

A CONCEPTUAL DESIGN OF ELECTRONIC BILL PRESENTMENT AND PAYMENT SYSTEM

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Abstract

The emergence of the internet has deeply affected the way in which the business is conducted. It has simplified transactions between entities by connecting them "virtually" it has enabled people to transact business online (i.e. order goods and services) as well as pay for them. The consumers used their credit card to pay online. Though the existing credit card-based electronic payment systems are simple in comparison to the digital cash and electronic checks, they suffer from a variety of drawbacks. Using such an electronic payment systems, may not be suitable for the developing countries due to the complexity and excessive cost associated with it; which may make it unpopular. This paper presents a framework for electronic bill presentment and payment for developing countries that enables the goods or service provider to present the invoice details electronically to the consumer who can access the information from any geographic location (having access to the internet) and authorize the payment.

Keywords: aggregators, bill payment, bill presentment, consolidator, credit card, electronic commerce, payer,

Introduction

With the rapid growth of information and communication technology, electronic commerce is now acting as a new means of carrying out business transactions through electronic means such as internet environment. Electronic commerce is the most recent step in the evolution of business transactions. It replaces (or augments) the swapping of money or goods with the exchange of information from computer to computer (Slater 2000).

Though the electronic commerce sounds like a great opportunity with low overhead, few employees and no physical location, several questions are needed to be addressed to resolve the issue of payment. Electronic commerce and electronic business greatly need new payment systems that will support their further development (Dennis 2002). On-line electronic payment systems are widely used in e-commerce and include wholesale payments, wire transfers, recurring bill payments, the automated clearing house, electronic draft capture, and electronic check presentment (Kalakota and Whinston 2000). On-line electronic commerce payments mostly involve credit card-based payment system.

Electronic bill presentment and payment (EBPP)

EBPP is the process in which the goods/services providers present invoices to its customers (either on their own or through a third-party provider) in an electronic format, which the customers can access using the internet, view the details, and authorize their payments through their banks. The entire process is electronic with minimal manual intervention.

Participants in the process of EBPP

Different entities participate in the EBPP process at different stages. These entities are – *Customer (or Payers)*. This is the entity that is responsible for making the final payment for the goods and services rendered to them. They could be individuals (e.g., buyers, consumers), other businesses, and government organizations. The payers are the ones that receive the invoice for their purchases and it is the replacement of this paper invoice by the

electronic format that is the main objective of Electronic Bill Presentment. Electronic Bill Payment takes the process a bit further by enabling the payers to make the payment electronically, thereby eliminating the need for paper used for such things as checks and money orders.

Billers – These are the entities that provide the goods and services that the payers desire. Billers can be individuals, businesses (e.g., telecommunications service providers), or government agencies (e.g., tax authorities). Billers are responsible for producing the invoice to be sent to the payers.

Banks (or Aggregators) – Most of the non-cash payment methods require banks to play a major role. The same is the case in EBPP where banks, as representatives of the payers and billers (there may be two different banks representing the payer and the biller), complete the payment and posting functions on their behalf. They make sure that the billers get the payment owed to them by the payers once it has been authorized. The processing takes place behind the scenes through entities like clearinghouses and lockboxes (where payments are physically processed in financial institutions).

Processors (or Consolidators) – Processors, as the name suggests, are the entities that are responsible for invoice preparation, deliver, and tracking of the invoice-related items. They are also known as consolidators or aggregators as they are a central point for the above-mentioned activities. For the purposes of processing the data for the billers, the processors charge them a fee. They are usually third-party providers (different from banks and billers). Another set of players that have joined the processors is the portals. Portals are like aggregators that perform the function of aggregating invoices for a set of customers that frequently access a network where all their billers would like their invoices to be displayed, e.g., the web sites of internet service providers (providing Internet access to their customers) could serve as the home site for invoice of all its customers.

