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Feasibility Study of Capturing Supplemental Nutrition Assistance Program (SNAP) Purchases at the Point of Sale

Technical Solutions Report

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GLOSSARY OF ABBREVIATIONS

ANSI	American National Standards Institute
ALERT	Anti-Fraud Locator using Electronic Benefits Transfer Retailer Transactions
CES	Consumer Expenditure Survey
DSS	Data Security Standard
EBT	Electronic Benefits Transfer
ECR	Electronic Cash Register
ETL	Extract, Transform, and Load
FedRAMP	Federal Risk and Authorization Management Program
FNS	Food and Nutrition Service
IECR	Integrated Electronic Cash Register
IFPS	International Food Produce Standards
NFC	Near Field Communications
NHANES	National Health and Nutrition Examination Survey
PAN	Personal Account Number
PCI	Payment Card Industry
PLU	Price Lookup Code
POS	Point of Sale
SKU	Stock Keeping Unit
SNAP	Supplemental Nutrition Assistance Program
SSC	Security Standards Council
STARS	Store Tracking and Redemption System
TPP	Third-Party Processor
TWILD	Transactions with Item-Level Data
UPC	Universal Product Code
USDA	United States Department of Agriculture
WIC	Women, Infants, and Children

EXECUTIVE SUMMARY

This report is the result of a United States Department of Agriculture (USDA) Food and Nutrition Service (FNS) study led by IMPAQ International, LLC, and its subcontractors Ventera Corporation and Cash Register Services (CRS). The study explored the feasibility of creating a data collection system capable of providing item-level data to FNS regarding food purchases made by SNAP households. The data would be captured at the point of sale (POS) from purchases made by SNAP beneficiaries using their State-issued Electronic Benefit Transfer (EBT) cards. Currently, only the total transaction amounts for SNAP purchases are available to FNS through the Anti-Fraud Locator for Electronic Benefits Transfer Redemption Transaction (ALERT) system. In addition to exploring the feasibility of creating and operating such a data capture system, the study identified and examined the system's possible technical parameters. This report presents the study's findings and outlines next steps for the project.

1. Background

1.1 Overview of FNS Needs and Data Sources

To support its mission of providing access to food and healthful diets for needy families, FNS would like to have a variety of data that describe the diet and food purchasing patterns of SNAP households. However, the Food and Nutrition Act does not currently require retailers to collect or transmit item-level transaction data. As a result, FNS must rely on consumer-reported data, the SNAP ALERT system, and data from retailers, third-party companies and other sources. The strengths and weaknesses of these data are described below.

- **Consumer-reported data**. These include large datasets such as the Flexible Consumer Behavior Survey module of the National Health and Nutrition Examination Survey (NHANES), collected by other federal entities. Consumer-reported data also include new data collections from studies of SNAP participants, such as the Healthy Incentives Pilot Evaluation. These data present several challenges. Consumer-reported data collections are often cross-sectional surveys that rely on self-reported dietary intake and purchasing behaviors. The data tend to cover a limited period, often relying on participants' recall, and either do not capture food purchases at the item level or do not accurately capture the prices paid at the point of sale.
- **ALERT system.** This system records payment information for every EBT purchase that includes store and household identifiers; EBT card number; date, time, and type of transaction; and total amount of the transaction. These data do not include item-level details about the actual goods purchased.
- **Retailers and Third-Party Companies.** These stakeholders capture, store, and analyze data on individual food items purchased by customers to inform marketing and retail operations. Although many of these data and analyses are available commercially, FNS has not identified one company, or set of companies, that produce sufficiently accurate item-level data on a large enough sample of identifiable SNAP households to allow for statistically reliable analysis of food purchases. In addition, it is challenging to track total purchases of a particular SNAP household over time because they often make purchases from multiple food retailers.

FNS is investigating the feasibility of creating a data collection system that will regularly transmit item-level data on purchases made by SNAP households. Such a system would leverage current retail

environment POS technology, communication infrastructure, and data processing and storage environments.

1.2 Overview of Challenges and Constraints

Collecting item-level transaction data from the point of sale has several challenges and constraints. These challenges and constraints fall into three broad categories: 1) functional and programmatic requirements, 2) technical and system requirements, and 3) legal and policy considerations.

- **Functional and Programmatic Requirements:** The ability to distinguish item-level purchases made using SNAP EBT benefits poses a critical issue for any proposed data collection system. SNAP customers can decide what portion of SNAP-eligible totals to pay with SNAP funds or other tender types. Retailer systems are not designed to distinguish between SNAP-eligible items purchased with SNAP benefits versus another form of tender when those purchases are part of the same transaction. As a result, proposed technical solutions would collect data on *all* SNAP-eligible food items purchased in any transaction made with a SNAP EBT card. Technical solutions considered would ideally capture item-level data as granular as universal product codes (UPCs) to facilitate uniformity of data. However, not all electronic cash registers (ECRs) and retailers collect this level of detail which would require substantial investment in new ECR systems. In addition, authority to gather UPC data for all SNAP-eligible items may be necessary.
- **Technical and System Requirements:** These requirements include the cash register and POS terminal technology; data capture and transmission standards; and data size, transmission, and storage considerations. Retailers authorized to accept SNAP currently utilize a variety of different POS terminal technologies. The most sophisticated systems are integrated electronic cash register (IECR) systems, in which cash registers are linked to a scanner, a store inventory database, and a POS terminal that processes a variety of payment card transactions, including SNAP EBT. However, many SNAP retailers have less sophisticated systems, some of which do not include scanners or inventory databases, and have separate POS terminals that process only SNAP EBT transactions. Current SNAP EBT transactions are governed by industry standards and operating rules. These standards do not address transmission of item-level data and may require either new standards or modification of the existing standards to support collection of item-level data. Finally, transmission of item-level data introduces capacity, cost, data security, and storage issues for all stakeholders.
- **Legal and Policy Considerations:** While no specific FNS policy or regulation prevents states from collecting SNAP-eligible item-level data at the point of sale, there also is no explicit authority for data collection of this type. Collecting item-level data raises privacy and confidentiality concerns that would need to be addressed. Moreover, it is not technically possible to distinguish item-level data collection by payment tender when customers use more than one tender type in addition to their EBT card. Item-level data for the entire transaction would be collected for all SNAP-eligible goods in any transaction that uses EBT tender. This poses potential legal and policy challenges authorizing collection of data on transactions paid for by non-EBT tender. Retailers may also not be as willing to provide transaction level data on items potentially paid for using non-EBT tender.

2. Study Design and Methodology

The primary objectives of this study included:

- Gathering basic requirements to determine the technical parameters for a data collection system.
- Examining technical alternatives, including relevant cost and policy issues.
- Performing limited proof-of-concept tests of solutions.

We identified the data products from and the technical parameters for an FNS-owned data capture system and database for storing SNAP purchase data as part of basic requirements gathering. We interviewed key stakeholders including FNS staff, EBT and Third Party Processors, and POS hardware and software vendors, and conducted document reviews and targeted research.

Next, we developed and analyzed an array of technical alternatives for collecting item-level purchase data at the POS. We focused on three solution areas: POS technical solutions, communication and data transmission, and data storage. We characterized stakeholders into three entities: retailers, contractors (including EBT processors and third party processors – TPPs), and FNS. We studied technical solutions capable of transmitting item-level data from retailers to contractors and ultimately to FNS. As discussed in more detail in Section 3, FNS selected the most feasible combinations of POS, communications and transmission, and data storage options for additional research. Selected options focused on the IECR environment.

After FNS selected combinations of technical alternatives to pursue, we began preliminary limited solution testing. We will undertake more comprehensive testing as we examine findings and lessons learned from the initial limited testing. This proof-of-concept (POC) testing will focus on demonstrating that data can be collected using the proposed technical solution(s) and that the data collected are of sufficient quality to be useful in meeting project objectives.

3. Technical Solution Set Options Selected for Additional Research and Limited Development

FNS carefully weighed the advantages and disadvantages of the POS, communications, and processing and storage options to prioritize options for further research and development. Among the POS technical solution options, IECR options emerged as the most promising for the following reasons:

- IECR transactions represent more than 80 percent of all EBT redemptions. IECR systems are technologically sophisticated; they can most easily be adapted to fulfill FNS data needs. Retailers can use their existing ECR hardware, requiring only POS software modifications.
- IECR systems include dynamic inventory databases that contain the item-level data FNS desires.
- IECR-based solutions could leverage existing transmission infrastructures between retailers and processors.

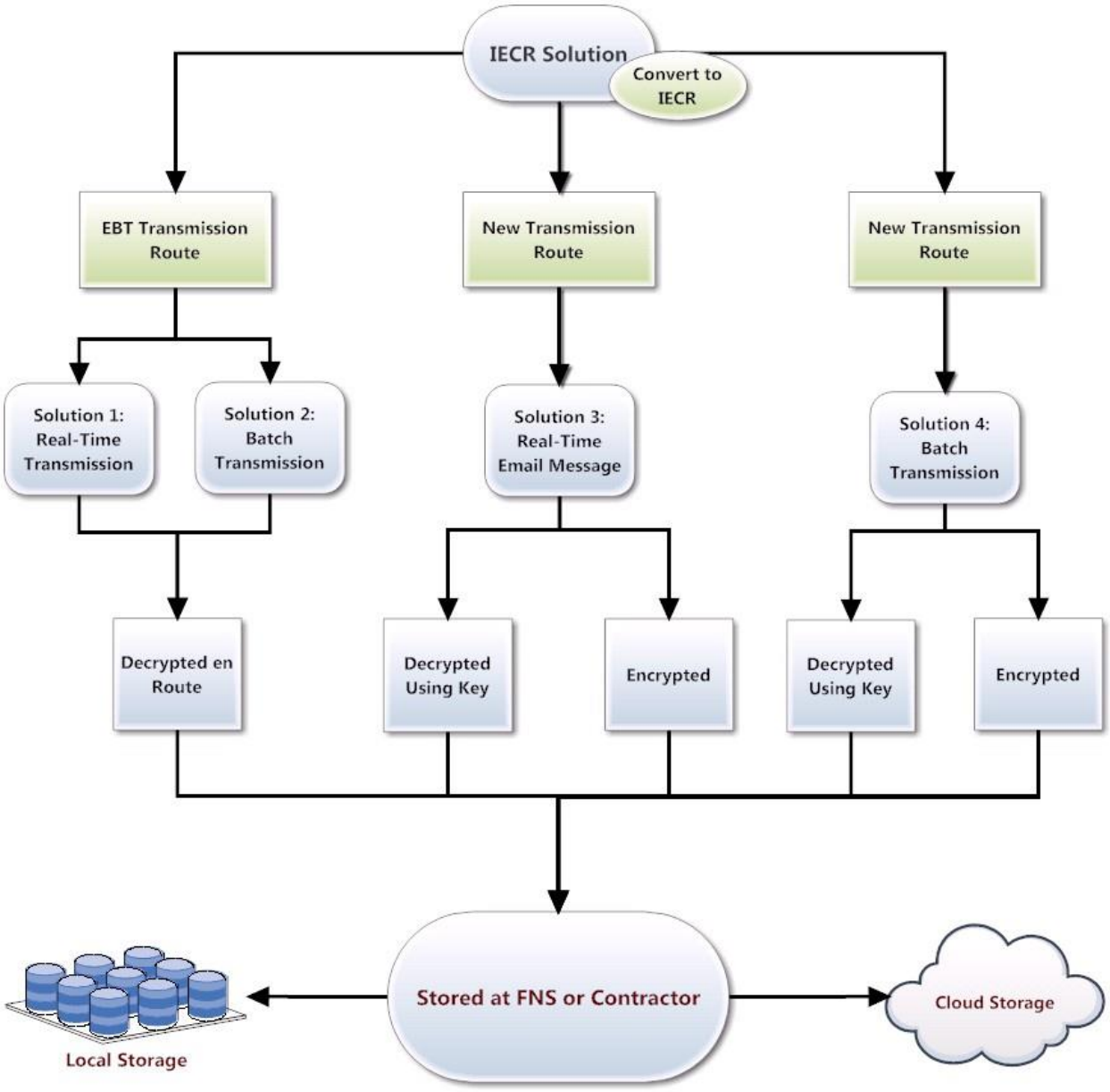
The proposed technical solutions are combined into four solutions sets, outlined in

Exhibit 1. These solution sets vary in terms of how data are collected and packaged, the transmission route used, and frequency of transmission. The four IECR solution set options all depend on using a uniform data capture and transmission standard, either based on existing standards or as part of a new standardized message format. Under each of the options, FNS would have some flexibility in terms of how and where data would be stored.

- **Solution Set Option 1: Existing Transmission Infrastructure with Real-time Data Transmission.** Under this option, we plan to use the current communications infrastructure through EBT processors and TPPs. These processors, or an approved contractor, could decrypt transaction or item-level data from retailers to FNS, if necessary.
- **Solution Set Option 2: Existing Transmission Infrastructure with Batch Data Transmission.** This option is similar to Option 1, but would transmit the item-level data in batch, limiting the real-time -- as a transaction is processed for approval or denial -- capacity burden on all stakeholders. However, local and processor storage capacity would need to increase to accommodate data accumulation prior to transmitting in batch.
- **Solution Set Option 3: New Transmission Infrastructure Using Electronic Messaging.** This proposed new transmission route would generate standardized electronic email messages sent directly to FNS to capture and transmit item-level data from retailers. With the absence of EBT processors and TPPs, decrypting data from retailers will require FNS to generate unique decryption keys for each retailer. Alternatively, encrypted data could be transmitted containing partially masked identifiers that could be systematically matched to current ALERT system records to append EBT card information.
- **Solution Set Option 4: New Transmission Infrastructure Using Batch Processing.** This proposed option is similar to Option 3 in that it would work with new transmission routes, bypassing TPPs and EBT processors. However, new transmission routes could be required to accommodate larger batch files. Encrypted item-level data would be matched to ALERT system data.

FNS will select a subset of these options for proof-of-concept testing based on initial project research and development findings. As mentioned previously, some preliminary testing and prototype development was required in order to explore critical elements of the four solution set options. A key issue was whether transaction data with partially encrypted EBT card numbers could be matched to ALERT data, thus eliminating the need to transmit decrypted data or share decryption keys. In order to test this, we matched transaction data, including partially masked EBT card numbers, to ALERT data. We generated mock retail data from actual grocery store data and matched it to actual ALERT system data for limited testing of matching transaction data. More specifically, we masked the personal identifiable sections of EBT card numbers to simulate actual transaction record masking. Matching algorithms determined that using a combination of a masked EBT card number, date of transaction, store identity number, and transaction amount yielded a greater than 99 percent match rate between mock retail data and ALERT system records. In other words, we determined that it is possible to reliably match encrypted transactions to ALERT data if other information is included in the transaction record.

Exhibit 1: Technical Solution Sets



CHAPTER 1: INTRODUCTION

This report is the result of a United States Department of Agriculture (USDA) Food and Nutrition Service (FNS) study led by IMPAQ International, LLC, and its subcontractors Ventera Corporation and Cash Register Services (CRS). The study is exploring the feasibility of creating a data collection system capable of directly and automatically providing FNS with item-level data on food purchases made by Supplemental Nutrition Assistance Program (SNAP) households. These data would be captured from purchases made by SNAP beneficiaries using their State-issued electronic benefits transfer (EBT) cards: plastic cards, similar to bank debit cards, which are used at retailers approved to accept SNAP payments. In addition to exploring the feasibility of creating and operating such a data capture system, the study is identifying and examining the possible technical parameters of this system. This report presents the study's findings to date.

1.1 Background

To support its mission of providing needy families with access to food and healthful diets, FNS would like to have a variety of data on the diet and food purchasing patterns of SNAP household. FNS currently does not have the infrastructure to capture item-level food purchases made by SNAP households using their EBT cards. Furthermore, SNAP authorized retailers are not required by statute to report item-level data to FNS. Therefore, FNS must rely on consumer-reported data from several sources to gain insight on SNAP households' food purchasing and dietary behaviors. These include large datasets collected by other federal entities such as the Flexible Consumer Behavior Survey module of the National Health and Nutrition Examination Survey (NHANES) and the Bureau of Labor Statistics' Consumer Expenditure Survey (CES). In addition, FNS conducts or collaborates on new data collections involving participants in SNAP and other programs, including the Healthy Incentives Pilot Evaluation, School Nutrition Dietary Assessment Study, and National Household Food Acquisition and Purchase Survey. However, these data collections are cross-sectional surveys that rely on self-reported dietary intake and purchasing behaviors. They also tend to cover a limited period of time (one day to one week).

Insight into SNAP participant shopping patterns also comes from analysis of data available from the SNAP Anti-Fraud Locator for EBT Redemption Transaction (ALERT) system, which records payment information for every EBT transaction for every SNAP household. Each record includes store and household identifiers; EBT card number; date, time, and type of transaction; total amount of the transaction; and account balance. ALERT was not designed to capture item-level purchase data.

Many retailers and third-party companies (for example, Catalina Marketing, LoyaltyOne, or Nielsen) regularly capture, store, and mine data on individual food items purchased by customers. Unfortunately, they do not produce sufficiently accurate item-level data on a large enough sample of identifiable SNAP households to allow for statistically reliable analysis of food purchases. As a result, FNS is investigating the feasibility of creating a data collection system that will automatically deliver item-level data on purchases made by SNAP households on an ongoing basis.

SNAP, and in particular EBT, require the involvement of several parties for successful operation. We describe their roles below:

- ***FNS*** sets national program policy and regulations for federal nutrition assistance programs, including SNAP. Included in these policies and regulations are the rules that govern EBT. FNS

pays 100 percent of benefit costs and a portion of administrative costs for SNAP. It also authorizes retailers to redeem SNAP benefits.

- ***State offices or agencies.*** While FNS sets program policy and regulations, actual responsibility for operating SNAP rests with state agencies. The states develop operating procedures and ensure that the program operates in accordance with federal law. With respect to EBT, state agencies also conduct procurements for EBT processor services.
- ***EBT processors*** provide EBT equipment to retailers, manage card issuance and support to participants, approve or reject EBT transactions, and maintain interfaces with FNS and states to maintain an updated list of participants and authorized retailers.
- ***Third-party processors*** manage electronic transactions from retailers using debit and credit card approval services. TPPs enter into agreements with EBT processors to process EBT transactions on integrated or standalone equipment. This equipment processes debit and credit card transactions in addition to EBT card transactions.

1.2 Study Design

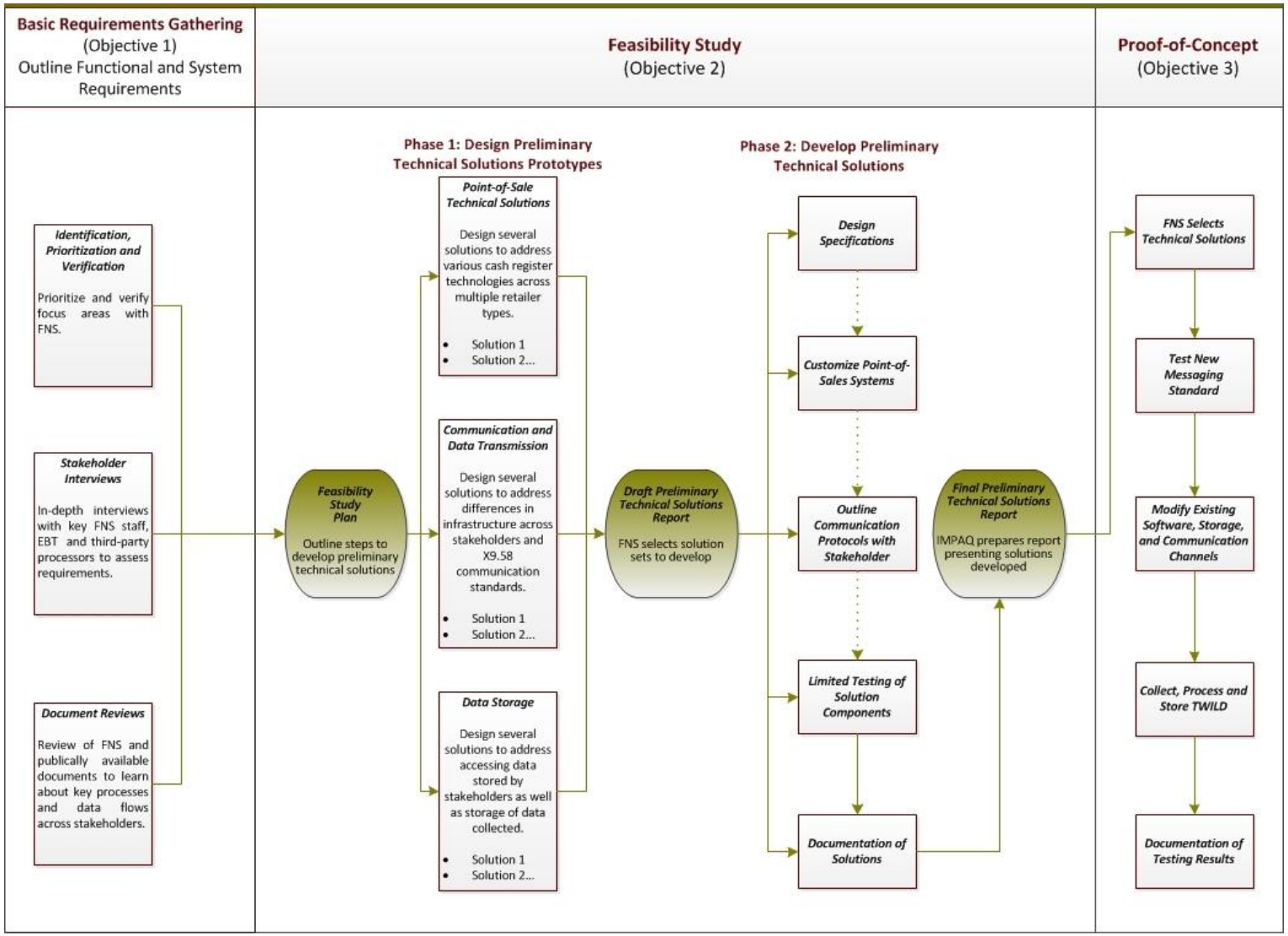
The primary objectives of this study are to 1) gather basic requirements to determine the technical parameters for a system that would automatically capture and transmit item-level purchase data on food purchases made by SNAP households; 2) examine technical alternatives, including considering relevant cost and policy issues, for a data capture system; and 3) perform limited proof-of-concept tests of proposed technical solutions. Exhibit 2 presents the objectives and phases of the feasibility study. We characterized stakeholders into three groups: retailers, processors, and FNS. We studied technical solutions that would be capable of transmitting item-level data from retailers and ultimately to FNS.

For the first objective—gathering basic requirements—we identified the data products from and the technical parameters for an FNS-owned data capture system and database for storing SNAP purchase data. In order to do so, we interviewed FNS staff and a variety of stakeholders. We also reviewed pertinent documents to gather information about the functional, data, and preliminary system requirements that a data collection and database storage system would need to meet.

For the second objective—examining technical alternatives—we developed and analyzed an array of technical alternatives for collecting item-level purchase data at the point of sale (POS). We focused on three solution areas: POS technical solutions, communication and data transmission, and data storage. POS technical solutions refers to proposed options to collect item-level data that depend on the POS hardware and software technology. With respect to communication and data transmission, the proposed options addressed item-level data transmission pathways and frequency. Finally, data storage solutions considered data processing and storage location, such as at FNS or cloud-based solutions.

For the third objective—proof-of-concept testing—we began preliminary limited testing on proposed solutions as we addressed the second objective. We will undertake more comprehensive testing as we examine findings and lessons learned from the limited testing. More comprehensive POC tests will focus on demonstrating that data can be collected using the proposed technical solution(s) and that the data collected are of sufficient quality to be useful in meeting study objectives. Specifically, during POC testing we will test new messaging standards; test necessary modifications to software, storage, and communications channels; and collect, process and store item-level data to gather information on system functionality and data quality.

Exhibit 2: Overview of Feasibility Study of Capturing SNAP Purchases at the Point of Sale



1.3 Challenges and Constraints

Current constraints and barriers related to capturing transactions with item-level data (TWILD) fall into three broad categories: 1) functional and programmatic requirements, 2) technical and system requirements, and 3) legal and policy considerations. We provide an overview of these challenges and constraints below. Within the context of these three broad areas, we also discuss current federal and state laws and regulations that govern EBT transactions. These constraints form the parameters within which any proposed technical solutions must operate.

1.3.1 Functional and Programmatic Requirements

Distinguishing between SNAP and Non-SNAP Purchases

As described in Chapter 2, SNAP recipients may use their SNAP benefits only, non-SNAP forms of payment only, or multiple payment types. SNAP customers can decide what portion of SNAP-eligible totals to pay with SNAP funds or other tender types during transactions. Retailer systems are not designed to distinguish between SNAP-eligible items purchased with SNAP benefits versus another form of tender when those purchases are part of the same transaction. Redesigning how retailers capture this information would pose significant technical, privacy, and cost issues that are beyond the scope of the project. Given these limitations, proposed solutions collect data on *all* SNAP-eligible food items purchased in any transaction made with a SNAP EBT card.

Item-Level Coding Issues

Product codes are routinely captured at the point of sale either by a barcode-scanning cash register or via manual entry. Universal product codes (UPCs) and price look-up codes (PLUs) are unique numerical identifiers for individual items. Each UPC is associated with a brief product description generated by the retailer. Many UPCs are universal making it easy to identify unique items from a variety of retailers. However, retail stores routinely add new products with new UPCs to their shelves. PLUs are four- or five-digit identifiers used to identify individual and bulk produce. These codes, generated by the International Federation of Produce Standards (IFPS), are designed to be unique and universal to the specific type of produce. For example, the four-digit PLU for *red onions* is 4082 while that of *pearl onions* is 4660. However, retailers sometimes assign their own internal "retailer assigned PLUs" at the level of the corporate distributor or individual outlet.[1] For example, the IFPS has reserved the PLU code 4666 for retailer-assigned onions.[2]

There is considerable variation among retailers with respect to coding other random weight items. Some industry groups have developed uniform numeric standards for the identification of non-produce random weight items such as meat, seafood, deli and bakery products. Nevertheless, most retailers use their own numbering system for these items.

[1] USDA FNS (September 2008). WIC EBT System Implementation of WIC Cash Value Voucher (CVV) – Business Rules, Technical Considerations, and Requirements for Retail Electronic Cash Register and Point of Sale Systems. Prepared by the Peachtree Group, Indianapolis, Indiana.
[2] http://www.plucodes.com/. Retrieved on February 16, 2013.

Several challenges exist related to capturing item-level product coding. Databases tracking UPCs are inherently unable to keep pace with new UPCs being generated by retailers. In addition, large retailers carry generic store-brand products. UPCs for these products are typically unique to the retailer and may not be easily accessible in national databases. The quality and consistency of item-level data will be a major issue given the diversity and nuances associated with UPCs and PLUs. In the absence of truly universal UPCs and PLUs, any FNS-owned data capture system must reconcile retailer-assigned PLUs with universal product codes. To mitigate the complexities of reconciling differences across all data captured, proposed technical solutions prioritize capturing item descriptions to the extent possible and are evaluated on the completeness of available item-level codes and item descriptions.

Availability of item-level descriptors hinges on the ability of retailers to capture data at this level of detail. Larger retailers using sophisticated IECRs and comprehensive electronic inventories are more capable of providing item-level descriptors. Smaller retailers using EBT-only devices installed by EBT processors would require cash register upgrades, including device memory enhancements and a scanner[3] to capture UPC data. Many smaller retailers would have to acquire a more capable IECR and set up all SNAP eligible food items in the IECR system. These key factors will influence data quality and consistency for each potential solution.

1.3.2 Technical and System Requirements

POS Terminal Technology

Proposed technical solutions are driven by POS terminal technology which varies greatly across retailers. The vast majority of SNAP transactions come through retailers who operate electronic cash registers (ECRs) with the capability of collecting POS data. The most sophisticated ECR systems are integrated systems (IECRs), in which SNAP EBT redemption processing is included with all other tender types as a part of the total payment processing system for the store.

SNAP EBT redemptions also occur in standalone systems which may or may not utilize ECRs. Standalone systems require a SNAP-eligible subtotal, obtained either from an automated flag for SNAP-eligible items in the store's inventory database or by manually separating SNAP-eligible items from other items in the basket. See Appendix B: "Integrated Electronic Cash Register Hardware and Software Technology" for additional details about POS technology.

Data Capture and Transmission Standards

SNAP EBT transactions conform to standards governed by the American National Standards Institute (ANSI). ANSI standard X9.58-2013[4] provides technical specifications for exchanging financial transaction messages between a retailer and an EBT card processor. The specifications cover message structure, format and content, data elements, and values for data elements used in the SNAP program. However, X9.58-2013 message standards do not accommodate item-level detail and would need to be revised or modified. Revisions or modifications to ANSI standards do not occur quickly. ANSI considers openness,

[3] The Agricultural Act of 2014 (P.L. 113-79) requires that nonexempt stores use scanner devices in the future. However, regulations will need to be promulgated to implement the provision.

[4] American National Standards for Financial Services ANS X9.58-2013. Financial Transaction Messages – Electronic Benefits Transfer (EBT) – Supplemental Nutrition Assistance Program (SNAP) and cash benefit programs.

balance, consensus, and due process as keys to ensuring that standards are developed in an environment that is equitable, accessible, and responsive to the requirements of various stakeholders. ANSI's process ensures that all interested and affected parties have an opportunity to participate in a standard's development, thereby serving and protecting the public interest. The time needed to modify messaging standards or create new ones, combined with the time to approve the changes, often takes years. ANSI standard modification is a key factor for any proposed technical solution.

Additionally, if X9.58-2013 standards were changed or replaced, retailers, EBT processors and third-party processors (TPPs), independent sales organizations, and POS vendors would likely need extensive modifications to their software systems. Costs of such changes would likely be significant. Furthermore, these changes might require modifications to existing rules and regulations governing how data are captured and shared, such as Quest® Operating Rules.[5]

Data Transmission and Size

Design and development considerations for proposed technical solutions include identifying optimal junctures at which to capture the most complete item-level data; addressing whether these POS data will be captured and transmitted in real-time processing, batch processing, or both; and deciding how and where to store these data. Moreover, proposed technical solutions should be designed to minimize burden on the current data flow streams as discussed in Chapter 2, Current Environment.

The SNAP EBT environment has several interdependencies across stakeholders. At the program level, data are transmitted to and from numerous stakeholders including FNS; state offices and agencies; TPPs and EBT processors; retailers; and SNAP participants. Among other programmatic activities, the data are used to:

- Certify SNAP households and issue EBT cards for them;
- Authorize SNAP retailers;
- Establish SNAP participant, authorized retailer, and state agency monetary reconciliation mechanisms; and
- Update the Store Tracking and Redemption System (STARS) and ALERT system.

How transaction-level data flow from the retailer's cash register is critical for developing an FNS-owned POS item-level data capture system. In TPP-provided terminal or IECR environments, EBT transaction data flow from the retailers' systems to TPPs, to EBT processors, back to TPPs, and finally back to the retailers. In EBT-only terminal environments, EBT transaction data flow from the retailers directly to the EBT processors and back.

Another concern relates to data size and changes that will have to be made to the current communication infrastructure. To exchange information across various SNAP EBT stakeholders, a standard messaging format is required. For example, the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) administered by FNS requires the transmission of eligible item-level data at the point of sale. FNS worked with retailers and ANSI standards bodies in the development of

[5] According to the NACHA website, "NACHA manages the development, administration, and governance of the ACH Network, the backbone for the electronic movement of money and data." https://www.nacha.org/intronacha

the X9.93 standard to facilitate data exchange among WIC EBT stakeholders. The X9.93 message standards in WIC EBT can support up to 50 unique items per transaction due to communication infrastructure limitations negotiated between TPPs and the retail industry's need to meet FNS requirements. Collecting item-level data for SNAP transactions will be a challenge as SNAP transactions frequently include more than 50 unique items.

1.3.3 Legal and Policy Considerations

Current Legal and Policy Environment Assumptions

We examined the current policy and regulatory environment to ensure that proposed solutions meet federal regulations, data security and privacy concerns, and industry standards (Quest Operating Rules). In light of these requirements, we identify below legal or policy concerns that may arise from a proposed solution.

We found no specific FNS policy or federal regulation that prevents states from collecting SNAP-eligible item-level data at the point of sale. In the absence of specific policies or regulations prohibiting collection of these data, FNS can legally collect item-level data. However, collecting this information raises privacy and security concerns that would need to be addressed. Furthermore, although FNS is not prohibited from collecting this information, FNS also does not have explicit authority permitting data collection of this sort.

It is not technically possible to distinguish item-level data collection by payment tender when customers use more than one tender type in addition to their EBT card. Item-level data for the entire transaction would be collected for all SNAP-eligible goods in any transaction that uses EBT tender. This poses potential legal and policy challenges authorizing collection of data on transactions paid for by non-EBT tender. Retailers may also not be as willing to provide transaction level data on items potentially paid for using non-EBT tender.

Facilitating transmission of item-level data to and from TPPs and EBT processors, through which more than 80 percent of SNAP redemptions pass, (see Exhibit 4, Benefit Redemptions by Retailer Type), may not pose a serious policy and regulation concern. At a minimum, TPPs already comply with WIC X9.93 standards that could be utilized as well for SNAP EBT.[6] Though potential TPP cost and implementation concerns must be addressed, they are client-driven and should be expected to enhance message standards to meet client needs. Similarly, EBT processor concerns about implementation costs need to be addressed, but these processors are expected to comply with the FNS requirement to collect item-level data.

FNS will need to develop and implement explicit policies and guidelines that address concerns about SNAP households' privacy and confidentiality in light of these stakeholder concerns. Moreover, communication infrastructure issues such as capacity and cost must be considered in order to incorporate the additional item-level data elements—specifically, UPC and PLU codes—currently transmitted using WIC X9.93 standards into SNAP X9.58 standards.

[6] This would be a major undertaking for FNS and TPPs and would require significant time for system-wide changes (5 years or more) that includes careful planning and providing resources. This would also be a costly undertaking.

1.4 Report Organization

The report continues as follows: Chapter 2 examines the current environment of SNAP EBT transactions. It discusses solution parameters including POS terminal limitations, current data transmission standards and infrastructure, POS data availability, and potential legal and policy hurdles to implementing any proposed technical solution. In Chapter 3, we discuss high level issues that need to be considered in the design of technical solutions. We outline issues for POS software and hardware, communication infrastructure and frequency, and processing and storage of these data. Once these high level issues are presented, a subset of technical solution options with greatest viability for development are selected for detailed discussion in Chapter 4. In this chapter, POS, communication, processing and storage options are combined into several solution sets. These solution sets represent systems that could be implemented to capture item-level data at the retailer and transmit it to FNS. Developing technical solutions involved designing technical specifications, customizing POS systems, establishing stakeholder communication protocols that meet current standards, limited testing of components of the system, and documenting all preliminary solutions. Chapter 5 discusses this limited testing, the findings, and the next steps for the project. The appendices provide additional details on selected topics covered in the report.

CHAPTER 2: CURRENT ENVIRONMENT

In this chapter, we describe the current operational environment for retailer point-of-sale systems; communications and data transmission among retailers, third party processors (TPPs), and EBT processors; data, infrastructure, and security standards and regulations; and data processing and storage across the EBT infrastructure. We provide comprehensive details in appendices as necessary.

2.1 Current POS Environment

2.1.1 Electronic Cash Register Types

POS technology varies greatly across retailers, as seen in Exhibit 3 below. Most retailers currently use an electronic cash register (ECR) device to collect POS purchase data. Depending on their level of sophistication, ECRs may track transaction data related to the total items in the sale, the value of the sale, discounts, and the EBT total of SNAP- and WIC-eligible items. The most sophisticated ECR systems can also collect detailed information about customers' purchases for proprietary use. In the current retail environment, two main kinds of systems implement EBT technology at the point of sale: **integrated (IECR)** and **non-integrated systems**.

