

SERENEDI

HEALTHCARE INTEGRATION PLATFORM

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Introduction

Integration is the combining of two systems so they are synchronized to act as one. Healthcare integration is the combining and synchronizing of different healthcare systems, often across corporate boundaries, so they act as one. A simple example of this is *eligibility*. If a provider group has a three-month-old snapshot of eligibility from the payer, it could be sending claims to the payer for a patient who was disenrolled two months ago. These claims would be denied by the payer, and the provider would be in the position of trying to collect payment from the patient. If both the payer's and provider's eligibility systems were tightly integrated, this problem would cease to exist.

In the "old days" of healthcare, this integration was generally handled with flat files or CSV (Comma Separated Values) files that were customized between trading partners as needed. In some cases, very large trading partners, like Medicare, generated large, complex flat files that were consumed universally across the country. Although there were some attempts to universalize file formats, little to no legislation supported them and therefore they lacked incentive. As a result, the late 1990s saw the healthcare industry with millions of proprietary data formats, and even small changes in business requirements demanded heavy investment in development time.

Enter the Healthcare Insurance Portability Administration Act, or HIPAA: by federal law, trading partners would no longer be allowed to exchange variable and custom file formats. Instead, the ASC X12 committee agreed on a fixed file format for a specific business-to-business transaction and authored something called a *HIPAA Implementation Guide*, and then this guide became the final law to determine what the file would look like and what data it could contain.

These implementation guides established a Rosetta Stone for the healthcare industry. The authors of the guides used their industry knowledge to encapsulate all the different situations that can occur during these common business functions, such as transmitting eligibility from a payer to a provider, and created a file format that could accommodate many different business needs.

These new hierarchical data formats vastly differ from the CSV or flat files that came before. Furthermore, many of the tools and technologies available to tackle these complex, hierarchical formats have a steep learning curve and a long development time. SERENEDI is a third-generation healthcare integration platform—building on the 2003 product Chiapas Version 1, and the 2012 product, Chiapas EDI Enterprise—designed specifically to address this complexity.

Designed by and for healthcare IT professionals, SERENEDI was in development for six years before we considered it ready for release, and it brings powerful technology to bear on modern integration challenges. In a nutshell, it is a development environment for creating automated, highly parallelized solutions that are natively capable of powerful healthcare EDI translations. This software is compatible with Windows and Unix operating systems. It requires an SQL Server instance to operate, but can send and retrieve data to and from different Microsoft SQL Server databases.

The underlying automation system is driven by a customized PowerShell Core 7 environment with over 60 additional "cmdlets" that control the automation environment as well as the SERENEDI translation engine. The translation engine is capable of transforming EDI to and from CSV, XML, and two different types of database storage systems. The predefined field names are the mappings that bind data elements to the HIPAA EDI transaction sets. These are defined within the CGIF2 mapping technology, detailed here in this manual.

To help offset the learning curve needed to create *outbound* EDI transactions, the SERENEDI distribution database ships with the sample data and stored procedures that are used to generate the 14 "seed" files, one for each of the supported 5010 transaction sets. To query data on *inbound* EDI transactions, the built-in pipeline system has a rich set of capabilities for transforming hundreds or thousands of EDI files into queryable database tables. This pipeline is the default automation

process for transforming EDI files into two-dimensional BIN tables, and is an easy place to start learning how the SERENEDI engine works and what it does – you can start merely by dragging EDI files into the 01_in_edi folder and it will start working from there. As the automation pipeline encounters new fields from the incoming data, the BIN tables are automatically extended with new columns to hold this data.

The advantage of the Flat BIN system is that the data is very accessible; the disadvantage is that the denormalized nature of the data makes it a bit more difficult to access some of the data that is stored that way. The Hierarchical Database is another BIN system that trades accessibility for flexibility. Loops in the EDI transaction are stored in separate database tables, but the cost is in complexity: you will need to know how each table relates to the parent table in order to parse it. Data is stored much more efficiently with this system and takes less time to transfer.

Along with these database capabilities, SERENEDI contains a rules engine to measure EDI compliance with the rules defined within the HIPAA Implementation Guides. This rules engine is user-extensible – if you need to add custom rules to analyze incoming EDI transactions, the simple REP Code language is documented here to allow you to create new rules.

We hope this user manual clearly presents the capabilities of the SERENEDI engine, and we aspire to ensure that by using these tools, you will be able to adapt to new challenges in the healthcare industry quickly and effectively.

Technical Summary

FEATURE	CAPABILITY
Operating Systems	Windows Server 2012 and above, Windows Client 7+.
Database Compatibility	SERENEDI needs an instance of SQL Server 2012 or above for operation; EDI data can be stored and retrieved from SQL Server databases.
Transformations	SERENEDI can translate EDI files to and from CSV files, XML files, and both flat and hierarchical database formats.
GUI	SERENEDI includes an access-controlled, Blazor-based, web browser-based interface that enables testing of transforms, maintaining triggers and events, BIN activities, database endpoints, and SecureFTP sessions.
Specifications Supported	5010 270/271, 275C/275R, 276/277, 277 CA, 278 REQ & 278 RESP, 820, 820X, 824, 834, 835, and 837 I & 837 P. Integrity checking of SNIP Types 1 and 2 is supported for all of these transactions, whereas 834/835/837 I/837 P support deeper SNIP Type 5 integrity checks with a user-extensible rules engine.
Automation	Events are generated based on file-system triggers or SQL-based triggers, or based on date and time criteria.
Scripting System	SERENEDI events are handled by a custom PowerShell Core environment with custom extensions. Visual Code IDE debugging is supported.
Licensing	SERENEDI is licensed on a per-server, per-year basis, with a next-business-day SLA for email support and a number of hours of Tier 2 direct support renewed annually.

Operating Systems

SERENEDI operates primarily on Windows 10/11 and Microsoft Server 2019 and above. SERENEDI does not need internet access – as long as you are able to update a single license file once a year, SERENEDI should be able to run without interruption.

That said, it's important to note that SERENEDI's graphic development environment, SERENEDI Studio, is a web app served directly from the installed application. Unless external IP addresses are whitelisted, SERENEDI Studio will *only* launch from a web browser on the server itself. If the server operating system doesn't have a GUI shell, the GUI will be inaccessible. The GUI can be completely disabled if needed. To enable remote access, the server must be set up to respond to the same subnet as the end-user and firewall rules must be in place.

Database Compatibility

SERENEDI requires an SQL Server instance, version 2012 or above, to run the serenediCore distribution database. This contains all the core tables SERENEDI needs to function. Any tier of SQL Server version 2012 and above is capable of running serenediCore, but be aware that the free tier of SQL Server is limited to database sizes of 10 GB or less.

By default, SERENEDI sends decoded EDI information submitted to its Decode pipelines to the serenediCore distribution database. It is possible to send this data to an external SQL Server database by configuring database endpoints within the environment and directing pipelines to use this endpoint. All column names used by SERENEDI are 30 characters or less.

Transformations

Out of the box, SERENEDI can transform the supported HIPAA EDI transactions to flat database tables, hierarchical database tables, XML files, and CSV files. Because SERENEDI has every valid HIPAA EDI element built in and pre-mapped, this capability is built-in and nonconfigurable. The output of one EDI conversion is a complete representation of all data elements within the original file, and the bidirectional capability of SERENEDI provides the capability to reverse the transformation and create a binary-accurate representation of the original file.

EXAMPLE:

As a quick introduction, let's say you need to get all the unique subscriber last names from two gigabytes of mixed 837 Professional files. Starting from a fresh SERENEDI installation, you would need to do the following:

1. Drag all the files into the <install folder>/serenedi/pipeline/006_EDIToBIN/01_in_edi.
2. Wait for them to finish processing.
3. Run the following query:

```
SELECT DISTINCT(L2010BA_NM103PERSN_LNM) FROM BIN_5010_837P
```

The 006_EDIToBIN Pipeline demonstrated in this example is ideal for data warehousing and querying the data as simply as possible – it will stuff all the EDI's transaction data into a two-dimensional data table, and will also automatically expand that table's schema when new EDI fields are encountered. There are two main tradeoffs with using this method: first, these two-dimensional projections of a hierarchical data source store data very inefficiently; and second, extracting certain data elements can be difficult because header-level elements are repeated across database rows.

The 007_EDIToHDB Pipeline stores hierarchical data by assigning one database table for every loop defined by the implementation guides, with rows of each table identified by a unique ID specific to the file as well as a parent-child key mechanism that preserves the data aggregation present within the original EDI file. Thus, all line items stored in the 2400 loop table are keyed to one row in the 2300 claim table, and so on up to the ISA loop header table. This eliminates data redundancy, but also makes it more difficult to make ad-hoc queries of the data, as you need to know how these tables relate to one another.

On the other side of the coin is *encoding*, creating new EDI files from your enterprise data. The learning curve here is steeper, as you need to become very familiar with the column-naming convention SERENEDI uses to project this data. The distribution database ships with a number of SQL-stored procedures that pull some sample, fake PHI together in a way that can be fed to SERENEDI and generate the sample EDI files. These “seed” files can be used as a starting point for developers creating their own EDI extracts. One key point to remember here is that *decoding* can be done without development. If you are challenged to find a way to make SERENEDI encode a certain sequence of segments, it is easy to manually create an EDI file with these segments and then decode it to see how SERENEDI translates the information. Because this is a bidirectional transformation, you learn the exact data and mappings you would need to supply to get SERENEDI to encode it.

Graphical User Interface

SERENEDI ships with a graphical user interface (GUI) called SERENEDI Studio to enable you to test various transformations and see the results in real time. This web app allows you to test database extracts you have created using database development tools (such as SQL Server Management Studi). This way, you gain immediate feedback about the validity of your mappings and logic.

In addition to this, SERENEDI Studio enables you to create and maintain *triggers* that control the highly parallel automation system, *SecureFTP sessions* that enable SFTP access, and database *endpoints* that enable access to databases outside of the distribution database. Furthermore, it allows you to see the status of BIN items that have been committed to the BIN system.

SERENEDI Studio does not directly make writes to the distribution database – instead, it leverages the SCORE scripting commands to make these changes, and it provides a record of these commands in the *runbox* on the main screen of the interface. This fulfills a second role of SERENEDI Studio: to help end-users learn the commands that drive the automation environment.

Specifications Supported

SERENEDI deeply targets the transactions used most in the healthcare industry: 5010 270/271, 275C/275R, 276/277, 277 CA, 278 REQ & 278 RESP, 820, 820X, 824, 834, 835, and 837 I & 837 P.

When decoding EDI files, the SERENEDI Engine will check basic syntax covering segment repeats, loop repeats, and segment composition. For the 834 Eligibility, 835 Remittance, and 837 Institutional and Professional specifications, SERENEDI has a user-extensible rules engine covering over 300 distinct validation rules. The engine will optionally check code-set compliance during decoding, covering claim adjustment reason codes, remittance adjustment reason codes, ICD 9 & 10 CM & PCS code sets, claim frequency codes, provider taxonomy, state abbreviations, and ISO country codes. Updates for these code sets are downloaded from the SecureFTP site that distributes the SERENEDI binaries.

Automation

SERENEDI uses a *multi-process* model for automation. Triggers are scanned by a background service, and when firing criteria are discovered, new events are created. A number of background worker processes poll the events table, and when they discover new work to do, they take ownership of that event and run a SCORE script – a concatenation of SERENEDI and PowerShell Core. When the SCORE script has finished executing, any messages regarding errors that occurred along the way are inserted into the messages table. If a critical error occurs at any point, the event is flagged as such at the high-level events table so it can be more easily caught and researched.

Scripting System

SERENEDI uses PowerShell Core for its versatility and cross-platform compatibility. PowerShell Core scripts (“SCORE” scripts) spawn an instance of the SERENEDI translation engine and contain all the dozens of custom commands that work with that engine. Normally these scripts are executed sight-unseen using parameters passed to it by the automation system. However, it is also possible to run the script within a Visual Code interactive shell and to run it line by line, provided a few commands are inserted at the top of the SCORE script that initializes the SERENEDI engine. In this way, SERENEDI leverages proven, open-source development and debugging environments to speed the development of complex business processes.

If a particular integration task is not provided within the SCORE scripting environment, it’s quite possible to extend the functionality by linking to outside libraries for many tasks.

Licensing

SERENEDI is licensed in two ways: either as an evaluation, or with full production licenses. For production, SERENEDI is licensed on a per-server basis, which is renewed annually. For more information, see the licensing terms that came with the distribution.

Installation

SERENEDI can be installed to a Windows (Server 2016 or Windows 7 Client and above).

Internet access is not required for any function. License renewals are performed by replacing a single licensing file once a year. SERENEDI needs access to an SQL Server instance (2012 or above) in order to function. SERENEDI can store and retrieve data to and from SQL Server databases, and requires a SQL Server for installation.

The user interface displays the current state of the SERENEDI environment and provides tools that are useful during development or troubleshooting of production processes. By default, this interface only responds to web browser connections launched locally from the SERENEDI server (it restricts connections to the localhost 127.0.0.1 IP address). The interface can be disabled two ways: via the command line that launches SERENEDI, or by renaming the SERENEDI Studio binary file.

SERENEDI requires at *least* 4 GB of RAM for the base installation. If the licensing tier enables additional cores to run, SERENEDI requires 1 GB of RAM per additional core. On Windows installations, it is necessary to have local administrator privileges to install the package.

BASE REQUIREMENTS

Operating System:	Windows 7 / Windows Server 2016 and above
Prerequisites:	Access to SQL Server 2012 or Above A login account with local administrator access
RAM	SERENEDI requires at <i>least</i> 4 GB of RAM to function. If SERENEDI is licensed for additional cores, it requires 1 GB of RAM per additional core.
Storage:	The base installation requires 150 MB of free disk space.

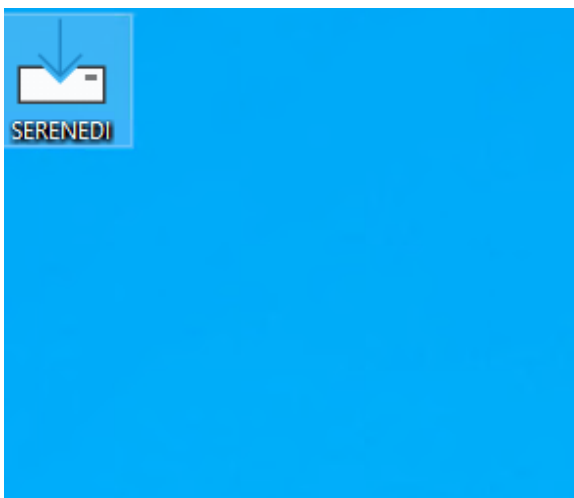
INSTALLATION

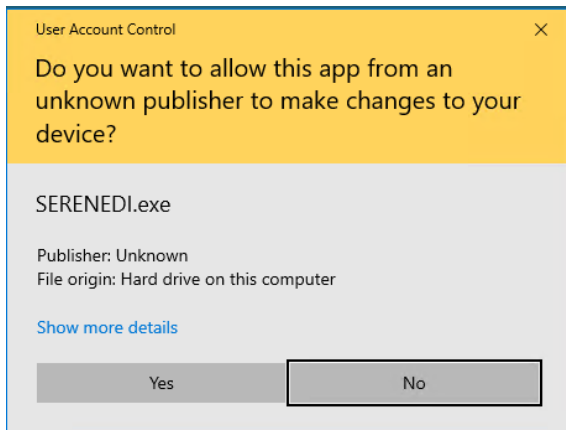
1. Gather the following prerequisites:

- a. **SQL Server:** SERENEDI requires a running SQL Server instance; the examples included in these instructions assume that it was installed:
 - i. Using a server instance name of MSSQLSERVER (and *not* ./SQLEXPRESS)
 - ii. Using SQL Mixed Mode authentication
 - iii. Using an 'sa' password of 'strongPass1'
- b. **An account and password with local administrator privileges:** This is the account that will be used with the SERENEDI Service that is installed. If this is a domain account, it should be expressed in the form DOMAIN\username. If it is a local account, it should be expressed as '.\username' (no quotes).
- c. **SQL Server connection string:** This defines the location and possibly the login credentials of the SQL Server account. For different examples of the connection string, visit <https://www.connectionstrings.com/sqlconnection/>. This connection string will be used in conjunction with the supplied login credentials above to access the SQL Server specified above. It will also specify the name of the distribution database – by convention, this is normally called 'serenediCore'.

2. Run the Installer

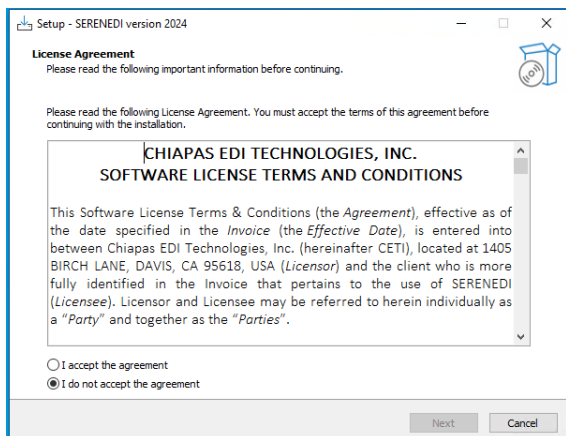
The SERENEDI Windows installer is a single MSI file, around 120MB in size, looking like this:





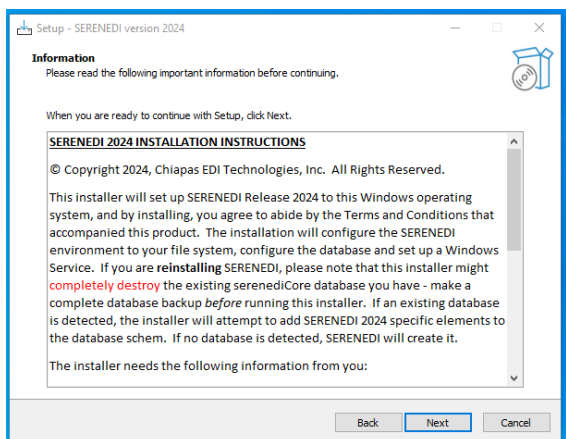
Click "Yes" to continue.

3. Accept the License Agreement



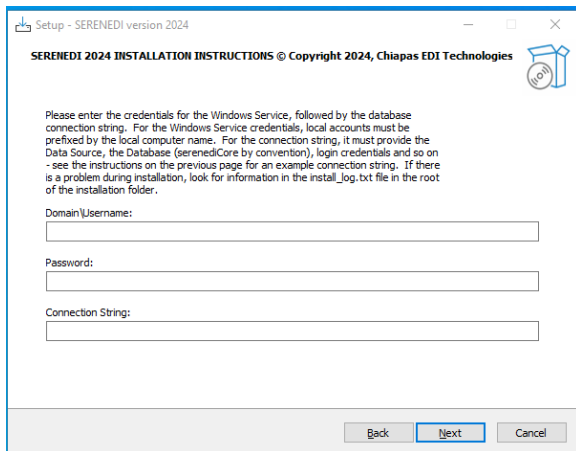
Click "I accept the agreement" and hit Next.

4. Read the installation instructions



Click "Next" when you are finished reading.

5. Fill in the Prompts



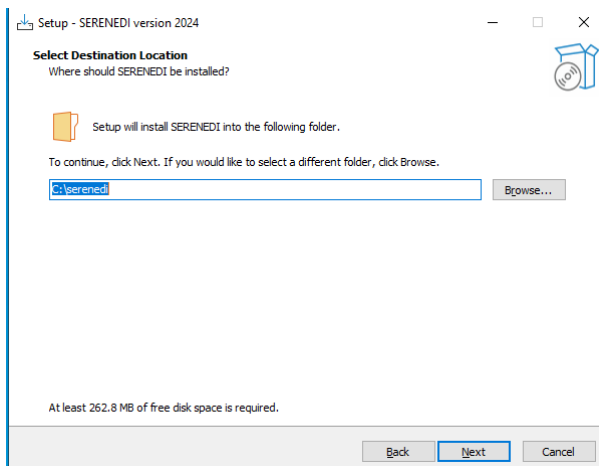
The Domain\Username prompt is the login credentials used to use the Windows Service. If you are using a local domain account, use "." for the domain – for example: .\admin

Enter the password associated with that account in the password prompt.

Finally, enter a connection string that SERENEDI will use to connect to an existing serenediCore database (which it will attempt to upgrade, if it has not been upgraded), or to create a new serenediCore database if one does not exist on that server. An example connection that would connect to a local SQL Server instance with an administrator password of 'strongPass1' is as follows:

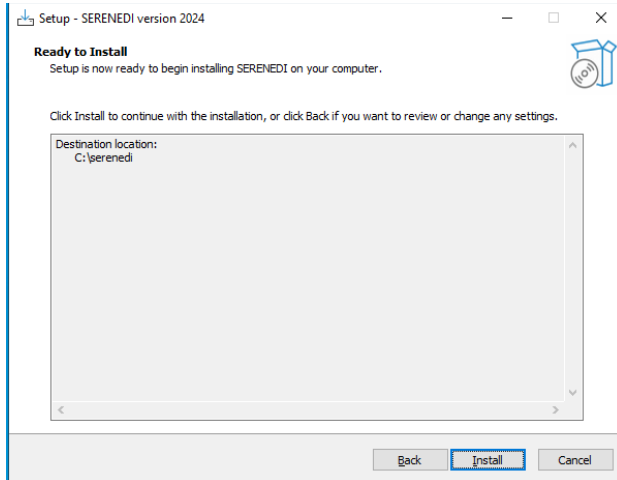
```
Data Source=(local);Database=serenediCore;User id=sa;Password=strongPass1;TrustServerCertificate=true;
```

6. Enter the Destination Folder



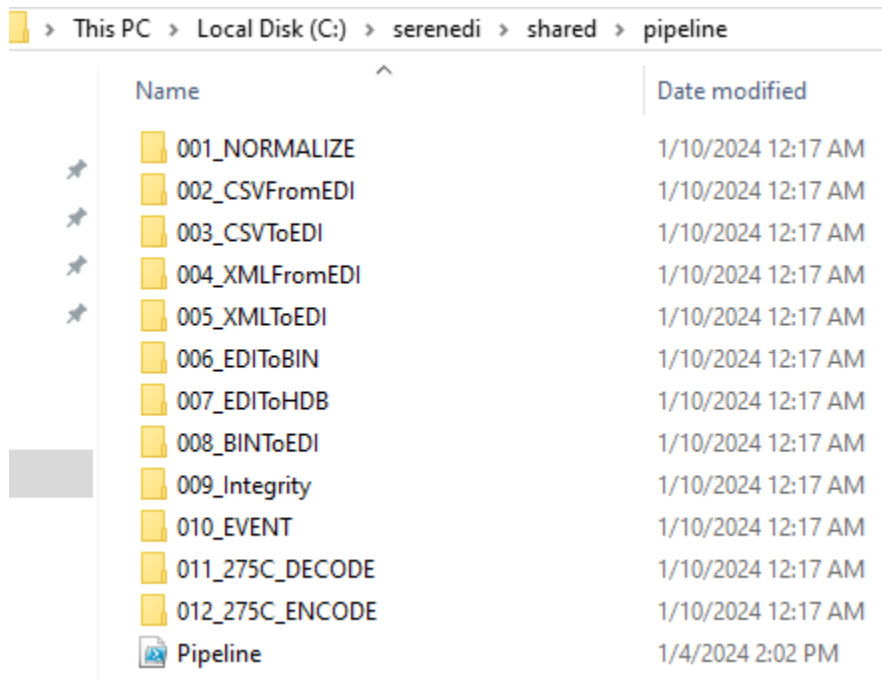
Enter the destination folder for SERENEDI, or use the default in place, and hit "Next."

7. Confirm the Installation



Press “Install” to start the installation process.

8. **Confirm success:** If all steps are successful, you should get a Setup Complete dialog. Go to the To further ensure normal operation of SERENEDI, go to C:\serenedi\shared\pipeline, and look for the following folder structure:



If this folder structure exists, then SERENEDI is running and processing events successfully.

TROUBLESHOOTING:

1. If upgrading the schema of an existing database and you do not see the new 011 and 012 pipeline folders appear, try running the command on the associated distribution SQL Database:
`insert into BIZ_EVENT (event_data3, event_data4) select 'INITIALIZE', '$\Pipeline.ps1'`
2. If you have problems, try validating the SQL login credentials. You may have to install SQL Server Studio in order to test the login credentials to the server.
3. Most operations are logged to the serenedi root folder under a file called “install_log” – see if there are any problems there.

(OPTIONAL) Disabling the SERENEDI Studio

SERENEDI uses an HTTP web browser user interface that listens on port 5000 on the local machine when SERENEDI Service is started. By default, the web server will ignore any connections except those originating from the same machine. In certain situations, it may be desirable to disable SERENEDI Studio.

To **completely disable** SERENEDI Studio, run the following steps:

1. Run regedit from the command prompt to edit the registry.
2. Go to this key by entering this into the registry path window, and hitting enter:

Computer\HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Services\SERENEDIService
3. Double click and edit "ImagePath" – remove the word "STUDIO" from the expression. The resulting string should look similar to this:
C:\serenedi\bin\serenedi.exe SERVER SC H:C:\serenedi MSSQL.... <SQL string omitted>
4. Press OK, then restart the SERENEDI Server windows service. The SERENEDI Studio interface should now be disabled.
5. If you need to reinstate the SERENEDI Studio, follow the same instructions, but in step 3, *add* the STUDIO string so that that the string will appear like this:
C:\serenedi\bin\serenedi.exe SERVER STUDIO SC H:C:\serenedi MSSQL.... <SQL string omitted>

WARNING

SERENEDI is designed to be used on security-hardened servers containing Protected Healthcare Information (PHI). SERENEDI Studio is a development and diagnostics tools designed to give extensive access to both the server file system and the database environment; it is not security-hardened. By design, it uses unencrypted HTTP connections. If the default settings are overridden and external IP access is opened to the Studio interface, it is your responsibility to ensure that all PHI remains encrypted and that no PHI is transmitted across insecure lines.

OPTIONAL: Visual Code Installation

SERENEDI processes are driven by *SCORE Scripts*, which are PowerShell Core scripts with SERENEDI-specific command extensions. SERENEDI is distributed with a single SCORE script called 'Pipeline.ps1', that both sets up and handles the default integration environment. When clients need to customize this script or create brand new ones, they have the option to use the Visual Code development environment with full support for the SERENEDI extensions – this enables users to use breakpoints and the Visual Code debugger to develop new integration scripts.

For Windows-based SERENEDI Installations:

1. Install the latest version of PowerShell Core 7.X

Go to the page <https://docs.microsoft.com/en-us/powershell/> and choose the PowerShell Core installer topic for your operating system. Make sure you are installing Power Shell Core 7.X.

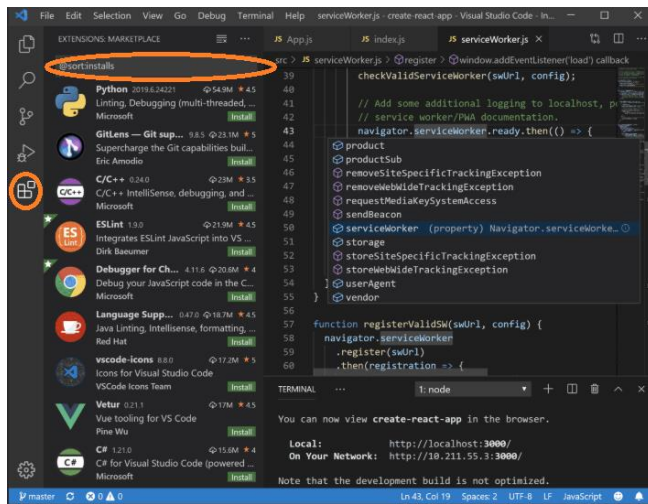
2. Install Visual Code

Go to the page <https://code.visualstudio.com/> and follow the instructions to install it on your operating system.

3. Launch Visual Code

4. Install the PowerShell Extension

Click the Extensions icon (circle, far left) and enter "powershell" in the search window (second circle, top left). Click Install.



To activate the SERENEDI extensions, Visual Code *must* be executed on a licensed SERENEDI server, and you must add these lines to the top of every PowerShell script:

```
Set-Location C:\serenedi\bin
Import-Module -Name (Resolve-Path 'serenedi.dll')
sapi-InitializeSession -BasePath 'C:\serenedi' -MSSQL 'Data
Source=(local);Database=serenediCore;User
id=sa;Password=strongPass1;TrustServerCertificate=true;'
```

The first command loads the SERENEDI library, and the second command initializes a new session. The BasePath argument points to the base SERENEDI folder; the MSSQL argument provides the connection string to the serenediCore database. These arguments are required. It is also possible to supply one additional argument, -BizEventId – this will allow you to recreate failed process events and step through the execution with the Visual Code debugging environment.

SERENEDI Overview

This chapter will explain how to use the major features of SERENEDI. First, we'll review the business requirements behind the architecture. Then we'll explore the automation system, the SERENEDI engine that runs all workflows, and the BIN system that stores EDI data in a human-accessible form. We'll examine changes from Chiapas EDI Enterprise, and, finally, we'll walk through the Pipeline system. Those of you wishing to immediately get hands-on with the system can skip directly to the Pipeline section, as that also functions as a Quick Start guide to using SERENEDI.

The SERENEDI Technical Reference section goes much deeper into the details of the SCORE script commands, rules engine, and table schemas used in the distribution database.

Business Requirements

Before we go into the specifics of SERENEDI, we need to review the exact business objectives this technology is addressing. These are explained in the three guiding principles of SERENEDI's design, the Three P's:

PARALLELISM

Bottlenecks are very common in the healthcare IT space. When building new systems, legacy components can sometimes severely limit the potential to achieve objectives. For example, when building a claim processing system, you may find that a legacy eligibility-checking component is limited to one eligibility verification per second. This severely limits the systems you can build that rely on this mechanism.

SERENEDI is built from the ground up to handle multiple operations simultaneously, with special considerations to prevent database "locking" scenarios when storing data in the database. The error-logging and data-storage systems contribute to an automation environment designed to take full advantage of modern hardware.

PORTABILITY

The rise of Unix-based operating systems means that sometimes the computing resources available are far from homogenous – it's very common for IT server rooms to be filled with both Unix-based and Windows-based servers. Furthermore, even without that consideration, most healthcare solutions are designed on a developer server, tested on a QA server, and released on a production server, meaning that the solution has to be migrated at least twice before running in production. If a solution is *portable*, it's easy to make this migration – and the less portable it is, the harder the process becomes.

SERENEDI makes it possible to develop a solution on a Windows-based workstation, test it on a Unix-based QA server, then release it on a Windows production server. A good example of this is the SERENEDI Pipeline system, which ships as a single SCORE script that quickly inflates to an entire directory hierarchy and over a dozen event triggers when the SERENEDI system is first started. This single script works the same on Windows and Unix, and because the script is broken up into different functional modules, it's easy to develop and maintain.

PROJECTION

This software is primarily focused on one driving requirement: enable users to focus on the *business data* within HIPAA EDI transactions, and not on the transactions themselves. Because healthcare data requirements are so complex across the United States, the EDI formats themselves are also complex, so this is not easy to do.

There are a number of different technological solutions to this problem. Some parse EDI transactions with an XML schema and then let users map individual fields, one by one, to their own data requirements. Others give a fixed, preset translation

capability and provide a number of database tables for the supported transactions; customization is often difficult for these solutions.

SERENEDI's approach is a bit different. Its proprietary technology *projects* EDI transactions directly into three formats: XML, database flat table, or database hierarchical table. This projection is bidirectional, and as long as SERENEDI's mapping rules are maintained and the file is completely HIPAA compliant, it can reproduce the original EDI transaction character for character. These projections are completely automated, "black box" operations that are built into SERENEDI.

If you are a developer who needs to extract business information from large amounts of existing EDI files, this capability lets you complete your work using only the existing pipelines as-is and accessing the data elements using SQL-stored procedures and views.

If you need to create new outgoing EDI files, you'll need to learn more about the CGIF2 (Chiapas Gate Intermediate Format Version 2) mapping system. It helps that you can always add new segments, decode them, and see how they are mapped in real time with the user interface tools provided. Furthermore, a collection of views and sample data enclosed with the distribution database keeps you from ever having to start completely from scratch.



Once SERENEDI is installed and linked to an instance of the distribution database, SerenediService starts up. This service is kept purposefully lightweight so it can run for many months without disruption and is responsible for launching other processes as needed. When it first starts, it assesses the cores allowed under the license and the physical cores available; whichever is *less* is the maximum number of worker processes allowed. This sets a ceiling on the simultaneous number of worker processes according to both the licensing and the limits of the server.

SerenediService handles the following tasks:

Trigger Scan

This process loads in the active triggers and polls the trigger criteria at a preset interval. When trigger-firing criteria are met, *events* are generated.

Worker

SERENEDI maintains a small number of workers that poll the distribution database constantly for new work in the form of events generated by trigger scans. When a large number of events are pending, SERENEDI scales up the number of simultaneous workers, but otherwise keeps it to a quarter of the maximum to minimize unnecessary database polling. Each event is tied to a SCORE script, which the worker runs with the arguments associated with that event. If a worker process exceeds four hours to execute a script, it is forcibly terminated and the worker slot is made available again.

Data Shuttle

The *data shuttle* is an ongoing process that enables the BIN system – a way to decode large amounts of EDI files into human-accessible database tables. Table schemas are dynamic in the BIN system and can expand according to the needs

of incoming data. However, by ensuring that only the data shuttle process is moving data to the destination tables and altering schemas, it avoids the schema locks that would occur if multiple worker processes were trying to insert data and expand the schema at the same time.

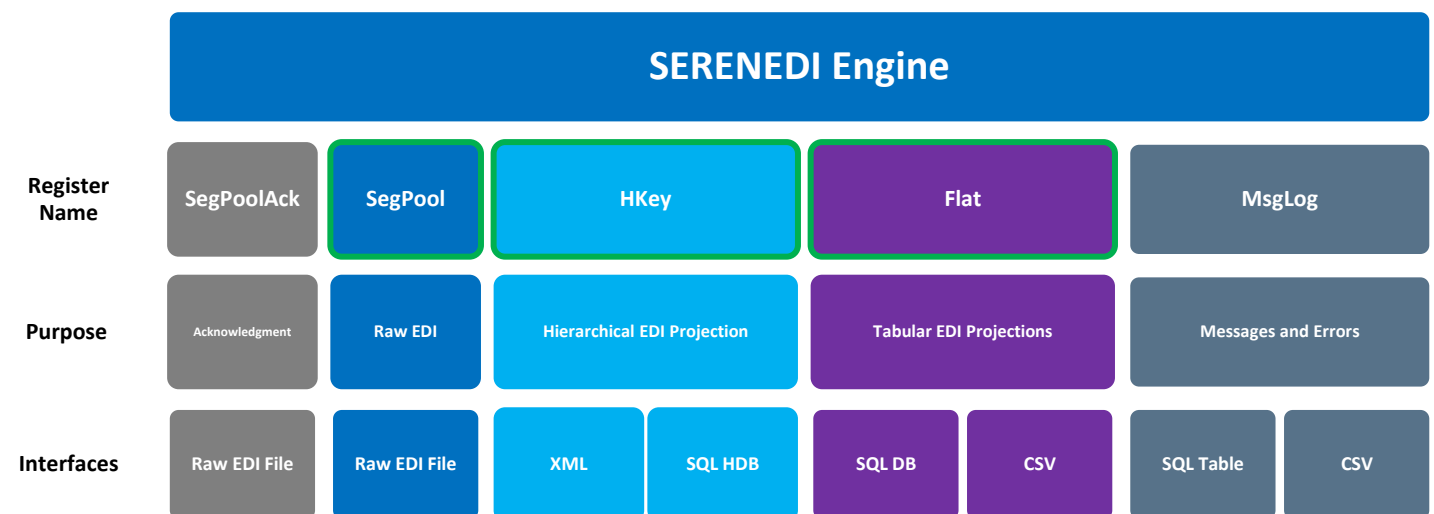
SERENEDI Studio

The SERENEDI Studio process is a web app that is accessible on the server machine and allows developers to test various data transformations as well as see the current state of the BIN, triggers, endpoints, and SFTP systems. This defaults to port 5000, and by default does not accept connections except from browsers launched on the server itself. The Studio process can be completely disabled and can be configured to accept outside connections.

SERENEDI Engine

The SERENEDI engine is the environment that is loaded every time an event is fired. Aside from the registers used for logging messages and generating Transaction Acknowledgments (defined within specification 999A1), there are three primary registers: SegPool, HKey, and Flat. These are shown in the following diagram. The green border indicates registers that support bidirectional projection, meaning that data can be transformed laterally between the three registers in addition to the methods listed on the Interfaces line.

The SERENEDI engine is composed of several parts: the registers, the interfaces, and the Integrity Rules Engine.



PRIMARY REGISTERS

SegPool

This register is the built-in representation of an EDI file. It interfaces directly with the file system to load and store EDI files.

HKey

This register represents an internal representation of an EDI file, laid out in hierarchical form. The process of projecting the SegPool to the HKey register is normally called *decoding*, whereas projecting from HKey to SegPool is *encoding*. HKey registers can be stored as XML files on the file system, to an internal XML register, or translated to a series of database tables where each table represents data stored in one loop.

Flat

This register represents a two-dimensional view of hierarchical data, with the data heavily repeated row after row. It is often the projected form of EDI data that is easiest to work with for normal operations.

AUXILIARY REGISTERS

SegPoolAck

This register stores a secondary SegPool completely dedicated to generating or parsing 999 Acknowledgment files. It provides a simple facility for generating transaction acknowledgments without needing to unload the primary SegPool register first.

MsgLog

This register stores all errors and messages accumulated during a workflow execution. The automation system will then normally push those messages to the BIZ_MSG table on the distribution database.

INTERFACES

Interface	Business Role
Raw EDI Files	These are the basic units of transaction containing PHI (Protected Health Information) between two enterprises.
XML	An XML-readable version of an EDI transaction enables NoSQL/XML-based database systems to ingest and process healthcare information. For enterprises that are accomplished in creating XML files, this is also an avenue to create transactions.
Hierarchical Database Tables	The HDB interface lets a transaction be split up into a number of tables, one for each loop within the transaction. Each row in each table is assigned a unique BIN ID for the whole transaction. Because the data is stored in a highly optimized way, it's ideal for high-speed decoding at the cost of a higher complexity of tracking the relationships between parent and child loops, which mirrors the way they are arranged in the implementation guides. For some transactions, creating files with logically arranged hierarchical tables may be easier than creating a flat projection of the data.
Flat Database Table	This is normally the easiest way to create or retrieve EDI transaction data, as all healthcare data for a transaction is projected into a single database table that can be queried or created. All the sample EDI transactions are created by a single stored procedure associated with each transaction to serve as a springboard for creating new transactions. This simplicity comes at the cost of highly denormalized data storage.
CSV File	This stores data in exactly the same way as the flat database table, except that it's stored in CSV files on the file system. It's provided for use with legacy enterprise systems that can only accept or export CSV data. Also, CSV files can easily be opened with Microsoft Excel.

