

A Survey on E-Payment Systems: Elements, Adoption, Architecture, Challenges and Security Concepts

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Abstract

Objectives: This paper is aimed at investigating and increasing awareness about various concepts related to Electronic Payment Systems (EPS) including its advantages, challenges and security considerations. The proposed study also evaluates the adoption of e-payment systems and the resulting impact on economy of a nation. **Methods/Statistical Analysis:** In this paper, a comprehensive survey on all the aspects of electronic payment was conducted after analysis of several research studies on online payment systems. The most recent references and information have been explored in order to gain significant information about electronic payments systems. **Findings:** From the study conducted, it can be elucidated that despite various issues that usage of electronic payment systems pose, these are identified as a positive step towards the economic development of a nation. Nevertheless, its full potential can be realized only by raising its awareness among people. **Applications/Improvements:** With the advancement in technology and popularity of Internet, the perception of making online transactions is bound to gain momentum. In the future, the payment modes currently used and supported shall see a declining trend owing to the numerous benefits offered by electronic payment systems.

Keywords: E-commerce, Electronic Payment System, Payment Gateway, Payment Gateway Security

1. Introduction

In person trading of products and services between two parties goes back to before the start of written history. With time, as exchange turned out to be more muddled and difficult, people represented values in an abstract manner, advancing from barter system through certified notes of money, cheques, payment orders, debit and credit cards, and nowadays electronic payment (or E-payment) systems. Some well-known issues or defects are found in the customary methods of payment: cash can be falsified, cheques bounced, and signatures forged. Contrary to

this, appropriately planned electronic system of payment can really give ideal security over conventional methods of payments, with the added advantage of pliability in usage^{1,2}. The ease of making monetary exchanges and additionally a more secure and faster access to capital resources, among different other components, has put e-payment system on a celebrated stride than the cash currency based system³⁻⁵. With intangible transactions becoming more impactful in overall economies and their prompt transference at little cost, conventional systems of payment have a tendency to be more expensive than the present-day strategies. Furthermore, processing on the

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internet can be of less worth than the smallest estimation of cash in the manual world⁶.

With the immense participation of the web in our everyday life, individuals feel accustomed to online exchange in E-Commerce for selling and purchasing of products and ventures. People are paying cash electronically over the Internet⁷. Moreover, the rise of web-based business has led to new money-related necessities that by and large can't be viably satisfied by the customary methods of payment. Following to this growing trend, related individuals are investigating different electronic systems of payment including issues encompassing electronic system of payment and digitized currency². Every single transaction that takes place online is made via payment gateways which act as points at which the financial organizations can be accessed. Payment gateways authorize and validate details of payment between different parties and the various financial organizations⁷.

This paper gives a detailed description aimed to increase awareness about the electronic payment system. The organization of the paper is as follows: The various definitions of an E-payment system and its related aspects have been provided in Section II. Section III discusses the adoption of E-payment systems followed by important security considerations of E-payment in Section IV. E-payment gateway model and the elucidation of its various security requirements and mechanisms have been given in Section VI. Finally, the paper is concluded in Section VII.

2. E-Payment System

As exchanges among different partners of business keep on proffering on the e-commerce platform, the previous cash-based system of payment was slowly replaced by the electronic payment systems⁸. The appearance of this advancement in the worldwide business platform prompted most business establishments to naturally change from the customary paper-based cash exchanges to an electronic system of payment which is generally known as the e-payment system. By and large, these electronic systems can be seen as a method of making payments for merchandise or services which have been established online using the internet^{9,10}.

An Electronic Payment System can be defined as a type of inter-organizational information system (IOS) for money related transactions, connecting numerous associations and individual clients. A need of complex interactions may be required among the partners, the

environment and the technology. The exclusive attributes of EPS/IOS also separate it from the conventional internal based systems of information; technologically, relationally and organizationally, it is more intricate and complicated¹¹⁻¹³, highlighting the significance of cooperation and the need to unite all aspects together¹⁴.

Notably, the global annual non-cash transactions facilitated by e-payment and mobile payment (m-payment) had been on the upsurge over the years, except for 2012 where it decelerates from an annual growth rate of 8.6% in 2011 down to 7.7% in 2012¹⁵. Furthermore, in 2014, volumes of worldwide non-paper exchange went upto 8.9% reaching 387.3 billion, the most noteworthy development rate since the first publication of World Payments Report. The growth was chiefly determined by quickened development in newly forming markets. The higher worldwide development is anticipated to have kept up in 2015, with assessments of a development rate of 10.1% which will make the non-paper exchange volume reach 426,300,000,000¹⁶. E-payment systems are important mechanisms used by individual and organizations as a secure and convenient way of making payments over the internet and at the same time a gateway to technological advancement in the field of world economy¹⁷. In addition, it has also become the major facilitating engine in e-commerce through which electronic business success relied upon. Electronic systems of payment had likewise realized proficiency, reduced rate of frauds and resourcefulness in the systems of world payment^{10,18}.

2.1 Various Definitions of E-Payment System

The electronic payment system is a comprehensive term, portraying various scopes of delivery through electronic multichannel. Its use for various purposes offers an amplified imprecision of characterizing e-payment in literature. E-payment can be seen from its capacities as e-banking, m-payment, e-cash, internet banking, online banking, e-broking, e-finance and so on. All things considered, recent researchers have demonstrated a few endeavors to come up with a definition of e-payment⁵.

The system of e-payment is characterized by⁸ as a type of financial commitment that includes the purchaser and the vendor enabled by the utilization of electronic infrastructures. Additionally, e-payment is viewed by¹⁴ as a type of inter-relation amongst associations and people

helped by banks and inter-switch houses that empowers financial transaction electronically.

Another point of view is put forward by¹⁹ who see e-payment system as any type of money exchange through the internet. On a similar note, as indicated by²⁰, a system of electronic payment alludes to an electronic method for making payments for merchandise obtained on the web or in markets and shopping centers. Another definition suggests that e-payment systems are payments made in electronic exchange conditions as exchange of money via electronic means²¹.

Besides, view electronic payment is viewed by²² as an exchange of money that happens online between the merchant and the purchaser. In addition, as per²³, electronic payments allude to money and related exchanges actualized utilizing means of electronics. E-payment is also defined as payment by means of electronic exchange of details of credit cards, direct credit or some other electronic means other than payment with money and cheque²⁴.

E-payment was characterized by²⁵ as an exchange of a fiscal claim by a payer on a party worthy to be useful. E-payment is defined by²⁶ as payments made via the automated clearing house, commercial card systems and electronic transfers. According to²⁷, e-payment is characterized as any trade of money started by means of an electronic correspondence channel. E-payment is defined by²⁸ as payments made by the use of electronic signals connected debit or credit accounts. As per²⁹, e-payment is observed as any sort of non-money payment that does not include a paper cheque.

