In the broadest sense, the purpose of Foreign System Interfaces (FSI) is to enable information sharing across disparate systems, such as Cerner systems and non-Cerner systems.

Features

Foreign System Interfaces includes three primary solutions: External Systems Inbound (ESI), External Systems Outbound (ESO), and Open Engine. Each of these solutions is described in the following sections.

Health Level Seven (*HL7*)

Before looking further into ESI, ESO, and Open Engine, some background on *HL7* is necessary. *HL7* is a standard for electronic data exchange in healthcare environments, and is the primary protocol that ESI, ESO, and Open Engine use to format the data exchanged between *Cerner Millennium* and foreign systems. It endeavors to create standards for the format and protocol for the exchange of certain key sets of data among healthcare computer application systems. *HL7* is accredited by the American National Standards Institute (ANSI) to write these standards.

As with almost all United States standards, *HL7* is voluntary and consensus-based. There is no governmental mandate to use *HL7*, except in very limited circumstances. *HL7* follows procedures, approved by ANSI, to review new standards and put them forward for balloting by its members in order to establish consensus among the users and producers of healthcare information systems.

HL7 is also the name of the group that publishes these standards. *HL7*-sanctioned national groups also exist in many other countries outside of the United States, including Australia, Germany, Japan, the Netherlands, and New Zealand.

External Systems Inbound

External Systems Inbound (ESI) acts as the gatekeeper for data inbound to *Cerner Millennium* from a non-Cerner system. ESI allows data from a variety of disparate sources to be written seamlessly to the *Cerner Millennium* database.

ESI performs data validation, translation, and matches and reconciles the incoming data with existing database records. ESI is controlled using SI Manager (SI_Manager.exe), which is discussed in more detail in the Configure ESI With SI Manager Reference page. Each external system providing data is configured separately. Configuration options determine data matching, data translation, and the parameters for updating.

ESI Features

ESI provides support for the following features:

- Flexible Match and Reconcile Configuration for Persons and Encounters
- Personnel validation
- Complete transaction handling
- Load balancing

Flexible Match and Reconcile Configuration for Persons and Encounters

Match and Reconcile process ensures medical record integrity in the *Cerner Millennium* system. Matching is the process of determining whether to add a new person or encounter row to the database or update an existing row. Reconciliation only occurs with authenticated feeds and is the process of determining whether two authenticated person records, or an authenticated and an unauthenticated person record, should be combined. ESI provides several options for configuring how Match and Reconcile is performed. Configuration of Match and Reconcile processing is done with SI_Manager.

Flexible Personnel Validation

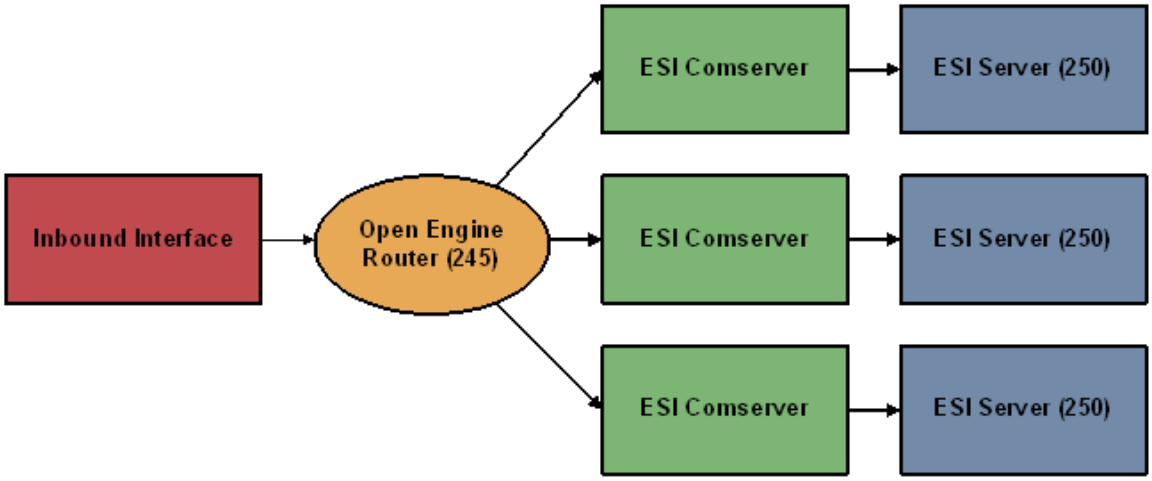
Personnel processing defines the ways to capture the personnel aliases into the database and whether relationships between encounter and personnel are created. ESI provides several options for determining how personnel are processed and committed to the database. Again, configuration of personnel processing is done with SI_Manager.

