

# REBS – Assignment 3

Albert Friis-Hansen (ghv657), Felix Fleckenstein (vcb456)

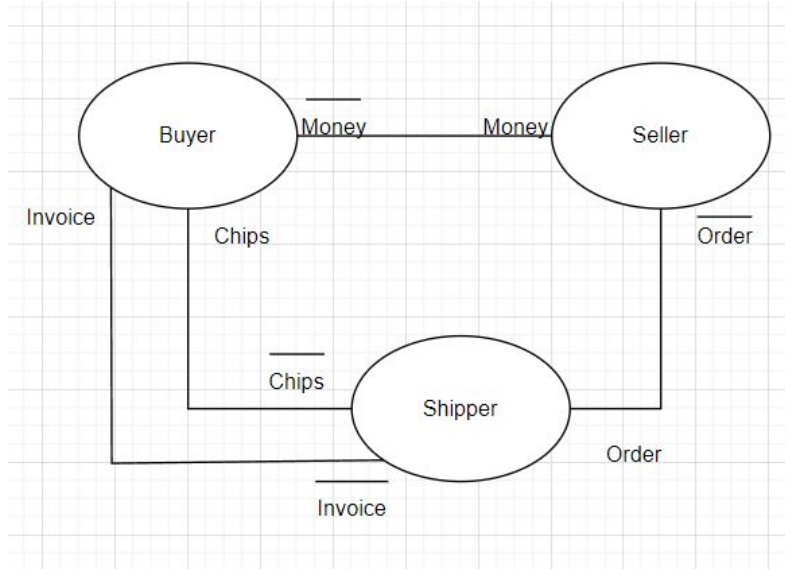
Group 3

22. januar 2024

# 1 Part1

## 1.1 Exercise 1.1

We made the interface model with the rules from lecture 6 slide 26-29.



Figur 1: Interface model

## 1.2 Exercise 1.2

$S_B$  = Buyer's state

$S_S$  = Seller's state

$S_H$  = Shipper's state

Transistions:

$S_B$ :

quote2buy  $\rightarrow S_S$

accept2sell  $\rightarrow S_H$

$S_S$ :

ask2sell  $\rightarrow S_B$

reject2sell  $\rightarrow S_B$

details2buy  $\rightarrow S_B$

order2ship  $\rightarrow S_H$

$S_H$ :

Here we indicate that the shipper accepts to ship the order

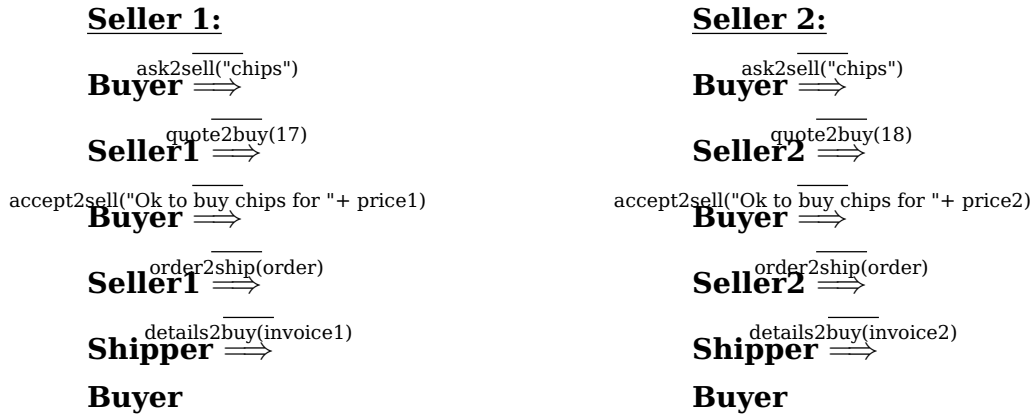
order2ship  $\rightarrow S_H$

**Buyer**  $\xRightarrow{\text{ask2sell}}$  **Seller**  $\xRightarrow{\text{quote2buy}}$  **Buyer**  $\xRightarrow{\text{accept2sell}}$  **Seller**  $\xRightarrow{\text{order2ship}}$  **Shipper**  $\xRightarrow{\text{details2buy}}$  **Buyer**

### 1.3 Exercise 1.3

- First big difference we see is sequential vs concurrent Execution. Sequential meaning the original CCS process waits for a product request and then it either accepts or rejects the order. The concurrent execution splits into parallel branches.
- The next difference is how the processes terminate. The original process keeps the seller active until the buyer makes a decision. The relaxed version terminates the seller after quoting the price.
- The handling of orders will now be different. For the original version it will only be able to accept or reject offers after the price has been quoted. The relaxed process can reject and accept offers independently of the quoting process.
- For safety and sustainability the original process will be more secure and reliable, and the relaxed version will give more flexibility, but this can also resolve into more errors like deadlocks or liveness issues.