Likewise, e-payment was seen by³⁰ as any exchange of an electronic worth of payment from the buyer to the seller by means of an e-payment channel that permits clients to remotely access and deal with their financial accounts and exchanges over an electronic system.

In general, an electronic payment system is an arrangement of monetary exchange amongst purchasers and vendors on online conditions that is helped by a digital financial instrument, (for example, electronic cheques, encoded credit card numbers, or cash in digital form) supported by a bank, a mediator, or by a lawful associate³¹.

2.2 History of E-Payment Systems

The history of e-payment can be traced back to 1918 the time when currency was first moved in the United States (U.S.) by the Federal Reserve Bank with the aid of

telegraph. However, that technology had not been widely used in the US until the time when their Automated Clearing House (ACH) was incorporated in 1972. Since that time, the electronic money turned out to be quite popular. This enabled U.S. commercial banks and its central treasury came out with an alternative to cheque payment¹⁰.

Credit card industry can also be traced back to 1914 when department stores, oil companies, Western Union and hotels started issuing cards to their customers to enable them to pay for goods and services. After about 40 years of credit card evolution, there have been increasing numbers of credit card usage as they have become more acceptable by people as a medium of payment, especially in transportation. Initially, credit cards were all paper-based payments, until in the 1990s when such cards were transformed to electronic completely. Due to the increasing number of credit card usage, the industry has grown rapidly which led to the introduction of a debit card too. Debit and credit cards are now used in transaction payments for all types of purchases or services rendered all over the world^{10,32}.

2.3 Types of E-Payment Systems

There are quite a number of e-payment services that have been developed within the payment system around the globe. These include electronic cheques, e-cash, credit cards and electronic fund transfers^{10,33}.

In general, online payment can be divided into two types: one in view of the Internet Banking Payment Gateway (IBPG) and one in light of the outsider payment platform. The first one is a sort of a direct mode of payment, and the client understands the online payment via an e-business framework which is connected to the banking framework. On the other hand, the second one involves money exchange from the account of purchaser to merchant's account by means of an outsider or third party payment platform. The IBPG lies amongst the banking process system and the Internet; it is a system which has been especially made for managing payment and payment authorization. The IBPG is the link which links the purchaser, vender and the bank. The online mode of payment which is based on IBPG cannot come into existence without the payment gateway³⁴.

According to the study of³⁵, there are four classifications of electronic payment systems worth mentioning: electronic cash, online credit card payment, small

payments and electronic cheques. They further stressed that every one of these systems has its own merits and demerits. It was emphasized that each type could be assessed through these four distinct qualities viz.: Technological aspect, Economic aspect, Social aspect and Institutional and law aspects.

In reality, we encounter two uniquely varied kinds of payment systems^{2,36}:

2.3.1 Internet-Based Payment System

The Internet-Based payment system comes in the following four modes:

2.3.1.1 Debit Card

One of the most generally utilized frameworks for e-payment is the debit card. The debit card technique consolidates the elements of the Automatic Teller Machine (ATM) card with Internet banking³⁷. A Debit card holder pays for his buys directly through the bank replacing cheque and physical money. In this system of debit cards, clients store money ahead of time into the bank and draw out the same at the time of buying. In the real world, there are two sorts of debit cards³⁶: i) Online debit card, and ii) Offline debit card.

2.3.1.2 Credit Card

This is other type of e-payment system in which there is utilization of the card issued by a monetary organization to the cardholder for making payments on the web or by means of an electronic gadget without the utilization of paper money³⁸. The most popularly utilized type of e-payment is the credit card. Contrasted with different EPS, it is not proper to use credit cards for exchanges of small value i.e., exchanges which involve not as much as a dollar³⁷.

2.3.1.3 Smart Card

This makes use of a plastic card installed with the microchip on which funds can be loaded in order to make instant payment of bills and transactions. Another name for the smart card is a chip card³⁸. Smart cards are able to store individual/related data about the business of client. In the same way, a chip card is used for storing cash which is lessened as per its usage. Smart card can be authorized with the help of a PIN provided to the client. These cards are secure because of the provision to store data in an encoded form and higher processing speeds. Some examples of smart cards are Mondex and Visa Cash cards³⁹.

2.3.1.4 E-Cash

This technique was produced as a contrasting option to the utilization of credit cards for buys over the Internet³⁷. It is a type of an electronic payment arrangement in which certain measure of cash is put away on a customer gadget and made open for transactions over the internet. Electronic money can further be alluded to as cash in digital form and it utilizes an e-cash software which is installed on the client PC or electronic gadgets³⁸. The standout feature of electronic cash is its low cost and hence is amongst the most encouraging strategies for smaller scale payments^{37,40}.

2.3.2 Electronic Transaction-Based Payment System

Internet-Based payment system has four modes:

2.3.2.1 Secure Electronic Transaction (SET)

The system of secure electronic transaction is an arrangement for online payments for guaranteeing the security of money related exchanges on the web. The SET determination is an open, technical standard for business, created by Master Card and VISA⁴¹. SET enables secure transactions by payment card over the web. A trust change throughout the system is created by means of a digital certificate, confirming vendor legitimacy and cardholders³⁶.

2.3.2.2 Cyber Cash

Cyber Cash is an online service that of its own processes and confirms client's credit card information and then charging the client's account and depositing the money in the dealer's account electronically. The servers of cyber cash act as a gateway between the trader on the web and bank's protected monetary system. Digital signatures are used by this system in order to maintain the security in electronic payment³⁶. While money in electronic form ('e-money') is a more extensive idea which refers to all PC based transfer of fund systems (for example ACHs, debit or credit cards) and the hardware involved with them (for instance, point of sale terminals, ATMs), cyber cash specially emphasizes on all money exchange systems which are being steered through the web. It is difficult to distinguish 'electronic money' from 'cyber cash', since the latter has been derived from the former and is currently bit by bit converging into it⁴².

2.3.2.3 Net Bill

Net bill payment system utilizes the internet for obtaining merchandise and various services and is able to make secure and economical payments for them. It is a micro-payment system where the net bill server is responsible for maintaining accounts for both buyers and sellers, which enables clients to pay vendors for products to be conveyed. The exchange of information goods comprises of conveying bits to the customer. This arrangement of bits may assume any internal structure, for instance, the search results of a database inquiry, a software program, or a page of text. Customers might be charged based on the number of items they use, or by a membership permitting an unlimited access, or by various other valuing models⁴³. There is a software with money tool which checks the products' receipts. Along these lines, net bill arrangement of electronic payment makes the money tool communicate with the dealers' server and net bill server³⁶.

