



Electronic Cash over the Internet and Security Solutions

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**Abstract:** In Digital era, Electronic payment systems are becoming important to on-line shopping or business process to serve consumers faster and at very low cost. Electronic payment systems and Electronic commerce are linked together with each other that on-line consumers must pay for products and services. An important feature of electronic commerce is prompt and secure payment by security provisions and settlement of credit and debit claims. Electronic Cash is important concept in electronic payment systems through internet because it combines computerized convenience with security mechanisms. Electronic Cash can be used for making and receiving payments between consumer and merchant or for any money transaction. This paper includes different electronic payment systems, electronic cash, process, properties, components of electronic cash and security solutions provided through the internet.

**Key words:** Electronic payment systems, Electronic Cash, Components, Security solutions, Cryptography

I. INTRODUCTION

In Digital era, Electronic payment systems are using in banking, retail, health care, online markets and in government, in fact, anywhere money needs to change hands. Organizations are motivated by the need to deliver products and services more cost effectively and to provide a higher quality of service to customers. Research into electronic payment systems for consumers can be traced back to the many years, and the first applications credit cards appeared soon after. The emerging electronic payment technology was labeled electronic funds transfer is defined as any transfer of funds initiated through an electronic terminal, telephonic instrument, or computer so as to order, instruct or authorize a financial institution to debit or credit an account. [1]

Electronic Cash is an important concept to execute cash payments using computers connected over internet. To make it a reality with security and privacy of transactions, a number of security solution providers have come into being. Using software on the consumer’s own computer, the consumer can withdraw electronic cash from own account in a bank. The electronic cash is stored in the hard disk of the customer’s computer in an electronic wallet which can be spent by the customer for purchase of the items from any shop. Electronic cash can be used for making and receiving payments between customer and merchant or persons or for any money transaction. [2]

II. REVIEW OF LITERATURE

The new developments also require a rethinking of cash and the vision of a cashless society. In the sixties some of the drawbacks of cash became apparent and the vision of a cashless society built on electronic means of payment emerged.[6] Agimo (2004) define an electronic payment system as that payment by direct credit, electronic transfer of credit card details, or some other electronic means as opposed to payment by cheque and cash. Accordingly, an electronic payment system is any means used to make payment using internet. Many new payment services have come into existence in last years, most of which are based on technological innovations such as debit/credit cards or on the internet. [1]

Table I. Developments in Payment Systems

Year	Developments
1958	BankAmerica, in Fresno, California, executes the first mass mailing of credit cards
1967	Westminster Bank installs first automated teller machine (ATM) at Victoria, London, and branch.
1970	The New York clearing house launches CHIPS – the clearing house interbank payments system – which provides U.S. dollar funds transfer and transaction settlements online and in real time.
1975	Chemical Bank launches it’s pronto system providing 3000 computer terminals to customer homes linked to its central computers by telephone, it offers a range of facilities: balance inquiries, money transfers and bill payments.
1985	Electronic data interchange (EDI) extensively used in bank-to-bank payment systems.
1994	Digital cash trials by DigiCash of Holland conducted on-line.
1995	Mondex electronic currency trials begin in Swindon, England.
late 2000	Increase use of Real Time Gross Settlement (RTGS), NEFT, Automated Teller Machines (ATMs), Credit Cards, Western Union, Debit Card, Smart Card etc.

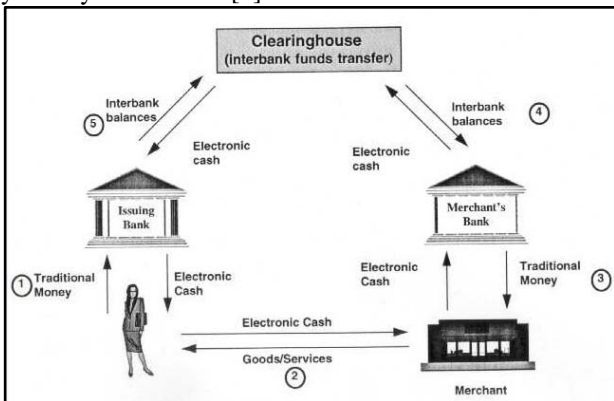


Fig 1. Electronic Cash [10]

