WebSocket Actor

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Description

A library implementing a high-level actor-based WebSocket communication. An actor can subscribe to a WebSocket Actor (either server or client) to facilitate WebSocket-based communication.

Main Features

- Fully Actor Framework Based
- Full WebSocket Compatibility
- Support for WebSocket resources
- Keepalive infrastructure
- Secure connection capabilities

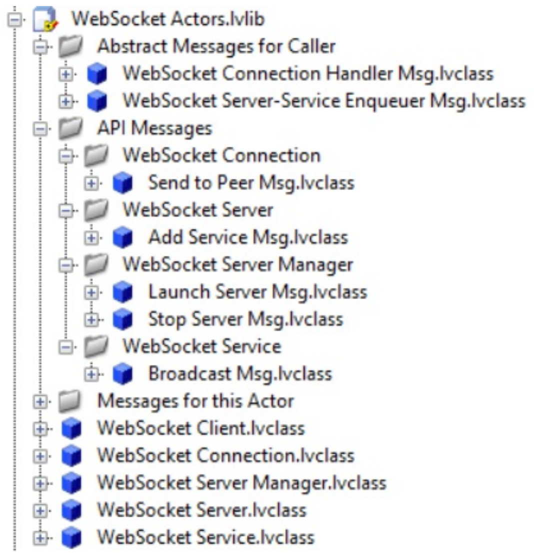
Example Code

Look in the example folder for a comprehensive set of code examples covering the full functionality of the library.

Note About Terminology

Please note that within this library **resource names**, as defined in the WebSocket protocol specification, are referred to as **services**.

Library



```
WebSocket Actors.lvlib
    Abstract Messages for Caller
        WebSocket Connection Handler Msg.lvclass
        WebSocket Server-Service Enqueuer Msg.lvclass
    API Messages
        WebSocket Connection
            Send to Peer Msg.lvclass
        WebSocket Server
            Add Service Msg.lvclass
        WebSocket Server Manager
            Launch Server Msg.lvclass
            Stop Server Msg.lvclass
        WebSocket Service
            Broadcast Msg.lvclass
    Messages for this Actor
    WebSocket Client.lvclass
    WebSocket Connection.lvclass
    WebSocket Server Manager.lvclass
    WebSocket Server.lvclass
    WebSocket Service.lvclass
```

Actors

WebSocket Client.lvclass

It forwards packets received from the connected WebSocket Service to its subscriber as "WebSocket Connection Handler Msg" messages. It allows its subscriber to send data to a specified service to which the WebSocket client is connected ("Send to Peer Msg" message" message of the parent "WebSocket Connection" class). Before starting the actor, the subscriber must provide, by means of suitable properties, a data handler message in form of a concrete implementation of the "WebSocket Connection Handler Msg" abstract message used to handle the connection events corresponding to the WebSocket communication, a concrete implementation of the "WebSocket Server-Service Enqueuer Msg" abstract message used to receive the WebSocket service actor enqueuer, and the WebSocket service URI to which the client should connect.

WebSocket Server Manager.lvclass

This actor's role is solely that of launching and managing the stop of "WebSocket Server" actors listening on at a specific port and interface address ("Launch Server Msg" and "Stop Server Msg" messages). The actor will ensure that the launched "WebSocket Server" doesn’t conflict on interface and port resources. If the server is already running at that port or on the specified interface the method sends just the server enqueuer to the client. If the server is not running it will be launched.

WebSocket Server.lvclass

Defines a WebSocket Server characterized by an interface and a port on which it listens. Allows for the definition of WebSocket Services. Services can be defined by the server subscriber by sending the "Add Service" message to the actor. The subscriber must provide a concrete implementation of the "WebSocket Server-Service Enqueuer Msg" abstract message used to let its subscriber receive the WebSocket service actor enqueuer and a data handler message in form of a concrete implementation of the "WebSocket Connection Handler Msg" abstract message used to handle the connection events corresponding to the WebSocket communication. For each service defined a "WebSocket Service" actor is started that will send data to the subscriber that has defined the service. The actor listens according to the server specifications on a port and on an interface if not all, when a connection is established, the actor performs the WebSocket handshake. If the service requested is defined in this server, it informs the WebSocket service Actor who will start a corresponding WebSocket connection actor. If either the service is not defined, or the handshake fails, we do nothing, the WebSocket protocol will take care of communicating the failure to the client.

