Part VII: JSON compatibility

Tables of Contents

JSON compatibility

You can use the popular JSON-oriented query language created by MongoDB to interact with data stored in IBM® Informix®.

- External resources
- Main resource

External resources

- Getting Started with MongoDB (Documentation)
  This tutorial provides an introduction to basic database operations using MongoDB.
- MongoDB Manual (Documentation)
  Learn about the MongoDB NoSQL database and product features.
- IBM NoSQL (Blog)
  Learn about the latest IBM NoSQL hybrid solutions in this blog authored by John Miller.
- JSON quick reference (FAQ)
  The information in this quick reference lists commonly used JSON features supported by . This cheat sheet assumes that you are using the MongoDB shell. All MongoDB drivers are supported.
- IOD photo sharing demo created for IOD (Demo)
  A mobile photo application is shown which you can use to upload photos, tag photos, and view photos. The photos are stored in an Informix database by using JSON, SQL, and time series data.
- JSON tutorial from IOD in November 2013 (Video)
  Watch a recording of the JSON tutorial that was given at IOD in November 2013. Included are details about the creation of the photo sharing demo.
- JSON Chat with the Labs (Presentation)
  Learn about the Informix JSON implementation that includes information on the ability to store JSON and relational tables in the same storage engine and the ability to access both JSON collections and SQL data by using either a MongoDB API or a SQL API. Included are business use cases, implementation of a real big data mobile application, internals of IBM's implementation of JSON and best practices for enterprise development to exploit JSON and SQL in the application environment.
- Packing a One-Two Punch (IBM Data Magazine)
  Learn how IBM Informix incorporates a MongoDB data type to help simplify unstructured and structured data integration.
- NoSQL Deep Dive (Presentation)
  Take a detailed look at IBM Informix JSON compatibility with Keshava Murthy, IBM Informix Development Architect. Included are details about hybrid access, Informix support of MongoDB API and native JSON storage, flexible schema support, and sharding.

Main resource

- JSON Compatibility Guide
  Applications that use the popular JSON-oriented query language created by MongoDB can interact with data stored in IBM Informix. This information is intended for application programmers.

IBM Informix JSON compatibility

Applications that use the popular JSON-oriented query language created by MongoDB can interact with data stored in IBM® Informix®.

This information is intended for application programmers.

These topics are taken from *IBM Informix JSON Compatibility Guide*.

- About the JSON compatibility
  You can combine relational and JSON data into a single query by using the JSON compatibility features.

- JSON data sharding
  You can shard data with IBM Informix. 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 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.
- MongoDB API and commands
  The support for MongoDB application programming interfaces and commands are described here.
- REST API
  The REST API provides a method for accessing JSON collections in and provides driverless access to your data.
- MQTT protocol
  The MQTT protocol provides a method for loading JSON data in .
- 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.
- Troubleshooting JSON compatibility
  Several troubleshooting techniques, tools, and resources are available for resolving problems that you encounter with JSON compatibility.

About the JSON compatibility

You can combine relational and JSON data into a single query by using the JSON compatibility features.

Applications that use the JSON-oriented query language can interact with relational and non-relational data that is stored in databases by using the wire listener. The database server also provides built-in JSON and BSON (binary JSON) data types.

You have the following options for accessing relational tables, including time series tables and tables with WebSphere® MQ data, 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.

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.

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.

MQTT protocol
: You can insert JSON data into relational tables and JSON collections through the MQTT protocol for Java, JavaScript, C++, PHP, Python, Ruby, and other clients. You can use the MQTT protocol to load time series data from sensor devices.

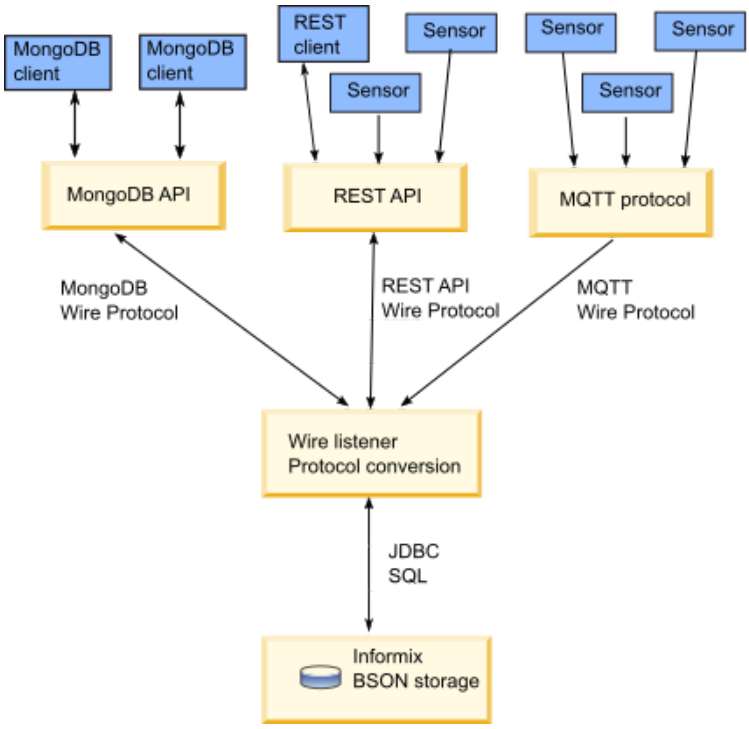
The JSON document format provides a way to transfer object information in a way that is language neutral, similar to XML. Language-neutral data transmission is a requirement for working in a web application environment, where data comes from various sources and software is written in various languages.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

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 the correct 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.

You can configure multiple wire listeners for multiple client protocols. The following illustration shows the architecture of the wire listeners and the database server.



- Getting started with Informix JSON
  You can begin using the Informix JSON features after installing Informix.
- Requirements for JSON compatibility
  JSON compatibility has specific software dependencies and database server requirements.
- MongoDB to term mapping
  The commonly used MongoDB terminology and concepts are mapped to the equivalent terminology and concepts.
- Support for dots in field names
  Unlike MongoDB, which does not allow dots, (.), in JSON or BSON field names, IBM Informix 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.
- Manipulate BSON data with SQL statements
  As an alternative to using the MongoDB API, you can use 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.

Getting started with Informix JSON

You can begin using the Informix® JSON features after installing Informix.

If you create the Informix server instance as a part of your installation, the wire listener is automatically started and connected to the MongoDB API and the database server with the default operational instance. You can use the MongoDB shell and any of the standard MongoDB command utilities and tools. To use the REST API or the MQTT protocol, you must modify the default configuration.

If you create the Informix server instance outside of the installation process, you must configure and start the wire listener manually.

Related concepts:
MongoDB API and commands
REST API
Related tasks:
Modifying the wire listener configuration file
Configuring the wire listener for the first time

Requirements for JSON compatibility

JSON compatibility has specific software dependencies and database server requirements.

Java requirements

JSON compatibility requires IBM® Informix® version 12.10.xC2 or later, with the J/Foundation component, which enables services that use Java™.

You must use a supported Java runtime environment. Java version 1.8 is recommended.

MongoDB version

JSON compatibility is based on MongoDB version 2.4, 2.6, and 3.0.

You set the version of the MongoDB API that the wire listener uses by setting the **mongo.api.version** parameter in the wire listener configuration file. The MongoDB API version affects the type of authentication that you can use. For example, MongoDB version 3.0 supports the MongoDB SCRAM-SHA-1 authentication method, but does not support database server authentication or connections with the REST API.

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. 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.

MongoDB to term mapping

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

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

Table 1. MongoDB concepts mapped to one or more concepts.

MongoDB concept	concept	Description
collection	table	This is the same concept. In this type of collection is sometimes referred to as a JSON collection. A JSON collection is similar to a relational database table, except it does not enforce a schema.
document	record	This is the same concept. In , this type of document is sometimes referred to as a JSON document.
field	column	This is the same concept.

MongoDB concept	concept	Description
master / slave	primary server / secondary server	This is the same concept. However, 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	This is the same concept. However, when the replica set is updated, it is then sent to all servers, not only to the primary server.
sharded cluster	shard cluster	This is the same concept. In , a shard cluster is a group of servers (sometimes called shard servers) that contain sharded data.
shard key	shard key	This is the same concept.

Support for dots in field names

Unlike MongoDB, which does not allow dots, (.), in JSON or BSON field names, IBM® Informix® 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 :

- 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. 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 . 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 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 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 Informix® Warehouse Accelerator. 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 and BSON_UPDATE functions manipulate 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 table that is named **people** is created with **names** and **ages** 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 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.
```

Related information:
BSON and JSON built-in opaque data types
BSON processing functions

Wire listener

The wire listener is a mid-tier gateway server that enables communication between MongoDB, REST API, and MQTT clients and the database server.

The wire listener is a Java™ application and is provided as an executable JAR file, $INFORMIXDIR/bin/jsonListener.jar, that is included with the database server. The JAR file provides access to the MongoDB API, the REST API, and the MQTT protocol.

MongoDB API access
: You can connect to a JSON collection with the MongoDB API by using the MongoDB Wire Protocol.
When a MongoDB client is connected to the wire listener and requests a connection to a database, the wire listener creates a connection.

REST API access
: You can connect to a JSON collection by using the REST API.
When a client is connected to the wire listener through the REST API, each database is registered. The wire listener registers to receive session events such as create or drop a database. If a REST request refers to a database that exists but is not registered, the database is registered and a redirect to the root of the database is returned.

MQTT protocol access
: You can connect to a JSON collection by using the MQTT protocol.
When an MQTT client publishes data to the wire listener, the wire listener creates a connection to the database for inserting the data.

The wire listener connection properties file, named jsonListener.properties by default, defines every operational characteristic.

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.

The default logging mechanism for the wire listener is Logback. Logback is pre-configured and installed along with the JSON components.

Related information:
SQL administration API portal: Arguments by privilege groups
Managing automatic location and fragmentation

Configuring the wire listener for the first time

You must configure the wire listener by specifying an authorized user and customizing the wire listener configuration file.

Before you begin

The wire listener JAR file is included in the database server installation at $INFORMIXDIR/bin/jsonListener.jar.

Procedure

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.
   - **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, grant the user REPLICATION privilege by running the **admin** or **task** SQL administration API command with the **grant admin** argument. For example:

```
EXECUTE FUNCTION task('grant admin','userID','replication');
```

3. Create a wire listener configuration file in $INFORMIXDIR/etc with the .properties file extension. You can use the $INFORMIXDIR/etc/jsonListener-example.properties file as a template. For more information, see The wire listener configuration file.
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. All other parameters are optional.
   Tip: Review the defaults for the following parameters and verify that they are appropriate for your environment: mongo.api.verion,authentication.enable, listener.type, listener.port, and listener.hostName.
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 Informix® 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. For example: `lo_informix1210`.
   b. Add an entry to the sqlhosts file for the database server alias to the loopback address `127.0.0.1`. For example:

```
ol_informix1210 onsoctcp 127.0.0.1 9090
```

   c. In the wire listener configuration file, update the url entry with the wire listener alias. For example:

```
url=jdbc:informix-sqli://localhost:9090/sysmaster:
INFORMIXSERVER=ol_informix1210;
```

What to do next

Start the wire listener.

Related concepts:
JSON data sharding
Related tasks:
Running SQL commands by using the MongoDB API
Related information:
CREATE USER statement (UNIX, Linux)
grant admin argument: Grant privileges to run SQL administration API commands
What is JDBC?

The wire listener configuration file

The settings that control the wire listener and the connection between the client and database server are set in the wire listener configuration file.

The default name for the configuration file is $INFORMIXDIR/etc/jsonListener.properties. You can rename this file, but the suffix must be .properties.

If you create a server instance during the installation process, a configuration file that is named jsonListener.properties is automatically created with default properties, otherwise you must manually create the configuration file. You can use the $INFORMIXDIR/etc/jsonListener-example.properties file as a template.

In the configuration file that is created during installation, and in the template file, all of the parameters are commented out by default. To enable a parameter, you must uncomment the row and customize the parameter.

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

- Required
  - url
- Setup and configuration
  - documentIdAlgorithm
  - include
  - listener.onException
  - listener.hostName
  - listener.port
  - listener.timezone
  - listener.type
  - response.documents.count.default
  - response.documents.count.maximum
  - response.documents.size.maximum
  - sharding.enable
  - sharding.parallel.query.enable
- Command and operation configuration
  - collection.informix.options
  - command.listDatabases.sizeStrategy
  - update.client.strategy
  - update.mode
- Database resource management
  - database.buffer.enable
  - database.create.enable
  - database.dbspace
  - database.locale.default
  - database.log.enable
  - database.onException.errorCodes
  - dbspace.strategy
  - fragment.count
  - jdbc.afterNewConnectionCreation
- MongoDB compatibility
  - compatible.maxBsonObjectSize.enable
  - mongo.api.version
  - update.one.enable
- Performance
  - delete.preparedStatement.cache.enable
  - insert.batch.enable
  - insert.batch.queue.enable
  - insert.batch.queue.flush.interval
  - index.cache.enable
  - index.cache.update.interval
  - insert.preparedStatement.cache.enable
  - preparedStatement.cache.enable
  - preparedStatement.cache.size
- Security
  - authentication.enable
  - authentication.localhost.bypass.enable
  - command.blacklist
  - db.authentication
  - listener.admin.ipAddress
  - listener.authentication.timeout
  - listener.http.accessControlAllowCredentials
  - listener.http.accessControlAllowHeaders
  - listener.http.accessControlAllowMethods
  - listener.http.accessControlAllowOrigin
  - listener.http.accessControlExposeHeaders
  - listener.http.accessControlMaxAge
  - listener.http.headers
  - listener.http.headers.size.maximum
  - listener.rest.cookie.domain
  - listener.rest.cookie.httpOnly

    - listener.rest.cookie.length
    - listener.rest.cookie.name
    - listener.rest.cookie.path
    - listener.rest.cookie.secure
    - listener.ssl.algorithm
    - listener.ssl.ciphers
    - listener.ssl.enable
    - listener.ssl.key.alias
    - listener.ssl.key.password
    - listener.ssl.keyStore.file
    - listener.ssl.keyStore.password
    - listener.ssl.keyStore.type
    - listener.ssl.protocol
    - security.sql.passthrough
- Wire listener resource management
    - cursor.idle.timeout
    - listener.connectionPool.closeDelay.time
    - listener.connectionPool.closeDelay.timeUnit
    - listener.idle.timeout
    - listener.idle.timeout.minimum
    - listener.input.buffer.size
    - listener.memoryMonitor.enable
    - listener.memoryMonitor.allPoint
    - listener.memoryMonitor.diagnosticPoint
    - listener.memoryMonitor.zeroPoint
    - listener.output.buffer.size
    - listener.pool.admin.enable
    - listener.pool.keepAliveTime
    - listener.pool.queue.size
    - listener.pool.size.core
    - listener.pool.size.maximum
    - listener.socket.accept.timeout
    - listener.socket.read.timeout
    - pool.connections.maximum
    - pool.idle.timeout
    - pool.idle.timeunit
    - pool.lenient.return.enable
    - pool.lenient.dispose.enable
    - pool.semaphore.timeout
    - pool.semaphore.timeunit
    - pool.service.interval
    - pool.service.threads
    - pool.service.timeunit
    - pool.size.initial
    - pool.size.minimum
    - pool.size.maximum
    - pool.type
    - pool.typeMap.strategy
    - response.documents.size.minimum
    - timeseries.loader.connections

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.

You can include additional JDBC properties in the url parameter such as INFORMIXCONTIME, INFORMIXCONRETRY, LOGINTIMEOUT, and IFX_SOC_TIMEOUT. For a list of Informix® environment variables that are supported by the JDBC driver, see Informix environment variables with the IBM Informix JDBC Driver.

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 database server. If you plan to use this connection to establish or modify collection shards by using the 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 **informix-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 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`.

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-1
: Indicates that the SHA-1 hashing algorithm is used to derive an identifier from the _id field.

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. For more information, see Running multiple wire listeners.

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.

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.

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.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.type
: This optional parameter specifies the type of wire listener to start.

mongo
: Connect the wire listener to the MongoDB API. This is the default value.

rest
: Connect the wire listener to the REST API.

mqtt
: Connect the wire listener to the MQTT protocol.

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

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.

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

  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**.

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

  true
  : Enable parallel sharded queries.

Command and operation configuration

These parameters provide configuration options for JSON commands and operations.

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

  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 Informix 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.

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.

  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`.

  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.

true
: Enable buffered logging. This is the default value.

false
: Do not enable buffered logging.

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

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

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.

  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.

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

  For example, to accelerate queries run through the wire listener by using Informix Warehouse Accelerator:

  ```
  jdbc.afterNewConnectionCreation=["SET ENVIRONMENT USE_DWA 'ACCELERATE ON'"]
  ```

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, Informix supports a maximum document size of 2 GB.

  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.

  Note: 2.4 is the default value.
  Important: Do not set **mongo.api.version=3.0 or higher** if you want to use the REST API with MongoDB style authentication. See User authentication with the wire listener.

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.

  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.

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.

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.

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`.

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.

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`.

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

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.

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`.

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.

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 **admin** database, and the **admin** database contains no users, this optional parameter indicates whether to grant full administrative access.
The **admin** database is similar to the MongoDB admin database. The authentication.localhost.bypass.enable parameter is similar to the MongoDB enableLocalhostAuthBypass parameter.

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

false
: Do not grant full administrative access to the user.

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

db.authentication
: This optional parameter specifies the user authentication method. See User authentication with the wire listener.

mongodb-cr
: Authenticate through the wire listener with a MongoDB authentication method. The MongoDB authentication method depends on the setting of the **mongo.api.version** parameter. This is the default value when listener.type is set to "mongo".

informix-password
: Authenticate through the database server with the username and password provided by the client connection. Informix password authentication is only supported on the REST and MQTT listeners. It is not supported on Mongo listeners. This is the default value when listener.type is set to "rest" or "mqtt".

informix-mongodb-cr
: Authenticate through the database server with a pluggable authentication module.

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.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.http.accessControlAllowCredentials
: This optional parameter indicates whether to display the response to the request when the omit credentials flag is not set. When this parameter is part of the response to a preflight request, it indicates that the actual request can include user credentials.

true
: Display the response to the request. This is the default value.

false
: Do not display the response to the request.

listener.http.accessControlAllowHeaders
: This optional parameter, which is part of the response to a preflight request, specifies the header field names that are used during the actual request. You must specify the value by using a JSON array of strings. Each string in the array is the case-insensitive header field name. The default value is `listener.http.accessControlAllowHeaders=["accept","cursorId","content-type"]`.

For example, to allow the headers `foo` and `bar` in a request:

```
listener.http.accessControlAllowHeaders=["foo","bar"]
```

listener.http.accessControlAllowMethods

This optional parameter, which is part of the response to a preflight request, specifies the REST methods that are used during the actual request. You must specify the value by using a JSON array of strings. Each string in the array is the name of an HTTP method that is allowed. The default value is `listener.http.accessControlAllowMethods=["GET","PUT","POST","DELETE","OPTIONS"]`.

listener.http.accessControlAllowOrigin
: This optional parameter specifies which uniform resource identifiers (URI) are authorized to receive responses from the REST listener when processing cross-origin resource sharing (CORS) requests. You must specify the value by using a JSON array of strings, with a separate string in the array for each value for the HTTP Origin header in a request. The values that are specified in this parameter are validated to ensure that they are identical to the Origin header.
HTTP requests include an Origin header that specifies the URI that served the resource that processes the request. When a resource from a different origin is accessed, the resource is validated to determine whether sharing is allowed.
The default value, `listener.http.accessControlAllowOrigin={"$regex":".*"}`, means that any origin is allowed to perform a CORS request.

  Here are some usage examples:

  - Grant access to the localhost:

    ```
    listener.http.accessControlAllowOrigin="http://localhost"
    ```

  - Grant access to all hosts in the subnet 10.168.8.0/24. The first 3 segments are validated as 10, 168, and 8, and the fourth segment is validated as a value 1 - 255:

    ```
    listener.http.accessControlAllowOrigin={"$regex":"^http://10\\\\.168\\\\.8\\\\.([01]?\\\\
    d\\\\d?|2[0-4]\\\\d|25[0-5])$" }
    ```

  - Grant access to all hosts in the subnet 10.168.8.0/24. The first 3 segments are validated as 10, 168, and 8, and the fourth segment must contain one or more digits:

    ```
    listener.http.accessControlAllowOrigin={"$regex":
    "^http://10\\\\.168\\\\.8\\\\.\\\\d+$" }
    ```

listener.http.accessControlExposeHeaders
: This optional parameter specifies which headers of a CORS request to expose to the API. You must specify the value by using a JSON array of strings. Each string in the array is the case-insensitive name of a header to be exposed. The default value is `listener.http.accessControlExposeHeaders=["cursorId"]`.

  For example, to expose the headers `foo` and `bar` to a client:

  ```
  listener.http.accessControlExposeHeaders=["foo","bar"]
  ```

listener.http.accessControlMaxAge
: This optional parameter specifies the amount of time, in seconds, that the result of a preflight request is cached in a preflight result cache. A value of 0 indicates that the Access-Control-Max-Age header is not included in the response to a preflight request. A value greater than 0 indicates that the Access-Control-Max-Age header is included in the response to a preflight request.
The default value is `listener.http.accessControlMaxAge=0`.

listener.http.headers
: This optional parameter specifies the information to include in the HTTP headers of responses, as a JSON document. The default value is no additional information in the HTTP headers.

  For example, you set this parameter to the following value:

  ```
  listener.http.headers={ "Access-Control-Allow-Origin" : "http://192.168.0.1",
  "Access-Control-Allow-Credentials" : "true" }
  ```

Then the HTTP headers for all responses look like this:

```
Access-Control-Allow-Origin : http://192.168.0.1
Access-Control-Allow-Credentials : true
```

listener.http.headers.size.maximum
: This optional parameter specifies the maximum size of headers in incoming HTTP requests. The default is 8192 bytes.

listener.rest.cookie.domain
: This optional parameter specifies the name of the cookie that is created by the REST wire listener. If not specified, the domain is the default value as determined by the Apache Tomcat web server.

listener.rest.cookie.httpOnly
: This optional parameter indicates whether to set the HTTP-only flag.

  true
  : Set the HTTP-only flag. This flag helps to prevent cross-site scripting attacks. This is the default value.

  false
  : Do not set the HTTP-only flag.

listener.rest.cookie.length
: This optional parameter specifies the length, in bytes, of the cookie value that is created by the REST wire listener, before Base64 encoding. The default value is `listener.rest.cookie.length=64`.

listener.rest.cookie.name
: This optional parameter specifies the name of the cookie that is created by the REST wire listener to identify a session. The default value is `listener.rest.cookie.name=informixRestListener.sessionId`.

listener.rest.cookie.path
: This optional parameter specifies the path of the cookie that is created by the REST wire listener. The default value is `listener.rest.cookie.path=/`.

listener.rest.cookie.secure
: This optional parameter indicates whether the cookies that are created by the REST wire listener have the secure flag on. The secure flag prevents the cookies from being used over an unsecure connection.

  false
  : Turn off the secure flag. This is the default value.

  true
  : Turn on the secure flag.

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.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.

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.

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.

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.

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.

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.

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).

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.

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.

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.

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.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.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.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.

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.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.

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.

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.

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.

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.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.

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.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.

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.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.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.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.

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

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.timeunit
: Prerequisite: `pool.idle.timeout=`*`time`*
This optional parameter specifies the unit of time that is used to scale the pool.idle.timeout parameter.

  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.

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.

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.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.

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.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.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.

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

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

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

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.

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.

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

timeseries.loader.connections

This optional parameter specifies the number of connections between each time series table and the MQTT wire listener for loading time series data. The default value is 10 connections per table.

Related tasks:
Configuring database server authentication with PAM (UNIX, Linux)
Related reference:
Collection methods
REST API syntax

Modifying the wire listener configuration file

You can modify the wire listener connection properties that are set in the configuration file.

About this task

The wire listener configuration file, named %INFORMIXDIR%\etc\jsonListener.properties by default, controls the wire listener and the connection between the client and database server.

Procedure

To modify the wire listener configuration file:

1. Stop the wire listener.
2. Update the wire listener configuration file.
3. Start the wire listener.

Related tasks:
Stopping the wire listener
Related reference:
The wire listener configuration file

Wire listener command line options

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

Syntax

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

>--+- -start-+--------------------+-+----------------------+-+-------------------------+-+-->
   |         '- -logfile--log_file-' |             .-error-. | |         .-27017-------. | |
   |                                 '- -loglevel--+-warn--+-' '- -port--+-port_number-+-' |
   |                                               +-info--+                               |
   |                                               +-debug-+                               |
   |                                               '-trace-'                               |
   '- -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.
-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: If you have customized the Logback configuration or specified another logging framework, the settings for -loglevel and -logfile are ignored.
-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: If you have customized the Logback configuration or specified another logging framework, the settings for -loglevel and -logfile are ignored.
-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.

Examples

In this example, the wire listener is started and the log is specified as $INFORMIXDIR/jsonListener.log:

```
java -jar $INFORMIXDIR/bin/jsonListener.jar
-config $INFORMIXDIR/etc/jsonListener.properties
-logfile $INFORMIXDIR/jsonListener.log -start
```

In this example, the wire listener is started with the log level set to debug:

```
java -jar $INFORMIXDIR/bin/jsonListener.jar
-config $INFORMIXDIR/etc/jsonListener.properties
-loglevel debug -start
```

In this example, port 6388 is specified:

```
java -jar $INFORMIXDIR/bin/jsonListener.jar
-config $INFORMIXDIR/etc/jsonListener.properties
-port 6388 -start
```

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

```
java -jar $INFORMIXDIR/bin/jsonListener.jar
-config $INFORMIXDIR/etc/jsonListener.properties
-wait 10 -stop
```

In this example, the wire listener version is printed:

```
java -jar $INFORMIXDIR/bin/jsonListener.jar
-version
```

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

```
java -jar $INFORMIXDIR/bin/jsonListener.jar
-buildInformation
```

Related reference:
Wire listener logging

Starting the wire listener

You can start the wire listener for the MongoDB API, the REST API, or the MQTT protocol, by using the **start** command.

Before you begin

- Stop all wire listeners that are currently running. If you create a server instance during the installation process, the MongoDB API wire listener is started automatically and connected to the MongoDB API.
- 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
- Requirements for JSON compatibility

Procedure

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

```
java -jar $INFORMIXDIR/bin/jsonListener.jar
-config $INFORMIXDIR/etc/jsonListener.properties -start
```

The `listener.type` property in the configuration file that you specify defines whether to start the wire listener for the MongoDB API, the REST API, or the MQTT protocol.

Results

The wire listener starts.

Examples

In the following example, the wire listener is started with the configuration file specified as jsonListener_mongo.properties, the log file specified as jsonListener_mongo.log, and the log level specified as **info**:

```
java -jar $INFORMIXDIR/bin/jsonListener.jar
-config $INFORMIXDIR/etc/jsonListener_mongo.properties
-logfile $INFORMIXDIR/jsonListener_mongo.log
-loglevel info -start
```

Here is the output from starting the wire listener:

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

In the following example, the wire listener is started with the configuration file specified as jsonListener_rest.properties:

```
java -jar $INFORMIXDIR/bin/jsonListener.jar
-config $INFORMIXDIR/etc/jsonListener_rest.properties -start
```

Here is the output from starting the REST API wire listener:

```
starting rest listener on port 27017
```

Related concepts:
REST API
Related tasks:
Running multiple wire listeners
Related reference:
Wire listener logging
Related information:
start json listener argument: Start the MongoDB API wire listener

Running multiple wire listeners

You can run multiple wire listeners.

About this task

By running multiple wire listeners, you can use a combination of the APIs that are supported by the wire listener: MongoDB, REST, and MQTT. Create a configuration file for each listener type that you want to run. For example, you can create a configuration file for the MongoDB API and a configuration file for the REST API or the MQTT protocol. You can start all wire listeners with the same **start** command by providing multiple **-config** arguments.

Procedure

1. Create the individual configuration files in the $INFORMIXDIR/etc directory. You can use the $INFORMIXDIR/etc/jsonListener-example.properties file as a template.
2. Customize each configuration file and assign a unique name.
   Important: The url parameter must be specified, either in each individual configuration file or in the file that is referenced by the include parameter.
   a. Specify the include parameter to reference an additional configuration file. The path can be relative or absolute. If you have multiple configuration files, you can avoid duplicating parameter settings in the multiple configuration files by specifying a subset of shared parameters in a single configuration file, and the unique parameters in the individual configuration files.
3. Start the wire listeners.

Example: Running multiple wire listeners that share parameter settings

In this example, the same url, authentication.enable, and security.sql.passthrough parameters are used to run two wire listeners:

1. Create a configuration file named shared.properties that includes the following parameters:

   ```
   url=jdbc:informix-sqli://localhost:9090/sysmaster:
   INFORMIXSERVER=ol_informix1210;
   authentication.enable=true
   security.sql.passthrough=true
   ```

2. Create a configuration file for use with the MongoDB API that is named mongo.properties, with the parameter `include=shared.properties` set:

   ```
   include=shared.properties
   listener.type=mongo
   listener.port=27017
   ```

3. Create a configuration file for use with the REST API that is named rest.properties, with the parameter `include=shared.properties` set:

```
include=shared.properties
listener.type=rest
listener.port=8080
```

4. From the command line, run the start command. Include separate `-config` arguments for each wire listener API type.

```
java -jar $INFORMIXDIR/bin/jsonListener.jar
-config json.properties
-config rest.properties -start
```

Related tasks:
Starting the wire listener
Related reference:
REST API syntax
Wire listener command line options

Stopping the wire listener

You can stop the wire listener by using the stop command.

About this task

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

Procedure

From the command line, run the stop command with the configuration file specified. For example:

```
java -jar $INFORMIXDIR/bin/jsonListener.jar -config
 $INFORMIXDIR/etc/jsonListener.properties -stop
```

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

Results

The wire listener is stopped.
Related information:
stop json listener: Stop the wire listener

Wire listener logging

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

The default logging mechanism for the wire listener is Logback. Logback is pre-configured and installed along with the JSON components. For more information on how to customize Logback, see http://logback.qos.ch/.

If you start the MongoDB API wire listener from the command line, you can specify the amount of detail, name, and location of your log file by using the -loglevel and -logfile command-line arguments.

Important: If you have customized the Logback configuration or specified another logging framework, the settings for -loglevel and -logfile are ignored.

Related tasks:

Starting the wire listener

Related reference:

Wire listener command line options

User authentication with the wire listener

You can authenticate users through the wire listener with MongoDB authentication or with the database server, through a pluggable authentication module (PAM).

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

MONGODB-CR challenge-response

The wire listener authenticates users with the MongoDB challenge-response authentication method outside of the database server environment. You create users with the MongoDB API create user commands. 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.

For MongoDB version 2.4, user information and privileges are stored in the **system_users** collection in each database.

For MongoDB version 2.6 and later, user information and privileges are stored in the **system.users** collection in the **admin** database. If you are upgrading your MongoDB version and you have existing users, you must upgrade your user schema.

SCRAM-SHA-1 two-step authentication

SCRAM-SHA-1 is only available when the mongo.api.version=3.0 parameter is set in the wire listener configuration file. The wire listener authenticates users with the SCRAM-SHA-1 authentication method outside of the 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.

Important: You cannot use SCRAM authentication with the REST API or the MQTT protocol.

Database server authentication with a user and password

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. The database server controls all user accounts and privileges. You can audit user activities and configure fine-grained access control.

Important: You can use database server user password authentication only with the REST API and MQTT protocol.

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.

Which types of authentication that you can use depend on the type of client and the version of MongoDB.

MongoDB clients

Table 1. Authentication types for the MongoDB API by version

Authentication type	MongoDB 2.4	MongoDB 2.6	MongoDB 3.0	Details
MONGODB-CR	Yes	Yes	No	Follow the instructions for configuring MongoDB authentication.

Authentication type	MongoDB 2.4	MongoDB 2.6	MongoDB 3.0	Details
SCRAM-SHA-1	No	No	Yes	The user schema must be at MongoDB version 2.6 or later.
Informix user password	No	No	No	Database server authentication with a user and password is not supported for MongoDB clients because of the way MongoDB drivers hash the password.
PAM	Yes	Yes	No	Follow the instructions for configuring database server authentication with PAM.

REST API clients

Important: You cannot set the mongo.api.version parameter to 3.0 in the wire listener configuration file because the REST API does not support SCRAM authentication.

Table 2. Authentication types for the REST API by supported MongoDB versions

Authentication type	MongoDB 2.4	MongoDB 2.6	MongoDB 3.0	Details
MONGODB-CR	Yes	Yes	No	Follow the instructions for configuring MongoDB authentication. HTTP clients authenticate using the HTTP basic authentication method.
SCRAM-SHA-1	No	No	No	SCRAM is not supported.
Informix user password	Yes	Yes	Yes	Set db.authentication=informix-password in your listener properties file. HTTP clients authenticate using the HTTP basic authentication method.
PAM	Yes	Yes	No	Follow the instructions for configuring database server authentication with PAM. HTTP clients authenticate using the HTTP basic authentication method.

MQTT clients

Important: You cannot set the mongo.api.version parameter to 3.0 in the wire listener configuration file because the MQTT protocol does not support SCRAM authentication.

Table 3. Authentication types for the MQTT protocol by supported MongoDB versions

Authentication type	MongoDB 2.4	MongoDB 2.6	MongoDB 3.0	Details
MONGODB-CR	Yes	Yes	Yes	Follow the instructions for configuring MongoDB authentication. The MQTT CONNECT packet must include the database name as a prefix of the user name, in the following format: "*database_name.user_name*".
SCRAM-SHA-1	No	No	No	SCRAM is not supported.
Informix user password	Yes	Yes	Yes	Set db.authentication=informix-password in your listener properties file. The MQTT CONNECT packet must include the database name as a prefix of the user name, in the following format: "database_name.user_name".

Authentication type	MongoDB 2.4	MongoDB 2.6	MongoDB 3.0	Details
PAM	Yes	Yes	No	Follow the instructions for configuring database server authentication with PAM. The MQTT CONNECT packet must include the database name as a prefix of the user name, in the following format: "*database_name.user_name*".

Configuring MongoDB authentication

You can configure the wire listener to use MongoDB authentication.

Before you begin

If you are upgrading your MongoDB version and you have existing MongoDB users, you must upgrade your user schema.

Procedure

To configure MongoDB 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-cr**.
   - Set the MongoDB version: Set **mongo.api.version** to the version that you want.
   - 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.
3. If necessary, upgrade your user schema by running the **authSchemaUpgrade** command in the **admin** database. For example:

   ```
   use admin
   db.runCommand({authSchemUpgrade : 1})
   ```

   The **authSchemaUpgrade** command upgrades the user schema to the MongoDB version that is specified by the **mongo.api.version** parameter.

Adding users

Procedure

To add authorized users:

1. Start the wire listener with authentication turned off: Set **authentication.enable=false** in the wire listener configuration file.
2. Add users:
   - For MongoDB version 2.4, run the **addUser** command for each user in each database.
   - For MongoDB version 2.6 and 3.0, run the **createUser** command for each user.
3. Turn on authentication: Set **authentication.enable=true** in the wire listener configuration file.
4. Restart the wire listener.

Related tasks:
Starting the wire listener
Stopping the wire listener
Related reference:

The wire listener configuration file

Configuring database server user password authentication

You can configure the database server to authenticate wire listener users based on the client user and password.

About this task

This is only supported for the REST and MQTT listener types. Mongo listeners do not support this type of authentication against the database server because of the way the Mongo client drivers hash the password before it is passed to the wire listener.

Procedure

To configure database server user password authentication:

1. Set the following parameters in the wire listener configuration file:
   - Enable authentication: Set authentication.enable=true.
   - Specify Informix password authentication: Set db.authentication=informix-password.
2. Restart the wire listener.
3. Configure REST and MQTT clients to connect to the wire listener with a username and password that has privileges on the database server.

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.

Procedure

To configure PAM authentication for MongoDB, REST, or MQTT clients:

1. Set the IFMXMONGOAUTH environment variable. 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 $INFORMIXDIR/lib/pam_mongo.so file=mongohash
   account required $INFORMIXDIR/lib/pam_mongo.so
   ```

   Replace *$INFORMIXDIR* with the value of the $INFORMIXDIR environment variable.

3. On IBM® AIX® 64-bit computers, create a symbolic link that is named 64 that points to the lib directory by running the following commands:

```
cd $INFORMIXDIR/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_informix1210 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. For example, on a typical Linux system, the user **nobody** is appropriate. Add the following line to the /etc/informix/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**. 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:

   ```
   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=informix-mongodb-cr**.
    - Set the MongoDB version: Set **mongo.api.version=2.6** or **mongo.api.version=2.4**. The PAM authentication method is not compatible with MongoDB version 3.0.
    - 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:informix-sqli://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.

Related reference:
The wire listener configuration file
Related information:
sqlhosts file and SQLHOSTS registry key options
IFMXMONGOAUTH environment variable
Pluggable authentication modules (UNIX or Linux)
CREATE USER statement (UNIX, Linux)
USERMAPPING configuration parameter (UNIX, Linux)
Internal users (UNIX, Linux)

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.

Related information:
Secure sockets layer protocol

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.

About this task

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

Procedure

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.

Procedure

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 IBM® Global Security Kit (GSKit), OpenSSL, or the Java keytool tool.
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. For REST listeners (listener.type=rest), if you are using Java 8, you will need to include the Jetty ALPN boot jar file in the -Xbootclasspath JVM argument when starting the listener. See https://www.eclipse.org/jetty/documentation/9.4.x/alpn-chapter.html for more information.
   Note: If you are running the REST listener with Java 9 or higher, ALPN is built into the JRE, so this step is not required.
4. 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 to client applications, use the appropriate method:

- For REST clients, you can use a reverse proxy for multiple wire listeners.
- For MongoDB clients, use a high-availability cluster configuration for your Informix® 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 Informix 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 Informix JDBC Driver methods of connecting to a high-availability cluster. For more information, see Dynamically reading the Informix sqlhosts file or Properties for connecting directly to an HDR pair of servers.

JSON data sharding

You can shard data with IBM® Informix®. 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 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 database servers is a special form of Enterprise Replication. You can create a shard cluster with Enterprise Replication commands or with MongoDB commands.

shard cluster architecture is very flexible:

- Shard servers can run on different hardware and operating systems.
- Shard servers can run different version of . For example, you can upgrade 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.
- Creating a shard cluster with MongoDB commands
  You create a shard cluster by adding shard servers with the The MongoDB **sh.addShard** shell command or the **db.runCommand** command with the **addShard** syntax.
- Shard-cluster definitions for distributing data
  A cluster of shard servers uses a definition to distribute data across shard servers.
- 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.

Related tasks:
Configuring the wire listener for the first time
Related information:
Shard cluster setup
Sharded queries

Preparing shard servers

You must prepare shard servers before you can shard data.

Procedure

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. If you created a database server instance during installation, the **ifxjson** user, who has the REPLICATION privilege, is automatically set as the value of the USER attribute. Otherwise, see Configuring the wire listener for the first time for instructions.
4. On each shard server, restart the wire listener.

What to do next

When applications 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;
```

Related information:
cdr add trustedhost argument: Add trusted hosts (SQL administration API)
cdr list trustedhost argument: List trusted hosts (SQL administration API)
Starting the wire listener
onmode -wf, -wm: Dynamically change certain configuration parameters
SHARD_ID configuration parameter
SHARD_MEM configuration parameter
USE_SHARDING session environment option

Creating a shard cluster with MongoDB commands

You create a shard cluster by adding shard servers with the The MongoDB **sh.addShard** shell 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.

Procedure

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 server that you want to add. The specified port must run the 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**.

Examples

Add a server to a shard cluster with addShard

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

```
> sh.addShard("myhost2.ibm.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.ibm.com** to a shard cluster.

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

Add multiple servers to a shard cluster

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

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

Related reference:
Database commands
Related information:
cdr define shardCollection
cdr add trustedhost argument: Add trusted hosts (SQL administration API)
cdr remove trustedhost argument: Remove trusted hosts (SQL administration API)
cdr list trustedhost argument: List trusted hosts (SQL administration API)

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 Informix® 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.
- 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.

Related information:
cdr change shardCollection
cdr delete shardCollection

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.

Procedure

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

1. Run the **mongo** command. The command starts the MongoDB shell.
2. Run the **shardCollection** command. There are two ways to run the command:
   - 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:

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:

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**.

Related reference:
Database commands
Related information:
cdr change shardCollection
cdr delete shardCollection

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.

Procedure

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

1. Run the **mongo** command. 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:

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.
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:

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**.

Related reference:
Database commands

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.
- 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.

Related tasks:
Preparing shard servers
Creating a shard cluster with MongoDB commands
Related information:
cdr list trustedhost argument: List trusted hosts (SQL administration API)
onstat -g shard command: Print information about the shard cache

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.

Procedure

To change the definition for a shard cluster:

1. Run the **mongo** command. 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.

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

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.

Procedure

1. Run the **mongo** command. The command starts the MongoDB shell.
2. Run the **listShards** command:

```
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

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
}
```

Related reference:
Database commands
Related information:
cdr list trustedhost argument: List trusted hosts (SQL administration API)
Installing the OpenAdmin Tool for Informix with the Client SDK
cdr list shardCollection
onstat -g shard command: Print information about the shard cache

MongoDB API and commands

The support for MongoDB application programming interfaces and commands are described here.

- Language drivers
  The wire listener parses messages that are based on the MongoDB Wire Protocol.
- Command utilities and tools
  You can use the MongoDB shell and any of the standard MongoDB command utilities and tools.
- Collection methods
  supports a subset of the MongoDB collection methods.
- Index creation
  supports the creation of indexes on collections and relational tables by using the MongoDB API and the wire listener.
- Database commands
  supports a subset of the MongoDB database commands.
- Informix JSON commands
  The JSON commands are available in addition to the supported MongoDB commands. These commands enable functionality that is supported by and they are run by using the MongoDB API.
- Running Informix 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.
- Operators
  The MongoDB operators that are supported by are sorted into logical areas.

Language drivers

The wire listener parses messages that are based on the MongoDB Wire Protocol.

You can use the MongoDB community drivers to store, update, and query JSON documents with as a 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.

You can use the MongoDB shell to run interactive queries and operations against Informix. You can use any version of the MongoDB shell that supports the **mongo.api.version** configured for the wire listener.

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

Collection methods

supports a subset of the MongoDB collection methods.

The collection methods are 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, *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 1. Supported collection methods

Collection method	JSON collections	Relational tables	Details
aggregate	No	No	
count	Yes	Yes	
createIndex	Yes	Yes	For more information, see Index creation.
dataSize	Yes	No	
distinct	Yes	Yes	
drop	Yes	Yes	
dropIndex	Yes	Yes	
dropIndexes	Yes	No	
ensureIndex	Yes	Yes	For more information, see Index creation.
find	Yes	Yes	You can use the $nativeCursor query modifier with the addSpecial function.
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	
indexStats	No	No	
insert	Yes	Yes	
isCapped	Yes	Yes	This command returns false because capped collections are not supported in .
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/.

