Payment Gateway System Design

By The Tech Granth

- Terms to Note
- How card payments work?
- How 3D secure card payments work?
- Requirements for System Design
- Design Consideration
- High Level Architecture
- Relevant APIs
- Payment Processor

Payment Gateway: A service which allows us to make payments online while making purchase from e-commerce website. It supports paying through card, internet banking, e-wallets etc.

Payment Service Provider(PSP): It is the service which makes sure that money is transferred from buyer's account to merchant's account

Issuer Bank: This is the bank to which Buyer is related to.

Card Association: This is the entity which links a card number to it's relevant Issuing Bank like Visa, MasterCard

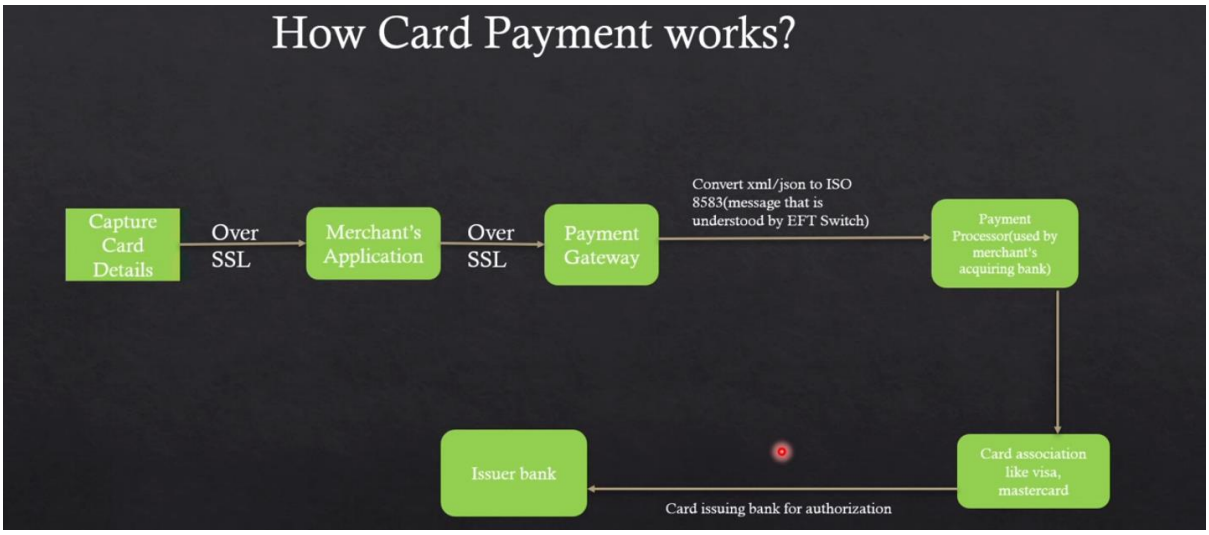
Payment Card Industry Data Security Standard (PCI DSS): It is a security standard, if a seller is compliant with this standard then payment page can be generated on seller's page else they need to redirect the request to payment gateway's payment page, which is complaint with this standard.

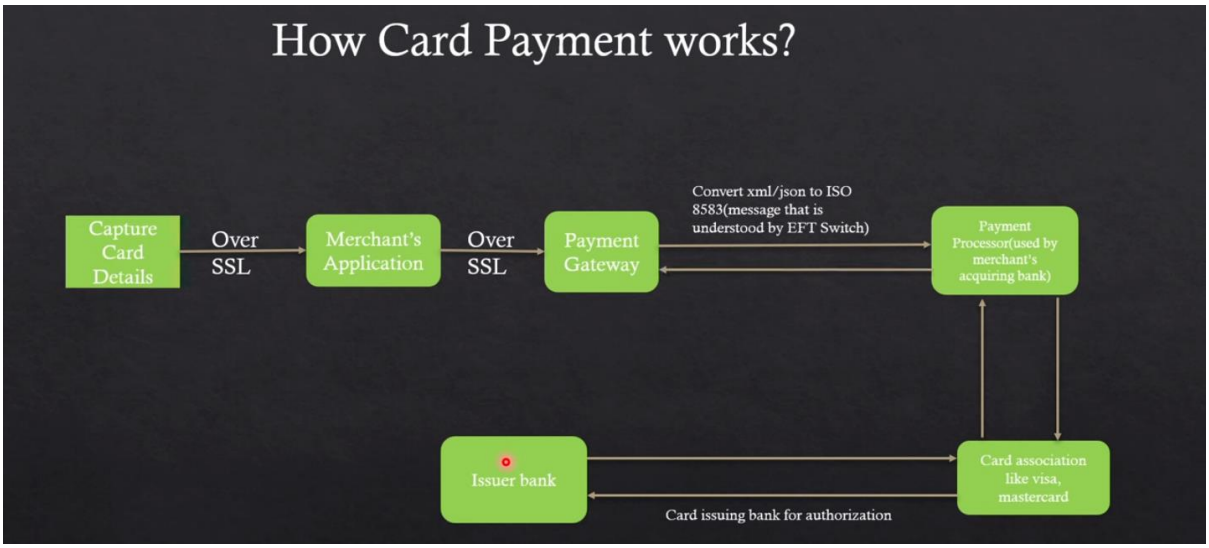
Acquiring Bank: Bank associated with seller's Payment processor (Think of it as an e-POS machine ;))

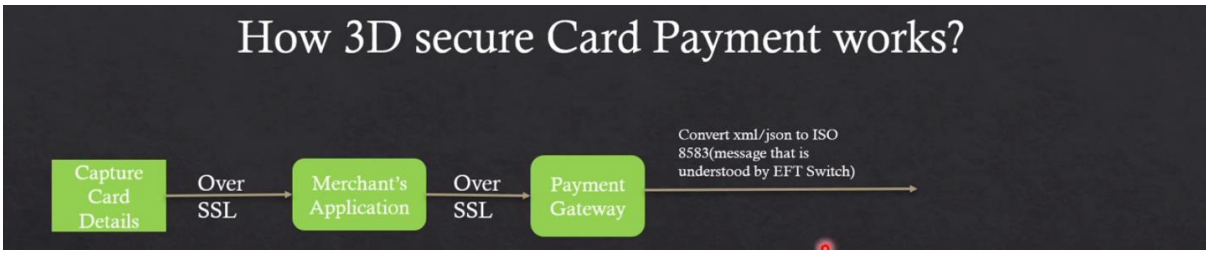
3D secure: It is protocol defined by Visa and now used by all Card Association for added security of online card transactions

ISO-8583: EFT switch message format for card payment processing

The **amazon.com** website is **PCI DSS compliant** and that is why they can save your CC details in their database so that you don't have to retype it on their site every time. The payment messages are done in an ISO-8583 format like EFT and not JSON.

