Análise e Modelação de Sistemas

Teacher: Maria do Rosário Gomes Osório Bernardo Ponces de Carvalho

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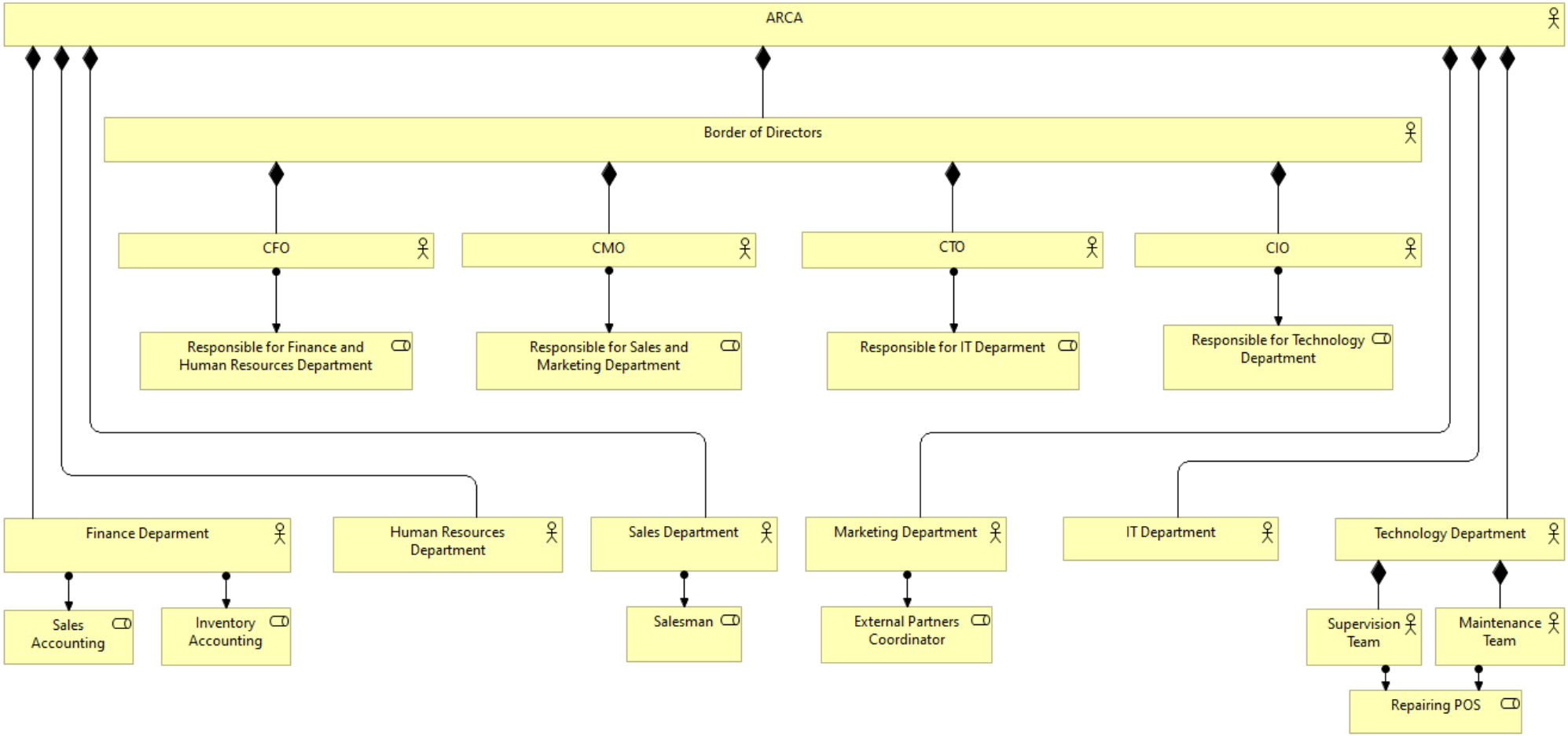
Project - Delivery 3

Group 4 - AMS1113264PB09

Thursday: 8:00 - 9:30

Name	Number	Total Hours	Delivery 1 Improve Hours	Delivery 2 Improve Hours	Task 7 Hours	Task 8 Hours	Task 9 Hours	Task 10 Hours	Task 11 Hours
Sara Machado	86923	12	0.5	1.5	2	2	2	2	2
Gonçalo Freire	90719	12	0.5	1.5	2	2	2	2	2
Rafael Figueiredo	90770	12	0.5	1.5	2	2	2	2	2
Ricardo Grade	90774	12	0.5	1.5	2	2	2	2	2

Task 1: "*Viewpoint*" of Organic Structure:



TASK 1: Description: Structure of the organization "*ARCA*".

- Board of directors that has a "*CFO*", "*CMO*, "*CTO*", "*CIO*".
  - "*CFO*" is responsible for the Finance and Human Resources Department.
  - "*CMO*" is responsible for the Sales and Marketing Department.
  - "*CTO*" is responsible for the IT Department.

- Finance Department is responsible for the roles of "*Sales Accounting*" and "*Inventory Accounting*".
  - "*Sales Accounting*" registers the sales done by the company.
  - "*Inventory Accounting*" manages the inventory of the company.

- Human Resources Department is responsible for or managing the employee life and administering employee benefits.

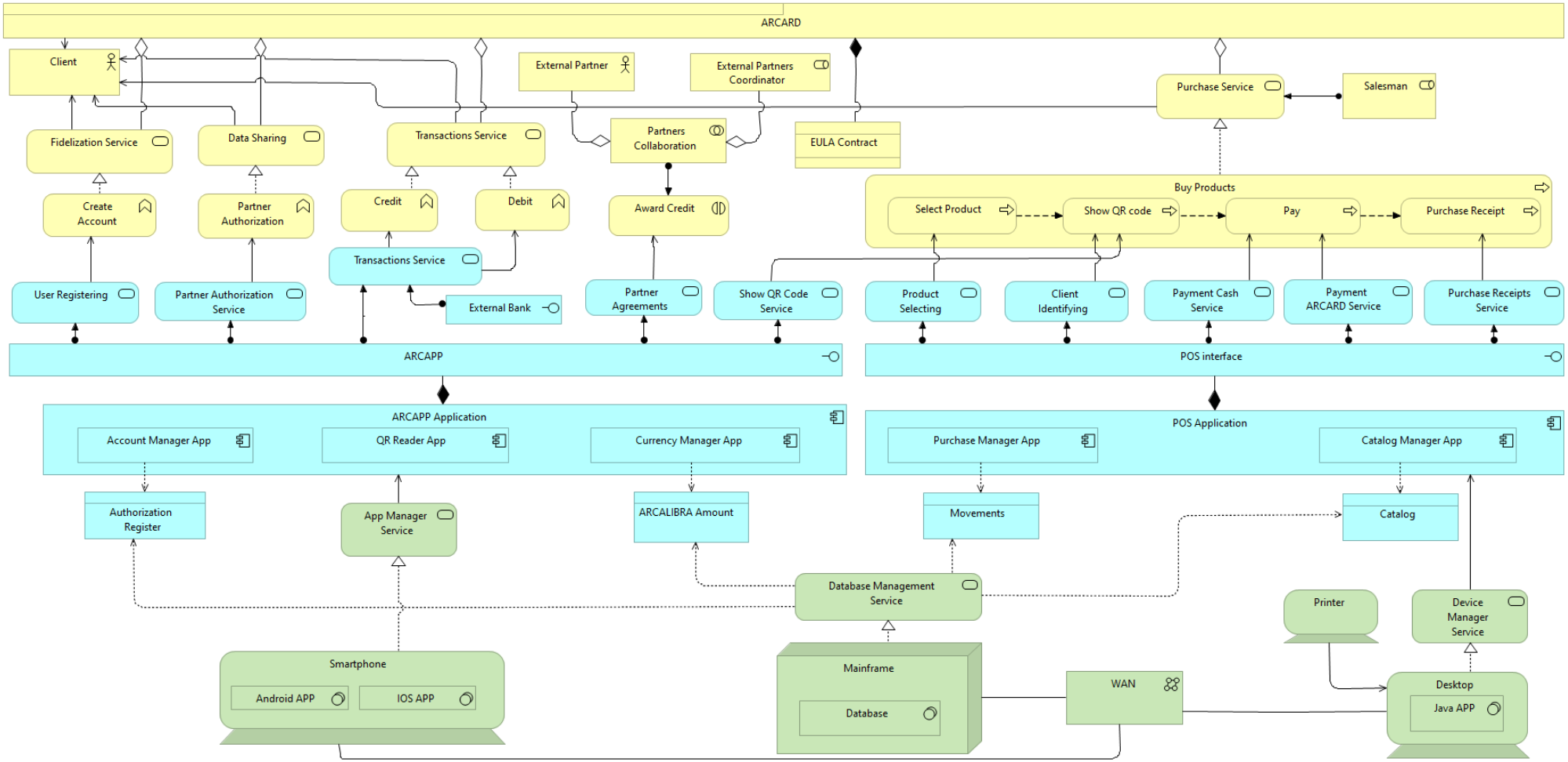
- Sales Department is responsible for the sales operations of the company.

