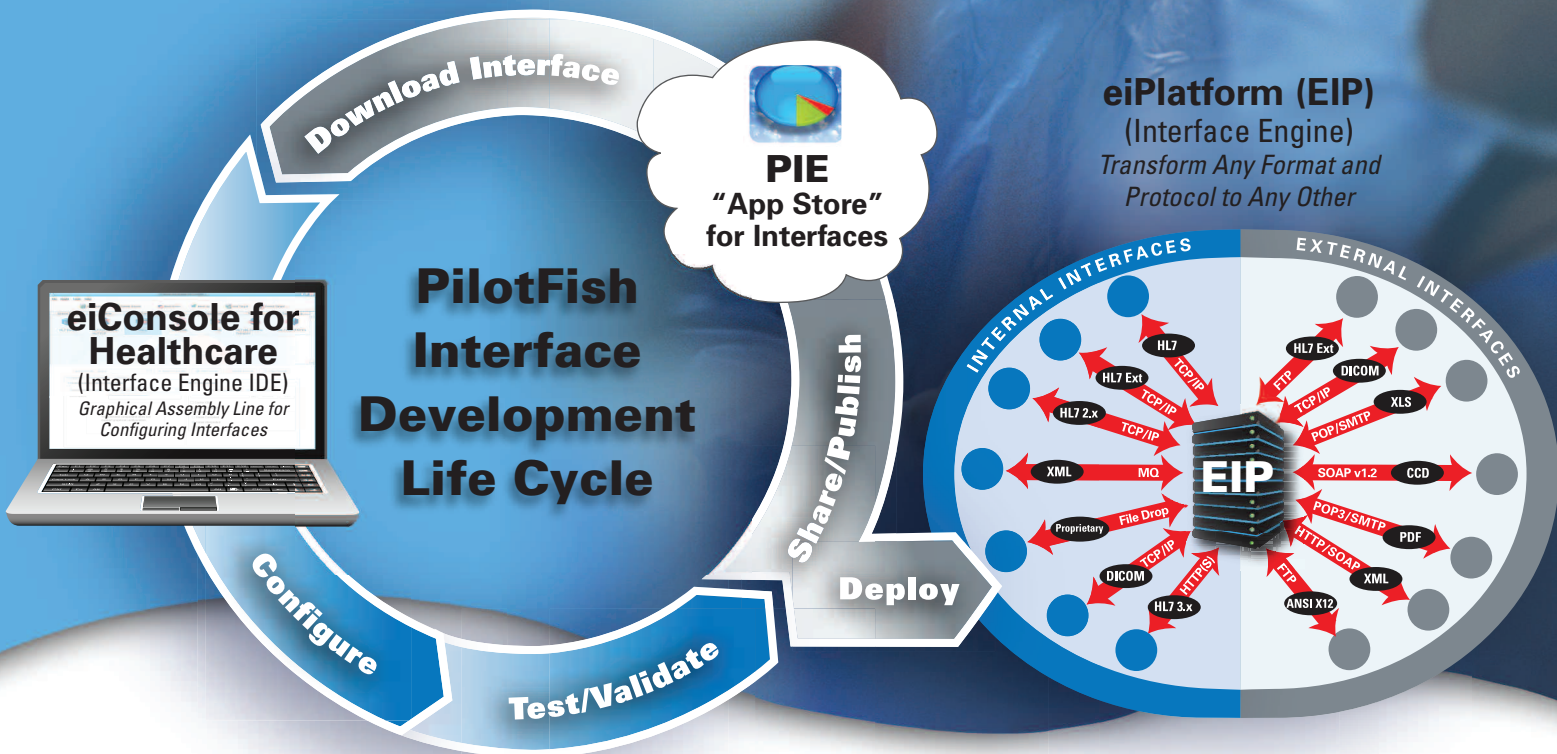
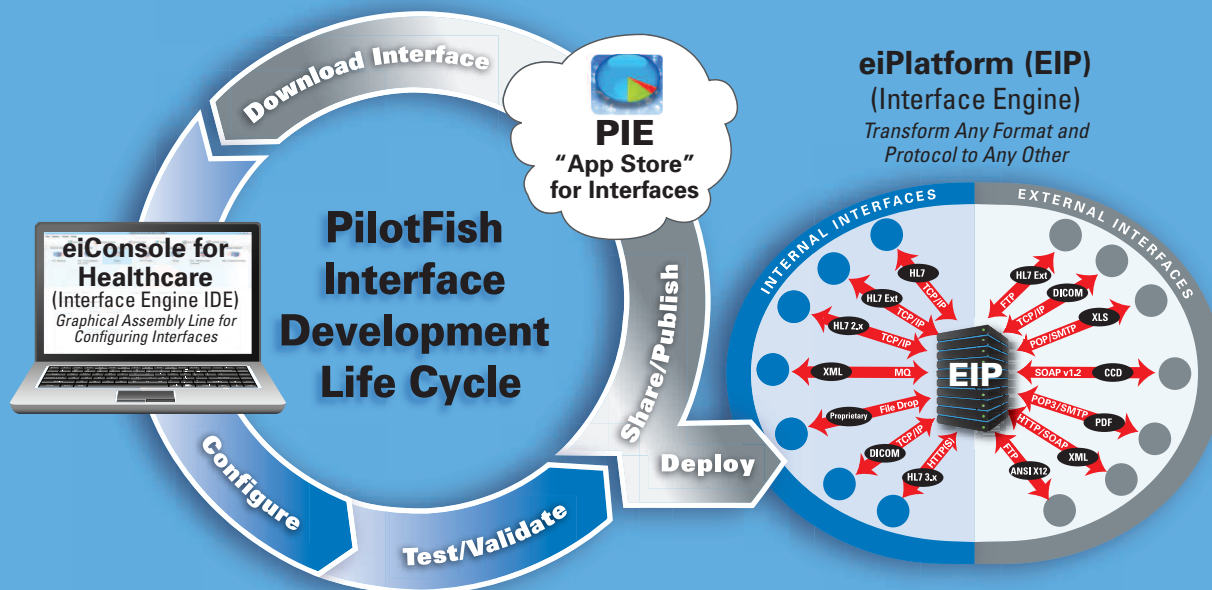