2.3.2.4 First Virtual Holdings

It is one of the primary web payment frameworks that offered an outsider confirmation technique to make payment possible over the web. The first virtual system of payment is interesting as it doesn't utilize encryption. It is to be utilized solely for selling data over the Internet, as opposed to goods and services. It utilizes an automated telephone system to gather participant's payment information, the first virtual shuns digital signatures or cryptographic techniques of encryption and more likely depends on careful observation of purchases and sales so as to decrease fraud and misrepresentation⁴⁴. A principal viewpoint of the payment system is that some data is not supposed to go over the web since it is an open system. This data is essentially related to the credit card information. Rather than utilizing the numbers of credit cards, the exchanges are done by utilizing a first virtual PIN, issued by a first virtual organization. Since these PIN numbers work like ID they can be sent over the web and no seller can charge the client's account without getting an affirmation email from the client³⁶.

Since 2010, the cards as instruments of payment have shown fastest growth, which is evident from the fact that the use of cheques has declined in the last 13 years. Debit cards stand out among the other types of payment instruments and accounts for the highest share (45.7%) of worldwide non-cash money exchanges and have proved to be the fastest growing (12.8%) instruments of pay-

ment in the year 2014. These statistics allude to the fact that the security and convenience provided by the cards in comparison to other instruments of payment and the compatibility with the newcomers to build innovative series because of their easy payment infrastructure¹⁶.

Furthermore, the electronic mode of payment can be accomplished in a mobile environment as well. Various Android applications in smart-phones like Ngpay, Paytm provide an online service of payment. In case of the electronic payment system, these mobile applications work equally well on a Desktop computer. There are other ways in which clients employ their mobile phones for paying their transactions. By making use of the mobile internet, customers may transmit a PIN number, send an SMS message or utilize WAP to pay electronically over the internet. For E-payment, the vendors can authenticate a particular client's debit or credit card transaction by assigning an instrument to their mobile phones. In the United States, a conglomerate of late publicized Power Swipe, which is physically connected to a Nextel telephone, has a weight of 3.1 ounces, and involves a reader for magnetic stripe, goes through connector for charging the battery of the handset, and an infrared port for printing⁴⁵.

2.4 Advantages of E-Payment System

For the first time in history, a review by the Federal Reserve Financial Services Policy Committee shows that electronic payment exchanges in the United States have surpassed cheque payments. In 2003, the total number of electronic exchanges were equivalent to 44.5 billion dollars, while the quantity of cheques paid were equal to 36.7 billion dollars. Evidently, a pattern among buyers can be recognized; purchasers are seen to be more willing to work with electronic transactions and employing an automated medium to do their businesses.

As indicated in a review by⁴⁶, the ingress of the web has put electronic payments and exchanges on an exponential development rate. Customers could buy merchandise from the web and send credit card numbers in an unencrypted form over the system, which made the transactions quite vulnerable to threats and frauds. With development in e-payment systems, a wide assortment of new secure systems of payments have come up as customers turned out to be more mindful of their protection and security. As argued by⁴⁷, Electronic Payments have remarkable number of financial benefits in addition to their safety and ease of operation. These advantages when

expanded can go far in contributing hugely to financial improvement of a country.

Computerized electronic payments help develop deposits in banks and in this manner, increase reserves accessible for business credits – which is considered as a driver of financial achievement. As per⁴⁷, advantageous and secure electronic payments convey with them a noteworthy scope of full scale financial advantages. “The impact of introducing electronic payments is akin to using the gears on a bicycle. Add an efficient electronic payments system to an economy, and you kick it into a higher gear. Add better-controlled consumer and business credit, and you notch up economic velocity even further”.

EPS can be helpful in uprooting shadow economies, bringing masked exchanges into the banking system and help in bringing straightforwardness, cooperation, and confidence in the economic system. In addition to this, as specified by⁴⁷, there is a relationship between the rise in demand deposits and increase in point of sales volumes. “Automated electronic payments act as a gateway into the banking sector and as a powerful engine for growth. Such payments draw cash out of circulation and into the bank accounts, providing low cost funds that can be used to support bank lending for investment – a driver of overall economic activity. The process creates greater transparency and accountability, leading to greater efficiency and better economic performance”.

In a comparative account by⁴⁸, electronic payment is extremely helpful for the buyer. Most of the time, the user is required to enter his account related information - for example, credit card number and delivering address - once. The data is then kept on the retailer’s web server’s database. When the client returns to the webpage, he simply signs in with his username and password. “Completing a transaction is as simple as clicking your mouse: All you have to do is confirm your purchase and you’re done”.

Additionally, electronic payments are observed by⁴⁸ to bring down expenses of organizations. Less cash is spent on paper and postage with increasing number of electronic payments. Presenting the option of electronic payments can likewise help organizations enhance client preservation. “A customer is more likely to return to the same e-commerce site where his or her information has already been entered and stored”.

As indicated by⁴⁷, “Electronic payments can thus lower transaction costs stimulate higher consumption and GDP, increase government efficiency, boost financial

intermediation and improve financial transparency”. She additionally states, “Governments play a critically important role in creating an environment in which these benefits can be achieved in a way consistent with their own economic development plans”.

Likewise, the study by⁴⁹ bolster the reality that utilization of electronic payment systems holds the guarantee of tremendous advantage to both vendors and buyers as costs are reduced, more ease of use and higher security, dependable means of payment and settlement for a possibly immeasurable scope of products and enterprises offered worldwide over the web or other electronic systems. One such advantage is that electronic payment systems empower bank clients to deal with their everyday money related transactions without visiting their nearby bank office. Electronic payments could save dealer’s time and cost in taking care of money⁵⁰.

As signified by⁵¹, the asset cost of the payment framework of a country can represent 3% of its GDP. Since most electronic payment systems cost just around 33% to 50% of the paper-based non-money payment, clearly the social cost of a payment framework could be impressively lessened if it is computerized⁵⁰. Mechanizing and reshuffling electronic payments produced using self-serve channels, for example, ATMs, point-of-sale (POS) systems, and branch office terminals can lessen paper-based mistakes and expenses.

An examination work completed by Visa Canada Association as a team with Global Insight (A main monetary and budgetary counseling firm) discovered that electronic payment systems give proficiency in transactions to purchasers, traders, banks and on the whole the economy. Electronic payments have contributed \$C 107 billion to the Canadian economy since 1983 and comprise of about 25% of the \$C 437 billion aggregate development in the Canadian economy over the said period. Over the same two decades, \$C 60 billion of the expansion in Personal Consumption Expenditures was specifically inferable from electronic payments, with credit card having a major share in this development (\$C 49.4 billion) in comparison to debit cards (\$C 10.4 billion)⁵².

