ibm.com:9204","myhost5.ibm.com:9205"]})
```

The following example output is shown when the listShards command is run in the MongoDB shell, and the listener is connected to the database server at `myhost1.ibm.com`.

Figure 1. listShards command output for a shard cluster

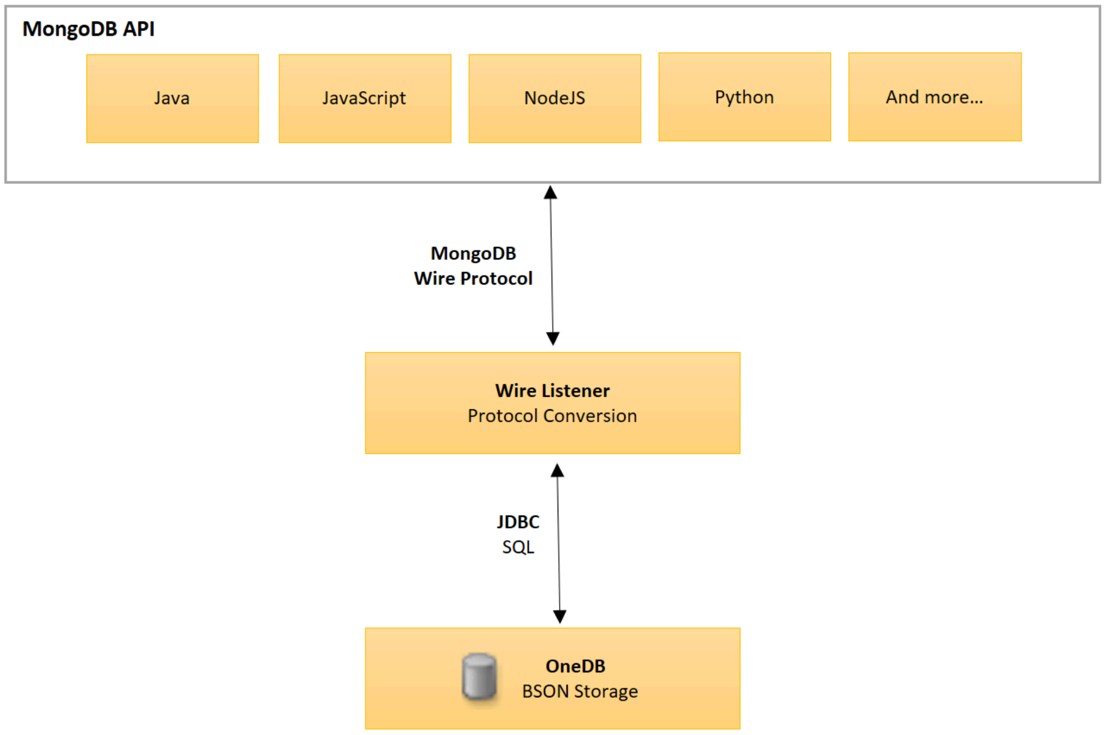
```
{
        "serverUsed" : "myhost1.ibm.com/192.0.2.0:9200",
        "shards" : [
                {
                        "_id" : "g_myserver1",
                        "host" : "myhost1.ibm.com:9200"
                },
                {
                        "_id" : "g_myserver2",
                        "host" : "myhost2.ibm.com:9202"
                },
                {
                        "_id" : "g_myserver3",
                        "host" : "myhost3.ibm.com:9203"
                }
                {
                        "_id" : "g_myserver4",
                        "host" : "myhost4.ibm.com:9204"
                }
                {
                        "_id" : "g_myserver5",
                        "host" : "myhost5.ibm.com:9205"
                }
        ],
        "ok" : 1
}
```

MongoDB API

The HCL OneDB™ support for MongoDB application programming interfaces and commands is described here.

The wire listener implements the MongoDB Wire Protocol. This allows you to connect MongoDB applications and client drivers to the HCL OneDB™ database through the wire listener. The MongoDB applications send MongoDB operations and commands to the wire listener, which automatically translates those commands to SQL which it runs against the HCL OneDB™ database using JDBC.

You can use the MongoDB API to access HCL OneDB™ JSON/BSON collections, relational tables, or TimeSeries tables.



Getting Started with HCL OneDB™'s MongoDB Solution

This topic covers the basics of getting started with using MongoDB API with HCL OneDB™.

How does HCL OneDB™ support the MongoDB API?

The HCL OneDB™ wire listener implements the MongoDB wire protocol. This allows MongoDB applications to connect to the HCL OneDB™ wire listener and its associated HCL OneDB™ database server. These applications communicate with HCL OneDB™ as if it was a MongoDB server, with the wire listener acting as a translation layer between theMongoDB wire protocol and the SQL understood by the HCL OneDB™ database server.

What are the components of the HCL OneDB™ MongoDB solution?

There are three main components: the OneDB® server, the wire listener, and a MongoDB client. The wire listener is a mid-tier gateway server that enables communication between the MongoDB client and the OneDB® server.

How are JSON collections different from relational tables?

A JSON collection holds BSON (binary JSON) data. BSON documents have a flexible schema and can be used with unstructed data, meaning the structure and contents of BSON documents can differ from one document to another. This differs from relational tables where all rows must following the same predefined structure.

HCL OneDB™ fully supports JSON collections, which can be created through the wire listener. Additionally, the wire listener also makes it possible to run MongoDB queries against your traditional relational tables, using the same MongoDB API that you would use with JSON collections.

How do MongoDB commands map to SQL features?

MongoDB collection methods	Informix SQL statements
`find`	`SELECT`
`save/insert`	`INSERT`
`remove`	`DELETE`
`update`	`UPDATE`
`ensureIndex`	`CREATE INDEX`
`sort`	`ORDER BY`
`limit`	`LIMIT/FIRST`

Commonly customizable wire listener properties

The properties that control the wire listener and the connection between the client and database server are set in the wire listener configuration on page 10. The url parameter is required, but all other parameters are optional. Here are the commonly customized parameters.

`url`

This required parameter specifies the host name, database server, user ID, and password that are used in connections to the HCL OneDB™ database server.

`authentication.enable`

This optional parameter indicates whether to enable user authentication. The default value is false.

`listener.port`

This optional parameter specifies the port number to listen on for incoming connections from MongoDB clients. The default value is 27017.

`security.sql.passthrough`

This optional parameter indicates whether to enable support for issuing SQL statements through the MongoDB API. The default value is false.

`sharding.enable`

This optional parameter indicates whether to enable the use of commands and queries on sharded data. The default value is false.

Starting the wire listener from the command line

You can start the wire listener on page 41 by using a system command. For example:

```
java -jar onedb-wire-listener.jar
   -config onedb-wire-listener.properties
   -logFile onedb-wire-listener.log -loglevel info -start
```

MongoDB Create, read, update, and delete (CRUD) operations on collections and tables

These standard MongoDB CRUD operations are supported by HCL OneDB™:

- **`insert`**
- **`find`**
- **`update`**
- **`remove`**

This table shows an example of MongoDB operations and comparable SQL statements against relational tables. In the example, the retirement age of a customer is queried:

MongoDB operation	Informix SQL statement
`db.customer.insert( { name: “John", age: 65 } )`	`INSERT INTO customer (name, age) VALUES (“John”,65)`
`db.customer.find()`	`SELECT * FROM customer`
`db.customer.find( {age: { $gt:65 } } )`	`SELECT * FROM customer WHERE age > 65`
`db.customer.drop()`	`DROP TABLE customer`
`db.customer.ensureIndex( { name : 1, age : -1 } )`	`CREATE INDEX idx_1 on customer(name, age DESC)`
`db.customer.remove( {age: { $gt:65 } } )`	`DELETE FROM customer where age > 65`
`db.customer.update( { age: { $gt: 64 } }, { $set: { status: “Retire" } }, { multi: true } )`	`UPDATE customer SET status = “Retire" WHERE age > 64`

Implicit operations for JSON collections and databases

If you insert into a non-existent JSON collection, a collection is implicitly created.

If you create a JSON collection in a non-existent database, a database is implicitly created.

Creating and listing indexes

You can use the MongoDB ensureIndex syntax to create an index that works for all data types. For example:

```
db.collection.ensureIndex( { zipcode: 1 } )
```

```
db.collection.ensureIndex( { state: 1, zipcode: -1} )
```

You can use the HCL OneDB™ ensureIndex syntax to create an index for a specific data type. For example:

```
db.collection.ensureIndex( { zipcode : [1, “$int”] } )
```

```
db.collection.ensureIndex( { state: [1, “$string”], zipcode: [-1, “$int”] } )
```

You can list indexes by running the MongoDB `getIndexes` command.

Accessing multiple databases per connection

In standard OneDB® JDBC connections, you must specify the database name on the connection string and you must create one connection per database. In MongoDB, all messages include a fully qualified namespace that includes the database name and the collection. MongoDB connections are not associated with a particular database and each individual message or command specifies the intended database. A single MongoDB connection can switch between databases.

Moving data to and from collections and tables

You can run the MongoDB mongodump and mongoexport utilities to export data from MongoDB to OneDB®.

You can run the MongoDB mongorestore and mongoimport utilities to import data from MongoDB to OneDB®.

Viewing usage statistics

You can run the MongoDB `serverStatus` command to get the wire listener status information, including:

- Uptime
- Number of active and available connections
- Number of open cursors
- Total number of requests
- Counters for the number operations (queries, inserts, updates, deletes, commands, etc)

MongoDB to HCL OneDB™ term mapping

The commonly used MongoDB terminology and concepts are mapped to the equivalent HCL OneDB™ terminology and concepts.

The following table provides a summary of commonly used MongoDB terms and their HCL OneDB™ conceptual equivalents.

Table 2. MongoDB concepts mapped to one or more HCL OneDB™ concepts.

MongoDB concept	HCL OneDB™ concept	Description
collection	table	In HCL OneDB™, a collection (also referred to as a JSON collection) is just a special type of table. A JSON collection is similar to a relational database table, except it does not enforce a schema.
document	record / row	In HCL OneDB™, a document is sometimes referred to as a JSON document and is stored as a record or row in a JSON collection (table).
field	column	While JSON documents allow for the storage of unstructured data with a flexible schema, you can also think of fields within the JSON document as similar to relational columns in that they define the attributes contained within the record.
primary / secondary	primary server / secondary server	The MongoDB primary and secondary is equivalent to the HCL OneDB™ primary server and secondary server. However HCL OneDB™ secondary servers have additional capabilities. For example, data on a secondary server can be updated and propagated to primary servers.
replica set	high-availability cluster	The MongoDB replica set is equivalent to the HCL OneDB™ high-availability clusetr. However, when the replica set is updated, it is then sent to all servers, not only to the primary server.
sharded cluster	shard cluster	In HCL OneDB™, a shard cluster is a group of servers (sometimes called shard servers) that contain sharded data.
shard key	shard key	These concepts are equiavlent between MongoDB and HCL OneDB™.

Language drivers

The wire listener parses messages sent using the MongoDB Wire Protocol.

Therefore you can use any of the MongoDB community drivers to store, update, and query JSON documents with HCL OneDB™ as your backend JSON data store. These drivers can include Java™, C/C++, Ruby, PHP, PyMongo, and so on.

Download the MongoDB drivers for the programming languages at http://docs.mongodb.org/ecosystem/drivers/.

Command utilities and tools

You can use the MongoDB shell and any of the standard MongoDB command utilities and tools with the HCL OneDB™ wire listener.

You can use the MongoDB shell to run interactive queries and operations against HCL OneDB™. You can use any version of the MongoDB shell that supports the **mongo.api.version on page 23** configured for the wire listener.

You can run the MongoDB mongoexport, mongoimport, mongodump, and mongorestore utilities to import and export data to or from HCL OneDB™.

Collection methods

HCL OneDB™ supports a subset of the MongoDB collection methods.

The collection methods can be run on a JSON collection or a relational table. The syntax for collection methods in the **mongo** shell is `db.`*`collection_name`*`.`*`collection_method`*`()`, where `db` refers to the current database, and *collection_name* is the name of the JSON collection or relational table, *collection_method* is the MongoDB collection method. For example, `db.cartype.count()` determines the number of documents that are contained in the **cartype** collection.

Table 3. Supported collection methods

Collection method	JSON collections	Relational tables	Details
aggregate	Yes	Yes	
count	Yes	Yes	
createIndex	Yes	Yes	For more information, see Index creation on page 67.
dataSize	Yes	No	
distinct	Yes	Yes	
drop	Yes	Yes	
dropIndex	Yes	Yes	
dropIndexes	Yes	No	
ensureIndex	Yes	Yes	For more information, see Index creation on page 67.
find	Yes	Yes	
findAndModify	Yes	Yes	For relational tables, findAndModify is supported only for tables that have a primary key. This method is not support sharded data.
findOne	Yes	Yes	
getIndexes	Yes	No	
getShardDistribution	No	No	
getShardVersion	No	No	
getIndexStats	No	No	
group	No	No	

Table 3. Supported collection methods (continued)

Collection method	JSON collections	Relational tables	Details
indexStats	No	No	
insert	Yes	Yes	
isCapped	Yes	Yes	This command returns false because capped collections are not supported in HCL OneDB™.
mapReduce	No	No	
reIndex	No	No	
remove	Yes	Yes	The justOne option is not supported. This command deletes all documents that match the query criteria.
renameCollection	No	No	
save	Yes	No	
stats	Yes	No	
storageSize	Yes	No	
totalSize	Yes	No	
update	Yes	Yes	The multi option is supported for JSON collections if `update.one.enable=true` in the wire listener properties file. For relational tables, the multi-parameter is ignored and all documents that meet the query criteria are updated. If `update.one.enable=false`, all documents that match the query criteria are updated.
validate	No	No	

For more information about the MongoDB features, see http://docs.mongodb.org/manual/reference/.

Index creation

HCL OneDB™ supports the creation of indexes on collections and relational tables by using the MongoDB API and the wire listener.

- Index creation by using the MongoDB syntax on page 68
- Index creation for a specific data type by using the HCL OneDB extended syntax on page 68
- Index creation for arrays using the Informix extended syntax on page 69
- Index creation for text, geospatial, and hashed on page 70

Index creation by using the MongoDB syntax

For JSON collections and relational tables, you can use the MongoDB createIndex and ensureIndex syntax to create an index that works for all data types. For example:

```
db.collection.createIndex( { zipcode: 1 } )
db.collection.createIndex( { state: 1, zipcode: -1} )
```

Tip: If you are creating an index for a JSON collection on a field that has a fixed data type, you can get the best query performance by using the HCL OneDB™ extended syntax.

The following options are supported:

- name
- unique

The following options are not supported:

- background
- default_language
- dropDups
- expireAfterSeconds
- language_override
- sparse
- v
- weights

Index creation for a specific data type by using the HCL OneDB™ extended syntax

You can use the HCL OneDB™ createIndex or ensureIndex syntax on collections to create an index for a specific data type. For example:

```
db.collection.createIndex( { zipcode : [1, "$int"] } )
db.collection.createIndex( { state: [1, "$string"],  zipcode: [-1, "$int"] } )
```

This syntax is supported for collections only. It not supported for relational tables.

Tip: If you are creating an index on a field that has a fixed data type, you can get better query performance by using the HCL OneDB™ extended syntax.

The following data types are supported:

- $bigint
- $binary
- $boolean
- $date
- $double[2 on page 69]

- $int[3 on page 69]
- $integer[3 on page 69]
- $lvarchar[1 on page 69]
- $number[2 on page 69]
- $string[1 on page 69]
- $timestamp
- $varchar

Notes:

1. $string and $lvarchar are aliases and create lvarchar indexes.
2. $number and $double are aliases and create double indexes.
3. $int and $integer are aliases.

Index creation for arrays using the Informix extended syntax

You can use the HCL OneDB™ createIndex or ensureIndex syntax on collections to create an index for arrays. For example:

```
db.collection.createIndex( { "my_array" : [ 1, "$array", "$int" ] } )
```

which creates an integer array index on the field named "my_array".

This syntax is similar to the Informix extended typed syntax. Specify the type of the index as "$array" and then provide a third argument specifying the data type stored in the array.

Note: This syntax is supported for collections only. It is not supported for relational tables.

The following data types are supported with array indexes:

- $bigint
- $date
- $double[1 on page 69]
- $int[2 on page 69]
- $integer[2 on page 69]
- $number[1 on page 69]
- $varchar

Notes:

1. $number and $double are aliases and create double indexes.
2. $int and $integer are aliases.

Index creation for text, geospatial, and hashed

Text indexes

Text indexes are supported. You can search string content by using text search in documents of a collection.

You can create text indexes by using the MongoDB or HCL OneDB™ syntax. For example, here is the MongoDB syntax:

```
db.articles.ensureIndex( { abstract: "text" } )
```

The HCL OneDB™ syntax provides additional support for the HCL OneDB™ basic text search functionality. For more information, see createTextIndex on page 79.

Geospatial indexes

2dsphere indexes are supported in HCL OneDB™ by using the GeoJSON objects, but not the MongoDB legacy coordinate pairs.

2d indexes are not supported.

Hashed indexes

Hashed indexes are not supported. If a hashed index is specified, a regular untyped index is created.

For more information about the MongoDB features, see http://docs.mongodb.org/manual/reference/.

Database commands

HCL OneDB™ supports a subset of the MongoDB database commands.

The basic syntax for database commands in the **mongo** shell is `db.command()`, where *db* refers to the current database, and *command* is the database command. You can use the **mongo** shell helper method **db.runCommand()** to run database commands on the current database.

- User commands on page 71
- Database operations on page 72

User commands

Aggregation commands

Table 4. Aggregation commands

MongoDB command	JSON collections	Relational tables	Details
aggregate	Yes	Yes	
count	Yes	Yes	
distinct	Yes	Yes	
group	No	No	
mapReduce	No	No	

Geospatial commands

Table 5. Geospatial commands

MongoDB command	JSON collections	Relational tables	Details
geoNear	Yes	No	Supported for the GeoJSON format. The MongoDB legacy coordinate pairs are not supported.
geoSearch	No	No	
geoWalk	No	No	

Query and write operation commands

Table 6. Query and write operation commands

MongoDB command	JSON collections	Relational tables	Details
delete	Yes	Yes	
eval	No	No	
find	Yes	Yes	
findAndModify	Yes	Yes	For relational tables, the findAndModify command is supported only for tables that have a primary key. This command does not support sharded data.
getLastError	Yes	Yes	

Table 6. Query and write operation commands (continued)

MongoDB command	JSON collections	Relational tables	Details
getMore	Yes	Yes	
getPrevError	No	No	
insert	Yes	Yes	
resetError	No	No	
update	Yes	Yes	

Database operations

Authentication commands

Table 7. Authentication commands

Name	Supported	Details
authenticate	Yes	
logout	Yes	
getnonce	Yes	

User management commands

Table 8. User management commands

Name	Supported	Details
createUser	Yes	
dropAllUsersFromDatabase	Yes	
dropUser	Yes	
grantRolesToUser	Yes	
revokeRolesFromUser	Yes	
updateUser	Yes	
usersInfo	Yes	

Role management commands

Table 9. Role management commands

Name	Supported	Details
createRole	Yes	
dropAllRolesFromDatabase	Yes	
dropRole	Yes	
grantPrivilegesToRole	Yes	
grantRolesToRole	Yes	
invalidateUserCache	No	
rolesInfo	Yes	
revokePrivilegesFromRole	Yes	
revokeRolesFromRole	Yes	
updateRole	Yes	

Diagnostic commands

Table 10. Diagnostic commands

Name	Supported	Details
buildInfo	Yes	Whenever possible, the HCL OneDB™ output fields are identical to MongoDB. There are additional fields that are unique to HCL OneDB™.
collStats	Yes	The value of any field that is based on the collection size is an estimate, not an exact value. For example, the value of the field 'size' is an estimate.
connPoolStats	No	
cursorInfo	No	
dbStats	Yes	The value of any field that is based on the collection size is an estimate, not an exact value. For example, the value of the field 'dataSize' is an estimate.
features	Yes	
getCmdLineOpts	Yes	

Table 10. Diagnostic commands (continued)

Name	Supported	Details
getLog	No	
hostInfo	Yes	The `memSizeMB`, `totalMemory`, and `freeMemory` fields indicate the amount of memory that is available to the Java™ virtual machine (JVM) that is running, not the operating system values.
indexStats	No	
listCommands	Yes	
listDatabases	Yes	The value of any field that is based on the collection size is an estimate, not an exact value. For example, the value of the field 'sizeOnDisk' is an estimate. The listDatabases command estimates the size of all collections and collection indexes for each database. However, relational tables and indexes are excluded from this size calculation. **Important:** The listDatabases command performs expensive and CPU-intensive computations on the size of each database in the HCL OneDB™ instance. You can decrease the expense by using the sizeStrategy option. **sizeStrategy** You can use this option to configure the strategy for calculating database size when the listDatabases command is run. **sizeStrategy:** { { **estimate** | { **estimate:***n*} | **compute** | **none** | **perDatabaseSpace** } } **estimate** Estimate the size of the documents in the collection by using 1000 (or 0.1%) of the documents. This is the default value. The following example estimates the collection size by using the default of 1000 (or 0.1%) of the documents: `db.runCommand({listDatabases:1, sizeStrategy:"estimate"})`

Table 10. Diagnostic commands (continued)

Name	Supported	Details

		estimate: *n*
		Estimate the size of the documents in a collection by sampling one document for every *n* documents in the collection.
		The following example estimates the collection size by using sample size of 0.5% or 1/200th of the documents:
		`db.runCommand({listDatabases:1, sizeStrategy:{estimate:200}})`
		compute
		Compute the exact size of each database.
		`db.runCommand({listDatabases:1, sizeStrategy:"compute"})`
		none
		List the databases but do not compute the size. The database size is listed as 0.
		`db.runCommand({listDatabases:1, sizeStrategy:"none"})`
		perDatabaseSpace
		Calculate the size of a database by adding the sizes for all dbspaces, sbspaces, and blobspaces that are assigned to the tenant database.
		Important: The **perDatabaseSpace** option applies only to tenant databases that are created by the multi-tenancy feature.
		`db.runCommand({listDatabases:1 , sizeStrategy:"perDatabaseSpace"})`

ping	Yes	
serverStatus	Yes	
top	No	
whatsmyuri	Yes	

Instance administration commands

Table 11. Instance administration commands

Name	JSON collections	Relational tables	Details
clone	No	No	
cloneCollection	No	No	
cloneCollectionAsCapped	No	No	
collMod	No	No	
compact	No	No	
convertToCapped	No	No	
copydb	No	No	
create	Yes	No	HCL OneDB™ does not support the following flags: • capped • autoIndexID • size • max
createIndexes	Yes	Yes	
drop	Yes	Yes	HCL OneDB™ does not lock the database to block concurrent activity.
dropDatabase	Yes	Yes	
dropIndexes	Yes	No	The MongoDB deleteIndexes command is equivalent.
filemd5	Yes	Yes	
fsync	No	No	
getParameter	No	No	
killCursors	Yes	Yes	
listCollections	Yes	Yes	The includeRelational and includeSystem flags are supported

Table 11. Instance administration commands (continued)

Name	JSON collections	Relational tables	Details
			to include or exclude relational or system tables in the results. Default is includeRelational=true and includeSystem=false.
listIndexes	Yes	Yes	
logRotate	No	No	
reIndex	No	No	
renameCollection	No	No	
repairDatabase	No	No	
setParameter	No	No	
shutdown	Yes	Yes	The timeoutSecs flag is supported. In the HCL OneDB™, the timeoutSecs flag determines the number of seconds that the wire listener waits for a busy client to stop working before forcibly terminating the session. The force flag is not supported.
touch	No	No	

Replication commands

Table 12. Replication commands

Name	Supported
isMaster	Yes
replSetFreeze	No
replSetGetStatus	No
replSetInitiate	No
replSetMaintenance	No
replSetReconfig	No

Table 12. Replication commands (continued)

Name	Supported
replSetStepDown	No
replSetSyncFrom	No
Resync	No

Sharding commands

Table 13. Replication commands

Name	JSON collections	Relational tables	Details
addShard	Yes	Yes	The MongoDB maxSize and name options are not supported. In addition to the MongoDB command syntax for adding a single shard server, you can use the HCL OneDB™ specific syntax to add multiple shard servers in one command by sending the list of shard servers as an array. For more information, see Creating a shard cluster with MongoDB commands on page 50.
enableSharding	Yes	Yes	This action is not required for HCL OneDB™ and therefore this command has no affect for HCL OneDB™.
flushRouterConfig	No	No	
isdbgrid	Yes	Yes	
listShards	Yes	Yes	The equivalent HCL OneDB™ command is **cdr list server**.
movePrimary	No	No	
removeShard	No	No	
shardCollection	Yes	Yes	The equivalent HCL OneDB™ command is **cdr define shardCollection**. The MongoDB unique and numInitialChunks options are not supported.
shardingState	No	No	

Table 13. Replication commands (continued)

Name	JSON collections	Relational tables	Details
split	No	No	

For more information about the MongoDB features, see http://docs.mongodb.org/manual/reference/.

HCL OneDB™ JSON commands

The HCL OneDB™ JSON commands are available in addition to the supported MongoDB commands. These commands enable functionality that is supported by HCL OneDB™ and they are run by using the MongoDB API.

The syntax for using HCL OneDB™ commands in the MongoDB shell is:

```
db.runCommand({command_document})
```

The *command_document* contains the HCL OneDB™ command and any parameters.

- createTextIndex on page 79
- exportCollection on page 80
- importCollection on page 82
- lockAccounts on page 83
- runFunction on page 84
- runProcedure on page 84
- transaction on page 85
- unlockAccounts on page 86

createTextIndex

Create HCL OneDB™ Basic Text Search (BTS) indexes.

Important: If you create text indexes by using the HCL OneDB™ createTextIndex command, you must query them by using the HCL OneDB™ $ifxtext query operator. If you create text indexes by using the MongoDB syntax for text indexes, you must query them by using the MongoDB $text query operator.

```
createTextIndex : " collection_name " , name : " indexName " [ ,  key : { " column " } ] ,  options : { [  <btx index parameters> (explicit id ) ] }
```

createTextIndex

This required parameter specifies the name of the collection or relational table where the BTS index is created.

name

This required parameter specifies the name of the BTS index.

options

This required parameter specifies the name-value pairs for the BTS parameters that are used when creating the index. If no parameter values are required, you can specify an empty document.

Use BTS index parameters to customize the behavior of the index and how text is indexed. Include JSON index parameters to control how JSON and BSON documents are indexed. For example, you can index the documents as field name-value pairs instead of as unstructured text so that you can search for text by field. The name and values of the BTS index parameters in the options parameter are the same as the syntax for creating a BTS access method with the SQL CREATE INDEX statement. The following example creates an index named articlesIdx on the articles collection by using the BTS parameter **all_json_names="yes"**:

```
db.runCommand({
 createTextIndex:"articles",
 name:"articlesIdx",
 options:{all_json_names:"yes"}})
```

key

This parameter is required if you are indexing relational tables, but optional if you are indexing collections. This parameter specifies which columns to index for relational tables.

The following example creates an index named myidx in the mytab relational table on the title and abstract columns:

```
db.runCommand({
 createTextIndex:"mytab",
 name:"myidx",
 key:{"title":"text","abstract":"text"},
 options:{}})
```

exportCollection

Export JSON collections from the wire listener to a file.

exportCollection : " *collection_name* " , **file** : " *filepath* " , **format** : { { " **json** " | " **jsonArray** " } [, **fields** : { " *filter* " }] | " **csv** " , **fields** : { " *filter* " } } [, **query** : { " *query_document* " }]

exportCollection

This required parameter specifies the collection name to export.

file

This required parameter specifies the output file path on the host machine where the wire listener is running. For example:

- UNIX™ is `file:"/tmp/export.out"`
- Windows™ is `file:"C:/temp/export.out"`

format

This required parameter specifies the exported file format.

json

Default. The `.json` file format. One JSON-serialized document per line is exported.

The following command exports all documents from the collection that is named c by using the json format:

```
> db.runCommand({exportCollection:"c",file:"/tmp/export.out"
 ,format:"json"})
```

The result of this command will look like this:

```
{
  "ok":1,
  "n":1000,
  "millis":NumberLong(119),
  "rate":8403.361344537816
}
```

Where `"n"` is the number of documents that are exported, `"millis"` is the number of milliseconds it took to export, and `"rate"` is the number of documents per second that are exported.

jsonArray

The `.jsonArray` file format. This format exports an array of JSON-serialized documents with no line breaks. The array format is JSON-standard.

The following command exports all documents from the collection c by using the jsonArray format:

```
> db.runCommand({exportCollection:"c",file:"/tmp/export.out"
 , format:"jsonArray"})
{
 "ok":1,
 "n":1000,
 "millis":NumberLong(81),
 "rate":12345.67901234568
}
```

Where `"n"` is the number of documents that are exported, `"millis"` is the number of milliseconds it took to export, and `"rate"` is the number of documents per second that are exported.

csv

The `.csv` file format. Comma-separated values are exported. You must specify which fields to export from each document. The first line of the `.csv` file contains the fields and all subsequent lines contain the comma-separated document values.

fields

This parameter specifies which fields are included in the output file. This parameter is required for the csv format, but optional for the json and jsonArray formats.

The following command exports all documents from the collection that is named c by using the csv format, only output the "_id" and "name" fields:

```
> db.runCommand({exportCollection: "c" ,file:"/tmp/export.out",
 format: "csv", fields: {"_id": 1, "name": 1}})
```

query

This optional parameter specifies a query document that identifies which documents are exported. The following example exports all documents from the collection that is named c that have a "qty" field that is less than 100:

```
> db.runCommand({exportCollection: "c", file: "/tmp/export.out",
  format: "json", query: {"qty": {"$lt": 100}}})
```

importCollection

Import JSON collections from the wire listener to a file.

```
importCollection : " collection_name " , file : " filepath " , format : " { json  | jsonArray  | csv } "
```

importCollection

The required parameter specifies the collection name to import.

file

This required parameter specifies the input file path. For example, `file: "/tmp/import.json"`.

Important: The input file must be on the same host machine where the wire listener is running.

format

This required parameter specifies the imported file format.

json

Default. The `.json` file format.

The following example imports documents from the collection that is named c by using the json format:

```
> db.runCommand({importCollection: "c", file: "/tmp/import.out",
  format:"json"})
```

jsonArray

The `.jsonArray` file format.

The following example imports documents from the collection c by using the jsonArray format:

```
> db.runCommand({exportCollection: "c", file: "/tmp/import.out",
  format:"jsonArray"})
```

csv

The `.csv` file format.

lockAccounts

Lock a database or user account.

Important:

- To run this command, you must be the instance administrator.
- If you specify the `lockAccounts:1` command without specifying a **db** or **user** argument, all accounts in all databases are locked.

```
lockAccounts : { 1 [ { , db : { " database_name " | [ " database_name " ] | { " $regex " : " json_document " } | { { | " include " : { " database_name " | [ " database_name " ] | { " $regex " : " json_document " } } | " exclude " : { " database_name " | [ " database_name " ] | { " $regex " : " json_document " } } } } } " | , user : { " user_name " | " json_document " } } ] }
```

lockAccounts:1

This required parameter locks a database or user account.

db

This optional parameter specifies the database name of an account to lock. For example, to lock all accounts in database that is named `foo`:

```
> db.runCommand({lockAccounts: 1 ,db: "foo"})
```

exclude

This optional parameter specifies the databases to exclude. For example, to lock all accounts on the system except the accounts that are in the databases named `alpha` and `beta`:

```
> db.runCommand({lockAccounts: 1, db: {"exclude": ["alpha", "beta"]})
```

include

This optional parameter specifies the databases to include. For example, to lock all accounts in the databases named `delta` and `gamma`:

```
> db.runCommand({lockAccounts: 1, db: {"include": ["delta", "gamma"]})
```

$regex

This optional MongoDB evaluation query operator selects values from a specified JSON document. For example, to lock accounts for databases that begin with the character `a.` and end in `e`:

```
> db.runCommand({lockAccounts: 1, db: {"$regex": "a.*e"})
```

user

This optional parameter specifies the user accounts to lock. For example, to lock the account of all users that are not named `alice`:

```
> db.runCommand({lockAccounts: 1, user: {$ne: "alice"}});
```

runFunction

Run an SQL function through the wire listener. This command is equivalent to the SQL statement EXECUTE FUNCTION.

