Getting started with

Habari Client for RabbitMQ

Version 6.10
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Broker-specific information

For broker-specific notes, please read chapter Broker-specific notes on page 82 ff.
Installation

Requirements

Development Environment

- Embarcadero Delphi 2009 Update 4 or higher
- or -
- Free Pascal 3.0.4 or higher

Lazarus 1.8 or newer is required to run the **FPCUnit** test suite. The DUnit test suite and the GUI demo applications require Delphi 2009 for compilation.

TCP/IP Communication Library

- Internet Direct (Indy) **10.6** (recommended)
- or -
- Synapse Release **40** (deprecated)

Installation steps

The installer application will guide you through the installation process. By default Habari Client for RabbitMQ will be installed in the folder

C:\Users\Public\Documents\Habarisoft\habari-rabbitmq-6.10

1 Only release 40 of Ararat Synapse is used for Habari Client library development and tests
Simplified API introduced in version 6.0

New interface types

The new API in Habari Client libraries 6.0 is based on three new interfaces which reduce the amount of client code:

- **IMQContext**
- **IMQProducer**
- **IMQConsumer**

**IMQContext interface**

A IMQContext object encapsulates both the IConnection and the ISession object of the classic API. The connection factory interface contains new methods to create IMQContext objects:

```
function CreateContext: IMQContext; overload;
function CreateContext(const AcknowledgeMode: TAcknowledgementMode): IMQContext; overload;
function CreateContext(const Username, Password: string): IMQContext; overload;
function CreateContext(const Username, Password: string; const AcknowledgeMode: TAcknowledgementMode): IMQContext; overload;
```

The IMQContext provides methods to create messages, producer and consumer objects, destinations (queues, topics, temporary queues, temporary topics, durable subscribers and so forth), and for transaction control (commit, rollback).

**IMQProducer interface**

A IMQProducer object provides methods to produce and send messages to the broker. As a shortcut, a method allows to send text or bytes messages without creating ITextMessage or IBytesMessage object by providing the text or bytes as a parameter.

```
function Send(const Destination: IDestination;
```
const Body: string): IMQProducer; overload;

function Send(const Destination: IDestination;
const AMessage: IMessage): IMQProducer; overload;

IMQConsumer interface

An IMQConsumer object provides methods to consume messages from the broker.

The following example is taken from the unit tests. It uses the new API to create and send a text message to a broker queue destination, and then receives the message from this queue.

Source code example

```
procedure TNewApiTests.TestSendMessage;
var
  Context: IMQContext;
  Destination: IQueue;
  Producer: IMQProducer;
  Consumer: IMQConsumer;
  TextMessage: ITextMessage;
begin
  Context := Factory.CreateContext;
  Destination := Context.CreateQueue(GetQueueName);

  Producer := Context.CreateProducer;
  Producer.Send(Destination, 'Hello World');

  Consumer := Context.CreateConsumer(Destination);
  TextMessage := Consumer.Receive(2500) as ITextMessage;

  CheckEquals('Hello World', TextMessage.Text);
  Context.Close;
end;
```
Breaking changes in version 6.0

Removed conditional symbol HABARI_RAW_TRACE
For detailed logging of network traffic, you may use the conditional symbol HABARI_USE_INTERCEPT.

Removed support for asynchronous message receive
The following methods and properties are no longer available:

```plaintext
function CreateConsumer(const Destination: IDestination;
   const MessageSelector: string; const NoLocal: Boolean;
   const MessageListener: IMessageListener): IMessageConsumer;

IMessageConsumer = interface
   ...
   function GetMessageListener: IMessageListener;
   procedure SetMessageListener(const Value: IMessageListener);

   property MessageListener: IMessageListener read GetMessageListener write
      SetMessageListener;
   ...
```
Communication Adapters

Introduction
Habari Client for RabbitMQ uses communication adapters as an abstraction layer for the TCP/IP library. All connections create their own internal instance of the adapter class.

Configuration of communication adapters
No configuration is required for the communication adapters. Applications specify communication and connection options in URL parameters or connection class properties or connection factory settings.

Registration of communication adapter class
A communication adapter implementation can be prepared for usage by simply adding its Delphi unit to the project.

Code example

```
program ClientUsingIndy;
uses
    BTCommAdapterIndy, // use Internet Direct (Indy)
    BTConnectionFactory, BTJMSInterfaces,
    SysUtils;
...
```

Behind the scenes, the communication adapter class will register itself with the communication adapter manager in the BTAdapterRegistry unit.

Default adapter class
Applications typically use only one of the available communication adapter classes for all connections.

The library allows to register two or more adapter classes and switch at run-time, using methods in the adapter registry in unit BTAdapterRegistry - this feature is mainly for tests and demonstration purposes.

If more than one communication adapter is in the project, the first adapter class in the list will be the default adapter class. Example:
Communication Adapters

The default adapter class can be changed at run-time by setting the adapter class either by its name or by its class type.

### Available communication adapters

The library includes two adapter classes for TCP/IP libraries, one for Indy (Internet Direct) and one for Synapse.

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*Table 1: Communication Adapters*

### Limitations of the Synapse communication adapter class

- The Synapse library does not support the ConnectTimeout property in synchronous socket operation mode, as connect timeouts are handled by the operating system. Indy uses a background thread to abort the connect operation.\(^2\)

- Release 40 of Ararat Synapse is used for Habari Client library development and tests. This is the last announced release, dated April 24, 2012. This release is compatible for Delphi versions before XE4\(^3\). If you use a newer release of Ararat Synapse, please let me know if you encounter any API incompatibilities or other problems.

---


The Programming Model

Habari Client libraries use a programming model which is based on message producers and message consumers, sessions, connections and connection factories.

The basic API is the same for all library versions to allow easy migration between supported message brokers (with the exception of broker-specific features).

Illustration 1: Programming Model
Quick Start Tutorial

This tutorial provides a very simple and quick introduction to Habari Client for RabbitMQ by walking you through the creation of a simple "Hello World" application. Once you are done with this tutorial, you will have a general knowledge of how to create and run Habari applications.

This tutorial takes less than 10 minutes to complete.

Setting up the project

To create a new project:

1. Start the Delphi IDE.
2. In the IDE, choose File > New > VCL Forms Application – Delphi
3. Choose Project > Options … to open the Project Options dialog
4. In the options tree on the left, select 'Delphi Compiler'
5. Add the source directory of Habari Client for RabbitMQ and the Indy source directories to the 'Search path'
6. Choose Ok to close the Project Options dialog
7. Save the project as HelloMQ

Now the project is created and saved.

You should see the main form in the GUI designer now.

Adding code to the project

To use the Habari Client for RabbitMQ library, you need to add the required units to the source code.

8. Switch to Code view (F12)
9. Add the required units to the interface uses list:

```pascal
uses
    BTConnectionFactory,
    BTJMSInterfaces,
```
10. Compile and save the project.

11. Switch to Design view (F12), go to the Tool palette (Ctrl+Alt+P) and select TButton, add a Button to the form.

12. Double click on the new button to jump to the Button Click handler

13. Add the following code to send the message:

```
procedure TForm1.Button1Click(Sender: TObject);
var
  Factory: IConnectionFactory;
  Connection: IConnection;
  Session: ISession;
  Destination: IDestination;
  Producer: IMessageProducer;
begin
  Factory := TBTConnectionFactory.Create('stomp://localhost');
  Connection := Factory.CreateConnection;
  Connection.Start;
  Session := Connection.CreateSession(False, amAutoAcknowledge);
  Destination := Session.CreateQueue('HelloMQ');
  Producer := Session.CreateProducer(Destination);
  Producer.Send(Session.CreateTextMessage('Hello world!'));
  Connection.Close;
end;
```

14. Add a second button and double click on the new button to jump to the Button Click handler

15. Add the following code to receive and display the message:

```
procedure TForm1.Button2Click(Sender: TObject);
var
  Factory: IConnectionFactory;
  Connection: IConnection;
  Session: ISession;
  Destination: IDestination;
  Consumer: IMessageConsumer;
  Msg: ITextMessage;
begin
  Factory := TBTConnectionFactory.Create('stomp://localhost');
  Connection := Factory.CreateConnection;
  Connection.Start;
  Session := Connection.CreateSession(False, amAutoAcknowledge);
  Destination := Session.CreateQueue('HelloMQ');
  Consumer := Session.CreateConsumer(Destination);
  Consumer.OnNext := procedure(TMessage) begin
    MSG := TTextMessage.Create(TMessage);
    ShowMessage(MSG.Text);
  end;
end;
```
Destination := Session.CreateQueue('HelloMQ');
Consumer := Session.CreateConsumer(Destination);
Msg := Consumer.Receive(1000) as ItextMessage;

if Assigned(Msg) then
  ShowMessage(Msg.Text)
else
  ShowMessage('Error: no message received');

Connection.Close;
end;

16. Compile and save the project

**Run the demo**
- Launch the message broker
- Start the application
- Click on Button 1 to send the message to the queue
- Click on Button 2 to receive the message and display it

You can run two instances of the application at the same time, and also on different computers if the IP address of the message broker is used instead of localhost.

**Check for memory leaks**
To verify that the program does not cause memory leaks, insert a line in the project file HelloMQ.dpr:

```
program HelloMQ;

uses
  Forms,
  Unit1 in 'Unit1.pas' {Form1};

{$R *.res}

begin
  ReportMemoryLeaksOnShutdown := True; // check for memory leaks
  Application.Initialize;
  Application.MainFormOnTaskbar := True;
  Application.CreateForm(TForm1, Form1);
  Application.Run;
end.
```

**Tutorial source code**
The tutorial source code is included in the demo folder. It does not include a .proj file so you still need to add the Habari and Indy source paths to the project options.
**Map Message Tutorial**

This tutorial provides a quick introduction to Habari Client for RabbitMQ by walking you through the creation of a simple map message exchange application. This tutorial takes less than 10 minutes to complete.

**Setting up the project**

To create a new project:

1. Start the Delphi IDE.
2. In the IDE, choose File > New > VCL Forms Application – Delphi
3. Choose Project > Options … to open the Project Options dialog
4. In the options tree on the left, select 'Delphi Compiler'
5. Add the source directory of Habari source, the Habari source\optional, and the Indy source directories to the 'Search path'
6. Choose OK to close the Project Options dialog
7. Save the project as HelloMapMessage

Now the project is created and saved.

