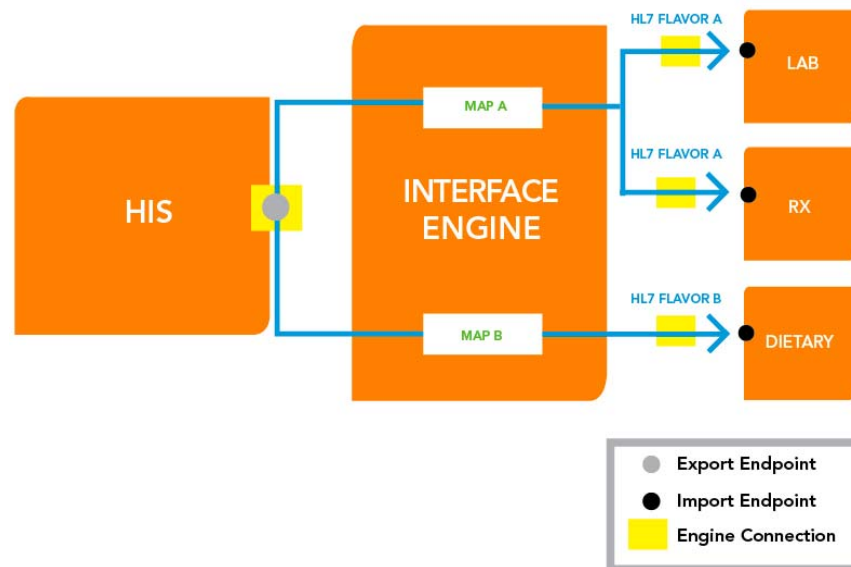# Corepoint Integration Engine™
Technical Overview

Corepoint Integration Engine is a new generation of [interface engine](#) that provides flexibility in message management, routing, mapping, and database access. The engine is designed around easier workflow and lower cost of ownership compared to other engines. Graphical tools and a published API make it possible to quickly build real world healthcare interfaces, including support for many message formats ([HL7](#), XML, CSV, X12, Clinical Document Architecture - CDA, [Continuity of Care Record - CCR](#), [Continuity of Care Document - CCD](#), DICOM, custom formats, etc.) and communications protocols (TCP/IP, [MLP](#), files, HTTP, MSMQ, Web Services, etc.)

Corepoint Integration Engine can be used to:

➢ Provide a hospital, imaging center, clinic, lab, ASP, or other facility a core interface engine. It provides message routing, filtering, and message transformation using powerful tools and adaptable publish/subscribe techniques.

➢ HL7-enable a commercial or internally-developed clinical application. It provides for direct mapping of HL7 messages into a database via query/read/write and flexible data manipulation.

Healthcare Provider: Using Corepoint Integration Engine as an Interface Engine

As illustrated above, healthcare providers and vendors use Corepoint Integration Engine to map, route, and filter messages. The key benefits in using Corepoint Integration Engine as an interface engine include:

➤ Lowering the cost of initial implementation and on-going support of interface environment

➤ Leveraging investment in interfaces by repurposing existing data flows

➤ Broadening the role of interfaces though data extraction and the creation of an operational data store in any database

➤ Focusing on interface quality through industry-leading monitoring, alerting, and debugging tools

➤ Adapting existing message flows without vendor involvement

Healthcare Vendor: Using Corepoint Integration Engine as a HL7 Subsystem
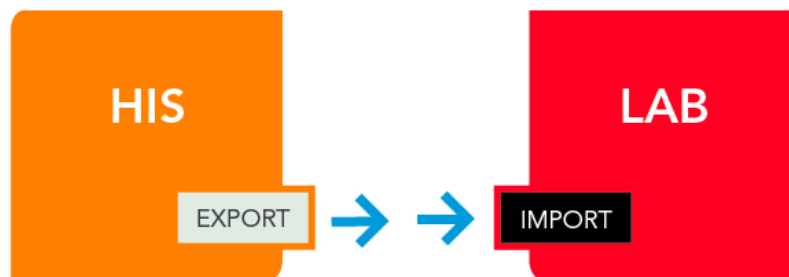
Clinical application development teams create HL7 export and import modules that manage the sending and receiving of healthcare messages typically in an HL7 message format through TCP/IP connections. These modules are created using custom code or built with third-party tools. There are many benefits to having a fully-featured HL7-subsystem based on Corepoint Integration Engine:

➤ Leveraging proven interfacing technology that provides a fast customer-focused implementation cycle

➤ Achieving full HL7 compliance with support for all versions of HL7 2.X messaging, HL7 Version 3, CDA, CCD, CCR, IHE, and CCHIT

➤ Extending application integration reach through flexible HL7 derivatives, data mapping, code set conversion, custom Z segments, data types, and message triggers

➤ Ensuring message delivery with extensive support for HL7's MLP protocol and acknowledgement handling

➤ Providing high quality clinical data through message validation

➤ Focusing product development efforts on a single iteration touch point with other applications and mapping foreign workflows, data models, and code sets onto native application functionality

You do not need to be a programmer or an HL7 expert to create and maintain interfaces using Corepoint Integration Engine. Simply define the data you want and where it should be sent.

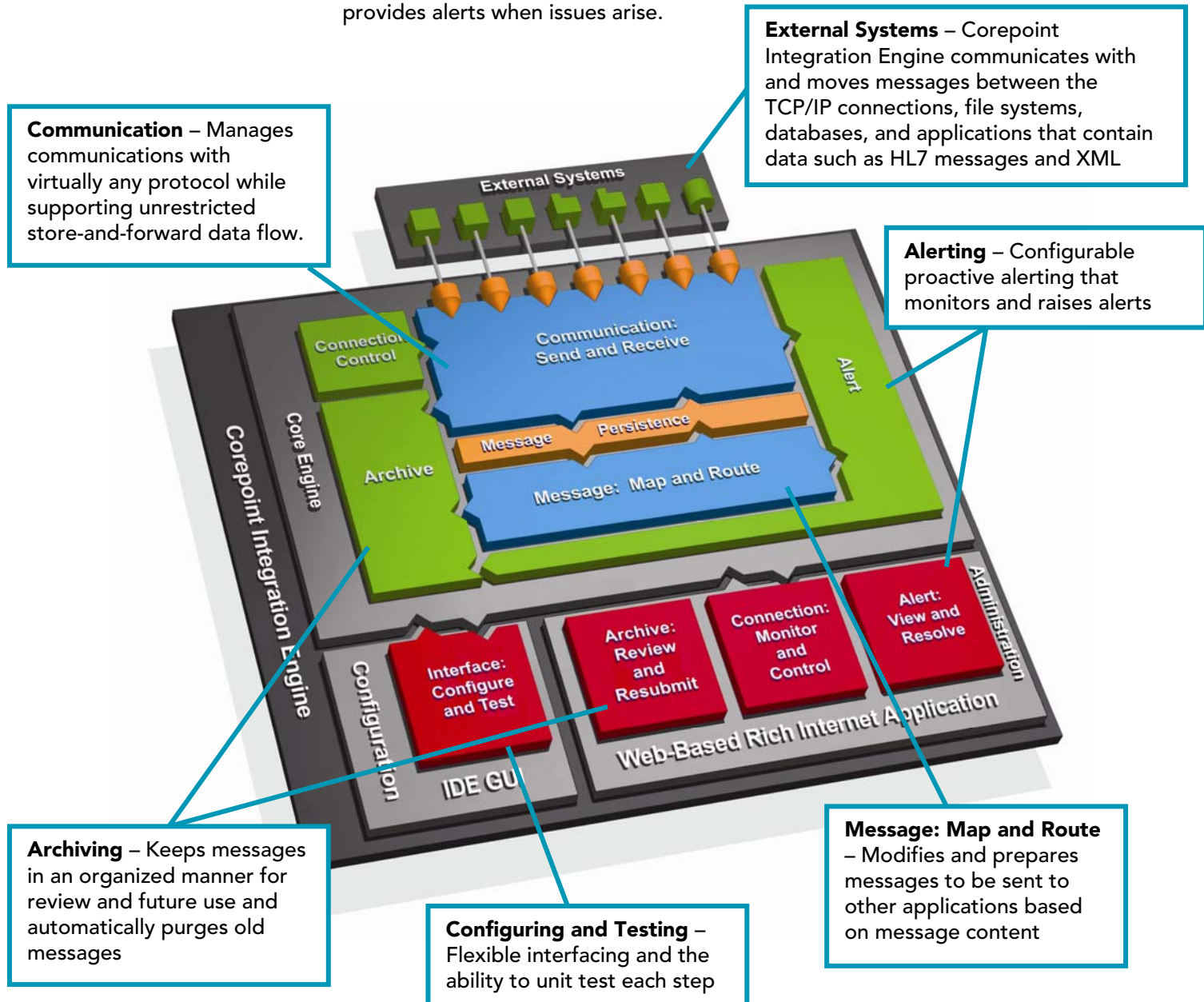Corepoint Integration Engine makes it simple to:

➢ Create new interfaces

➢ Monitor connection states

➢ Define database relationships

➢ Review messages sent across an interface

➢ Resend selected messages one at a time or in batches

➢ Enhance service levels through automated alerting (visual and e-mail) of unusual conditions

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Key Corepoint Integration Engine Features

API for extending Corepoint Integration Engine's core functionality
GUI driven Routing, Mapping, and Filtering
Agile connection creation
Processes HL7 2.X and HL7 3.0 messages
Built-in support for CDA, CCR, CCD, X12, and DICOM
GUI driven process to define your specific HL7 messages and Z segments
Complete TCP/IP (MLP) communication infrastructure
Robust HL7-to-XML-to-HL7 conversion
Remote management and monitoring from a secure web-based application
Configurable proactive alerting
Centralized configuration GUI

Built-in code set conversion
Comprehensive message/activity logging
Log viewing tools to filter and display message traces
Message resend (inbound/outbound)
Handles cardinality during message processing
Database access (read/write/query)
XSLT (XML-to-XML) support
File Read and Write
Robust intuitive and integrated testing tools
Web Services (HTTP) connectivity
XML support including custom XSDs
Highly available for continuous processing

Corepoint Integration Engine Architecture

As illustrated in the following diagram, Corepoint Integration Engine is able to receive messages from a wide variety of external systems, modify the messages and route them to other external systems. Throughout the processing, Corepoint Integration Engine archives the message activity and provides alerts when issues arise.