```
runFunction : " function_name " [ , " arguments " : [ argument ] ]
```

runFunction

This required parameter specifies the name of the SQL function to run. For example, a **current** function returns the current date and time:

```
> db.runCommand({runFunction: "current"})
{"returnValue": 2016-04-05 12:09:00, "ok":1}
```

arguments

This parameter specifies an array of argument values to the function. You must provide as many arguments as the function requires. For example, an **add_values** function requires two arguments to add together:

```
> db.runCommand({runFunction: "add_values", "arguments": [3,6]})
{"returnValue": 9, "ok": 1}
```

The following example returns multiple values from a **func_return3** function:

```
> db.runCommand({runFunction: "func_return3", "arguments" :[101]})
{"returnValue": {"serial_num": 1103, "name": "Newton", "points": 100}, "ok": 1}
```

runProcedure

Run an SQL stored procedure through the wire listener. This command is equivalent to the SQL statement EXECUTE PROCEDURE.

```
runProcedure : " procedure_name " [ , " arguments " : [ argument ] ]
```

runProcedure

This required parameter specifies the name of the SQL procedure to run. For example, a **colors_list** stored procedure, which uses a WITH RESUME clause in its RETURN statement, returns multiple rows about colors:

```
> db.runCommand({runProcedure: "colors_list"})
{"returnValue": [
  {"color" : "Red","hex" : "FF0000"},
  {"color" : "Blue","hex" : "0000A0"},
  {"color" :"White","hex" : "FFFFFF"}
], "ok" : 1}
```

arguments

This parameter specifies an array of argument values to the procedure. You must provide as many arguments as the procedure requires. For example, an **increase_price** procedure requires two arguments to identify the original price and the amount of increase:

```
> db.runCommand({runProcedure: "increase_price", "arguments": [101, 10]})
{"ok":1}
```

transaction

Enable or disable transaction support for a session, run a batch transaction, or, when transaction support is enabled, commit or rollback transactions. This command binds or unbinds a connection to the current MongoDB session in a database. The relationship between a MongoDB session and the HCL OneDB™ JDBC connection is not static.

Important: This command is not supported for queries that are run on shard servers.

transaction : { " **enable** " | " **disable** " | " **commit** " | " **rollback** " | " **execute** " , " **commands** " : [*command_docs*] [, " **finally** " : [*command_docs*]] | " **status** " }

enable

This optional parameter enables transaction mode for the current session in the current database. The following example shows how to enable transaction mode:

```
> db.runCommand({transaction: "enable"})
{"ok":1}
```

disable

This optional parameter disables transaction mode for the current session in the current database. The following example shows how to disable for transaction mode:

```
> db.c.find()
{"_id":ObjectId("52a8f9c477a0364542887ed4"),"a":1}
> db.runCommand({transaction: "disable"})
{"ok":1}
```

commit

If transactions are enabled, this optional parameter commits the current transaction. If transactions are disabled, an error is shown. The following example shows how to commit the current transaction:

```
> db.c.insert({"a": 1})
> db.runCommand({transaction: "commit"})
{"ok":1}
```

rollback

If transactions are enabled, this optional parameter rolls back the current transaction. If transactions are disabled, an error is shown. The following example shows how to roll back the current transaction:

```
> db.c.insert({"a": 2})
> db.c.find()
{"_id":ObjectId("52a8f9c477a0364542887ed4"),"a":1}
```

```
{"_id":ObjectId("52a8f9e877a0364542887ed5"),"a":2}
> db.runCommand({transaction: "rollback"})
{"ok":1}
```

execute

This optional parameter runs a batch of commands as a single transaction. If transaction mode is not enabled for the session, this parameter enables transaction mode for the duration of the transaction.

The list of command documents can include insert, update, delete, findAndModify, and find command documents. In insert, update, and delete command documents, you cannot set the **ordered** property to false. You can use a find command document to run queries, including SQL queries, but not commands. A find command document can include the **$orderby**, **limit**, **skip**, and **sort** operators. The following example deletes a document from the inventory collection and inserts documents into the archive collection:

```
> db.runCommand({"transaction" : "execute",
 "commands" : [
 {"delete": "inventory", "deletes" : [ { "q" : { "_id" : 432432 } } ] },
 {"insert" : "archive",
  "documents" : [ { "_id": 432432, "name" : "apollo", "last_status" : 9} ]
        }
 ]
})
```

Include the optional **finally** argument if you have a set of command documents to run at the end of the transaction regardless of whether the transaction is successful. The following example runs a query with the . The command document for the **finally** argument unsets the USE_DWA environment variable regardless of whether the previous query succeeds.

```
> db.runCommand({"transaction" : "execute",
 "commands" : [
    {"find" : "system.sql", "filter" : {"$sql" :
              "SET ENVIRONMENT USE_DWA 'ACCELERATE ON'" } },
    {"find" : "system.sql", "filter" : {"$sql" :
              "SELECT SUM(s.amount) as sum FROM sales AS s
              WHERE s.prid = 100 GROUP BY s.zip" } }
 ],
"finally" : [{"find":"system.sql", "filter" : {"$sql" :
             "SET ENVIRONMENT USE_DWA 'ACCELERATE OFF'" } } ]
})
```

status

This optional parameter prints status information to indicate whether transaction mode is enabled, and if transactions are supported by the current database. The following example shows how to print status information:

```
> db.runCommand({transaction: "status"})
{"enabled": true, "supports": true, "ok": 1}
```

unlockAccounts

Unlock a database or user account.

Important:

- To run this command, you must be the instance administrator.
- If you specify the `unlockAccounts:1` command without specifying a **db** or **user** argument, all accounts in all databases are unlocked.

```
unlockAccounts : { { 1 [ { , db : { " database_name " | [ " database_name " ] | { " $regex " : " json_document " } | { { | " include
" : { " database_name " | [ " database_name " ] | { " $regex " : " json_document " } } | " exclude " : { " database_name " | [ "
database_name " ] | { " $regex " : " json_document " } } } } } " | , user : { " user_name " | " json_document " } } ] } }
```

unlockAccounts:1

This required parameter unlocks a database or user account.

db

This optional parameter specifies the database name of an account to unlock. For example, to unlock all accounts in database that is named `foo`:

```
> db.runCommand({unlockAccounts: 1, db: "foo"})
```

exclude

This optional parameter specifies the databases to exclude. For example, to unlock all accounts on the system except the accounts that are in the databases named `alpha` and `beta`:

```
> db.runCommand({unlockAccounts: 1, db: {"exclude": ["alpha", "beta"]})
```

include

This optional parameter specifies the databases to include. For example, to unlock all accounts in the databases named `delta` and `gamma`:

```
> db.runCommand({unlockAccounts: 1, db: {"include": ["delta", "gamma"]})
```

$regex

This optional MongoDB evaluation query operator selects values from a specified JSON document. For example, to unlock accounts for databases that begin with the character `a.` and end in `e`:

```
> db.runCommand({unlockAccounts:1, db:{"$regex":"a.*e"})
```

user

This optional parameter specifies the user accounts to unlock. For example, to unlock the account of all users that are not named `alice`:

```
> db.runCommand({unlockAccounts: 1, user: {$ne: "alice"}});
```

Running HCL OneDB™ queries through the MongoDB API

You can use MongoDB API commands through the wire listener to query collections and relational tables, run SQL commands, and run queries that join collections and relational tables.

Running SQL commands by using the MongoDB API

You can run SQL statements by using the MongoDB API and retrieve results back. The results of the SQL statements are treated like they are documents in a JSON collection.

Before you begin

You must enable SQL operations by setting **security.sql.passthrough=true** in the wire listener properties file.

From the MongoDB shell command, use the abstract system collection `system.sql` as the collection name and `$sql` as the query operator, followed by the SQL statement.
For example:

```
> db.getCollection("system.sql").find({ "$sql": "sql_statement" })
```

To use host variables, include question marks in the SQL statement, and include the `$bindings` operator with an array that contains a value for each host variable in order of appearance. For example:

```
> db.getCollection("system.sql").find({ "$sql": "sql_statement",
  "$bindings": [values]})
```

Example

Examples

Create an SQL table

In this example, an SQL table is created by running the HCL OneDB™ CREATE TABLE command by using the MongoDB API:

```
> db.getCollection("system.sql").find({ "$sql": "create table foo (c1 int)" })
```

Drop an SQL table

In this example, an SQL table is dropped by running the HCL OneDB™ DROP TABLE command by using the MongoDB API:

```
> db.getCollection("system.sql").find({"$sql": "drop table foo" })
```

Delete SQL customer call records that are more than 5 years old

In this example, customer call records stored in SQL tables are deleted by running the HCL OneDB™ DELETE command by using the MongoDB API:

```
> db.getCollection("system.sql").findOne({ "$sql":
  "delete from cust_calls where (call_dtime + interval(5) year to year) < current" })
```

Result: 7 rows were deleted.

```
{ "n" : 7 }
```

Join JSON collections

In this example, a query counts the number of orders customers placed by using an outer join to include the customers who did not place orders.

```
> db.getCollection("system.sql").find({ "$sql": "select
 c.customer_num,o.customer_num as order_cust,count(order_num) as
 order_count from customer c left outer join orders o on
 c.customer_num = o.customer_num group by 1, 2 order by 2" })
```

Result:

```
{ "customer_num" : 113, "order_cust" : null, "order_count" : 0 }
{ "customer_num" : 114, "order_cust" : null, "order_count" : 0 }
{ "customer_num" : 101, "order_cust" : 101, "order_count" : 1 }
{ "customer_num" : 104, "order_cust" : 104, "order_count" : 4 }
{ "customer_num" : 106, "order_cust" : 106, "order_count" : 2 }
```

Delete rows based on a host variable

In this example, the statement includes a host variable that specifies to delete the rows that have the name "john".

```
> db.getCollection("system.sql").find({"$sql": "delete from mytab
                                  where name = ?", "$bindings" : ["john"] })
```

Run a user-defined function with host variables

In this example, the statement runs a user-defined routine with two host variables to raise prices.