You should see the main form in the GUI designer now.

**Adding code to the project**

To use the Habari Client for RabbitMQ library, you need to add the required units to the source code.

8. Switch to Code view (F12)
9. Add the required units to the interface uses list:

```
uses
    BTConnectionFactory, BTJMSInterfaces, BTCommAdapterIndy, BTConnection,
    BTMessageTransformerXMLMapDocument, BTSerialIntf, BTTypes,
    // auto-generated unit references
    Windows, Messages, SysUtils, ...
```

10. Compile and save the project.
11. Switch to Design view (F12), go to the Tool palette (Ctrl+Alt+P) and add a TMemo and a TButton to the form.
12. Double click on the new button to jump to the Button Click handler
13. Add the following code to send the message:
procedure TForm1.Button1Click(Sender: TObject);
var
  Factory: IConnectionFactory;
  Connection: IConnection;
  Session: ISession;
  Destination: IDestination;
  Producer: IMessageProducer;
  MapMessage: IMapMessage;
  Key: string;
begin
  Factory := TBTConnectionFactory.Create('stomp://localhost');
  Connection := Factory.CreateConnection;
  SetTransformer(Connection, TBTMessageTransformerXMLMapDocument.Create(nil));
  Connection.Start;

  Session := Connection.CreateSession(False, amAutoAcknowledge);
  Destination := Session.CreateQueue('HelloMapMessage');
  Producer := Session.CreateProducer(Destination);

  MapMessage := Session.CreateMapMessage;
  MapMessage.SetString('DateTimeToStr(Now)', DateTimeToStr(Now));
  MapMessage.SetString('ParamStr(0)', ParamStr(0));
  Producer.Send(MapMessage);

  Memo1.Lines.Append('Sent:');
  for Key in MapMessage.GetMapNames do
  begin
    Memo1.Lines.Append(Key + '=' + MapMessage.GetString(Key));
  end;

  Connection.Close;
end;

14. Add a second button and double click on the new button to jump to the Button Click handler

15. Add the following code to receive and display the message:

procedure TForm1.Button2Click(Sender: TObject);
var
  Factory: IConnectionFactory;
  Connection: IConnection;
  Session: ISession;
  Destination: IDestination;
  Consumer: IMessageConsumer;
  MapMessage: IMapMessage;
  Key: string;
begin
  Factory := TBTConnectionFactory.Create('stomp://localhost');
  Connection := Factory.CreateConnection;
  SetTransformer(Connection, TBTMessageTransformerXMLMapDocument.Create(nil));
  Connection.Start;

  Consumer := Session.CreateConsumer(Destination);
  Consumer.MessageReceive += ConsumerMessageReceive;

  Consumer.Start;
end;
```delphi
Session := Connection.CreateSession(False, amAutoAcknowledge);
Destination := Session.CreateQueue('HelloMapMessage' + '?transformation=' + BTSerialIntf.TRANSFORMER_ID_MAP_XML);
Consumer := Session.CreateConsumer(Destination);

MapMessage := Consumer.Receive(1000) as IMapMessage;
if Assigned(MapMessage) then
begin
  Memo1.Lines.Append('Received:');
  for Key in MapMessage.GetMapNames do
  begin
    Memo1.Lines.Append(Key + '=' + MapMessage.GetString(Key));
  end;
end;
Connection.Close;
end;
```

16. **Compile and save the project**

**Run the demo**
- Launch the message broker
- Start the application
- Click on Button 1 to send the map message to the queue
- Click on Button 2 to receive the map message and display it

You can run two instances of the application at the same time, and also on different computers if the IP address of the message broker is used instead of localhost.

**Map Message Conversion with Apache ActiveMQ**

Note: if you send and receive map messages using the library, message brokers will receive them as simple STOMP text messages with a special header property "transformation" which is set to the value JMS_MAP_XML (or JMS_MAP_JSON if you use a JSON based map transformer class).

Most message brokers will not perform any special processing of these STOMP messages. A notable exception is Apache ActiveMQ: if the broker receives a STOMP message with the JMS_MAP_XML or JMS_MAP_JSON transformation header, it will convert the message internally to a 'native' JMS MapMessage. This allows Java clients to receive the message sent from the Delphi application as a MapMessage without the need to parse a XML body.

Habari Client map message transformers only support string properties.

**Tutorial source code**

The tutorial source code is included in the demo folder. It does not include a .proj file so you still need to add the Habari and Indy source paths to the project options.
Connection Factory

Overview

A connection factory is an object which holds all information required for the creation of a connection objects.

A factory instance is created and configured only once. It then may be used to create actual connection objects when needed. For example, a worker thread may create the connection factory once at program start-up and use it to create a new connection object whenever a connection failure occurred.

Creation and configuration

The code example below shows a helper function which creates a connection factory, and returns it using the interface type `IConnectionFactory`.

The factory will be freed automatically when there are no more references to it.

```
function TExample.CreateConfiguredFactory: IConnectionFactory;
var
  Factory: IConnectionFactory;
begin
  // ------------------------------------------------------------
  // create an instance
  // ------------------------------------------------------------

  // ------------------------------------------------------------
  // return the instance
  // ------------------------------------------------------------
  Result := Factory;
end;
```

This code example is useful for most simple client applications. However, because the local factory variable is declared as `IConnectionFactory`, advanced configuration properties in the class `TBTConnectionFactory` such as `ClientID` and `SendTimeout` are not accessible.

To access them, declare the local factory with the class type as shown in the next example:
Code example

```pascal
function TExample.CreateConfiguredFactory: IConnectionFactory;
var
  Factory: TBTCOnnectionFactory;
begin
  // ------------------------------------------------------------
  // create and assign to local variable
  // ------------------------------------------------------------
  Factory := TBTCOnnectionFactory.Create;

  // ------------------------------------------------------------
  // additional configuration
  // ------------------------------------------------------------
  Factory.BrokerURL := 'broker.example.com';
  Factory.UserName := 'guest';
  Factory.Password := 'guest';
  Factory.ClientID := 'myclientId';
  Factory.SendTimeOut := 10000;
  Factory.ConnectTimeOut := 10000; // Indy only

  // ------------------------------------------------------------
  // return the configured factory
  // ------------------------------------------------------------
  Result := Factory;
end;
```

Warning: if the method signature is changed to return the class TBTCOnnectionFactory instead, a memory leak will occur.

Code example

```pascal
function TExample.Run;
var
  F: IConnectionFactory;
  C: IConnection;
begin
  // ------------------------------------------------------------
  // get a factory and use it to create a connection object
  // ------------------------------------------------------------
  F := CreateConfiguredFactory;

  C := F.CreateConnection;

  // ------------------------------------------------------------
  // start and use the connection
  // ------------------------------------------------------------
  C.Start;

  // ------------------------------------------------------------
  // close the connection
  // ------------------------------------------------------------
  C.Close;
end;
```
Connection URL parameters

Heart-beating Support
STOMP 1.1 introduced heart-beating, its configuration is covered in the chapter Stomp 1.2.

Failover Support
The Failover transport layers reconnect logic on top of the Stomp transport. The Failover configuration syntax allows you to specify any number of composite URIs. The Failover transport randomly chooses one of the composite URI and attempts to establish a connection to it. If it does not succeed, a new connection is established to one of the other URIs in the list.

Example for a failover URI:

```
failover:(stomp://primary:61613,stomp://secondary:61613)
```

Failover Transport Options

<table>
<thead>
<tr>
<th>Option Name</th>
<th>Default Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>initialReconnectDelay</td>
<td>10</td>
<td>How long to wait before the first reconnect attempt (in ms)</td>
</tr>
<tr>
<td>maxReconnectDelay</td>
<td>30000</td>
<td>The maximum amount of time we ever wait between reconnect attempts (in ms)</td>
</tr>
<tr>
<td>backOffMultiplier</td>
<td>2.0</td>
<td>The exponent used in the exponential backoff attempts</td>
</tr>
<tr>
<td>maxReconnectAttempts</td>
<td>-1</td>
<td>-1 is default and means retry forever, 0 means don’t retry (only try connection once but no retry) If set to &gt; 0, then this is the maximum number of reconnect attempts before an error is sent back to the client</td>
</tr>
<tr>
<td>randomize</td>
<td>true</td>
<td>use a random algorithm to choose the the URI to use for reconnect from the list provided</td>
</tr>
</tbody>
</table>

Table 2: Failover Transport Options

Example URI:

```
failover:(stomp://localhost:61616,stomp://remotehost:61616)?
initialReconnectDelay=100&maxReconnectAttempts=10
```

Code example

```go
localhost:61613)?maxReconnectAttempts=3&randomize=false') do
  try
    Conn := Factory.CreateConnection;
    Conn.Start;
  ...
  finally
    Conn.Close;
end;
```

Receipt Support

The STOMP standard supports receipt messages since version 1.0:

"Any client frame other than CONNECT may specify a receipt header with an arbitrary value. This will cause the server to acknowledge receipt of the frame with a RECEIPT frame which contains the value of this header as the value of the receipt-id header in the RECEIPT packet."\(^5\)\(^6\)\(^7\)

With Habari Client for RabbitMQ, client applications may configure receipt headers for the frame types listed below.

After the STOMP frame has been sent to the broker, the client library waits for the RECEIPT frame for a defined time, which may be configured per frame type. If the broker does not send a receipt within the time-out interval, the client library will raise an exception. If the client receives a receipt with the wrong receipt-id header, it will raise an exception.

Receipt Support Parameters

<table>
<thead>
<tr>
<th>STOMP frame</th>
<th>Parameter</th>
<th>Example URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUBSCRIBE</td>
<td>subscribe.receipt</td>
<td>stomp://localhost?subscribe.receipt=true</td>
</tr>
<tr>
<td>UNSUBSCRIBE</td>
<td>subscribe.receipt</td>
<td>stomp://localhost?unsubscribe.receipt=true</td>
</tr>
<tr>
<td>SEND</td>
<td>send.receipt</td>
<td>stomp://localhost?send.receipt=true</td>
</tr>
<tr>
<td>DISCONNECT</td>
<td>disconnect.receipt</td>
<td>stomp://localhost?disconnect.receipt=true</td>
</tr>
</tbody>
</table>

5 [https://stomp.github.io/stomp-specification-1.0.html](https://stomp.github.io/stomp-specification-1.0.html)
6 [https://stomp.github.io/stomp-specification-1.1.html#Header_receipt](https://stomp.github.io/stomp-specification-1.1.html#Header_receipt)
7 [https://stomp.github.io/stomp-specification-1.2.html#Header_receipt](https://stomp.github.io/stomp-specification-1.2.html#Header_receipt)
SUBSCRIBE Receipt
To request server receipts for SUBSCRIBE frames, use the optional connection URL parameter, subscribe.receipt.

