

# **Design**

**PSE of**

PSE Group

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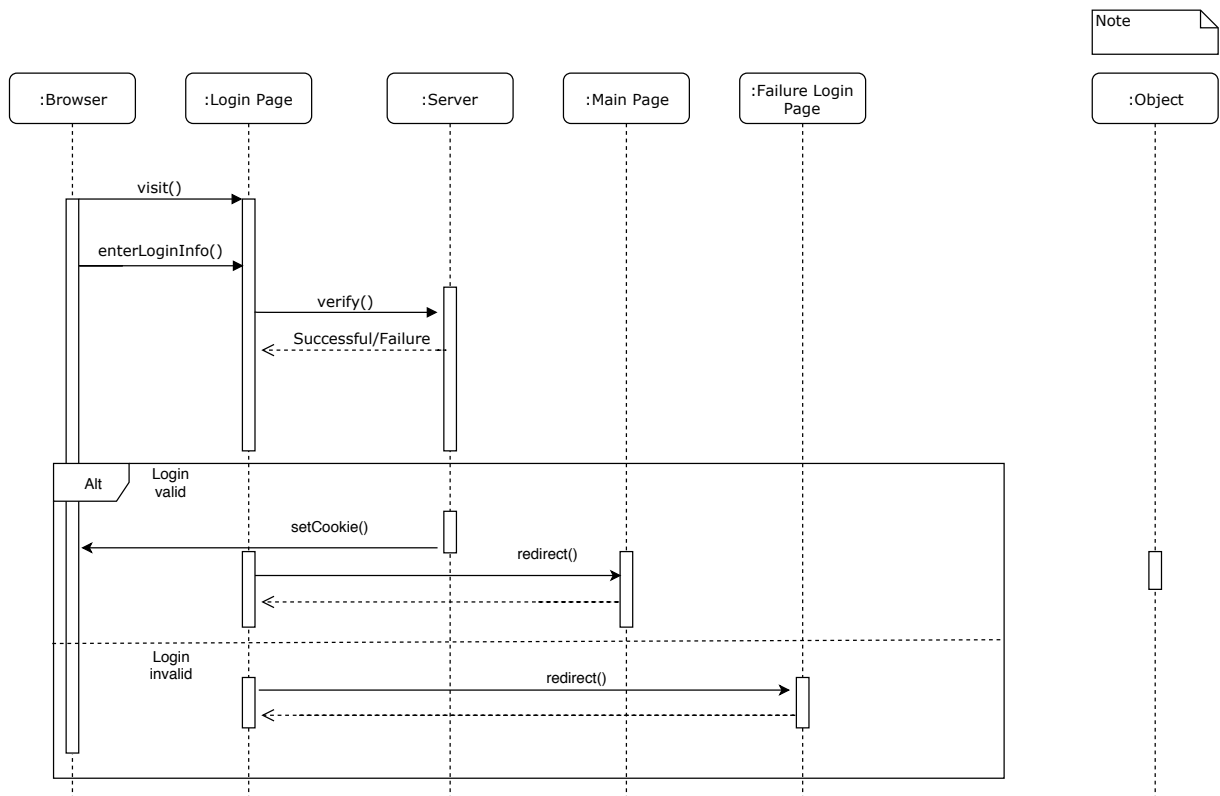
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