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TRAFFIC RULES IN ELECTRONIC FINANCIAL TRANSACTIONS (EFT) NETWORKS

ABSTRACT

This paper presents the traffic rules in the EFT (Electronic Financial Transactions) networks, based on the implementation of the solution called Gold-Net developed and implemented by Euronet Worldwide Inc. Following the traffic rules in EFT networks, out of its worldwide experience, Gold-Net evolved a comprehensive and expandable EFT network solution designed to meet an institution's needs today and in the future. It is an ITM (Integrated Transaction Management) solution, modular and expandable, and consists of a comprehensive EFT software modules with ATM and POS driving capabilities. The combination of ATM management and the online connection form the intercept processing control module. As the marketplace grows, this solution ensures that an enterprise may position itself for future growth and expanded service offerings.

KEY WORDS

traffic, electronic financial transactions, EFT, ATM, POS, network solution, Gold-Net, financial industry, banking industry

1. INTRODUCTION

About a decade ago in the financial and banking industry, only the largest financial institutions controlled their own ATMs and offered EFT network services. At that time only they could take advantage of the savings, fee generation and flexibility gained by running an EFT network. But now, this has changed. Networks offer an affordable solution that allows for EFT transaction growth for network owners and members or participants of the network. Today, institutions and enterprises can realize a proven and cost-effective EFT network solution that empowers

them with flexible solutions for customer needs today and tomorrow. Gold-Net is a comprehensive network switching and management solution designed for financial institutions with ATM and/or POS terminal networks and financial enterprises that wish to meet marketplace demands by offering network services. It allows institutions to provide clients with EFT services through institutional network sharing arrangements and national and international interchange networks. Through modular expansions, this can mean a complete ATM and POS processing system where the network drives the devices as well as switches transactions. If device driving capabilities are not required today, but can be seen above the horizon for tomorrow, the package can provide the operational functionality required for the existing marketplace demands, while positioning institutions for growth through modular expansions as needed. Business requirements may only need network switching capabilities and associated operations such as fee billing, settlement and connections to other networks or gateways, today, but as marketplace demands grow, this solution can grow as well. The software package enables financial institutions to offer account holders access to funds and services around the clock, every day, every hour of the week. Cardholders are provided fast, reliable service and virtually no downtime. The system supports all major brands of ATMs and allows cardholders to access multiple accounts for deposits, withdrawals, transfers, inquiries, statements and payments. The network administrator has the convenience of a versatile reporting system that generates valued reports. Through a flexible and expandable network package, users can respond quickly to new opportunities and service requirements. This package interfaces to host banking systems and interchanges to acquire, autho-

size, and switch transactions. Software interfaces are also available for terminals to attach to the acquired host. Authorization can take place in the current network or an attached host system. Enhanced ATM services are available through a series of ITM modules to increase the functionality of ATM terminals. These modules offer expanded consumer transactions, additional competitive card services, improved back-office and systems operations, and enhanced device capabilities. Coin dispensing, stamp dispensing, multiple currency and language support, and debit card support are a few of the features of the ITM modules. Network control, device control and customer service functions can be easily performed from single or multiple terminals through use of simple menu-driven screen access. An extensive operational and transaction security, incorporating worldwide industry standards, has been offered. This solution is applicable to the most cases from a small shared network jointly owned by a few financial institutions offering ATM driving and settlement services to a more complex shared network settling transactions among numerous institutions, and routing transactions to external networks. Multiple participants or network members are linked together to create a shared network, to settle transactions within the network and to connect the network to other regional, national, international networks and gateways.

2. DESIGNING A NETWORK

Network design is an integral part in establishing a functional and profitable EFT network data center. There are a number of options in network design, each related to a different need or business case. This section will identify two main types of networks: proprietary networks and shared networks. Each network type has strengths and advantages as well as differing features and functionality. The different network types will appeal to different business needs and can adapt as the marketplace demands.