WebSocket Service.lvclass

It forwards packets received from the connected WebSocket Clients to its subscriber actor as "WebSocket Connection Handler Msg" messages. It allows the subscriber to send data to a specified client ("Send to Peer Msg" message of the parent "WebSocket Connection" class) or to all connected clients (“Broadcast Msg” message). When launching the actor by means of the “WebSocket Server.lvclass” actor, the subscriber must provide a data handler message in form of a concrete implementation of the "WebSocket Connection Handler Msg" abstract message used to handle the connection events corresponding to the WebSocket communication and a concrete implementation of the "WebSocket Server-Service Enqueuer Msg" abstract message used to let the server subscriber actor receive the WebSocket service actor enqueuer.

Abstract messages

Two abstract messages must be subclassed to allow the interaction of either a WebSocket Server, a WebSocket Service or a WebSocket Client with the corresponding subscriber actor.

WebSocket Connection Handler Msg.lvclass

This abstract message is sent by either the WebSocket Client or by the WebSocket Service to the subscriber Actor on four events:

- Connect
- Disconnect
- Message
- Drop

For each subscriber Actor a concrete subclass of the message should be created by overriding the methods:

- "On Connect.vi"
- "On Disconnect.vi"
- "On Message.vi"
- "On Drop.vi"

The subscriber actor can program the required action for the corresponding event.

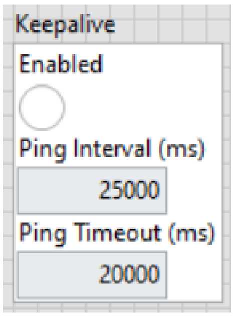
WebSocket Server-Service Enqueuer Msg.lvclass

This abstract message is used either by the WebSocket Server Manager or by the WebSocket Server to send the just launched/added Server/Service Enqueuer to the subscriber actor requesting the operation. Each subscriber actor requesting the operation should subclass this message and then override the Do.vi in which the Server/Service Enqueuer is stored in the requesting actor.

API

WebSocket Server Manager

Keepalive Settings

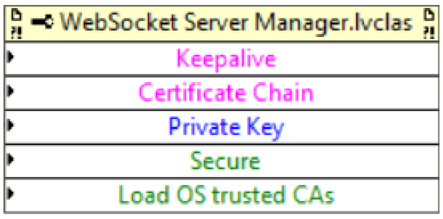

Keepalive
Enabled
Ping Interval (ms)
25000
Ping Timeout (ms)
20000

The Keepalive settings allow for the configuration of the Keepalive functionality whereby client/server checks if the peer is still responding ("Alive") by sending WebSockets Ping messages to the peer on a certain time interval. The peer will answer with a WebSockets Pong message. If the answer is not received within a certain amount timeout the client/server will drop the connection.

Enable If true enables the Keepalive functionality **Ping Interval (ms)** is the interval of time in milliseconds that elapses between the receipt of the previous pong response and the sending of the next ping message **Ping Timeout (ms)** is the interval of time in milliseconds that a client/server waits after sending a ping message until declaring the peer not Alive and dropping the connection

WebSocket Server Manager Configuration

Before launch the "Server Manager Actor" can be configured with the Keepalive settings described above by means of the following property node


WebSocket Server Manager.lvclas
Keepalive
Certificate Chain
Private Key
Secure
Load OS trusted CAs

Keepalive The Keepalive settings will be active for all the WebSocket Servers launched by the "WebSocket Server Manager Actor"

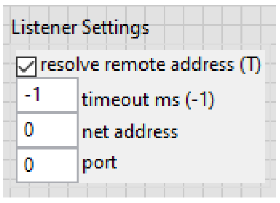
Certificate Chain specifies an array of Distinguished Encoding Rules (DER) certificates. The certificates must be supplied depth-first: the server's certificate, followed by the Certificate Authority (CA) that signs the certificate of the server, on up to the root CA. For more details see LabVIEW TLS examples.