In an **IECR system**, EBT redemption processing is included with all other payment types as a part of the total payment processing system for the store. EBT transactions are processed seamlessly through interconnected in-lane hardware that links:

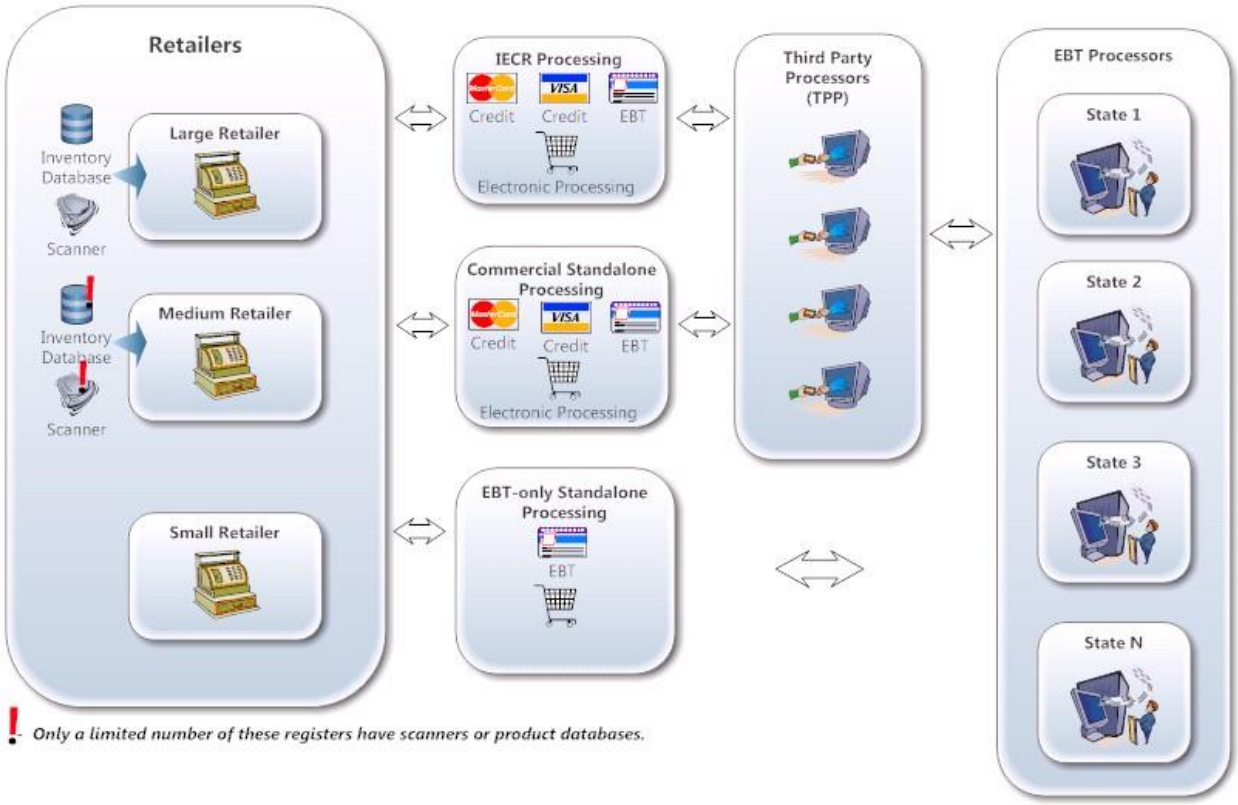
- Scanning devices that capture item data from UPCs or PLUs
- The ECR, including its printer and the inventory cached on its local hard drive
- A POS terminal, where consumers swipe their EBT or credit cards to initiate payment
- The retailer's automated inventory database, which maintains, among other information, data on items' SNAP eligibility.

IECR systems can capture item-level data from the merchandise inventory for each transaction. They therefore facilitate processing of mixed shopping baskets, so that all SNAP and non-SNAP items can be scanned without the need to separate SNAP items manually. The IECR flags all SNAP-eligible items as they are scanned and accepts SNAP benefits to pay for SNAP items.

In a **non-integrated ECR system**, EBT redemption processing for SNAP purchases occurs in a *commercial standalone* or *EBT-only standalone* system. These systems require generation of a SNAP-eligible subtotal. Like IECRs, *commercial standalone* ECR systems handle transaction processing for multiple payment types including EBT. However, the POS terminals in these systems do not interface with other in-lane hardware. Additionally, processing mixed baskets is limited, posing an additional burden on the SNAP participant. The isolation of commercial standalone systems poses challenges to associating item-level data with each EBT transaction for transmission to FNS, as discussed in detail throughout this chapter. *EBT-only standalone* terminals process only SNAP EBT transactions; many states also accept cash EBT transactions. SNAP consumers or store clerks must manually separate SNAP-eligible items from other items. Other payment types are processed through different equipment or cash is the only other payment type acceptable to the retailer.

TPPs provide IECR and commercial standalone systems to retailers at a negotiated cost. EBT processors provide EBT-only standalone systems to retailers that opt to use them, charging the cost not to the retailers but to state SNAP agencies as part of their overall cost per case month fees. Generally, national supermarket chains and large- to medium-sized independent grocery stores have IECRs. Small grocery stores or convenience stores may have commercial standalone or EBT-only standalone systems.

Exhibit 3: SNAP EBT Processing and Data Transmission



As can be seen in Exhibit 4 below, we estimate that retailers with IECR technology account for approximately 80 percent of all EBT redemptions. These retailers account for at least 45 percent of all authorized retailers. Retailers using commercial standalone technology account for approximately 2 percent of EBT redemptions and at least 8 percent of all authorized retailers. Finally, retailers in the EBT-only standalone environment account for approximately 3 percent of all EBT redemptions. The number of EBT-only standalone authorized retailers is not easily estimated, but they could account for as much as 36 percent of all authorized retailers.

Exhibit 4: SNAP Redemptions by Retailer Type

Retailer Type	% of Total Authorized Retailers	SNAP Redemption Amounts (million)**	% of Total Redemptions	Cash Register Technology*
Superstore	7.46%	$36,195	48.53%	IECR
Supermarket	7.62%	$24,956	33.46%	IECR
Combination Grocery/Other Store	24.18%	$4,066	5.45%	IECR or Standalone
Convenience Store	39.25%	$3,688	4.94%	IECR or Standalone
Medium Grocery Store	4.62%	$1,580	2.12%	IECR
Small Grocery Store	6.78%	$1,264	1.69%	Standalone or IECR
Large Grocery Store	1.45%	$1,175	1.58%	IECR
Meat/Poultry Specialty Store	1.61%	$571	0.77%	Standalone
Seafood Specialty Store	0.88%	$233	0.31%	Standalone
Bakery Specialty Store	1.71%	$231	0.31%	Standalone
Meal Services***	1.72%	$203	0.27%	Standalone
Delivery Route	0.43%	$146	0.20%	Standalone
Fruit and Vegetable Specialty Store	0.74%	$121	0.16%	Standalone
Military Commissary	0.08%	$99	0.13%	Standalone
Non-Profit Food Provider	0.16%	$32	0.04%	Standalone
Farmers' Market	0.76%	$12	0.02%	Standalone
Wholesaler	0.01%	$8	0.01%	Standalone
Direct Marketer	0.54%	$4	0.01%	Standalone
TOTALS	**100%**	**$74,584**	**100%**	

Source: SNAP Benefit Redemption Division, 2012 Annual Report.

* Estimates based on current industry trends.

** Numbers have been rounded up to the next million.

*** Meal services include communal dining facilities and group living arrangements, among others.

Whether the ECRs are integrated or non-integrated determines the potential solutions for capturing item-level data at the point of sale. This factor has implications for the number of retailers who can be reached by each potential solution and, equally important, for the proportion of redemptions that can be captured. Furthermore, as discussed in detail below, the cash register type and retailer type determine the availability and portability of the item-level data. ECRs used in supermarkets and grocery stores are not the same as those used in convenience stores and similar operations. Depending on the particular store, ECRs used in convenience stores are often less functional and may not be as easy to update or upgrade to handle additional data elements. For example, some urban areas have many *bodegas* or smaller retailers with less than fully featured cash registers and with standalone SNAP EBT terminals.

2.1.2 Encrypting Personally Identifiable Transaction Data at the POS

A critical element in a typical transaction is the encryption of personally identifiable data that occurs at the POS. The Payment Card Industry Security Standards Council (PCISSC), an open global forum founded by major credit card companies, developed Data Security Standards to protect cardholder data. Exhibit 5 outlines the major PCI DSS goals and requirements for merchants and processors. The second goal, protecting cardholder data, is the goal with the most significant implications for the feasibility of capturing item-level data.

Exhibit 5: PCI Data Security Standards for Merchants and Processors

Goal	Requirements
Build and maintain a secure network	Install and maintain a firewall configuration to protect cardholder data.
	Do not use vendor-supplied defaults for system passwords and other security parameters.
Protect cardholder data	Protect stored data.
	Encrypt transmission of cardholder data across open, public networks.
Maintain a vulnerability management program	Use and regularly update anti-virus software or programs.
	Develop and maintain secure systems and applications.
Implement strong access control measures	Restrict access to cardholder data by business need-to-know.
	Assign a unique ID to each person with computer access.
	Restrict physical access to cardholder data.
Regularly monitor and test networks	Track and monitor all access to network resources and cardholder data.
	Regularly test security systems and processes.
Maintain an information security policy	Maintain a policy that addresses information security for all personnel.

According to PCI SSC, cardholder data includes the primary account number, personal identification number (PIN), cardholder name, card expiration date, and card service code. PCI standards, which have been widely adopted in the retail industry, require all of these elements of cardholder data to be encrypted. FNS does not mandate compliance with PCI standards for EBT transactions. However, retail environments that accept EBT must encrypt the PIN and display only the last digits of the primary account number—the EBT card number—when necessary. They must also follow additional requirements enumerated in 7 CFR 274.8 (and presented in Appendix D). In order to associate item-level data with the SNAP participant who purchases those items, the EBT card number would have to be transmitted by retailer systems along with the item-level data. No other cardholder data would be required.

Most IECR systems today encrypt cardholder data at the POS terminal; those that do not are moving to do so. This practice means that the EBT card number is not available to the IECR software; that is, the data stored locally at the ECR or at the retailer's servers do not contain complete identifiers. Rather, a partial record of the encrypted identifiers is retained. For example, the first six digits and the last four digits of the EBT card number may be encrypted as part of the IECR transaction record. Any potential

POS technical solution that requires complete EBT identifiers will need to take into serious consideration these data security mechanisms. Possible solutions include using the partial EBT card number to coordinate with other information available to the EBT processor and to FNS in order to generate EBT transaction records with unique identifiers. We explore this option in Chapter 5.

2.1.3 Current Operating Environments

The rest of this section presents detailed discussions about the current operational environment for each of the cash register types, starting with IECRs.

Integrated Electronic Cash Register Systems

As can be seen in Exhibit 6, IECRs connect the ECR, a local hard drive storing a dynamic version of the retailer inventory database and transaction records, a scanning device, a printer, and the integrated POS terminal. The IECR also connects either directly or through the POS terminal to a central processor or mainframe that transmits the transactions to a TPP. These hardware components, available from many different vendors, communicate with each other within an *operating system.*

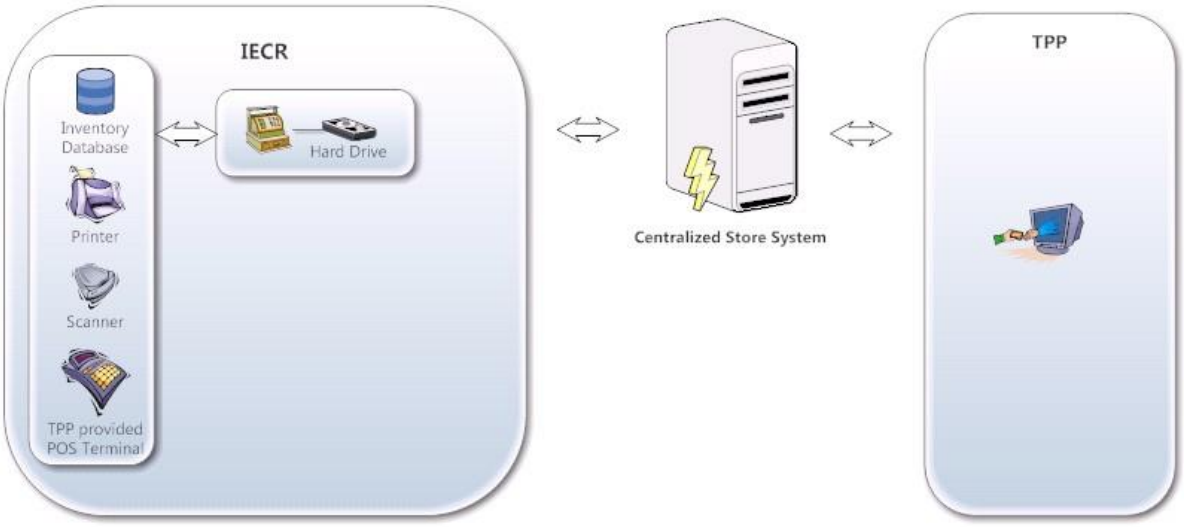
While not all IECRs function the same way, cashiers typically use cash register hardware which runs a *POS software application,* which facilitates tasks such as:

- Scanning purchased items
- Looking up items in the retailer's inventory system
- Applying discounts and coupons
- Sending transaction totals to the POS terminal
- Communicating directly or indirectly with TPP or EBT processors to validate an EBT card or check availability of funds[7]
- Preparing receipts
- Reconciling the retailer's inventory database at both the ECR and the local server

The most critical hardware components that could potentially affect potential solutions for collecting POS item-level data are the ECR, the POS terminal, and external servers. Given the variety of ECR hardware and software applications in the retail environment, it is important to understand the market penetration of each hardware and software technology because it informs the proportion of retailers affected by potential changes based on the technology they are using. The major element to consider is the POS software application. The hardware matters, but much less, as most ECR hardware will run most POS software applications.

[7] Indirect communication, used by large retail chains, involves connection to a centralized transaction processing system.

Exhibit 6: Hardware Configuration in an IECR System



POS terminal technology and software connected to the ECR are also key factors in solution flexibility. POS terminals have their own operating systems that interface with current ECR operating systems and POS software applications. Another factor to consider is the servers to which retailer systems connect at TPPs, EBT processors, or other potential contractors. These servers are flexible, designed to interface with multiple POS hardware and POS software applications. While all of these hardware and software systems are compatible, proposed modifications to any system necessitate a collaborative and synchronized modification of all operating systems and software to retain this compatibility while accommodating additional services and functionality. Appendix B outlines the major hardware and software technologies in the IECR environment.

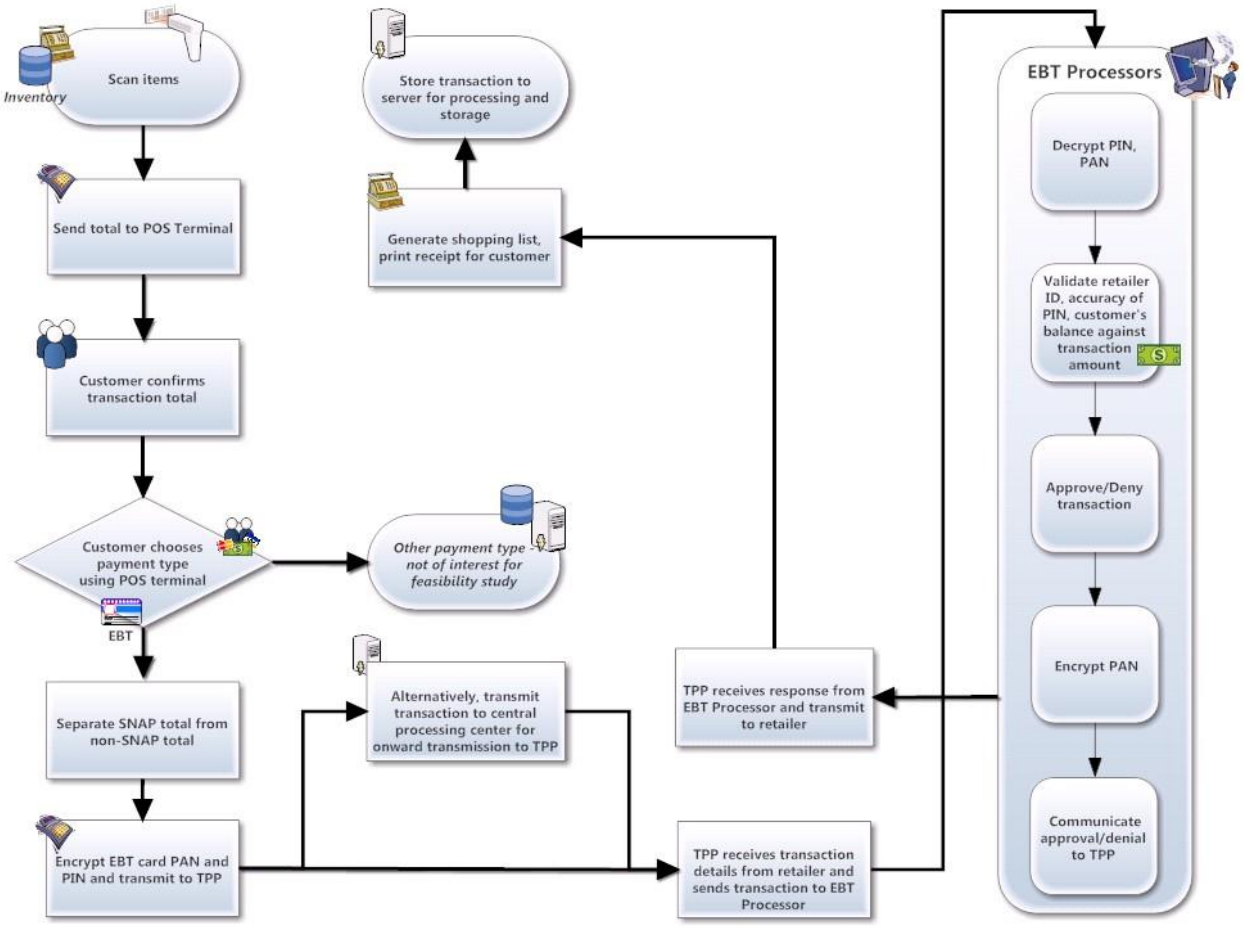
As outlined below, a SNAP EBT transaction at an IECR is similar to all other IECR transactions, with a few differences representing steps to process the EBT payment. The usual steps that take place when a SNAP customer is completing a transaction are summarized and depicted in Exhibit 7 .

1. The cashier scans all items in the basket. The cash register simultaneously logs into the local ECR hard drive, which contains a dynamic copy of the store's inventory database including item UPC, description, price details, and SNAP eligibility.
2. The cashier prompts the ECR to send the transaction totals to the POS terminal.
3. The SNAP customer confirms the amount, swipes his or her EBT card for payment, and enters the PIN using the POS terminal. When the customer selects EBT as the payment option, the register generates separate SNAP and non-SNAP transaction totals.
4. The customer's PIN and EBT card number are encrypted at the POS terminal and sent to the ECR, which links the encrypted personal data with the EBT transaction total. The linked data are then transmitted either directly to the TPP or, in the case of large retailers, to a central point for transmission to the TPP. The TPP's system applies a decryption key, processes the data, determines the appropriate EBT processor, encrypts the data and transmits it to the relevant EBT processor for approval or denial. The EBT processor first decrypts the PIN and the card number and then validates the retailer FNS ID, the customer account status—whether the account exists and is active—and the accuracy of the PIN. Then it checks the EBT transaction

total against the customer's balance, using the EBT card number, and approves or denies the transaction. The response is channeled back to the TPP, where the data is encrypted again with an approval or denial flag that is sent back to the ECR and ultimately to the POS terminal.

5. The EBT customer then selects a payment type for the non-SNAP transaction totals.
6. After an entire transaction has been paid for, the shopping list—a set of records typically including item description and price—is generated by the interaction between the scanning device and the local inventory at the ECR and compiled into a receipt for printing.
7. All transactions are stored at the ECR before being transmitted to the retailer's servers. Communication between the ECR and the retailer's servers can take place in real time or in batch processing at given intervals. In addition to regular transmission of transactions to centralized storage systems, some IECRs store transactions for up to three days.

Exhibit 7: Typical SNAP EBT Transaction at an IECR



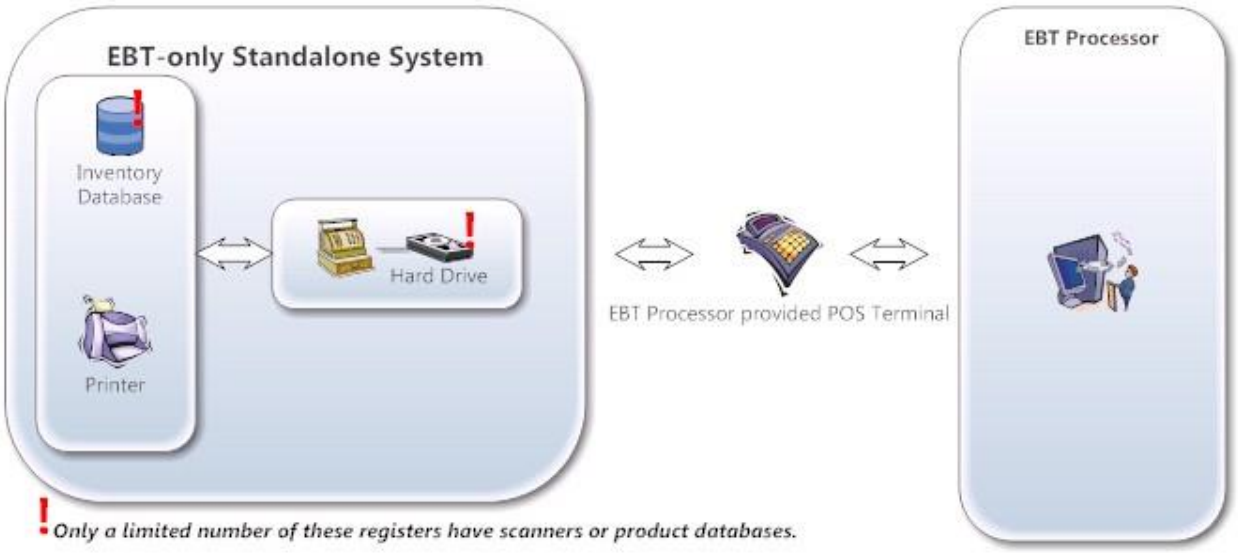
These steps represent the processes that take place during a typical SNAP customer transaction at the IECR; however, there are some differences across retailers caused primarily by differences in hardware and POS software applications. Differences in hardware determine when and how a cashier will generate the EBT transaction total as well as how multiple forms of payment are processed. Hardware differences also determine the volume of data that can be stored locally at the ECR. Most critical to

development of preliminary POS technical solutions for capturing item-level data are the differences caused by the POS software applications. POS software applications determine the type of item-level variables generated and retained during a transaction—essentially, what gets printed on a receipt and retained locally on the ECR's hard drive.

EBT-Only Standalone Cash Register Systems

As shown in Exhibit 8, the primary difference between EBT-only standalone cash register systems and IECRs is that the ECR is not interfaced with the POS terminal. In addition, however, the POS terminal device, supplied by an EBT processor or the state agency, processes *only* EBT card payments.

Exhibit 8: Hardware Configuration in an EBT-Only Standalone System



These systems, typical of small grocery and convenience stores, usually consist of a cash register, which may or may not be electronic, a printer, and, in rare instances, a scanner. A comprehensive electronic inventory database is not typical. These hardware components are not typically integrated; that is, they all act independently. The range of hardware and software systems that serve this market is small and tends to consist of "off-the-shelf" cash registers and printed price tags where scanners are not in use. These systems also tend to be older, with outdated basic POS software applications. As in the commercial standalone environment, the POS terminal is not connected to the cash register, and EBT transaction totals are manually entered into the POS terminal. The POS terminal is directly connected to an EBT processor rather than a TPP.

The process that takes place when a SNAP customer completes a transaction at an EBT-only standalone terminal is very similar to the one at a commercial standalone terminal.

1. The cashier manually enters the price for all items in the sale.
2. The cashier manually generates an EBT transaction total by separating SNAP-eligible transactions from non-eligible purchases during the scanning or manual price entry process. After scanning or keying all SNAP-eligible items, the cashier hits the total key for an EBT transaction total.

3. The cashier manually enters the EBT transaction total, asks for the EBT card, and swipes or keys it into the POS terminal.
4. The cashier, SNAP customer, and POS terminal display engage in "conversation" to process the transaction.
5. The EBT customer enters the PIN using the POS terminal. The EBT card number and PIN are encrypted at the POS terminal and sent, along with the EBT transaction total, to the EBT processor for approval or denial. The EBT processor receives the encrypted data, applies a decryption key, and then approves or denies the transaction. The response is sent directly back to the POS terminal.
6. Typically, as the item amounts are being entered, the cash register generates a receipt of the transaction. The receipt contains scant information on the items purchased, possibly listing generic shopping categories along with prices, or just prices. Specifics on the approved EBT transaction are not available to the cash register record.
7. If the customer is purchasing items that are not SNAP-eligible, the entire process is repeated, except that the payment tendered is processed using a different POS terminal.

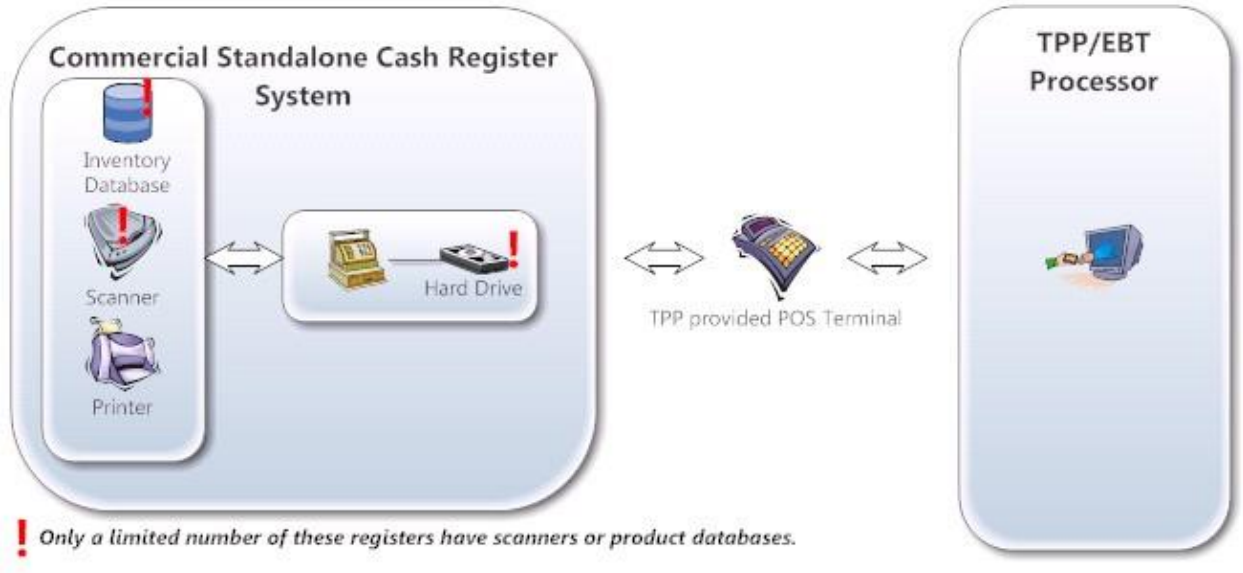
The EBT-only standalone terminal environment poses the greatest challenges to collecting item-level data for each transaction, because store inventories are not typically part of the system. Furthermore, transaction records are typically not stored at the cash register or on an external retailer server. Any proposed POS technical solutions must first address building a retailer inventory system to provide detailed item-level data. Scanning, storage, and transmission of these data represent a second set of issues.[8]

Commercial Standalone Cash Register Systems

[8] "The Agricultural Act of 2014 (P.L. 113-79) requires that nonexempt stores use scanner devices in the future. However, regulations will need to be promulgated to implement the provision."

Exhibit 9 presents the primary difference between commercial standalone cash register systems and IECRs: The ECR is detached from the POS terminal (similar to the EBT-only standalone systems). The environment may consist of connections among the ECR, a scanning device, a printer, a local dynamic inventory at the ECR, and the retailer's inventory database server- but this presents the minority of commercial standalone cash register systems. The range of hardware, operating, and software systems that serve this market is similar to that of the IECR market. Generally, the POS terminal processes all payment types, including EBT transactions (unlike the EBT-only ECRs that only process EBT transactions). However, some retailers set up a separate POS terminal, provided free of charge by the contracting TPP, to process only EBT transactions. The clerk manually enters EBT transaction totals—similar to all other payment type totals—into the POS terminal. The POS terminal is directly connected to a TPP, which connects ultimately to the EBT processor. However, item-level records reside on the ECR and cannot be associated with the EBT card number, which is retrieved and encrypted at the POS terminal.

Exhibit 9: Hardware Configuration in a Commercial Standalone System



As anticipated, the process that takes place when a SNAP customer completes a transaction at a commercial standalone terminal is similar to the EBT transaction processing at the EBT-only ECRs, with the key difference being whether EBT transactions are completed via TPP processor or the retailer uses an EBT-only dedicated POS terminal. Commercial standalone cash register environments are typically found at small grocery stores—outlets that do not handle large volumes of inventory compared to supermarkets and superstores. These outlets' retail inventory systems are typically less sophisticated than those of larger retailers. Not all commercial standalone retailers have an integrated interface between their retail inventory servers and the ECRs. Consequently, detailed item-level information may be only partially available or not available at all. Similarly, POS software applications in this environment vary depending on the level of sophistication of the retailer's inventory system. In a worst-case scenario, cashiers manually separate SNAP-eligible purchases from non-eligible purchases before generating EBT transaction totals.

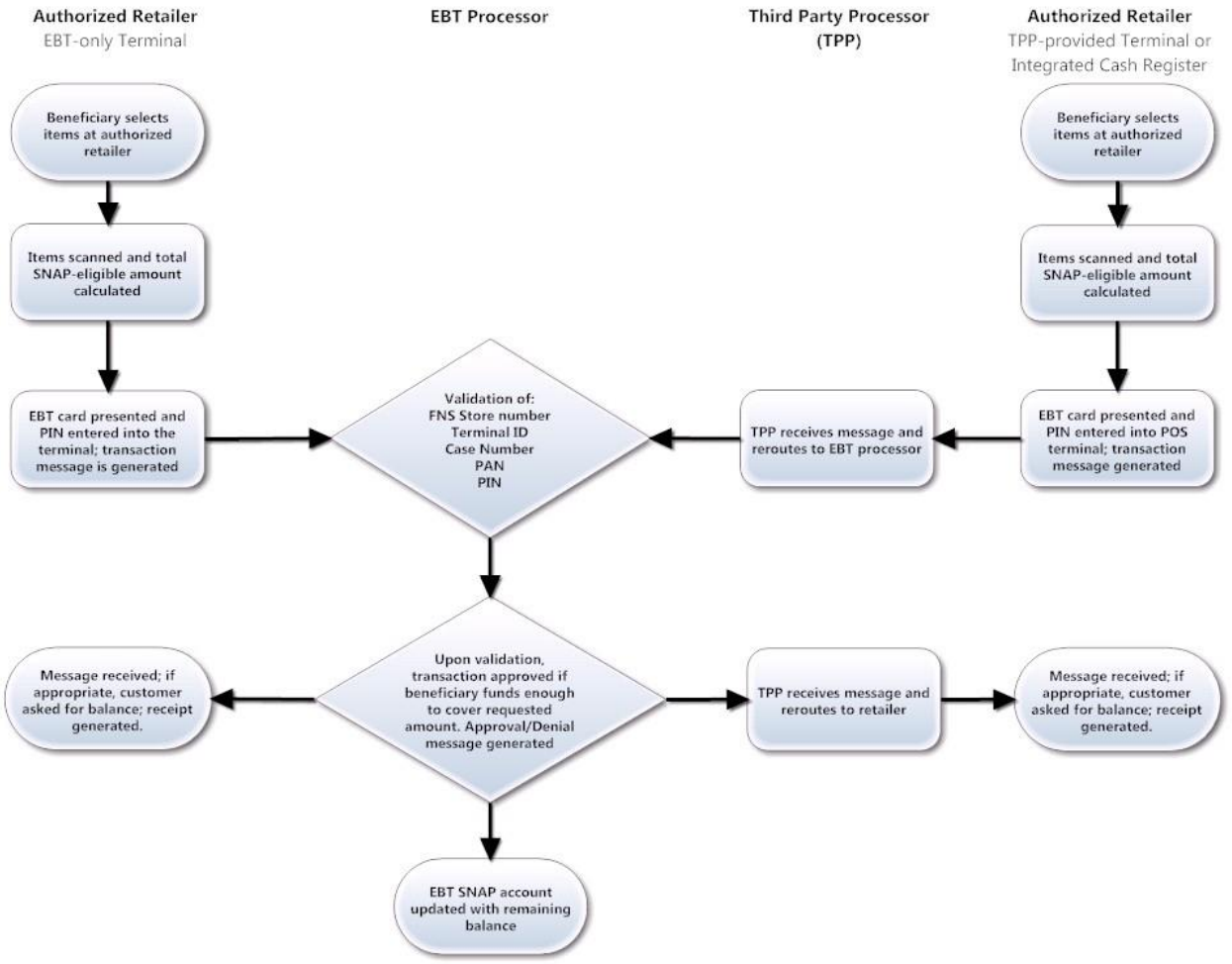
2.2 Communication and Data Transmission

Section 2.1 describes the typical steps that occur when SNAP participants swipe their EBT cards to complete transactions in IECR, commercial standalone, and EBT-only standalone systems. This section focuses on the message generated at the cash register by the transaction and the infrastructure that moves the message from one stakeholder to the next. EBT processors play a pivotal role in the existing processes for communication and data transmission. At the transaction level, EBT processors verify each SNAP transaction by ensuring that it originates from an authorized retailer with an active FNS number. After confirming the authenticity of the retailer, the EBT processor verifies the customer's EBT card number and PIN and checks that the account has sufficient balance to cover the SNAP transaction. At the program level, EBT processors transmit transaction data files each day to FNS' ALERT system.

Because a large percentage of authorized retailers use TPPs to consolidate debit, credit, and EBT authorization services, TPPs often play a pivotal role as well. When TPPs are involved, EBT processors establish a connection with the TPP systems to receive transactions initiated by the retailers and send

back responses that are rerouted to retailers. Retailers establish contracts with TPPs, and states establish contracts with EBT processors, to ensure payment of approved SNAP transactions. EBT processors ensure payment to TPPs who, in turn, process payments to retailers. For EBT-only systems, EBT processors are responsible for payment directly to retailers. Depending on their agreements with TPPs, retailers using IECR systems may collect item-level purchase data and transmit them in messages to TPPs. However, currently TPPs drop item-level transaction data from messages prior to transmitting them to EBT processors because these data are not required by the current standards (ANSI X9.58) for transaction messages between TPPs and EBT processors. EBT-only systems, as explained above, typically do not generate item-level data at all.

Exhibit 10: SNAP Transaction Data Flow



As shown in Exhibit 10, when a SNAP transaction is initiated at a retailer using an IECR or commercial standalone system, an encrypted message containing the store identifier, EBT transaction total, and EBT card number is sent to the TPP. The TPP reroutes this information to the state EBT processor.[9] The TPP

[9] EBT processors identify a redemption state by using the first six numbers of the PAN (also known as the Bank Identification Number).

receives a response from the EBT processor to approve or deny the transaction and sends this response to the retailer.

In addition, the EBT processor computes the total amount owed to the TPP as a sum of the total of transactions for each retailer based on the transaction record and its attributed settlement date. TPPs also keep track of these same transaction totals, and any differences that exist between the two totals are resolved in a reconciliation process. Subsequently, retailers receive the funds from TPPs comingled with payments from other sources, such as credit and debit cards. TPPs also send transactions to EBT processors in other states in instances of cross-state SNAP benefits redemptions. In the case of EBT-only standalone POS environments, the message goes directly to EBT processors, who replace TPPs in the process described here. In all cases, EBT processors transmit transaction data files each day to FNS' ALERT system as an electronic batch file.

2.3 Current Data, Communication Infrastructure, and Security Standards and Regulations

2.3.1 Current Data Standards

ANSI standard X9.58[10] provides technical specifications for exchanging transaction messages between EBT processors and all other parties involved in SNAP EBT transactions. Data transfer between retailers and TPPs are not governed by X9.58. TPPs convert messages from retailers to X9.58 format for transfer to EBT processors. Based on the International Organization for Standardization (ISO) 8583 interchange specifications for messages originated using financial transaction cards, the X9.58 standards are tailored specifically for EBT transactions, specifying the message structure and data elements to be used. SNAP EBT financial transaction messages are structured in three components—message type, message bitmaps, and data elements—as described in Appendix C.

FNS previously identified and prioritized specific item-level transaction data that would help to achieve the goals of this data collection. The priority data elements are UPC description, UPC/PLU code, net expenditure, amount purchased (quantity, volume or weight as applicable), and price paid. Of these, the only element currently included in the transaction messages is the net expenditure. The other elements are not currently included in these transaction messages. As shown in Section 3.1.2, however, some of the additional data items are currently collected in WIC EBT using the WIC data message standard X9.93. The WIC standard then might serve as a model for a new item-level data capture standard for SNAP.

2.3.2 Current Communication Infrastructure

Communication and data transmission in the SNAP EBT environment occur within the existing communication infrastructure, usually using land-based transmission lines. Retailers in remote locations may rely on satellite broadband Internet services to transmit and receive transaction data. These data are transmitted through channels that vary in their physical components and capacity.

[10] American National Standards for Financial Services ANS X9.2013. Financial Transaction Messages – Electronic Benefits Transfer (EBT) – Supplemental Nutrition Assistance Program (SNAP) and cash benefit programs.