Complete Transaction Handling

The Open Engine Universal Interface accepts *HL7* delimited messages from external systems, unpacks the external data into a Cerner interface common request package and sends the request to the ESI connectivity server. The CPM ESI server (SCP 250) ensures and commits the data to the *Cerner Millennium* database and returns an acknowledgment to the ESI Communication server (Comserver).

Load Balancing

Load Balancing is the configuration of multiple ESI comservers to share the processing load by sending a transaction to the next available ESI server. For optimum performance, there should be one ESI server for each configured ESI comserver.



The inbound interface includes multiple ESI comservers in its route configuration. An internal algorithm, in conjunction with a designated field within each transaction, determines to which server the inbound comserver routes a given transaction. In this fashion, multiple ESI servers share the processing load equally.

ESI Servers

ESI uses two primary servers to perform its tasks.

- **CPM ESI server:** The CPM ESI server receives transactions from external systems via the Open Engine comservers, translates the data, and then inserts and updates it into the *Cerner Millennium* database. For more detailed information, see the CPM ESI Server Reference page.
- **The Foreign System Interfaces Order Grouper server (SCP 255):** The Foreign System Interfaces Order Grouper server receives orders from the CPM ESI server and stores them temporarily under the order's encounter. Once the release criteria are met (for example, a 90 second time window), the FSI Order Grouper server reformats the encounter node into the Netting server request structure. The Netting server performs such tasks as accessioning and printing labels. For detailed information, see the FSI Order Grouper Server Reference page.

External Systems Outbound

External Systems Outbound (ESO) performs event-driven tasks to collect data from the *Cerner Millennium* database repository for transmission to a non-Cerner system. Client-server architecture is used to collect requests from client applications, which can be *Cerner Millennium* back-end servers or front-end applications. The ESO servers commit client requests to disk queues that are part of the Cerner Common Queuing Model (CQM). ESO depends on Open Engine services to finalize message formatting and transmit the messages to the external systems.

ESO Features

ESO provides support for the following features:

- Outbound event reliability
- Retransmission of outbound event
- Data retrieval
- Runtime debugging
- Downtime logic
- Hold transaction processing
- Load balancing
- Open Engine HL7 duplication

Outbound Event Reliability

Transaction reliability is provided by disk queues used to store the outbound triggers and their resulting, formatted *HL7* messages at each processing stage. As the outbound trigger progresses through the linear ESO data path, it is committed to a disk queue each step of the way. This way, if a failure occurs in one of the processing servers, the processing of the outbound trigger can be resumed right where it was left off.

Retransmission of Outbound Event

Each queue has the potential for retransmission of an outbound trigger. With this feature, an outbound event can be replayed at any point along the linear ESO data path.

Data Retrieval

Data retrieval is the ability to retrieve data from the database using *Discern Explorer*(CCL) scripts and domain server calls instead of hard coding. This reduces any required knowledge of the data and results in a generic and flexible model for processing outbound events.

Runtime Debugging

CSA objects (for example, outbound triggers and *HL7* messages) are stored in the CQM tables; this reduces runtime-debugging dependencies because any outbound trigger or resulting *HL7* message can be reviewed any time after an erroneous event.

