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Design Model	

Stereotypes

UseCase			
Tagged Value Definitions	Level		
	Туре	Enumeration	
	Enumeration Values	Summary, User, Subfunction	
	Complexity		
	Туре	Enumeration	
	Enumeration Values	Low, Medium, High	
	Use Case Status		
	Туре	Enumeration	
	Enumeration Values	Name Only, Initial, Base, Complete, Deferred	
	Implementation Status		
	Туре	Enumeration	
	Enumeration Values	Scheduled, Started, Partially Complete, Complete, Partially Deferred	
	Preconditions		
	Туре	Multi-line Text	
	Post-conditions Post-conditions		
	Туре	Multi-line Text	
	Author		
	Туре	Text	
	Assumptions		
	Туре	Multi-line Text	

requirement			
Tagged Value Definitions	Text		
	Туре	HTML	
	ID		
	Туре	Text	
	source		
	Туре	Text	
	kind		
	Туре	Enumeration	
	Enumeration Values	Functional, Performance, Interface	
	verifyMethod		
	Туре	Enumeration	
	Enumeration Values	Analysis, Demonstration, Inspection, Test	
	risk	1	
	Туре	Enumeration	
	Enumeration Values	High, Medium, Low	
	status		
	Туре	Enumeration	
	Enumeration Values	Proposed, Approved, Rejected, Deferred, Implemented, Mandatory, Obsolete	

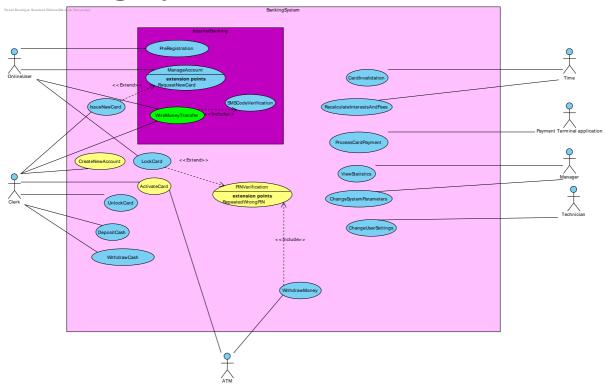
Include

Extend

use

Use Case Diagram

Banking System



Summary

Name	Documentation
₹ OnlineUser	
₹ Clerk	
₹ ATM	
₹ Time	
Payment Terminal application	
🚶 Manager	
🚶 Technician	
DepositCash	
UnlockCard	
LockCard	
PINVerification	
	Use Case 1
	Brief UC1 verifies the PIN number of card
	Description
	Primary ATM
	Actors
	Secondar Customer
	Actors

	Precondit	Card is activated and unlocked
	ions	3.100.00
	Main	
	Main Flow of Events	 UC is evoked when card is inserted into ATM WHILE number of attempts <= 3 AND access is not allowed System prompts the user to enter PIN code User enters PIN code into ATM System compares PIN code to database entry IF PIN matches database entry Allow ATM to access user data IF access is not allowed extension point(LockCard)
	Alternativ	, , ,
	Flows	
	III	ATM has access to user data or the card is locked
IssueNewCard		
CardInvalidation		
ActivateCard		
, ouvalocard	Use Case	2
		UC2 activates the card
	Description	
	Primary Actors	Clerk, ATM
	Secondar Actors	
	ions	Card is not activated
	Main Flow of Events	 UC is evoked when card activation is requested Actor enters card information Specified card is marked as active in database
	Alternativ Flows	Card does not exists or is not valid
	Post-con ditions	Card is activated
WithdrawMoney		
WithdrawCash		
_		
SMSCodeVerification		