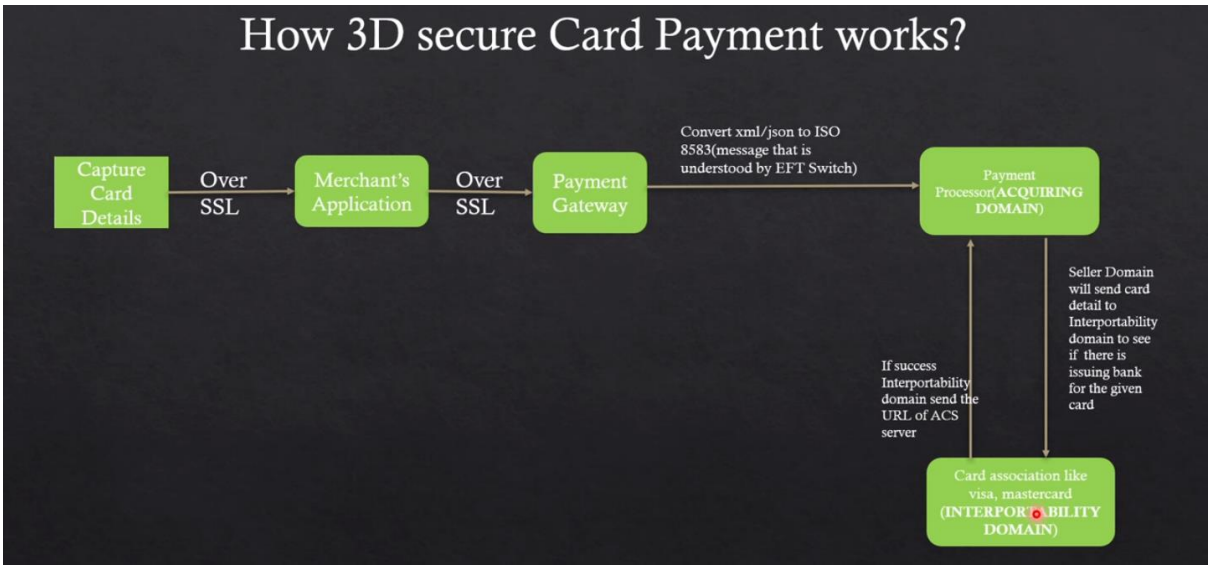




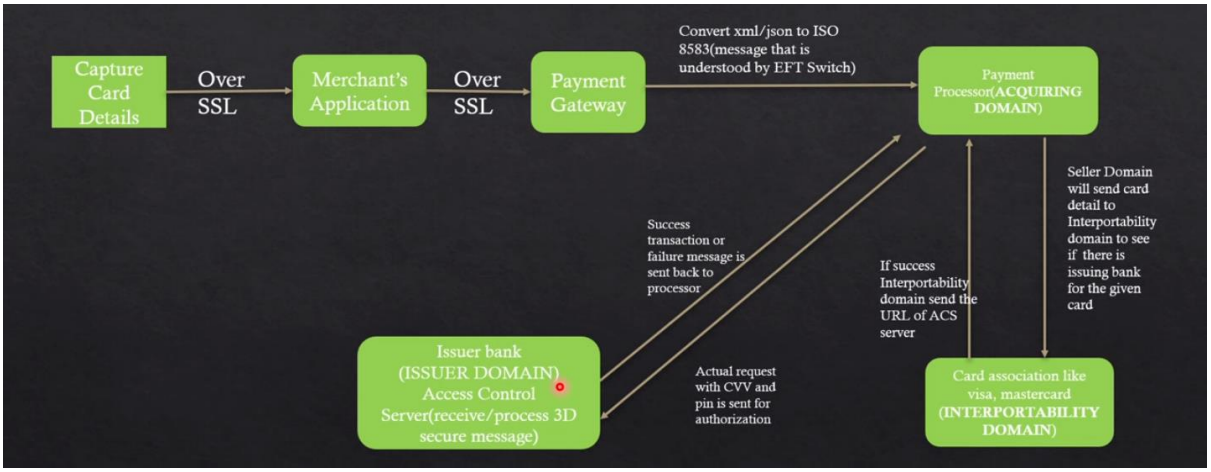


There are 3 domains involved in a 3D secure card payment.

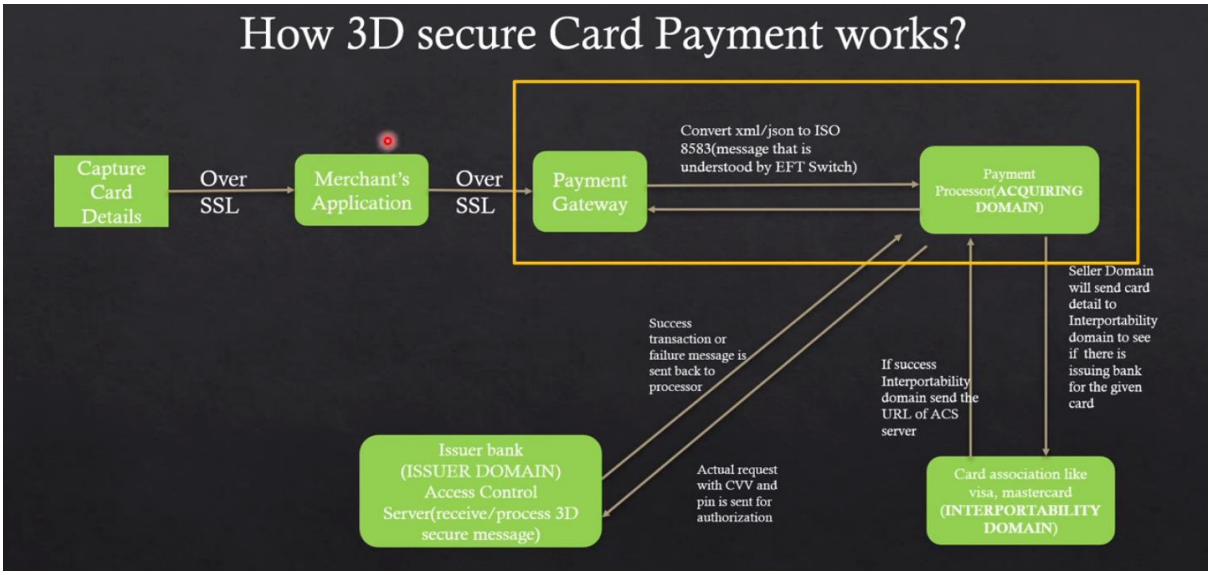
The Acquiring domain will receive the ISO format message, it will then secure it using encryption before forwarding it



The Interoperability domain is a set of directory checks like the issuing bank to be contacted or if the card has expired or invalid, a URL to the access control server for the issuing bank to contact is returned back for a valid transaction.



