Unit-3

Electronic Payment System

Unit 3: Electronic Payment System (9 Hrs.) E-payment System, Online Credit Card Transaction, Online Stored Value Payment System, Digital and Mobile Wallet, Smart Cards, Social/Mobile Peer-to-Peer Payment Systems, Digital Cash/e-cash, E-Checks, Virtual Currency, Electronic Billing Presentment and Payment (EBPP) System, Auctioning in E-commerce (English, Dutch, Vickery, Double), SET Protocol, Features of SET, Participants in SET, Card Holder Registration, Merchant Registration, Purchase Request, Dual Signature, Payment Authorization, Payment Capture, Status of E-Payment Systems in Nepal, Case Studies of Global and Local Payment Systems

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E-payment System:

Electronic payment system (EPS) is a way of paying for goods and services electronically instead of using direct cash or physical cheque. EPS is gaining its popularity on the current growing online trading environment. EPS simply means online transaction of values. EPS actually are many types. development of the mobile platform, have also created both a need and an opportunity for the development of new payment systems.

An electronic payment system is needed for compensation for information, goods and services provided through the Internet – such as access to copyrighted materials, database searehes or consumption of system resources – or as a convenient form of payment for external goods and services – such as merchandise and services provided outside the Internet. it helps to automate sales activities, extends the potential number of customers and may reduce the amount of paperwork.

Hundreds of EPS have been developed to provide secure electronic transactions. Fundamental feature of EPS is secure transaction. In any EPS;

- Communications are private.
- Communications have not been changed during transmission.
- Communications should be initiated from signed author.

To meet above fundamental security goals, every EPS must implement some type of encryption or digital certificate technique. EPS such as e-banking, e-wallet etc. are the online services that utilize internet for transaction. Similarly, EPS such as credit card, debit card etc. can be used offline for transaction.

At present, there are variety of EPS including;

- Debit card
- Credit card
- Smart card

- E-banking
- E-cash/E-currency
- E-cheque
- E-wallets etc.

Electronic payment system is popular specially in online services such as online ticket reservation, online payment, online order placing,

i. **Debit Card:** They are the prepaid cards issued by banks to its customers. We can use them for electronic transaction. They are linked to our bank account and deduct balance directly from our bank account. It is a dual-purpose card. It can be used to perform electronic payment as well as it can be used in ATM machine to withdraw cash from our account. It has a daily purchase limit set by the bank. It is used by a PIN to complete transaction.

ii. **Credit card:** A credit card is a thin rectangular plastic card similar to debit card issued by a financial institution like a bank that lets you burrow funds to pay for your purchases. They are similar to debit cards as discussed above however, the main difference with debit card is that it is postpaid card. User can pay for purchases in advance and later they have to fulfill the amount with the card provider. User has to pay interests for the amount they used. It is a kind of on-demand loan. Some credit card companies let the user withdraw cash through atm in case of emergency.

iii. **Smart Card:** It is a tiny rectangular piece of card that can be fitted in a pocket and has smart features. It can be used for electronic transactions by an individual. It is highly secure and convenient. It is issued by a bank. It has integrated circuit chip that stores individual and account details. Smart cards can be contact based or contact less. Contact based smart cards must be inserted into card reader to perform any transaction. Contactless smart cards use NFC (Near Field Communication) technology with which, they can communicate wirelessly when they reach to active devices. Smart cards are not only used for electronic transaction. They can also be used for authentication, authorization and access control.

iv. **E-banking:** It is a method of banking in which customer can perform transaction electronically using internet. In short is the banking services moved online. It is the online version of banking service, also called virtual banking. User can perform banking activities like taking loan, installment payment, online payment, load e-wallets etc. online. Most of the customers are using smart phones for e-banking, hence it is also called as mobile banking.

v. **E-cash:** It is an EPS in which, a user gets a card issued by a bank that can be used for electronic transaction. It is a physical card that can be used in supported machine. The transaction has to be verified by bank during payment. It is a prepaid card. User must deposit some amount against which bank will issue the card. User can even take cash by submitting card to the bank.