### 1.4 Exercise 1.4



#### 1.4.1 Pseudocode for description purposes

**Buyer =**

```

ask2sell("chips").quote2buy(price1).
ask2sell("chips").quote2buy(price2).
if (price1 < price2 && price1 < 20) :
    accept2sell("Ok to buy chips for " + price1).details2buy(invoice1).0
elif (price2 < price1 && price2 < 20) :
    accept2sell("Ok to buy chips for " + price2).details2buy(invoice2).0
else :
    reject2sell("Not ok to buy chips for either offer").0

```

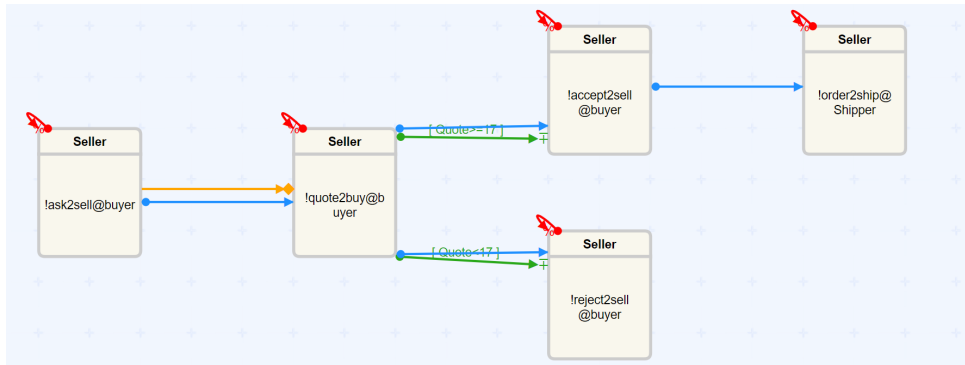
## 2 Part 2

### 2.1 Exercise

Here we see the endpoint for our seller in CCS:

```
Seller = ask2sell(product).quote2buy(17).(accept2sell(order).order2ship(order).0 +  
reject2sell(order).0)
```

The endpoint DCR graph for our seller:

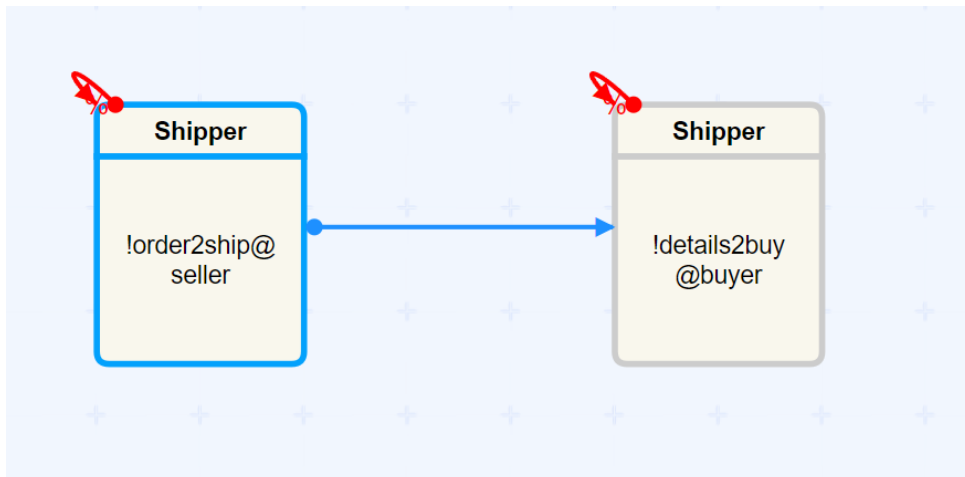


Figur 2: Seller

Here we see the endpoint for our shipper in CCS:

```
Shipper = order2ship(product).details2buy("invoice for " + product).0
```

The endpoint DCR graph for our shipper:



Figur 3: Shipper

### 2.2 Exercise 2.2

We have implemented this as seen in our code. What we have in the code is more than just this, due to the exercises below. We chose to do this in python, as we are more familiar with it.