Retailers, including SNAP EBT retailers, use transmission lines accessed through contracts with Internet service providers (ISPs). The main variable of these contracts is the data transfer rate. Several transmission technologies exist including traditional analog phone service, digital subscriber line (DSL), cable broadband, and T1/T2/T3 or DS1/DS2/DS3. Exhibit 11 shows a summary of the various data transmission technologies.

Exhibit 11: Communication and Data Transmission Technology

Technology	Upload Speed	Common SNAP Retailer Applications
Analog Phone Service	28Kb-128kB	Small "mom and pop" local grocery or convenience stores
DSL	256 kilobits per second (Kbps) to 8 megabits per second (Mbps)	Low-volume chains such as Dollar Tree and other small businesses
DS-1/T1 or DS-2/T2	1.544 Mbps to 6.312 Mbps	Large chain stores such as 7-Eleven
DS-3/T3	43.736 Mbps	Superstores such as Wal-Mart or Target to transmit very large databases

In general, DS-3/T3 provides the fastest data transfer rate (upload and download of data) and the most expensive data communication technology. T1 lines, specifically integrated T1s offer faster upload speeds, more dependable download speeds, and a sizable block of long distance minutes at rates not much higher than DSL.

2.3.3 Security Standards and Regulations

Secure Environments

Stakeholders currently transfer transaction data text files using hypertext transfer protocol secure (HTTPS), secure shell (SSH), or secure file transfer protocol (SFTP). HTTPS, a widely used protocol for secure communication over a computer network, has an especially wide deployment on the Internet. HTTPS authenticates Websites and associated Web servers, protecting users against "man-in-the-middle" attacks.[11] Additionally, HTTPS provides bidirectional encryption of communications between a client and server, a process that protects against eavesdropping and tampering with or forging the content of the communication.

Before a TPP connects to an EBT processor, the TPP needs to go through a certification process to ensure that its communication channels meet security criteria and other standards, such as the X9.58 message standards. However, almost all EBT processors and TPPs have already established relationships with one another. Unless there are major changes in the communication protocols, re-certification processes are not necessary; for example, the changes required in the proposed technical solutions outlined in this report will not require higher security standards than current ones.

[11] Criminals use man-in-the middle attacks to make independent connections among victims and relay messages between them. Victims believe that they are "talking" directly to each other over a private connection, but they are not. Their interaction is controlled by the attacker.

Standards

TPPs work with independent sales organizations to market transaction processing services and ensure that the retail systems they provide to retailers meet security criteria for EBT transactions. For example, sales organizations marketing IBM-based registers to retailers work with TPPs to code the systems they are selling to meet X9.58 standards. When sales organizations start to market new transaction terminals, TPPs typically take the lead, working with the sales organizations to certify that the new products comply with standards. This process ensures that the terminals and the software they run can function in a retail environment without requiring new certifications or extensive compliance testing. Exhibit 12 outlines standards that apply to SNAP EBT data transmission, along with some of the relevant regulations.

Regulations

Regulations related to SNAP EBT data collection and reporting currently require data systems to provide information only on total SNAP EBT purchases. Exhibit 12 below summarizes the regulations and standards that affect the feasibility of POS data collection, storage, and transmission. FNS amended SNAP rules between 2000 and 2010 to account for changes to the program resulting from using EBT technology. The majority of the rule changes occurred in 7 CFR 274, "Issuance and Use of Program Benefits." Appendix D lists the SNAP federal standards and EBT rule amendments.

The most relevant regulations pertaining to data collection and reporting under SNAP EBT are:

- **7 CFR 274.1–274.8** contains the majority of EBT-related regulations. The regulation requires states to establish secure, reliable issuance systems; allows states to use online and offline EBT technology for SNAP benefits[12]; outlines state reconciliation and reporting requirements; and specifies functional and technical EBT system requirements.
- **7 CFR 277.18** defines the advance planning documents and procurement standards that must be followed for EBT systems. In general, **7 CFR 277** also outlines security requirements for the EBT system.
- **SSAE No. 16** requires, at a minimum, states annually conduct an examination of their EBT transaction processing.

These regulations govern collection, storage, transmission, and use of EBT transaction data and therefore will affect proposed solutions for collecting item-level data. The EBT processors contract with authorized retailers using agreements that describe the terms and conditions for participating in the SNAP EBT system, including data collection and reporting requirements. The exact language of these contracts varies by state and processor. Furthermore, retailers that accept SNAP EBT must collect transaction-related data elements and provide them (often via TPPs) to the EBT processor, which then must transmit these data to FNS through the ALERT system and STARS.[13]

[12] Specifically, 7 CFR 274.1 permits states to use an offline EBT technology without the need for an EBT processor to authorize transactions in real-time.

[13] *FNS Handbook 901*, Section 3.3.1 Roles and Responsibilities, p. 89.

Exhibit 12: Standards and Regulations Applicable to SNAP EBT Data Transmission

Document	Scope
7 CFR 274	This section establishes rules for the approval, implementation, and operation of SNAP EBT systems.
ISO 8583	ISO 8583 is the standard message specification adopted for financial transaction cards originated and interchanged by wide segments of the payment industry. The standard extends to support the transactions taking place between POS terminals and merchant acquirers – financial institutions that accept and process card transactions. ISO 8583 specifies message structure, format and content, data elements, and values of data elements.[14] 7 CFR 274.8(b) directs states to ensure compliance with this standard.
ANSI X9.58-2013	An extension of ISO 8583, this standard provides technical specifications for all parties involved in SNAP EBT transactions exchanging financial transaction messages between a TPP and an EBT processor. The standard specifies message structure, format and content, data elements, and values for data elements.
Federal Information Processing Standard (FIPS)	This standard specifies the security requirements for a cryptographic module used within a security system protecting sensitive information in computer and telecommunication systems.
NIST Special Publication 800-122	This document assists federal agencies in protecting the confidentiality of personally identifiable information (PII) in information systems. The document explains the importance of protecting the confidentiality of PII in the context of information security and explains its relationship to privacy using the Fair Information Practices, which are the principles underlying most privacy laws and privacy best practices.
Quest Operating Rules, Version 2.0	The rules outlined in this document harmonize and maintain uniform EBT operating rules across states and program stakeholders.

2.4 Current Data Storage and Processing Environments

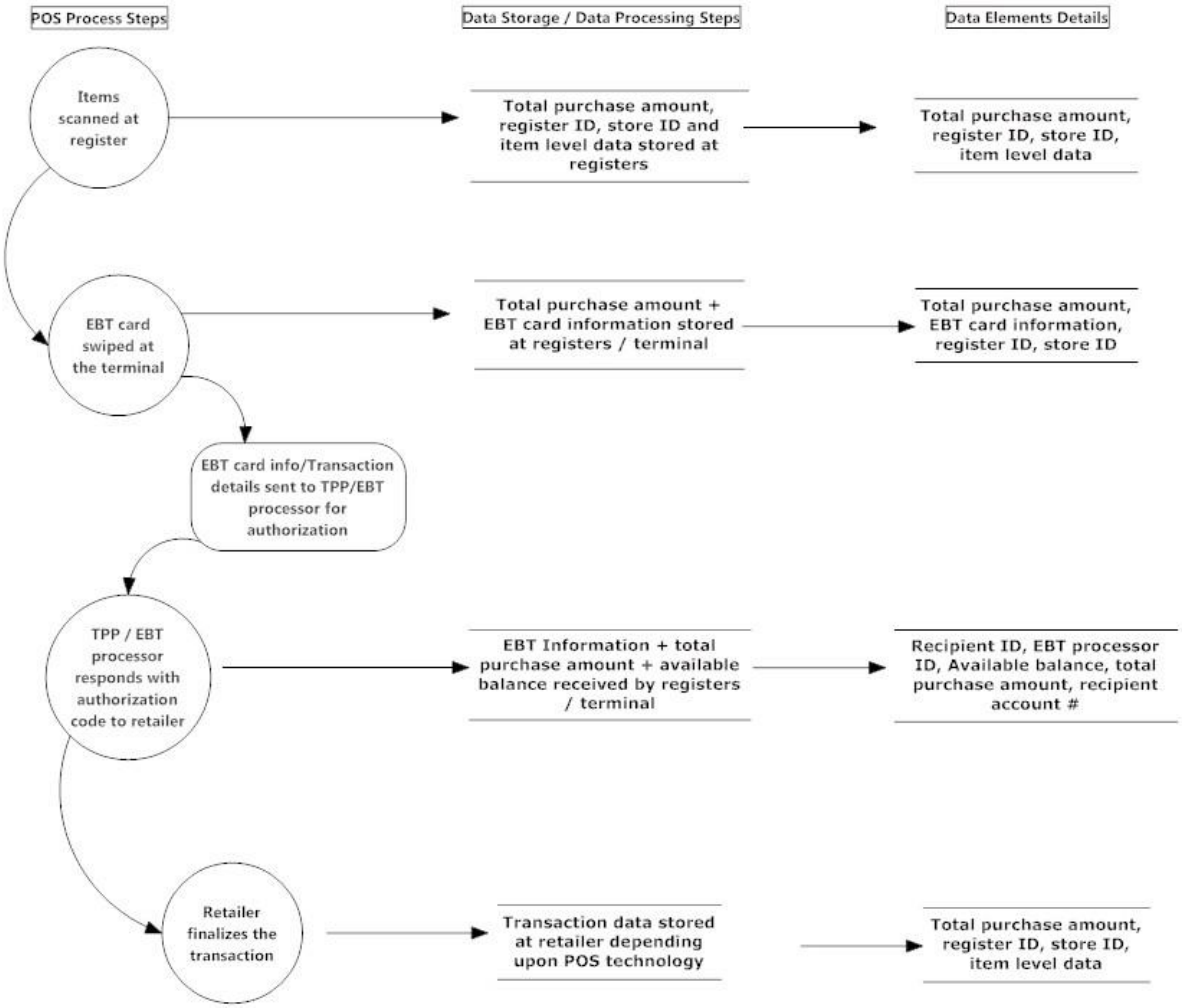
This section outlines data storage and processing procedures for each POS environment during a typical transaction. It describes the "back end" of the processes described in Section 2.1 (SNAP transaction from the customer perspective along with the authorization by TPP and EBT processors).

2.4.1 Data Storage during a Typical SNAP Transaction

The diagram and outline in Exhibit 13 illustrate the SNAP transaction data processing and storage process in retail environments with database inventories and scanners. The transaction item-level data may be stored in a retailer's system (either a central database or at the register), depending on the POS environment. Retailers with standalone systems may not have the ability to store item-level detail for each transaction.

[14] Kumar, S. 2010. "Introduction to ISO 8583." CodeProject. Retrieved 11/27/13 from http://www.codeproject.com/Articles/100084/Introduction-to-ISO-8583.

Exhibit 13: SNAP EBT Data Processing and Storage

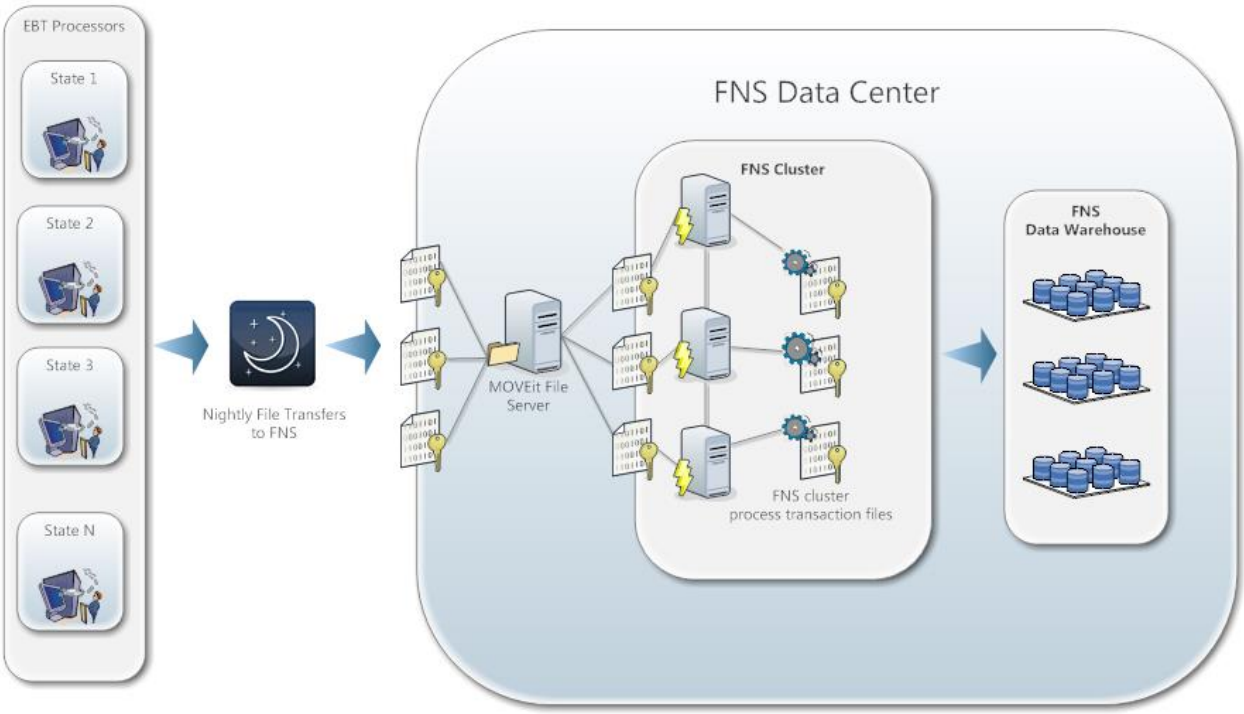


2.4.2 Data Transmission from EBT Processors to FNS Data Center

On successful completion of the transaction outlined in Exhibit 13, EBT processors process the data and submit it to FNS. Exhibit 14 illustrates the data transfer process from EBT processors to FNS that occurs as part of the ALERT system.

- EBT processors process files of completed transactions. Processing may include reconciling transactions with updated data from retailers, verifying transaction totals, and preparing the files for transmission to FNS.
- EBT processors connect with FNS and transfer transaction files on a nightly basis. Currently, the mode of transfer varies by EBT processor.
- The files are received via the MoveIT File Server and servers in the FNS Cluster validate and process files for data analytics. Processed data are stored in the FNS data warehouse.

Exhibit 14: ALERT System: Transmission of SNAP Transaction Files from EBT Processors to FNS



CHAPTER 3: DESIGNING TECHNICAL SOLUTIONS

As introduced in Section 1.2, technical solution options are grouped into three distinct but interdependent areas:

- POS technical solutions
- Communications technical solutions
- Processing and storage technical solutions.

Each of these areas offers several design options for consideration. As can be seen in Exhibit 15, POS technical solution options focus on and are driven by the prevailing ECR technologies. In addition, POS options are distinguished by whether EBT transaction identifiers are encrypted or unencrypted and by whether data are captured and transmitted in real time, in batch processing, or in a combination of both. Communications technical solution options include whether to transmit data in real time, in batch processing, or in a combination of both across all stakeholders, including retailers, contractors, and FNS. Communications options also are concerned with whether to use a combination of existing TPP and EBT processors or new contractors. Finally, processing and storing technical solution options include decisions on whether processing and data storage occur at FNS, an external contractor, or a combination of both. Federally approved cloud storage offers an additional option.

Exhibit 15: Technical Solution Options

Technical Solution	Options

POS Technical Solutions	▪ Register and POS terminal system
	  ○ IECR
	  ○ Commercial standalone
	  ○ EBT-only standalone
	▪ Encrypted or decrypted personal identifiers
	▪ Real-time or batch capture of item-level data

Communications Technical Solutions	▪ Transmission frequency
	  ○ Real-time
	  ○ Batch
	  ○ Combination of both
	▪ Transmission pathway
	  ○ Existing processors (TPP, EBT, or both)
	  ○ New contractors

Processing and Storage Technical Solutions	▪ Processing infrastructure
	  ○ FNS
	  ○ Contractor
	  ○ Combination of both
	▪ Storage infrastructure
	  ○ FNS
	  ○ Contractor
	  ○ Combination of both
	  ○ Cloud storage

These options across the technical solutions can be executed in multiple combinations as *solution sets*, each with their own advantages and disadvantages; technical, implementation, and policy challenges; and costs to retailers, to processors, and, potentially, to FNS. This chapter presents an overview of the

options within the three technical solution areas, discussing the advantages and challenges of each. Finally, recommendations on the most promising options for further research and development are presented.

3.1 POS Technical Solution Options

There are three potential methods for capturing item-level data from SNAP EBT transactions for all POS technical solution options: directly capturing data at the ECR during the transaction, using electronic messages (email)[15] to transmit details of transactions completed at the ECR, or using new data transfer technologies such as near field communication (NFC).[16] As discussed in Chapter 2, the current POS environment presents two key issues for any potential solution for collecting item-level data: the cash register and POS terminal system used by the retailer and how to address encrypted personally identifiable data. Another question is whether data should be captured and transmitted in real time, in batch processing, or in a combination of both. Ideally, all proposed solutions would involving capturing POS item-level data in real time, that is, as each transaction is completed. Then data could either be transmitted in real time or stored in a secure environment for batch transmission. These differences are discussed in Sections 3.2 and 3.3.

3.1.1 Cash Register and POS Terminal Systems

Differences in technological capacity among the three cash register systems—IECR, commercial standalone, and EBT-only standalone—determine the complexity of the solutions required to capture POS item-level data. The technological sophistication of the ECR is also a key factor in the type and quality of item-level data that can be captured. For example, in an IECR environment, electronic store inventories are typically dynamic, that is, they are updated automatically. This automation allows for detailed and accurate records of purchases. Furthermore, these inventories are typically comprehensive, providing UPC and PLU detail in the item record. By comparison, in standalone POS environments, the store inventories are not interfaced with other in-lane hardware, limiting the ability to associate SNAP EBT item-level data with each transaction. These inventories are also not as detailed or dynamic as those in IECR systems and may lack updated UPC and PLU data, even where these data are available. Where these UPC databases are unavailable or deficient, FNS may have to consider purchasing comprehensive commercial UPC databases to identify UPCs scanned from product barcodes. Appendix G discusses commercial UPC databases in detail. Moreover, standalone systems may also lack scanning devices, limiting the ability to capture UPC data in item barcodes. Ultimately, capturing item-level data would require significant upgrades to introduce scanning devices to these non-integrated systems.[17]

3.1.2 Encrypted or Decrypted Personal Identifiers

[15] Some ECR applications currently use electronic message cash receipts: Retailers complete transactions in the usual way but have added the option of sending receipts to consumers as email.

[16] Near field communication (NFC) enables radio communication between NFC-enabled devices, which can include smartphones and similar devices. Some retailers, such as gas stations, provide an NFC-enabled key fob to enable consumers to complete transactions at NFC-enabled gas pumps. The consumer merely taps the fob to a designated receiver at the gas pump to exchange transaction information.

[17] The Agricultural Act of 2014 (P.L. 113-79) requires that nonexempt stores use scanner devices in the future. However, regulations will need to be promulgated to implement the provision.

Encryption also affects the complexity of potential solutions for item-level data collection. The ability to associate a household with item-level transaction data depends on the proposed technical solution's ability to provide an unencrypted set of personal identifiers, primarily the EBT card number. The EBT card number is typically encrypted at the POS terminal. Alternatively, encrypted partial EBT card numbers could be used in conjunction with data currently collected in the ALERT system to append Household identifiers to all item-level data captured.

Outlined in Exhibit 16 is a summary of the advantages and disadvantages of the POS technical solution options, bearing in mind that all solutions face similar personal identifiers challenges.

Exhibit 16: POS Technical Solutions Advantages and Disadvantages

POS Technical Solution	IECR	Commercial Standalone	EBT-Only Standalone
Capture at ECR	▪ These have sophisticated inventory databases (including UPCs) that currently capture item-level data for receipts. These data can be captured and transmitted to FNS with moderate POS software modifications. ▪ These systems typically have capacity to capture and store item-level data at the ECR or on a central server. They also have elaborate data backup systems.	▪ While these systems also have relatively sophisticated inventory systems and UPC databases, the POS terminals are not interfaced to the ECR. This hinders the ability to associate EBT card number to EBT transactions. ▪ These systems may or may not have sophisticated data storage and backup systems, depending on the retailer size and type of ECRs they deploy.	▪ These systems process EBT transactions only and do not interface with other ECR and POS hardware. They also do not offer sophisticated data inventory systems or UPC databases if any at all. This limits the ability to generate item-level data and to link it to customer EBT card numbers.
Electronic Messages	▪ IECR systems have the software technology to generate electronic messages and transmit them. However, a transmission route and protocol would need to be developed. Furthermore, additional steps would be required to process these data.	▪ Commercial standalone systems are less sophisticated IECR and are less likely to send electronic messages.	▪ It is not anticipated that EBT-only standalone systems have POS software sophisticated enough to generate electronic messages.

POS Technical Solution	IECR	Commercial Standalone	EBT-Only Standalone
Near Field Communication	▪ This is a relatively new technology currently available at some IECR systems. Not all retailers have adopted the technology. Similarly, customer uptake of the technology is limited and requires them to have NFC enabled devices such as mobile phones or other data transmitters. Furthermore, this solution would require interaction with State-owned NFC devices to transmit information.	▪ As is the case with IECR systems, NFC technology has low uptake for retailers and customers alike, likely even lower uptake for these retailers relative to IECR systems.	▪ Little to no uptake of NFC hardware is expected for these ECR systems.

NFC options were considered but rejected because retailers would need new hardware and software and SNAP customers would have to be issued NFC-enabled EBT cards, key fobs, or cellphones. Moreover, SNAP customers' EBT cards or key fobs would have to be submitted periodically to an FNS-approved repository of data, such as the state SNAP office, or the data stored on cellphones would have to be transmitted.

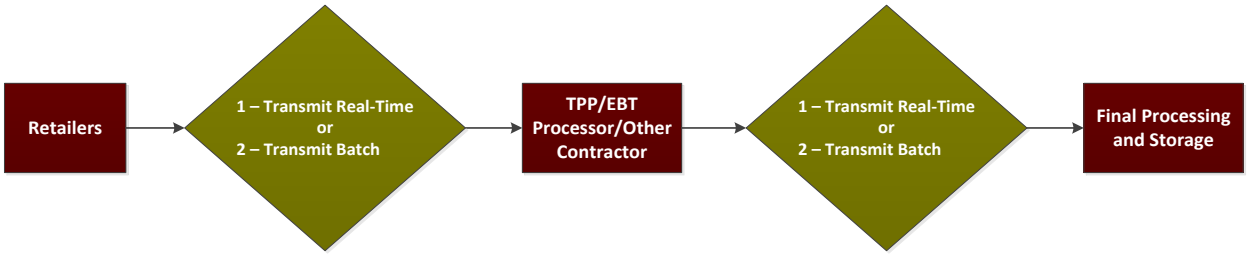
3.2 Communications Technical Solution Options

Two factors—the frequency of data transmissions and the transmission pathways—distinguish the technical solution options for transmitting item-level transaction data from retailers to other stakeholders such as TPPs, EBT processors, or other contractors.

3.2.1 Transmission Frequency

Exhibit 17 below shows the transmission frequency options. To ensure consistency and seamless integration with current transmission protocols, all data transmissions need to adhere to the industry standards discussed in Chapter 2. As the exhibit shows, there are two options for retailers to transmit item-level data once it has been captured at the POS: real-time or batch processing. TPPs, EBT processors, or other contractors also face the same options for transmitting item-level data. Real-time and batch transmission options could be combined across the various stakeholders.

Exhibit 17: Data Transmission Frequency Options



There are two key issues for consideration for all communications options regardless of transmission frequency. These issues include:

- **A need for a uniform data capture and transmission standard.** As noted in Chapter 2, SNAP EBT data transmission is governed by ANSI X9.58 standards and Quest Operating Rules. These standards ensure that all retailers are able to capture all the information required by EBT processors to authorize SNAP transactions and by the FNS ALERT system to monitor fraud. However, as noted in Section 2.3, these standards do not address transmission of all the item-level data FNS is interested in capturing, for example UPC or PLU codes, item description, or amount purchased. A new standard will need to be developed to include these fields. WIC X9.93 standards provide a useful template for structuring this proposed new standard, as they specify a message structure that captures the majority of item-level fields FNS needs. Any new transmission standard would need to be adopted by ANSI and incorporated into Quest Operating Rules.

  There are several steps required to initiate and execute any proposed changes to current ANSI standards. As an example, the following are the general steps required to change X9.58 or X9.93 standards:

  i. Proposed changes are first presented to industry members invited by FNS to participate in discussion.

  ii. Once the proposed issues have been duly discussed by the wider group of stakeholders, they are brought to X9, Inc., the ANSI-designated organization responsible for the development and maintenance of financial standards. A member must submit a change request, which is then forwarded to the X9AB11 EBT work group for action. Unlike the open session, the work group consists of dues-paying X9 Organization members who have an interest in EBT. The work group debates the issues associated with the proposal until a consensus is reached.

  iii. Once consensus has been reached by the work group, the proposal is passed to the full X9AB group for approval via balloting.

  iv. Upon passing the X9AB committee, the refined proposal is passed to the X9 board for final decision, also reached via a balloting process. If passed, it must be accepted and published by the ANSI organization. At this stage, it is ready for implementation. A one-year implementation period is generally expected.

While these steps are linear and relatively straightforward, the most prominent factor influencing how long a proposal or change is adopted is its complexity and the stakeholders involved. As an

example, the most recent changes to X9.93 standards (deemed as minor)[18] took about 1 year through all four steps. An additional year was required for retailers and processors to implement the changes. Major changes are likely to take longer.

- **Data size limits.** In compliance with ANSI standard X9.93, TPPs have limited the size of WIC transaction files to 4,096 bytes, or 4 kilobytes. This size constraint allows WIC transaction messages to contain item-level information for up to 50 unique items. While this number may be adequate for WIC, a SNAP basket using new but similar standards could easily exceed this number. In addition, WIC transmissions do not include UPC descriptions. The addition of UPC description data would further stretch the file size needed to transmit SNAP transaction data.[19]

Given these issues, the advantages and disadvantages of the data transmission frequency options are summarized in Exhibit 18.

Exhibit 18: Communication Frequency Options Advantages and Disadvantages

Communications Frequency Option	Advantages	Disadvantages
Real-Time Transmission	▪ Real-time transmission limits the volume of data that needs to be stored at the source, for example the retailer, TPP or EBT processor. ▪ IECR based systems are already equipped to transmit real-time data from retailers to FNS through existing pathways via TPP and EBT processors. Other ECR technology would require investments to enable real-time linkages between POS terminals where EBT card numbers are read and the ECR. For this reason, real-time transmission applies to larger retailers who typically have IECR systems.	▪ It places an additional capacity burden on existing transmission pathways that may be in use for other purposes, for example, authorization of EBT transactions ▪ Additional use of transmission pathways may negatively impact the processing speeds for other existing transmissions such as EBT processing. ▪ Additional burden on the existing pathways to handle data may lead to additional transmission costs for all stakeholders. ▪ It misses the majority of smaller retailers who are limited by their non-integrated ECR systems.
Batch Processing	▪ Batch processing enables all IECR-based retailers to transmit data independent of EBT authorization transactions, limiting speed bottlenecks on existing transmission pathways from TPP and EBT processors.	▪ Some smaller retailers will need to upgrade their transmission capacity to accommodate transmission of large data files. ▪ In addition, some retailers will need to invest in data storage capacity.
Combination of Real-Time and Batch Processing	Using a combination of real-time and batch processing facilitates development of solutions that leverage the advantage of real-time and batch transmission while limiting the disadvantages.	

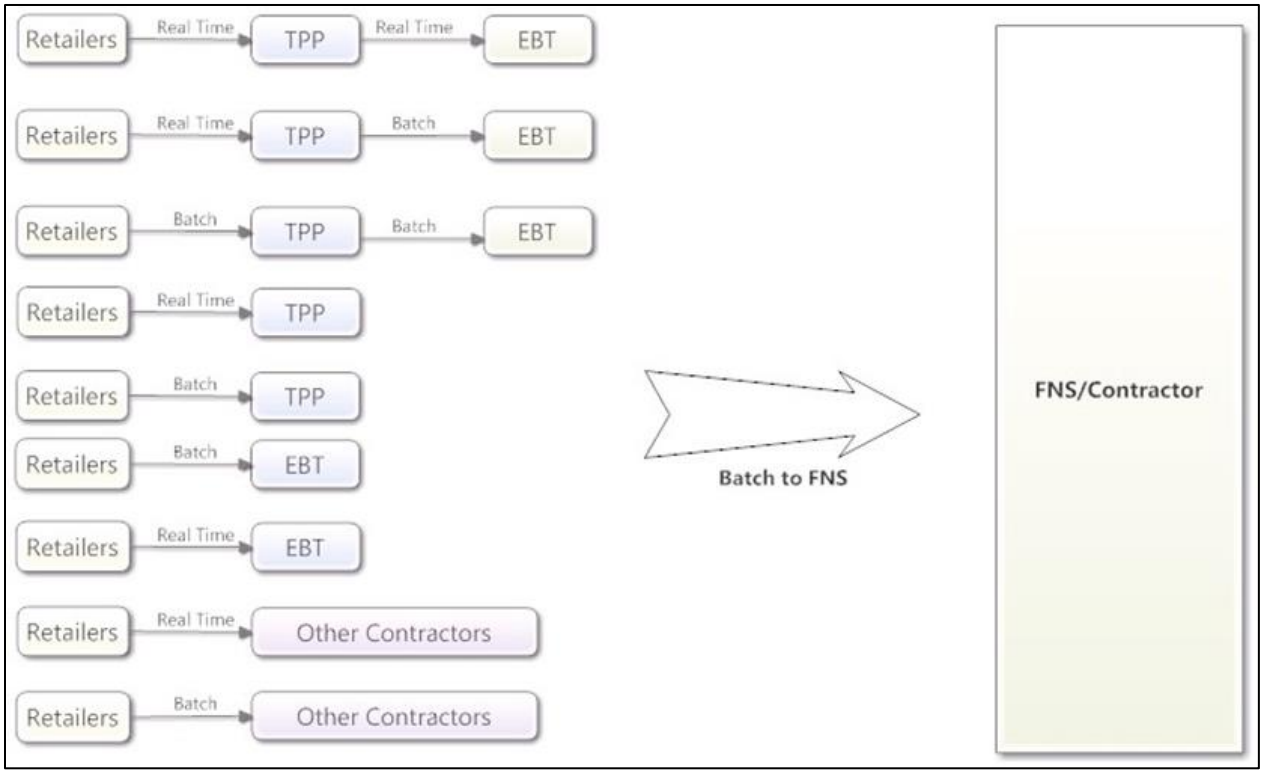
[18] Based on X9 work groups participants interviewed in December 2013

[19] WIC X9.93 rules specify that a retailer system can split a transaction into two parts if the size limitation is reached. However, the addition of UPC descriptions along with other item-level data is likely to exceed data size thresholds, resulting in an unwieldy number of split transactions.

3.2.2 Transmission Pathways

Retailer hardware devices have differing communication capabilities. Given the breadth of capabilities, multiple options exist for communication with and data transfer to and from the contractors. Actual transaction authorization from TPPs and EBT processors is captured in a transaction separate from the proposed capture of item-level data; hence, discussions in this section are limited to data transmission after authorization has been completed. As shown in Exhibit 19, there are numerous transmission pathway options to move item-level data from retailers to FNS for eventual research use. These pathways can use *existing pathways*, namely through TPPs, EBT processors or a combination of both; *new pathways*, namely the introduction of new contractors or direct transmission to FNS; or a combination of existing and new pathways. Ultimately, the last stage of the transfer process will be in batch mode to FNS for all the transmission pathways depicted in the exhibit. These transmission options take into account transmission frequency and POS technical solution options. Appendix F provides detailed discussions of each transmission pathway option.

Exhibit 19: Communications Solution Options



3.2.3 Comparison of Proposed Communications Technical Solution Options

Each of the pathways for transmitting item-level transaction data between retailers and contractors presents advantages and disadvantages.

- Real-time only options that use current pathways to TPPs and EBT processors place an additional data load burden on both retailers and contractors. Each entity needs to increase data storage capacity, even if it is temporary storage. In addition, as item-level data are transmitted at the same time transmission lines are being used to authorize EBT and other

transactions, data transmission speed may be affected negatively, leading to slower authorization feedback.

- Real-time only options that use current pathways will necessitate software modifications on the part of both retailers and TPPs and EBT processors
- More than 90 percent of all retailers connect to TPPs, while the rest communicate directly with EBT processors. Transmission options that require all retailers to transmit data directly to EBT processors place an added burden on the majority of retailers to establish connections with EBT processors. This is also true for transmission options that introduce other contractors currently not part of the system. Unless they are subsidized by FNS, these changes come at a cost to retailers, to EBT processors, and ultimately to consumers.
- Batch transmission options require all stakeholders to increase storage capacity to accommodate storing item-level transaction data over extended periods. Having retailers store transaction data along with EBT card numbers and other identifiers adds immediate privacy and fraud concerns. A potential solution is to enforce encryption or masking of card numbers and other personal identifiers at the retailers. However, this solution introduces additional complexity related to linking data with encrypted identifiers to other data sets, such as ALERT.

As seen in Exhibit 20, the batch-only solution stands out as the most flexible solution type covering all retailer technologies. Retailers with IECR and new technologies can accommodate all three types of solutions.

Exhibit 20: Flexibility of Communications Solutions

Retailer POS Technology	Solution Types		
	Real Time Only	Real Time / Batch	Batch Only
IECR	✔	✔	✔
Commercial Standalone			✔
EBT-only Standalone			✔
New Technologies	✔	✔	✔

3.3 Processing and Storage Technical Solution Options

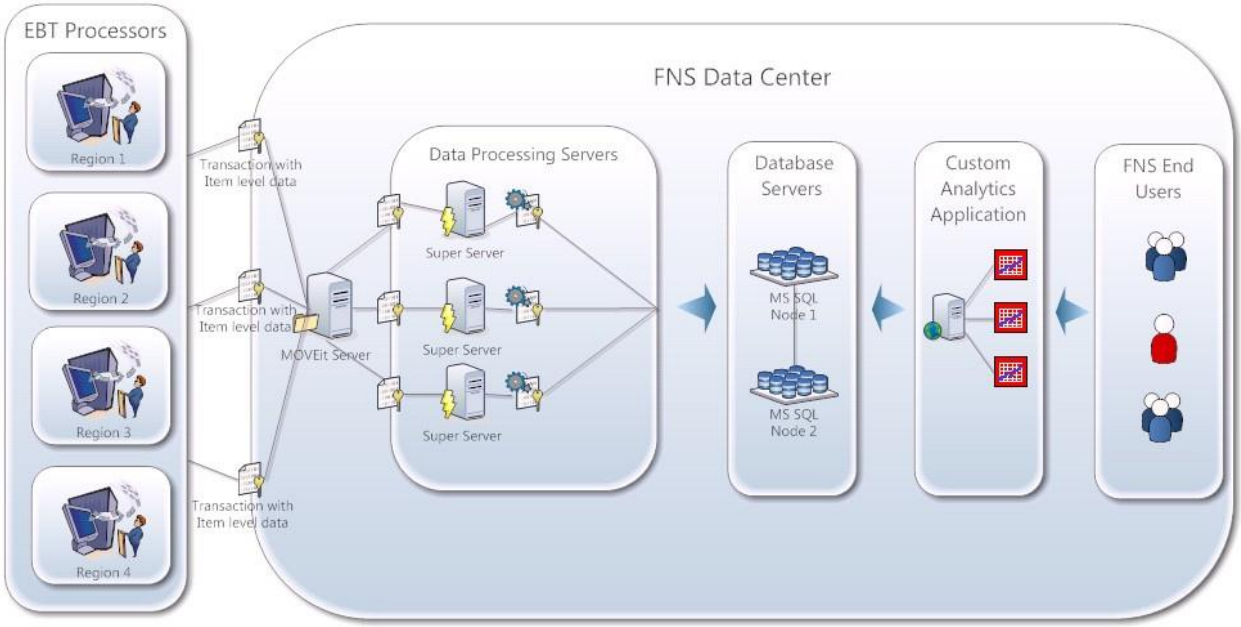
Two options are proposed for analysis and storage of the POS data. Both involve a customized system for receiving data from contractors and processing, analyzing, and storing those data. In the first solution, the customized system is hosted at the FNS data center. In the second solution, it is hosted by a contractor in a "cloud" environment approved by the Federal Risk and Authorization Management Program (FedRAMP).

3.3.1 FNS Data Center

The first option is very similar to the current ALERT system, except that it would capture and transfer SNAP item-level data in addition to transaction data. EBT processors would continue to process and transfer these data in a predetermined format to the FNS data center, where they would be processed for analysis and stored in the FNS data warehouse. The data warehouse would consist of a group of

servers responsible for data processing and storage of the received SNAP item-level data. This option would require a custom analytics application at the FNS data center for reporting and analyzing data. Exhibit 21 is a graphical representation of this option.

