

# **A FRAMEWORK FOR PLANNING ACCEPTANCE TESTING OF THE ELECTRONIC BENEFIT TRANSFER (EBT) SYSTEMS**

Stephen L. Tracy, School of Business, University of South Dakota, Vermillion, SD 57069, (605) 677-5287  
Bijayananda Naik, School of Business, University of South Dakota, Vermillion, SD 57069, (605) 677-5290

## **ABSTRACT**

Electronic Benefit Transfer (EBT) systems are large scale information systems designed to deliver government benefits using a debit card instead of paper coupons, checks or vouchers. These systems are similar to Electronic Funds Transfer (EFT) systems operating in the banking industry. Development of an EBT system normally follows the Systems Development Life Cycle (SDLC) approach. Acceptance testing is a very important activity in this approach during the implementation phase prior to the production run of the system. In this paper, the authors present the essential elements of a framework for planning the acceptance testing activities for the benefit of MIS professionals and users involved in the development and implementation of EBT systems. The paper is based on their experience in conducting acceptance testing for an EBT system for a state partnership.

## **INTRODUCTION**

Traditionally, the federal and state governments have provided cash benefits and food assistance using coupons, checks and vouchers through a variety of programs. An alternative to using the paper-based system is the use of a debit card in an Electronic Benefit Transfer (EBT) system. A benefit recipient enrolls in the system and an EBT account is setup. The account is similar to a bank account with debit access only. Deposits to the account can be made only through transactions from the government agency providing the benefit. Drawdowns from the account can only be made using the debit card at point-of-sale (POS) terminals or automated teller machines (ATMs) installed at a merchant location.

In 1994, the Federal EBT Task Force identified at least 12 federal and state benefit programs where EBT systems could be used to replace the paper-based system (EBT Task Force 1994). The advantages of the EBT system include reduction in the cost of benefit delivery, better management of benefit funds, and reduced fraud. Although a few pilot EBT systems were operational in several states, it was deemed undesirable to create a patchwork quilt of state EBT systems [Fox 1995]. The federal EBT task force recommended a nationwide integrated EBT system to be created with initiative from state partnerships and private industries.

The EBT systems currently under development are initiated by state partnerships and are contracted out to private sector firms for building the systems. The system development process normally follows the System Development Life Cycle (SDLC) approach. The SDLC approach involves five major stages in the project's life cycle: preliminary investigation, requirements analysis, systems design, implementation, and post-implementation evaluation. Acceptance testing is an important activity in the implementation phase. It is conducted prior to the production run of the system. Acceptance testing ensures that the system

performs as specified in the design document and is acceptable to the users of the system. Many different types of tests are conducted to examine many different aspects of the performance of EBT systems. For a reader unfamiliar with the details of acceptance testing, it may be difficult to understand the purpose and interrelationship of these tests without a suitable framework to describe them. In this paper, the essential elements of such a framework are presented. However, details of how to conduct the tests are generally extensive and beyond the scope of this paper. A brief description of the major processing components of an EBT system is presented next to facilitate understanding of the framework discussed later.

## **PROCESSING COMPONENTS OF AN EBT SYSTEM**

An EBT system comprises of a number of important processing components [King and Kirlin 1993]. Although individual designs may vary slightly, the following processing components are identified in most EBT systems: client eligibility systems interface processing, merchant processing, client processing, on-line transaction processing, Back-up transaction processing, ARU processing, settlement processing, reporting, and administrative processing. These processing components are explained briefly in the following paragraphs.

The client eligibility system provides the interface between the state welfare system providing benefits and the EBT system. Eligible benefit recipients are enrolled in the system using interface processing. When an EBT system becomes operational, client file conversion would be necessary prior to system startup. Merchant processing involves merchant account setup, POS terminal interaction, transaction processing, settlement, dispute processing, and funds transfer processing from the perspective of the merchant. Client processing involves client account setup, benefit authorization, benefit posting, card activation, Personal Identification Number (PIN) issuance, history information, terminal usage, and transaction processing activities from the perspective of a client (benefit recipient).