## 2.3 Exercise 2.3

```
Anaconda Prompt (Anaconda) X + -
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:8002/ (Press CTRL+C to quit)
Price is lower than 20 (acceptable price).
Received Some invoice details from Shipper!
Price is not lower than 20 (high price scenario).
127.0.0.1 - - [14/Jan/2024 20:35:06] "GET /buy HTTP/1.1" 200 -

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>python buyer_endpoint.py
* Serving Flask app "buyer_endpoint" (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:8002/ (Press CTRL+C to quit)
Price is not lower than 20 (acceptable price).
Successfully sent rejection to Shipper.
Price is not lower than 20 (high price scenario).
127.0.0.1 - - [14/Jan/2024 20:36:28] "GET /buy HTTP/1.1" 200 -

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>python buyer_endpoint.py
* Serving Flask app "buyer_endpoint" (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:8002/ (Press CTRL+C to quit)
```

Figur 4: Two sellers, not comparing price

```
Anaconda Prompt (Anaconda) X + -
* Running on http://127.0.0.1:8000/ (Press CTRL+C to quit)
127.0.0.1 - - [14/Jan/2024 20:31:10] "GET /ask HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 20:31:43] "GET /ask HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 20:31:47] "GET /ask_high_price HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 20:34:30] "GET /ask HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 20:34:40] "GET /ask HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 20:34:44] "GET /ask_high_price HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 20:35:02] "GET /ask HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 20:35:06] "GET /ask_high_price HTTP/1.1" 200 -

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>python seller_endpoint.py
* Serving Flask app "seller_endpoint" (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:8000/ (Press CTRL+C to quit)
127.0.0.1 - - [14/Jan/2024 20:36:07] "GET /ask HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 20:36:24] "GET /ask HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 20:36:28] "GET /ask_high_price HTTP/1.1" 200 -

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>python seller_endpoint.py
* Serving Flask app "seller_endpoint" (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:8000/ (Press CTRL+C to quit)
127.0.0.1 - - [14/Jan/2024 20:37:47] "GET /ask HTTP/1.1" 200 -
```

Figur 5: Two sellers, not comparing price

```
Anaconda Prompt (Anaconda X + v)

* Serving Flask app "shipper_endpoint" (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:8001/ (Press CTRL+C to quit)
127.0.0.1 - - [14/Jan/2024 20:31:23] "POST /order HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 20:31:45] "POST /order HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 20:34:35] "POST /order HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 20:34:42] "POST /order HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 20:35:04] "POST /order HTTP/1.1" 200 -

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>python shipper_endpoint.py
* Serving Flask app "shipper_endpoint" (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:8001/ (Press CTRL+C to quit)
127.0.0.1 - - [14/Jan/2024 20:36:12] "POST /order HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 20:36:26] "POST /order HTTP/1.1" 200 -

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>python shipper_endpoint.py
* Serving Flask app "shipper_endpoint" (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:8001/ (Press CTRL+C to quit)
```

Figur 6: Two sellers, not comparing price

```
Anaconda Prompt (Anaconda X + v)

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>curl http://localhost:8002/buy
{"product":"chips"}

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>curl http://localhost:8000/ask
{"quote":17}

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>curl -X POST -H "Content-Type: application/json"
-d '{"order\":"chips\":" http://localhost:8001/order
{"details":"Some invoice details"}

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>curl http://localhost:8002/buy
{"product":"chips"}

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>curl http://localhost:8002/buy
{"product":"chips"}

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>curl http://localhost:8000/ask
{"quote":21}

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>curl -X POST -H "Content-Type: application/json"
-d '{"order\":"chips\":" http://localhost:8001/order
{"details":"Some invoice details"}

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>curl http://localhost:8002/buy
{"product":"chips"}

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>curl http://localhost:8000/ask
{"quote":17}

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>
```