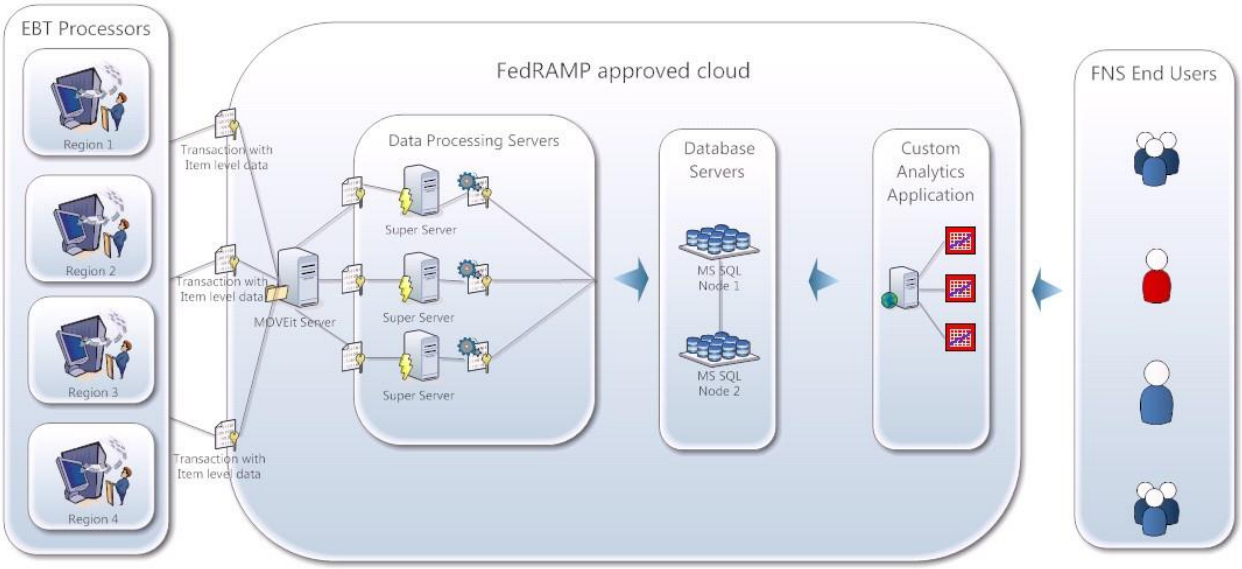
Exhibit 21: FNS Data Center Storage and Analysis Option



3.3.2 FedRAMP-Approved Cloud

A second option would be to store data and host the custom data analysis application in a FedRAMP-approved cloud. FedRAMP is a close collaboration among cyber-security and cloud experts from various federal agencies concerned with data and data privacy. FedRAMP requirements are based on the NIST 800-53 standards. In this option, EBT processors would transfer item-level transaction data to a FedRAMP-approved cloud, where the data would be stored in the database servers after being integrated and verified through the data processing servers. This cloud would host a custom data analysis application like that used in the first option. FNS end users would connect securely to this FedRAMP-approved cloud to perform analyses. Exhibit 22 is a graphical representation of this option.

Exhibit 22: FedRAMP Cloud Storage and Analysis Option



3.4 Feasibility Assessment

FNS carefully weighed the advantages and disadvantages of the POS, communications, and processing and storage technical solutions outlined above in order to prioritize specific options for further research and development.

Among the POS technical solution options, IECR options emerged as the most promising set of options for further research and development, for the following reasons:

- IECR transactions represent approximately 80% of all EBT redemptions (see Exhibit 4).
- At least 45% of all authorized SNAP retailers use IECR systems.
- Although IECRs are most common in large stores, some convenience stores also operate in an IECR environment. Convenience stores account for 36% of authorized retailers.
- IECR systems already capture the item-level data FNS requires.
- IECR systems are technologically sophisticated, so that they can most easily be adapted to fulfill FNS' data needs. Retailers will be able to use their existing ECR hardware, requiring only modifications to the machines' POS software.
- This solution could leverage the existing transmission infrastructure between retailers and processors.

In addition, FNS opted to explore the communication option of electronic messages. These messages have great potential to capture item-level data where IECR solutions are not an option—a situation that includes approximately 60 percent of all authorized FNS retailers. In these environments, the electronic message option will require a scanner device to read UPC codes.

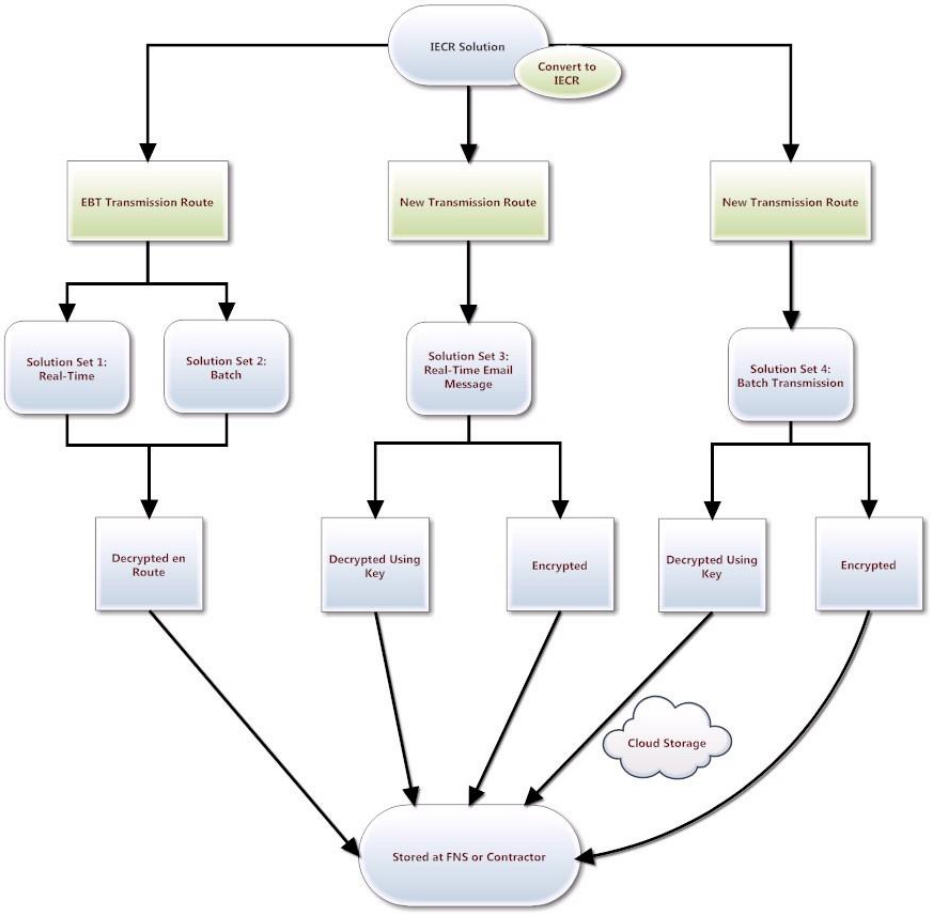
Finally, FNS decided to research ways that commercial standalone POS systems could be modified to operate like IECR systems. Non-IECR retailers with relatively developed store inventory systems might be encouraged to convert to IECR-based POS systems.

The next chapter further explores the options chosen for future development: IECR POS systems and electronic messages. These options are conceptualized within frameworks suggested by other options discussed above: transmission frequency and pathway options, access to encrypted or decrypted personal identifiers, and storage at an FNS or cloud-based data center.

CHAPTER 4: PROPOSED TECHNICAL SOLUTION SETS

As discussed in the previous chapter, proposed technical solutions to address the collection, transmittal, processing, and storage of item-level SNAP transaction data have three components: POS solutions, which address modifications necessary to collect and prepare item-level data; data communication and transmission solutions; and data processing and storage solutions. Each component has several options, which can be combined in multiple ways across the three components to form complete solution sets. FNS prioritized the various options, choosing IECR retailers as the most promising environment for additional research, potential prototype development, and ultimately proof-of-concept testing. This priority, in combination with other options, leads to selection of four technical solution sets, shown in Exhibit 23. This chapter explores each of these four solution sets, discussing their advantages and disadvantages.

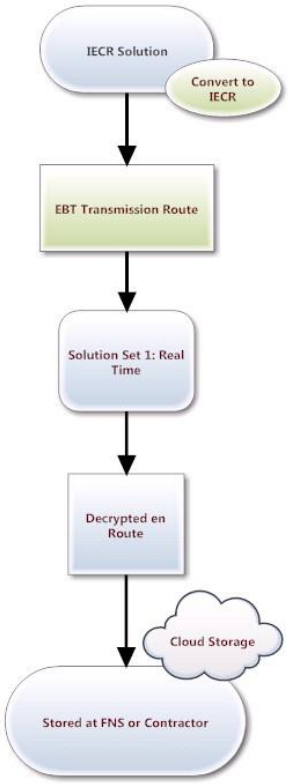
Exhibit 23: Technical Solution Sets



4.1 Solution Set Option 1: Existing Transmission Infrastructure with Real-time Data Transmission

As shown in Exhibit 24, the distinguishing factor of Solution Set Option 1 is that current infrastructure is utilized to transmit the item-level SNAP transaction data. The transmission could occur either in real time (Solution Set Option 1) or in batch mode (Solution Set Option 2). As discussed in Chapter 3, both modes of transmission have potential data load challenges. Real-time transmission burdens the system with large data files as SNAP EBT transactions are authorized throughout the day, while batch transmission involves sending significantly larger files during off-peak hours. A key advantage of using TPPs and EBT processors and the current infrastructure is that all data can be decrypted by the processors, so that FNS would not have to match partial EBT card numbers with ALERT data system transaction records. In this and all other solution sets, data can be processed and stored at FNS, a contractor, or a federally approved cloud location.

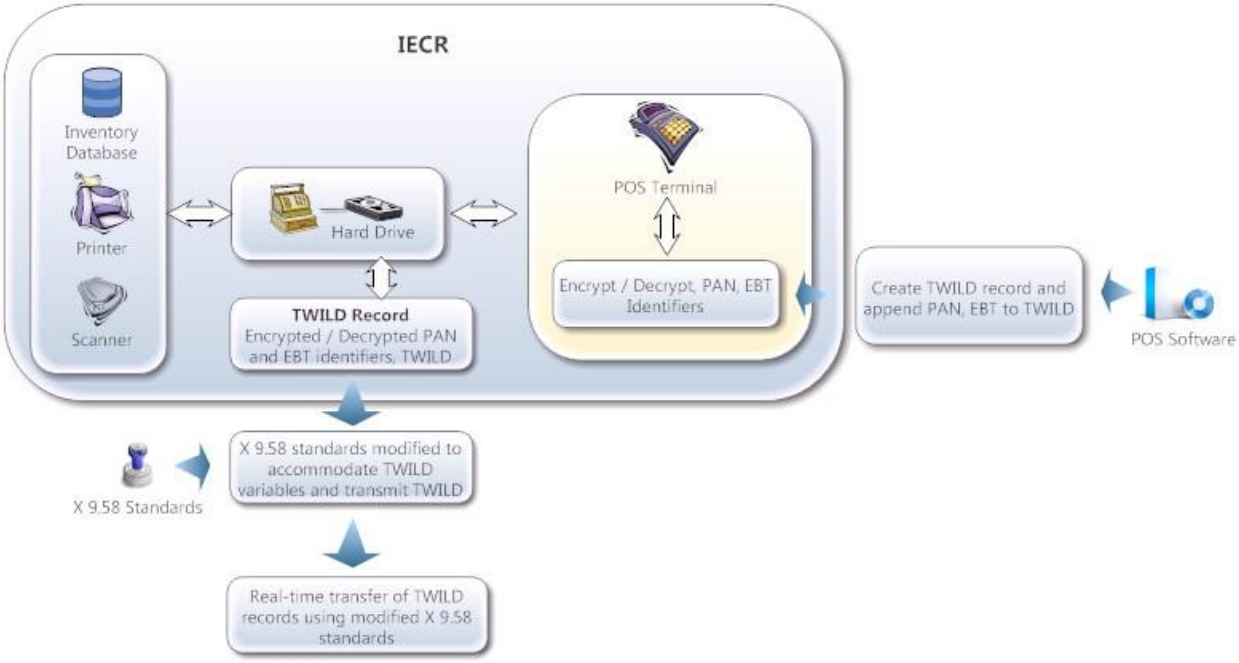
Exhibit 24: Solution Set Option 1: Existing Transmission Infrastructure via TPPs and EBT Processors



The first POS technical solution set option, illustrated in

Exhibit 25, calls for real-time transmission of decrypted transactions with item-level data (TWILD) captured at the POS for all EBT transactions. Unencrypted transaction identifiers would be appended to the item-level data.

Exhibit 25: Solution Set Option 1: Real-Time Processing



4.1.1. Modifications to Existing Standards and Processes

Although the proposed solution relies on the existing data transmission channels, implementation would require modifications to the standards governing SNAP data transmission, to IECR systems, and to TPP and EBT processor operations.

Development of New Standards. Current X9.58 standards do not accommodate listing item-level data in messages. New fields would have to be designated for item-level details such as UPC, UPC description, price, volume, and other variables of interest to FNS. The modifications could be partially based on WIC standard X9.93. The modifications will affect the size of the messages transmitted and stored. Experience with WIC EBT suggests that it is possible to modify the standards with FNS guidance, as was done in developing the WIC Operating Rules.

In addition, retailers are required to encrypt transaction identifiers such as the EBT card number, so that transaction details passed from the ECR partially mask the identifiers. This encryption makes it difficult to associate item-level transaction data with SNAP households. One solution is for FNS to work with the retail industry to exempt all SNAP transactions from this encryption. This option places increased liability and security burdens on retailers. Alternatively, FNS could rely on TPPs and EBT processors, who already decrypt data from retailers in order to process it. These processors use unique decryption keys. In every case, data are always transmitted over secure transmission lines.

Modification of POS Software Applications. As discussed in Section 2.1.1, there are numerous POS software applications used by retailers. In an IECR environment, these applications are typically customized by retailers to capture transaction details important to them. At a minimum, these applications generate the list of items purchased, which is ultimately printed on receipts, from the local inventory stored in ECRs. Modifications to these applications would involve making sure that key variables requested by FNS are captured during each transaction. Additionally, these variables would need to be appended to messages using the new transaction standards described above. Modified POS software applications are currently in use in several pilot WIC EBT programs. The capabilities and flexibility of the operating system used by each retailer's IECR system would affect cost and compatibility.

Modifications to TPP and EBT Operations. To facilitate real-time processing of item-level transaction data associated with personal identifiers, two possibilities exist:

- **Ask TPPs/EBT processors to decrypt encrypted personal data.** The transaction records TPPs currently receive from retailers contain both encrypted identifiers (the EBT card number) and unencrypted EBT transaction totals. These are passed along to EBT processors for verification. In the scenario in which retailers continue to encrypt the messages passed to TPPs, TPPs would decrypt the encrypted identifiers and transmit the data, with unencrypted identifiers, over secure transmission lines.
- **Ask EBT processors to manage decrypted item-level transaction data.** FNS, EBT processors, and TPPs will need to modify and create new processes for processing and managing larger-volume data files for transmission to FNS or an approved contractor in real time. EBT processors currently transmit transaction totals, along with retailer identifiers, to the FNS ALERT system in batches nightly. FNS would need to require EBT processors and TPPs to receive item-level data, process them, and ultimately transmit them to FNS.

These requirements to decrypt identifiers or manage encrypted item-level data with identifiers may place additional privacy and security liability on all processors. To alleviate this potential additional burden, the item-level transaction data could be transmitted to FNS in an encrypted format.

4.1.2. Evaluation of Solution Set Option 1

Data Characteristics, Availability, and Quality. Data characteristics, availability, and quality are primarily dependent on the existence of detailed retailer inventory systems and of POS software applications that capture these details in order to print them on customer receipts and, in the case of all proposed technical solutions, to them to FNS. As discussed in Section 1.1, FNS would like to capture item-level, basket-level, and store-level data for each transaction. In the current IECR environment, the store-level variable—the FNS-authorized retailer number—is already being captured and relayed to FNS for the ALERT system.

Retailers operating in an IECR environment maintain sophisticated inventory databases and POS software applications that enable automatic identification of SNAP-eligible items, pricing, and descriptive information for printing on receipts. Implementation of solution set option 1—and any other technical solution in an IECR environment—will generate high-quality item-level and basket-level data that are relatively complete and accurate. Limitations to this solution center on adopting new standards (modeled after ANSI X9 standards) and retailers' ability to modify their POS software applications to append FNS-required data to current messages. Implementation of this aspect of the solution will vary

from retailer to retailer; to mitigate variation in the data submitted, FNS should consider providing very specific guidelines.

Despite anticipated increases in message size, existing IECR POS hardware systems are expected to have the capacity to store the larger messages locally at the cash register or in a centralized server. What may vary is how long the data are stored. In an online environment, these data would be made available to EBT processors on a daily basis.

Technical Advantages and Pitfalls. Solution Set Option 1 offers several advantages. The focus on IECR systems means that the solution has the potential to capture approximately 80 percent of all EBT redemptions. However, this coverage comes at a cost in the total number of authorized retailers covered. More than 80 percent of all authorized retailers, predominantly smaller grocers and convenience stores, operate in non-IECR environments. The IECR-based technical solutions are not flexible enough to be applicable to non-IECR environments but inform the development issues for non-IECR environments.

In addition, this proposed technical solution places some additional burden on retailers, TPPs, and EBT processors. For retailers, the issue is not the ability to provide the needed data but the ability to transmit those data in line with new standards. It will take time to move the whole industry to these new standards. Furthermore, this solution will require retailers to modify existing POS software applications to transmit item-level data.

Transmitting unencrypted personal data represents a security and privacy risk for all stakeholders, including FNS. Again, WIC EBT implementation offers a useful example. WIC EBT transactions are exempted from encryption at the POS terminal, suggesting that the industry is open to the idea of transmitting partially decrypted data. Although the messages are partially decrypted, they are still transmitted using secure data lines and protocols.

Finally, although enhanced messages are expected to be larger, thus increasing storage and transmission burdens, the increases are anticipated to be within the capacity of existing infrastructure. Retailers are not expected to experience significant changes in processing speed and transmission time. However, TPPs will likely charge retailers more for handling larger messages.

Legal and Policy Environment Considerations. As discussed in section 1.3.3, there are no current federal regulations stipulating the specific types of data that can be collected from SNAP participants. Generally, states are required to provide administrative data to support SNAP implementation. A review of WIC EBT implementation offers some guidelines on FNS, TPP, EBT processor, and retailer collaboration to establish common operating rules. A similar approach would need to be developed for any proposed SNAP item-level data collection effort. Moreover, building on WIC EBT implementation and WIC Operating Rules will ensure that proposed changes are congruent with the WIC EBT process.

In addition, FNS currently has contractual relationships with TPPs and EBT processors and thus has no legal authority to compel them to modify their current operations in order to collect item-level data from retailers. The roles and relationships between States on one hand, and EBT processors and TPPs on the other, are governed by federal regulations 7 CFR 274. In order to implement Option 1, FNS will need laws and regulations that will define the nature of the terms of the relationship with EBT processors and TPPs.

Implementation Costs. Implementing this proposed solution set requires that POS software applications be modified to enable development of preliminary technical solutions and proof-of-concept testing—and, ultimately, for use in the real-world environment. These modifications would enable item-level data currently stored locally at the ECR to be appended to messages to TPPs. These changes would also accommodate new standards that would enable transmission of item-level transaction data. The modification of POS software applications to meet these new functions could be time-, labor-, and cost-intensive.

An overview of the process used to modify POS software applications for WIC EBT provides some insight.

1. Defining specifications and standards
    - Making use of all ANSI X9.93 data transmission standards elements for information capture
    - Identifying each data element to be collected and appended to the messages, making sure all stakeholders are in agreement
    - Mapping out the flow of data across all stakeholders involved
    - Developing a communication protocol for all stakeholders involved
2. Identifying all relevant stakeholders to ensure that all software development needs are addressed and relevant for each stakeholder
    - FNS
    - State EBT processors
    - POS vendors
    - Retailers
    - Clients

Operational Costs. Although the current IECR-based retailer infrastructure can accommodate the increased data storage and transmission demands associated with the larger messages, TPPs may charge retailers for the increased load on their transmission lines. Furthermore, TPPs will need to reprogram their current data processing to accommodate new fields in the messages and, potentially, the decryption of item-level data associated with personal identifiers.

EBT processors currently store daily transaction data, process them, and transmit them to FNS on a nightly basis. The proposed solution set imposes additional data storage and processing requirements due to the increased message size.

Retailer Costs. The costs to retailers include the cost of modifying POS software applications and, potentially, some hardware. Retailers may also incur increased fees from their TPPs.

4.1.3. Conclusions on Solution Set Option 1

This solution set option calls for the transmission of item-level data on all SNAP purchases in real time. To accomplish this goal, POS software applications will need to be modified to ensure that item-level details currently available in the local inventory maintained at the IECR are appended to messages transmitted to FNS. Moreover, appending additional data to the current message requires developing

new standards to accommodate new item-level data fields in the message. TPPs or EBT processors could have the responsibility of appending decrypted EBT card numbers to the item-level data. Exhibit 26 summarizes the evaluation.

In the scenario in which the item-level transaction data transmitted to FNS include decrypted identifiers associating the item-level data to EBT card numbers, Technical Solution Option 1 offers perhaps the best opportunity for capturing complete item-level data already collected by the IECR. IECR systems are sophisticated, rendering most of the item-level data in which FNS is interested to be available and complete. IECR inventory systems and POS software applications provide rich data with sufficient detail to meet FNS needs. However, given the variety of POS software applications and retailer demands, item-level and basket-level details are not uniform across retailer brands or nationally. FNS may need to develop operating rules to offer guidance on the level of detail required for any modifications to POS software systems to delineate item-level data for capture. These new operating rules would then be added to Quest Operating Rules. Store-level data are already currently available in STARS and the ALERT system.

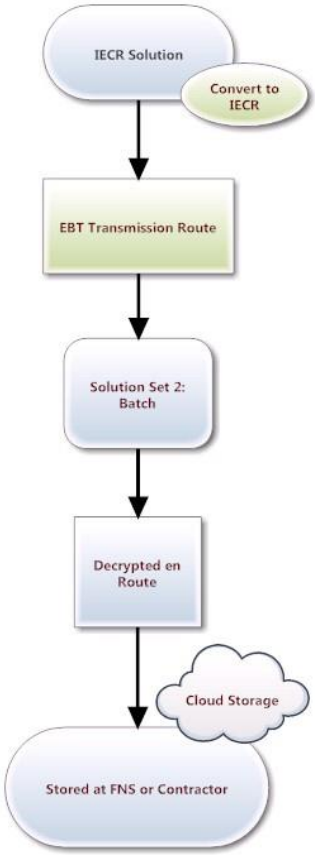
Exhibit 26: Evaluation Summary of Solution Set Option 1: Existing Infrastructure with Real-Time Data Transmission

Evaluation Criteria			Cost Criteria		
Technical Advantages	**Technical Disadvantages**	**Legal and Policy Concerns**	**Implementation Costs**	**Operational Costs**	**Retailer Costs**
▪ Most IECRs already maintain detailed inventory ▪ Existing retailer infrastructure has storage capacity ▪ Captures about 80 percent of EBT redemptions ▪ Can use existing communication and transmission modes with TPPs or EBT processors	▪ Misses at least 45 percent of authorized retailers ▪ TPPs and EBT processors transmit EBT card numbers ▪ Requires modified POS software applications ▪ Requires new X9 based standards ▪ Encryption potentially degrades quality of data available to FNS if it has to correlate records from the retailer, STARS, and ALERT to associate EBT card numbers with item-level data	▪ FNS needs to mandate or suggest operating rules for types of data to be collected by all POS software ▪ FNS needs to require item-level data collection and transmission ▪ FNS could request that EBT card numbers be exempt from encryption at the POS terminal ▪ Decryption of data increases privacy and security liability for all stakeholders ▪ FNS currently has no contractual relationship with EBT processors and TPPs. FNS would require new regulations to govern any changes EBT processor and TPP operations.	▪ POS software application programming to accommodate new X9 based standards ▪ POS software application programming to accommodate creation of enhanced item-level messages ▪ Possible POS terminal programming to exempt EBT card number encryption	▪ EBT processor costs for increased data storage ▪ Costs for reprogramming current TPP and EBT processor data processing to accommodate item-level data ▪ Storage and processing costs for external contractors if TPPs and EBT processors are not used	▪ Increased TPP fees for data transmission of enhanced messages ▪ POS software application programming ▪ Possible POS terminal programming to exempt EBT card numbers from encryption

4.2 Solution Set Option 2: Existing Infrastructure with Batch Data Transmission

As shown in Exhibit 27, the second proposed POS technical solution set option differs from the first in that data are transmitted periodically in batches. Item-level transaction data would be saved at the retailers' servers to be aggregated and transmitted periodically. As with Option 1, the data would be transmitted using existing channels among TPPs and EBT processors. The data transmission pathway to FNS would determine the transmission, storage, and processing costs to all stakeholders. It is important to note that retailers are not expected to face additional storage costs; retailers in the IECR environment currently have the capacity to store itemized transaction data locally at their ECRs and on internal servers. Exhibit 28 shows in detail the junctures where POS software is modified and the batch transmission of TWILD data.

Exhibit 27: Solution Set Option 2: Existing Transmission Infrastructure with Batch Transmission

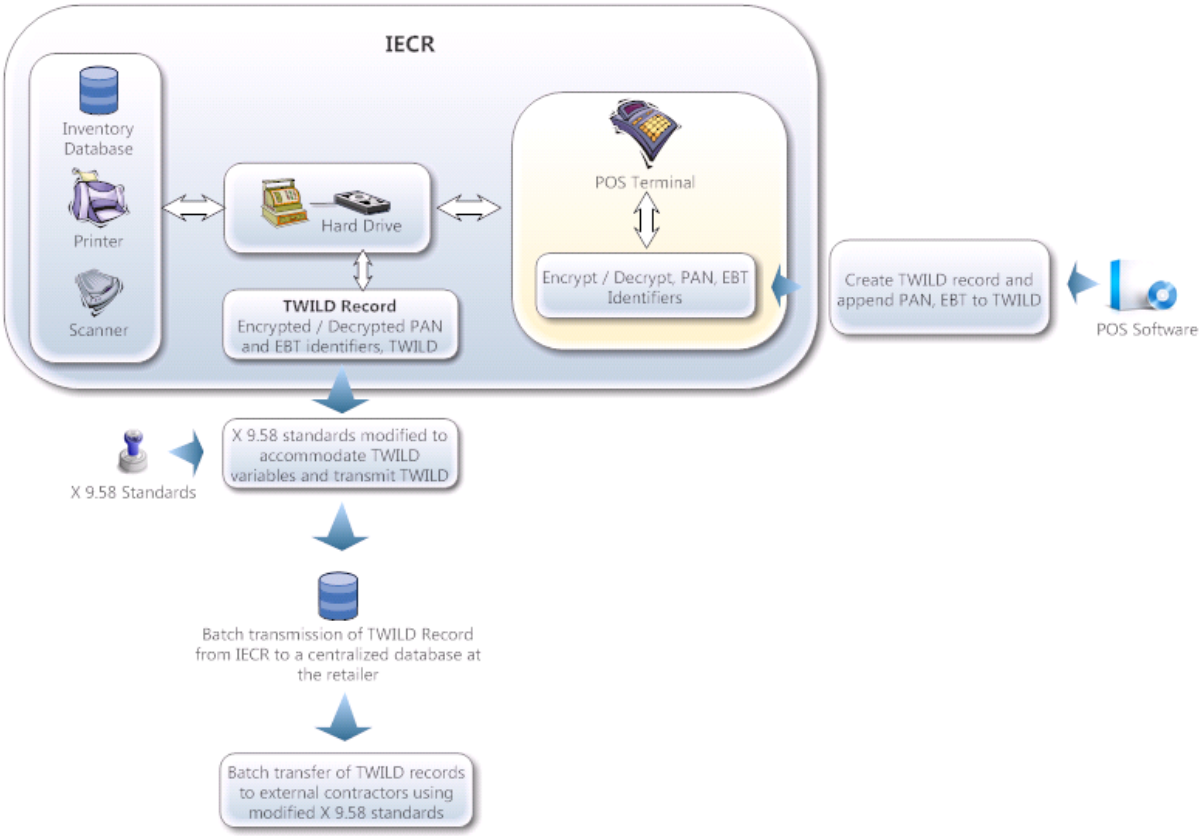


Similar to Option 1, this solution relies on appending unencrypted transaction identifiers to the item-level transaction data. Security and privacy implications for all stakeholders are identical. Similarly, this option also requires modifications to POS software applications and developing new standards in order to capture item-level data and append them to messages. TPPs and EBT processors would face operational modifications to decrypt, process, and temporarily store the enhanced data. Currently, when TPPs receive consolidated data from large retail chains, they have to use the BIN to identify the appropriate EBT processor. If done separately for every retailer it results in a very piecemeal approach, which is prone to errors. FNS could reduce the potential for errors by requiring States to consolidate all retailer data to ensure that there is only one transmission per TPP per State per day.

4.2.1. Evaluation of Solution Set Option 2

Data characteristics, availability, and quality for Option 2 are very similar to those of Option 1, since both operate in an IECR environment. However, batch processing and transmission of larger files containing aggregated item-level data offer unique **technical advantages and disadvantages**. Retail IECRs typically have the capacity to store detailed transaction records. IECR retailers also typically store these data on their own servers. Potential technical disadvantages of batch processing relative to real-time processing arise when considering transmission of data from the retailer to the next recipient—the TPP. In the current environment, each ECR typically has a connection to the TPP to facilitate authorization and verification of transaction payments. Data messages between the ECR and TPP are small to enable speedy communication. The proposed real-time option transmits the item-level data directly to the TPP, as the increased size of the message is still within the limitations of the transmission channels. However, if all transactions at an ECR are aggregated (either at the ECR or at an internal server) to be transmitted to the next recipient using batch processing, messages may exceed the capacity of the transmission lines. New, higher-capacity transmission infrastructure from the retailer to the next recipient is likely to be required. In addition, before files can be transmitted in batches, they must be processed into meaningful file formats. This requirement calls for modification of POS software applications.

Exhibit 28: Solution Set Option 2: Batch Processing



Batch transmission of item-level data with personal identifiers does not pose any unique **legal or policy challenges** relative to real-time transmission. Reconfiguring existing ECR and local server infrastructure

presents additional costs to all stakeholders. **Implementation costs** for proof-of-concept testing and real-world implementation include modifications of POS software applications to create the item-level data and to process a local batch file at the ECR, on the retailer's local server, or both. Additional costs to create the item-level data include costs associated with developing new standards to accommodate additional data fields.

Operational costs include the potential need for retailers to invest in higher-capacity lines to accommodate batch processing from ECRs or retailers' local servers to TPPs or new contractors. Depending on the pathway to FNS, other stakeholders may also face additional processing and storage costs. In addition to infrastructure cost, TPPs will also incur development cost to streamline their processes to ensure a single transmission of data per State especially for large retail chains that consolidate data before sending to TPPs.

Exhibit 29 summarizes this solution set option. As data quality and legal and policy concerns are identical for real-time and batch capture of item-level data in an IECR environment, the major differences are in the technical advantages and disadvantages and in cost implications.

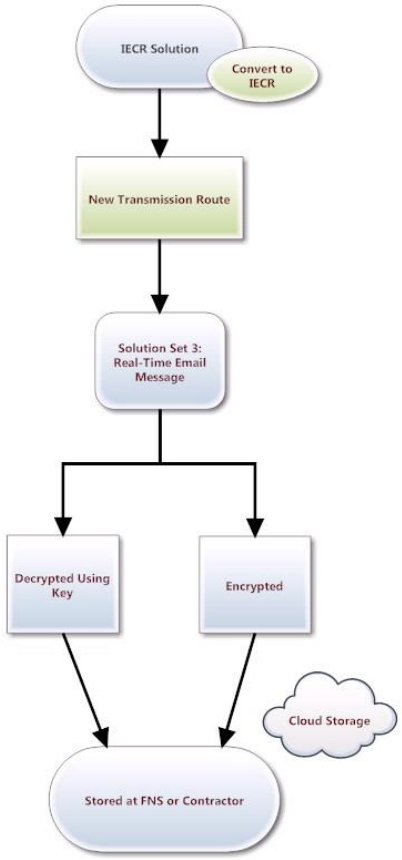
Exhibit 29: Evaluation Summary of Solution Set Option 2: Existing Infrastructure with Batch Data Transmission

Evaluation Criteria			Cost Criteria		
Technical Advantages	**Technical Disadvantages**	**Legal and Policy Concerns**	**Implementation Costs**	**Operational Costs**	**Retailer Costs**
▪ Most IECRs already maintain detailed inventory ▪ Existing retailer infrastructure has storage capacity ▪ Captures about 80 percent of EBT redemptions ▪ Ongoing real-time transmissions are not burdened with larger message packets ▪ Can use existing communications and transmission modes with TPPs, EBT processors, or other contractors	▪ Requires modified POS software applications ▪ Requires new X9 based standards ▪ Misses at least 45 percent of authorized retailers ▪ Batch transmission may not be possible with existing transmission infrastructure between ECRs and TPPs, EBT processors, or other contractors ▪ Retailers may need to process and transmit batch files from their internal server ▪ Encryption potentially degrades quality of data available to FNS if it has to correlate records from the retailer, STARS, and ALERT to associate EBT card numbers with item-level data	▪ FNS needs to mandate or suggest operating rules for types of data to be collected by all POS software ▪ FNS needs to require item-level data collection and transmission ▪ FNS or the industry may need to mandate a file format for batch files ▪ FNS could request that EBT card numbers be exempt from encryption at the POS terminal ▪ Decryption of data increases data and security liability for all stakeholders	▪ POS software application programming to accommodate new X9 based standards ▪ POS software application programming to accommodate creation of item-level data ▪ POS software application programming to process local batch files ▪ Reconfiguring transmission lines between retailers and external recipients of batch files	▪ EBT processor costs for increased data storage ▪ TPP costs for increased data storage ▪ Potential costs for reprogramming current TPP and EBT processor data processing to accommodate item-level data sent in batches by retailers	▪ Increased TPP fees for data transmission of enhanced messages ▪ POS software application programming ▪ Possible POS terminal programming to exempt EBT card numbers from encryption

4.3 Solution Set Option 3: New Transmission Infrastructure Using Electronic Messaging

As shown in Exhibit 30, Solution Set Option 3 uses a new transmission route outside the routes currently used by TPPs and EBT processors to transmit the item-level transaction data with personal identifiers. For this reason, the data cannot be decrypted at the processors. Moreover, Solution Set Option 3 proposes the use of electronic messages (secure emails). Once these electronic messages have been transmitted using secure means, two options are offered for processing the data. The data can be decrypted using TPP-provided decryption keys, or the encrypted data with partially masked personal identifiers could be matched to current ALERT data. Finally, as with Solution Set 1 and 2, data are processed and stored at FNS, a contractor, or a federally approved cloud solution.

Exhibit 30: Solution Set Option 3: New Transmission Infrastructure with Electronic Messaging

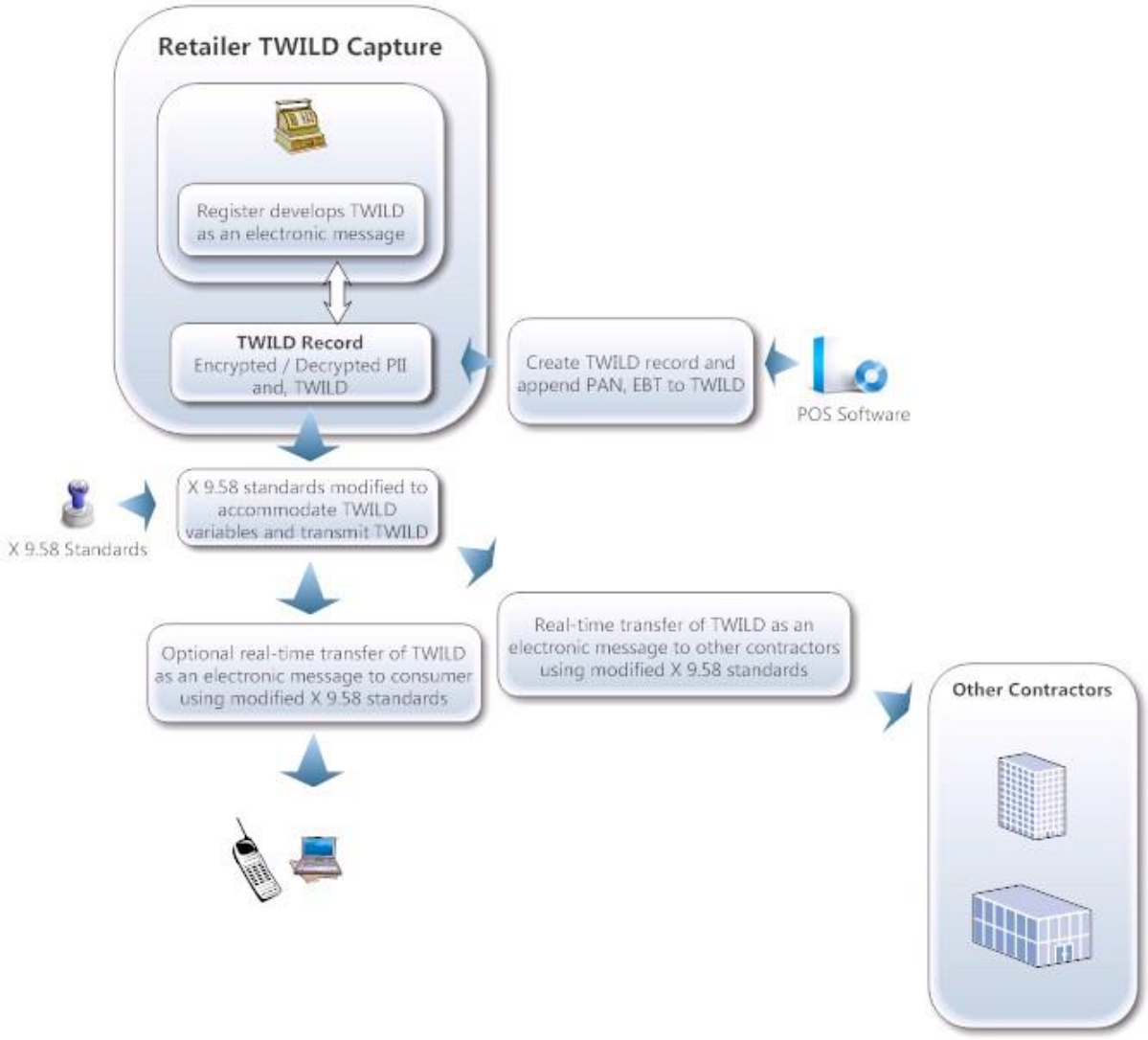


Shown in Exhibit 31 are the processes that would take place when using electronic messages to transmit item-level data with personal identifiers.