```
> db.getCollection("system.sql").find({
  "$sql": "execute function raise_price(?, ?)",
  "$bindings" : [101, 0.10] })
```

Running MongoDB operations on relational tables

You can run MongoDB operations on HCL OneDB™ relational tables by using the MongoDB API.

About this task

Use the MongoDB database methods to run read and write operations on a relational table as if the table were a JSON collection. The wire listener examines the database and if the accessed entity is a relational table, it converts the basic operations on that table to SQL and converts the returned values into a JSON document. At the first access to an entity, the wire listener caches the name and type of that entity. The first access results in an extra call to the HCL OneDB™ server, but subsequent operations do not.

From the MongoDB API, enter the relational table name as the collection name in the MongoDB collection method.
For example:

```
>db.getCollection("tablename");
```

Example

Examples

The following examples use the **customer** table in the **stores_demo** sample database. All of the tables in the **stores_demo** database are relational tables, but you can use the same MongoDB collection methods to access and modify the tables, as if they were collections.

Get the customer count

In this example, the number of customers is returned.

```
> db.customer.count()
28
```

Query for a particular customer

In this example, a specific customer record is retrieved.

```
> db.customer.find({customer_num:101})
{ "customer_num" : 101, "fname" : "Ludwig", "lname" : "Pauli", "company" :
 "All Sports Supplies", "address1" : "213 Erstwild Court", "address2" :
 null, "city" : "Sunnyvale", "state" : "CA", "zipcode" : "94086",
 "phone" : "408-555-8075" }
```

Update a customer phone number

In this example, the customer phone number is updated.

```
> db.customer.update({"customer_id":101}, {"$set":{"phone":"408-555-1234"}})
```

Running join queries by using the wire listener

You can use the wire listener to run join queries on JSON and relational data. The syntax supports collection-to-collection joins, relational-to-relational joins, and collection-to-relational joins. Join queries are supported in sharded environments when parallel sharded queries are enabled.

About this task

Join queries in the wire listener are done by submitting a join query document to the **system.join** pseudo table.

- Wire listener join queries support the sort, limit, skip, and explain options that you can set on a MongoDB cursor.
- Fields that are specified in the sort clause must also be included in the projection clause.
- The **$hint** operator is not supported.

1. Create a join query document.

   Example

   The join query document has the following syntax:

   ```
   {"$collections": { "table_or_collection_name" :{"$project":{specifications } [ ,"$where":{filter} ] } , "$condition":
   { { "tabName1.column" :"tabName2.column" | "tabName1.column" :[ "tabName2.column" ] } } }
   ```

   $collections

   This required HCL OneDB™ JSON operator defines the two or more collections or relational tables that are included in the join.

$project

This required MongoDB JSON operator applies a projection clause to the *table_or_collection_name* that is specified.

$where

This optional MongoDB JSON operator applies a query filter to the table or relational table. You can use any of the supported query operators that are listed here: Query and projection operators on page 92.

$condition

This required HCL OneDB™ JSON operator defines how the specified collections or tables are joined. You can specify a condition by mapping a single table column to another single table column, or a single table column to multiple other table columns.

2. Run a find query against a pseudo table that is named **system.join** with the join query document specified.

   Example

   For example, in the MongoDB shell:

   ```
   > db.system.join.find({join_query_document})
   ```

Results

The query results are returned.

Example

Examples of join query document syntax

This example retrieves customer orders that total more than $100. The join query document joins the **customer** and **orders** tables, on the **customer_num** field where the order total is greater than 100. The same query document works if the customers and orders tables are collections, relational tables, or a combination of the two.

```
{"$collections":
        {
             "customers":
                 {"$project":{customer_num:1,name:1,phone:1}},
             "orders":
                 {"$project":{order_num:1,nitems:1,total:1,_id:0},
                  "$where":{total:{"$gt":100}}}
        },
  "$condition":
        {"customers.customer_num":"orders.customer_num"}
}
```

This example retrieves the order, shipping, and payment information for order number 1093. The array syntax is used in the **$condition** syntax of the join query document.

```
{"$collections":
         {
             "orders":
                  {"$project":{order_num: 1,nitems: 1,total: 1,_id:0},
                   "$where":{order_num:1093}},
```

```
              "shipments":
                   {"$project":{shipment_date:1,arrival_date:1}},
              "payments":
                   {"$project":{payment_method:1,payment_date:1}}
          },
   "$condition":
     {"orders.order_num":["shipments.order_num","payments.order_num"]}
}
```

This example retrieves the order and customer information for orders that total more than $1000 and that are shipped to the postal code 10112.

```
{"$collections":
        {
             "orders":
                  {"$project":{order_num:1,nitems:1,total:1,_id:0},
                   "$where":{total:{$gt:1000}}},
             "shipments":
                  {"$project":{shipment_date:1,arrival_date:1,_id:0},
                   "$where":{address.zipcode:10112},
             "customer":
                  {"$project":{customer_num:1,name:1,company:1,_id:0}}
       },
   "$condition":
       {
             "orders.order_num":"shipments.order_num",
          "orders.customer_num":"customer.customer_num",
       }
}
```

Operators

The MongoDB operators that are supported by HCL OneDB™ are sorted into logical areas.

MongoDB operators are supported on both JSON collections and relational tables, unless explicitly stated otherwise.

If the wire listener determines the accessed entity is a relational table, it converts the basic MongoDB operators on that table to SQL, and then converts the returned values back into a JSON document. The initial access to an entity results in an extra call to the HCL OneDB™ server. However, the wire listener caches the name and type of an entity so that subsequent operations do not require an extra call.

Query and projection operators

HCL OneDB™ supports a subset of the MongoDB query and projection operators.

You can refine your queries with the MongoDB query and projection operators. For example, in the **mongo** shell, to find members of the **cartype** collection with an age greater than 10, you can use the $gt operator: `db.cartype.find({"age":{"$gt":10.0}})`.

The JSON wire listener supports the skip, limit, and sort query options. You can set these options by using the **mongo** shell or MongoDB drivers.

- Query selectors on page 93
- Projection operators on page 95

Query selectors

Use query selectors to select specific data from queries.

Array query operators

Table 14. Array query operators

MongoDB command	JSON collections	Relational tables	Details
$elemMatch	Yes	No	
$size	Yes	No	

Comparison query operators

Table 15. Comparison query operators

MongoDB command	JSON collections	Relational tables	Details
$all	Yes	Yes	Supported for primitive values and simple queries only. The operator is only supported when it is the only condition in the query document.
$eq	Yes	Yes	
$gt	Yes	Yes	
$gte	Yes	Yes	
$in	Yes	Yes	
$lt	Yes	Yes	
$lte	Yes	Yes	
$ne	Yes	Yes	
$nin	Yes	Yes	
$query	Yes	Yes	

Element query operators

Table 16. Element query operators

MongoDB command	JSON collections	Relational tables	Details
$exists	Yes	No	
$type	Yes	No	

Evaluation

Table 17. Evaluation query operators

MongoDB command	JSON collections	Relational tables	Details
$mod	Yes	Yes	
$regex	Yes	Yes	The only supported value for the $options flag is i, which specifies a case-insensitive search.
$text	Yes	Yes	The $text query operator support is based on MongoDB version 2.6. You can customize your text index and take advantage of additional text query options by creating a basic text search index with the createTextIndex command. For more information, see HCL OneDB JSON commands on page 79.
$where	No	No	

Geospatial query operators

Geospatial queries are supported by using the GeoJSON format. The legacy coordinate pairs are not supported.

Table 18. Geospatial query operators

MongoDB command	JSON collections	Relational tables	Details
$geoWithin	Yes	No	
$geoIntersects	Yes	No	
$near	Yes	No	
$nearSphere	Yes	No	

JavaScript™ query operators

The JavaScript™ query operators are not supported.

Logical query operators

Table 19. Logical query operators

MongoDB command	JSON collections	Relational tables	Details
$and	Yes	Yes	
$or	Yes	Yes	
$not	Yes	Yes	
$nor	Yes	Yes	

Projection operators

Use projection operators to select specific data from a document.

Projection operators

Table 20. Projection operators

MongoDB command	JSON collections	Relational tables	Details
$	No	No	
$elemMatch	Yes	No	
$meta	Yes	Yes	
$slice	No	No	

Query modifiers

Table 21. Query modifiers

MongoDB command	JSON collections	Relational tables	Details
$comment	No	No	
$explain	Yes	Yes	
$hint	Yes	No	
$orderby	Yes	Yes	

For more information about the MongoDB features, see http://docs.mongodb.org/manual/reference/.

Update operators

HCL OneDB™ supports a subset the MongoDB update operators.

You can use update operators to modify or add data in your database. For example, in the **mongo** shell, to change the username to atlas in the document with the _id of 101 in the users collection, you can use the $set operator: `db.users.update({"_id":101},{"$set":{"username":"atlas"}})`.

Array update operators

Table 22. Array update operators

MongoDB command	JSON collections	Relational tables	Details
$	No	No	
$addToSet	Yes	No	Supported for primitive values only. The operator is not supported on arrays and objects.
$pop	Yes	No	
$pullAll	Yes	No	Supported for primitive values only. The operator is not supported on arrays and objects.
$pull	Yes	No	Supported for primitive values only. The operator is not supported on arrays and objects.
$pushAll	Yes	No	
$push	Yes	No	

Array update operators modifiers

Table 23. Array update modifiers

MongoDB command	JSON collections	Relational tables	Details
$each	Yes	No	
$slice	Yes	No	
$sort	Yes	No	
$position	Yes	No	

Bitwise update operators

Table 24. Bitwise update operators

MongoDB command	JSON collections	Relational tables	Details
$bit	Yes	No	

Field update operators

Table 25. Field update operators

MongoDB command	JSON collections	Relational tables	Details
$currentDate	Yes	Yes	
$inc	Yes	Yes	
$max	Yes	Yes	
$min	Yes	Yes	
$mul	Yes	Yes	
$rename	Yes	No	
$setOnInsert	Yes	No	
$set	Yes	Yes	
$unset	Yes	Yes	

Isolation update operators

The isolation update operators are not supported.

For more information about the MongoDB features, see http://docs.mongodb.org/manual/reference/.

HCL OneDB™ query operators

The HCL OneDB™ query operators are extensions to the MongoDB API.

Query operators

You can use the HCL OneDB™ query operators in all MongoDB functions that accept query operators, for example find() or findOne().

$onedbText

The $onedbText query operator is similar to the MongoDB $text operator, except that it passes the search string as-is to the **bts_contains()** function.

When using relational tables, the MongoDB $text and HCL OneDB™ $onedbText query operators both require a column name, specified by $key, in addition to the $search string.

The search string can be a word or a phrase as well as optional query term modifiers, operators, and stopwords. You can include field names to search in specific fields. The syntax of the search string in the $ifxtext query operator is the same as the syntax of the search criteria in the **bts_contains()** function that you include in an SQL query.

In the following example, a single-character wildcard search is run for the strings `text` or `test`:

```
db.collection.find( { "$ifxtext" : { "$search" : "te?t" } } )
```

$like

The $like query operator tests for matching character strings and maps to the SQL LIKE query operator. For more information about the SQL LIKE query operator, see LIKE Operator on page .

In the following example, a wildcard search is run for strings that contain `machine`:

```
db.collection.find( { "$like" : "%machine%" )
```

Aggregation framework operators

The MongoDB aggregation framework operators that are supported by HCL OneDB™ are sorted into logical areas.

You can use aggregation framework operators to aggregate and manipulate documents as they move through the aggregation pipeline stages. You can use some operators to aggregate or slice time series data.

- Pipeline operators on page 98
- Expression operators on page 99

Pipeline operators

Table 26. Pipeline operators

MongoDB command	JSON collections	Relational tables	Details
$geoNear	Yes	No	• Supported by using the GeoJSON format. The MongoDB legacy coordinate pairs are not supported. • You cannot use dot notation for the distanceField and includeLocs parameters.
$group	Yes	Yes	For the syntax to aggregate time series data, see Aggregate or slice time series data on page 111.
$limit	Yes	Yes	

Table 26. Pipeline operators (continued)

MongoDB command	JSON collections	Relational tables	Details
$match	Yes	Yes	
$out	Yes	Yes	
$project	Partial	Partial	• You can use $project to include fields from the original document, for example `{ $project : { title : 1 , author : 1 }}`. • You cannot use $project to insert computed fields, rename fields, or create and populate fields that hold subdocuments. • Projection operators are not supported. • You can use the $slice operator to return part of a time series. For the syntax to slice time series data, see Aggregate or slice time series data on page 111.
$redact	No	No	
$skip	Yes	Yes	
$sort	Yes	Yes	
$unwind	Yes	No	

Expression operators

$group operators

Table 27. $group operators

Command	JSON collections	Relational tables	Time series tables	Details
$addToSet	Yes	No	No	
$avg	Yes	Yes	Yes	
$first	Yes	Yes	Yes	
$last	Yes	Yes	Yes	
$max	Yes	Yes	Yes	
$median	No	No	Yes	An HCL OneDB™ JSON operator for aggregating time series data. For the syntax to aggregate time series data, see

Table 27. $group operators (continued)

Command	JSON collections	Relational tables	Time series tables	Details
				Aggregate or slice time series data on page 111.
$min	Yes	Yes	Yes	
$nth	No	No	Yes	An HCL OneDB™ JSON operator for aggregating time series data. For the syntax to aggregate time series data, see Aggregate or slice time series data on page 111.
$push	Yes	No	No	
$sum	Yes	Yes	Yes	

For more information about the MongoDB features, see http://docs.mongodb.org/manual/reference/.

Change Streams

You can use the MongoDB change steams API to watch for real time changes to your tables and collections.

The HCL OneDB™ wire listener supports the MongoDB change streams API which allows MongoDB clients to subscribe to all data changes in a collection or relational table on the HCL OneDB™ database server. This support is based on the JDBC Smart Trigger support for the database's push data feature.

With the wire listener, you must open a change stream on each individual table or collection that you want to subscribe to. The wire listener does not support watching an entire database or the entire system from a single change stream.

HCL OneDB™ generates the following change stream events:

- `insert`
- `update`
- `delete`

For `update` change stream events, unlike MongoDB, the wire listener always returns the full document as part of the update event. `Replace` change stream events are not generated by HCL OneDB™. Any replace operation run against HCL OneDB™ through a MongoDB client will result in a change stream event of type `update`.

HCL OneDB™ also does not generate `drop`, `rename`, or `dropDatabase` change stream events. You cannot drop or rename a table that is being watched by a smart trigger, nor can you drop the database that contains it.

The wire listener allows you to filter which change stream events you are subscribed to. You can filter by the change stream operation type ("insert, "update", and/or "delete") or by matching against one or more fields in the full document. Filters are set by providing a `pipeline` when calling the MongoDB API's `watch` function. The wire listener only supports `$match` stages in the `pipeline`. You can provide a `$match` stage to filter on the `operationType` field of the change stream event. You an also provide a `$match` stage to filter on one or more fields in the `fullDocument` field of the change stream event.

The wire listener does not support resuming a change stream. Resume tokens are included in change stream events to indicate the log id and position associated with the change stream event. But the tokens cannot be used to resume a change stream from a particular event.

Manage time series through the wire listener

You can create and manage time series through the wire listener. You interact with time series data through a virtual table.

You can create, load, and query time series through the MongoDB API. Because you act on a virtual table, the **TimeSeries** row type does not need to contain a BSON column.

The following restrictions apply when you create a time series through the wire listener:

- You cannot define hertz or compressed time series.
- You cannot define rolling window containers.
- You cannot load time series data through a loader program. You must load time series data through a virtual table.
- You cannot run time series SQL routines or methods from the time series Java™ class library. You operate on the data through a virtual table.

Creating a time series through the wire listener

You can create time series with the MongoDB API through the wire listener. You create time series objects by adding definitions to time series collections.

Before you begin

You must understand time series concepts, the properties of your data, and how much storage space your data requires. For an overview of time series concepts and guidance on how to design your time series solution, see HCL OneDB™ TimeSeries solution on page .

Perform the following prerequisite tasks:

- Connect to a database in which to create the time series table. You run all methods in the database.
- Configure and start the wire listener for the MongoDB API. For more information, see Configuring the wire listener for the first time on page 9.
- Configure storage spaces for your time series data.

To create a time series through the wire listener:

1. Choose a predefined calendar from the `system.timeseries.calendar` collection or create a calendar by adding a document to the `system.timeseries.calendar` collection.
2. Create a **TimeSeries** row type by adding a document to the `system.timeseries.rowType` collection.
   The row type must include one BSON column for the JSON data.

3. Create a container by adding a document to the `system.timeseries.container` collection.
4. Create a time series table with the time series table format syntax.
5. Instantiate the time series by creating a virtual table with the time series virtual table format syntax.
6. Use the MongoDB API to load time series data through a through a virtual table.

What to do next

After you create and load a time series, you query the data though the virtual table with MongoDB clients.

Time series collections and table formats

You can add, view, and remove documents from the time series collections with MongoDB API methods to create and manage your time series. You must use a specific format to create time series tables and virtual tables that are based on time series tables.

For the MongoDB API, use the query, create, or remove methods to view, insert, or delete data in the time series collections.

The time series collections are virtual collections that are used to manage the objects that are required to store time series data in a database.

- system.timeseries.calendar collection on page 102
- system.timeseries.rowType collection on page 103
- system.timeseries.container collection on page 104
- Time series table format on page 104
- Virtual table format on page 105

system.timeseries.calendar collection

The `system.timeseries.calendar` collection stores the definitions of predefined and user-defined calendars. A calendar controls the times at which time series data can be stored. The calendar definition embeds the calendar pattern definition. For details and restrictions about calendars, see Calendar data type on page . For a list of predefined calendars, see Predefined calendars on page .

Use the following format to add a calendar to the `system.timeseries.calendar` collection.

calendar

{ **name** : " *calendar_name* " , **calendarStart** : " *start_date* " , **patternStart** : " *pattern_date* " , **pattern** : { **type** : " *interval* " , **intervals** : [{ **duration** : " *num_intervals* " , **on** : { **true** | **false** } }] } }

name

The name of the calendar.

calendarStart

The start date of the calendar.

patternStart

The start date of the calendar pattern.

pattern

The calendar pattern definition.

type

The time interval. Valid values for *interval* are: `second`, `minute`, `hour`, `day`, `week`, `month`, `year`.

intervals

The description of when to record data.

duration

The number of intervals, as a positive integer.

on

Whether to record data during the interval:

`true` = Recording is on.

`false` = Recording is off.

system.timeseries.rowType collection

The `system.timeseries.rowType` collection stores **TimeSeries** row type definitions. The **TimeSeries** row type defines the structure for the time series data within a single column in the database. For details and restrictions on **TimeSeries** row types, see TimeSeries data type on page .

Use the following format to add a **TimeSeries** row type to the `system.timeseries.rowType` collection.

```
{ name : " rowtype_name " , fields : [ { name : " field_name " , type : " data_type " } ] }
```

name

The *rowtype_name* is the name of the **TimeSeries** row type.

fields

name

The name of the field in the row data type. The *field_name* must be unique for the row data type. The number of fields in a row type is not restricted.

type

Must be `datetime year to fraction(5)` for the first field, which contains the time stamp.

The data type of the field. Most data types are valid for fields after the time stamp field.

system.timeseries.container collection

The `system.timeseries.container` collection stores container definitions. Time series data is stored in containers. For details and restrictions on containers, see TSContainerCreate procedure on page . Rolling window container syntax is not supported.

Use the following format to add a container to the `system.timeseries.container` collection.

```
{ name : " container_name " , dbspaceName : " dbspace_name " , rowTypeName : " rowtype_name " , firstExtent : extent_size ,
nextExtent : next_extent_size }
```

name

The *container_name* is the name of the container. The container name must be unique.

dbspaceName

The *dbspace_name* is the name of the dbspace for the container.

rowTypeName

The *rowtype_name* is the name of an existing **TimeSeries** row type in the `system.timeseries.rowType` collection.

firstExtent

The *extent_size* is a number that represents the first extent size for the container, in KB.

nextExtent

The *next_extent_size* is a number that represents the increments by which the container grows, in KB. The value must be equivalent to at least 4 pages.

Time series table format

A time series table must have a primary key column that does not allow null values. The last column in the time series table must be the **TimeSeries** column. For details and restrictions on time series tables, see Create the database table on page .

The following format describes the simplest structure of a time series table. You can include other options and columns in a time series table.

```
{ collection : " table_name " , options : { columns : [ { name : " col_name " , type : " data_type " , primaryKey : true , notNull
: true } , { name : " col_name " , type : " timeseries ( rowtype_name ) " } ] } }
```

collection

The *table_name* is the name of the time series table.

options

The collection definition.

columns

The column definitions.

name

The *col_name* is the name of the column.

type

The *data_type* is the data type of the column.

For the **TimeSeries** column, the *rowtype_name* is the name of an existing **TimeSeries** row type in the `system.timeseries.rowType` collection.

primaryKey

`true` = The column is the primary key.

notNull

`true` = The column does not allow null values.

Virtual table format

You use a virtual table that is based on the time series table to insert and query time series data.