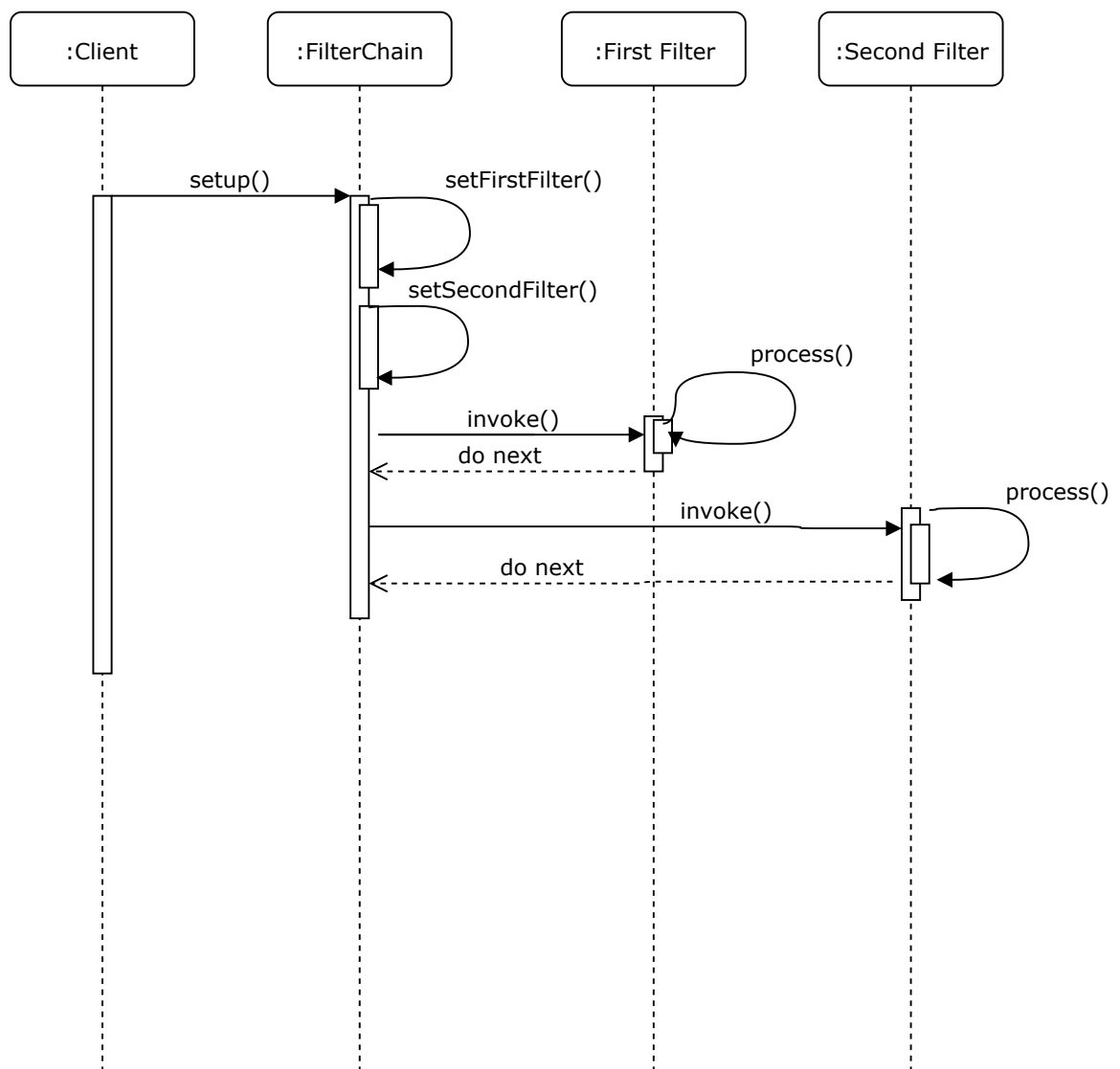
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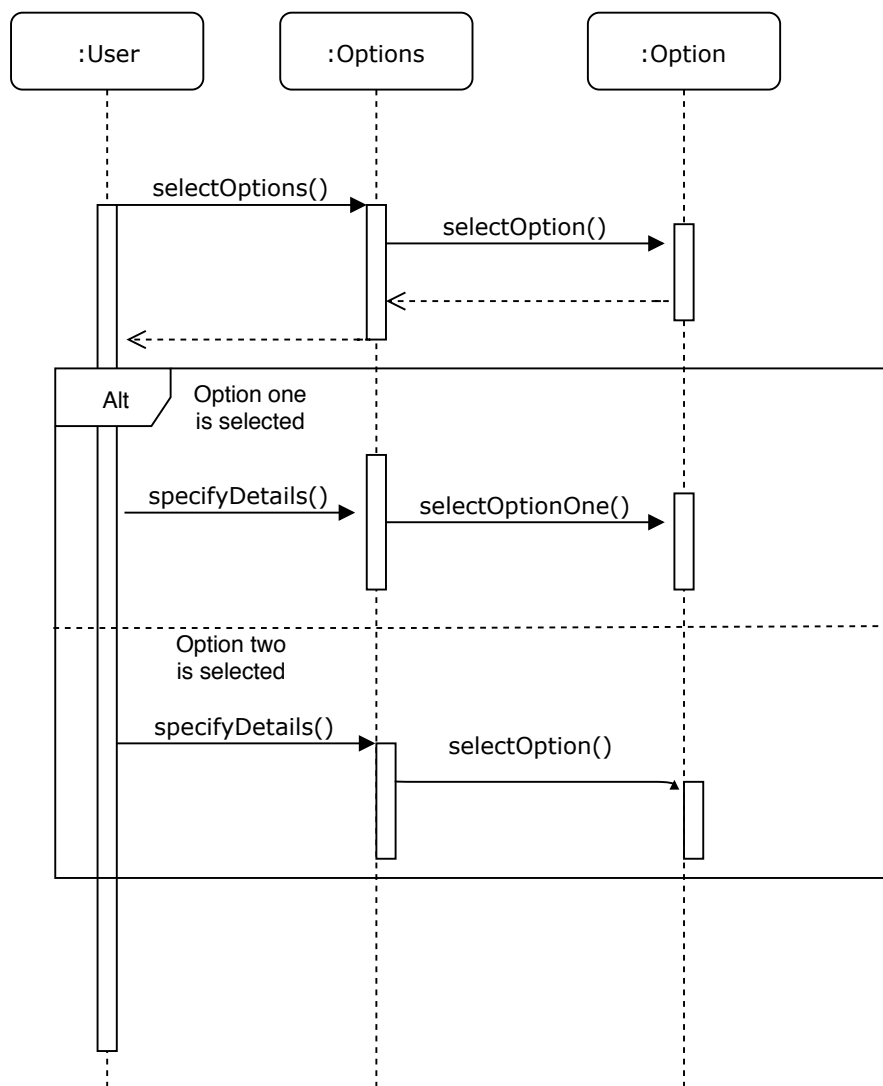
# 1 Design

