

# Web Sockets - Scala

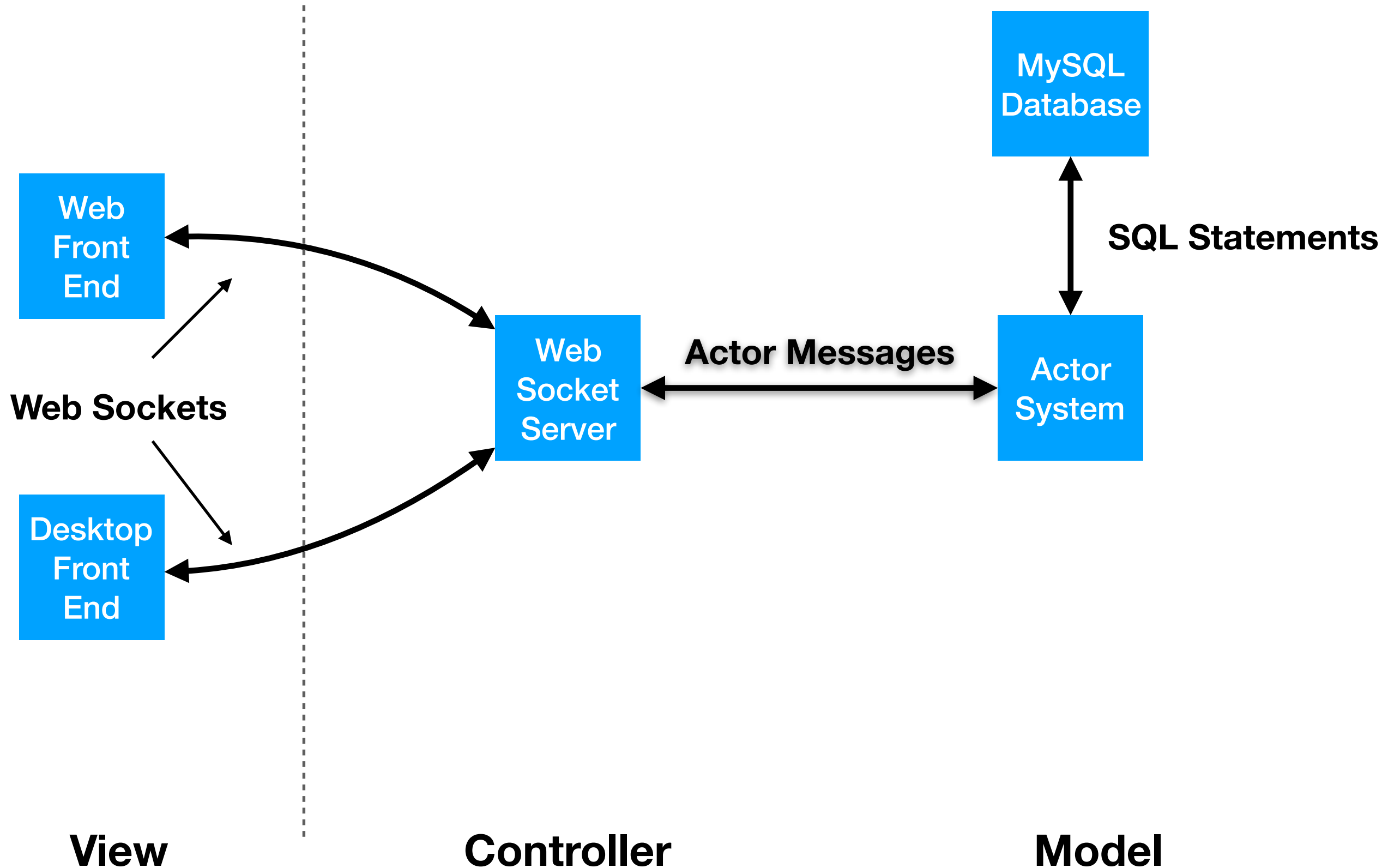
# Lecture Question

**Task: Write a Web Socket Server that counts the