Code example

```pascal
```

If the broker does not send a receipt within the time-out interval, the client library will raise an exception.

UNSUBSCRIBE Receipt
To request server receipts for UNSUBSCRIBE frames, use the optional connection URL parameter, unsubscribe.receipt.

Code example

```pascal
```

If the broker does not send a receipt within the time-out interval, the client library will raise an exception.

SEND Receipt
To request server receipts for SEND frames, use the optional connection URL parameter, send.receipt.

Code example

```pascal
```

If the broker does not send a receipt within the time-out interval, the client library will raise an exception.
Note: for additional reliability, the client can use transactional send (see section "Transacted Sessions").

DISCONNECT Receipt

To request server receipts for DISCONNECT frames, use the optional connection URL parameter, disconnect.receipt.

Code example

```plaintext
```

Without this parameter, the client will disconnect the socket connection immediately after sending the DISCONNECT frame to the broker.

With disconnect.receipt=true, the client will send the DISCONNECT frame and then wait for the broker receipt frame. If the broker does not answer, the client library will raise an exception. The client application should treat its messages as undelivered.

Note: for additional reliability, the client can use transactional send (see section "Transacted Sessions"), and message receipts (see section "SEND Receipt").
Connections and Sessions

Connections use Stomp 1.2 by default

Connections use Stomp 1.2 by default since

- Habari Client for Apache ActiveMQ 5.1
- Habari Client for Apache Artemis 5.1
- Habari Client for RabbitMQ 5.1

With OpenMQ, the library still uses Stomp 1.0.

Stomp version may be specified by connection URL parameters. The default protocol version is defined in the BTBrokerConsts unit.

Step-by-Step Example

Overview

This example will send a single message to a destination queue (ExampleQueue).

Add required units

Three units are required for this example

- a communication adapter unit (e.g. BTCommAdapterIndy)
- a connection factory unit (BTConnectionFactory)
- the unit containing the interface declarations (BTJMSInterfaces)

The SysUtils unit is necessary for the exception handling.

Code example

```
program SendOneMessage;
{$APPTYPE CONSOLE}
uses
```

8 Compatibility note: non-existing queues are created automatically by the broker – with the exception of Artemis and HornetQ which require them to be configured before usage
Creating a new Connection

New connections are created by calling the CreateConnection method of a connection factory.

Code example

```pascal
var
  Factory: IConnectionFactory;
  Connection: IConnection;
  ...
begin
  Factory := TBTConnectionFactory.Create('user', 'password', 'stomp://localhost');
  Connection := Factory.CreateConnection;
  ...
```

- For connection factory creation and configuration options please see chapter "Creation and configuration".
- Since IConnection is an interface type, the connection instance will be destroyed automatically if there are no more references to it in the program.

Connection URL Parameters

Connection URL parameters are documented in chapter "Connection URL parameters" and in chapter "Stomp 1.2".

Creating a Session

To create the communication session,

- declare a variable of type ISession
- use the helper method CreateSession of the connection, and specify the acknowledgment mode

Please check the API documentation for the different session types and acknowledgement modes.

Since ISession is an interface type, the session instance will be destroyed automatically if there are no more references to it in the program.

Code example
Using the Session

The Session variable is ready to use now. Destinations, producers and consumers will be covered in the next chapters.

Code example

```plaintext
Destination := Session.CreateQueue('ExampleQueue');
Producer := Session.CreateProducer(Destination);
Producer.Send(Session.CreateTextMessage('This is a test message'));
```

Closing a Connection

Finally, the application closes the connection. The client will disconnect from the message broker. Closing a connection also implicitly closes all open sessions.

Code example

```plaintext
finally
  Connection.Close;
end;
end.
```

Note: Close will be called automatically if the connection is destroyed. But because unclosed connections use resources, Close should be called when the connection is no longer needed. When logging is enabled, the connection class will also log a message when a connection is destroyed without calling Close.

Session types overview

The table below shows the supported parameter combinations for the Connection.CreateSession method and their effect on the session transaction and acknowledgment features.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Client MUST acknowledge message receipt</th>
<th>Transaction support for</th>
<th>STOMP Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>CreateSession(False, amAutoAcknowledge)</td>
<td>No</td>
<td>-</td>
<td>1.0</td>
</tr>
</tbody>
</table>

9 [https://stomp.github.io/stomp-specification-1.2.html#SUBSCRIBE_ack_Header](https://stomp.github.io/stomp-specification-1.2.html#SUBSCRIBE_ack_Header)
### Table 3: Session creation parameters

Table 3: Session creation parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Supported</th>
<th>Required</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>CreateSession(False, amClientAcknowledge)</td>
<td>Yes (cumulative effect)</td>
<td>-</td>
<td>-</td>
<td>1.0</td>
</tr>
<tr>
<td>CreateSession(False, amClientIndividual)</td>
<td>Yes</td>
<td>-</td>
<td>-</td>
<td>1.2</td>
</tr>
<tr>
<td>CreateSession(True, amAutoAcknowledge)</td>
<td>No</td>
<td>✓</td>
<td>-</td>
<td>1.0</td>
</tr>
<tr>
<td>CreateSession(True, amClientAcknowledge)</td>
<td>Yes (cumulative effect)</td>
<td>✓</td>
<td>①</td>
<td>1.0</td>
</tr>
<tr>
<td>CreateSession(True, amClientIndividual)</td>
<td>Yes</td>
<td>✓</td>
<td>①</td>
<td>1.2</td>
</tr>
<tr>
<td>CreateSession(True, amTransactional)</td>
<td>No</td>
<td>✓</td>
<td>-</td>
<td>1.0</td>
</tr>
</tbody>
</table>

① – not supported by ActiveMQ Artemis

---

## Transacted Sessions

A session may be specified as transacted. Each transacted session supports a single series of transactions.

**Each transaction groups a set of message sends into an atomic unit of work.**

A transaction is completed using either its session's Commit method or its session's Rollback method. The completion of a session's current transaction automatically begins the next. The result is that a transacted session always has a current transaction within which its work is done.

### Create a transacted session

To create a transacted session, set the parameter of CreateSession to amTransactional as shown in the code example

```
Code example

Session := Connection.CreateSession(amTransactional);
```

or (using the older API version)

```
Code example

Session := Connection.CreateSession(True, amTransactional);
```
This code will automatically start a new transaction for this session.

**Send messages**

Now send messages using the transacted session.

**Code example**

```plaintext
Destination := Session.CreateQueue('testqueue');
Producer := Session.CreateProducer(Destination);
Producer.Send(Session.CreateTextMessage('This is a test message'));
```

**Committing a transaction**

If your client code has successfully sent its messages, the transaction must be committed to make the messages visible on the destination.

**Code example**

```plaintext
// send messages ...
finally
  // commit all messages
  Session.Commit;
end;
```

Note: committing a transaction automatically starts a new transaction

**Rolling back a transaction**

If your client code runs wants to undo the sending of its messages, the transaction may be rolled back, and the messages will not become visible on the destination.

**Code example**

```plaintext
// send messages ...
except
  ...
  // error!
  Session.Rollback;
  ...
end;
```
Note: rolling back a transaction automatically starts a new transaction. A transacted session will be rolled back automatically if the connection is closed.

Transacted message acknowledgement

Some library versions (see table “Communication Adapters” on page 13) support transactions also for the acknowledgement of received messages.

When a transaction is rolled back or the connection is closed without a commit, messages which have been acknowledged after the transaction start will return to unacknowledged state.

Code example

```c
// receive in a transacted session
Session := Connection.CreateSession(True, amClientAcknowledge);
Queue := Session.CreateQueue(GetQueueName);
Consumer := Session.CreateConsumer(Queue);
Msg := Consumer.Receive(1000);

// process the message
...

// acknowledge the message
Msg.Acknowledge;
...

// in case of errors, roll back all acknowledgements
Session.Rollback;
```

This is an experimental feature. It requires the STOMP 1.2 communication protocol.
Introducción

El API soporta dos modelos:

1. modelo punto-a-punto o model de cola
2. modelo de publicación y suscripción

En el modelo de punto-a-punto o de cola, un produtor publica mensajes a una cola específica y un consumidor lee los mensajes de la cola. Aquí, el produtor sabe el destino del mensaje y lo publica directamente a la cola del consumidor. Este modelo está caracterizado por lo siguiente:

- Sólo un consumidor recibirá el mensaje
- El produtor no necesita estar ejecutándose cuando el receptor consume el mensaje, ni el receptor necesita estar ejecutándose cuando el mensaje es enviado
- Cada mensaje exitosamente procesado es reconocido por el receptor

El modelo de publicación/suscripción soporta publicar mensajes a una cola específica. Cero o más suscriptores pueden registrar interés en recibir mensajes sobre un tema de mensaje específico. En este modelo, ni el produtor ni el suscriptor saben nada el uno del otro. Un buen metáfora para él es un tablón de anuncios anónimo. Los siguientes son los caracterísitcas de este modelo:

- múltiples consumidores pueden recibir el mensaje
- Existe una dependencia de tiempo entre los produtors y los suscriptores. El produtor debe crear una suscripción para que los clientes puedan suscribirse. El suscriptor debe estar activo continuamente para recibir mensajes, a menos que haya establecido una suscripción duradera. En ese caso, los mensajes publicados mientras el suscriptor no está conectado se redistribuirán cuando vuelva a conectarse.

Crear un nuevo Destino

Colas

Una cola se puede crear usando el método CreateQueue del Session.
The queue can then be used to send or receive messages using implementations of the IMessageProducer and IMessageConsumer interfaces. (See next chapter for an example)

Topics

A topic can be created using the CreateTopic method of the Session.