Related tasks:

Running MongoDB operations on relational tables

Related reference:
The wire listener configuration file

Index creation

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
- Index creation for a specific data type by using the extended syntax
- Index creation for arrays using the Informix extended syntax
- Index creation for text, geospatial, and hashed

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 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 extended syntax

You can use the 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 createIndex or ensureIndex syntax.
The following data types are supported:

- $bigint
- $binary
- $boolean
- $date
- $double[2]
- $int[3]

- $integer[3]
- $lvarchar[1]
- $number[2]
- $string[1]
- $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 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]
- $int[2]
- $integer[2]
- $number[1]
- $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 syntax. For example, here is the MongoDB syntax:

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

The syntax provides additional support for the basic text search functionality. For more information, see createTextIndex.

Geospatial indexes
: 2dsphere indexes are supported 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

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
- Database operations

User commands

Aggregation commands

Table 1. Aggregation commands

MongoDB command	JSON collections	Relational tables	Details
aggregate	Yes	Yes	The wire listener supports version 2.4 of the MongoDB aggregate command, which returns a command result. For more information, see Aggregation framework operators.
count	Yes	Yes	
distinct	Yes	Yes	
group	No	No	
mapReduce	No	No	

Geospatial commands

Table 2. Geospatial commands

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

Query and write operation commands

Table 3. Query and write operation commands

MongoDB command	JSON collections	Relational tables	Details
delete	Yes	Yes	
eval	No	No	
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	
getPrevError	No	No	
insert	Yes	Yes	
resetError	No	No	
text	No	No	Text queries are supported by using the $text or $ifxtext query operators, not through the text command.

MongoDB command	JSON collections	Relational tables	Details
update	Yes	Yes	

Database operations

Authentication commands

Table 4. Authentication commands

Name	Supported	Details
authenticate	Yes	
authSchemaUpgrade	Yes	This command upgrades user data to MongoDB API version 2.6 or higher.
logout	Yes	
getnonce	Yes	

User management commands

Table 5. User management commands

Name	Supported	Details
createUser	Yes	Supported for MongoDB API version 2.6 or higher.
dropAllUsersFromDatabase	Yes	Supported for MongoDB API version 2.6 or higher.
dropUser	Yes	Supported for MongoDB API version 2.6 or higher.
grantRolesToUser	Yes	Supported for MongoDB API version 2.6 or higher.
revokeRolesFromUser	Yes	Supported for MongoDB API version 2.6 or higher.
updateUser	Yes	Supported for MongoDB API version 2.6 or higher.
usersInfo	Yes	Supported for MongoDB API version 2.6 or higher.

Role management commands

Table 6. Role management commands

Name	Supported	Details
createRole	Yes	Supported for MongoDB API version 2.6 or higher.
dropAllRolesFromDatabase	Yes	Supported for MongoDB API version 2.6 or higher.
dropRole	Yes	Supported for MongoDB API version 2.6 or higher.
grantPrivilegesToRole	Yes	Supported for MongoDB API version 2.6 or higher.
grantRolesToRole	Yes	Supported for MongoDB API version 2.6 or higher.
invalidateUserCache	No	
rolesInfo	Yes	Supported for MongoDB API version 2.6 or higher.
revokePrivilegesFromRole	Yes	Supported for MongoDB API version 2.6 or higher.
revokeRolesFromRole	Yes	Supported for MongoDB API version 2.6 or higher.
updateRole	Yes	Supported for MongoDB API version 2.6 or higher.

Diagnostic commands

Table 7. Diagnostic commands

Name	Supported	Details

Name	Supported	Details
buildInfo	Yes	Whenever possible, the output fields are identical to MongoDB. There are additional fields that are unique to .
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	
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 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. 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"})` 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:

Name	Supported	Details

		`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 8. 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	does not support the following flags: • capped • autoIndexID • size • max
createIndexes	Yes	Yes	
drop	Yes	Yes	does not lock the database to block concurrent activity.
dropDatabase	Yes	Yes	

Name	JSON collections	Relational tables	Details
dropIndexes	Yes	No	The MongoDB deleteIndexes command is equivalent.
filemd5	Yes	Yes	
fsync	No	No	
getParameter	No	No	
listCollections	Yes	Yes	The includeRelational and includeSystem flags are supported 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 , 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 9. Replication commands

Name	Supported
isMaster	Yes
replSetFreeze	No
replSetGetStatus	No
replSetInitiate	No
replSetMaintenance	No
replSetReconfig	No
replSetStepDown	No
replSetSyncFrom	No
Resync	No

Sharding commands

Table 10. Replication commands

Name	JSON collections	Relational tables	Details

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 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.
enableSharding	Yes	Yes	This action is not required for and therefore this command has no affect for .
flushRouterConfig	No	No	
isdbgrid	Yes	Yes	
listShards	Yes	Yes	The equivalent command is cdr list server.
movePrimary	No	No	
removeShard	No	No	
shardCollection	Yes	Yes	The equivalent command is cdr define shardCollection. The MongoDB unique and numInitialChunks options are not supported.
shardingState	No	No	
split	No	No	

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

Related tasks:
Defining a sharding schema with an expression
Viewing shard-cluster participants
Creating a shard cluster with MongoDB commands
Defining a sharding schema with a hash algorithm

Informix JSON commands

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

The syntax for using commands in the MongoDB shell is:

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

The *command_document* contains the command and any parameters.

- createTextIndex
- exportCollection
- importCollection
- killCursors
- lockAccounts
- runFunction
- runProcedure

- transaction
- unlockAccounts

createTextIndex

Create **bts** indexes.

Important: If you create text indexes by using the createTextIndex command, you must query them by using the $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.

Notes:

1. See bts access method syntax.

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
: 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"})
{
        "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"}})
{
        "ok":1,
        "n":1000,
        "millis":NumberLong(57),
        "rate":17543.859649122805
}
```

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.

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}}})
{"ok":1,"n":100,"millis":NumberLong(5),"rate":20000}
```

importCollection

Import JSON collections from the wire listener to a file.

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.

killCursors

Close native cursors that were created with the &nativeCursor query modifier in a REST API query.

killCursors
: This required parameter closes native cursors.

cursorIds
: This required parameter lists the native cursor IDs to close.

The following command closes the cursor with the ID of 22:

```
GET /dbname/$cmd?query={killCursors:1, cursorsIds:[22]}
```

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

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 Informix® Warehouse

Accelerator. 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
: 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 Informix 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.
- Running MongoDB operations on relational tables
  You can run MongoDB operations on relational tables by using the MongoDB API.
- 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.

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.

Procedure

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]})
```

Examples

Create an SQL table
: In this example, an SQL table is created by running the 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 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 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] })
```

Related tasks:
Configuring the wire listener for the first time
Related reference:
The wire listener configuration file

Running MongoDB operations on relational tables

You can run MongoDB operations on 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 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 server, but subsequent operations do not.

Procedure

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

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

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"}})
```

Related reference:
Collection methods

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.

Procedure

1. Create a join query document. The join query document has the following syntax:

$collections
: This required 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.

$condition
: This required 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. For example, in the MongoDB shell:

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

Results

The query results are returned.

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 are sorted into logical areas.

MongoDB read and write operations on existing relational tables are run as if the table were a collection. The wire listener determines whether the accessed entity is a relational table and converts the basic MongoDB operations 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 Informix® server. However, the wire listener caches the name and type of an entity so that subsequent operations do not require an extra call.

MongoDB operators are supported on both JSON collections and relational tables, unless explicitly stated otherwise.

- Query and projection operators
  supports a subset of the MongoDB query and projection operators.
- Update operators
  supports a subset the MongoDB update operators.
- query operators and modifier
  The query operators and modifier are extensions to the MongoDB API.
- Aggregation framework operators
  The MongoDB aggregation framework operators that are supported by are sorted into logical areas.

Query and projection operators

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
- Projection operators

Query selectors

Use query selectors to select specific data from queries.

Array query operators

Table 1. Array query operators

MongoDB command	JSON collections	Relational tables	Details
$elemMatch	Yes	No	
$size	Yes	No	

Comparison query operators

Table 2. Comparison query operators

MongoDB command	JSON collections	Relational tables	Details

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 3. Element query operators

MongoDB command	JSON collections	Relational tables	Details
$exists	Yes	No	
$type	Yes	No	

Evaluation

Table 4. 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 Informix JSON commands.
$where	No	No	

Geospatial query operators

Geospatial queries are supported by using the GeoJSON format. The legacy coordinate pairs are not supported.

Table 5. 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 6. 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 7. Projection operators

MongoDB command	JSON collections	Relational tables	Details
$	No	No	
$elemMatch	Yes	No	
$meta	Yes	Yes	
$slice	No	No	

Query modifiers

Table 8. 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

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 1. Array update operators

MongoDB command	JSON collections	Relational tables	Details
$	No	No	

MongoDB command	JSON collections	Relational tables	Details
$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 2. 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 3. Bitwise update operators

MongoDB command	JSON collections	Relational tables	Details
$bit	Yes	No	

Field update operators

Table 4. 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/.

query operators and modifier

The query operators and modifier are extensions to the MongoDB API.

Query operators

You can use the query operators in all MongoDB functions that accept query operators, for example find() or findOne().

$ifxtext

The $ifxtext 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 $ifxtext 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.
In the following example, a wildcard search is run for strings that contain `machine`:

```
db.collection.find( { "$like" : "%machine%" )
```

Query modifier

You can use the query modifier in the MongoDB find() function with the addSpecial function.

$nativeCursor

The $nativeCursor query modifier holds open a true cursor on the database server during a query. A native cursor requires more wire listener resources because connections and result set objects are tied to a single session, but the cursor guarantees consistent query results. You can control the cursor idle timeout with the cursor.idle.timeout wire listener property. For REST API queries, use the killCursors command to close the cursor.
In the following example, query results are returned in a cursor:
Note: For Mongo client applications, whether you are able to add Informix specific query or cursor modifiers is highly dependent on the Mongo driver you are using. Many of the latest Mongo driver do not support non-standard options in the addSpecial API.