The secure message can now be sent directly to the Issuer domain's Access Control Server URL for authorization and payment



This is the actual payment gateway to discuss further

Functional Requirements

- Allows multiple ways of payments
- Secure Payment details
- Secure Transactions
- Avoid Double Payment
- Fast Response
- Handle Timeout and failure

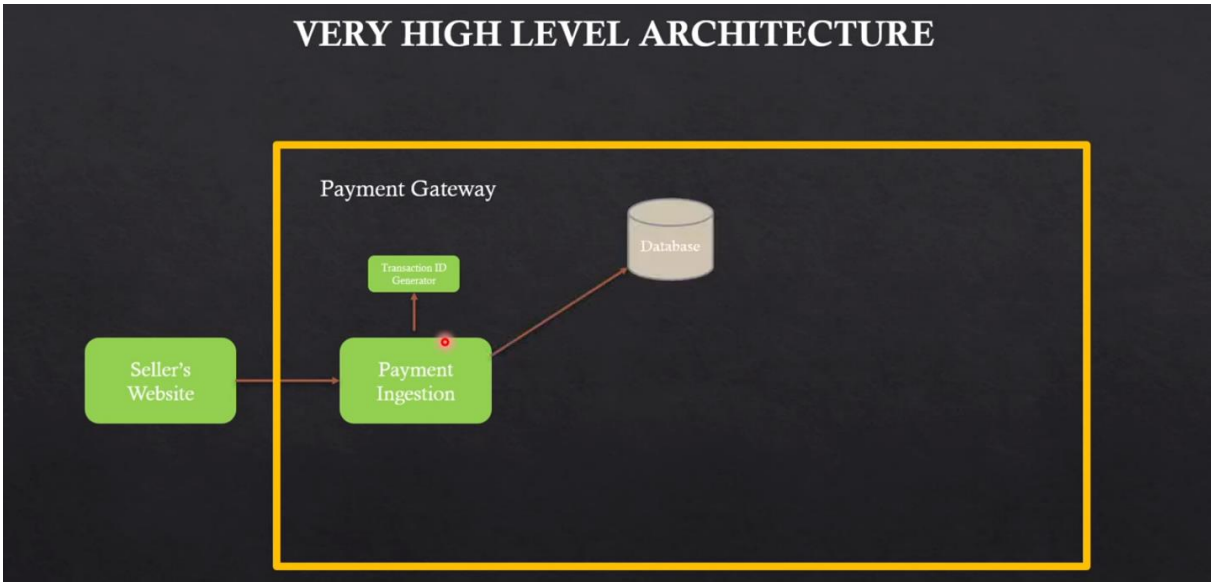
Non Functional Requirements

- Highly Consistent
- Highly Available
- Scalable

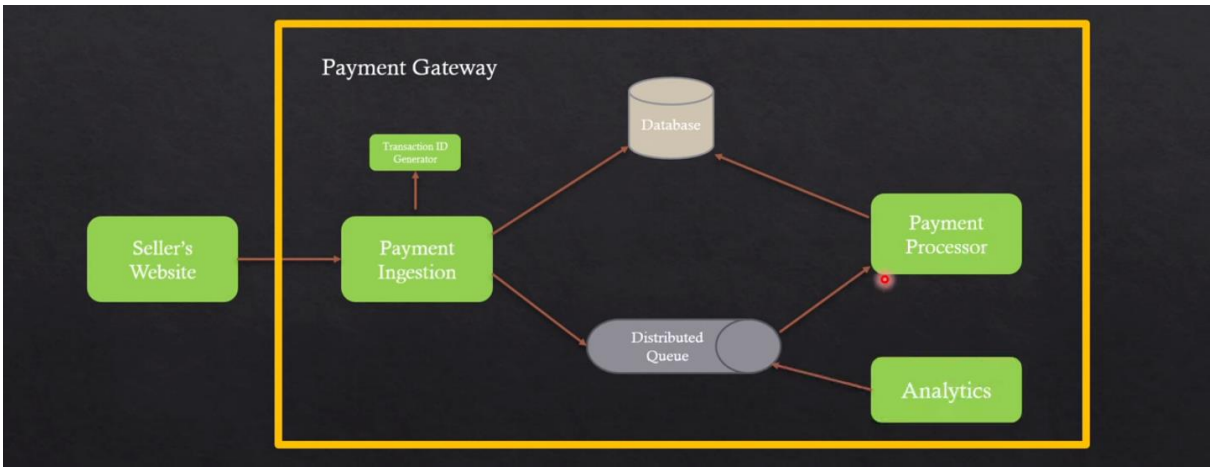
Design Considerations

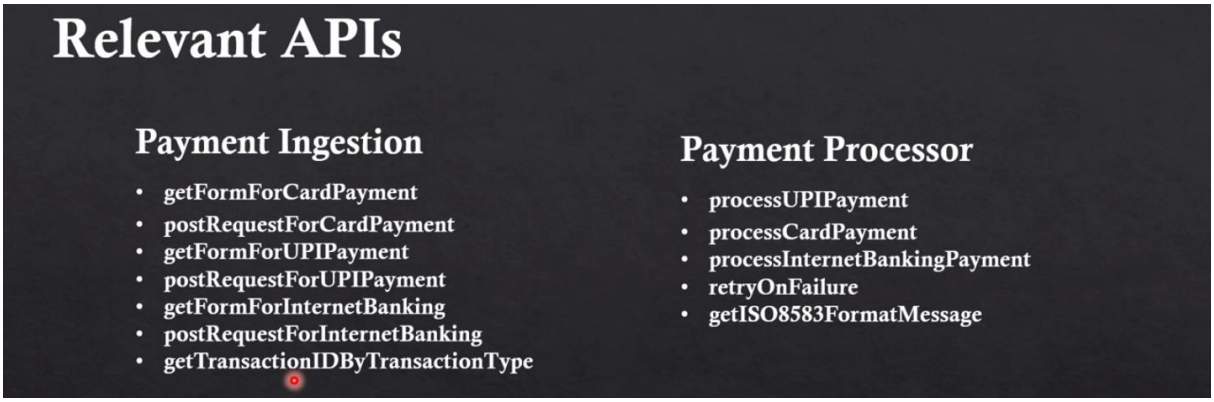
- Multiple subsystems to handle different kind of payments like card, internet banking payments, UPI etc.
- Secure Payment details, may be use some tools like Protegrity to encrypt PII fields
- Use SSL
- Consistency and Availability should be chosen over partition tolerance, one way will be to save the transaction message 1st and then use it
- Need scalable system because number of payments per day can be like 10M