3. PROPRIETARY NETWORK

A proprietary network (Fig. 1.) is the simplest form of a closed network in terms of routing transactions and transaction settlement as well as other networking functions such as account balancing and maintaining an accurate and dependable database. One institution owns, or is provided directly by a vendor or lessor, the terminals, the data storage facility and the communication network that transmits information between the ATM and the institution's account database. The owning institution issues the cards allowing its customers access to the system. In a proprietary network,

only the institution's cardholders may use the ATM system. Since there is no connection to an external network or gateway, other cardholders at other institutions cannot access proprietary ATMs. The same is true for the institution's cardholders; they cannot access other ATMs with their ATM cards nor withdraw funds from that other institution. An example of a proprietary network is Bank A which owns 10 ATMs. All ATMs would be connected via network to the bank's central account database where transactions are authorized. All ATM driving, authorization and reporting is handled by the network for the one institution. Through modular selection, ATM Management offers the solution needed to accommodate a closed proprietary network.

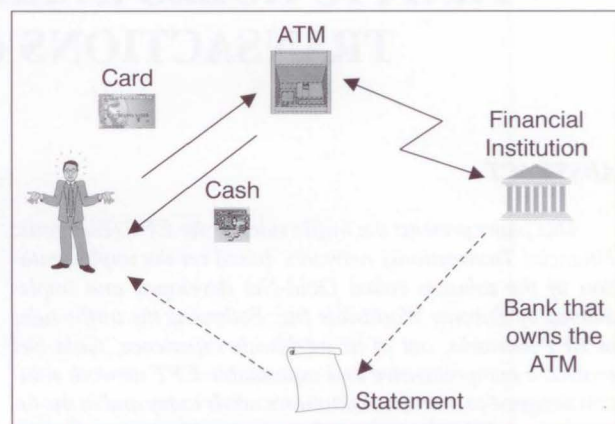


Figure 1 - Proprietary Network

4. SHARED NETWORK

A shared network simply identifies a situation in which the customers of a card-issuing institution are permitted to use an ATM that is owned or controlled by another institution or entity.

An example is Gold-Net from Euronet Worldwide Inc. Participants in a shared network share the components of an ATM system. There are distinct methods

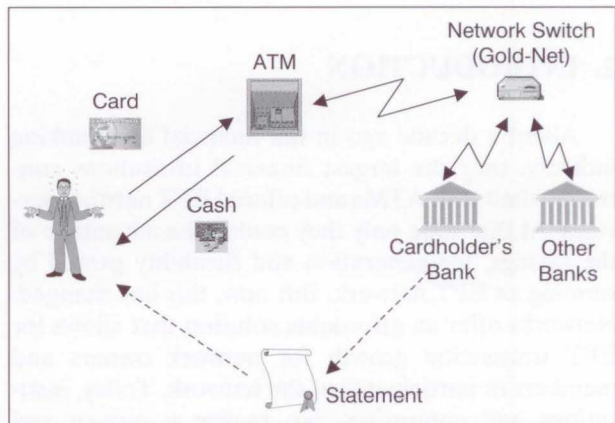


Figure 2 - Closed Shared Network Switch System

by which institutions can share ATM system components: a true shared network and a gateway arrangement. The closed shared network switch system is shown in Fig. 2.

4.1. True shared network

In a true shared network, all participating institutions have access to all other's ATM components, such as ATM terminals. Several financial institutions agree to support financially an ATM switch network in which each participating financial institution permits its ATMs and cards to be used. Each participant must adhere to common security, operational and technical standards. Usually, a common logo is decided upon for the network to help cardholders identify participating ATMs that may be accessed. Common advertising goals are agreed upon for all participants to help market the service and promote its use among all cardholding customers. A true shared network can be closed, where only the participating institutions can access each other's ATMs, or the network can be open, where the network switch connects to an external network. The open solution provides external network connections to local, regional, national and international networks and gateways.

Shared networks realize economies of scale. For example, if three institutions form a network, they could enlarge their potential cardholder base by purchasing one shared system rather than three proprietary systems.

