



SolovatsSoft HL7 experience and projects

▶ What is HL7?

Health Level Seven is one of several [American National Standards Institute](#) (ANSI) - accredited Standards Developing Organizations (SDOs) operating in the healthcare arena. Most SDOs produce standards (sometimes called specifications or protocols) for a particular healthcare domain such as pharmacy, medical devices, imaging or insurance (claims processing) transactions. Health Level Seven's domain is clinical and administrative data.

▶ HL7's Vision

To create the best and most widely used standards in healthcare.

▶ SolovatsSoft healthcare connectivity abilities and experience Overview

SolovatsSoft developed healthcare and technology domain expertise helps organizations in the current competitive world to achieve their goals on time and within budget.

If your IT department is performing a migration of the legacy system to a real-time electronic health record system, how do you proceed? In developing your new system according to **HIPAA requirements**, do you know the way to find competitive solution in your approach to patient rights? If your IT department is automating the claims processing operations, what would be the best optimized solution in terms of cost-control as well as the efficiency benefits?

Read more to know how **SolovatsSoft** with its centers of excellence for data warehousing as well as for the **Health Insurance Portability and Accountability Act** (HIPAA) built this innovative solution, reduced project cycle time and helped our client achieve faster time to market.

This document contains an overview of our healthcare integration and connectivity experience with related projects. **SolovatsSoft** has an extensive experience in **healthcare connectivity** and specifically in **HL7**.

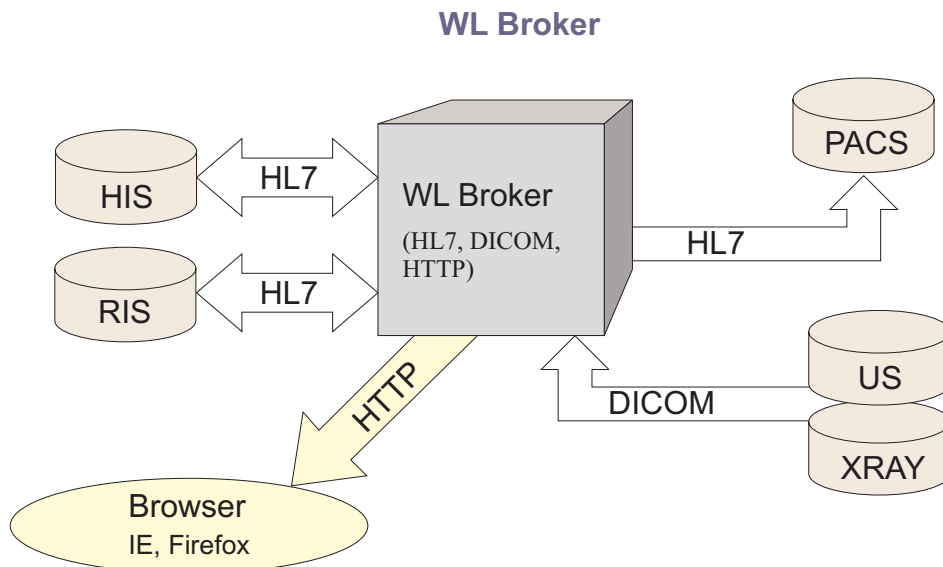
Summary of SolovatsSoft HL7 and connectivity experience

- ✓ Developed **WL Broker**. Specialized interface engine that translates information between various flavors of HL7 and between **HL7** and **DICOM** and handles communications between multiple medical systems to accomplish complete **radiology workflow**
- ✓ Developed an **incoming and outgoing HL7 interfaces** for number of systems we implemented for our customers
- ✓ Built set of **IHE integration tools** and participated in IHE on behalf of one of our customers
- ✓ Prior to joining us, Eugene Shifrin, head of our medical software development department, has built and managed interfacing department of world's leading cardiac software vendor.

SolovatsSoft expertise goes beyond standard connectivity, we also can interconnect various connectable systems using any pre-defined (and sometimes undefined) protocols.

For example WL Broker in addition to HL7 also supports various ASCII protocols and provides ability to map from various other file formats without changing the code.

In addition to HL7 and connectivity, we have experience with development of mission critical cardio-monitoring systems (**FDA class II devices**, **CE directive** for medical devices), **PACS** (including Web PACS) and other significant healthcare systems.