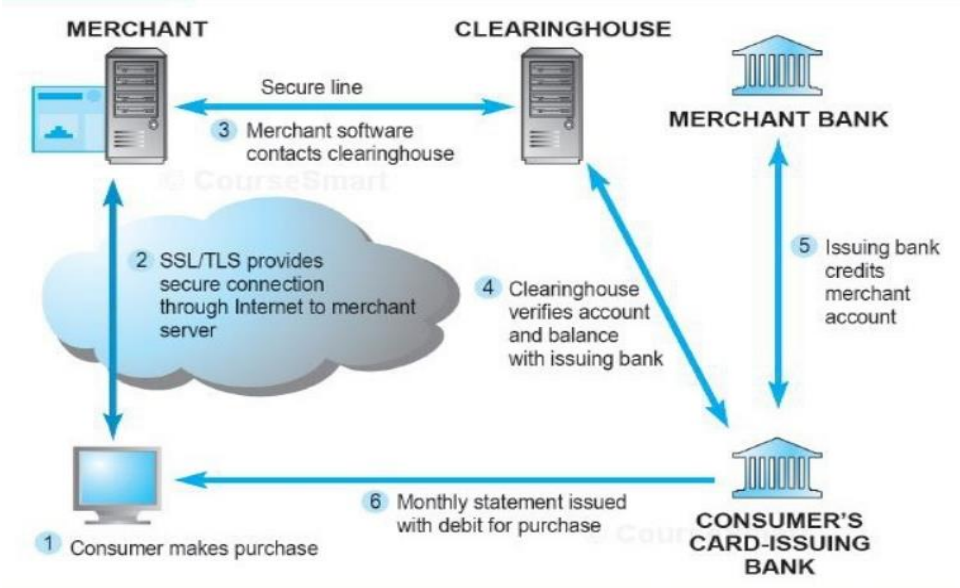
vi. **E-cheque:** It is an electronic document which is used instead of physical cheques for online transactions. E-cheques use digital signatures for authentication. It has the functionality same as traditional physical cheque. Unlike physical cheques, it has no chance of rejection for any authenticity issue. It is highly secure as it uses PKI technique. It can be deposited, delivered and issued at any time. It can be tracked when transmitted. There is almost zero chance of fraud with e-cheques. Most of the time, e-cheques are the digitally signed checks in pdf format and are provided by many banks as well as payment gateways or e-wallets. An e-cheque remains valid about 90 days from issue date. It explicitly includes the address/information of the payee. The payee's bank must accept e-cheque as well. Currently famously used in US and China. You are allowed to design background and other looks for your e-check yourself. Most importantly, blank cheques can not be issued.

vii. **E-wallet:** It is a type of electronic payment system which provides user account that can be accessed through websites or mobile applications. It is a digital system that stores payment information of a person. People can use it to pay for things. It is highly secure encrypted system. It is a prepare system. It has high utility as one can use it for purchasing online, transferring fund (within limit). It doesn't require any physical card to carry. Unlike debit/credit cards, user can't withdraw cash from ATM. These are being popular these days due to ease of use, security and accessibility.

Online Credit Card Transaction:

Because credit and debit cards are the dominant form of online payment, it is important to understand how they work and to recognize the strengths and weaknesses of this payment system. Online credit card transactions are processed in much the same way that in-store purchases are, with the major differences being that online merchants never sec the actual card being used, no card impression is taken, and no signature is available.

illustrates the online credit card purchasing cycle;



There are five parties involved in an online credit card purchase: consumer, merchant, clearinghouse, merchant bank (sometimes called the "acquiring bank"), and the consumer's card

issuing bank. In order to accept payments by credit card, online merchants must have a merchant account established with a bank or financial institution. A merchant account is simply a bank account that allows companies to process credit card payments and receive funds from those transactions.

An online credit card transaction begins with a purchase (1). When a consumer wants to make a purchase, he or she adds the item to the merchant's shopping cart. When the consumer wants to pay for the items in the shopping cart, a secure tunnel through the Internet is created using SSL/TLS. Using encryption, SSL/TLS secures the session during which credit card information will be sent to the merchant and protects the information from interlopers on the Internet (2). SSL docs not authenticate either the merchant or the consumer. The transacting parties have to trust one another.