Healthcare Interoperability Solved

Middleware & Cloud Solutions That Enable Interfacing Anything-to-Anything





Healthcare Interoperability Solved

*The PilotFish Interface Development Life Cycle –
The End-to-End Solution for Integrating All Entities in the Healthcare Ecosystem*

The PilotFish Interface Exchange (PIE)

The “App Store” with a Growing Library of eiConsole Interfaces, Interface Templates and Components that Facilitate Rapid Integration

If you’re an end user, configuring an interface with the eiConsole for Healthcare may begin with a download from the PilotFish Interface Exchange (PIE). There you’ll find a free library of Healthcare Interoperability templates based on healthcare standards. These templates (2.x, 3.x, CDA, CCD, DICOM and others) may be directly downloaded into your eiConsole (IDE) project where they provide a “paint-by-numbers” solution to producing or consuming healthcare data exchange messages that conform to implementation guides. As an eiConsole end user, you can tweak the templates to meet your exact requirements and deploy the finished interfaces into production.

Virtually any entity in the healthcare industry can benefit from publishing interface templates to the PIE and making them available for download. If you are a healthcare provider, payer or lab you might publish interface templates to and from your systems to speed up customer implementations. If you’re a manufacturer or software provider you might publish interface templates to make interfacing with your medical devices, equipment or software application easier.

Publishing on the PIE is free. You decide whether to make an offering free or charge a license fee, or if you’d like it to be a public or private offering. The PIE encourages reuse. With the PIE, each participant need only be responsible for the “tweaks” particular to integrating their healthcare systems without having to reinvent what is common and can be shared throughout their industry.

The eiConsole for Healthcare

A Breakthrough Interface Engine IDE with a Graphical Assembly Line Process for Rapidly Configuring Healthcare Interfaces

Use the eiConsole’s self-documenting “Assembly Line” and streamline interface creation through a unique methodology and feature set. Each interface is constructed from a sequence of stages – all graphically configurable and extensible. Leverage open source components with our open API. Included components handle virtually every common communication protocol, parsing, transformation or manipulation task – all graphically configured with virtually no coding or scripting. Configure interfaces 10x faster with its exclusive graphical, drag & drop Data Mapper and benefit from the most HL7-specific features of any product on the market.

The eiPlatform (EIP)