- Marketing Department is responsible for the promotion of the company products.

- IT Department is responsible for providing the infrastructure for automation.

- Technology Department that has a "*Supervision Team*" and "*Maintenance Team*".
  - Both can have the role of "*Repairing POS*" where the supervision team sends a notification to the maintenance team when a POS needs repairing.

Task 2: "*Layered Viewpoint*"



Task 2: Description: ARCA has a product "*ARCARD*" and has an "*EULA Contract*". The client uses 4 services of "*ARCARD*".

- The service "*Fidelization Service*" is realized by a function "*User Registering*" that communicates through ARCAPP with the application service "*User Registering*". This service creates an account for the client using the "*Account Manager App*" that communicates with the technology service "*App Manager Service*". This service is realized by the smartphone with Android or IOS version of the application. After this the data is sent to the Mainframe that has a "Database" through the "*Wide Area Network*" (WAN) and writes on this "*Database*".

- The service "*Data Sharing*", is realized by a function "*Partner Authorization*", that communicates through ARCAPP with the application service "*Partner Authorization Service*". This service enables a partner to see what the client buys in order to receive rewards. The ARCAPP Application then communicates with the technology service "*App Manager Service*" and as explained writes on the "*Database*".

- The service "*Transactions Service*", is realized by the functions "*Credit*" or "*Debit*", that communicates through ARCAPP with the application service "*Transaction Service*". This service communicates with the "*External Bank*" in order to enable a credit transaction or a debit transaction through different clients or to debit to their own account. The ARCAPP Application then communicates with the technology service "*App Manager Service*" and as explained writes on the "*Database*".

- The "*Purchase Service*" is assigned to the client and the salesman, meaning they both participate in it. It has a function "*Buy Products*" that has the following processes "*Show QR Code*", "Select the Product", "Pay" and finally "*Purchase Receipt",* the "*Show QR Code*" code is an optional step, because it's not used when paying in cash.

- "*Show QR Code*" process communicates through ARCAPP with the application service "*Show QR Code Service*" this enables the QR code to be loaded. The ARCAPP Application then communicates with the technology service "*App Manager Service*". This service is realized by the smartphone.

- When the "*QR Code*" is loaded this service allows the communication through POS with the application service "*Client Identifying*", that allows the POS application to get the client's data. The POS Application then communicates with the technology service "*Device Manager Service*". This service is realized by a desktop with a Java version of the application. After this the data is sent to the Mainframe that contains the "*Database*" through the "*WAN*" and realizes the "*Database Management Service*" and gets the clients data.

- "*Select the product*" process communicates through POS with the application service "*Product Selecting*". This service enables the salesman to choose the products that the client wants to buy using the "*Catalog Manager App*". This application then communicates with the technology service "*Device Manager Service*" and as explained for the client gets the product data in the "*Database*".

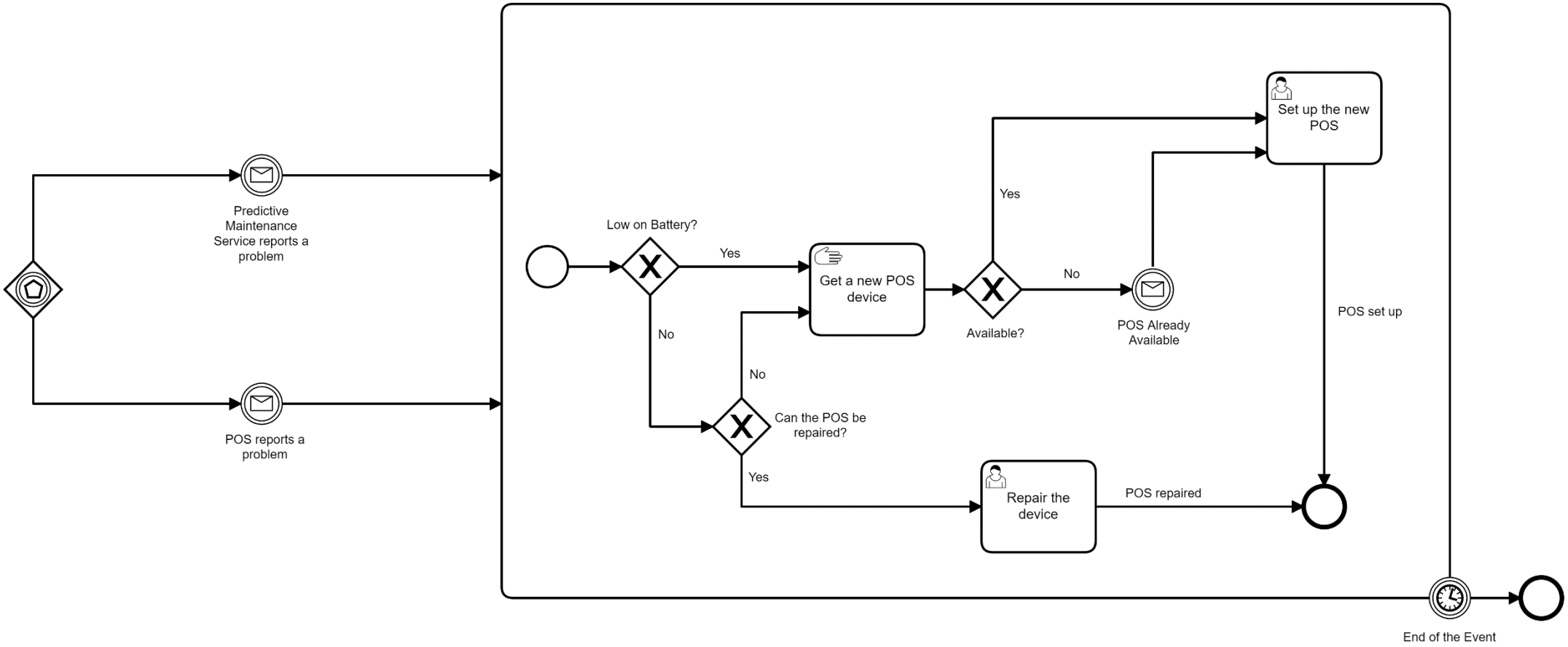
- "Pay" process communicates through POS with the application service "*Payment Cash Service*" or "*Payment ARCARD Service*" through the "*Manager Application App*" in order to make the purchase. This application communicates with the technology service "*Device Manager Service*" and writes in the "*Database*". The "*Movements*" are also updated.