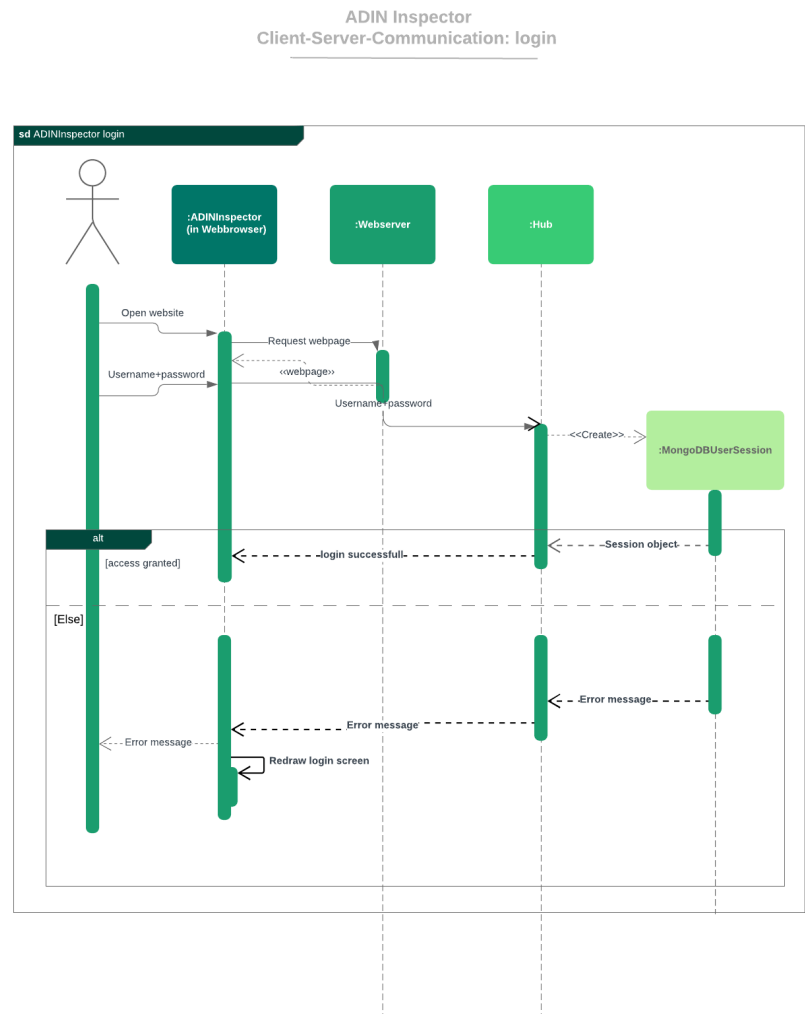
## 1.1 Front-End

### 1.1.1 Sequence Diagram





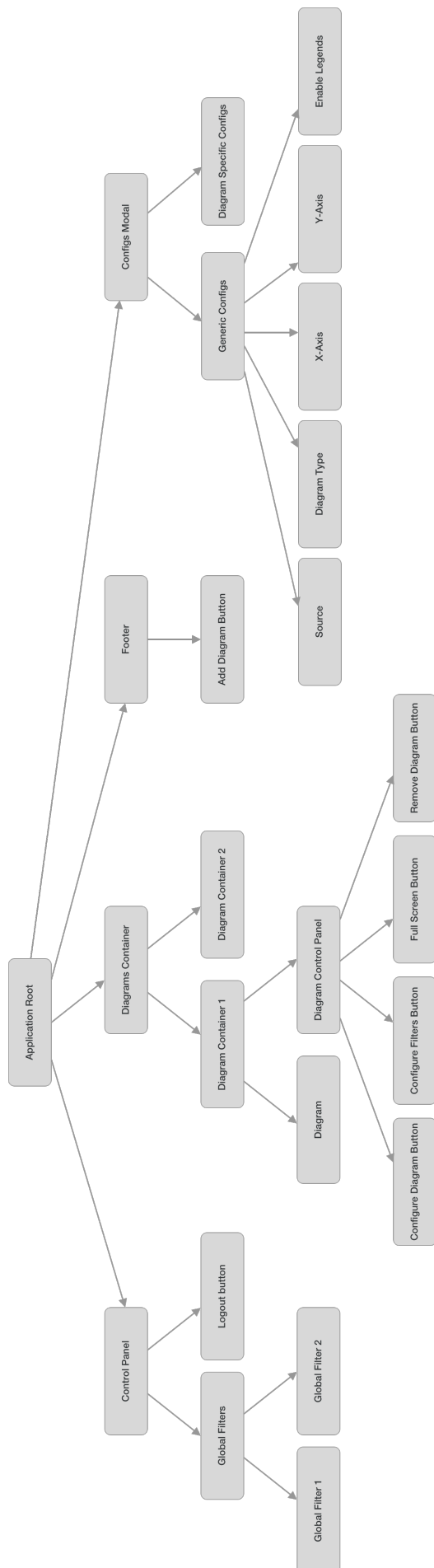




Inspector Client-Server-Communication-login.png