On-line transaction processing involves accessing client accounts for the payment of purchases using a debit card. On-line transaction processing includes a complex set of rules governing normal and abnormal conditions during interaction between the POS terminal and the host computer system. Back-up transaction processing is referred to as "manual" or "off-line" transaction. It is used when immediate processing of all purchase transactions at the POS terminal cannot be performed. This situation may occur when the card is damaged, the POS terminal malfunctions, the telecommunication network fails, or the host computer breaks down.

Audio Response Unit (ARU) is used within the EBT system to provide balance inquiry and history information to clients and participating merchants. ARU could also be used for back-up transaction processing in some cases. Settlement processing

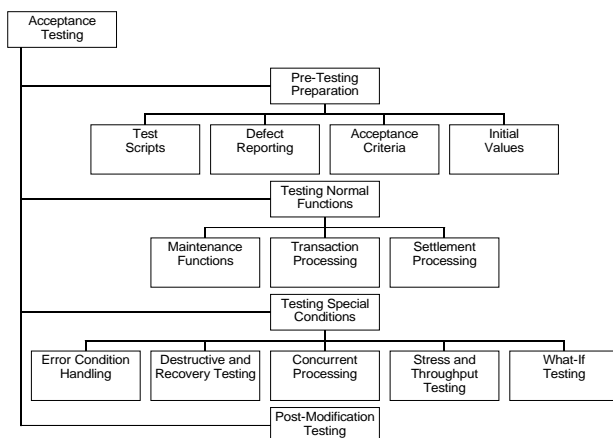
involves funds transfer between relevant parties involved in the EBT system. Reporting provides details of every aspect of EBT system processing activities. It addresses the areas of government agency requirements, MIS requirements, financial requirements, processing requirements and administrative requirements. Finally, administrative processing specifies workstation screens required to provide queries, make corrections to system processing activities, and access system databases.

Acceptance testing rigorously examines the system integrity and performance in each of the above processing components. It is an extremely time consuming and exhaustive process that must be planned carefully for successful execution. The following section describes a framework for planning and documenting the different aspects of acceptance test.

## A FRAMEWORK FOR ACCEPTANCE TESTING

Acceptance testing of every EBT system is required by federal regulations. The objective is to verify that each component of the EBT system not only complies with the system design specifications, but also meets the Food Stamp Program requirements [Costa 1993]. The framework presented here is expected to help better understanding of the different facets of acceptance testing of EBT systems. This framework is shown in Figure 1.

**Figure 1**  
ACCEPTANCE TESTING FRAMEWORK



Acceptance testing of EBT systems can be divided into four major phases of activities: pre-testing preparation, testing normal functions, testing special conditions, and post-modification testing. Each of the first three phases involve a number of testing activities as shown in Figure 1. The details of these testing phases and activities are presented in the following sections.

### Pre-Testing Preparation

The pre-testing preparation involves activities necessary to make the EBT system ready for acceptance testing. These activities include development of the test scripts, specifying a procedure for defect reporting, specifying the acceptance criteria, and populating the system files with initial values necessary for executing the tests. A great deal of time and effort is dedicated to the preparation of test scripts. The considerations in developing test scripts are presented next.

### Test Scripts:

The first step toward preparing test scripts is the identification of all potential permutations of transaction sequences in a particular processing component. For example, sample transaction sequences can be stated as “balance inquiry, food stamp purchase” or “food stamp purchase, food stamp return.” Once the transaction sequences are identified, they can be converted to test scripts. Variations of these test scripts can then be developed for many different conditions and circumstances under which each transaction can occur. Test scripts should include all essential information to conduct the intended test without ambiguity, yet should avoid repetition of common information for multiple test cases.

### Defect Reporting Procedure:

Prior to conducting the acceptance testing, a procedure for reporting defects must be formulated. The procedure should specify how to document the defect, and when and whom to report the defect. The documentation should include information such as the date of the test, the identification of the testing personnel, the test script used, problem description, and proposed action for defect resolution. A defect-severity rating system should be devised to classify the defects and assign priorities for defect resolution. For example, a priority 1 defect may indicate major system defect or malfunction, and a priority 4 defect may mean edit error or cosmetic defect.