- "*Purchase Receipt*" process also communicates through POS with the application service "*Purchase Receipt Service*", this creates the client receipt. The POS Application then communicates with the technology service "*Device Manager Service*". This service is realized by a desktop and if the purchase was made with cash then prints the receipt using the Printer, else creates an electronic receipt and then writes this information as explained to the "*Database*".

- Periodically the movements of partner products of the clients that authorized it are sent to the partners. This is not explicitly represented in the model but is assumed.

- Finally, the External Partners and the "*External Partners Coordinator*" work together to give users, awards for the partner products. The awards come in the form of refunds to the clients' accounts when buying a product of a partner. The "*Award Credits*" interaction communicates through ARCAPP, with the application service "*Partner Agreements Service*". The ARCAPP application then communicates with "*Currency manager app*", that updates the "*ARCALIBRA amount*" of the account and writes that information on the database as explained before.

Task 3: BPMN Diagram of POS Repair or Substitution Process

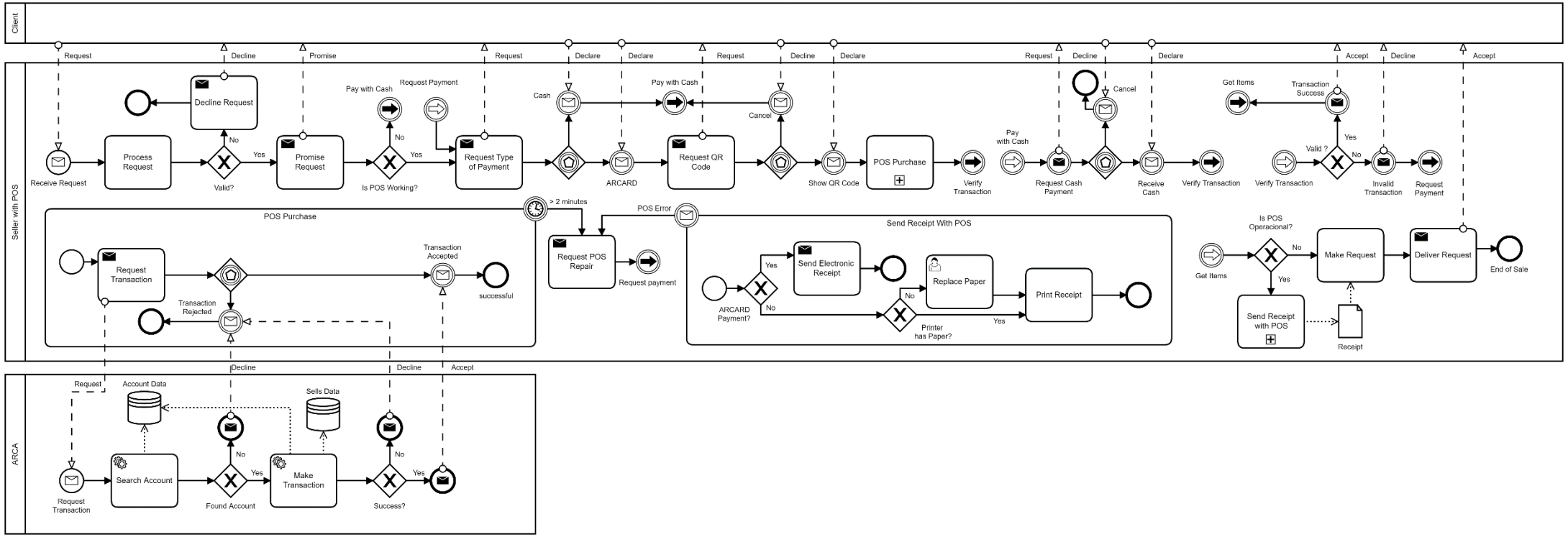


Task 3: Description: BPMN Diagram of POS Repair or Substitution Process

The process can start if the POS reports a problem or if the Predictive Maintenance Service detects a problem.

- In the process, the first thing to do is check if the problem is low battery or if the POS is broken. If the device is low on battery or broken and cannot be repaired, this means that it needs to be replaced. However, there could be no more POS available to replace them in that moment, so we will have to wait until a notification is received notifying that they have become available. Once they become available or if they were already available in the first place, the last step will be to set up the device to be used and the process ends.
- However, if the POS is broken but can be repaired the process is much simpler, it only needs to be repaired and the process ends.
- Every step of the process can be interrupted if the event ends because it will no longer be necessary a POS.