INTEGRITY VALIDATIONS

Code Set Checks

SERENEDI does not check for code-set compliance by default. The SCORE Script command **sapi-SegPoolToHKey**, which decodes incoming EDI files can be made to do so with a command-line flag **-EnableCodeSetChecks**. The following code sets are validated during decoding:

Code Set	Source
Claim Adjustment Reason Codes	Washington Publishing Company

Remittance Adjust Reason Codes	Washington Publishing Company
Claim Frequency Codes	Washington Publishing Company
ICD-9-CM Diagnosis Codes	CMS
ICD-9-PCS Procedure Codes	CMS
ICD-10-CM Diagnosis Codes	CMS
ICD-10-PCS Procedure Codes	CMS
National Drug Codes	CMS
Provider Taxonomy Codes	Washington Publishing Company
State Abbreviation Codes	United States Post Office
ISO Country Codes	United States Post Office

These code sets are on a twice-a-year basis on the first of February and September; see the root folder of your Chiapas EDI Enterprise SecureFTP folder to obtain code set updates. Replace the existent files in the “resources” subfolder to update the codesets.

Integrity Rules Engine

SERENEDI is capable of five levels of SNIP integrity checks for incoming EDI file decoding operations. The SNIP Type checks are summarized here:

1. Integrity Testing – Basic segment and element integrity checks
2. Requirement Testing – Validating the presence of elements, segments, and loops marked as mandatory
3. Balance Testing – Testing of monetary totals across loops and transactions
4. Situational Testing – Testing of specific inter-segment situations
5. External Code Set Tests – Testing specific values being present in predefined code sets
6. Line of Business Testing

SERENEDI runs SNIP Type 1 and 2 validations automatically across all file decodes – this cannot be disabled. SNIP Type 5, External Code Set Tests, is an optional integrity check that executes during decoding. SNIP Type 3 and 4 rules are parsed using the built-in Integrity Rules Engine. These rules can only be executed after the file has been successfully decoded.

If you need to add SNIP Type 6 Line of Business rules for a particular trading partner, you have the ability to add new rules with the user-extensible rules engine.

BIN System

SERENEDI’s data storage system was designed according to the following business requirements:

1. Provide a scalable solution to ingest large amounts of EDI data across multiple SQL Server databases
2. Make this EDI data easy to access with common SQL queries and stored procedures
3. Make the data accessible in two ways:
 - a. The *Flat* BIN system is a two-dimensional, denormalized representation of heirarchical data that is the easiest to use for reading EDI data or for encoding simpler EDI files.

- b. The *Hierarchical* BIN (HDB) system stores data using tables in which data from every loop is stored in separate, linked tables. It stores data more efficiently and makes it easier to encode complex situations, at the cost of needing to track the interrelationships of the tables.

By default, SERENEDI ships with two pipelines that automatically decode files to the distribution database, 006_EDIToBIN and 007_EDIToHDB. Unless overridden, they will go to data tables that are named according to the specification of the data. An incoming 837P file will go to BIN_5010_837P for that Flat interface. For the HDB interface, it will decode to a number of tables matching the loops it contains: HDB_5010_837P_ISA, HDB_5010_837P_GSHDR, and so on.

When a workflow pulls in data during execution, the data is not immediately inserted into these destination tables. Instead, it goes to a temporary table named according to this convention:

Flat: T_<event Id>_<10-digit random number>

HDB: T_<event Id>_<increment>_<10-digit random number> for each loop in the incoming file

The background *data shuttle* process transports the data from the temp tables to the actual BIN table destinations. Unless overridden, by default, the data shuttle will alter the destination table schemas to add new data elements when they are encountered. That is, if the existing database schema does not hold the data elements needed to accommodate the information coming with the new incoming EDI file, it will be expanded so the new data can be stored. This is called a *ForceMerge* operation. The *Merge* operation will prevent the data shuttle from expanding the schema, and instead raise messages when data is encountered that cannot be stored in the existing schemas.

The data shuttle ensures that data can be streamed into a database from literally over two dozen active operations, and that the data will all reach its destination in the same way. This fulfills requirement 1.

Requirement 2 is fulfilled by having all of the decoded data in a form that is fairly straightforward to access using normal SQL. Requirement 3 is fulfilled by the two methods of data storage allowed by the BIN system.

NOTE: The background data shuttle process handles all schema alterations in real time, without needing user intervention. However, this process can be “frozen” by external factors if you use database cursors to open the BIN tables. The cursors could open up a *schema lock* that prevents the schema from being changed while the cursor is reading data. This can severely delay the speed at which SERENEDI processes data. The best practice is to access the BIN and HDB data using only set-based operations. If you need to iterate the data in a cursor, copy the rows you need into a temporary table, and then iterate those records – this way, the main BIN tables will not be locked by a long-running read operation.

Changes from Chiapas EDI Enterprise

Those of you who have experience with the previous generation of our EDI product should know that we have changed many aspects of the platform. Here are some of the biggest changes between Chiapas EDI Enterprise and SERENEDI:

1. The architecture behind the CGIF mapping technology has been heavily revamped to reduce the number of possible mappings. This was done by adding new *cutout loops* that place “solo” infinitely repeating segments into their own pseudo-loop and improve accessibility to the data in most situations. This means that many mappings in the previous version condense to fewer mappings in the new address space, and that the data can be retrieved from different table rows in both the Flat and HDB interfaces. In essence, the update made in Chiapas EDI Enterprise to handle PLB segments with a few mappings is now used throughout all specifications in SERENEDI.

2. As a result of the fewer mappings, the BIN system now defaults to a ForceMerge as the primary mode of functionality. New columns are automatically added to the BIN table as they occur, by default, and this is seamlessly handled by the automation system running at full volume.
3. Windows Workflow Foundation has been replaced with PowerShell Core as the main scripting system for SERENEDI. PowerShell Core is completely supported cross-platform, whereas Windows Workflow Foundation could only function on Windows platforms and also experienced very limited adoption. PowerShell Core, implemented in SERENEDI as *SCORE Scripts*, is a completely cross-platform way to execute workflows.
4. SERENEDI Studio is now entirely a client-hosted intranet application as opposed to a locally installed Windows Presentation Foundation application. This mitigates the need for local client installations. The GUI is now a web page that can be accessed by default locally from the server, or externally from the server if further setup is done.

Pipelines

The built-in pipeline system is designed to be a highly accessible, easy-to-use method to access the core conversions without needing to directly program the SERENEDI system. Here, a *pipeline* specifically means a business process associated with both a SCORE script and one or more triggers in the automation system. Generally, SCORE scripts have code to “bootstrap” the environment – that is, to set up the folders and triggers.

After SERENEDI is set up but prior to the background SERENEDIService being activated, there is only a single SCORE Script named Pipeline.ps1 in the Pipeline folder, as the bootstrap sequence has not been executed yet. Once the service is started, the SCORE script will run the bootstrap sub-module and create a number of both folders and triggers. All execution flow goes into that same Pipeline.ps1 SCORE script, but different parameters are used to execute the various triggers.

In most cases, actually using the pipelines is pretty simple – just drop new files into the incoming folder for each pipeline. The action of moving the file from the *in* folder to the *out* folder “unlocks” the file and gets it ready to be processed. If there is a critical integrity error in the file, the source file is moved from the 02_done folder to the 04_err folder.

QUICK START

To quickly demo the functionality of SERENEDI, you can execute the following steps. First, from a file explorer window on the SERENEDI server, make a copy of the SERENEDI/seed folder and put the copies into the first incoming folder, C:\serenedi\pipeline\001_Normalize\01_in_edi (base folder depends on the installation option). Then, move the 14 files that result from this operation, that are generated in the 03_out_edi folder, into the *in* folder of the next pipeline in sequence. Skip Pipeline 006 and drop the results of the *out* folder from Pipeline 005 directly to the *in* folder for Pipeline 007. Wait one minute for the data to be completely finalized in the BIN system.

Then, open the user interface from the local server via <http://127.0.0.1:5000> (default install option), go to the Endpoints screen, select the left menu bar, and then enter the following in the AD-HOC SQL window:

```
INSERT INTO BIZ_EVENT (BIZ_TRIGGER_ID, EVENT_DATA1, EVENT_DATA3) SELECT (SELECT BIZ_TRIGGER_ID FROM
BIZ_TRIGGER WHERE TRIGGER_NAME = 'PIPE008_BINToEDI'), BIN_ID, 'PIPE008_BINToEDI' FROM BIN_LOG WHERE
BIN_STATUS = 'COMPLETE' AND BIN_TYPE = 102
```

The above actions will convert all seed files to CSV files, and then back to EDI files; convert the results to XML files, and then back to EDI files; convert the results of that operation to the HDB BIN system; and finally, pull the HDB data back into EDI files, completing a tour of all of the supported *projection* operations of the engine. As long as the original files are HIPAA compliant, they should still be the same size and content as the files resulting from the first Normalize operation.

Pipeline 001: Normalize

Pipeline	Type	Purpose
001: Normalize	Upload	Reformat incoming EDI files so that they have consistent separator characters and line feeds between segments.

Initial: \serenedi\pipeline\001_Normalize\01_in_edi

Finished: \serenedi\pipeline\001_Normalize\02_done_edi

Output: \serenedi\pipeline\001_Normalize\03_out_edi

Error: \serenedi\pipeline\001_Normalize\04_err_edi

Parameters:

EVENT_DATA1: full path to filename of the EDI file

EVENT_DATA3: PIPE001_NORMALIZE

This pipeline decodes and then immediately *re-encodes* an EDI file. It will set all segment and element terminators to default values, and add a carriage return and line feed after every segment. Any syntactically invalid elements that do not pose a critical error will be discarded – for example, a qualifier/identifier pair where either the qualifier or the identifier is missing. This “normalizing” process is useful to ensure a set of files have homogenous formatting and can be easily read in a text editor.

Pipeline 002: CSVFromEDI

Pipeline	Type	Purpose
002: CSVFromEDI	Upload	Convert incoming EDI files to CSV format.

Initial: \serenedi\pipeline\002_CSVFromEDI\01_in_edi

Finished: \serenedi\pipeline\002_CSVFromEDI\02_done_edi

Output: \serenedi\pipeline\002_CSVFromEDI\03_out_csv

Error: \serenedi\pipeline\002_CSVFromEDI\04_err_edi

Parameters:

EVENT_DATA1: full path to filename of the EDI file

EVENT_DATA3: PIPE002_EDIToCSV

This pipeline converts incoming EDI files to a CGIF2-formatted CSV file. The resulting file will enclose all values within quotes and have a header row containing the column names. The first column name will be prefixed by the specification tag. The destination filename will be the same as the source filename, except with a .CSV extension.

Pipeline 003: CSVToEDI

Pipeline	Type	Purpose
003: CSVToEDI	Upload	Convert incoming CGIF2 flat-formatted CSV files to EDI.

Initial: \serenedi\pipeline\003_CSVToEDI\01_in_csv

Finished: \serenedi\pipeline\003_CSVToEDI\02_done_csv
Output: \serenedi\pipeline\003_CSVToEDI\03_out_edi
Error: \serenedi\pipeline\003_CSVToEDI\04_err_csv

Parameters:

EVENT_DATA1: full path to filename of the CSV file
 EVENT_DATA3: PIPE003_CSVToEDI

This pipeline executes the reverse of the 002 pipeline, converting a CGIF2-formatted CSV file back to EDI. If the file cannot be successfully converted to EDI, it will be placed in the 04_err folder. The EDI file will inherit the same filename as the CSV file, except with a .txt extension.

Pipeline 004: XMLFromEDI

Pipeline	Type	Purpose
004: XMLFromEDI	Upload	Convert incoming EDI files to CGIF2-formatted XML files.

Initial: \serenedi\pipeline\004_XMLFromEDI\01_in_edi
Finished: \serenedi\pipeline\004_XMLFromEDI\02_done_edi
Output: \serenedi\pipeline\004_XMLFromEDI\03_out_xml
Error: \serenedi\pipeline\004_XMLFromEDI\04_err_edi

Parameters:

EVENT_DATA1: full path to filename of the EDI file
 EVENT_DATA3: PIPE004_XMLFromEDI

This pipeline projects incoming EDI files into CGIF2-formatted XML files. The files generated will begin like this:

```

<?xml version="1.0" encoding="utf-8" standalone="yes"?>
<CGIFXML3Root_U0 xml:space="preserve">
... edi data...
</CGIFXML3Root_U0>
  
```

The **U0** will be replaced with the actual specification tag for this file.

Pipeline 005: XMLToEDI

Pipeline	Type	Purpose
005: XMLToEDI	Upload	Convert incoming XML files to EDI.

Initial: \serenedi\pipeline\005_XMLToEDI\01_in_xml
Finished: \serenedi\pipeline\005_XMLToEDI\02_done_xml
Output: \serenedi\pipeline\005_XMLToEDI\03_out_edi
Error: \serenedi\pipeline\005_XMLToEDI\04_err_xml

Parameters:

EVENT_DATA1: full path to filename of the XML file
EVENT_DATA3: PIPE005_XMLToEDI

This pipeline converts incoming XML files to EDI. If the file does not adhere to the CGIF XML rules, then the conversion will fail and the XML file will be placed in the 04_err folder. The filename will be the same as the source XML except with a .txt suffix.

Pipeline 006: EDIToBIN

Pipeline	Type	Purpose
006: EDIToBIN	Upload	Load an incoming EDI file to the Flat BIN system.

Initial: \serenedi\pipeline\006_EDIToBIN\01_in_edi
Finished: \serenedi\pipeline\006_EDIToBIN\02_done_edi
Error: \serenedi\pipeline\006_EDIToBIN\03_err_edi

Parameters:

EVENT_DATA1: full path to filename of the EDI file
EVENT_DATA3: PIPE006_EDIToBIN

This pipeline ingests files into the Flat BIN system built into SERENEDI. If the BIN table does not exist, it will be created. If the table exists but certain mapped fields are not present, the fields will be added. The EDI file will be assigned a unique BIN_ID defined in the BIN_LOG table.

The default table name is BIN_5010_<specification short name> (example: BIN_5010_837P)

This pipeline is geared toward ingesting large amounts of data into the BIN system, so it doesn't wait for the data to go into the destination tables – instead, it places the data into a marked temporary table and immediately exits. To see if the data for this event is finalized in the BIN system, you'll need to look up the BIZ_EVENT_ID in the BIN_LOG table and see if the BIN_STATUS is COMPLETE. When that occurs, the data is available in the destination BIN table, which is listed in the BIN_TABLE field.

Pipeline 007: EDIToHDB

Pipeline	Type	Purpose
007: EDIToHDB	Upload	Loads an incoming EDI file to the HDB BIN system.

Initial: \serenedi\pipeline\007_EDIToHDB\01_in_edi
Output: \serenedi\pipeline\007_EDIToHDB\02_done_edi
Error: \serenedi\pipeline\007_EDIToHDB\03_err_edi

Parameters:

EVENT_DATA1: full path to filename of the EDI file
 EVENT_DATA3: PIPE007_EDIToHDB

This pipeline ingests files into the HDB BIN system built into SERENEDI. The HDB stores data hierarchically, with one table present for each loop and all tables joined by keys.

The default table names are HDB_5010_<specification short name>_<loop short name>

For example, the seed 834 file will decode to the following tables:

HDB_5010_834_ISA	HDB_5010_834_L1000B
HDB_5010_834_GSHDR	HDB_5010_834_L2000
HDB_5010_834_STHDR	HDB_5010_834_L2100A
HDB_5010_834_L1000A	HDB_5010_834_L2300

These tables will be prefixed by two to four fields, depending on the situation. For ISA tables, only the BIN_ID and BIN_IX (BIN Index) fields are used. For all other tables, a PAR_BIN_IX relates that loop to its parent loop table. For L2300 tables for 837 Institutional and 837 Professional specifications only, an optional PAR_2000C_IX field also relates claims to a specific 2000C patient loop.

Similar to what was described in the previous pipeline for the Flat BIN system, this pipeline will place data into a number of temp tables before actually populating the destination tables. Once all the temp table data has been migrated to the destination tables by the background data shuttle process, the BIN_LOG entry for this file will be changed to COMPLETE.

Pipeline 008: BINToEDI

Pipeline	Type	Purpose
008: BINToEDI	Upload	Retrieves EDI data from either the Flat or HDB system identified by the BIN_ID and encodes it to an EDI file to the filesystem.

Output: \serenedi\pipeline\008_BinToEDI\01_out_edi

Parameters:

EVENT_DATA1: BIN_ID of the file to pull from the BIN system, or a SELECT or EXEC SQL statement for a dynamically generated FLAT-formatted extract
 EVENT_DATA2: **OPTIONAL:** full path and filename of the EDI file to create
 EVENT_DATA3: PIPE008_BINToEDI

This pipeline will pull data from a completed Flat BIN or HDB BIN and create a new EDI file. By default, the filename will follow the BIN_FILENAME listed in the BIN_LOG table and be placed in the 01_out_edi folder. This can be overridden by placing a fully pathed filename in EVENT_DATA2. Files that are encoded in either the Flat BIN or HDB BIN can be extracted with this pipeline.

Here’s an example of the SQL you would need to execute to generate a single file that was previously decoded to the BIN system:

```
INSERT INTO BIZ_EVENT(BIZ_TRIGGER_ID, EVENT_DATA1,EVENT_DATA3) SELECT
BIZ_TRIGGER_ID,<<BIN ID>>,'PIPE008_BINToEDI' FROM BIZ_TRIGGER WHERE
TRIGGER_NAME='PIPE008_BINToEDI'
```

To supply a name and location for this file and override the defaults, it should be supplied in EVENT_DATA2 as follows:

```
INSERT INTO BIZ_EVENT(BIZ_TRIGGER_ID, EVENT_DATA1, EVENT_DATA2, EVENT_DATA3) SELECT
BIZ_TRIGGER_ID, <<BIN ID>>, 'c:\SERENEDI\OUTPUT.TXT', 'PIPE008_BINToEDI' FROM
BIZ_TRIGGER WHERE TRIGGER_NAME='PIPE008_BINToEDI'
```

If a non-numeric value is supplied in EVENT_DATA1, this pipeline will assume it is dynamic SQL tied to the distribution database. Here's an example of regenerating the seed_837p.txt file from the sample data built into the system:

```
INSERT INTO BIZ_EVENT(BIZ_TRIGGER_ID, EVENT_DATA1, EVENT_DATA2, EVENT_DATA3) SELECT
BIZ_TRIGGER_ID, 'EXEC USP_837P_EXTRACT', 'c:\SERENEDI\SEED_837P.TXT', 'PIPE008_BINToEDI'
FROM BIZ_TRIGGER WHERE TRIGGER_NAME='PIPE008_BINToEDI'
```

Pipeline 009: Integrity

Pipeline	Type	Purpose
009: Integrity	Upload	Decodes an EDI file with all integrity and codeset checks enabled.

Initial: \serenedi\pipeline\009_Integrity\01_in_edi
Finished: \serenedi\pipeline\009_Integrity\02_done_edi
Output: \serenedi\pipeline\009_Integrity\03_integ_html
Error: \serenedi\pipeline\009_Integrity\04_err_edi

Parameters:

EVENT_DATA1: filename of the EDI file to check
EVENT_DATA3: PIPE009_INTEG

This pipeline decodes an incoming EDI file with full code-set checks, and then executes the Integrity Rules Engine to perform a deeper rule validation on the file. This pipeline is currently supported only for specifications 834, 835, 837 P, and 837 I.

Pipeline 010: Event

Pipeline	Type	Purpose
010: Event	Upload	Creates an event based off of an XML file, then writes messages to an output XML file sharing the same filename with a .result suffix.

Initial: \serenedi\pipeline\010_Event\01_in_xml
Finished: \serenedi\pipeline\010_Event\02_done_xml
Output: \serenedi\pipeline\010_Event\03_msg_xml
Error: \serenedi\pipeline\010_Event\04_err_xml

Parameters:

EVENT_DATA1: filename of the XML file containing EVENT information
EVENT_DATA3: PIPE010_EVENT

This pipeline allows you to create a new event in the automation system using a specially crafted XML file. It will parse out the arguments of the XML file, insert them into the automation system, wait for completion, and then output the messages generated by that workflow in the 03_msg_xml folder. The message result file bears the original filename with a .result suffix added to the filename.

Pipeline 011: 275C Decode

Pipeline	Type	Purpose
011: 275C Decode	Upload	This pipeline's purpose is to decode a 5010 275C file that stores a MIME-encoded .PNG image file, and split it into two files: an XML that stores the EDI information, and a PNG image file.

Initial: \serenedi\pipeline\011_275C_DECODE\01_in_edi
Finished: \serenedi\pipeline\011_275C_DECODE\02_done_edi
Output: \serenedi\pipeline\011_275C_DECODE\03_out_bin

Parameters:

EVENT_DATA1: filename of the 275C EDI file

This pipeline is meant to be a starting point for developing your own business processes involving decoding 275C Patient Information files. Specifically, it will extract the embedded MIME embedded binary file as a separate output.

The pipeline script executes the following actions:

1. Decode the EDI and translate it to the internal SERENEDI Flat register
2. Convert the Flat register into a .NET Datable object
3. Extract the original MIME filename and push it out as a message (to the BIZ_MSG table), prefixed by "Original MIME filename: "
4. Store the binary attachment to the 03_out_bin folder, using the original EDI filename but with a PNG extension
5. Remove the MIME fields, translate the EDI to XML and store the XML file in the 03_out_bin, using the original filename but with an XML extension

Pipeline 012: 275C Encode

Pipeline	Type	Purpose
012: 275C Encode	Upload	This pipeline's purpose is to encode a 5010 275C SERENEDI XML encoded file along with a provided PNG file, and output a single EDI file in the output folder

Initial: \serenedi\pipeline\012_275C_ENCODE\01_in_xml
Finished: \serenedi\pipeline\012_275C_ENCODE\02_done_xml
Output: \serenedi\pipeline\012_275C_ENCODE\03_out_edi

Parameters:

EVENT_DATA1: filename of the 275C XML file

This pipeline is meant to be a starting point for developing your own business processes for creating outbound 275C Patient Information files, and enables you to encode arbitrary PNG image files as embedded MIME encoded binaries within the EDI file. The PNG file should be placed in the 02_done_xml folder *prior* to a 275C XML file being placed in the 01_in_xml folder, and it should share the same base filename as the XML file. Furthermore, the XML file should not have any MIME fields – if they exist, they will be overwritten. The workflow executes the following steps:

1. Convert the 275C SERENEDI-mapped XML file into an internal SERENEDI Flat register
2. Read in the PNG file from disk and set the internal maps for MIME Type, MIME Disposition, and MIME Attachment fields.
3. Convert the Flat register to an EDI file, then store it in the outgoing 03_out_edi folder, removing the .xml extension in the outgoing filename.

Pipeline: SFTP_MIRROR

Pipeline	Type	Purpose
SFTP_MIRROR	SQL	Provide file mirroring for all triggers linked to a SecureFTP session.

This is an SQL-triggered pipeline that periodically *mirrors* the local and remote file systems for triggers that are tied to a SecureFTP session. This mirroring operation can be tested with the SERENEDI Studio GUI under the SFTP Session menu bar.

It works by actively scanning the BIZ_TRIGGER table for passive, enabled triggers that are linked to a SecureFTP session. These SFTP mirror triggers need to have the local synchronization directory in the FORCE_ARG3 field, and the remote synchronization directory in the FORCE_ARG4 field. The LAST_POLL_DT and POLL_INTERVAL are used by this pipeline to control the polling of these SecureFTP directories. The actual direction of the synchronization is controlled by the SFTP session itself.

Since SFTP operations can take a minute or more, it's best to set the POLL_INTERVAL on the SFTP triggers to 900 or more (15+ minutes) so the remote SecureFTP server is not bombarded by refresh requests.

SERENEDI Studio

SERENEDI Studio is the graphical user interface for SERENEDI. It fulfills a number of requirements:

- Test the validity of EDI files and transformations
- Provide an interactive interface for testing and learning about the various registers and projections
- Show the SCORE scripting system in action so end users can learn how to script their own workflows
- Review and edit the automation triggers, and see recently triggered events and messages
- Examine the BIN system and what data is stored there
- Review and edit the SecureFTP sessions, and test folder mirror operations

SERENEDI Studio is accessible by default at <http://localhost:5000> – this means it will only respond to browser requests originating from the server itself. Since SERENEDI Studio gives extensive access to the local file system, this is done for security reasons. SERENEDI Studio can be completely disabled (as shown in the installation instructions).

Like the rest of SERENEDI, SERENEDI Studio does not need external internet access to function – the server can be completely firewalled from all internet access and it will continue to function normally.

This interface is best run at 1920 x 1080 in a web browser. It is fully tested with Chrome and the latest Microsoft Edge browser. For best results, press the Fullscreen button to remove the various browser interface elements (F11 on Chrome and many browsers). The server can be accessed by multiple people at once, and each session will have its own dedicated instance of the SERENEDI engine. The triggers, endpoints, BIN system, and SFTP sessions are shared among all sessions.

The left side of the screen is the NavBar, used to switch between various functions of SERENEDI Studio. The two light blue areas on the left is the Information pane and the Control pane. These give information about the current state, provides register control buttons, and gives a small tabbed interface covering additional options. The top blue area is the RunBox, which shows the SCORE commands generated and executed in response to all GUI activities. It also shows the results of these operations. The red area is the Flat Register pane, showing the current state of the Flat register. The green area is the SegPool Register, and the purple area is the HKey register.

SERENEDI Studio is oriented to operating on a single encode or decode operation at a time, and it functions to give you as much information as possible about what is occurring throughout the environment. If you need to work on a different file within the same session, you should press the RESET button so that the internal environment registers are cleared. Alternatively, you can reload the browser, which will also reset all session information.

Control Pane

The Control pane is split into three sections: the info panel (top), the register control buttons (middle), and a tab panel (bottom) that fulfills various functions.

The **info panel** displays information about the current engine state: how many segments are loaded into the SegPool register, whether the HKey is loaded and with what specification of data, the number of columns and rows loaded in the Flat register, and the number of messages in the message log.

The **register control buttons** control the major conversion functions. First, the RESET button will clear all registers and refresh all panes so the engine can be used on another major file operation. SEG > HKEY will decode the SegPool to the HKey register, while SEG < HKEY encodes the HKey to the SegPool. HKEY > FLAT projects the HKEY to the Flat register, and HKEY < FLAT projects the Flat register to the HKEY register. Non-critical errors that occur during decoding will be shown in the SegPool pane.

The **tab control** flips between five tabs. The MAPS tab accompanies the Flat pane to show more detail about the currently selected mapping and allows you to fully look up the element in the HIPAA Implementation Guides or the SERENEDI mapping documentation. If SERENEDI can “parse” the actual value underneath the cursor – for example, an NDC code or an ICD-10-CM diagnosis code – it will show that information in this box as well. The SEG, HKEY, and FLAT tabs control functions related to those specific registers. The BIN tab allows loading and saving to the SERENEDI BIN system, and the ACK tab provides functionality related to the ACK register.

STATE INFO
HKey: 5010_837I_A2
Flat: 106x00000889
SegPool: 7163 segs
Messages: 11 msgs

CONTROL

RESET

SEG > HKEY SEG < HKEY

HKEY > FLAT HKEY < FLAT

MAPS	SEG	HKEY	FLAT	BIN	ACK
Element	Value				
MAP	L2400_SV203_LIN_ITM_CHG_AMT				
VALUE	115				
VALID	Y				
LOOPTYPE	Standard				

SEG Interface

The SEG tab is used in conjunction with the SegPool Register pane, and enables you to load and save the contents as well as search for keyphrases in the loaded SegPool.

To load an existing EDI file, double click area with the grey words “SegPool to Load”. The following dialog will pop up:



The default location of all File Dialogs is the pipeline folder. Pressing the ‘.’ will ascend a folder level, and clicking on directories will descend to that folder. You cannot ascend above the ‘shared’ folder level within the dialog. You can select a file and press ‘OK’, or double click the file – both will load the filename into the input box. Press ‘Select Folder’ to select the current folder, or Cancel to exit the dialog without selecting anything.

MAPS **SEG** HKEY FLAT BIN ACK

C:\serenedi\shared\seed\seed_837i.txt

LOAD SEG **SAVE SEG**

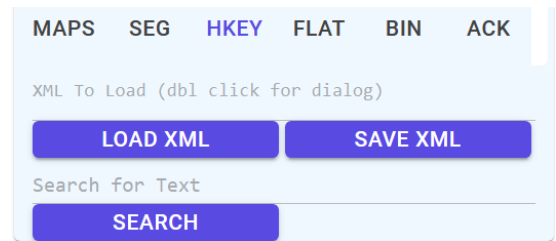
Search for Text

SEARCH

When the SegPool is loaded, you can type a search phrase into the “Search for Text” input box and then press the SEARCH button to search for successive occurrences of that text within the loaded EDI File.

HKEY Interface

The HKEY tab is used in conjunction with the HKEY register pane, which displays the EDI file in an XML format. Just like the previous tab, double-clicking the input box will bring up a file dialog to load an existing XML file, or allow you to select a folder. Save XML will save the loaded HKEY to an XML file on the system, and typing in a search term and pressing SEARCH will search through the contents of the XML file for successive occurrences of the search term.



FLAT Interface

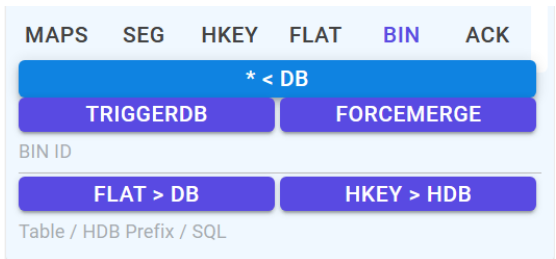
The FLAT tab is used in conjunction with the FLAT register pane, and supports loading and saving the FLAT register as CSV files.



BIN Interface

The BIN tab allows you to interact with the BIN system and consists of four buttons and two text boxes.

TriggerDB is a button that switches between different database endpoints configured in the Endpoints interface. This allows you to send Flat or HDB BINs to different SQL Server databases. Simply clicking the button will advance through the list of defined endpoints. Database endpoints are configured within the DB Endpoints interface that is available via the Navbar on the left side of the screen.



The **FORCEMERGE / FORCE** button is a toggle between two different modes – Force Merge and Merge. Force Merge requests the background data shuttle process to extend the schema of the destination BIN tables for any additional mappings that are not already present. Merge requests will *not* extend the schema, so additional EDI elements that are not present in the schema will be lost. By default, all operations use the FORCEMERGE system.

The **Retrieve BIN (* < DB)** button works in conjunction with the BIN ID textbox below the button. If the BIN ID is populated, then the interface will load either the Flat or HKey register, depending on if the corresponding BIN was stored as a Flat or an HDB tableset. If these BINs are not available, a modal popup will appear instead.

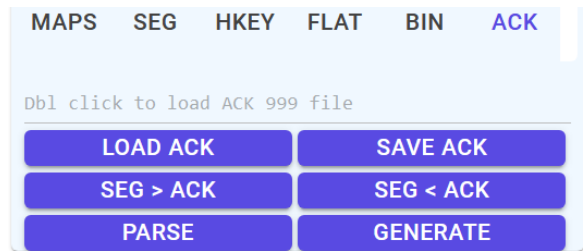
The bottom **Data Source** textbox has multiple purposes. If it is populated with the name of a table or starts with EXEC or SELECT, then this information can be used in conjunction with * < DB button to load the table, the contents of the stored procedure, or the SELECT query, respectively. Alternatively, if it is populated with a table name, the FLAT > DB button will store the FLAT register to the indicated table and create a new BIN ID entry, which is displayed in the BIN ID textbox.

If you press the HKEY > KDB button and the HKEY register is loaded, the Data Source textbox will instead provide a prefix to storing a set of hierarchical database tables (HDB). If the textbox is empty, default names will be used.

ACK Interface

SERENEDI has the ability to automatically generate 999 Acknowledgment transactions as well as parse existing 999s. The ACK register is similar to a SegPool register in that it stores a single 999 EDI file. Although the SegPool *can* load and save

999 transactions and therefore enable very customized scenarios, the ACK register is provided as a simple facility to generate “Accept” or “Reject” transactions depending on the outcome of a SegPool decode operation.



The **ACK File Text Box** allows you to specify the path to a 999 acknowledge file. If you double-click the text box, a file dialog will pop up and allow you to load in a file that exists on the server file system, or to upload a file from your *client* file system to the remote one. Alternatively, you can supply the name of a file that you will be generating in another step.

The **Load ACK** button loads the ACK register with whatever file is selected in the ACK File text box.

The **Save ACK** button will save the ACK register (as long as it’s loaded) to the file indicated in the ACK File text box.

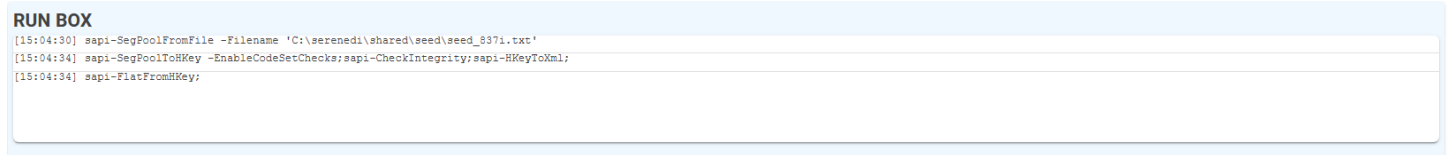
The **SEG > ACK** button allows you to pull the SegPool register to the ACK register, so long as it is a 999 file. This lets you create custom 999s user other parts of the environment, transfer the SegPool to the ACK register, reload a different SegPool, and then parse the 999 against that new SegPool and verify the results.

The **SEG < ACK** button allows you to pull the ACK register into the SegPool register. You can then commit that 999 to the BIN system or analyze it in the various Studio interfaces.

The **Parse** button will parse the 999 against the loaded SegPool register. For example, if a trading partner generates a 999 message in response to a file you sent, this operation will generate a series of messages that you could then use to analyze why the transaction was rejected, and where.

The **Generate** button will take the result of the last decode operation (a SegPool to HKey projection) and automatically generate a simple 999 transaction depending on what happened. If the decode operation was successful, it will generate a 999 showing all the transactions as Accepted. If the decode failed, it will generate an overall Rejection 999 and show exactly what line and segment resulted in the decode failure.

Runbox



The RunBox gives a running display of all SERENEDI Studio operations in the form of SCORE script commands. Since all the buttons interface to the environment using these commands, it gives you a history of your activity within the interface as well as a way to learn to execute these functions through the automation system. If any messages are generated during the execution, they will be displayed at the bottom.

Flat Pane

FLAT REGISTER					
L2010CA_N402_PT_STAT	L2010CA_N403_PT_ZIP	L2010CA_DM02_D8	L2010CA_DM03_PAT_GNDR_CD	L2300_CLM01_PT_CTL_NR	L2300_CLM02_TOT_CLM_CHG_AMT
CA	94117	1904-04-01	F	PAT00037690	2355
CA	94117	1904-04-01	F	PAT00037690	2355
CA	94117	1904-04-01	F	PAT00037690	2355
CA	94117	1904-04-01	F	PAT00037690	2355
CA	94117	1904-04-01	F	PAT00037690	2355
CA	94117	1904-04-01	F	PAT00037690	2355

Enter Column Filter: L2300_CLM01_PT_CTL_NR: 'PAT00037690' X

The FLAT register pane displays the contents of the Flat register. Use the sliding control at the bottom to view different columns; use the scrollbar at right to scroll through the dataset. When you click on a cell, information about both the mapping of that cell and the data it contains is displayed in the Info Panel part of the Control Panel.

The **Column Filter** text box allows you to focus on a limited set of rows from the register. First, click on a mapping, then enter a value into the Column Filter text box. This will create a filter that displays only the rows for which the column matches the given value. Another way to do this is to double-click on any cell, and a column filter will automatically be generated against the data stored in that cell. Whenever a column filter is added, an orange X is displayed to allow you to remove the last column filter added. Up to three column filters can be active at one time. Adding or removing filters will automatically regenerate the displayed data.

MAPS	SEG	HKEY	FLAT	BIN	ACK
Element	Value				
MAP	L2300_CLM01_PT_CTL_NR				
VALUE	PAT00037690				
VALID	Y				
LOOPTYPE	Standard				

The mapping info pane to the left of the Flat pane displays information about the currently selected mapping. This makes it easier to look up in both the SERENEDI mapping documentation as well as the HIPAA implementation guides. It displays these values:

Map – This is the CGIF V2 map this column is linked to. Following this is the HIPAA EDI data type for this element: AN for string, NO for number, DT for Date/Time, TM for Time, and R for floating-point number or

money.

Value - Value. This will display both the name of the value, and, if the value is given a defined name in either the implementation guides or the SERENEDI-supported code sets, that value name is given here.

Valid – This is “Y” if this is a valid SERENEDI mapping, “N” otherwise.

LoopType - The type of the loop associated with this mapping, as described in the SERENEDI User Manual

LoopCutout – This is “Y” if the loop is a special case “cut out” which helps SERENEDI encode special segment data that can repeat numerous times, such as CAS segments.

LoopNm – Name of the Loop

LoopRpt - Valid repeats of the loop

LoopReq - “Y” if the Loop is required, “N” otherwise

SegType – Segment Type

SegRpt – Allowed Segment Repetitions

SegReq – Segment Required?

SegCd – 2-3 digit Segment Code

SegNm – Segment Name

SegPos – Segment Position

XSENm – Element Name

XSEReq – Element Required?

XSEUnused – Element Unused?

SubXSE – Is this is a composite element?

EleRpt – Allowed Element Repetitions

EleMinChar – Minimum characters allowed in element

EleMaxChar – Maximum characters allowed in element

EleType – Data type of Element

SegPool Pane

The **SegPool Pane** displays the current state of the SegPool register. If the SegPool is initially loaded, it will display the line number in blue and the segments and elements in black. If the SegPool has been decoded, additional information about the loop will be displayed in blue, and any integrity errors will be displayed in red.

SEGPPOOL REGISTER	
0000001	ISA 00 01 22 SAMPL_SENDRID.. 22 SAMPL_RECVRID.. 191116 1439 ^ 00501 100000067
0000002	GSHDR G8 HC SENDER_ID RECVR_ID 20191116 1439 1 X 005010X223A2
0000003	STHDR ST 837 100000001 005010X223A2
0000004	STHDR BHT 0019 00 BAT1000000 20191116 1439 CH
0000005	L1000A NM1 41 2 LOWEST BIDDER HMO ... 46 150001342
0000006	L1000A FER IC SAMPLE TE 4155551212
0000007	L1000B NM1 40 2 BUY 1 GET 1 FREE HEALTHCARE ... 46 1234567885
0000008	L2000A HL 1 20 1
0000009	L2010AA NM1 85 2 LOWEST BIDDER HMO ... XX 1234568917
0000010	L2010AA N3 400 FICTION ST
0000011	L2010AA N4 SAN FRANCISCO CA 941170001
0000012	L2010AA REF EI 150001342
0000013	L2000B HL 2 1 22 0
0000014	L2000B SBR P 16 GRP0001 ... HM

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The pager controls at the bottom allow you to traverse through the SegPool contents. Searching through the SegPool is performed via the Seg tab in the control group.

HKEY Pane

The HKey Pane displays the contents of the HKey register in an XML format. Searching through the XML document is performed in the HKEY control tab, and traversing through the contents of the file is performed via the paging controls at bottom.