```
db.collection.find().addSpecial("$nativeCursor",1);
```

Related information:
Basic Text Search query syntax

Aggregation framework operators

The MongoDB aggregation framework operators that are supported by 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
- Expression operators

Pipeline operators

Table 1. 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.
$limit	Yes	Yes	
$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.
$redact	No	No	
$skip	Yes	Yes	
$sort	Yes	Yes	
$unwind	Yes	No	

Expression operators

$group operators

Table 2. $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 JSON operator for aggregating time series data. For the syntax to aggregate time series data, see Aggregate or slice time series data.
$min	Yes	Yes	Yes	

Command	JSON collections	Relational tables	Time series tables	Details
$nth	No	No	Yes	An JSON operator for aggregating time series data. For the syntax to aggregate time series data, see Aggregate or slice time series data.
$push	Yes	No	No	
$sum	Yes	Yes	Yes	

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

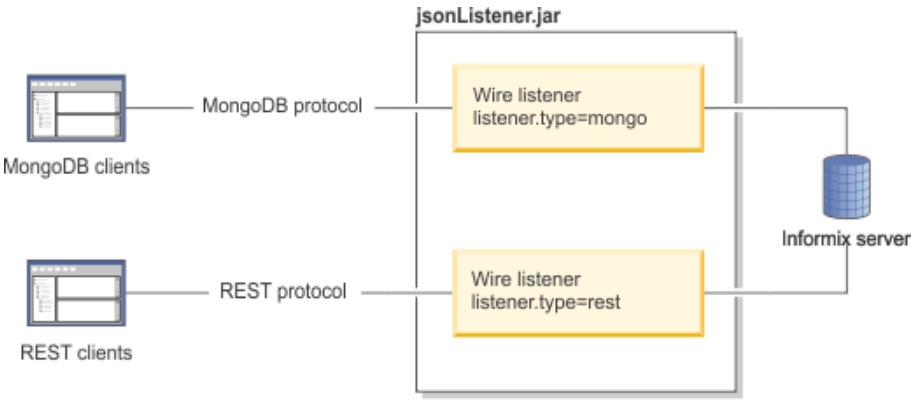
Related reference:
Aggregate or slice time series data

REST API

The REST API provides a method for accessing JSON collections in and provides driverless access to your data.

With the REST API, you can use MongoDB and SQL queries against JSON and BSON document collections, traditional relational tables, and time series data. The REST API uses MongoDB syntax and returns JSON documents.

To use the REST API, define the wire listener type to `rest` in the wire listener configuration file.



- REST API syntax
  A subset of the HTTP methods is supported by the REST API. These methods are DELETE, GET, POST, and PUT.
- Running SQL passthrough queries through REST
  You can run any SQL statement and retrieve results back using SQL passthrough queries with the REST listener.
- Running join queries through REST
  You can use the REST API to run join queries on JSON and relational data. This join syntax supports collection-to-collection joins, relational-to-relational joins, and collection-to-relational joins.

Related tasks:
Starting the wire listener

REST API syntax

A subset of the HTTP methods is supported by the REST API. These methods are DELETE, GET, POST, and PUT.

- POST
- PUT
- GET
- DELETE

The examples that are shown in this topic contain line breaks for page formatting; however, the REST API does not allow line breaks.

POST

The POST method maps to the MongoDB insert or create command.

Table 1. Supported POST method syntax

Method	Path	Description
POST	/	Create a database.
POST	/*databaseName*	Create a collection. *databaseName* The database name.
POST	/*databaseName*/*collectionName*	Create a document. *databaseName* The database name. *collectionName* The collection name.

Create a database
: This example creates a database with the locale specified.

  Request:
  : Specify the POST method:

    ```
    POST /
    ```

  Data:
  : Specify database name mydb and an English UTF-8 locale:

    ```
    {name:"mydb",locale:"en_us.utf8"}
    ```

  Response:
  : The following response indicates that the operation was successful:

    ```
    {"msg":"created db 'mydb'","ok":true}
    ```

Create a collection
: This example creates a collection in the mydb database.

  Request:
  : Specify the POST method and the database name as mydb:

    ```
    POST /mydb
    ```

  Data:
  : Specify the collection name as bar:

    ```
    {name:"bar"}
    ```

  Response:
  : The following response indicates that the operation was successful:

    ```
    {"msg":"created collection mydb.bar","ok":true}
    ```

Create a relational table

This example creates a relational table in an existing database.

Request:

Specify the POST method and stores_mydb as the database:

```
POST /stores_mydb
```

Data:

Specify the table attributes:

```
{ name: "rel",
  options: {
                columns:[{name:"id",type:"int",primaryKey:true,},
                         {name:"name",type:"varchar(255)"},
                         {name:"age",type:"int",notNull:false}]
  }
}
```

Response:

The following response indicates that the operation was successful:

```
{msg: "created collection stores_mydb.rel" ok: true}
```

Insert a single document

This example inserts a document into an existing collection.

Request:

Specify the POST method, mydb database, and people collection:

```
POST /mydb/people
```

Data:

Specify John Doe age 31:

```
{firstName:"John",lastName:"Doe",age:31}
```

Response:

Here is a successful response:

```
{"n":1,"ok":true}
```

Insert multiple documents into a collection

This example inserts multiple documents into a collection.

Request:

Specify the POST method, mydb database, and people collection:

```
POST /mydb/people
```

Data:

Specify John Doe age 31 and Jane Doe age 31:

```
[{firstName:"John",lastName:"Doe",age:31},
{firstName:"Jane",lastName:"Doe",age:31}]
```

Response:

Here is a successful response:

```
{"n":2,"ok":true}
```

PUT

The PUT method maps to the MongoDB update command.

Table 2. Supported PUT method syntax

Method	Path	Description

Method	Path	Description
PUT	*/databaseName/collectionName?queryParameters*	Update a document. *databaseName* The database name. *collectionName* The collection name. *queryParameters* The supported Informix® *queryParameters* are query and options. The parameter named query maps to the equivalent MongoDB query. The options parameter can contain {"upsert":true/false} or {"multiUpdate":true/false}.

Update a document in a collection

This example updates the value for Larry in an existing collection, from age 49 - 25:

```
[{"_id":{"$oid":"536d20f1559a60e677d7ed1b"},"firstName":"Larry"
,"lastName":"Doe","age":49},{"_id":{"$oid":"536d20f1559a60e677d7ed1c"}
,"firstName":"Bob","lastName":"Doe","age":47}]
```

Request:

Specify the PUT method and query the name Larry:

```
PUT /mydb/people?query={firstName:"Larry"}
```

Data:

Specify the MongoDB $set operator with age 25:

```
{"$set":{age:25}}
```

Response:

Here is a successful response:

```
{"n":1,"ok":true}
```

GET

The GET method maps to the MongoDB query command.

Table 3. Supported GET method syntax

Method	Path	Description
GET	*/*	List databases
GET	*/databaseName*	List collections *databaseName* The database name.

Method	Path	Description
GET	/*databaseName*/*collectionName*?*queryParameters*	Query the collection. *databaseName* The database name. *collectionName* The collection name. *queryParameters* The query parameters. The supported Informix *queryParameters* are batchSize, query, fields, and sort. These map to the equivalent MongoDB batchSize, query, fields, and sort parameters.
GET	/*databaseName*/system.sql?query={"$sql":"*sql_statement*"}	Run SQL passthrough query. Note: You must enable SQL operations by setting security.sql.passthrough=true in the wire listener properties file. *databaseName* The database name. *sql_statement* Any SQL query or statement.
GET	/*databaseName*/$cmd?query={*command_document*}	Run the Informix or MongoDB JSON command. *databaseName* The database name. *command_document* The Informix or MongoDB JSON command document. Specify the command document in the same format that is used by the **db.runCommand()** in the mongo shell.

List databases

This example lists all of the databases on the server.

Request:

Specify the GET method and forward slash (/):

```
GET /
```

Data:

None.

Response:

Here is a successful response:

```
[ "mydb" , "test" ]
```

List all collections

This example lists all of the collections in a database.

Request:

Specify the GET method and mydb database:

```
GET /mydb
```

Data:

None.

Response:

Here is a successful response:

```
["bar"]
```

Query a collection and sort the results in ascending order

This example sorts the query results in ascending order by age.

Request:

Specify the GET method, mydb database, people collection, and query with the sort parameter. The sort parameter specifies ascending order (age:1), and filters id (_id:0) and last name (lastName:0) from the response:

```
GET /mydb/people?sort={age:1}&fields={_id:0,lastName:0}
```

Data:

None.

Response:

The first names are displayed in ascending order with the _id and lastName filtered from the response:

```
[{"firstName":"Sherry","age":31},
{"firstName":"John","age":31},
{"firstName":"Bob","age":47},
{"firstName":"Larry","age":49}]
```

Run the collStats command to get statistics about a collection

This example submits the MongoDB collStats command by using the REST API to get statistics about the jsonlog collection.

Here is the MongoDB shell syntax:

```
db.runCommand({collStats:"jsonlog"})
```

Request:

Specify the GET method, mydb database, and the collStats command document as the query:

```
GET /mydb/$cmd?query={collStats:"jsonlog"}
```

Data:

None.

Response:

```
[
            {
                "ns":"mydb.jsonlog",
                "count":1000,
                "size":322065,
                "avgObjSize":322,
                "storageSize":323584,
                "numExtents":158,
                "nindexes":1,
                "lastExtentSize":2048,
                "paddingFactor":0,
                "flags":1,
                "indexSizes":
                {
                    "_id_":49152
                },
                "totalIndexSize":49152,
                "ok":1
            }
        ]
```

Run an SQL function

This example runs an SQL function that adds two values.

Here is the MongoDB shell syntax:

```
> db.runCommand({runFunction:"add_values", "arguments":[3,6]}
```

Request:

Specify the GET method, mydb database, the runFunction parameter with the function name, and the arguments parameter with the argument values as the query:

```
GET mydb/$cmd?query={"runFunction":"add_values","arguments":[3,6]}
```

Data:

None

Response:

```
[{"returnValue": 9,"ok":1.0}]
```

Query with a native cursor

Use the following format to return query results in a native cursor:

```
GET /dbname/collectionname?query={query_condition}&nativeCursor=1
```

After you obtain the results, run the killCursors command to close the cursor.

DELETE

The DELETE method maps to the MongoDB delete command.

Table 4. Supported DELETE method syntax

Method	Path	Description
DELETE	*/*	Delete all databases.
DELETE	*/databaseName*	Delete a database. *databaseName* The database name.
DELETE	*/databaseName/collectionName*	Delete a collection. *databaseName* The database name. *collectionName* The collection name.
DELETE	*/databaseName/collectionName?queryParameter*	Delete all documents that satisfy the query from a collection. *databaseName* The database name. *collectionName* The collection name. *queryParameters* The query parameters. The supported *queryParameter* is query. This map to the equivalent MongoDB query parameter.

Delete a database

This example deletes a database called mydb.

Request:

Specify the DELETE method and the mydb database:

```
DELETE /mydb
```

Data:

None.

Response:

Here is a successful response:

```
{msg: "dropped database", ns: "mydb", ok: true}
```

Delete a collection

This example deletes a collection from a database.

Request:

Specify the DELETE method, mydb database, and bar collection:

```
DELETE /mydb/bar
```

Data:

None.

Response:

Here is a successful response:

```
{"msg":"dropped collection", "ns":"mydb.bar", "ok":true}
```

Delete documents from a collection

This example deletes documents from a collection that contains the user "bob".

Request:

Specify the DELETE method, mydb database, people collection, and the query condition:

```
DELETE /mydb/people?query={user:"bob"}
```

Data:

None.

Response:

Here is a successful response where *n* indicates the number of documents deleted.