Once the consumer credit card information is received by the merchant, the merchant software contacts a clearinghouse (3). As previously noted, a clearinghouse is a financial intermediary that authenticates credit cards and verifies account balances. The clearinghouse contacts the issuing bank to verify the account information (4). Once verified, the issuing bank credits the account of the merchant at the merchant's bank (usually this occurs at night in a batch process) (5). The debit to the consumer account is transmitted to the consumer in a monthly statement (6).

Limitations of Online Credit Card Payment System: There are a number of limitations to the existing credit card payment system. The most important limitations involve security, merchant risk, administrative and trans action costs, and social equity.

The existing system offers poor security. Neither the merchant nor the consumer can be fully authenticated. The merchant could be a criminal organization designed to collect credit card numbers, and the consumer could be a thief using stolen or fraudulent cards. The risk facing merchants is high: consumers can repudiate charges even though the goods have been shipped or the product downloaded. The banking industry attempted to develop a secure electronic transaction (SET) protocol, but this effort failed because it was too complex for consumers and merchants alike.

The administrative costs of setting up an online credit card system and becoming authorized to accept credit cards are high. Transaction costs for merchants also are significant—roughly 3.5% of the purchase plus a transaction fee of 20-30 cents per transaction, plus other setup fees.

Credit cards are not very democratic, even though they seem ubiquitous. Millions of young adults do not have credit cards, along with millions of older adults who cannot afford cards or who are considered poor risks because of low incomes.

Online Stored Value Payment System:

Online stored value systems a form of electronic payment system. Accounts created by depositing funds into an account and from which funds are paid out or withdrawn as needed are stored value payment systems.

They principally target the low value transactions. This system has very low transactions cost. This system is based on creating the electronic value, more likely the digital cash. Monitory value

is stored in the card itself. No external financial institutions maintain account. Unlike debit/credit cards which are issued to an account holder, stored value card can be anonymous. Stored value cards are prepaid money cards. They do not need bank verification during processing. PayPal is an example of online stored value payment system.

Two types of stored value cards are:

a. **Closed system prepaid cards:** Closed system prepaid cards have substituted the traditional gift certificate and are known as merchant gift cards. “Closed system” means that the cards are only accepted at a single merchant. These cards are also referred to as “closed loop” or “single-purpose” cards. Purchasers buy a card for a fixed amount and can only use the card at the merchant that issues the card. The cards have often an expiration date or a service fee. In addition, most closed system cards cannot be repaid in cash. For example, card issued by “Bhatbhateni”.

b. **Open system prepaid cards:** Open system prepaid cards have nothing in common with credit cards. The issuer doesn't allow a credit to the cardholder. Stored Value Cards use magnetic stripe technology to store information about funds that have been prepaid to the card. The value is not physically stored on the card. With the aid of the card number it is possible to identify the record in a central database. These cards are similar to closed system prepaid cards but they are connected with a retail electronic payments network such as Visa, Visa Electron, MasterCard or Maestro. Different to gift cards they can be used anywhere where debit cards with the same logo are accepted. They are very similar to debit cards except that they don't require a bank account and can be used to make debit transactions or to withdraw cash from ATM’s.

The major disadvantage of this system (or any EPS) is the money laundering.

Social/Mobile Peer-to-peer Payment System:

P2P payment, short for peer-to-peer or person-to-person payment, means a transaction that enables society to transfer their money to people in online mode with the help of personal bank and credit unions accounts or mobile apps. This way, it is easy to split a bill with your friends or family members. Besides, this digital technology can certainly deprive you of constant problems that appear when you have to carry cash with you. You should not worry that you forget your wallet at home or do not have small money to give somebody change.

Peer-to-peer payment services let you use a bank account or a credit or debit card to pay friends or family from your phone. Peer-to-peer payment systems — also known as P2P payments or money transfer apps — like PayPal allow users to send one another money from their mobile devices through a linked bank account or card. They make splitting bills with friends and family painless.

In Peer-to-peer payment system, the network architecture may not be peer-to-peer but the payment system must be of P2P nature. In this system, one party (peer) can directly pay to other party (peer) by using some mobile application providing the EPS service.

