

Group members: Teodor Costica, Adam Lewandowski - Group 16

## 1. Links to github repos:

Messaging:

GetCreditScore repo: <https://github.com/teutzue/GetCreditScore>

GetBanks: <https://github.com/teutzue/GetBanks>

RecipList: <https://github.com/teutzue/RecipientList>

CphBusinessJSONTranslator: <https://github.com/teutzue/CphBusinessJSONTranslator>

CphBusinessXMLTranslator: <https://github.com/teutzue/CphBusinessXMLTranslator>

RiskAverseTranslator: <https://github.com/teutzue/RiskAverseTranslator> RabbitMQBankTransator: <https://github.com/teutzue/RabbitMQBankTransator>

RabbitMqBank: <https://github.com/teutzue/RabbitMQBank>

Aggregator: <https://github.com/teutzue/Aggregator>

Normalizer: <https://github.com/teutzue/Normalizer>

Web services:

Bank of norrebro: <https://github.com/Stargarth/BankOfNorrebroOk>

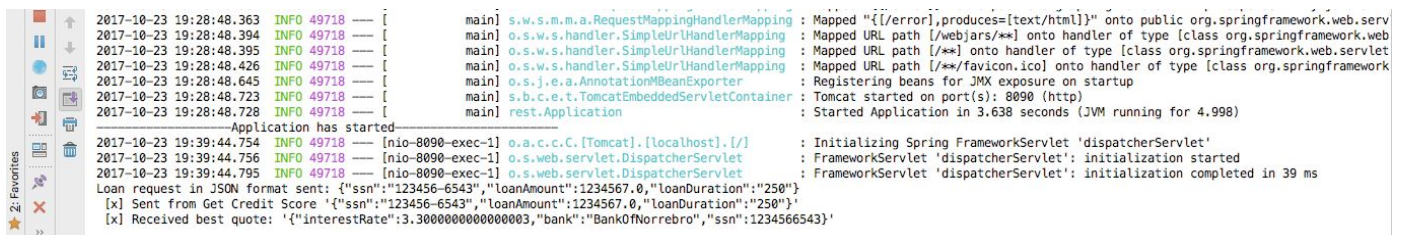
RuleBase: <https://github.com/Stargarth/RuleBaseSI>

LoanBroker16 (rest): <https://github.com/teutzue/LoanBroker16>

Please see description of LoanBroker16 to get instruction how to run whole project.

## 2. Screen dumps of a process flow:

- Start the Client



```
2017-10-23 19:28:48.363 INFO 49718 --- [main] s.w.s.m.a.RequestMappingHandlerMapping : Mapped "[/error],produces=[text/html]" onto public org.springframework.web.serv
2017-10-23 19:28:48.394 INFO 49718 --- [main] o.s.w.s.handler.SimpleUrlHandlerMapping : Mapped URL path [/webjars/**] onto handler of type [class org.springframework.web
2017-10-23 19:28:48.395 INFO 49718 --- [main] o.s.w.s.handler.SimpleUrlHandlerMapping : Mapped URL path [/**] onto handler of type [class org.springframework.web.servlet
2017-10-23 19:28:48.426 INFO 49718 --- [main] o.s.w.s.handler.SimpleUrlHandlerMapping : Mapped URL path [/**/favicon.ico] onto handler of type [class org.springframework
2017-10-23 19:28:48.645 INFO 49718 --- [main] o.s.j.e.a.AnnotationMBeanExporter : Registering beans for JMX exposure on startup
2017-10-23 19:28:48.723 INFO 49718 --- [main] s.b.c.e.t.TomcatEmbeddedServletContainer : Tomcat started on port(s): 8090 (http)
2017-10-23 19:28:48.728 INFO 49718 --- [main] rest.Application : Started Application in 3.638 seconds (JVM running for 4.998)

Application has started
2017-10-23 19:39:44.754 INFO 49718 --- [nio-8090-exec-1] o.a.c.c.C.[Tomcat].[localhost].[/] : Initializing Spring FrameworkServlet 'dispatcherServlet'
2017-10-23 19:39:44.756 INFO 49718 --- [nio-8090-exec-1] o.s.web.servlet.DispatcherServlet : FrameworkServlet 'dispatcherServlet': initialization started
2017-10-23 19:39:44.795 INFO 49718 --- [nio-8090-exec-1] o.s.web.servlet.DispatcherServlet : FrameworkServlet 'dispatcherServlet': initialization completed in 39 ms

Loan request in JSON format sent: {"ssn":"123456-6543","loanAmount":1234567.0,"loanDuration":"250"}
[x] Sent from Get Credit Score '{"ssn":"123456-6543","loanAmount":1234567.0,"loanDuration":"250"}'
[x] Received best quote: '{"interestRate":3.3000000000000003,"bank":"BankOfNorrebro","ssn":"1234566543"}'
```