External Systems – Corepoint Integration Engine communicates with and moves messages between the TCP/IP connections, file systems, databases, and applications that contain data such as HL7 messages and XML

Communication – Manages communications with virtually any protocol while supporting unrestricted store-and-forward data flow.

Alerting – Configurable proactive alerting that monitors and raises alerts

Archiving – Keeps messages in an organized manner for review and future use and automatically purges old messages

Configuring and Testing – Flexible interfacing and the ability to unit test each step

Message: Map and Route – Modifies and prepares messages to be sent to other applications based on message content

Details about the main areas of Corepoint Integration Engine architecture are outlined on the following page.

Corepoint Integration Engine contains a core engine and various graphical user interfaces that interact with the core engine. Corepoint Integration Engine contains the following main functional areas:

Communication

➢ Generate outbound messages and acknowledgements

➢ Manage inbound messages and acknowledgements

➢ Handle HL7 resends

➢ Manage communication with multiple applications

➢ Support unrestricted and non-blocking data flow

➢ Resolve MLP implementation and communication problems

➢ Provide pre-configured sender and receiver logic

➢ Read, write, query, insert, and/or delete data in an ODBC database

➢ Store-and-forward message persistence

Message: Map and Route

➢ Use preloaded definitions of messages, segments, fields and data types for all HL7 2.X versions

➢ Support 2.X messages, segments, fields, and data types including customizations such as Z segments

➢ Process repeating fields, repeating segments, groups of segments, etc.

➢ Built-in code set conversion

➢ Preloaded support for HL7 V3

➢ Support for XML messages

➢ Support for CCR, CCD, CDA, X12, and DICOM messages

➢ Handle one input message to produce 0-to-N output messages through dynamic, content-based routing

➢ Run HL7 conformance checks using sample messages.

➢ No coding or scripting required

Alert

➢ Configurable alerts by day, time, type of day, and connection.

➢ Automatically monitor connection states and related conditions, and raise alerts when problems occur

➢ Escalation of alerts based on severity of problem

➢ Display alerts in a secure web-interface application

➢ Send alerts via e-mail to pagers, cell phones, etc.

➢ Support for quick resolution of alerts

Configure and Test

➢ Perform all configuration tasks in a single GUI with a streamlined work flow

➢ Allow user-defined variations in messages; for example, making segments optional, required or changing segments or field sequences.

➢ Validation check on defined HL7 messages

➢ Configure alerts flexibly according to time and severity thresholds

➢ Test alerting components prior to implementation

- History stored in alert logs including documented resolution

Archive

- View message logs for each connection by day, including session, error, and alert information

- View messages over a range of days

- Search for messages by message content, history, and metadata attached to the message

- Edit messages easily, especially useful in testing

- Re-send messages to resolve problems quickly

- Store and view alert and resolution log

- Configure message mapping easily to reduce integration work

- Define filter criteria such as 'Only send A04 and A08' and 'Remove all outpatients from data stream' through GUI-based tool

- Point-and-click GUI to move data from point A to B in a message

- Print configuration files for clear documentation

- Completely re-format interface message without writing any compiled code or interpreted scripts

- Test mapping operations in GUI testing screen before using in a running connection

Communication
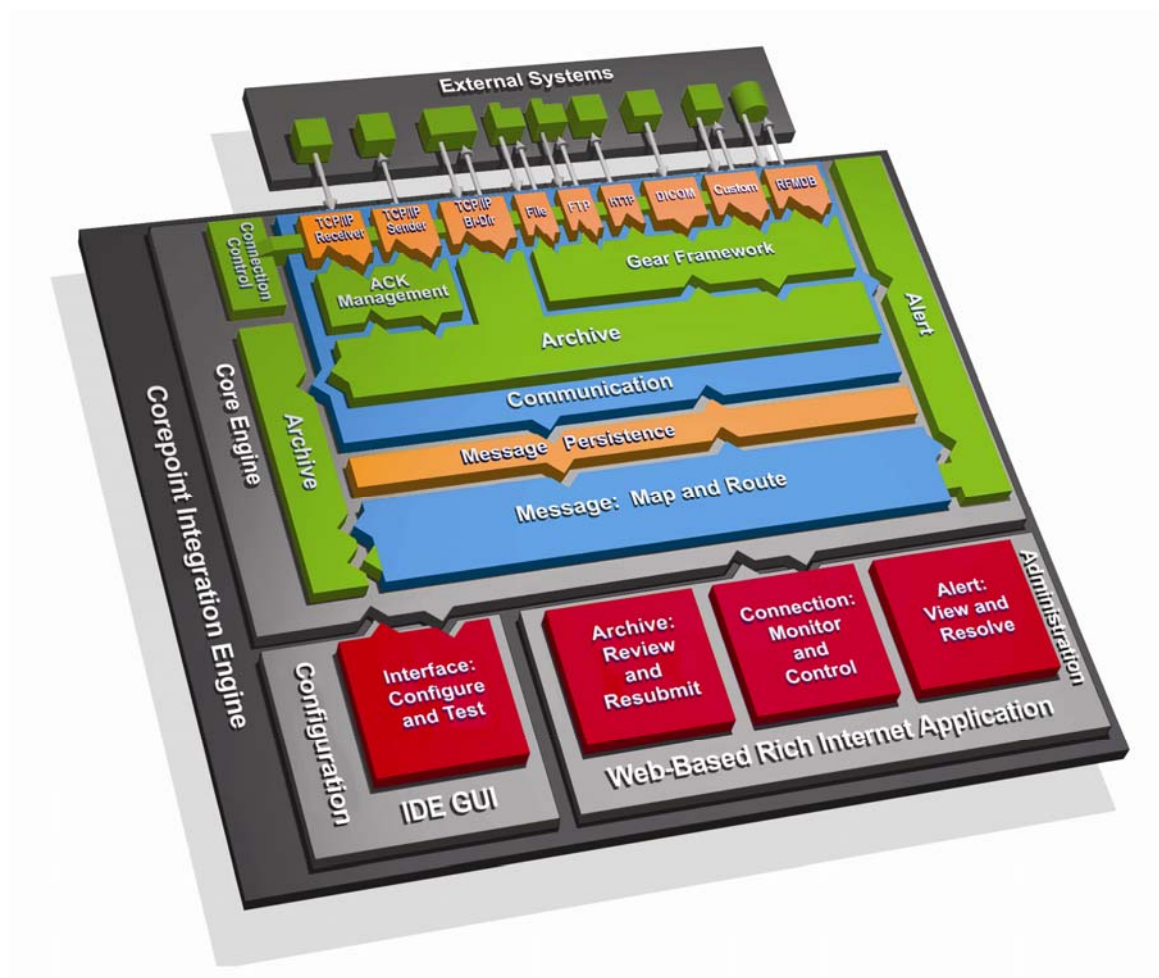
The communication layer of Corepoint Integration Engine manages all communications with other systems while supporting an unrestricted store-and-forward data flow. Corepoint Integration Engine can communicate with virtually any protocol including TCP/IP, file systems, web services, and databases while managing HL7 acknowledgement messages and resolving MLP problems. Connections are configured remotely with an easy to use graphical interface. This same interface provides the ability to remotely monitor connection information and view system logs.

The communication functionality in Corepoint Integration Engine includes:

- ➢ TCP/IP Communication

- ➢ Creating Connections

- ➢ File Read/Write

- ➢ Connection Monitoring

- ➢ XSLT

> ➤ Non-Standard MLP characters

> ➤ ACK Management

TCP/IP Communication

TCP/IP MLP communication is simple with Corepoint Integration Engine. Define the connection's role (client or server), the port the connection will be using, and the framing of the message. Select the appropriate HL7 acknowledgement options and you have completed TCP/IP MLP configuration.