The topic can then be used to send or receive messages using implementations of the IMessageProducer and IMessageConsumer interfaces. (See next chapter for an example).
Producer and Consumer

Message Producer

A client uses a MessageProducer object to send messages to a destination. A MessageProducer object is created by passing a Destination object to a message-producer creation method supplied by a session.

Code example

```plaintext
Destination := Session.CreateQueue('foo');
Producer := Session.CreateProducer(Destination);
Producer.Send(Session.CreateTextMessage('Test message'));
```

A client can specify a default delivery mode, priority, and time to live for messages sent by a message producer. It can also specify the delivery mode, priority, and time to live for an individual message.

Persistent messages

The delivery mode for outgoing messages may be set to persistent in one of two ways. From the docs for TBTMessageProducer: "A client can specify a default delivery mode, priority, and time to live for messages sent by a message producer. It can also specify the delivery mode, priority, and time to live for an individual message."

Setting the default delivery mode

Code example

```plaintext
Destination := Session.CreateQueue('foo');
Producer := Session.CreateProducer(Destination);
Producer.DeliveryMode := dmPersistent;
Producer.Send(Session.CreateTextMessage('Test message'));
```

Setting the delivery mode for an individual message

Code example

```plaintext
Destination := Session.CreateQueue('foo');
Producer := Session.CreateProducer(Destination);
Producer.Send(Session.CreateTextMessage('Test message'), dmPersistent, BTBrokerConsts.DEFAULT_PRIORITY, 0);
```
Message Consumer

A client uses a MessageConsumer object to receive messages from a destination. A MessageConsumer object is created by passing a Destination object to a message-consumer creation method supplied by a session.

Code example

```pascal
Destination := Session.CreateQueue('foo');
Consumer := Session.CreateConsumer(Destination);
```

Message Selector

A message consumer can be created with a message selector\(^{11}\).

A message selector allows the client to restrict the messages delivered to the message consumer to those that match the selector.

Synchronous Receive

A MessageConsumer offers a Receive method which can be used to consume exactly one message at a time.

Code example

```pascal
while I < EXPECTED do
begin
  TextMessage := Consumer.Receive(1000) as ITextMessage;
  if Assigned(TextMessage) then
  begin
    Inc(I);
    TextMessage.Acknowledge;
    L.Info(Format('%d %s', [I, TextMessage.Text]));
  end;
end;
```

Receive and ReceiveNoWait

There are three different methods for synchronous receive:

- **Receive**  
The Receive method with no arguments will block (wait until a message is available).

- **Receive(TimeOut)**  
The Receive method with a timeout parameter will wait for the given time in milliseconds. If no message arrived, it will return nil.

\(^{11}\)The RabbitMQ message broker does not support message selectors.
**ReceiveNoWait**  The ReceiveNoWait method will return immediately. If no message arrived, it will return nil.
Durable Subscriptions

Description
If a client needs to receive all the messages published on a topic, including the ones published while the subscriber is inactive, it uses a durable TopicSubscriber.

The message broker retains a record of this durable subscription and insures that all messages from the topic's publishers are retained until they are acknowledged by this durable subscriber or they have expired.\(^\text{12}\)

The combination of the clientId and durable subscriber name uniquely identifies the durable topic subscription.

After you restart your program and re-subscribe, the broker will know which messages you need that were published while you were away.

Creation
The Session interface contains the CreateDurableSubscriber method which creates a durable subscriber to the specified topic.

A durable subscriber MessageConsumer is created with a unique clientID and durable subscriber name.

Only one thread can be actively consuming from a given logical topic subscriber.

\(^\text{12}\) http://download.oracle.com/javaee/5/api/javax/jms/TopicSession.html
Temporary Queues

Introduction

“Temporary destinations (temporary queues or temporary topics) are proposed as a lightweight alternative in a scalable system architecture that could be used as unique destinations for replies. Such destinations have a scope limited to the connection that created it, and are removed on the server side as soon as the connection is closed.” (“Designing Messaging Applications with Temporary Queues”, by Thakur Thribhuvan 13)

Library Support

Temporary destinations are supported by

- ActiveMQ
- OpenMQ
- RabbitMQ

Resource Management

The session should be closed as soon as processing is completed so that TemporaryQueues will be deleted on the server side.

**Message Options**

### Standard Properties

The Apache ActiveMQ message broker supports some JMS standard properties in the STOMP adapter. These properties are based on the JMS specification of the Message interface.\(^{14}\)

Habari Client libraries for other message brokers may support a subset of these standard properties.

**Note:** If your application makes use of these properties, your application depends on a broker-specific feature which is not guaranteed to be available in the STOMP adapter of other message brokers

#### Properties for outgoing messages

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>JMSCorrelationID</td>
<td>The correlation ID for the message.</td>
</tr>
<tr>
<td>JMSExpiration</td>
<td>The message's expiration value.</td>
</tr>
<tr>
<td>JMSDeliveryMode</td>
<td>Whether or not the message is persistent.(^{15})</td>
</tr>
<tr>
<td>JMSPriority(^{16})</td>
<td>The message priority level.</td>
</tr>
<tr>
<td>JMSReplyTo</td>
<td>The Destination object to which a reply to this message should be sent.</td>
</tr>
</tbody>
</table>

#### Properties for incoming messages

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>JMSCorrelationID</td>
<td>The correlation ID for the message.</td>
</tr>
<tr>
<td>JMSExpiration</td>
<td>The message's expiration value.</td>
</tr>
<tr>
<td>JMSDeliveryMode</td>
<td>Whether or not the message is persistent.</td>
</tr>
<tr>
<td>JMSPriority</td>
<td>The message priority level.</td>
</tr>
</tbody>
</table>


\(^{15}\) For sending persistent messages please see documentation for IMessageProducer

\(^{16}\) Clients set the JMSPriority not directly, but either on the producer or as a parameter in the Send method
<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>JMSTimestamp</td>
<td>The timestamp the broker added to the message.</td>
</tr>
<tr>
<td>JMSMessageId</td>
<td>The message ID which is set by the provider.</td>
</tr>
<tr>
<td>JMSReplyTo</td>
<td>The Destination object to which a reply to this message should be sent.</td>
</tr>
</tbody>
</table>

**Reserved property names**

Some headers names are defined by the Stomp specifications, and by broker-specific extensions of the Stomp protocol. These reserved Stomp header names can not be used as names for user defined properties.

**Note**
The client library will raise an Exception if the application tries to send a message with a reserved property name.

**Examples**

- login
- passcode
- transaction
- session
- message
- destination
- id
- ack
- selector
- type
- content-length
- content-type
- correlation-id
- expires
- persistent
- priority
- reply-to
- message-id
- timestamp
- client-id
- redelivered
Prefix for custom headers

A common practice to avoid name collisions is using a prefix for your own properties (example: `x-type` instead of `type`).

Selectors

Selectors are a way of attaching a filter to a subscription to perform content-based routing. For more documentation on the detail of selectors see the reference on `javax.jmx.Message`\(^\text{17}\).

Supported message brokers

Message selectors are supported by

- Habari Client for ActiveMQ
- Habari Client for Artemis
- Habari Client for OpenMQ

All supported brokers allow supports string type properties and operations in selectors. ActiveMQ also allows integer properties and operations in selectors (see special note\(^\text{18}\)).

---

17 http://docs.oracle.com/javaee/5/api/javax/jms/Message.html
18 http://activemq.apache.org/selectors.html
Map Messages

Introduction
A map message is used to exchange a set of name-value pairs. The names are strings, the values are also strings (but may be textual representations of other data types).

Usage Example
Create a map message and add map entries:

```delphi
MapMessage := Session.CreateMapMessage;
MapMessage.SetString('key', 'value');
MapMessage.SetInt('key_int', 4096);
MapMessage.SetBoolean('key_b', True);
```

Read a map message from a consumer and access its entries:

```delphi
MapMessage := Consumer.Receive(1000) as IMapMessage;
StringValue := MapMessage.GetString('key'));
IntegerValue := MapMessage.GetInt('key_int'));
BoolValue   := MapMessage.GetBoolean('key_b'));
```

Enumerate map entries:

```delphi
MapKeys := MapMessage.GetMapNames;
for I := 0 to Length(MapKeys) - 1 do
begin
  MapKey := MapKeys[I];
  MapValue := MapMessage.GetString(MapKey);
  ... // process map entry
end;
```

Map Message Transformer
To send and receive map messages, the application needs to convert incoming and outgoing map messages from and to the STOMP message body.

The IMessageTransformer interface must be implemented for map message and and object message transformation. This interface defines two methods, ConsumerTransform and ProducerTransform.
Habari Client for RabbitMQ 6.10

### Interface

```pascal
function ConsumerTransform(const Session: ISession; const Consumer: IMessageConsumer; const AMessage: IMessage): IMessage;

function ProducerTransform(const Session: ISession; const Producer: IMessageProducer; const AMessage: IMessage): IMessage;
```

### Implementation guide for map messages:

1. create a class which implements the IMessageTransformer interface
   - for ConsumerTransform, the **incoming** map message is passed as the AMessage parameter, the method must **read** its body to reconstruct the map properties, and return the map message as function result
   - for ProducerTransform, the **outgoing** map message is passed as the AMessage parameter, the method must **write** its body to store a representation of the map, and return the map message as function result
2. create an instance of this class and register it as the message transformer on the IConnection instance
   - Note: only one map message transformer may be active for one connection

#### Code example

```pascal
Connection := Factory.CreateConnection;
try
  MyMapTransformer := TMyMapMessageTransformer.Create;
  // use the helper method in unit BTConnection:
  SetMapMessageTransformer(Connection, MyMapTransformer, 'my-map-message');
  Connection.Start;
  // send / receive messages
finally
  Connection.Close;
end;
```

### Transformation Identifier

To detect that an incoming message is a map message, it needs to carry a special header property. Without this transformation identifier, the message will still be delivered but its actual type will be undefined – it may arrive as a ITextMessage or IbytesMessage.

By default, the library will set this header property to the transformation identifier passed to the SetTransformer method.

You may explicitly set the header property on the created message:
Map Messages

Code example

```pascal
MapMessage := Session.CreateMapMessage;
... // add map entries

// add the transformation identifier
MapMessage.SetStringProperty(SH_TRANSFORMATION, 'my-map-message');
Producer.Send(MapMessage);
```

Example ProducerTransform implementation with TStrings

This implementation uses a TStrings to collect the map entries. The outgoing message contains the TStrings as body.

