# COMP1023 Software Engineering

## Spring Semester 2019-2020

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Lecture 7

2020-04-01

# Topics covered

- Last week we learnt about **UML Class Diagrams**.
- **Today** we will look at an example of drawing a class diagram based on a system description (set of requirements).

# Recall: how to come up with a class design?

Class identification from **requirements specification**

- Nouns are potential classes, class attributes, objects.
- Verbs are potential methods or responsibilities of a class.

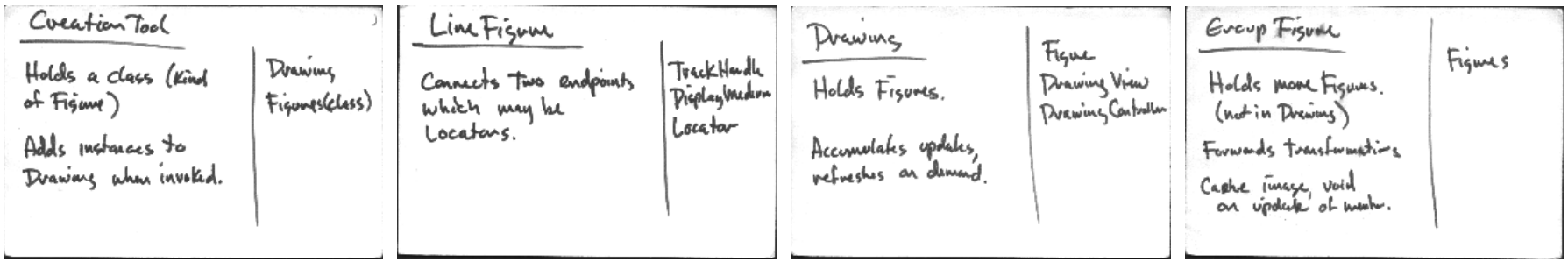
Based on other (already existing) **models**:

- Sequence diagrams
- Activity diagrams
- …

# How to come up with a class design: CRC cards

**Class-Responsibility-Collaboration** (CRC) cards – for brainstorming

- Typically created from index cards (paper)
- Card is partitioned in three areas:
  1. Name
  2. Responsibilities
  3. Collaborators: other classes with which this class interacts to fulfill its responsibilities




See: https://wiki.c2.com/?CrcCard

# The example

You have been contracted to design a new ATM system for UNMBank. UNMBank is a new bank on campus and you have been asked to build an interactive ATM system that can handle multiple types of transactions (e.g. withdraw cash, check balance, make deposits) securely.

# High level description of ATM system functionality

The ATM system allows customers to perform certain financial transactions. A customer is required to insert a UNMbank debit or credit card and enter a personal identification number (PIN). These will be verified by the bank system. Once verified, the customer is able to:

- Make a cash withdrawal from her checking or savings accounts. Approval must be obtained from UNMbank before cash is dispensed;
- Make a transfer of funds between accounts;
- Inquire about account balances and past transactions.

Additionally, the ATM system accepts Visa cards issued by banks other than UNMBank. Visa card customers are only able to make cash withdrawals, which have to be approved by the Visa system.