```
{ collection : " virtualtable_name " , options : { timeseriesVirtualTable : { baseTableName : " table_name " , newTimeSeries :
" calendar ( calendar_name ) , origin ( origin ) , container ( container_name ) [ { , irregular | , regular } ] , virtualTableMode
: mode , timeseriesColumnName : " col_name " } } }
```

collection

The *virtualtable_name* is the name of the virtual table.

options

timeseriesVirtualTable

The definition of the virtual table.

baseTableName

The *table_name* is the name of the time series table.

newTimeseries

The time series definition.

calendar

The *calendar_name* is the name of a calendar in the `system.timeseries.calendar` collection.

origin

The *origin* is the first time stamp in the time series. The data type is DATETIME YEAR TO FRACTION(5).

container

The *container_name* is the name of a container in the `system.timeseries.container` collection.

regular

Default. The time series is regular.

irregular

The time series is irregular.

virtualTableMode

The *mode* is the integer value of the TSVTMode parameter that controls the behavior and display of the virtual table for time series data. For the settings of the TSVTMode parameter, see The TSVTMode parameter on page .

timeseriesColumnName

The *col_name* is the name of the **TimeSeries** column.

Example: Create a time series through the wire listener

This example shows how to create, load, and query a time series with the MongoDB API through the wire listener.

Before you begin

Before you start this example, ensure these tasks are complete:

- Connect to a database in which to create the time series table. You run all methods in the database.
- Configure the wire listener for the MongoDB API. For more information, see Configuring the wire listener for the first time on page 9.
- Define a dbspace that is named **dbspace1**. For more information, see Dbspaces on page .

About this task

In this example, you create a time series that contains sensor readings about the temperature and humidity in a house. Readings are taken every 10 minutes. The following table lists the time series properties that are used in this example.

Table 28. Time series properties used in this example

Time series property	Definition
Timepoint size	10 minutes
When timepoints are valid	Every 10 minutes
Data in the time series	The following data:

Table 28. Time series properties used in this example (continued)

Time series property	Definition
	• Timestamp • A float value that represents temperature • A float value that represents humidity
Time series table	The following columns: • A meter ID column of type INTEGER • A **TimeSeries** data type column
Origin	2014-01-01 00:00:00.00000
Regularity	Regular
Where to store the data	In a container that you create
How to load the data	Through a virtual table
How to access the data	Through a virtual table

To create a time series with the MongoDB API **mongo** shell:

1. Create a time series calendar. The time series calendar is named **ts_10min**, with a calendar and pattern start date of **2014-01-01 00:00:00**, a calendar pattern that is defined with intervals of minutes, and data is recorded in 10 minute increments after the origin.

   MongoDB API

   Add to the predefined system.timeseries.calendar collection.

   ```
   db.system.timeseries.calendar.insert({"name":"ts_10min",
    "calendarStart":"2014-01-01 00:00:00",
    "patternStart":"2014-01-01 00:00:00",
    "pattern":{"type":"minute",
             "intervals":[{"duration":"1","on":"true"},
                        {"duration":"9","on":"false"}]}})
   ```

2. Create a **TimeSeries** row type. The row type is named **reading** and includes fields for timestamp, temperature, and humidity.
   Example

   MongoDB API

   Add to the predefined system.timeseries.rowType collection.

   ```
   db.system.timeseries.rowType.insert({"name":"reading",
   "fields":[{"name":"tstamp","type":"datetime year to fraction(5)"},
           {"name":"temp","type":"float"},
           {"name":"hum","type":"float"}]})
   ```

3. Create a container. The container is named **c_0** and is created in the **dbspace1** dbspace, in the **reading** time series row, with a first extent size of **1000**, and with growth increments of **500**.

   Example

   MongoDB API

   Add to the predefined system.timeseries.container collection.

   ```
   db.system.timeseries.container.insert({"name":"c_0",
    "dbspaceName":"dbspace1",
    "rowTypeName":"reading",
    "firstExtent":1000,
    "nextExtent":500})
   ```

4. Create a time series table. The time series table is named **ts_data1** and includes **id** and **ts** columns.

   Example

   MongoDB API

   Create the **ts_data1** time series table:

   ```
   db.runCommand({"create":"ts_data1",
    "columns":[{"name":"id","type":"int","primaryKey":"true","notNull":"true"},
             {"name":"ts","type":"timeseries(reading)"}]})
   ```

5. Create a virtual table. The virtual table is named **ts_data1_v** and is based on the time series table that is named **ts_data1** and its timeseries column **ts**, using the **ts_10min** calendar, starting on **2014-01-01 00:00:00.00000**, in the time series container **c_0**, with the virtualTableMode parameter set to **0** (default).

   Example

   Important: This example contains line breaks for page formatting, however, JSON does not allow line breaks within strings.

   MongoDB API

   Create the **ts_data1_v** virtual table:

   ```
   db.runCommand({"create":"ts_data1_v",
    "timeseriesVirtualTable":
            {"baseTableName":"ts_data1",
             "newTimeseries":"calendar(ts_10min),origin(2014-01-01
    00:00:00.00000),container(c_0)",
             "virtualTableMode":0,
             "timeseriesColumnName":"ts"}})
   ```

6. Load records into the time series by inserting documents into the **ts_data1_v** virtual table.

   Because this time series is regular, you are not required to include the time stamp. The first record is inserted for the origin of the time series, 2014-01-01 00:00:00.00000. The second record has the time stamp 2014-01-01 00:10:00.00000, and the third record has the time stamp 2014-01-01 00:20:00.00000.

   MongoDB API

   Add documents to the **ts_data1_v** virtual table:

```
db.ts_data1_v.insert([{"id":1,"temp":15.0,"hum":20.0},
 {"id":1,"temp":16.2,hum:19.0},{id:1,temp:16.5,hum:22.0}])
```

7. Query the time series data by using the **ts_data1_v** virtual table.

   MongoDB API

   Query the **ts_data1_v** virtual table:

```
db.ts_data1_v.find()

Results:
> db.ts_data1_v.find()
{"id":1,"tstamp":ISODate("2014-01-01T06:00:00Z"),"temp":15,"hum":20}
{"id":1,"tstamp":ISODate("2014-01-01T06:10:00Z"),"temp":16.2,"hum":19}
{"id":1,"tstamp":ISODate("2014-01-01T06:20:00Z"),"temp":16.5,"hum":22}
```

Example queries of time series data by using the wire listener

These examples show how to query time series data by using the MongoDB API.

Before using these examples, you must configure the wire listener for the MongoDB. For more information, see Configuring the wire listener for the first time on page 9. These examples are run against the **stores_demo** database. For more information, see dbaccessdemo command: Create demonstration databases on page . These examples query the **ts_data_v virtual** table that stores the device ID in the **loc_esi_id** column.

- List all device IDs on page 109
- List device IDs that have a value greater than 10 on page 109
- Find the data for a specific device ID on page 110
- Find and sort data with multiple qualifications on page 110
- Find all data for a device in a specific date range on page 110
- Find the latest data point for a specific device on page 111
- Find the 100th data point for a specific device on page 111

For examples of aggregating or slicing time series data, see Aggregate or slice time series data on page 111.

List all device IDs

This query returns all unique device IDs.

MongoDB API

Run a distinct command on the ts_data_v virtual table:

```
db.ts_data_v.distinct("loc_esi_id")

Results:
["4727354321000111","4727354321046021","4727354321090954",...]
```

List device IDs that have a value greater than 10

This query returns the list of device IDs that have at least one measured value in the time series that is greater than 10.

MongoDB API

Run a distinct command on the ts_data_v table, with $gt value comparison operator specified:

```
db.ts_data_v.distinct("loc_esi_id",{"value":{"$gt":10}})

Results:
["4727354321046021","4727354321132574","4727354321289322",...]
```

Find the data for a specific device ID

This query returns the data for the device with the ID of 4727354321046021.

MongoDB API

Run a find command on the ts_data_v virtual table with the loc_esi_id value specified:

```
db.ts_data_v.find({"loc_esi_id":4727354321046021})

Results:
 {"loc_esi_id":"4727354321046021","measure_unit":"KWH",
 "direction":"P","tstamp":ISODate("2010-11-10T06:00:00Z"),
 "value":0.041}
 {"loc_esi_id":"4727354321046021","measure_unit":"KWH",
 "direction":"P","tstamp":ISODate("2010-11-10T06:15:00Z"),
 "value":0.041}
 {"loc_esi_id":"4727354321046021","measure_unit":"KWH",
 "direction":"P","tstamp":ISODate("2010-11-10T06:30:00Z"),
 "value":0.04}
...]
```

Find and sort data with multiple qualifications

This query finds all data for the device with the ID of 4727354321046021 with a value greater than 10.0 and a direction of P. The query returns the tstamp and value fields, and sorts the results in descending order by the value field.

MongoDB API

Run a find command on the ts_data_v table, with the $and boolean logical operator specified:

```
db.ts_data_v.find({"$and":[{"loc_esi_id":4727354321046021},
{"value":{"$gt":10.0}},{"direction":"P"}]},
{"tstamp":1,"value":1}).sort({"value":-1})

Results:
 {"tstamp":ISODate("2011-01-25T16:15:00Z"),"value":14.58}
 {"tstamp":ISODate("2011-01-26T00:45:00Z"),"value":12.948}
 {"tstamp":ISODate("2011-01-26T02:30:00Z"),"value":12.768}
 ...
```

Find all data for a device in a specific date range

To query for specific dates, convert the dates to milliseconds since the epoch. For example:

- 2011-01-01 00:00:00 = 1293861600000
- 2011-01-02 00:00:00 = 1293948000000

This query returns the data from midnight January 1, 2011 to January 2, 2011 for device ID 4727354321000111. The date that is queried is greater than 1293861600000 and less than 1293948000000. The query returns the tstamp and value fields.

MongoDB API

Run a find command on the ts_data_v table, with values specified for the $and boolean logical query operator:

```
db.ts_data_v.find({"$and":[{"loc_esi_id":"4727354321000111"},
{"tstamp":{"$gte":ISODate("2011-01-01 00:00:00")}},
{"tstamp":{"$lt":ISODate("2011-01-02 00:00:00")}}]},
{"tstamp":"1","value":"1"})

Results:
 {"tstamp":ISODate("2011-01-01T00:00:00Z"),"value":0.343 }
 {"tstamp":ISODate("2011-01-01T00:15:00Z"),"value":0.349 }
 {"tstamp":ISODate("2011-01-01T00:30:00Z"),"value":1.472 }
...]
```

Find the latest data point for a specific device

This query sets the sort parameter to order the tstamp field in descending order and sets the limit parameter to 1 to return only the latest value. The device ID is 4727354321000111 and the query returns the tstamp and value fields.

MongoDB API

Run a find command on the ts_data_v table, with sort and limit values specified:

```
db.ts_data_v.find({"loc_esi_id":"4727354321000111"},
{"tstamp":"1","value":"1"}).sort({"tstamp":-1}).limit(1)

Results:
 {"tstamp":ISODate("2011-02-08T05:45:00Z"),"value":1.412 }
```

Find the 100th data point for a specific device

This query sets the sort parameter to order the tstamp field in ascending order and sets the skip parameter to 100 to return the 100th value. The device ID is 4727354321000111 and the query returns the tstamp and value field.

MongoDB API

Run the find command on the ts_data_v table, with values specified for sort, limit and skip:

```
db.ts_data_v.find({"loc_esi_id":4727354321000111},
{"tstamp":1,"value":1}).sort({"tstamp":1}).limit(1).skip(100)

Results:
 {"tstamp":ISODate("2010-11-11T07:00:00Z"),"value":0.013}
```

Aggregate or slice time series data

You can use the MongoDB aggregation pipeline commands to aggregate time series values or return a slice of a time series.

When you run an aggregation query on a time series table, internally the time series Transpose function converts the aggregated or sliced data to tabular format and then the genBSON function converts the results to BSON format. Therefore, the output of the $group or $project stage in the aggregation pipeline is collection-style JSON data. Any subsequent stages of the aggregation pipeline can process the data as JSON documents.

The aggregate and slice operations return JSON documents that include the primary key columns of the time series table. You can remove the primary key columns with the $project operator in the next stage of the aggregation pipeline.

To run the examples of aggregating and slicing time series data, create a JSON time series by following the instructions for loading hybrid data: Example for JSON data: Create and load a time series with JSON documents on page .

- Aggregate: The $group operator syntax on page 112
- Slice: The $slice operator syntax on page 115

Aggregate: The $group operator syntax

To aggregate time series values, you use the $group operator and include a $calendar object to define the aggregation period, and include one or more aggregation operator expressions to define the type of operation and the data to aggregate. The data to aggregate must be numeric and able to be cast to float values. The $group operator produces the same results as running the time series AggregateBy function. If you have multiple **TimeSeries** columns in a table, you can aggregate values with the $group operator for only the first **TimeSeries** column.