Notes:

- the method uses a method of a helper interface, IContentProvider.SetContent, to write the body content
- the method returns nil if the passes message is no map message

Code example

```pascal
function TMyMapMessageTransformer.ProducerTransform(const Session: ISession;
const Producer: IMessageProducer; const AMessage: IMessage): IMessage;
var
  TmpMapMsg: IMapMessage;
  Keys: PMStrings;
  I: Integer;
  MapKey: string;
  MapValue: string;
  MapStrings: TStrings;
begin
  Result := nil;
  if Supports(AMessage, IMapMessage, TmpMapMsg) then
    begin
      MapStrings := TStringList.Create;
      try
        Keys := TmpMapMsg.GetMapNames;
        for I := 0 to Length(Keys) - 1 do
          begin
            MapKey := Keys[I];
            MapValue := TmpMapMsg.GetString(MapKey);
            MapStrings.Values[MapKey] := MapValue;
          end;

        (AMessage as IContentProvider).SetContent(Utf8Encode(MapStrings.Text));
        Result := AMessage;
      finally
        MapStrings.Free;
        end;
    end;
end;
```
See unit MapMessageTransformerTests for integration / unit tests.
Object Messages

“Object serialization is the process of saving an object's state to a sequence of bytes, as well as the process of rebuilding those bytes into a live object at some future time.”

Introduction

In messaging applications, object serialization is required to transfer objects between clients, but also to store objects on the broker if they are declared persistent.

Object Message Transformer

To send and receive object messages, the application needs to convert incoming and outgoing object messages from and to the STOMP message body.

The IMessageTransformer interface must be implemented for map message and and object message transformation.

This interface defines two methods, ConsumerTransform and ProducerTransform.

Code example

```pascal
function ConsumerTransform(const Session: ISession;
    const Consumer: IMessageConsumer; const AMessage: IMessage): IMessage;

function ProducerTransform(const Session: ISession;
    const Producer: IMessageProducer; const AMessage: IMessage): IMessage;
```

Implementation guide for map messages:

3. create a class which implements the IMessageTransformer interface
   - for ConsumerTransform, the incoming object message is passed as the AMessage parameter, the method must read its body to reconstruct the object, and return the object message as function result
   - for ProducerTransform, the outgoing object message is passed as the AMessage parameter, the method must write its body to store a representation of the object, and return the object message as function result

19 https://www.oracle.com/technical-resources/articles/java/serializationapi.html
4. create an instance of this class and register it as the message transformer on the IConnection instance
   ◦ Note: only one object message transformer may be active for one connection

See unit ObjectMessageTransformerTests for integration / unit tests.
Stomp 1.2

Connection configuration
A connection string can use additional URL parameters to configure Stomp version 1.1 and 1.2
All Parameters are case sensitive.
Parameters can be omitted to use the default value.

<table>
<thead>
<tr>
<th>Switch</th>
<th>Description</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>connect.accept-version</td>
<td>Supported Stomp versions in ascending order</td>
<td>Broker specific, see below</td>
</tr>
<tr>
<td>connect.host</td>
<td>The name of a virtual host that the client wishes to connect to. It is recommended clients set this to the host name that the socket was established against, or to any name of their choosing. If this header does not match a known virtual host, servers supporting virtual hosting MAY select a default virtual host or reject the connection.</td>
<td>Server URI</td>
</tr>
<tr>
<td>connect.heart-beat</td>
<td>Heart beat (outgoing, incoming)</td>
<td>0,0</td>
</tr>
</tbody>
</table>

Default Stomp version (broker-specific)
If the connection URL does not contain the connect.accept-version parameter, the client library will add an accept-version header to the CONNECT frame with the value defined in the SH_DEFAULT_STOMP_VERSION constant in the BTLBrokerConsts unit.

Default Stomp version

<table>
<thead>
<tr>
<th>ActiveMQ</th>
<th>Artemis</th>
<th>OpenMQ</th>
<th>RabbitMQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2</td>
<td>1.2</td>
<td>1.0</td>
<td>1.2</td>
</tr>
</tbody>
</table>

20 http://stomp.github.com//stomp-specification-1.2.html#protocol_negotiation
21 http://stomp.github.com//stomp-specification-1.2.html#CONNECT_or_STOMP_Frame
22 http://stomp.github.com//stomp-specification-1.2.html#Heart-beating
23 Since version 5.1 (2017.06)
Connection Factory Code Example:

```pascal
```

This example creates a connection factory with these connection settings:

- **host:** localhost
- **port:** 61613
- **accept-version:** 1.2
- **heart-beat:** 1000,0

  - virtual host is localhost
  - the client requests Stomp 1.2 protocol
  - client heart beat interval is 1000 milliseconds, no server heart beat signals

**Specification**

For details see the Stomp specification pages:

- [http://stomp.github.com//stomp-specification-1.2.html](http://stomp.github.com//stomp-specification-1.2.html)

**Sending heart-beat signals**

A client can use the **SendHeartbeat** method of the connection object to send a heart-beat byte (newline 0x0A).

SendHeartbeat is a method of the IHeartbeat interface, which is declared in the BTSessionIntf unit. A cast of the IConnection object is required to access this method.

```pascal
(Connection as IHeartbeat).SendHeartbeat;
```
Notes:

• the client application code is responsible for sending a heartbeat message within the maximum interval which was specified in the connect parameter – the Habari Client library does not send heart-beats automatically
• client messages which are sent after the heart-beat interval expires may be lost

---

**Checking for incoming heartbeats**

The Habari client library stores a time-stamp of the last incoming data. If the time which elapsed since this time-stamp is greater than two times the heart-beat interval, calling **CheckHeartbeat** will raise an exception of type EBTStompServerHeartbeatMissing.

**Code example**

```csharp
(Connection as IHeartbeat).CheckHeartbeat;
```

Notes:

• the method raises an exception if the connection does not use server-side heart-beating
• the method only checks the time elapsed since the last heart-beat, it does not try to read any data from the connection

---

**Reading server-side heartbeats**

If the client never needs to consume any messages, but still needs to check for server-side heartbeats, it can use the **ReceiveHeartbeat** method of the connection object.

This method takes one argument, TimeOut.
The function returns True if it found at least one heart-beat signal on the connection.

Calling ReceiveHeartbeat is only useful for applications which never call Receive, to check if the server is still healthy, and to consume the pending heart-beat signals from the connection.

If the client reads messages (using Consumer.Receive), calling ReceiveHeartbeat is not required.
## Example Applications

<table>
<thead>
<tr>
<th>Directory</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>common</td>
<td>Shared units (see below)</td>
</tr>
<tr>
<td>common-consumertool</td>
<td>Receive messages from broker</td>
</tr>
<tr>
<td>common-consumertool-fpc</td>
<td>Free Pascal version of ConsumerTool</td>
</tr>
<tr>
<td>common-producertool</td>
<td>Send messages to broker</td>
</tr>
<tr>
<td>common-producertool-fpc</td>
<td>Free Pascal version of producertool</td>
</tr>
<tr>
<td>common-producertool-ssl</td>
<td>Send messages to broker with SSL connection</td>
</tr>
<tr>
<td>common-tests</td>
<td>DUnit tests</td>
</tr>
<tr>
<td>common-tests-fpc</td>
<td>FPCUnit tests</td>
</tr>
<tr>
<td>delphichat</td>
<td>Simple chat client (Delphi 2009)</td>
</tr>
<tr>
<td>heartbeat-server</td>
<td>Uses server-side heart-beating to check the connection / server health 24</td>
</tr>
<tr>
<td>performance</td>
<td>Multi-threaded performance test application (Delphi 2009)</td>
</tr>
<tr>
<td>reconnect</td>
<td>Send messages and reconnect on connection failure</td>
</tr>
<tr>
<td>rpc</td>
<td>Use temporary queues to implement request/response style communication (not supported on all message brokers25)</td>
</tr>
<tr>
<td>textmessage</td>
<td>Simple text message example</td>
</tr>
<tr>
<td>throughput</td>
<td>Produces and consumes messages continuously</td>
</tr>
<tr>
<td>throughput-fpc</td>
<td>Free Pascal version of throughput</td>
</tr>
<tr>
<td>transactions</td>
<td>Transaction example</td>
</tr>
<tr>
<td>tutorial1</td>
<td>Tutorial one</td>
</tr>
</tbody>
</table>

24 Requires STOMP 1.2; not supported by OpenMQ  
25 Not available with ActiveMQ Artemis and HornetQ message broker
<table>
<thead>
<tr>
<th>Directory</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>tutorial2</td>
<td>Tutorial two</td>
</tr>
</tbody>
</table>

Table 4: Example Applications (in alphabetic order)

Shared units for demo projects

The directory `demo/common` contains shared units:

- connection configuration form
- command line parameter support class
- LoggingHelper example unit (see “Logging with SLF4J” on page 64)

Illustration 2: Connection configuration dialog example
ConsumerTool

The ConsumerTool demo may be used to receive messages from a queue or topic. This example application is configurable by command line parameters, all are optional.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Default Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AckMode</td>
<td>CLIENT_ACKNOWLEDGE</td>
<td>Acknowledgment mode, possible values are: CLIENT_ACKNOWLEDGE, AUTO_ACKNOWLEDGE or SESSION_TRANSACTED</td>
</tr>
<tr>
<td>ClientId</td>
<td></td>
<td>Client Id for durable subscriber</td>
</tr>
<tr>
<td>ConsumerName</td>
<td>Habari</td>
<td>name of the message consumer - for durable subscriber</td>
</tr>
<tr>
<td>Durable</td>
<td>false</td>
<td>true: use a durable subscriber</td>
</tr>
<tr>
<td>MaximumMessages</td>
<td>10</td>
<td>expected number of messages</td>
</tr>
<tr>
<td>Password</td>
<td></td>
<td>Password</td>
</tr>
<tr>
<td>PauseBeforeShutDown</td>
<td>false</td>
<td>true: wait for key press</td>
</tr>
<tr>
<td>ReceiveTimeOut</td>
<td>0</td>
<td>consume messages while they continue to be delivered within the given time out</td>
</tr>
<tr>
<td>SleepTime</td>
<td>0</td>
<td>time to sleep after receive</td>
</tr>
<tr>
<td>Subject</td>
<td>TOOL.DEFAULT</td>
<td>queue or topic name</td>
</tr>
<tr>
<td>Topic</td>
<td>false</td>
<td>true: topic false: queue</td>
</tr>
<tr>
<td>Transacted</td>
<td>false</td>
<td>true: transacted session</td>
</tr>
<tr>
<td>URL</td>
<td>localhost</td>
<td>server url</td>
</tr>
<tr>
<td>User</td>
<td></td>
<td>user name</td>
</tr>
<tr>
<td>Verbose</td>
<td>true</td>
<td>verbose output</td>
</tr>
</tbody>
</table>