HKEY REGISTER	
0000001	<CGIFXML3Root_W2>
0000002	<ISA>
0000003	<ISA02_NO_AUTH_NFO>.....</ISA02_NO_AUTH_NFO>
0000004	<ISA04_PSSWD>.....</ISA04_PSSWD>
0000005	<ISA06_MUTLY_DEF>SAMPL_SENDRID..</ISA06_MUTLY_DEF>
0000006	<ISA08_MUTLY_DEF>SAMPL_RECVRID..</ISA08_MUTLY_DEF>
0000007	<ISA09_INTCHG_DT>191116</ISA09_INTCHG_DT>
0000008	<ISA10_INTCHG_TM>1439</ISA10_INTCHG_TM>
0000009	<ISA11_REPTN_SEP>~</ISA11_REPTN_SEP>
0000010	<ISA12_ICN_VERS_NR>00501</ISA12_ICN_VERS_NR>
0000011	<ISA13_ICN>100000067</ISA13_ICN>
0000012	<ISA14_ACK_REQ>0</ISA14_ACK_REQ>
0000013	<ISA15_ICN_USG_IND>P</ISA15_ICN_USG_IND>
0000014	<ISA16_COMP_ELE_SEP></ISA16_COMP_ELE_SEP>

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Triggers/Events Interface

The screenshot displays the Triggers/Events interface. On the left, the **TRIGGERS** pane shows a table of triggers:

ID	Name	Type
1	PIPE001_NORMALIZE	LOCAL_UPLOAD
2	PIPE002_CSVFromEDI	LOCAL_UPLOAD
3	PIPE003_CSVtoEDI	LOCAL_UPLOAD
4	PIPE004_XMLFromEDI	LOCAL_UPLOAD
5	PIPE005_XMLtoEDI	LOCAL_UPLOAD
6	PIPE006_EDITtoIN	LOCAL_UPLOAD
7	PIPE007_EDITtoHDB	LOCAL_UPLOAD
8	PIPE008_BINToEDI	PASSIVE
9	PIPE009_INTRO	LOCAL_UPLOAD
10	PIPE010_EVENT	LOCAL_UPLOAD
11	SFTP_MIRROR	SQL

The **TRIGGER DETAIL** pane shows details for trigger **PIPE007_EDITtoHDB**, which is **Enabled** and has a **LOCAL_UPLOAD** type. The configuration includes:

- Trigger Name: PIPE007_EDITtoHDB
- Score Script: \$Pipeline.ps1
- Init Dir: \$\\007_EDITtoHDB\01_in_edi
- Source Dir: \$\\007_EDITtoHDB\02_done_edi
- Last Fire Time: 1/9/2024
- Polling Interval: 30
- Max Workers: (empty)
- Args: ARG 1, ARG 2, ARG 3 (PIPE007_EDITtoHDB), ARG 4
- Filter: (empty)
- Trigger SQL: (empty)

The **EVENTS** and **EVENT DETAILS** panes are currently empty.

The Triggers/Events interface provides a window into the automation system and all the triggers, events, and messages. Triggers can be added, edited, and deleted, and you can view recent events as well as the messages generated during an event. This section is not meant to provide the full workings of the trigger and automation systems – instead, it defines all the controls that you as a user can manipulate, and the technical section on the automation system will go more deeply into the actual functioning of the trigger system.

The **Triggers** pane in the upper left (outlined in orange) is a view of all triggers defined in the automation system. Clicking on a trigger here will highlight it and the data for that trigger will be displayed in the **Trigger Detail** pane, outlined in blue. Events that have been fired by that trigger – sorted in time-descending order – are listed in the **Events** pane, outlined in green. Clicking on a specific event will display more detail about that event in the **Detail** pane, outlined in gray, and any messages that occurred during that event will be displayed below in the **Event Messages** pane.

Triggers

The Triggers pane allows you to view all the triggers defined in the automation system (the BIZ_TRIGGER) table. Click on a trigger to bring up the trigger editor on the right. Triggers can be sorted by ID, name, and type by clicking on the row header.

Trigger Detail

The screenshot shows the **TRIGGER DETAIL** interface for trigger **PIPE007_EDITtoHDB**. It includes a **UPDATE** button and a **Trigger Name** field. The configuration is as follows:

- Trigger Name: PIPE007_EDITtoHDB
- Score Script: \$Pipeline.ps1
- Init Dir: \$\\007_EDITtoHDB\01_in_edi
- Source Dir: \$\\007_EDITtoHDB\02_done_edi
- Last Fire Time: 1/9/2024
- Polling Interval: 30
- Max Workers: (empty)
- Args: ARG 1, ARG 2, ARG 3 (PIPE007_EDITtoHDB), ARG 4
- Filter: (empty)
- Trigger SQL: (empty)

The SERENEDI automation system is highly versatile, enabling a rich set of criteria used in creating events. The Trigger Detail pane exposes these criteria to you via this interface.

The top row starts with the **Button Bar** – this control gives you the option to commit changes, add a new trigger, or delete a trigger. Triggers cannot be deleted if there are any associated events in the BIZ_EVENT table – which in turn cannot be removed if there are associated BIN_LOG or BIZ_MSG entries. To create a new trigger, first press the + button on the left of the update bar, enter the information pertaining to the trigger, and then press UPDATE. This will commit the new trigger’s information to the environment, although you will have to re-select it in the Trigger interface to make further edits. Once you do, just click the Update button again, and they will be committed to the distribution database.

To make changes to the triggers, you can adjust the options presented on-screen, but they will *not* go into immediate effect. Any changes you make will only be on “in-memory” copies of the triggers, and the changes will not be committed to the database until you press the Update button.

To delete a trigger, it must not have any related BIZ_EVENT entries – these must be deleted (along with messages in the BIZ_MSG table) before the trigger can be removed. The first time you click the - button, a modal dialog will pop up informing you that you must press it a second time before the trigger can be deleted.

Button bars are used throughout the SERENEDI Studio interface, and they all work the same way.

The **Trigger Name** field allows you to provide a name for the trigger. The **Enabled** checkbox controls whether the trigger is active or not – the automation system will completely ignore disabled triggers for the purposes of generating new events. Next to this is the **Trigger Type** pulldown menu. It contains the following options:

PASSIVE – Passive triggers do not themselves generate events, but do allow events generated from other sources to execute the SCORE script associated with this trigger.

SQL – SQL triggers execute queries periodically and fire triggers when the SQL evaluation equals to an integer value of 1.

LOCAL_UPLOAD – This trigger type will fire events based on files it is able to pull from the *Initial Directory* to the *Source Directory*.

LOCAL_ARCHIVE – This trigger type will fire events based on files that exist in the *Initial Directory* that have not been processed by an event before.

The **SCORE Script** textbox provides a location for the SCORE Script that is executed by this trigger. Instead of providing the full path, you can provide a single \$ symbol to represent the full path to the pipeline directory within the environment.

The second line in the Trigger window is labeled INIT DIR. This text box is where you supply the **Initial Directory** that works in conjunction with Local Upload and Local Archive trigger types. Afterward, the SRC DIR is where you can supply the **Source Directory** for LOCAL_UPLOAD triggers.

The third line allows you to supply a **Secure FTP** session linked with this trigger. Triggers with linked SFTP sessions are special-purpose designed to mirror remote and local directories. This can only be set if there are already SFTP sessions defined. Triggers with defined SFTP Sessions can generate events on newly downloaded files from a remote SecureFTP if they are set to LOCAL_ARCHIVE. To clear an SFTP session once it’s been set, press the ‘X’ button and then the UPDATE button to save changes to the trigger.

After this is a date/time stamp of when the trigger was last fired. Then there is a numeric text box for the **Polling Interval**, which indicates the number of seconds between polling of the trigger conditions. It's followed by the **Max Workers** textbox, which allows you to set limits on the number of worker processes SERENEDI will commit to this trigger's events at any one time.

The fourth line defined **ARG 1**, **ARG 2**, **ARG 3**, and **ARG 4**. These represent pre-defined values that automatically populate into event data when this trigger is fired.

Below the main body of the Trigger definition is a tab control that regulates the auxiliary behavior of the trigger.

SQL TIMESTAMP FILTER

Trigger SQL

The **SQL Tab** is used in conjunction with SQL triggers. The above example shows the SQL used to trigger the SFTP_POLL pipeline that runs mirror operations on triggers with the SFTP session set, and is due for a poll operation.

SQL **TIMESTAMP** FILTER

UPLOAD Timestamp Format

The **Timestamp Tab** is used in conjunction with LOCAL_UPLOAD triggers and allows you to set timestamps within the files as they are moved from the Initial Directory to the Source Directory. This is useful if you have a trading partner that sends files with a fixed name and you need to differentiate it from the other files using a timestamp. It is a .NET date/time format string that will add a custom suffix to the filename according to the format string. For example, placing 'yyyyMMddHHmmss' will rename incoming files to have a suffix of 20231211135510 (on Dec 11th, 2023, 1:55:10 PM).

SQL TIMESTAMP **FILTER**

.

X

|

+

The **Filter Tab** sets file filters for UPLOAD and ARCHIVE triggers. Regular text characters can be used in addition to ? and * wildcard characters; the file-based triggers will only trigger if incoming files match the criteria. If two filters are provided, the trigger only files if files fulfilling *both* criteria are present. For UPLOAD triggers, only the file matching the first criteria is moved, and in all triggers, the file matching the first filter is generated as an event. For example, if the filters HDR_*.txt and DTL_*.txt are provided, an event will be generated on the HDR_20231211.txt file so long as there is *also* another file in the same folder with the name DTL_20231211.txt – but only the HDR file will be moved.

The X button allows you to delete the last filter defined, and the + button allows you to define a new file filter.

Events

ID	Criteria	Summary	Time Complete
57	seed_824.txt	SUCCESS	9/2/2021 10:24:10 PM
56	seed_278_resp.txt	SUCCESS	9/2/2021 10:24:08 PM
55	seed_278_req.txt	SUCCESS	9/2/2021 10:24:06 PM
54	seed_820.txt	SUCCESS	9/2/2021 10:24:04 PM
53	seed_270.txt	SUCCESS	9/2/2021 10:24:03 PM
52	seed_271.txt	SUCCESS	9/2/2021 10:24:02 PM
51	seed_820X.txt	SUCCESS	9/2/2021 10:24:00 PM
50	seed_277CA.txt	SUCCESS	9/2/2021 10:24:01 PM
49	seed_834.txt	SUCCESS	9/2/2021 10:23:56 PM
48	seed_276.txt	SUCCESS	9/2/2021 10:23:55 PM

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This shows the most recent 5,000 events in the automation system. The bottom represents the pager to switch through multiple pages of events. Selecting an event row will bring up the detail in the Event Detail pane, and also any messages associated with this event in the Event Messages pane.

Event Detail

This pane shows all the details associated with a specific event, including all parameters, summary information, the times it was started and completed, and when the event was actually generated.

EVENT DETAILS			
57	7	LOCAL_UPLOAD	SUCCESS
BizEventId	BizTriggerId	SourceNm	Summary
20210902 22:24:09	20210902 22:24:10	20210902 22:23:41	seed_824.txt
Process Begin	Process Complete	Event Date	Event Crit
/app/shared/pipeline		PIPE007_EDIT0HDB	
Data1	Data2	Data3	Data4

Event Messages

EVENT MESSAGES					
ID	Origin	Msg	Str	N1	N2
20357	H2SEG0230	Required segment is missing	L2000E:Health Care Services Review Information	15	0
20358	H2SEG0230	Required segment is missing	L2000E:Health Care Services Review Information	29	0
20359	H2SEG0230	Required segment is missing	L2000E:Health Care Services Review Information	43	0
20360	H2SEG0230	Required segment is missing	L2000E:Health Care Services Review Information	57	0
20361	H2SEG0230	Required segment is missing	L2000E:Health Care Services Review Information	71	0

This pane shows the messages associated with an event in numerical order.

The screenshot displays the SFTP Interface with four main panels:

- SFTP SESSIONS (Green outline):** A table with columns ID, Host, and User. It shows one session with ID 1, Host 192.168.1.131, and User admin. Navigation controls are at the bottom.
- SFTP SESSION DETAIL (Orange outline):** A form for session configuration. It includes a '+ UPDATE -' button bar, Host Name (192.168.1.131), User Name (admin), Password (masked), SFTP Port (22), and Fingerprint. There are checkboxes for Binary, ASCII, Local Mirror, Remote Mirror, and File Move. Buttons for 'RESET FINGERPRINT' and 'TEST SYNCHRONIZE' are also present.
- LOCAL FILESYSTEM (Brown outline):** Shows the local path 'E:\app\shared\pipeline' with a list of files including '001_NORMALIZE', '002_CSVFromEDI', '003_CSVToEDI', '004_XMLFromEDI', '005_XMLToEDI', '006_EDIToBIN', '007_EDIToDB', '008_BINToEDI', and '009_Totopctv'. Buttons for 'REFRESH' and 'UPLOAD FILE' are at the top.
- REMOTE FILESYSTEM (Brown outline):** Shows the remote path '/' with an '< upload >' button. Buttons for 'REFRESH' and 'DOWNLOAD FILE' are at the top.

SERENEDI incorporates a number of SFTP commands into the SCORE scripting language, and also provides a way to enable local and remote directory mirroring by using special SFTP mirroring triggers. The SFTP Pipeline automatically polls these SFTP triggers that are linked to SFTP sessions. This interface allows you to test the SFTP sessions directly, set options for logging and mirroring, and test various operations.

The **SFTP Sessions** pane outlined in green is a list of all defined SFTP sessions. After you select one of the sessions, its details are set in the **SFTP Session Detail** pane. Below this, outlined in brown, are the **Local File System** and **Remote File System** panes.

SFTP Sessions

This pane will simply list the SFTP Session ID, the host name, and the user for the session. Sorting by these fields can be done normally by clicking on the column headers.

SFTP Session Detail

At the top is the **Button Bar** control that handles creating new SFTP sessions, updating existing sessions, and deleting existing sessions. To create a new session, click +, enter the information for the session, then click Update. Changes to the session will not be committed to the database until the Update button is clicked. Likewise, to delete a session, you must click the - button twice.

Below this is the **Host Name** text box. You may use an IP address or a fully qualified host name. Below that is the **User Name** and **Password** that will be used to log into the specified SFTP server. Alongside these text boxes, the **Log Dir** will enable you to provide a directory to place logging files. The **SFTP Port** enables you to provide an override for the SFTP port for connections.

Below that is the **Fingerprint**, used to validate the SFTP server’s identity. Initially it is set to a null value, and it will be set on the first operation or Update operation. If the server changes for any reason, you will need to press the **RESET Fingerprint** button to clear it again, or the server session will not connect.

Below these are options to force **Binary** and **ASCII** file transfers. The **Private Key File** will reference a file on the local system that stores the public and private keys used for the session, and the **Passphrase** provides a way to unlock the Private Key file if it is locked.

The **Local Mirror** checkbox will direct the SFTP session to download new files from the remote server to the local file system. The **Remote Mirror** checkbox will direct the SFTP session to upload new files from the local file system to the remote server. The **File Move** checkbox directs the SFTP session to delete the file from the local or remote file system once the file has been downloaded or uploaded.

The **Test Synchronize** button will execute a mirror operation using the Local File System and Remote File System values.

Local File System / Remote File System

These two panes allow you to experiment with uploading and downloading files, viewing the files on the remote server, and set things up so you can click the **Test Synchronize** button to see how the mirror operation functions with the parameters set for this session. Initially, you’ll need to click the **Refresh** button to get the active directory on both the local and remote file systems. Click on the directory folders to move to different locations. You can also change the path directly in the Local Path / Remote Path text boxes and click Refresh to go immediately to a specific directory in the local or remote file systems.

BIN Interface

BinLog Events

1000
5000
All Rows

Bin ID	Event ID	Completion Date	Filename	Endpoint	Table	Type
28	48	1/10/2024 3:43:40 AM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_024.txt		HDB_S024_S04	HDB
29	46	1/10/2024 3:43:40 AM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_270.txt		HDB_S024_S70	HDB
30	47	1/10/2024 3:43:40 AM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_278.txt		HDB_S024_S78	HDB
31	45	1/10/2024 3:43:40 AM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_279.txt		HDB_S024_S79	HDB
32	42	1/10/2024 3:43:40 AM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_271.txt		HDB_S024_S71	HDB
33	44	1/10/2024 3:43:40 AM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_026.txt		HDB_S024_S26	HDB
34	43	1/10/2024 3:43:40 AM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_270.txt		HDB_S024_S70	HDB
35	41	1/10/2024 3:43:40 AM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_026.txt		HDB_S024_S26	HDB
36	40	1/10/2024 3:43:40 AM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_271.txt		HDB_S024_S71	HDB
37	38	1/10/2024 3:43:40 AM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_270.txt		HDB_S024_S70	HDB
38	39	1/10/2024 3:43:40 AM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_024.txt		HDB_S024_S24	HDB
39	36	1/10/2024 3:43:38 AM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_026.txt		HDB_S024_S26	HDB
40	35	1/10/2024 3:43:38 AM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_026.txt		HDB_S024_S26	HDB
41	37	1/10/2024 3:43:38 AM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_277.txt		HDB_S024_S77	HDB
42	34	1/10/2024 3:43:38 AM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_021.txt		HDB_S024_S21	HDB
43	33	1/10/2024 3:43:11 PM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_024.txt		HDB_S024_S24	HDB
44	32	1/10/2024 3:43:11 PM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_278.txt		HDB_S024_S78	HDB
45	31	1/10/2024 3:43:11 PM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_270.txt		HDB_S024_S70	HDB
46	30	1/10/2024 3:43:11 PM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_278.txt		HDB_S024_S78	HDB
47	29	1/10/2024 3:43:11 PM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_271.txt		HDB_S024_S71	HDB
48	28	1/10/2024 3:43:11 PM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_270.txt		HDB_S024_S70	HDB
49	27	1/10/2024 3:43:11 PM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_271.txt		HDB_S024_S71	HDB
50	26	1/10/2024 3:43:11 PM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_026.txt		HDB_S024_S26	HDB
51	25	1/10/2024 3:43:11 PM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_271.txt		HDB_S024_S71	HDB
52	24	1/10/2024 3:43:11 PM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_026.txt		HDB_S024_S26	HDB
53	23	1/10/2024 3:43:11 PM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_026.txt		HDB_S024_S26	HDB
54	22	1/10/2024 3:43:11 PM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_277.txt		HDB_S024_S77	HDB
55	21	1/10/2024 3:43:11 PM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_026.txt		HDB_S024_S26	HDB
56	20	1/10/2024 3:43:11 PM	C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_026.txt		HDB_S024_S26	HDB

HDB

```

BIN START: 1/10/2024 3:54:10 PM
BIN COMPLETE: 1/10/2024 3:54:11 PM
EVENT ID: 33
PROCESS START: 1/10/2024 3:54:10 PM
PROCESS COMPLETE: 1/10/2024 3:54:11 PM
EVENT SOURCE: LOCAL_UPLOAD
EVENT JOBNAME: SUCCESS
EVENT CRIT: sead_024.txt
EVENT DATA1: C:\areded\shared\pipeline\007_EDITOR\02_done_edi\sead_024.txt
EVENT DATA3: PIPE007_EDITOR\HDB
TRIGGER ID: 7 NAME:PIPE007_EDITOR\HDB TYPE: LOCAL_UPLOAD
ENDPOINT ALIAS: TriggerEDB
    
```

The BIN interface provides a window into the BIN system, which stores two types of information: HDB and Flat representations of EDI files. Both of these data types are stored in human-accessible SQL tables, and when used in conjunction with DB Endpoints, can be stored on other databases.

The **BIN LOG Events** window displays the BIN_ID, Event ID, source filename, destination table name and type. Nothing is displayed until you press the '1000', '5000', or 'All Rows' button to filter the selection. Afterwards, clicking on an individual row will yield more information about the BIN Log entry at the bottom.

The screenshot shows the 'Endpoints Interface' with a blue header and a purple navigation bar. On the left, a green-outlined 'ENDPOINTS' table lists two entries:

ID	DB Type	Alias
1	SqlServer	SAMPLE_ENDPOINT_2
2	SqlServer	SAMPLE_ENDPOINT_2

Navigation controls at the bottom of the table show '1-2 of 2' and arrows for sorting. On the right, an orange-outlined 'ENDPOINT DETAIL' pane shows a '+ UPDATE -' button and the following fields:

- DATABASE TYPE: SQLSERVER
- ENDPOINT ALIAS: SAMPLE_ENDPOINT_2
- CONNECTION STRING: Data Source=192.168.1.142\CHIAFAB;Database=serenediCore;User id=sa;Password=

The Endpoints interface enables you to create, update and delete database endpoint connections. If you'd like to send BIN table data to databases other than the serenediCore distribution database, you must define the connection here first.

Endpoints

The **Endpoints** pane outlined in green in the upper left is a list of all defined endpoints. Clicking on the column headers allows you to sort the results. Clicking on a database endpoint will bring up its information in the Endpoint Detail pane on the right.

Endpoint Detail

The orange-outlined **Endpoint Detail** pane gives you the ability to create, update, and delete database endpoints and set the connection string and database type for the endpoint. The + button will create a blank endpoint in the window, but will not actually commit it to the environment until you enter the information and press the Update button. To make a change to the endpoint, highlight it, make the change, and then click Update. To delete an endpoint, the delete button, -, needs to be hit twice to prevent accidental erasures. Note that there should not be any data associated in the BIN_LOG table, or this operation will fail.

INTRODUCTION

Want a 37-minute training course on mapping with SERENEDI?

Visit <https://www.youtube.com/watch?v=BjoT9J3O4jE>

A lot of the learning curve of using SERENEDI involves understanding how the integration platform maps EDI transaction elements to database elements. This process is just as complex as the hierarchical HIPAA implementation guides themselves.

Before going into detail about the CGIF2 mapping naming conventions, it's important to note the underlying business objectives behind this system. HIPAA-compliant EDI transactions are laid out in a completely hierarchical fashion – starting with outer envelope segments such as ISA, GS, and ST, then wrapping up with the closure envelope segments of SE, GE, and IEA. Within this structure, data is arranged in loops, segments, and elements. A loop is an aggregate of segments, whereas a segment is a collection of elements. Elements and composite elements are generally tied to specific business items such as claim numbers, last names, and the many thousands of other items that are discretely identified within the HIPAA implementation guides. These elements are surrounded by well-defined scaffolding segments that positions the data elements correctly within the hierarchy.

SERENEDI's architecture and CGIF2 mapping system are oriented to enable end-users to focus as much as possible on the business information contained within the transaction and ignore the scaffolding that contains it. At the same time, this mapping system needs to completely encapsulate every element within a transaction. Because the HIGs themselves can sometimes allow for a deeply complex nesting of iterated loops and segments, the mapping system must account for every single possibility.

One thing to note is that the CGIF2 mappings *completely* define the contents of an EDI file. The SERENEDI engine is solely programmed through the presence and contents of these mappings. It differs from many EDI packages that contain XML schemas and enable end-users to alter them to fit a particular business scenario. Because the mapping system is tightly integrated to the specifications, it does not allow for "custom" segments or departures from the HIPAA implementation guides.

Therefore, the simplest way to define CGIF2 is as a way of encapsulating all the complexity of locating a single data element within the HIPAA implementation guide and projecting it into a two-dimensional space. In this way, the hierarchy's many complexities are "unrolled" and flattened to a two-dimensional table, as that is the natural data structure for an enterprise system: a relational database. Since this format rigidly follows all the complexities of the HIGs, then it must stand to reason that any valid HIPAA EDI transaction can be projected into a flat database table. Following this, it stands to reason that to *create* a new HIPAA EDI transaction, the user must generate a SQL data table that stages the data exactly as if the file were freshly decoded in SERENEDI, with field names that strongly adhere to the CGIF2 conventions.

In order to make this mapping convention work, SERENEDI categorizes all the loops into a number of specific categories. As defined within the HIGs, loops often have specific relationships with other loops, and these relationships have to be a part of the mapping methodology in order to pinpoint an element's exact location within the hierarchy.

The following sections explain how SERENEDI maps elements and binds them to the hierarchy. All these maps are provided in the HTML files inside of the `serenedi/docs/specs` directory. As per the `5010_837I.html` file:

L2310F - REFERRING PROVIDER NAME

L2310F	NM1	Referring Provider Name		
03		L2310F_NM103_REF_FVR_LNM	String	Referring Provider Last Name
04		L2310F_NM104_REF_FVR_FNM	String	Referring Provider First Name
05		L2310F_NM105_REF_FVR_MNM	String	Referring Provider Middle Name or Initial
07		L2310F_NM107_REF_FVR_SFX	String	Referring Provider Name Suffix
09		L2310F_NM109_REF_FVR_ID	String	Referring Provider Identifier
L2310F	REF	Referring Provider Secondary Identification		
02		L2310F_REF_STAT_LIC_NR	String	State License Number
02		L2310F_REF_UPIN	String	Provider UPIN Number
02		L2310F_REF_FVR_COMM_NR	String	Provider Commercial Number

L2320 - OTHER SUBSCRIBER INFORMATION (Single Iteration)

L2320	SBR	Other Subscriber Information		
01		L2320_xx_SBR01_PVR_RESP_SEQ_NR	String	Payer Responsibility Sequence Number Code
02		L2320_xx_SBR02_IND_RELAT_CD	String	Individual Relationship Code
03		L2320_xx_SBR03_INS_GRP_PLCY_NR	String	Insured Group or Policy Number
04		L2320_xx_SBR04_OINS_GRP_NM	String	Other Insured Group Name
09		L2320_xx_SBR09_CLM_FIL_IND_CD	String	Claim Filing Indicator Code

The specification code and type are found at the top of the file and are part of the filename. The loop short and long names are listed in bold here. Below that, you will find a list of segments and the actual maps. The Element Index is the first column. If there is a *composite element index*, it will be listed in the second column in red. The actual map is the third column. In some cases, you'll see different-colored characters within the map itself, indicates variation according to the situation. In the above example, the loop is categorized as a *Single Iteration*, which means that the Other Subscriber Information can repeat a certain number of times. The green xx identifies the number of the iteration, starting at 01. This 01 is carried into all *child loop maps*, which is how all the information in those maps is related together with this specific iteration of the 2320 loop.

CGIF3 Loop Types

STANDARD – This loop can iterate one time or many times, and has no special relationship with the parent or child loops. It's the designation for all loops within a specification's *main data encoding branch*, the set of parent/child loops encoding the information that is the general purpose of the transaction.

SINGLE ITERATION – This loop is defined in the HIG as not being within the main data encoding branch and having a specific number of repeats. In general, these loops encode auxiliary information. A good example is Loop 2320 in both the 837 Institutional and 837 Professional implementation guides, which establishes Coordination of Benefits information associated with a claim. These loops can repeat up to 10 times to relay information for 10 different COB providers. Every mapping in a Single Iteration loop must contain a number that indicates a specific iteration of this loop.

INHERITED ITERATION – This loop is a child of the Single Iteration loop described above. Every mapping for this loop has to *inherit* the iteration of the parent loop. An example of this is the 837 Institutional loop 2330D, Other Payer Operating Physician.

INHERITED ITERATION & VALUE – This loop is just like the Inherited Iteration loop type described above, but with the added twist of multiple qualifiers present within the header segment. One example is Loop 2330C in the 837 Professional HIG. This loop iterates along with the parent 2320 loop, but also with the qualifier present in the NM1 segment, determining whether that loop represents a COB Referring Provider or a COB Primary Care Provider.

QUALIFIED VALUE – This represents a loop that contains multiple qualifiers in the header segment that change the information composition of all mappings within that loop. Generally, the first element in the first segment determines the most pertinent information about the loop. One example is the 837 P 2420F loop, Referring Provider. Each of the two possible iterations can encode information about either a Referring Provider or a Primary Care Provider.

INHERITED VALUE – If a Qualified Value loop has child loops, they inherit the value of the parent loop within the mapping. This only occurs in a few instances, but one example is the Transmission Receipt Control Identifier loop 2200A, which is a child of the 2100A Information Source Name loop within the 277CA specification.

Element Mapping

Elements in SERENEDI have four discrete data types: String, Integer, Floating Point, and Date/Time. For maps that involve date ranges (which are prefixed by an RD8 qualifier), there are actually *two* mappings that correspond to the beginning and ending date range, which are suffixed with RD8_1 and RD8_2. These data types are especially important when working with database tables, as they reflect how the cells are stored and queried.

Element maps have the following components: the Segment Code and Element Abbreviation or Qualifier are always required; the other components may or may not be present, depending on the mapping.

Segment Iteration	Segment Code	Segment Suffix	Element Index	Composite Element Index	Element Repeat Index	Element Abbreviation or Qualifier
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Segment Iteration (OPTIONAL)

For segments with a fixed number of repetitions, the maps enable binding to a specific segment iteration by prefixing it with a two-digit number. This number is at least 02 or above – the first iteration of any segment does not need any prefix.

Segment Code (MANDATORY)

This is the two- to three-digit code of the segment itself, like REF or CLM.

Segment Suffix (OPTIONAL)

Sometimes the combination of Element Abbreviation and Segment Code is not sufficient to uniquely identify a segment, especially when the specification calls for a run of segments describing closely aligned information, like in the 837 guides with HI segments. For these cases, a single character suffix is added to the segment.

Element Index (OPTIONAL)

This is a two-digit index referring to the exact element of the map. It occurs for most mappings, but may be omitted for segments that do not convey many mappings, such as DTP and REF segments.

Composite Element Index (OPTIONAL)

This is a two-digit index referring to the index within a composite element.

Element Repeat Index (OPTIONAL)

In a few elements among the many in the HIG, sometimes an element is able to *repeat*. For example, the *composite race or ethnicity information* element in the 834 DMG04 can repeat 10 times, separated by the element repeat character specified in the outer ISA segment. In this mapping system, an E followed by a two-digit number allows these elements to be mapped.

Element Abbreviation or Qualifier (MANDATORY)

This specifies additional information about the element being mapped and is usually a compressed shorthand for the element’s Implementation Name given in the HIGs. If the element is the identifier of a qualifier/identifier pair (where both elements are listed in the HIG as REQUIRED), then this abbreviation will relate to one of the qualifiers in the preceding element. For these cases, it means that a single mapping is bound to two elements, both the qualifier and identifier, in the target EDI file, and also that it is not necessary to know what the qualifier is, just what the data point represents.

Note that Date/Time elements have special suffixes that bind the information to a certain format in the EDI file. These possible valid suffixes for every element will be provided in the associated mapping documentation, but they will be a part of this set:

TM – Four-digit timestamp, HHMM.

TM6 – Six-digit timestamp, HHMMSS.

TM8 – Eight-digit timestamp, HHMMSScc.

DT – For six-character date fields, this will be a six-character date following YYMMDD. For all others, it will be a 12-digit date time stamp following YYYYMMDDHHMM.

D8 – This is a normal eight-digit date, following YYYYMMDD.

RD8_1, RD8_2 – These suffixes denote the lower and higher dates of a date time span for a single element. Date Range elements are always “split” into two columns for the lower and upper part of the date span.

ATTCHMNT – This is a special case data type for storing binary data within a 275 attachment

EXAMPLES

A CGIF2 map is subdivided into three sections. The total amount of characters for each map will never exceed 30 characters. Here are some examples of the different conventions used in CGIF2 mappings:

Example #	Loop Identifier & Qualifier	Segment/Element Map	Full Mapping
1	ISA	ISA02_NO_AUTH_NFO	W2_ISA_ISA02_NO_AUTH_NFO
2	L2300	CLM02_TOT_CLM_CHG_AMT	L2300_CLM02_TOT_CLM_CHG_AMT
3	L2320_02	CAS03_ADJ_AMT	L2320_02_CAS03_ADJ_AMT
4	L2200DX	STC04_TOT_CLM_CHG_AMT	L2200DX_STC04_TOT_CLM_CHG_AMT
5	L2100A_IL	DMG0501_E03_RAC_ETH_CD	L2100A_IL_DMG0501_E03_RAC_ETH_CD
6	L2300	DTP_STMNT_RD8_2	L2300_DTP_STMNT_RD8_2
7	L2330C_02P3	REF_PVR_COMM_NR	L2330C_02P3_REF_PVR_COMM_NR
8	STHDRX	PLB030_PVR_ADJ_ID	STHDRX_PLB030_PVR_ADJ_ID
9	L2110B	BIN02_MIME_TYP BIN02_MIME_DISP BIN02_ATTCHMNT	L2110B_BIN02_MIME_TYP L2110B_BIN02_MIME_DISP L2110B_BIN02_ATTCHMNT

Example 1

W2_ISA_ISA02_NO_AUTH_NFO

If we look at the 837 Institutional HIG C.1 section on control segments, we'll see the definition of the ISA segment, and by the mapping conventions established above, we know that this is a map to the ISA loop, the ISA segment, Element 02. One unusual thing is the W2 prefix, which occurs once and only once in a set of mappings, and is what tells the SERENEDI encoding engine exactly what specification these maps belong to. This is universal to all valid sets of CGIF2 maps, that the very first (and *only* the first) mapping needs to establish the specification being mapped.

The NO_AUTH_NFO element suffix is referencing the ISA Element 01 qualifier 00, "No authorization information present." Therefore, it maps to two discrete elements in the ISA segment, ISA01 with the qualifier set to 00, and ISA02, where the mapped data is actually stored.

Example 2

L2300_CLM02_TOT_CLM_CHG_AMT

To see more about this mapping, we can look it up in the internal mapping documentation, located at:

C:\serenedi\docs\specs\5010_837I_A2.html / Loop 2300:

L2300 - CLAIM INFORMATION

L2300	CLM	Claim Information		
01		L2300_CLM01_PT_CTL_NR	String	Patient Control Number
02		L2300_CLM02_TOT_CLM_CHG_AMT	Decimal	Total Claim Charge Amount

The data type is present in the fourth column, meaning that the information being stored in this Total Claim Charge Amount field is **floating point**. In SQL Server, this is equivalent to the FLOAT(53) data type.

Example 3

L2320_02_CAS03_ADJ_AMT

This is an example of an Adjustment Amount segment.

C:/serenedi/docs/specs/5010_837I_A2.html / Loop 2320:

L2320_02_CAS03_ADJ_AMT

02		L2320_xx_nnCAS02_ADJ_RSN_CD	String	Adjustment Reason Code
03		L2320_xx_nnCAS03_ADJ_AMT	Decimal	Adjustment Amount
04		L2320_xx_nnCAS04_ADJ_QTY	Decimal	Adjustment Quantity

In the above listing, the green xx stands in for the numeric 2320 loop iteration, and the red nn is for the segment iteration prefix, which is only present on the second iteration and above.

If it were necessary to send a second CAS segment right after the first one, the mapping would gain a segment iteration index and look like this:

L2320_02_02CAS03_ADJ_AMT

Example 4

L2200DX_STC04_TOT_CLM_CHG_AMT

This is a 277CA map, found here:

C:/serenedi/docs/specs/5010_277CA.html / Loop 2200DX:

L2200DX - CLAIM STATUS TRACKING NUMBER - STC CUTOUT

L2200DX	STC	Claim Level Status Information		
01	01	L2200DX_STC0101_HTCRCLM_CAT_CD	String	Health Care Claim Status Category Code
01	02	L2200DX_STC0102_HTCRCLM_STATCD	String	Health Care Claim Status Code
01	03	L2200DX_STC0103_ENTY_ID_CD	String	Entity Identifier Code
02		L2200DX_STC02_STMT_NFO_EFF_D8	Date/Time	Status Information Effective Date
03		L2200DX_STC03_ACTN_CD	String	Action Code
04		L2200DX_STC04_TOT_CLM_CHG_AMT	Decimal	Total Claim Charge Amount

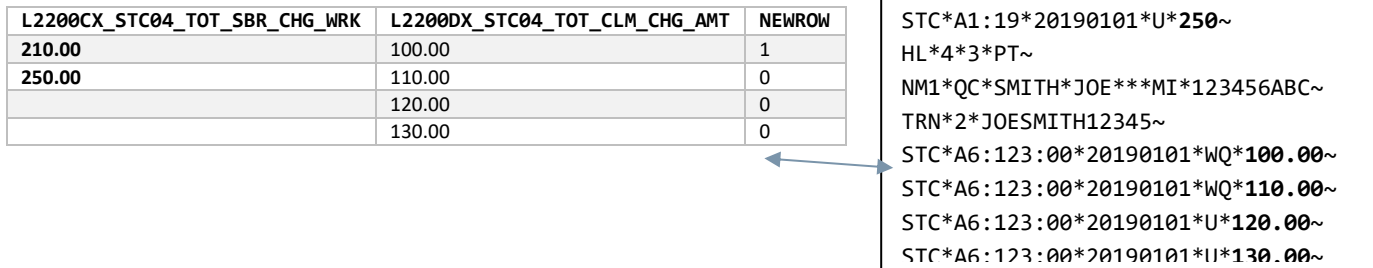
This is an example of a *cutout*. The 2200DX loop does not appear in the HIPAA implementation guides; instead, it's a convention of *cutting out* segments that have infinite repetitions so they can be mapped in a different way. Cutout maps are mapped *vertically* across multiple database rows. If a cutout iterates more than once, then a new database row that copies all data values up to the L2200D loop is presented, but with new values for the L2200DX maps. To prevent SERENEDI from seeing the L2200D values as a new row, the mandatory field NEWROW is set to 0, which blocks out all other columns from the data parser and focuses only on cutout mappings.

Normally, NEWROW is set to 1 and is mandatory on every CGIF2 Flat, even for specifications that lack cutout loops. When NEWROW is 1, then the data parser is guaranteed to emit a new row for the deepest Standard loop present in the data row. When NEWROW is 0, then all other mapped values are ignored and only the cutouts are focused on. The other values may be present, especially in SQL Views, to maintain the sequence in properly sorted order, but the parser will scan each row for non-null values in cutout mappings.

Here's an example of how this works:



Note, that it may give rise to a question: what if there are multiple cutouts at multiple levels? The data is presented in the same way, and the parser will intelligently restructure the database output and link them into the correct places in the EDI hierarchy. For example, earlier in the hierarchy is the loop 2200C and the associated cutout, 2200CX. This gives an example of how multiple levels of cutouts are presented and encoded in the destination EDI.



Example 5

L2100A_IL_DMG0501_E03_RAC_ETH_CD

This example is drawn from the 834 Implementation Guide. The SERENEDI maps are found here:

C:\serenedi\docs\specs\5010_834_A1.html / Loop 2100A:

05	01	L2100A_yy_DMG0501_Enn_RAC_ETH_CD	String	Race or Ethnicity Code
05	03	L2100A_yy_DMG0503_Enn_CS_RC_ETH	String	Classification of Race or Ethnicity

It demonstrates a fairly complex mapping – let’s start at the top:

1. **Value Qualified Loop** – The red yy in the mapping guide indicates that one of the two Loop Qualifier values should be placed here. For the 834 2100A loop, these are **70** to indicate a Corrected Insured loop, or **IL** to indicate an Insured Member loop.
2. **Composite Element** – These values represent composite elements, which are elements defined in the HIGs that are nested within other elements. From the parsing of the DMG0501 part of the map, this means the first composite element within the fifth element of the DMG segment.
3. **Repeated Element** – Looking at the element definition for this element within the HIG, we’ll see this box:

DMG05 C056
**Comp Race
or Ethn Inf**
X 10

The X 10 means that this element – meaning all of the composite elements – can repeat up to 10 times. The **E03** provided in the example mapping means this map binds to the *third* repetition.