Task 4: BPMN Diagram of a Collaboration of a Sale in an ongoing Event

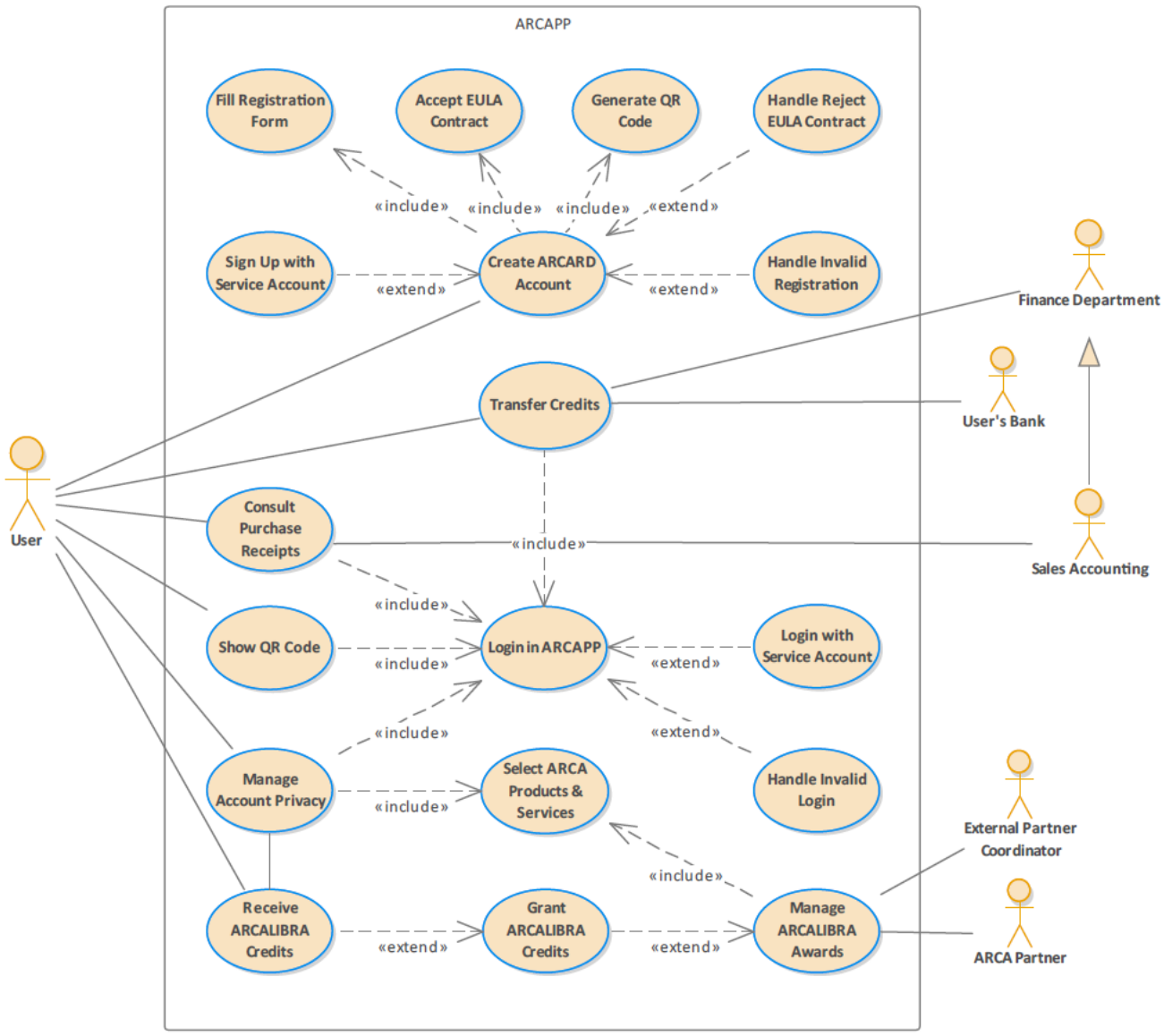


Task 4: Description: BPMN Diagram of a Collaboration of a Sale in an ongoing Event

1. A Salesman Receives a Client Request – Go to Step 2
2. Is Request Valid?
   - Yes: Promises Client Request - Go to Step 3
   - No: Declines Client Request - (End)
3. Is POS Working?
   - Yes: Go to Step 4
   - No: Go to Step 5
4. Request Type of Payment:
   - Client wants to Pay with Money - Go to Step 5
   - Client wants to Pay with ARCARD - Go to Step 11
5. Request Cash Payment:
   - Client Cancels – (End)
   - Receive Cash – Go to Step 6
6. Is Transaction Valid?
   - Yes: Accept Payment – Go to Step 7
   - No: Invalid Transaction – Go to Step 4
7. Is POS Operational?
   - Yes: Go to Step 8
   - No: Go to Step 10
8. ARCARD Payment?
   - Yes: Send Electronic Receipt – (End)
   - No: Go to Step 9
9. Printer has Paper?
   - Yes: Print Receipt – Go to Step 10
   - No: Replace Paper & Print Receipt – Go to Step 10
10. Make & Deliver Request – (End)
11. Request QR Code:
    - Show QR Code: Go to Step 12
    - Client Cancels: Go to Step 5
12. Request Transaction:
    1) Request Transaction to ARCA: Go to Step 13
    2)
       - Transaction Accepted: Transaction is Valid - Go to Step 6
       - Transaction Rejected: Transaction is Invalid - Go to Step 6
13. Search Account:
    - Account Found: Make Transaction – Go to Step 14
    - Account Not Found: Transaction Rejected – Go to Step 12.2
14. Transaction Succeeded?
    - Yes: Transaction Accepted – Go to Step 12.2
    - No: Transaction Rejected – Go to Step 12.2

Interrupt Events: Steps 12, 13, 14: During > 2 Minutes - Request POS Repair – Go to Step 4
Steps 8, 9: Receive POS Error - Request POS Repair – Go to Step 4

Task 5: UML Diagram of Use Cases for ARCAPP



Task 5: Description: UML Diagram of Use Cases for ARCAPP

- **Fill Registration Form:** The User is presented with a Form, where he needs to fill relevant information for the account creation
- **Accept EULA Contract:** The User is presented with a EULA Contract in a Pop-Up, reads the Contract and accepts it by checking a checkbox.
- **Generate QR Code:** The QR Code is generated through an algorithm that uses the device's unique serial number and the time of the account creation.

Name: Create ARCARD account

Extension Points:
- Sign Up with Service Account
- Handle Reject EULA Contract
- Handle Invalid Registration.

Main Scenario:
1. The User presses the button "*Sign Up*".
2. The User gives the registration information, accomplished in "*Fill Registration Form*".
3. The User accepts the EULA Contract with ARCA, accomplished in "*Accept EULA Contract*".
4. The User presses the button "*Create new account*".
5. The User's unique QR Code is generated automatically, accomplished in "*Generate QR Code*".

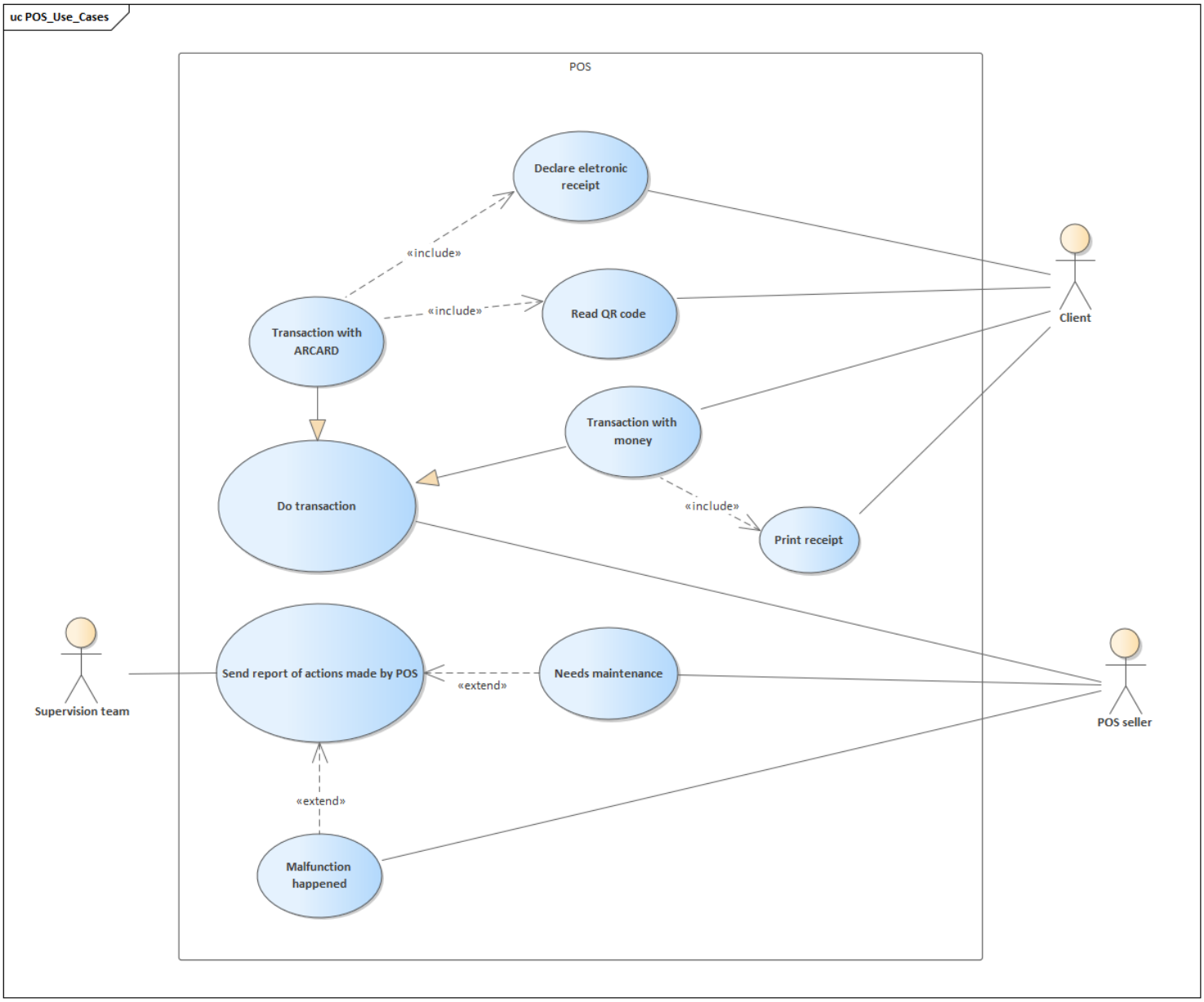
Alternative Scenario:
1. The User presses the button "*Sign Up*", presses the button "*Sign Up with Service Account*" i.e. "*[…] with Google Account*" and the registration information is automatically filled provided by the User's Google Account moving forward to *Main Scenario's* step 3 and so on.