# Identifying potential classes from requirements

*"Nouns are potential classes, class attributes, objects."*

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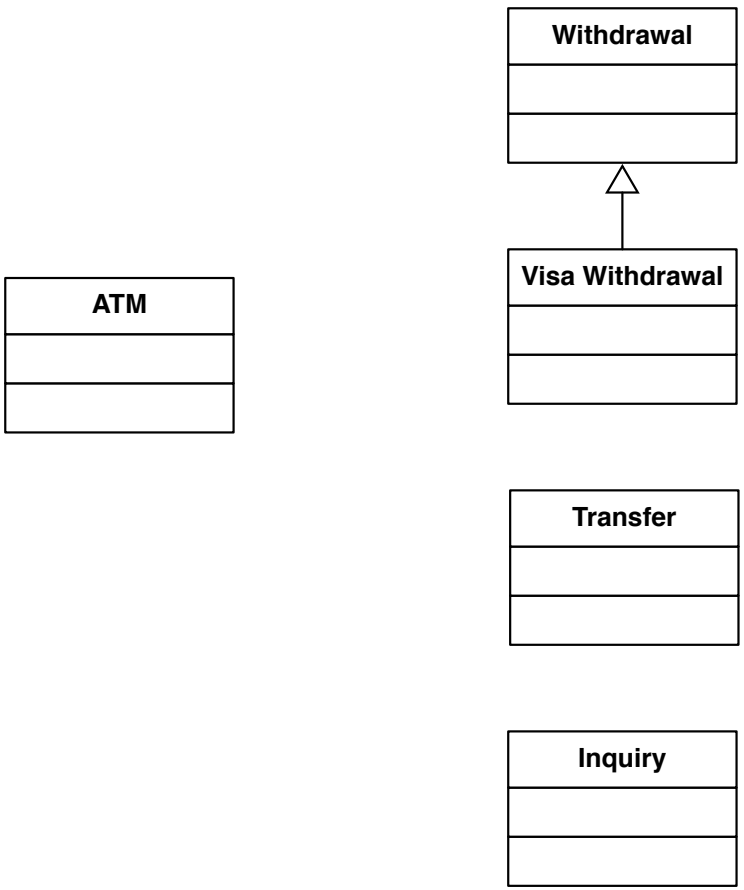
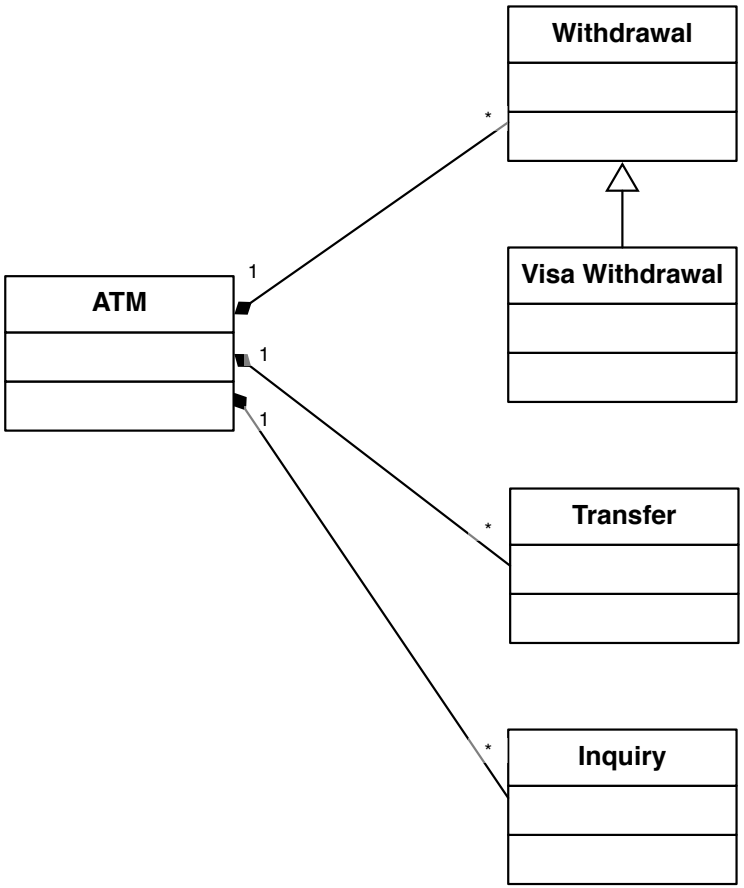
# First objects