Existing credit card-based electronic payment systems

Though the use of credit cards during electronic transaction added a new flavour in electronic commerce, there is nothing new in the basic process. The consumers, who want to buy a product or service, simply send their credit card details to the involving service provider and the credit card organization handles this payment like any other electronic transaction. Existing credit card-based electronic payment systems include: (a) the use of encrypted credit cards (e.g., *World Wide Web* form-based encryption) and (b) third-party authorization

Encryption and credit cards

An on-line electronic payment system using encrypted credit card suffers from several problems including security, risks and financial unattractiveness or micro-transactions. In this scheme, in order to make a truly secure and no refutable transactions using an encrypted credit card, each consumer and each vendor generates a public and a secret key, the public key is sent to the credit card company and put on its public key server. The secret key is re-encrypted with a password and the unencrypted version is erased. To buy something from vendor *X*, the consumer sends vendor *X* the message, “It is now time *T*, I am paying *Y* Naira to *X* for item *Z*” then the consumer uses his or her password to sign the message with the public key. The vendor will then sign the message with its own secret key and send it to the credit card company, which will bill the consumer for *Y* Naira and give the same amount (less a fee) to *X*.

Third-party processors and credit cards

A credit card-based payment system using third-party verification asks for the use of a third-party (i.e., a company that collects and approves payments from one client to another) on the internet. In third-party processing, consumers register with a third-party on the internet to verify the electronic micro-transactions. Here, the two key servers are merchant-server and payment-server. Using a client browser, a user makes a purchase from a merchant server by clicking on a payment URL (hyperlinks), which is attached to the product on a *www* page. The payment URLs send the encoded information including the details of purchase (e.g., price of item, target URL and duration) to the payment server. If the information entered by the customers is valid and funds are available, the payment server processes the payment transaction and redirects the user’s browser to the purchased item with an access URL, which encodes the details of the payment transaction. Using such a third-party in electronic payment systems, may not be suitable for the developing countries due to the complexity and excessive cost associated with it; which may make it unpopular.

Drawbacks of the existing credit card-based electronic payment systems

Though the existing credit card-based electronic payment systems are simple in comparison to the digital cash and electronic checks, they suffer from a variety of drawbacks:

- * The credit card companies need to maintain a public server with all the public keys.
- * Encrypted credit card transactions may not be micro enough to purchasing information.

If the encrypted credit card electronic payment system is extended to all of the small Naira services, available over the internet (e.g., ₦100 file transfers and ₦120 video game rentals), the overall processing load on key system components will likely become unmanageable or commercially nonviable unless a significant amount of automation takes place:

- * The companies maintaining credit-card based payment systems have to be big enough so that the costs for management and maintenance of the system do not entail considerable profit loss. Technological and financial strength of the company need to be pretty solid.

Since such a hurdle is not insurmountable; in order to resolve this issue in the developing countries, in this paper, a suitable electronic payment system is proposed, which does not require an on-line third-party connection. More importantly it is low-cost with necessary security incorporation thereby suitable for the developing countries.

Electronic bill presentment and payment (EBPP) models

Almost all of the variations of EBPP process can be structured under two models; direct biller and consolidator models.

Direct biller model

In the direct biller model, the biller presents the bill directly to the customer. The biller has complete control of all the data. Customers access their bills by logging onto the biller's web site. Billers create the electronic invoice by aggregating data from their own billing systems. Since they host the details of the bills, they have full access to monitor the customers' activities when they log onto their Web sites to view their bills. This provides the billers with a great opportunity market and sell more products and services to them. At the same time, they are responsible for customer enrollment and authentication and thus also have complete information on the customer profiles, which enables them to perform targeted marketing as well. Fig.1 shows the transactions that occur in a direct biller model. Since individual billers present their own bills, a typical customer would have to log onto multiple web sites to access all their bills. This acts as a roadblock to the success of this model.

Consolidator model

For customers who have multiple service providers and need the convenience of accessing all their bills from a single source, the direct biller model is cumbersome. The consolidator model addresses these needs by aggregating multiple bills and presenting them at a single location. In this model, the customers need to log onto just one site to access summaries and details of all their bills. This model transfer control of data from the billers to the consolidators who consolidate multiple customer bills and present them through an aggregate (e.g., banks, financial institutions). The aggregators use online applications to provide customers an interface to electronic bills. With the consolidators acting as the central link in this model. It is their responsibility to invest in infrastructure and open systems that communicate with numerous billers as well as financial institutions.

Consolidators perform the function of enrollment of customers thereby eliminating the need for customers to enroll with multiple billers. By doing so, the consolidators get access to key customer data that they can use to drive traffic to their Web site. They also manage the payment-processing functionality by providing debit information to consumer banks and sending credit information to the biller banks.

