[Flask SocketIO Websocket]

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Code Repository	https://github.com/miguelgrinberg/Flask-SocketIO/blob/main/src/flask_socketio/__init__.py
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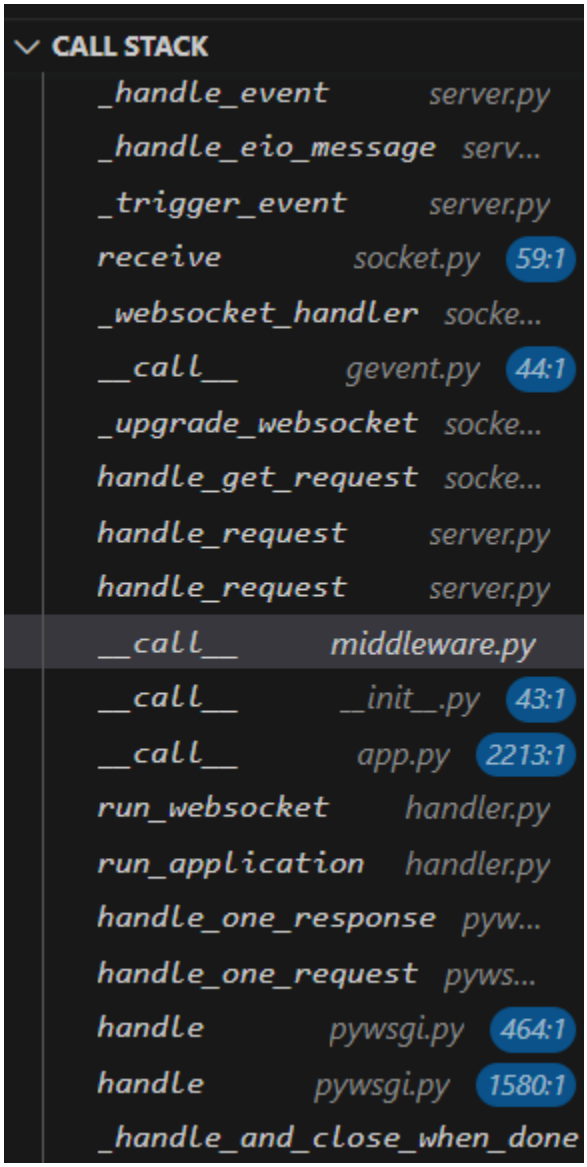
Magic



The flask_socketio library uses socketio to handle websocket connections. The socketio library is seen to send polling requests prior to establishing a successful websocket and after said websocket connection fails. However, the actual websocket upgrade request will come in the form of a long-polling GET request that has the header Connection set to upgrade and the header Upgrade set to websocket.

In the flask socketio WSGIServer, it will ultimately respond with a sec-websocket-accept and confirm the websocket connection, after which it will constantly listen on the socket hosting the websocket for frames.

The entry point of the websocket begins after the TCP header parsing.

https://github.com/gevent/gevent/blob/master/src/gevent/pywsgi.py#L694
handle_one_request() will call handle_one_response() to sent back the response that tells the browser that the upgrade is agreed on.

https://github.com/gevent/gevent/blob/master/src/gevent/pywsgi.py#L980
handle_one_response() initiates the response generation and sending process. It will call run_application() to construct the websocket response and write the response to the client.

https://github.com/wwwtyro/gevent-websocket/blob/master/geventwebsocket/handler.py#L62
run_application() will use upgrade_websocket() to generate the websocket response, after storing the response, it will then use write() to send the response to the client, and run_websocket() to have the current socket listen for websocket frames.

https://github.com/wwwtyro/gevent-websocket/blob/master/geventwebsocket/handler.py#L90
upgrade_websocket() performs various exception checks to ensure the request is a valid websocket upgrade request. This includes checking the request method to be GET, if the request actually asked for upgrade and the upgrade type.

After passing the conditionals, upgrade_connection() is called.

https://github.com/wwwtyro/gevent-websocket/blob/master/geventwebsocket/handler.py#L137
upgrade_connection() uses the environ dict to perform key and version check. It will then prepare the response headers.

upgrade_connection() creates new dict headers and assigns key values for Upgrade, Connection, and more importantly a base64 encoded value that acts as a ack to the upgrade request.

start_response() is then called to begin the final response header construction.

https://github.com/wwwtyro/gevent-websocket/blob/master/geventwebsocket/handler.py#L243
calls super.start_response(), which handles additional parsing of header key value pairs into a response header list with latin-1 encoding.
https://github.com/gevent/gevent/blob/master/src/gevent/pywsgi.py#L802
start_response() validates the headers passed down the parameters, then it returns self.write()

back in start_response(), _prepare_response() is called to assign several constructor values used for upholding websocket connection. It will then return

upgrade_connection returns as well.