Table 5: ConsumerTool Command Line Options

Illustration 3: ConsumerTool demo application
### Examples

Receive 1000 messages from local broker

```
ConsumerTool --MaximumMessages=1000
```

Receive 10 messages from local broker and wait for any key

```
ConsumerTool --PauseBeforeShutDown
```

Use a transacted session to receive 10,000 messages from local broker

```
ConsumerTool --MaximumMessages=10000 --Transacted --AckMode=SESSION_TRANSACTED
```
ProducerTool

The ProducerTool demo can be used to send messages to the broker. It is configurable by command line parameters, all are optional.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Default</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MessageCount</td>
<td>10</td>
<td>Number of messages</td>
</tr>
<tr>
<td>MessageSize</td>
<td>255</td>
<td>Length of a message in bytes</td>
</tr>
<tr>
<td>Persistent</td>
<td>false</td>
<td>Delivery mode 'persistent'</td>
</tr>
<tr>
<td>SleepTime</td>
<td>0</td>
<td>Pause between messages in milliseconds</td>
</tr>
<tr>
<td>Subject</td>
<td>TOOL.DEFAULT</td>
<td>Destination name</td>
</tr>
<tr>
<td>TimeToLive</td>
<td>0</td>
<td>Message expiration time</td>
</tr>
<tr>
<td>Topic</td>
<td>false</td>
<td>Destination is a topic</td>
</tr>
<tr>
<td>Transacted</td>
<td>false</td>
<td>Use a transaction</td>
</tr>
<tr>
<td>URL</td>
<td>localhost</td>
<td>Message broker URL</td>
</tr>
<tr>
<td>Verbose</td>
<td>true</td>
<td>Verbose output</td>
</tr>
<tr>
<td>User</td>
<td></td>
<td>User name</td>
</tr>
<tr>
<td>Password</td>
<td></td>
<td>Password</td>
</tr>
</tbody>
</table>

Table 6: ProducerTool Command Line Options

*Illustration 4: ProducerTool demo application*

**Examples**

Send 10,000 messages to the queue TOOL.DEFAULT on the local broker
Send 10 messages to the topic ExampleTopic on the local broker

ProducerTool --Topic --Subject=ExampleTopic
Performance test

The performance test application provides a GUI for multi-threaded sending and receiving of messages.

- A broker configuration dialog can be invoked by clicking the URL field
- The communication library (Indy or Synapse) can be selected
- Number and length of messages and thread number can be adjusted using the sliders

For every thread a message queue with the name ExampleQueue.<n> will be used.

Habari Client for RabbitMQ 5.1 includes an enhanced performance test application, which optionally collects message rates of multiple test runs and displays the sample median. Shown above is an example for a client configuration:
• 21 test runs (triggered by a shift-click on the test button)
• 2000 messages per thread
• 210 bytes payload
• two producer threads, two consumer threads

To start the long-running tests, shift-click on the run button. Taking all test samples takes around ten seconds.
Throughput test

This example application is configurable by command line parameters, all are optional.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Default Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Password</td>
<td>(broker-specific)</td>
<td>Password</td>
</tr>
<tr>
<td>Subject</td>
<td>ExampleTopic</td>
<td>Topic name</td>
</tr>
<tr>
<td>URL</td>
<td>(broker-specific)</td>
<td>Connection URL</td>
</tr>
<tr>
<td>User</td>
<td>(broker-specific)</td>
<td>User name</td>
</tr>
</tbody>
</table>

*Table 7: Throughput Test Tool Command Line Options*

**Examples**

Use remote broker 'mybroker' and specify user and password

```
tptest --url=stomp://mybroker --user=test1 --password=secret
```

*Illustration 6: Throughput test tool output*
Unit Tests

Introduction
Habari Client libraries include DUnit and FPCUnit tests. They require the classic DUnit framework (included in Delphi 2009) or FPCUnit (included in Lazarus 2.6).

The test projects are installed in the common-tests and common-tests-fpc folders.

Test project configuration

Logging
To switch on SLF4P logging, add the conditional symbol HABARI_LOGGING (see chapter 'Logging with SLF4P') and rebuild the project. Set the DEFAULT_LOG_LEVEL constant in unit TestHelper to a valid SLF4P level.

Raw message logging
To switch on raw logging, add the conditional symbol HABARI_RAW_TRACE and rebuild the project. The project has the {$APPTYPE CONSOLE} flag, which will cause a console window to open.

Optional units
To switch on tests for optional units (object message exchange), add the conditional symbol TEST_OPTIONAL_UNITS and rebuild the project.

Synapse communication adapter
To switch from Indy to Synapse for the tests, add the conditional symbol HABARI_TEST_SYNAPSE and rebuild the project.

Test units
The common-tests folder contains these units
### Test setup and test case base classes

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TestHelper</td>
<td>Main test set-up and utility unit, contains no tests</td>
</tr>
<tr>
<td>HabariTestCase</td>
<td>Test case base classes used for most tests</td>
</tr>
</tbody>
</table>

### Unit tests

<table>
<thead>
<tr>
<th>Test Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ApiTests</td>
<td>Tests Habari Client core API methods – part 1</td>
</tr>
<tr>
<td>BasicTests</td>
<td>Tests Habari Client core API methods – part 2</td>
</tr>
<tr>
<td>BrokerExtensionsTests</td>
<td>Tests broker-specific features and extensions of the STOMP protocol</td>
</tr>
<tr>
<td>HabariExtensionsTests</td>
<td>Tests non-standard features provided by the Habari Client library</td>
</tr>
<tr>
<td>HabariTypesTests</td>
<td>Tests internal data types</td>
</tr>
<tr>
<td>ObjectExchangeTests</td>
<td>Tests object message exchange (for Delphi DUnit only)</td>
</tr>
<tr>
<td>Stomp12Tests</td>
<td>Tests features introduced with version 1.2 of the STOMP standard</td>
</tr>
<tr>
<td>StubServerTests</td>
<td>Tests using a simple local Stomp server</td>
</tr>
</tbody>
</table>

Free Pascal specific test units are in the folder common-tests-fpc

---

### Test execution

### Requirements

The test projects require a message broker running on the local system, which accepts STOMP connections on the default port, with the default user credentials. User name and password for the default user are defined in unit BTBrokerConsts.

### Test destinations

Most tests create a test-specific destination (queue or a topic) to reduce the risk of side effects.

The name of the destination is the combination of the test class name and the unit test name.

Note: the unit tests will not clean up or remove these destination objects after usage.

---

26 only added to the test suite if TEST_OPTIONAL_UNITS is defined
STOMP 1.2

Since Habari Client for RabbitMQ 5.0, the unit test use STOMP 1.2 for connections.
Logging with SLF4P

Introduction
Habari Client libraries include the free open source logging framework SLF4P as an optional dependency.
SLF4P is available at https://github.com/michaelJustin/slf4p

IDE and project configuration
In order to compile with SLF4P support,
1. include the path to the slf4p library in the project search or in the global library path
2. add the conditional symbol HABARI_LOGGING to the project options

Delphi
• choose Project | Options... | Delphi Compiler > Conditional defines
• add HABARI_LOGGING

Lazarus
• choose Project | Project Options ... | Compiler Options > Other
• add -dHABARI_LOGGING in the Custom options field

LoggingHelper unit
A simple LoggingHelper unit is located in the demo\common\ directory and can be copied to a project to add slf4p support with little extra coding.

Code example
```
uses
  LoggingHelper,
...
begin
```
The `LoggingHelper` unit may be adjusted to your configuration needs. Here is an example which uses the `SimpleLogger` implementation (included in SLF4P).

```pascal
// set up logging
LoggingHelper.ConfigureLogging;
```

Code example

```pascal
unit LoggingHelper;

interface

uses

{$IFDEF HABARI_LOGGING}
djLogOverSimpleLogger, SimpleLogger
{$ENDIF HABARI_LOGGING};

const

DEFAULT_LOG_LEVEL = 'info';

procedure ConfigureLogging(const LogLevel: string = DEFAULT_LOG_LEVEL);

implementation

procedure ConfigureLogging(const LogLevel: string);
begin

{$IFDEF HABARI_LOGGING}
SimpleLogger.Configure('defaultLogLevel', LogLevel);
SimpleLogger.Configure('showDateTime', 'true');
{$ENDIF HABARI_LOGGING}
end;

end.
```
Conditional Symbols

Caution

All conditional symbols enable experimental or optional features, which are not covered by the free basic support plan. Feedback (suggestions for improvements, feature requests, and bug reports) are always welcome.

Conditional symbols for release builds

HABARI_ALLOW_UNKNOWN_URL_PARAMS

Disables strict connection URL parameter checking.

If this symbol is defined, connection URLs may contain arbitrary parameters. By default, the library only accepts well-known connection parameters and raises an exception for unknown parameters.

Broker versions: all broker versions.

HABARI_LOGGING

Enables logging support. Requires the open source SLF4P logging facade.

Broker versions: all broker versions.

See also: Logging with SLF4P

HABARI_SSL_SUPPORT

Enables SSL support. Support for SSL connections is an advanced / optional feature, technical support is not included in the basic support plan.

The directory source/optional contains example implementations of Indy and Synapse adapter classes with OpenSSL support. Please note that these are basic implementations and not supported in the free basic support plan.

Broker versions: all broker versions.

See also: SSL/TLS Support
**HABARI_USE_INTERCEPT**

Enables detailed logging of Stomp message frames

This uses the Indy interceptor implementation in unit IdInterceptSimLog.

All communication data will be logged to a file. A new file will be created for every new STOMP connection. The file is located in a folder below the current working directory.