ManageAccount	Includes tra	ansfer history and card requests
WireMoneyTransfer		1 12
CreateNewAccount		
	Use Case	3
	ID	
	III	UC3 creates new account
	Description	
	11	Clerk
	Actors Secondary	Cuatamar
	Actors	Customer
	Precondit	
	ions	
	Main	UC is evoked when customer requests
	Flow of	opening an account
	Events	Customer presents his/her personal ID
		3. IF customer didn't pre-register online
		3.1. Clerk fills in customer's personal data3.2. Clerk fills in requested account type
		3.2. Clerk fills in requested account type 3.3. Clerk fills in requested currency
		Customer signs the documents
		5. IF customer is not registered in the bank
		yet
		5.1. Clerk creates new user account for the
		customer
		5.2. System saves the new user account
		System saves the newly created bank account in database
		7. Bank account is assigned to customer's
		user account
		8. Account login information is given to
		customer
	Alternative	e
	Flows	A coount is expected
	ditions	Account is created
	ditions.	
PreRegistration		
ChangeUserSettings		
ChangeSystemParameters		
ViewStatistics		
ProcessCardPayment		
RecalculateInterestsAndFees		
InternetBanking		
BankingSystem		
D	•	

Documentation

Functional Requirements

- FR001 A clerk will be able to create an account for a customer using customer's ID.
- FR002 A customer will be able to pre-fill a registration form online and and then, visiting a bank, a clerk will be able to finish the account creation using the form.
- FR003 Only when creating an account a customer will be able to choose a type of the account (current or saving account), account currency (CZK or EUR).
- FR004 A timer will be periodically (at the end of the month) computing fees and interests for the past month.
- FR005 A clerk will be able to set a money transfer after a customer's request.
- FR006 A customer can set a money transfer using a online interface (internet banking).
- FR007 Every online money transfer must be authorized by a code which will be sent to the user's cell phone via SMS
- FR008 Every transaction code is valid for 5 minutes
- FR009 Transaction is canceled if wrong code is submitted 3 times
- FR010 A client can view his/her transfer history using the internet banking.
- FR011 Card payments at shops or online will be processed by the external system.
- FR012 Money in cash can be deposited or withdrawn in person at the bank's cash desk, served by bank cashier.
- FR013 Money in cash can be withdrawn from an ATM using a card.
- FR014 Card can be delivered to a customer by post (including authorization PIN sent separately) or he/she can pick it up at the bank.
- FR015 The card can be only activated by a clerk or through an ATM.
- FR016 Card has a validity date. After the date the card will be invalidated.
- FR017 Card can by blocked by a customer through online banking.
- FR018 A clerk can unblock a card that is blocked.
- FR019 Bank managers can view system statistics.
- FR020 Bang managers can change system parameters.
- FR021 Technicians can maintain the system and change user settings.

Non-Functional Requirements

- NFR001 Every ATM has a working connection to the bank server.
- NFR002 SMS authorization code will be sent in less than 30s after request.
- NFR003 Card activation and lock/unlock has to take effect in less than a minute after request.
- NFR004 A transaction details must be available for up to 10 years after transaction.
- NFR005 There must be a redundant copy of every server and connection element.
- NFR006 In case of hardware failure, system must switch to the redundant copy in less than 30s.
- NFR007 Every bank employee is authenticated using a USB token and a password.
- NFR008 Creating a new account can take up to 24h.
- NFR009 All system preferences and user data changes has to be saved as separate revisions in case of rollback.
- NFR010 An internal money transfer has to be completed in less than a day. A money transfer to any other bank has to be completed in less than a week.

Details





- ₽ ATM
- **₹** Time
- Payment Terminal application
- Manager
- **Rechnician**
- DepositCash
- UnlockCard
- LockCard
- PINVerification

Extension Points

RepeatedWrongPIN

- IssueNewCard
- CardInvalidation
- ActivateCard
- WithdrawMoney
- WithdrawCash
- SMSCodeVerification
- ManageAccount

Extension Points

RequestNewCard

- WireMoneyTransfer
- CreateNewAccount
- PreRegistration
- ChangeUserSettings
- ChangeSystemParameters

- ViewStatistics
- ProcessCardPayment
- RecalculateInterestsAndFees
- InternetBanking

Children

Name	Documentation
ManageAccount	Includes transfer history and card requests
PreRegistration	
WireMoneyTransfer	
SMSCodeVerification	