1. The process begins at the point where retailers are already capturing item-level at the cash register. In the new process, they would use modified POS software that complies with a newly defined standard, modeled after ANSI X9 standards, for transmission of item-level data. POS software applications would need to be further modified to generate electronic messages to be formatted using newly developed standards. The POS software applications could also be modified to generate a consumer-friendly email receipt.

2. Once a transaction is authorized and completed, the retailer's ECR or server sends an electronic message in real time to a designated "other contractor." As described in Chapter 3, the other contractor would be responsible for processing the item-level data or passing the messages along to FNS in batch mode. The message may include encrypted PII, or the PII may be sent unencrypted. If encrypted, two options are available for linking the TWILD to PII: the data could be decrypted using a decryption key, or encrypted data could be matched to ALERT data to append PII. Details about processing encrypted item-level data by matching them to ALERT data, derived from preliminary prototype activities for this project, are provided in Chapter 5.

Exhibit 31: Solution Set Option 3 with Electronic Messaging



4.3.1. Evaluation of Solution Set Option 3

As is the case for the other solution sets, the data availability and quality, technical advantages and pitfalls, and costs of Solution Set Option 3 are dependent on the use of IECR technology. The IECR-related data, technical, and cost factors of Solution Set Option 3 are thus identical to those summarized

for Options 1 and 2. In addition, using a new transmission route could potentially be cheaper than using TPPs and EBT processors since the data would be transmitted directly without the need to go through multiple stakeholders. FNS could also avoid the legal and regulatory requirements needed to ensure TPPs and EBT processors modify their existing processes and infrastructure. However, using electronic messaging presents additional costs, including:

- Costs of labor associated with modifications to POS software applications to implement electronic message transmission;
- Costs for transmission and processing expenses to contractors other than the traditional EBT processors and TPPs.
- Costs related to encryption, including either access to retailer or TPP decryption keys or processing to match encrypted data to ALERT records.

Although accessing decryption keys is presented as an option, it poses significantly more challenges. The volume of decryption keys from TPP processors may prove significant, as there are numerous TPPs, and their keys may be constantly changing. However, matching encrypted PII to ALERT records does not guarantee a 100 percent match, as is discussed in Chapter 5.

4.4 Solution Set Option 4: New Transmission Infrastructure Using Batch Processing

The final solution set also works with new transmission routes, bypassing TPPs and EBT processors, as shown in Exhibit 32. Developing a new transmission route offers increased flexibility in developing new transmission standards independent of ANSI X9 standards. However, uniform standards will still need to be developed. Modeling them after ANSI X9 standards may ease retailer adoption, as retailers would face lower development costs to produce files in a format similar to what they already use. Another advantage of using new transmission routes is that current transmission routes would not be overloaded with additional data. However, the cost of developing, testing, implementing, and continued operation of these new routes would need to be factored in for the various stakeholders. Using new transmission routes would present the same issues with data encryption as discussed for Solution Set Option 3. As with previous solution sets, data would be processed and stored at FNS, a contractor, or federally approved cloud solution.

Solution Set Option 4 is also technically similar to Solution Set Option 2, described in Section 4.2 and depicted in Exhibit 27, in that it relies on batch transmission. The primary difference is the transmission route. Advantages and disadvantages of batch transmission in Solution Set Option 4 are similar to those of Option 2. The introduction of a new transmission route and new contractors, both to transmit the data and/or process the data, introduces significant development, testing, implementation, and operational costs for these new contractors. These contractors will need to ensure that they have adequate transmission bandwidth and establish new connections with retailers and with FNS. One advantage of setting up new transmission routes is that this presents an opportunity to move away from aging technologies.

Exhibit 32: Solution Set Option 4: New Transmission Infrastructure with Batch Processing

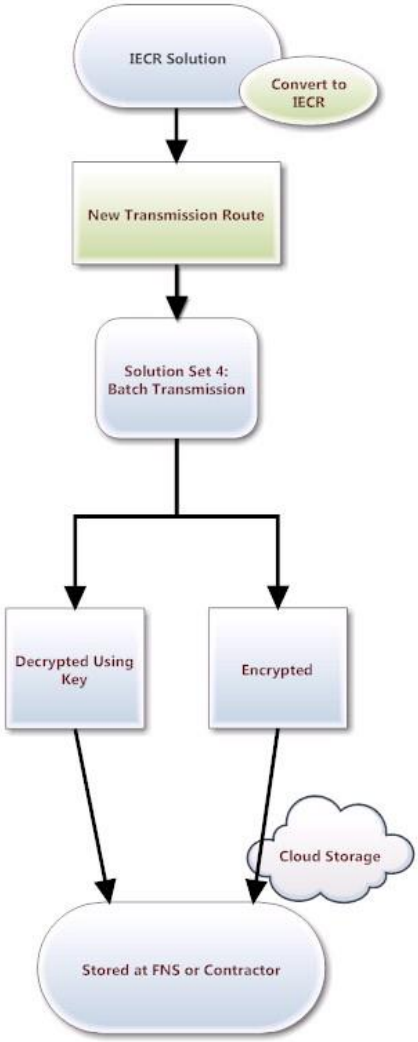


Exhibit 33 summarizes the advantages and disadvantages of each technical solution option. In the next chapter, preliminary prototypes of some of the components discussed in Chapters 3 and 4 are discussed. Issues to be considered include the feasibility of matching partially masked personal identifiers to ALERT data records. Data processing and storage options are also explored further.

Exhibit 33: Evaluation Summary of Technical Solution Options

Technical Solutions Options	Advantages	Disadvantages
Option 1: Existing Infrastructure, Real-time Data Transmission	There is no need to build and maintain new infrastructure. FNS can use existing communication and transmission modes with TPPs or EBT processors.	Time and cost to modify POS software applications
	Can use existing storage/communication capacity.	Time and cost to create a new X9 based standard.
		Encryption potentially degrades quality of data available to FNS if it has to correlate records from the retailer, STARS, and ALERT to associate EBT card numbers with item-level data.
		FNS needs legal authority to require EBT processors and TPPs to collect and transmit data.
		FNS needs to create operating rules to guide data collection and transmission.
		Decryption of data increases privacy and security liability for all stakeholders
		Retailers could face increased TPP fees for data transmission of item-level data.
Option 2: Existing Infrastructure, Batch Data Transmission	There is no need to build and maintain new infrastructure. FNS can use existing communication and transmission modes with TPPs or EBT processors.	Time and cost to modify POS software applications
	Ongoing real-time transmissions are not burdened with larger message packets	Time and cost to create a new X9 based standard.
		Batch transmission may not be possible with existing transmission infrastructure between ECRs and TPPs, EBT processors, or other contractors
Option 3: New Transmission Infrastructure, Real-Time (Electronic Messaging)	Opportunity for FNS to build a new data transmission infrastructure that is free from existing constraints.	Could require significant level of effort to modify POS software applications to implement electronic messaging.
	Data transmission could be cheaper than using existing stakeholders.	FNS will incur processing and transmission costs.
	FNS can avoid the legal and regulatory requirements needed to amend current operations of EBT processor and TPPs.	
Option 4: New Transmission Infrastructure, Batch Data Transmission	Ongoing real-time transmissions are not burdened with larger message packets	Cost to acquire adequate transmission bandwidth to transmit data.
		Significant set up costs in terms of development, testing, implementation and operational costs.

CHAPTER 5: NEXT STEPS

FNS chose parameters for technical solutions for capturing, transmitting, and processing item-level SNAP transaction data with personal identifiers based on the options discussed in Chapter 3 of this report. Chapter 4 proposes four solution sets that combine these options. All four solution sets:

- Focus on IECR retail environments
- Depend on development of new standards, modeled after ANSI X9 standards, for capture and transmission of item-level transaction data
- Assume that transmitted data can be either encrypted or decrypted
- Can deliver data to be processed and stored at FNS, an external storage site provided by a contractor, or a FedRAMP cloud solution

The first two solution sets use existing TPP and EBT processor pathways, while the third and fourth solution sets are based on use of new transmission pathways to new contractors and ultimately to FNS.

The research team engaged in preliminary prototype development to explore critical elements of the four solution sets:

- Testing of the ability to match transaction data, including partially masked EBT card numbers, to ALERT data. Use of partially masked PANs data eliminates the need to ask retailers, processors, or other contractors to store and transmit decrypted data.
- Delineating the steps required to develop new ANSI X9-based standards on the capture and transmission of item-level data.
- Delineating the steps required to process and store item-level data from retailers throughout the U.S. This knowledge will enable FNS to understand volume and processing infrastructure needs.

This chapter proceeds as follows: In 5.1, we present the results of a simulation that matched partially masked EBT card numbers to FNS ALERT data files. Section 5.2 outlines a basic framework for a new data messaging standard. In Section 5.3, we discuss processing and storage resource considerations. In Section 5.4, we provide technical implementation details.

5.1 Matching Partially Masked EBT Card Numbers to ALERT Data

In the proposed solution sets, data transmitted directly from retailers will include item-level transaction data, trace number, terminal ID number, issuer identification number (the first six digits of the EBT card number, which identify the state that issued the card), last four digits of the EBT card number, and transaction date and time. The remaining digits of the EBT card number may be encrypted when transmitted. Industry security standards require that customer identifiers such as PAN be encrypted or masked. These elements therefore would not be completely visible in the message; this is the reason that only the first six and last four digits of the EBT card number are displayed. The other fields in the message need not be encrypted.

As noted in Section 2.3, SNAP regulations do not require PCI compliance for EBT transactions, and so the full EBT card number could theoretically be transmitted without encryption. However, it is important to

consider the scenario in which the EBT card number is masked. In this case, the solution set would need to match the TWILD files to the daily ALERT files to create a complete record. In order to determine if this would possible, we conducted preliminary testing of the feasibility of matching TWILD files to ALERT files. Using the masked EBT card number along with additional transaction details that are common to both files, a significant proportion of all transactions can be mapped to individual SNAP participants. A brief discussion on the current practices in masking EBT card numbers follows.

5.1.1 The PAN and EBT Masking

Experience with SNAP retailer practices shows that a portion of the EBT card number is typically masked during transmission, storage, or both. There is no uniform masking format across retailers. The length of EBT card number ranges from 16 to 19 digits. Six states, including Texas and Pennsylvania, use 19 digits; two states use 18-digit card numbers, while all other states use only 16 digits. The choice of which successive digits to mask is a function of the level of security being implemented. The first six digits of the EBT card number identify the issuing state, which means exposure poses no security risk. The last four digits of the EBT card number are not unique to an individual, so they also pose no security risk. The middle numbers usually identify the cardholder. For example, in Pennsylvania digits 7–15 identify the individual recipient.[20]

Security considerations influence the decision to mask the middle digits. PCI requirements limit the portion of the card number to be displayed to the first six and the last four digits.[21] This simulation exercise adhered to this PCI requirement and masked all but the first six and the last four digits of the EBT card number. For example, the fictitious 19-digit EBT card number 1234 5678 9101 1121 314 is masked as 1234 56** **** **13 14.

5.1.2 Simulation Matching Mock Transaction Data to ALERT Data

We used three ALERT data files, one each from Texas, Ohio, and Washington for the simulation. These files included all transactions in these states for the month of August 2011. The largest of the files, from Texas, had more than 18 million transaction records. Ohio had more than 1 million and Washington approximately 6 million records.[22] Inherent in this simulation is the assumption that total transaction amounts in the current ALERT records are accurate and that therefore there will be no discrepancies between them and the transaction amounts in the item-level transaction records from the retailers.

[20] http://services.dpw.state.pa.us/oimpolicymanuals/manuals/bop/ca/180_Issuing_Benefits/180_7_Pennsylvania_EBT_ACCESS_Card.htm

[21] https://www.pcisecuritystandards.org/documents/pci_dss_v2.pdf

[22] For this simulation exercise, we used a sample of 5 percent of the ALERT data records from the three states.

Exhibit 34 shows the data elements in the ALERT files.

Exhibit 34: ALERT File Data Elements

Data Element	Description
FNS Retailer ID Number	Valid FNS number identifying retailer
Retailer State Location	State abbreviation for retailer location
POS Terminal ID	ID of POS terminal (unique within retailer)
House Account Number	Account number that identifies household of EBT card holder
Card Account Number	Account number on card used in transaction
Transaction Date	Date of transaction (based on GMT)
Transaction Time	Time of transaction (in GMT)
Transaction Amount	Transaction amount (in cents, so that 123456 represents $1,234.56)
Transaction Sign	+ to designate credit to recipient – to designate debit to recipient Ignored for balance inquiry transactions
EBT Program	00: SNAP
Transaction Type	10: Purchase 20: Refund 30: Void last transaction 40: Balance inquiry
Transaction Method	0: Electronic swipe 1: Manual/key entered 2: Paper voucher 3: Radio frequency identification/pay by touch
Store & Forward Indicator	0: Not a store & forward 1: Denied 2: Partially approved 3: Fully approved
Response Code	Indicator for accepted or rejected transactions
Available Balance Prior to Transaction	Balance amount (in cents)
Filler	
Record Delimiter	Carriage return (ASCII value 0D) Linefeed (ASCII value 0A)

The potential that one ALERT record would match to multiple item-level transaction records is quite high. This is because ALERT files retain one row for each completed EBT transaction in the course of a month, including both purchases and refunds. Every time a SNAP participant uses his or her EBT card, a record of the transaction total is stored in the ALERT file. For example, of the 18 million transaction records in Texas, 17 million are duplicate EBT card numbers, meaning that at least 8.5 million EBT card numbers appear in the data file more than once. The magnitude of duplication is exacerbated because EBT card numbers may be masked. Matching is more accurate when the EBT card numbers are not masked.

Using the transaction amounts in the ALERT data, the team created item-level data for this simulation (based loosely on ANSI X9.93) as follows:

1. We randomly associated transaction amounts from the ALERT records with real retail item-level transaction data – the mock TWILD. Each transaction record from the mock TWILD contained both a main transaction record, which had a masked EBT identifier and a total transaction amount and addenda records that provided detailed data elements on items purchased

including the item price and quantity of item purchased.[23] The addenda records were built using item-level data from archived retailer transaction data records available to the study team.

2. For each transaction record in the mock TWILD, we forced the total transaction amount to be equal to the associated ALERT transaction amount.[24]

We then proceeded to simulate matching the records based on available variables. Exhibit 35 below summarizes the results of the simulation exercise matching the mock item-level data records to ALERT data files for the three states using various combinations of variables. We matched the mock item-level data to the ALERT files in several steps, as shown in columns 3–7 in the exhibit. We started with the scenario that is most likely to succeed in matching the two data sets (Column 3) – all item-level transaction records include full EBT card numbers. With just the EBT card number and the full transaction amount, we were able to match about 99.5 percent of the records in all three states. For example, out of more 900,000 records in the Texas sample, just over 4,000 transaction records could not be matched (duplicate matches) from the mock item-level data to the ALERT data files using the full EBT card number and the full transaction amount. This represents a 99.4 percent success rate.

Exhibit 35: Results of Simulation Matching Item-Level Transaction Records with ALERT Records

St (1)	Number of Records (2)	With Card Number and Amount (3)		With Masked Card Number and Amount (4)		With Masked Card, Store ID, and Amount (5)		With Masked Card, Store ID, Amount, and Date (6)		With Masked Card, Store ID, Amount, Date, and Time (7)	
		Duplicate Matches	Match Rate (%)	Duplicate Matches	Match Rate (%)	Duplicate Matches	Match Rate (%)	Duplicate Matches	Match Rate (%)	Duplicate Matches	Match Rate (%)
TX	909,810	4,014	99.4%	182,729	80.0%	3,179	99.7%	1,871	99.8%	1,871	99.8%
WA	291,399	1,408	99.6%	13,583	95.4%	1,003	99.9%	407	99.8%	82	99.9%
OH	52,429	89	99.8%	1,058	98.0%	87	99.9%	80	99.8%	32	99.9%

Columns 4–7 show the results for scenarios in which the full card number is not available. In Column 4, the mock item-level data and ALERT data are matched using the masked EBT card number and the transaction amount. Here, we see varying degrees of success. For the largest state, Texas, we were able to match only 80 percent of the ALERT data records to their corresponding transaction detail records. In comparison, the Ohio data had a much higher match rate of 98 percent, suggesting that the accuracy of the match increases as the number of transaction records decreases. In Column 5, the matching variables include the store ID; Column 6 adds the date of the transaction, and, Column 7 adds the transaction time. In column 7, match rates near 100 percent in all States. Therefore, it appears possible for the solutions sets to match encrypted data to ALERT files.

It is clear that precision of the matching increases with the number of variables included in the matching process. Given that actual TWILD data files may contain more transactions than the files used for

[23] We discuss the transaction record and addenda records in detail in the next sub-section.

[24] The procedure simply sorted addenda records in ascending order of item amount (item price times quantity purchased) – smaller amounts first. We then added up the item amounts until the sum matched the transaction amount, and then discarded the remaining addenda records for that transaction.

testing, in proof-of-concept testing, we will include other data elements such as terminal ID and the system audit trace numbers issued by EBT processors, which will further increase the match precision. Notably, in the absence of EBT card numbers, system audit trace numbers would provide a unique identifier for matching purposes, especially if they were formatted to X9.58 standards.

5.2 Creating a Standard for SNAP TWILD Transmission

To enable the transfer of item-level transaction data from retailers to FNS, new standards must be created for data transmission. These new standards could be to be similar to ANSI standard X9.93, used in the WIC EBT program, but the format of the values must be compatible with X9.58 to ensure problem-free data matching with the ALERT files. Following the current SNAP data format, each transaction using the new standards would have its own *detail* record similar to the current ALERT record. For each transaction, an *addenda* file would list all items purchased. Currently, in standard X9.93, each transaction record can contain a maximum of 255 addenda records. FNS will need to decide on the final number of addenda records for the new SNAP standards. X9.93 could serve as model for the development of future messaging standards to transmit SNAP item-level transaction data.

5.3 Processing and Storing Item-Level Transaction Data

The proposed solution for the prototype would require changes to the EBT software environment while maintaining existing compatibilities. In addition to POS software modification, the components that would have to be modified include data processing and storage.

5.3.1 Processing

An essential element of any system designed to automatically capture and transmit TWILD is to develop a prototype standard that would govern item-level transaction data and that could apply to any SNAP EBT application using online message exchange to complete transactions. This includes retail merchants, POS system integrators, and EBT processors and TPPs. Although the prototype standard could at first be compatible with EBT processors or TPPs for only a few states, the data standard should be flexible enough to allow for ease of adoption across all states.

Process and Storage Design Considerations

For any project that involves the extraction, transformation, and loading of data, the first step is to understand the data to be transmitted and received. This understanding informs decisions about the preferred file format, file-naming conventions, data format, and field and record delimiters. Rules and validation procedures must be defined for transforming the extracted source data for loading into the target database. For example, the data can be validated by checking that the sum of all item prices equals the total transaction amount, including taxes and discounts for transaction baskets where only EBT tender was used. This validation can help to ensure the accuracy of the data.

Assumptions

We make the following assumptions as we evaluate various solutions for transmitting item-level transaction data:

- Plain text format may be sufficient for the transmission and receipt of prototype data because it should not include personally identifiable information that would be subject to PCI security standards.
- The recognized standard for transmission of WIC EBT data, ANSI standard X9.93, may be considered as a model for SNAP EBT data, as long as the formatting and definitions are the same as those specified in standard X9.58, which is currently used for the ALERT file transmission. Standard X9.93 addresses item-level data elements. Although our simulations were built on a modified version of this standard to capture item-level data, our assumptions have left the standard essentially intact.
- The initial prototype should be based on data received from IECR-based retailers. Subsequent research efforts may focus on data received from non-IECR and other retailer technologies.
- The expected volume of item-level data to be transmitted may be estimated based on an analysis of an ALERT EBT file for a single day from each state combined with background knowledge of SNAP benefits. In consultation with FNS, we will utilize EBT data from selected states for the prototype.
- ALERT files contain only a single string of data for each transaction. This transaction-level data string is equivalent to the *detail* record of the proposed enhanced data. For each detail record for a given EBT card number, we assume that there would be an average of 10–15 item-level addenda records in the proposed file. (For example, if the total dollar amount of the transaction is $2, there might be only one item-level addenda record, but if the total is $100, there could be more than 15 addenda records.)
- The proof-of-concept test should assume that there would be an average of six to eight transactions per month for a participating household.
- The design should be based on the assumption that the average monthly benefit per account is $300. This amount assumes a household of two people.

As we develop the prototype, we will use the volume of data transmitted and received to plan storage capacity.

5.3.2 Storage

The proposed database design includes a staging database for extraction, transformation, and loading of data; it also includes a data warehouse for reporting functions. The staging database would house only the data extracted from transaction files for the current year. These data would be backed up annually for archival purposes. Values for data fields needed for reporting purposes would be copied from the staging database to the data warehouse on a scheduled basis, at a frequency to be determined. Historical data for the subset of fields needed for reporting would be stored in the data warehouse indefinitely. The staging database would need a high-performance central processing unit (CPU), while the data warehouse would need a higher storage capacity in order to house historical data.

5.4 Technical Implementation Detail

5.4.1 Data Transfer

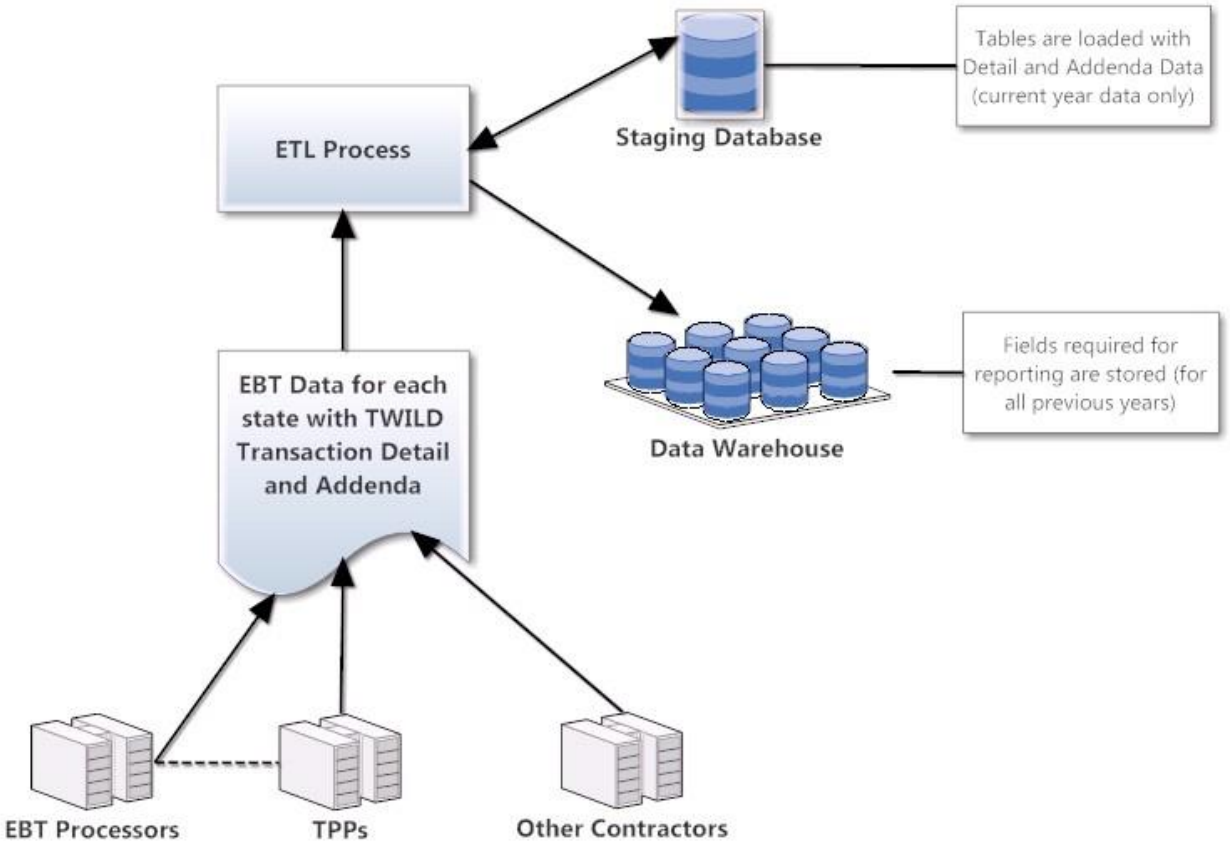
TWILD may be transferred to SNAP database servers from an FNS secure FTP server on a daily basis in a process much like that of the existing ALERT data transfer. The source of the data would vary depending upon the solution set. The transaction data would be transmitted to FNS within several flat files.

Processing time for copying the data from a single transaction file to the target database depends on the format of the incoming data. Processing time should be taken into account when defining the format of the item-level transaction data files.

- If both transaction detail and addenda (item-level) data are included in a single file, processing time is higher than if the different types of data are stored in separate files due to the time required by the database code to identify the record type of a data string as it is read and copied into the appropriate table.
- If a certain data element is of variable length, and a separate field is used to indicate the length of that field in a specific row of data in a file (for example, EBT card number and card number length), processing time is higher than if the maximum length for the field can be pre-defined and assigned as the length of the field. Extra processing time will be required for the code to first identify the length of the field by looking up a value in the data string and then calculate the positions of all data elements in the data string following that particular data element. The length of the field can be made uniform by adding leading or trailing zeros or spaces to serve as padding when the value for that field is not as long as the pre-defined length. For example, if the EBT card number field is defined as 19 digits in length and a certain customer's EBT card number is only 16 digits, trailing zeros can be placed after the EBT card number so that the value is the correct number of characters.

FNS would ultimately decide on the data transmission route, frequency, and time of a system to capture TWILD. It is likely, however, that multiple files containing TWILD data will be sent to a target database server on a regular basis (such as by a specified time each day) using FTP or a similar type of file transfer process. The raw TWILD data from the data files should be loaded into a staging database. The staging database would process one new file at a time, beginning at a scheduled time each day, extracting and loading (ETL process) the raw data using SQL Server Integration Services (SSIS) and organizing the data into a meaningful database structure, as illustrated in Exhibit 36.

Exhibit 36: Data Transfer Process



Every year, the data for a subset of fields used for reporting purposes would be copied from the staging database to the data warehouse. The data warehouse would store the reporting data indefinitely, while the staging database would be cleared after each successful data copy, on a schedule to be determined by FNS.

The following aspects of the design will need to be defined in the service level agreement governing all parties sending and receiving SNAP transaction files:

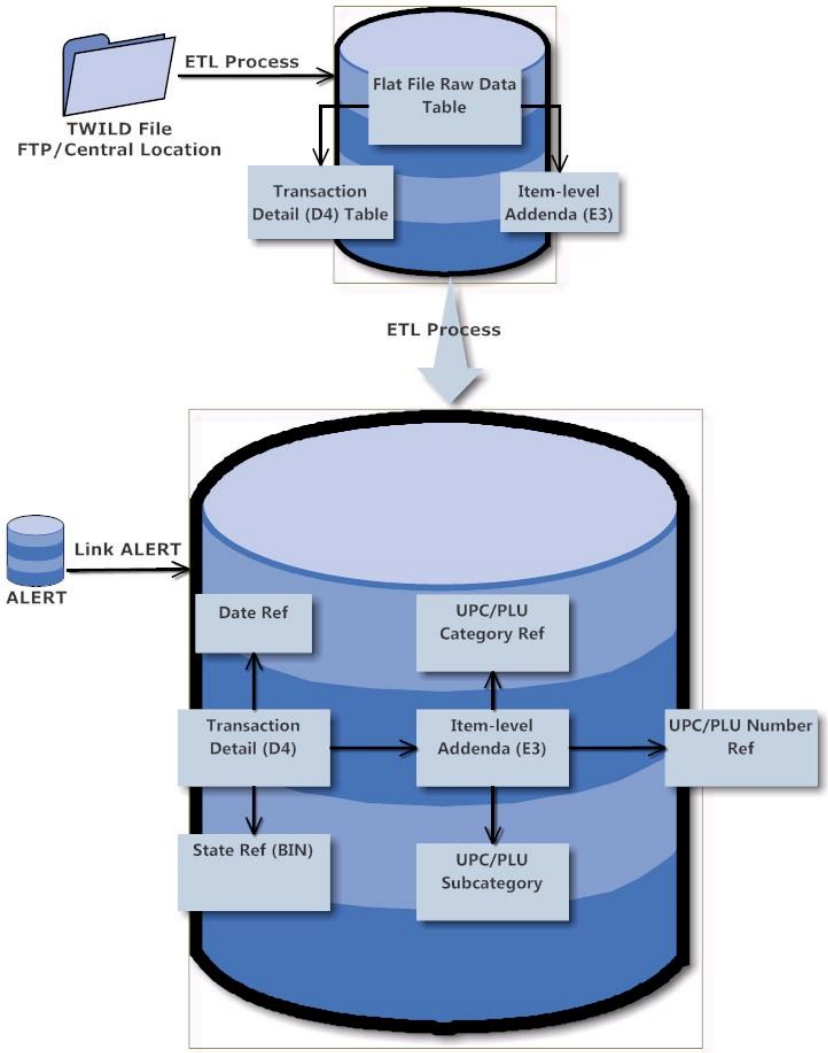
- A file-naming convention needs to be established to enable the database code to identify each state's file each day, if the files are transmitted by the state. If the files are transmitted by TPPs or other contractors, there will be multiple files for each state, and the naming convention must be adapted. For example, the file could be named with the two character state abbreviation followed by a file type name and date stamp (e.g., VATWILD20131203.DAT).
- Rules for data file preservation need to be defined. As an example, a rule is needed to determine whether all files will be stored in the same location, so that the database code needs to look for the most recent date in the file name when copying new data, or whether, after being copied into the database, a file will be automatically moved to another location. A plan could be created whereby, after each day's file is processed, it is moved to an archive folder. If files from a previous day are needed for reference, they can be accessed from the archive folder. A data definition file needs to be available, enabling the database code that parses the

data to identify the length, position, and data type of each data element in each row of data in the source file. Ideally, the data definition would be the same for all states, ensuring that all files are formatted the same way and that the database can process them all using a single set of rules.

5.4.2 Database Schema

Exhibit 37 illustrates the proposed database schema. The staging database would consist of tables for capturing raw transaction data as well as tables for storing the extracted transaction detail and addenda records. The data warehouse would include transaction detail and addenda record tables, as well as lookup and dimension tables for reference. One process would extract the raw data from the flat file and load it into the staging database, and another process would move data from the staging database to the data warehouse.

Exhibit 37: Database Schema



5.4.3 Staging Database Tables

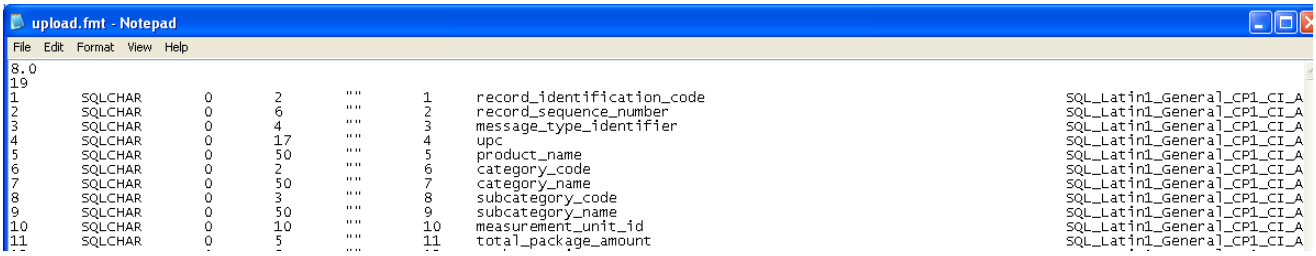
As shown in Exhibit 38, SNAP transaction files submitted for each state would include transaction detail records, which should be matchable to ALERT records, and addenda records containing item-level data. To facilitate the extraction and loading of data, the target database would include tables for capturing raw data and tables for storing extracted transaction detail and addenda records. Records for a single transaction in these tables could be linked using unique identifiers in the transaction detail records and addenda records.

Exhibit 38: SNAP Data Database

Table Name	Table Definition
Raw Transaction Data Table	Stores the raw data copied into the database directly from the flat files.
Transaction Detail Table	Stores the transaction-level data for a SNAP transaction, such as the transaction price, customer EBT card number, and date of purchase.
Addenda Record Table	Stores the item-level data associated with a SNAP POS transaction, such as UPC, quantity, and price of each item purchased.

Data elements contained in the incoming flat files would be identified using a data format definition file. This file would map values at defined positions in a given string of data to an established column in a database table, as illustrated in Exhibit 39: Sample Data Format Definition File.

Exhibit 39: Sample Data Format Definition File



Appendix H provides detailed examples of all proposed data tables.

5.4.4 Hardware and Software Recommendations

Exhibit 40 displays recommended minimum software and hardware specifications for the staging database and data warehouse, which should be housed in separate servers. The data warehouse is the location where all analysis, reporting, online analytical processing, and cube processing, as well as most end-user activity, would take place. The capacity, hardware, and software estimates in Exhibit 40 are based on an assumption that approximately 30–50 users could be accessing this database concurrently. Some 5–10 users with administrative rights could use proprietary reporting and business intelligence tools to run advanced queries that could join multiple tables and access more than a billion rows of data. SQL Server can break down such queries into parallel tasks that run on separate cores to improve throughput and response times.

Exhibit 40: Minimum Software Requirements for Staging Database and Data Warehouse

Software	
Operating System	Windows Server 2008 R2 Enterprise Edition
Database Version/Features	SQL Server Enterprise Edition 2008R2 or 2012 Features: SQL Server Database Engine, SSRS, SSIS, SSAS
Hardware	
Server Model	Dell PowerEdge M620 (equivalent) or above
Storage System	Dell Compellent SC8000 (equivalent) or above
Disaster Recovery/Backup	SQL Server log shipping may be used for backup. Similar configurations should be employed for database mirroring of Windows and the database server. Backup schedules consistent with those of current ALERT files are recommended on the staging database, so that the prior year's data is backed up and archived in a location outside of the two servers used for the staging and data warehouse databases. Further detail about backup and recovery can be discussed and determined as the solution is refined.
Preferred Storage Type	Fibre Channel Array
Processor Type	Intel Xeon® Blade Server
High Availability	Windows Server Failover Clustering (FC)
Memory	At least 512 GB

5.4.5 Error Handling

A notification procedure, consistent with that used by STARS and ALERT, would be set up to notify the sender of the file of any issues encountered with an incoming flat file placed in the staging database. Other interested parties, including the FNS production support team, would also be notified. A process for resubmitting files would be established to provide guidance on retransmitting data that could not be processed initially. Some examples of potential problems are:

- The data within a flat file do not adhere to data format specifications and therefore cannot be extracted and loaded.
- The file name does not match the data file name specifications.
- The file format does not match the data file format specifications.
- Established error thresholds for individual records are exceeded, in which case the transaction files will be rejected.

In addition, if the extraction and loading process should fail due to any problems with server availability, such as network or connection issues, all interested parties would receive notification that the affected files were not processed.

5.5 Technical Solutions Summary

To date, preliminary development included generation of a SNAP transaction dataset in a structured format derived from the X9.93 standard. The dataset was matched against an ALERT file to illustrate the matching algorithm if the EBT card number is encrypted at the POS so that only the last four digits are visible. The processing and storing design was vetted using FNS and industry best practices. Technical solution proof-of-concept testing will continue to explore the solution sets, develop cost methods, and refine legal and policy considerations tailored to the solutions chosen for further development. To the extent possible, retail data will be acquired and used to enhance the mock TWILD database construction.