In the background Corepoint Integration Engine:

> ➤ Supports real time TCP/IP MLP

> ➤ Enables communication with multiple applications

> ➤ Uses unrestricted, non-blocking dataflow to send messages

> ➤ Fixes incorrectly implemented MLP communication logic

> ➤ Evaluates and manages inbound acknowledgements (Send)

> ➤ Generates acknowledgements (Receive)

> ➤ Handles timeouts, resends, and other communication issues

> ➤ Supports standard and nonstandard communication logic
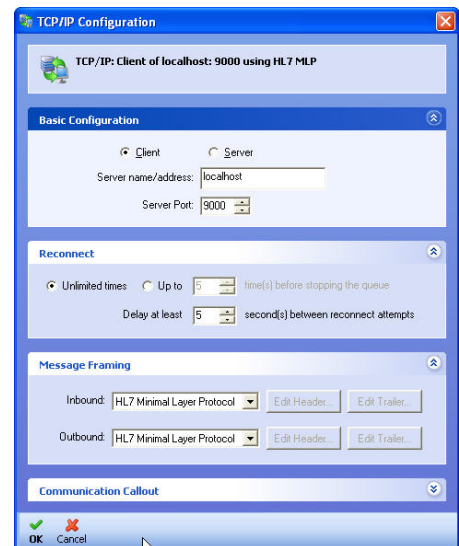
Creating Connections

Receiver, Sender and Bidirectional connections are created in seconds using Corepoint Integration Engine Configuration. Connections can be monitored and managed remotely through Corepoint Integration Engine Administration.

To create a connection select the type of connection and enter the minimum required information. The details are easily accessed for editing, if required.
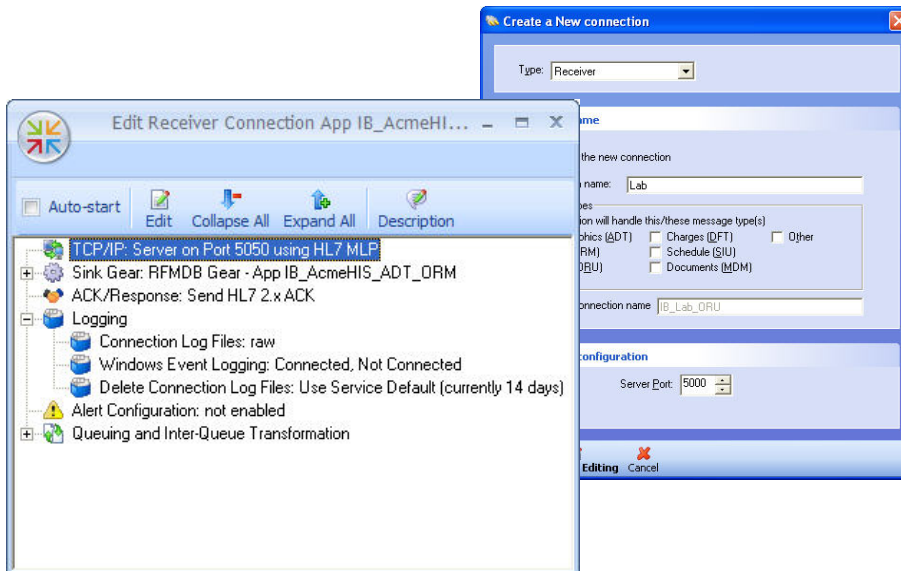
Above: Enter minimum information to create connection.

left: View and edit connection details.

File Read Write

Corepoint Integration Engine can write a message stream into a series of uniquely named files. It can also read files from a local directory based on a specified file name pattern (e.g., *.hl7 or mes*.txt) and then archive the files once processed.

When paired with Corepoint Integration Engine's base TCP/IP functionality, this allows many uses, including turning a TCP/IP real-time message stream into a set of files for testing, development or interfacing to non-real-time applications.

Connection Monitoring

Corepoint Integration Engine allows you to remotely, control and monitor the engine from a secure web-based application. Because Corepoint Integration Engine Administration is viewed in a web browser, the tools needed to manage Corepoint Integration Engine and your HL7 connections are readily available from any machine with safe access to the service allowing for maximum flexibility.

Corepoint Integration Engine provides comprehensive, real-time information about each connection. Some of the information displayed includes:

➢ The state of the connection, displayed by color and state column

➢ How long it has been since a message has been sent or received, displayed as idle time

➢ How behind the connection is in processing data, displayed as queue depths

➢ Message delivery age, delivery rate, and time to clear up any backlog

➢ Active, resolved, and inactive alerts

Corepoint Integration Engine provides various views of the high-level connection information including:

➢ A connection chart, with all connection details in a chart format and indications of the connection state by colored icons

➢ A connection grid showing connection states and alerts
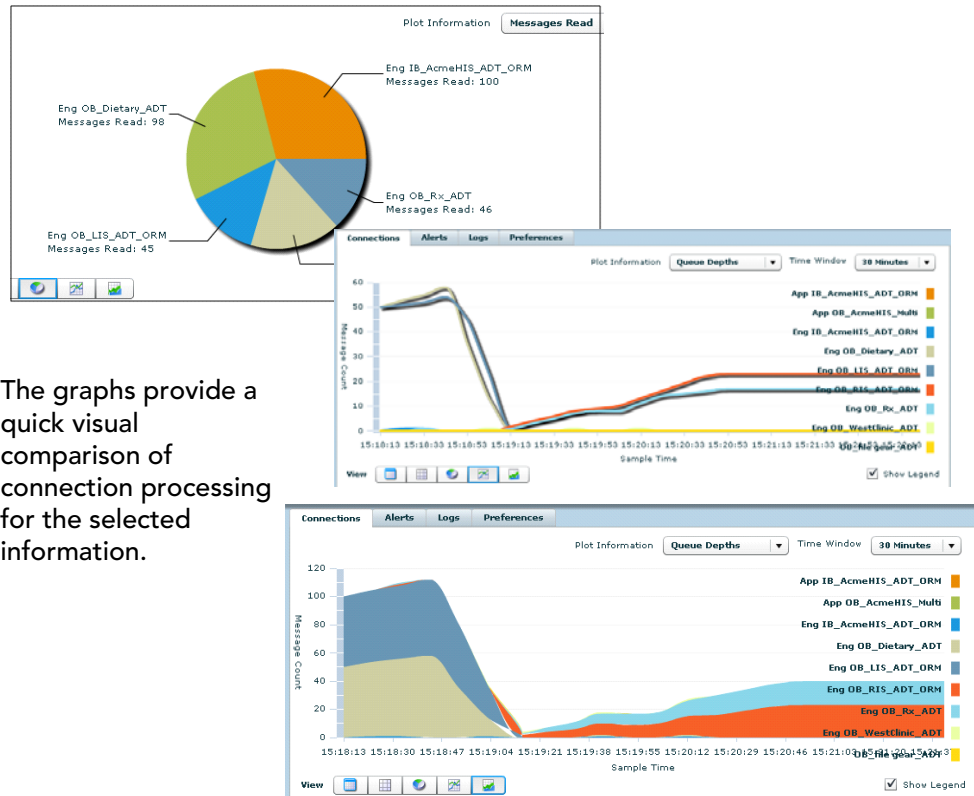
➢ Various graphical formats

Connections	Alerts	Logs	A2	Preferences										

Connection Name (6 of 26)	Queue Depths	Idle Time	Backlog	Delivered Age	Active Alerts	Unresolved Alerts	Errored Msgs	Read Msgs	Written Msgs	Msgs Posted Inbound	Msgs Posted Outbound	Last Enqueue
Eng IB_AcmeHIS_ADT_ORM	0 - 0	5.0 s		0.6 s			5	250	250	250		12/12/2008 15:33:23
Eng OB_Dietary_ADT	0 - 228										190	
Eng OB_LIS_ADT_ORM	0 - 192										160	
Eng OB_RIS_ADT_ORM	0 - 23	30.0 s	10.8 s	0.7 s				117	121		140	
Eng OB_Rx_ADT	0 - 0	17.0 s		0.8 s				115	115		115	
Eng OB_WestClinic_ADT	0 - 0	00:50:21		1.2 s							190	

Above: Connection chart shows details about the connection.

**Right:** Connection grid shows status at a glance.

The graphs provide a quick visual comparison of connection processing for the selected information.

XSLT

XSLT was defined by W3C as a standard method for transforming XML documents. For legacy XSLT maps, Corepoint Integration Engine's XSLT gear provides a solution to perform XML to XML mapping. This XSLT gear provides a set of Xpath expressions that invoke external XSLT maps. These XSLT maps can be defined using a third party graphical mapper such as Altova XMLSpy®. For custom or Version 3 XML documents, use Corepoint Integration Engine's standard XML message mapping functionality.