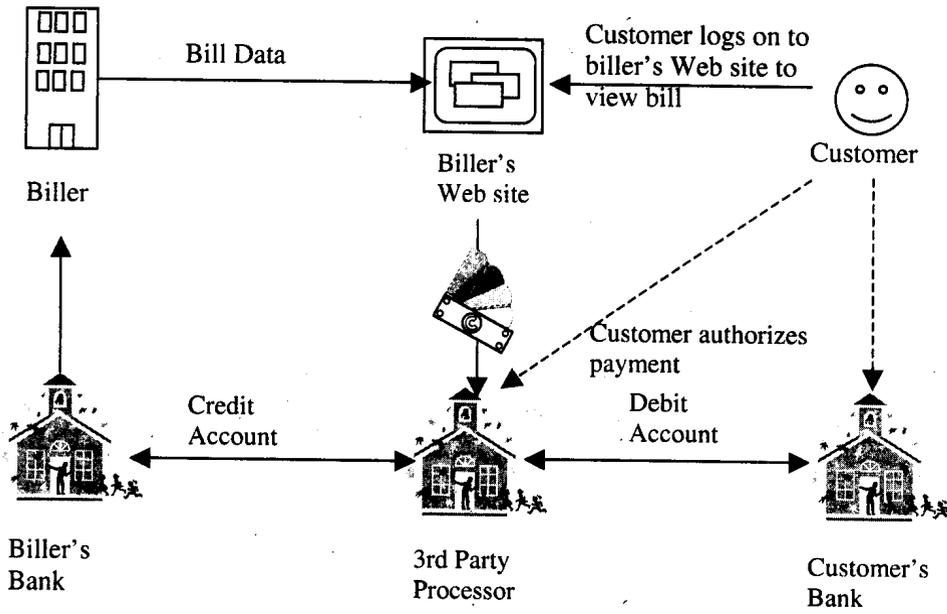


Figure 1: Direct biller model.

There are two basic variations to the consolidator model, namely, thick consolidator and thin consolidator.

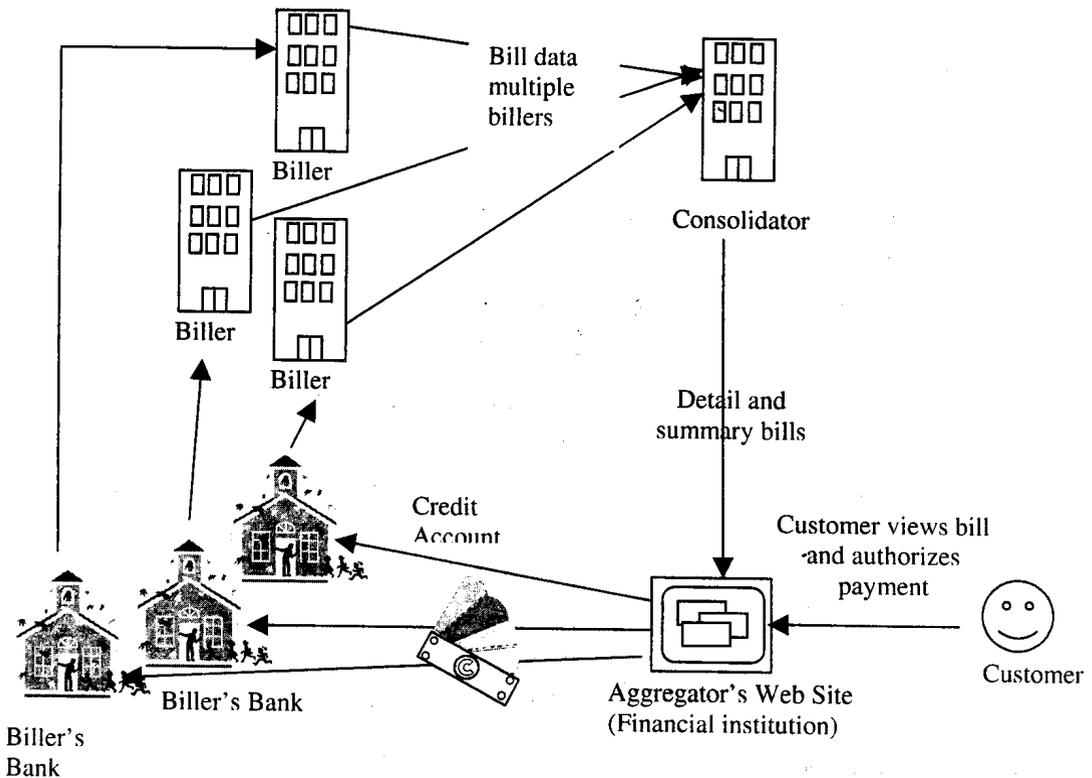


Figure 2: Thick consolidation model.