If earlier, all online services were more popular among the young generation, now, it becomes a general tendency. People of all ages have mobile phones and use them whenever it is possible. Therefore, new P2P services and mobile apps that are connected with bank accounts are constantly being developed. The most popular P2P payment services include:

- PayPal
- Apple Pay
- Google Pay
- E-sewa
- Khalti etc.

No matter which P2P payment service you will select to transfer a certain sum of money to your friend, family member, or close associate, the working principle does not differ considerably. It is as simple as creating an account on social media sites and sending a message to your friend. The simplicity of the required actions is one of the reasons for the popularity of P2P payment services. Besides, you do not need extra tools except for a mobile phone or laptop to make a payment.

In general, there are no reasons to worry about the safety of P2P payments as all peer-to-peer services encrypt the personal information of their consumers. Furthermore, most P2P phone apps apply the procedures of fraud tracking that prevent information leak and hacking attacks.

Some problems related to P2P payment system are that, there is no option to cancel/undo payment and there may be fraud transferring.

Mobile payment is often known as social payment as it enables payments among people directly without any bank details. Now a days it is popular with the term mobile wallet or digital wallet.

Note: For better knowledge, have a read on

- Current status of electronic payment system of Nepal.
- Advantages/disadvantages of using P2P payment systems.

Electronic Billing Presentment and Payment (EBPP) Systems:

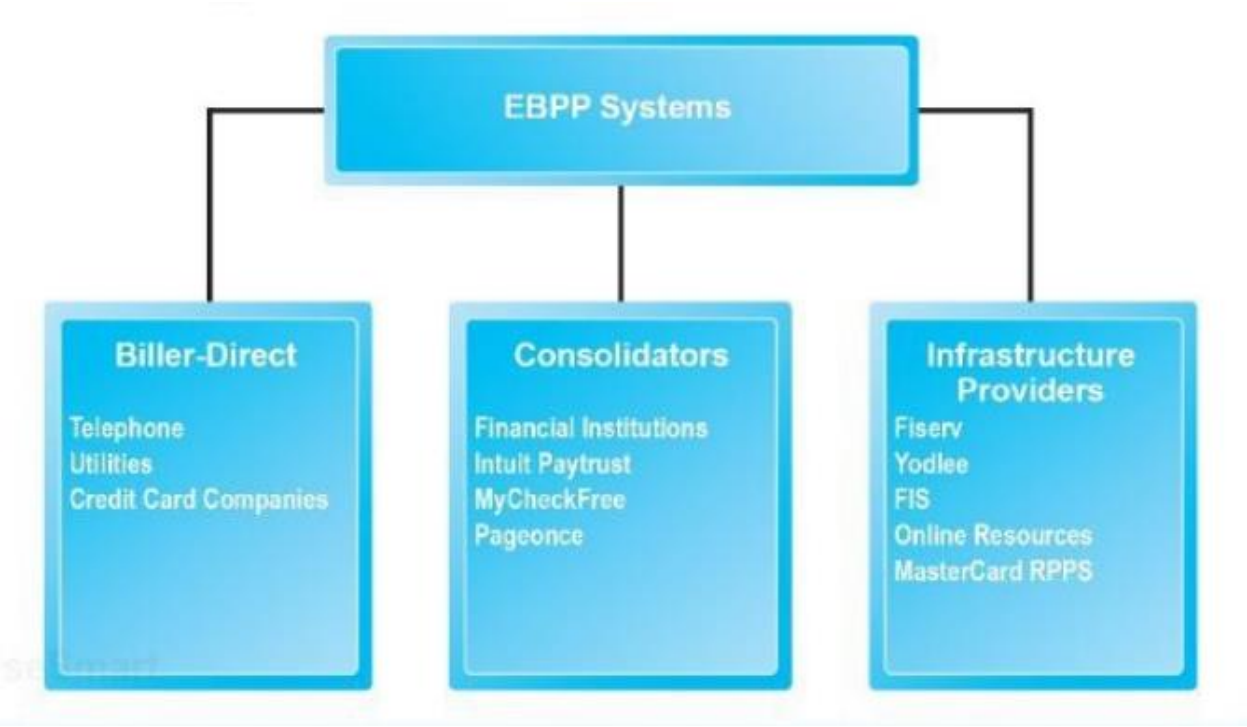
These are the systems that enable the online delivery and payment of monthly bills. EBPP services allow consumers to view bills electronically and pay them through electronic funds transfers from bank or credit card accounts. More and more companies are choosing to issue statements and bills electronically, rather than mailing out paper versions. But even those businesses that do mail paper bills are increasingly offering online bill payment as an option to customers, allowing them to immediately transfer funds from a bank or credit card account to pay a bill somewhere else.