Reserve Bank of India took the lead and developed effective electronic payment systems in India. Its mission was to promote a safe, secure, reliable and efficient payment system. To empower Reserve Bank of India to regulate and supervise payment and settlement systems, the Payment and Settlement (PSS) Act was enacted in 2007. It also provides a legal basis for multilateral netting and settlement finality. Reserve Bank of India has decided to set up a national organization to own and operate all retail payment systems in India. [8]

### III. OBJECTIVES OF THE STUDY

- A. To create awareness about electronic payment systems and electronic or digital cash.
- B. To encourage people to use cashless transactions using electronic cash in digital era.
- C. To make electronic payments process in secure manner.
- D. To create awareness about different types of security solutions available for internet.

### IV. PROCESS FOR ELECTRONIC CASH

Electronic cash main focus on replacing cash as the principal payment in a consumer oriented electronic payments. The consumer can use a web browser and website to see products offered for sale on the web and identifies the products and services available in different websites along their prices. After identifying the products the customer wants to purchase, and sends a purchase request to the consumer's bank server for sending electronic cash from bank account to own computer system. The message is in secured enciphered form. [2]

The bank server after checking authenticity of the request and balance in account then sends back a secure electronic cash packet which is stored in the electronic wallet of the consumer's hard disk.

The computer sends an order request to the merchant server along with billing and shopping complete address and the exact electronic cash required for buying. The merchant issues an invoice electronically to the consumer and sends the electronic cash to own account in the merchant's bank.

The merchant takes the necessary steps for delivery of the goods to the consumer. The merchant's bank sends the electronic cash packet to the consumer's bank. The consumer's bank after using the consumer's secret public key along with the secure packet received verifies and collects the actual amount to the merchant's bank that transfers this money to the account. The consumer collects and checks the items dispatched by the merchant at the shipping address.

### V. PROPERTIES OF ELECTRONIC CASH

Electronic cash presents some interesting features that should make it an attractive alternative for payment through the internet. Electronic cash must have these four properties: monetary values, interoperability, retrievable and security:-

- E-cash must have a monetary value, it must be deposited by either cash or bank authorized credit to merchant account.

- E-cash must be interoperable that is exchangeable as payment for e-cash, paper cash, goods or services, lines of credit, deposits in banking accounts and bank notes.[9]

- E-cash must be retrievable. Remote storage and retrieval allow users to exchange e-cash from home or office or while travelling or from anywhere.

- E-cash must be securable by security solutions like secure socket layer (SSL) or in encrypted form with cryptography solutions.

### VI. COMPONENTS IN ELECTRONIC CASH

#### A. Client Software and Merchant Software

Client software is required to execute e-cash through internet and client software available from various solution providers works on different operating systems and use of web browsers, require dedicated software for browsing encrypted information.

Merchant server software is required to execute e-cash through internet by solution providers to design custom application software for the merchant.

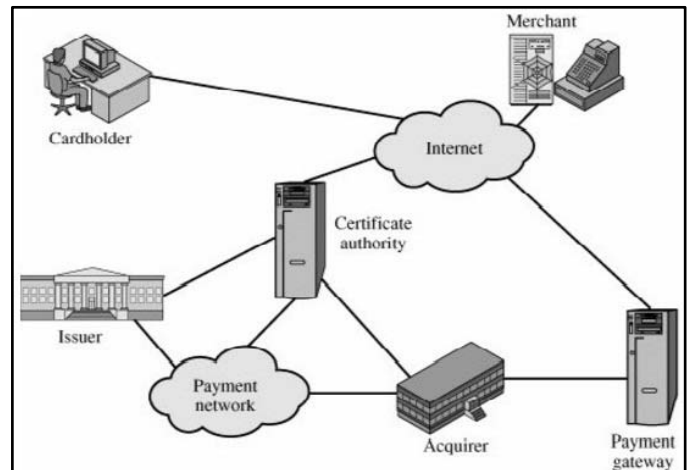


Fig. 2 - Electronic Cash Components [11]

#### B. Payment made by the Client

The client can pay using different electronic payment systems as credit card/debit card number or net banking, by e-cash from a concerned bank. The option depends on the solution being availed by the service provider to the client.