2.5 Issues of E-Payment System

In spite of the numerous advantages of the electronic payment systems, they have their own difficulties and challenges even in today’s technologically advanced world. The challenges which have been identified by previous

researchers are Infrastructure, Regulatory, Legal issues and Socio-Cultural issues.

2.5.1 Infrastructure

Infrastructure is fundamental for the effective execution of electronic payments. Appropriate infrastructure for electronic payments is an issue⁵³. For electronic payments to be fruitful, it is necessarily required to have a financially savvy and reliable infrastructure that can be availed by dominant part of the populace. In developing nations, large portions of the country don't have banks and have no access to basic infrastructure that drives electronic payments. In connection to this, a research work by⁵⁴ reveals that in Nepal, Electricity and Telecommunication are not accessible all through the nation, which contrarily influences the advancement of e-payments.

2.5.2 Regulatory and Legal Issues

National, provincial or global arrangement of laws, standards and different other directions are imperative prerequisites for the effective execution of e-payment plans. A significant portion of components incorporate guidelines on tax evasion, supervision of e-money organizations and commercial banks by supervisory specialists; central banks should keep an oversight on payment systems, buyer and information protection, participation and rivalry issues. As indicated by⁵³, the worldwide and virtual nature of e-payment additionally brings up legal issues, for example, which laws are relevant in debated cases and which jurisdiction will be competent, legitimacy of digital signatures and electronic contracts. A legitimate and administrative structure that builds confidence and trust helping technical endeavors is a vital issue to be tended to in executing e-payments.

2.5.3 Socio-Cultural Challenges

Social and cultural dissimilarities in outlooks and the utilization of various types of cash (e.g. utilization of credit cards in North America and utilization of debit cards in Europe) muddle with the job of building an electronic payment system that is relevant at a global level⁵³. As indicated by⁵³, discrepancy in the level of the security required and productivity among individuals of various societies and the degree of advancement worsens the issue.

Buyer's trust and confidence in the customary methods of payment make clients more averse to embrace new innovations. New innovations won't rule the market

until clients are sure that their privacy is ensured and satisfactory confirmation of security is safeguarded⁵³. New advances likewise need to stand the test of time so as to secure people's confidence, regardless of the fact that it is simpler to use and less expensive than the more established techniques⁵².

2.6 Popularly Used E-Payment Systems

One of the best apparatus that the Internet offers in today's world is the ability to shift one's business wherever they want by means of a website. This is the reason it became noticeably vital to buy by means of the Internet through numerous payment service providers. Payment Service Provider is an organization that offers online services related to marketing; it recognizes electronic payments by overseeing exchanges amongst vender and purchaser. The most well-known payment techniques that are typically provided are by bank transfer, real time orders and credit card.

Some popular systems of Online payments are⁵⁵:
1. Braintree, 2.Stripe, 3. PayPal, 4. Authorize.Net, 5. 2CheckOut, 6. Dwolla, 7. Worldpay, 8. Eway, 9. Samurai, by Feefighters, 10. Serve, from American Express, 11. Intuit GoPayment, 12. Icepay, 13. Amazon Payments, 14. Skrill (before Moneybookers), 15. WePay, 16. V.me by Visa, 17. Square, 18. Google Wallet/ Google Checkout

3. Adoption/Economic Growth of E-Payment System

Globalization in today's world is the result of innovative technological endeavors. The advancement in technology has changed the skyline of payment systems, moving towards e-World⁵⁶. Decisively, current innovation has changed customary systems of payment into a more proficient and viable system, which is free from the cash-and-carry disorder. The effectiveness of executing financial transactions and also a more secure and faster access to funds, among different other components, has put e-payment system on a more celebrated pace than the paper money based framework^{3,4}. Interestingly, in Nigeria, e-payment framework is picking up eminence to the degree that clients have now wanted to do financial transactions without going to the banks. Thus, time of money based payment framework is slowly blurring out as the cashless economy dominates present day financial systems^{57,58}. Lately,

e-payment system has turned into a standard through which fiscal element moves advantageously, particularly in a developing country like Nigeria where it is habitual to carry cash. In such a country, the e-payment system has shaped into an important starting point of her present-day economy; a well-working system of e-payment has been perceived to have much pertinence to budgetary strength, overall financial activity, and monetary policy⁵. In the meantime, the initiative for an economy that is not based on cash will be preferred in the new era only when it is supported with age advantage, good education, ownership of important innovative foundations, among different other components, appropriately set up by every concerned individual of the economic system and proficiently managed before forcing the citizens to comply.

A number of researches were done on the systems of e-payment and development of economy in the current time. The study of⁵⁹ inspected cashless systems of payment and monetary development and found a connection between cashless payment and the pace of financial development. The review discovered that cashless payment volumes are developing twice as quick in the developing countries as they are over the world. Likewise, World Payments Reports (2012) investigated the state and advancement of worldwide non-paper money systems and discovered non-cash payments make it less demanding and speedier for individuals and organizations to purchase products and enterprises, thrusting cash into the framework quicker and adding to the GDP⁶⁰. The conclusion of the review was like that of^{5,61} who investigated principal connection between electronic retail payment and general financial development utilizing information from over 27 European nations from 1995 to 2009 and came to know that relocation to proficient electronic retail payment empowers general financial development, utilization and exchange.

Apart from the safety and convenience, Electronic Payment Systems additionally have a significant number of financial advantages⁶². The chief financial advantage of EPS involves mobilizing investment funds and guaranteeing a large portion of the cash accessible to the nation and with the banks, making funds accessible to borrowers (organizations and people). Moreover, an electronic system of payment can track spending of a particular individual; to simplify the framework of services offered by the banks. This data is likewise helpful to

the administration when settling on financial adoptions. EPS likewise can diminish the cost on money handling and costs on printing. As per (Moody’s Analytics, 2010), genuine worldwide GDP on an average increased by an additional 0.2% per year considered to what it would have been without the utilization of cards. Basically, the use of cards develops a nation’s GDP by 0.2% every year⁶².

In a society where 90% of money is held outside of the banks to migrate to a cashless economy is a major transformation. It is subsequently a gigantic test for the government, money related establishments, people and different other partners in charge of making this framework accomplish its financial advantages. There are probably going to be economic, operational, financial and advertising changes that should be overseen in a proper manner⁵².

Conventional techniques of payment incorporate bank exchanges, debit cards, and credit cards. In 2014, the quantity of cards with a function of payment improved up to 766 million in the EU. The measure of exchanges by means of cards was 47.5 billion, with an aggregate estimation of 2.4 trillion dollars. However, individuals incline towards other choices or local solutions of payment. The scene of optional payments has advanced and is believed to assert 55% of e-Commerce revenue by 2019 as described in Figure 1³⁸.