BankingSystem

Children

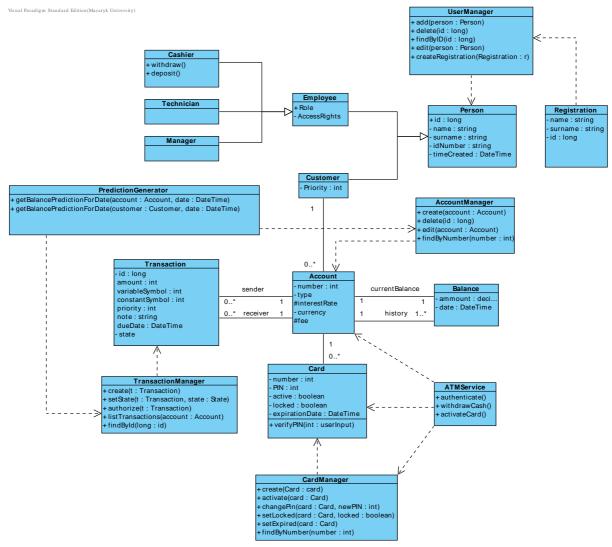
Name	Documentat	ion
RecalculateInterestsAndFees		
ProcessCardPayment		
ViewStatistics		
ChangeSystemParameters		
ChangeUserSettings		
CreateNewAccount		
	Use Case ID	
	Brief Description	UC3 creates new account
		Clerk
	Actors	CICIN
	Secondar	Customer
	Actors	
	Precondit	
	ions	
	Main	UC is evoked when customer requests
	Flow of	opening an account
	Events	2. Customer presents his/her personal ID
		 3. IF customer didn't pre-register online 3.1. Clerk fills in customer's personal data 3.2. Clerk fills in requested account type 3.3. Clerk fills in requested currency 4. Customer signs the documents 5. IF customer is not registered in the bank yet 5.1. Clerk creates new user account for the customer

	Alternativ Flows Post-con ditions	5.2. System saves the new user account 6. System saves the newly created bank account in database 7. Bank account is assigned to customer's user account 8. Account login information is given to customer e Account is created
WithdrawCash		
WithdrawMoney		
ActivateCard	-	
- i divato da la	Use Case ID Brief	UC2 activates the card
	Description	
	Primary Actors	Clerk, ATM
	Secondar Actors	Customer
	Precondit ions	Card is not activated
	Main Flow of Events	 UC is evoked when card activation is requested Actor enters card information Specified card is marked as active in database
	Alternativ Flows	£ard does not exists or is not valid
		Card is activated
CardInvalidation		
IssueNewCard	+	
PINVerification		
	Use Case ID	1
	Brief Description	UC1 verifies the PIN number of card
	Primary Actors	АТМ
	Secondar Actors	Customer

I In the	<u> </u>
Precondition	Card is activated and unlocked
ions	
Main	
Flow of Events	 UC is evoked when card is inserted into ATM WHILE number of attempts <= 3 AND access is not allowed System prompts the user to enter PIN code User enters PIN code into ATM System compares PIN code to database entry IF PIN matches database entry Allow ATM to access user data IF access is not allowed extension point(LockCard)
Alternativ	40
Flows	
Post-con	ATM has access to user data or the card is
ditions	locked
LockCard	
UnlockCard	
DepositCash	

Class Diagram

Analysis Class Diagram



Summary

Name	Documentation
UserManager	
Cashier	
Employee	
Technician	
Person	
Registration	
Manager	
Customer	
PredictionGenerate	pr
AccountManager	
Transaction	

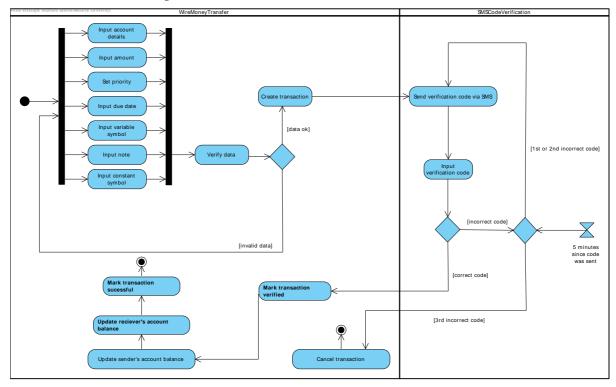
Account	
Balance	
Card	
TransactionManag	er
ATMService	
CardManager	