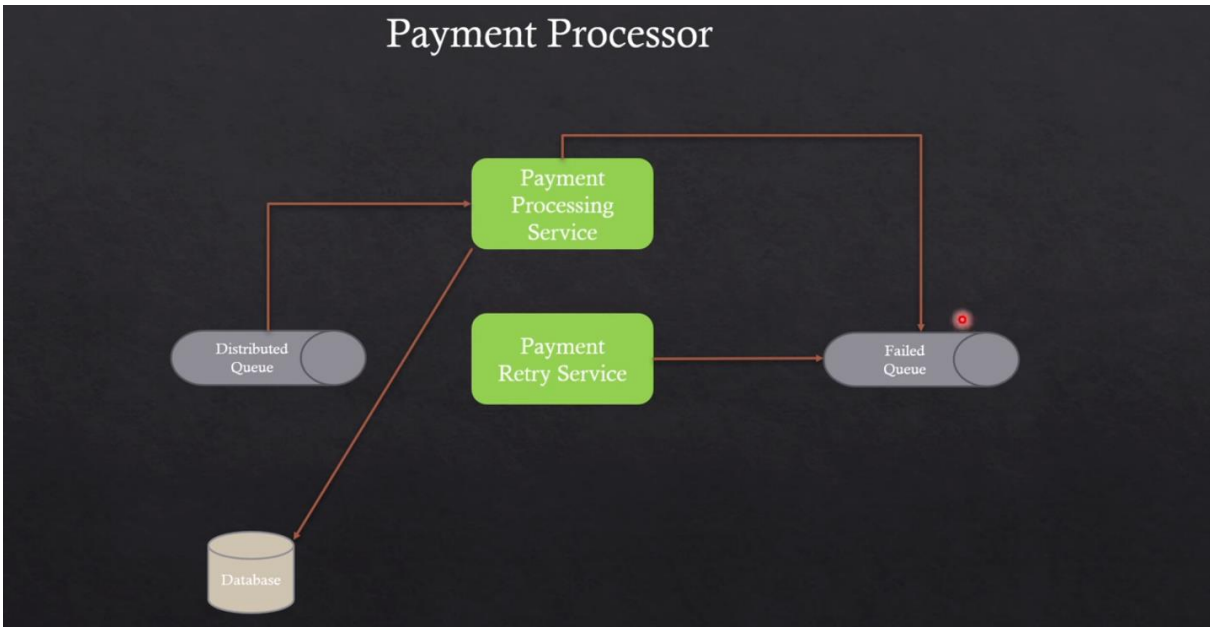
VERY HIGH LEVEL ARCHITECTURE



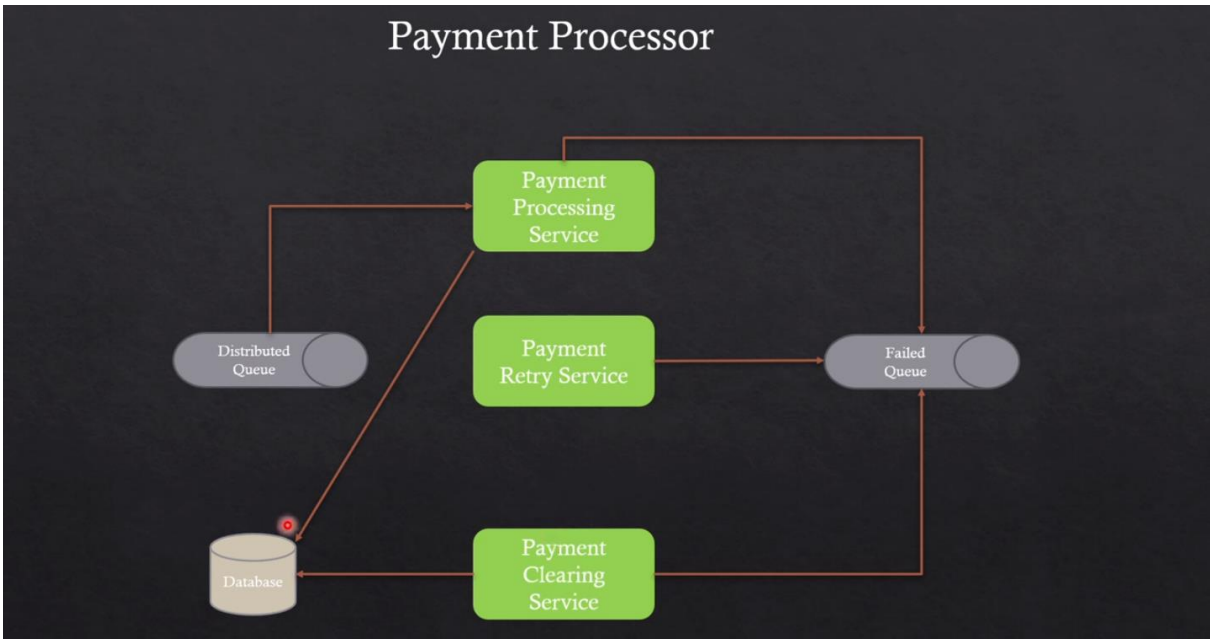
The **Payment Ingestion service** will use the TxID from the **TransactionID Generator Service** for tracking this transaction within the flows and to save the payment details (TxID, card details, internet banking user Id, amount, payment type, tx merchantId, etc) in our DB for retries if needed. Partition DB by date and payment types for querying speed.