#### C. Payment to Merchant account

Payment paid by the client to merchant through different electronic payment systems and amount deposited directly to merchant account through clearing house or bank.

#### D. Transaction Cost and Applications

Presently in India, Govt. has waived off all the transaction cost on online transactions after demonetization to promote cash less transactions. Different electronic payment system is available for payments with applications include debit/credit cards, internet banking etc.

## VII. DIFFERENT ELECTRONIC PAYMENT SYSTEMS

### A. Credit card

A credit card is a plastic card issued to the users to use money for purchase of goods and services. The customer type the card number, expiry date and billing address on the order form and the vendor can verify the details and be confident of payment. Credit cards from visa maser card or any other network allow you to pay for purchase or services by borrowing from the credit card company. [3]

### B. Real Time Gross Settlement (RTGS)

RTGS refers to funds transfer systems where transfer of money or securities takes place from one bank to another on a real time and on a gross basis. [4]

### C. Debit Card

Debit card is a prepaid card and also known as ATM card. An individual has to open an account with the issuing bank which gives debit card with a personal id number, when anyone makes a purchase then enter pin number on shop pin pad. [7]

### D. Smart card

Smart card was first introduced in Europe most of these methods are known as stored value card. A smart card is about the size of a credit card, made of a plastic with an embedded microprocessor chip that holds important financial and personal information.

### E. Digital Wallet

Electronic wallets being very useful for frequent online shoppers are commercially available for pocket, palm-sized, handheld, and desktop PCs. They offer a secure, convenient, and portable tool for online shopping. [7]

### F. Internet Banking

Internet banking can be used for making payments and transferring money to any other account, it can be getting from bank having account and anyone linked with directly with his account by entering secret user name and password.

### G. Electronic Cash

Electronic Cash is a important concept to execute cash payments using computers connected over networks. To make it a reality with security and privacy of transactions, a number of security solution providers have come into being. Its versatility opens up a host of new markets and applications.

## VIII. ADVANTAGES OF ELECTRONIC PAYMENT SYSTEM

- **Time savings** - Money transfer between virtual accounts usually takes a few minutes that is fast service, while a wire transfer or a postal one may take several days.
- **Reduced risk of loss and theft** - Anyone cannot forget his virtual wallet somewhere and it cannot be taken away by robbers.
- **User-friendly** - Usually every service is designed to reach the widest possible audience by feature of user friendly. In addition, there is always the opportunity to submit a question to customer support team, which often works anytime.

Anyway anyone can always get an answer using the forums on the subject.

**Convenience** - All the transfers can be performed at anytime, anywhere 24/7. It's enough to have an access to the Internet.

## IX. SECURITY SOLUTIONS FOR ELECTRONIC PAYMENT SYSTEM

Internet security consists of the provisions and policies adopted by a network administrator to prevent and monitor unauthorized access, misuse, modification, or denial of a computer network and network-accessible resources. Internet security involves the authorization of access to data in a network, which is controlled by the network administrator. Users choose or are assigned a user name and password or other authenticating information that allows them access to information and programs within their authority.