APPENDIX A: POS DATA REQUESTED BY FNS

Data Type	Data to Be Captured at POS	FNS Priority (high=1, medium=2, low=3)
Item-level data	UPC description	1
	UPC or PLU code	1
	Retail department of the item (around 10 groups)	2
	Retail commodity description (typically several hundred)	2
	Retail subcommodity description (typically a few thousand)	2
	Net expenditure (as a derivative of total amount captured by X9.58 standards)	1
	Amount purchased (quantity, volume, or weight as applicable)	1
	Price paid	1
	Other price (regular price, flag for sale price)	2 or 3
Basket-level data	Date and time of transaction	1 for date, 2 for time
	Transaction basket total	1
	SNAP EBT basket total	1
	Complementary payment type (in case SNAP benefits did not cover the full amount of SNAP-eligible items)	1
	Customer retailer loyalty card number	2 or 3
	Customer household account number (EBT card number generated by EBT processor)	1
Store-level data	Store identification number (FNS-authorized retailer number)	1
	Store address	Not necessary
	Terminal where purchase took place	3

APPENDIX B: INTEGRATED ELECTRONIC CASH REGISTER HARDWARE AND SOFTWARE TECHNOLOGY

Hardware

The most critical hardware components that could affect potential solutions for collecting POS item-level data are the ECR and the POS terminal. Given the breadth of POS hardware and software applications in the retail environment, it is important to understand the market presence of each hardware and software technology. As shown in Exhibit 41, the major IECR hardware manufacturers are IBM—which has recently purchased Toshiba—Dell, NCR, HP, and Casio. The major hardware operating systems, in order of market penetration, are Windows-based operating systems, IBM- and Toshiba-developed systems, and Linux-based operating systems.

Software

The major POS software application developers are Retalix (which recently purchased Fujitsu), Toshiba, Microsoft, and NCR. Although there are a number of POS hardware manufacturers, there is flexibility with the types of operating systems that can run on the hardware; in general, most POS hardware can run Windows-based operating systems. By contrast, proprietary Toshiba operating systems run only on IBM/Toshiba hardware, while NCR hardware can operate both Linux-based and Windows-based operating systems. Similarly, POS hardware running on Windows-based operating systems can run a variety of POS software applications, including software developed by key software application developers like Retalix/Fujitsu. Like IBM/Toshiba operating systems, Toshiba POS software applications are proprietary and can run only on IBM/Toshiba hardware. In general, when considering modifications to POS systems, the major element to consider is the POS software applications. The hardware matters less, as most hardware will run most POS software applications.

POS terminal technology and software are also key factors to solution flexibility. The major POS terminal manufacturers are VeriFone, Ingenico, and Hypercom. These devices have their own operating systems and are designed to interface with current ECR operating systems and POS software applications. Another factor to consider is the servers that retailer systems connect to at TPPs, EBT processors, or other potential contractors. Here too, servers are flexible and are designed to interface with multiple POS hardware and POS software applications. While most of the aforementioned hardware and software elements are designed to be compatible, proposed modifications to any system necessitate a collaborative and synchronized modification of all programming code to retain this compatibility as systems are changed to accommodate additional services and functionality.

Exhibit 41: Point-of-Sale Hardware Manufacturers, Operating Systems, and POS Software Applications

Primary Manufacturer	Operating Systems	Supported POS Software Applications
IBM/Toshiba	Proprietary OS ▪ Toshiba 4690 OS, Version 6.3	SurePOS ACE for 4690 OS
	Windows-based OS ▪ Windows Embedded POSReady ▪ Other	▪ Microsoft Dynamics RMS (Windows-based) ▪ Microsoft Dynamics POS 2009 ▪ StoreNext (Retalix) ▪ Retalix10 ▪ StorePoint (Retalix) ▪ StoreLine (Retalix) ▪ JPMA POS Designer ▪ Aurora ▪ RORCvIPOS V6 ▪ Retail Professional
NCR	Windows-based OS ▪ 82XRT – Windows 7 Professional ▪ 70XRT – Windows XP Professional ▪ Windows Embedded POSReady	▪ NCR Advanced Checkout Solution (ACS) ▪ Microsoft Dynamics RMS (Windows-based) ▪ Microsoft Dynamics POS 2009 ▪ StoreNext (Retalix) ▪ Retalix10 ▪ StorePoint (Retalix) ▪ StoreLine (Retalix) ▪ JPMA POS Designer ▪ Aurora ▪ RORCvIPOS V6 ▪ Retail Professional
	Linux-based OS ▪ SUSE® Linux® Enterprise for Point-of-Service (SLEPOS) 25, 40, 50, 60	▪ NCR Advanced Checkout Solution (ACS) ▪ Aurora
Casio	Window-based OS ▪ Windows Embedded POSReady ▪ Other	▪ Microsoft Dynamics RMS (Windows-based) ▪ Microsoft Dynamics POS 2009 ▪ StoreNext (Retalix) ▪ Retalix10 ▪ StorePoint (Retalix) ▪ StoreLine (Retalix) ▪ JPMA POS Designer ▪ Aurora ▪ RORCvIPOS V6 ▪ Retail Professional
HP	Windows-based OS ▪ Windows Embedded POSReady ▪ FreeDOS	▪ Microsoft Dynamics RMS (Windows-based) ▪ Microsoft Dynamics POS 2009 ▪ StoreNext (Retalix) ▪ Retalix10 ▪ StorePoint (Retalix) ▪ StoreLine (Retalix) ▪ JPMA POS Designer

Primary Manufacturer	Operating Systems	Supported POS Software Applications
		▪ Aurora ▪ RORCvIPOS V6 ▪ Retail Professional
Dell	Windows-based OS ▪ Windows Embedded POSReady ▪ FreeDOS	▪ QuickBooks Point of Sale ▪ Microsoft Dynamics RMS (Windows-based) ▪ Microsoft Dynamics POS 2009 ▪ StoreNext (Retalix) ▪ Retalix10 ▪ StorePoint (Retalix) ▪ StoreLine (Retalix) ▪ JPMA POS Designer ▪ Aurora ▪ RORCvIPOS V6 ▪ Retail Professional

APPENDIX C: CURRENT DATA, COMMUNICATION INFRASTRUCTURE, AND SECURITY STANDARDS AND REGULATIONS

This Appendix discusses in detail the current data and communication infrastructure used by retailers, EBT processors, and TPPs. Retailer data security standards and FNS driven regulations are also discussed.

Current Data: X9.58 Standards

ANSI standard X9.58 provides all parties involved in EBT SNAP transactions with technical specifications for exchanging transaction messages between retailers and EBT processors, with or without TPPs as go-betweens. Based on the International Organization for Standardization (ISO) 8583 interchange specifications for messages originated by financial transaction cards, the X9.58 standards are tailored specifically for EBT transactions, specifying the message structure and data elements to be used. SNAP EBT financial transaction messages are structured in three components: message type, message bitmaps, and data elements.[25]

The first component of the financial transaction message is the message type, described by a message type indicator (MTI) and illustrated in Exhibit 42. The four-digit MTI communicates the ISO 8583 version, message class, message function, and message origin. The first digit identifies the version number of the standard being used to transmit the message. This identification allows for proper processing. The second digit of the MTI is the message class, which specifies the purpose of the message, whether it is an authorization message, a financial message, a reconciliation message, and so on. The third digit of the MTI is the message function, which defines how the message should flow in the payment system—either as an end-to-end "request" or as point-to-point "advice." The EBT financial transaction messages with which we are concerned here are requests. The fourth digit of the MTI defines the location of the message source in the payment chain. The four digits of the MTI completely specify what a message should do and how it should be transmitted around the network.[26] Exhibit 42 illustrates the layout of the message type elements. In this example, the message is based on ISO 8583, version year 1993, and the acquirer of the card is requesting an authorization of the transaction.

Exhibit 42: Message Type Elements

Example Message Type Indicator			
1	2	0	0
Version Number	**Class**	**Function**	**Originator**
ISO 8583 1993	Authorization	Request	Acquirer

The second component of the financial transaction is the message bitmap or message bitmaps. A bitmap is an indexing technique used in an ISO 8583 message to indicate which data elements are present. Messages can have either a primary bitmap only or a primary bitmap and a secondary bitmap. All

[25] ANSI X9.58-2007: Financial transaction messages—Electronic benefits transfer (EBT)—Food Stamps. Accredited Standards Committee X9, Incorporated. Financial Industry Standards. American National Standards Institute. Annapolis.

[26] ISO 8583-1:2003 Financial transaction card originated messages -- Interchange message specifications -- Part 1: Messages, data elements and code values

financial transaction messages originating with EBT cards have both primary and secondary bitmaps. Exhibit 43 describes the message bitmap.

Exhibit 43: Message Bitmap Configuration

Message Type	Primary Bitmap	Secondary Bitmap
1100	Bits 01–64	Bits 65–128

The primary bitmap indicates the presence of data element bits 01 to 64. For EBT transactions, bit 01 begins with a 1, which indicates the presence of the secondary bitmap. Bits 01–64 transmit information such as transaction amount, time and date of transaction, and customer PIN. The secondary bitmap includes bits 65–128, which contain, among other data, the FNS number that indicates an authorized SNAP location.

The third component of the financial transaction message, and most critical to the feasibility of capturing item-level POS data, is the data elements. The data elements contain all the information mapped in the primary and secondary bitmaps. These data elements are strings of 128 bits of alphanumeric characters that indicate the specific data that is being captured in the bitmaps. The data elements can be encoded in text files as Extended Binary Coded Decimal Interchange Code (EBCDIC) or American Standard Code for Information Interchange (ASCII). EBCDIC is an eight-bit character encoding scheme used mainly on IBM mainframe and IBM midrange computer operating systems.[27] ASCII is the character-encoding scheme developed by ANSI. The total size of current SNAP EBT transaction messages is 256 bits, which equals 32 bytes.

[27] Character Data Representation Architecture (CDRA) Reference, Document Number: SC09-2190-00. International Business Machines Corporation 1990, 1995. Retrieved 11/27/2013 from http://publibfp.boulder.ibm.com/cgi-bin/bookmgr/BOOKS/focref00/CCONTENTS.

APPENDIX D: SNAP FEDERAL STANDARDS AND EBT RULE AMENDMENTS

Authorities Governing SNAP, Including EBT[28]

SNAP Regulations		EBT Details
2 CFR 225 (OMB A-87)	Cost Principles for State, Local, and Indian Tribal Governments (Grants and Agreements)	Not applicable.
7 CFR 271.1 to 271.8	General Information and Definitions	271.3 – Delineates responsibilities of FNS for SNAP program administration, including EBT-related functions. 271.4 – Delineates responsibilities of state agencies for SNAP program administration, including EBT-related functions. 271.5 – Outlines misuse of SNAP benefits and associated penalties, which includes issues related to EBT cards. 271.7 – Outlines allotment reduction, suspension, and cancellation procedures.
7 CFR 272.1 to 272.14	Requirements for Participating State Agencies, including the ADP/CIS Model Plan and Disclosure of Beneficiary Information	272.1: ▪ A State agency must submit a Planning Advanced Planning Document for FNS approval to get approved for an EBT system ▪ Requires states to implement EBT adjustment regulations by January 2, 2001. ▪ Requires states to implement SNAP EBT systems by October 1, 2002. ▪ Requires states to implement Standards for Approval & Operation of SNAP Electronic Benefits Transfer Systems regulations by October 11, 2005. 272.3: ▪ Requires states to submit their operating guidelines and forms and amendments to these materials to FNS for review and audit purposes simultaneous with distribution within the States
7 CFR 273.1 to 273.32	Certification of Eligible Households	273.11 – Discusses EBT requirements for clients in drug and alcohol treatment and rehabilitation programs. 273.13 – Requires states to inform SNAP clients of adjustments reducing benefits due to EBT system errors no later than the date of the adjustment. 273.15 – States will debit a household's EBT account for the amount of an adjustment from the next month's benefits, regardless of whether the amount in the account is sufficient to satisfy the adjustment. 273.18 – Discusses steps to calculate and manage/collect claims, which includes EBT accounts. States must allow clients to pay claims from their SNAP EBT accounts.

[28] Food and Nutrition Service, "FNS Handbook 901", September 7, 2007, pages 14-15.

7 CFR 274.1 to 274.8	Issuance and Use of Coupons – 274.8 contains the majority of EBT-related regulations	274.1 – Issuance system approval standards 274.2 –Providing benefits to participants 274.3 – Retailer management 274.4 – Reconciliation and reporting 274.5 – Record retention and forms security 274.6 – Replacement issuances and cards to households 274.7 – Benefit redemption by eligible households 274.8 – Functional and technical EBT system requirements. ▪ Functional requirements. The State agency must ensure the EBT system is able to perform the following functional requirements prior to implementation: a. Authorize household benefits. (i) Issue and replace EBT cards to eligible households b. Provide food benefits to households. (i) Confirm the identity of eligible households or their representatives at POS c. Credit retailers and financial institutions for redeemed benefits. (i) Confirming electronic transactions to and from participating retailers' bank accounts; d. Manage retailer participation ▪ Performance and technical standards. a. Ensures system processing speeds are met b. Ensures system availability and reliability c. Ensures system security in addition to or as a part of the Security Program required of Automated Data Processing systems d. Ensures system ease-of-use for all system users e. Ensures minimum card requirements are met f. Requires POS terminals meet all necessary requirements g. Requires Transaction receipts be provided to all households at the time of transaction h. Requires performance bonding i. Requires a minimum transaction set j. Ensures Interoperability by requiring State agencies to adopt uniform standards to facilitate interoperability and portability nationwide. ▪ Concentrator bank responsibilities. The concentrator bank must be a Federally-insured financial institution or other entity approved by the Federal Reserve capable of accepting retailer credits and/or debits from the EBT processor. The bank should be able to transmit them to the ACH network. ▪ Re-presentation. The State agency must have a manual purchase system available for use when the EBT system is inaccessible. ▪ Store-and-forward. Among others, the State agencies may allow retailers, at the retailer's discretion, to perform store-and-forward transactions when the EBT system cannot be accessed for any reason.

7 CFR 275.1 to 275.24	Performance Reporting System	Not applicable.
7 CFR 276.1 to 276.7	State Agency Liabilities and Federal Sanctions	276.2 – States are liable for over-issuance of EBT benefits related to system errors.
7 CFR 277.1 to 277.18	Payments of Certain Administrative Costs of State Agencies,	277.18 – Requires establishing an Automated Data Processing (ADP) and Information Retrieval System.
7 CFR 278.1 to 278.10	Participation of Retail Food Stores, Wholesale Food Concerns, and Insured Financial Institutions	278.2 – Allows authorized drug and alcohol treatment and rehabilitation programs, group living arrangements, shelters for battered women and children, and homeless meal providers to redeem EBT benefits.
7 CFR 279.1 to 279.8	Administrative and Judicial Review - Food Retailers and Food Wholesalers	Not applicable.
7 CFR 280.1	Emergency Food Assistance for Victims of Disasters	280.1 – Can use alternate approach to distributing SNAP benefits when EBT systems use is impractical because of a disaster.
7 CFR 281.1 to 281.10	Administration of the Food Stamp Program on Indian Reservations	Not applicable.
7 CFR 282.1 to 282.2	Demonstration, Research, and Evaluation Projects	Not applicable.
7 CFR 283.1 to 283.32	Appeals of Quality Control (QC) Claims	Not applicable.
7 CFR 284	Provision of a Nutrition Assistance Program for the Commonwealth of the Northern Mariana Lands (reserved)	Not applicable.
7 CFR 285.1 to 285.	Provision of a Nutrition Assistance Grant for the Commonwealth of Puerto Rico	Not applicable.
7 CFR 3016	Departmental Regulation for Program Administration and Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments	Not applicable.
Amended Rules for EBT		
EBT Systems—Statement of Auditing Standards No. 70 (SAS No. 70)—Examination	States with EBT systems ensure an examination of their EBT transaction processing is conducted at least annually (Amends 7 CFR 272.1; 274.12) February 29, 2000	
EBT Adjustments Requirements	SNAP EBT system–State agency's ability to make adjustments to a household's account in an EBT system (Amends 7 CFR 272.1; 273.13; 273.15; 274.12) July 8, 2000	

EBT Interoperability and Portability	Interoperability of SNAP EBT systems and portability of electronically issued benefits nationwide (Amends 7 CFR 274.12) June 25, 2003
EBT Provisions of PRWORA	EBT provisions of the 1996 Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) (Amends 7 CFR 272.1; 274.3; 272.12) October 4, 2000
EBT Retail Food Store Provisions of the Food Stamp Reauthorization Act of 2002	Revises SNAP regulations pertaining to the standards for approval of EBT systems, the participation of retail food stores and wholesale food concerns, and State agency liabilities and Federal sanctions (Amends 7 CFR 274.1; 274.12; 276.7; 278.1; 278.2; 278.6; 278.7; 279.1; 279.12; 280.1) May 6, 2003
Regulatory Review: Standards for Approval and Operation of Food Stamp EBT Systems	Revises food stamp regulations affecting the standards and administration of EBT systems for food stamp issuance (Amends 7 CFR 274.12) April 11, 2005

APPENDIX E: IDEAS CONSIDERED BUT NOT DEVELOPED

During the development of possible technical solutions for capturing and transmitting item-level data, several additional options were discussed but ultimately were not developed further due to cost, technology, or other considerations. Those ideas are described in more detail in this appendix.

Proposed Commercial Standalone POS Technical Solution

The commercial standalone POS environment typically consists of a connection among an ECR, a scanning device, a printer, and the retailer's inventory database, which varies depending on the store size and level of POS sophistication. The POS Terminal used to process all payment tender types, including EBT, does not interface with the other hardware. However, the POS Terminal is the only piece of hardware that communicates with TPPs to authorize payments. Given this environment, there are major challenges to collecting POS item-level data on SNAP transactions:

- SNAP transaction records at the ECR do not contain the associated EBT card numbers. These identifiers are extracted only by the POS Terminal device and cannot be electronically passed to the ECR. No communication occurs between the ECR and the POS Terminal.
- The infrastructure is likely to be outdated, presenting challenges to any modifications required to enable POS item-level data collection.
- Not all retailers have sophisticated inventory systems, so that the availability of item-level data may be limited.

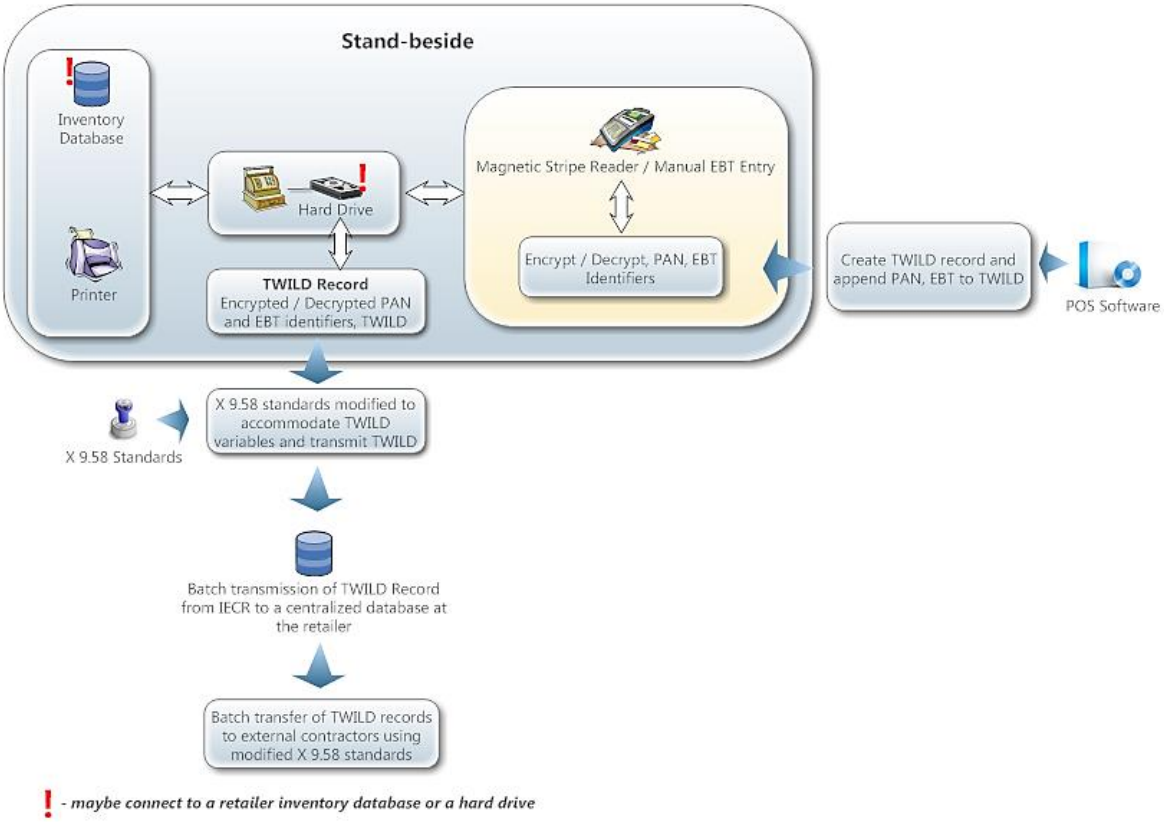
Shown in Exhibit 44 is a POS technical solution that addresses some of these challenges. Since the only real-time communication currently occurs at the POS terminal, which cannot pull item-level data from the ECR, the suggested solution relies on batch processing.

In this solution, once cashiers generate an EBT transaction total, they enter it into the commercial standalone POS terminal. SNAP customers then swipe their card at the POS terminal, initiating the TPP and EBT processor account authorization process. Once cashiers receive the authorization and complete the transaction at the POS terminal, a new process is introduced to associate EBT card number with the item-level data. Cashiers can use either a magnetic stripe reader or manual entry to capture an EBT card number in the ECR. The ECR would then append the EBT card number to the transaction record stored at the ECR or on the retailer's internal server.

In order to implement this proposed POS technical solution, the following steps are required:

- Modification of X9.58 standards to require inclusion and transmission of item-level data
- Modification of POS software applications to append item-level data at ECRs to messages for transmission to FNS
- Modification of POS hardware to enable use of a magnetic stripe device to capture EBT card numbers at the ECR, or modification of POS software applications to prompt cashiers to enter the EBT card number manually into the ECR
- Updates to electronic inventory databases, for some retailers

Exhibit 44: Commercial Standalone POS Technical Solution with Batch Processing



However, modifying POS software applications is complicated when retailers are using outdated POS software applications. IMPAQ's experience suggests that older POS software applications may not be well documented, supported by their vendors, compatible with newer applications, or compatible with new hardware that would also be required as part of the solution.

In order to capture EBT card numbers, existing ECRs could be modified to include a magnetic stripe reader. This modification requires compatibility across the ECR operating system, the POS software application, and the magnetic stripe reader. Alternatively, POS software applications could be modified to prompt cashiers to enter the EBT card number manually into the ECR for all authorized SNAP transactions.

Finally, and perhaps most critically, successful implementation of a commercial standalone POS technical solution depends on the existence of an inventory database that enables development of a detailed transaction record. Retailers with commercial standalone ECR systems are likely to be smaller than those with IECRs, including small independent grocers and convenience stores. Characteristics of any inventory system, such as variables tracked or whether each ECR maintains a local copy of the inventory, are likely to be driven by the sophistication of the ECR, which in turn is driven by the retailer type and size.

Evaluation Summary of Proposed Commercial Standalone POS Technical Solution

Exhibit 45 summarizes the proposed commercial standalone POS technical solution and scores it using our established evaluation and cost criteria.

Data characteristics, availability, and quality for the proposed technical solution are dependent on the quality of retailer inventory systems, where they exist. The level of sophistication of these systems depends in turn on the type and size of the retailer. Smaller retailers are less likely to invest in intricate electronic inventory systems that keep track of all or most of the item-level data FNS would like to collect. Additional limitations include retailers' willingness to modify their POS software applications to append FNS-required data to current messages, as well as modifications to X9.58 standards. Absent FNS requirements for all retailers to maintain inventory systems that track all the variables in which it is interested, the IMPAQ team expects that the quality and completeness of data available from commercial standalone POS systems will be lower than that from most retailers operating in an IECR environment. Furthermore, the data quality will vary from retailer to retailer.

There are **technical advantages and pitfalls** associated with the proposed commercial standalone POS technical solution. SNAP authorized retailers operating in a commercial standalone environment are generally smaller or medium-sized stores. Although these retailers represent approximately 2% of EBT redemptions, they represent approximately 8% of authorized retailers. The socioeconomic profile and neighborhood characteristics of SNAP EBT consumers at these retailers and of the retailers themselves are likely to be different from those of IECR customers and retailers. This standalone technical solution facilitates research on these differences. Another technical advantage of this solution is that it can be implemented without placing additional burden on TPPs or EBT processors. All POS data would be captured and appended with EBT identifiers by the retailer. Once the TWILD are ready, they can be transmitted directly to FNS, bypassing TPPs and EBT processors. Details of the data storage and processing options are discussed in Chapter 4.

The **legal and policy concerns** for this technical solution are similar to those for the IECR solutions.

Modifications of POS software applications to accommodate enhanced X9.58 standards, add item-level data to current transaction data, and append EBT card numbers to the TWILD for transmission to FNS bring **implementation and operational costs**. Some retailers will also bear the cost of introducing magnetic stripe readers to their POS infrastructure. Finally, upgrading POS software applications is anticipated to be more labor intensive than a similar effort for IECRs would be because the changes affect a wider variety of retailers, many of whom use outdated hardware and software. Enhancing or creating an electronic inventory system also adds to retailer implementation costs.

Exhibit 45: Evaluation Summary of Proposed Commercial Standalone POS Technical Solution – Batch Capture of Item-Level Data

Evaluation Criteria			Cost Criteria		
Technical Advantages	**Technical Disadvantages**	**Legal and Policy Concerns**	**Implementation Costs**	**Operational Costs**	**Retailer Costs**
▪ Captures data from most commercial standalone applications ▪ TPPs and EBT processors probably do not need to change their current operations	▪ Requires modified POS software applications ▪ Requires new X9 based standards ▪ Targets less than 2 % of EBT redemptions ▪ Requires retailers to purchase new hardware (magnetic stripe readers) or to manually enter EBT card numbers	▪ FNS needs to mandate or suggest operating rules for types of data to be collected ▪ FNS needs to require item-level data collection and transmission ▪ FNS needs to exempt EBT card numbers from encryption ▪ Not encrypting EBT card numbers increases stakeholder liability ▪ FNS or the industry may need to mandate a file format for processing batch files	▪ POS software application programming to accommodate new X9 based standards ▪ POS software application programming to accommodate creation of enhanced item-level message ▪ Reconfiguring transmission lines between the retailer and external recipient of batch files ▪ Reconfiguring ECR to include magnetic stripe readers to capture EBT card numbers	▪ Potential EBT processor costs for increased data storage ▪ Increased transmission costs if batch data are passed through TPP connection ▪ Storage and processing costs for other contractors if TPPs and EBT processors are not used ▪ Costs associated with processing batch files	▪ Data transmission cost of enhanced messages passed down by TPP ▪ POS software application programming ▪ Purchase of magnetic stripe readers ▪ Costs associated with enhancing or creating an electronic inventory system

Proposed Standalone POS Technical Solution

The standalone POS environment is very similar to the commercial standalone environment – the typical hardware and software setup consists of a connection between a cash register (it may or may not be an ECR), a printer, and the retailer's inventory database, if it is an ECR and an inventory is developed. However, the POS terminal available for processing EBT transactions is supplied by EBT processors (FNS subsidized) and only handles EBT transactions. Retailers operating in a standalone POS environment are likely to be the smallest stores or specialty stores such as Farmer's Markets. As shown in section 2.1., these retailers constitute less than 3% of EBT redemptions but potentially account for approximately up to 36% of all authorized retailers. These retailers are the most likely to have the least developed POS infrastructure. IMPAQ's experience suggests that these retailers are likely to be equipped with of-the-shelf cash registers that have basic POS software applications if any at all. Not surprisingly, challenges to collecting item-level POS data from standalone retailers are similar to those of commercial standalone retailers, some being more acute, namely:

- SNAP transaction records at the cash register do not contain the EBT card number associated with the respective transaction. These identifiers are only extracted by the standalone POS terminal and cannot be electronically passed onto the cash register – no communication occurs between the cash register and the POS terminal.
- The infrastructure is likely to be outdated presenting challenges to any modifications required to enable POS item-level data collection.
- Not all retailers have sophisticated inventory systems limiting the item-level data available. Electronic retailer inventory systems, where available, are likely to contain few details for each food item sold at the store. Scanning hardware are not expected to be standard, if present at all – cashiers likely rely on manual entry of item prices using broad department categories limited by cash register configurations. An example of a broad category could be "100 Grocery" to capture a set of products defined by the retailer.

Two standalone POS technical solutions are proposed to meet these challenge; *Proposed Standalone Technical Solution 1 – Enhanced Wireless Terminal* and *Proposed Standalone Technical Solution 2 – Linking Store Inventory to POS terminal.* Both solutions rely on batch processing once a file aggregating TWILD has been generated.

Standalone POS Technical Solution 1 – Enhanced Wireless Terminal for Batch Capture of Item-Level Data

The unifying theme for challenges associated with the standalone POS environment is a low level of technological sophistication. For this solution, we propose introducing new wireless technology to overcome these challenges. Using a wireless solution would make the proposed solution more accessible to specialty retailers such as Farmer's Market where a mobile POS would ease transactions with customers. As shown in Exhibit 46, retailers would use a wireless terminal in place of the standalone terminal. The wireless device would connect to an EBT processor using the existing internet connection between the standalone terminal and EBT processor – replacing the standalone terminal. Wireless POS terminals are not new and they are currently in use by retailers of all type and size. However, there are key differences between the proposed wireless solution and existing wireless POS technology. Existing POS applications do not have an in-built retailer inventory and hence will not be

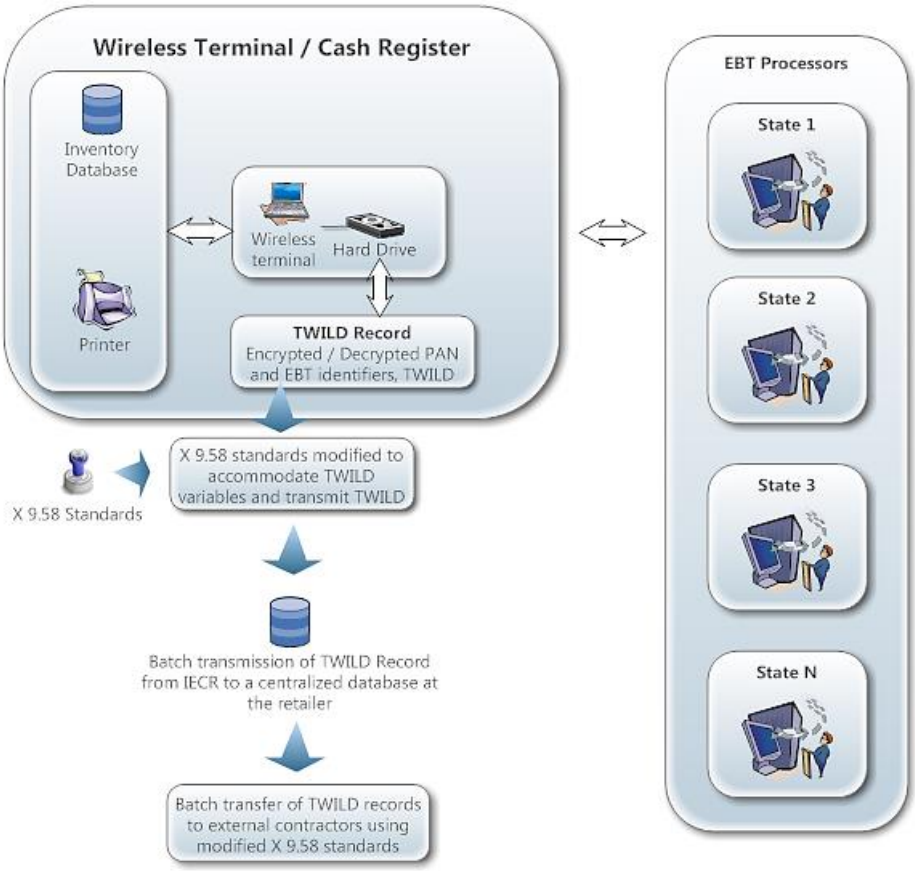
able to report item-level data to FNS. Other important differences between the proposed wireless terminal and the current standalone terminal are that the wireless terminal would have:

- scanning capabilities;
- an in-built updatable retailer inventory and pricing database;
- in-built temporary storage of TWILD; and
- the ability to aggregate the TWILD stored on the terminal into a file and transmit it in batch to a data endpoint for final transmission and processing to FNS.

While the new technology will facilitate capture of the TWILD, as with other proposed POS solutions, the infrastructure calls for two key modifications:

- Modification of X.958 standards to accommodate new item-level data fields
- Modification of POS software applications to capture EBT card number and transaction identifiers to append to the newly captured item-level data.

Exhibit 46: Standalone POS Technical Solution with Wireless Terminal



As shown, the retailer scans or enters the items purchased by the SNAP customer directly into the wireless terminal. As the items are scanned, a "shopping list" with item-level data is generated within

the terminal's in-built storage to serve two purposes – printing a customer receipt and generating the TWILD record for transmission to FNS. Once all items are scanned, the retailer would initiate the transaction approval process using the wireless terminal by swiping the SNAP EBT card. The terminal would communicate with EBT processors in real-time for an approval token. Once the cashier receives the authorization and completes the transaction at the wireless terminal, a new process is introduced to facilitate EBT card number association with the item-level data to create the TWILD record to be stored on the in-built storage. The retailer can then transfer these stored records to an external local storage in real-time or batch. A file containing all TWILD records can then be created for batch transmission to FNS as discussed in Chapter 4.

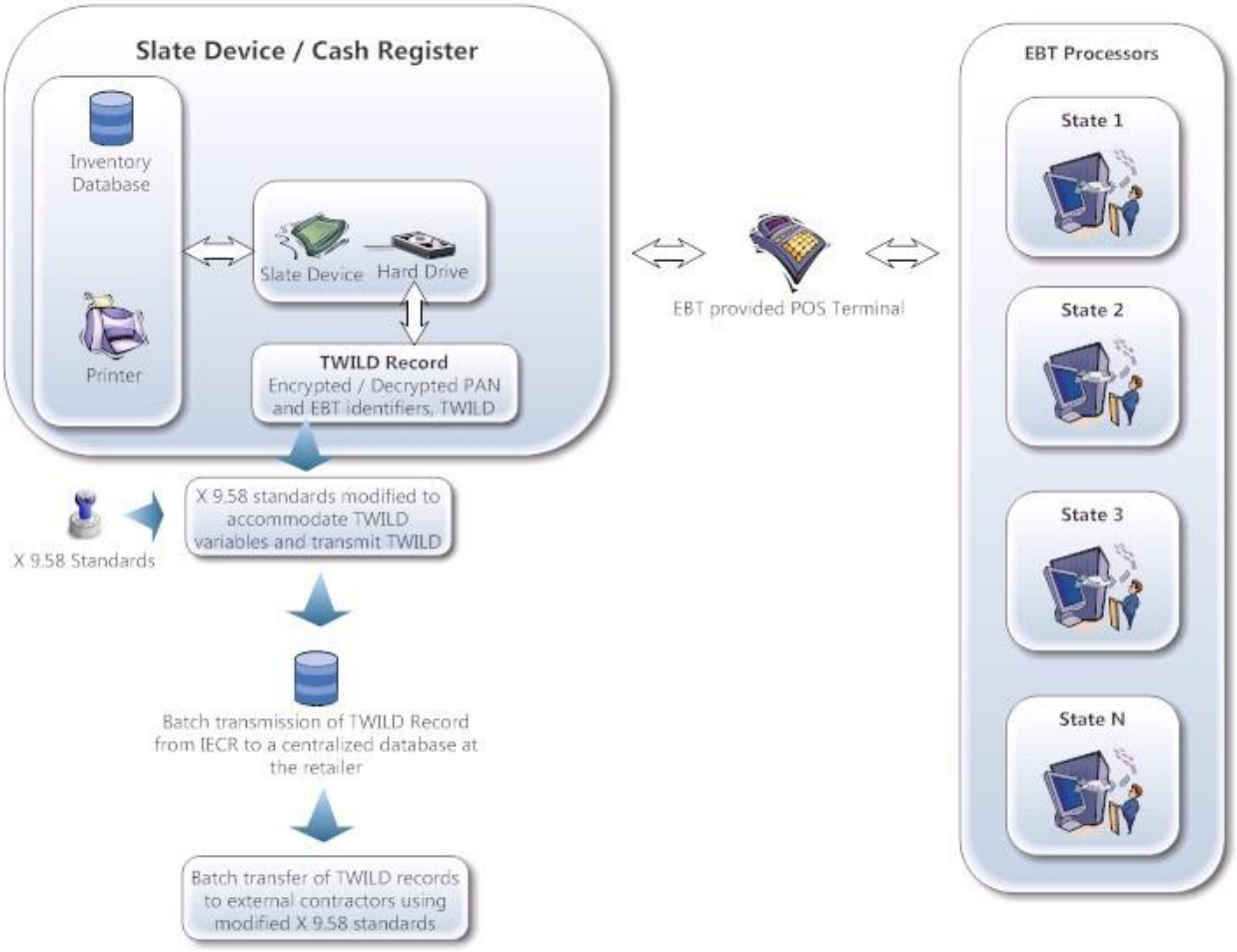
Standalone POS Technical Solution 2 – Linking Store Inventory to POS Terminal for Batch Capture of Item-Level Data

This technical POS solution also calls for the introduction of new technology to retailers. The IMPAQ team proposes introducing a "Slate-like" device that operates as a computer to facilitate SNAP transactions. This device would be linked to existing EBT processor provided POS Terminals and would replace the current cash register. This infrastructure would enhance existing cash register environments by:

- Providing an in-built updatable retailer inventory and pricing database;
- Running using modified POS software applications and X9.58 standards to capture and transmit a TWILD;
- Acting as a local storage for TWILD records; and
- Aggregating the TWILD stored on the device into a file and transmit it in batch to a data endpoint for final transmission and processing to FNS

As shown in Exhibit 47, retailers would use the new device along with the standalone terminal in place of a cash register. The retailer would enter all transactions into the device, as they would they would cash register. The device would communicate with the POS Terminal device to authorize and complete the transaction. A TWILD would be generated within the device's local storage once the transaction is complete. This TWILD record would then be aggregated and transmitted in batch to a local storage point and ultimately to FNS as discussed in Chapter 4.

