E-Commerce in Pakistan:
Growth Potentials & E-Payment Solutions

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Abstract— **In Pakistan, millions of people have access to internet and now it has become essential part of their lives. It is now a driving force for innovation of all industries. After arrival of wireless service providers, internet users are growing rapidly. On the other hand, internet is still just a source of information sharing and social interaction. Its role in trade and business is limited. Some business organizations have adopted partial-ecommerce solutions but no pure-ecommerce business model is implemented throughout the country. E-Commerce plays an important role in economic development. It reduces cost of products and services and creates new job opportunities. Major obstacles in the way of ecommerce in Pakistan are absence of cyber law, poverty, illiteracy and lack of infrastructure. Apart from these, the most challenging one is lack of suitable electronic payments system. Existing systems are either unavailable in Pakistan or not suitable for local entrepreneurs. In this paper, current potentials for ecommerce growth are explored and a new protocol "Dual-Network E-Payments Protocol" is proposed. Protocol is based on combination of IP and GSM networks. It satisfies all desired characteristics of e-payment mechanism. The protocol is quite secure, trust worthy and suitable for local infrastructure.**

Keywords— Ecommerce in Pakistan; E-payments in Pakistan; Obstacles in the way of eCommerce; ECommerce growth potentials in Pakistan.

I. INTRODUCTION

At the present time, internet has become a platform for social interaction and collaboration. It allows people and organizations to communicate, exchange ideas and trade goods and services more efficiently [2]. In Pakistan, like other developing countries of the world, internet has already been established and accepted warmly for information and social interaction. But role of internet in commerce and trade (ecommerce) is still very limited. E-Commerce plays vital role in economic development by reducing cost of products and services. It promotes Small and Medium size Enterprises (SMEs) and allows them to compete with giants in same marketplace. Small business organizations in Pakistan are suffered badly due to political instability in the country especially after 9/11. In this situation, ecommerce has become very important solution for their growth. Pakistan is among those few countries that made remarkable performance in Information and Communication Technologies (ICTs). Banking and Information Technology industries also made excellent advancements in past decade. Country is producing thousands of IT professionals every year.

On the other hand, weaknesses like absence of cyber law, illiteracy and lack of infrastructure are standing in the way of ecommerce development. The biggest obstacle is unavailability of feasible electronic payments system. There is not a single suitable e-payment solution for entrepreneurs. As a result, they are unable to launch their online business. There are various e-payment systems working for secure transactions worldwide. But these systems are either unavailable in Pakistan or not suitable for local market especially for new entrepreneurs. In past few years, some telecom operators joined hands with commercial banks and lunched online funds transfer mechanisms. Easypaisa, UBL Omni, Zong Timepey and Mobicash They also provide online utility bill payments, branchless banking and mobile card purchases but these systems have nothing to do with ecommerce payments.

In this paper, "Dual-Network E-Payments Protocol" is proposed. The protocol is designed by keeping in mind the existing infrastructure of Pakistan and some other developing countries. For any e-payment system basic requirements are authentication, access control, confidentiality, integrity, fraud prevention, and non-repudiation [7]. Dual-Network E-Payments Protocol fulfills all required demands of any e-payment system in more efficient way. It works on two networks simultaneously: IP and GSM network. GSM network will be used for authentication and identification purpose. It minimizes the transaction cost and enhances customer trust. Protocol also guaranties accurate delivery of products.

II. ECOMMERCE IN GLOBAL ECONOMY

Electronic commerce can be defined as the exchange of information, goods, services and payments by electronic

means. After significant developments of Internet and WWW ability to exchange information is now exceptionally fast. Companies have realized this fact and are using the Internet as a tool to expand their businesses. E-Commerce is not just suitable for trading concerns but for manufacturing businesses, ecommerce helps them to purchase materials that they need for manufacturing of goods or provide services at comparably lower cost [12]. An additional advantage of ecommerce is that the internet is frequently active and there is no closing hour in virtual marketplaces. Internet based organizations are increasing at an exponential rate in recent years and have significant role in financial sector. The most recent statistics show that there has actually been a substantial progress in the ecommerce businesses in the leading markets (USA, UK, Germany, and France). Data shows that there was 15% growth in B2C ecommerce transactions in USA in year 2007-08. In other top five ecommerce markets, its growth rate was 25% [12].