4.2. Gateway arrangement

In a gateway arrangement the network can design the system where card issued by a non-participant in the shared network may be used at ATMs that are part of the shared system. For the gateway arrangement to work properly, a non-member institution would make an agreement with a gateway system, or a switch or router for other networks, under which, for an agreed price, the gateway system would make the ATMs bearing the gateway's logo available to cardholders of the non-member financial institution. Usually, in a gateway arrangement, there is no joint financial responsibility, no common logo or joint marketing and not as many requirements for standardization. Gateway arrangements usually involve relatively low volumes per ATM and may be viewed as a step towards a more formal linking of local and regional networks.

4.2.1. Open shared network switching system - a routing network

Another type of network may be viewed as a routing network (Fig. 3.). A routing network is a type of gateway network arrangement where the network

does not manage or drive ATMs for its participants. The network's primary responsibilities lie in the routing and settling of transactions among its participants. The routing network is an open network because it maintains an external connection to one or more other networks or gateways, whereby a gateway is considered to be a router (or switch) for networks and routes transactions from one network to another for authorization. As stated previously, the routing network's main function lies in routing and settling transactions among its member institutions. Each participating institution is responsible for driving its own ATMs, although the routing network may be responsible for the creation and maintenance of the cardholder card files holding data regarding the plastic cards themselves, i.e. for embossing and encoding purposes. All member institutions cardholders can use ATMs belonging to other member institutions as well as ATMs that can be linked to their network through external network connections. Gold-Net provides a comprehensive routing solution with the desired external connections that meet business requirements. It consists of an open routing network with external network or gateway connections and ATM driving and management capabilities. This network provides full-feature performance options and services to all member financial institutions in the network. Member financial institutions can own ATMs, but do not have to maintain the technology or staff required to operate and manage their ATMs. Through network service fees, all ATMs management and driving could be covered.

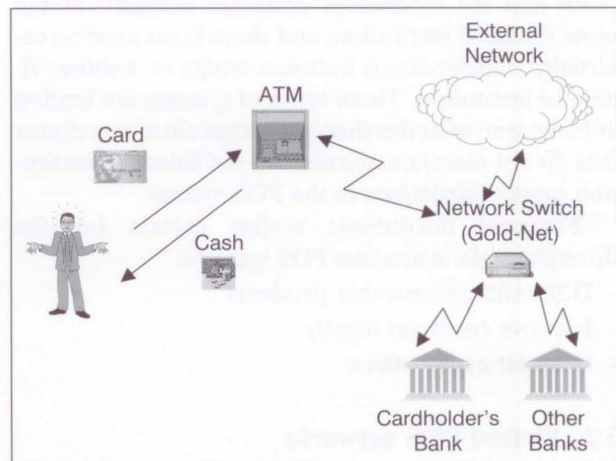


Figure 3 - Open Shared Network Switch System - a Routing Network

4.3. A market overview of the sharing arrangements

Shared networks have increased rapidly for several reasons. First, they have allowed financial institutions to enhance customer access to their ATM services

without the large expense that proprietary network expansions require. Secondly, financial institutions have been able to offer their cardholder base access to interregional ATM services by entering into sharing agreements with financial institutions in differing geographic locales. Another reason is that financial institutions realize an additional revenue source of user fees due to the additional institutions' cardholders that increase the cardholder base that can access their ATMs.

5. EFT POS NETWORKS

Like ATM systems, the first POS (Point-of-Sale) networks were proprietary networks and the early POS projects showed that large transaction volumes were required to be profitable to financial institutions. It soon became clear that the shared system was the answer to many early POS problems.

5.1. Proprietary POS networks

A single-institution POS transaction requires three parts: a financial institution (or non-banking institution), a merchant and a customer. The financial institution places a POS terminal at each merchant location and connects the terminals to its own computer which contains records of all customer accounts. The cardholder is issued a card and a PIN (Personal Identification Number) that allows access to the POS terminal. In an unshared POS network, both the merchant and the cardholder maintain accounts at the same financial institution, and there is no need to externally transfer funds between banks or another financial institution. These types of systems are limited as compared with the shared systems since merchants that do not maintain accounts at the financial institution cannot participate in the POS system.