- Send the request to Credit Score

```

/Library/Java/JavaVirtualMachines/jdk1.8.0_121.jdk/Contents/Home/bin/java ...
objc[51765]: Class JavaLaunchHelper is implemented in both /Library/Java/JavaVirtualMachines/jdk1.8.0_121.jdk/Contents/Home/bin/java (0
SLF4J: Failed to load class "org.slf4j.impl.StaticLoggerBinder".
SLF4J: Defaulting to no-operation (NOP) logger implementation
SLF4J: See http://www.slf4j.org/codes.html#StaticLoggerBinder for further details.
[*] Waiting for messages. To exit press CTRL+C
[x] Received loan request '{"ssn":"123456-6543","loanAmount":1234567.0,"loanDuration":"250"}'
Loan request in JSON format before it was enriched: {"ssn":"123456-6543","loanAmount":1234567.0,"loanDuration":"250"}
Loan request in JSON format after enrichment: {"ssn":"123456-6543","loanAmount":1234567.0,"loanDuration":"250","creditScore":265}
[x] Sent from Get Credit Score '{"ssn":"123456-6543","loanAmount":1234567.0,"loanDuration":"250","creditScore":265}'

```

- Send the request to Get Banks

```

/Library/Java/JavaVirtualMachines/jdk1.8.0_121.jdk/Contents/Home/bin/java ...
objc[52157]: Class JavaLaunchHelper is implemented in both /Library/Java/JavaVirtualMachines/jdk1.8.0_121.jdk/Contents/Home/bin/java (0x104c1f4c0) and /Library/Java/J
SLF4J: Failed to load class "org.slf4j.impl.StaticLoggerBinder".
SLF4J: Defaulting to no-operation (NOP) logger implementation
SLF4J: See http://www.slf4j.org/codes.html#StaticLoggerBinder for further details.
[*] Waiting for complete loan requests from Get Credit Score. To exit press CTRL+C
[x] Received loan request complete from Get Credit Score: '{"ssn":"123456-6543","loanAmount":1234567.0,"loanDuration":"250","creditScore":265}'
Credit score before Rule Base call: 265
Banks received in the GetBanks Service: 2
SSN extracted: 123456-6543; Loan amount: 1234567.0; Loan duration 250; Credit Score: 265
Loan Request in JSON format after enrichment with the banks array: {"loanDuration":"250","creditScore":265,"banks":["NordeaBank","BankOfNorrrebro"],"loanAmount":123456;
[x] Sent '{"loanDuration":"250","creditScore":265,"banks":["NordeaBank","BankOfNorrrebro"],"loanAmount":1234567,"ssn":"123456-6543"}' from Get Banks(GetBanksService) 1