Exception Scenario:
1. The User gives Invalid Registration Information i.e. "*Invalid Username*", "*Weak password*", etc. accomplished in "*Handle Invalid Registration*". The User is informed of the invalid field and is invited to fill it again or cancel the account creation.
2. The User Rejects the EULA Contract with ARCA, accomplished in "*Handle Reject EULA Contract*". An Error Message is given, informing the User that he hasn't accepted it and he must accept or cancel the account creation.

- **Login in ARCAPP:** The User presses the button "*Login*", fills "*Username*" and "*Password*" fields and presses the button "*Confirm*".
- **Login with Service Account:** The User presses the button "*Login*", then presses the button "*Login with Service Account*" i.e. "*[…] with Google Account*" and perform the Login through his Google Account.
- **Handle Invalid Login:** The User tries to Login in ARCAPP with invalid "*Username*" or "*Password*" fields and is presented an Error Message i.e. "*Invalid Username*", "*Invalid Username or Password*", etc. and the User can try to Login again or Cancel the Login.
- **Transfer Credits:** The User Logs in ARCAPP, presses the button "*Credit*" or "*Debit*", connects with his Bank Account, fills the "*Value*" field with the number of ARCALIBRAS he intends to Transfer, presses the button "*Confirm*", and the Transfer is made accordingly with ARCALIBRA's Real Value established by the Financial Department.
- **Consult Purchase Receipts:** The User Logs in ARCAPP, presses the button "*Purchase Receipts*" and the receipts that the Sales Accounting issued are presented.
- **Show QR Code:** The User Logs in ARCAPP, presses the button "*QR Code*" and the QR Code associated with his Account is presented.
- **Manage Account Privacy:** The User Logs in ARCAPP, presses the button "*Account Privacy*" where he can choose to share his purchases with ARCA Partners.
- **Select ARCA Products & Services:** On "*Account Privacy*" in the case that the User chooses to share his purchases with ARCA Partners, the Products & Services are presented with a checkbox for each one, that the User can check accordingly with his will to share its purchases.
- **Receive ARCALIBRA Credits:** The User receives ARCALIBRA Credits on ARCAPP from the ARCA Partners in the case he chose to share his purchases with them, based on Products & Services selected by him.
- **Manage ARCALIBRA Awards:** ARCA Partners Coordinator accordingly with ARCA Sales, can advise the ARCA Partners about which are the Products & Services that should be selected as Special Items (1) in order to increase their sales.
- **Grant ARCALIBRA Credits:** The ARCA Partner grants ARCALIBRA Credits for the Users that have purchase them Special Items (1).

- Special Items (1): ARCA Products & Services selected by the ARCA Partners to reward their purchases.
- User's Bank: A Secondary Actor that helps the User to accomplish Credits Transactions.

Task 6: UML Diagram of Use Cases for POS



Task 6: Description: UML Diagram of Use Cases for POS

- **Read QR code:** The POS scans the clients QR code associated with his account, validating this one.
- **Declare electronic receipt:** The POS creates an electronic receipt of the transaction and sends it to the ARCARD account of the client.
- **Prints receipt:** The POS prints a receipt of the transaction and gives it to the client.

Transaction with ARCARD:

- Includes **"*Read QR code*".**
- The POS processes the transaction made with the ARCARD.
- Includes **"Declare electronic receipt"**

Transaction with cash:

- The POS processes the transaction made with cash.
- Includes **"Prints receipt"**

Do Transaction:

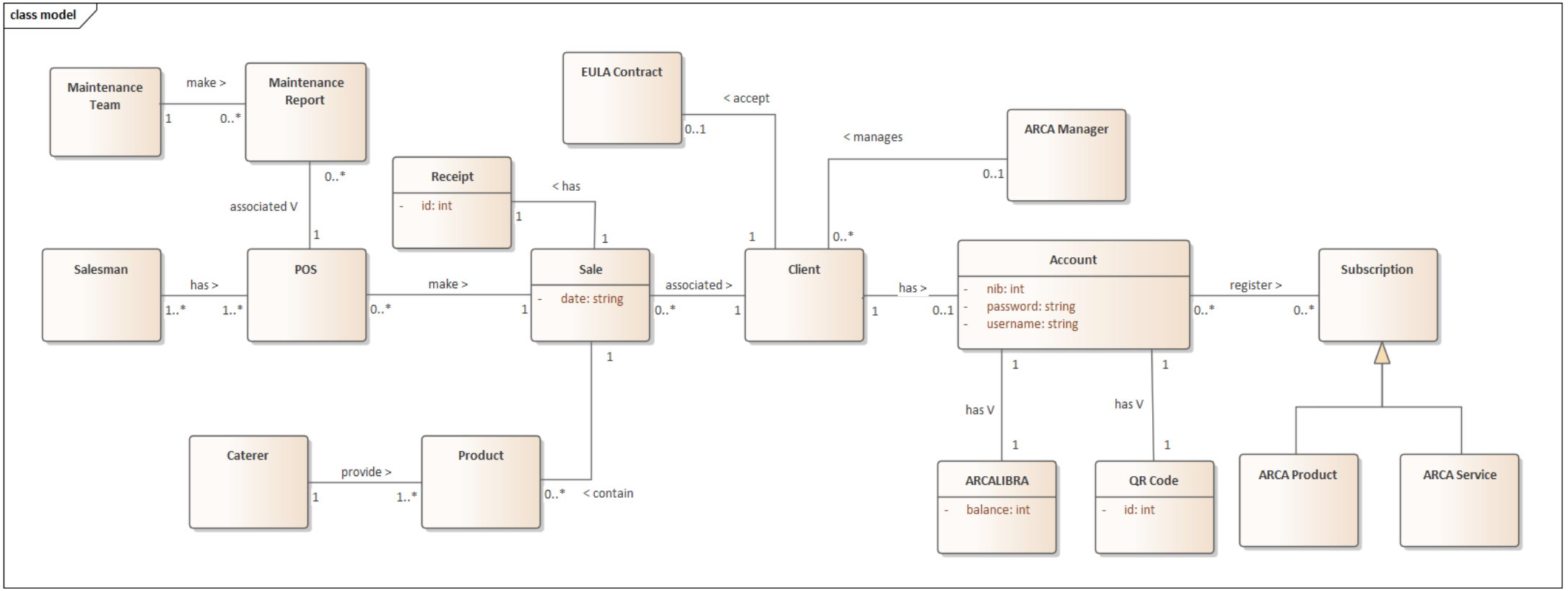
- The POS allows the POS salesman to make transactions with cash or ARCARD. If the transaction is done with the ARCARD then **"Transaction with ARCARD"** is performed. If the transaction is done with cash, then **"Transaction with cash"** is performed.

- **Malfunction happened:** Together with the report of actions of the POS is sent to the maintenance team a warning that a malfunction happened and the traceback of this malfunction. This warning and traceback is also showed in the screen of the POS to the POS salesman.
- **Needs Maintenance:** Together with the report of actions of the POS is sent to the maintenance team a warning that the POS needs maintenance and what kind of maintenance this needs. This warning is also showed in the screen of the POS to the POS salesman.