Financial institutions realize certain benefits through single institution POS systems:

- Differentiate customer products
- Improve customer loyalty
- Increase market share

5.2. Shared POS networks

Whereas the proprietary network is controlled by one institution, the shared network is utilized by multiple institutions (Fig. 4.). They offer shared networks to share costs, obtain economies of scale and meet the needs of retailers and their customers. A shared POS system typically involves at least five participants and various technical components to connect them. The participants are the merchant, the merchant's bank, the card-issuing bank, the switching network (i.e.

Gold-Net) and the customer. Financial institutions, the merchants or the network place POS terminals at merchant locations. Merchant personnel operate the terminals at the checkout counters which are connected to concentrators or controllers that enable many terminals to share a few communications lines. When the merchant's bank or processor receives the merchant's transaction, the merchant's account is adjusted accordingly. The bank may be connected to the merchant terminals or to the network switch by telephone lines.

The card-issuing bank completes the transaction as the counterpart to the merchant bank. The customer bank issues the card to the cardholder and adjusts the banking customer's account as required. If both the cardholder and the merchant hold accounts at the same institution, the institution will merely transfer money between accounts. The cardholder makes purchases using debit cards obtained from the card issuer at the merchant POS terminal.

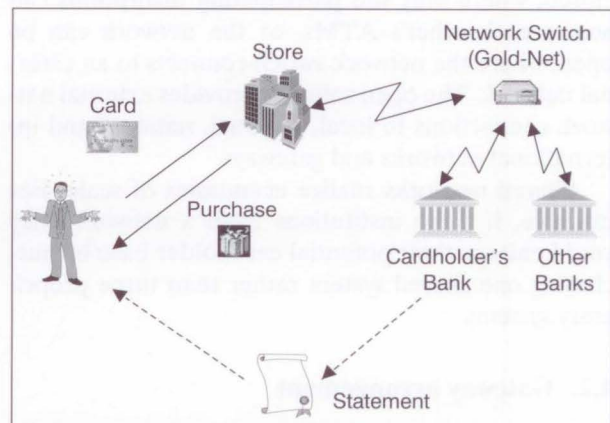


Figure 4 - EFT Point-of-Sale Network Switch System

5.2.1. Before the bank routing

The switch routes transactions to the proper destinations. Depending on network connections and design within the system, the switch can be either "before" or "after" the banks. If the switch is considered to

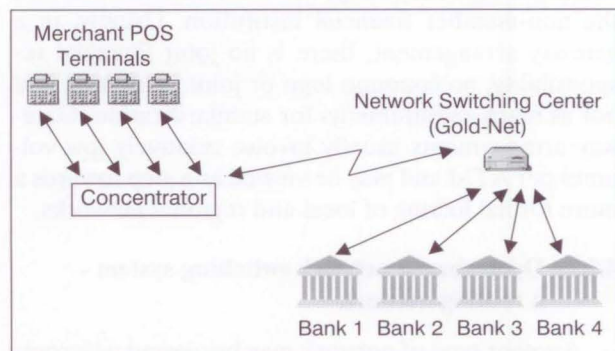


Figure 5 - EFT Point-of-Sale Network Switch System (Before the Bank Switching or Intercept Processing)

be located before the banks (Fig. 5.), it will receive the transaction messages directly from the merchant terminal and will route them to the merchant banks. In this scenario, all transactions will go through the switch.