Non-Standard MLP

Corepoint Integration Engine provides a simple way during connection creation to configure for the use of non-standard characters. Therefore, any character-based wrapping scheme is supported providing maximum flexibility to deal with non-standard MLP implementations.
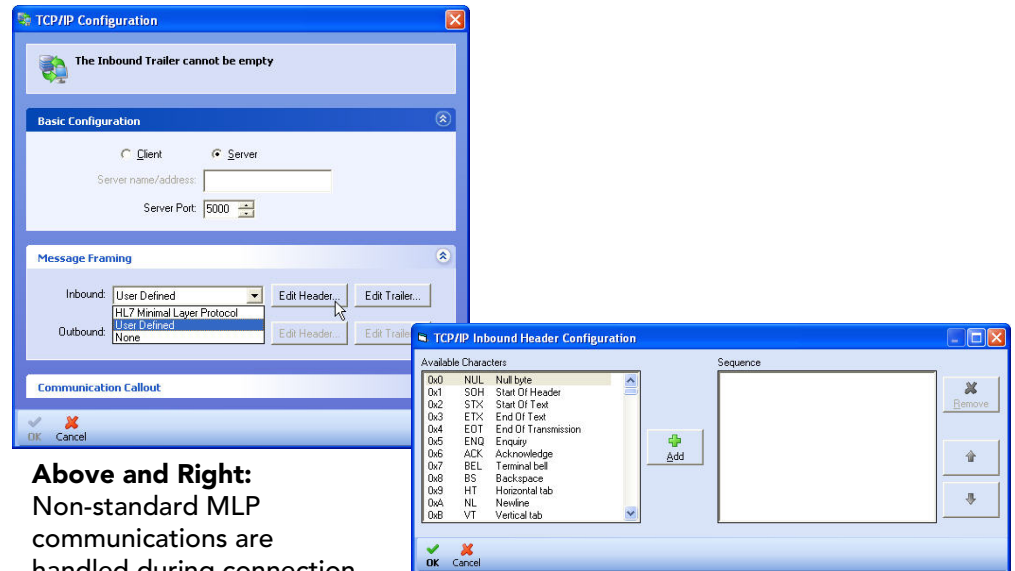
Above and Right:
Non-standard MLP communications are handled during connection creation or editing

ACK Management

Corepoint Integration Engine allows for maximum flexibility in sending and receiving ACK messages through the configuration of the sending and receiving connections.

Right: The sending application can be configured to:

➢ Require an HL7 2.x response

➢ Require an HL7 2.x ACK response

➢ Resend the message if the response does not conform to the required ACK format

➢ Resend the message if it does not receive any acknowledgement after a specified period of time for a specified number of times
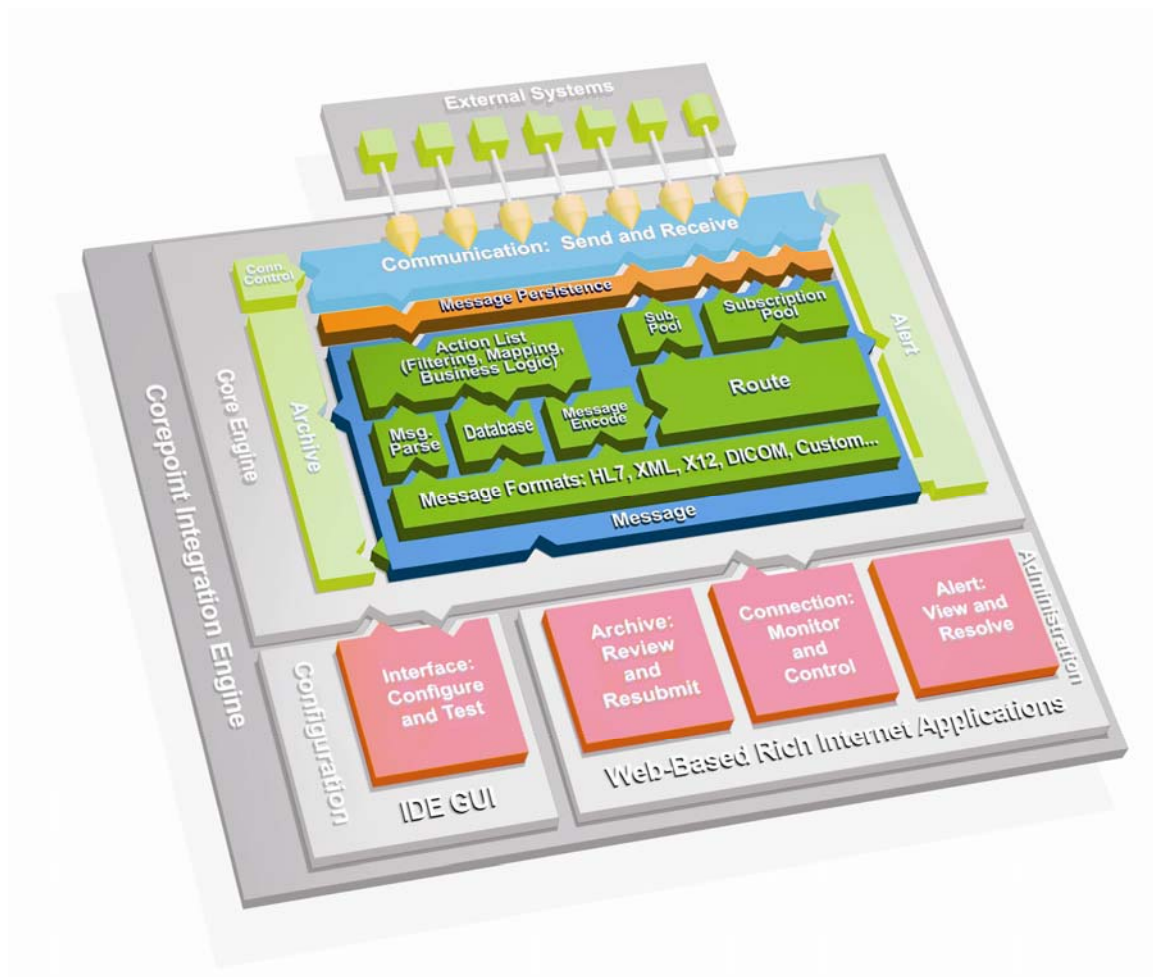
12
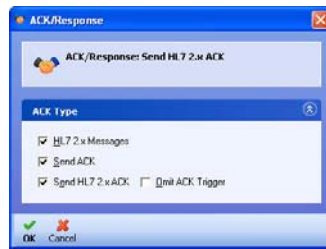
Left: The receiving application can be configured to:

Send ACKs
Send an HL7 ACK
Omit an ACK trigger
Send a static ACK string

Message: Map and Route

Messages are modified and prepared for sending to other applications in Corepoint Integration Engine's message layer.

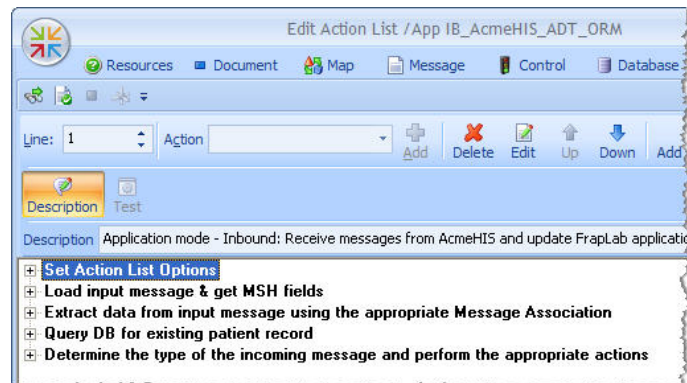Corepoint Integration Engine's message layer includes:

➢ Message Routing, Mapping and Filtering

➢ HL7 Support for version 2.x and 3.0

13

> ➢ HL7-to-XML-to-HL7 Conversion
>
> ➢ Database Query, Read, Write
>
> ➢ Native XML support including importing XSDs
>
> ➢ Support for CCR, HL7 CCD, HL7 CDA, X12, DICOM and ELINCS
>
> ➢ Code set conversion

Message Routing, Mapping and Filtering

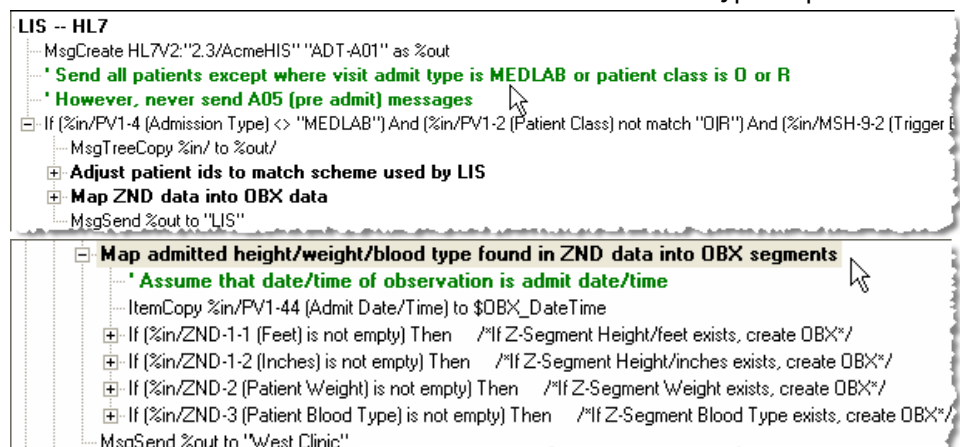Corepoint Integration Engine provides the ability to perform:

> ➢ Routing: Dynamically transform input message to 0-n output messages and then deliver messages to subscribing connections.
>
> ➢ Filtering: Content based message filtering, such as only sending A04 and A08 messages to the LIS and then only sending inpatients plus outpatients with a hospital service of "breast center" to the RIS.
>
> ➢ Mapping: Adjust message structure such as move data from Z segments to the right place, modify data, select correct patient IDs, change coded values, or allow a "strict" HL7 system to take a non-compliant feed.