Figur 7: Two sellers, not comparing price

## 2.4 Exercise 2.4

```
Anaconda Prompt (Anaconda) x + v
WARNING: This is a development server. Do not use it in a production deployment.
Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:8002/ (Press CTRL+C to quit)
Price is acceptable, I choose seller2
Received (Your order has been shipped) from Shipper!
127.0.0.1 - - [14/Jan/2024 20:59:17] "GET /buy HTTP/1.1" 200 -

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>python buyer_endpoint.py
* Serving Flask app "buyer_endpoint" (lazy loading)
* Environment: production
WARNING: This is a development server. Do not use it in a production deployment.
Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:8002/ (Press CTRL+C to quit)
Price is acceptable, I choose seller1
Received (Your order has been shipped) from Shipper!
127.0.0.1 - - [14/Jan/2024 21:04:20] "GET /buy HTTP/1.1" 200 -

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>python buyer_endpoint.py
* Serving Flask app "buyer_endpoint" (lazy loading)
* Environment: production
WARNING: This is a development server. Do not use it in a production deployment.
Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:8002/ (Press CTRL+C to quit)
Price is acceptable, I choose seller1 because 15 < 19
Received (Your order has been shipped) from Shipper!
127.0.0.1 - - [14/Jan/2024 21:06:28] "GET /buy HTTP/1.1" 200 -
```

Figur 8: Two sellers, comparing price

```
Anaconda Prompt (Anaconda) x + v
Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:8000/ (Press CTRL+C to quit)
127.0.0.1 - - [14/Jan/2024 20:58:56] "GET /ask HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 20:59:13] "GET /ask HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 20:59:15] "GET /ask_high_price HTTP/1.1" 200 -

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>python seller_endpoint.py
* Serving Flask app "seller_endpoint" (lazy loading)
* Environment: production
WARNING: This is a development server. Do not use it in a production deployment.
Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:8000/ (Press CTRL+C to quit)
127.0.0.1 - - [14/Jan/2024 21:04:04] "GET /ask HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 21:04:16] "GET /ask HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 21:04:18] "GET /ask_high_price HTTP/1.1" 200 -

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>python seller_endpoint.py
* Serving Flask app "seller_endpoint" (lazy loading)
* Environment: production
WARNING: This is a development server. Do not use it in a production deployment.
Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:8000/ (Press CTRL+C to quit)
127.0.0.1 - - [14/Jan/2024 21:06:19] "GET /ask HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 21:06:24] "GET /ask HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 21:06:26] "GET /ask_high_price HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 21:08:54] "GET /ask_high_price HTTP/1.1" 200 -
```

Figur 9: Two sellers, comparing price

```
Anaconda Prompt (Anaconda) x + v
(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>python shipper_endpoint.py
* Serving Flask app "shipper_endpoint" (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:8001/ (Press CTRL+C to quit)
127.0.0.1 - - [14/Jan/2024 20:59:02] "POST /order HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 20:59:17] "POST /order HTTP/1.1" 200 -

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>python shipper_endpoint.py
* Serving Flask app "shipper_endpoint" (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:8001/ (Press CTRL+C to quit)
127.0.0.1 - - [14/Jan/2024 21:04:09] "POST /order HTTP/1.1" 200 -
127.0.0.1 - - [14/Jan/2024 21:04:20] "POST /order HTTP/1.1" 200 -

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>python shipper_endpoint.py
* Serving Flask app "shipper_endpoint" (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:8001/ (Press CTRL+C to quit)
127.0.0.1 - - [14/Jan/2024 21:06:28] "POST /order HTTP/1.1" 200 -
```

Figur 10: Two sellers, comparing price

```
Anaconda Prompt (Anaconda) x + v
(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>curl http://localhost:8000/ask
{"quote":17}

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>curl -X POST -H "Content-Type: application/json"
-d '{"order\":"chips\":" http://localhost:8001/order
{"details":"(Your order has been shipped)"}

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>curl http://localhost:8002/buy
{"product":"chips"}

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>curl http://localhost:8000/ask
{"quote":15}

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>curl -X POST -H "Content-Type: application/json"
-d '{"order\":"chips\":" http://localhost:8001/order
{"details":"(Your order has been shipped)"}

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>curl http://localhost:8002/buy
{"product":"chips"}

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>curl http://localhost:8000/ask
{"quote":15}

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>curl http://localhost:8002/buy
{"product":"chips"}

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>curl http://localhost:8000/ask_high_price
{"quote":19}

(base) C:\Users\Albert Friis-Hansen\Documents\GitHub\REBS\Assignment 3>
```

Figur 11: Two sellers, comparing price