Private Key a byte array containing the private key of the servers started by the server manager. For more details see LabVIEW TLS examples.

Secure If set to TRUE all server started by the server manager will be providing only secure connections. In this case you will need to suitably configure at least the following parameters: **Certificate Chain**, **Private Key**.

Load OS trusted CAs specifies whether to load Certificate Authority (CA) certificates trusted by the OS for the secure connection.

WebSocket Server Listener Settings


Listener Settings
☑ resolve remote address (T)
-1 timeout ms (-1)
0 net address
0 port

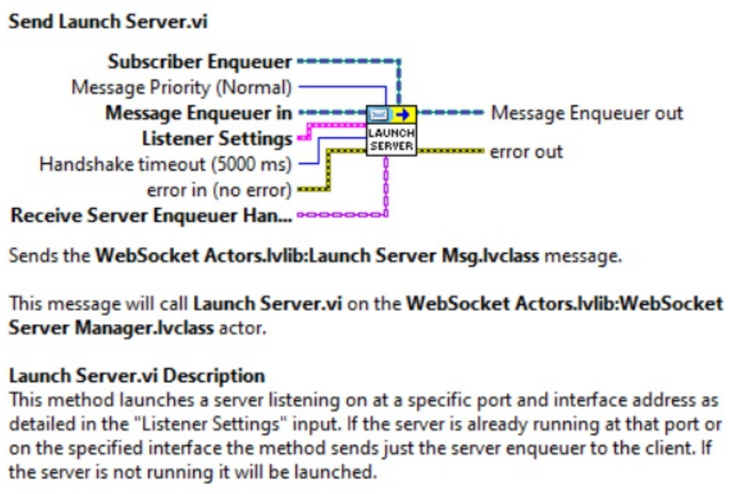
timeout ms specifies the time, in milliseconds, that the function waits for a connection. If a connection is not established in the specified time, the function returns an error. The default value is –1, which indicates to wait indefinitely.

resolve remote address indicates whether to call the IP To String function on the remote address.

net address specifies on which network address to listen. Specifying an address is useful if you have more than one network card, such as two Ethernet cards, and want to listen only on the card with the specified address. If you do not specify a network address, LabVIEW listens on all network addresses.

port is the port number on which you want to listen for a connection.

Launch Server



Sends the **WebSocket Actors.lvlib:Launch Server Msg.lvclass** message.

This message will call **Launch Server.vi** on the **WebSocket Actors.lvlib:WebSocket Server Manager.lvclass** actor.

Launch Server.vi Description
This method launches a server listening on at a specific port and interface address as detailed in the "Listener Settings" input. If the server is already running at that port or on the specified interface the method sends just the server enqueuer to the client. If the server is not running it will be launched.

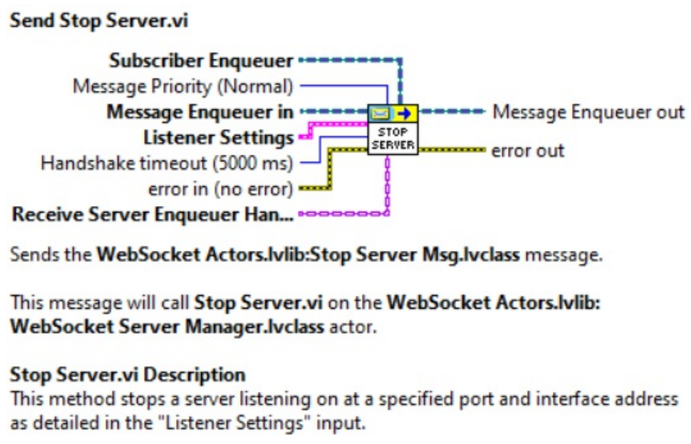
Message Enqueuer in specifies the enqueuer of the WebSocket Server Manager actor.

Listener Settings specifies the listener settings for the Server.