- An ATM provides three types of service…



# First objects

- These can be related to the ATM using composition.…



# Identifying potential classes (2)

*Performing these services requires help from other objects…*

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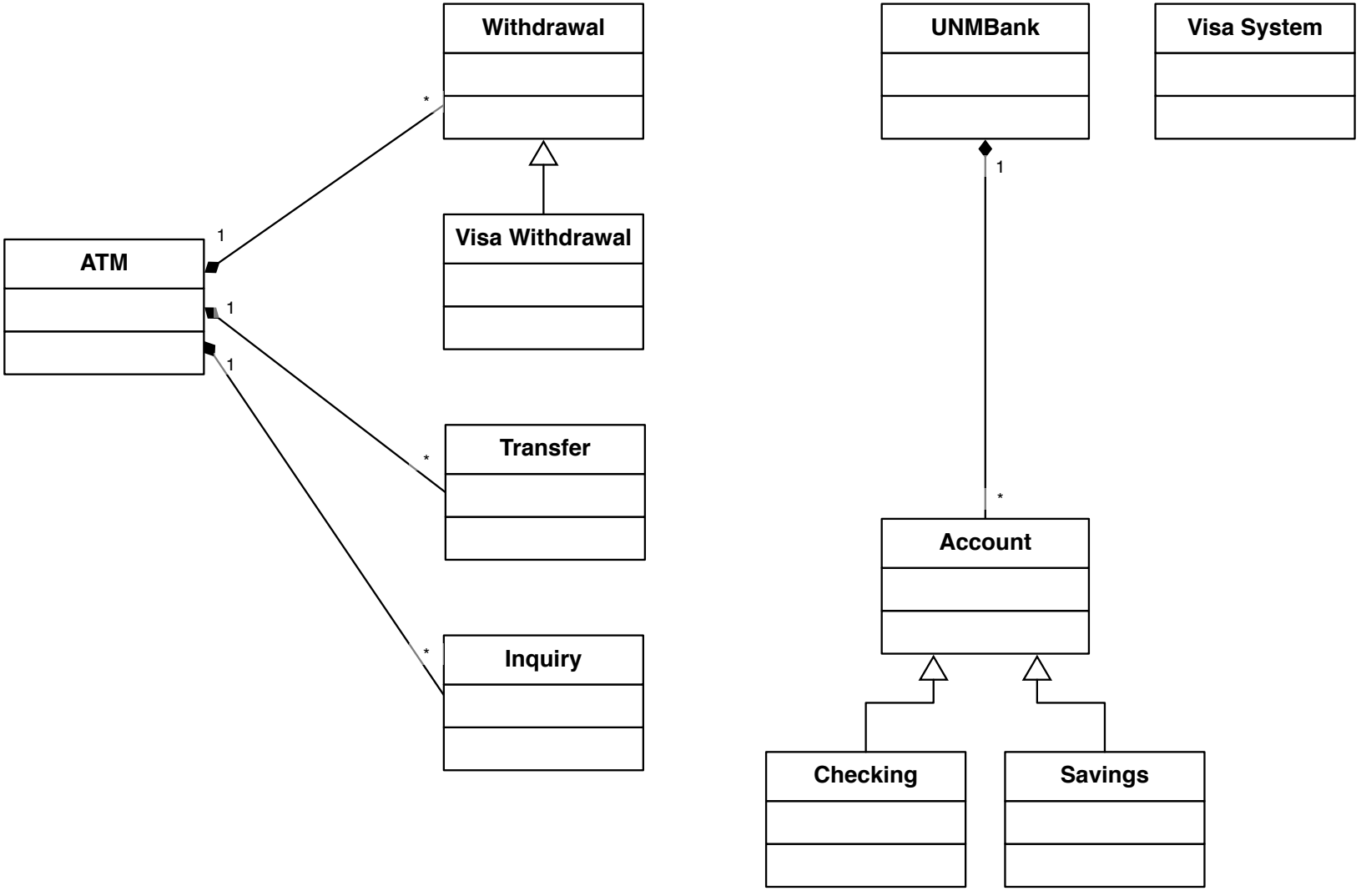
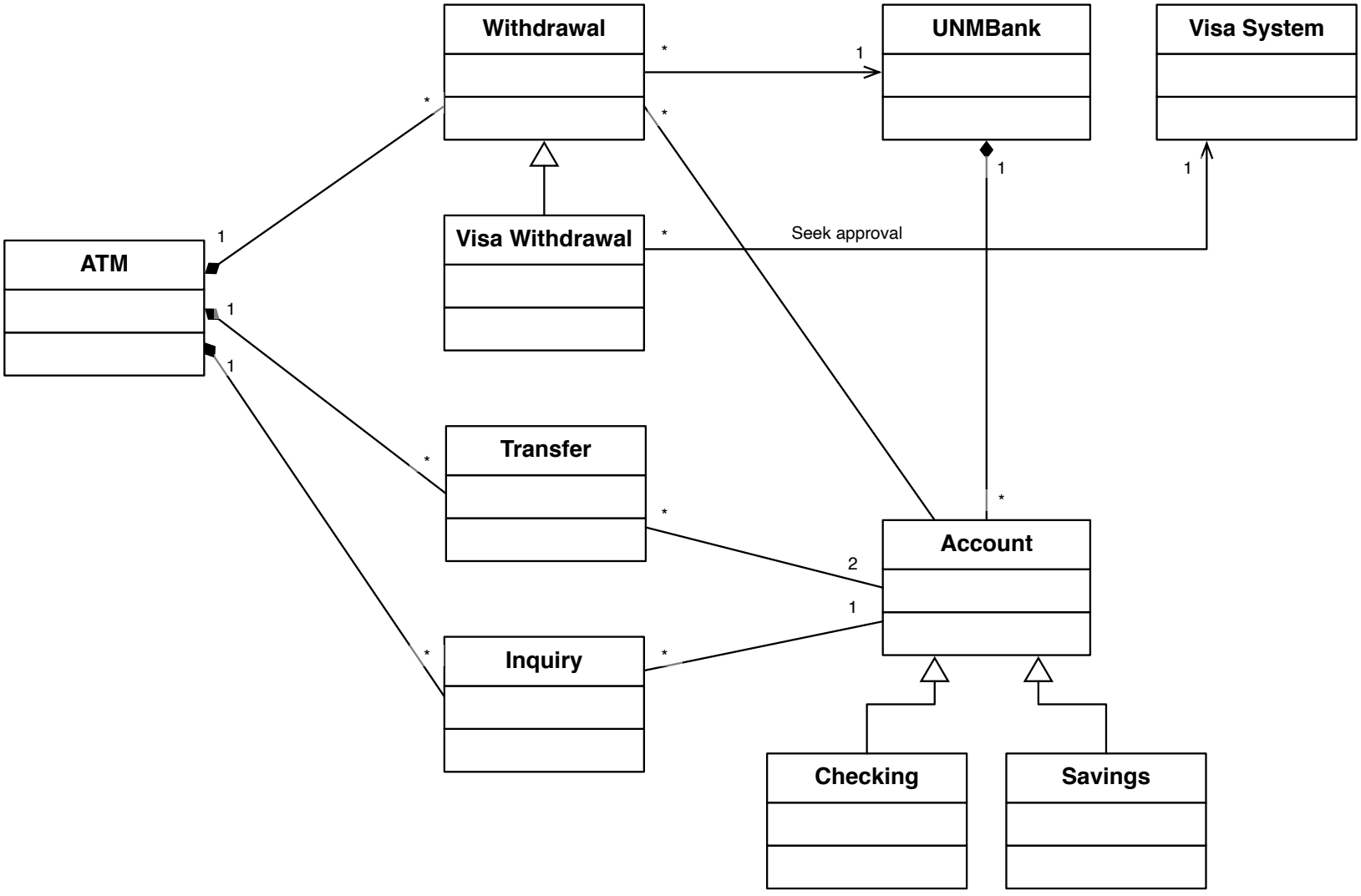
# Adding the accounts and the bank systems…