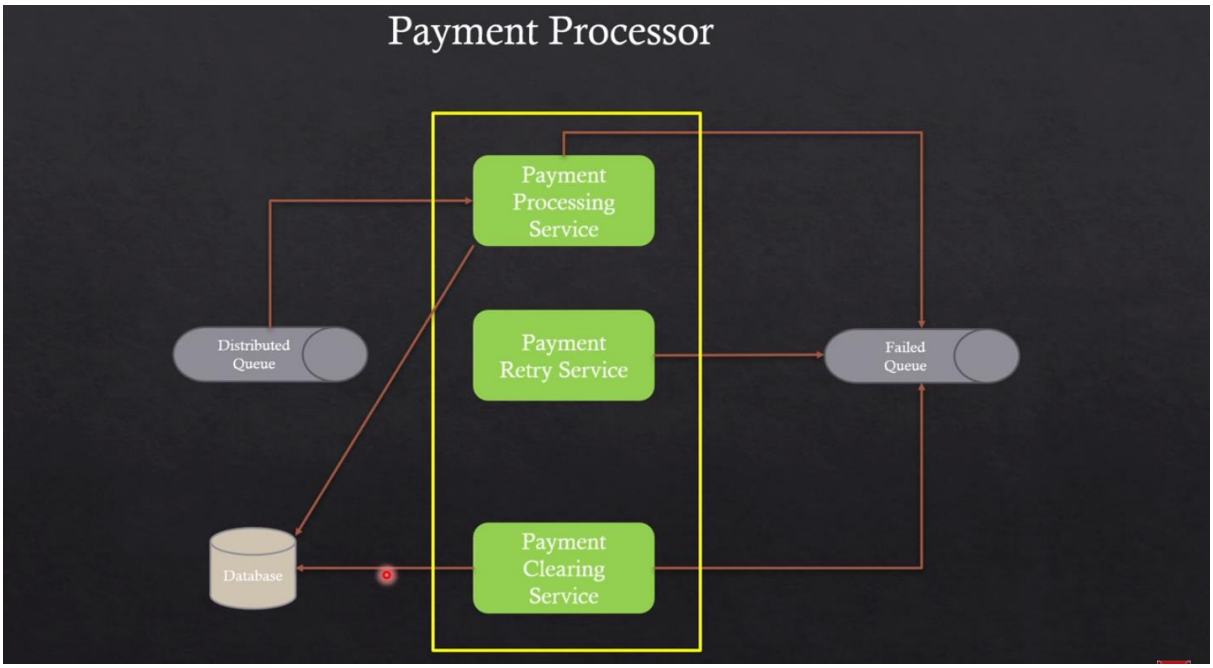




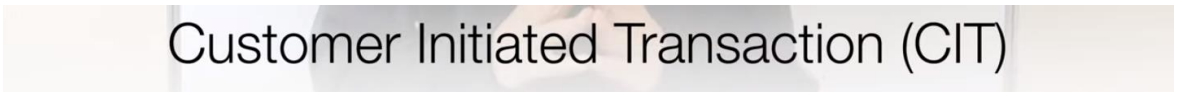
The **Payment Processing Service** will have a plugin that is used to secure the message before sending it further to the Acquiring domain to get the Issuer Access Control server URL for the Issuer bank. It puts a failed/successful transaction in the DB and puts it in the queue for retry by the **Payment Retry Service** or success.

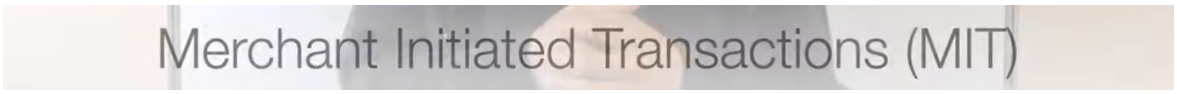


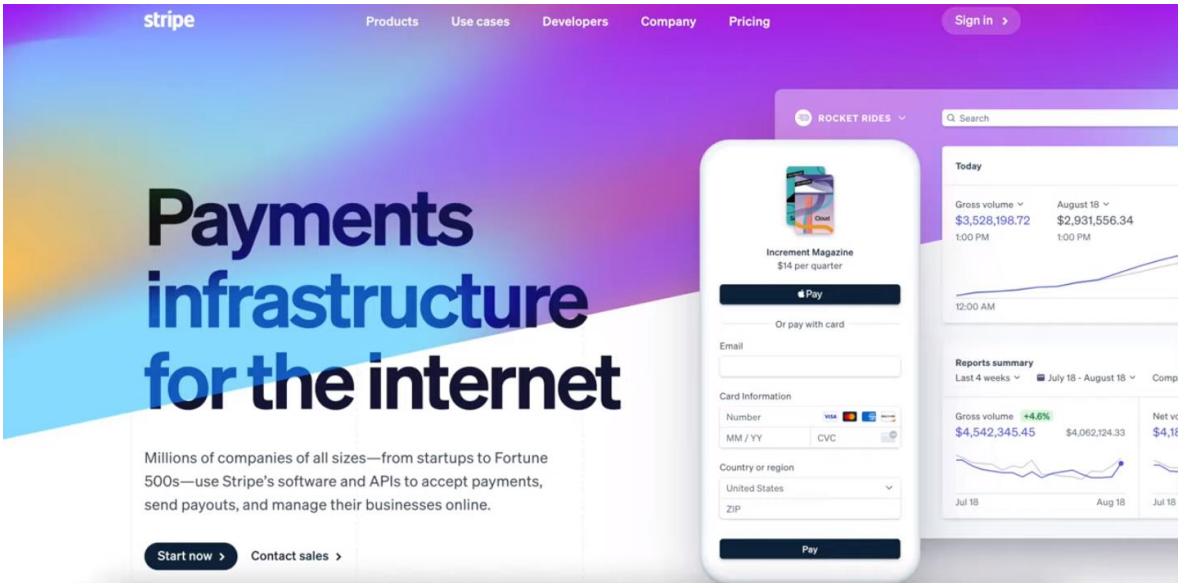
Once all the payment is done, the **Payment Clearing Service** will read the DB for all daily successful transactions that are yet to be cleared and send them out to the clearing process for settlement from Acquiring bank account to the Issuer bank account.