Details

- UserManager
- Cashier
- **Employee**
- **Technician**
- Person
- Registration
- **Manager**
- Customer
- PredictionGenerator
- AccountManager
- **Transaction**
- Account
- **Balance**
- Card
- TransactionManager
- ATMService
- CardManager

Activity Diagram

WireMoneyTransfer



Summary

Name	Documentation
Swimlane	
MireMoneyTransfer	
SMSCodeVerification	
Input account details	
Input amount	
Set priority	
nput due date	
Input variable symbol	
Input note	
Input constant symbol	
Verify data	
Create transaction	
Send verification code via SMS	
Input verification code	
Cancel transaction	
Mark transaction verified	
Update sender's account balance	
Update reciever's account balance	
Mark transaction sucessful	

Details

Swimlane Activity Partitions

WireMoneyTransfer			
Quality Score	Fair		
Quality Reason	Problem		Suggestion
	Name does not contain glossar	y terms	Define name as term in glossary
Contained Elements	Name	Docum	nentation
	N/A		
	→L N/A		
	Input account details		
	Input amount		
	Set priority		
	Input due date		
	Input variable symbol		
	Input note		
	⇒ N/A		
	Create transaction		
	Input constant symbol		
	Cancel transaction		
	Update sender's account balance		
	N/A		
	N/A		
	Verify data		
	₩ N/A		
	Update reciever's account balance		
	Mark transaction sucessful		
	Mark transaction verified		

SMSCodeVerification			
Quality Score	Fair		
Quality Reason	Problem		Suggestion
	Name does not contain glossar	ry terms	Define name as term in glossary
Contained Elements	Name Documentation		nentation
	Input verification code		
	₩ \$ N/A		
	₩ \$ N/A		
	Send verification code via SMS		
	≥ 5 minutes since code was sent		

- N/A
- 北N/A
- Input account details
- Input amount
- Set priority
- Input due date
- Input variable symbol
- ■Input note
- Input constant symbol
- **∄N/A**
- Verify data
- **¾**SN/A
- Create transaction
- Send verification code via SMS
- Input verification code
- **¾** N/A
- **¾** N/A
- Cancel transaction

- N/A
- Mark transaction verified
- Update sender's account balance
- Update reciever's account balance
- Mark transaction sucessful
- N/A
- ≥ 5 minutes since code was sent

Textual Analysis

Textual Analysis1

Registration and new account: Both the registration of a new customer and opening of a new account can follow two scenarios. First, a customer can register/open an account in person at the bank with the help of a bank assistant. Second, the registration/account opening can consist of an online pre-registration and registration finalization in person at the bank (again with the help of a bank assistant), where he/she signs the documents and presents his personal ID. For simplicity, let each account be assigned to exactly one person.

Account types: The bank offers "checking" accounts and "savings" accounts, which have different interest rates and withdrawal conditions. Both types of accounts can have either CZK or EUR currency. The account type cannot be changed after account opening.

Fees: At the beginning of each month the system is periodically computing the fees for account management and interest rates for the past month. The computation is based on the priority of the customer, which is derived from how long the customer has been with the bank, and what has been the balance on his/her accounts in the past year.

Non-cash money transfer: Money transfer can be done in the bank with the help of a bank assistant or through Internet banking (from a browser), where the customer can also see the transaction history on his/her accounts. To start a transfer, the customer first needs to enter necessary information (bank account of the receiver, amount, etc.) and then the customer needs to authorize the transaction by entering an authorization code sent to his/her mobile phone. The authorization code can be entered at most three times

(each time within 5 minutes from its delivery). If the code is entered three times unsuccessfully (wrong code or entered late), the whole transaction is canceled and the reserved money (for the transaction) is unblocked.

Non-cash payments: Card payments in shops or online and their evidence are realized by means of the integration of the banking system with an external application that is responsible for these activities.

Cash: Money in cash can be deposited or withdrawn in person at the bank's cash desk, served by bank cashiers. Money from checking accounts can be withdrawn also from ATM with a card. Each "checking" account is assigned one card, there is no card for a "savings" account.