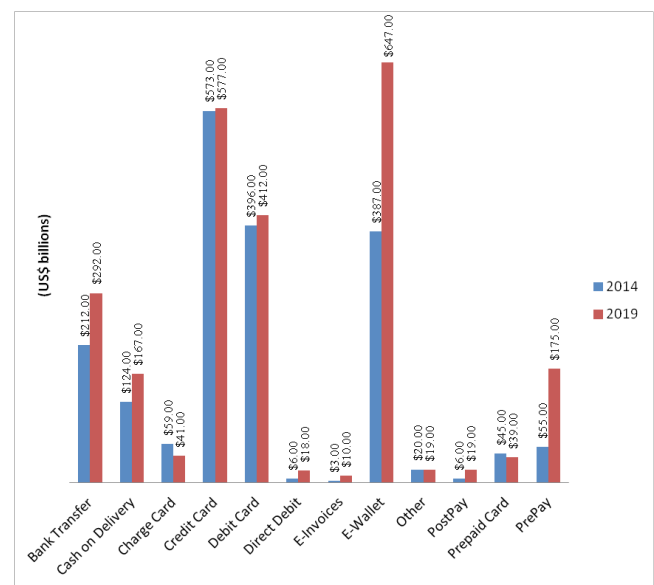


Figure 1. Future trends of payment methods[Source: Global payments report preview, Worldpay, November 2015³⁸].

4. Security of E-Payment Systems

In all information systems, the security of data and information is of significant importance. Data Security involves methodology, technology and practices which guarantee that data is secured from

- i. alteration or unintentional change (integrity),
- ii. unauthorized access (confidentiality), while
- iii. promptly accessible (availability) to approved clients on demand.

The electronic payment systems need to have all the above security features; an e-payment system which is not secured will not be trusted by its clients. And, trust is extremely important to guarantee acceptance from the clients. As indicated by⁶³, e-banking and e-payment applications have security issues as they rely upon basic ICT frameworks that make vulnerabilities in economic organizations, businesses and can possibly hurt clients.

4.1 Security Requirements in E-Payment Systems

A safe economic exchange electronically needs to meet some prerequisites. They may be stated as follows:

4.1.1 Integrity and Authorization

Integrity may be characterized as the validity, accuracy and completeness of data as per business qualities and desires. In payment systems, integrity implies that no cash is taken from a client lest a payment is approved by the client. Additionally, merchants need not accept any payment without the absolute permission of the clients; this is alluring when clients need to keep away from unwanted bribery⁶⁴.

4.1.2 Confidentiality

Confidentiality may be defined as the safety of private or sensitive data from unapproved divulgence. A few organizations included may want to have confidentiality in their exchanges. Confidentiality in this setting implies the confinement of knowledge about different snippets of data which are related to the exchange; the verification of payer/payee, buy content, sum and so forth. Commonly, members included want to guarantee that transactions are secret⁶⁴. Where untraceability or anonymity is sought, the prerequisite might be to make available this information to only certain specific subsets among the participants.

4.1.3 Availability and Reliability

Availability is guaranteeing that data frameworks and information are prepared for utilization when they are required; regularly communicated as the rate of time that a framework can be utilized for profitable work. All factions need to have the capacity to make or get payments whenever the need arises⁶⁴.

4.2 Enhancing E-payments Security

As per⁵³, the most widely recognized strategy for securing e-payments is utilizing cryptographic-based innovations, for example, digital signatures and encryption. On application, these innovations lessen speed and proficiency and thus trade off must be made amongst effectiveness and security. The following are a few means to secure e-payments:

4.2.1 Secure Electronic Transaction (SET)

This is an open standard created by Visa and Master Card to give an answer for security related issues for online payment system involving credit cards. This is accomplished by giving both client and dealer a digital certificate. As indicated by⁵³, this was not welcomed by people since it was complex and both client and dealer needed to download a software of 5MB.

4.2.2 3D Secure

It is an alternative to SET created by Visa SET and does not oblige to have a certificate for verification⁵³.

4.2.3 Smart Card Security

Information put on a smart card is encoded in nature and can't be availed without a PIN/password and hence good security is ensured. It is contended by⁵³ that smart cards are ousting cards involving magnetic strips i.e. credit cards, debit cards and so on. Legitimate arrangements, methodology and proper Government laws should likewise be set up to guarantee advancements, giving best possible security⁵².

5. E-Payment Gateway Model

In today's world, online shopping has become popular; the utilization of e-payment provides a large number of advantages to vendors as well as clients. For processing, the transactions that take place over the web must

go through a payment gateway. In practice, the payment gateways act as a link amongst financial organizations responsible for conducting the money exchange and the vendor's website⁶⁵.

In business over the Internet, different factions are included in E-Payment for selling and purchasing products. An electronic Payment Gateway is a fundamental part for online transactions and supposed to ensure the client that exchange is reliable and safe in every aspect of security⁷.

An E-Commerce Payment Gateway is a basic part of infrastructure to guarantee that such exchanges happen with no problems and the overall security over electronic systems is maintained. A Payment Gateway acts as an access point to the national banking system. Every single online exchange must go through a Payment Gateway to be handled. A Payment Gateway routes and confirms details of payment in amazingly secure conditions between related banks and different factions. The Payment Gateway works basically as an "encoded" channel, which safely routes details of transactions from the purchaser's Personal Computer (PC) to banks for authentication and countersignature. Upon approval, the Payment Gateway sends back the data to the vendor consequently finishing the "order", and giving confirmation⁶⁶.

5.1 Basics

An electronic exchange involves the following components⁶⁷:

1. Online client: A client is a person who will purchase items by making payments in a prompt way.
2. Merchants: A merchant is a vendor who will take the payments made by client.
3. Banks: It include two banks
 - i. Client bank: It is responsible for holding customer's bank account and approving the client while registering for the account.
 - ii. Merchant bank: It is responsible for holding merchant's bank account. It also manages the exchange and controls frauds.
4. Payment Gateway: It is associated with all clients, vendors and banks by means of the Internet and is in charge of security, reliability and speed of all exchanges that occur.