Customer: PACS Vendor

WL Broker is specialized healthcare interface engine that allows to implementation of complete and ideal radiology department workflow.

WL Broker serves as a hub that interconnects all participants of radiology care delivery including:

- ◆ **HIS** – hospital information system
- ◆ **RIS** – radiology information system or other order management system
- ◆ **PACS** – imaging system in radiology department
- ◆ Various imaging modalities including **X-Ray, ultrasound, CT, MRI** and **nuclear medicine**.

WL Broker is equipped with extensive set of tools that allows complex mapping of various formats of the messages from various systems and complex custom data and dictionary transformation.

WL Broker supports all HL7 features and additional tools to accommodate various deviations from HL7 standard.

Tools and Technologies:

- ◆ Visual Studio 2005
- ◆ C# and .NET Framework 2.0
- ◆ MS SQL Server database 2000 and 2005
- ◆ DCMKT DICOM toolkit
- ◆ ASP .NET for user interface
- ◆ DTS (Microsoft data transformation services) for import of hospital dictionaries
- ◆ Nullsoft Install Studio for installations.

Key Success Factor:

Because of our extensive expertise in all aspects of healthcare connectivity and interfacing, complete product and set of support tools was developed and tested in less then 4 month timeframe because complete requirements for the project were provided and analyzed prior to starting the development process.

EMS HL7 interfaces



As a result of this project multimodality system of the customer has enhanced its support for ECG modality.

Now it includes support for ECG review and analysis, conversion from legacy formats and smart workflow support suitable for huge hospitals.

EMS is complex patient signal review and workflow management system that was developed in our medical software development center.

It **accepts patient signals** from a lot of various systems in the hospital and allows physicians to review it in less then 5 seconds per patient.

Central role of EMS in complex workflow requires it to **accept incoming HL7** and proprietary messages from other signal management systems and to be able to **generate HL7 events** that reports acquisition of study and final diagnosis. The system also **exports HL7 messages** that refers to PDF documents and allows HIS to import PDF reports into patient file of physician portals.

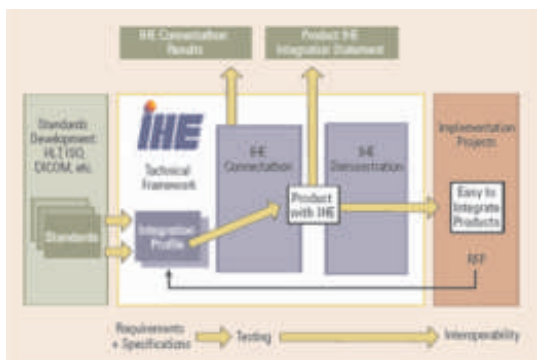
This project started as mid-size project and was intended to give temporary solution to local need. However because of big success of its development, the product is launched to general market as best of the breed ECG management technology is available today.

The system was developed using **C# .NET, MSSQL and VC++, XSLT transformations and Component One PDF library.**

The project included development of the components required to support review, measurements and diagnosis on one hand and smooth user-centered workflow on other hand. Then developed components were integrated with big and complex product line with only minimal interference with customer development process.

We defined, developed and tested all necessary functionality. We also handled the most challenging task - integration of the product into existing product line.

IHE integration



During the course of work for the world's leading cardiac vendor, our teams participated in the **IHE integration framework.**

We added support of necessary IHE scenarios to the existing products such as **ECG management system, cardio-monitoring system and image management system.**

IHE is an initiative by to improve the way computer systems in healthcare share information. IHE promotes the coordinates use of established standards such as **DICOM** and **HL7** to address specific clinical need in support of optimal patient care. Systems developed in accordance with IHE communicate with one another better, are easier to implement, and enable care providers to use information more effectively.

Building complete connectivity department

Before joining **SolovatSoft**, Eugene was heading a connectivity department of the world's leading cardiology product line.

This position included establishing and managing connectivity department (turned to be Project Department), which provided whole range of connectivity and integration services to the customers of Symphony product line (cardiac department information system).

Connectivity department developed infrastructure for building cardiac department workflow and integrating with other relevant systems, which included **HIS, CIS, hemodynamic and electrophysiology, order management, scheduling, billing, inventory management, ACC, STS** and other clinical registries.

Cardiac department was also completely responsible for implementation of all interfaces in Europe and US.

Links were established using **HL7, DICOM, MML** (Japan) standards and proprietary interfaces.