### Acceptance Criteria:

Based on the defect-severity rating system, acceptance criteria should be developed to make a “go” or “no go” decision. Typically, the acceptance criteria should specify the acceptable range of defects of a certain category that may be detected by the test procedures and still result in a “go” decision. For example, any priority 1 defect may require that all testing be repeated after the defect has been corrected, whereas any priority 4 defect may be corrected prior to the production run of the EBT system.

### Establishing Initial Values:

Key EBT system files need data that will be used during acceptance testing to support testing activities. Thus, prior to actual testing, the system files are populated with information known as the “initial values.” Establishing initial values, however, is not a “test.” Examples of initial values may include names, addresses, and card numbers of a certain minimum number of clients (benefit recipients). Once the initial values are established the system is ready for carrying out the testing activities. As shown in Figure 1, the next stage in the testing framework indicates activities related to testing of normal functions.

### Testing Normal Functions

Testing normal functions include testing of maintenance functions in each of the nine processing components described earlier in this paper, testing of various types of transaction processing, and settlement processing. The objective here is to ensure that the EBT system is capable of handling normal functions without

errors or problems under normal operating conditions. However, unusual and unexpected situations do occur in the real-world operation of these systems which must be handled by the system successfully. Testing the system against these unusual or unexpected situations is discussed in the next phase of the framework.

#### Maintenance Functions:

Maintenance functions of the processing components include tasks such as validation of data elements, terminal devices, and their prompt sets (e.g., screen instructions), correct sequencing of simple transaction sets, database update, the operation of the workstation function keys, and terminal and system reporting. Testing of the maintenance functions is the first “real” testing activity after the system files are initialized with data and forms the basis for all subsequent testing activities. The maintenance testing also validates the results of establishing the initial values.

Testing of maintenance functions for the client eligibility processing component covers three aspects: interface processing, message formats and processing codes, and client file conversion [Costa 1993]. Interface processing concerns the transfer of eligibility and allotment information from the information system of the state to the EBT system. Testing maintenance functions for merchant processing component concerns the tasks related to establishing and maintaining approved merchants on the EBT system. Testing maintenance functions for the client processing component is concerned with the tasks needed to establish and maintain clients on the EBT system.

#### Transaction Processing:

Testing of transaction processing is perhaps a major part of the testing activities in this phase of the acceptance testing of EBT systems. Clients and merchants access client accounts through three types of transaction processing activities: on-line processing, backup processing, and ARU processing. In addition, system reversals are also considered transaction processing. The objective of this aspect of the acceptance testing is to examine the system’s ability to process valid transactions under normal conditions.

On-line transaction processing allows accessing client accounts for payment of food purchases or for cash withdrawal in the case of non-food benefit programs. Transaction sets supported by on-line processing include balance inquiry, purchase, refunds, cash withdrawals, cashback, and voids [Costa 1993]. Backup transaction processing is an alternative means of processing the same transaction sets when electronic on-line transaction processing is not available due to a damaged card or a system failure. Another aspect of the backup processing involves various controls. Examples of such controls include timely submission of vouchers, and the placing of a “hold” on an account until the paperwork is received.

ARU (Audio Response Unit) processing within the EBT system is normally used to provide balance inquiry and history information to the clients and participating merchants. However, ARU can also be used to authorize backup transactions. In addition to the above three types of transaction processing, there is another category of transactions within the EBT system. These

transactions are system-generated, and their type and extent vary from system to system. One common type of system-generated transactions involves system-generated reversals. These reversals occur when a normal transaction set is disrupted.

#### Settlement Processing:

Settlement refers to the process of exchanging funds between the government and the retailer in the food stamp programs (or the bank owning the ATM in non-food benefit programs). Settlement occurs in a two step process where funds are first transferred from the project account at a concentrator bank to the retailer’s bank account. Next, funds are transferred from the government to the concentrator bank [Costa 1993]. Settlement processing also includes holdover processing when the merchant’s settlement time differs from settlement time of the EBT host computer.

Large scale information systems, particularly transaction processing systems, are designed not only to perform routine tasks and functions under normal conditions, but also to respond appropriately to incorrect input or error conditions. Furthermore, the system should be robust enough to deal with unusual traffic volume and withstand disruptions to system components. Acceptance testing should include testing these aspects. Thus, the next stage in the acceptance testing framework is the testing of special conditions.