Card: An interesting object in the system is the card, which goes through the following life cycle. The card can be delivered to the bank customer either by post (with authorization PIN number sent separately) or in person at the bank (based on his/her preference). At the beginning, the card is inactive. The card can be activated by the customer either at the bank with the help of a bank assistant, or through an ATM. Then the card is valid till the validity date, when it is discarded. When valid, the card can be blocked to protect the acc ount against attack if the card is lost or stolen - and then again unblocked at the bank. The card is blocked also in an ATM if the authorization PIN code is entered unsuccessfully three times.

Users: Besides bank assistants, cashiers and bank customers, the banking system is accessed also by bank managers (each bank branch has its own manager, one of which is the manager of the whole bank), who can access various statistics about money flows, including future predictions, and can set various system parameters (interest rates of savings accounts, fees, etc.). The last type of users are the technicians, who take care of the system and when

asked by the managers, they change the access rights of other users (e.g. when a cashier is promoted to a manager position).

Candidate Classes

Name	Value		
Quality Score	Fair	Fair	
Quality Reason	Problem	Suggestion	
	Name does not contain glossary terms	Define name as term in glossary	
Candidate Item Type	Class	Class	
Candidate Item Text	Registration		
Create Model	Registration	Registration	
Highlight Color	#ffff00	#ffff00	
Ignore	false		

Name	Value	
Quality Score	Fair	
Quality Reason	Problem Suggestion	
	Name does not contain glossary terms	Define name as term in glossary
Candidate Item Type	Class	
Candidate Item Text	account	
Create Model	Account	
Highlight Color	#ffff00	
Ignore	false	

Name	Value
Quality Score	Good
Candidate Item Type	Class
Candidate Item Text	bank assistant
Highlight Color	#ffff00
Ignore	false

Name	Value	
Quality Score	Fair	
Quality Reason	Problem Suggestion	
	Name does not contain glossary terms	Define name as term in glossary
Candidate Item Type	Class	
Candidate Item Text	transaction	
Create Model	Transaction	
Highlight Color	#ffff00	
Ignore	false	

Name	Value	
Quality Score	Fair	
Quality Reason	Problem	Suggestion
	Name does not contain glossary terms	Define name as term in glossary
Candidate Item Type	Class	
Candidate Item Text	Card	
Create Model	□ Card	
Highlight Color	#ffff00	
Ignore	false	

Name	Value	
Quality Score	Fair	
Quality Reason	Problem Suggestion	
	Name does not contain glossary terms	Define name as term in glossary
Candidate Item Type	Class	
Candidate Item Text	АТМ	
Create Model	ATMService	
Highlight Color	#ffff00	
Ignore	false	

Name	Value	
Quality Score	Fair	
Quality Reason	Problem Suggestion	
	Name does not contain glossary terms Define name as term in glossary	
Candidate Item Type	Class	
Candidate Item Text	external application	
Highlight Color	#ffff00	
Ignore	false	

Name	Value	
Quality Score	Fair	
Quality Reason	Problem Suggestion	
	Name does not contain glossary terms	Define name as term in glossary
Candidate Item Type	Class	
Candidate Item Text	cashiers	
Create Model	Cashier	
Highlight Color	#ffff00	
Ignore	false	

Name	Value	
Quality Score	Fair	
Quality Reason	Problem Suggestion	
	Name does not contain glossary terms	Define name as term in glossary
Candidate Item Type	Class	
Candidate Item Text	manager	
Create Model	Manager	
Highlight Color	#ffff00	
Ignore	false	

Name	Value	
Quality Score	Fair	
Quality Reason	Problem Suggestion	
	Name does not contain glossary terms	Define name as term in glossary
Candidate Item Type	Unspecified	
Candidate Item Text	personal ID	
Highlight Color	#90cb48	
Ignore	false	

Name	Value		
Quality Score	Fair	Fair	
Quality Reason	Problem	Suggestion	
	Name does not contain glossary terms	Define name as term in glossary	
Candidate Item Type	Class	Class	
Candidate Item Text	customer		
Create Model	Customer		
Highlight Color	#ffff00		
Ignore	false		

Name	Value	
Quality Score	Fair	
Quality Reason	Problem Suggestion	
	Name does not contain glossary terms Define name as term in glossary	
Candidate Item Type	Class	
Candidate Item Text	technicians	
Create Model	Technician	
Highlight Color	#ffff00	
Ignore	false	