Tools and Technologies:

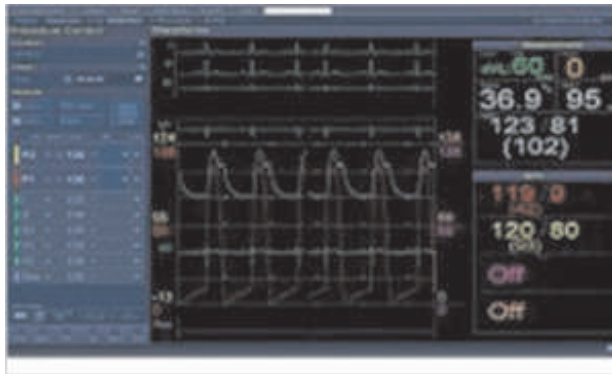
- ◆ VC++/DCOM
- ◆ .NET Framework 2.0/VSS
- ◆ MS SQL Server
- ◆ DTS
- ◆ ADO, ADO.NET
- ◆ BizTalk, XML database tools.

Eugene was also responsible for product definitions, per-customer project management, on-site implementation and customization, RFP/RFI preparations, sales training and marketing materials preparation, customer collaboration, support, software demonstrations, internal development process integration and coordination with respective system vendors.

Approximately 50% of this time Eugene spent at major US hospitals and another half of the time managing the team and coordination of product delivery to the customers. During those three years connectivity team turned “island” non-customizable system into the product with connectivity and workflow design as its primary competitive advantage.

Eugene's major achievement was establishment of project department in 100% product-oriented company and development of adequate development, deployment and maintenance processes for project team.

CardioWiz – Complex Cardio-Monitoring System



*During recent 2 years **CardioWiz** product line was enriched by 2 additional products for acute workflow and acute monitoring.*

We operate development and maintenance team that product is the best system in the market..

Customer: major Cardiac Imaging and Database vendor

The system provides **patient monitoring, heart assessment and information management for cardiac procedures**. This is mission-critical FDA class II system with real-time components.

Our company initiated, defined, designed and develops high-end cardio-monitoring system which is integrated into customer's cardiac department management product line.

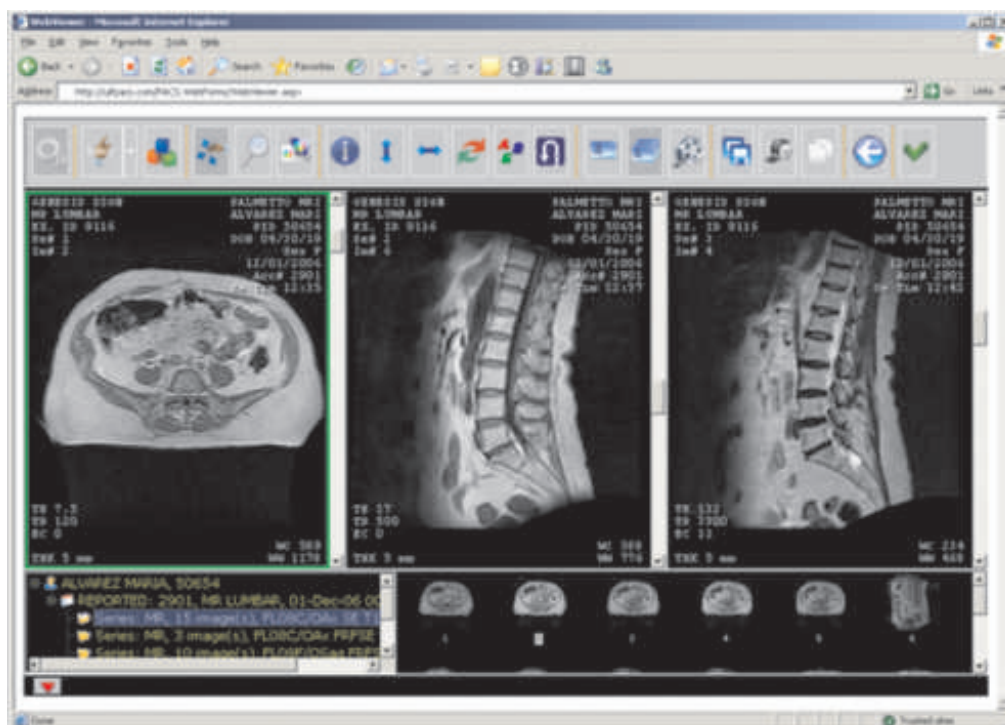
The product received FDA and CE clearance and now has huge amount of installations and is the star of product line of leading cardiac software vendors.