5.2.2. After the bank routing

If the switch is located after the banks (Fig. 6.), it will only route transactions when the cardholder and the merchant do not have accounts in the same bank. The bank will intercept the transaction before it ever reaches the network. These switches are sometimes referred to as front-end and back-end switches. The banks or their data processors are called intercept processors when the switch is placed after the bank. In a flexible solution, a participant of a network can become an intercept processor. In addition to routing messages and transactions, the networking switch has to offer other responsibilities and capabilities such as maintaining network settlement records and audit trails, performing security checks and providing backup processing and authorization services during temporary downtimes for participants of the network. Downtime authorization and processing is also referred to as stand-in processing. Dependable and reliable solution (i.e. Gold-Net) offers the routing, selling, billing and fee generation capabilities that is required out of the POS shared network.

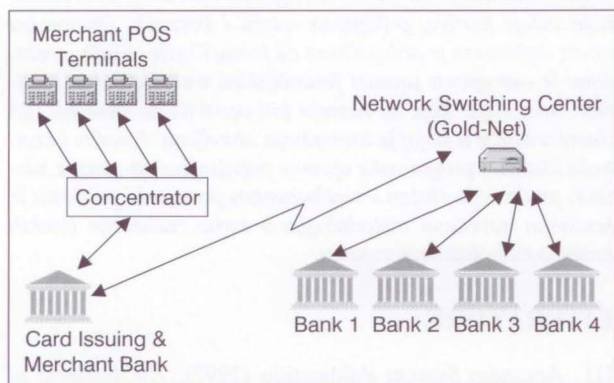


Figure 6 - EFT Point-of-Sale Network Switch System (After the Bank Switching or Intercept Processing)

6. QUALITY CONTROL PROCESS

The principles of the proposed method have been successfully applied in development of an application where the software quality requirements are especially high. The quality control process has to be observed with special care (as in Fig. 7). In fact it can be split up to several control segments and each of them should present one separate quality control unit.

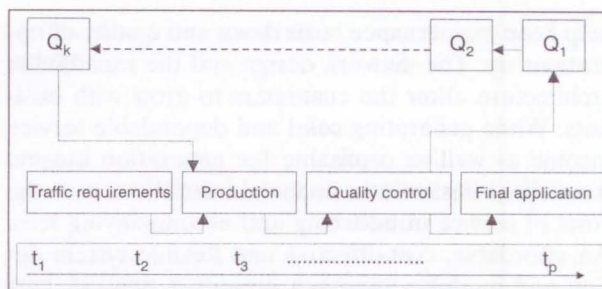


Figure 7 - The Quality Control Process

The following rules have been applied as in equation (1) :

$$\Delta Q_k = |Q_{kX} - Q_{k0}|, k = 1, 2, \dots, n \tag{1}$$

- n – number of quality control units
- Q_{kX} – measured value of the quality control unit
- Q_{k0} – reference value of the quality control unit
- ΔQ_k – difference between reference and measured value at the same quality control unit

According to the timing between separate production steps an additional consideration is shown:

$$\Delta t_p = |t_{pX} - t_{p0}|, p = 1, 2, \dots, m \tag{2}$$

- m – serial number of the process segment
- t_{pX} – measured value of the timing at the process segment
- t_{p0} – reference value of the timing at the process segment
- Δt_p – difference between reference and measured timing value at the same process segment

The aim of the quality control process follows:

$$\min \sum_k (\Delta Q_k) \tag{3}$$

$$\min \sum_p (\Delta t_p) \tag{4}$$

The quality control units have not the equal weight, as presented in the final expression (5):

$$\min \sum_k [g_k (\Delta Q_k)] \tag{5}$$

- g_k – specific weight of the quality control unit k.

7. CONCLUSION

Through modular expansion opportunities, the EFT network solution (Gold-Net) permits the network to drive ATMs and POS devices or virtually any type of self-service financial transaction terminal for the institution and participating clients or member institutions. Following the network's traffic rules, all balancing operations occur during settlement as the network balances to its participants and fees are identified and processed. Settlement options allow the network to immediately receive fee income daily as transactions are processed and balanced. In addition, the network can bill for services through other specified time process. All features essential for successful network operations are available. Automated procedures