L2100A_IL_DMG0501_RAC_ETH_CD	L2100A_IL_DMG0501_E02_RAC_ETH_CD	L2100A_IL_DMG0501_E03_RAC_ETH_C	L2100A_IL_DMG0503_CS_RC_ETH	L2100A_IL_DMG0503_E02_RAC_ETH_CD	L2100A_IL_DMG0503_E03_RAC_ETH_CD
9	A	8	B	7	C



DMG*D8*19890809*M**9>RET>A^8>RET>B^7>RET>C~

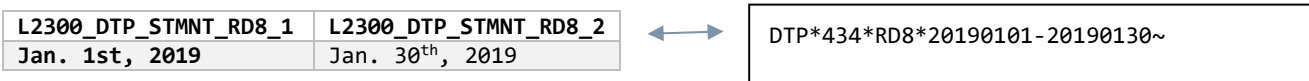
Example 6

L2300_DTP_STMNT_RD8_2

C:\serenedi\docs\specs\ 5010_837I_A2.html / Loop 2330:

L2300	DTP	Statement Dates		
03		L2300_DTP_STMNT_RD8_1	Start Date	Statement (RD8)
03		L2300_DTP_STMNT_RD8_2	End Date	Statement (RD8)

This is an example of a date range map. This map will always appear as a pair, and both maps together will encode a single element, in this way:



Example 7

L2330C_02P3_REF_PVR_COMM_NR

The mapping documentation is found in the 837 P mapping guide:

C:\serenedi\docs\specs\5010_837P_A1.html / Loop 2330C:

L2330C - OTHER PAYER REFERRING PROVIDER (Inherited Loop Iteration & Value Qualified)

Mapping Prefix: L2330C_xxDN - Referring Provider

Mapping Prefix: L2330C_xxP3 - Primary Care Provider

L2330C	NM1	Other Payer Referring Provider		
L2330C	REF	Other Payer Referring Provider Secondary Identification		
02		L2330C_xxyy_REF_STAT_LIC_NR	String	State License Number
02		L2330C_xxyy_REF_UPIN	String	Provider UPIN Number
02		L2330C_xxyy_REF_PVR_COMM_NR	String	Provider Commercial Number

This is an example of the Inherited Iteration and Value Loop Type. The four digits after the loop identifier (L2330C) indicate that this is the second loop iteration of the inherited parent loop, 2320, and that this map pertains to a Primary Care Provider (P3 qualifier listed in the mapping guide) iteration of the 2330C loop.

Example 8

STHDRX_PLB0301_PVR_ADJ_ID

The PLB segment mappings at the end of the 5010 835 transaction are unique in that they represent a cutout that's not in the normal data encoding path.

To present these mappings in a Flat interface, the STHDR and parent loops should be present in the data row along with the first PLB segment information, with NEWROW set to 1. For any subsequent iteration of the PLB segment for that transaction, NEWROW should be 0.

Example 9

L2110B	BIN	Binary Data Segment		
01		L2110B_BIN01_BIN_LEN	Integer	Binary Data Length Number
02		L2110B_BIN02_MIME_TYP	String	MIME Type
02		L2110B_BIN02_MIME_DISP	String	MIME Disposition
02		L2110B_BIN02_ATTCHMNT	Binary	Binary Attachment

SERENEDI supports encoding *binary* attachments within a 275C file via the BIN and BDS segments. BIN01 is the integer length of the binary; this is automatically populated from the actual content of the BIN02_ATTCHMNT field. If data is supplied in the BIN02_MIME_TYP and BIN02_MIME_DISP fields, the binary supplied in the BIN02_ATTCHMNT field will be encoded to Base64 and stored as a MIME attachment within the EDI envelope. These will be plugged into the MIME message envelope as follows:

Content-Type: L2110B_BIN02_MIME_TYP

Content-Transfer-Encoding: base64

Content-Disposition: L2110B_BIN02_MIME_DISP

Then, the Base64 of the binary will be transmitted. For XML transports, the data is also encoded into Base64, but the MIME envelope is not generated. The CSV transport is not supported for binary attachments. For database, BIN02_ATTCHMNT is stored as a VARBINARY(MAX) column. If BIN02_MIME_TYP is left empty, the binary will be sent as a normal string, and it will be up to the developers to ensure segment separators are not encoded into the string. **If sending an attachment, ALL BIN02 fields are mandatory and should be presented in the order above or else a critical error will occur during parsing.** If you are transmitting plain text in the ATTCHMNT map and *not* a binary file, transmit only the BIN02_ATTCHMNT column.

ENCODING VS. DECODING

Up to now, we have covered the essentials of how SERENEDI binds mappings from database tables and cells to defined elements within a supported EDI transaction. In this section, we will approach this problem at a higher level, and discuss how the business requirements of creating and parsing EDI transactions relate to the bidirectional SERENEDI translation engine.

When decoding EDI transactions, SERENEDI will create a mapping and assign values for every mapping it encounters. Note that “mapping” here is very different from “elements” because, as we see in the above examples, a single mapping can be half of an element, such as when encoding RD8 time spans, or it can encapsulate two elements in the EDI file, as is the case for every qualifier/identifier pairing.

Note that the CGIF2 Flat map will generally contain every single mapping present in the file, in every single row, starting at the ISA02 element at the outer envelope and going on to the GS loop, Transaction Set header loop, and so on into the deepest loop. Furthermore, a mandatory NEWROW column ends every Flat, forcing the engine to encode multiple cutout mappings instead of continuing to parse segments along the main data encoding branch of the hierarchy.

Along with the most common business mapping, many *scaffolding* elements are present as well – for example, the number of segments in the SE segment that ends a transaction will be decoded and parsed, and present in every single row of the transaction. These are generally ignored since these scaffolding elements do not directly represent business information. The problem here is that it conflicts with a very common scenario, which is to reprocess EDI files for a different trading partner or business purpose.

For example, say that an HMO has been collecting all of the Provider 837 Claim files for the entire year, but then the state dictates that these files must be resubmitted to the state’s health department for analysis of certain health metrics on a populace scale. The state requires that the headers be changed and that certain data elements be altered or removed to accommodate its data requirements.

With SERENEDI, this may seem simple and straightforward – decode the original file to the Flat register, send that to a database table, UPDATE the columns to reflect the new header values, remove the columns for the maps the state does not want, then re-encode the file and send it to the state. But this approach will definitely fail.

The reason is that all the decoded scaffolding elements, like Number of Segments, are now being provided to the SERENEDI engine for encoding, and removing some data elements will alter the number of segments from the original file. The file will be parsed by the state and rejected because the number of segments provided in the file does not match the number of segments actually present in the file.

The solution to this problem? Give SERENEDI *fewer* mappings so it can generate correct default values independently.

DEFAULTED SCAFFOLD ELEMENTS

SERENEDI can generate default mappings for the following **ISA** segments:

ISA01-ISA04 – If values are not provided for these maps, SERENEDI will default them to 00 and spaces. Note that no matter what, the first mapping provided to SERENEDI must contain the two-digit specification identifier.

ISA09 – The six-digit year time stamp will default to the current date.

ISA10 – The four-digit time stamp will default to the current time.

ISA14 – If no value is supplied, SERENEDI will default a value of P, meaning production.

IEA01 – This will be defaulted to the number of included GS/GE functional groups.

GS04 – This will default to the current eight-digit date stamp.

GS05 – This will default to the current four-digit time stamp.

GS08 – This will default to the correct specification identifier supplied in the initial two-digit specification mapping prefix.

GE01 – This will default to the number of Transaction Sets encoded.

ST03 – This will share the same value as GS08.

SE01 – This will default to the number of segments in the transaction.

BHT04 – This will default to the current eight-digit date stamp.

BHT05 – This will default to the current four-digit time stamp.

HL01-HL04 – The hierarchical level mappings will be automatically generated based on the situation of the data present within the transaction.

CAS02-CAS19 – SERENEDI will *shift* CAS mappings in groups of three to the left if there are data “bubbles” filled with unassigned values, such as when data is present for mapping CAS05/CAS06/CAS07, but no data is present for CAS02/CAS03/CAS04. This enables developers to assign specific business adjustment amounts to specific elements without worrying about creating a noncompliant segment because of missing elements earlier in the segment – SERENEDI will respect the contents of the data but not the specific position of the data in order to create a compliant segment.

Therefore, a “less is more” approach is necessary when recasting transactions for another purpose by removing all the elements defined above that pertain to scaffolding and letting SERENEDI choose the best values automatically.

FLAT INTERFACE

Encoding CGIF2 Flat to HKey

The HKey register is the internal SERENEDI representation of a HIPAA EDI transaction, but not yet generated into a text file. This section will dive into the process SERENEDI uses to translate a CGIF2 Flat register into the HKey register, which is very close to generating an actual EDI transaction.

When SERENEDI encounters a loaded CGIF2 Table, whether loaded from a database table, CSV file, or other source, it goes through the following process to translate this two-dimensional data source into a hierarchical data projection:

1. First, it obtains the specification from the first two digits of the mapping, the specification tag. These tags are defined in the *Appendix 1*
2. Second, all the mappings are sorted into hierarchical order, with the initial ISA mappings occurring first and the deepest hierarchy mappings put in the last place.
3. Third, data is scanned from left to right in sorted order – thus, the ISA mappings are scanned first in every row, then the GS mappings, and so on down the hierarchy.

4. Mappings are empty if they contain a database *null* value. String values are empty if they have a database null or zero-length string. Any loop that contains at least one non-empty mapping is considered as having data and will be encoded.
5. The first row encountered by the parser will have all non-empty loops encoded. For every subsequent row thereafter, every loop is compared to the corresponding loop in the previous data row. If a difference is detected, then that loop and *all* non-empty loops that are deeper in the hierarchy are considered “fresh” data.
6. For each database row, the NEWROW column must be present with a 1 or 0 value. If the value is 1, then the deepest standard data-carrying loop is considered fresh data and will not be compared to the previous database row. If the value is 0, then every non-empty cutout loop will be marked as fresh data and encoded into the HKey.

To give a simplified visual example of this process, consider the following table, which represents a simplified selection of loops in an 837 Institutional file:

ISA	GS	ST	2000 SBR	2300 CLM	2400 SVC	NEWROW
X	X	X	X	X	X	1
0	0	0	0	0	X	1
0	0	0	0	DELTA	X	1
X	X	DELTA	X	X	X	1

X – Data present and selected for encoding

0 – Data present and *not* selected for encoding

DELTA – Data present that is distinct and different from the previous row

Each cell in this table represents a collection of individual mappings associated with each loop and presented to the SERENEDI parser. In this example, every loop is considered non-empty. Examining the top row, we see that *every* loop has data and every loop is selected for encoding. In the second row, every data element is exactly the same as in the previous row. The deepest non-empty standard loop is 2400 SVC, and it will automatically be selected for encoding since NEWROW contains 1 and therefore the deepest non-empty standard loop is automatically selected for encoding.

In Row 3 of the above example, the CLM loop contains at least one element that is different from the previous row. As a result, that loop and everything deeper are considered fresh data marked for encoding.

In Row 4, the Transaction Set header loop contains at least one element that is different from the previous row, and as a result, everything deeper along the hierarchy is marked as fresh data and encoded.

The order of the encoded loops in an EDI file, ignoring trailing envelope segments, will proceed like this:

ISA	Outer Envelope
GS	Group Header
ST	Transaction Set Header
2000 SBR	Subscriber Loop
2300 CLM	Claim Loop
2400 SVC	Service Line
2400 SVC	Service Line
2300 CLM	Claim Loop
2400 SVC	Service Line
ST	Transaction Set Header
2000 SBR	Subscriber Loop

2300 CLM	Claim Loop
2400 SVC	Service Line

Potential Pitfalls of CGIF2 Flats

For well-formed EDI transactions, this system allows SERENEDI to handle virtually any file, transform it into a representation that is straightforward for humans to work with using SQL database tools, and then transform it back into an EDI file. But what about *broken* EDI transactions?

In this case, what if an original set of claims and a *duplicate* set of claims data is sorted and then presented to the SERENEDI parser – how does SERENEDI handle this case? According to the rules given above, it’s very predictable: since SERENEDI is expecting data to be completely sorted before seeing it, all duplicate claims will be aggregated together in sequential order and processed row-by-row by the parser.

Since there is no difference between the Original Claim and Duplicate Claim maps, it won’t trigger a delta that will help the SERENEDI parser trigger the row as a new claim. However, since each database row is guaranteed to encode at least one loop, *all* the original and duplicate service lines for the claims will be encoded – leading to each claim having double the original number of service lines, and obvious imbalances in the Claim Charge amounts.

For more information on creating outbound EDI files, see the chapter “Creating Outbound EDI Files.”

DECODING HKEY TO CGIF2 FLAT

The opposite of encoding an HKey (and by implication, an EDI transaction) is *decoding* an HKey to a Flat. Unlike the encoding step, this process is completely automated. The format of a HIPAA EDI transaction is rigidly predefined within the HIPAA implementation guides, and therefore every loop, segment, and element has a strictly assigned role. The way SERENEDI automatically creates a Flat register from an HKey register is pretty much the opposite of the encoding steps:

1. Descend into the hierarchical segments of the transaction and decode all mappings into a two-dimensional data table.
2. When the deepest loop encountered iterates or starts to ascend to a higher hierarchical level, trigger a new row and store all the encountered maps in the columns. Copy all parent loop maps. Mark the NEWROW column as 1.
3. When cutouts are encountered, they are stored and processed in line with the other maps *unless* they repeat more than once. If that occurs, create a brand-new row, copy the parent loop maps, and iterate only on the cutout segments, with each NEWROW field marked as 0.

At the end of the decoding process, a table that maintains proper sorting from highest hierarchy mappings to lowest hierarchy order is generated. And, assuming there were no integrity errors in the source EDI, immediately feeding this Flat table back into the encoder should yield a verbatim copy of the original EDI file.

HIERARCHICAL DATABASE INTERFACE

The Hierarchical Database (HDB) interface provides an alternative method to storing SQL query-accessible transaction data compared to the Flat interface. Instead of a single database table, one database table per loop is utilized in the transaction, joined together in parent-child relationships that exactly mirror the structure of the EDI transaction. To see the exact relationship between parent and child loops in SERENEDI’s somewhat customized implementation of the HIPAA implementation guide’s hierarchies, see “Appendix: Specification Hierarchy Structures.”

By default, the names of the HDB tables begin with HDB_5010, an underscore, the short specification name without any Addenda suffix, an underscore, and the loop short name. A collection of HDB tables for a specific transaction is called an *HDB tableset*.

For example: **HDB_5010_837P_L2320**

The layout of every HDB table begins with four columns:

PK_ID (int)	Primary key , auto-generated identity column
BIN_ID (int)	Foreign key reference to the BIN_LOG table
BIN_IX (int)	BIN Index, a numerically increasing index starting at 1 for every new BIN_ID.
PAR_BIN_IX (int)	Parent BIN_IX, relates this loop's maps and data to the parent BIN_IX identifier
PAR_2000C_IX (int)	Optional field occurring only in 837 I / P L2300 Claim loops that links the claim to patient loops

In the example above, this table could contain maps such as:

L2320_01_SBR01_PYR_RESP_SEQ_NR

The CGIF2 mappings are *very* similar to the Flat interface implementation, with one key difference: all loop iterations belonging to Single Iteration and ValueIteration maps are locked at 01. The loop iteration maps are redundant as the loop data structure itself encodes this information merely by having two Single Iteration loops parented to the same row. Besides this, the maps are functionally identical to CGIF2 Flat interface mappings.

The default table names can be overridden with a supplied prefix. In this case, the loop names will be added to the supplied prefix so that the loop data can be retrieved.

WARNING: Child loops need to occur in an order that is synchronized with parent loops; in other words, SERENEDI is expecting both the BIN_IX and the PAR_BIN_IX key columns to occur in an incrementing and ascending to be able to register the database rows as valid child loops. This means that you cannot arbitrarily “insert” new children loops by adding new rows to the bottom of the data associated with that BIN_ID; all child loops pertaining to the same PAR_BIN_IX parent loop reference *must* be grouped together in ascending order in relation to the BIN_IX key.

XML INTERFACE

The XML interface is ideal for making data consumable by “NoSQL” hierarchical database systems. The mapping rules for XML differ somewhat from the database-centric systems described above, with the loop and segment-element parts of the mapping split into two.

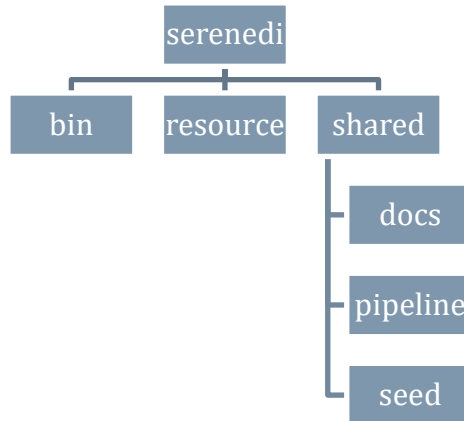
Similar to the hierarchical database system, loop iterations for qualified loops are not present in the XML Interface mapping system – these are implied naturally from the structure of the XML file. Thus, mappings that normally look like this:

L2330C_01DN_REF_PVR_COMM_NR	L2330C_01P3_REF_PVR_COMM_NR
123450004	123450005

... will be presented in XML like this:

```
<L2330C_DN>  
  <REF_PVR_COMM_NR>123450004</REF_PVR_COMM_NR>  
</L2330C_DN>  
<L2330C_P3>  
  <REF_PVR_COMM_NR>123450005</REF_PVR_COMM_NR>  
</L2330C_P3>
```

Technical Inventory



At left is the default installation hierarchy for SERENEDI, with the base folder being 'serenedi'.

In the **bin** folder are the binaries required by the .NET Core environment; most of the files and subdirectories are various libraries used by .NET Core and SERENEDI.

The **license.key** file is associated with your licensing tier and period.

Replacing it can be done while the service is running, so if your licensing options change, it can be replaced in real time. SERENEDI searches for the license.key file in three places: serenedi/shared/license.key, serenedi/license.key, and finally, serenedi/bin/license.key.

The **resource** file contains information necessary to spawn itself to databases, as well as various binary dependencies.

The **docs** folder contains the manual, the licensing information, and various licensing files needed by the libraries SERENEDI uses.

The **pipeline** folder starts with a single SCORE script, Pipeline.ps1. When SerenediService is first run, it executes a single bootstrap event that calls on the pipeline system to initialize itself. If initialization is successful, a number of folders will be present relating to the built-in pipeline system in this directory.

The **seed** folder contains 14 seed files. These can be used to test different scenarios, and are created from the sample data and SQL Stored Procedures stored in the serenediCore distribution database.

SERENEDI TECHNICAL REFERENCE

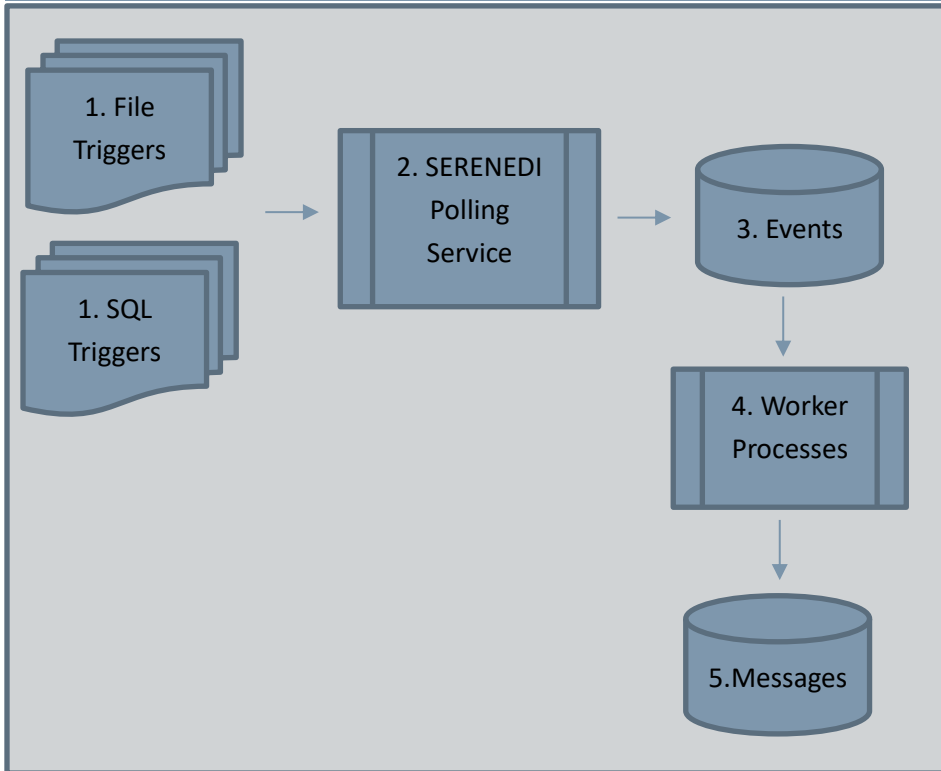
OVERVIEW

This technical reference is meant to give a full, detailed review of all technical aspects of SERENEDI. All aspects of the platform are covered so that you have a single reference point.

We start with a review of the CGIF V2 mapping system that is the core of all projections for HDB, CSV, Flat, and XML conversions. We go deep into the automation system and review the technology behind triggers, events, and workers. Then, we go into the architecture of the distribution database, serenediCore, and review each table and column.

Next, in the SCORE Script reference, we review the SERENEDI API commands that comprise the SCORE scripting system, along with error messages. Afterward, we review the REP Code user-extensible Rules Engine codes. Finally, we review the hierarchical relationships of the loops within each specification – which is critical for understanding how HDB BIN data is committed to the database.

Event System



Event Life Cycle

1. Triggering conditions are set up in the BIZ_TRIGGER table.
2. The SERENEDI Polling service continuously scans for firing conditions.
3. When a firing condition is met, a new entry is made in the BIZ_EVENT table.
4. A background Worker Process is assigned to the new event, and processes it.
5. The event result is stored in the BIZ_EVENT table and messages are stored in the BIZ_MSG table.



SERENEDI uses PowerShell Core with custom Cmdlet extensions and runtime environment. In the rest of the manual, these are referred to as **SCORE scripts**.

The SERENEDI Event system is designed to make automation of healthcare integration processes simple and straightforward. It begins with the triggers set up in the BIZ_TRIGGER table. This table defines the criteria by which events are generated, and also specifies the PowerShell Core SERENEDI (“SCORE”) script to execute when the trigger is fired. A background process constantly scans the firing criteria, and if the criteria are met, then a new event is generated. New events can be generated by external database events as well.

In the background are a number of worker processes that scan the BIZ_EVENTS table for new work to do. When a worker process manages to take exclusive ownership of an event, it runs the SCORE script associated with that trigger and sets certain global variables according to the firing criteria and type of event. It’s important to note that SCORE scripts generally run in *parallel* with one another unless a trigger is set up for serial execution.

SCORE SCRIPT SYSTEM

SERENEDI contains an embedded scripting system called PowerShell Core. It extends the default library with a number of *cmdlets*, which is PowerShell Core terminology for custom functions. Each time a SCORE script runs, a new SERENEDI Session state object is spawned that encapsulates the main registers used for EDI translation and conversion. It also contains the “MsgLog,” register, a running list of messages generated throughout execution of the script; at the end of execution, these messages will be added to the BIZ_MSG table for later reference.

Each event has up to four string arguments that are available to be used within the SCORE script as in-session variables. The maximum runtime of a SCORE script is one hour. If that threshold is exceeded, the background service will assume it is a hung process and stop it. This prevents rogue events from tying up individual worker resources dedicated to processing the events.

SCORE scripts are aimed at handling discrete events in a single business process, with one SCORE script servicing one business process that is composed of one or more related triggers, which run in small, independent sections within that script. With the “bootstrapping” capability, SCORE scripts can be designed to initialize their own runtime environment, creating all the objects needed to run a full multi-trigger business process from scratch, including triggers and directory structures.

One good example to follow is the default Pipeline script – initially, the SERENEDI environment exists only as an empty pipeline folder and nothing predefined in the serenediCore database except for a single BIZ_EVENT row that causes SERENEDI to call the Pipeline bootstrap procedure. The entire pipeline environment is created from that single event.

By designing SCORE scripts this way, business processes can be easily be migrated to other environments, such as QA or PROD.

TRIGGERS

A SERENEDI trigger is broadly defined as the initial condition established to begin work on a specific item. Because the events fired by the trigger are meant to run in parallel, all the work it accomplishes should be isolated from interfering with other triggers, or from being influenced by other events fired by the same trigger. The SERENEDI system architecture is specifically designed to let dozens of concurrent processes work without interference.

There are four ways to trigger an event:

1. **Direct Injection** – Bypasses the normal trigger system to directly execute a SCORE script with parameters. Direct Injection can be accomplished with either SQL inserts or XML messages.
2. **SQL Trigger** – Sets specific criteria based on SQL results to fire an event.
3. **Upload Trigger** – Sets specific criteria based on moving files from one folder to another to fire an event
4. **File Trigger** – Sets specific criteria based on the presence of files in a specific folder to fire an event.

Direct Injection

Direct Injection of events means you are creating an event that is not tied to a specific trigger. Since the trigger contains information about the SCORE script to execute, then the path and filename of the SCORE script must be included in the fourth argument parameter for this event, which leaves the first three arguments available to pass information to the script.

One example is to present the way the whole pipeline environment is able to bootstrap during the initial install. Before the bootstrap, no triggers are defined at all in the database environment:

```
INSERT INTO BIZ_EVENT (EVENT_DATA3, EVENT_DATA4) SELECT 'INITIALIZE',  
'C:\SERENEDI\PIPELINE\PIPELINE.PS1'
```

Direct Injection events can be used anytime you don't need a complex triggering architecture, and only need to run business processes on an as-needed basis. When the event is finished executing, you may review the logs in BIZ_MSG that are tied to the new BIZ_EVENT row.

XML Injection

The XML Injection path enables users to create events and see the results using only XML files. The XML file must have a unique name, and it must contain a single XML message formatted similar to the following:

```
<CtrlMsg>  
  <trig>1</trig>  
  <crit>FIRING_CRITERIA</crit>  
  <arg1>Argument1</arg1>  
  <arg2>Argument2</arg2>  
  <arg3>Argument3</arg3>  
  <arg4>Argument4</arg4>  
</CtrlMsg>
```

The 010 Event pipeline picks up the message and pushes it into the BIZ_EVENTS table, where a worker process picks it up. Then, when it has finished execution, the resulting messages are pushed into the BIZ_MSG message log, to an XML file in the output folder.

If the **trig** parameter is not supplied, then the **arg4** parameter is used as the path and filename to a SCORE script that runs. The first three arguments are passed to the SCORE script when it starts execution.

SQL Trigger

This fires a trigger when an SQL statement returns a result of 1. The actual SQL itself is supplied in the FIRE_LOGIC column of the trigger and must be prefixed with **SQL:**. If this condition becomes true during polling, the event is fired. If any of the FORCE_ARG1 – FORCE_ARG3 parameters are set within the trigger, they will propagate to the ARG parameters within the resulting event. If FORCE_ARG4 is set, it will be parsed as a Bin Endpoint Alias and the query will be executed against that database endpoint. This allows externally defined database servers to trigger new events.

File Trigger

The file trigger system in SERENEDI is quite flexible. First, there are two primary modes of operation, ARCHIVE and UPLOAD mode. UPLOAD mode requires two folders, the Initial folder and the Source folder. The Initial folder is where files are initially dropped; when the background SerenediService is able to move a file from the Initial folder to the Source folder, then the event on that file is fired. The only dependency is that the file does not exist in the Source folder prior to the event.

ARCHIVE mode will poll the BIZ_EVENT system and the file system every time the trigger is polled. Any new files that have *not* been linked to an event will be fired as new events.

Fire Logic

Fire Logic filters a triggering condition of Upload, Archive, and SecureFTP Archive file triggers in one of four ways. The filters can be *stacked* with the pipe character, allowing a rich set of criteria.

FILTER

The filter is a flexible tool to tightly control the types of files that fire the trigger. For example:

FILTER:*.835

The above filter will trigger on files *only* if they end in the .835 extension – all other files will be ignored.

FILTER:ELIG?????.834

The above uses the ? wildcard character to establish that the filtered file must begin with ELIG, end with .834, and have six indeterminate characters in the middle to fire the trigger.

In some cases, it's necessary to process *file sets* instead of individual files – that is, a file should be processed if and only if it's accompanied by a set of files with a common naming protocol. SERENEDI can accomplish this by stacking the FILTER directive with different criteria. This behavior is ideal for ARCHIVE triggers since files don't need to be moved to fire the trigger, and thus the set is kept together.

Example:

FILTER:Z1*.TXT|FILTER:Z2*.TXT

If two files named Z1XYZ.TXT and Z2XYZ.TXT arrived, then this filter would allow the Z1XYZ.TXT to fire the trigger. If the second file was named Z2XYZZ.TXT, the file would *not* trigger because the wildcard pattern is not common to both files.

TIMESTAMP

Technically, this is not a filter so much as it is a modification to an Upload trigger. In this case, the timestamp value is treated as a C# DateTime Format string that will be added to the end of a filename (and prior to the extension) when the file is moved to the Source folder. This enables Upload triggers to operate on new files with old filenames – by suffixing a unique date/time stamp, the old filename becomes a new one, and the file can fire the trigger.

Example:

TIMESTAMP:yyyyMMddHHmm

If an Upload trigger filename started as CLINIC_001.835 and was uploaded on December 21, 2019, 12:51 a.m., it would end up as CLINIC_001201912210051.835, as an example.

SQL

This sets the SQL that will be used in an SQL trigger. For SQL triggers, the firing condition is when this SQL executes on the SERENEDI database and results in an integer 1 value.

Example:

```
SQL:SELECT 1
```

This will result in an SQL trigger that executes every time it is polled. Note that only SQL triggers can execute triggers external to the serenediCore database; the FORCE_ARG4 field of the trigger is used for the BIN Endpoint Alias.

SCORE SCRIPTS

SCORE scripts – aka SERENEDI PowerShell Core scripts – leverage the cross-platform basic functionality of PowerShell Core to expose virtually every part of the SERENEDI engine to the developer. If your business needs go beyond the basic transformations supported by the built-in pipeline system, then you'll need to learn about developing SCORE scripts.

See the installation instructions to install Visual Code and hook it up to the SERENEDI environment. This is ideal way to develop SCORE scripts, as that allows a rich debugging and development system.

To get the most out of the SCORE system, it's important to keep these points in mind:

PORTABLE

Portable scripts are ones that can easily be deployed from one server to another, especially from a development environment to a QA or production environment. This means:

- Absolute paths should be avoided. The SERENEDI installation path may not be the same on the server you are targeting. The \$ wildcard used within SERENEDI directory names will always resolve to the SERENEDI/pipeline directory as it exists in that particular environment. Because this wildcard is unknown to normal PowerShell Core commands, you could set the \$ pipeline variable in this example, and use that instead:

```
$pipeline = (Join-Path $basePath 'pipeline')
```

- You'll need to be careful with path name separators. For example, Unix pathnames follow a *forward-slash*, while Windows uses a *backslash* character to specify paths. By using the Join-Path command as shown above, you can indicate a full path that will work regardless of whether the target server is on a Unix or Windows platform.
- Use SCORE Environment commands for setup. Because triggers, endpoints, and SecureFTP sessions can all be initialized using only SCORE commands, this also means that a single INITIALIZE subroutine in your workflow can fully set up and prepare the SERENEDI environment from scratch. You could also have a DEINITIALIZE subroutine for takedowns, but be aware that once messages and events are tied to your new triggers, it's not a simple matter of deleting everything – you'll need to delete the messages, then events, before the relational constraints allow you to delete the triggers.

PARALLEL

- SCORE scripts are meant to be executed in parallel – many processes executing the same script, but with different arguments. The background BIN system is engineered to feed data from dozens of processes simultaneously without database locks or choke points. This means that *generally*, SCORE scripts should process at most one file at a time. Although PowerShell Core has looping mechanisms, you will get much better performance from the environment if you write short scripts that operate on one file at a time, then exit. This way, the SERENEDI load-balancing system can make the most of system resources.
- This also means you should avoid having SCORE scripts execute long-running database operations. SERENEDI has safeguards to prevent SCORE scripts from running too long, and will kill the process if it exceeds the built-in four-hour time limit.
- SERENEDI will have a set number of worker processes running in the background, waiting for new work to appear in serenediCore. This is usually a quarter of the licensed workers or a quarter of the available CPU cores, whichever is less. Once it starts to become busy, SERENEDI automatically launches the full available number of worker processes (the number of available CPU cores or the licensed number of cores, whichever is less) until there is no more work to do, at which point it returns to “idle” mode.

PIPELINE WALKTHROUGH

In this section, we will go into much more detail about one SCORE script that is provided with the distribution: Pipeline.ps1. The main reason is that this single SCORE script does the following things:

1. It creates the entire pipeline folder hierarchy as well as all pipeline triggers
2. It partitions functionality to serve all the pipeline triggers in individual sections

This is a good model to follow when creating custom SCORE scripts for your own applications. With a dedicated installation function, the SCORE script becomes *portable*. This same script could be tested and deployed on a development server, then deployed on a QA server, then on a production server, all with the same steps.

By handling multiple triggers, it's possible to maintain a single script to handle multiple, related business processes and have a single point of maintenance.

Setting the Base Directory

...

```
$base = (Join-Path $basePath 'pipeline')
```

...

The \$basePath is a predefined SCORE variable that represents the SERENEDI installation directory. Many people would choose to simply add the pipeline folder to the base directory, like so:

```
$base = $basePath + '\pipeline'
```

Since UNIX systems and Windows systems use different characters for path separators, this is *not* cross-platform. The Join-Path function, however, will work reliably to join two paths regardless of platform.

Installing the Environment

...

```

if ($eventData3 -eq 'INITIALIZE')
{

    $pipebase = (Join-Path $base '001_Normalize')
    mkdir $pipebase
    mkdir (Join-Path $pipebase '01_in_edi')
    mkdir (Join-Path $pipebase '02_done_edi')
    mkdir (Join-Path $pipebase '03_out_edi')
    mkdir (Join-Path $pipebase '04_err_edi')
    sapi-EnvTriggerUpsert -TriggerName 'PIPE001_NORMALIZE' -Script '$\Pipeline.ps1' -TriggerType
'LOCAL_UPLOAD' -InitFolder '$\001_NORMALIZE\01_in_edi' -SourceFolder '$\001_NORMALIZE\02_done_edi' -
PollInterval 30 -IsEnabled $True -ForceArg3 'PIPE001_NORMALIZE'

```

...

First, the *third* argument is checked for the Initialize command. This is important because when the serenediCore database is first set up, prior to SerenediService running, there are no triggers at all – only a single BIZ_EVENT set up to execute this script in *immediate mode*. Once SerenediService first starts to run and launches a worker process, this initialization event will be the first thing to be processed.

This small section sets up the environment for the *Normalize* pipeline. First, it makes the directory hierarchy for the pipeline, and then it creates the trigger. Note the use of the \$ in the command – this is shorthand for C:\serenedi\pipeline or wherever SERENEDI is installed to, and is cross-platform compatible. The **sapi-EnvTriggerUpsert** command will either update an existing trigger with the same name or, if the trigger does not exist, create it from scratch. The script is set the same for all of these triggers: **`\${Pipeline}.ps1**. The LOCAL_UPLOAD trigger type is a reliable way of processing incoming EDI files, as the trigger cannot fire unless the file has been successfully moved from the Init to the Source folders. The Poll Interval is set to 30 seconds, the event is enabled, and, finally, all events created with this trigger will have Argument 3 set to PIPE001_NORMALIZE. This is the how the SCORE script will differentiate this trigger from all of the other triggers executing this same script – via Argument 3.

Handling the Event

...

```

# NORMALIZE Pipeline
# 01_in_edi - EDI file to ingest
# 03_out_edi - Reprocessed and Normalized EDI file
# 04_err_edi - Errored EDI file

if ($eventData3 -eq 'PIPE001_NORMALIZE')
{
    sapi-SegPoolFromFile -Filename $eventData1
    sapi-SegPoolToHKey
    sapi-SegPoolFromHKey

    if ((sapi-FetchVar -Value "CRIT_ERR") -eq $false)
    {
        $newPath = (Split-Path (Split-Path $eventData1 -Parent) -Parent) + '\03_out_edi\' +
[System.IO.Path]::GetFileName($eventData1)
        sapi-SegPoolToFile -Filename $newPath -Formatting '*~>^' -bolCR $true -bolLF $true
    }
    else
    {
        $newPath = (Split-Path (Split-Path $eventData1 -Parent) -Parent) + '\04_err_edi\' +
[System.IO.Path]::GetFileName($eventData1)
        Move-Item -Path $eventData1 -Destination $newPath
    }
}

```


This small set of code is the entirety of the Normalize pipeline handler. After checking Argument 3, first the file is loaded from the **\$eventData1** variable. This variable reflects EVENT_DATA1 from the BIZ_EVENT table, as set by the LOCAL_UPLOAD trigger type, when it is able to successfully move a file from the Init folder to the Source folder as defined in the trigger.

From there, it translates *to* the HKey register and then *back* from the HKey register. This will set all the encoding options – such as the element and segment separators – to the same value, and ensure all files are formatted the same way with respect to carriage returns at the end of segments, and so on. Furthermore, any minor deviances from the HIPAA Implementation Guide specifications will get filtered out in this step.

Assuming that the file did not have any critical errors, then **sapi-FetchVar -Value “CRIT_ERR”** will return a False Boolean value, and the **sapi-SegPoolToFile** command will re-create the file in the 03_out_edi folder.

If there *was* a critical error, then the original file will be moved from the 02_done_edi folder to the 04_err_edi folder.

Creating Outbound Transactions

The SEED system within SERENEDI is a set of stored procedures and fixed data that enable you to create new, non-PHI test files for 14 different 5010 EDI specifications. These files have been tested with third-party bureaus to ensure full HIPAA compliance. This provides everyone developing outbound EDI transactions a fixed starting point from which to begin development, using well-known SQL syntax and objects. Furthermore, by copying / modifying these procedures, it's easy

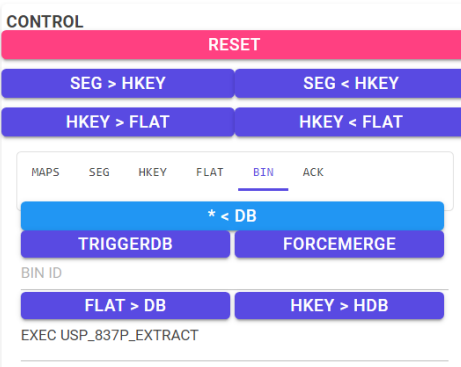
Because HIPAA EDI files are necessarily concerned with transmitting managed care data, we needed to create a rich set of sample tables that mimic a simple managed care system so these seed files have information that makes them look and feel like normal EDI files. The clue that these tables do not actually contain any PHI is in the last names: they are names of ethnically diverse foods. The 14 stored procedures are described in more detail at the end of this chapter.