Like developed nations, ecommerce is rising in developing countries like China, India, Brazil, and Malaysia. These countries have most significant rate of economic growth. E-Commerce adoption in developing nations is different from developed ones. Developing countries usually lack the required economic, legal, and physical infrastructures for ecommerce growth. In addition, these countries generally have different conditions, ethnicities and business philosophies, which in turn minimize the applicability and transferability of the ecommerce models designed by Western developed countries [16].

III. E-Commerce in Pakistan

Pakistan is still far behind in adoption of ecommerce as compared to developed countries. It has great potential. Country is enriched with IT professionals, innovative business minds but because of to some significant limitations like unavailability of optimal infrastructure, safety and security issues, very high-priced bandwidth charges, and last but not least the absence of acceptable e-payment mechanism. Apart from current enterprises the most potential ecommerce entrepreneurs are fresh IT graduates.

The State Bank of Pakistan (The country's central bank) issued a circular in 2000 and empowered banks to open internet merchant account. This was an expectation for advancement of ecommerce organizations but after ten years of that circular, only one commercial bank named Citibank introduced internet merchant account. We will have a discussion about these accounts in subsequent section. Pakistan has accomplished remarkable advancements in communication sector. IT infrastructure is establishing in the country but ecommerce development does sound far away.

IV. E-Payment system

Electronic Payment System is a method of transferring money over Electronic Media. The electronic transaction process takes place through internet among three participants: client; merchant; and bank [3]. A fundamental pre-requisite in e-payments system is that all participants should have absolute trust in the mechanism. Cryptography ensures the only way in which business can work quite similar to traditional paper based mechanisms [11]. For creating trust, certification authority (CA) certifies it. Hence, authentication is achieved. In internet security protocols, three popular techniques are used. These are encryption, certification and hash functions for achieving above characteristics. [7].

There are three building blocks of security mechanism. Encryption: provides confidentiality, authentication, and integrity; Digital Signatures: provides authentication integrity, and non-repudiation; Checksums/ Hash algorithms: provide integrity and can authentication [09]. Cryptography is the backbone of e-payment systems. An ideal e-payment system must be suitable for small, medium and large payments. Transaction cost should be as limited as possible [07].

V. Characteristics of E-Payment System

Some desirable characteristics of money are discussed here briefly. The first one is atomicity that means either a transaction takes place completely or it does not occur at all. Second one is consistency that means all relevant parties must agree on important facts of the exchange. Next is isolation that means transactions should not conflict with each other, and the outcome of a set of overlapping dealings must be equivalent to some sequence of those transactions executed in non-concurrent serial order. Some essential requirements of any e-payment system are discussed in detail as below.

A. Trust

Trust is the willingness of a party to be vulnerable to the actions of yet another party based on the hope that the other will perform a particular action, regardless of the capability to monitor or control that other party [02]. Reputation models are used as methods to optimize trust in ecommerce environments. E-Commerce titans like eBay and BizRate have used aggregated feedback from many of their customers to enhance the trust of potential upcoming customers in them [06]. Reputation is the most significant factor influencing consumers' willingness to shop at and willingness to pay for goods from a specific vendor [1].

B. Authentication

Authentication is a process by which we verify that persons participating in a transaction are the one they claim to be [02]. E-payment protocols like SET and SSL provide authenticity using digital certificates. Digital Certificates work like driver's license is used in a physical exchange. A trusted third party recognized as Certification Authority (CA), issues the digital certificate. Parties concerned in an exchange make use of the certificates to guarantee the other that they are not an imposter, which is absolutely essential prior to exchanging secret or public keys. Authentication is required to guarantee non-repudiation of users as well of network factors.

C. Integrity

Another important e-payment system prerequisite is to keep integrity of the messages transmitted in the transaction. It

is a proof that the communication was not changed in the way from sender to recipient. The conventional form for attaining this protection is to stamp the letter envelope with the wax seal. In e-transactions, the seal will be a series of bits linked with the message. This series of bits is known as hash value of message. A hash function turns a sequence of characters of any size into a string of characters of a fixed length. If the hash algorithm is known, any entity can easily calculate the hash value from the message using that hash function..

D. Confidentiality

Confidentiality means that the contents of messages being interchanged must be held private. If credit card numbers or financial institution account detail is being sent, it is extremely important that it must be kept private by using encryption. When security is applicable, it is physically guaranteed by restricting accessibility to records or maintaining only approved person in privy of the information [06]. Usually symmetric encryption algorithms are used for information secrecy. They offer appropriate level of protection as well as efficiency.