Business Model: There are two main competing business models in the EBPP marketspace: biller-direct and consolidator. The biller-direct system was originally created by utility companies that send millions of bills each month. Their purpose is to make it easier for their customers to pay their utility bills routinely online. Today, telephone and credit card companies also frequently offer this service, as well as a number of individual stores. Companies implementing a biller-direct system can either develop their own system in-house (usually only an option for the very largest companies), install a system acquired from a third-party EBPP software vendor, use a third-party EBPP service bureau (the service bureau hosts a biller-branded Web site that enables consumers to view and pay bills and handles all customer enrollment, bill presentment, and payment processing), or use an application service provider (similar to a service bureau, but runs on the billers Website rather than being hosted on the service provider's Web site).

In the consolidator model, a third party, such as a financial institution or a focused portal such as Intuit's Paytrust.com and others, aggregates all bills for consumers and ideally permits one-stop bill payment (pay anyone). Currently, financial institutions have been more successful than portals in attracting online bill payers. The consolidator model faces several challenges. For billets, using the consolidator model means an increased time lag between billing and payment, and also inserts an intermediary between the company and its customer.

For consumers, security continues to be a major issue. Most consumers are unwilling to pay any kind of fee to pay bills online, and many are concerned about sharing personal financial information with nonfinancial institutions. Today, more and more banks are offering online bill payment free to some or all of their customers as an enticement.

Supporting these two primary business models arc infrastructure providers such as Fiserv, FIS, Online Resources Corporation, MasterCard RPPS (Remote Payment and Presentment Service), and others that provide the software to create the EBPP system or handle billing and payment collection for the biller. Following figure illustrates major players in EBPP marketplace.



Auctioning in E-commerce:

The word auction is derived from Latin world "Augere" which means to increase. Auctioning or e-auctioning is the process of conducting an auction to sell assets, natural resources or other goods through online competitive bidding. It can occur business to business, business to consumer, or consumer to consumer, and allows suppliers to bid online against each other for contracts against a published specification. E-auction takes place in online marketplace.

Using e-auctions, the auctioneers can have competitive value for their assets where bidders can participate virtually from any part of the world. Online auctions are typically managed by a business which specializes in conducting auctions over an Internet based platform instead of in person or by mail. The business, or auctioneer typically takes a percentage of what an item sells for before the proceeds are given to the seller. A potential buyer makes a bid, which is the amount that the buyer is willing to pay for that item. How the winning bid is reached depends greatly on which specific type of auction is being conducted.

In normal trading environment seller decides the price for an item/asset. Auction is used in the situations in which the seller doesn't know the actual price of an asset. In such case, seller can go for auction. Auctioning can be done directly by the seller or the seller can take help of auctioneer agency. Auction is used as a price discovery mechanism.

Types of auctioning: Auctions can be categorized in many types as follows:

a. **English Auction:** It is the most general form of auction. Opening price of an asset is low and the price goes on increasing in bidding process. With this type of auction, the seller gets highest possible price for the asset. The seller can declare the reserve price that ensures the minimum expected price below which the bidding will not be accepted. The major points about this type of auctions are:
    - Public ascending price.