# …and their relationships with the ATM services



# Identifying potential classes (3)

***Cards** seem to play an important role too…*

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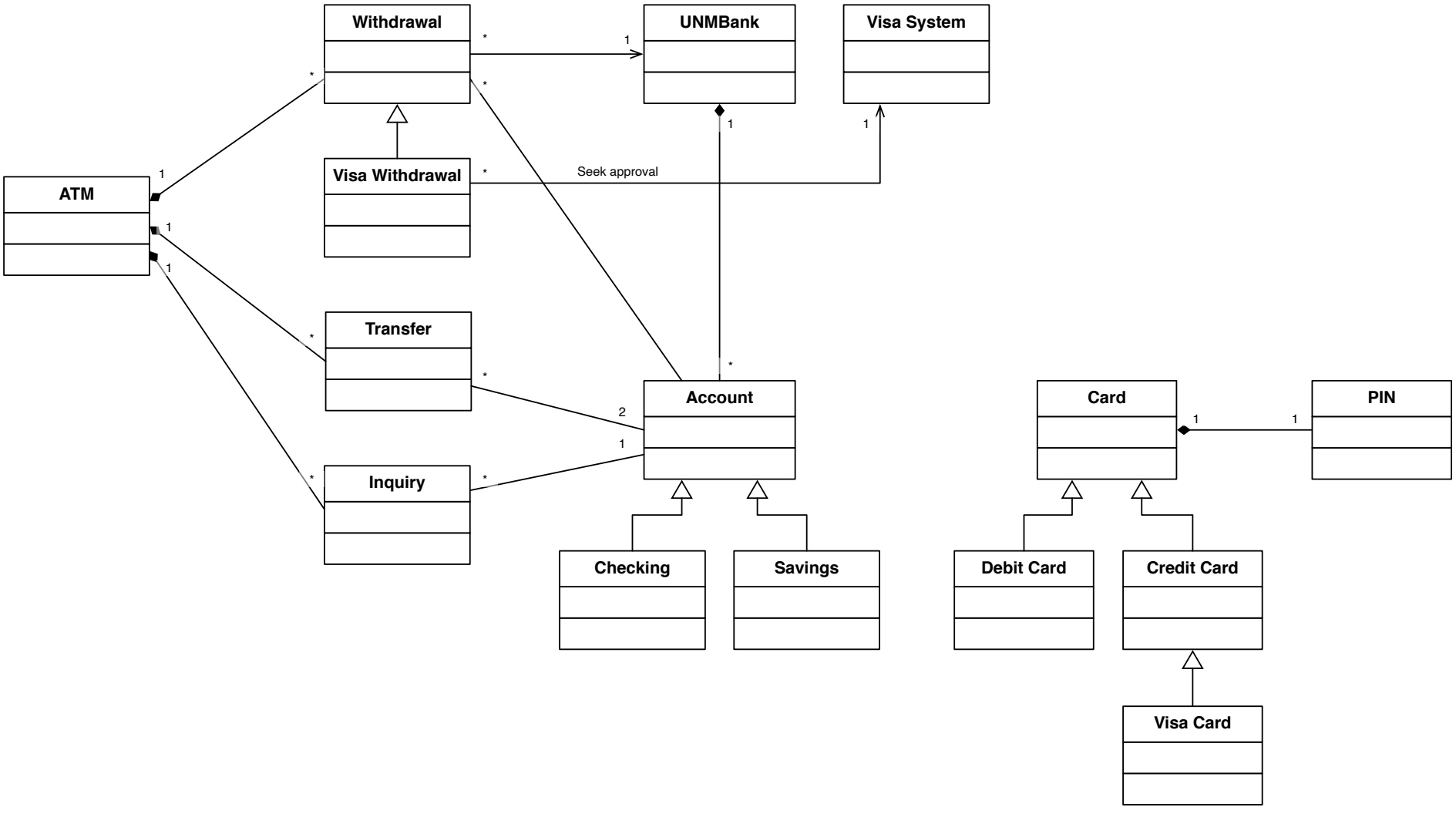
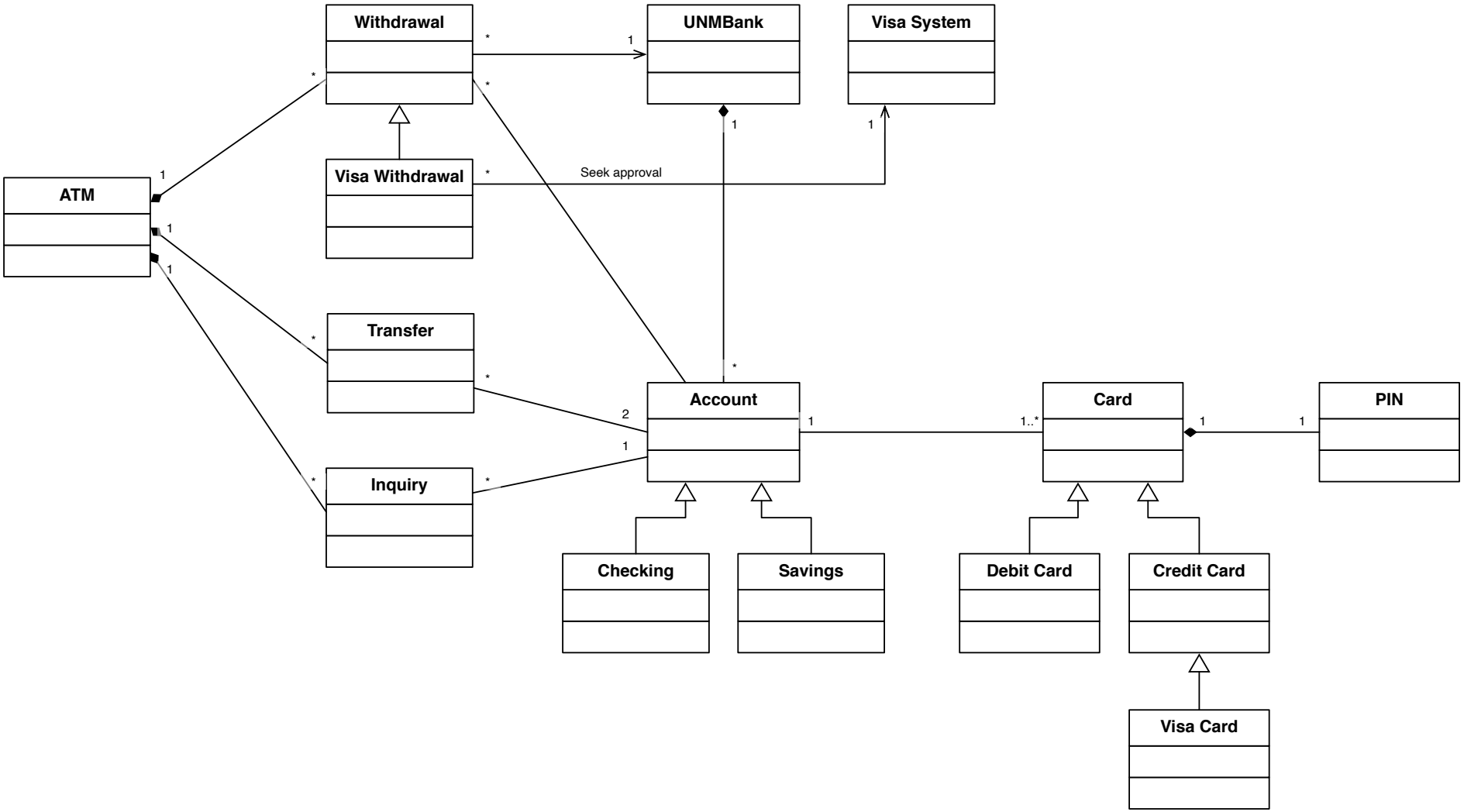
# Adding the cards to the model…