Left: Corepoint Integration Engine supports top-down thinking. The implementer breaks the action list into logical blocks of actions.

Below: Corepoint Integration Engine filters messages based upon admit type or patient class

Right: Corepoint Integration Engine moves the height, weight, and blood type found in the ZND segment into the OBX segment.

HL7 Support

Corepoint Integration Engine supports all versions of HL7 as evidenced by:

➢ Support for user-defined variations in HL7 messages

➢ Configuration tools to reduce customer site integration

➢ Adherence to standard HL7 file formats - message delimiters in each MSH segment

➢ Handling of non-standard HL7 formats

➢ Inclusion of ASCII or UNICODE character sets

➢ Configurable Z segments and custom messages

➢ Support for 2.X messages, segments, fields, and data types

➢ Support for Version 3 XSDs and XML messages

➢ Parsing repeating fields, repeating segments, groups of segments, groups of groups, etc.

Corepoint Integration Engine can communicate with any HL7-enabled application. The message format differences between "standard HL7" and the way a given vendor implements HL7 are handled effectively in Corepoint Integration Engine. When you exchange messages with a variety of healthcare applications, Corepoint Integration Engine allows you to create and manage the differently defined HL7 messages.
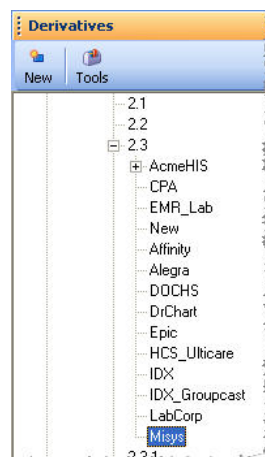
Above: Corepoint Integration Engine stores the vendor or provider unique definitions of the HL7 messages that they use
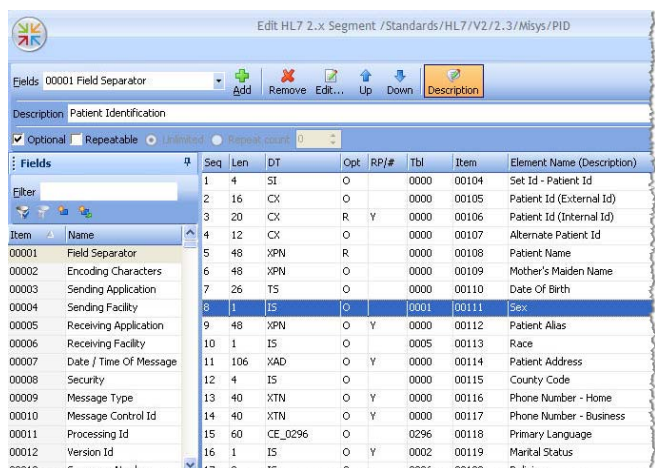
Above: Corepoint Integration Engine's HL7 repository contains all HL7-defined messages, segments, fields and data types. Users quickly leverage these base definitions by creating a modified message where only the changes made to HL7 by a given vendor are entered.

HL7-to-XML-to-HL7 Conversion

Corepoint Integration Engine's HL7-to-XML parsing software converts inbound HL7 messages into XML documents before passing them on to your application. Corepoint Integration Engine also converts XML documents into HL7 messages, allowing you to send HL7 information to your external healthcare providers or internal healthcare applications.

Corepoint Integration Engine:

- ➢ Transforms logically tagged XML documents into fully parsed HL7 messages

- ➢ Creates hierarchical XML documents from received HL7 messages

- ➢ Provides XML schemas for 2.X HL7 versions

XML Support

Corepoint Integration Engine has the ability to import custom XSD files and use the message structure defined in the XSD to parse and encode the messages. Additionally, Corepoint Integration Engine contains all the HL7 Version 3 schemas.
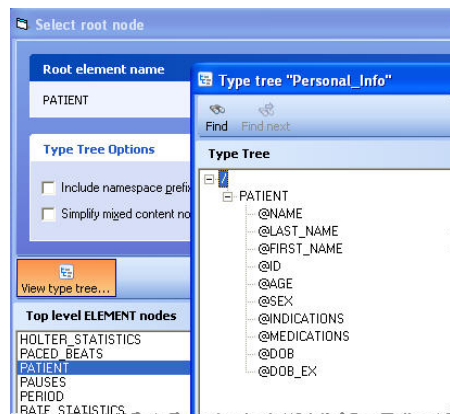

Database Query, Read, Write

Corepoint Integration Engine can read, write, query, insert or delete data in an ODBC database. The database schemas are not "fixed", thus allowing you to use your existing database, or design a new one. Extensive debugging support allows viewing of database updates made while processing a given message.

Database interaction is accomplished through record set interaction and the ability to execute stored procedures.

Focused on reliability, ease of debugging, and field maintenance, the database interactions are logically created and flexible.
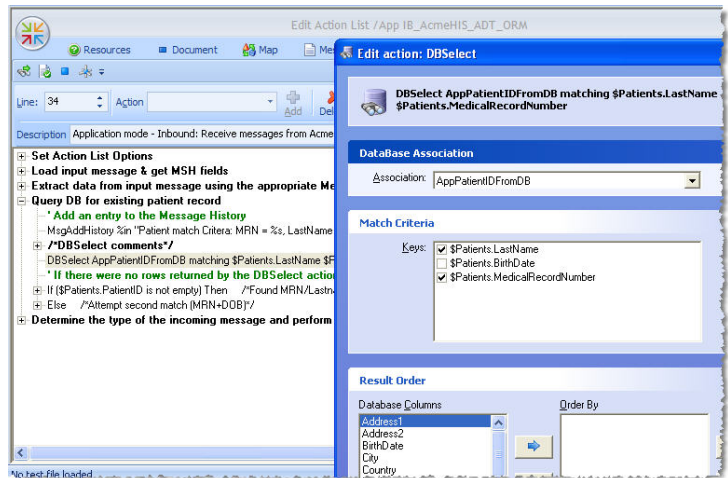
Above: Interaction with database tables and stored procedures is quick and easy, requiring no knowledge of SQL.

Code Set Translation

Corepoint Integration Engine fully supports code set translation which allows the code set of one system to be mapped to the code set of another system using a graphical interface. These correlations can then be used during message mapping to easily convert or look up codes.

Above: Code set correlations allow for mapping of even different types of code
sets – as shown above with a simple code set mapped to a qualified code set.