- Single unit is sold with auction.
- Highest bidder wins the auction.
- Buyers can skip bidding at each price and return at higher price.
- This type of auction is used when seller/auctioneer is unaware about the estimated price of the asset.

b. Dutch Auction: It is in nature, opposite to the English Auction. In this type of auction, seller or auctioneer starts with an opening higher price and keeps on lowering price until a buyer bid on it. The first person to bid wins the auction. Major points about this auction are:

- Auctioneer descending price.
- Single or multiple units may be sold with auction.
- First bidder wins the auction.
- Buyers can't skip bidding at higher price and return at lower price.
- This type of auction is used when seller/auctioneer has expected price for the asset.

c. Shield-bid Auction: It is a private or shield auction in which a single unit is sold with private auction. The bidders bid on their own price writing on paper which is not transparent to other bidders. The bidder with highest price wins the auction and pays corresponding price. In many ways it is similar to the English auction, with the major difference being closed/private/shield nature.

d. Vickery Auction: A Vickrey auction is a type of sealed-bid auction. Bidders submit written bids without knowing the bid of the other people in the auction. The highest bidder wins but the price paid is the second-highest bid. This type of auction is often called as "second-price shield-bid auction".

e. Double Auction: The double auction system is what we see in the stock market. Buyers place bids and sellers place offers throughout the trading day. This can be done electronically, or by open outcry where each party calls out prices, they are willing to buy or sell at and make a transaction if the prices match up. In this way a negotiation of sorts occurs where buyer and seller work together to arrive at a fair market price. The major points are:

- Seller/auctioneer starts with higher price and bidder starts with lower price.
- Single or multiple units may be sold with auction.
- A bidder with first match wins the auction.
- This type of auction is suitable if there are multiple sellers and multiple bidders such as share market.

SET Protocol:

SET stands for Secure Electronic Transaction. This is a communication protocol designed for secure electronic payment transaction such as credit card transaction. It is an open source and cryptography-based protocol that make payment transaction secure in a network. It is not a

payment system on its own, rather it makes the payment transaction in open network secure. It implements encryption and hashing technique due to which hackers can't get credit card details. SET in fact is a set of protocols for ensuring security and confidentiality on credit card transaction. SET protocol was supported in development by major organizations like Visa, Mastercard, Microsoft which provided its Secure Transaction Technology (STT) and NetScape which provided technology of Secure Socket Layer (SSL).

SET protocol restricts revealing of credit card details to merchants thus keeping hackers and thieves at bay. SET protocol includes Certification Authorities for making use of standard Digital Certificates like X.509 Certificate.

Before discussing SET in detail, lets recall the infrastructure for online credit card transaction as shown in figure below.

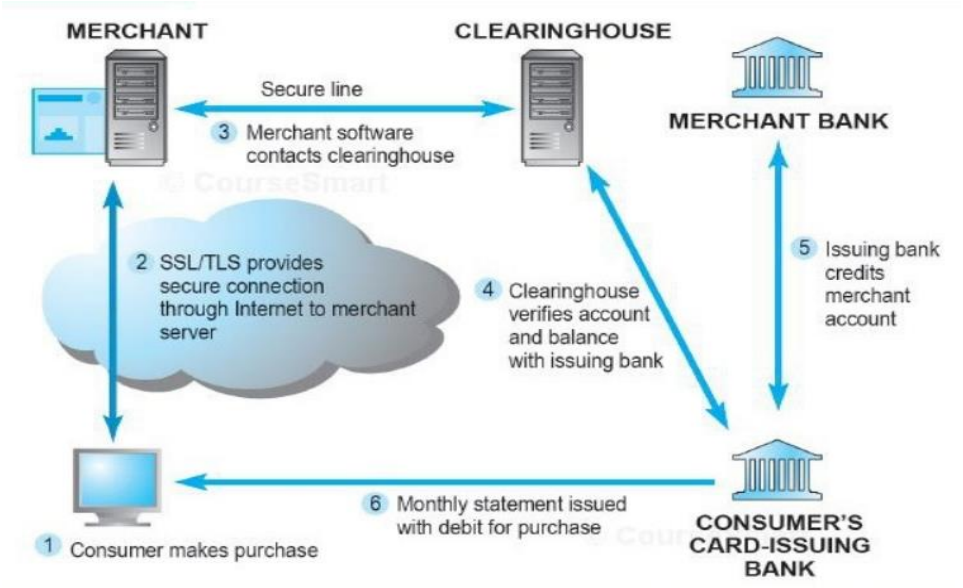


Fig: Online credit card transaction infra-structure

Primary purpose of SET is to be responsible for blocking out the personal details of card information, thus preventing merchants, hackers, and electronic thieves from accessing consumer information. Secure electronic transaction protocols allowed merchants to verify their customers' card information without actually seeing it, thus protecting the customer against account theft, hacking, and other criminal actions. The information on the cards was transferred directly to the credit card company for verification.