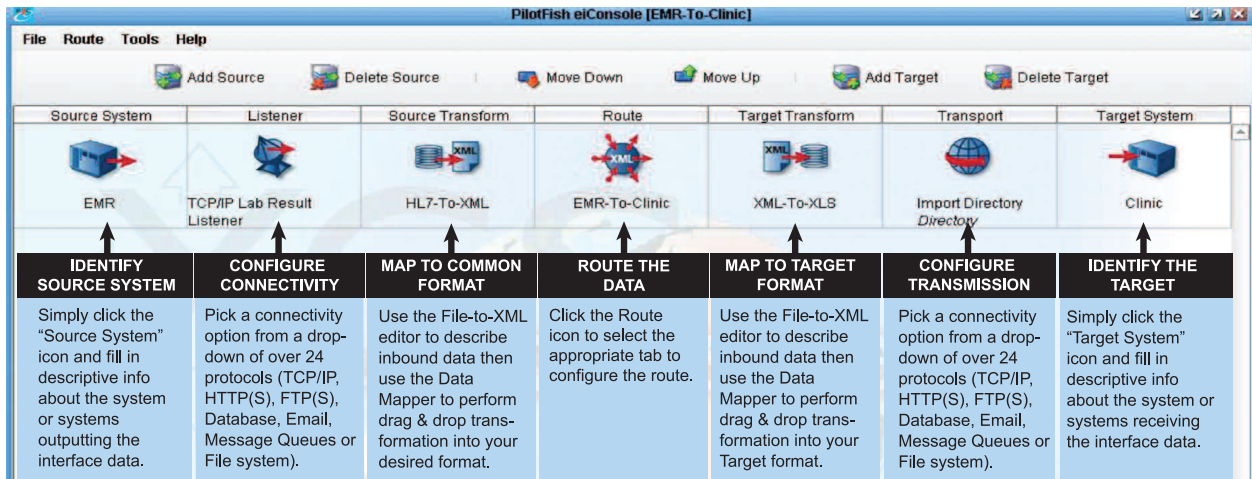
The Interface Engine Runtime Complement to the eiConsole for Healthcare for High Performance Execution

Once an interface has been configured and tested in the eiConsole, it is deployed to the eiPlatform. The eiPlatform is a lightweight, robust and scalable execution environment for all of your integrations. Once migrated to the eiPlatform, interfaces execute unattended and worry-free. The eiPlatform’s unique “NTM Acceleration” allows reliable, multi-threaded message processing under the most demanding conditions. A flexible logging and reporting architecture allows for the capture of business-critical information every step of the way and proactive error notifications ensure that operations staff are notified the moment a problem is detected.

Reusability, Flexibility and Extensibility to Meet Any Integration Requirement

The eiConsole for Healthcare Assembly Line

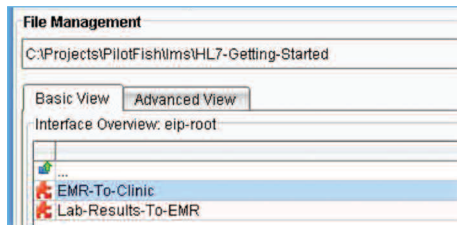
Rapidly create end-to-end interfaces with the eiConsole for Healthcare using an intuitive Assembly Line process that uses a combination of configuration screens and an intuitive Data Mapper



10 Easy Steps to Building and Deploying a Healthcare Interface

Step 1: Select the Interface

The eiConsole File Management Screen provides a single place to manage all of an organization's interfaces.



When an existing interface is selected, such as EMR-to-Clinic or you click "New", a graphical representation of that end-to-end interface is presented with all of its configurable components (see below). Components of the interface, going left to right, include the Source System, Listener, Source Transform, Route, Target Transform, Transport and Target System – these comprise the eiConsole "Assembly Line".

Step 2: Identify the Source System

Click the "Source System" icon and fill in descriptive information about the system outputting the interface data. This information is user defined and might include the system name and owner, format type, etc. Later, this information can be used to search for interfaces maintained in the eiConsole.

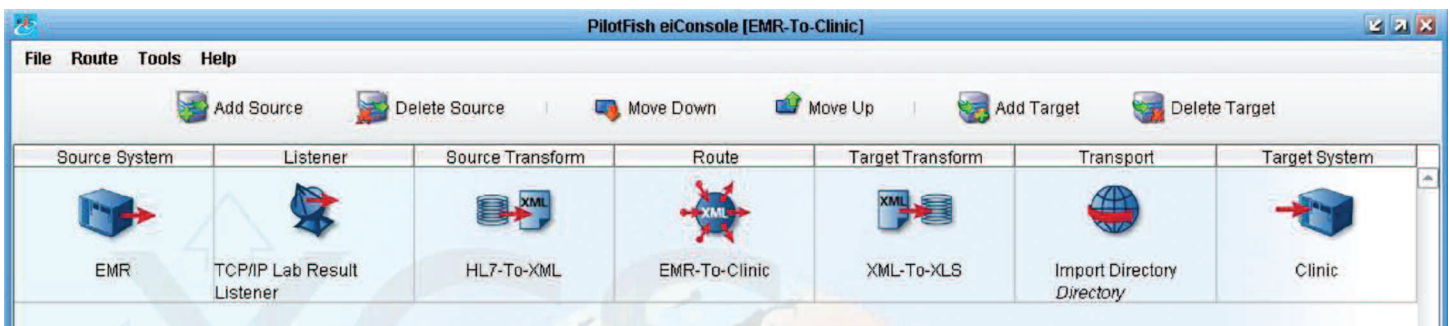
HL7-Specific Productivity Boosting Features