The most common and simple way of protecting a network resource is by assigning it a unique name and a corresponding password. SSL (Secure Sockets Layer) is the standard security technology for establishing an encrypted link between a web server and a browser. This link ensures that all data passed between the web server and browsers remain private and integral. SSL is an industry standard and is used by millions of websites in the protection of their online transactions with their customers. The objective of internet security includes protection of information and property from theft, corruption or natural disaster while allowing information and property to remain accessible and productive to its indented users. These are important features of security – confidentiality, authentication, integrity, non-repudiation, non-deny, availability, identification. [1]

Implementation of technology solutions for all the security services is based on cryptographic techniques. Cryptography is the science of providing security for information. It has been used historically as a means of providing secure communication between individuals, government agencies, and military forces. Today, cryptography is a cornerstone of the modern security technologies used to protect information and resources on both open and closed networks. Cryptography is the study of "Secret (crypto-) writing (-graphy). The art or science encompassing the principles and methods of transforming an intelligible message into one that is unintelligible, and then retransforming that message back to its original form

Modern electronic cryptosystems use complex mathematical algorithms and other techniques and mechanisms to provide network and information security. Cryptography-based security technologies commonly use one or more of the following basic components to provide security functions:

- Encryption algorithms
- Message digest functions
- Hashed Message Authentication Code (HMAC) functions
- Secret key exchange algorithms
- Digital signatures

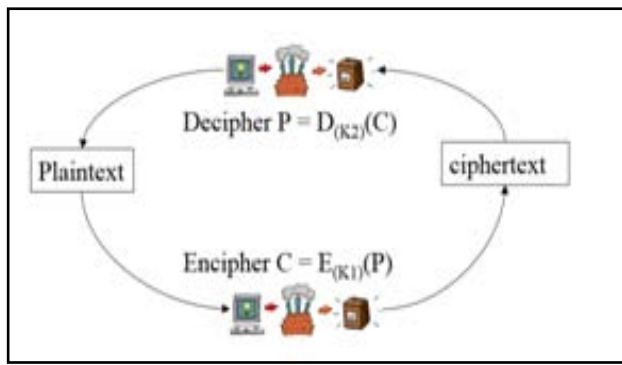


Fig. 3 Cryptography

- **Plaintext** -The original intelligible message
- **Cipher text** -The transformed message
- **Cipher** - An algorithm for transforming an intelligible message into unintelligible by transposition and/or substitution
- **Key** - Some critical information used by the cipher, known only to the sender & receiver
- **Encipher(encode)** - The process of converting plaintext to cipher text
- **Decipher(decode)** - The process of converting cipher text back into plaintext

Symmetric systems operate either in the block cipher or in the stream cipher mode. The secret key is shared between two persons or entities it is very important to be able to ensure the secure exchange of the secret key.

Asymmetric or Public Key Cryptosystems are built around the possession of a pair of keys – a public key and a private key – by each entity wishing to engage in secure communication. Public key is known to everyone and private key is known to the owner. The algorithm used to generate these keys is such that if either of the keys is used to encrypt a message only the other corresponding key is the key pair will be able to decrypt it. Public key cryptosystems are used to provide both the services of confidentiality and authentication. [5]

One of the most popular and widely used public key cryptosystems is the RSA algorithm – developed in 1978 by Ron Rivest, Adi Shamir and Len Adleman of MIT. [2] Digital signatures are not used only to verify the authenticity of the message and the claimed identity of the sender, but also to verify message integrity. Using RSA cryptosystem, a message is encrypted with the sender’s private key to generate the ‘signature’. The message is then sent to the destination along with signature. The recipient decrypts the signature using sender’s public key, and if result matches with the copy of the message received, the recipient can be sure that the message was sent by the claimed originator and that the message has not been modified during transmission.

A firewall is an integrated collection of security measures designed to prevent unauthorized electronic access to a networked computer system to protect private network and individuals machines from the dangers of the greater internet, a firewall can be employ to filter incoming or outgoing traffic based on a predefined set of rules called firewalls policies.

## X. CONCLUSION

Electronic payment systems are using in every field in banking, retail, health care, online markets and in government, in fact, anywhere money needs to change hands. Electronic Cash is important concept in online payment systems in current digital era, because it combines computerized convenience with security and privacy that improve on paper cash. Electronic cash presents some interesting characteristics that should make it an attractive alternative for payment over the internet. Implementation of technology solutions for all the security services is based on cryptographic techniques. Electronic Cash system is found to be more efficient, anybody can use it. Presently in India, Govt. has waived off all the transaction cost on online transactions after demonetization to promote cash less transactions.

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