Handshake timeout specifies the timeout of the handshake when the client establishes a WebSocket connection to the server.

Receive Server Enqueuer Handler specifies the concrete message (to be created) child of the abstract message "*WebSocket Server-Service Enqueuer Msg.lvclass*".

Stop a Server



Sends the **WebSocket Actors.lvlib:Stop Server Msg.lvclass** message.

This message will call **Stop Server.vi** on the **WebSocket Actors.lvlib: WebSocket Server Manager.lvclass** actor.

Stop Server.vi Description
This method stops a server listening on at a specified port and interface address as detailed in the "Listener Settings" input.

Subscriber Enqueuer specifies the enqueuer of the actor that has subscribed to the previously launched WebSocket Server actor.

Message Enqueuer in specifies the enqueuer of the WebSocket Server Manager actor to be stopped.

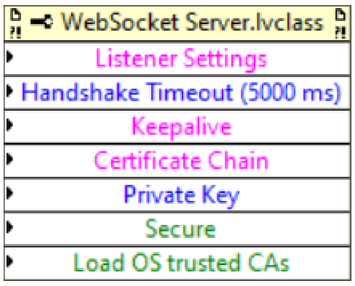
Listener Settings specifies the listener settings for the previously launched WebSocket Server actor.

Handshake timeout specifies the timeout of the handshake when the client establishes a WebSocket connection to the server.

Receive Server Enqueuer Handler specifies the concrete message (to be created) child of the abstract message "*WebSocket Server-Service Enqueuer Msg.lvclass*".

WebSocket Server

In case the WebSocket Server Actor is manually launched the following properties are available to configure it (the port must be entered) before its launch


WebSocket Server.lvclass

Listener Settings

Handshake Timeout (5000 ms)

Keepalive

Certificate Chain

Private Key

Secure

Load OS trusted CAs

Listener Settings specifies the Listener settings for the Server (see definition above).

Handshake timeout specifies the timeout of the handshake when the client establishes a WebSocket connection to the server.

Keepalive specifies the Keepalive settings for the Server (see definition above).

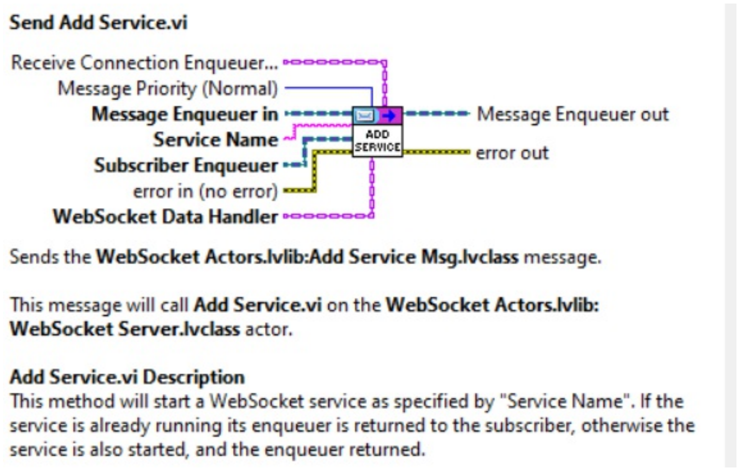
Certificate Chain specifies an array of Distinguished Encoding Rules (DER) certificates. The certificates must be supplied depth-first: the server's certificate, followed by the Certificate Authority (CA) that signs the certificate of the server, on up to the root CA. For more details see LabVIEW TLS examples.

Private Key a byte array containing the server private key. For more details see LabVIEW TLS examples.

Secure If set to TRUE the server will be providing only secure connections. In this case you will need to suitably configure at least the following parameters: **Certificate Chain**, **Private Key**.

Load OS trusted CAs For secure connections specifies whether to load Certificate Authority (CA) certificates trusted by the OS for the secure connection.

Add Service


Send Add Service.vi

Sends the **WebSocket Actors.lvlib:Add Service Msg.lvclass** message.

This message will call **Add Service.vi** on the **WebSocket Actors.lvlib: WebSocket Server.lvclass** actor.