Name	Value	Value	
Quality Score	Fair	Fair	
Quality Reason	Problem	Problem Suggestion	
	Name does not contain glos	sary terms Define name as term in glossary	
Candidate Item Type	Unspecified	Unspecified	
Candidate Item Text	types	types	
Highlight Color	#90cb48	#90cb48	
Ignore	false		

Name	Value	
Quality Score	Fair	
Quality Reason	Problem Suggestion	
	Name does not contain glossary terms Define name as term in glossary	
Candidate Item Type	Unspecified	
Candidate Item Text	interest rates	
Highlight Color	#90cb48	
Ignore	false	

Name	Value	
Quality Score	Fair	
Quality Reason	Problem Suggestion	
	Name does not contain glossary terms Define name as term in glossary	
Candidate Item Type	Unspecified	
Candidate Item Text	currency	
Highlight Color	#90cb48	
Ignore	false	

Name	Value	
Quality Score	Fair	
Quality Reason	Problem Suggestion	
	Name does not contain glossary terms Define name as term in glossary	
Candidate Item Type	Unspecified	
Candidate Item Text	priority	
Highlight Color	#90cb48	
Ignore	false	

Name	Value	Value	
Quality Score	Fair	Fair	
Quality Reason	Problem	Problem Suggestion	
	Name does not contain gloss	sary terms Define name as term in glossary	
Candidate Item Type	Unspecified	Unspecified	
Candidate Item Text	bank account	bank account	
Highlight Color	#90cb48	#90cb48	
Ignore	false		

Name	Value	
Quality Score	Fair	
Quality Reason	Problem Suggestion	
	Name does not contain glossary terms Define name as term in glossary	
Candidate Item Type	Unspecified	
Candidate Item Text	receiver	
Highlight Color	#90cb48	
Ignore	false	

Name	Value	Value	
Quality Score	Fair	Fair	
Quality Reason	Problem	Problem Suggestion	
	Name does not contain gl	glossary terms Define name as term in glossary	
Candidate Item Type	Unspecified	Unspecified	
Candidate Item Text	amount	amount	
Highlight Color	#90cb48	#90cb48	
Ignore	false		

Name	Value	
Quality Score	Fair	
Quality Reason	Problem Suggestion	
	Name does not contain glossary terms	Define name as term in glossary
Candidate Item Type	Unspecified	
Candidate Item Text	balance	
Highlight Color	#90cb48	
Ignore	false	

Name	Value	
Quality Score	Fair	
Quality Reason	Problem Suggestion	
	Name does not contain glossary terms	Define name as term in glossary
Candidate Item Type	Unspecified	
Candidate Item Text	authorization code	
Highlight Color	#90cb48	
Ignore	false	

Name	Value	
Quality Score	Fair	
Quality Reason	Problem Suggestion	
	Name does not contain glossary terms	Define name as term in glossary
Candidate Item Type	Unspecified	
Candidate Item Text	inactive	
Highlight Color	#90cb48	
Ignore	false	

Name	Value	
Quality Score	Fair	
Quality Reason	Problem Suggestion	
	Name does not contain glossary terms	Define name as term in glossary
Candidate Item Type	Unspecified	
Candidate Item Text	valid	
Highlight Color	#90cb48	
Ignore	false	

Name	Value	
Quality Score	Fair	
Quality Reason	Problem Suggestion	
	Name does not contain glossary terms	Define name as term in glossary
Candidate Item Type	Unspecified	
Candidate Item Text	validity date	
Highlight Color	#90cb48	
Ignore	false	

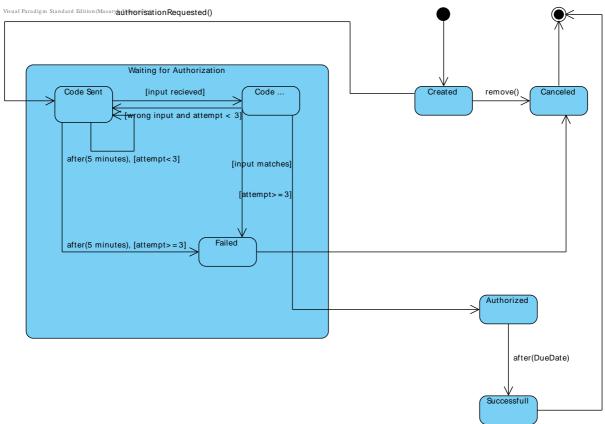
Name	Value	Value	
Quality Score	Fair	Fair	
Quality Reason	Problem	Problem Suggestion	
	Name does not contain glos	ssary terms Define name as term in glossary	
Candidate Item Type	Unspecified	Unspecified	
Candidate Item Text	blocked	blocked	
Highlight Color	#90cb48	#90cb48	
Ignore	false		