5.2 The Process

A Payment Gateway Transaction is performed in the following stepwise manner^{65,66}:

1. Customer goes to a website meant for shopping and chooses the products/services and taps the "Buy" button. A message goes to the site with respect to the customer's interest to purchase a product and make payment.
2. The server of the Web store, in the wake of accepting the request from purchaser, appends its own digital certificate to recognize the shopping center. At this stage, this message is referred to as a "Digital Order" and furthermore incorporates the IP address of the customer plus the sum he is supposed to pay. The Digital Order is then directed towards the Payment Gateway over a safe channel. Security is guaranteed by information encryption.
3. Based on the Digital Certificate, the e-Payment Gateway sends confirmation to the web store.
4. The Electronic Payment Gateway displays different payment choices to the purchaser on a screen.
5. Buyer picks the payment option he wants to use, which is transmitted through a safe connection to the e-Payment Gateway.
6. Electronic Payment Gateway transmits the details input by customer to the attaining bank (if it involves card exchanges) or merchant's bank (in case of other instruments).
7. The attaining bank transmits the data to the purchaser's bank (if it involves card exchanges) or purchaser's bank (in case of other instruments) by means of a safe connection.
8. Depending upon the credit limit and validity of the instrument used for payment, the issuing bank either acknowledges or turns down the exchange. The affirmation/dismissal message is sent to e-Payment Gateway by the attaining bank.
9. Electronic Payment Gateway sends the digital receipts back to shopping website and additionally to the purchaser.
10. The shopping web store can now transport the services/merchandise to the purchaser.

5.3 Architecture of Payment Gateway

Five participants are involved as shown in Figure 2.

1. Server (Electronic Payment Gateway) 2. Customer
3. Merchant 4. Client Bank 5. Merchant Bank

Online Shopper will be connected to the e-payment gateway by means of the Internet. The gateway will make a connection to the bank and check whether the customer's financial balances are sufficient to purchase the said item. The online client can likewise visit Merchant's site by means of the Gateway. The payment gateway has frameworks set up to interface with different banks, credit card organizations, clearing houses, and other economic establishments. In case of online credit card system, the company does the processing of credit cards for the vendors. For such companies, the payment processors process credit cards for the vendors and enable them to connect to its site. These kinds of organizations host the webpage for payments that asks the client to enter the information of their credit cards. After the client gives all his details and finishes the exchange, the payment processor checks these details and later directs the client back to the shipper's page⁶⁷.

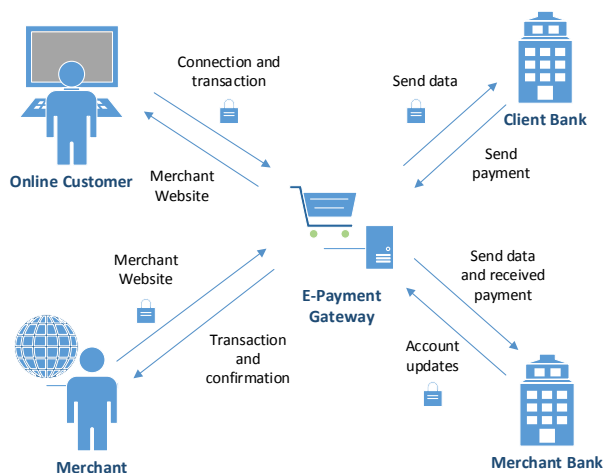


Figure 2. Payment gateway model.

5.4 Comparison of Payment Gateways

While making a choice for a payment gateway, the main considerations that should be considered are as follows: card types, transaction fees, recurring bills and form payments. These elements will fluctuate accordingly with the processor, so it must be guaranteed that payment gateway selected has to be in accordance with the needs and budget of the client⁶⁸.

5.4.1 Transaction Fees

Some payment gateways keep some part of the money charged for using their application when a payment is processed. Either a percentage of exchange is charged

or some flat rate is fixed for each exchange. Sometimes, a combination of both is used to calculate the charged amount.

5.4.2 Card Types

It is critical to recognize what sorts of debit or credit cards are acknowledged by the online payment gateway chosen. Moreover, a few processors oblige clients to connect their bank accounts instead of entering details of the card.

5.4.3 On-Form Payments

In the event that a pre-fabricated form incorporated with a payment gateway is utilized to gather money, this variable must be taken into account. Some gateways gather the right of payment on the form, while some others guide clients to another page to finish the buying process.

5.4.4 Recurring Billing

It gives the capability to create a payment that repeatedly occurs in a given timeframe. In the event that the clients are to be charged on a monthly basis, then an online payment gateway that supports recurring billing is required. Cases of organizations that may require this element are organizations which are based on subscriptions or NGO's with repeated benefactors.

By making a comparative investigation of payment gateways, different services and criteria are described below. Each one of these payment gateways concentrate on various elements such as currencies, cost, security, support, features and tools. These appear underneath in a tabulated form as given in Table 1 and Table 2.

5.5 Major Advantages of Payment Gateway

In the entire e-commerce activity, payment gateways have a key role to pay, from one perspective, it allows secure online exchanges of goods and services via the Internet. However, it guarantees security of the bank's financial systems via a security channel and it also acts as a link for both communications and commercial dealings of goods and services and the economic system, hence, it has joined together each member of e-business in one body⁶⁹.

A Payment Gateway is tremendously reasonable by virtue of the numerous advantages it has to offer which include:

- The evident 365 x 24x7 availability

Table 1. Different factors of comparison for payment gateways

Payment Gateway	Bundled Merchant Account	Cost	Setup Cost	Chargeback fee	Currencies	Countries	Card Types
PayPal Standard	Yes	\$0 monthly 2.9%+\$0.30 per transaction	\$0		25	203	9
PayPal Pro	Yes	\$30 monthly 2.9%+\$0.30 per transaction	\$0	\$20	23	3	9
Authorize.net	No	\$25 monthly 2.9%+\$0.30 per transaction	\$49	\$25	11	5	6
2Checkout	Yes	\$0 monthly 2.9%+\$0.30 per transaction	\$0	\$20-\$25 (for US-based sellers) \$25-\$65 (for others)	87	200+	8
Stripe	Yes	\$0 monthly 2.9%+\$0.30 per transaction	\$0	\$15	100+	25	6
Brain Tree	Yes/No options	\$0 monthly 2.9%+\$0.30 per transaction	\$0	\$15	130+	44	6
WePay	No	\$0 monthly 2.9%+\$0.30 per transaction	\$0	\$15	1	USA	4
Amazon Payments	Yes	\$0 monthly 2.9%+\$0.30 per transaction	\$0	\$20	11	3	6
Dwolla	No	\$0 monthly \$0.30 per transaction (free from purchases under \$10)	\$0	\$15	1	USA	Limited Bank Account
Bean Stream		\$0 monthly 2.8%+\$0.30 per transaction	\$0	\$25	2	3	3
Chargify		\$149+ monthly	\$0		23	Based on your Payment Gateway	Based on your Payment Gateway
First Data		\$0.75 monthly	\$0	\$15	140	50+	5