Alerting
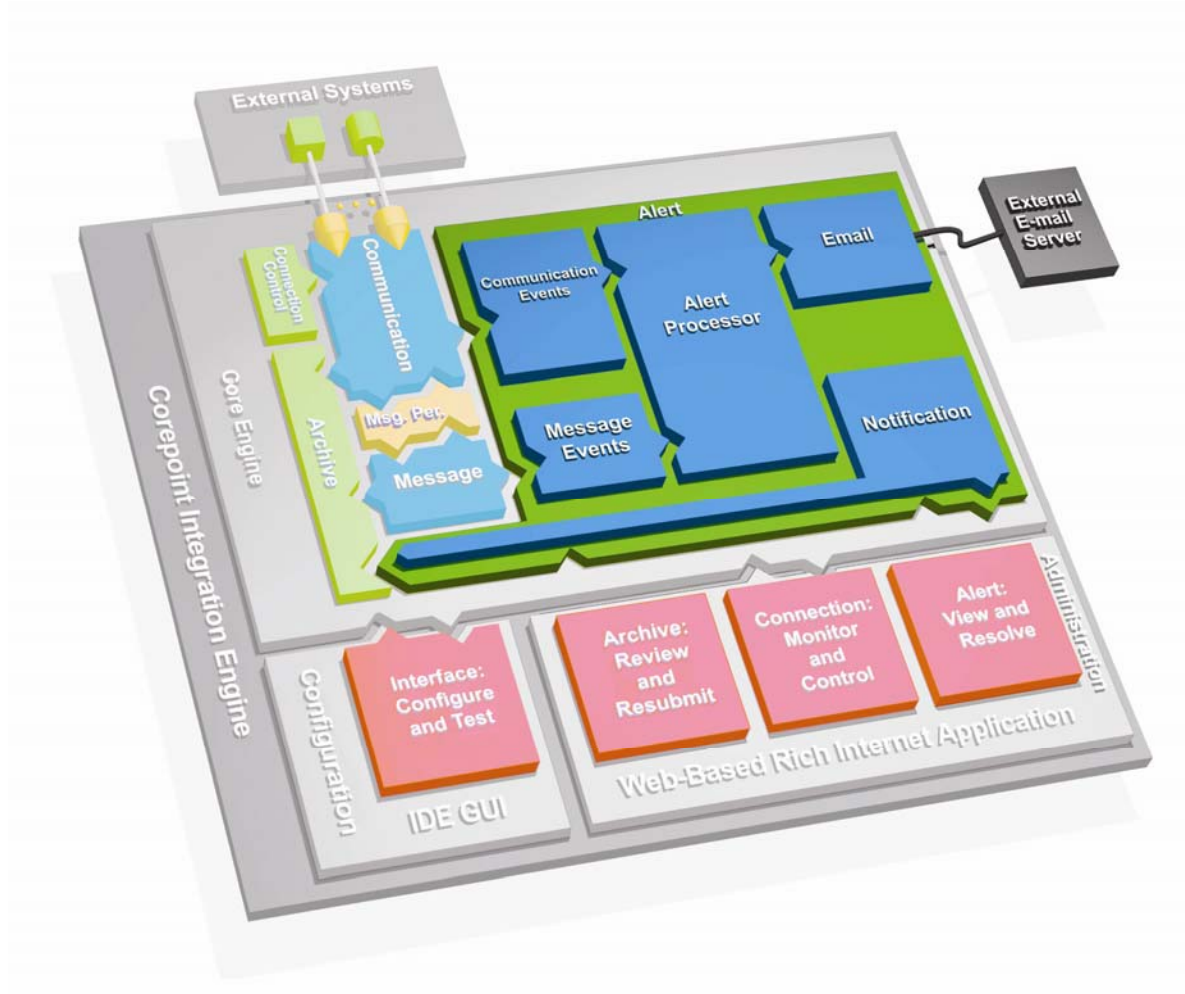
Corepoint Integration Engine's proactive alerting provides immediate notification of any interfacing event that needs attention. This allows staff to quickly respond to the issue without constantly manually monitoring the system. Ultimately, issues are resolved more quickly – often before there is a business or clinical impact.

The alerting functionality in Corepoint Integration Engine includes:

➢ Alert Configuration

➢ Managing Service Levels

➢ Alert Logging

Alert Configuration

Alerts are easily configured allowing complete control over which events will trigger an alert. Configuration can be by connection, by day, and by time. The alert sub-system can proactively monitor for any number of events, where each event may have the following unique attributes:

- Day and time of the event

- Type of event:

  - Message events (Send Fail, Error Message)

  - Connection oriented events (Stopped, Not Connected, Idle, No Response)

  - Queue depth events

- Severity of event required to create an alert

- Escalation of alerts in the case of unresolved issues

- E-mail notification in the case of an alert
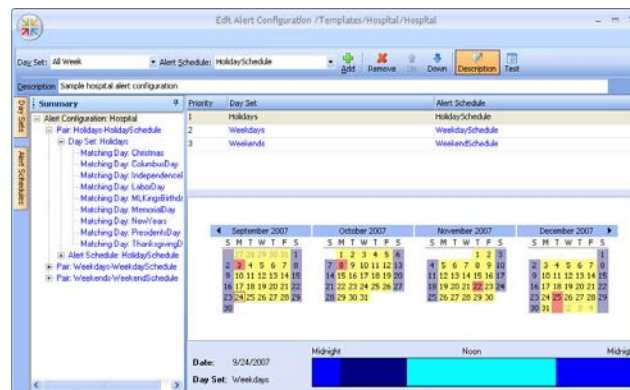
Right: The Hospital Alert Configuration has different alerts for different days as shown on the calendars and different times of a weekday as shown on the time bar.

Managing Service Levels

Alerts are automatically displayed in the secure web-based Corepoint Integration Engine Management Administration application sorted by all alerts, active alerts, or resolved alerts. In addition, the system can be configured to send an e-mail to the appropriate staff when an alert occurs.

When conditions cause an alert to occur, it is displayed under the Active Alerts column on the connection tab of Corepoint Integration Engine Administration, on the Alerts tab, and on the connection grid as a caution symbol. Alerts can be viewed and filtered by state (Active or Unresolved) and by user for whom the alert is targeted (e.g., operator, engine manager, or clinical application team).

Corepoint Integration Engine Administration is also used to record resolution to alerts. The resolution information is recorded in the alert log to be reviewed in the future.
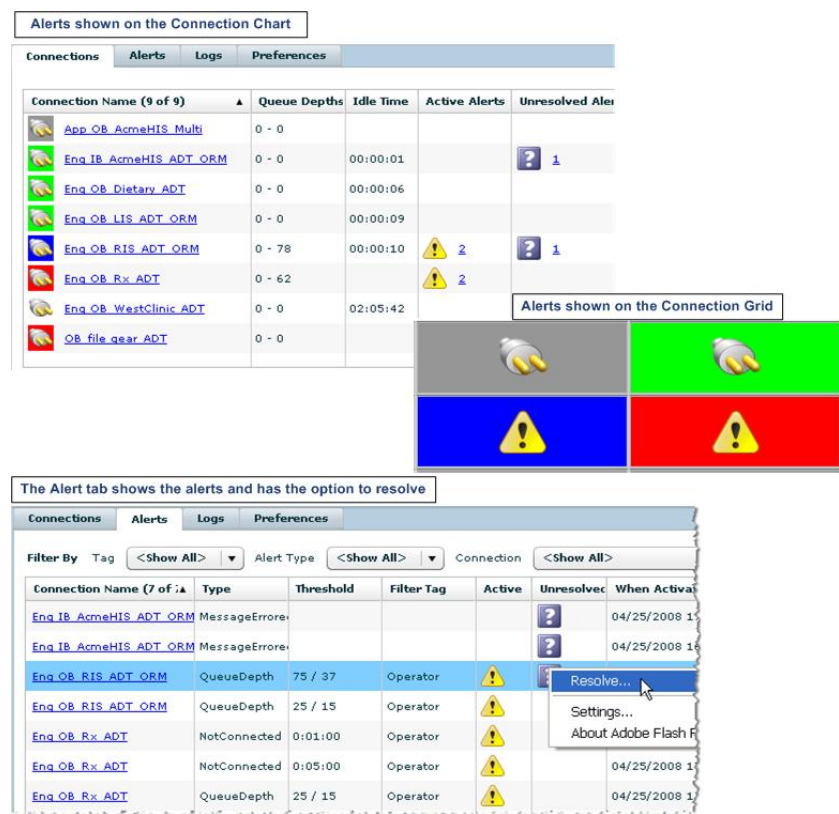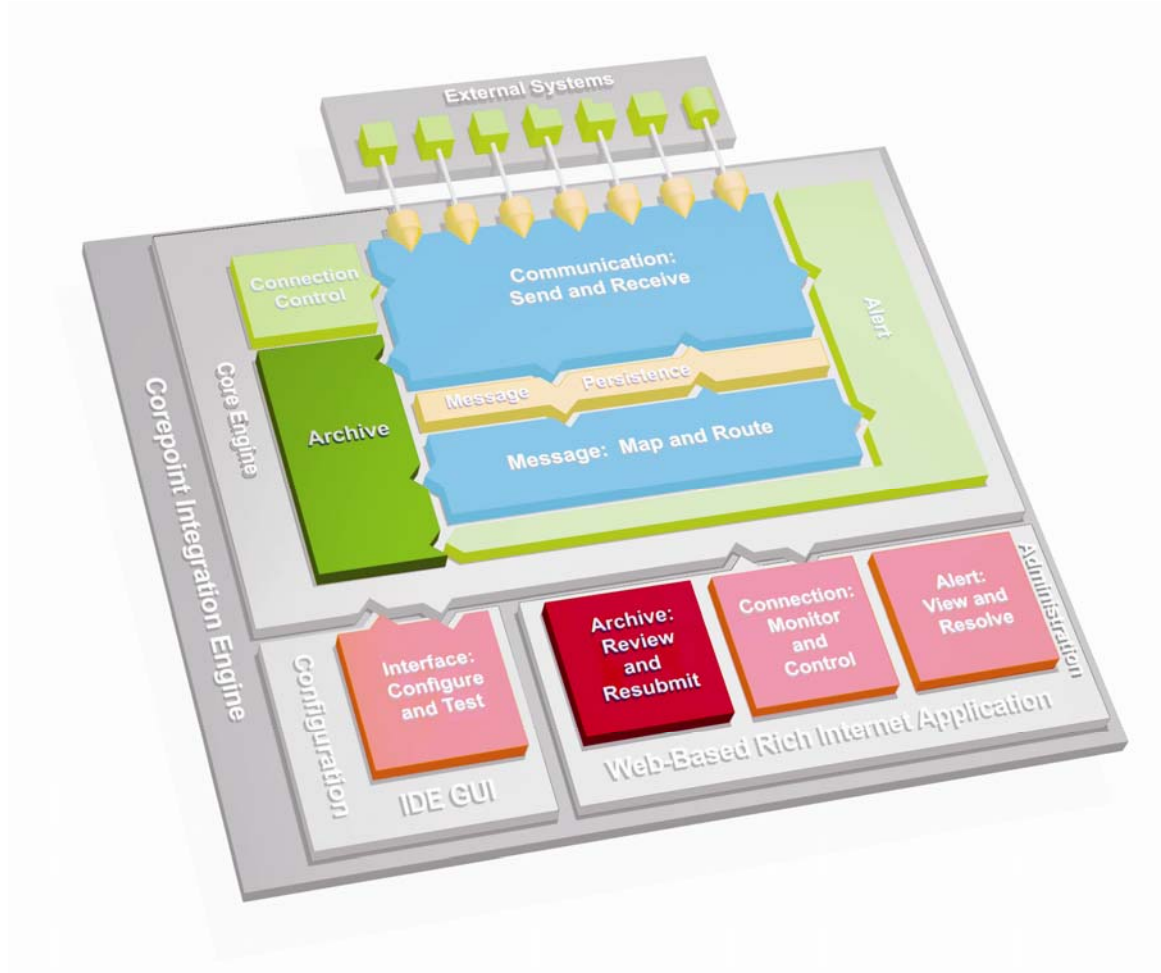

Above: Corepoint Integration Engine Administration shows the alert on the Connection and Alert tabs and the connection grid.