In the thick consolidator arrangement, the biller has the largest control over the bill and customer ownership. They send the billing data to the thick consolidator who is responsible for both presentment and payment. The thick consolidator hosts the bill summary and details and presents the bills to the customer through an aggregator branded web site. The aggregator, in most cases, is the customer's financial institution. Thus, the consolidator has access to all customer data that it can use to its own advantage. Figure 2 shows the transactions that occur in a thick consolidator model.

Thin consolidator

The thin consolidator model allows the biller to retain some control over the bill. In this arrangement, the billers produce the bill summary and details from raw billing data and send only the summary information to the consolidator or aggregator who aggregates multiple bills and presents them on web site. This summary bill is enveloped in the URL of the biller's web site so that the customer can easily access the details by clicking on the hotlink. The aggregators in this model include personal financial managers and financial sites of portals such as Yahoo or Netscape. The thin consolidator requires the biller to communicate with multiple aggregators, as its customers may use different institutions as the aggregators. Figure 3 shows the transactions that occur in a thin consolidator model.

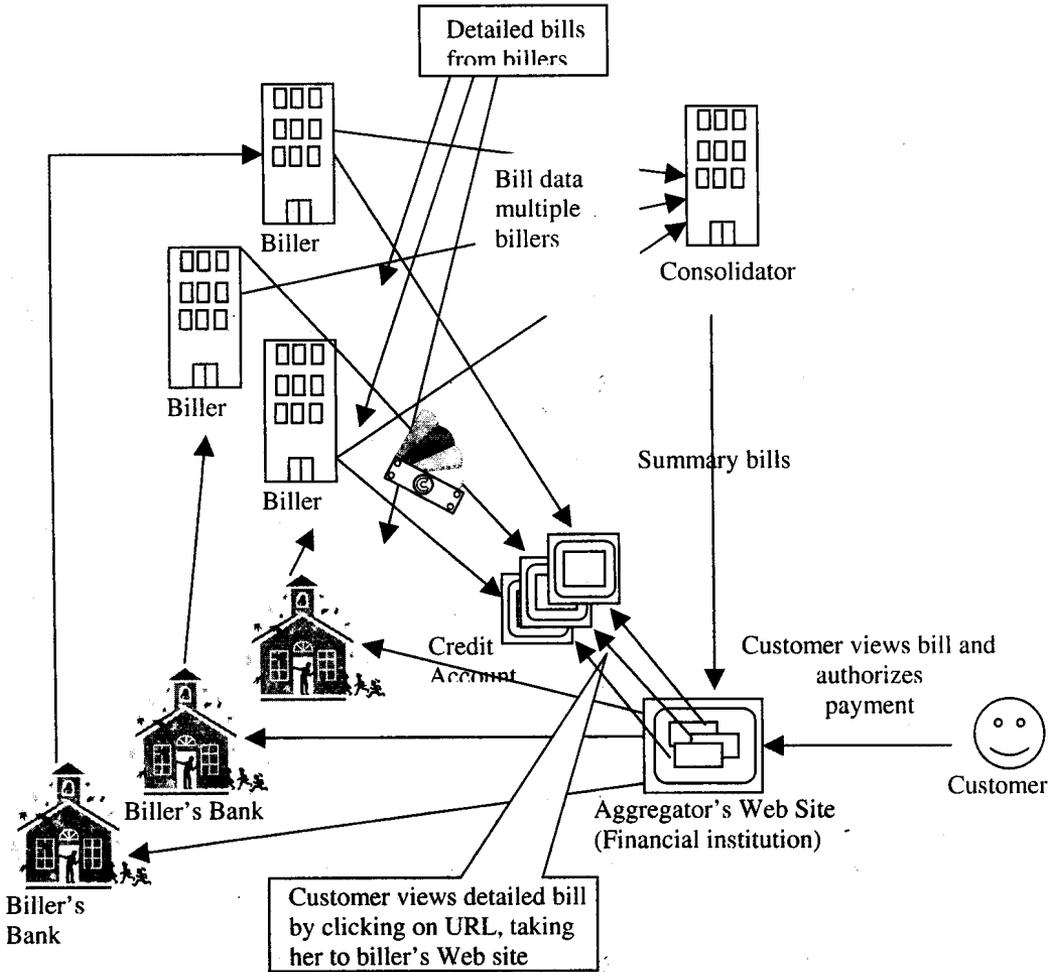


Figure 3: Thin consolidation model.

The proposed framework for electronic bill presentment and payment system

Despite the cost and efficiency gains, many hurdles remain in building an on-line Electronic Bill Presentment and Payment System (EBPP). These include several factors, addressed as below:

- ◆ Privacy should be assured as the users expect to trust a secure system. Electronic communication through the use of electronic payment system should be as safe as a private medium like a telephone free of wiretaps and hackers.