```
{ $group : { $calendar : { { <Calendar definition> | name : " calendar_name " } } , <Aggregation operator expression> } }
```

Calendar definition

```
“ interval : number , ”
“ timeunit : " unit " , ”
“ start : " start_time " ”
“ [ , end : " end_time " ] ”
“ [ , discrete : { true | false } ] ”
“ } ”
```

Aggregation operator expression

```
“ field_name : { ”
“ { operator : { " $ column . field " | " $ column " } | $nth : [ { " $ column . field " | " $ column " } , position
] } ”
“ } ”
```

$calendar

The calendar that defines the aggregation period. You can specify the name of an existing calendar with the following document: `{name: "calendar_name"}`. The calendar must exist in the **CalendarTable** table.

You can define a calendar for the aggregation operation with a document that contains the following fields:

interval

The *number* is a positive integer that represents number of time units in the aggregation period. For example, if the interval is 1 and the time unit is DAY, then the values are aggregated for each day.

timeunit

The *unit* is the size of the time interval for the aggregation period. Can be SECOND, MINUTE, HOUR, DAY, WEEK, MONTH, or YEAR.

start

The *start_date* is the start date of the aggregation operation in DATETIME YEAR TO FRACTION(3) format.

end

Optional. The *end_date* is the end date of the aggregation operation in DATETIME YEAR TO FRACTION(3) format. If you omit the end date, the aggregation operation continues through the latest time series element.

discrete

Optional. Controls whether the data remains as discrete values or is smoothed to be continuous.

true = Default. The data remains discrete.

false = The data is smoothed. You might want to smooth your data if you want to treat your data as continuous, for example, temperature data. Smoothing data can accurately compensate for missing data. You can only use the $avg, $min, and $max aggregation operators on smoothed data. You cannot use the $sum, $median, $first, $last, or $nth aggregation operators on smoothed data.

For example, the following calendar definition produces an aggregate value per day for a month:

```
{ $calendar: { interval: 1,
               timeunit: "DAY",
               start: "2015-07-03 15:40:03.000",
               end: "2015-08-03 15:40:03.000",
               discrete: true }
```

Aggregation operator expression

The *field_name* is a descriptive name for the results of the aggregation operation.

The *operator* can be $sum, $avg, $min, $max, $median, $first, $last, or $nth. The $nth operator requires a position value.

The *column* is the name of the column to aggregate in the **TimeSeries** row type. If the column contains BSON data, include a dot followed by the field name to aggregate within the BSON documents. For example, if the column name is **sensor_data** and the field name is **value**, the column name is specified as `"$sensor_data.value"`.

The *position* is an integer that follows the $nth operator to represent the position of the value to return within the aggregation period. Positive integers begin at the first value. A position of 1 is the same as using the $first operator. Negative integers begin at the latest value. A position of -1 is the same as using the $last operator.

Example: Daily average value

The following example returns the daily average of a value over the period of three days for the **v1** field in the **sensor_data** column in the **tstable_j** table for the sensor 1:

```
db.tstable_j.aggregate(
      {$match: {id: 1 } },
      {$group: { $calendar: { interval: 1,
                 timeunit: "DAY",
                 start: "2014-03-01 00:00:00.000",
                 end: "2014-03-03 23:59:59.000",
                 discrete: true },
               val_AVG: {$avg: "$sensor_data.v1"} } }
)

{
        "result" : [
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-03-01T00:00:00Z"),
                        "val_avg" : 1.416666666666667
                },
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-03-02T00:00:00Z"),
                        "val_avg" : 1.4437500000000003
                },
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-03-03T00:00:00Z"),
                        "val_avg" : 1.4447916666666671
                }
        ],
        "ok" : 1
}
```

Example: Get the maximum value for each month

The following example returns the maximum value for each month over a six-month period for the **v2** field in the **sensor_data** column in the **tstable_j** table for the sensor 1:

```
db.tstable_j.aggregate(
      {$match: {id: 1 } },
      {$group: { $calendar: { interval: 1,
                 timeunit: "MONTH",
                 start: "2014-01-01 00:00:00.000",
                 end: "2014-6-30 23:59:59.000",
                 discrete: true },
               maximum: {$max: "$sensor_data.v2"} } }
)
{
        "result" : [
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-01-01T00:00:00Z"),
                        "maximum" : 22.9
                },
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-02-01T00:00:00Z"),
                        "maximum" : 23.4
                },
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-03-01T00:00:00Z"),
                        "maximum" : 23.1
                },
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-04-01T00:00:00Z"),
                        "maximum" : 22.9
                },
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-05-01T00:00:00Z"),
                        "maximum" : 24.0
                },
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-06-01T00:00:00Z"),
                        "maximum" : 24.8
                }
        ],
        "ok" : 1
}
```

Slice: The $slice operator syntax

To slice a time series, you use the $project operator to identify the time series and include a document with a $slice operator to specify the time range of the time series elements to return. The $slice operator produces the same results as running the time series Clip or ClipCount functions.

{ **`$project`** : { *time_series* : { **`$slice`** : { *N* | [*N* , *flag*] | [*tstamp* , *N* [, *flag*]] | [*begin_tstamp* , *end_tstamp* [, *flag*]] } } } }

$project

The *time_series* is the name of the time series column.

$slice

The *N* is an integer that represents the number of elements to return. Positive values return elements from the beginning of the time series or starting at the specified time stamp. Negative values return elements from the end of the time series or ending with the specified time stamp.

The *tstamp* is a DATETIME value that represents the start or end time stamp of the elements to return.

The *begin_tstamp* is the beginning time stamp of the elements to return.

The *end_tstamp* is the ending time stamp of the elements to return.

The *flag* controls the configuration of the resulting time series. For values, see the Clip function on page .

Example: Get the next five elements

The following example returns the first five elements, beginning at March 14, 2014, at 9:30 AM, from the **tstable_j** table for the sensor with the ID of 1:

```
db.tstable_j.aggregate(
    { $match: { id: 1}},
    { $project: { sensor_data: { $slice: ["2014-03-14 09:30:00.000", 5] }
} }
)

{
        "result" : [
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-03-14T09:30:00Z"),
                        "v1" : 1.7,
                        "v2" : 20.9
                },
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-03-14T09:45:00Z"),
                        "v1" : 1.6,
                        "v2" : 17.4
                },
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-03-14T10:00:00Z"),
                        "v1" : 1.6,
                        "v2" : 20.3
                },
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-03-14T10:15:00Z"),
                        "v1" : 1.8,
                        "v2" : 20.4
                },
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-03-14T10:30:00Z"),
                        "v1" : 1.3,
                        "v2" : 17.1
                }
        ],
        "ok" : 1
}
```

Example: Get the previous three elements

The following example returns the previous three elements, ending at March 14, 2014, at 9:30 AM, from the **tstable_j** table for the sensor with the ID of 1:

```
db.tstable_j.aggregate(
    { $match: { id: 1}},
    { $project: { sensor_data: { $slice: ["2014-03-14 09:30:00.000", -3] }
} }
)
{
        "result" : [
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-03-14T09:00:00Z"),
                        "v1" : 1,
                        "v2" : 22.8
                },
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-03-14T09:15:00Z"),
                        "v1" : 1.8,
                        "v2" : 21.6
                },
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-03-14T09:30:00Z"),
                        "v1" : 1.7,
                        "v2" : 20.9
                }
        ],
        "ok" : 1
}
```

Example: Get elements in a range

The following example returns the elements between March 14, 2014, at 9:30 AM and March 14, 2014, at 10:30 AM, from the **tstable_j** table for the sensor with ID 1:

```
db.tstable_j.aggregate(
  { $match: { id: 1 }},
  { $project: { sensor_data: { $slice: ["2014-03-14 09:30:00.000",
                                        "2014-03-14 10:30:00.000"] } } }
)

{
        "result" : [
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-03-14T09:30:00Z"),
                        "v1" : 1.7,
                        "v2" : 20.9
                },
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-03-14T09:45:00Z"),
                        "v1" : 1.6,
                        "v2" : 17.4
                },
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-03-14T10:00:00Z"),
                        "v1" : 1.6,
                        "v2" : 20.3
                },
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-03-14T10:15:00Z"),
                        "v1" : 1.8,
                        "v2" : 20.4
                },
                {
                        "id" : "1",
                        "tstamp" : ISODate("2014-03-14T10:30:00Z"),
                        "v1" : 1.3,
                        "v2" : 17.1
                }
        ],
        "ok" : 1
}
```

Troubleshooting HCL OneDB™ JSON compatibility

Several troubleshooting techniques, tools, and resources are available for resolving problems that you encounter with HCL OneDB™ JSON compatibility.

Problem	Solution
How do I start the wire listener?	See Starting the wire listener on page 41.
How can I debug wire listener problems?	When staring the wire listener, add `-loglevel level` to the java command use to start the listener process, where *level* is the logging level. Log level options are: • error • warn • info • debug • trace For more information, see Wire listener command line options on page 39.

Problem	Solution
How can I view all of the current properties for the wire listener properties file?	An example properties file is available in the HCL OneDB™ APIs package which provides descriptions of all of the wire listener's configuration properties. For more information, see The wire listener configuration file on page 10.
How do I access the wire listener help?	You can view a list of available command line options by running the `-help` command.

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