number of messages it receives**

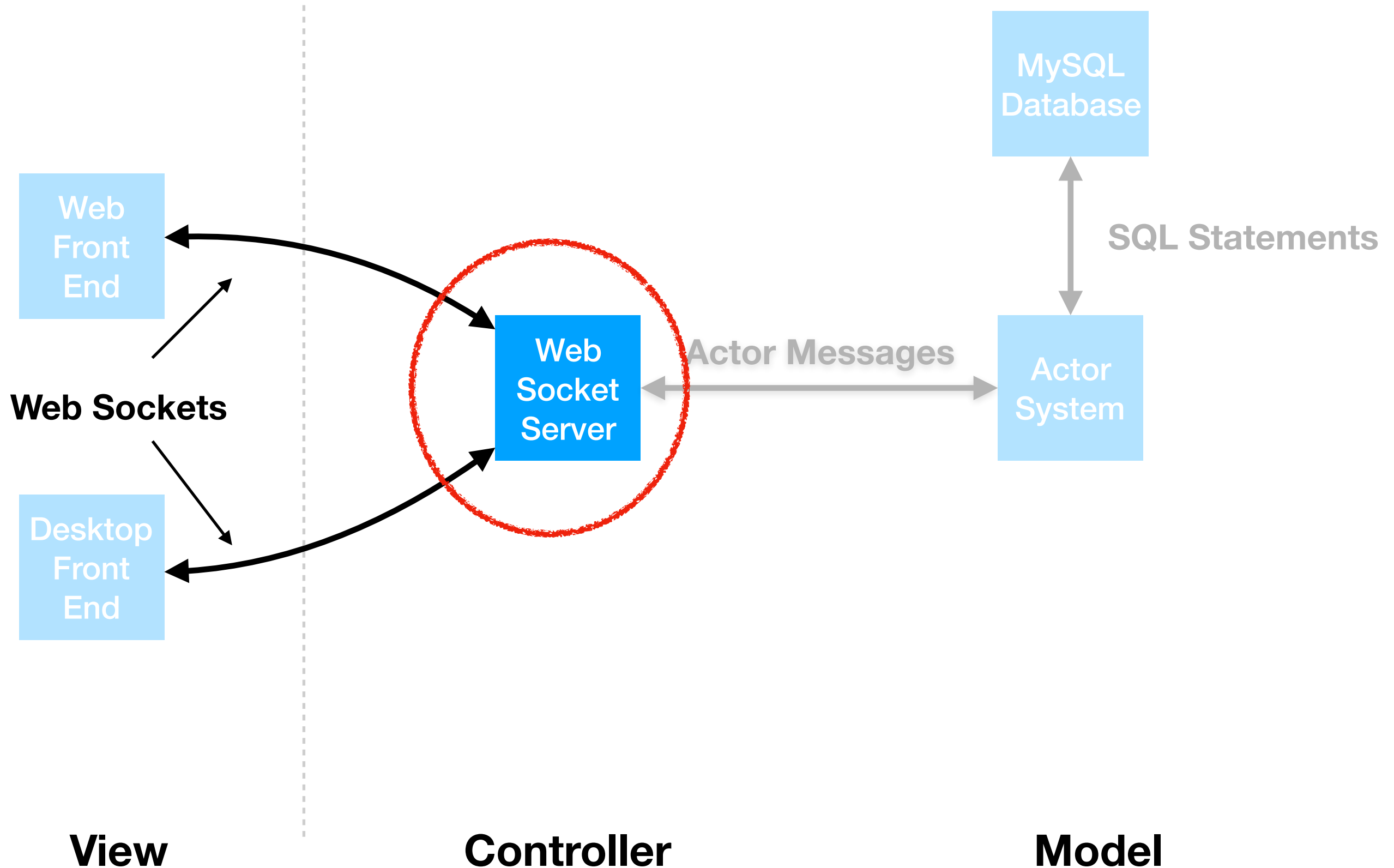
In a package named server, write a class named LectureServer that:

- When created, sets up a web socket server listening for connections on localhost:8080
- Listens for messages of type increment with no data
- Has a method named numberOfMessages that returns (as an Int) the number of times a message of type increment was received

# MMO Architecture



# MMO Architecture



# The Problem

- In CSE115 you used HTTP request/responses to build web apps
- If you wanted more data from the server after the page loads, you used AJAX
  - Server hosts JSON data at certain end points
  - Client makes an AJAX call to retrieve the most current data
- But the server has to wait for a request before sending a response

# The Problem

- What if the server wants to send time-sensitive data without waiting for a request?
- In CSE115
  - Built a chat app using polling
  - Client sent AJAX requests at regular intervals
  - Only get updates when AJAX request is sent
- Can use long-polling
  - Server hangs on poll requests until it has new data to send
  - Popular solution on major sites (Compatible with old browsers)

# Web Sockets

- A newer solution (Standardized in 2011)
- Establishes a lasting connection
  - Enables 2-way communication between server and client
- Server can push updates to clients over the web socket without waiting for the client to make a new request

# socket.io

- A library build on top of web sockets
- Maintains connections and reconnecting
- Uses message types
  - Similar to actors, except the message type is always a string
- Add listeners to react to different message types
  - Similar to ScalaFX/JavaFX Listeners to handle different event types



# socket.io Server in Scala

- New library
- Link on the course website
- Dependency included in pom.xml in examples repo

# Web Socket Server

- Import from the new library
- Setup and start the server

```
import com.corundumstudio.socketio.listener.{ConnectListener, DataListener, DisconnectListener}  
import com.corundumstudio.socketio.{AckRequest, Configuration, SocketIOClient, SocketIOServer}
```

```
class Server() {  
  
  val config: Configuration = new Configuration {  
    setHostname("localhost")  
    setPort(8080)  
  }  
  
  val server: SocketIOServer = new SocketIOServer(config)  
  
  server.addConnectListener(new ConnectionListener())  
  server.addDisconnectListener(new DisconnectionListener())  
  server.addEventListener("chat_message", classOf[String], new MessageListener())  
  server.addEventListener("stop_server", classOf[Nothing], new StopListener(this))  
  
  server.start()  
}
```

# Web Socket Server

- Create a configuration object for the server
- This server will run on localhost port 8080

```
import com.corundumstudio.socketio.listener.{ConnectListener, DataListener, DisconnectListener}
import com.corundumstudio.socketio.{AckRequest, Configuration, SocketIOClient, SocketIOServer}

class Server() {

  val config: Configuration = new Configuration {
    setHostname("localhost")
    setPort(8080)
  }

  val server: SocketIOServer = new SocketIOServer(config)

  server.addConnectListener(new ConnectionListener())
  server.addDisconnectListener(new DisconnectionListener())
  server.addEventListener("chat_message", classOf[String], new MessageListener())
  server.addEventListener("stop_server", classOf[Nothing], new StopListener(this))

  server.start()
}
```

# Web Socket Server

- Create and start the server
- Use the configuration to tell the library how to setup the server
- Call the start() method to start listening for connections

```
import com.corundumstudio.socketio.listener.{ConnectListener, DataListener, DisconnectListener}
import com.corundumstudio.socketio.{AckRequest, Configuration, SocketIOClient, SocketIOServer}

class Server() {

  val config: Configuration = new Configuration {
    setHostname("localhost")
    setPort(8080)
  }

  val server: SocketIOServer = new SocketIOServer(config)

  server.addConnectListener(new ConnectionListener())
  server.addDisconnectListener(new DisconnectionListener())
  server.addEventListener("chat_message", classOf[String], new MessageListener())
  server.addEventListener("stop_server", classOf[Nothing], new StopListener(this))

  server.start()
}
```