#### **Testing Special Conditions**

Testing special conditions includes five categories of tests: error condition handling, destructive and recovery testing, testing concurrent processing, stress and throughput testing, and “what-if” testing. Each of these testing activities is described in the following paragraphs.

#### Error Condition Handling:

The EBT systems should be able to identify and resolve problems caused by system or operations errors. The integrity of the system databases should not be compromised. The provision of edit check in data input is an example of error handling capability. The objective of the error condition handling testing is to ensure that the system can detect and recover from the initiation of incorrect conditions or transactions. In an EBT system, error condition handling is particularly important in the following areas: workstation screens, interface of the state eligibility system and the EBT system, and system security [Costa 1993]. An example of correct response to an error condition as a result of edit check would be rejection of the data input and display of correct error message on the screen.

#### Destructive and Recovery Testing:

Destructive testing involves deliberate attempt to disrupt the operation of the system. Recovery testing involves examining the system’s ability to remain in or return to an operational status without loss of data integrity [Costa 1993] after a disruption occurs. One of the ways in which system disruption can be initiated includes “pulling the plug” in the electrical power supply for the input devices, in-store controllers, LANs and file servers. Other ways of causing system disruption involve disabling communication line, host computer components such as disk

drives, and interfaces between computer systems. Whether the system recovered from the disruption properly or not can be verified by comparing the composition of the databases immediately before and after each test.

#### Concurrent Processing Testing:

Normally, functions within the EBT system are viewed and used separately. However, in a real-world operational environment functions are executed randomly by different users. This situation may lead to simultaneous execution of functions giving rise to unexpected and undesirable results. The objective of concurrent processing testing is to ensure that undesirable effects do not result when apparently unrelated functions are executed simultaneously. Typically, simultaneous transactions may occur in an EBT system between two work stations, between a workstation and a POS terminal, and between two POS terminals. Examples of these simultaneous transactions include: two users at workstations attempt to cancel the same benefit; a workstation user attempts to cancel a benefit during a POS transaction; one user attempts a purchase using the card while another user attempts to purchase by manually entering the card number at another POS.

#### Stress and Throughput Testing:

System processing speed is an important issue in the EBT system. Response time and throughput are indicators of the processing capacity of the system. Response time is the interval between pressing the "enter" or "send" key and the appearance of the return response or message on the screen of the terminal or workstation. Throughput is defined as the number of transactions executed per second. In practice, throughput may be considered as the ability of the system to meet response time requirement. The main objective of the stress and throughput testing is to ensure that the system meets the response time requirements while processing the transactions correctly. The testing should be done at different transaction volumes, particularly under heavy traffic, to observe the system behavior.

#### "What-If" Testing:

The objective of the "what-if" testing is to enable observers and participants to test possible operational scenarios in a free-form manner. Test personnel can attempt any "wild and crazy" transactions that they can think of and observe the system behavior. "What-if" testing does not require any pre-developed test scripts, but often represents tests that seem to have been overlooked while developing the test scripts. Since no predefined test scripts are used, timing of these tests is important. These tests may be done at the end of each day (to avoid disruption to the regularly scheduled testing) throughout the testing period.

#### **Post-Modification Testing**

As a result of the tests described above, modifications to system and/or correction of defects are most likely to be made. In most cases, retesting of the system known as "regression testing" must be carried out after modifications to the system are made. The main objective of regression testing is to ensure that the modifications do not introduce problems in a previously error-free component of the system. Regression testing involves repeating

relevant test procedures that did not result in an error condition previously and observing the system behavior.

### **CONCLUSION**

In this paper, we have presented a framework for understanding the various testing activities necessary during the acceptance testing of the EBT system. Implementation of these systems has begun only recently, and a national integrated system is expected by the end of this century. Therefore, increased interests in the design and implementation of these systems are likely to be exhibited by MIS professionals and potential users of these systems in future. Very little seems to have been reported in literature about acceptance testing of EBT systems. This paper is expected to generate further interest on the subject in addition to providing a valuable framework for understanding it.

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