It is developed with **C# and Visual C++** by using **MS SQL and MSDE database, OEM hardware components, custom and Infragistics user interface libraries**. Custom protocol over TCP/IP and custom reliability and recovery mechanisms were developed.

The work was performed according to ISO standards in FDA and CE regulated environment.

DICOM and HL7 support is also provided.

Web/Desktop Viewer for PACS systems



Customer: PACS Vendor

WebPACS Viewer is a complete solution that allows organizing all process of preparing, validation and reviewing exams from different types of modalities. It also has built in workflow enhancement system that allows significantly decrease costs of reviewing in radiology.

System can work either as a desktop application (smart client) or can be directly launched from PACS provider web site. In both cases user gets undisputable usability.

Even web version has very rich user interface.

Both versions are completely web-aware and are able to work with remote data storage, showing several know-how industry features to ensure best value for the money for end-user.

Application was built as **3-tier system** using **.NET Framework, C#, Jscript, MSSQL Server database** and **ASP.NET** as a base platform for deploying web-based client.

Clinical and Statistical Reports



During this project we have designed and developed a number of clinical and statistical reporting applications for major clinical database vendor in cardiology area.

As always, those reports were plugged into large existing product line of the customer.

HTML reports are generated “on the flight” as soon as user populates information in the fields.

C# .NET, MSSQL Server database and **XML Enterprise Studio** (XSLT transformation) and new **MSSQL Reporting services** were the right tools for that project's implementation.

PDA Demonstration Applications



During this project we developed PDA versions of few of client's applications purposely to demonstrate PDA capabilities during the important trade show.

Those demo applications were developed using **C# .NET, Microsoft PocketPC SDK** and **Windows services**.

PDAMon client



During this project we have prototyped viability of implementing patient monitoring client for Windows Mobile PDA.

We used **C# .NET for mobile**, **TCP communications** and **SQL Server database** for information storage.

Healthcare e-Booking system design



Customer: Medisol Software Corp, Canada. Healthcare Booking System Vendor

Medisol is Toronto based startup company that develops **Medisol e-Booking System**.

Medisol e-Booking System is a Web-based software system, which will implement the process of the medical appointments online booking and automate the digital documents workflow across the various layers of the healthcare system.

Medisol utilized we integration specialists experience to come up with HL7-based architecture for integration of the e-booking system with various Hospital Information Systems as well as our GUI designers to produce the product prototype interface design.

Technologies: J2EE, Ajax, MySQL/Oracle.

DHR – Diabetes Personal Health Record for diabetic patients



Customer: Undisclosed Diabetes Information Provider, US

DHR is the only **Personal Health Record Service (PHR)** specialized for patient with chronic diabetes disease. It is by now the only truly specialized PHR in the market.

We handles entire R&D of this full fledged, smart client-based PHR service, from development of specifications and business model to content to software and visual design to implementation and testing.

DHR is fully functional PHR (because diabetes opens the door for almost every other disease) implemented with **.NET Framework** and **SmartClient 2.0 technology** and **MS SQL Server database**. It allows combination of best of both worlds: usable and beautiful GUI of desktop, launching application by URL and secured storage over the web of internet service.