```
{"n":1,"ok":true}
```

Related concepts:
Manage time series through the wire listener
Related tasks:
Running multiple wire listeners
Related reference:
The wire listener configuration file

Running SQL passthrough queries through REST

You can run any SQL statement and retrieve results back using SQL passthrough queries with the REST listener.

Before you begin

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

Procedure

Use **GET** method and `system.sql` as the collection name and `$sql` as the query operator, followed by the SQL statement.

```
GET /databaseName/system.sql?query={"$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.

```
GET /databaseName/system.sql?query={"$sql": "sql_statement", "$bindings": [values]}
```

Examples

Create an table

```
GET /mydb/system.sql?query={"$sql": "create table foo (c1 int)"}
```

Run an SQL query

```
GET /mydb/system.sql?query={"$sql": "select count(*) as count from foo"}
```

Sample response:

```
[ { "count": 10 } ]
```

Delete rows based on a host variable

```
GET /mydb/system.sql?query={"$sql": "delete from foo where c1 < ?", "$bindings" : [100] })
```

Sample response:

```
[ { "n": 2 } ]
```

Running join queries through REST

You can use the REST API to run join queries on JSON and relational data. This join syntax supports collection-to-collection joins, relational-to-relational joins, and collection-to-relational joins.

About this task

Join queries in the REST listener are performed by running GET request against the **system.join** pseudo table with a join query document supplies in the **query** parameter.

- Join queries also support the sort, limit, skip, and explain query parameters.
- Fields that are specified in the sort clause must also be included in the projection clause.

Join queries are supported in sharded environments when parallel sharded queries are enabled.

Procedure

1. Create a join query document. The join query document has the following syntax:

   $collections
   : This required 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.

   $condition
   : This required 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 GET request against the pseudo table that is named **system.join** with the join query document specified as the query parameter named **query**. For example, `GET /mydb/system.join?query={join_query_document}`

Example 1

This example retrieves the 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 would be used if the customers and orders tables are collections, relational tables, or a combination of the two.

```
GET /mystore/system.join?query=
{"$collections":
        {
             "customers":
                 {"$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"}
}
```

Example 2

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.

```
GET /stores_demo/system.join?query=
{"$collections":
         {
              "orders":
                   {"$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"]}
}
}
```

Example 3

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

```
GET /stores_demo/system.join?query=
{"$collections":
        {
             "orders":
                  {"$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",
        }
}
```

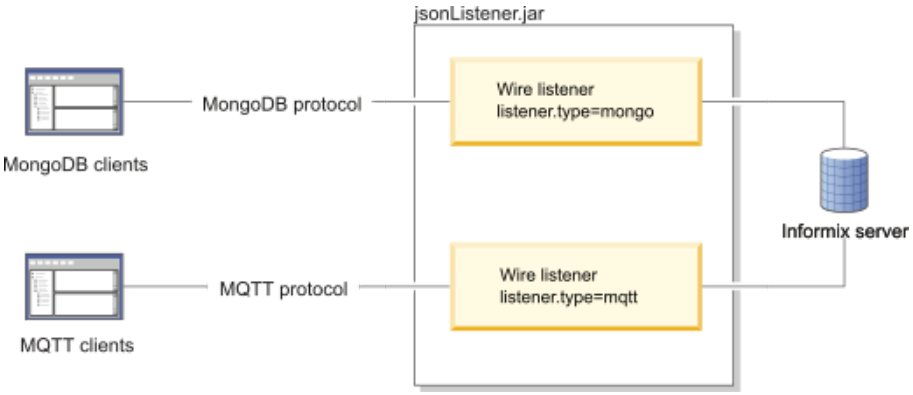

MQTT protocol

The MQTT protocol provides a method for loading JSON data in .

The MQTT protocol is a light-weight messaging protocol that you can use to load data from devices or sensors. For example, you can use the MQTT protocol to publish data from sensors into a time series table.

When you define the wire listener type as `mqtt`, you can insert JSON documents to the database by sending PUBLISH packets. The MQTT wire listener does not support querying data with SUBSCRIBE packets.

The jsonListener.jar file is the executable file that includes the wire listener configuration file, named jsonListener.properties by default, which defines the operational characteristics for theMongoDB API and the MQTT protocol.



- MQTT packet syntax
  You can run MQTT packets through the MQTT wire listener.

MQTT packet syntax

You can run MQTT packets through the MQTT wire listener.

The SUBSCRIBE packet and its associated packets are not supported by the wire listener. MQTT clients can use the standard syntax for other MQTT packets, except for the CONNECT and PUBLISH packets, which have requirements specific to the MQTT wire listener.

For full syntax of MQTT packets, see http://mqtt.org.

CONNECT

You must include a CONNECT packet to identify the client user.

If authentication is enabled in the MQTT wire listener with the `authentication.enable=true` setting, you must specify a user name and password. The user name must include the database name with the following format: *`database_name.user_name`*. The following example connects to the database **mydb** as user **joe** with the password `pass4joe`:

```
CONNECT(mydb.joe, pass4joe)
```

The password is not encrypted by default. You can encrypt connections by configuring Secure Sockets Layer or Transport Layer Security encryption in the wire listener configuration file.

PUBLISH

The PUBLISH packet maps to the MongoDB insert or create command. The syntax of the PUBLISH packet without optional arguments is: `PUBLISH(`*`topicName, message`*`)`. The *topicName* specifies the database and table name and the *message* contains the content to publish.

When you run the PUBLISH packet through the MQTT wire listener, the mandatory arguments have the following requirements:

- The *topicName* field must identify the target database and table in the following format: *database_name.table_name*.
- The *message* field must be in JSON format. If you are inserting data into a relational table, the field names in the JSON documents must correspond to column names in the target table. If you are inserting into a time series table specifying the timestamp field as a string in the JSON, you must specify the timestamp in ISO 8601 format. For example, { "id": "sensor1234", "tstamp": "2017-09-01T09:05:00", "reading": 87.5}

The following example inserts a JSON document into the **sensordata** table in the **mydb** database:

```
PUBLISH(mydb/sensordata, { "id": "sensor1234", "reading": 87.5})
```

Related tasks:
Loading time series data with the MQTT protocol

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 or the REST API. For example, you can program sensor devices that do not have client drivers to load time series data directly into the database with HTTP commands from the REST API. Because you act on a virtual table, the **TimeSeries** row type does not need to contain a BSON column.

You can load time series data through the MQTT protocol if your time series data is stored in a BSON column in the **TimeSeries** row type.

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 REST API or the MongoDB API through the wire listener. You create time series objects by adding definitions to time series collections.
- 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 or the REST API.
- 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.
- Loading time series data with the MQTT protocol
  You can load JSON documents into time series through the MQTT wire listener. The MQTT wire listener publishes data directly to the time series base table by internally running time series loader routines.

Related reference:
REST API syntax

Creating a time series through the wire listener

You can create time series with the REST API or 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 Informix® TimeSeries solution.

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 the wire listener for the MongoDB API or the REST API. For more information, see Configuring the wire listener for the first time.
- Configure storage spaces for your time series data.

Procedure

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. Load time series data. You can use the REST API or the MongoDB API to load time series data through a virtual table. You can use the MQTT protocol to load time series data into the time series base table.

What to do next

After you create and load a time series, you query the data though the virtual table with MongoDB and REST clients.

- Time series collections and table formats
  You can add, view, and remove documents from the time series collections with REST API and 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.
- 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 or the REST API through the wire listener.

Time series collections and table formats

You can add, view, and remove documents from the time series collections with REST API and 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 REST API, use the GET, POST, and DELETE methods to view, insert, or delete data in the time series collections.

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
- system.timeseries.rowType collection
- system.timeseries.container collection
- Time series table format
- Virtual table format

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. For a list of predefined calendars, see Predefined calendars.

Use the following format to add a calendar to the `system.timeseries.calendar` collection.

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.

Use the following format to add a **TimeSeries** row type to the `system.timeseries.rowType` collection.

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. Rolling window container syntax is not supported.

Use the following format to add a container to the `system.timeseries.container` collection.

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.

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
: 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
: 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.

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 or the REST 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 or the REST API. For more information, see Configuring the wire listener for the first time.
- Define a dbspace that is named **dbspace1**. For more information, see Dbspaces.

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 1. 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: • 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

Time series property	Definition
How to access the data	Through a virtual table

Procedure

To create a time series with the MongoDB API mongo shell or the REST API:

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"}]}})
   ```

   REST API

   Request:

   Specify the POST method and the **system.timeseries.calendar** collection:

   ```
   POST /stores_demo/system.timeseries.calendar
   ```

   Data:

   Specify the calendar attributes:

   ```
   {"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}]}}
   ```

   Response:

   The following response indicates that the operation was successful:

   ```
   [{"ok":true}]
   ```

2. Create a **TimeSeries** row type. The row type is named **reading** and includes fields for timestamp, temperature, and humidity.

   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"}]})
   ```

   REST API

   Request:

   Specify the POST method and the **system.timeseries.rowType** collection:

   ```
   POST /stores_demo/system.timeseries.rowType
   ```

   Data:

   Specify the row type attributes:

   ```
   {"name":"reading",
   "fields":[{"name":"tstamp","type":"datetime year to fraction(5)"},
   ```

```
        {"name":"temp","type":"float"},
        {"name":"hum","type":"float"}]}
```

Response:

The following response indicates that the operation was successful:

```
[{"ok":true}]
```

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**.

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})
```

REST API

Request:

Specify the POST method and the **system.timeseries.container** collection:

```
POST /stores_demo/system.timeseries.container
```

Data:

Specify the container attributes:

```
{"name":"c_0",
 "dbspaceName":"dbspace1",
 "rowTypeName":"reading",
 "firstExtent":1000,
 "nextExtent":500}
```

Response:

The following response indicates that the operation was successful:

```
[{"ok":true}]
```

4. Create a time series table. The time series table is named **ts_data1** and includes **id** and **ts** columns.

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)"}]})
```

REST API

Request:

Specify the GET method:

```
GET /stores_demo/$cmd?query={create:"ts_data1",
                "columns":
[{"name":"id","type":"int","primaryKey":true,"notNull":true},
          {"name":"ts","type":"timeseries(reading)"}]}
```

Data:

None.

Response:

The following response indicates that the operation was successful:

```
[{"ok":true}]
```

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).