Alert Logging

All alerts are logged in Corepoint Integration Engine providing a history of alerts and resolution taken to resolve the alerts. Corepoint Integration Engine creates a log that contains each alert and resolution for each connection.

Archiving

Corepoint Integration Engine archives every message that flows on each connection. Corepoint Integration Engine's logging feature allows for:

➢ Archiving Logs

➢ Message Resends

➢ Log Maintenance

Archiving Logs

Corepoint Integration Engine logs messages that flow through each connection. The logs are automatically sorted per-connection and per-day for easy review. Within Corepoint Integration Engine Administration the logs can be sorted by date, connection, and log type. Message data, history, and meta data can be viewed for each message. Messages that fail processing are stored in a special file in addition to the connection log file for review, repair, and resubmission.
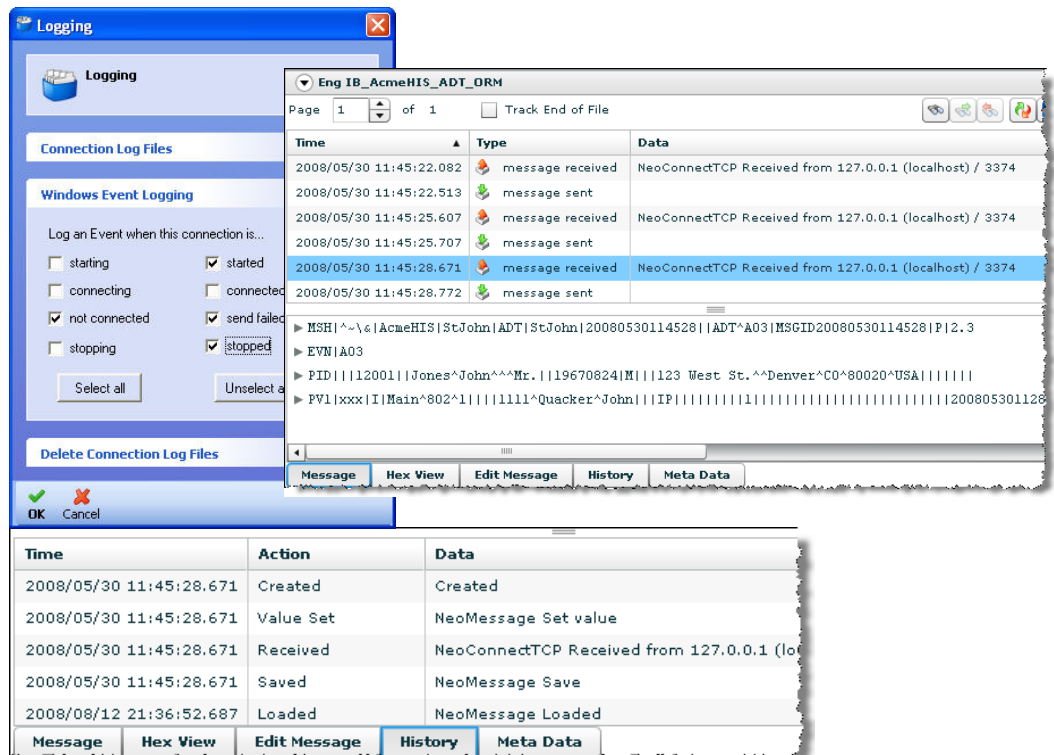
Above: In addition to message logging, Corepoint Integration Engine logs connection state changes per your specification during connection creation which can be viewed on the History tab. This allows you to maintain the desirable amount of history for each connection.

Messaging Trends

Corepoint Integration Engine allows you to view the logged information in a graphical format to see messaging trends for a connection. The graphical format allows you to graphically compare messages received, messages sent, messages delivered, messages errored, queue depths, delivered age, inbound processing time, and outbound wait time for the connection.
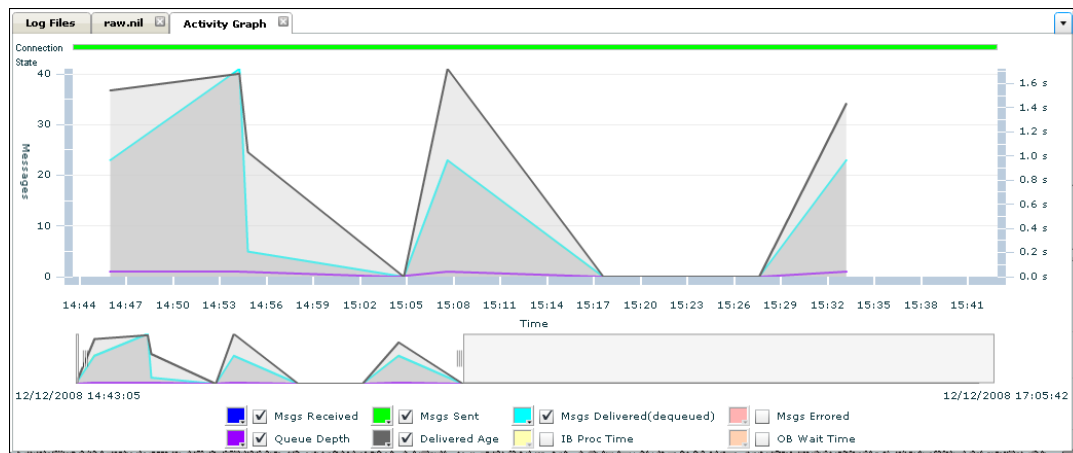
Above: A quick glance at a connection graph reveals that the delivered age of messages spiked three times but the connection quickly caught up each time and the queue depth was relatively low the entire time so this connection is keeping up in spire of message number peaks.

Using Corepoint Integration Engine's logging features, message, error, and alert logs are easily viewed.

Corepoint Integration Engine provides the ability to:

➢ Track a message throughout the system

➢ Know exactly when a message was sent, received and acknowledged, and what information the message contained

➢ Easily troubleshoot communication problems

➢ View message body in text, tree, or hex form

➢ View a graphical representation of data flow for a connection

➢ Edit messages for testing and resubmission purposes

➢ View a date range of logs for message load trending

Message Resend

Corepoint Integration Engine provides the ability to resend messages. The value of this very powerful feature is quickly realized when messages must be reprocessed due to an ancillary system issue or reload**.**

Log Maintenance

Corepoint Integration Engine automatically deletes log files that reach a configured age. Corepoint Integration Engine provides the ability to configure what time the log file maintenance is performed, a different number of purge days for different types of logs, and how verbose the logging information is. Additionally, the number of days logs are kept can be configured separately by connection.