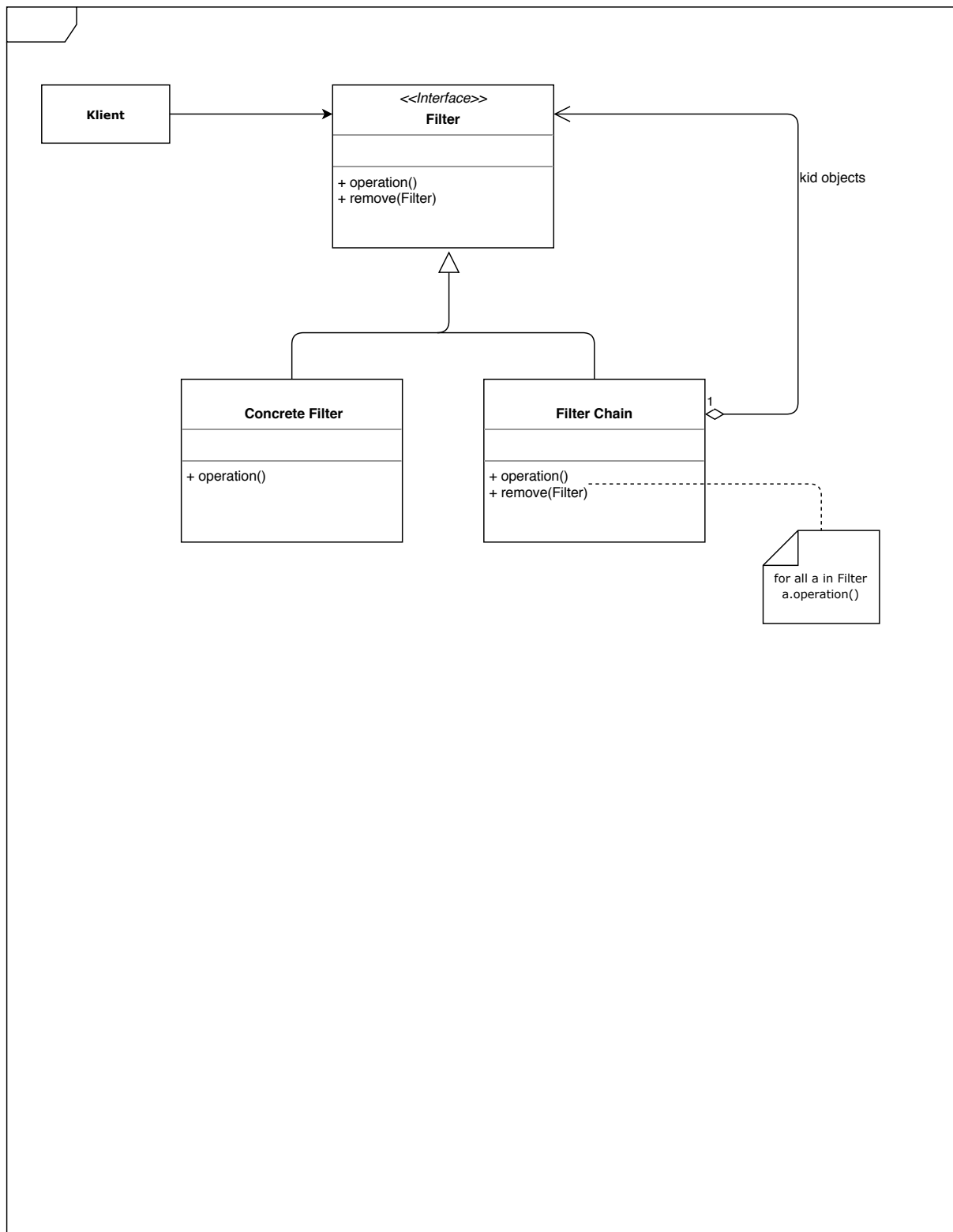
### 1.1.2 Activity Diagram

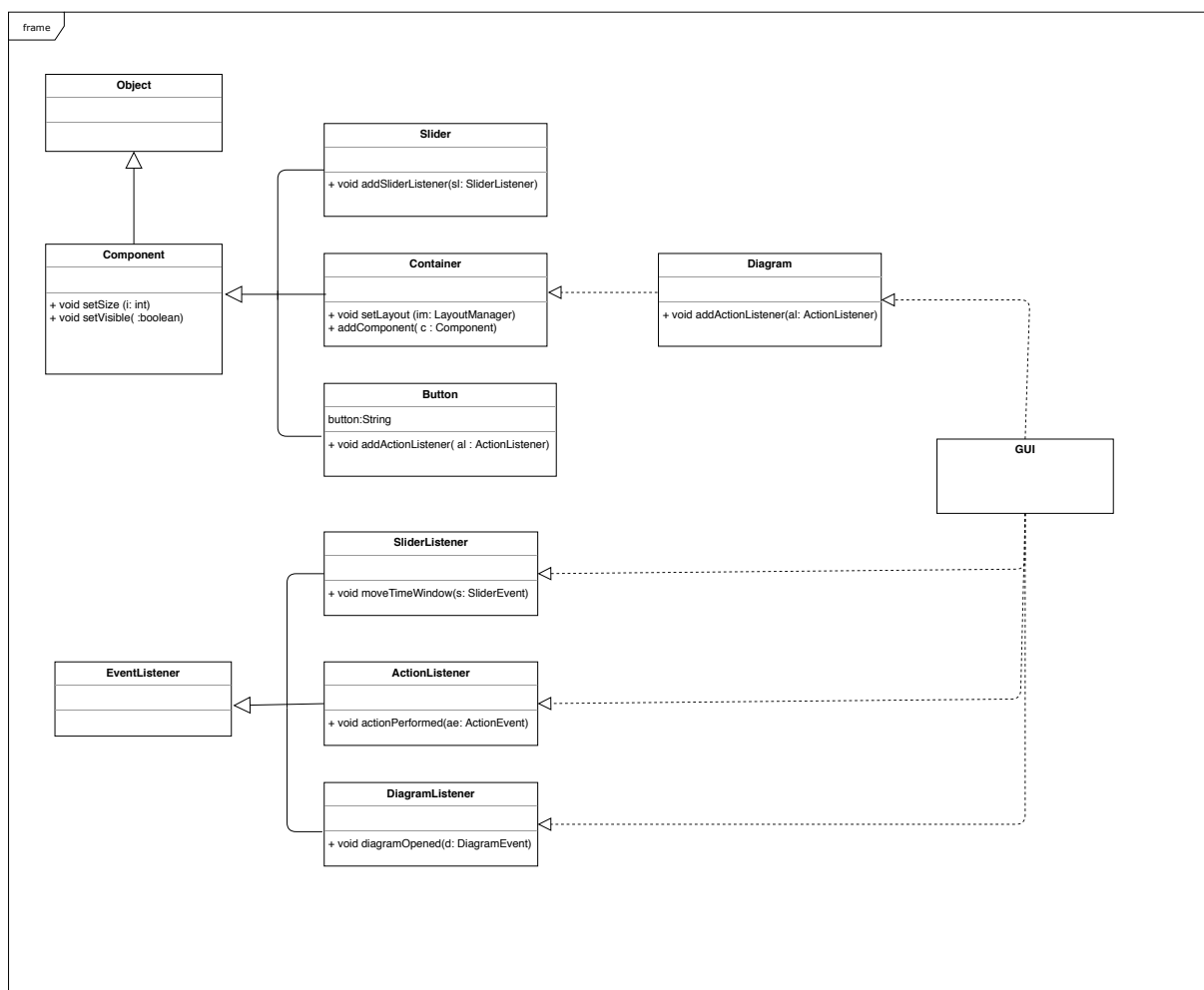
### 1.1.3 UI Structure Diagram

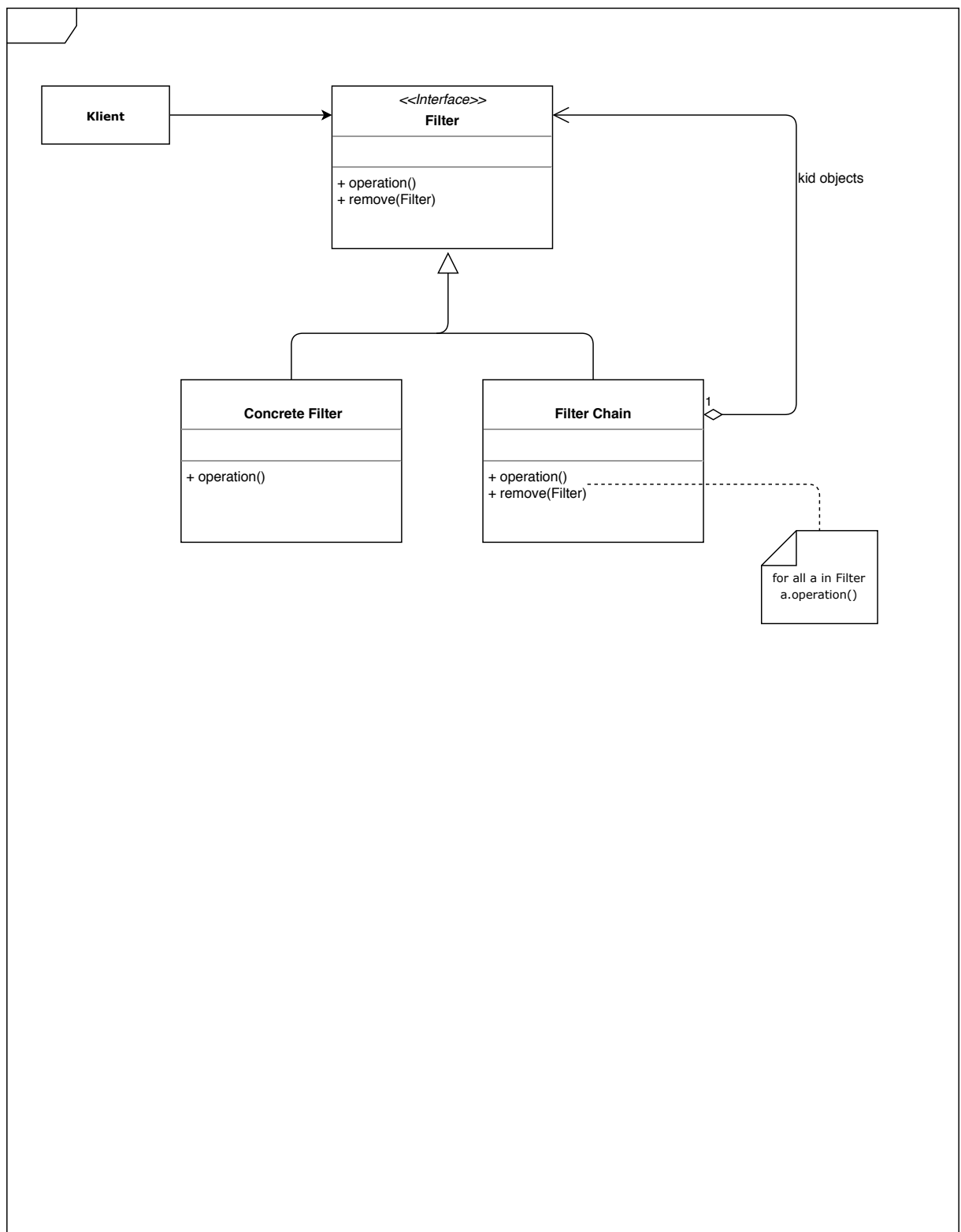




## 1.1.4 Class Diagram







## 1.2 Client-server protocol

Messages between client and server are exchanged as strings in JSON format. In the following list words in angle brackets ("`<>`") are placeholders.