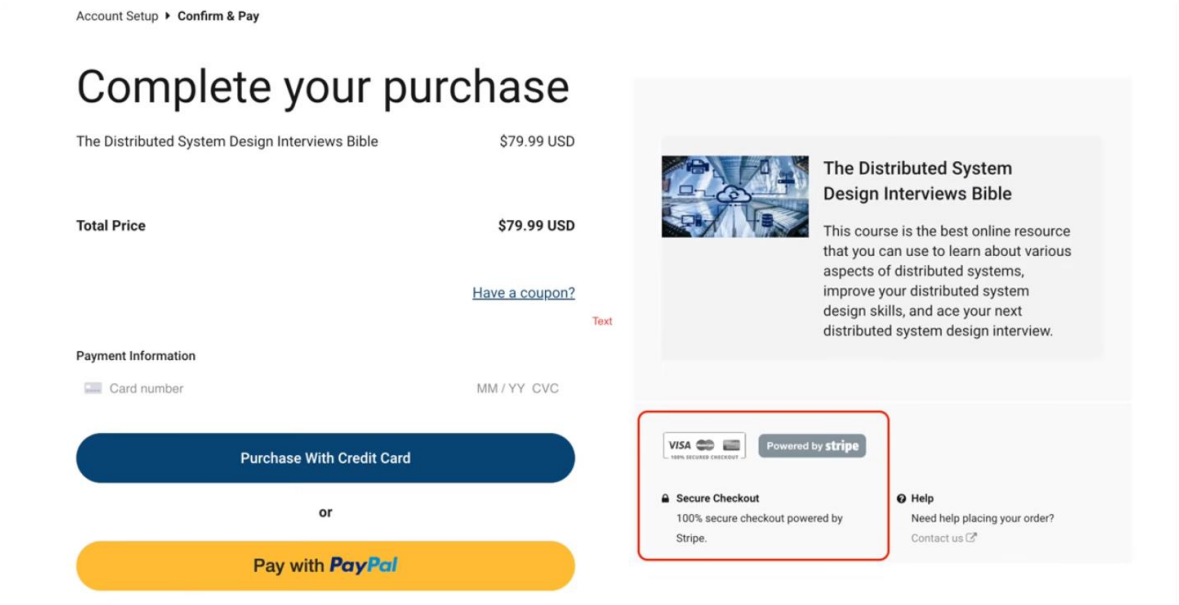
Payment Gateway System Design | Design Payment System | Payment Service Design | Stripe Product System Design - In this video, we are discussing how to design a payment gateway service such as Stripe Payment Service. A Payment service is an important distributed system that is used almost everywhere where money is involved. In this video we are discussing how does the credit card system work and what are different properties and requirements for a payment gateway service.

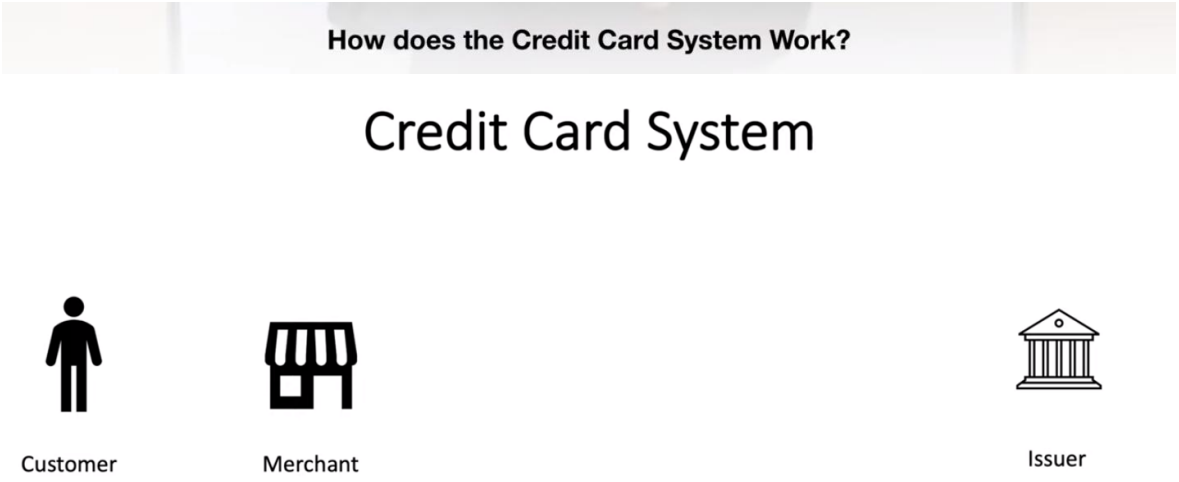






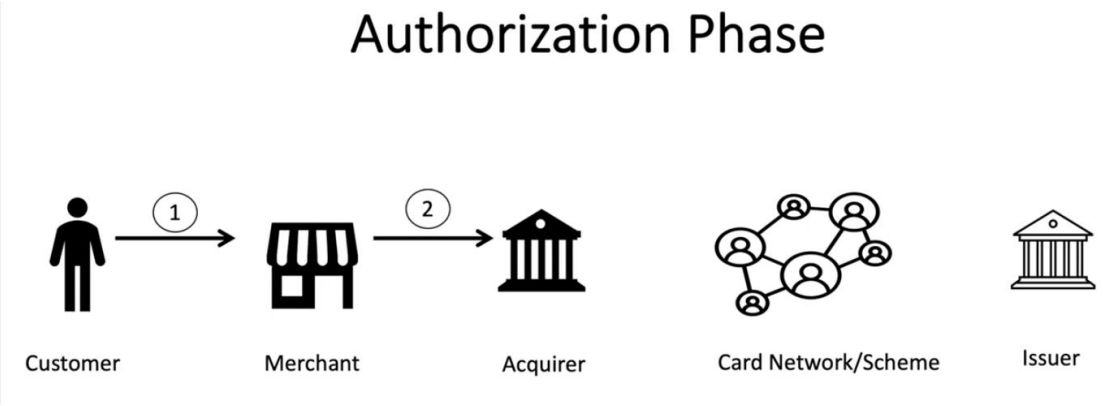
Stripe is a Payments Gateway Service used by 3rd party sellers to integrate payments for goods and services



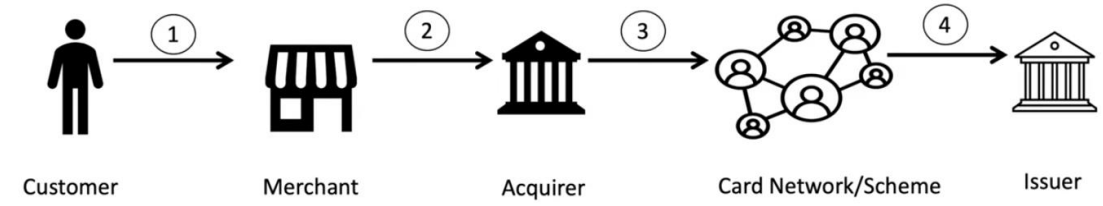


The Merchant sells goods/services to Customers and accepts credit or debit cards for payments. Each merchant maintains a merchant account that enables them to accept credit or debit cards from their customers. The card Issuer is the financial institution or bank that distributes CC cards to their customers. Issuers transfer money for purchases to the acquiring bank

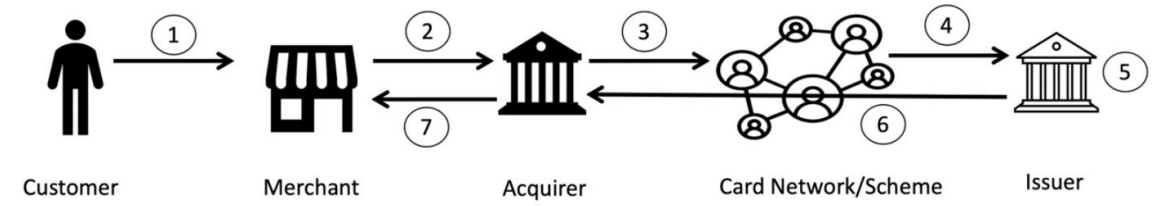
The Acquiring bank is the financial institution or bank that processes CC payments on behalf of the merchant. The Acquirer allows the merchant to accept CC payments from the card issuing banks within a Card Association/Scheme like Visa, MasterCard, Discover, Amex etc. that sets interchange rates, qualification guidelines and acts as an arbiter.