Configuration and Testing

Corepoint Integration Engine aids in the development of quality interfaces by allowing detailed configuration and testing of those interfaces with the following features:

- ➢ Message Format Conformance Checking

- ➢ Configuration and Testing of Business Rule Logic

- ➢ Support for Production and Test Environments
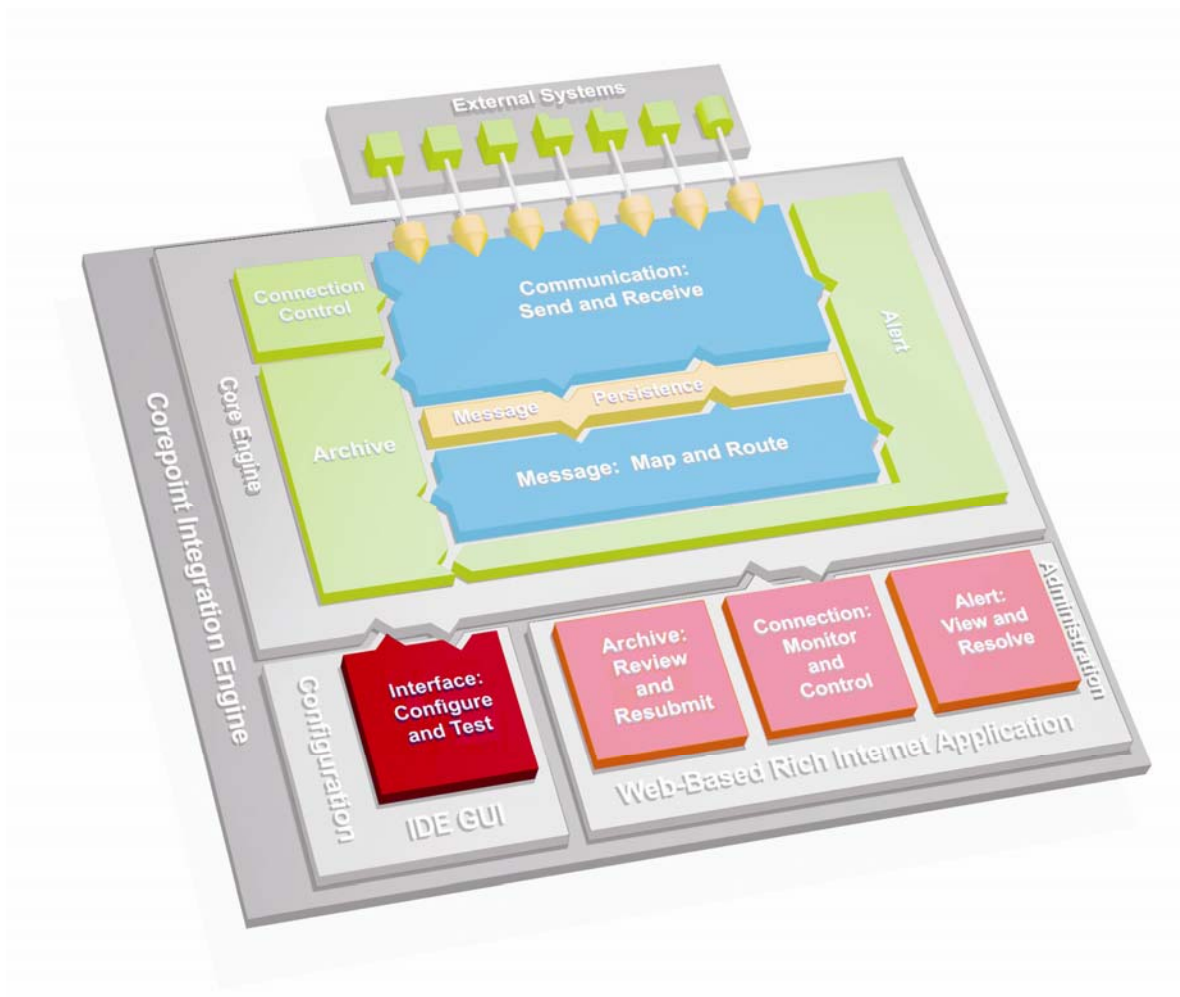
Message Format Conformance Checking

In addition to allowing you to define different message formats for different healthcare partners, Corepoint Integration Engine also serves as a testing tool to check conformance between messages received from an external healthcare partner and the expected message format.
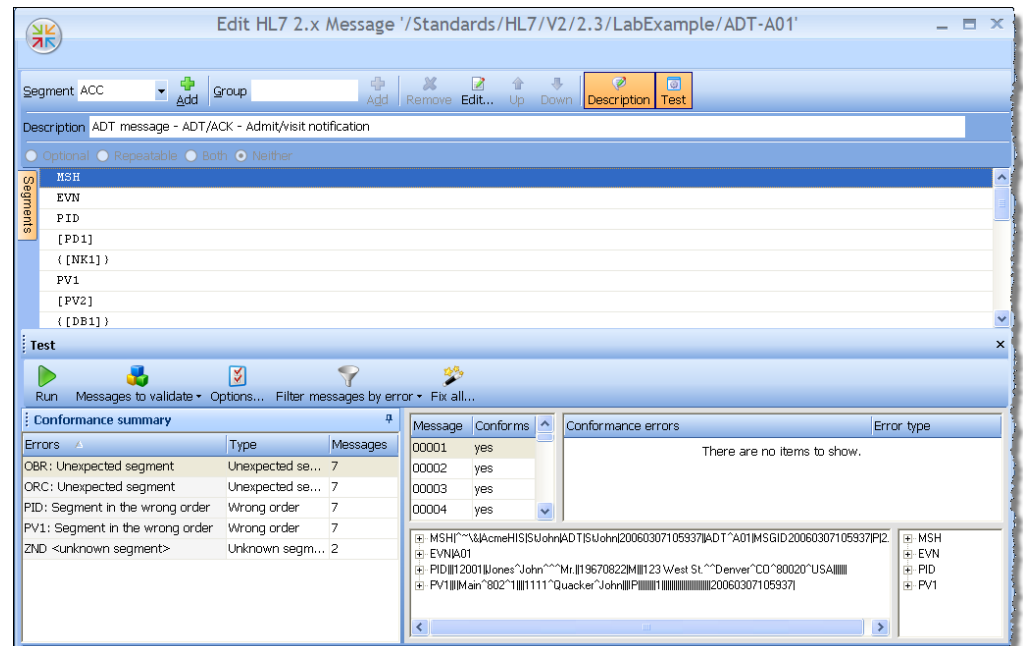

Above: Of the 36 sample messages, six conformed to the "LabExample" message format. The Conformance summary pane details the reasons for nonconformance and how many messages were affected by each issue.

Once the errors in the messages have been identified, Corepoint Integration Engine provides the ability to edit the messages or the expected format and resend to test again.

Configuration and Testing of Business Rule Logic

Corepoint Integration Engine provides the ability to configure business rules to use in the mapping, filtering, and routing of messages without any programming. Additionally it provides a method to instantly test the configured business rule logic with sample messages to confirm that the business logic is correct before putting it into a test or production environment.
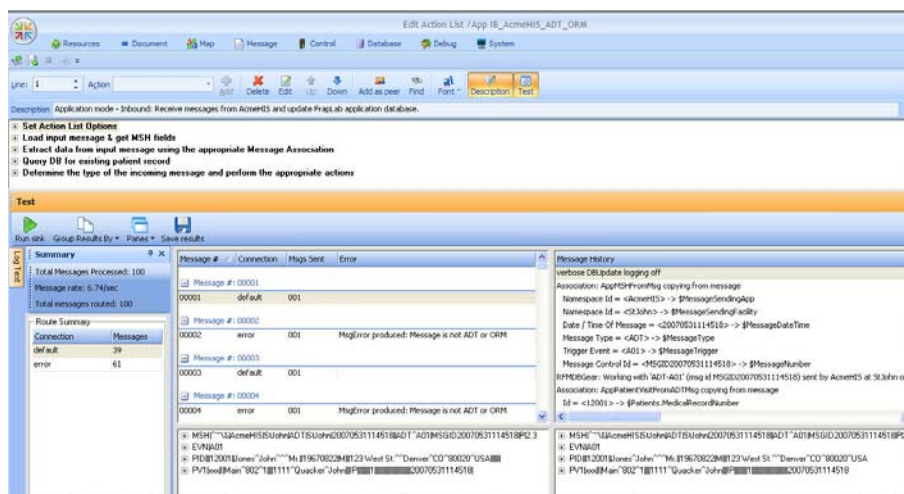
Above: After the test file of sample messages is run through the action list containing the business logic, the Test pane shows the history, original format, and modified format for each message and a summary of all messages, providing confidence in the actions taken by the logic.

Support for Production and Test Environments

In addition to unit testing for message formats and business rule logic, Corepoint Integration Engine provides support for a test environment so the entire system can be tested prior to affecting actual healthcare messages.

Corepoint Integration Engine provides the ability to export all the configuration elements into a single file that can be imported into another system to exactly duplicate the test environment. If there is a database involved in your environment, you can change all the database interactions with only one small modification. These features provide an efficient method of maintaining test and production environments.

Summary

Corepoint Integration Engine can be used to:

➢ Provide a hospital, imaging center, clinic, lab, ASP or other facility a core interface engine

➢ HL7-enable a commercially or internally-developed clinical application

In both scenarios, Corepoint Integration Engine provides a powerful tool to manage all communications with virtually any protocol while supporting unrestricted data flow. In support of that communication, Corepoint Integration Engine provides robust mapping and routing functionality that allow for modification and preparation of messages to be sent to other applications based upon message content. During processing, Corepoint Integration Engine archives all the message activity for easy retrieval and recovery and constantly monitors for any conditions that might affect message delivery. All the powerful functionality of Corepoint Integration Engine is configurable with easy-to-use GUI application that provides for uni t testing of each part of the interface.

About Corepoint Health

Corepoint Health solutions deliver interoperability for healthcare organizations and simplify the complexities of healthcare data through practical software applications, consulting and training. Our innovative and proven software solutions leverage clinical data flow efficiently for a diverse group of healthcare entities including hospitals, imaging centers, laboratories, clinics and healthcare vendors. This next generation approach to healthcare data and streamlined workflow is where Corepoint Health specializes in helping customers discover the power of integration.
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