The process of secure electronic transactions used digital certificates0 that were assigned to provide electronic access to funds, whether it was a credit line or bank account. Every time a purchase was made electronically, an encrypted digital certificate was generated for participants in the transaction–the customer, merchant, and financial institution–along with matching digital keys that allowed them to confirm the certificates of the other party and verify the transaction. The algorithms used would ensure that only a party with the corresponding digital key would be able to confirm the transaction. As a result, a consumer's credit card or bank account information could be used to complete the transaction without revealing any of their personal details, such

as their account numbers. Secure electronic transactions were meant to be a form of security against account theft, hacking, and other criminal actions.

Working of SET protocol:

Following diagram depicts the various parties involved in credit card payment transaction.

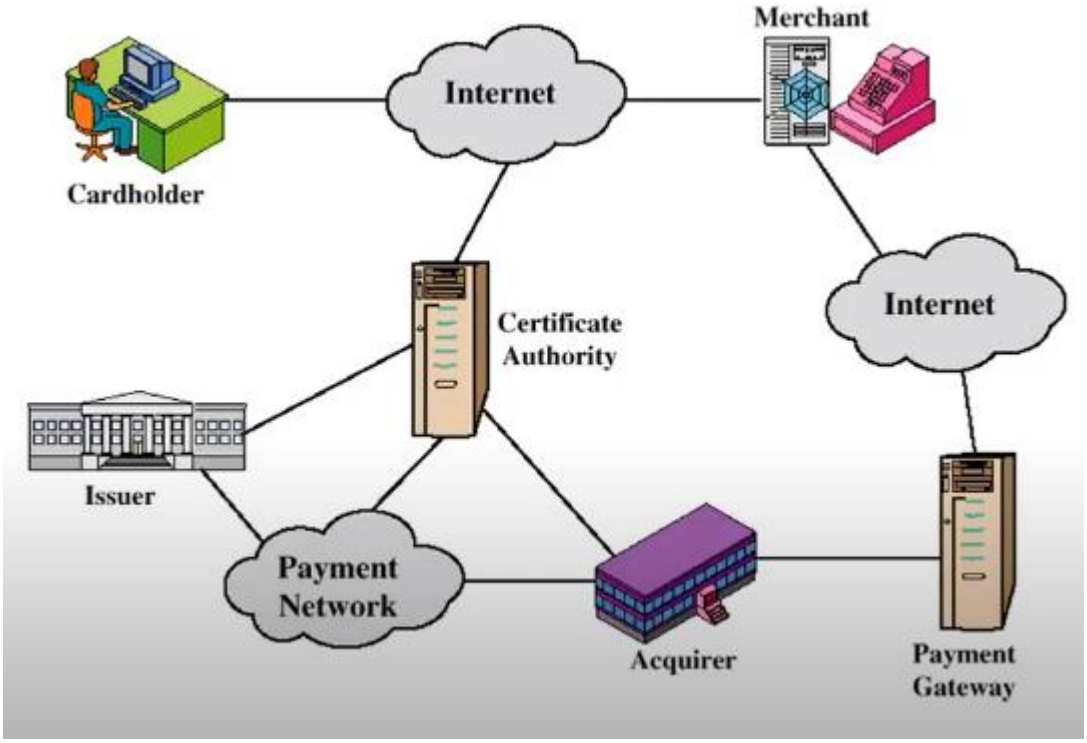


Fig: Participants of the SET protocol

a. **Cardholder:** This is an authorized holder of a payment card such as credit card (eg. MasterCard, Visa, SCT) that has been issued by an issuer.

b. **Merchant**: This is the seller organization that provides credit card purchase facility to the cardholders. A merchant that accepts credit card payment, must have a relationship with an acquirer.

c. **Issuer:** This is a financial institution such as a bank that provides cardholder with a payment card.