Exhibit 47: Standalone POS Technical Solution with Slate-Device



Evaluation Summary of Proposed Standalone POS Technical Solutions

Exhibit 48 summarizes and scores the proposed standalone POS technical solutions. Data availability and quality for the proposed technical solutions are dependent on the willingness and ability of retailers to develop and maintain a detailed inventory database where they typically would not have had one. In the case of a wireless terminal, the retailer would be responsible for ensuring that the inventory was loaded onto or accessible to the terminal. For the "Slate-like device" with an inventory linked to the POS terminal, the retailer would also be responsible for maintaining the inventory database. This poses an additional burden to what IMPAQ anticipates to be primarily small retailers – they are less likely to invest in intricate electronic inventory systems that keep track of all or most of the item-level data FNS would like to collect. Without FNS requirements for all retailers to maintain inventory systems that track all the variables they are interested in, it is expected that the quality and completeness of data available from standalone POS technical solutions will be lower than that available from most retailers operating in an IECR environment and that it will vary from retailer to retailer.

Since these solutions introduce new hardware to retailers, the additional burden of having to modify current POS software applications on the market to create the TWILD record does not directly affect retailers, rather it falls on the POS terminal providers (EBT Processors). Modifications to X9.58 standards

are a general burden to the retail industry and all stakeholders involved. These modifications pose result in increased implementation and operational costs for all stakeholders. The cost of new hardware would be significant and will likely have to be subsidized by FNS.

As with the stand-beside technical solution, standalone technical solutions represent a fairly small share of EBT redemptions. A technical advantage of this solution is that it can be implemented without placing additional burden on TPPs or EBT processors. All POS data would be captured and appended with EBT identifiers within the retailer's infrastructure. Once the TWILD is ready, it can be transmitted to FNS bypassing TPP and EBT processors.

Exhibit 48: Evaluation and Cost Summary of Proposed Standalone POS Technical Solution – Batch Capture of Item-Level Data

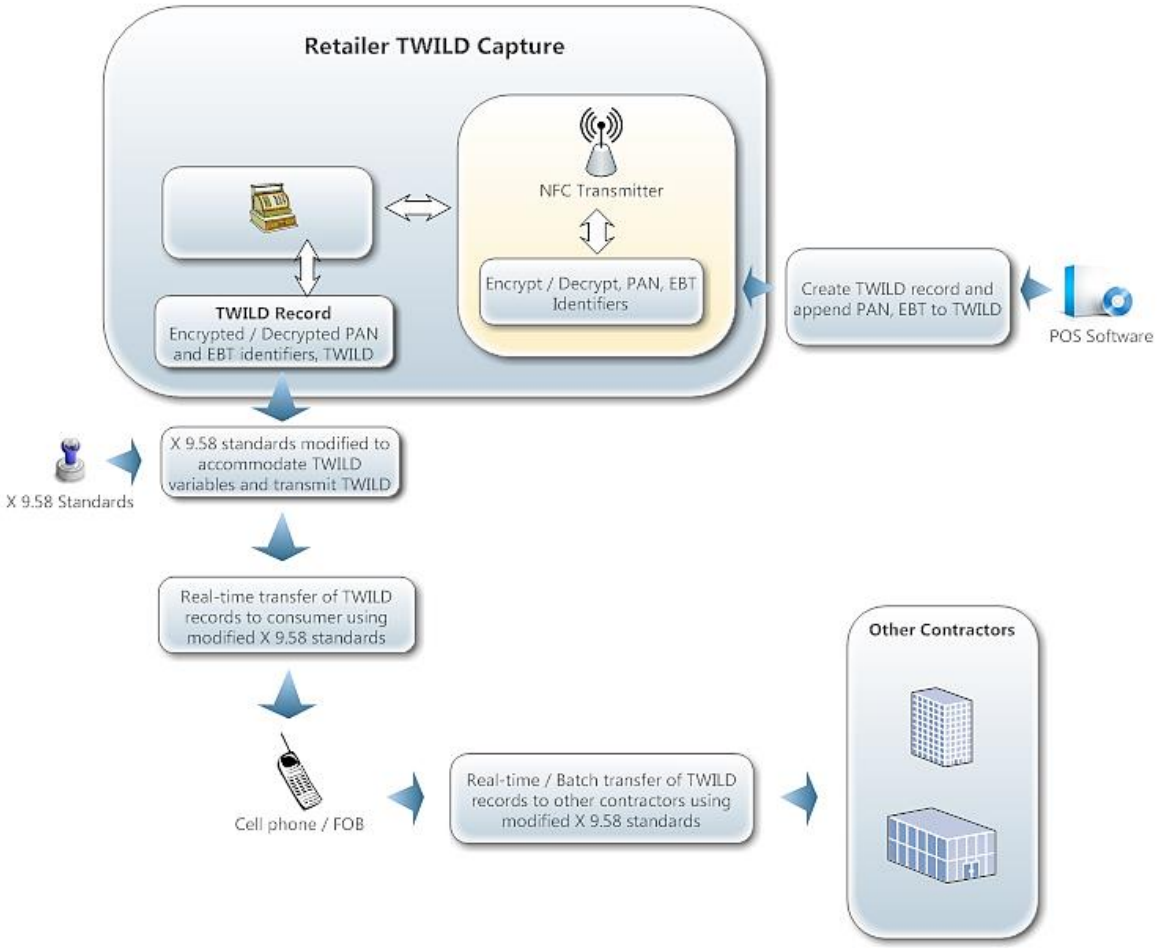
Evaluation Criteria			Cost Criteria		
Technical Advantages	**Technical Disadvantages**	**Legal and Policy Concerns**	**Implementation Costs**	**Operational Costs**	**Retailer Costs**
▪ Captures data from at least 36% of authorized retailers ▪ TPPs and EBT processors probably do not need to change their current operations	▪ Requires modified POS software applications ▪ Requires new X9 based standards ▪ Targets less than 2 percent of EBT redemptions ▪ Retailers are required to develop or enhance detailed inventory systems ▪ Retailers are required to acquire new equipment (wireless terminal or Slate-device)	▪ Consumer and advocacy group privacy concerns ▪ FNS needs to mandate or suggest operating rules for types of data to be collected ▪ FNS needs to require item-level data collection and transmission ▪ FNS or the industry may need to mandate a file format for processing batch files	▪ POS software application programming to accommodate new X9 based standards ▪ POS software application programming to accommodate creation of enhanced item-level message ▪ Reconfiguring transmission lines between the retailer and external recipient of batch files ▪ Cost of new equipment (wireless terminal; Slate-device)	▪ Potential EBT processor costs for increased data storage ▪ Increased transmission costs if batch data are passed through TPP connection ▪ Storage and processing costs for other contractors if TPPs and EBT processors are not used ▪ Costs associated with processing batch files	▪ Data transmission cost of TWILD passed down by TPP (if this pathway is used) ▪ POS software application programming ▪ Costs associated with enhancing or creating an electronic inventory system

New Technology POS Technical Solution 2 – Near Field Communications

Exhibit 49 shows the processes that take place at an NFC-enabled cash register to transmit the TWILD to FNS.

1. The process also begins at the point where retailers are already capturing TWILD at the cash register. POS software applications need to be modified to enable NFC communication.
2. Once a transaction is authorized and completed, the consumer can provide their smartphone or FOB to be brought within proximity of the NFC-enabled cash register.
3. The cash register transmits the TWILD to the smartphone or FOB in real-time.
4. The smartphone or FOB can transmit the TWILD in real-time or batch processing to a designated contractor. In the case of the FOB, TWILD data can be stored in its memory and transmitted when a SNAP recipient visits and FNS office.

Exhibit 49: POS Technical Solution with Electronic Message Receipt



Evaluation Summary of Proposed New Technology POS Technical Solutions

The data availability and quality; technical advantages and pitfalls, and costs of either technology is dependent on the underlying proposed POS technical solution. Implementation of these new technologies at IECRs collecting TWILD records will provide higher quality data than implementation at standalone cash registers collecting TWILD. Costs and labor associated with modifications to POS software applications to implement the new technologies are additional.

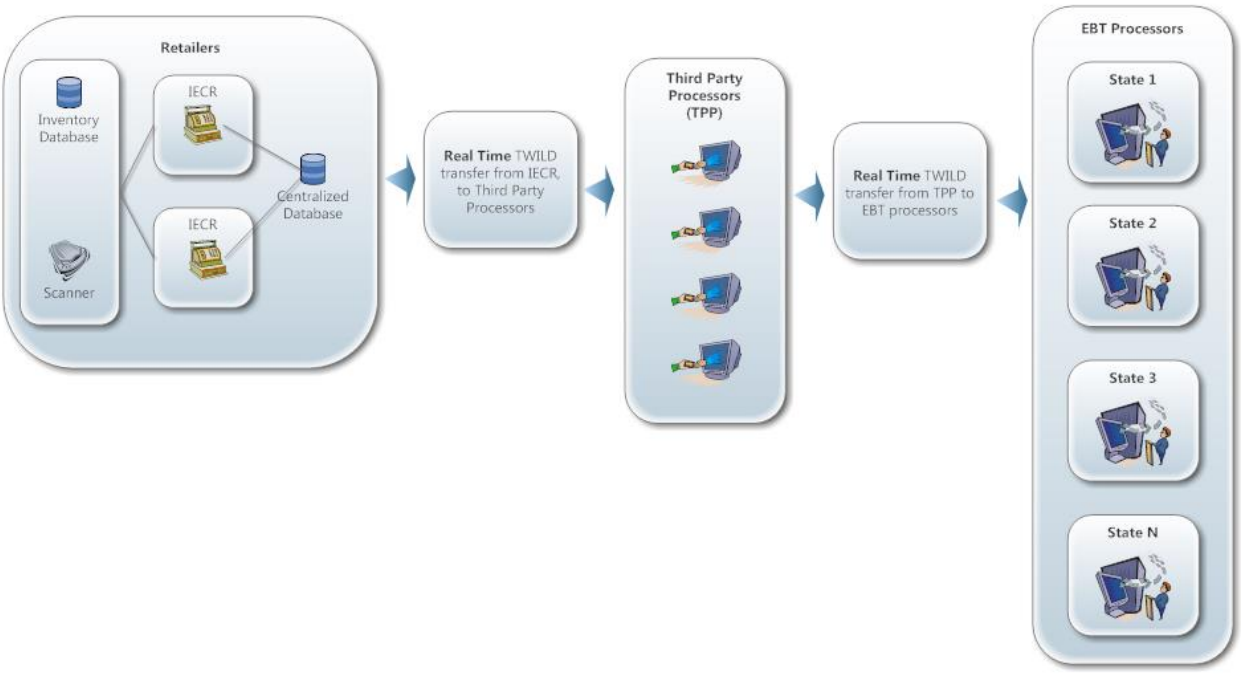
In addition to the evaluation factors in the aforementioned sections, implementation of NFC imposes new hardware costs to retailers. Retailers would need to invest in NFC-enabled cash registers. Similarly, SNAP consumers would need to have NFC-enabled smartphones or to be issued with FOBS by FNS. Finally, in NFC applications where consumers are using a FOB, collection of the TWILD stored on the FOB is dependent on the consumer providing their FOB to FNS once it has data on it. Furthermore, consumers can selectively choose when to permit TWILD data to be transmitted between the cash register and their smartphone or FOB.

APPENDIX F: COMMUNICATION AND DATA TRANSFER PATHWAYS

Real-Time Only Solution 1: TWILD Transfer from Retailers to TPPs to EBT Processors

In the current EBT environment, IECR retailers connect to TPPs, which connect to EBT processors for authorization. This proposed technical solution uses the existing communication channels for real-time transfer of TWILD from the retailers to EBT processors, with TPPs acting as pass-through entities. Exhibit 50 illustrates this process. The TWILD will be submitted after the EBT processor authorizes each transaction. Retailers, TPPs, and EBT processors need to modify their existing systems to accommodate this solution.

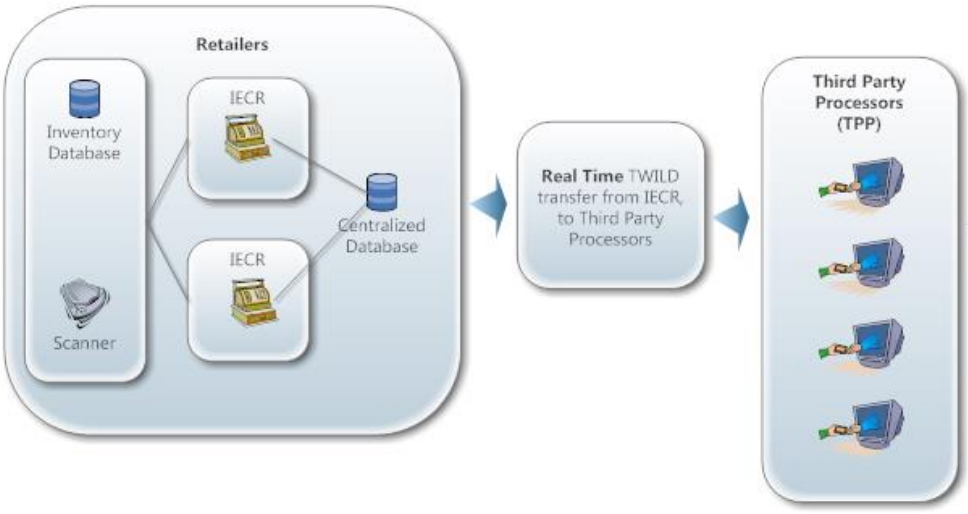
Exhibit 50: Real-Time Transfer from Retailers to TPPs to EBT Processors



Real-Time Only Solution 2: TWILD Transfer from Retailers to TPPs

In this variation of technical solution 1, IECR retailers use existing communication channels to transfer TWILD to TPPs. The TPPs are responsible for processing and transferring TWILD data directly to FNS. Exhibit 51 is a graphical representation of this process. Retailers and TPPs will need to modify their existing systems to accommodate this solution.

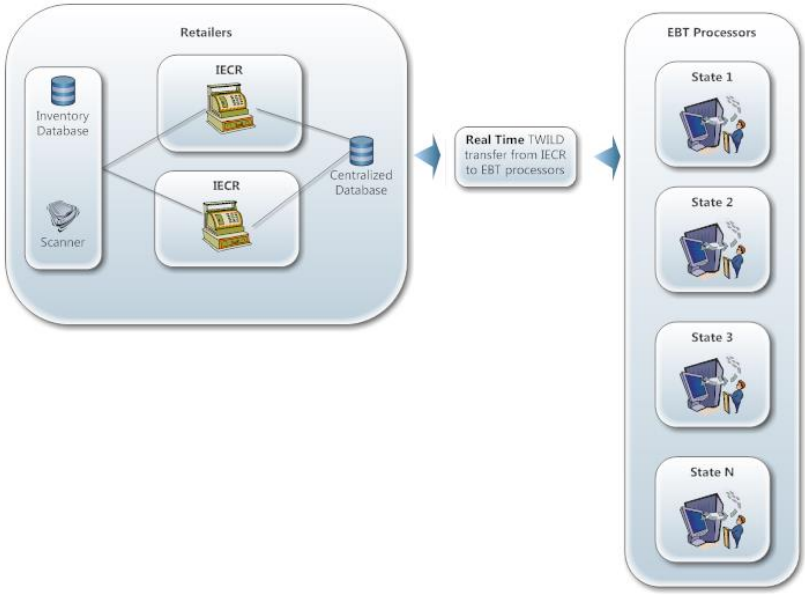
Exhibit 51: Real-Time Transfer from Retailers to TPPs



Real-Time Only Solution 3: TWILD Transfer from Retailers to EBT Processors

In this technical solution, IECR retailers transfer TWILD directly to EBT processors in real time. Retailers with IECR must establish a direct communication channel with EBT processors for real-time data transfer. Exhibit 52 is a graphical representation of this option. Retailers and EBT processors need to modify their existing systems to accommodate this solution.

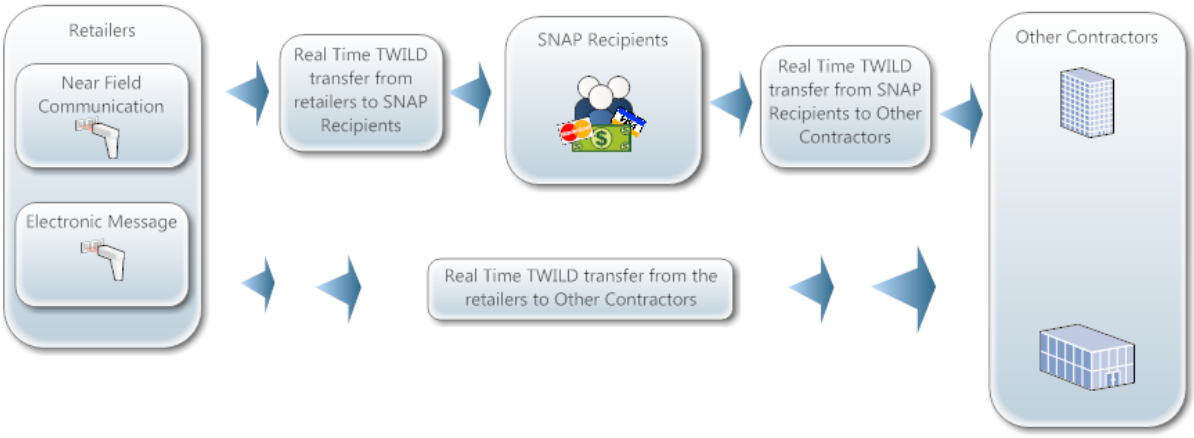
Exhibit 52: Real-Time Transfer from Retailers to EBT Processors



Real-Time Only Solution 4: TWILD Transfer from Retailers to Other Contractors Using New Technologies

In real-time technical solution 4, new technologies at IECR retailers send TWILD using NFC or electronic messages. For the NFC application, TWILD from the retailers is transferred to SNAP recipients; at regular intervals, SNAP recipients send these messages to other contractors. For the electronic messages application, TWILD from the retailers is transmitted straight to other contractors using existing Internet connections Exhibit 53 illustrates both possibilities. Retailers and other contractors need to create new systems to accommodate this solution. SNAP recipients also need to participate in the collection of TWILD using NFC devices (i.e., smart phones).

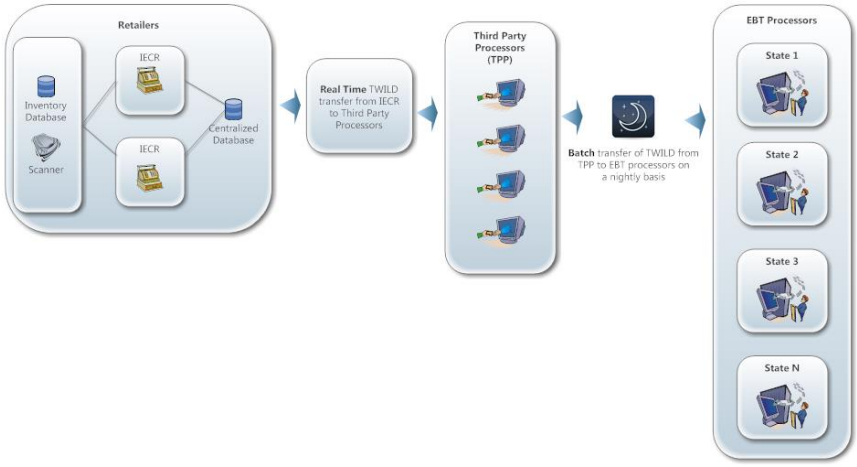
Exhibit 53: Real-Time Transfer from Retailers to Other Contractors Using New Technologies



Combined Real-Time/Batch Solution: TWILD Transfer from Retailers to TPPs to EBT Processors

The solution shown in Exhibit 54 uses existing communication channels from IECR retailers to TPPs for real-time transfer of TWILD. TPPs need to establish new communication channels and protocols for nightly batch transfer of TWILD to EBT processors. Retailers, TPPs, and EBT processors need to modify their existing systems to accommodate this solution.

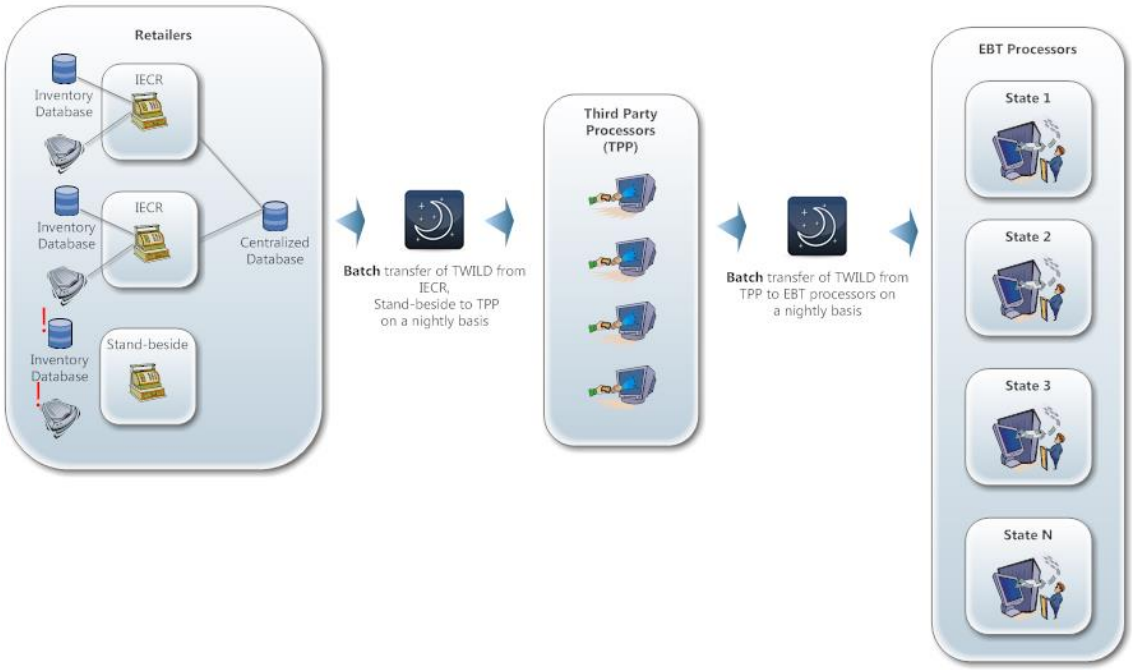
Exhibit 54: Real-Time Transfer from Retailers to TPPs, Batch Transfer from TPPs to EBT Processors



Batch-Only Solution 1: TWILD Transfer from Retailers to TPPs to EBT Processors

The first batch-only technical solution uses batch processing to transfer TWILD from IECR or stand-beside retailers to TPPs. Similarly, TPPs use batch processing to transmit the data to EBT processors. All entities need to establish communication channels and protocols for batch processing. Exhibit 55 is a graphical representation of this process. Retailers, TPPs, and EBT processors need to modify their existing systems to accommodate this solution.

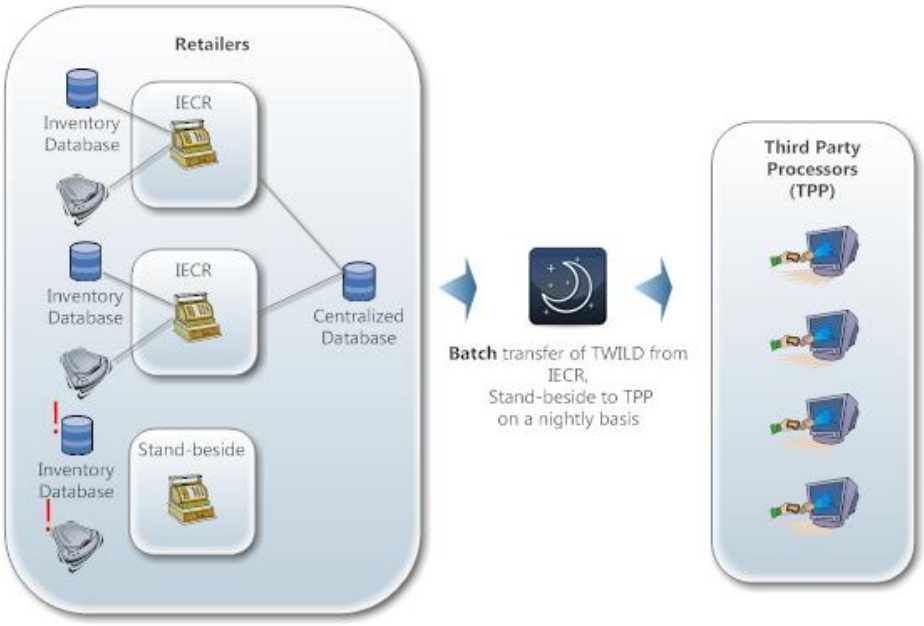
Exhibit 55: Batch Transfer from Retailers to TPPs to EBT Processors



Batch-Only Solution 2: TWILD Transfer from Retailers to TPPs

IECR and stand-beside retailers transfer TWILD to TPPs in batch mode, as shown in Exhibit 56. Retailers need to establish communication channels with TPPs to enable the batch transfer. Retailers and TPPs need to modify their existing systems to accommodate this solution.

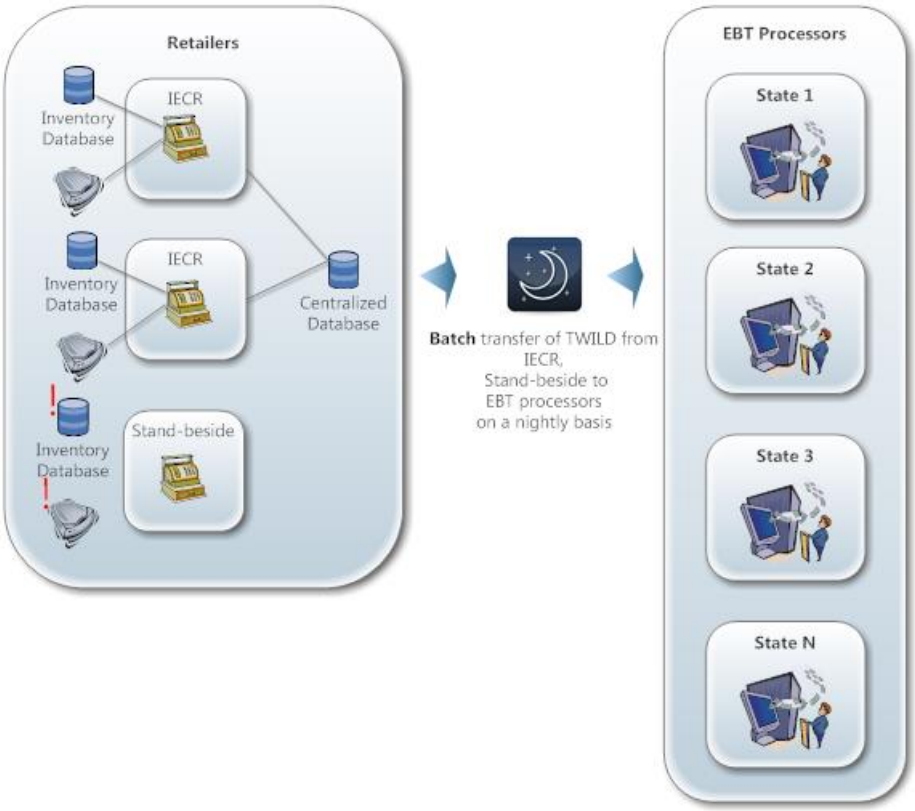
Exhibit 56: Batch Transfer from Retailers to TPPs



Batch-Only Solution 3: TWILD Transfer from Retailers to EBT Processors

Retailers in IECR or stand-beside environments transfer TWILD to EBT processors in a batch process. This option requires establishing communication channels and protocols for batch transfer. Exhibit 57 is a graphical representation of this option. Retailers and EBT processors need to modify their existing systems to accommodate this solution.

Exhibit 57: Batch Transfer from Retailers to EBT Processors

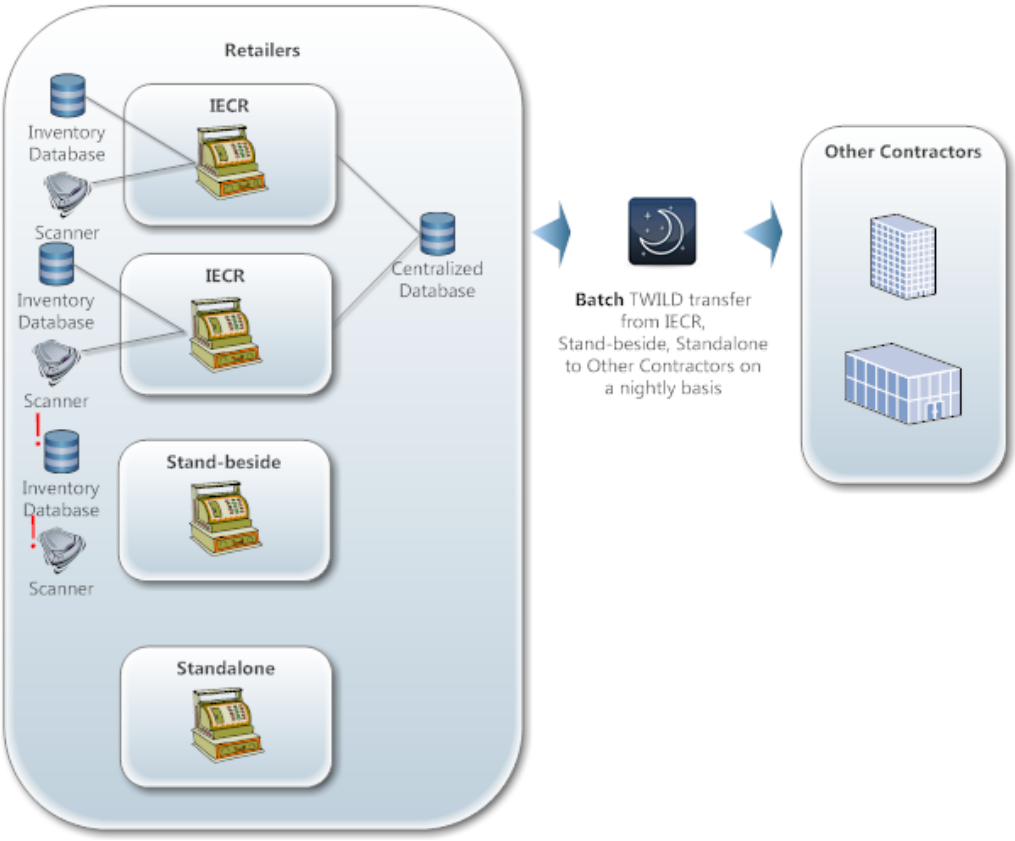


Batch-Only Solution 4: TWILD Transfer from Retailers to Other Contractors

Retailers using IECR, stand-beside, or standalone hardware transfer TWILD to other contractors in a batch process. These contractors establish communication channels and protocols for batch data transfer. Exhibit 58 is a graphical representation of this process. Retailers and other contractors need to create new systems to accommodate this solution.[29]

[29] The Hamacher Resource Group supported the SIGIS system that explored a similar model for Flexible Spending Accounts. The SIGIS IIAS standards enable a broad range of participants in health benefit payment card transactions to implement consistent systems and processes for transaction processing and data retention. These companies include retailers, acquirer processors, payment card networks, issuer processors, and third-party benefit plan administrators. Based in California, SIGIS provides a range of services to its membership with a focus on standards-based industry solutions to support merchant acceptance of health benefit cards.
https://www.sig-is.org/about-sigis
The IMPAQ team is continuing to explore this solution and learn from previous work done.

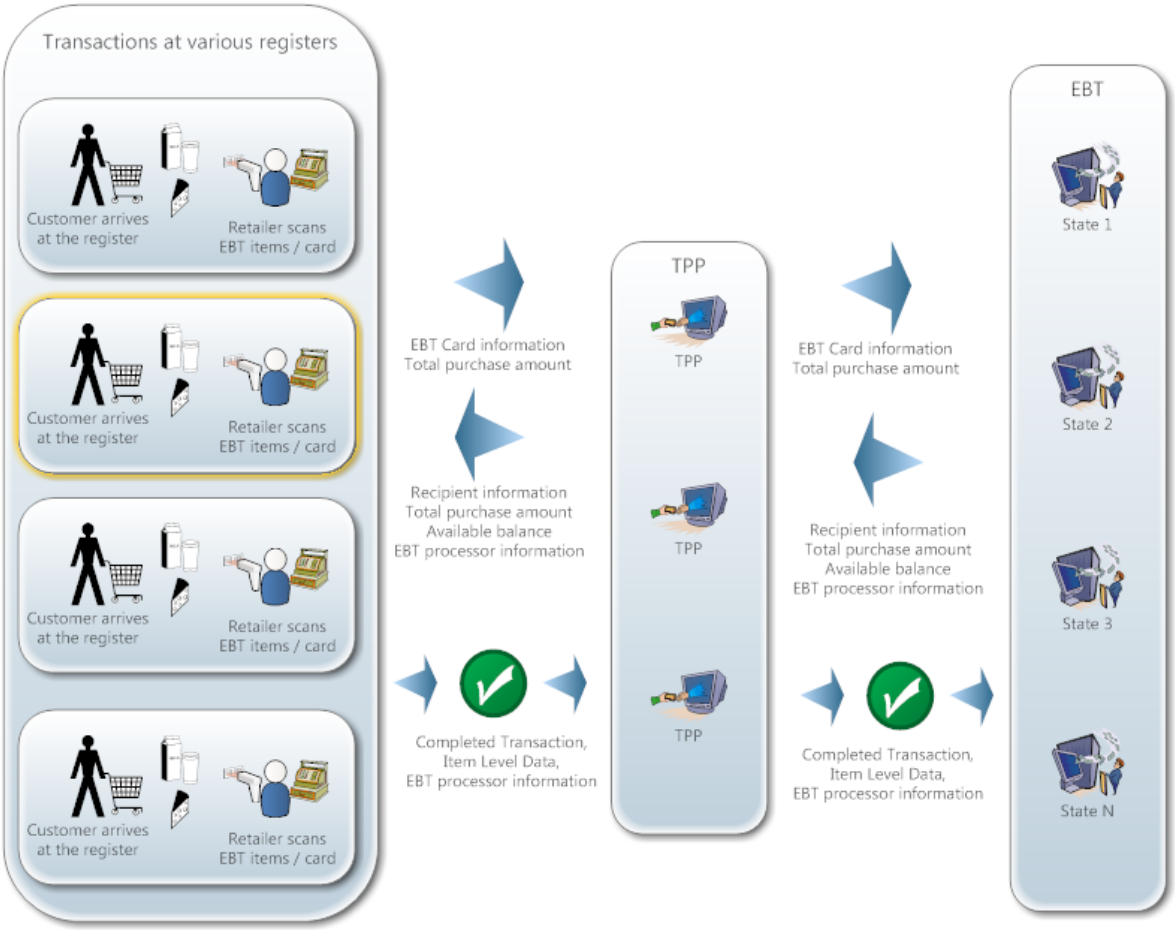
Exhibit 58: Batch Transfer from Retailers to Other Contractors



Proposed Real-Time Data Processing

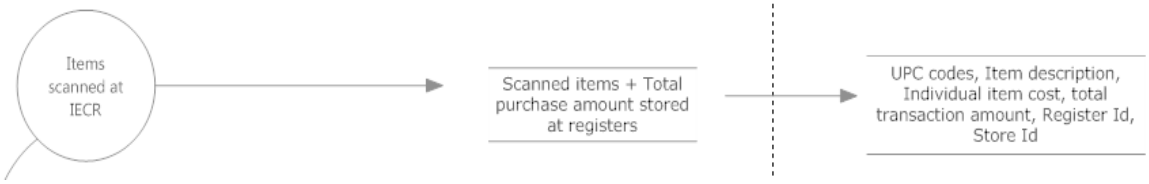
During a real time data processing, retailer scans items at the register and swipe EBT card for approval, EBT card information and total purchase amount are sent to TPP for approval, TPP sends information received from the retailers to EBT processor for further approval, EBT processors send available balance, EBT processor identifier and recipient information back to TPP processors and to retailers. Retailers complete transaction and send transaction with item level data to TPP / EBT processors. Exhibit 59 below provides an overview for real-time TWILD processing from retailer to EBT processors.