Add Service.vi Description
This method will start a WebSocket service as specified by "Service Name". If the service is already running its enqueuer is returned to the subscriber, otherwise the service is also started, and the enqueuer returned.

Receive Connection Enqueuer specifies the concrete message (to be created) child of the abstract message "*WebSocket Server-Service Enqueuer Msg.lvclass".*

Message Enqueuer in specifies the enqueuer of the WebSocket Server actor.

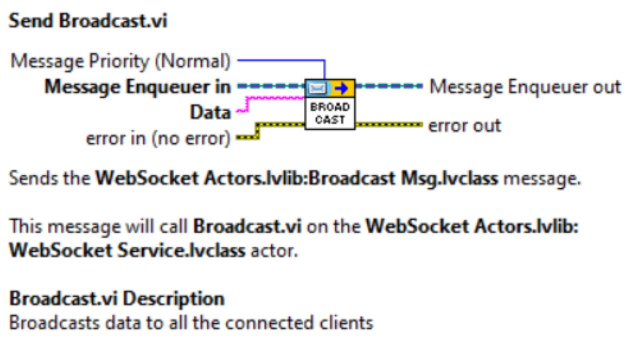
Service Name specifies the name of the service.

Subscriber Enqueuer specifies the enqueuer of the actor that subscribes to the WebSocket Server Actor.

WebSocket Data Handler specifies the concrete message (to be created) child of the abstract message "*WebSocket Connection Handler Msg.lvclass".*

WebSocket Service

Broadcast



Send Broadcast.vi

Sends the **WebSocket Actors.lvlib:Broadcast Msg.lvclass** message.

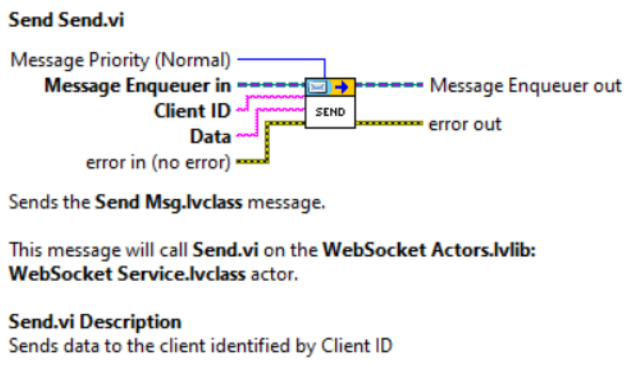
This message will call **Broadcast.vi** on the **WebSocket Actors.lvlib: WebSocket Service.lvclass** actor.

Broadcast.vi Description
Broadcasts data to all the connected clients

Message Enqueuer in specifies the enqueuer of the WebSocket Service actor.

Data specifies the data to be sent.

Send



Send Send.vi

Sends the **Send Msg.lvclass** message.

This message will call **Send.vi** on the **WebSocket Actors.lvlib: WebSocket Service.lvclass** actor.

Send.vi Description
Sends data to the client identified by Client ID

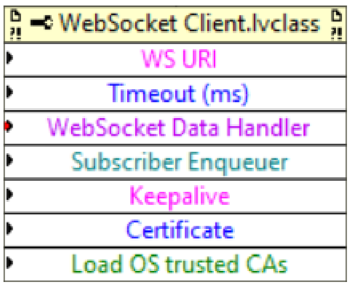
Message Enqueuer in specifies the enqueuer of the WebSocket Service actor.

Data specifies the data to be sent.

Client ID ID that identifies the specific WebSocket client to which we want to send the data

WebSocket Client

The following properties of the WebSocket Client actor must be set before launching it:



WS URI specifies the URI of the client with the following format:

plain connections: *ws://hostname:port/service*

secure connections: *wss://hostname:port/service*

for secure connections one has to configure the **Certificate** and **Load OS trusted CAs**, see below for description of these parameters.

Timeout (ms) is the timeout to establish the connection to the server. A value of –1 indicates to wait indefinitely.