If this symbol is defined in a release build, a compiler warning will be emitted:

```
HABARI_USE_INTERCEPT should not be used for release builds
```

**Broker versions:** all broker versions.

Indy communication adapter only

**Note:** this feature requires permissions

- create a directory in the current directory if it does not exist
- create files

---

**Conditional symbols for unit test projects**

**HABARI_TEST_OPTIONAL_UNITS**

Enables tests for experimental / optional units.

**HABARI_TEST_SYNAPSE**

Enables Synapse communication adapter in DUnit/FPCUnit tests, default is Indy.

**Supported for:** all versions.

**HABARI_TEST_USE_MGMT_API**

**Enables additional test steps**

If this symbol is defined, a broker-specific management client will be used to perform one or more of these actions:

- create destinations on the message broker (test preparation)
- destroy destinations on the message broker (cleanup)
- check destinations for their pending message count

Actual actions depend on the message broker type, see HabariTestCase unit source code for details.

Only available with the DUnit test suite, not for FPCUnit.

**Available since version 5.2.0 (2017.10)**
Status: This is work in progress / experimental

**Broker versions:** Apache ActiveMQ, Apache ActiveMQ Artemis and RabbitMQ. For OpenMQ, a “no op” client will be used to keep the test source code compatible between all broker versions.
SSL/TLS Support

SSL communication adapter classes

Habari Client for RabbitMQ includes two experimental adapter classes for usage with OpenSSL, one for Indy (Internet Direct) and one for Synapse. The units for these classes are in the source\optional folder.

<table>
<thead>
<tr>
<th>Adapter Class</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>TBTCommAdapterIndySSL</td>
<td>BTCommAdapterIndySSL</td>
</tr>
<tr>
<td>TBTCommAdapterSynapseSSL</td>
<td>BTCommAdapterSynapseSSL</td>
</tr>
</tbody>
</table>

Table 8: Communication Adapters with SSL Support

Mixed Use

It is possible to use SSL and non-SSLL connections in the same project:

- connections with the “stomp://” scheme will remain unencrypted
- connections with the “stomp+ssl://” scheme will use SSL

SSL configuration

The TBTCommAdapterIndySSL class includes very basic configuration of the Indy SSL handler. Your server or your specific security requirements may require additional configuration.

Indy SSL Demo

A demo application is included in common-producertool-ssl.

Code example

```pascal
program ProducerToolIndySSL;

{$APPTYPE CONSOLE}

uses
```
begin
BTAdapterRegistry.SetDefaultAdapter(TBTCommAdapterIndySSL);

with TProducerTool.Create do
try
  try
    Run;
  except
    on E:Exception do WriteLn(E.Message);
  end
finally
  Free;
end;
ReadLn;
end.

Notes

- the TBTCommAdapterIndySSL class must be registered using
  (BTAdapterRegistry.SetDefaultAdapter(TBTCommAdapterIndySSL)
- the project must be compiled with HABARI_SSL_SUPPORT
- the connection URL must be in the form "stomp+ssl://server.com:sslport"
- the OpenSSL libraries must be in the application search path

Example output

Habari Client for RabbitMQ 5.1.0 (c) 2008-2017 Michael Justin
Connecting to URL: stomp+ssl://localhost:61614
Publishing a Message with size 255 to queue: ExampleQueue
Using persistent messages
Sleeping between publish 0 ms
313 INFO habari.TBTCommAdapterIndySSL - Verifying SSL certificate
313 INFO habari.TBTCommAdapterIndySSL - Issuer: /C=GB/ST=Greater Manchester/L=Sa
1ford/O=COMODO CA Limited/CN=COMODO RSA Domain Validation Secure Server CA
313 INFO habari.TBTCommAdapterIndySSL - Verifying SSL certificate
313 INFO habari.TBTCommAdapterIndySSL - Issuer: /C=GB/ST=Greater Manchester/L=Sa
1ford/O=COMODO CA Limited/CN=COMODO RSA Domain Validation Secure Server CA
329 INFO habari.TBTStompClient - Connected with RabbitMQ/3.6.10 using STOMP 1.2
Sending message: Message: 0 sent at: 28.06.2017 10:26:43           ...
Sending message: Message: 1 sent at: 28.06.2017 10:26:43           ...
Sending message: Message: 2 sent at: 28.06.2017 10:26:43           ...
Sending message: Message: 3 sent at: 28.06.2017 10:26:43           ...
Sending message: Message: 4 sent at: 28.06.2017 10:26:43           ...
Sending message: Message: 5 sent at: 28.06.2017 10:26:43           ...
Sending message: Message: 6 sent at: 28.06.2017 10:26:43           ...
Support

Support for SSL/TLS connections and the example adapter classes is not included in the basic support package of Habari Client for RabbitMQ.
Useful Units

BTStreamHelper unit
This unit contains the procedure LoadBytesFromStream which can be used to read a file into a BytesMessage.

Code example

```delphi
// create the message
Msg := Session.CreateBytesMessage;

// open a file
FS := TFileStream.Create('filename.dat', fmOpenRead);
try
  // read the file bytes into the message
  LoadBytesFromStream(Msg, FS);
  Size := Length(Msg.Content);
  // display message content size
  WriteLn(IntToStr(Size) + ' Bytes');
finally
  // release the file stream
  FS.Free;
end;
```

BTJavaPlatform unit
This unit contains some helper functions for Java dates. Java dates are Int64 values based on the Unix date.

```delphi
function JavaDateToTimeStamp(const JavaDate: Int64): TDateTime;

function TimeStampToJavaDate(const TimeStamp: TDateTime): Int64;
```
Library Limitations

MessageConsumer

How do I implement synchronous receive from multiple destinations?
The library does not support synchronous receive from more than one destination over a single connection.

To receive messages synchronously (using Receive and ReceiveNoWait) from two or more destinations, create one connection per destination.

Background: all pending messages in a connection are serialized in one TCP stream, so reading only the messages which come from one of the destinations would require 'skipping' all messages for other destinations.

Message properties

Only string data type supported by Stomp
The STOMP protocol uses string type key/value lists for the representation of message properties. Regardless of the method used to set message properties, all message properties will be interpreted as Java Strings by the Message Broker.

As a side effect, the expressions in a Selector are limited to operations which are valid for strings.

Timestamp properties are converted to a Unix time stamp value, which is the internal representation in Java. But still, these values can not be used with date type expressions.

Broker-specific exceptions
Apache ActiveMQ 5.6 introduced support for numeric expressions in JMS selectors.

Multi threading
A session supports transactions and it is difficult to implement transactions that are multi-threaded; a session should not be used concurrently by multiple threads.
Free Pascal specific restrictions

- the library has only been tested on the Windows platform
- the included unit test project uses FPCUnit for Free Pascal / Lazarus instead of DUnit
- the third-party libraries for XML and JSON based object exchange do not support Free Pascal
- the library source code use the Delphi mode switch {$MODE DELPHI}
- other limitations or restrictions may apply

Broker-specific limitations

Transacted Sessions

Transactional acknowledging
The STOMP implementations of Artemis and OpenMQ message broker do not support transactional acknowledging of incoming messages.

Other broker specific limitations
For broker-specific notes, please read chapter Broker-specific notes.
Frequently Asked Questions

Technical questions

Why am I getting 'undeclared identifier IndyTextEncoding_UTF8'?

Short answer
Your Indy version is too old.

Long answer
The library requires a current Indy 10.6.2 version.

Solution
Please download a newer Indy version.

Why am I getting 'Undeclared identifier: 'TimeSeparator''?

Short answer
Your Synapse version does not support your version of Delphi.

Long answer

Solution
Please use Indy instead of Synapse or use a compatible version of Synapse.

Why am I getting 'Found no matching consumer' errors?

Short answer
The client closed a consumer while there still were pending messages on the wire for it, and then tried to receive the pending messages with a new consumer.
Long answer

If the client subscribes to a destination, it creates a unique subscription identifier and passes it to the broker. Messages which the broker sends to the client always include this subscription identifier in their header properties. The client verifies that the subscription id in the incoming message has the same id as the consumer.

If the client closes the consumer before all messages waiting on the wire have been consumed, and creates a new subscription (which has a new unique id), the remaining messages which are waiting on the wire, will have a subscription id which does not match the id of the new subscription. The client will raise an exception if no matching consumer can be found.

Solution

Do not create another consumer on the same connection while there are still pending messages for the first consumer. To discard all pending messages which are still waiting on the wire, the client can simply close the close the connection and create a new consumer on a new connection.

Example

Here is a small code example which causes this error:

```
procedure TErrorHandlingTests.TestReceiveMessageForOtherSubscription;
var
  Factory: IConnectionFactory;
  Conn: IConnection;
  Session: ISession;
  Destination: IDestination;
  Producer: IMessageProducer;
  Consumer: IMessageConsumer;
  Msg: IMessage;
begin
  Factory := TBTConnectionFactory.Create;
  Conn := Factory.CreateConnection;
  Conn.Start;
  Session := Conn.CreateSession(amAutoAcknowledge);
  Destination := Session.CreateQueue(GetQueueName);
  Consumer := Session.CreateConsumer(Destination);
  Producer := Session.CreateProducer(Destination);
  Msg := Session.CreateMessage;
  Producer.Send(Msg);
  Consumer.Close;
  Consumer := Session.CreateConsumer(Destination);
  Consumer.Receive(1000);
end;
```

In line 20 and 21, the consumer is closed and a new consumer created for the same destination.

The Receive in line 22 will detect that the incoming message does not have a matching consumer id and raise an EIllegalStateException.

27 This code example is included in the library unit test project.
Online Resources

Third-party libraries

Indy
Indy is an open source client/server communications library that supports TCP/UDP/RAW sockets, as well as over 100 higher level protocols including SMTP, POP3, IMAP, NNTP, HTTP, FTP, and many more. Indy is written in Delphi but is available for C++Builder, Delphi, FreePascal, .NET, and Kylix.

Project home  https://www.indyproject.org/
GitHub  https://github.com/IndySockets

SLF4P
SLF4P is a simple logging facade for Object Pascal, developed with Delphi 2009 and Lazarus 2.0. Tested with DUnit and FPCUnit.