Each stored procedure translates the sample data and projects it to a CGIF2-compliant data extract that SERENEDI can turn into an EDI file. Therefore, if you'd like to quickly create a new EDI extract process, you can create a copy of an existing stored procedure and alter the extract so that instead of pulling from the sample tables, it pulls data from your managed care system sources. If the fields you need are not present within the extract, you can look up the HIPAA EDI equivalent in SERENEDI in the html files located under the /serenedi/shared/docs/specs directory.

Note that these examples are all data-ready to project data as a Flat register, but this is not your only option. Some situations – especially those that involve highly repeating segments or highly dynamic mappings – are more difficult to express in the Flat projection than with the Hierarchical DB projection. You could artificially create a new HDB BIN entry in the BIN_LOG table, programmatically make insertions into the HDB tables using the BIN_ID to tie the data together, and then use the 008_BINToEDI pipeline to export the file to the file system, just as if you had originally imported that file from an EDI source instead of generating the data yourself. However, using the Flat export mechanism is easy and straightforward in most situations, and with stored procedures, SERENEDI can go directly from procedure to an EDI file in the file system.

The fastest way to generate an EDI file using these sample EDI extracts is simply to create a new BIZ_EVENT row that requests the 008_BINToEDI pipeline to generate a file from a dynamic data source. This generates a 'seed_837p.txt' file and places it in the SERENEDI base directory:

```
INSERT INTO BIZ_EVENT(BIZ_TRIGGER_ID, EVENT_DATA1, EVENT_DATA2, EVENT_DATA3) SELECT
BIZ_TRIGGER_ID,'EXEC USP_837P_EXTRACT','SEED_837P.TXT', 'PIPE008_BINToEDI' FROM
BIZ_TRIGGER WHERE TRIGGER_NAME='PIPE008_BINToEDI'
```



Another way to do this is by using SERENEDI Studio. This gives you several advantages during development: you can load the Flat register and then immediately decode it, thus validating it against the many business validation rules built into the SERENEDI environment. From SERENEDI Studio:

First, click on the BIN tab, enter EXEC USP_837P_EXTRACT in the bottom text box, and then click the blue * < DB button above the text box. This results in a popup:

second, you can use the above steps to repeatedly test the maps and extract logic to make sure the segments are generated in the way that you expect.

2. Be aware that each field in SERENEDI is associated with four cardinal data types: integer, decimal, string, and date/time. The types are provided for each mapping in the HTML files under the docs directory so you know what data type each column is expecting. Encoding the wrong data type into a map can have unpredictable effects.
3. SERENEDI will not encode a loop unless at *least* one non-null data value is present in that loop. If you are getting invalid loops in the outbound file, check the data extract to make sure you aren't accidentally sending any non-null data elements for that loop. If you examine the sample extracts, you'll see several cases where entire sets of fields are encased in CASE WHEN <logic> THEN <value> ELSE NULL END. This is a way to ensure that the loop will only occur for a specific condition, and at no other time.
4. Remember that this encoding/decoding process is completely *two-way* – so if you're having trouble conceptualizing the data maps you need to create a certain set of segments, it might be easier to copy one of the sample files, manually edit it to add the segments you need, and observe how it decodes to the CGIF2 Flat space. This will guide you toward the best way to project your business data to achieve that result.

Common Attributes of the Seed Extracts

There are 14 stored procedures within the distribution database that define the seed extracts. At the very beginning, the distribution database increments the Interchange Control Number record in the SAMPL_HEADER that is linked to that transaction. This ensures that every file generated has a unique ICN. Then, it projects the sample data to create a compliant EDI transaction for that specification. A critical ORDER BY statement comes at the end. Although the extract itself could be placed in an SQL View, SQL Server does not honor ORDER BY clauses within Views, and therefore stored procedures are the most reliable way to ensure the data is in the proper order for encoding.

Also, each specification remaps the first field, ISA_ISA02_NO_AUTH_NFO from the SAMPL_HEADER table, to a different name that incorporates the specification tag. Without this specification tag, SERENEDI will not know what transaction these maps belong to, so this is quite crucial.

In each of the remaining sections in this chapter, we will discuss a different extract. To see the source code of the extract itself, you can right-click on the stored procedure and select Script Stored Procedure As, then Create To from within SQL Server Management Studio.

USP_270_EXTRACT

This stored procedure projects a group of subscribers and dependents in a mock 270 eligibility request file. It joins the Payer Provider ID provided in the Sample Member data to the Sample Provider table, and the ORDER BY clause at the end ensures data is sorted by these providers first, and then by the Member ID number. It generates 120 records.

USP_271_EXTRACT

The 271 extract is almost exactly the same as the 271 extract, except that it adds a Plan Begin date of 2019-01-01 for all of the 120 records it returns.

USP_275C_EXTRACT

This stored procedure is a “proof-of-concept” method for encoding 5010 275C Patient Information EDI files from a database. It pulls the member information for the first defined member in the SAMPL_MEMBER table (MEMBER_ID = 1) and pulls the binary contents of the new “PATIENT_CHARTS” column that is part of that table. This SERENEDI Flat-encoded set of maps and data can then be used to create a new 275C Patient Information file.

USP_276_EXTRACT

This query hits the sample tables to generate a Health Care Claim Status Request transaction for 889 claim lines. Some things to note about this extract:

- Because there are members without dependents defined in the sample tables, the 2200D and 2210D loops should only be present when the member is also the subscriber; the 2200E and 2210E maps should be completely nulled out to prevent an erroneous loop being encoded. This is accomplished with the CASE WHEN DOB1 IS NOT NULL THEN ... ELSE NULL END logic for the 2100E/2210E maps – it ensures the claim information is only transmitted when DOB1 (Dependent Date of Birth in the subquery) has a non-null value, meaning that member is a dependent.
- The subquery is a way to bifurcate the member population into subscribers and dependents so that the appropriate logic branches can be used for each claim line.

USP_277_EXTRACT

This extract is a mirror of the 276 extract, simulating a response to a claim inquiry. Since the dependent date of birth is not sent back, the dependent ID card is checked for a non-null value to verify whether to send the 2200E loops.

USP_277CA_EXTRACT

This is a Claims Acknowledgment extract. Instead of sending, unlike other files, it requires that the total submitted charges for claims be submitted at a header level and member level. This is the responsibility of the two subqueries that generate the BLLR_CLM_CHG_AMT and the CLM_CHG_AMT fields: generate a sum total of all claims by biller and a sum total of claims by member.

USP_278_REQ_EXTRACT

This is a Health Care Services Review – Request for Review transaction. For this specification, each member to be reviewed is sent as a different transaction with its own ST/SE envelope. The Place of Service code filter restricts the query results to Inpatient claims. The subquery gathers Place of Service and minimum service dates for this extract that go in the 2000E loop.

USP_278_RESP_EXTRACT

This query provides a member-level response to the Health Care Services Review, so it does not need to encode any claim lines and gives a simple, canned response.

USP_820_EXTRACT

This is a Payroll Deducted and Other Group Premium Payment for Insurance Products extract where the payer is being billed \$10 for every member (as shown in the L2300B_RMR04_DTL_PRM_PMT_AMT mapping). This file is split into six transactions, one for every payer, and every member is assigned a unique invoice within the file through the use of a ROW_NUMBER() command.

The subquery counts the members per payer so it can generate a header-level invoice amount for the whole bill.

USP_820X_EXTRACT

This Health Insurance Exchange Related Payments file is similar to the 820 extract above, except it needs to transmit policy dates. All policy dates are defaulted to 2020-01-01 to 2020-12-31.

USP_824_EXTRACT

This Application Reporting for Insurance specification reports a single Transaction Accepted status for a sample transaction.

USP_834_EXTRACT

This is a sample eligibility extract that uses hard-coded benefit begin and end dates. It transmits subscribers first, followed by dependents later in the file, and will only transmit the member address if the member is also a subscriber.

USP_835_EXTRACT

This is a sample 835 extract that transmits payment information for all the claim lines present in the sample data. The extract-stored procedure is a bit complex because of the following factors:

- The Transaction Header must contain a valid sum amount for all the claims within the transaction
- The claims must also transmit accurate total payment information
- The presence of the various Patient Responsibility amounts affects the presence and composition of CAS claim adjustment segments

The first subquery that generates CHK_PMT_AMT generates the transaction-level payment amount, whereas the second subquery generates the sums for Claim Charge Amount, Claim Payment Amount, and Claim Patient Responsibility Amount, as well as the minimum and maximum service dates per claim.

The real complexity lies in the UNION subquery within the CAS_DTL inner join. SERENEDI treats CAS segments as *cutouts*, which means repetitions of these segments are encoded vertically as different rows instead of as new columns. To keep the cutout information related to the claim detail line in the previous row, the NEWROW column is set to 0. This flag basically means “The only relevant information in this entire database row is the cutout mappings.” This NEWROW column is used only for flat-formatted extracts.

This means that our 835 extract must keep track of whether it is the *first* CAS segment (NEWROW = 1) or *additional* CAS segments (NEWROW = 0). The CAS_DTL clause establishes this logic: If there is a Claim Line Patient Responsibility amount above 0 (copay + coinsurance + deductible), then it will emit a CAS*PR segment, fill it with the appropriate information, and set the NEWROW to 1, and then any remaining difference will be transmitted as a successive CAS*CO segment where NEWROW is set to 0. If there is no Patient Responsibility amount, then only the CAS*CO segment is transmitted with a NEWROW set to 1 (it’s the only Claim Adjustment segment).

The CAS*CO will vary depending on whether there is a *claim withholding* flagged for this claim line. If so, it will be encoded with a 104 Remittance Adjustment Reason Code, and the remaining balance will be encoded in the same segment with a reason code of 45.

Note that within the CAS*PR encodings, the deductible, coinsurance, and copays are all assigned discrete slots within the CAS segment – CAS03, CAS 06, and CAS09 adjustment amounts. For claims with only a copay amount, this could lead to an invalid CAS segment as it would leave the CAS03 and CAS06 elements empty. As a convenience, SERENEDI will

automatically “fill” in these earlier elements if they are left blank and higher elements are filled in – this check is done only on CAS segments.

At the end of the extract, all lines are sorted by Provider ID, Claim ID, Claim Detail ID, and NEWROW in *descending* order. This way, NEWROW = 1 will always occur before NEWROW = 0 rows for additional CAS segments, which is correct.

USP_837I_EXTRACT

USP_837P_EXTRACT

The 837 Institutional and Professional extracts share enough in common that they will be discussed here together. Three different situations are demonstrated by this extract:

1. Subscribers with claims
2. Dependents with claims
3. Both subscribers and dependents with claims

In the first case, these extracts simply omit the 2000C patient loop for subscribers, and the claim and claim lines are encoded in a straightforward fashion.

In the second case, the extract gives the subscriber information, followed by the 2000C patient loop that describes the dependent information, followed by the claim.

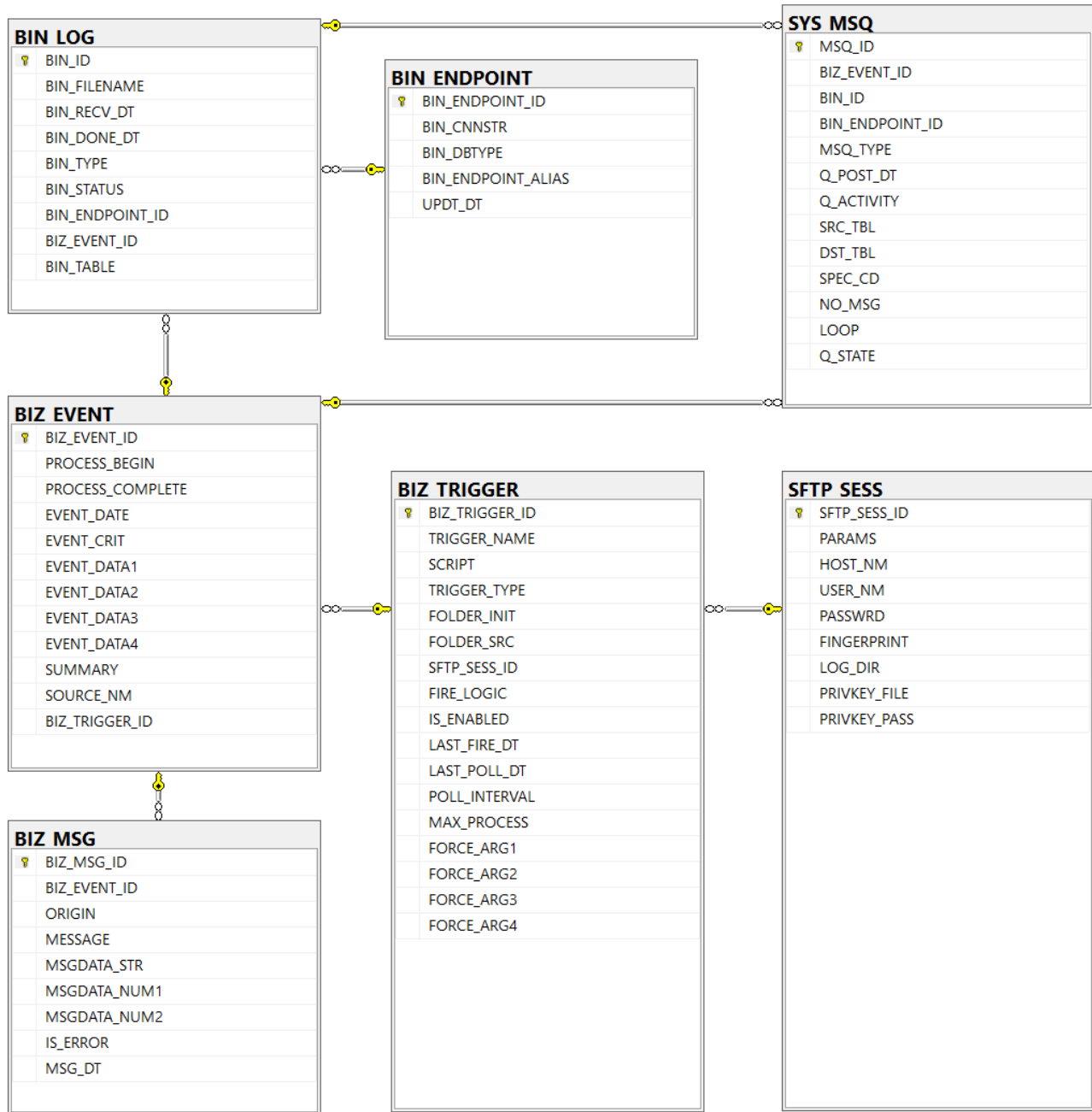
In the third case, the subscriber information is first transmitted along with associated claims. Then, the subscriber information is relayed again, and each dependent is transmitted in separate iterations of the 2000C patient loop, followed by claims for that dependent. The initial HL**22 loop for the subscriber appears only once for all the dependents. This sequence is described in detail starting on p. 30 of the 837 Institutional Implementation Guide.

One of the design goals of these extracts is to convey these more complex EDI relationships; therefore, all of the above cases are present in the sample data and the seed file extract. Most of the “heavy lifting” for these requirements is handled in the large UNION subquery labeled MEM. This layer provides all the raw data used by the 2010BA, 2010BB, and 2010CA loops. Note that the HL segments are not mapped in this extract; SERENEDI dynamically generates the correct values for these segments based on the data being projected.

Within the clause itself, the UNION clause provides values for the Subscriber and Patient loops, depending on the PAR_MEMBER_ID column to decide if the member is a subscriber, and fills in or nulls out all values based on that information. This is one way to avoid needing excessive CASE WHEN ... THEN ... ELSE NULL END statements when encoding loops.

The final subquery generates Claim Charge Amounts and Claim From/To dates that are used at the 2300 Claim header loop level.

Finally, the ORDER BY statement at the end sorts data by Biller ID, Subscriber ID, Patient ID, Claim ID, and Claim Detail ID, ensuring the data is emitted in the correct order to create a valid file.



On the previous page are the core tables for the serenediCore distribution database. Omitted from this diagram are the database objects related to the Sample Data and extracts, which are covered separately. These objects are used by the SERENEDI automation system, which is covered in deeper technical detail in this chapter.

As described in the introduction to SERENEDI, this platform was designed to facilitate portability, parallelism, and projections. Portability is made possible with the specific design choices and environment-related SCORE script commands

that are part of the platform. Parallelism is possible due to the highly multi-process nature of the automation environment. Projections are provided as an aspect of the underlying technology.

SerenediService

When SerenediService is first run on either Windows or a Container, it reads database connection information from the command line that defines the location of the serenediCore distribution database and pulls in information from the *license.key* file related to the licensing level of the SERENEDI installation.

SerenediService then sits in the background and runs the following checks at these intervals:

1. Four times a second, it polls the BIZ_EVENT table using the following query:

```
SELECT      BE.BIZ_TRIGGER_ID,
            MIN(BIZ_EVENT_ID) BIZ_EVENT_ID
FROM        BIZ_EVENT BE
LEFT JOIN   (
            SELECT      BE.BIZ_TRIGGER_ID
            FROM        BIZ_EVENT BE
            INNER JOIN  BIZ_TRIGGER BT
            ON          BT.BIZ_TRIGGER_ID = BE.BIZ_TRIGGER_ID
            WHERE       PROCESS_BEGIN IS NOT NULL
            AND         PROCESS_COMPLETE IS NULL
            GROUP BY   BE.BIZ_TRIGGER_ID,
                    BT.MAX_PROCESS
            HAVING      COUNT(*) > COALESCE(MAX_PROCESS, 9999)
        ) EXCEED
ON          EXCEED.BIZ_TRIGGER_ID = BE.BIZ_TRIGGER_ID
WHERE      BE.PROCESS_BEGIN IS NULL
AND        EXCEED.BIZ_TRIGGER_ID IS NULL
GROUP BY  BE.BIZ_TRIGGER_ID
ORDER BY  BIZ_EVENT_ID
```

This query returns the oldest unprocessed event for each trigger that does not exceed the MAX_PROCESS count for concurrent processes, and sorts the results so that the oldest event from any trigger gets processed first. This query is re-run if there is worker capacity remaining

Maximum worker count is defined as either 7/8 of the available CPU cores or the licensed core count, whichever is less. Minimum worker count is defined as 1/4 of the maximum core count, with a minimum of 1. If the number of outstanding events exceeds the minimum worker count, new workers are launched up to the maximum worker count – otherwise, only the minimum worker count is maintained.

If a worker executes an event that exceeds four hours of execution time, it is forcibly terminated and the event is marked TIMEOUT FAILURE in the SUMMARY column.

2. Four times a second, SerenediService checks the Trigger Scan process. If it is not running, it is relaunched.
3. Every 1.5 seconds, SerenediService checks for unprocessed data shuttle requests with this query:

```
SELECT COUNT(*) FROM SYS_MSQ WHERE Q_STATE='U' AND MSQ_TYPE = 'DATA_SHUTTLE'
```

If this value is nonzero and the data shuttle process is not running, it is relaunched.

4. Every 1.5 seconds, SerenediService checks to see if the SERENEDI Studio process is running. If not, and the serenediStudio.dll binary is found in the C:\serenedi\bin directory, it is relaunched.

SerenediService is designed to run in the background continuously – for this reason, it is solely concerned with launching child processes. The SerenediService process ID is communicated to all child processes; if SerenediService is terminated, all child processes will self-terminate as soon as possible.

SERENEDI Command Line Arguments

SERENEDI Service

The command line arguments for the SERENEDI Service give end-users the ability to tailor the functionality of SERENEDI for specific use-cases. Normally, the command line will look something like this:

```
C:\serenedi\bin\serenedi.exe SERVER STUDIO SC H:C:\serenedi MSSQL:"Data Source=(local);Database=serenediCore;User id=sa;Password=strongPass1;TrustServerCertificate=true;"
```

These parameters are the *default* installation, assuming the initial install folder was C:\serenedi. It can be customized as follows:

STUDIO – This is an *optional* parameter that directs SERENEDI to listen to socket 5000 for local web browser requests. If you'd like to disable the STUDIO interface, just omit this parameter.

H:<Home Path> - This specifies the home folder for SERENEDI.

MSSQL: “<MSSQL Database Connection String>” – This is the database connectivity string for SERENEDI and directs it to connect to the serenediCore distribution database.

PIPE:<Pipeline Path> - This optional parameter is an override to the pipeline folder.

NOSHUTTLE -This optional parameter disables Data Shuttle processes from being launched, and will completely shut down the data shuttle functionality of SERENEDI. This can be useful in certain real-time data processing scenarios.

TICK:<Service Tick Milliseconds Interval> - This is an override to the service polling interval, which defaults to polling triggers every 1000 milliseconds. Lowering this value too low could have severe consequences by hammering the serenediCore database with too many consecutive queries; raising this value too high will reduce the responsiveness of the trigger system. This enables SERENEDI to be used for certain edge-case real-time scenarios.

SERENEDI Command Line

The SERENEDI product covers two cases where users can execute the serenedi.exe command line directly. They are: 1) checking the license information, and 2) Executing the REPL environment for non-production test and validation purposes.

Checking the License

In the serenedi\bin folder, execute the following:

```
serenedi.exe LICENSE
```

This will provide information about the licensee, license effective data, and number of cores. If the database connection string is provided (see MSSQL above), this command will also return the total number of events in the BIZ_EVENT table.

REPL

```
serenedi.exe REPL SC H:C:\serenedi MSSQL:"Data Source=..."
```

This is a method to open a simple command-line shell that can execute both PowerShell Core commands as well as SERENEDI-specific commands. This command should be used by a developer testing commands for development purposes only; it should **not** be used for production processes. This shell does not allow for logic branching commands; the normal way to develop new SCORE scripts is via Visual Code with the PowerShell Core extension (see installation instructions for more information on this).

Worker Process

Worker processes are launched by the SerenediService when there is work to be done. They operate in parallel with other worker processes. They are designed to be short-lived: they process a single, predetermined event and then exit.

If the event does not complete within one hour, it is assumed to be hung and it terminated by the SERENEDI Service and the SUMMARY field will be updated to 'TIMEOUT FAILURE'.

There is a limit to the amount of simultaneous worker processes SERENEDI launches; this is predetermined by both the licensing level as well as the CPU resources available. Normally, pending events are assigned to workers evenly among the triggers, so that each trigger will be assigned some resources and not be hung up when a large amount of events get added to the serenediCore database. However, triggers can be assigned a "MAX_PROCESS" integer that limits the number of parallel Worker Processes that can be launched at any single time.

Worker Processes can also be assigned to special events called Immediate Mode events that are unbound to a trigger. These special events are generally used to call "bootstrap" operations on SCORE scripts. In this case, the BIZ_TRIGGER_ID for the event will be null, and the EVENT_DATA4 column will store the file path of the SCORE script to be executed. In this case, only the first three arguments are passed on to the script.

If there is a trigger associated with this event, then the SCORE script associated with that event is executed and all four arguments are passed to the script.

Trigger Scan

The Trigger Scan functionality is executed periodically to scan all trigger criteria that are a) enabled and b) have a POLL_INTERVAL greater than 0.

Each row of the result set is processed as follows:

1. If the LAST_POLL_DT column is null or is set to a value that is older than the number of seconds stored in the POLL_INTERVAL column, then this trigger is eligible to be scanned.
2. After the trigger is found to be eligible, the trigger scan will update LAST_POLL_DT by adding POLL_INTERVAL seconds to it. If the LAST_POLL_DT column is null, it is set to the current date/time.
3. If the TRIGGER_TYPE is set to LOCAL_UPLOAD, LOCAL_ARCHIVE, or SQL, control is passed to one of these handlers.

Upload Triggers

1. If an SQL filter is defined in the upload trigger, that is checked before anything else. In this way, developers can limit execution to certain days or times using standard SQL date/time expressions – when an SQL filter is set, it must return an integer '1' value for the trigger to execute. If the SQL filter is not set, or if the SQL filter expression resolves to numeric 1, execution continues.

2. The Initial directory is defined in the FOLDER_INIT column. Upload triggers generate events when the Trigger Scan process is able to move files from the Initial directory to the Source directory defined in the FOLDER_SRC column. If file filters are set, they operate in the following way:
 - a. When a single file filter is defined, this limits what files are scanned in the Initial directory. For example, a *.837 filter will ignore all files except those ending in the .837 filename extension.
 - b. When *multiple* file filters are defined, they act to define file sets where the wildcard expressions must be matched on all filters. Even when a match is found, only the file matching the *first* filter will be used to fire the event.

Example: Two filters are defined for this trigger: *.837 and *.HDR. Five files are present in the Initial directory: ABC.837, DEF.837, GHI.837, ABC.HDR, and DEF.HDR. This results in two files that will generate events: ABC.837 and DEF.837. The *.HDR files, not being the first defined filter, do not generate events, but does prevent GHI.837 from triggering an event because it does not form a complete file set.
3. If a TIMESTAMP filter is set on this event, it is used to evaluate a timestamp expression that is then added to the end of the filename when it is moved to a new location.
4. Files fulfilling all of the previously established criteria are moved to the directory as defined in the Source directory. If a file already exists in the Source directory, or if the file fails to be moved, it is assumed to be locked in some way and does *not* generate an event. Files are sorted based on their file size, with the largest files sorted first.
5. For all files satisfying the above criteria, an event is generated with the fully pathed filename as EVENT_ARG1 for each one.

Archive Triggers

1. If an SQL filter is defined in the archive trigger, that is checked first as defined in Step 1 for Upload triggers.
2. The sole directory used for Archive triggers is the Init directory defined in the FOLDER_INIT column of the trigger. All files present in the directory are scanned; if one or more file filters is set for this trigger, they are evaluated in exactly the same fashion as steps 2a and 2b defined for the Upload trigger above.
3. The bare filenames that result after step 2 is evaluated are compared with the results of this query:

```
SELECT EVENT_CRIT FROM BIZ_EVENT BE INNER JOIN BIZ_TRIGGER BT ON BE.BIZ_TRIGGER_ID = BT.BIZ_TRIGGER_ID AND BT.IS_ENABLED=1 AND BT.BIZ_TRIGGER_ID=<<BIZ_TRIGGER_ID>>
```

4. Files that do *not* match are flagged as new and inserted as events. Files are sorted based on their file size, with the largest files sorted first. Within the event, the EVENT_CRIT column is the filename without paths, whereas EVENT_DATA1 is the fully pathed filename.

SQL Triggers

1. For SQL Triggers, only the SQL filter is checked to determine if the event is fired. If the SQL evaluates to an integer '1', an event is spawned.

Data Shuttle

The data shuttle is launched by SerenediService when there are unfulfilled data shuttle requests. The shuttle has a unique responsibility in the SERENEDI automation system to drive the BIN system, specifically flat and HDB data storage. Before the data shuttle can operate, the data needs to be “staged” properly so the shuttle can do its job. This means initially

sending the data to one or more temporary tables on the database server and database that will be the home for that data. Because SERENEDI creates new columns spontaneously depending on the source data, it has to establish very tight control of when data is actually inserted into the destination tables, thus the need to stage the data in temp tables first.

The automation system acts in slightly different ways depending on whether the data being stored is a single flat table or a multi-table HDB insertion.

When SERENEDI worker processes run SCORE scripts and execute the **sapi-FlatForceMergeToBIN** or **sapi-FlatMergeToBIN** commands, they perform these actions to stage the data for the shuttle:

1. A new BIN ID is generated by the distribution database that uniquely identifies the data stored with this command.
2. A set of new records is created in the serenediCore SYS_MSQ table as follows:
 - a. Flat Merge operations: Q_ACTIVITY = 'FLAT_MERGE', Q_STATE = 'O'
 - b. Flat ForceMerge operations: Q_ACTIVITY = 'FLAT_FORCEMERGE', Q_STATE = 'O'
 - c. MSQ_TYPE = 'DATA_SHUTTLE'
 - d. SRC_TBL receives the *temporary table* name
 - e. DST_TBL receives the *destination table* name
 - f. BIN_ENDPOINT_ID, if null, is set to the serenediCore database. If set, all temp tables and merge operations will be performed on the specified endpoint database.
 - g. If the flag NO_MSG is set, no messages will be generated for column spawning operations (Force Merge) or column not found (Merge) conditions.
3. The data is bulk stored to the destination SQL database as a single temporary table with a table name beginning with T_<Event ID>_<10-digit random number>. From the perspective of the database servers, these tables do not have any special designation as temporary tables.
4. After the table is successfully inserted, the SYS_MSQ entry for this table is changed from having a Q_STATE of O to a Q_STATE of U. This marks the table as ready for the data shuttle.

When SERENEDI worker processes run the SCORE script commands **sapi-HKeyMergeToHDB** and **sapi-HKeyForceMergeToHDB**, they commit these actions:

1. A new BIN ID is generated by the distribution database that uniquely identifies the data stored with this command.
2. Temp tables are generated in the distribution database for each loop represented in the HKey register. They follow this naming convention: T_<Event ID>_<1-Based Increment>_<10-digit random number>. From the perspective of the database server, these tables have no specific classification as temporary tables.
3. If all the tables were inserted successfully, a single transaction inserts a SYS_MSQ for each table that was generated:
 - a. HKey Merge operations: Q_ACTIVITY: 'FLAT_MERGE', Q_STATE='U'
 - b. HKey ForceMerge operations: Q_ACTIVITY: 'FLAT_FORCEMERGE', Q_STATE='U'
 - c. MSQ_TYPE = 'DATA_SHUTTLE'
 - d. SRC_TBL receives the *temporary table* name
 - e. DST_TBL receives the *destination table* name
 - f. BIN_ENDPOINT_ID, if null, is set to the serenediCore database. If set, all temp tables and merge operations will be performed on the specified endpoint
 - g. If the flag to suppress schema messages is set, ARG_03 will be set to NO_MSG.

- h. The SPEC_CD and LOOPNM are set for each loop table in the dataset.

The background data shuttle service is responsible for quickly and reliably moving the data from the temporary data staging tables to the final destination tables. For “ForceMerge” requests, it also has to manipulate the destination table schema so that all source schema data elements have a home in the destination schema. This data staging system also ensures that database worker threads are not overwhelmed trying to make dozens of simultaneous table inserts into a single destination table, which can lead to lock contention and dropped database connections. By having a single background process handle these responsibilities, data is “shuttled” to the BIN tables reliably and without locking contention.

If the data shuttle is able to complete a request, the SYS_MSQ for that entry is removed completely. In this way, the SYS_MSQ acts as a temporary work table. If there was an error, the data shuttle will either retry the operation or update the Q_STATUS to ‘Z’, which is an unrecoverable error. All hierarchical operations work in transactions, so either all data for all loop tables is inserted into the destination tables, or none of them are.

To ensure the integrity of the SERENEDI BIN system, here are some important notes:

1. Do not use cursors on the BIN tables when there are active data operations
 - a. Cursors lock the schema during their operation, which will prevent Force Merge operations from working
2. Be careful with any manual schema changes
 - a. If you alter the schema during a data shuttle operation, you can cause the data shuttle to crash or have unpredictable results
 - b. If you add a column with an incorrect data type, this will cause the data shuttle to error on all inserts occurring with that column

BIN_LOG

This table is the key reference point for the entire BIN system – SERENEDI’s method of storing a diverse set of information associated with EDI files. The BIN system can store Flat database stores and HDB (hierarchical database) stores. Each item committed is referenced with a single BIN_LOG_ID, often referred to as the BIN ID in this manual. The flat and hierarchical data stores must be accessible to normal SQL queries and can be stored locally in the serenediCore database or externally in another database. The location of the item is stored along with the BIN_LOG_ID reference so that when Data Fetch commands are executed, only the BIN_LOG_ID is needed to retrieve the item.

In most cases, the commands that store BIN items to the Flat and HDB stores do not usually *wait* for the item to be completely committed before the command concludes. That’s because the data first immediately goes to a temp table in the serenediCore database before both the schema and data are *merged* to an existing data store in a way that is scalable across a large number of simultaneous transactions. The BIN_DONE_DT field is populated when the data for that BIN entry is fully committed and ready to be queried; while this field is null, you can assume that the data is *not* available to be read by your data consumer applications.

SERENEDI does not have any premade BIN tables for data to go to initially. Instead, when all default parameters are used, SERENEDI creates them dynamically as new EDI specifications are encountered.

Field Name	Data Type	Purpose
BIN_LOG_ID	Integer (PK)	This is the unique primary key for each BIN_LOG entry. It is the single point used to load in a BIN entry and is stored externally as a foreign key by all data stores.
BIN_FILENAME	Varchar(200)	This is the filename of the item that created the BIN entry.
BIN_RECV_DT	DateTime (not null)	This is the timestamp for when the BIN entry was created.
BIN_DONE_DT	DateTime	This is the timestamp for when the BIN entry data was committed to the database and became available for querying.
BIN_TYPE	Integer (not null)	102 – This entry references an HDB set of data tables. The BIN_TABLE will contain a <i>prefix</i> that goes before each of the Loop names. This increases both the difficulty of accessing the EDI data and the storage efficiency. 103 – This entry references a Flat data table. By default, it will reside in the serenediCore database and be named BIN_5010_837I (for a 5010 837 I file, in this example). This data is the least efficient for storage, but the easiest to access.
BIN_STATUS	Varchar(20)	COMPLETE – The BIN entry has completely finished processing. PENDING – The BIN entry is still being processed. ERROR – There was a critical error while processing the BIN entry.
BIN_ENDPOINT_ID	Integer (FK)	This is an optional foreign key to the BIN_ENDPOINT table. When present, it signifies that the BIN entry is residing outside the default serenediCore database in a different database or server.
BIZ_EVENT_ID	Integer (FK)	When populated, this indicates the BIZ_EVENT_ID foreign key of the event that created this entry.
BIN_TABLE	Varchar(200)	This is mandatory for HDB and Flat entries and is the data table name where the BIN entry is stored.

BIN_ENDPOINT

This table stores references to other databases and database servers. Furthermore, it sets up “aliases” that can be used during SCORE workflow steps as shorthand for storing EDI-related objects in the BIN system.

Field Name	Data Type	Purpose
BIN_ENDPOINT_ID	Integer (PK)	This is the primary key to the table.
BIN_CNNSTR	Varchar(2000) (not null)	This is the Connection String used for opening the connection. The exact format of the string depends on the database provider used.
BIN_DBTYPE	Varchar(20) (not null)	This represents the database server used for the database. SQLSERVER – MS SQL Server (version 2012 or above is supported)
BIN_ENDPOINT_ALIAS	Varchar(100)	This is the alias used for this database connection.
UPDT_DT	DateTime (not null)	This is the creation date or update time of the connection.

BIZ_TRIGGER TABLE

This is the core table that drives the generation of events from the SERENEDI automation system. See the “Events” chapter for more information about how the values in the table’s fields drive the generation of new events.

Field Name	Data Type	Purpose
BIZ_TRIGGER_ID	Integer (PK)	This is the primary key for the table. It is auto-generated upon record insertion.
TRIGGER_NAME	Varchar(200)	This is the name of the trigger. If the trigger is grouped with other triggers as part of a business process, they should share a common prefix to make it clear that the process is associated with a group.
SCRIPT	Varchar(200)	This is the path and filename to the SCORE script executed by the events generated by this trigger.
TRIGGER_TYPE	Varchar(20)	This is defined as follows: SQL: An SQL query is executed during the trigger polling; a 1 integer result from the SQL fires the event. The SQL is defined in the FIRE_LOGIC column. PASSIVE: The trigger will not actively fire events, but is used to link events to a SCORE script. LOCAL_UPLOAD: This trigger will create new events for every file that is 1) Placed in the FOLDER_INIT folder and 2) can be successfully moved to the FOLDER_SRC folder. LOCAL_ARCHIVE: This trigger fires for every file that is present in the file system but <i>not</i> present as an event in the BIZ_EVENT table.
FOLDER_INIT	Varchar(200)	This is used for both LOCAL_UPLOAD and LOCAL_ARCHIVE triggers. For LOCAL_UPLOAD triggers, the file starts here and then is moved to the FOLDER_SRC. For LOCAL_ARCHIVE triggers, only this folder is used.
FOLDER_SRC	Varchar(200)	This is used by the LOCAL_UPLOAD triggers as the destination to move files to prior to firing the trigger. Syntax in the FIRE_LOGIC column is available to post-fix a timestamp and give a unique identifier to files that have the same name.
SFTP_SESS_ID	Integer (FK)	This is a foreign key to the SFTP Session table, used to define a SFTP Mirror triggers. These triggers do not spawn any events of their own – instead, they trigger SFTP Mirror operations via the pipeline system. The <i>local</i> directory is specified in FORCE_ARG3, and the <i>remote</i> directory is specified in FORCE_ARG4. The LAST_POLL_DT and POLL_INTERVAL, in turn, are used to track when the SFTP server is polled.
FIRE_LOGIC	Varchar(4000)	This is a pipe-delimited list of filters. TIMESTAMP applies only to UPLOAD trigger types. SQL is used for all triggers, and FILTER is used only for UPLOAD and ARCHIVE triggers. More information is available in the “Triggers” chapter.
IS_ENABLED	Integer	When this value is 1, the trigger is enabled. Any other value will disable the trigger.
LAST_FIRE_DT	DateTime	This defines the last time the trigger fired to create events.
LAST_POLL_DT	DateTime	The defines the last time the trigger was polled.
POLL_INTERVAL	Integer (not null)	This is the number of seconds between polls. Setting this to a value below 1 completely disables the trigger.
MAX_PROCESS	Integer	This is the limit on the number of active events that can process a trigger at the same time. Setting it to 1 ensures that any events created by this trigger

		will be serial – the next event will not be fired until the previous one is completely finished.
FORCE_ARG1	Varchar(200)	When specified, these values will set the EVENT_ARG1 to EVENT_ARG4 columns in the newly created trigger to a fixed value. This is primarily useful when you'd like to create a single SCORE script that handles multiple triggers or business processes. By forcing a fixed value into one of the arguments, the SCORE script can branch execution and assign dedicated handlers to each process based on the argument. In this way, a SCORE script is able to orchestrate a full business system as opposed to handling an individual functional process.
FORCE_ARG2	Varchar(200)	
FORCE_ARG3	Varchar(200)	
FORCE_ARG4	Varchar(200)	
		For SQL triggers, FORCE_ARG4 will be used as a BIN Endpoint Alias to allow the SQL defined in the FIRE_LOGIC column to be executed in external databases.

BIZ_EVENT TABLE

One row in the BIZ_EVENT table represents one unit of work that is scheduled to be farmed out to a number of parallel worker processes. Most of the time, this unit of work is centered around a single file moving through the EDI pipeline via the Upload or Archive triggers, but the system is flexible enough to do many other things, triggered actively via SQL triggers or passively via external inserts to this table.

Events are “owned” by worker processes as described in more detail earlier in this section, carrying specific arguments to the SCORE scripts associated with the trigger that generated the event. When large groups of events are triggered by a large number of files being processed at once, SERENEDI will attempt to process the largest files first. This helps reduce the overall time to complete the workload.

This system is also flexible enough to operate without an associated trigger – if the BIZ_TRIGGER_ID value is null, the EVENT_DATA4 column is treated as the local filename of a SCORE script to execute. This feature enables new SCORE scripts to bootstrap and prepare the local environment.

The Event Date column indicates when the event was created, the Process Begin column shows when a worker process started work on the event, and Process Complete indicates when the worker process was completed. If the event is completed without critical errors, it is flagged as SUCCESS in the Summary column.

To learn how to debug a SCORE script while executing a specific event, see the Visual Code Installation section in the Installation chapter.