Send Report of actions made by POS:

- The POS sends periodically, to the maintenance team a report of events that happened to the POS. In case a malfunction happened to the POS is performed **"Malfunction happened"**. In case the POS detected that it needs maintenance (low battery or paper for example) is performed **"Needs Maintenance"**.

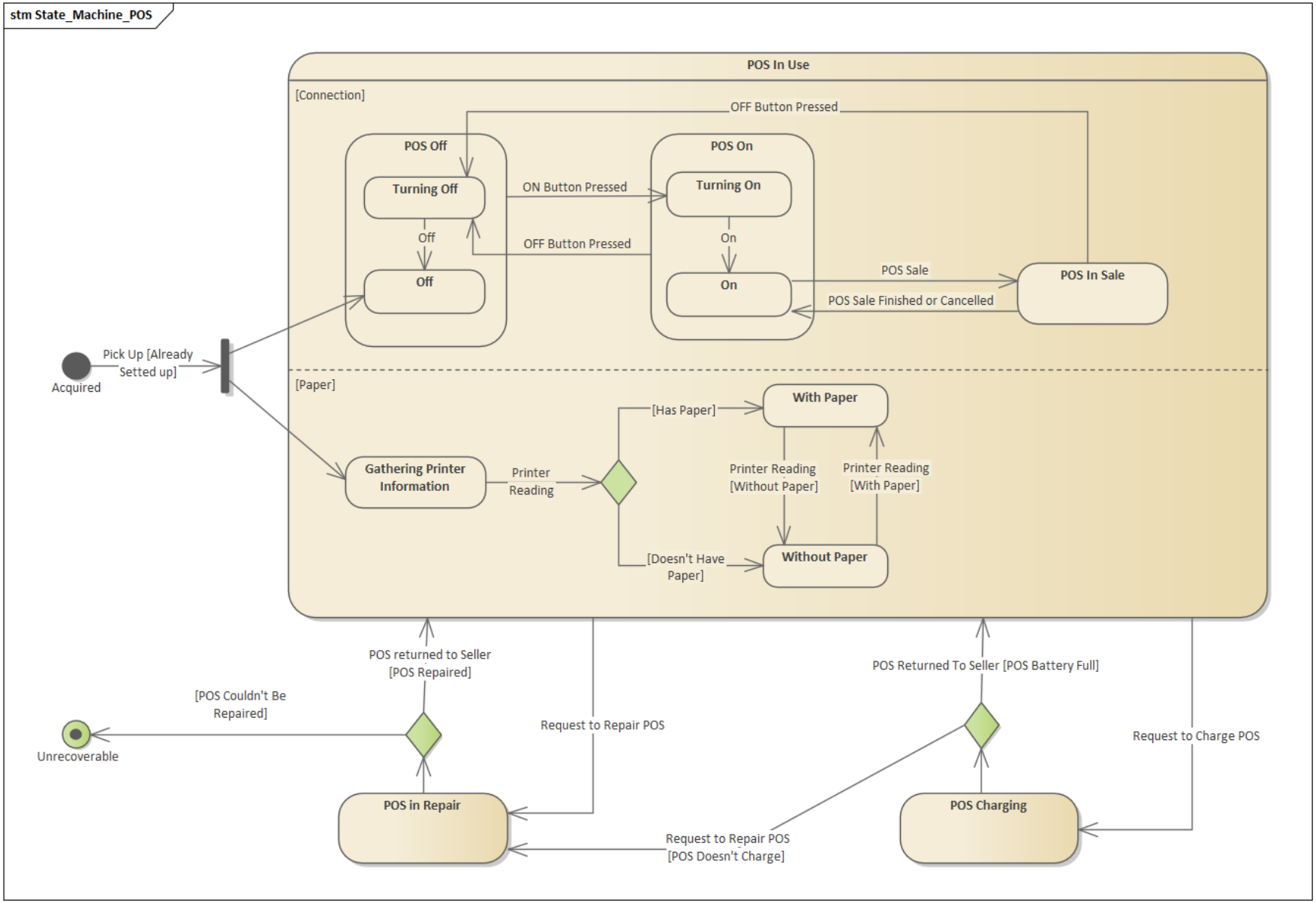
Task 7: UML Domain Model of ARCA



Task 7: Description: UML Domain Model of ARCA

- A "**Client**" can have an "**ARCA**" "**Account**", in which the client accepts an "**EULA Contract**".
- An "**ARCA Manager**" can manage "**Client**"s.
- An "**Account**" has associated:
  - The "**nib**" of a bank.
  - A "**username**" and a "**password**" for login.
  - The "**ARCALIBRA**", that maintains the balance of the account, and manages how it is displayed.
  - "**QR Code**", that maintains a unique identifier, that identifies the "**Account**".
- An "**Account**" can register "**Subscription**"s, that can be "**ARCA Product**" or "**ARCA Service**", in order to get awards from external partners.
- A "**Salesman**" uses "**POS**" devices, to make "**Sale**"s.
- A "**Sale**" has associated:
  - A "**date**" of the "**Sale**".
  - "**Product**"s that are being bought.
  - A "**Client**" that is making the purchase, with money or with the ARCA "**Account**".
  - A "**Receipt**" of the purchase.
- "**Product**"s are provided by a "Caterer".
- The "**Maintenance Report**"s are made by the "**Maintenance Team**" and are associated to a "**POS**" device.

Task 8: UML State Machine of POS



Task 8: Description: UML State Machine of POS

In the diagram above is represented the UML State Machine of a POS device, from the moment it is acquired to the moment it is unrecoverable.

- The State Machine of the POS starts when it is acquired.

- When the device is picked up, if already set, it starts "**Off**".
    - At the same time, in the beginning of the state machine is gathered information about the printer.

- Once the ON button is pressed on the POS, it turns "**On**" after a little delay.

- Once "**On**", the POS can change into a selling state, when a sale starts, changing its state back to "**On**" when the sale is finished or cancelled.

- While the POS is "**On**" or in a selling state, if the OFF button is pressed the POS turns "**Off**" after a little while.

- While it is gathering printer information, it checks if the printer has paper:
    - If it has paper, it goes into the state "**With Paper**".
    - If it does not, it goes into the state "**Without Paper**".