# …and their relationships with the rest of the system



# Identifying potential classes (4)

*Making sure we have not forgotten anything…*

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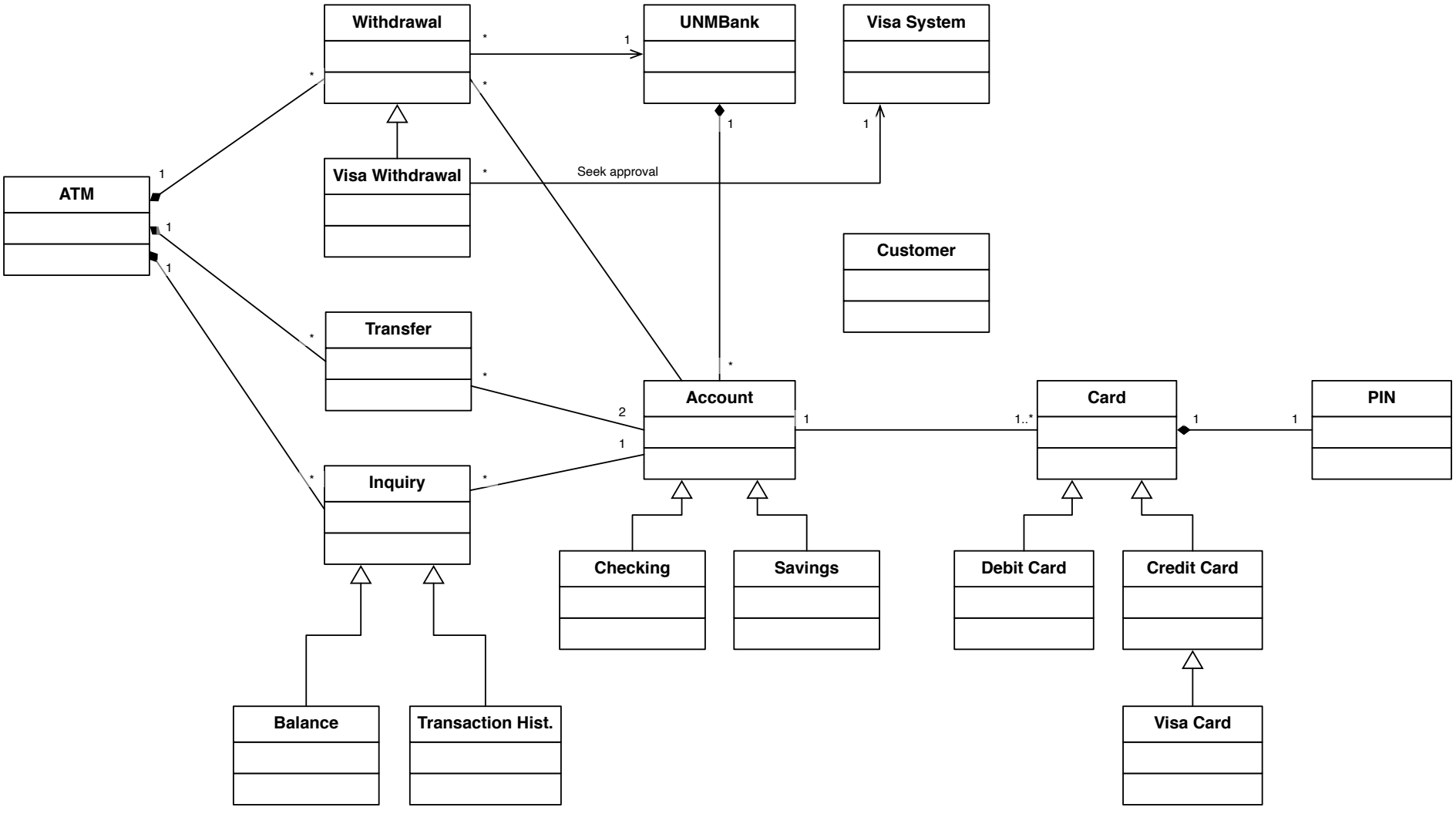
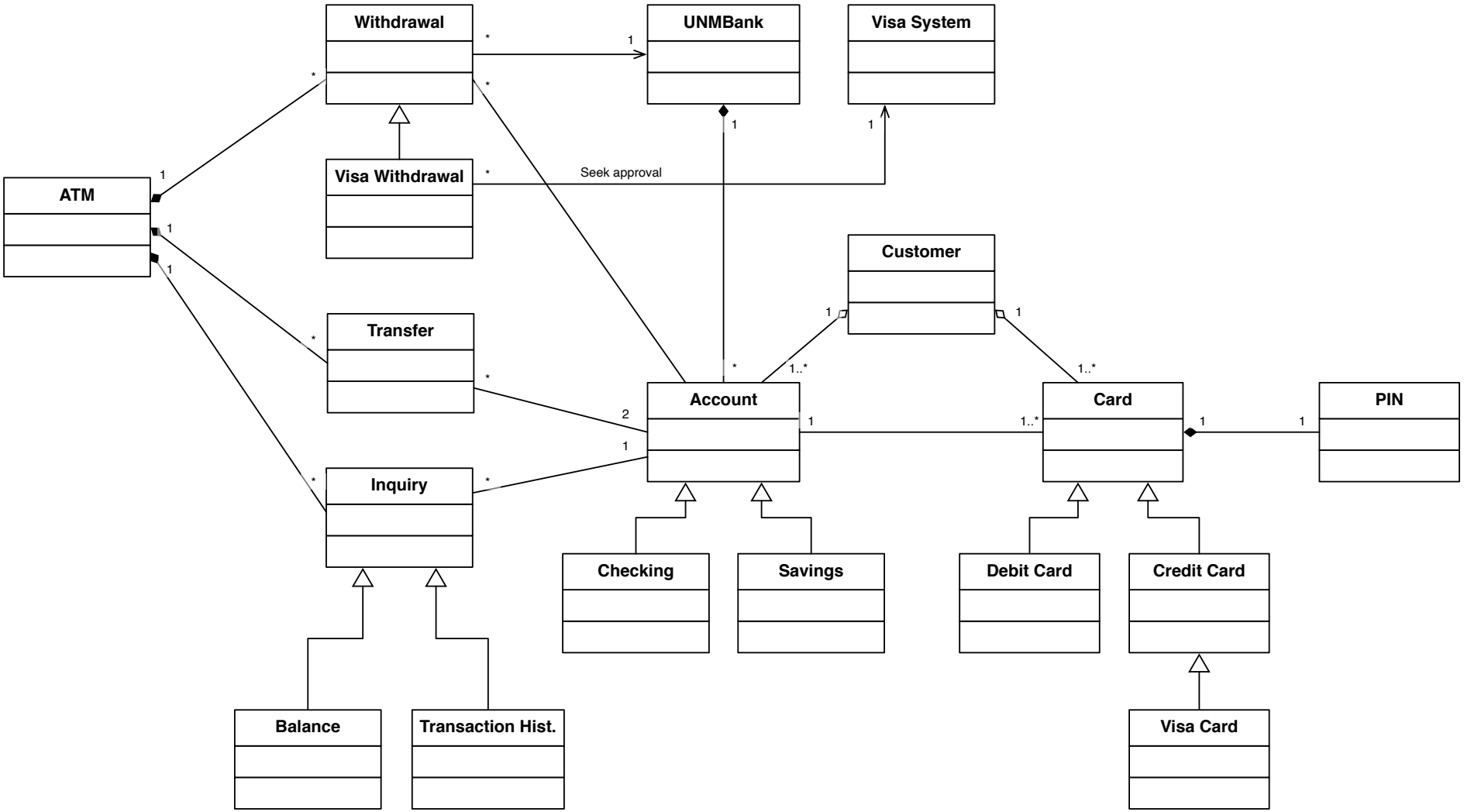
# Adding the customer and “Inquiry” specialisation…