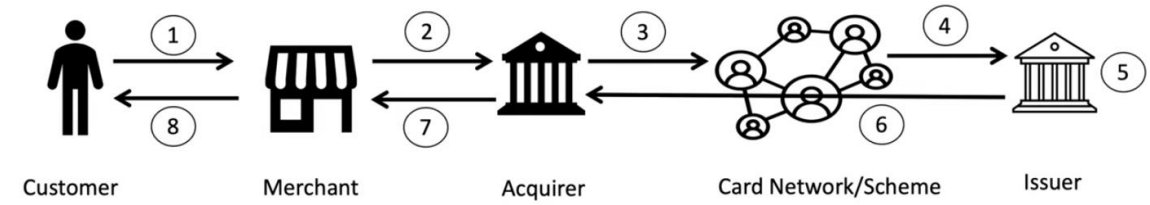
For the Authorization Phase, when a card holder provides their card for purchase on a merchant site or POS, there are 2 processing phases. The Merchant system captures transaction details, perform some basic validations,



The card network/scheme then performs basic validations and routes the transaction information to the Issuing bank. The issuer then does validation, credit availability checks and then declines or approves the transaction and the Issuer holds the amount of money for later settlement.

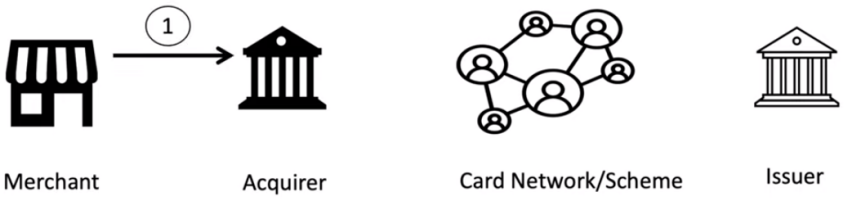


A successful authorization code is sent if approval is successful. The response code then reaches the merchant terminal or software gateway, it is stored their as retained settlement.

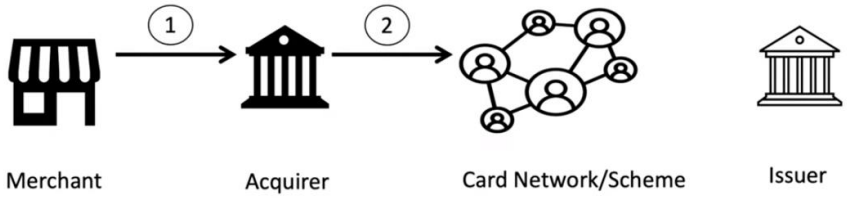


After getting a successful authorization code, the merchant then releases the goods or services to the customer

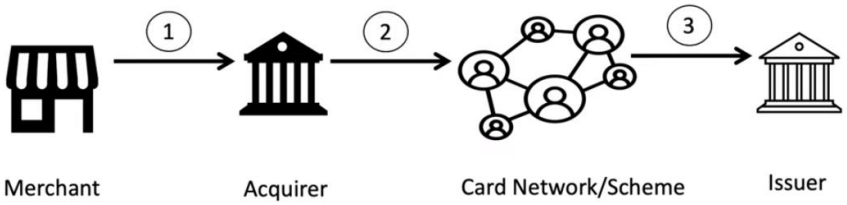
Settlement & Clearing Phase



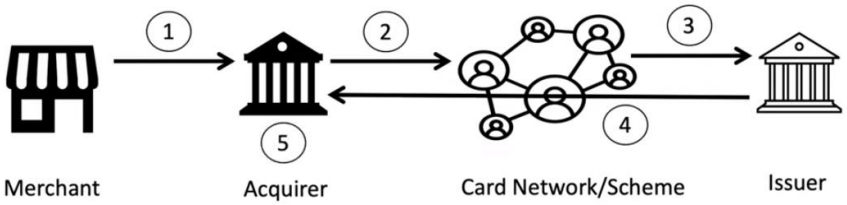
At the end of each business day, a clearing and settlement phase runs. All the merchant approved authorization codes along with their transaction details for the whole day are written to a batch file by the merchant or the payment gateway service and sent to the Acquirer via SFTP.



The Acquiring bank then reconciles and forwards the codes and details to the Card Network/Scheme via SFTP.



The Card Network reads all the authorization codes along with the transaction details from the merchant-provided batch file and then writes them into separate batch files targeting the different issuers. The Card Network then passes the batch files to each Issuer via SFTP.



The Acquiring banks then releases the money for the approved transactions and transfers the money into the respective Acquiring banks. The Acquiring bank then submits the money into the merchant accounts.

Why SFTP is used for this phase?

PCI compliance helps with security and identity theft.

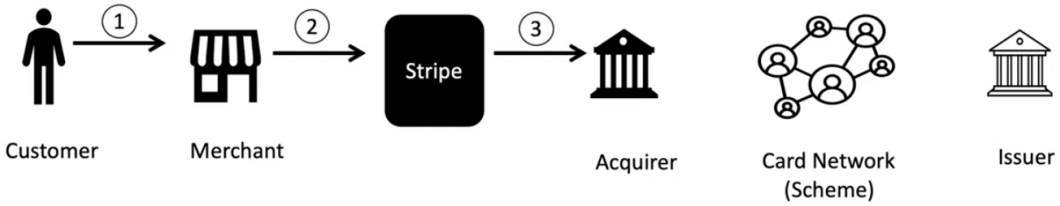
Different regions have different compliance requirements

Master Merchant & Payment Facilitator

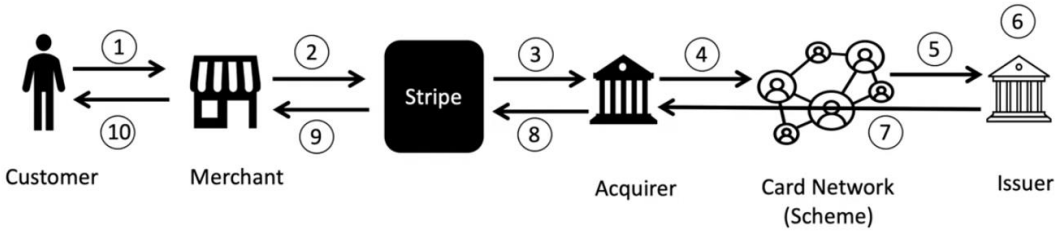
Stripe is a Master Merchant & Payment Facilitator for 3rd-party sellers, Stripe registers a Master Merchant Account with the Acquiring bank and Stripe then provides a virtual merchant accounts to its 3rd-party sellers who register with Stripe and integrate to Stripe Checkout Workflow on their website checkout processes.