d. **Acquirer:** This is a financial institution such as a bank that keeps an account for the merchant to process credit card authorization and payments. The acquirer provides authorization to the merchant that a given card account is active and the proposed purchase doesn't exceed the credit limit. Acquirer also provides electronic payment transfers to the merchant's account.

e. **Certificate authority:** This is an entity that provides X.509V3 public-key certificates to cardholders, merchants and payment gateways.

f. **Payment Gateway:** This is the system through which a merchant is connected to the payment system. This is the service that the payment service provides (acquirers) use to process the online payment information. It acts as an interface between merchant's website and the payment processing bank (acquirer). The payment gateway may be provided by a bank to its customers, but can be provided by a specialized financial service provider as a separate service, such as a payment service provider. It encrypts sensitive credit card details to ensure that the information is passed securely between the customer, the merchant and the acquirer bank.
When a cardholder sends payment details, the gateway performs variety of tasks to process the transaction. The credit card information stored in the secure servers of the payment gateway. The payment gateway sends information to the issuer for approval on behalf of the acquirer. After the authorization completes, gateway sends success message to the customer through the merchant website.

The following diagram shows in brief, flow of events in ETA:

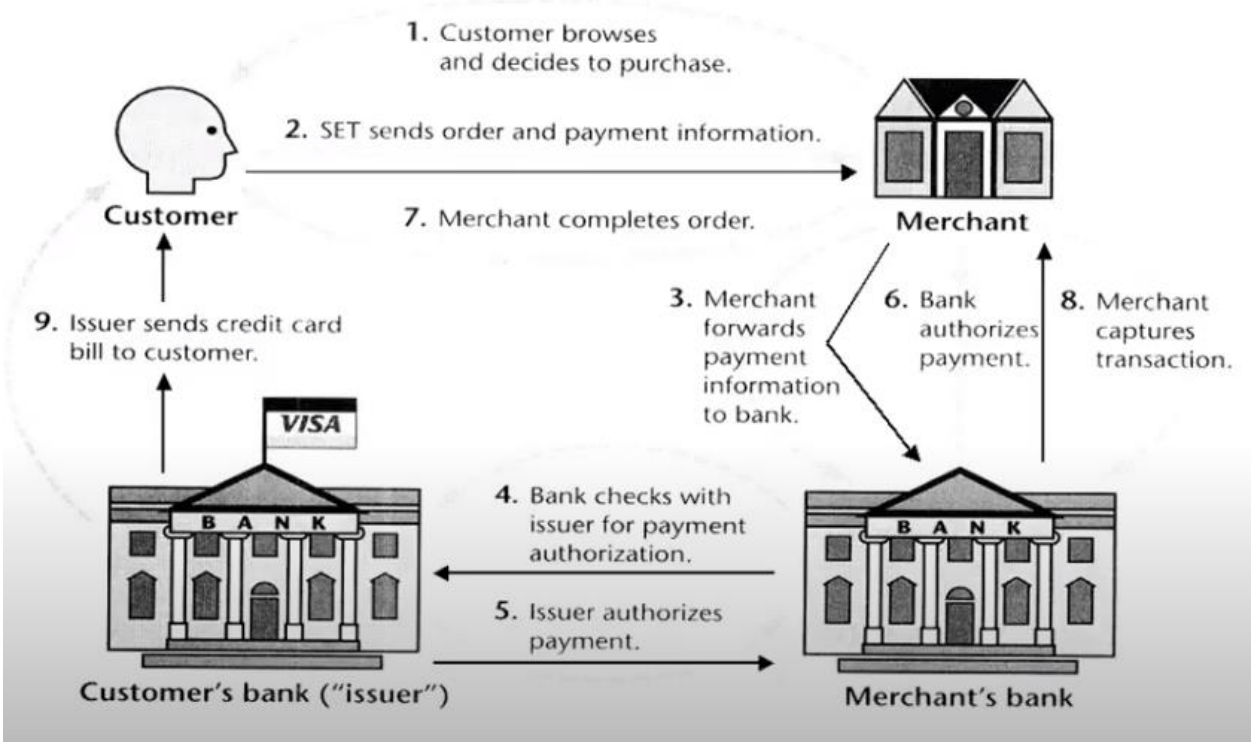


Fig: flow of events in SET protocol

To be cont ….