### 1.2.1 Requests from client to server:

- `getAvailableCollections`  
syntax: `{"cmd": "GET_AV_COLL"}`  
expected response: list of collections
- `getCollectionSize(collection)`  
syntax: `{"cmd": "GET_COLL_SIZE", "par": "<collection>"}`  
where `<collection>` is the name of a collection  
expected response: collection size
- `getCollection(collection)`  
syntax: `{"cmd": "GET_COLL", "par": "<collection>"}`  
expected response: data set
- `getRecordsInRange(collection, key, start, end)`  
syntax: `{"cmd": "GET_RECORDS_RANGE", "par": "<collection>", "key": "<keyvalue>", "start": "<startvalue>", "end": "<endvalue>"}`  
where `<key>` is the name of a key in the given collection and `<startvalue>` and `<endvalue>` are valid values for this key  
expected response: data set
- `getRecordsInRangeSize(collection, key, start, end)`  
syntax: `{"cmd": "GET_RECORDS_RANGE_SIZE", "par": "<collection>", "key": "<key-value>", "start": "<startvalue>", "end": "<endvalue>"}`  
expected response: collection size

### 1.2.2 Messages from server to client:

- list of collections  
syntax: `{"cmd": "LIST_COL", "par": ["<collection>"]}`  
where `<collection>` is the name of a collection
- collection size  
syntax: `{"cmd": "COLL_SIZE", "par": "<size>"}`  
where `<size>` is the number of records in this collection
- data set  
syntax: `{"cmd": "DATA", "par": [<record>]}`  
where each record is a JSON object

## 1.3 Back-End

This subsection deals with the back-end of the ADIN INSPECTOR. How the system deals with client http calls, and how kafka interacts with the system. An overview of the system can be seen in Figure 1

### 1.3.1 Class Diagram

Next we'll look at each class and method in detail

- **Config properties file**  
The config file is stored alongside the built application .jar file and contains the path to the Kafka installation folder, the user name and password of a mongoDB account with the highest level of access and the name of the database.
- **Initializer**  
Methods:
  - main  
parameters: String of arguments from the console  
returns: void  
App entry point.  
We load the config.properties file and use the path provided to start the zookeeper, kafka and mongodb services
- **MongoConsumer**  
The Mongo Consumer, as the name implies, consumes all messages from all topics in the Kafka messaging system. Once a message is found it is passed along to the Mongo Client for further processing.  
Variables
  - clientMediator  
Type : MongoClientMediator  
An instance of the Mongo Client Mediator, created with the credentials from the config file.
 Methods
  - MongoConsumer constructor  
parameters: user name and password of a mongoDB account with the highest level of access.  
Initializes the MongoClient variable and calls listenForRecords();
  - getAllTopics  
parameters: none  
returns: an array of strings containing all the available kafka Topics.  
Asks the kafka server service which topics exists.
  - listenForRecords  
parameters: none

returns: void

This Method first calls getAllTopics and uses the array of topics to poll the kafka server for new messages.

If new messages are found then the messages are passed to the Mongo Mediator for adding them to the Database.

If no new messages are found for a topic notify the Mongo Mediator that the collection tied to the topic is ready for pre-processing.

- MongoClientMediator This object serves as a nexus between the users who want to get data out of the database and the consumer and dataProcessor who want to add data into the database. This class encapsulates the mongo client from the mongo API.

#### Variables

- client

type: MongoClient

An instance of the Mongo Client from the official java API.

- dataProc

A reference to the data processor class for this client.

#### Methods

- MongoClientMediator constructor

parameters: Username and password

Initializes the client variable, throws an error if the user is not found.

- addRecordToCollection

parameters: String representation of a record in json format

String name of the collection it should be added to.

returns: void

Converts the json string into a java object, then to a bson document and uses the mongoAPI to insert it into the database.

- addRecordsToCollection

parameters: String Array of records to be added to a collection

String name of the collection it should be added to.

returns: void

for each one of the members of the array call addRecordToCollection

- ProcessCollection

parameters: String, name of a collection

returns: void

signal the data processor to start the processing of a collection

- getCollection

parameters: String, name of a collection

returns: String array containing all entries of the collection

- getStartRecord

parameters: String, name of a collection

returns: the first entry of the collection as a String.

- getEndRecord  
parameters: String, name of a collection  
returns: the last entry of the collection as a String.
  - getCollectionSize  
parameters: String, name of a collection  
returns: the number of entries in the collectoin as int
  - getRecordsInRange  
parameters: String, name of the collection to query  
String, key of the parameter used for filtering  
String start and end ranges for the filtering  
returns: String array containing all entries of the collection within that range  
this Method is very general to allow for flexibility. For example by letting the key be, SourceIPaddresses, or a timeStamp.
  - getRecordsInRangeSize  
parameters: String, name of the collection to query  
String, key of the parameter used for filtering  
String start and end ranges for the filtering  
returns: number of elements matching the range as int
- Record  
Every message that comes from kafka and needs to be added to the database has it's own Record class that inherit from this one.  
Every single class that inherits needs to be able to, using reflection, convert itself into a Bson Document where every variable is a key Value pair of the name of the variable and it's associated value.  
Variables
    - id  
type: String
 Methods
    - getAsDocument()  
parameters: none  
returns: A Document, containing every variable of any class inheriting from this one.  
This function checks for every variable, gets it's name and value as a string and adds it to the document that it eventually returns.
  - PacketRecord  
Inheriting from Record, this class contains the variables that match the json string obtained from kafka.  
Variables
    - id  
type: String

this id is used for determining the ordering when saving to mongoDB, it's the offset of the message in the kafka messaging queue. inherited from Record

- client  
type: String
- L2Protocol  
type: String
- SourceMACAddress  
type: String
- L4Protocol  
type: String
- SourceIPAddress  
type: String
- PacketSummary  
type: String
- DestinationIPAddress  
type: String
- Timestamp  
type: String
- DestinationPort  
type: String
- SourcePort  
type: String
- DestinationMACAddress  
type: String

#### Methods

- getters / setters  
parameters: variable  
returns: variable type  
Each variable has it's getters and setter methods.