E. Non-repudiation

Non-repudiation involves that the originator of a message should probably not be able to reject it later. Non-repudiation provides help in upcoming conflicts. There must be a system to make sure that an unbiased third party should determine whether an entity did take part in a deal. In daily life this is achieved through the use of personal signatures of legitimately approved parties. In ecommerce digital signatures can be applied to associate the identification of engaging entities with messages and also with purchases. Digital signatures are actually cryptographic constructions which usually utilized a hash function to create a digest of the message to be signed and after that encrypt that digest with the private key of the entity [17].

VI. POPULAR E-PAYMENT SOLUTIONS

The most working e-payment solution is credit card based system and the second notable payment method in ecommerce world is PayPal. Figure 1 shows the ecommerce transactions using different payment systems.
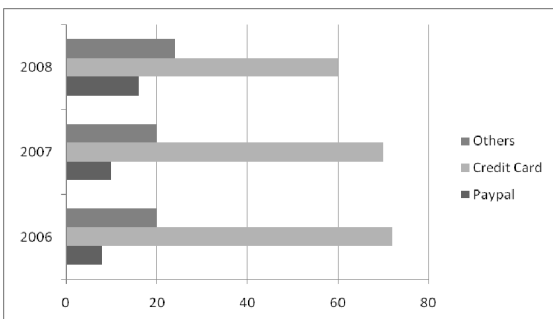

Fig 1: E-payment Solutions in global eCommerce *[12]*

In recent years we see notable decline in credit card usage because it lacks trust. On the other hand PayPal's popularity is increasing every year even it is not available in all countries.

VII. CURRENT E-PAYMENT SOLUTIONS IN PAKISTAN

State Bank of Pakistan in his "*First Quarterly Report on Retail E-Payments and Paper Based instruments*" published in *July –September, 2010* reported that during 1st quarter of 2010 the volume of total E & Paper Based Payments registered a decrease of 0.9 percent against 6.9 percent increase in the previous quarter and value of total retail payment transactions registered an increase of 3.9 percent against 4.8 percent decline in the previous quarter.

Entrepreneurs have limited services for ecommerce payments. The fastest and most convenient method to pay for a product is to pay by means of credit card. To accept a credit card, merchant need to have a merchant account. In just recently available scenario, Citibank is the simply just a bank who offer true online merchant account. It is the only financial institution in Pakistan that serves up internet merchant account services for e-businesses established in Pakistan. But for small or new businesses merchant account is not a choice. Due to its high setup cost and hard approval policy it is not suitable for local merchants. Additionally, it is also essential to accommodate credit card transfers that company must have to get SSL certificate for website. It will also demand a complete method to function credit cards and securely store credit card data. This choice is really expensive and cost is very much. For modest company, it would be much better to avoid beginning directly using a merchant account.

A. Citibank Merchant Accounts

Citibank offers e-Merchant Accounts at some branches in Pakistan. This service accommodates only VISA card and MasterCard. These both groups are partners of Citibank. A bare minimum 15 days' time interval for settlement processing is necessary. This shows that right from time of ordering money in the bank is normally up to thirty day period. This thing not only discourages entrepreneurs from running ecommerce services, but also places an unfavorable financial stress on small and moderate businesses with small cash flows. As the recovery time for transfers is particularly long, vendors are unwilling to make investments. For the purpose, they have to wait for a month for recovery. Customers are also dissatisfied by absence of security certifications and the perceptions regarding lack of safety and security in online operations.

B. Easypaisa

In 2009, Telenor Pakistan in conjunction with Tameer Microfinance Bank launched "easypaisa" for processing bill payments and money transfers. This service is not for ecommerce payments but provides basic funds transfer and card purchases. Customers simply need to present their cash and bills to agent who can complete the payment on a mobile phone. Sender simply needs to visit any authorized Easy Paisa outlet for remittances. He has to provide retailer the amount of money and his CNIC. Receiver's CNIC number is also

obligatory. Retailer will do the transaction using his mobile phone, and will inquire sender to enter a secret code. This code must be confidential. One time transaction is done, Sender will be given a Transaction-ID and hard copy of receipt. Sender and Receiver can receive transaction information by SMS if their mobile phone numbers are provided. Easypaisa also provides many other valuable services like Mobile Bill payment, mobile donations, flight tickets, and insurance. Summarizing above conversation, we can say that easypaisa started new trends in electronic money transfer and other services. But easypaisa still does not provide any solutions for ecommerce payments.