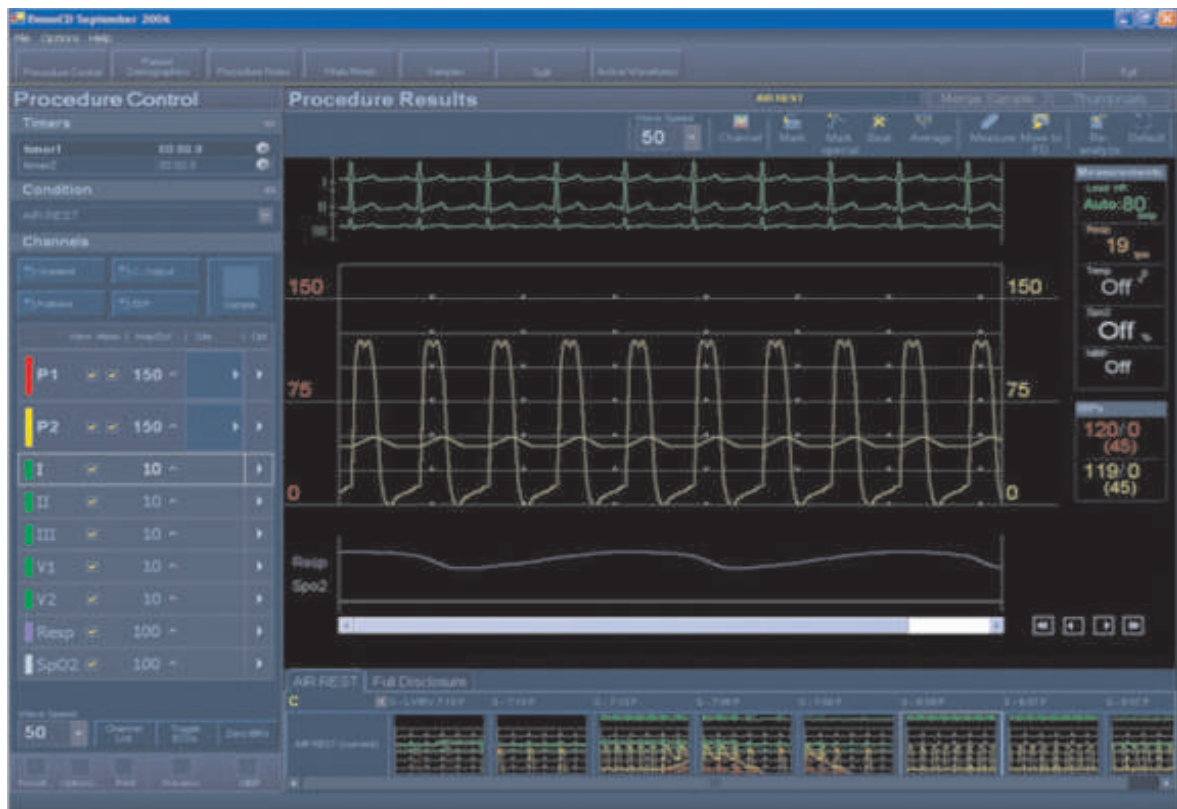
This service is although wrapped by many important community features embedded directly into SmartClient GUI. Currently we are approaching end of prototype phase of the project and estimating main development phase.

► Addendum

This chapter consists of screenshot of some of application, developed by us.

Please keep in mind that most of our clients do not want to populate that their products were developed out-of-house thus we can not populate either true product names or real market place of these products. But we could supply references from our customers upon your request.

Cardio-monitoring measure and analysis system



- ✓ Best system in the world in its segment
- ✓ Good device, good software, good network
- ✓ FDA less then 2 years from the beginning of the work

Electrocardiography management system



- ✓ Complete review and clinical capability
- ✓ Workflow: optimized for every role
- ✓ Optimized for 1+ million procedures
- ✓ Web Services based client server system
- ✓ FDA less then 2 years from the beginning of the work

Messaging engine

The screenshot displays a messaging engine interface. At the top, there are filter conditions for date, event type, message type, and recipient. Below this is a table of events with columns for Event Action, Queue Date, Recipient, Priority, Rate, Status, Delivery Time, Status Info, and Rule Name. The table shows several events, including 'CIS Procedure Finished', 'Email', and 'File', with their respective dates and statuses. Below the table is an 'Event Tracking Details' section with a 'Log' table showing the sequence of events from receipt to successful delivery.