Table 2. Provision of user-friendly features by various payment gateways

Payment Gateway	Mobile Payments	On-form Payments	Recurring Billing	Requires SSL	Phone Support	E-mail Support
PayPal Standard	☑	☒	☑	☒	☑	☑
PayPal Pro	☑	☑	☑	☑	☑	☑
Authorize.net	☑	☑	☑	☑	☑	☑
2Checkout	☒	☒	☑	☒	☑	☑
Stripe	☑	☑	☑	☒	☒	☑
Brain Tree	☒	☑	☑	☑	☑	☑
WePay	☑	☑	☑	☑	☑	☑
Amazon Payments	☒	☑	☑	☑	☑	☑
Dwolla	☑	☑	☑	☒	☒	☑
Bean Stream	☑	☑	☑	☑	☑	☑
Chargify	☒	☑	☑	☑	☑	☑
First Data	☑	☑	☑	☑	☑	☑

- Real-time authentication of debit/credit cards
- Proficient and rapid transaction handling
- Various payment alternatives
- Safe transference of details of transaction between purchasers, dealers and banking organizations
- Effective and flexible real time generation of reports
- Support for multi-currency settlements, if required
- Refund to customer is possible
- Vendors can dispose-off huge databases, complicated software and extensive processing
- CA (Certifying Authority) verified servers that are secure
- Cost-efficient collection of voluminous data plus added advantage of being verified for card validity
- Card hot-list access for filtering out fraudulent transactions
- Provision of value added services to issuing banks, acquiring banks and merchants
- Multi-host interfaces provision
- Simple and comprehensive administrative control
- Strict security measures for gaining merchant as well as customer trust

Besides these, the payment gateways are beneficial to common man as well as the economy of a country as elaborated below⁶⁶:

5.5.1 Benefits for the Economy

- A homogenous and efficient payment system in a country having a variety as well as a large number of customers and banks
- Capability to stay at par with international payments mechanisms i.e. undertaking global level transactions in the split of a second
- Easing up on resources like money and human capital so as to invest in other crucial areas
- Lesser frauds and security lapses
- Evolution of novel payment instruments
- Tracking transactions and their maintenance that is beneficial to detect any irregularities in finance
- Support for a range of payment instruments, infrastructures and needs through a single platform
- Instant decision making owing to rapid flow of information
- Reduction in costs due to fewer intermediaries
- Easy processing of exports
- Rapid settlement and authorization leading to zero risks of bounced cheques and defaults
- Evolution of entirely new service providers for website development, maintenance, integration services, etc.
- Payments for government based services through a highly streamlined approach

- A payment infrastructure scalable for a variety of payment instruments and future applications
- No need to maintain costly infrastructure for shops/offices leading to business and government savings

5.5.2 Benefits for the Common Man

- Access to numerous counters simultaneously from a single location
- Highly secure transactions
- Easily accessible payment system in which customers make transactions directly from their homes
- Ability to make transactions in reduced time
- Comparatively reachable to the interior regions and rural areas of a large country like India
- Fewer intermediaries and savings from merchants for zero maintenance of shop infrastructure result in price reduction of services and goods
- Infrastructure availability and cost benefits make service providers willing to provide services or products in rural areas
- Increased Internet-savvy population in India as a result of reduction in prices that attract new users unwilling to shun traditional payment modes

5.6 Payment Gateway Issues

Not being a new concept, payment gateways are now being offered by service providers and few banks although in a restricted manner. Majority of them provide support for credit card transactions only, without taking into consideration other emerging payments instruments such as E-cheques, Electronic Funds Transfer (EFT), etc. However, in order to exploit the full potential of online electronic commerce, users should be given provision to adopt various payment options including ATM cards, EFT, E-cheque besides others. One more issue with the current payment gateways is the facility to make only Business-to-Business (B2B) or Business-to-Customer (B2C) transactions and thus neglecting worthwhile government businesses. Additionally, a single service is not able to suffice the variety of transactions and multiple banks. Many issues, therefore, debilitate the propagation of payment gateways. At the outset, payment shall fail straightaway if a user does not possess account with the bank that supports a particular payment gateway. Moreover, payments gateways at present have a few number of banks only. Besides these, other issues include problems with delivery, lack of trust, limited payment

avenues and reliability among the users plus reservations about service providers. At macro level, the concerns regarding usage of payment gateways require international intervention and cooperation among the agencies. Some of those issues have been enlisted below⁶⁹:

- Conflicts in regulation
- High costs
- Covert fee structure
- Insufficient support for various types of international currencies
- Statutory hassles
- Exigency of standards
- Interoperability tribulations
- Maintenance and ownership concerns
- Bigoted conduct of merchants on charge backs and disputes
- Acquiring agreement for a payment infrastructure on national level
- Expenses of international deals

6. Security Considerations in Payment Gateways

As more and more people are connected to the Internet, the popularity of online commercial activities is growing as well⁷⁰. The usage of payment gateways comes to the fore when people make online transactions. When online transactions are taken into account, payment gateway plays an important role since it intermediates between the bank and the merchant⁶⁵. This is because customers are required to input sensitive information while using payment gateway as the mode of payment. However, as online transactions are growing rapidly, security threats are also on the rise. Security is the main challenge in online transactions because it is the responsibility of the payment gateway to safeguard all sensitive information from fraudsters and hackers. This makes the provision of payment gateway security a must. Gateways, therefore, employ several protocols, encryption techniques and standards for providing safe and reliable service to the users. In this paper, few technologies and mechanisms have been discussed that are used by payment gateways to further enhance security features of online transactions.

6.1 Features of a Secure Payment Gateway

A payment gateway forms an integral part of e-business. The users are prompted to input their personal

information while making transactions online. With the growing popularity of online payments, security threats in the form of malware, theft, hacking, spyware, data security breaches and phishing are also increasing. Thus, payment gateways should be such that they cater to the needs and requirements of the users besides providing privacy and security. A secure payment gateway is characterized by the following four properties viz. confidentiality, integrity, authentication and non-repudiation.

Confidentiality refers to the prevention of disclosing data to unauthorized people²¹. This is important since the card details of customer are transmitted through payment gateway and thus secrecy of such details ought to be assured. Integrity implies the prevention of data modification present in the communication channel by unauthorized means²¹. Therefore, data integrity should be maintained between the payment gateway and merchant besides payment gateway and customer. The verification of identities of the participating entities is called Authentication²¹. Mutual authentication between the participants and payment gateway is a must. Furthermore, non-repudiation ensures that no entity participating in a transaction claims not to have participated in the same²¹.

It can be concluded that security is the biggest issue for a customer. Customers will not be able to put their trust on payment gateways if authenticity and security are not ensured. So, security in payment gateways is considered as the principal feature responsible for enhancing their usage thereby promoting e-commerce. Various protocols and techniques are utilized for enhancing payment gateway security.