# …and the customer's involvement with the the system



# Identifying operations (methods) that objects perform

*"Verbs are potential methods or responsibilities of a class."*

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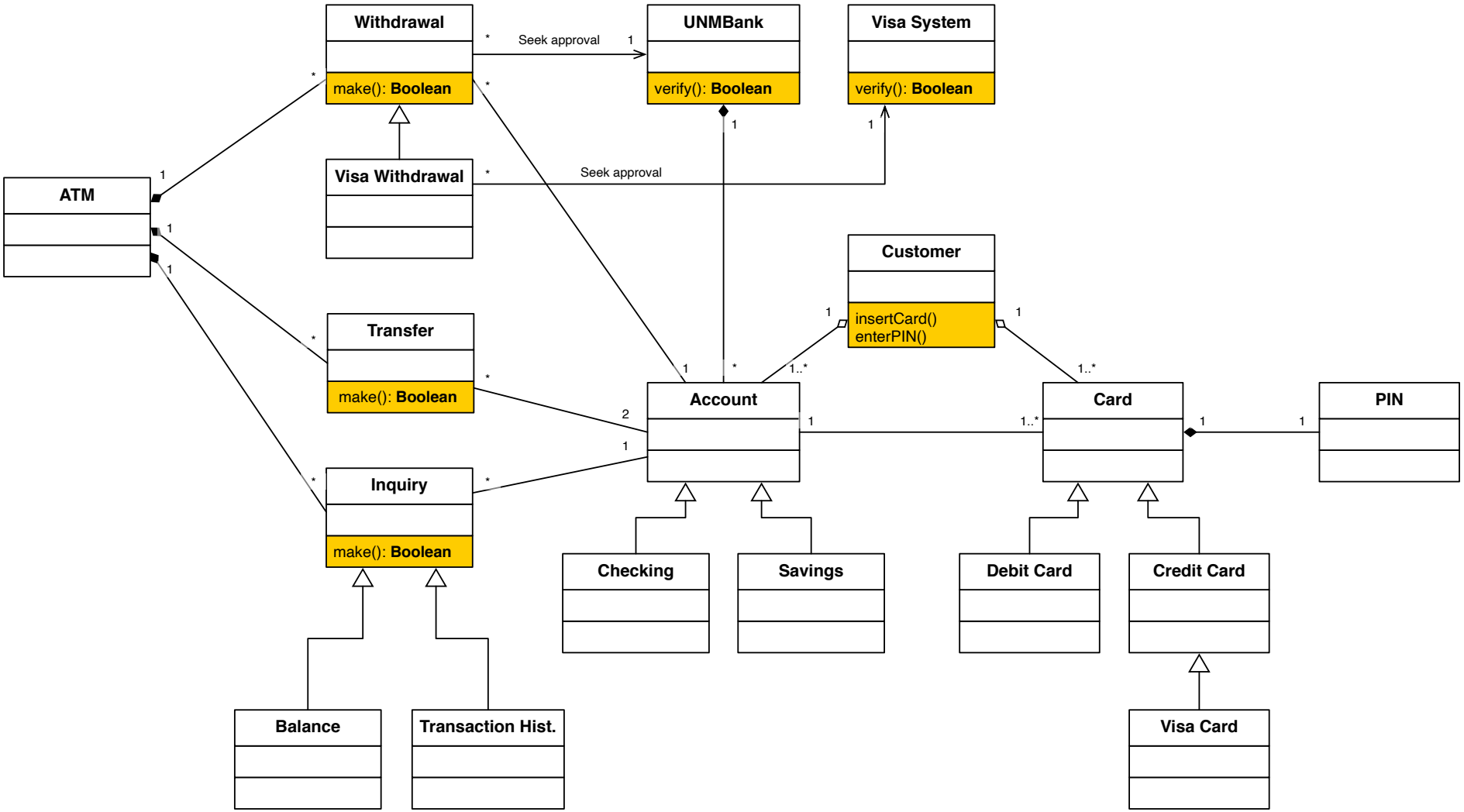
# Adding operations…



# In summary

- Based on a short, high-level functional description of an ATM, we were able to design a relatively detailed class model.
- To complete the model, we need a more detailed and comprehensive set of requirements – including system requirements.
- Identifying classes, operations and relationships based on requirements documents is not an exact science. This model is just one among many possible ways to structure the system.
- The model is far from perfect. If you spot any errors or omissions please let me know so I can fix these!

# Key points

- Coming up with a good class model requires practice & experience (and enough time).
- System design is an iterative process (just like specification, implementation etc.)
- Discussing the pros and cons of alternative design choices with team members often leads to better models (simpler, more elegant, easier to understand etc).
- Design is more fun when done in a team.