```

- Send message to Recipient List which in this case send messages to BankOfNorrrebro and NordeaBank

```

/Library/Java/JavaVirtualMachines/jdk1.8.0_121.jdk/Contents/Home/bin/java ...
objc[52157]: Class JavaLaunchHelper is implemented in both /Library/Java/JavaVirtualMachines/jdk1.8.0_121.jdk/Contents/Home/bin/java (0x105bb84c0) and /Library/Java/J
SLF4J: Failed to load class "org.slf4j.impl.StaticLoggerBinder".
SLF4J: Defaulting to no-operation (NOP) logger implementation
SLF4J: See http://www.slf4j.org/codes.html#StaticLoggerBinder for further details.
[*] Waiting for messages from GetBanks. To exit press CTRL+C
[x] Received '{"loanDuration":"250","creditScore":265,"banks":["NordeaBank","BankOfNorrrebro"],"loanAmount":1234567,"ssn":"123456-6543"}' from GetBanks
SSN extracted: 123456-6543; Loan amount: 1234567.0; Loan duration 250; Credit Score: 265; Banks: ["NordeaBank","BankOfNorrrebro"]
The message to be sent to the banks is: {"ssn":"123456-6543","creditScore":265,"loanAmount":1234567.0,"loanDuration":"250"}
Header sent: #contentType=application/json; charset=UTF-8; content-type=null, content-encoding=null, headers={bank=NordeaBank}, delivery-mode=null, priority=null, correlation-id=null, reply-
NordeaBank
[x] Sent to 'NordeaBank': '{"ssn":"123456-6543","creditScore":265,"loanAmount":1234567.0,"loanDuration":"250"}' From RecipientListWorker
Header sent: #contentType=application/json; charset=UTF-8; content-type=null, content-encoding=null, headers={bank=BankOfNorrrebro}, delivery-mode=null, priority=null, correlation-id=null, re
BankOfNorrrebro
[x] Sent to 'BankOfNorrrebro': '{"ssn":"123456-6543","creditScore":265,"loanAmount":1234567.0,"loanDuration":"250"}' From RecipientListWorker

```

- Bank of Norrebro responds and send the message further

```

[*] Waiting for messages. To exit press CTRL+C
[x] Received on key binding 'BankOfNorrrebro': '{"ssn":"123456-6543","creditScore":265,"loanAmount":1234567.0,"loanDuration":"250"}'
SSN stripped: 1234566543
LoanDuration: 250
Message processed: {"ssn":1234566543,"creditScore":265,"loanAmount":1234567.0,"loanDuration":3000}
[x] Requesting response from CPHBusiness JSON bank.
[.] Got response back '{"interestRate":3.3000000000000003,"ssn":1234566543}'
Sending response to Normalizer.
[x] Sent '{"bank":"BankOfNorrrebro","interestRate":3.3000000000000003,"ssn":1234566543}'

```

- Our RabbitMQ bank does not receive any request

```
/Library/Java/JavaVirtualMachines/jdk1.8.0_121.jdk/Contents/Home/bin/java ...
objc[52206]: Class JavaLaunchHelper is implemented in both /Library/Java/JavaVirtualMachines/jdk1.8.0_121.jdk/Contents/Home/bin/java (0x10366d4c0) and /L
SLF4J: Failed to load class "org.slf4j.impl.StaticLoggerBinder".
SLF4J: Defaulting to no-operation (NOP) logger implementation
SLF4J: See http://www.slf4j.org/codes.html#StaticLoggerBinder for further details.
[*] Waiting for messages. To exit press CTRL+C
```

- Nordea Bank responds to the request and the message is sent to the normalizer

```
In XML format: <LoanRequest><loanDuration>2220-01-13 05:46:40.0 CET</loanDuration><creditScore>265</creditScore><loanAmount>1234567.0</loanAmou
XML message generated: <LoanRequest><loanDuration>2220-01-13 05:46:40.0 CET</loanDuration><creditScore>265</creditScore><loanAmount>1234567.0</
[x] Received on key binding 'NordeaBank': '{"ssn": "123456-6543", "creditScore": 265, "loanAmount": 1234567.0, "loanDuration": "250"}'
[x] Requesting response from CPHBusiness XML bank.
[.] Got response back '<LoanResponse>
<interestRate>3.6399999999999997</interestRate>
<ssn>1234566543</ssn>
</LoanResponse>'
Sending response to Normalizer.
[x] Sent '<LoanResponse><bank>NordeaBank</bank>
<interestRate>3.6399999999999997</interestRate>
<ssn>1234566543</ssn>
</LoanResponse>'
```