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"}})
```

REST API

Request:

Specify the GET method:

```
GET /stores_demo/$cmd?query={"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"}}
```

Data:

None.

Response:

The following response indicates that the operation was successful:

```
[{"ok":true}]
```

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}])
```

REST API

Request:

Specify the POST method:

```
POST /stores_demo/ts_data1_v
```

Data:

Specify the documents to load:

```
[{"id":1,"temp":15.0,"hum":20.0},
{"id":1,"temp":16.2,"hum":19.0},
{"id":1,"temp":16.5,"hum":22.0}]
```

Response:

The following response indicates that the operation was successful:

```
{"ok":true}
```

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}
```

REST API

Request:

```
GET /stores_demo/ts_data1_v
```

Data:

None.

Response:

The following response indicates that the operation was successful:

```
[{"id":1,"tstamp":{"$date":1388556000000},"temp":15.0,"hum":20.0},
 {"id":1,"tstamp":{"$date":1388556600000},"temp":16.2,"hum":19.0},
 {"id":1,"tstamp":{"$date":1388557200000},"temp":16.5,"hum":22.0}]
```


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 or the REST API.

Before using these examples, you must configure the wire listener for the MongoDB or REST API. For more information, see Configuring the wire listener for the first time. These examples are run against the **stores_demo** database. For more information, see dbaccessdemo command: Create demonstration databases. These examples query the **ts_data_v virtual** table that stores the device ID in the **loc_esi_id** column.

- List all device IDs
- List device IDs that have a value greater than 10
- Find the data for a specific device ID
- Find and sort data with multiple qualifications
- Find all data for a device in a specific date range
- Find the latest data point for a specific device
- Find the 100th data point for a specific device

For examples of aggregating or slicing time series data, see Aggregate or slice time series data.

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",...]
```

REST API

Request:

Specify the GET method on the stores_demo database with the query parameter specified:

```
GET /stores_demo/$cmd?query={"distinct":"ts_data_v",
"key":"loc_esi_id"}
```

Data:

None.

Response:

The following response indicates that the operation was successful:

```
[{"values":["4727354321000111","4727354321046021",
"4727354321090954",...],"ok":1.0}]
```

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",...]
```

REST API

Request:

Specify the GET method with the query condition on the ts_data_v table and the $gt value comparison operator specified:

```
GET /stores_demo/$cmd?query={"distinct":"ts_data_v",
"key":"loc_esi_id","query":{"value":{"$gt":10}}}
```

Data:

None.

Response:

The following response indicates that the operation was successful:

```
[{"values":["4727354321046021","4727354321132574",
"4727354321289322",...],"ok":1.0}]
```

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}
...]
```

REST API

Request:

Specify the GET method on the ts_data_v virtual table, with the loc_esi_id specified on the query operator:

```
GET /stores_demo/ts_data_v?query=
{"loc_esi_id":4727354321046021}
```

Data:

None.

Response:

The following response indicates that the operation was successful:

```
[{"loc_esi_id":"4727354321046021","measure_unit":"KWH",
"direction":"P","tstamp":{"$date":1289368800000},"value":0.041},
 {"loc_esi_id":"4727354321046021","measure_unit":"KWH",
"direction":"P","tstamp":{"$date":1289369700000},"value":0.041},
 {"loc_esi_id":"4727354321046021","measure_unit":"KWH",
"direction":"P","tstamp":{"$date":1289370600000},"value":0.040},
 ...]
```

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.

To query for specific dates when using the REST API, convert the dates to milliseconds since the epoch. For example:

- 2011-01-01 00:00:00 = 1293861600000
- 2011-01-02 00:00:00 = 1293948000000

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}
        ...
```

REST API

Request:

Specify the GET method on the ts_data_v table, with the $and boolean logical operator specified:

```
GET /stores_demo/ts_data_v?query={"$and":[{"loc_esi_id":
4727354321046021},{"value":{"$gt":10.0}},{"direction":"P"}]}
&fields={"tstamp":1,"value":1}&sort={"value":-1}
```

Data:

None.

Response:

The following response indicates that the operation was successful:

```
[{"tstamp":{"$date":1295972100000},"value":14.580},
 {"tstamp":{"$date":1296002700000},"value":12.948},
 {"tstamp":{"$date":1296009000000},"value":12.768},
 ...]
```

Find all data for a device in a specific date range

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 }
...]
```

REST API

Request:

Specify the GET method on the ts_data_v table in the stores_demo database, with values specified for the $and boolean logical query operator:

```
GET /stores_demo/ts_data_v?query={"$and":
[{"loc_esi_id":4727354321000111},{"tstamp":{"$gte":
{"$date":1293861600000}}},{"tstamp":{"$lt":
{"$date":1293948000000}}} ]}&fields={"tstamp":1,"value":1}
```

Data:

None.

Response:

The following response indicates that the operation was successful:

```
[{"tstamp":{"$date":1293840000000},"value":0.343},
 {"tstamp":{"$date":1293840900000},"value":0.349},
 {"tstamp":{"$date":1293841800000},"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 }
```

REST API

Request:

Specify the GET method on the ts_data_v table, with sort and limit values specified in the query parameter:

```
GET /stores_demo/ts_data_v?query={"loc_esi_id":4727354321000111}
&fields={"tstamp":1,"value":1}&sort={"tstamp":-1}&limit=1
```

Data:

None.

Response:

The following response indicates that the operation was successful:

```
[{"tstamp":{"$date":1297143900000},"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}
```

REST API

Request:

Specify the GET method on the ts_data_v table, with values specified for sort, limit, and skip in the query parameter:

```
GET /stores_demo/ts_data_v?query={"loc_esi_id":4727354321000111}
&fields={"tstamp":1,"value":1}&sort={"tstamp":1}&limit=1&skip=100
```

Data:

None.

Response:

The following response indicates that the operation was successful:

```
[{"tstamp":{"$date":1289458800000},"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.

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.

$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
: 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.

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
}
```

Related reference:
Aggregation framework operators
Related information:
CalendarTable table
AggregateBy function
Clip function
ClipCount function

Loading time series data with the MQTT protocol

You can load JSON documents into time series through the MQTT wire listener. The MQTT wire listener publishes data directly to the time series base table by internally running time series loader routines.

Before you begin

You cannot create a time series through the MQTT wire listener. Create a JSON time series with the REST API, the MongoDB API, or SQL statements.
For instructions on creating a JSON time series with SQL statements, see Example for JSON data: Create and load a time series with JSON documents.

Procedure

To load JSON data through the MQTT wire listener:

1. Set the following parameters in the wire listener configuration file:
   - Set the wire listener type to MQTT: listener.type=mqtt
   - Optional. Set the number of connections between the wire listener and each time series table: Set timeseries.loader.connections to the number of connections that you want.
2. Restart the wire listener.
3. From the MQTT clients, load the data into the time series table by publishing data as JSON documents.
   - For BSON timeseries tables, i.e. tables where the timeseries row type contains only a timestamp plus one BSON column, the *message* argument of the PUBLISH packet must contain the following fields within the JSON documents:
     - One or more fields that identifies the primary key of the time series table. The field names must be the same as the primary key column names in the time series table.
     - A field that identifies the time stamp. The field name must be the same as the time stamp column in the **TimeSeries** row type.
     - One or more fields to insert into the BSON column in the **TimeSeries** row type. All fields that are not identified as a primary key column or the time stamp field are inserted into the BSON column.

     For example"

     ```
     { "pkey": value, "tstamp": value, "field1": value, "field2": value, ...}
     ```

     where "pkey" is the name of the primary key column, "tstamp" is the name of the timestamp column, and "field1", "field2", etc. are whatever fields you want in the BSON column of the timeseries.
     Note: For BSON timeseries tables, you do not use the BSON column name from the row type. The timeseries loader will extract the primary key field(s) and timestamp fields; all other fields will be inserted into the BSON column of the row type.
   - For non-BSON timeseries tables, the *message* argument of the PUBLISH packet must contain the following fields within the JSON documents:
     - One or more fields that identify the primary key of the time series table. The field names must be the same as the primary key column names in the time series table.
     - A field that identifies the time stamp. The field name must be the same as the time stamp column in the **TimeSeries** row type.
     - One or more fields that match the names of the other columns in the **TimeSeries** row type.

     For example"

     ```
     { "pkey": value, "tstamp": value, "rowtypeField1": value, "rowTypeField2": value,
     ...}
     ```

     where the fields in addition to primary key and timestamp match the column name in the timeseries row type.

     If the timeseries row type has an integer column (named "intData") and a BSON column (named "bsonData"), the data will take the following format:

     ```
     { "pkey": value, "tstamp": value, "intData": 10, "bsonData":
       { "value1": 1.234, "label": "any fields can go here within the bsonData
     document..."}}
     ```

Example 1

The following example creates a BSON **TimeSeries** row type, a time series table, a time series container, and a time series instance:

```
CREATE ROW TYPE ts_data_j2(
      tstamp       datetime year to fraction(5),
      tsdata       BSON);

CREATE TABLE IF NOT EXISTS tstable_j2(
   id  VARCHAR(50) NOT NULL PRIMARY KEY,
   ts  timeseries(ts_data_j2)
) LOCK MODE ROW;

EXECUTE PROCEDURE
   TSContainerCreate('container_j', 'dbspace1', 'ts_data_j2', 512, 512);

INSERT INTO tstable_j2 VALUES(1, 'origin(2014-01-01 00:00:00.00000),
                              calendar(ts_15min), container(container_j),
                              regular, threshold(0), []');
```

For this example, the *message* argument has and **id** field for the primary key, a **tstamp** field for the time stamp, and two fields for the BSON column:

```
{"id": "value", "tstamp": "time_stamp", "reading": number, "sensor_type": "string"}
```

The following sample Java code connects a client to the MQTT wire listener, loads a sensor reading, and disconnects from the client:

```
String broker = "tcp://localhost:1883";
String topicName = "mydb/tstable_j2";
String clientId = "mqttclient1";
MemoryPersistence persistence = new MemoryPersistence();

MqttClient sampleClient = new MqttClient(broker, clientId, persistence);
MqttConnectOptions connOpts = new MqttConnectOptions();
connOtps.setCleanSession(true);
sampleClient.connect(connOpts);

String content = "[{ \"id\": \"sensor1234\" , \"tstamp\": "2016-01-01 00:00:00" ,
                     \"reading\": 87.5,  \"sensor_type\": "TEMP"}];
MqttMessage message = new MqttMessage(conent.getBytes());
message.setQos(2);
sampleClient.publish(topicName, message);

sampleClient.disconnect();
```

Related reference:
The wire listener configuration file
MQTT packet syntax

Troubleshooting JSON compatibility

Several troubleshooting techniques, tools, and resources are available for resolving problems that you encounter with JSON compatibility.

Problem	Solution

Problem	Solution
How do I start the wire listener?	If the wire listener does not automatically start: 1. Verify that the user was created. For more information, see Configuring the wire listener for the first time. 2. Manually start the wire listener. For more information, see Starting the wire listener.
How can I debug wire listener problems?	From the wire listener command line, run the `-loglevel level` command, where *level* is the logging level. Log level options are: • error • warn • info • debug • trace For more information, see Wire listener command line options.
How can I view all of the current properties for the wire listener properties file?	From the wire listener command line, you can run the `-listProperties` command. This command prints all of the supported properties and their default values. For more information, see The wire listener configuration file.
How do I access the wire listener help?	You can view a list of available command line options by running the `-help` command.