Payment Process

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1 Introduction

I become interested in payment systems and I started researching how they work. A lot of tech companies and banks are investing a lot of their resources into means how to create better and operationally more efficient payment systems. A great resource that I used during this journey was a book written by Ahmed Siddiqui: Anatomy of the Swipe by Ahmed Siddiqui. The purpose of this research article is to describe the basic architecture of the payment systems, to understand different structures how these systems are organized and to master the concepts in this domain. These systems are interesting from an engineering and economic perspective. From the engineering perspective, they are distributed decentralized networks of servers that communicate with different protocols. They need to implement standard requirements of distributed systems which ar e: scalability, availability, information consistency, performance and security. From the economic point of view, they have tremendous societal value because today's businesses are part of global market. Their business is increasingly becoming dependent on financial information system infrastructure and internet.

2 Payment systems

In the figure 1 we can see activity diagram for the payment system authorization process. The payment process is triggered by the contact between the Point-of-sale (POS) device and the payment card. The POS device is connected to the internet, it receives the card's information and sends it to the Acquirer Processor. This information authentificates the card and card holder and we can see it on 2.

The Acquirer Processor reads the card number or PAN and routes the message to the payment network which creates the debit card. The biggest payment network companies are Visa, Mastercard, and American Express. The payment network company routes the traffic to the Issuer Processor or the processing unit of the issuing bank or the bank to which the customer was registered and which issued the payment card to him. The issuer processor processes the message and makes security and validity checks. In the end, it approves or disapproves

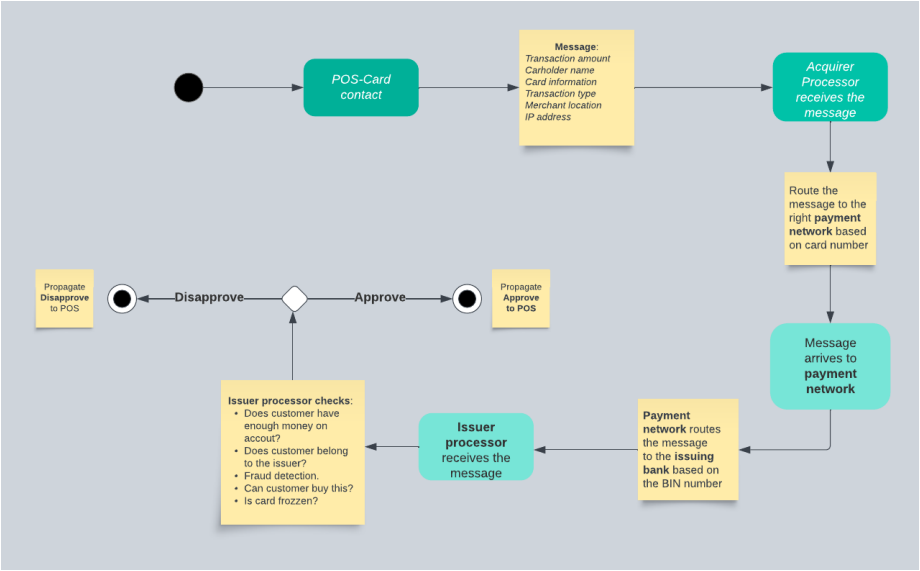

Figure 1: Activity diagram for the payment authorization process.

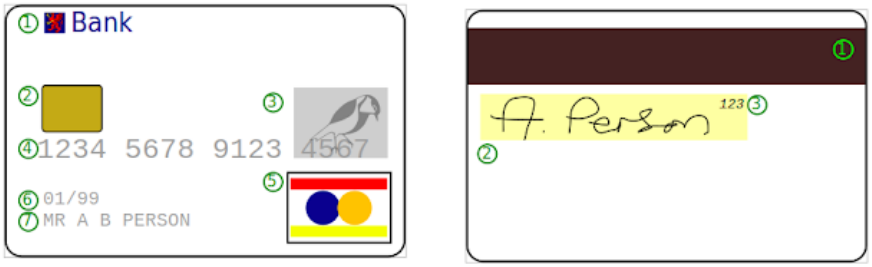

Figure 2: Important information printed on debit card which is transmitted through POS device.