- The normalizer converts the messages in JSON and sends them the aggregator

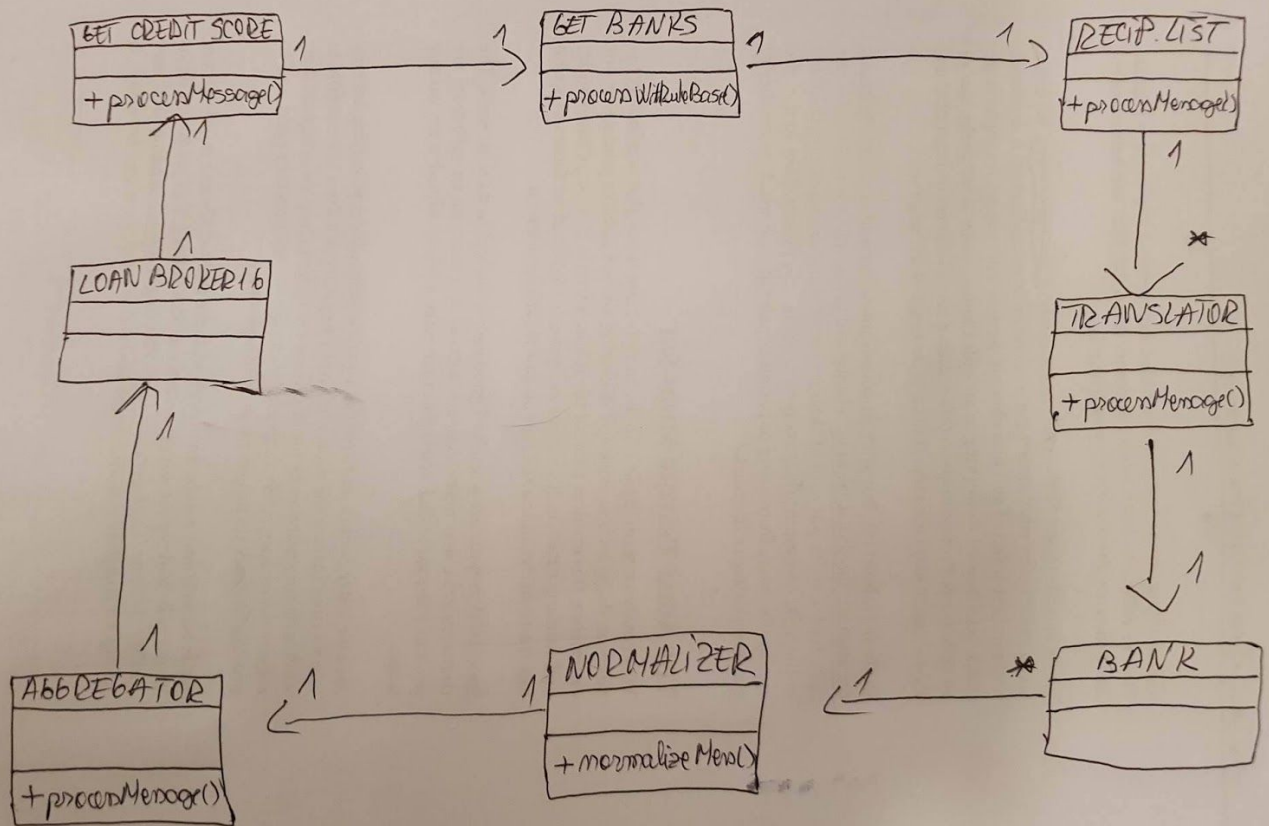
```
/Library/Java/JavaVirtualMachines/jdk1.8.0_121.jdk/Contents/Home/bin/java ...
objc[52309]: Class JavaLaunchHelper is implemented in both /Library/Java/JavaVirtualMachines/jdk1.8.0_121.jdk/Contents/Home/bin/java (0x10e5144c0) and /Library/Java/JavaVirtu
SLF4J: Failed to load class "org.slf4j.impl.StaticLoggerBinder".
SLF4J: Defaulting to no-operation (NOP) logger implementation
SLF4J: See http://www.slf4j.org/codes.html#StaticLoggerBinder for further details.
[*] Waiting for loan responses from the banks :). To exit press CTRL+C
[x] Received loan response: '{"bank": "BankOfNorrebro", "interestRate": 3.3000000000000003, "ssn": 1234566543}' correlationId: null
was jos: '{"bank": "BankOfNorrebro", "interestRate": 3.3000000000000003, "ssn": 1234566543}'
[x] Received loan response: '<LoanResponse><bank>NordeaBank</bank>
<interestRate>3.6399999999999997</interestRate>
<ssn>1234566543</ssn>
</LoanResponse>' correlationId: null
was xml('<LoanResponse>{"interestRate": 3.6399999999999997, "bank": "NordeaBank", "ssn": 1234566543}')
SSN stripped: 1234566543
XML converted to JSON: '{"ssn": 1234566543, "interestRate": 3.6399999999999997, "bank": "NordeaBank"}'
Sending response to Normalizer.
[x] Sent '{"interestRate": 3.3000000000000003, "bank": "BankOfNorrebro", "ssn": 1234566543}, {"interestRate": 3.6399999999999997, "bank": "NordeaBank", "ssn": 1234566543}'
{"interestRate": 3.3000000000000003, "bank": "BankOfNorrebro", "ssn": 1234566543}, {"interestRate": 3.6399999999999997, "bank": "NordeaBank", "ssn": 1234566543}]
```