help keep maintenance costs down and quality of operations up. The network design and the expandable architecture allow the customers to grow with business. While generating solid and dependable service income as well as profitable fee generation income from client institutions, financial institutions save the costs of service outsourcing and accompanying fees. An affordable, cost-effective and flexible system design and modular approach provide a network that meets the business needs of enterprises and their customers today and in the future. It provides financial control, fee billing, balancing and network settlement. Network settlement can occur within the region or shared network (intra-network settlement) or with other networks and gateways (inter-network settlement). It can also provide real-time information for management and control of ATM and/or POS terminal operations. Entering and maintaining customer account information, managing account access limits and relationships, generating and controlling PINs (Personal Identification Numbers), and automated links to card encoding and embossing operations are just a part of the offerings. It can also provide administrative reports and mailing label files, PIN mailer files and other features that make card management accurate and effective. The solution lets the institution or enterprise select the terminal equipment, backroom accounting software environment, transactions, services and the functions and screens seen by cardholders. In addition to supporting standard financial transactions for all customer accounts, it can provide a wide variety of non-financial requests and inquiries. These can range from requesting stop payments on checks and paying bills, to printing statements or purchasing travellers' checks. Due to the fact that various methods defining validation criteria for application (software) metrics and inspection are often too complicated, practical solution is observed. Some principles of the proposed method have been successfully applied in the development of a client / server banking application where the software quality requirements are especially high.

SAŽETAK

Ovaj rad predstavlja sažetu analizu prometa transakcija u mrežama koje omogućuju realizaciju elektroničkih financijskih transakcija (EFT), a temelji se na iskustvenim spoznajama uvođenja rješenja zvanog Gold-Net, koji je razvila tvrtka Euronet Worldwide Inc. i primijenjenog u većem broju zemalja širom svijeta. Ovakvo EFT rješenje uz primjenu odgovarajuće kombinacije upravljanja ATM i POS uređajima omogućuje ustanovama koje ga koriste, praćenje trendova rasta i širenje neovisno o lokaciji ili veličini transakcijskog prometa. Izrada mreže, koja omogućava funkcionalnost i profitabilnost ovakvog transakcijskog poslovanja, temelji se na tehnološkim mogućnostima i poslovnim potrebama zainteresiranih institucija. U načelu postoje dva tipa EFT mreža: vlastite i zajedničke (podijeljene), pri čemu svaki od tipova ima svoje prednosti i nedostatke. Vlastita mreža predstavlja zatvoreni oblik mreže sa stajališta usmjeravanja i usklađenja (poravnavanja) transakcija. U ovom slučaju, jedna institucija je vlasnik elemenata mreže, skladišta podataka i komunikacijske infrastrukture koja omogućuje prijenos informacija između pojedinih uređaja i središnje baze podataka. Transakcije se izvode uporabom kartica, pri čemu institucija koja je izdala te kartice, omogućuje pristup mrežnom sustavu koji je pod njenom kontrolom. U vlastitoj mreži, samo korisnici kartica izdanih od te iste institucije imaju pristup elementima institucijskog mrežnog sustava. U ovom slučaju mreža je zatvorena i nema vezu prema drugim sličnim mrežama. Za razliku od vlastite mreže, kojom upravlja jedna institucija, zajedničku mrežu kontrolira više njih. Time se postiže podjela troškova održavanja i upravljanja mrežom. Na primjeru POS mreže uočljivo je da uključuje barem pet sudionika i različite tehničke komponente za međusobno spajanje. Sudionici takve mreže su: trgovac, banka trgovca, banka koja izdaje kartice, priključna mreža i korisnik. Otvorenost mreže definirana je priključkom na jednu ili više sličnih mreža, čime je omogućen promet financijskim transakcijama različitih institucija, koje ne moraju biti upravljački elementi niti vlasnici mreže u kojoj je transakcija obavljena. Izvedba i kontrola kvalitete programske opreme primjenjive na ovakve sustave, predstavlja složen i sveobuhvatan postupak, pri čemu je korištena navedena metodologija u svrhu realizacije visokih kriterija raspoloživosti sustava.

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