- AlarmRecord

Inheriting from Record, this class contains the variables that match the json string obtained from kafka.

#### Variables

- id  
type: String
- AlarmID  
type: String
- AlarmType  
type: String



- AlarmOccurrenceTime  
type: String
- AlarmCategory  
type: String
- AlarmScore  
type: String
- AlarmDescription  
type: String
- PacketSummary  
type: String

#### Methods

- getters / setters  
parameters: variable  
returns: variable type  
Each variable has it's getters and setter methods.

- MiscRecord

Inheriting from Record, this class is used by the data processor as an 'in-between' state before saving to the database. As well as an extension point for adding more types of records into the database programatically in the future.

Refer to the data processor class for further data on the key value pairs.

#### Variables

- pairs  
A Map of strings to Objects to store any 1 to many relationships

#### Methods

- getters / setters  
parameters: none  
returns: variable type  
Each variable has it's getters and setter methods.

- DataProcessor

This class is a mediator for each one of our data aggregators used for extraciton of features from the raw data stored in mongoDB.

We might want to hve multiple data processors for chaining different aggregators together or to split up the work into mutliple threads. This is dependant on further performance testing.

#### Variables

- client  
an instance of the associated mongoClient that requested the data aggregation
- aggregators  
A Arraylist containing all the aggregators to be applied on a collection.

## Methods

- getters / setters
- processData
  - parameters: variable
  - returns: variable type

### • IAggregator

This interface is the building block for every aggregator to be applied to data

#### Variables Methods

- processData
  - parameters: Records array of the records to be processed

### • FlowRatePerSecond

Implements IAggregator. This calculates, per port, the outgoing and ingoing connections. A record processed by this aggregator is stored in a collection as follows:

Name of collection: `collectionName\_FlowratePerSec`

structure of record as json:

```
{
  "date" : \{" date" " Unix_Timestamp  }
  rounded down to the second this record points to.
  Connections : [
    { Port: "portNumber", "InOut" : " In/Out ", count : "Number" }
    { Port: "portNumber", "InOut" : " In/Out ", count : "Number" }
    ...
  ]
}
```

] This array has an entry per port if the port communicated that second.

Precomputing this allows us to stream whenever the client needs the information for a specific node.

}

## Methods

- processData
  - parameters: Records array of the records to be processed
  - specific implementation left to the classes implementing this interface

### • NumberOfConnectionsPerNodePerSecond

Implements IAggregator. This calculates the outgoing and ingoing connections. A record processed by this aggregator is stored in a collection as follows:

Name of collection: `collectionName\_FlowratePerSec`

structure of record as json:

```
{
  "date" : \{" date" " Unix_Timestamp  }
  rounded down to the second this record points to.
```

```

Connections : [
{ Port: "portNumber", count : "Number" }
{ Port: "portNumber", count : "Number" }
...

```

] This array has an entry per port if the port communicated that second.  
 Precomputing this allows us to stream whenever the client needs the information for a specific node.

```

}
```

## Methods

- processData  
 parameters: Records array of the records to be processed

## • Hub

This class implements the network handlers for the websocket connection to the client and access methods for a database connection.

## Variables

- requestHandler  
 Type : ClientProtocolHandler  
 The strategy object we call for the actual parsing of the client requests.
- database  
 Type : IUserSession  
 The database we use during a user session.

## Methods

- handleOpen  
 parameters: Session session - the current session  
 returns: void  
 Event handler for the start of websocket connection.
- handleClose  
 parameters: Session session - the current session  
 returns: void  
 Event handler for closing a connection.
- handleMessage  
 parameters: String message - the message that we received from the client  
 Session session - the current session  
 returns: String - the response to be sent to the client  
 Event handler for receiving a message. The message is passed to the ClientProtocol-Handler.
- handleError  
 parameters: Session session - the current session  
 Throwable t - the exception that occurred

returns: void

Event handler for errors/exceptions during communication.

- IUserSession

An IUserSession object encapsulates a data base session. On instantiation an IUserSession connects to a database using the given user id and password and uses this connection for all following data base access.

Methods

- UserSession

parameters: String username - the user id to login with

String password - the password

returns: IUserSession

Factory method to instantiate a new UserSession and log in into the database using the given credentials.

- getAvailableCollections

parameters: -

returns: String array with collection names

Returns an array with the names of the collections available to the current user.

- getCollectionSize

parameters: String collection - the collection to query

returns: long - the number of records

Returns the number of records in the specified collection.

- getCollection

parameters: String - name of a collection

returns: String array containing all entries of the collection

- getRecordsInRange

parameters: String - name of the collection to query

String key - the parameter used for filtering

String start and end - range for the filtering

returns: String array containing all entries of the collection within the filter range

Returns an array containing all records of this collection for which the value of the specified key is in the range [start, end). The records will be in the same order as they are in the collection.