- Aggregator calculates the best interest Rate and sends the message back to the client

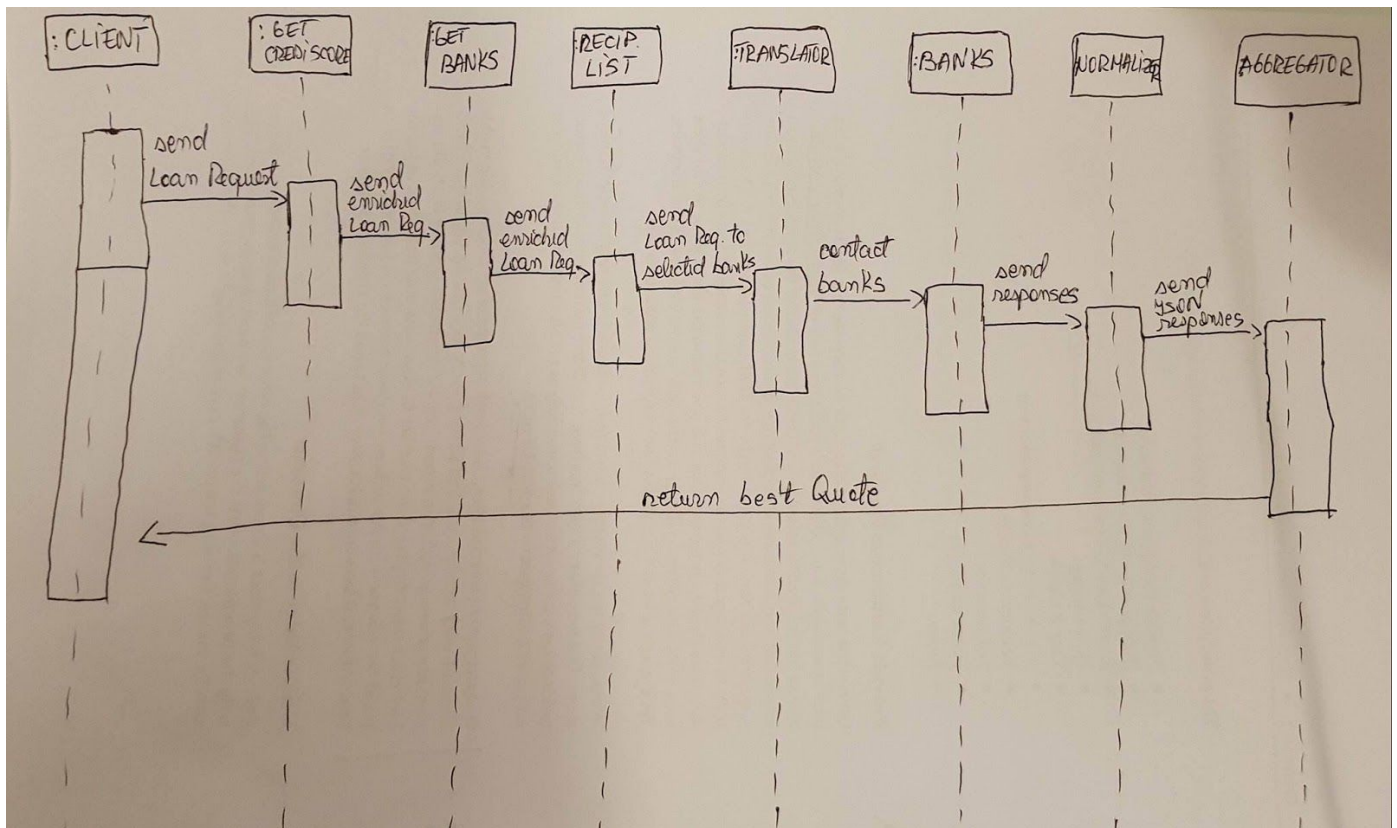
```
/Library/Java/JavaVirtualMachines/jdk1.8.0_121.jdk/Contents/Home/bin/java ...
objc[52332]: Class JavaLaunchHelper is implemented in both /Library/Java/JavaVirtualMachines/jdk1.8.0_121.jdk/Contents/Home/bin/java (0x10b0cf4c0) and /Library/Java/JavaVirtu
SLF4J: Failed to load class "org.slf4j.impl.StaticLoggerBinder".
SLF4J: Defaulting to no-operation (NOP) logger implementation
SLF4J: See http://www.slf4j.org/codes.html#StaticLoggerBinder for further details.
[*] Waiting for messages in Aggregator. To exit press CTRL+C
[x] Received '{"interestRate": 3.3000000000000003, "bank": "BankOfNorrebro", "ssn": 1234566543}, {"interestRate": 3.6399999999999997, "bank": "NordeaBank", "ssn": 1234566543}]'
2
{"interestRate": 3.3000000000000003, "bank": "BankOfNorrebro", "ssn": 1234566543}
{"interestRate": 3.6399999999999997, "bank": "NordeaBank", "ssn": 1234566543}
Lowest interest rate: 3.3000000000000003
Best quote: '{"interestRate": 3.3000000000000003, "bank": "BankOfNorrebro", "ssn": 1234566543}'
[x] Sent '{"interestRate": 3.3000000000000003, "bank": "BankOfNorrebro", "ssn": 1234566543}'
```