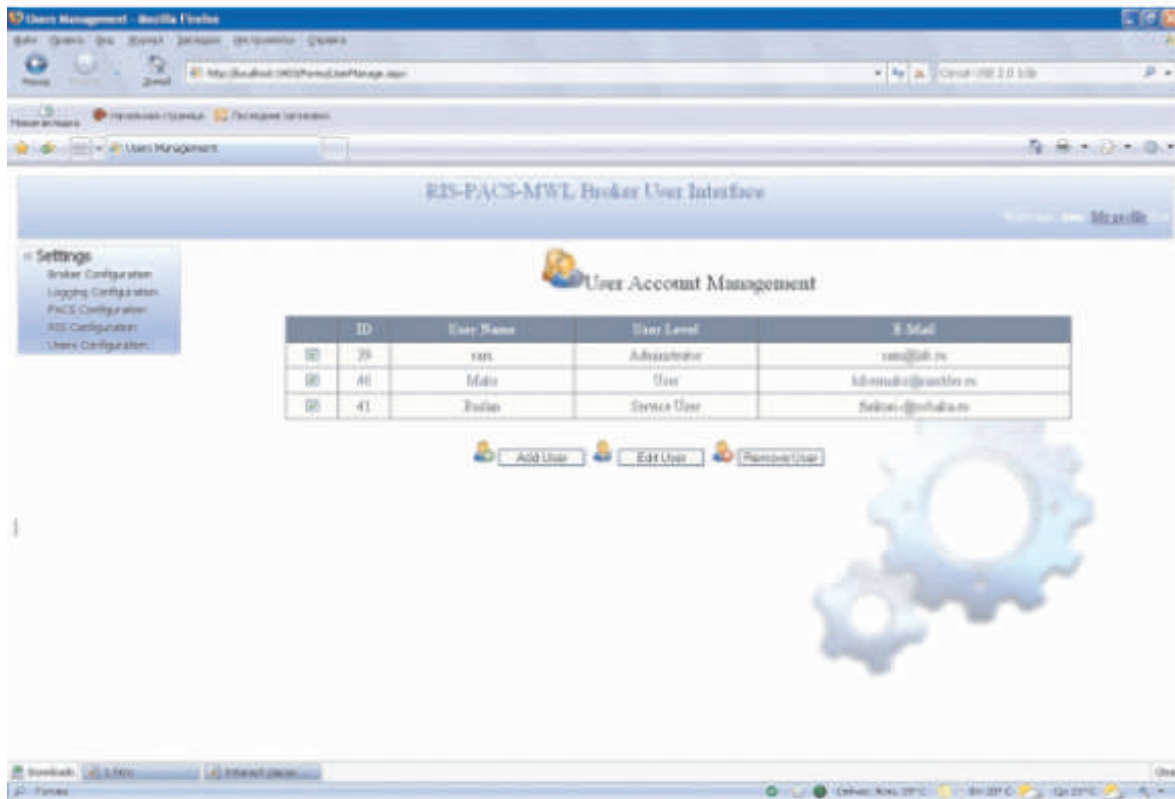
| Event Action | Queue Date | Recip... | Pri... | Rate... | Status | Delivery Time | Status Info | Rule Name |
|------------------------|---------------------|----------|--------|---------|-----------|---------------------|-----------------------------------------|-----------|
| CIS Procedure Finished | 5/2/2007 6:13:29 PM | 123 | 182 | HARRIS | Success | 5/2/2007 6:13:45 PM | 2 messages queued, 0 errors, 0 warnings | New Rule |
| Email | 5/2/2007 6:13:45 PM | both... | 182 | HARRIS | Delivered | 5/2/2007 6:13:50 PM | Email was sent | New Rule |
| File | 5/2/2007 6:13:45 PM | 123 | 182 | HARRIS | Delivered | 5/2/2007 6:13:49 PM | Document was delivered successfully | New Rule |
| ECG Imported | 5/2/2007 6:13:36 PM | n/a | n/a | n/a | Success | 5/2/2007 6:13:45 PM | 0 messages queued, 0 errors, 0 warnings | |
| ECG Imported | 5/2/2007 6:13:40 PM | n/a | n/a | n/a | Success | 5/2/2007 6:13:45 PM | 0 messages queued, 0 errors, 0 warnings | |
| ECG Imported | 5/2/2007 6:13:38 PM | n/a | n/a | n/a | Success | 5/2/2007 6:13:45 PM | 0 messages queued, 0 errors, 0 warnings | |
| CIS Procedure Finished | 5/1/2007 6:37:56 PM | 123 | 182 | RICH... | Success | 5/1/2007 6:37:01 PM | 2 messages queued, 0 errors, 0 warnings | New Rule |
| Email | 5/1/2007 6:37:01 PM | both... | 182 | RICH... | Delivered | 5/1/2007 6:37:06 PM | Email was sent | New Rule |
| File | 5/1/2007 6:37:01 PM | 123 | 182 | RICH... | Delivered | 5/1/2007 6:37:06 PM | Document was delivered successfully | New Rule |

| Type | Date | Message |
|------|---------------------|------------------------------------------------------------------------|
| Info | 5/1/2007 6:36:56 PM | Event with Code 'CISPROC_FINISH_HANDLER' has been received from 'SADP' |
| Info | 5/1/2007 6:36:56 PM | Event has been queued |
| Info | 5/1/2007 6:36:59 PM | Event was picked up for delivery. Attempt 1 of 3 |
| Info | 5/1/2007 6:37:01 PM | Event dispatching succeeded |
| Info | 5/1/2007 6:37:06 PM | Event was delivered successfully |