Project home  https://github.com/michaelJustin/slf4p

JsonDataObjects
JsonDataObjects is a JSON parser for Delphi 2009 and newer

GitHub  https://github.com/ahausladen/JsonDataObjects

Synapse

Project home  http://synapse.ararat.cz
Subversion  http://svn.code.sf.net/p/synalist/code/trunk/
Specifications

**Stomp** – Simple (or Streaming) Text Oriented Messaging Protocol

Stomp home  [https://stomp.github.io/index.html](https://stomp.github.io/index.html)

Stomp 1.2  [https://stomp.github.io/stomp-specification-1.2.html](https://stomp.github.io/stomp-specification-1.2.html)

Stomp 1.1  [https://stomp.github.io/stomp-specification-1.1.html](https://stomp.github.io/stomp-specification-1.1.html)

Stomp 1.0  [https://stomp.github.io/stomp-specification-1.0.html](https://stomp.github.io/stomp-specification-1.0.html)

**Broker-specific Stomp documentation**

ActiveMQ  [https://activemq.apache.org/stomp.html](https://activemq.apache.org/stomp.html)


RabbitMQ  [https://www.rabbitmq.com/stomp.html](https://www.rabbitmq.com/stomp.html)

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33 [https://mikejustin.wordpress.com/2013/05/21/rpc-with-delphi-client-and-java-server-using-rabbitmq/](https://mikejustin.wordpress.com/2013/05/21/rpc-with-delphi-client-and-java-server-using-rabbitmq/)
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³⁴ [http://vimeo.com/12654513](http://vimeo.com/12654513)
³⁵ [http://www.youtube.com/watch?v=RHUJBsy3udU](http://www.youtube.com/watch?v=RHUJBsy3udU)
Support

Bug reports and support inquiries
Please send bug reports and support inquiries to cases@habarisoft.com, and specify your message broker type and version.

To allow fast processing of your inquiry, please provide a detailed problem description, including configuration and environment, or code examples which help to reproduce the problem.

Advanced support
Advanced and experimental features such as (for example) SSL, third party libraries, Free Pascal, Linux, non-Unicode Delphi versions and message broker configuration are not covered by the basic support scheme.
Broker-specific notes

Minimum supported broker version

The minimum supported broker version for Habari Client for RabbitMQ 6.10 is RabbitMQ 3.8.0.36

The client library does not check the broker version, however client code may check the server version string.37

Online resources

The web page https://www.rabbitmq.com/stomp.html documents details of the STOMP implementation in RabbitMQ, including broker-specific extensions.

Note

If you use broker-specific extensions, be aware that moving to a different broker and a different version of Habari Client library later will require more than a simple recompilation of source code

Message type detection

The library determines the type (binary or text) of incoming STOMP messages based on the content-type header. If the header starts with 'text/', the message will be treated as a text message. Otherwise, it will be treated as a binary message (IBytesMessage).

Other STOMP clients (for example node.js) may be not aware of this RabbitMQ specific rule. If they send a text message without setting content-type to ‘text/plain’, Habari Client for RabbitMQ will misinterpret them as binary messages.

To fix this, adjust the producer client code to include the content-type header with value ‘text/plain’.

Prefetch count

The RabbitMQ STOMP documentation explains that

“The prefetch count for all subscriptions is set to unlimited by default. This can be controlled by setting the prefetch-count header on SUBSCRIBE frames to the desired integer count.”

36 https://www.rabbitmq.com/changelog.html
37 see IConnectionInfo.StompServerName
With Habari Client for RabbitMQ, the prefetch-count header can be set using a parameter on the destination name for a message consumer:

```
// create a queue with a prefetch count of 3
Queue := Session.CreateQueue('ExampleQueue?prefetch-count=3');

// create a consumer for this queue
Consumer := Session.CreateConsumer(Queue);
Msg := Consumer.Receive(1000);
```

**Destination types**

The RabbitMQ STOMP documentation describes five destination types:

- `/exchange` – SEND to arbitrary routing keys and SUBSCRIBE to arbitrary binding patterns;
- `/queue` – SEND and SUBSCRIBE to queues managed by the STOMP gateway;
- `/amq/queue` – SEND and SUBSCRIBE to queues created outside the STOMP gateway;
- `/topic` – SEND and SUBSCRIBE to transient and durable topics;
- `/temp-queue/` – create temporary queues (in reply-to headers only).

Habari Client for RabbitMQ supports all these types: for the special RabbitMQ destination names with "/amq/queue" or "/exchange", the prefixes can be used in the `Session.CreateTopic` / `Session.CreateQueue` methods.

**The prefixes for the three other destination types are added automatically by the library.**

**Header properties**

Habari Client for RabbitMQ does not process these RabbitMQ specific STOMP headers:

- `amqp-message-id` the AMQP message-id property
- `content-encoding` the content-encoding property

**Auto-delete queues**

The RabbitMQ STOMP plug-in supports advanced queue features, which can be defined in the management interface but also from clients when the queue is created. No matter how these features have been declared, RabbitMQ requires that the client specifies the same feature settings anytime when this queue is used.

38 https://www.rabbitmq.com/stomp.html
If a queue has been created with the auto-delete flag set, the queue is deleted when all consumers have finished using it.\textsuperscript{39}

**Creation of an auto-delete queue**

If the queue does not exist yet, it may be created dynamically by subscribing

```plaintext
Code example

ClientCallbackQueue := Session.CreateQueue('Callback?auto-delete=true');
Consumer := Session.CreateConsumer(ClientCallbackQueue);
```

The admin interface will show that the **auto-delete** feature is enabled.

**Sending a message to the auto-delete queue**

Sending a message to this queue requires to specify that the auto-delete feature is enabled:

```plaintext
Code example

Msg := Session.CreateTextMessage;
Msg.SetStringProperty('auto-delete', 'true');
Producer.Send(Msg);
```

**Queues with x-max-priority**

The RabbitMQ STOMP plug-in supports advanced queue features, which can be defined in the management interface but also from clients when the queue is created. No matter how these features have been declared, RabbitMQ requires that the client specifies the same feature settings anytime when this queue is used.

**Creation of the queue**

If the queue does not exist yet, it may be created dynamically by subscribing

```plaintext
Code example

PriorityQueue := Session.CreateQueue('Priority?x-max-priority=20');
Consumer := Session.CreateConsumer(PriorityQueue);
```

\textsuperscript{39} https://www.rabbitmq.com/amqp-0-9-1-reference.htm
The admin interface will show that the **maximum priority** is 20.

**Sending a message to the queue**

Sending a message to this queue requires to specify that the maximum priority is 20:

```
Code example
Msg := Session.CreateTextMessage;
Msg.SetIntProperty('x-max-priority', 20);
Producer.Send(Msg);
```

**Hint: check the broker log**

If your STOMP client code works with special destination features and does not work as expected, always check the RabbitMQ broker log file. On Windows, you may find it in `%APPDATA%\RabbitMQ\log`. On Unix, it is located in ${install_prefix}/var/log/rabbitmq (File Locations documentation).

**Quorum queues**

Quorum queues can be read, if the type is specified in the subscription STOMP frame. To do this, append the x-queue-type parameter to the queue name:

```
Code example

// create a destination
Queue := Session.CreateQueue('my-queue?x-queue-type=quorum');

// read the quorum queue value
Consumer := Session.CreateConsumer(Queue);
Msg := Consumer.Receive(10000);
```

**Send a value to a quorum queue**

```
Code example

// create a destination (but do not specify the queue type)
Queue := Session.CreateQueue('my-queue');

// send the quorum queue value
Producer := Session.CreateProducer(Queue);
Producer.Send(Session.CreateTextmessage('42'));
```
**Temporary queues**

RabbitMQ does not support message acknowledge with temporary queues.
To notify about this limitation, Habari Client for RabbitMQ raises an exception when Msg.Acknowledge is called on a temporary destination (queue or topic).

---

**Special character encoding in STOMP headers**

If a client sends a STOMP header to the RabbitMQ message broker which contains a colon character, the broker will escape it according to the STOMP 1.1 specification as `\c`.
However this happens independent of the STOMP version – even if the library uses STOMP 1.0 for the connection.
The Habari Client for RabbitMQ will not translate this non-standard escape sequence back to the colon character.
As a workaround, client applications should prefer STOMP 1.2 as this will activate correct escape sequence conversion.
Durable subscriptions with RabbitMQ

Description

If a client needs to receive all the messages published on a topic, including the ones published while the subscriber is inactive, it uses a durable TopicSubscriber.

The broker retains a record of this durable subscription and insures that all messages from the topic's publishers are retained until they are acknowledged by this durable subscriber or they have expired.

In RabbitMQ, the combination of the topic name and the durable subscriber name uniquely identifies the durable topic subscription.

AMQP Semantics

For SUBSCRIBE frames, a shared queue is created for each distinct subscription ID x destination pair, and bound to the amq.topic exchange with routing key <name>. A subscription is created against the queue.

After you restart your program and re-subscribe, the broker will know which messages you need that were published while you were away.

Note: if the same combination of topic name and durable subscriber name is used by more than one client, the broker behavior is undefined – messages can be distributed between clients, or one client will receive all messages and other clients never see a message.

Creation

The ISession interface contains the CreateDurableSubscriber method which creates a durable subscriber to the specified topic.

A durable subscriber MessageConsumer is created with a unique durable subscriber name.

Code example

```plaintext
// create a durable subscription

Topic := Session.CreateTopic('ExampleTopic');
Consumer := Session.CreateDurableSubscriber(Topic, 'my-subscription-id');
```

40 https://download.oracle.com/javaee/5/api/javax/jms/TopicSession.html
41 https://www.rabbitmq.com/stomp.html
Deletion

To delete a durable subscriber, RabbitMQ requires that the client first subscribes and then unsubscribes.

Code example

```go
// first subscribe, then unsubscribe

Topic := Session.CreateTopic('ExampleTopic');
Session.CreateDurableSubscriber(Topic, 'my-subscription-id');

Session.Unsubscribe(Topic, 'my-subscription-id');
```

Test tool example

With the ProducerTool and ConsumerTool demo applications, you can send messages to a durable topic:

```
ProducerTool --MessageCount=1000 --Topic --Persistent --Subject=test-durable
```

and receive them from a client:

```
ConsumerTool --MaximumMessages=1000 --Topic --Subject=test-durable --Durable --
ConsumerName=12345 -Verbose
```
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