- ◆ Although no systems are yet fool-proof, electronic payment systems designers should concentrate close on security.
- ◆ As the users value convenience more than anything, the payment interface should be user friendly having intuitive outlook and must be as easy to use as a telephone.
- ◆ Designing an EBPP should handle the challenge to integrate the databases used by each of the users, while keeping the data up-to-date and error free.
- ◆ A “network broker” – someone to broker goods and services, settle conflicts and facilitate financial transactions electronically–must be in place (Kalakota and Whinston 2000).
- ◆ An EBPP should resolve the issue of how to price payment system services. The necessity of using subsidies to price all service affordably should be recognized and the potential waste of resources for using subsidies to encourage users to shift from one form of payment to another should be considered.
- ◆ A common standard should be imposed and followed; since without standards the wielding of different payment users into different networks and different systems is impossible (Kalakota and Whinston 2000).
- ◆ An EBPP should be cheaper both for the buyers and sellers. Minimum cost should be associated with establishing an on-line electronic payment system.

Keeping these factors in mind, this paper presents a new framework suitable for use in the developing countries where costing is a great issue. In most of the developing countries, the e-commerce and electronic business are in nascent stage mainly due to the costing. Moreover, the users of the developing countries are not that much technologically sound to understand, handle and believe the credit card transaction often. Figure 4 presents the framework for Electronic Bill Presentment and Payment System