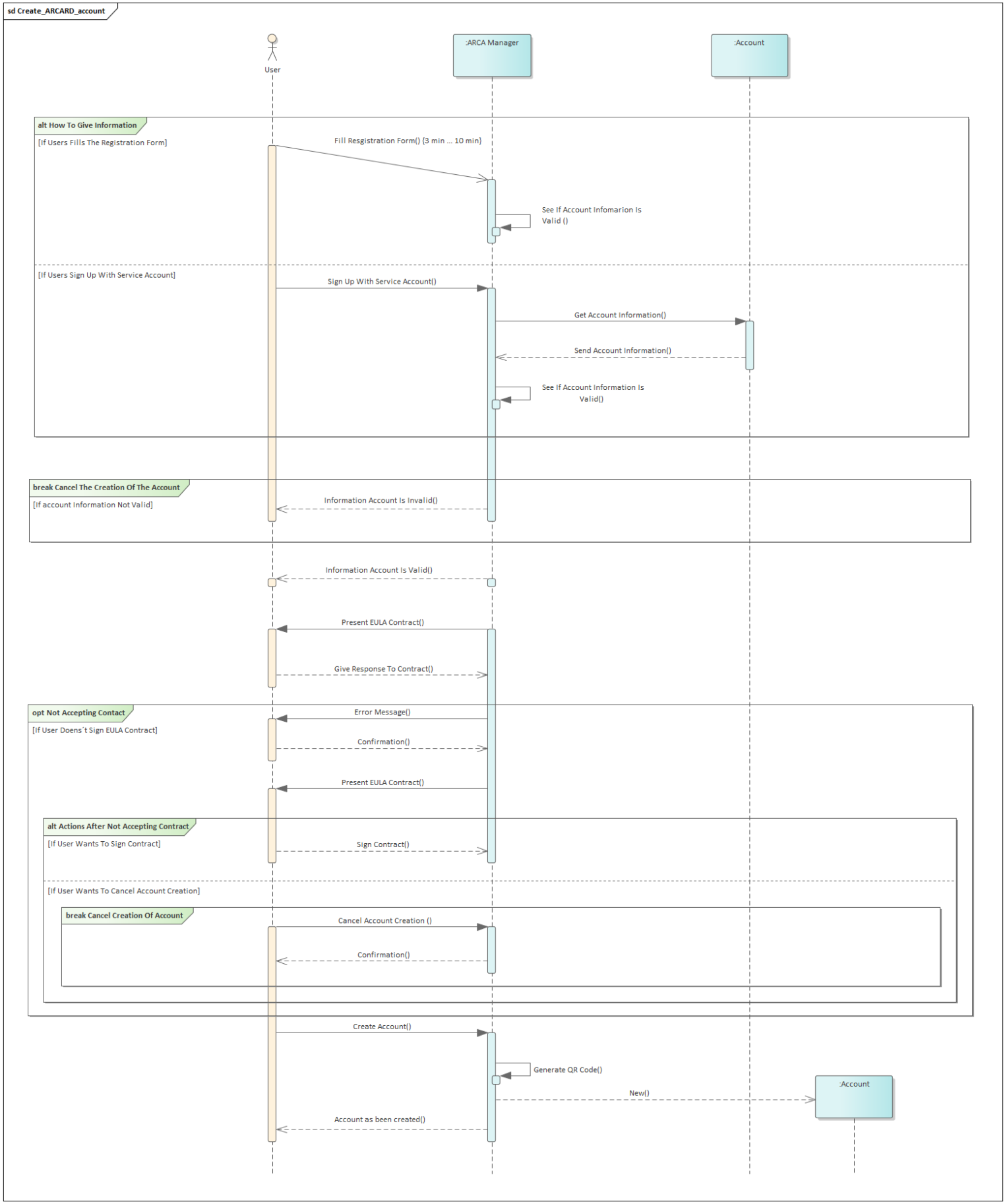
- While in the "**With Paper**", if a printer reading detects that is missing paper then it proceeds to the "**Without Paper**".

- On the other hand, while in the "**Without Paper**", if a printer reading detects paper it proceeds to the "**With Paper**".

- While in the "**POS In Use**", if it runs out of battery, a request is made to charge the device, and its state is set to "**POS Charging**".
    - While in the "**POS Charging**":
        - If the POS battery is full then POS device is returned to the seller.
        - If the POS battery does not charge a request is made to repair the device.

- While in the "**POS In Use**", if it fails or reports an error, a request is made to repair the device.
- Once a request to repair is made the device is set in the "**POS in Repair**".
    - While in the "**POS in Repair**":
        - If the POS can be repaired, it is repaired and sent back to the seller.
        - If the POS is irreparable then the final state of the machine is reached.

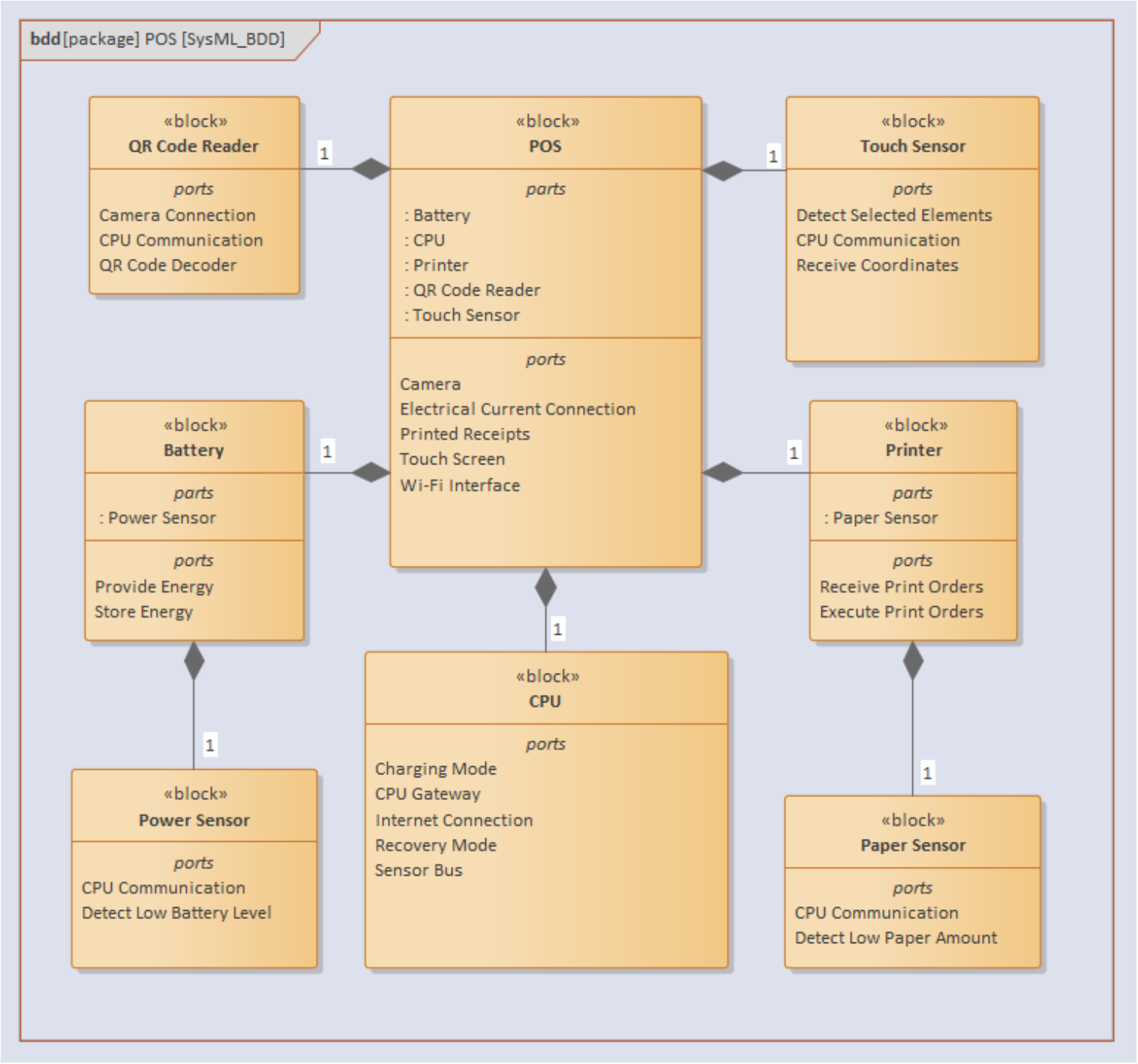
Task 9: UML Sequence Diagram for ARCARD Account Creation