upgrade_websocket() returns

https://github.com/wwwtyro/gevent-websocket/blob/master/geventwebsocket/handler.py#L74
Back in run_application, write() is called to write the response into the socket.

https://github.com/gevent/gevent/blob/master/src/gevent/pywsgi.py#L766
write() checks the result of the previous parsing to ensure the response is valid, then it calls _write_with_headers()

https://github.com/gevent/gevent/blob/master/src/gevent/pywsgi.py#L781
_write_with_headers() performs a loop to construct a byte array via appending the already parsed and encoded header key value pairs as well as the necessary ': ' and '\r\n'

in _write_with_headers(), _sendall() is used to send all the headers response and, _write is used to send the body of the response.

Afterwards, the chain of calls returns back to run_application, where run_websocket() is called to start the actual websocket.

https://github.com/wwwtyro/gevent-websocket/blob/master/geventwebsocket/handler.py#L34
run_websocket() performs a number of calls, the main purpose of these is to actually "upgrade" our socket from polling into websocket. This is again, necessary because flask socketio uses socketio which utilizes long-polling to start the websocket, it also defaults to long-polling if a websocket fails or timeout

A number of __call__ is used to ultimately get to the while true loop needed for the websocket.
https://github.com/pallets/flask/blob/main/src/flask/app.py#L2208
__call__ of the Flask class is triggered by list(self.application()) from run_websocket, this proceed to another __call__
https://github.com/miguelgrinberg/Flask-SocketIO/blob/main/src/flask_socketio/__init__.py#L40
Flask.__call__() will call self.wsgi_app, which triggers _SocketIoMiddleware's __call__
https://github.com/miguelgrinberg/python-engineio/blob/main/src/engineio/middleware.py#L45
We are now in WSGIApp.__call__

the chain of __call__ will call handle_request() of socketio, which will call engineio's handle_request().
https://github.com/miguelgrinberg/python-engineio/blob/main/src/engineio/server.py#L323
handle_request() will once again perform validation that the request is a properly formatted websocket upgrade request. It will call handle_get_request().

https://github.com/miguelgrinberg/python-engineio/blob/main/src/engineio/socket.py#L94
handle_get_request() will use getattr() to call _upgrade_websocket via method names on self, which is a engineio.socket.Socket object.

https://github.com/miguelgrinberg/python-engineio/blob/main/src/engineio/socket.py#L150
_upgrade_websocket() will then spawn in a async thread _websocket_handler using __call__

https://github.com/miguelgrinberg/python-engineio/blob/main/src/engineio/async_drivers/gevent.py#L33
this calls self.app() which will begin _websocket_handler that handles websocket frames

https://github.com/miguelgrinberg/python-engineio/blob/main/src/engineio/socket.py#L160
the _websocket_handler object will use a while true loop to constantly receive on the socket

This is also where the frame will be parsed if one has been received. This is achieved by

calling websocket_wait()

https://github.com/miguelgrinberg/python-engineio/blob/main/src/engineio/socket.py#L162
websocket_wait() will call WebSocketWSGI.wait(), check if the frame is valid size, and return it.

https://github.com/miguelgrinberg/python-engineio/blob/main/src/engineio/async_drivers/gevent.py#L52
WebSocketWSGI.wait() will simply read from the socket and return the data. The read is done via

https://github.com/jgelens/gevent-websocket/blob/master/geventwebsocket/websocket.py#L309
geventwebsocket.websocket.receive() will check if the websocket is closed first, and then call WebSocket.read_message()

https://github.com/jgelens/gevent-websocket/blob/master/geventwebsocket/websocket.py#L249
read_message() takes the output of WebSocket.read_frame(), which is a tuple of the header and payload of the websocket frame. Afterwards, it will perform conditionals on the opcode and return the payload message.

https://github.com/jgelens/gevent-websocket/blob/master/geventwebsocket/websocket.py#L193
read_frame() blocks until a entire frame has been read, it will call decode_header() to obtain important websocket frame information such as the mask
After decode_header(), read_frame() will unmask the payload.

https://github.com/miguelgrinberg/python-engineio/blob/main/src/engineio/socket.py#L230
call stack returns back to _websocket_handler which called websocket_wait().
packet.Packet object's __init__ is then used to decode the unmasked payload.

Finally, the returned unmasked and decoded message will be passed to socket.Socket's receive() which will call the appropriate event trigger for the message.