- getRecordsInRangeSize

parameters: String - name of the collection to query

String key - the parameter used for filtering

String start and end - range for the filtering

returns: number of elements matching the range as int

Returns the number of records in the specified collection for which the value of the specified key is within the range [start, end).

- MongoDBUserSession

Encapsulates a user session for a connection to a MongoDB database.

Methods

- MongoDBUserSession constructor  
parameters: -  
Private constructor to create a new MongoDB session.
- UserSession  
parameters: String username - the user id to login with  
String password - the password  
returns: a new MongoDBUserSession object  
Factory method to instantiate a new MongoDBUserSession and log in into the database using the given credentials.
- getAvailableCollections  
parameters: -  
returns: String array with collection names  
Returns an array with the names of the collections available to the current user.
- getCollectionSize  
parameters: String collection - the collection to query  
returns: long - the number of records  
Returns the number of records in the specified collection.
- getCollection  
parameters: String - name of a collection  
returns: String array containing all entries of the collection
- getRecordsInRange  
parameters: String - name of the collection to query  
String key - the parameter used for filtering  
String start and end - range for the filtering  
returns: String array containing all entries of the collection within the filter range  
Returns an array containing all records of this collection for which the value of the specified key is in the range [start, end). The records will be in the same order as they are in the collection.
- getRecordsInRangeSize  
parameters: String - name of the collection to query  
String key - the parameter used for filtering  
String start and end - range for the filtering  
returns: number of elements matching the range as int  
Returns the number of records in the specified collection for which the value of the specified key is within the range [start, end).

- ClientRequestHandler

This class handles client requests by parsing them, executing the requested action and producing responses. The requested actions are typically executed by calls to the database session object.

Methods

- handleRequest

parameters:

IUserSession dbSession - the current database session

Session session - the current client session

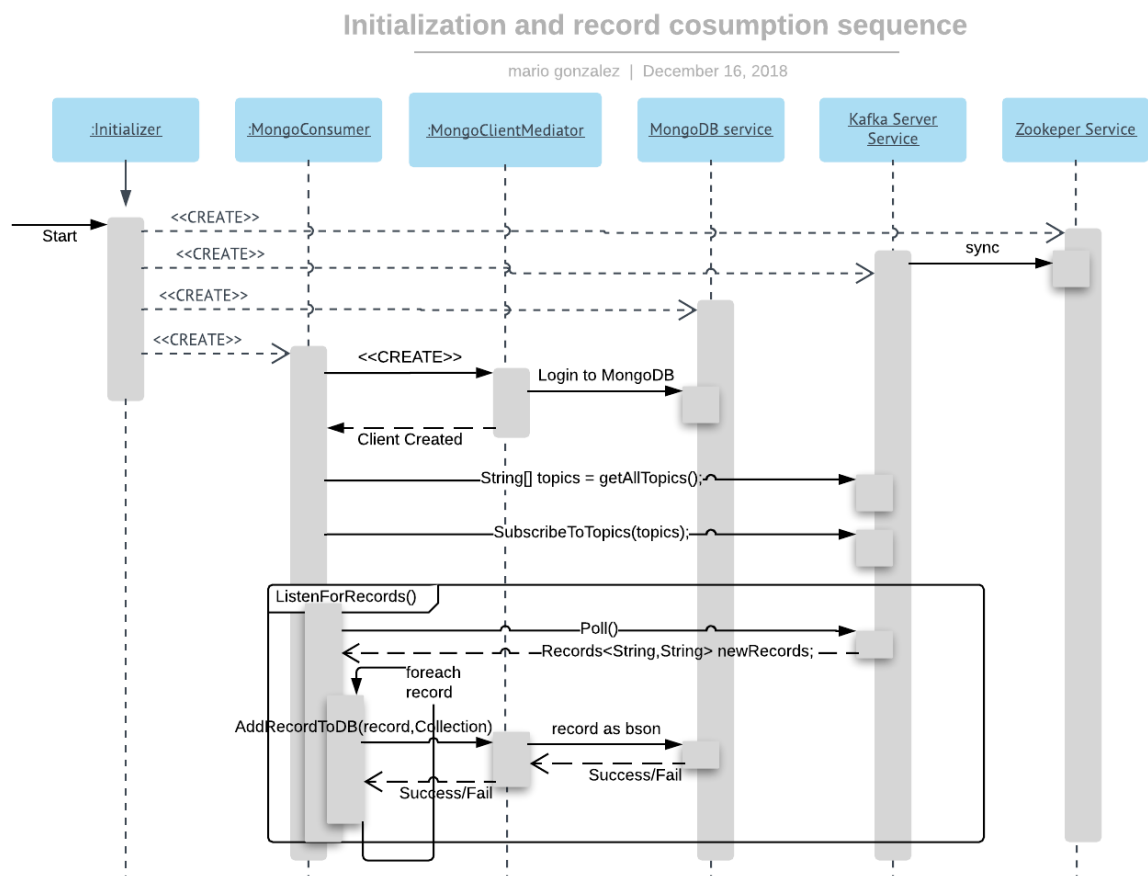
String message - the client request to process

returns: String - the response to be sent to the client

Parse the message from the client, execute the requested action (typically a database query) and construct the response message.



## 1.3.2 Sequence Diagram



## 1.3.3 Activity Diagram