Task 9: Description: UML Sequence Diagram for ARCARD Account Creation

- We consider that initially the **User** is in the forum for the registration of the new ARCARD account.
- The **User** can sign up through two different ways:
    - If the **User** choses to **fill the Registration Form** the **User** fills the information and sends it to the **ARCA Manager** where is validated.
    - If the **User** signs up with an **already existing Account**, the **ARCA Manager** gets the information from the chosen **Account**, after getting it, the **ARCA Manager** validates the information.
- If the information is valid the **ARCA Manager** informs the **User** of this fact and the process continues.
- If the information is invalid the **ARCA Manager** informs the **User** of this fact and the process ends.
- After this, it´s presented to the **User** a **EULA Contract** to read and sign. The **User** can choose either to **sign** or **not sign the Contract**, the **User´s** choice is then sent to the **ARCA Manager**. If the **User** signs the contract the process continues.
- If the **User** chooses not to sign the contract the **ARCA Manager** shows the **User** an **Error Message,** as the **User** cannot continue if the contract is not signed. In this situation the **User** can either **sign the contract** or **Cancel the Creation of the Account**.
- After signing the contract, the **User** sends to the **ARCA Manager** a message to **Create the Account**.
- After receiving the message, the **ARCA Manager** generates a unique **QR Code.**
- When the **QR Code** is created the **ARCA Manager** creates a new **Account**, with the information given by the **User** and the **QR Code** generated.
- The **ARCA Manager** sends confirmation to the **User** that the **Account** has been successfully created, ending the process.

Task 10: SysML bdd of POS



Task 10: Description: SysML bdd of POS

- POS:
  - Surface Components:
    - Camera: To capture QR Code image.
    - Touch Screen: To capture Touched Coordinates and display ARCA Catalog and Warnings.
    - Electrical Current Connection: To charge Battery when Battery Level is Low.
    - Wi-Fi Interface: To provide Internet Connection.

  - CPU
    - Sensor Bus: To Receive POS Sensors Messages.
    - CPU Gateway: To Send CPU Messages.
    - Internet Connection: Use Wi-Fi Interface to communicate with ARCA DB and Predictive Maintenance.
    - Charging Mode: To charge Battery efficiently.
    - Recovery Mode: To repair POS more effectively.

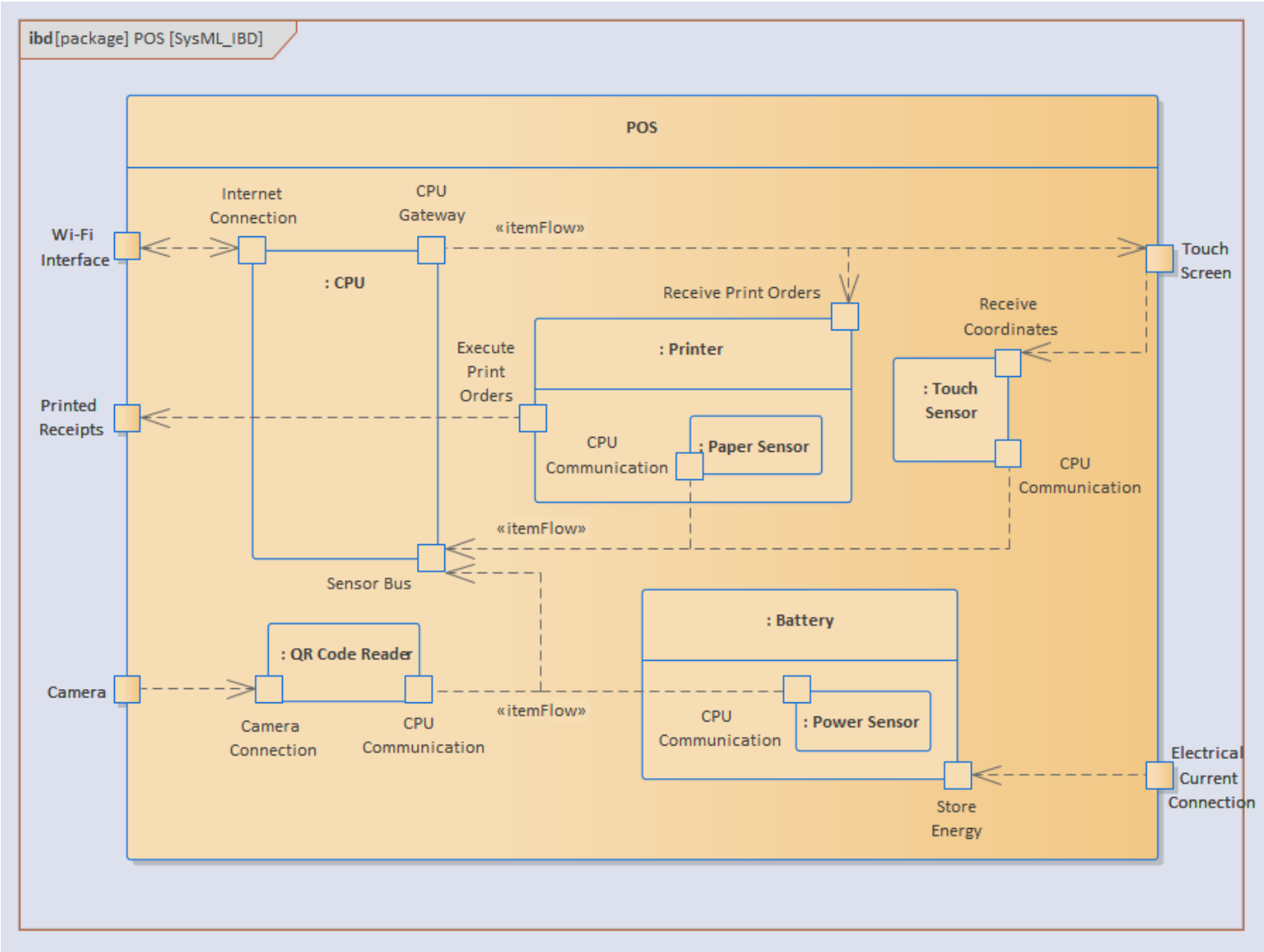
  - Battery: Stores and Provides Energy to POS
    - Power Sensor: To listen Battery Level, communicates to CPU when Battery Level is Low.

  - Printer: Receive and Execute Receipts Print Orders
    - Paper Sensor: To listen Paper Amount, communicates to CPU when Paper Amount is Low.

  - QR Code Reader: Use POS Camera to capture QR Code image, decodes them and notifies the CPU.

  - Touch Sensor: Use POS Touch Screen to capture Touched Coordinates, detects Selected Element based on Touched Coordinates and notifies the CPU.

Task 11: SysML ibd of POS



Task 11: Description: SysML ibd of POS

- CPU Establish Internet Connection through Wi-Fi Interface: Reports POS Errors to Predictive Maintenance and Queries ARCA Database.

- QR Code Reader: Captures QR Code image, decodes it and forwards to Sensor Bus in the CPU which queries ARCA Database through Internet Connection.

- Touch Sensor: Detects Touched Coordinates through Touch Screen, processes it by detecting the Selected Element and forwards to Sensor Bus in the CPU which processes it and updates the Touch Screen through CPU Gateway.

- Battery: Stores Energy provided by POS Electrical Current Connection.
    - Power Sensor: Detects when the Battery Level is Low and forwards a Warning to Sensor Bus in the CPU which reports it to Predictive Maintenance and displays the Warning in Touch Screen through CPU Gateway.

- Printer: Receives Print Orders requested by CPU Gateway and executes Print Orders that are Receipts.
    - Paper Sensor: Detects when the Paper Amount is Low, forwards a Warning to Sensor Bus in the CPU and displays it in Touch Screen through CPU Gateway.