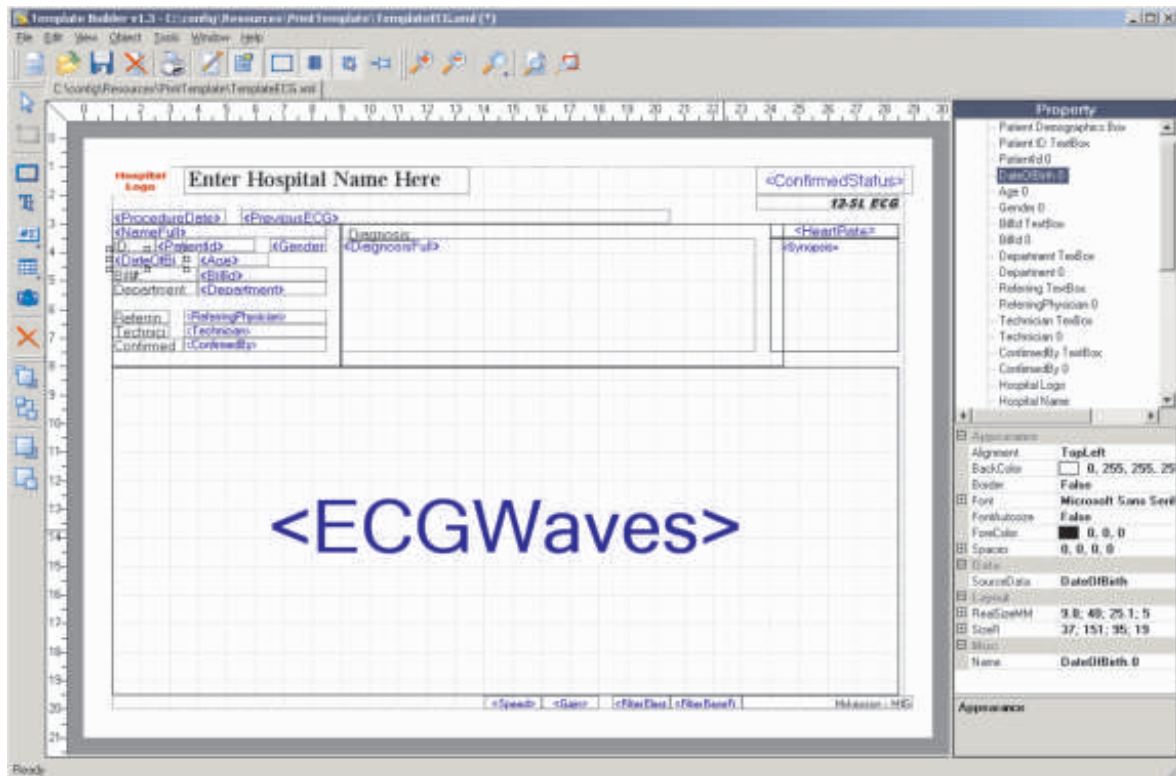
Diabetes PHR

The screenshot shows a Diabetes PHR interface. At the top, there are navigation icons for Save, Sign out, Home, Back, Forward, Report, Export, Sync with mobile device, Cut, Copy, Paste, Undo, Redo, Help, Online help, and Log out. Below this is a 'Views' sidebar with categories like PHR, Basic information, Personal information, Birth information, Emergency contacts, Insurance, Family members, Interactions, Communications, Visits, Health information, Conditions, Medications, Immunizations, Providers, and Professional. The main content area displays a form for 'Personal Information' with fields for Name, Prefix, First Name, Second Name, Last Name, Suffix, and SSN. Below this is a 'Basic Information' section with fields for Gender, Blood Type, Marital Status, Religion, Hair Color, Eye Color, Ethnicity, and Language. A 'News' sidebar on the right contains several articles related to heart health and diabetes.

MWL Broker



Report generator



* SolovtSoft can provide references for the above described projects