WebSocket Data Handler specifies the concrete message (to be created) child of the abstract message "*WebSocket Connection Handler Msg.lvclass".*

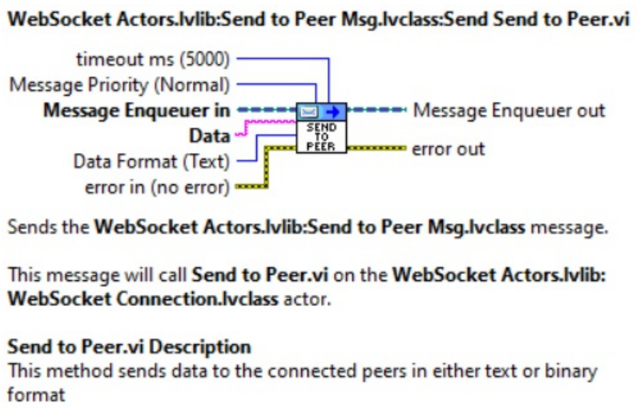
Subscriber Enqueuer specifies the enqueuer of the actor (must be created) that subscribes to the WebSocket Client Actor.

Keepalive specifies the Keepalive settings for the Client (see definition above).

Certificate Certificate Authority (CA) certificate input as a byte array. For more details see LabVIEW TLS examples.

Load OS trusted CAs For secure connections specifies whether to load Certificate Authority (CA) certificates trusted by the OS for the secure connection.

Send to Peers


WebSocket Actors.lvlib:Send to Peer Msg.lvclass:Send Send to Peer.vi

Sends the **WebSocket Actors.lvlib:Send to Peer Msg.lvclass** message.

This message will call **Send to Peer.vi** on the **WebSocket Actors.lvlib: WebSocket Connection.lvclass** actor.

Send to Peer.vi Description
This method sends data to the connected peers in either text or binary format

Message Enqueuer in specifies the enqueuer of the WebSocket Client actor.

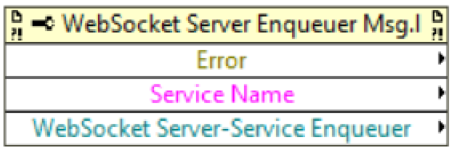
Data Format (Text) Specifies an Enum allowing to specify if the data format is either "Text" or "Binary".

Timeout ms (5000) is the timeout to establish the connection to the server. A value of –1 indicates to wait indefinitely.

Abstract Messages

Abstract messages have private properties that carry useful information to be used when the subscriber actor implementing the Do.vi method ("WebSocket Server-Service Enqueuer Msg" message) or the "On Close.vi", "On Connect.vi", "On Message.vi", "On Drop.vi" ("WebSocket Connection Handler Msg" message) to act on the subscriber actor

WebSocket Server-Service Enqueuer Msg

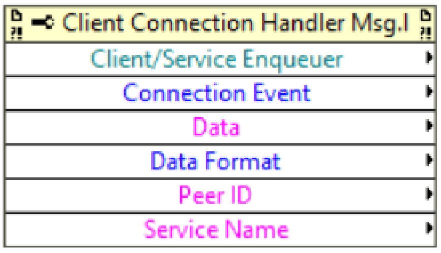

WebSocket Server Enqueuer Msg.l
Error
Service Name
WebSocket Server-Service Enqueuer

Error Carries the error resulting from either launching a server, or adding a service to a server or connecting to a client

Service Name String detailing the name of the service corresponding to the service that is being started and to which we are subscribing

WebSocket Server-Service Enqueuer the enqueuer of the server/service that was just started and to which we are subscribing

WebSocket Connection Handler Msg



Client/Service Enqueuer The enqueuer of the Client/Service to which we subscribed that triggered the event

Connection Event Enum specifying the type of event being triggered. Can take values "On Connect", "On Message", "On Close", and "On Drop"

Data String containing the data being received if the event triggered is of type "On Message"

Data Format Enum specifying the type of data being received in case of a "On Message" event. It can take values "Binary" and "Text"

Peer ID String specifying the Peer ID from which the event is being triggered if the event is originating from a client

Service Name String specifying the service name from which the event is being triggered