Name	Value	
Quality Score	Fair	
Quality Reason	Problem Suggestion	
	Name does not contain glossary terms	Define name as term in glossary
Candidate Item Type	Unspecified	
Candidate Item Text	PIN	
Highlight Color	#90cb48	
Ignore	false	

Name	Value	
Quality Score	Fair	
Quality Reason	Problem Suggestion	
	Name does not contain glossary terms	Define name as term in glossary
Candidate Item Type	Unspecified	
Candidate Item Text	access rights	
Highlight Color	#90cb48	
Ignore	false	

State Machine Diagram

State Machine Diagram1



Summary

Name	Documentation
Created	
Region	
Waiting for Authorization	
Code Sent	
Code Entered	
Authorized	
Successfull	
Failed	
Canceled	

Details



Created

Region

Children

Name	Documentation
Code Entered	
Code Sent	
Failed	

Waiting for Authorization

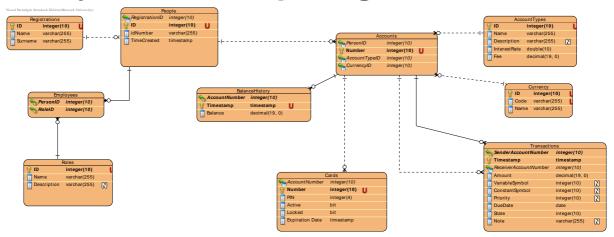
Regions

Name	Documentation
Region	

- Code Sent
- Code Entered
- Authorized
- Successfull
- Failed
- N/A
- Canceled

Entity Relationship Diagram

Entity Relationship Diagram1



Summary

Name	Documentation
People	
Registrations	
AccountTypes	
Accounts	
Currency	
BalanceHistory	
Employees	
Transactions	
Roles	
Cards	

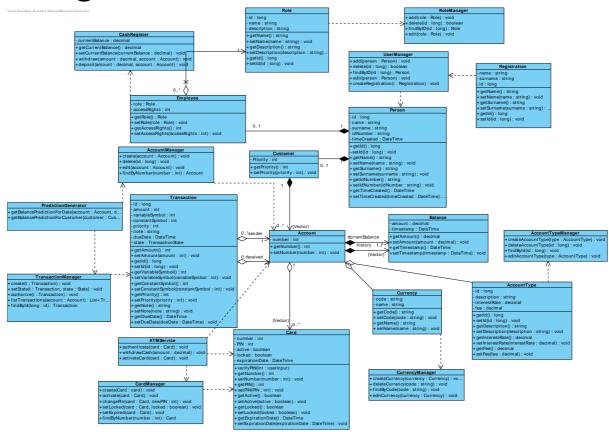
Details

- People
- Registrations
- AccountTypes
- Accounts
- Currency
- BalanceHistory
- Employees

- Transactions
- Roles
- Cards

Class Diagram

Design Model



Summary

Name	Documentation
Role	
RoleManager	
CashRegister	
UserManager	
Registration	
Employee	
Person	
AccountManager	
Customer	
Transaction	
PredictionGenerat	pr
Balance	
Account	
AccountTypeMana	ger
TransactionManag	er
AccountType	

Currency	
Card	
ATMService	
CurrencyManager	
CardManager	

Details

- Role
- RoleManager
- CashRegister
- UserManager
- Registration
- **Employee**
- Person
- AccountManager
- Customer
- Transaction
- PredictionGenerator
- Balance
- **Account**
- AccountTypeManager
- TransactionManager
- AccountType
- Currency
- Card
- ATMService
- CurrencyManager

CardManager