the message and propagates the result to the POS device through the Payment Network and Acquirer Processor entities. The POS device prints the receipt to the customer which shows the end result of the Issuer Processor. The flow of activities till the moment when the Issuer processor decides if he will approve or disapprove the transaction is called Authorization. The purpose of the authorization is to check if the potential buyer has enough money in the account and check if the transaction passes security checks. If the customer has enough money in the account, the issuer will place an Authorization hold on the cardholder's account. This process will freeze the money on the account and prevent the cardholder from withdrawing the money from it. After the Authorization

step is over, the Clearing phase starts. In banking, clearing denotes all the activities that happen until transaction settlement. The settlement is the actual movement of money from one account to another account. The settlement process is usually triggered at the end of the business day

3 Transaction settlements between the banks

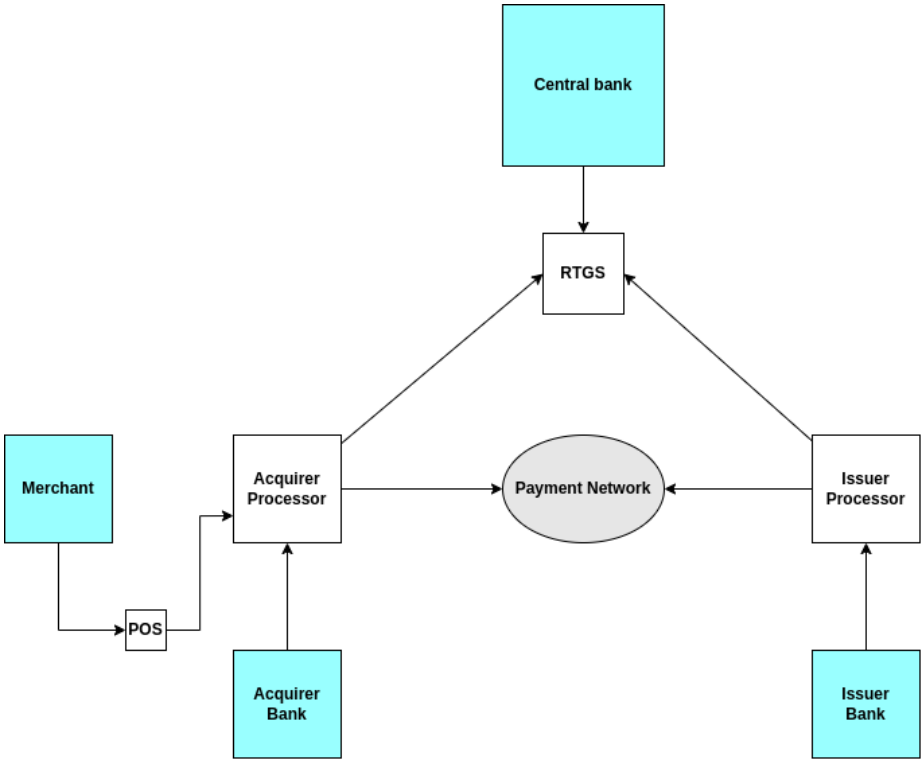

Figure 3: The relationship between key entities in the modern financial industry payment system. Blue color rectangles indicate socio-political organizations which own technical systems for data processing which are indicated as white rectangles. White rectangles are mostly dependent technical systems owned by other organizations but they could also be separated into independent organizations.

In figure 3 we can see brief architecture of the modern financial payment system and key technical systems. The settlements between banks in our current financial system is done through real-time gross settlement system or RTGS. This system is maintained by the central bank. The system is called that way because the payments are settled in real-time and without netting. Payment netting is delayed settlement where multiple obligations between financial in-

stitutions are collected over period of time and at some point aggregated and settled. This process is done in order to minimize the transaction traffic. In contrast with payment netting, Transactions in the RTGS are executed immediately throughout the day. Interbank payments occur without waiting period and with central bank money.

As we can see, the central bank resembles a settlement institution which intermediate all inter-bank transactions. Because of this structure, settlement risk or the risk that the payer will not be able to execute payment is practically reduced to zero because the central bank is a perfect creditor, it can always issue liquidity to the system.