C. UBL Omni

UBL started "Omni" a different from conventional banking service and similar to "EasyPaisa". All mobile networks are supported with UBL Omni. It is a branchless banking service. User does not need to go to bank branch for availing banking services.UBL Omni provides many services. All regular banking services are available for Omni account holders. Services are included money withdraw and deposit, funds transfer, mobile cards loading, electricity, gas and telephone bill payments. Other services are web-portal access, WAP services, Visa card, ATM, UBL branch support etc. All these services are available to UBL Omni account holders. Everyone with CNIC and mobile phone number can open UBL Omni account. Account holders can avail services by visiting UBL "Dukaan".

Like "Easypaisa" UBL Omni also has nothing to do with ecommerce payments. E-Merchants cannot receive online payments from their customers by these services.

D. Alternate Solutions

PayPal is the most significant and the most commodious online payment processor with over thirty million subscribers. However, it is available only in thirty eight countries. Pakistan is not included among those. The ultimate approach to acquire a PayPal account for Pakistani entrepreneurs is to request a business partner or good friend residing in those thirty eight countries. They can open a PayPal account and accept payments on behalf of your organization. Moneybookers is also a virtual payment processor from Europe. It is really the only payment processor introduced in recent years that built a solid reputation for itself. Moneybookers account is accessible to people from all countries and its use is more convenient for both buyers and sellers at the same time. The only problem of Moneybookers is fewer users.

VIII. DUAL-NETWORK E-PAYMENTS PROTOCOL

Summarizing above discussion, we can conclude that the country needs a trustful and secure e-payment solution for desired advancements in ecommerce. "Dual-Network e-Payments Protocol" is a new protocol for secure and low cost e-payments in Pakistan. It achieves all requirements for desired e-payments discussed in previous sections quite simply. It satisfies all requirements such as trust, identification, authentication, integrity, confidentiality, privacy and non-repudiation.

A. Core Idea

GSM Based E-Payments Protocol uses two networks for achieving all desired properties of e-payments. GSM network is used for authentication, and integrity purpose. GSM currently provides solid security characteristics such as authentication and encryption over air interface. GSM supports circuit switched fixed channel architecture. This architecture can just provide 9.6 kbps data rate [15]. These days GSM is used by more than 800 million users in 190 countries of the world. It represents over 70% of the worldwide digital wireless market. GSM provides robust security features comprising authentication and data encryption. GPRS is a carrier service over existing GSM infrastructure that improves the GSM network functionalities by providing additional packet data feature. It permits both packets switched and circuit switched traffic to exist in the same GSM structure.

GSM Based E-Payment Protocol is simply a GSM based authentication protocol for e-payments using mobile phones. In the protocol that is proposed here, the mobile number is registered at the relevant Financial Organization). The protocol eliminated the need of Certification Authority (CA) and certificates for Merchants. It is observed that almost every internet user also uses GSM networks for calls and SMS purpose. Hence, the protocol does not impose any change in existing infrastructure. Protocol also provides integrity by integrity check using GSM network. Protocol is quite feasible and just ready to use because it will use existing infrastructure in the country.

Figure 2 show that customer is using two networks at a time: Internet for shopping and dealing with merchant; GSM network for authentication and confirmation purpose with bank. In figure 2 key processes are shown in sequential way. A commercial provides merchant account to entrepreneur and internet customer account to customer. Customer will open his bank account in existing way with minor amendments. Customer will register his SIM with bank for authentication purpose. Almost every potential customer has GSM network access. GSM networks are growing very fast throughout the country. Customer and merchant both must have account with same bank. Merchant have to be registered his account as per prudential regulations. Prudential regulations are rules and regulations for banking activities defined by State Bank of Pakistan (SBP). SBP issued a circular in 2000 for allowing internet merchant accounts in commercial banks.