Stripe Checkout

How Stripe Work?



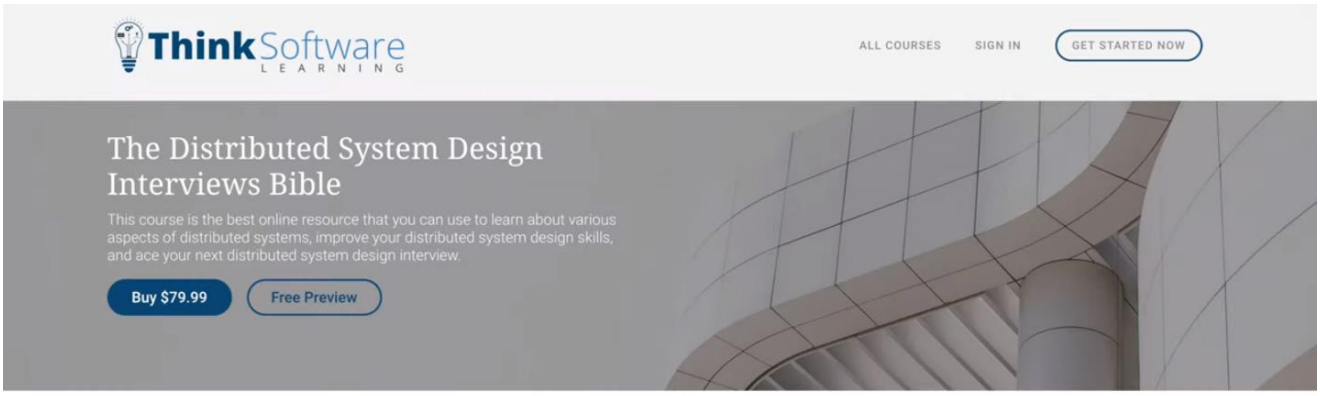
A merchant payment terminal/checkout collects customer payment information and sends it to the Stripe payment gateway, Stripe performs some merchant validation before transferring the transaction details to the Acquirer bank.



Stripe then records the authorization response in its database and forwards the response to the Merchant terminal/checkout process for release of the goods/service to their customer.

End of Day Workflows

There are end-of-day workflows that run in Stripe that takes all the authorization codes and passes them to the Issuer for final settlement and clearance. Let us now discuss some function and non-functional requirements for the Stripe Payment Gateway service.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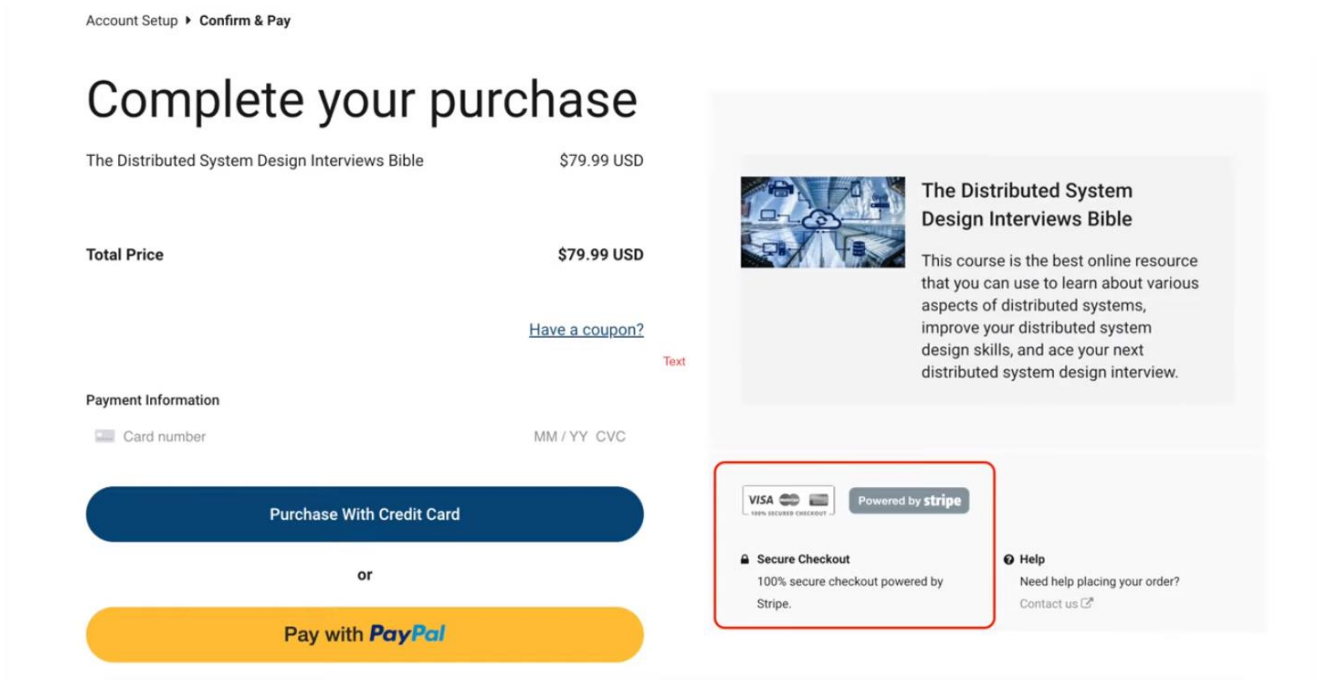
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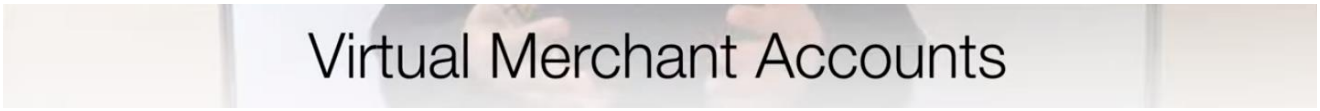
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