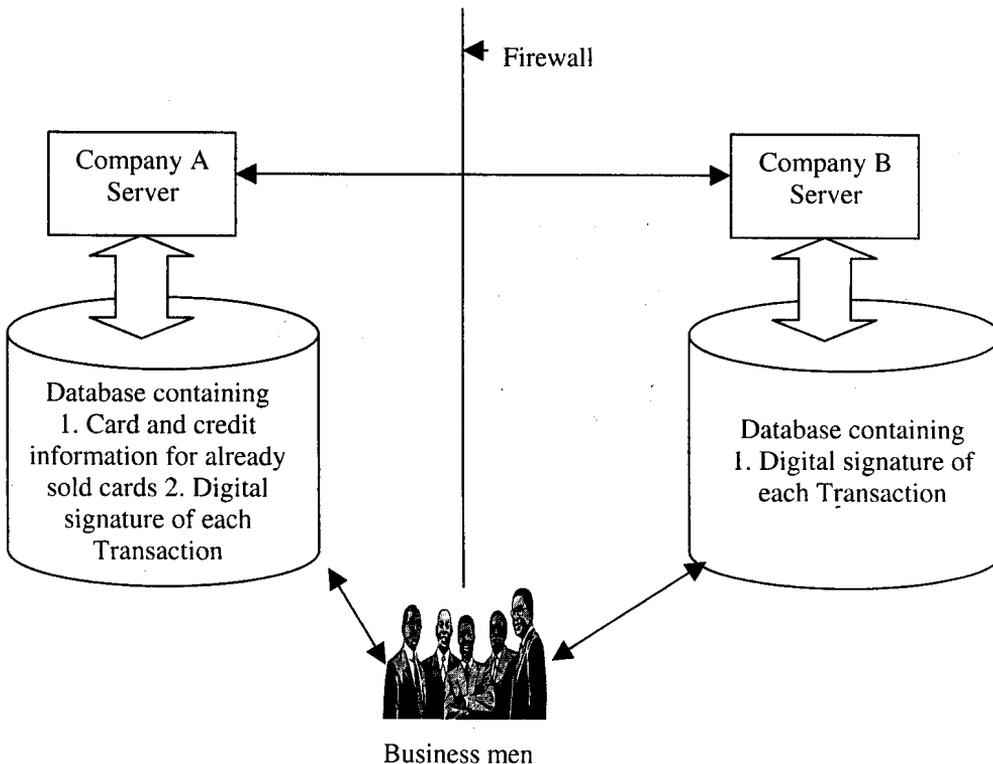


Figure 4: The framework for electronic bill presentment and payment system.

Advantages of the proposed framework

In consideration to the implementation in developing countries, the proposed framework has got a number of added benefits stated as follows:

- ◆ This framework can deal with micro transactions.
- ◆ As this framework for electronic payment system does not require an on-line third-party connection for each transaction to different banks, there is no threat for processing bottlenecks.
- ◆ The customers and the merchants do not require to be registered to a third party. So, there is no registration cost for the buyers and sellers.
- ◆ There is no performance bottleneck as with the credit card processing using an on-line third-party, in the verification phase.
- ◆ The costs of making cards are very low. Hence, the charge for preparing the card will be pretty low too. So, small companies of the developing countries can become interested for spreading their business in internet using the framework. The procedure of transaction is also less tricky to be understood by majority.
- ◆ The way of buying and using the cards will be very easy for the users as they are already familiar with the procedure for dialup prepaid internet account recharging and so on.
- ◆ The cards may range from ₦100 to ₦10,000. So, people having different level of capability and need can easily satisfy their necessity.

Discussions

In the third world developing countries, there has been little use of e-commerce applications, thus different e-commerce applications like the electronic payment system is not that much popular in those countries. The companies and the e-commerce service providers always look for their profit. But since the cost for establishment and maintenance of the on-line third-party processor is considerably high, they are not interested to use it and as a matter of fact, the credit card-based electronic payment system using on-line third-party processor is not at all used by them. So, in our system we have proposed the framework for a credit card-based electronic payment system that makes no use of the on-line third-party processor.

In the proposed system, there are three parties associated with a transaction: the credit card provider, the service providers and the customers. The consumers can get cards from the card providers who can eventually make these cards available in different stores and shops.

All the companies taking part in the card provider consortium can prepare and sell cards. But they should maintain a fixed format. Each card provider has a unique id. A card contains information about – the card provider id, secret number/text, balance, etc. Each of the companies will also maintain a database on the sold cards from where the credits will be made. Moreover, each company will maintain a server which will listen on a defined port for the 'Credit Requests'. Generally the card providers will prepare the card and will make them widely available in different shops. The cards will be ranging from very low amounts to high amounts so that users of wide variety of capability can utilize them. Each card will be bearing credit equivalent to its cost.

The customers buy products through the web server of the service provider for making on-line transactions. The web server prompts the customers to enter their card number, password and card provider id. It then sends a request for crediting money to the card provider company. Where it is processed and a notification is made to the service provider about the customer balance and after getting clearance, the service provider completes the rest of the transaction, which includes keeping the record of the transaction in the form of a digital signature (Kalakota and Whinston 2000) and requesting the deduction of credit in card sellers' database. A replica of the digital signature is stored on the credit card provider side so that it may check this against the demand for money by the service provider at the end of the month.

A firewall will be in place between the card provider and the service provider to stand against possible threats of hacking and to prevent the intruders and also secured communication between servers are to be ensured.

Conclusion

EBPP, with its numerous benefits, has already built a strong business case for its adoption. It promises benefits to all the participants in the process – from the customers to the billers. The market for these services is currently in the growth phase with consolidations and alliances already starting to take place. The race for capturing the huge potential market is on.

This rapid growth of e-commerce reflects the compelling advantages that it offers over conventional brick-and-mortar stores, including greater flexibility, enhanced market outreach, lower cost structures, faster transactions, broader product lines, greater convenience, and customization. As we are not actually arguing that this framework is better than others in performance or application, we have not shown any simulation result, rather, we are arguing on the fact that this easy and timely framework can be good alternative for the developing countries to boost up their electronic business.

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