Field Name	Data Type	Purpose
BIZ_EVENT_ID	Integer (PK)	This the unique primary key of the EVENT. It is referenced by the BIZ_MSG table, the SYS_MSG table, and the BIN_LOG table.
PROCESS_BEGIN	DateTime	This is the timestamp for when a worker process took ownership of this event and commenced work on it.
PROCESS_COMPLETE	DateTime	This is the timestamp for when the worker process completed the event.
EVENT_DATE	DateTime	This is the timestamp for when the event was created.
EVENT_CRIT	Varchar(4000)	This is the event <i>criteria</i> , generally the filename or some other string that fired the triggering mechanism.

EVENT_DATA1	Varchar(1000)	These event <i>data</i> fields provide data about the feeds to the SCORE script linked to the trigger that created this event. Alternatively, if the event is spawned with a <i>null</i> BIZ_TRIGGER_ID, then SERENEDI will check the field EVENT_DATA4 if it references a file. If so, then it's assumed this is a SCORE script executed in immediate mode, which does not require a trigger, and EVENT_DATA1, 2, and 3 are passed to this script during execution.
EVENT_DATA2	Varchar(1000)	
EVENT_DATA3	Varchar(1000)	
EVENT_DATA4	Varchar(1000)	
SUMMARY	Varchar(200)	This is generally either SUCCESS when an event completes without errors, or CRITICAL FAILURE if an error occurred when executing the SCORE script for this event.
SOURCE_NM	Varchar(1000)	This indicates the type of trigger that created the event. The three types are LOCAL_UPLOAD, LOCAL_ARCHIVE, and SQL.
BIZ_TRIGGER_ID	Integer	This is a foreign key reference to an item in the BIZ_TRIGGER table. If it is not supplied, then the event is executed in <i>immediate</i> mode.

BIZ_MSG

This table stores all messages generated in the course of processing events. Messages are not inserted into the table as they occur; instead, once the SCORE script for an event is completed, the messages are inserted in the order they were generated and tied to the BIZ_EVENT_ID.

Field Name	Data Type	Purpose
BIZ_MSG_ID	Integer (PK)	This is the unique primary key for the message.
BIZ_EVENT_ID	Integer (not null)	This is the foreign key to the BIZ_EVENT_ID that spawned this message.
ORIGIN	Varchar(50)	<p>This is a short string that denotes the origin of the message. Possible values are:</p> <p>DATA_SHUTTLE – This denotes fields that were added by the BIN system or flagged as not present.</p> <p>USER – This indicates a message generated by a SCORE script and given the default ORIGIN.</p> <p>For the syntax error messages, each “family” of errors will have a different Origin. The SCORE command documentation will more thoroughly cover those errors.</p>
MESSAGE	Varchar(400)	This is the primary point of communication for the message. It does not need to be too specific; it can rely on the following data fields to add information about what triggered this message.
MSGDATA_STR	Varchar(400)	This is string data for the message.
MSGDATA_NUM1	Integer	This is the first integer data for the message. If the message is a segment syntax error, this will store the segment index within the file of where the error occurred.
MSGDATA_NUM2	Integer	This is the second integer data for the message.
IS_ERROR	Integer	This is a flag, either 1 or 0, that indicates whether this message should be considered an error.
MSG_DT	DateTime (not null)	This is the timestamp for when the message was created.

SFTP_SESS

This table stores everything about a SecureFTP session, including sites, usernames, and passwords. It is used by the SFTP commands in the SCORE scripting system to centrally warehouse all the information related to SFTP sessions. If a fingerprint is received from an SFTP server that does not match a value set in this table, the command will fail with an error message.

Field Name	Data Type	Purpose
SFTP_SESS_ID	Integer (PK)	This is the unique primary key to the SFTP session.
PARAMS	Varchar(2000)	This is a comma-delimited list of options that direct the behavior of the SFTP session. They are: BINARY – Enforces a binary transfer mode during file operations. ASCII – Enforces an ASCII transfer mode during file operations. LOCAL_MIRROR – For Directory Mirror operations, this option directs new remote files to be downloaded to the local file system. If neither LOCAL_MIRROR nor REMOTE_MIRROR is supplied, this is the default mode of operation. REMOTE_MIRROR – For Directory Mirror operations, this option overrides the default Local Mirror setting and uploads files found on the local folder to the remote folder. FILE_MOVE – This option removes the source file after it is successfully uploaded or downloaded to the destination system.
HOST_NM	Varchar(200) (not null)	This is either the IP address or host name of the SFTP Site.
USER_NM	Varchar(100) (not null)	This is the username credential for the session.
PASSWRD	Varchar(100) (not null)	This is the password for the session.
FINGERPRINT	Varchar(200)	This is the remote site <i>fingerprint</i> . It is set automatically when first connecting to a remote SFTP site. Any subsequent connection will require the same fingerprint – if any changes are made, the connection will not go through and an error message will be logged. If you need to reset the fingerprint, it can be manually set to the string VOID. The next time this SFTP connects to the remote server, the fingerprint will be regenerated from the remote site.
LOG_DIR	Varchar(200)	This specifies a local file system directory that will be used to generate plain-text logs of SFTP operations as they occur.
PRIVKEY_FILE	Varchar(200)	Certain SFTP servers require public/private keys. This file refers to the local client's private key file. To be considered valid by the SSH.NET library used for SFTP communications, it must be in plain text and start and end with the following strings: -----BEGIN RSA PRIVATE KEY----- -----END RSA PRIVATE KEY-----
PRIVKEY_PASS	Varchar(200)	If a passphrase is needed to unlock the Private Key file, supply it in this column.

SYS_MSQ

The function of the SYS_MSQ table is explained in the earlier SERENEDI Architecture section about the data shuttle. It is a temporary workspace that enables the background data shuttle service to complete data storage requests. When the data storage request is successfully completed, the SYS_MSQ row is deleted. Only in the event of a critical failure will the row be left behind with a Q_STATE status of Z. If the row is stuck in a state of O, it means the Flat data could not be stored to the destination database as a temp table. If the row is stuck in a state of U, either the data shuttle is not running or it cannot access the distribution database.

When no data shuttle requests are ongoing, this table should have no rows, and letting Z error records accumulate in this table could slow down the overall performance of the system.

Field Name	Data Type	Purpose
MSQ_ID	Integer (PK)	This is the unique primary key of the MSQ record.
BIZ_EVENT_ID	Integer (FK)	This links the request to the event that spawned the data request. If a problem occurs, you can use this to analyze the root cause.
BIN_ID	Integer (FK)	This is a foreign key to the BIN_LOG table, and specifies the BIN_ID this operation is inserting to the destination table.
BIN_ENDPOINT_ID	Integer	If populated, this shuttle operation resides on the database defined within the BIN_ENDPOINT table.
MSQ_TYPE	Varchar(20)	This value is hard-coded as DATA_SHUTTLE. It is open to future expansion.
Q_POST_DT	DateTime	If there is a critical error, this is the time the record errored out. This is the only time that SYS_MSQ records are persisted for any length of time.
Q_ACTIVITY	Varchar(50)	This has two possible values: FLAT_MERGE FORCE_FLATMERGE The first value is a request to merge the data source from SRC_TBL to DST_TBL without making schema changes. If the NO_MSG flag is not set, it will create messages for any fields in the source it can't find in the destination. If this is set to FORCE_FLATMERGE, it is a request to merge the data source to the destination with schema changes. This way, all the data in the source can be inserted into the destination. New columns will be logged unless NO_MSG is set.
SRC_TBL	Varchar(200)	This specifies the <i>source</i> of the shuttle request, and is generally a temp table beginning with 'T_'
DST_TBL	Varchar(200)	This specifies the <i>destination</i> of the shuttle request.
SPEC_CD	Varchar(2)	This is the two digit specification code of the specification used for this merge/ force merge operation.
NO_MSG	Varchar(1)	This is a flag to indicate if messages are to be suppressed.
LOOP	Varchar(30)	This is used only for hierarchical operations, and indicates the loop short name used for the merge / force merge operation.
Q_STATE	Varchar(1)	This is a single-character status code:

DIAG03	Varchar(300)	Tertiary diagnosis
ADMIT_DT	Varchar(300)	Admission date
PROF_ID	Integer	Foreign key to the SAMPL_PROFESSIONAL table

SAMPL_CLAIM_DTL

This table contains claim lines tied to the claims. For encoding to 835 files, the patient responsibility amounts (copay, coinsurance, deductible, withholding) are used for encoding CAS adjustment segments.

Field Name	Data Type	Purpose
CLAIM_DTL_ID	Integer (PK)	Primary key to the Claim Detail table
CLAIM_ID	Integer	Foreign key to the SAMPL_CLAIM table
LINE_SEQ	Integer	Line sequence
HCPCS_CD	Varchar(300)	Procedure code
MOD01	Varchar(300)	Procedure modifier 01
MOD02	Varchar(300)	Procedure modifier 02
DESCR	Varchar(300)	Description
CHG_AMT	Numeric(18,2)	Line charge amount
PMT_AMT	Numeric(18,2)	Line payment amount
UNITS	Numeric(18,2)	Units
DIAG_CD_PTR	Varchar(300)	Diagnosis code pointer
SVC_DT	DateTime	Service date
COPAY	Numeric(18,2)	Patient copay
COINS	Numeric(18,2)	Patient coinsurance
DEDUCTIBLE	Numeric(18,2)	Patient deductible
WITHHOLD	Numeric(18,2)	Patient withholding

SAMPL_HEADER

This contains sample data used in the outer envelopes of all the extracts.

Field Name	Data Type	Purpose
HDR_ID	Integer (PK)	Primary key to the Header table
HDR_NAME	Varchar(300)	Header name
ISA_ISA02_NO_AUTH_NFO	Varchar(300)	ISA envelope map
ISA_ISA04_PASSWD	Varchar(300)	ISA envelope map
ISA_ISA06_MUTLY_DEF	Varchar(300)	ISA envelope map
ISA_ISA08_MUTLY_DEF	Varchar(300)	ISA envelope map
ISA_ISA11_REPTN_SEP	Varchar(300)	ISA envelope map
ISA_ISA12_ICN_VERS_NR	Varchar(300)	ISA envelope map
ISA_ISA13_ICN	Integer	ISA interchange control number
ISA_ISA15_ICN_USG_IND	Varchar(300)	ISA envelope map
ISA_ISA16_COMP_ELE_SEP	Varchar(300)	ISA envelope map
GSHDR_GS02_APP_SNDR_CD	Varchar(300)	GS envelope map
GSHDR_GS03_APP_RCV_CD	Varchar(300)	GS envelope map

GSHDR_GS06_GCN	Integer	GS control number
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SAMPL_MEMBER

This table defines 170 members/subscribers using completely random information. The relation code is D for dependent (member) or P for primary (subscriber). Dependents are tied to the parent record via the PAR_MEMBER_ID column.

Field Name	Data Type	Purpose
MEMBER_ID	Integer (PK)	Primary key to the Member table
PAYER_PROVIDER_ID	Integer	Foreign key to the SAMPL_PROVIDER table
BILLER_PROVIDER_ID	Integer	Foreign key to the SAMPL_PROVIDER table
RELATION	Varchar(300)	Relation code
MEM_ID	Varchar(300)	Plan member identification code
SSN	Varchar(300)	Social Security number
LAST_NM	Varchar(300)	Last name
FIRST_NM	Varchar(300)	First name
RES_ADDR	Varchar(300)	Residential address
RES_CITY	Varchar(300)	Residential city
RES_STATE	Varchar(300)	Residential state
RES_ZIP	Varchar(300)	Residential ZIP
DOB	Date	Date of birth
GENDER	Varchar(300)	Gender
LANG	Varchar(300)	Language
PAR_MEMBER_ID	Integer	Foreign key to SAMPL_MEMBER table (Parent record)

SAMPL_PROFESSIONAL

This table is a simple list of six professional providers. Their last names are all types of rocks.

Field Name	Data Type	Purpose
PROF_ID	Integer (PK)	Primary key to the Professional Table
PROF_LNAME	Varchar(300)	Last name
PROF_FNAME	Varchar(300)	First name
PROF_NPI	Varchar(300)	NPI

SAMPL_PROVIDER

This table contains six business-level entity providers.

Field Name	Data Type	Purpose
PROVIDER_ID	Integer (PK)	Primary key to the Provider Table
PROV_ORG_NM	Varchar(300)	Organization name
PROV_LAST_NM	Varchar(300)	Last name
PROV_FIRST_NM	Varchar(300)	First name
PROV_NPI	Varchar(300)	NPI
TAX_ID	Varchar(300)	Tax ID
BIZ_ADDR	Varchar(300)	Address

BIZ_CITY	Varchar(300)	City
BIZ_STATE	Varchar(300)	State
BIZ_ZIP	Varchar(300)	ZIP
BIZ_PHONE	Varchar(300)	Phone

Appendix A: SerenediAPI Workflow Reference

Serenedi is driven by PowerShell Core cmdlets. This cross-platform scripting solution is based on .NET Core and has a track record going back many years. PowerShell Core is easily extensible with external libraries, which makes it an ideal scripting solution for an integration platform.

Global Variables

When an event is fired, these variables will be populated prior to running the script:

Variable Name	Purpose
folderSrc	Source Folder
eventID	Biz Event ID of the current event
eventCrit	Event Trigger Criteria
eventData1	Argument Data 1
eventData2	Argument Data 2
eventData3	Argument Data 3
eventData4	Argument Data 4
mainScript	Main Process Execution Script

BIN COMMANDS

<p>sapi-FetchBinState</p>	<p>This command is used to interrogate the state of a BIN item. It provides the type of the BIN item and tells whether it is ready for use.</p> <p>If the BIN_ID is unknown, it returns UNKNOWN_BIN.</p> <p>If the BIN has not finished writing, one of these values will be returned:</p> <p>HKEY_PEND FLAT_PEND UNKNOWN_PEND</p> <p>If the BIN has completed being stored, one of these values will be returned, depending on the type of the BIN item:</p> <p>FLAT HKEY UNKNOWN</p>
<p>Parameter</p>	<p>Value</p>
<p>-BinId (int, mandatory)</p>	<p>Provide the BIN ID of the item to be investigated.</p>

<p>sapi-FlatForceMergeToBIN</p>	<p>This command will merge the loaded Flat table to the BIN system. If mappings are present in the Flat that are not in the destination BIN schema, the columns will automatically be added to the destination schema. Messages for these new files will be added to the message log <i>unless</i> the SuppressSchemaMsg flag is set.</p> <p>The return value from this command is an int of the BIN ID.</p>
<p>ERRORS</p>	
<p>WFDS0010</p>	<p>DataShuttle service not processing queued request - 20 minute timeout</p>
<p>WFDS0020</p>	<p>DataShuttle critical error while servicing request</p>
<p>WFDS0030</p>	<p>Critical error creating temp table</p>
<p>Parameter</p>	<p>Value</p>
<p>-Table (string, optional)</p>	<p>When specified, this will override the default destination BIN table with a provided table name.</p>

-Filename (string, optional)	When provided, this will be placed in the BIN_FILENAME column of the new BIN entry.
-SupressSchemaMsg (boolean, optional)	If set to True, SERENEDI will not generate message logs for new columns that are not present in the destination Flat schema.
-BinEndpointId (int, optional)	When given, this will override the default database connection and use the one defined in the BIN system using the BIN Endpoint ID.
-BinEndpointAlias (string, optional)	When given, this will override the default database connection and use the one defined in the BIN system using the BIN Endpoint Alias.
-NoWait (boolean, optional)	The default behavior of this cmdlet is to wait for the time it normally takes for the data to be inserted into the destination Flat table by the background data shuttle process. If this value is set to True, the script will continue execution.
EXAMPLE	
<pre>sapi-SegPoolFromFile -Filename 'C:\serenedi\shared\seed\seed_837p.txt' sapi-SegPoolToHKey sapi-FlatFromHKey \$binId = (sapi-FlatForceMergeToBIN -Filename \$eventData1 -NoWait \$true)</pre>	

sapi-FlatFromBIN	This is a general database command to load the Flat register. If a BIN ID is supplied, the Flat will be retrieved from the BIN system. If a table is supplied, the SQL in the table parameter will be executed and the Flat will be retrieved from that result instead. Note that "table" here can also mean an SQL View or an SQL Stored Procedure with parameters.
ERRORS	
BINX0085	Referenced BIN ID does not exist in the BIN_LOG table.
BINX0080	Cannot load Flat from this BIN ID: It is not storage in FLAT format.
BINX0120	Critical error during Fetch_BIN_Flat. Make sure that the SQL returns a valid dataset.
Parameter	Value
-BinId (int, optional)	When specified, this will direct SERENEDI to load the Flat register from the BIN system for the specified BIN ID.

-Table (string, optional)	This is mandatory if the BIN ID is not provided. The SQL given in this argument will be executed and the result will be processed into the Flat register. If this is prefixed with the capital letters EXEC, then the results of the following <i>stored procedure</i> will be assigned to the Flat register.
-BinEndpointId (int, optional)	When given, this will override the default database connection and use the one defined in the BIN system using the BIN Endpoint ID.
-BinEndpointAlias (string, optional)	When given, this will override the default database connection and use the one defined in the BIN system using the BIN Endpoint Alias.
EXAMPLE	
<pre>sapi-FlatFromBIN -BinId 1 sapi-FlatToHKey sapi-SegPoolFromHKey sapi-SegPoolToFile -Filename 'c:\serenedi\shared\test.txt' -Formatting '*~>^' -bolCR \$true -bolLF \$true</pre>	

sapi-FlatMergeToBIN	<p>This command will merge the loaded Flat table to the BIN system. If there are mappings present in the Flat that are not in the destination BIN schema, messages will be generated <i>unless</i> the SuppressSchemaMsg flag is set.</p> <p>The return value from this command is an int of the BIN ID.</p>
ERRORS	
WFDS0010	DataShuttle service not processing queued request - 20 minute timeout
WFDS0020	DataShuttle critical error while servicing request
WFDS0030	Critical error creating temp table
Parameter	Value
-Table (string, optional)	When specified, this will override the default destination BIN table with a provided table name.
-Filename (string, optional)	When provided, this will be stored in the BIN_FILENAME column of the new BIN entry.
-SupressSchemaMsg (boolean, optional)	If set to True, SERENEDI will not generate message logs for new columns that are not present in the destination Flat schema.

-BinEndpointId (int, optional)	When given, this will override the default database connection and use the one defined in the BIN system using the BIN Endpoint ID.
-BinEndpointAlias (string, optional)	When given, this will override the default database connection and use the one defined in the BIN system using the BIN Endpoint Alias.
-NoWait (boolean, optional)	The default behavior of this cmdlet is to wait for the time it normally takes for the data to be inserted into the destination Flat table by the background service process. If this value is set to True, the default behavior will be overridden and the script will continue execution.

sapi-HKeyMergeToHDB	<p>This command will merge the loaded HKey register to an existing HDB tableset. If the destination HDB tableset does not have column mappings that are present in the HKey, a message will be generated once for that mapping <i>unless</i> the SuppressSchemaMsg flag is set.</p> <p>The return value from this command is an int of the BIN ID.</p>
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ERRORS	
WFHDS0010	DataShuttle critical error while creating table
WFHDS0020	DataShuttle critical error while servicing request
WFHDS0030	DataShuttle service not processing queued request - 20 minute timeout
Parameter	Value
-Prefix (string, optional)	If supplied, this will override the default HDB_5010_<Specification Name> prefix for the HDB tableset.
-Filename (string, optional)	If supplied, the filename will be provided for this BIN entry.
-SupressSchemaMsg (boolean, optional)	If set to True, SERENEDI will not generate message logs for columns that can't be stored in the existing HDB schema.
-BinEndpointId (int, optional)	If supplied, this will provide the Endpoint ID for the destination database connection.
-BinEndpointAlias (string, optional)	If supplied, this will provide an Endpoint Alias for the destination database connection.

-NoWait (boolean, optional)	The default behavior of this cmdlet is to wait for the time it normally takes for the data to be inserted into the destination HDB tables by the background service process. If this value is set to True, the default behavior will be overridden and the script will continue execution.
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sapi-HKeyForceMergeToHDB	This command will merge the loaded HKey register to an existing HDB tableset. If the destination HDB tableset does not have column mappings that are present in the HKey, new mappings will be created and a message will be generated to that effect <i>unless</i> the SuppressSchemaMsg flag is set. The return value from this command is an int of the BIN ID.
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ERRORS	
WFHDS0010	DataShuttle critical error while creating table
WFHDS0020	DataShuttle critical error while servicing request
WFHDS0030	DataShuttle service not processing queued request - 20 minute timeout
Parameter	Value
-Prefix (string, optional)	If supplied, this will override the default HDB_5010_<Specification Name> prefix for the HDB tableset.
-Filename (string, optional)	If supplied, the filename will be provided for this BIN entry.
-SupressSchemaMsg (boolean, optional)	If set to True, SERENEDI will not generate message logs for new columns that will be added to the destination HDB schema.
-BinEndpointId (int, optional)	If supplied, this will provide the Endpoint ID for the destination database connection.
-BinEndpointAlias (string, optional)	If supplied, this will provide an Endpoint Alias for the destination database connection.
-NoWait (boolean, optional)	The default behavior of this cmdlet is to wait for the time it normally takes for the data to be inserted into the destination HDB tables by the background service process. If this value is set to True, the default behavior will be overridden and the script will continue execution.

EXAMPLE

```
sapi-SegPoolFromFile -Filename 'C:\serenedi\shared\seed\seed_837p.txt'
sapi-SegPoolToHKey
$binId = (sapi-HKeyForceMergeToHDB -Filename $eventData1 -Nowait $true)
```

sapi-HKeyFromHDB

This command will fetch data from an existing HDB BIN ID and load it into the HKey register. The database connection used will be the one that was used when the BIN ID was generated.

ERRORS

BINX0070	No entry with this BIN_ID exists in the database.
BINX0080	The ISA base table was not found for this BIN
BINX0090	Critical error during Fetch_BIN_HKey
Parameter	Value
-BinId (integer, mandatory)	The BIN ID of the HDB tableset present in the BIN system.
-EnvelopeOverrides (string, optional)	<p>If supplied, this will tell the HKey encoder to selectively ignore certain structural data elements. This is useful when users want to modify the BIN data and encode a new EDI file, and do not want to inherit possibly bad / outdated information from the originally decoded file such as segment counts or embedded timestamps. By telling SERENEDI to discard these original values, it enables the SERENEDI engine to recreate them with new values that reflect the new state of the data. In turn, this can fix errors relating to bad segment counts and other structural elements</p> <p>The EnvelopeOverrides string should contain a comma delimited string that contains the segments that should be culled from the incoming HDB data.</p> <p>Common segments to be culled for regeneration include:</p> <p>GSHDR_GS04_D8 GSHDR_GS05_TM STHDR_SE01_TS_SEG_CT GSHDR_GE01_NR_TS_INCLUDED GSHDR_GE02_GCN STHDR_SE02_TCN</p>

	<p>The default pipeline will automatically cull the following columns from input:</p> <p>STHDR_SE01_TS_SEG_CT GSHDR_GE01_NR_TS_INCLUDED</p> <p>Note: SERENEDI can also generate HL indexes and child codes. In this case, it is better to specify <i>all</i> HL related columns here for all loops to ensure that SERENEDI fully regenerates the HL structural information without conflicting with the existing information.</p>
--	--

CSV COMMANDS

<p>sapi-CSVToDB</p>	<p>This will load a CSV file and commit it to a BIN endpoint. The CSV file does <i>not</i> need to be CGIF2 formatted, but must contain only string data. The first row must contain the column definitions and the CSV must contain the same columns as a specified schema table. If any columns are missing, extra, or out of order, an error result will trigger.</p> <p>This command gives SERENEDI the ability to import general CSV data from an external source.</p> <p>The destination table and schema table need to have an integer column called BIN_ID, which will be populated during transfer automatically from the BIN system. The source CSV should <i>not</i> have this column.</p>
----------------------------	---

ERRORS	
CSV2DB0010	Unable to open DB Connection STR: filename
CSV2DB0020	Error Processing CSV To Table STR: column
CSV2DB0030	Error Processing CSV To Table – COLUMN NOT FOUND IN DESTINATION SCHEMA AT EXPECTED POSITION STR: column
CSV2DB0040	Error Processing CSV To Table – COLUMN MISMATCH – DESTINATION SCHEMA CONTAINS DIFFERENT COLUMN COUNT TO DESTINATION SCHEMA N1: destination column count N2: source column count
CSV2DB0050	Error Processing CSV To Table – ERROR BULK LOADING FILE STR: Exception message

CSV2DB0060	Error Processing CSV To Table - BIN_ID COLUMN FOUND BUT NOT EXPECTED STR: column
CSV2DB0070	General error sending CSV to DB STR: Exception message
Parameter	Value
-Filename (string, mandatory)	This is the filename of the headered CSV to load. It should contain only string quote-delimited data and have a single row header defining the columns.
-SchemaTable (string, mandatory)	This is the table that will be used to analyze the schema of the incoming CSV table to ensure it matches the expected column definition. If the destination table is not specified, the schema table will be used as the destination table.
-DestTable (string, optional)	This will override the schema table as the destination table where the rows will be inserted.
-BinEndpointId (int, optional)	This is the BIN Endpoint ID that will set the database destination for this operation. If both this and the Alias are unset, the default database will revert to the SERENEDI database.
-BinEndpointAlias (string, optional)	This is the BIN Endpoint Alias that will set the database destination for this operation. If both this and the ID are unset, the default will revert to the SERENEDI database.
-TruncateTable (bool, optional)	Setting this to True will truncate the destination table prior to insertion. This should never be set unless the PROCESS_THROTTLE is set to 1 on the base trigger so that this event will run in serial and never in parallel.

sapi-FlatToCSV	This will save the Flat register to a CSV file.
ERRORS	
DT2CSV0010	Datatable is null or empty.
DT2CSV0015	Critical error projecting FLAT to CSV STR: exception message
DT2CSV0020	Critical error while setting up CSV

DT2CSV0030	Critical error while creating the rows of the CSV
Parameter	Value
-Filename (string, mandatory)	This is the path to the CGIF2 Flat-formatted CSV file to be created.

sapi-FlatFromCSV	This will load the Flat register from a CSV file.
ERRORS	
CSV2DT0010	Filename not Valid
CSV2DT0020	Syntax error parsing CSV
CSV2DT0030	Critical error parsing headers
CSV2DT0040	Critical error parsing rows
CSV2DT0050	Encountered CSV row with different number of columns than expected
CSV2DT0060	Could not establish tree from mappings.
CSV2DT0070	No rows found.
Parameter	Value
-Filename (string, mandatory)	This is the path to the CGIF2 Flat-formatted CSV file.

ENVIRONMENT COMMANDS

sapi-ClearRegister	This command can clear individual state machine registers, allowing fine-grained control of the session state machine. This is an alternative to sapi-Reset, which completely refreshes the session state.
ERRORS	
GENR0010	Unknown Register STR: register
Parameter	Value
-Register (string, mandatory)	Clears one of the specified registers: HKEY

	SEGPOOL MSGLOG ACK FLAT XML
--	--

sapi-EnvEndpointRemove	This command removes an existing database endpoint. The command will fail if there are any BIN items associated with the specified endpoint.
ERRORS	
SENV0080	Critical error on EndpointRemove STR: Exception message
Parameter	Value
-BinEndpointID (int, mandatory)	The BIN endpoint to be removed

sapi-EnvEndpointUpsert	<p>This command inserts or updates a BIN endpoint, which is an alias for a predefined database connection.</p> <p>The return value from this command is an int of the BIN Endpoint ID that was created, or -1 if this was an update operation.</p>
ERRORS	
SENV0070	Critical error on EndpointUpsert STR: exception message
Parameter	Value
-BinEndpointID (int, optional)	This is provided when updating the information of an existing endpoint.
-BinConnStr (string, optional)	This is the connection string for the database.
-BinDbType (string, optional)	This is the database type. Valid values are: SQLSERVER – Microsoft SQL Server
-BinEndpointAlias (string, optional)	This is the optional alias that you can assign to the endpoint.

sapi-EnvSFTPSessionUpsert	<p>This will create a new SecureFTP session or update the information in an existing one. The “fingerprint” is not normally set, but will instead be updated to reflect the first SecureFTP session it connects to. If the server and/or fingerprint need to be reset, setting it to VOID will return it to its initial state.</p> <p>The return value is an int of the new SFTP session created, or -1 if the session was updated.</p>
ERRORS	
SFTP0090	AddSessionFirstConnect Critical Error STR: exception message
Parameter	Value
-SFTPSessID (integer, optional)	If provided, this will update the values of the SecureFTP session. If not provided, it will update the information associated with this session.
-Hostname (string, mandatory)	This is either the IP address or hostname of the target SFTP Server.
-Username (string, mandatory)	This is the username used to log in.
-Password (string, mandatory)	This is the password used to log in.
-Params (string, optional)	<p>This is a comma-separated list of parameters used for the SFTP session. Parameters represent various state flags that direct the operation of the session. The valid values are:</p> <p>SCP – Sessions will open as SCP sessions (SSH Copy) instead of SecureFTP (default).</p> <p>BINARY – All transfers will be done using BINARY mode.</p> <p>ASCII – All transfers will be done using ASCII mode.</p> <p>BOTH_MIRROR – Local and Remote file systems will be mirrored.</p> <p>REMOTE_MIRROR – Remote file systems will be mirrored.</p> <p>REMOVE_FILES – Files will be deleted during synchronization.</p>
-Fingerprint (string, optional)	If VOID is supplied for this parameter, the SecureFTP session fingerprint will be reset until next login.

-PrivateKeyFile (string, optional)	If supplied, this defines a private key file that will be used for authentication.
-PrivateKeyPass (string, optional)	If supplied, this provides a passphrase used to unlock the private key file specified above.

Example:

This example demonstrates setup of a Secure FTP session and its association with a LOCAL_ARCHIVE trigger. Every new file uploaded to the specified remote folder will fire an event once it is mirrored to the local file system. The following SCORE script can be entered into the REPL command line system:

```
md C:\serenedi\shared\pipeline\test_sftp_mirror
$sftpSessId = (sapi-EnvSFTPSessionUpsert -Hostname <<your sftp server host>> -Username
<<user id>> -Password <<password>>)
Write-Host (sapi-EnvTriggerUpsert -TriggerName SFTP_TEST -Script $\Pipeline.ps1 -
TriggerType LOCAL_ARCHIVE -InitFolder $\test_sftp_mirror -SourceFolder / -SFTPSessId
$sftpSessId -PollInterval 60 -IsEnabled $true -ForceArg3 TEST_SFTP)
```

It will write the ID of the newly created trigger to the console. Given valid SFTP credentials, it will create a trigger that polls the SecureFTP server every 60 seconds for new files, and trigger events when new files are found there.

sapi-EnvSFTPSessionRemove	This will remove an existing SecureFTP session.
ERRORS	
SFTP0080	SessionRemove Critical Error STR: exception message
Parameter	Value
-SFTPSessID	SFTP Session ID to be removed.

sapi-EnvTriggerRemove	This command will remove an existing trigger. Because of the relational links between the tables, all downstream entries in BIZ_MSG and BIZ_EVENTS, and BIN_LOG will need to be removed before the database will allow this trigger to be deleted. Either the ID or the name of the trigger needs to be supplied.
ERRORS	
SENV0060	Critical error on TriggerRemove STR: exception message

SENV0065	Invalid Name supplied to TriggerRemove STR: trigger name
Parameter	Value
-TriggerID (integer, optional)	This is the trigger to be removed from the BIZ_TRIGGER table.
-TriggerName (string, optional)	This is the name of the trigger to be removed.

sapi-EnvTriggerUpsert	This command will enable scripts to add new triggers or update existing triggers in the Event system. The Trigger system is explained further in the “Events” chapter. The return value is the int value BizTriggerId of the new trigger if inserting, or -1 if this is an update operation.
Parameter	Value
-TriggerID (integer, optional)	If you’re updating an existing trigger, this is the Trigger ID to modify. If this is not provided, then the action will be treated as a brand-new trigger.
-TriggerName (string, optional)	This is the optional name of the trigger. It can be used in lieu of the Trigger ID when making updates.
-Script (string, optional)	This is the path to execute the PowerShell Core script that will be run when the trigger is fired. For new triggers, this is mandatory.
-TriggerType (string, optional)	This establishes the firing criteria for the trigger. The valid values are: LOCAL_UPLOAD LOCAL_ARCHIVE SQL
-InitFolder (string, optional)	For Upload trigger types, this is the initial folder where files must be placed to fire the trigger. The act of successfully moving the file from the Init folder to the source folder is the primary firing criterion for Upload triggers. For Archive trigger types, the primary firing criterion is finding a new file in the Init folder that was not previously used to fire an event.

-SourceFolder (string, optional)	For triggers not bound to an SFTP session, this specifies the destination folder for Upload triggers. For LOCAL_ARCHIVE triggers bound to SFTP sessions, this specifies the remote folder for the SFTP session.
-SFTPSessID (integer, optional)	This is the SecureFTP session that establishes a <i>mirror</i> with a remote file archive. Every Poll Interval, the local mirror will be refreshed by this SecureFTP session as described in the Event system .
-FireLogic (string, optional)	This establishes various filters that set conditions for firing events based on groupings of files and/or month/day/time. More information is available in the “ Event System ” section.
-SFTPPollDt (Date Time, optional)	This is the last time this trigger’s SecureFTP session was scanned.
-LastFireDate (Date Time, optional)	This is the last time the trigger was fired.
-PollInterval (integer, optional)	This is the number of seconds the Event system will wait between checks for this trigger’s firing criteria.
-IsEnabled (Boolean, optional)	True will enable the trigger; False will disable it.
-MaxProcess (integer, optional)	This is the maximum number of simultaneous executions allowed for a trigger. Setting this to 1 will limit the trigger to serial execution and prevent all parallel execution.
-ForceArg1 (string, optional)	When provided, this will pass a fixed value to the trigger script for Archive and SQL type triggers. It cannot be used for Upload trigger types.
-ForceArg2 (string, optional)	When provided, this will pass a fixed value to all trigger types.
-ForceArg3 (string, optional)	When provided, this will pass a fixed value to all trigger types.
-ForceArg4 (string, optional)	When provided, this will pass a fixed value to all trigger types except the Immediate Event type, which uses Event Argument 4 to provide the path to a PowerShell Core script.
ERRORS	
SENV0050	Critical error on TriggerUpsert STR: exception message

sapi-FetchVar	This command pulls data from the SERENEDI session object to allow you to see the internal state. The return value from this command is determined by the parameter passed to it.
ERRORS	
MISC0010	Critical error fetching Variable <<Value>>
Parameter	Value
-Value (string, mandatory)	SEG – This returns a single-character Segment Separator.
	ELE – This returns a single-character Element Separator.
	SUBELE – This returns a single-character composite Element Separator.
	ELEREPEAT – This returns a single-character Element Repeat separator.
	SEG_CT – This returns the number of loaded segments in the SegPool register.
	ACK_CT – This returns the number of loaded segments in the Acknowledgment register.
	SPEC_CD – This returns the Specification Code for the active specification. See “Appendix: Specification Codes” for the list of return values.
	SPEC_NM – This returns the short specification name for the active specification. See “Appendix: Specification Codes” for the list of return values.
	CRIT_ERR – This returns Boolean True or False depending on the critical error status of the SERENEDI session state.
	FLAT_COL_CT – This returns 0 if no Flat register is loaded, or the column count of the Flat register if it is.
FLAT_ROW_CT – This returns 0 if no Flat register is loaded, or the row count of the Flat register if it is.	
FLAT_DT – This returns a C# DataTable object representing the active Flat register.	

	<p>“HKEY_DT” – If the HKey register is set, this will return a Dictionary<string, DataTable> object that holds the HKey rendered as a series of datatables. Each Key Value Pair within the Dictionary object is Keyed with ‘HDB_ISA’ for the first table, ‘HDB_GSHDR’ for the second table, and so on for all of the loops present within the HKey. The Data Tables follow the same specifications as the HDB data system defined earlier in the documentation.</p>
	<p>HKEY_XML – This returns an XDocument object representing the XML.</p>
	<p>HKEY_XML_LEN – This returns a 0 if the XML register is not loaded; otherwise, it will return the string length of the XML.</p>
	<p>HKEY_INFO – This returns two bar-separated numbers reflecting the Loop count and Element count of the loaded HKey register. For example: 480 1843</p>
	<p>MSG_CT – This returns the number of messages in the MsgLog register.</p>
	<p>TREE_NM – This returns the short specification of the loaded Tree, or writes Unloaded if the tree is not loaded.</p>
	<p>MSG_HTML – This returns an HTML dump of all messages.</p>
	<p>MSG_XML – This returns the message log in XML format.</p>
	<p>SEG_TEXTBLOCK – This emits the text of the SegPool, along with the established text division characters, to the console output.</p>
	<p>LOOP_LIST – This outputs a space-delimited list of all the loops (loaded with data or not) associated with the active loaded specification.</p>
	<p>DEFAULT_ICN DEFAULT_GCN DEFAULT_TCN</p> <p>These return the default values of the ICN/GCN/TCN envelope control numbers.</p>
<p>Example</p>	

Dumping error messages to an HTML file:

```
sapi-FetchVar -Value "MSG_HTML" | Out-File "C:\serenedi\msg.html"
```

Dumping error messages to an XML file:

```
sapi-FetchVar -Value "MSG_XML" | Out-File "C:\serenedi\msg.xml"
```

sapi-InitializeSession

This command sets up the PowerShell hosting environment for SERENEDI when it is being run outside of the primary SERENEDI trigger/event environment, such as developing scripts in Visual Code. You will need to supply the *base path* where SERENEDI is installed as well as the SQL connection string to the serenediCore distribution database. By running the code below, the environment is prepped to run SCORE scripts with the full complement of SERENEDI commands.

This command will also allow you to interactively debug previously executed events by passing the *BizEventId* argument. In this way, you can use the Visual Code interactive debugger on failed or problematic events to diagnose the issue.

```
Import-Module -Name (Resolve-Path  
'serenedi.dll')  
sapi-InitializeSession -BasePath 'C:\serenedi'  
-MSSQL 'Data  
Source=(local);Database=serenediCore;User  
id=sa;Password=strongPass1'
```

ERRORS

Emergency Directory	Error Log in Base	InitializeSession Spawn Error: exception message
Parameter		Value
-BasePath (string, mandatory)		This tells SERENEDI the base SERENEDI folder (such as C:\serenedi or /opt/serenedi) so it is able to locate other critical resources.
-BizEventId (int, optional)		When provided, the SERENEDI session's global variables will be preset to the values associated with an already-fired event. This can be useful for determining exactly what happened during that event that caused an error.

-MSSQL (string, mandatory)	When provided, links the SERENEDI session to the Microsoft SQL Server-hosted serenediCore distribution database that is required for executing SCORE scripts.
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sapi-Reset	This will completely reset the active session state. If you need to process two EDI files within a script session, it's best to reset the session between files so that various internal registers specific to that transaction are cleared.
-------------------	--

INTEGRITY COMMANDS

sapi-AddIntegrityRule	This command adds a custom rule to the integrity rules engine. The RuleCode parameter must be a valid REPCode Boolean expression. The rule will add the provided message to the message log when the REPCode expression evaluates to True during a decode operation.
------------------------------	--

ERRORS	
RE0010	Rule Engine Add Rule Failure STR: exception message
RE0020	Rule Engine Loop Unknown STR: loop name N1: rule order
TOKN0010	Invalid Map in Expression STR: invalid map
TOKN0020	Failure to Tokenize STR: REPCode text
TOKN0030	Failure to Parse Tokens STR: REPCode text
Parameter	Value
-SpecCd (string, mandatory)	This value represents all the two-digit specification codes that are linked for this rule.
-LoopNm (string, mandatory)	This is the loop short name (like L2300) that links to this rule. Every time this loop is encountered during a decode, this rule is executed.