Exhibit 59: Real-time TWILD Processing Overview

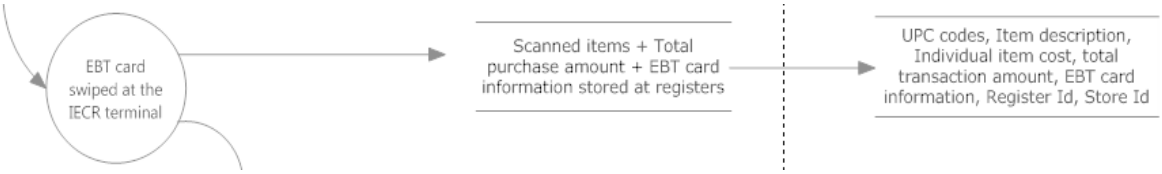


The following steps describe the real-time process in detail.

1) Items scanned at IECR. At this point, the register contains UPC codes, item description, individual item cost, total purchase amount, register identifier and a store identifier.

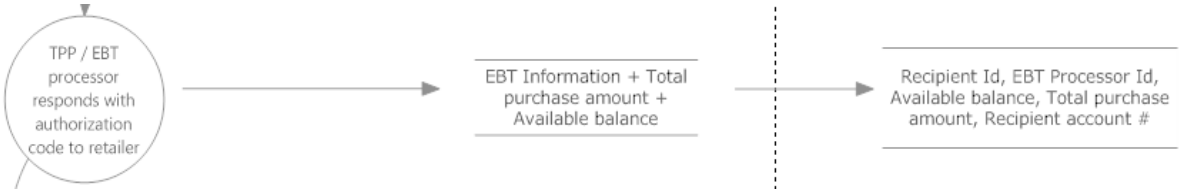


2) EBT card swiped at the IECR terminal and process EBT card information is added to the transaction data at the registers.

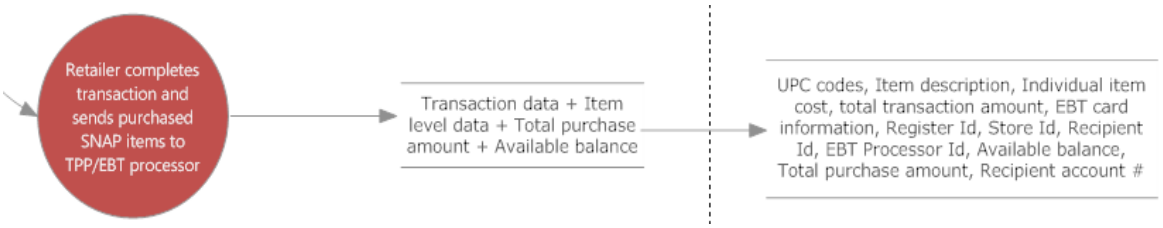


3) EBT card information and transaction details sent to TPP/EBT processor for authorization.

4) TPP/EBT processor responds with authorization code to retailer. The retailer receives EBT information such as available balance on the EBT card and temporarily stores it at the register/terminal.



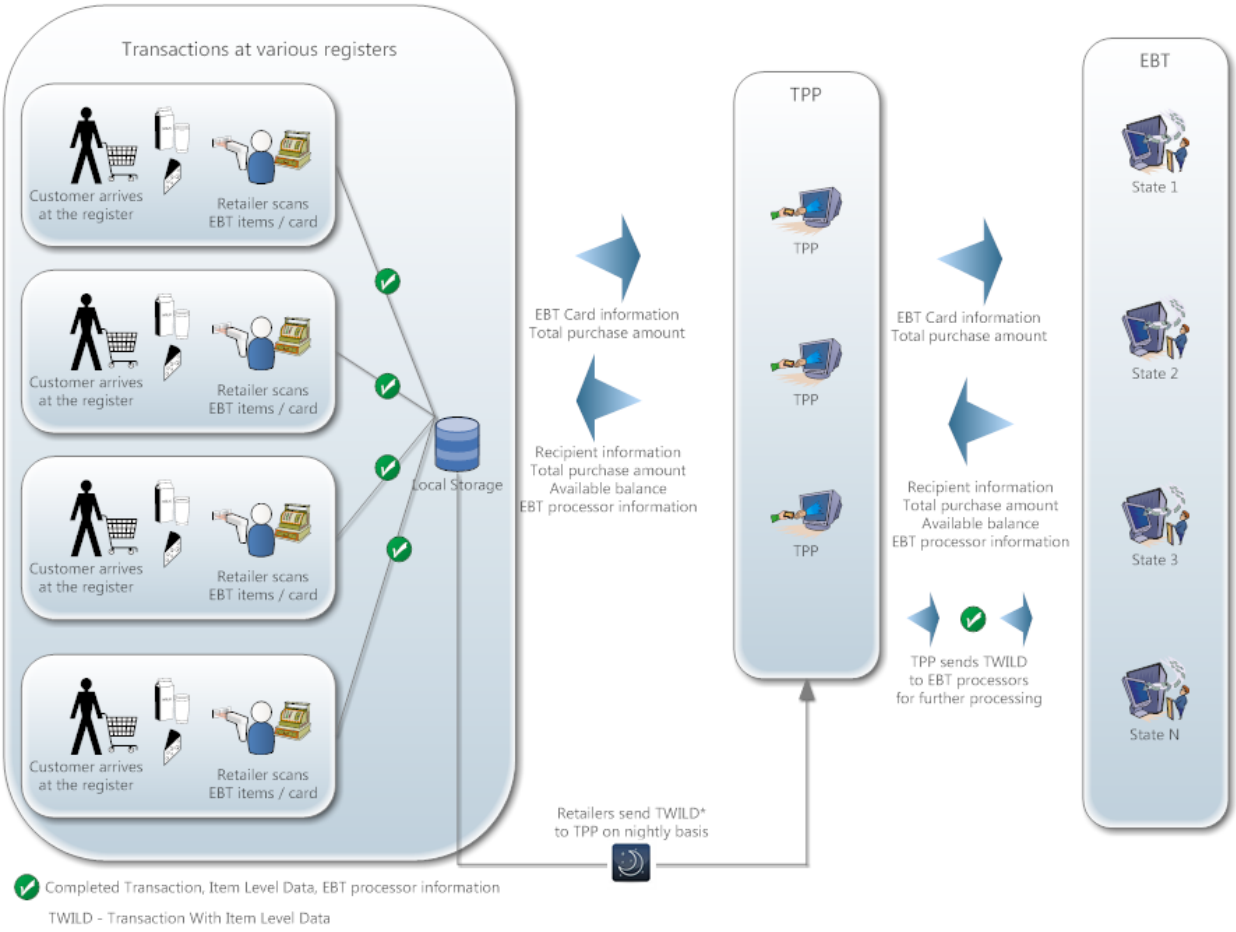
5) Retailer completes transaction and sends purchased SNAP-eligible items to TPP/EBT processor. This step requires modifications to existing SNAP implementation. At the end of this step, retailers will send item level point-of-sale data to the TPP/EBT processors for further processing. UPC codes, item description, individual item cost, total transaction amount, EBT card information, register identifier, store identifier, recipient identifier, EBT processor identifier, available balance on the EBT card, total purchase amount and recipient account number are sent to TPP/EBT processors.



Proposed Batch Data Processing

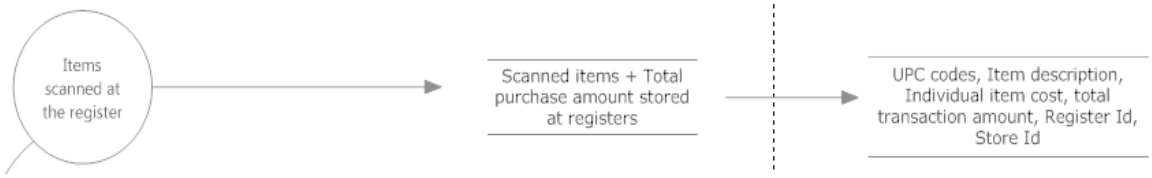
During the batch data processing, the retailer scans items at the register and swipes an EBT card for approval. EBT card information and total purchase amount are sent to TPP for approval. TPP sends information received from the retailers to EBT processor for further approval. EBT processors send available balance and recipient information back to TPP processor which forwards it to the retailer. The retailer completes the transaction and stores the completed transaction with item level data in a centralized local storage. Nightly, retailers send this data to TPP processors for further processing. Exhibit 60 outlines steps for offline data processing from retailer to EBT processors.

Exhibit 60: Batch TWILD Processing Overview

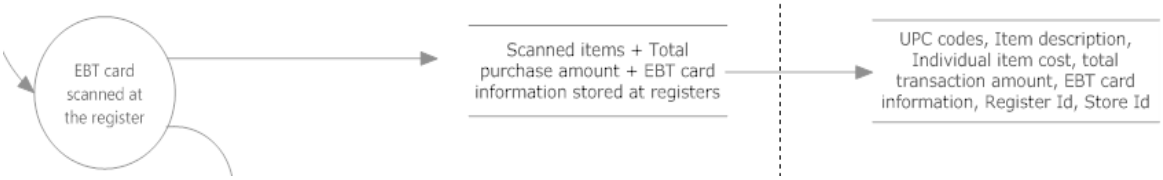


The following steps describe the batch process in detail.

1) Items scanned at the register. The register contains UPC codes, item description, individual item cost, total purchase amount, register identifier, and a store identifier.



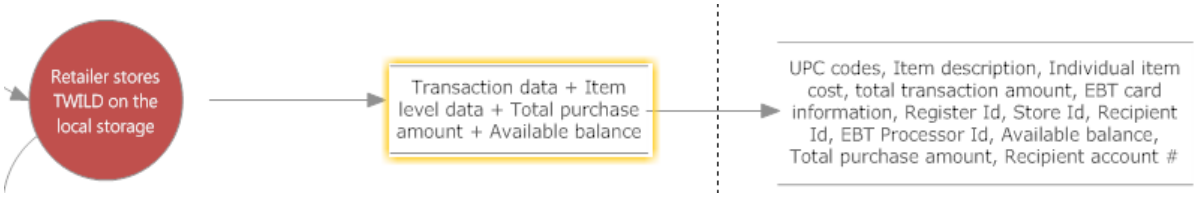
2) EBT card swiped at the IECR terminal. EBT card information is added to the existing transaction and item-level data stored at the register.



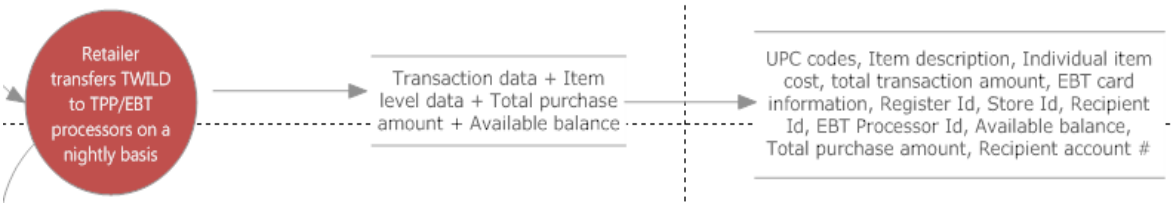
3) EBT card information and transaction details are sent to TPP/EBT processor for authorization.

4) TPP/EBT processor responds to the retailer with an authorization code. The retailer receives EBT information, such as available balance on the EBT card, and temporarily stores the information at the register/terminal.

5) The Retailer completes the transaction and stores TWILD on the local storage. This step may require modifications to existing retailer systems. At the end of this step, registers store UPC codes, item description, individual item cost, register identifier, store identifier, and recipient account number in the centralized location at the retailer.



6) Retailers transfer TWILD for all transactions that day to TPP/EBT processors on a nightly basis. The data store mentioned in Step 5 is sent to TBB/EBT processors for further processing. This step requires modification to existing SNAP EBT implementation.



7) TPP / EBT processors reconcile and send acknowledgement back to retailers. This step requires modification to existing SNAP EBT implementation. At the end of this step, the store identifier, register identifier, and an acknowledgement message are sent back to the retailers.

APPENDIX G: COMMERCIAL UPC DATABASES

This appendix provides an overview of commercial UPC databases. As discussed in Chapter 2, retailers in an IECR environment are the most likely to have sophisticated databases for their inventory providing various item-level elements including UPC codes and UPC descriptions. Retailers in standalone ECR environments are less likely to have these sophisticated inventories and any effort to collect item-level details on their inventories may need to be augmented by independent UPC level databases.

SNAP UPC Database

There are a few options for using UPC databases. Broadly, we can purchase an existing database or purchase API access. Each option has its advantages and disadvantages.

UPC Database

While it is impossible to know the exact quantity of products available, some efforts have been expended to create universal databases. Examples include EANData.com[30] which has over 16 million different products stored and categorized. This information is publicly available and requires purchase with additional restrictions. A typical UPC database will have three tables with information on *category*, *company* and *products*. Exhibit 61 below shows some of the most common fields in a UPC database schema.

Exhibit 61: Sample UPC Database Schema

UPC Category		Companies		Products	
Field	**Description**	**Field**	**Description**	**Field**	**Description**
id	In internal record identifier.	*id*	Internal ID of company	*EAN13*	Superset of UPC to allow for products in other countries.
parent_id	Parent category of UPC	*name*	Full name of company	*UPC*	UPC code.
top_parent_id	Parent ID of parent category.	*url*	Website, if available	*SKU*	Stock keeping unit.
category	Product category	*address*	Company address	*Price New*	Current price of item.
cat_path	The full path to this category.	*phone*		*Price Used*	Actual price used.
		created	Date UPC was created.	*Price Date*	Effective date of current price.
		modified	Last date on which UPC was modified.	*company*	Company of UPC code.
				product	Name of the product.
				description	Description of product.
				category	
				url	Website of product from company.

[30] EANData.com

UPC Category		Companies		Products	
Field	Description	Field	Description	Field	Description
				modified	Last date on which UPC was modified.

API Access

Application Programing Interface (API) is a feature of most data sources that allows consumers to retrieve specific pieces of data from a large dataset. In the case of UPC, the API allows the consumer to retrieve limited amount of information based on a number of possible query items. For example one can search by item category, product name, State, vendor, etc. In most cases, there are legal and architectural limitations to using API to access UPC information.

There are several websites that provide public access – free and paid – to product codes. The primary advantage of API is that products information is updated by the provider and the user have little to do in terms of maintenance cost. The main disadvantage is that when there are changes to the API, the code to retrieve the UPC information also has to change. Implementing such changes often involve engaging the services of a programmer or developer. In most cases, API is only viable for creating a web utility that retrieves product information "on-demand". The process of accessing and utilizing API typically involves the following steps:

1. Sign up using email address and company information. If the product is available commercially, make payment before receiving the **API key**.
2. Set up software or a web site to query and retrieve the UPC information. Typically, the information from the API provider is returned in XML or JSON formats. The API consumer should therefore have the capability of processing the returned information. The query involves using the **API key** as part of a web URL which is then sent to the API provider. The URL will have other parameters that allow the consumer to specify what specific information is needed. For example some API providers allow search criteria that limit results to States, specific store names, etc. Using the commercially available API by Supermarket API below, a typical query with API Key and parameters is given as:

   http://www.supermarketapi.com/api.asmx/COMMERCIAL_SearchByProductName?APIKEY=2f927baa0a&ItemName=Parsley where the API key is given as **2f927baa0a** follows the parameter name **APIKEY** and another parameter is **ItemName=Parsley**. In this example, we searched for the UPC codes of all item names that include the word "Parsley".
3. Process the returned UPC information using web utilities. The XML or JSON format returned is usually unreadable to the user without some processing. Thus the consumer will have to transform the XML or JSON into readable formats either for display to the user or for further processing. An example of XML output is given below:

   <Itemname>**Mccormick Parsley Flake Gourmet - .2 Oz**</Itemname>
   <ItemDescription>We've searched the world to gather the most exotic, premium herbs and spices so you can create an authentic flavor adventure all your own. All natural.
   </ItemDescription>
   <ItemCategory>Condiments/Spices & Bake</ItemCategory>
   <ItemID>32372</ItemID>
   <ItemImage>http://smapistorage.blob.core.windows.net/thumbimages/214200069_100x100.jpg
   </ItemImage>

<AisleNumber>Aisle:N/A</AisleNumber>
<Pricing>3.24</Pricing>
</Product_Commercial>
<Product_Commercial>
<Itemname>Mccormick Parsley Flakes - .5 Oz</Itemname>
<ItemDescription>Flavor Tip: 1 tsp. dried Parsley = 1 tbsp. fresh Parsley.</ItemDescription>

<ItemCategory>Condiments/Spices & Bake</ItemCategory>
<ItemID>32373</ItemID>
<ItemImage>
http://smapistorage.blob.core.windows.net/thumbimages/114150120_100x100.jpg
</ItemImage>
<AisleNumber>Aisle:N/A</AisleNumber>
<Pricing>3.55</Pricing>

The information returned include *Item description, item category, item ID, item image, Ailse number,* and item *price.*

A potential disadvantage of using API is the legal restriction. In most API user agreements, the consumer is prohibited from storing or caching extensive amounts of the product information retrieved from the provider. If

Free APIs Some APIs include http://upcdatabase.org/api which boasts of over **1.7 million** different product codes.[31] This site is **free** and only requires registration to access the codes. Codes are updated by members and all new postings undergo extensive review before they are made available.

Commercially available APIs include Supermarket API which has just over **1 million** product codes and **costs $199 per year** to access. Supermarket API is well-documented and fully supported.[32]

[31] http://upcdatabase.org/stats
[32] The API methods and parameters are available on http://www.supermarketapi.com/Methods_v1.aspx.

APPENDIX H: PROPOSED TWILD DATA STORAGE TABLES

Raw TWILD Table

At the end of each day, an automated process will execute and identify SNAP POS TWILD files received in a predefined location on the FNS Database server. This process copies each row of data from each file found into a row in the Raw TWILD data table. As each row of data is copied into the database table, it receives a unique identifier, such as in the following example where the Row ID is an automatically incrementing number:

Row ID	TWILD
1	A100000120131108165228…
2	D400000202201900000000…
3	E300000200100000001000…

When the raw data for a single file has been loaded into the TWILD table, it can be parsed and organized into transaction detail (D4) record and addenda (E3) record tables.

The following table defines the Raw TWILD table columns:

Column Name	Column Definition
Row ID	Unique Identifier for the row of data copied from the source flat file
TWILD	Contains the raw data for a row of data from a source flat file

Transaction Detail Record Table

A scheduled process will read each row of data in the Raw TWILD table and identify transaction detail rows based on the rules specified in the data definition file (these rows could be identified using the first two characters in the row, for example, “D4”). Each component of a transaction detail record will be copied into the associated database field in the Transaction Detail Record table. For example, the PAN number found at a specified position in the transaction detail row and copied into the PAN number field in the database table.

Column Name	Column Definition
Transaction Detail ID	A sequential number assigned as the unique ID for the transaction detail record, used to link to Addenda record data.
Record Identification Code	A code defining the type of record.
Record Sequence Number	A sequential number assigned to each record within a file by the file sender.
Message Type Identifier	Identifies the version, message class, message function, and transaction originator.
PAN Length	Length of the PAN in the PAN data element.
PAN	Primary Account Number. Left padded with zeros to length.
Processing Code	A series of digits used to describe the effect of a transaction on the customer account and identify the accounts affected.
Transaction Amount	Claim amount
System Trace Audit Number	A number assigned by the message initiator to uniquely identify a transaction.

Column Name	Column Definition
Transmission Date/Time	The date and time the message entered into the data interchange system, expressed in GMT.
Date and Time, Local Transaction	The local year, month, day, and time the transaction takes place at the card acceptor location.
National POS Condition code	A series of code intended to identify terminal capability, terminal environment, and presentation security data.
Acquiring Institution Code	An entity that acts as another level of proxy for file exchange. The Acquirer sends the files to the Forwarder. This code identifies the Acquirer to the forwarder. The ID only has meaning between the Acquirer and the Forwarder.
Card Acceptor Terminal ID	Value from the Card Acceptor Terminal Identification field in the original transaction record submitted with the claim file.
Card Acceptor ID	Indicates under which contract the transaction was conducted. Right pad with spaces to length. Often called the Merchant ID.
Card Acceptor Name/Location	Store name and full address of the institution where the redemption took place.
Count, Items	Count of addenda records associated with this detail record.
Discount Amount	Indicates the total of any amounts deducted from the purchase price because of a coupon, sale, or special discount.
Transaction Basket Total	TBD
Customer Retailer Loyalty Card Number	TBD

Addenda Record Table

A scheduled process reads each row of data in the Raw TWILD table and identifies transaction addenda rows based on the rules specified in the data definition file (these rows could be identified using the first two characters in the row, for example,"E3"). Each component of a transaction addenda record will be copied into the associated database field in the Addenda Record table. For example, the UPC for a single item purchased will be found at a specified position in the transaction addenda row and copied into the UPC field in the database table.

Column Name	Column Definition
Addenda ID	A sequential number assigned as the unique ID for the addenda record.
Transaction Detail ID	The unique ID for the transaction detail record associated with this addenda record.
Record Identification Code	A code defining the type of record.
Record Sequence Number	A sequential number assigned to each record within a file by the file sender.
Addenda Sequence Number	A sequential number that identifies the order of an addenda record associated with a detail record.
APL Category code	Category code of purchased item as specified in the UPC/PLU file.
APL Subcategory code	Subcategory code of purchased item as specified in the UPC/PLU file.
Purchased units	The number of units purchased of the UPC/PLU.
UPC/PLU	A product identifier unique for the recipient store (PLU) or for all stores (UPC).
Claim Price	Total Cost of all units purchased.
UPC Description	The product manufacturer's description of the product. Typically composed of the brand name, product name, and product line variant.

Retail Department of the Item	TBD
Retail Commodity Description	TBD
Retail Subcommodity Description	TBD
Price Paid	TBD

Data Warehouse Tables

The proposed data warehouse will store all historical TWILD submitted to date. The extract, transform and load process (ETL) will populate the tables from the staging database. The data warehouse will also include lookup/dimension tables as a reference for use in reporting. For example, UPC/PLU information will be stored in tables so that additional details about UPC/PLUs such as ID numbers, categories, and subcategories are available for reference. The following table lists the tables recommended for inclusion in the data warehouse.

Table Name	Table Definition
Transaction Detail Table	Stores the transaction level data for a SNAP POS transaction, such as the transaction price, customer PAN number, and date of purchase. The data will be linked to existing data such as ALERT and STARS.
Addenda Record Table	Stores the item level data associated with a SNAP POS transaction, such as UPC and quantity and price of an item purchased.
Date Reference Table	Stores date lookup information such as physical year and calendar year date formats and quarterly/monthly/weekly breakdowns.
State Reference Table	Stores lookup information such as abbreviations and descriptions for each state, the District of Columbia, and US territories.
UPC/PLU Number Reference Table	Stores UPC/PLU lookup information such as number and description of the item.
UPC/PLU Category Reference Table	Stores details of UPC/PLU categories.
UPC/PLU Subcategory Reference Table	Stores details of UPC/PLU subcategories.

EBT File and Target Database Fields

Each EBT prototype file is a text file that contains a single header record followed by one or more EBT transaction detail records with addenda records, followed by a single trailer record. The following table lists each component of the prototype file and its associated data format based on MySQL database. If the data element will be stored in the staging database, the relevant table and column name is also included.

Source File			Staging Database			
Field Name	Format	Description	Target Table	Column	Data Type	Transformation/Validation
Record Identification Code	Alphanumeric, length 2	"A1"	N/A – value not saved			
Record Sequence Number	Numeric, length (6)		N/A – value not saved			

Source File			Staging Database			
Field Name	**Format**	**Description**	**Target Table**	**Column**	**Data Type**	**Transformation/Validation**
File Create Date	Numeric, length (8)	Formatted as CCYYMMDD (GMT)	N/A – value not saved			
File Create Time	Numeric, length (6)	Formatted as HHMMSS (GMT)	N/A – value not saved			
File Format Version	Numeric, length (2)	TBD	N/A – value not saved			
Forwarding institution identification code	Numeric, length (11)	EBT processor-assigned identifier of the entity that will actually send/forward the file/files to the FNS. This could represent a store or a third party proxy. Formatted to be compatible with current FNS standards.	N/A – value not saved			
File Name	Alphanumeric, length (25)		N/A – value not saved			
File Sequence Number	Numeric, length (4)	Padded as appropriate.	N/A – value not saved			
Record Count	Numeric, length (7)		N/A – value not saved			
Record Rejected Count	Numeric, length (7)		N/A – value not saved			
State Identifier	Alphanumeric, length (2)	Two-letter state abbreviation	Transaction Detail (D4)	State_Code	char(2)	TBD
Receiving Institution Identification Code	Numeric, length (11)	Identifies the file's final destination.	N/A – value not saved			
Record Identification Code	Alphanumeric, length (2)	Constant value - always 'D4'	Transaction Detail (D4)	Record_Identification_Code	char(2)	TBD
Record Sequence Number	Numeric, length (6)	The record sequence numbers will be incremented by 1 for each detail record. Starting with value = "000002" because the header record sequence number started at "000001".	Transaction Detail (D4)	Record_Sequence_Number	int	TBD
Message Type Identifier	Numeric, length (4)	Constant value - always "0110"	Transaction Detail (D4)	Message_Type_Identifier	int	TBD

Source File			Staging Database			
Field Name	Format	Description	Target Table	Column	Data Type	Transformation/Validation
PAN Length	Numeric, length (2)	Value = “19”	Transaction Detail (D4)	PAN_Length	tinyint	TBD
PAN	Numeric, length (19)	Primary Account Number. Padded with zeros in accordance with other FNS data sets	Transaction Detail (D4)	PAN	varchar(19)	TBD
Processing Code	Numeric, length (6)	An indicator for purchase/refund/returns.	Transaction Detail (D4)	Processing_Code	int	TBD
Transaction Amount	Numeric, with leading sign and implied decimal point, length 9 (S9(7)v99)	Left padded with zeros to a length of 12. The decimal point omitted; positions 11 - 12 indicate the decimal portion of the value.	Transaction Detail (D4)	Transaction_Amount	decimal(12, 2)	TBD
System Trace Audit Number	Numeric, length (6)		Transaction Detail (D4)	System_Trace_Audit_Number	int	TBD
Transmission Date/Time	Numeric, length (10)	Formatted: MMDDHHMMSS in GMT	Transaction Detail (D4)	Transmission_Date_Time	char(10)	TBD
Date and Time, Local Transaction	Numeric, length (14)	Formatted CCYYMMDDHHMMSS (Not GMT)	Transaction Detail (D4)	Date_and_Time_Local_Transaction	char(14)	TBD – Dates/Times in received files to be stored as is and not converted to GMT or other common time zone. We assume that the time received is local time zone.
Acquiring Institution Code	Numeric, length (11)	The Acquirer is an entity that acts as another level of proxy for file exchange. The Acquirer sends the files to the Forwarder. This code identifies the Acquirer to the Forwarder. The ID only	Transaction Detail (D4)	Acquiring_Institution_Code	char(11)	TBD

Source File			Staging Database			
Field Name	Format	Description	Target Table	Column	Data Type	Transformation/Validation
		has meaning between the Acquirer and the Forwarder. Left padded with zeros to length. Fill with zeros If not used.				
Card Acceptor Terminal ID	Alphanumeric, length (8)	Value from the Card Acceptor Terminal Identification field in the original transaction record that was submitted with the claim file. Right padded with spaces to length.	Transaction Detail (D4)	Card_Acceptor_Terminal_ID	char(8)	TBD
Card Acceptor ID	Alphanumeric, length (15)	Indicates under which contract the transaction was conducted. Right pad with spaces to length. This field is often called the Merchant ID.	Transaction Detail (D4)	Card_Acceptor_ID	char(15)	TBD
Card Acceptor Name/Location	Alphanumeric, length (99)	Store name and full address of the institution where the redemption took place. Right pad with spaces to length - Format unspecified.	Transaction Detail (D4)	Card_Acceptor_Name_Location	varchar(99)	TBD
Count, Items	Numeric, length (3)	Count of addenda records associated with this detail record. Left pad with zeros to length	Transaction Detail (D4)	Count_Items	tinyint	TBD
Discount Amount	Numeric, with leading sign and implied decimal point, length 9 (S9(9)v99)	Indicates the total of any amounts deducted from the purchase price because of a coupon, sale, or special discount.	Transaction Detail (D4)	Discount_Amount	decimal(12, 2)	TBD
ICC system related data	Alphanumeric, length (99)	Security Information consists of the CRC32, CTC, and CSC.	Transaction Detail (D4)	ICC_system_related_data	varchar(99)	TBD
Transaction Basket Total	Numeric, with leading sign and		Transaction Detail (D4)	Transaction_Basket_Total	decimal(12, 2)	TBD

Source File			Staging Database			
Field Name	Format	Description	Target Table	Column	Data Type	Transformation/Validation
	implied decimal point, length 9 (S9(9)v99)					
Complementary Payment Type	Alphanumeric, length (20)		Transaction Detail (D4)	Complemetary_Payment_Type	char(20)	TBD
Customer Retailer Loyalty Card Number	Numeric, length (20)		Transaction Detail (D4)	Customer_Retailer_Loyalty_Card_Number	char(20)	TBD
Customer Case Number	Numeric, length (20)		Transaction Detail (D4)	Customer_Case_Number	char(20)	TBD
Customer Household Account Number	Numeric, length (15)		Transaction Detail (D4)	Customer_Household_Account_Number	char(15)	TBD
Record Identification Code	Alphanumeric, length (2)	"E3"	Addenda (E3)	Record_Identification_Code	char(2)	TBD
Record Sequence Number	Numeric, length (6)	The record sequence numbers incremented by 1 for each detail record. Starting with value = "000002" because the header record sequence number started at "000001".	Addenda (E3)	Record_Sequence_Number	int	TBD
Addenda Sequence Number	Numeric, length (3)		Addenda (E3)	Addenda_Sequence_Number	int	TBD
APL Category code	Numeric, length (2)	Category code of purchased item as specified in UPC/ PLU file. Left pad with zeros to length	Addenda (E3)	APL_Category_code	int	TBD
APL Subcategory code	Numeric, length (3)	Subcategory code of purchased item specified in UPC/ PLU file. Left pad with zeros to length	Addenda (E3)	APL_Subcategory_code	int	TBD
UPC/PLU	Numeric, length (17)	A unique product identifier for the recipient store (PLU) or for all stores (UPC). Right justified, zero	Addenda (E3)	UPC_PLU	char(17)	TBD

Source File			Staging Database			
Field Name	Format	Description	Target Table	Column	Data Type	Transformation/Validation
		filled.				
Purchase Quantity	Numeric, with leading sign and implied decimal point, length 3 (S9(3)V99)	Quantity UPC that are represented in this purchase. Left padded with zeros to a length of 5. The decimal point is omitted; positions 4-15 indicate the decimal portion of the value.	Addenda (E3)	Purchase_Quantity	decimal(5, 2)	TBD
Claim Price	Numeric, with leading sign and implied decimal point, length 6 (S9(6)v99)	Total Cost of all units purchased.	Addenda (E3)	Claim_Price	decimal(9, 2)	TBD
UPC Description	Alphanumeric, length (20)	Store description of the product. Typically composed of the brand name, product name, and product line variant.	Addenda (E3)	UPC_Description	char(20)	TBD
Retail department of the item	Alphanumeric, length (40)		Addenda (E3)	Retail_department_of_the_item	char(40)	TBD
Retail Commodity Description	Alphanumeric, length (40)		Addenda (E3)	Retail_Commodity_Description	char(40)	TBD
Retail Subcommodity Description	Alphanumeric, length (40)		Addenda (E3)	Retail_Subcommodity_Description	char(40)	TBD
Price Paid	Numeric, with implied decimal point, length 7 9(7)v99		Addenda (E3)	Price_Paid	decimal(9, 2)	TBD
Other Price	Numeric, with implied decimal point, length 7 9(7)v99		Addenda (E3)	Other Price	TBD	TBD
Record identification Code	Alphanumeric, length (2)	Value = Z1	N/A – value not saved			
Record Sequence Number	Numeric, length (6)	The last detail record sequence number value incremented by	N/A – value not saved			

Source File			Staging Database			
Field Name	Format	Description	Target Table	Column	Data Type	Transformation/Validation
		1. Left padded with zeros to length.				
File Create Date	Numeric, length (8)	Formatted as CCYYMMDD (GMT)	N/A – value not saved			
File Create Time	Numeric, length (6)	Formatted as HHMMSS (GMT)	N/A – value not saved			
File Format Version	Numeric, length (2)	"02"	N/A – value not saved			
Count, Records	Numeric, length (7)	Number of detail records in file. Left padded with zeros to length.	N/A – value not saved			
Count, adds	Numeric, length (7)	Number of details records. Left padded with zeros to length.	N/A – value not saved			
Count, changes	Numeric, length (7)	Fill with zeros	N/A – value not saved			
Count, deletes	Numeric, length (7)	Fill with zeros	N/A – value not saved			
Count, replacements	Numeric, length (7)	Fill with zeros	N/A – value not saved			

Capacity Planning

As we develop the prototype, we will use the volume of data transmitted and received for storage capacity planning. Preliminary estimates of the staging database size requirements have been based on a sample typical TWILD prototype flat file for a state for one day. Additional assumptions include:

- An estimated 30 to 50 users would require access to the data, including 5 to 10 power users.
- Capacity planning estimates are limited to the production environment, and additional capacity would be required for lower environment configurations, including development, system test, and user test environments.
- A server dedicated to the staging database will host data for the current year or active set, and confirmed data will be archived to Storage Area Network (SAN) storage as a replacement for daily/monthly archiving. Logging should be disabled, due to the large volume of data.
- A server dedicated to the data warehouse will host the transformed data in a star model for reporting purposes. Data should be mirrored to another site for high availability, and backed up periodically. Based on the SLA/requirements, data will be either purged periodically or archived to SAN Storage.
- For Disaster Recovery purposes, a remote location should be identified and differential backups should be transferred and applied periodically.

We estimated the capacity requirements using the following methodology:

Step Number:	Description:	Sample Data:
1	Estimate the size in bytes for the number of transactions and line items for one state for one day.	The header record in the file is approximately 120 bytes. State value is contained in this record; therefore, it is required for storage. Each transaction detail (D4) record is 460 bytes and there are approximately 60,000 records in the sample prototype file. Therefore, 460 bytes * 60,000 = 27,600,000 bytes. Each addenda (E3) record is 220 bytes and there could be up to 10 to 15 of these line items per transaction. Using 12 as an approximate number of line items for a single transaction, 220 * 12 * 60,000 = 158,400,000 bytes. The total bytes for transaction detail and addenda records for one state for one day = 186,000,000 bytes (0.17323 GB).
2	Multiply the result from Step #1 by 30 (approximate number of days in a month) and by 12 (number of months in a year) to arrive at the approximate minimum size of the data transmitted in bytes for a year for a single state.	186,000,000 bytes (0. 17323 GB) * 30 days = 5,580,000,000 bytes (5.19678 GB) per month * 12 months = 66,960,000,000 bytes (62.36136 GB) per year.
3	Multiply the result from Step #2 by the number of states and territories participating in SNAP.	50 states + Washington D.C. + Puerto Rico, The Virgin Islands, American Samoa, Guam, and The Mariana Islands = 56 states for the purpose of estimation. 66,960,000,000 bytes (GB) per year * 56 states =3,749,760,000,000 bytes (3492.23614 GB or 3.41039 TB) per year.
4	Add the estimated number of bytes required for indexing tables, as well as backups of the databases. - Transaction Detail (D4) index(s): Clustered Index on identity column, Non-Clustered index on Date, State, and PAN/EBT Card (3 Indexes). - Addenda record (E3) index(s): Clustered Index on identity Column, and Non-Clustered index on Master table key.	We recommend an additional 6 TB of space for OLAP cubes, indexes, and other overhead. We also advise adding a reserve of 3.5 TB of space every year to accommodate any new database objects and log files needed. This facilitates growth of the solution and accommodation of future data requirements. Based on the annual storage requirements specified above, we recommend approximately 25 TB per year to back up the staging and data warehouse databases.