6.2 Security Mechanisms in Payment Gateways

The research work carried on the security aspects of payment gateways include various security mechanisms for enhancing the security of information details transmitted online. Such mechanisms incorporate protocols, security standards, encryption techniques and hashing.

6.2.1 Data Encryption

It is one of the chief security mechanisms employed in payment gateways. It is the responsibility of payment gateway to ensure the protection of information (credit/debit card details) supplied by the customer from various types of network attackers. This sensitive information is

forwarded by payment gateways between customers and merchants in a secure way with the help of this method. The algorithm employed for data encryption and key value determines the transformation of data. This payment information when received by payment gateway is encrypted using public key of the payment gateway. The decryption is possible only with the private key of payment gateway. So, the encryption process is secure only as long as the keys are kept secret and this keeps the unauthorized parties from decrypting the data in encrypted form²¹. In this way, the data integrity is enhanced between the payment gateway and merchant as well as the payment gateway and customer since no one can perform modification of data during its transmission through the network. Thus, this method safeguards the customer's details from getting misused or stolen²².

6.2.1.1 Data Field Encryption

Also known as end-to-end encryption, this method makes use of industry standard encryption for preventing sensitive information to be read at the entry point only. Since the decryption key is accessible to authorized parties only, the card details encrypted by payment gateway can be read by just those who acquire the decryption key. Therefore, the access of the customer's details by unauthorized parties is reduced during the data transmission from payment gateway to bank²².

6.2.1.2 Cryptography

Cryptographic techniques can be categorized as: i) Symmetric cryptography and ii) Asymmetric cryptography²².

In symmetric cryptography, the same key is employed for encryption as well as decryption. This security mechanism resembles a traditional lock and key in which the encryption algorithm works as a lock and the card details can be locked or unlocked with a cryptographic key.

In asymmetric cryptography, encryption and decryption are done using two separate keys viz. the private key and the public key. This mechanism resembles an electronic lock on a safe where encryption is done using public key and decryption through private key. The customer's sensitive information is encrypted by the payment gateway with a public key that is known to everyone. It can however be decrypted by the acquiring bank using the private key of gateway that is kept secret. Asymmetric cryptography has some disadvantages like

the keys shared between participating entities have to be updated at regular intervals for providing a secure service and that it is slower as compared to symmetric cryptography.

6.2.1.3 Secure Socket Layer

A secure network protocol - Secure Socket Layer (or SSL) is used in servers and web browsers. It employs certificate authentication to transfer private data by creating a channel that is encrypted uniquely. This protocol is employed by payment gateways for providing better service for customers as well as merchants in terms of security. Fundamentally, point-to-point links are secured by SSL at session layer using two core encryption mechanisms – symmetric and asymmetric encryption. For symmetric encryption, Triple-DES, RC4 (Rivest Cipher 4), RC2 (Rivest Cipher 2), DES (Data Encryption Standard), IDEA (International Data Encryption Algorithm), AES (Advanced Encryption Standard) and Camellia are employed. And for asymmetric encryption, DSA (Digital Signature Algorithm), Diffie-Hellman key exchange and RSA (Rivest-Shamir-Adelman) algorithms are employed. In order to maintain a highly secure communication, SSL encodes the entire session. Other protocols employed in SSL include⁷²:

- SSL Record Protocol: It is used for data encapsulation using high-level protocols.
- SSL Handshake Protocol: It is used for authentication of server and client.

One of the great advantages of SSL is its independence from application layer so that it can be used to build higher level protocols transparently. As a consequence, this protocol is employed by majority of payment gateways for transferring data securely between the participating entities.

6.2.1.4 Secure Electronic Transaction

Another standard protocol which is used as a security mechanism is Secure Electronic Transaction (SET) that was developed by MasterCard and Visa in collaboration with companies namely VeriSign, Netscape and Microsoft. Any transaction through SET involves three entities – merchant, payment gateway and customer⁷¹. The security features provided by SET include:

- i. A secure channel of communication between the participating entities.

- ii. Restricting sensitive information to authorized parties only thereby providing privacy.
- iii. A provision of trust by employing digital signatures

SET employs encryption techniques such as public key encryption and symmetric/asymmetric encryption for transferring data securely among the participating entities. SET makes use of digital signature for sending credit card number of the customer that is kept secret from merchant. The resulting data item is referred to as PANSecret and is known only to the gateway and customer. Thus, SET ensures the secrecy of customer payment information from the merchant. This is because payment gateway encrypts the hidden data received with the help of a public key. Then, the hash values are compared in order to check if the purchase amount is valid. Furthermore, it performs verification of PANSecret and PAN for authenticating the account of cardholder. In this way, the basic security requirements i.e. confidentiality, integrity and authentication are satisfied using such a security mechanism. SET, therefore, provides a higher level of privacy and security to the participating entities by making use of digital signatures, verified messages and public key certificates.

6.2.1.5 Certification Authority

A novel approach for enhancing the payment gateway security was presented by Stephen Kent that authenticates the authorities using certification in order to make online transactions more secure. In this security mechanism, the first step involves the generation of Certificate Signing Request (CSR) that is passed to Certification Authority. The unsigned certificate is hashed by the Certification Authority followed by its encryption with the help of asymmetric algorithm. Subsequently, a signed certificate is issued by the Certification Authority to the customer. Therefore, as per this model, certification authority supplies digital certificates to users generating certificate signing request after verification of the same^{71,72}.

6.2.1.6 Public Key Infrastructure

A security mechanism is essential for safeguarding the sensitive information that is transmitted through payment gateways (like credit/debit card numbers) from unauthorized parties. Public Key Infrastructure (PKI) is another security mechanism that is employed for enhancing the security of e-commerce systems by taking the services of certification authorities, digital certificates and various other registration authorities. Based on public

key cryptographic technique, PKI makes use of two keys – public key and private key among which the public key is employed for signature verification and the hidden private key is employed for signature generation. The use of digital signatures ensures integrity, non-repudiation and authenticity of online transactions⁷².

7. Conclusion

The significance of electronic payment systems in global trade and commerce is quite evident from the changing modern trends. Their scope ranges from one dollar transactions to several million dollar transactions. This study gives a wide knowledge about electronic payment systems, payment gateways and their security considerations. However, it has been found that payment gateways pose some security issues despite their growing popularity and large-scale use. By looking through previous studies, it is possible to gain valuable knowledge about the pros and cons of currently available electronic payment systems as well as the available security mechanisms for the payment gateway. This paper has also analyzed the electronic payment systems from adoptability point of view with the aim to provide a better customer understanding and satisfaction.

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