# Web Socket Server

- Add listeners to handle different event types
- Connect and disconnect listeners to react to clients connecting and disconnecting
- Event listeners for each different message type received from clients

```
import com.corundumstudio.socketio.listener.{ConnectListener, DataListener, DisconnectListener}
import com.corundumstudio.socketio.{AckRequest, Configuration, SocketIOClient, SocketIOServer}

class Server() {

  val config: Configuration = new Configuration {
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  val server: SocketIOServer = new SocketIOServer(config)

  server.addConnectListener(new ConnectionListener())
  server.addDisconnectListener(new DisconnectionListener())
  server.addEventListener("chat_message", classOf[String], new MessageListener())
  server.addEventListener("stop_server", classOf[Nothing], new StopListener(this))

  server.start()
}
```

# Web Socket Server

- For connect and disconnect
  - Create classes overriding ConnectListener and DisconnectListener
  - Implement the onConnect/onDisconnect methods
- These methods take a reference to the sending socket as a parameter
  - Can use this reference to send messages to the client
  - Usually want to store each reference to send messages later

```
server.addConnectListener(new ConnectListener())  
server.addDisconnectListener(new DisconnectListener())
```

```
class ConnectionListener() extends ConnectListener {  
  override def onConnect(client: SocketIOClient): Unit = {  
    println("Connected: " + client)  
  }  
}
```

```
class DisconnectListener() extends DisconnectListener {  
  override def onDisconnect(socket: SocketIOClient): Unit = {  
    println("Disconnected: " + socket)  
  }  
}
```

# Web Socket Server

- To receive message, specify the message type and the class of the message
  - Create classes extending `DataListener[message_class]`
- For message class we'll use
  - `String` to receive text data
  - `Nothing` if it's just a message, similar to an actor receiving a case object

```
server.addEventListener("chat_message", classOf[String], new MessageListener())  
server.addEventListener("stop_server", classOf[Nothing], new StopListener(this))
```

```
class MessageListener() extends DataListener[String] {  
  override def onData(socket: SocketIOClient, data: String, ackRequest: AckRequest): Unit = {  
    println("received message: " + data + " from " + socket)  
  }  
}
```

```
class StopListener(server: Server) extends DataListener[Nothing] {  
  override def onData(socket: SocketIOClient, data: Nothing, ackRequest: AckRequest): Unit = {  
    println("stopping server")  
    server.server.stop()  
    println("safe to stop program")  
  }  
}
```

# Web Socket Server

- The DataListeners must implement onData with parameters:
  - A socket reference. Can be used to lookup a user after storing this reference on connection/registration
  - data with type matching the class of the message. This is the content of the message received
  - AckRequest. Not used in this course

```
server.addEventListener("chat_message", classOf[String], new MessageListener())  
server.addEventListener("stop_server", classOf[Nothing], new StopListener(this))
```

```
class MessageListener() extends DataListener[String] {  
  override def onData(socket: SocketIOClient, data: String, ackRequest: AckRequest): Unit = {  
    println("received message: " + data + " from " + socket)  
  }  
}
```

```
class StopListener(server: Server) extends DataListener[Nothing] {  
  override def onData(socket: SocketIOClient, data: Nothing, ackRequest: AckRequest): Unit = {  
    println("stopping server")  
    server.server.stop()  
    println("safe to stop program")  
  }  
}
```



# Web Socket Demo

# Lecture Question

**Task: Write a Web Socket Server that counts the number of messages it receives**

In a package named `server`, write a class named `LectureServer` that:

- When created, sets up a web socket server listening for connections on `localhost:8080`
- Listens for messages of type `increment` with no data
- Has a method named `numberOfMessages` that returns (as an `Int`) the number of times a message of type `increment` was received