Downtime Logic

This feature improves the reliability of the ESO data flow by allowing triggering *Cerner Millennium* servers to write directly into the CQM_FSIESO_QUE table when the Foreign System Interfaces CQM service is not detected across the message bus. This feature is only supported by outbound interfaces with events originating from the Clinical Event server (SCP Entry 200), the ORM servers (SCP Entries 101, 104, 105, and 107), and the PM Registration and Transaction servers (SCP Entries 330 and 332).

Hold Transaction Processing

Hold Transaction Processing provides a method for delaying the sending of transactions from *Cerner Millennium* systems to a foreign system until *Cerner Millennium* receives the appropriate person, encounter, order, or schedule event alias from the foreign system. The hold rules can be based on many different criteria that are defined in SI_Manager.

Typically, Hold Transaction Processing is used in the following situations:

1. The patient has been manually registered in the Cerner system, but not yet in the patient management system.
2. The order management system has not assigned an order number to the order originating in the Cerner system.

Load Balancing

ESO Load Balancing is an optional feature that can increase performance by routing outbound triggers to multiple Foreign System Interfaces ESO-CQM (SCP 252) servers. All the outbound triggers for a person are routed to a single Foreign System Interfaces ESO server, since it is essential that all the transactions for a person go outbound in the same order as they were received. Routing all the outbound triggers for a person to a single Foreign System Interfaces ESO server maintains their order.

Open Engine HL7 Duplication

Open Engine, which depends on ESO to create the outbound *HL7* message, performs the final formatting and routing of the message to a foreign system. This *HL7* message can be routed to multiple foreign systems, even though ESO created only one message, because Open Engine can create duplicate *HL7* messages for routing to multiple foreign systems.

ESO Servers

ESO uses several servers to perform its tasks:

- The Foreign System Interfaces ESO CQM and Foreign System Interfaces Batch CQM servers (SCP 252 and 291). These servers are general-purpose servers for handling and managing the Foreign System Interfaces ESO CQM application tables. This server accepts requests (or triggers) that are used to produce outbound messages for foreign systems. For more information, see the FSI ESO CQM and Batch CQM Servers (SCP 252 and 291)
- Foreign System Interfaces Notify server (SCP 275). The Foreign System Interfaces Notify server performs the table recovery from the CQM_FSIESO_QUE table and writes the transaction information to the CQM_FSIESO_TR_1 table. The Foreign System Interfaces Notify server falls between the Foreign System Interfaces ESO CQM server and the Foreign System Interfaces ESO server in terms of the data flow. For more information, see the FSI Notify Server.
- The Foreign System Interfaces ESO Listener/Batch servers (SCP 280-284, 285/292, and 290). The Foreign System Interfaces ESO Listener/Batch server is another of the three servers that provides the means for transmitting information from the *Cerner Millennium* database to various foreign systems. This server's primary function is to process the outbound *Cerner Millennium* CSA Event, to create *HL7* CSA Objects, and write the *HL7* CSA Objects to the CQM disk queuing system. The Foreign System Interfaces ESO Query server is a specially-bound Foreign System Interfaces ESO Listener server used to query the database for results. For more information, see the FSI ESO Listener, Batch, and Query Servers.
- Foreign System Interfaces Query server (SCP 270). The Foreign System Interfaces Query server is used to allow a foreign system to query against the database by sending a QRY transaction to find information. The Foreign System Interfaces Query server accepts an *HL7* QRY/R02 or an *HL7* QRY/A19

message and forwards a modified version of the request to the Foreign System Interfaces ESO Query Extract server or the PM Query server, respectively. For immediate queries, the query response is returned in the reply to the querying system. For more information, see the FSI Query Server (SCP 270).

- The Foreign System Interfaces ESO Query Extract server (SCP 290). The Foreign System Interfaces ESO Query Extract server immediately returns query information to the client application. This server is a bound version of the Foreign System Interfaces ESO server. For more information, see the FSI ESO Query Extract Server (SCP 290).
- Foreign System Interfaces Hold Release server (SCP 276). The Foreign System Interfaces Hold Release server releases transactions on hold. It receives requests for transaction release from the ESI Server. If the hold criterion is met, it releases the transaction. For more information, see the FSI Hold Release Server (SCP 276).