### 3. Design Class Diagram:





Sequence Diagram:



#### 4. Bottlenecks:

- The normalizer component is a bottleneck because it always waits 3 seconds to get responses from banks
- The normalizer can not, in some cases process all the incoming flow of data (if a lot of data comes in)

#### Solutions:

- Allocate more processing power and memory to the normalizer to be able to handle all

#### 5. Testability

- We could have used a gateway to keep the details of RabbitMQ hidden and improve testability
- Because we use the Pipes and Filters architecture, we benefit from testing each component in isolation
- Although not acknowledged as proper testing, logs are a good way of tracking the behaviour of the system
- We can insert a proxy between any service consumer and external service so we can have a management console where we monitor the messages (response time for example)
- We have tested internal logic of most components through unit testing

#### 6. Description of the loan broker system.

We communicate to our loan broker system using a REst webService (as Tine said it would be ok). The client makes the request using the url (example: <http://localhost:8090/broker/123456-6543/1234567.0/250>) which triggers the whole process of getting the best quote. All communication is done using JSON formatted strings. A loan request is being sent to GetCreditScore. The GetCreditScore component enriches the message with the credit score (contacts the CreditBureau using SOAP webservises) and sends it over to the GetBanks component. GetBanks uses again SOAP to get the appropriate banks for that specific credit Score and sends the message (enriched with the target banks )over to the Recipient List. Using a routing strategy, the Recipient List sends the loan request to the translators. Every translator is specifically designed to convert the loan request in the bank's format, send it and get it back and send it to the Normalizer. The Normalizer collects all the messages (using basic messaging strategy) and converts them back to JSON and sends them over to the Aggregator. The Aggregator calculates the lowest interest rate and sends the best one to the client.

Messaging strategies used: BASIC, ROUTING, RPC.