-RuleOrder (int, mandatory)	This is the order in which the rule is executed. Normally, it starts at more than 10000 so it does not conflict with baseline integrity rules.
-RuleCode (string, mandatory)	This is the REPCode of the rule itself.
-Message (string, mandatory)	This is the message added to the message log when this rule is triggered during a decode.
-ShowXMLTokens (flag, optional)	When this flag is given, an XML file showing the node composition of the supplied REPCode is returned as a string value.

sapi-CheckIntegrity	<p>This command requires that both the SegPool and the HKey register be loaded, and will conduct a deep integrity check of the file. Currently, the 834, 835, and 837 I & 837 P specifications are the only supported transactions for the Deep Integrity analysis engine. This command has no effect if run on other transactions.</p> <p>Over 300 different errors are supported for these specifications.</p> <p>Errors are identified by the Loop Short Name and the Rule Order. These can be individually disabled with the DisableIntegrityRule command.</p>
ERRORS	
INTEG0010	SegPool must be loaded and then decoded prior to an Integrity operation.

sapi-DisableIntegrityRule	
ERRORS	
RE0020	Rule Engine Loop Unknown
RE0030	Rule Engine Order Unknown
RE0040	Rule Engine Disable Failure
Parameter	Value
-SpecCd (string, mandatory)	This is the specification code of the rule to disable.
-LoopNm (string, mandatory)	This is the Short Loop Name of the rule to disable.
-RuleOrder (int, mandatory)	The is the Rule Order of the rule to disable.

MSGLOG COMMANDS

sapi-AddMsg	This command adds a custom message to the MsgLog register.
Parameter	Value
-Origin (string, optional)	The origin is a short string that identifies the source of the message. It will default to USER if not supplied.
-Message (string, mandatory)	This is the required primary message.
-StringData (string, optional)	This is additional string data that gives context to the primary message.
-IntData1 (integer, optional)	This is Integer Data 1 to give additional information to the message.
-IntData2 (integer, optional)	This is Integer Data 2 to give additional information to the message.

sapi-GetMsg	<p>This fetches a specific message from the MsgLog Session State register. Use the command <code>sapi-FetchVar -Value 'ERR_CT'</code> to obtain the total number of messages available.</p> <p>The return value is a string of a single message. Messages consists of five fields, separated by the pipe character .</p> <p>The format of the message is:</p> <p>Origin Message String Data 1 Integer Data 1 Integer Data 2</p>
ERRORS	
MSG0010	Invalid Message ID
Parameter	Value
-MessageID (int, mandatory)	This is the index of the message to fetch.

sapi-MsgLogToFile	This command allows dumping of the current message log into a CSV file in the file system in HTML format.
ERRORS	
MSG0020	Unable to write file STR: exception message
Parameter	Value

-Filename (string, mandatory)	This is the file to write the HTML-formatted message log.
--------------------------------------	---

sapi-MsgLogToHTML	This cmdlet will return the HTML as a string. The return value is an HTML string of the message log.
--------------------------	---

ERRORS	
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MSG0030	Unable to render msglog STR: exception message
---------	--

REGISTER COMMANDS

sapi-AckFromFile	This will load the Acknowledgment register from a 999 file in the file system.
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ERRORS	
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ACK0010	Failure reading stream STR: exception message
---------	---

Parameter	Value
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-Filename (string, mandatory)	This is the file path to a valid 999 transaction.
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sapi-AckFromHKey	This will project the HKey to the Acknowledgment register. It is predicated on the HKey being loaded with a valid 999 Acknowledgment transaction. This command inherits the errors from the SegPoolFromHKey command.
-------------------------	---

sapi-AckFromSegPool	This transfers the loaded SegPool register to the Acknowledgment register and forces the session tree variable to the 999 specification.
----------------------------	--

sapi-AckToFile	This will save the Acknowledgment register to a 999 file in the file system.
-----------------------	--

ERRORS	
---------------	--

ACK0020	Error generating ACK to File STR: exception message
Parameter	Value
-Filename (string, mandatory)	This is the file path to a valid 999 transaction to be created.
-Formatting (string, optional)	This four-character string enables you to override the encoder to use different text division characters: Position 1: Element Separator Default: * Position 2: Segment Separator Default: ~ Position 3: Composite Element Separator Default: : Position 4: Repeating Element Default: ^
-bolCR (bool, optional)	When true, inserts a Carriage Return (Char 13) after each segment. Default: True.
-bolLF (bool, optional)	When true, inserts a Line Feed (Char 10) after each segment. Default: True.

sapi-AckToHKey	This will project the Acknowledgment register to the HKey register. It inherits the errors from the SegPoolToHKey command.
-----------------------	--

sapi-AckToSegPool	This transfers the active Acknowledgment register to the SegPool register.
--------------------------	--

sapi-FlatFromHKey	This command executes a translation from the Flat register to the HKey register.
--------------------------	--

ERRORS	
H2F0010	Critical error during ScanRows STR: exception message
H2F0020	Critical error during ScanRows STR: exception message
H2F0030	Critical error during Copy Previous Row STR: exception message
H2F0040	Critical error during Populate RDR

	STR: exception message
H2F0050	Critical error during SpawnDataRow STR: exception message
H2F0060	Tree not loaded.

sapi-FlatToHKey	This command executes a translation from the HKey register to the Flat register.
------------------------	--

ERRORS	
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F2H0010	Flat Decode Critical Failure STR: exception message
F2H0020	Flat Decode Critical Failure - Unparsable Loop STR: name of last parsed loop N1: number of unparsed loops remaining
F2H0040	Flat Unsupported Data Type STR: column name Unsupported Type: type name N1: column index
F2H0050	Column cannot be parsed STR: column name N1: column index
F2H0060	Inherited Iteration mapping is referencing a loop iteration value not present in the Single Iteration parent loop maps STR: mapping name
F2H0065	Value Iteration mapping is referencing a loop iteration value not present in the Single Iteration parent loop maps STR: mapping name
F2H0070	Critical Flat Data Conversion Error STR: column name
F2H0080	Inherited Value mapping is referencing a value not present in the Value Qualified parent loop maps. STR: column name
F2H0090	Flat register is unloaded.
F2H0100	Last column must be NEWROW to be a valid Flat.
F2H0110	Flat Decode Critical Error - Could not parse data stream STR: last parsed short loop name

sapi-GenerateAck	This command will generate a generic 999 Acknowledgment transaction based on the currently loaded and processed SegPool, HKey, and MsgLog registers. If the most recent SegPool to HKey translation was successful, it will generate a Transaction Accepted 999 Acknowledgment. If the translation failed, it will generate a File Rejected Acknowledgment and specify the segment at which translation failed.
ERRORS	
ACK0010	There was an exception while attempting to generate the 999. STR: exception message
ACK0020	GenerateAck error - no SegPool loaded
ACK0030	GenerateAck error - SegPool not decoded

sapi-ParseAck	This command will parse a loaded Acknowledgement and generate a series of messages based on the contents. When a SegPool is loaded with the transaction this Acknowledgement was generated against, these messages can make it easier to understand why a particular transaction was rejected. The messages are defined in the HIPAA Implementation Guide for 999 specification.
ERRORS	
ACK0040	Parse Acknowledgment - no Acknowledgment loaded.

sapi-SegPoolFromFile	This command loads an EDI transaction composed of elements and segments into the SegPool register. Once it is loaded successfully, the active specification is set based on the contents of the file.
Parameter	Value
-Filename (string, mandatory)	This is the path of the file system EDI file.
ERRORS	
SEG0010	There was a low-level critical error loading the SegPool
SEG0020	Filename not valid

SEG0030	ConsumeTextStream encountered a critical error.
SEG0040	Insufficient segments were found on the incoming file.
SEG0050	Unknown Exception STR: exception message
SEG0060	An ISA/IEA envelope in the stream is invalid because it has non-unique partitioning characters STR: ELESEP/SUBELE/ELERPT/SEGSEP partitioning characters
SEG0070	A critical error was encountered while parsing the incoming SegPool stream. STR: exception message
SEG0080	There was a critical error generating the text stream for the SegPool. STR: exception message
SEG0085	FetchSpecificSegment is being accessed with an incorrect SegSlice index.
SEG0090	There was a critical error when fetching the specified segment from the SegPool. STR: exception message N1: segment index
SEG0100	There was a critical error when fetching the specified segment from the SegPool STR: exception message N1: segment index
SEG0110	There was a critical error encountered when adding a new segment to the SegPool. STR: exception message
SEG0120	There was a critical error encountered while closing the SegPool. STR: exception message

sapi-SegPoolFromHKey	This will translate the HKey register to the SegPool register.
ERRORS	
H2SEG0010	SegPool_from_HKey Critical Error STR: exception message N1: segment count
H2SEG0020	Tree is undefined - encoding failed

H2SEG0030	HKey is unloaded – encoding failed
H2SEG0040	Critical Error during SegPool Encode N1: segment count

sapi-SegPoolToFile	This will generate a new file system object from the loaded SegPool register.
---------------------------	---

ERRORS	
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SEG2F0010	No SegPool loaded
-----------	-------------------

SEG2F0020	There was a critical error generating the text stream for the SegPool. STR: exception message
-----------	---

Parameter	Value
------------------	--------------

-Filename (string, mandatory)	This is the path of the file system EDI file to be created.
--------------------------------------	---

-Formatting (string, optional)	This four-character string enables you to override the SegPool encoder to use different text-division characters: Position 1: Element Separator Default: * Position 2: Segment Separator Default: ~ Position 3: Composite Element Separator Default: : Position 4: Repeating Element Default: ^
---------------------------------------	---

-bolCR (bool, optional)	When true, inserts a carriage return (Char 13) after each segment. Default: True.
--------------------------------	--

-bolLF (bool, optional)	When true, inserts a line feed (Char 10) after each segment. Default: True.
--------------------------------	--

sapi-SegPoolToHKey	This will translate the SegPool to the HKey register. Note: all error messages listed below will store the segment index of the time of the error in the N1 field.
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ERRORS	
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H2SEG0010	Invalid Date Length STR: element
-----------	--

H2SEG0020	Invalid Time Length
-----------	---------------------

	STR: element
H2SEG0040	Element Requirement conditions not met
H2SEG0050	Invalid Qualifiers in DTP segment
H2SEG0060	Date stamp is not in a valid character format
H2SEG0070	DateTime stamp is not in a valid character format
H2SEG0080	Time stamp is not in a valid character format
H2SEG0090	RD8 date stamp is not in a valid 17 character format
H2SEG0100	Data present on an element marked as unused STR: element index
H2SEG0110	Data is below the minimum length for this element STR: element
H2SEG0120	Data exceeds the maximum length for this element STR: element
H2SEG0130	Data not present on an element marked as required STR: element index
H2SEG0140	Repeating element exceeds the allowed number of iterations STR: element index
H2SEG0150	Specified repeating element is not found in validating code list STR: element index
H2SEG0160	Specified repeating composite element is not found in validating code list STR: element index
H2SEG0170	Specified value-defined element is not valid
H2SEG0180	Specified qualifier element is not valid
H2SEG0190	Data present on a composite element marked as unused STR: element index
H2SEG0200	Specified composite value-defined element is not valid STR: element index
H2SEG0210	Specified composite value-defined element is not valid STR: element index
H2SEG0220	Segment present without elements
H2SEG0230	Required segment is missing STR: Short Loop Name : Segment Name

H2SEG0240	Segment exceeds maximum iterations STR: Short Loop Name : Segment Name
H2SEG0250	Required loop is not present STR: Short Loop Name
H2SEG0260	Loop has too many iterations STR: Short Loop Name
H2SEG0270	SegPool is not loaded.
H2SEG0280	Unable to determine specification - check the ISA/GS/ST/BHT segments for formatting issues
H2SEG0290	Critical error during decoding on setup STR: exception message
H2SEG0300	Premature End of File STR: invalid segment
H2SEG0310	Invalid HL Child Indicator STR: Inbound HL04 h104 Expected HL04 expected
H2SEG0320	Critical error during decoding during parse STR: exception message
H2SEG0330	Critical error during decoding
H2SEG0340	Could not decode file STR: invalid segment
Parameter	Value
-EnableCodeSetChecks (flag, optional)	This option will load the code sets that are supported by SERENEDI and raise error messages when invalid codes are used within segments.

sapi-SegPoolToHTML	This will create an HTML view of the SegPool along with any messages loaded highlighted in red. The return value from this cmdlet is a string of the SegPool in HTML form. Additionally, any messages in the MsgLog will be displayed.
ERRORS	
S2HTML0010	Critical error creating HTML STR: exception message

sapi-SetFlat	<p>This command allows you to manually set the internal Flat register from a DataTable formatted with valid CGIF2 maps. The DataTable must be a fully compliant Flat DataTable, including an ending NEWROW integer column, a specification tag in the first map, and correct maps for all columns.</p> <p>The sapi-FetchVar -Register 'FLAT_DT' command is the inverse of this command and can be used to retrieve the Flat DataTable.</p>
Parameter	Value
-DT (DataTable, mandatory)	DataTable to set. This is for advanced users who need to bypass the normal methods of loading the Flat register.

SFTP COMMANDS

sapi-GetSFTPDirectory	<p>Provided a predefined SecureFTP Session ID and a remote folder, this will return a string array of the directory contents.</p> <p>Each string corresponds to either a file or a directory. If it is a directory, the value will be the directory name and ending in a character. If the entry is a file, the value will be the file name, a character, and the file size in bytes.</p>
Parameter	Value
-SFTPSessID (integer, mandatory)	This is the unique ID of the predefined SecureFTP session.
-RemoteFolder (string, mandatory)	This is the remote folder to be retrieved.
ERRORS	
SFTP0140	<p>Directory Failure</p> <p>STR: remote directory</p>

sapi-GetSFTPFile	This will fetch a remote file from a predefined SecureFTP session to the local file system.
Parameter	Value
-SFTPSessID (int, mandatory)	This is the unique ID of the predefined SecureFTP session.
-LocalFile (string, mandatory)	This is the local file to be created.
-RemoteFile (string, mandatory)	This is the remote file to fetch.

ERRORS & MESSAGES	
SFTP0030	File Downloaded STR: filename
SFTP0040	SFTP Download Failure STR: filename

sapi-PutSFTPFile	This will push a local file to a remote SecureFTP directory.
Parameter	Value
-SFTPSessID (integer, mandatory)	This is the unique ID of the predefined SecureFTP session.
-LocalFile (string, mandatory)	This is the local file to be pushed to the remote file system.
-RemoteFile (string, mandatory)	This specifies the name of the file as it will exist on the remote file system.
ERRORS & MESSAGES	
SFTP0120	File Uploaded STR: filename
SFTP0130	SFTP Upload Failure STR: filename

sapi-SFTPMirror	<p>This command mirrors a remote file system with the local file system. The direction of data flow is set within the SFTP Session definition itself; the SecureFTP options are set via the sapi-SFTPSessionUpsert command with the “Params” argument. The available options are:</p> <p>BOTH_MIRROR: New files in the local folder will be uploaded to the remote server, and new remote server files will be downloaded to the local folder.</p> <p>REMOTE_MIRROR: New files in the local folder will be uploaded to the remote server.</p> <p>FILE_MOVE: After a successful file transfer, the source file is removed.</p> <p>The default behavior is to locally mirror: new server files will be downloaded to the local folder.</p>
Parameter	Value
-SFTPSessID (integer, mandatory)	This is the unique ID of the predefined SecureFTP session.
-RemoteFolder (string, mandatory)	This is the remote folder on the SecureFTP server to mirror.
-LocalFolder (string, mandatory)	This is the local file system folder that will mirror the remote folder.

SQL COMMANDS

sapi-ExecSQL	This executes arbitrary SQL in the specified database.
Parameter	Value
-SQL (string, mandatory)	SQL to be executed.
-BinEndpointId (int, optional)	When given, this will override the default database connection and use the one defined in the BIN system using the BIN Endpoint ID.
-BinEndpointAlias (string, optional)	When given, this will override the default database connection and use the one defined in the BIN system using the BIN Endpoint Alias.
ERRORS & MESSAGES	
SQL0020	SQL Error: <<sql executed>> STR: exception message

sapi-FetchDTFromDB	<p>This command will return a DataTable based on a passed SQL string. The database connection will default to the SERENEDI database unless overridden via the BIN Endpoint ID or BIN Endpoint Alias.</p> <p>This returns a DataTable of the SQL results.</p>
Parameter	Value
-SQL (string, mandatory)	This command will be used to execute a database SQL command and then return the result set as a .NET DataTable object.
-BinEndpointId (int, optional)	When given, this will override the default database connection and use the one defined in the BIN system using the BIN Endpoint ID.
-BinEndpointAlias (string, optional)	When given, this will override the default database connection and use the one defined in the BIN system using the BIN Endpoint Alias.
ERRORS & MESSAGES	
SQL0100	FetchDTFromDB critical error STR: exception message

sapi-FetchDTFromDB1Row	<p>This command will return a single-row DataTable based on a passed SQL string. The database connection will default to the SERENEDI database unless overridden via the BIN Endpoint ID or BIN Endpoint Alias.</p>
Parameter	Value
-SQL (string, mandatory)	<p>This command will be used to execute a database SQL command and then return the result set as a .NET DataTable object.</p> <p>Only the first row will be returned.</p>
-BinEndpointId (int, optional)	When given, this will override the default database connection and use the one defined in the BIN system using the BIN Endpoint ID.
-BinEndpointAlias (string, optional)	When given, this will override the default database connection and use the one defined in the BIN system using the BIN Endpoint Alias.
ERRORS & MESSAGES	
SQL0100	FetchDTFromDB critical error

	STR: exception message
sapi-FetchScalar	This command will return a single value based on a passed SQL string. The database connection will default to the SERENEDI database unless overridden via the BIN Endpoint ID or BIN Endpoint Alias.
Parameter	Value
-SQL (string, mandatory)	This command will be used to execute a database SQL command and then return the result as a single string, integer, or floating-point value, depending on the value being returned.
-BinEndpointId (int, optional)	When given, this will override the default database connection and use the one defined in the BIN system using the BIN Endpoint ID.
-BinEndpointAlias (string, optional)	When given, this will override the default database connection and use the one defined in the BIN system using the BIN Endpoint Alias.
ERRORS & MESSAGES	
SQLS0010	Error while FetchingScalar: <<sql executed>> STR: exception message

XML COMMANDS

sapi-HKeyFromXml	This will load the HKey register from the XML register.
ERROR	
X2H0010	Critical Error during XML Decode STR: last XML N1: # of XML loops remaining
X2H0020	HKey not loaded - cannot encode
X2H0030	Critical Error during XML Iterate Loop STR: last XML N1: # of XML loops remaining

sapi-HKeyToXml	This will save the HKey register to the XML register.
ERROR	
H2X0010	Critical Error during XML Encoding

	STR: exception message N1: segpool segment ID
H2X0020	HKey not loaded - cannot encode
H2X0030	Critical error during XML Encode STR: exception message

sapi-SetXML	This command allows you to manually set the internal XML register from the provided XML text.
ERROR	
MISC0010	Invalid XML STR: exception message
Parameter	Value
-XML (string, mandatory)	String of the XML to load. This must be formatted as a valid CGIF2 XML object.

sapi-XmlFromFile	This will load the XML register from a file.
Parameter	Value
-Filename (string, mandatory)	This is the path of the CGIF2-formatted XML file to be loaded.
ERROR	
XMFF0010	Filename not Valid STR: filename
XMFF0020	Critical error loading XML STR: exception message

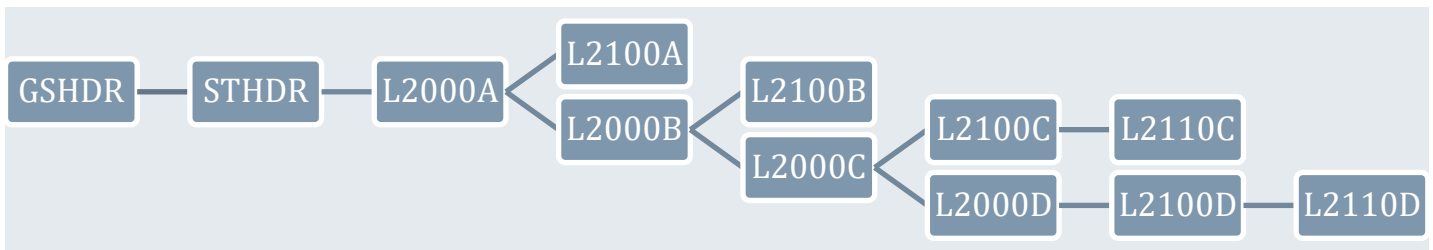
sapi-XmlToFile	This will save the XML register to a file.
Parameter	Value
-Filename (string, mandatory)	This is the path to the CGIF2-formatted XML to be created.
ERROR	
XMFF0030	Critical error saving XML STR: exception message

Appendix B: Specification Hierarchy Structures

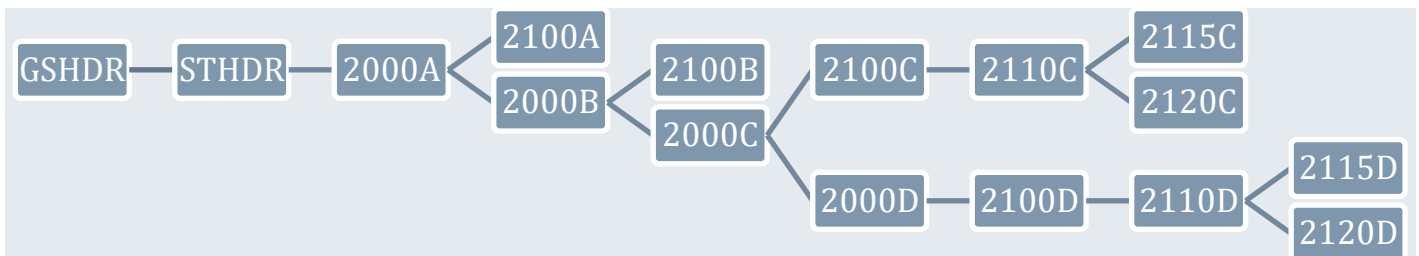
These diagrams show the hierarchical relationship between the loops within a transaction. This is important for knowing the parent/child loop relationships present within the HDB tables so that you know which table a parent ID is pointing to in a child table.

Any loop that has a name ending in X or Y is a *cutout* loop. These loops are not defined in the HIPAA Implementation Guides – instead, they are a SERENEDI convention in which a single segment is pulled from the parent loop because they are defined as having unlimited repeats. Keeping this information isolated in its own dedicated loop makes the data easier to access for both encoding and decoding.

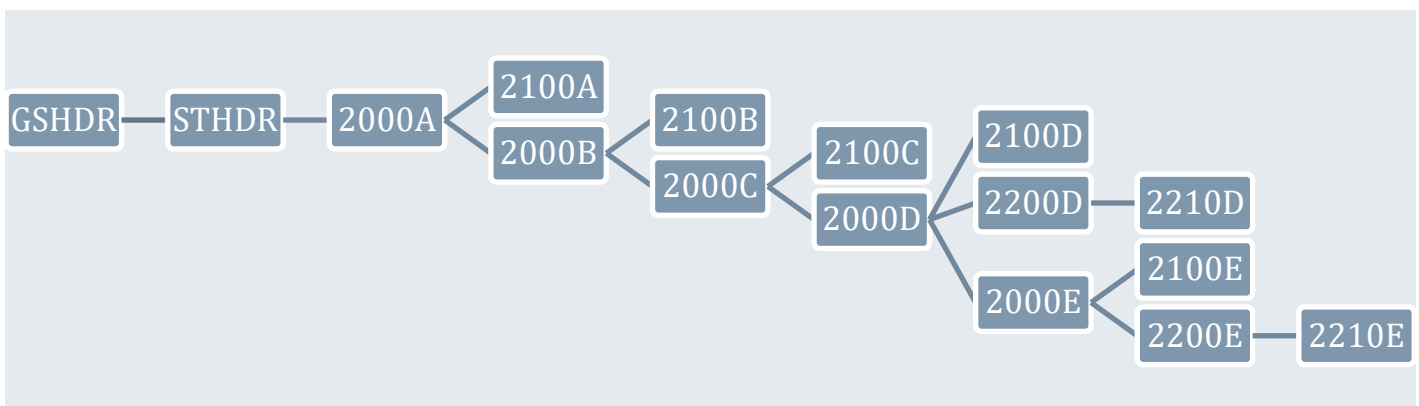
5010_270 / M0 Health Care Eligibility Benefit Inquiry



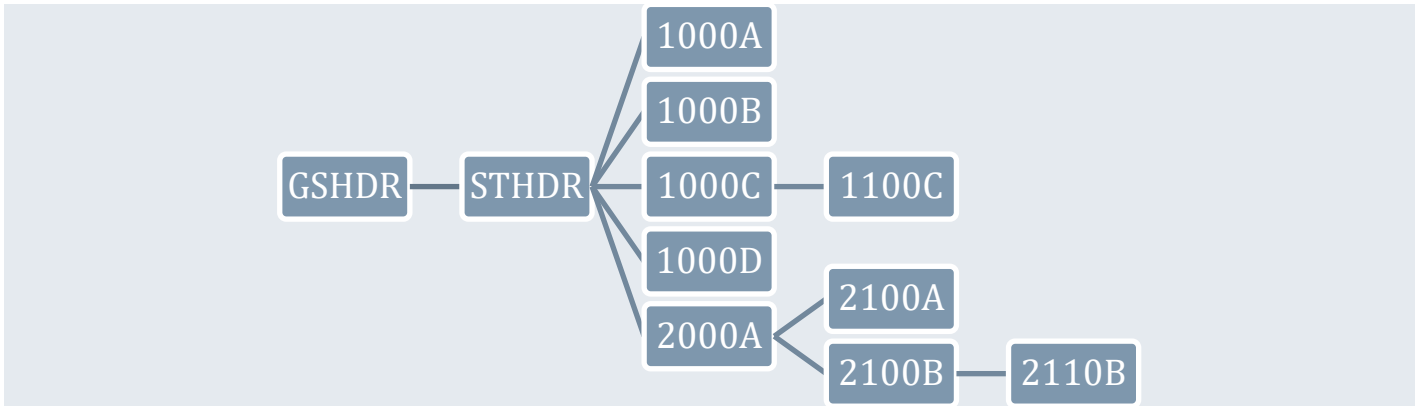
5010_271 / N0 Health Care Eligibility Benefit Response



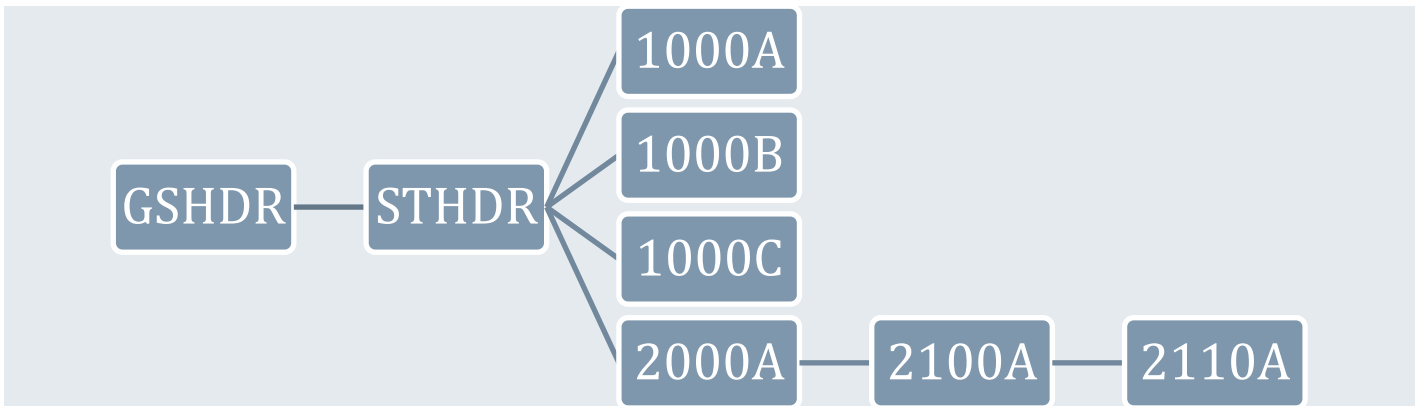
5010_276 / 00 Health Care Claim Status Request



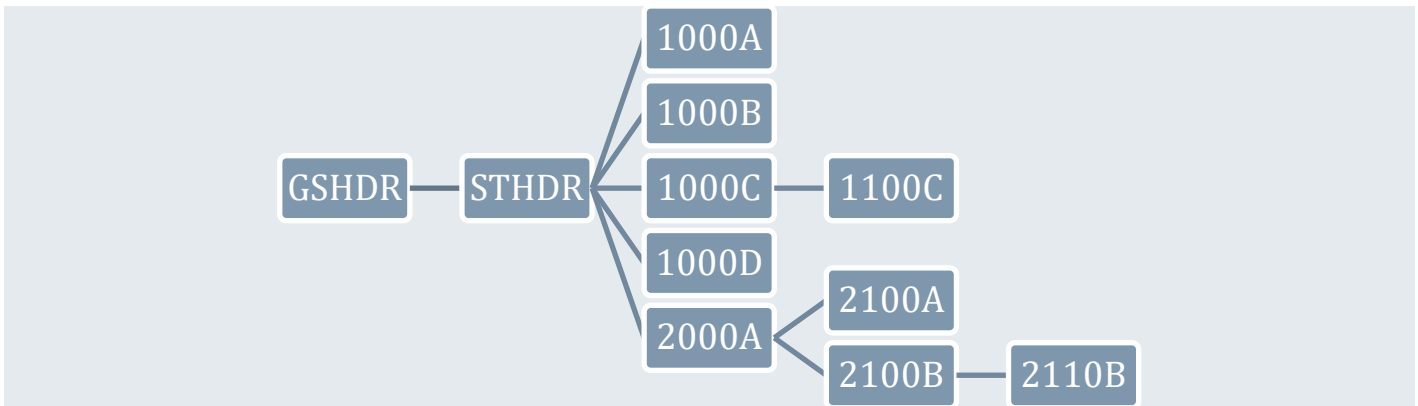
5010_275C / 01 Patient Information



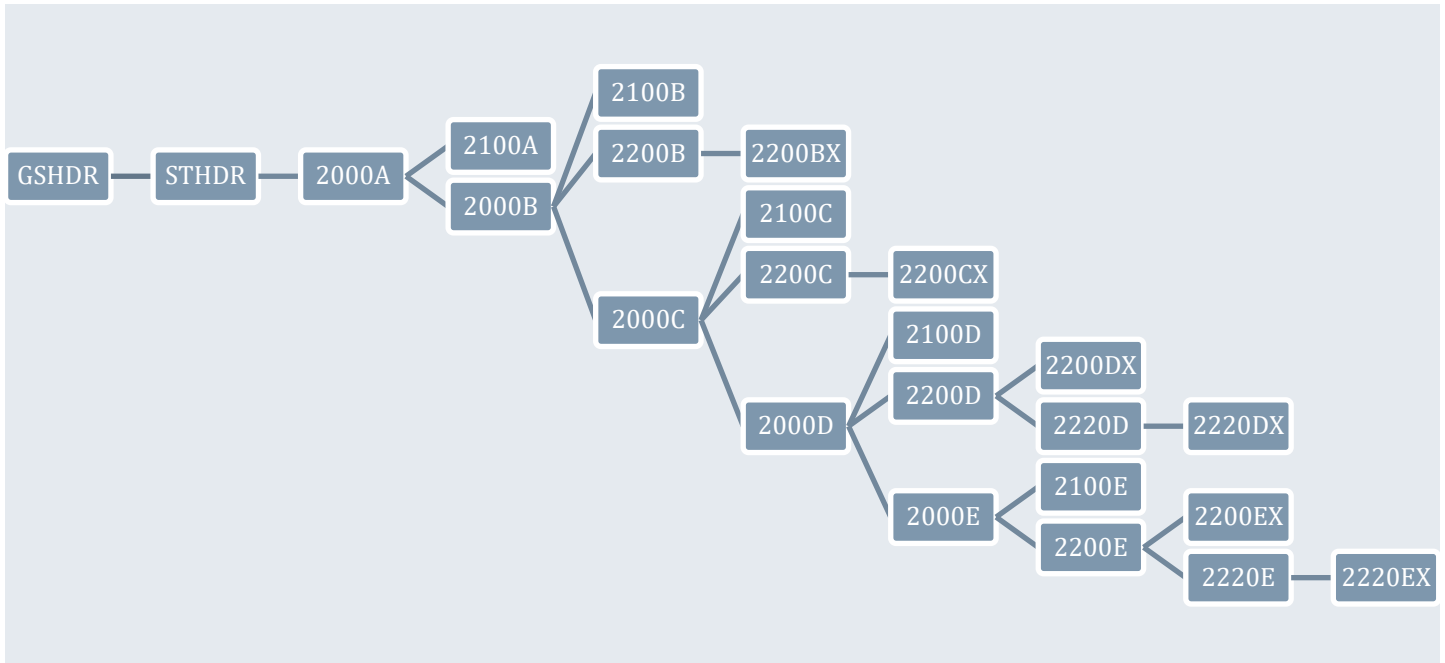
5010_275R / 02 Patient Information



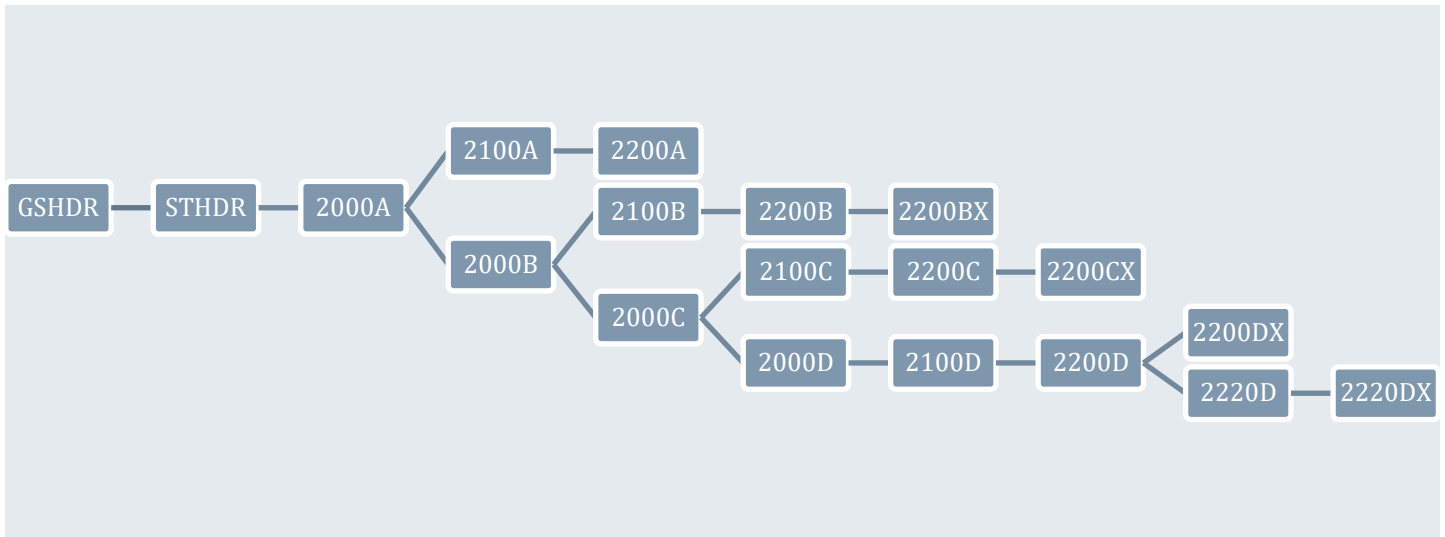
6020_275C / 03 Patient Information



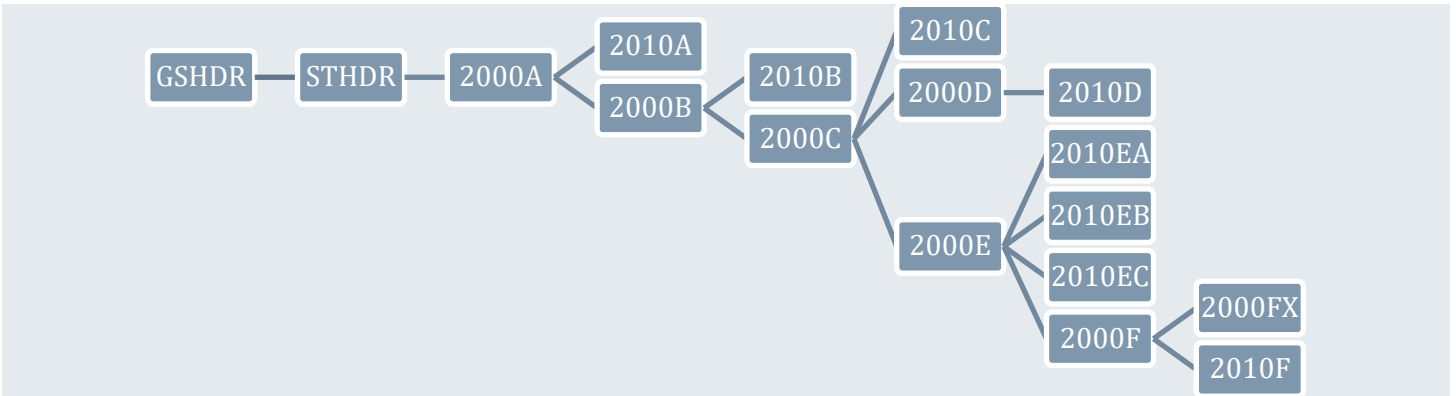
5010_277 / P0 Health Care Claim Status Response



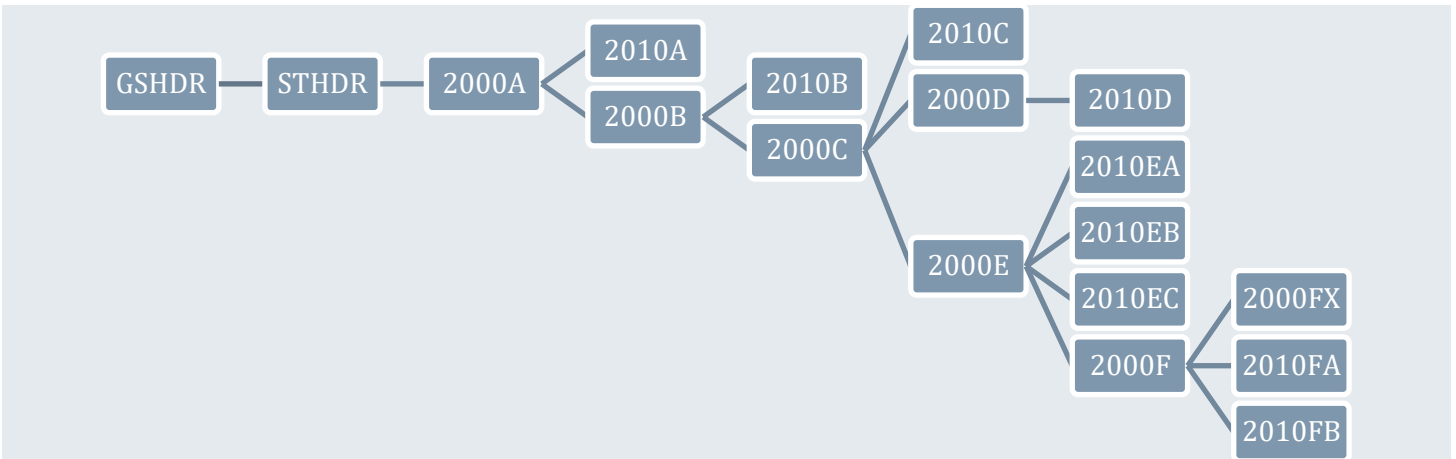
5010_277CA / P5 Health Care Claim Acknowledgment