After registration, customer will place online order to merchant via IP network. Customer will need registration with merchant as well. Customer after logging on the merchant's website could place orders. Merchant will generate order number after checking the PO and will send invoice to customer via IP network. Customer will send invoice number, related crucial order details to his bank via same IP network. After this, bank will send a message on customers SIM to authenticate either the customer is original or not. Customer will need to confirm by same registered SIM. After this, bank

will also confirm key purchase order details like amount, date, and order number. When bank will be satisfied with customer's information, it will update merchant as well. Merchant will need to authenticate himself in same way.
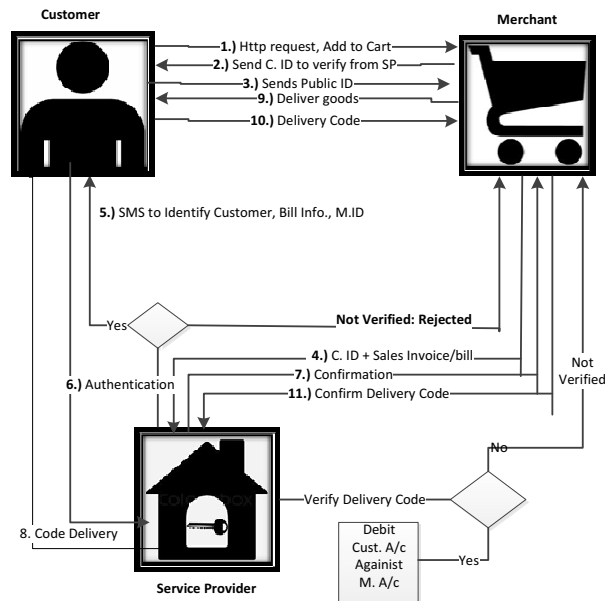

Fig 2:Protocol Process Flow

B. Participant and their role behavior

There are three participants in protocol: customer; merchant; and bank. Customer must have access to GSM network. S/he has to provide mobile number to bank for account opening. Bank will authenticate customer and verify transactions via GSM network. Sensitive transactions will be done via GSM network because it is secure.

Customer can create purchase order and authenticate payments. Customer usually initiate purchase request and provides personal details only to service provider. He provides only order related details to merchant. On the other hand merchant accepts order, generates sales invoice. He will have no access to customer's mobile number. Bank has key role in payment process. It will provide merchant account facility and normal customer account as well.

C. Security in Dual-Network e-paymentsProtocol

Dual-Network e-Payments Protocol is using two networks internet and GSM. All financial and sensitive information will be exchanged on GSM network. Authentication is done when real customer response from his mobile phone.

In Dual-Network e-Payments Protocol, privacy of mobile number is an important issue. Therefore, merchant has no access to mobile number of customer. Only bank will have mobile numbers of customer. It is assumed because bank is a trustful organization and it will take care of customer's privacy.
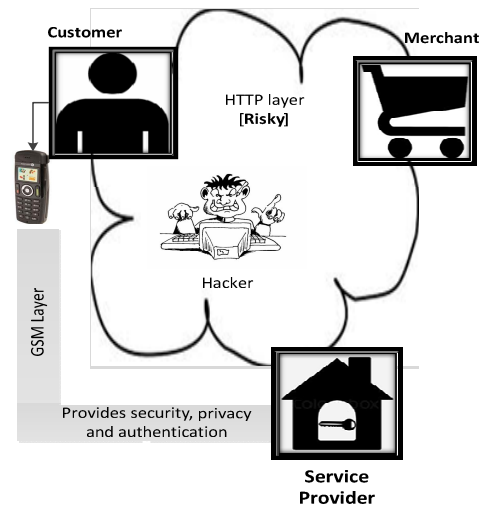

Fig 3:Security in Dual-Network e-paymentsProtocol

IX. CONCLUSION

Online payment is the biggest challenge for ecommerce industry in Pakistan. World's famous e-payment service providers like PayPal, Google Checkout, and Moneybookers are not providing their services to local entrepreneurs. Available solutions are either not secure or impose very high amount of payment overhead. For sustainable developments in ecommerce, suitable e-payment system is required. Apart from technical requirements, system must be cost effective. Dual-Network e-Payments Protocol is based on internet and GSM networks. This protocol is designed as per existing infrastructure of the country. It provides cost effective solutions. It satisfies all aspects of networks security including authentication, integrity, non-repudiation, and confidentiality. It is a secure e-payment system that has high potential for gaining trust of customers and merchants. This protocol can be implemented in other developing countries worldwide. Pakistan has exceptional potentials for ecommerce and ecommerce has excellent solutions for sustainable economic development of the country. It is important to overcome these basic obstacles. Government and country's central bank should play active role for resolution of legal and technical issues in its way.

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