Contributor Systems and Contributor Sources

There is a one to many (1:M) relationship between a contributor system and a contributor source. A primary contributor source and an alternate contributor source can be tied to one contributor system. The same contributor source can be tied to multiple contributor systems.

Contributor System

Contributor systems are the foreign or external systems that send data into the *Cerner Millennium* database. A Contributor system can be thought of as an interface or a feed. They are built in SI_Manager and will be captured in Code Set 89.

Contributor Source

A contributor source is a set of aliases. Multiple contributor sources are needed if multiple aliases are being sent by multiple contributor systems. They can be build from SI_Manager when configuring a contributor system or can be directly built in Code Set 73.

Open Engine

An interface engine allows information in the form of messages, records, or transactions to be easily exchanged, routed, and translated between disparate systems and applications.

Open Engine (OEN) is an interface application that gives developers the tools to build interfaces rather than wrestle with traditional point-to-point custom programming. Open Engine allows Cerner associates and clients to build, maintain, and monitor system-to-system interfaces. This Application Gateway System, or toolkit, provides advanced communication services, message formatting functions, intelligent message routing, and system management features as they relate to system-to-system interfaces.

Open Engine Features

Open Engine provides support for the following features:

- Communications services
- Message formatting
- Intelligent message routing and queuing
- Message and event logging services
- Monitor and control utilities

Communications Services

Open Engine supports TCP/IP and Asynchronous (via terminal server) communications protocols.

Message Formatting

Interface developers have numerous formatting features available with Open Engine, including data mapping and data translation.

Intelligent Message Routing and Queuing

Using Open Engine's custom routing feature, you can configure the rules for determining the unique routing of a message based upon the message content. Also, store and forward capabilities are available in the event a target system is unable to receive messages.

Message and Event Logging Services

In the event a target system indicates the non-receipt of messages, Open Engine, through its Logging Services, can replay the original transaction. Logging

Services also allows users to identify which transactions received a negative acknowledgment and may need to be re-sent.

Monitor and Control Utilities

You can view the current state of configured processes using Open Engine's Controller screen. From this screen, you can also go to a particular process configuration, start System Message Viewer, or Cerner's Enterprise Manager, and monitor the entire system.

Open Engine Servers

Open Engine uses three primary servers to perform its tasks:

- OEN Controller server (SCP 240). The OEN Controller server provides Open Engine users with a single application control point for Open Engine processes. The OEN Controller is primarily used by OpenView (OpenView.exe), a front-end, graphical interface application used to configure, start, stop, and monitor interfaces. OpenView sends and receives all of its data through the OEN Controller. The request is sent from OpenView to the OEN Controller which in turn passes the request to SCP. The results of the request are then sent back through the OEN Controller to OpenView. For detailed information, see the OEN Controller Server (SCP 240).
- OEN Router server (SCP 245). The OEN Router server, sometimes called the Router, is responsible for keeping track of transaction statistics. This server is notified every time a message is enqueued or dequeued from all the comservers. This allows utilities such as OpenView or OEN_QUERY_CLIENT to retrieve valuable information quickly without the overhead of reading the database. For detailed information, see the OEN Router Server (SCP 245).
- OEN Interface Debugger server (SCP 243). The OEN Interface Debugger server is used to develop and debug interface routing and formatting scripts. This server is another instance of the OEN Router server with a different binding. It is not used in the daily operations of Open Engine and is used primarily to debug formatting scripts. For detailed information, see the OEN Interface Debugger Server (SCP 243).

Applications

Foreign System Interfaces consists of the following applications:

- OpenView (OpenView)
- SI_Manager (SI_Manager)

Prerequisites

No prerequisites

System Considerations

No system considerations

Cerner Solutions and Licensing

No solutions or licensing

Third-Party Requirements

No third-party requirements

Additional Resources

No additional resources