5010_278_REQ / Q0 Health Care Services Review - Request for Review

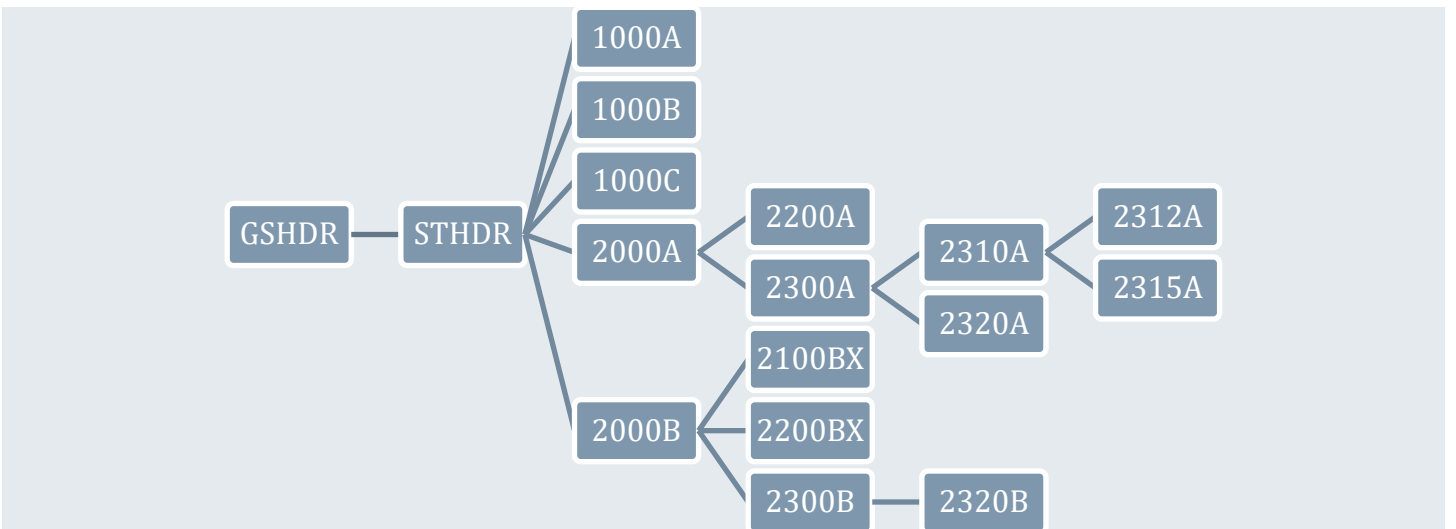


5010_278_RESP / R0 Health Care Services Review - Response

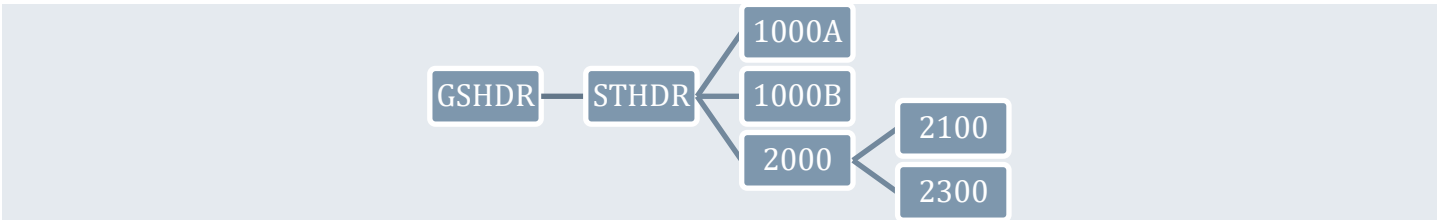


5010_820 / S0

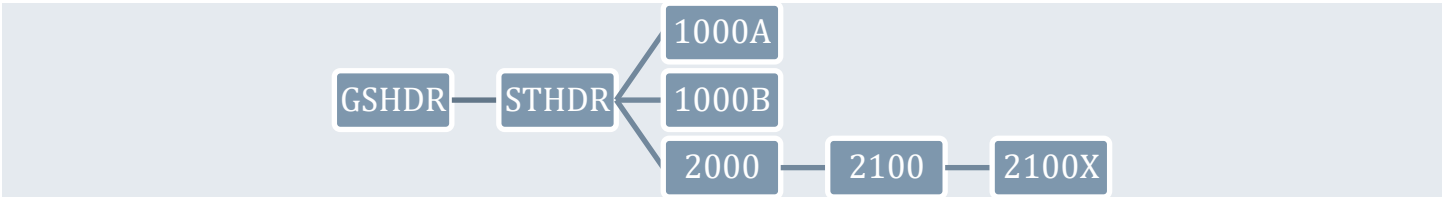
Payroll Deducted and Other Group Premium Payment for Insurance Products



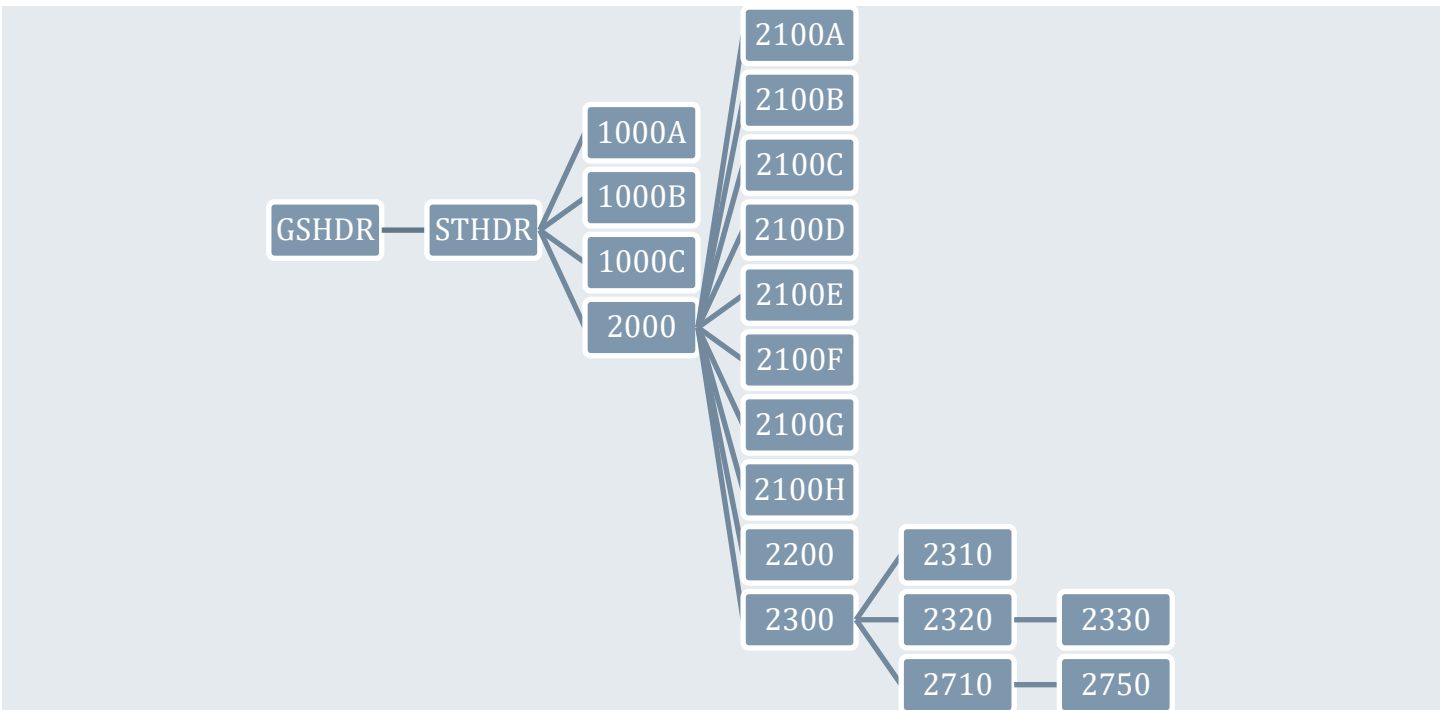
5010_820X / S5 Health Insurance Exchange Related Payments

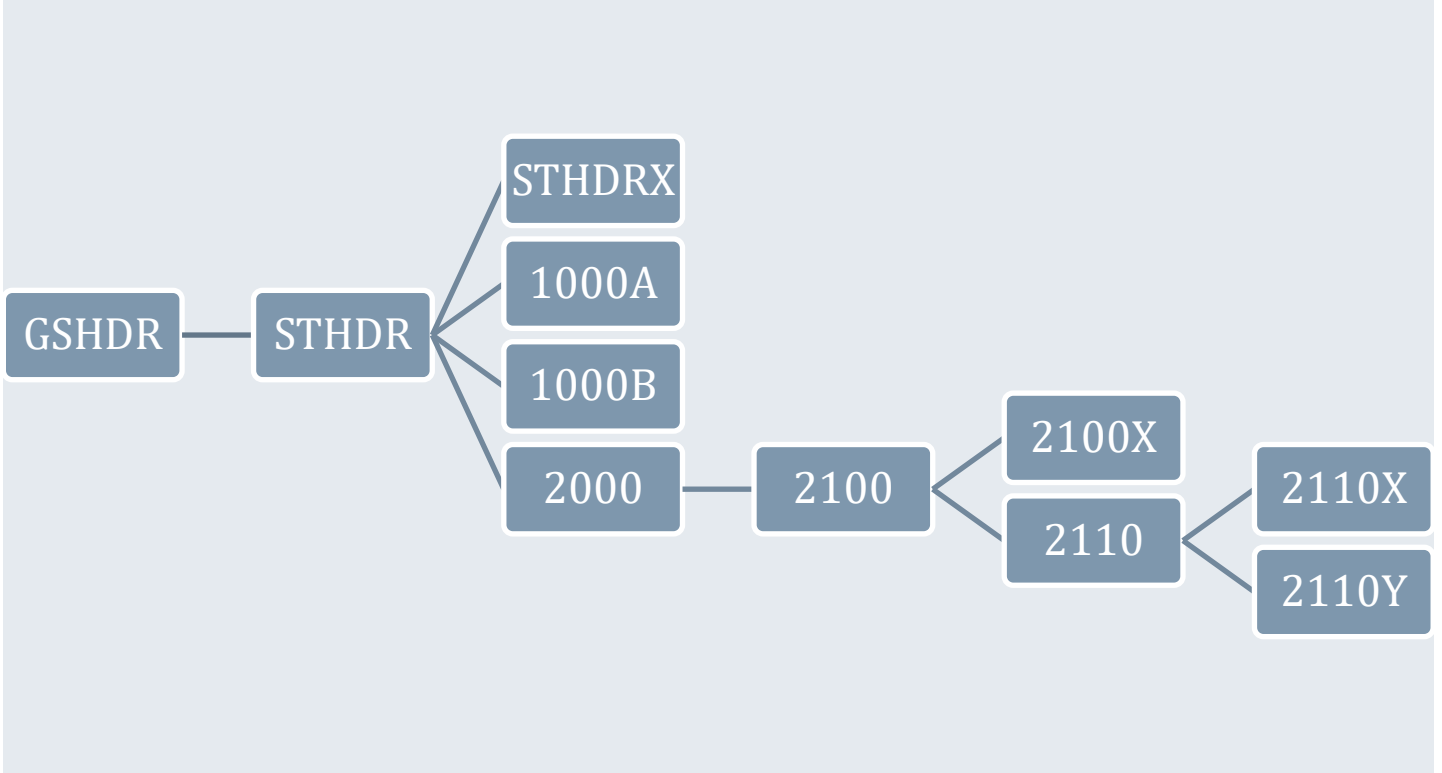


5010_824 / P7 Application Reporting for Insurance

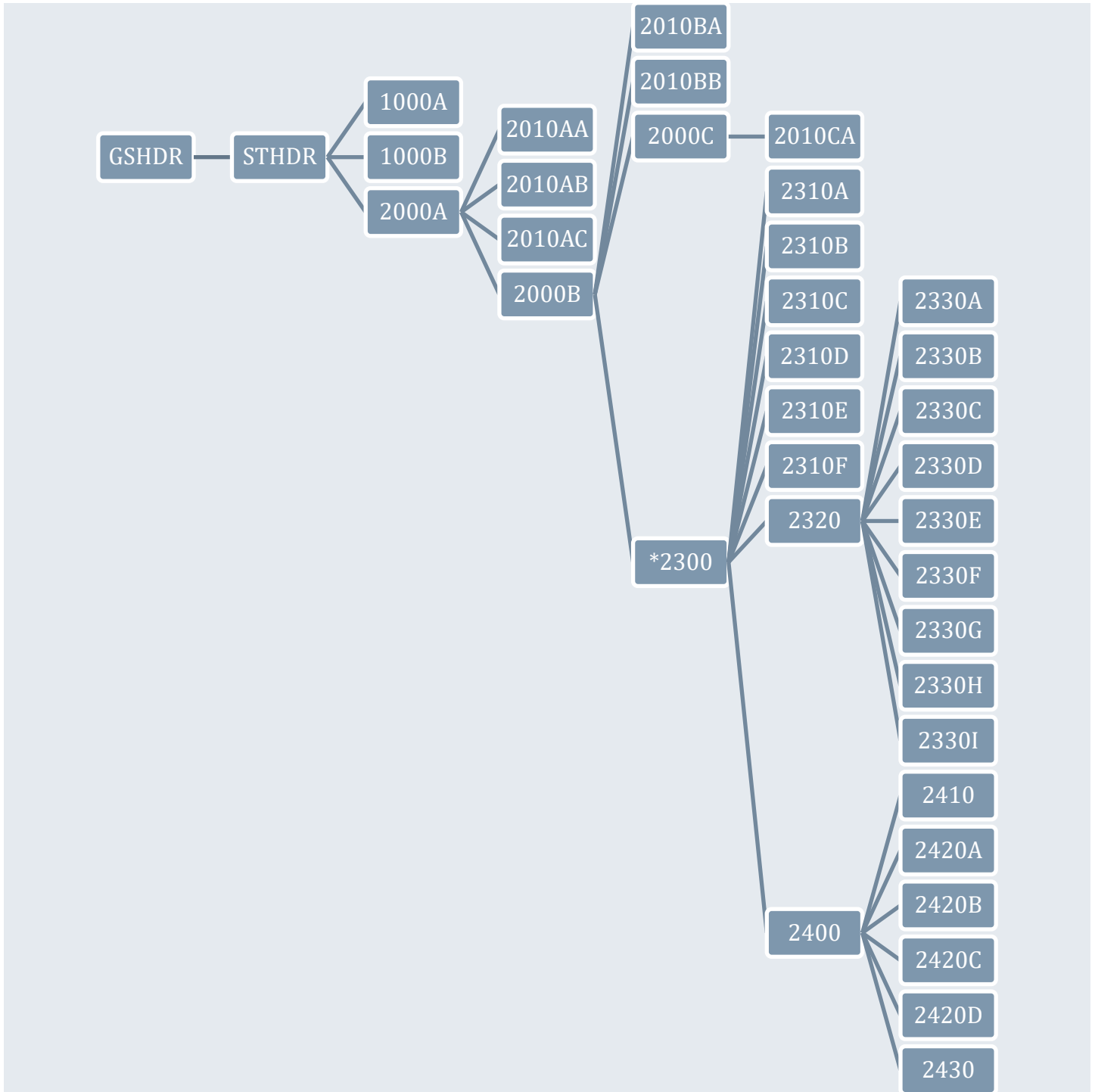


5010_834 / T0 Benefit Enrollment and Maintenance

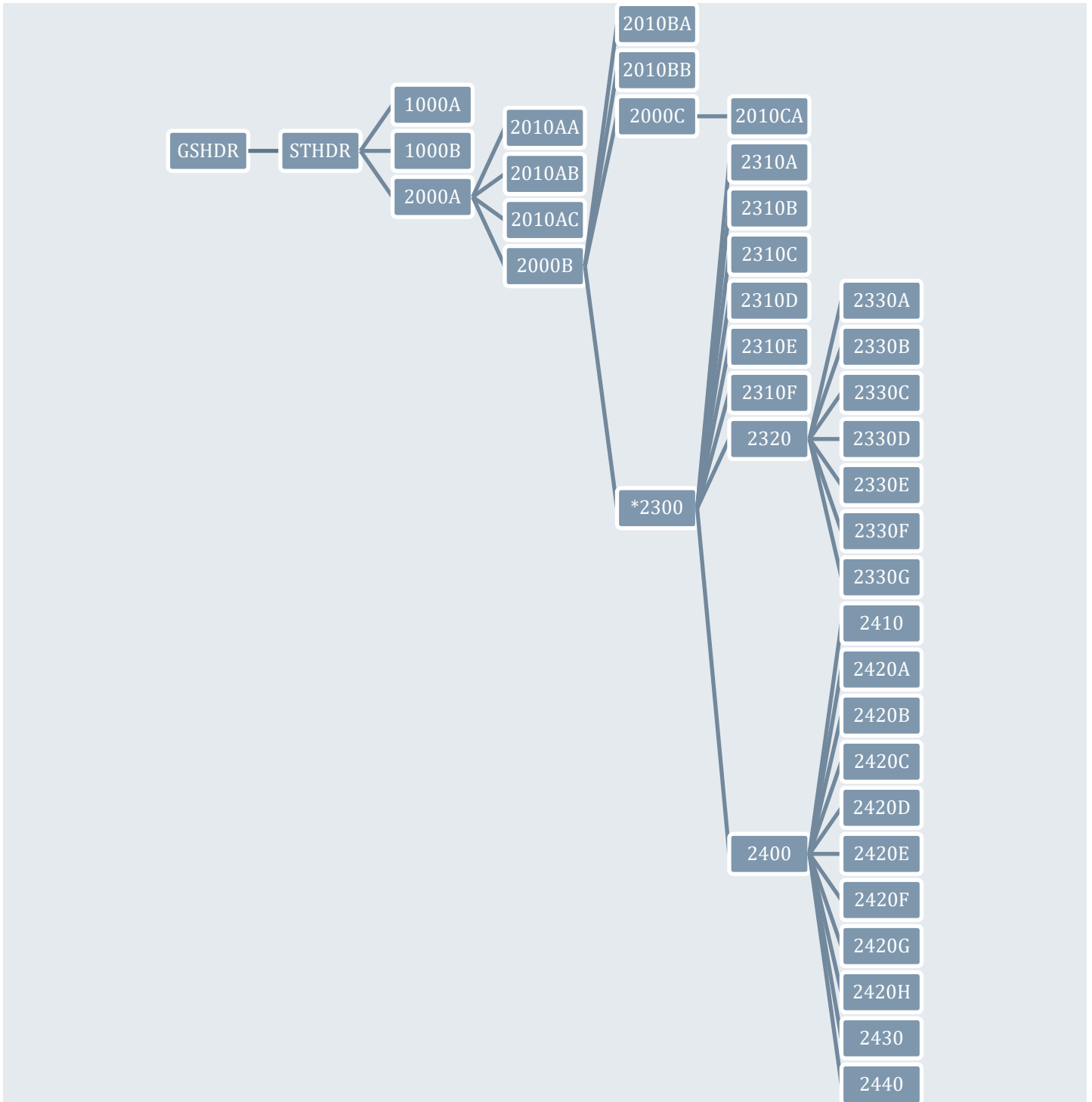




5010_837I / W0 Health Care Claim: Institutional



5010_837P / X0 Health Care Claim: Professional



* The L2300 tables in the 837 I and 837 P specifications have *two* parent indexes – one for 2000B as shown in these diagrams, and an *additional, optional* PAR_2000C_IX field that relates the claim to a specific iteration of the patient loop. If there are no L2000C patient loops, then this field can be left null.

Appendix C: Specification Codes

Specification Tag	Transaction Set / Addenda Level
M0	5010_270
M1	5010_270_A1
N0	5010_271
N1	5010_271_A1
O0	5010_276
O1	5010_275C
O2	5010_275R
O3	6020_275C
P0	5010_277
P5	5010_277CA
P7	5010_824
Q0	5010_278_REQ
R0	5010_278_RESP
S0	5010_820
S1	5010_820_A1
S5	5010_820X
T0	5010_834
T1	5010_834_A1
U0	5010_835
U1	5010_835_A1
V0	5010_837D
V1	5010_837D_A1
V2	5010_837D_A2
W0	5010_837I
W1	5010_837I_A1
W2	5010_837I_A2
X0	5010_837P
X1	5010_837P_A1

The table at left shows all of the specification codes possible. The specification tag consists of a letter and a number. Together, they define a specific transaction set and addenda level.

The specification tag is used for CGIF2-formatted Flat, HDB, and XML data projections, and is used to tell the SERENEDI engine what specification these mappings belong to.

For Flat and HDB projections, the specification code is found in the first ISA mapping. For XML, it's attached to the document root node.

In the 5010 Implementation Guides, the Addenda indicate relatively minor updates to segments and requirement rules; the loops are unchanged.

Appendix D: Rules Engine

To understand what the Rules Engine (RE) in SERENEDI is used for, it helps to understand the three classes of integrity checks SERENEDI is capable of running on decoded EDI files:

1. Basic Syntax – This is built into the decoding process and will generate messages based on simple syntax checks within the segments and loops. It will check for the existence of mandatory loops, segments, and elements. It will also check for elements containing invalid data and generate messages for all of these errors.
2. Special Segment Rules – Certain segments possess specific messages depending on the role the segment plays. For example, if an ST segment starts a transaction with a certain Transaction Control Number (TCN) and an SE segment ends the transaction with a different TCN, that is a segment rule violation and is flagged as such. If the file is decoded with the “Code Set Validation” option, then it is at this level these code sets are validated:
 - a. Claim Adjustment Reason Codes
 - b. Claim Frequency Codes
 - c. ICD 9 CM Diagnosis
 - d. ICD 9 PCS Procedure Codes
 - e. ICD 10 CM Diagnosis
 - f. ICD 10 PCS Procedure Codes
 - g. National Drug Code
 - h. Provider Taxonomy Codes
 - i. Remittance Advice Reason Codes
 - j. State Abbreviations
 - k. 5-Digit ZIP Codes
 - l. Country Codes
3. Rules Engine – This contains all the logic for the SNIP Type 3-5 integrity checks. When a file is successfully decoded, the SCORE script command `sapi-CheckIntegrity` can be used to validate these deeper integrity checks and generate messages when integrity violations are found. Currently, only 834, 835, and 837 I & P are supported for these integrity checks, with over 300 different rules. Each rule represents a specific error condition defined in the HIPAA Implementation Guides and is defined by a small programming language called REP (Rules Engine Programming). Individual Boolean REP scripts are called REP Code.

SERENEDI enables you to add custom REP rules. In this way, you can add custom validations to your business processes. Because REP was designed specifically for this purpose, it contains customized operations that make it far easier to create these rules compared to other ways, such as checking SQL elements. Each REP rule is codified in a single line of code that evaluates to a single Boolean expression – if it is true, then the error is flagged and a message is generated.

REP CODE Overview

REP rules can only be run when both the SegPool register and HKey register are loaded, and the HKey represents the decode of that particular SegPool. When these conditions are true, then the SERENEDI Integrity Engine can be invoked using the `sapi-CheckIntegrity` command. However, if you wish to add custom validations, you can do so *before* this command is invoked by using the `sapi-AddIntegrityRule` command.

It takes the following parameters:

Argument	Type	Purpose
SpecCd	String	This represents all the specifications that trigger the rule, without spaces or separator characters. The loop specified in LoopNm must be present in all the specifications listed. Example: WOW1W2 means the rule triggers on all 837 I specifications, including A1 and A2.
LoopNm	String	This is the loop within the specification this rule is bound to. This rule is executed for each instance of this loop within the HKey register. The loop name should be prefixed by L if it is not a part of the envelope loops.
RuleOrder	Integer	This is the numeric order of the execution. For custom rules, this must be 10000 or higher.
RuleCode	String	This is the REP Code of the rule.
Message	String	This is the message added to the message log when the REP is fired. If there were segment mappings within the REP Code that bind to this same loop, then the messages will be tied to that segment. Otherwise, the message will be tied to iterations of this loop that fire the message.

Before diving into actual examples of REP Codes, we need to distinguish the way CGIF2 maps are used within this syntax. In the CGIF2 mapping system, SERENEDI can define elemental maps containing specific loop iterations and specific segment iterations. For example, the 837 I 2320 loop can have 10 loop iterations, each referenced with a different loop iteration prefix. With REP Codes, all numeric loop iterations are ignored, so a mapping that explicitly defines the first iteration of a 2320 loop will also “hit” on the second and third iterations. Furthermore, segment iterations are normally *also* ignored, but this can be overridden with certain commands.

REP Codes are a single Boolean statement using a simple, common syntax. Behind the scenes, this syntax is *tokenized* into nodes that represent literals of different data types and commands. These nodes are an internal format that allows the Boolean expression to be evaluated quickly every time the associated loop for this REP Code occurs in the EDI file. There are three types of nodes: Literal nodes, Map nodes and Operation nodes. Literal nodes can have one of five types – String, Date/Time, Integer, Double, and Boolean. Map nodes are strongly typed references to data elements that can occur in the same loop the rule is bound to, or in a parent or child loop. Operation nodes will resolve to one of these values, depending on the operation.

REP CODE Example

To get an idea of what you can do with REP Codes, here is an actual integrity rule for the 837 P specification:

```

SPEC: XOX1    Loop: L2400    Order: 330    Message: AMT Tax should not exceed Line Item Charge Amount
L2400_AMT02_SALES_TAX_AMT.IsPresent && (L2400_AMT02_SALES_TAX_AMT >
L2400_SV102_LIN_ITM_CHG_AMT)

```

Because this REP Code is linked to the Service Line loop within the 837 Professional specification, this rule will be evaluated once for every Service Line in a file. The IsPresent token evaluates the linked map and returns a True if the mapping exists for this Service Line. The && is a Boolean “and” operation, followed by an expression that checks whether the Sales Tax Amount segment exceeds the Line Item Charge Amount.

Because the first mapped element in the REP Code belongs to the AMT segment, and this segment lies on the same loop it is bound to (Loop 2400), any messages generated by this integrity check will be bound to that segment. This is a simple example to demonstrate what REP Codes are and how they form the backbone of the SERENEDI Integrity Engine.

Testing new REP CODES

New REP Code rules can only be added *after* a SegPool has been loaded and decoded to an HKey. Therefore, you will need one of the included seed files to “prime” the environment so new rules can be added. It is possible to output an XML format display of what the parsed REP Code looks like to the internal environment; this is proof that it compiled properly.

You can use the SERENEDI REPL environment *or* the SERENEDI Studio RunBox for this walkthrough – there is a slight variation. For the purposes of this walkthrough, I will focus on the REPL environment. First, bring up the REPL command screen, (TODO: how to do this), then:

```
sapi-SegPoolFromFile -Filename 'C:\serenedi\seed\seed_837p.txt'
sapi-SegPoolToHKey
Write-Host (sapi-AddIntegrityRule -SpecCd "X0X1" -LoopNm "L2400" -RuleOrder 10000 -
RuleCode "L2400_AMT02_SALES_TAX_AMT.IsPresent && (L2400_AMT02_SALES_TAX_AMT >
L2400_SV102_LIN_ITM_CHG_AMT)" -RuleMessage "AMT Tax should not exceed Line Item Charge
Amount" -ShowXMLTokens)
```

The output from this command follows:

```
<Storage Data="L2400_10000:AMT Tax should not exceed Line Item Charge Amount">
  <AND ND="L">
    <MapDoesExist ND="L">
      <Map ND="L">L2400_AMT02_SALES_TAX_AMT</Map>
    </MapDoesExist>
    <GT ND="R">
      <Map ND="L">L2400_AMT02_SALES_TAX_AMT</Map>
      <Map ND="R">L2400_SV102_LIN_ITM_CHG_AMT</Map>
    </GT>
  </AND>
</Storage>
```

Now, run the command **sapi-CheckIntegrity**. On the seed 837 P file, this will not fire the trigger because it doesn't have the AMT segment. Go ahead and make two copies of the SEED_837P file:

```
C:\serenedi\pipeline\seed_837p_pos_test.txt
C:\serenedi\pipeline\seed_837p_neg_test.txt
```

Edit the first file and place a new segment, **AMT*T*294~**, between the DTP*472 segment and the LX*2 segment. This is the *positive test*, which replicates the condition being tested and shows that the check functions. On line 818, change the SE*815 segment to SE*816 to reflect the new segment count.

Edit the second file and place a new segment, **AMT*T*1~**, in the same place as before. This is the *negative test*, which proves that the new integrity rule doesn't fire when the criteria do not match. Also, change the segment count as above.

Back in the REPL environment:

```
sapi-Reset
sapi-SegPoolFromFile -Filename 'C:\serenedi\pipeline\seed_837p_neg_test.txt'
sapi-SegPoolToHKey
sapi-AddIntegrityRule -SpecCd "X0X1" -LoopNm "L2400" -RuleOrder 10000 -RuleCode
"L2400_AMT02_SALES_TAX_AMT.IsPresent && (L2400_AMT02_SALES_TAX_AMT >
L2400_SV102_LIN_ITM_CHG_AMT)" -RuleMessage "AMT Tax should not exceed Line Item Charge
Amount"
sapi-CheckIntegrity
```

An integrity check doesn't result in any messages, which is good because this is the negative test.

Now, change the above script to replace **seed_837p_neg_test** with **seed_837p_pos_test**, and run the whole script again. We get different results now:

```
SerenediREPL:
sapi-CheckIntegrity
IL2400_10000|L2400_10000:AMT Tax should not exceed Line Item Charge Amount||27|0
IL2400_330|L2400_330:AMT Tax should not exceed Line Item Charge Amount||27|0
```

Since this example is basically copying an existing rule, it's no surprise we are seeing the same error twice. This is also a very simple example; the REP Code syntax is capable of far more complex operations than demonstrated here.

REP CODE Token Library		
Token(s)	Value	Operation
()		The parenthesis tokens guide the tokenization of the REP Code expression. Enclose every Boolean expression with its own set of parentheses to ensure the operations occur in the correct order.
&&	Boolean	Logical AND
	Boolean	Logical OR
!	Boolean	This precedes a tokenized expression and reverses the Boolean result of that expression.
+	Integer String Double	This operator takes on the type of its right node and adds the two expressions together. Integers and Doubles will be added, and Strings will be concatenated.
-	Integer Double DateTime	This operator takes on the type of its right node and subtracts the expressions. Integers and Doubles will be subtracted. For DateTime expressions, the total days difference will be divided by 365.25, converted to an Integer, and returned as an Integer type.
		Example: ((STHDR_BGN03_TS_CRTN_D8 - L2100A_IL_DMG02_MBR_DOB) < 19) The above 834 REP Code expression will resolve to True if the difference between the transaction set creation date and the member's date of birth – the age of the member at the time the transaction was generated – is less than 19 years.

< <= > >=	Boolean	These operators will do a value comparison between the left and right nodes. They will work on Integer, Double, and DateTime values.
>=	Boolean	When this compares two strings, then the left-hand string is discarded and the right-hand node is evaluated; it returns True if there is a match in the internal text pool generated by the = operator below, and False otherwise.
!=	Boolean	This is a Boolean “Not Equal” operation, and will work on DateTimes, Doubles, Integers, and Strings. Both strings will be trimmed of leading and trailing spaces prior to the comparison.
==	Boolean	This is a Boolean “Equal To” operation, and functions similar to the != operation immediately above.
=		<p>The Variable Assignment operator, Equals, plays two roles. In one role, it passively links a variable defined by a string literal to a series of nodes, which are evaluated by the Fetch token, described later.</p> <p>If the right-hand expression evaluates to a string expression, then it stores the results of the expression in an internal storage area.</p> <p>Example (Passive Link):</p> <pre>'varMedicare' = ((L2000B_SBR09_CLM_FIL_IND_CD == 'MA') (L2000B_SBR09_CLM_FIL_IND_CD == 'MB'))</pre> <p>The above 837 P mapping tied to the L2000B loop stores a Boolean value depending on whether the Claim Filing Indicator is set to Medicare Part A or Part B. This variable can then be referenced by other REP Code rules, such as here:</p> <pre>L2300_REF_FAC_ID.IsPresent && (!'varMedicare'.Fetch)</pre> <p>Here, this rule tied to Loop 2300 in the same spec references the Medicare variable and fires an error if the Care Plan Oversight ID is present in non-Medicare claims.</p> <p>Example (String Accumulator):</p> <p><u>834, Loop 2000, Order 160</u></p> <pre>'varSub' = L2000_INS01_MEM_IND + L2000_INS03_MAINT_TYP_CD + L2000_REF_SUB_NR</pre> <p><u>834, Loop 2000, Order 170</u></p> <pre>('varSub' >= ('N021' + L2000_REF_SUB_NR)) && (L2000_INS01_MEM_IND == 'Y') && (L2000_INS03_MAINT_TYP_CD == '021')</pre> <p>In the first REP Code, the right-hand expression evaluates to a string value, and the 'varSub' string literal is ignored – the results are stored in a single internal text pool. This can be reset using the Clear command, but will otherwise accumulate values. Since this expression does not evaluate to a Boolean True, there is no Rule Message associated with this rule – it works in conjunction with another REP Code.</p> <p>The second REP Code uses the VarFetch function and the >= token, and returns a Boolean True if the string expression exists within the text pool. In this business</p>

		context, it means that a dependent with the same subscriber number as the current loop preceded this one, which is a violation of the HIPAA Integrity rules.
Clear		This completely resets all variables.
'XYZ'	String	String literals are enclosed in single quotes. When passing commands in PowerShell Core, it's important to use double quotes around all expressions.
123	Integer	Integer literals can be plus or minus, and have no decimal point.
#19000101#	DateTime	DateTime literals are always 8 digits (Year – Month – Day format) surrounded by hash characters.
0.00	Double	Double literals will always have a decimal point.
True	Boolean	Boolean literal
False	Boolean	Boolean literal
Fetch		This is attached to a string literal of a variable name, and retrieves the value stored in that value. This node takes on the type of whatever the variable was assigned to.
EvalExact		<p>This is attached to a mapping with explicit segment repeats. Normally, REP Code mappings match on the first occurrence within a loop without regard to loop numeric iterations or segment iterations. EvalExact allows checking on explicit iterations.</p> <p>Example:</p> <pre>L2100_02PER02_CLM_CON_NM.IsPresent && (L2100_02PER02_CLM_CON_NM.EvalExact == L2100_PER02_CLM_CON_NM)</pre> <p>This 835 REP Code example shows how to ensure the second iteration if the name in the 2100 PER segment doesn't match in the first iteration.</p>
Length	Integer	<p>This returns the length of the attached string expression.</p> <p>Example:</p> <pre>L2300_CLM01_PT_CTL_NR.Length > 20</pre> <p>This evaluates to True when the length of the Patient Control Number exceeds 20 characters.</p>
%= %!	Boolean	<p>These tokens represent the MapIsMatched and MapNotMatched operations. This is a set operation in that it takes a single value evaluated in the left-hand node and assesses it against a set of values represented in the right-hand node. The right-hand node is usually a mapping that is higher within the loop hierarchy tree, usually in a loop that repeats. This operation will gather all values that satisfy the right-hand map in relation to the left-hand map; if a single match is found, the MapIsMatched will return a True result, and will otherwise return False. Likewise, MapNotMatched will return True unless a match is found.</p> <p>Example:</p> <pre>L2420E_REF0402_PYR_ID.IsPresent && (L2420E_REF0402_PYR_PRI_ID %! L2330B_01_NM109_HCFA_PLAN_ID) && (L2420E_REF0402_PYR_PRI_ID %! L2330B_01_NM109_PAYR_ID)</pre>

		In the above example from the 837 Professional spec, this rule checks to see if the Loop 2420E Other Payer Primary Identifier matches any of the 2330B Payer IDs or HCFA Plan IDs in any of the iterations of the 2320 loops that lie relative to this 2420E loop within the same claim.
IsPresent NotPresent IsPresentExact NotPresentExact	Boolean	These operations will return True if the attached map exists, and False otherwise. This is also a set-based operation and can operate in different loops than the one the rule is bound to, similar to the example above for the %= token. The operations normally do not check for segment iterations, so for segments that can have multiple repetitions, it will match regardless of the iteration. If the Exact operations are used, then the segment iteration <i>is</i> used for the evaluation.
IsPOBox	Boolean	This will evaluate the attached map and return True if it appears to be formatted like a PO Box address.
IsChild NotChild	Boolean	This command is used in deeper-level mappings relative to the loop bound to the rule to see if that loop exists as a child to the bound loop. It must be bound to an element that is mandatory for the loop in question. It will return True if that loop is a child loop of the bound loop (existing lower on the hierarchy tree), False otherwise for the IsChild token, and the reverse of that for the NotChild token.
*=		This token is the Dynamic Assign operator. The string literal to the left of the token is resolved to be the <i>name</i> of a new variable, which is assigned a value with the expression to the right of the token. This value can later be retrieved within another REP Code via the DynFetch token.
DynFetch		This pulls values that were assigned via the Dynamic Assignment operator. It's useful when you need to store values across various iterations of loops and make comparisons.
VSum HSum	Double	<p>VSum, or Vertical Summation, is an operation in which a higher-order loop needs to sum up values lying within standard child loops.</p> <p>HSum, or Horizontal Summation, is an operation in which a higher-order loop needs to sum up values lying within loops parented to non-standard iterated loops. This includes loops with a loop count of less than 25, value-defined loops, and anything not defined as a standard loop.</p> <p>Example:</p> <pre>L2430_01_SVD02_SVC_LIN_PD_AMT.IsChild && (L2400_SV102_LIN_ITM_CHG_AMT != (L2430_01_SVD02_SVC_LIN_PD_AMT.VSum + L2430_01_01CAS03_ADJ_AMT.VSum + L2430_01_01CAS06_ADJ_AMT.VSum + L2430_01_01CAS09_ADJ_AMT.VSum + L2430_01_01CAS12_ADJ_AMT.VSum))</pre> <p>In the above REP Code, the VSum command is used to dynamically sum up the Adjustment Amounts throughout the 2430 loop. Since this command is bound to the 837 Professional 2400 Claim Line loop, it sets up a comparison between the Line Item Charge Amount and the 2430 Claim Adjustment segments.</p>
PRSum	Double	This is similar to a VSum operation as above, except it will match <i>only</i> in mappings that belong to CAS*PR segments.