- **Differencing Engine** – automates mapping between slightly incompatible HL7 messages and matching fields so the user only needs to work with the remaining deltas
- **Inline Documentation** – browse the HL7 vocabulary including codelists
- **Lenient HL7 Parser** – consume non-standards-compliant HL7 messages
- **Friendly Name Option** – replaces cryptic HL7 names with simple, understandable synonyms
- **Import Vendor-Specific HL7 Transaction Samples** – available for data mapping
- **CCD and CCR Output** – easily move Application Data into CCD and CCR Templates

Simplify Interface Management

The File Management screen provides a single place from which to manage your catalog of interfaces:

- Organize interfaces with nested folders
- Maintain general-purpose interfaces to foster re-use
- Clone interface templates with a few clicks
- Upload and download components from the PilotFish Interface Exchange (PIE)
- Synchronize your eiConsole IDE with an eiPlatform server



Step 3: Select the Listener

Click the "Listener" icon and choose the Listener Tab. Select a Listener from the drop-down-list and fill in the configuration information for the type of Listener selected. In the example right, HL7 TCP is selected.

The eiConsole for Healthcare supports all the popular connectivity types. A few of them are:

- TCP/IP (including LLP)
- RDBMS (all modern database systems)
- Local/Network File System
- FTP/SFTP/FTPS
- Email (POP3)
- HTTP/S
- Web Services
- Message Queues (MQ, MSMQ, JMS)
- Command Line Invocation
- API Call
- Workflow / Process Orchestration

Now choose the Processor Tab

Processors are also configured at this stage. Processors perform operations that affect all of the incoming data and may be layered in any order. A few of the Processors provided with the eiConsole for Healthcare are:

- Encryption/Decryption
- Authentication
- Text Scraping
- Compression/Decompression (ZIP, GZIP, etc.)
- DICOM
- Attachment Handling (MTOM, MIME)
- Validation (Schema, Schematron, XSLT)
- Regular Expression Replacement
- XPath Evaluation
- Character Set Conversion
- Text Extraction (PDF, DOC, etc.)

Step 4: Map the Source Data to the Common Standard

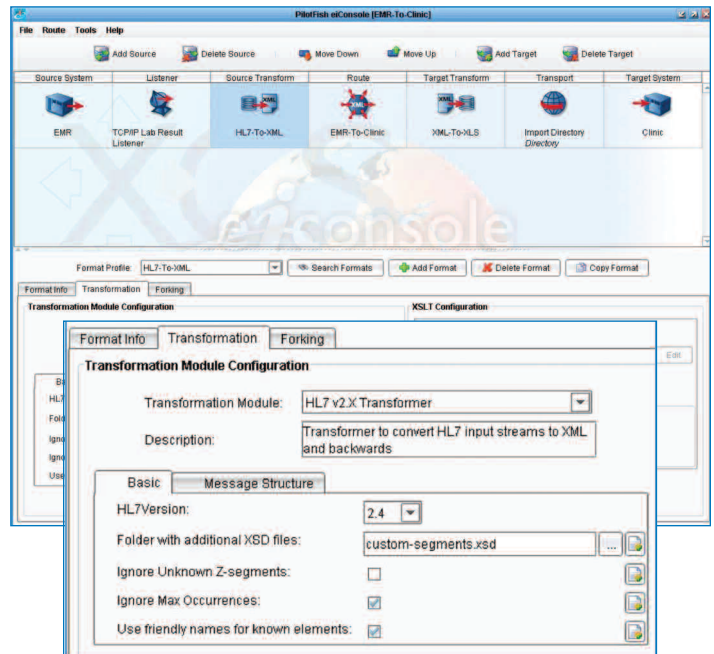
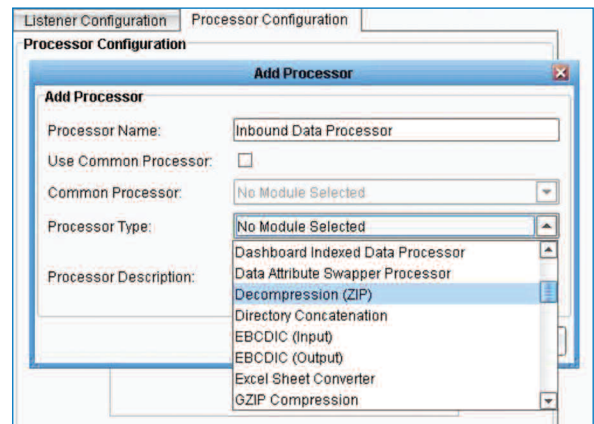
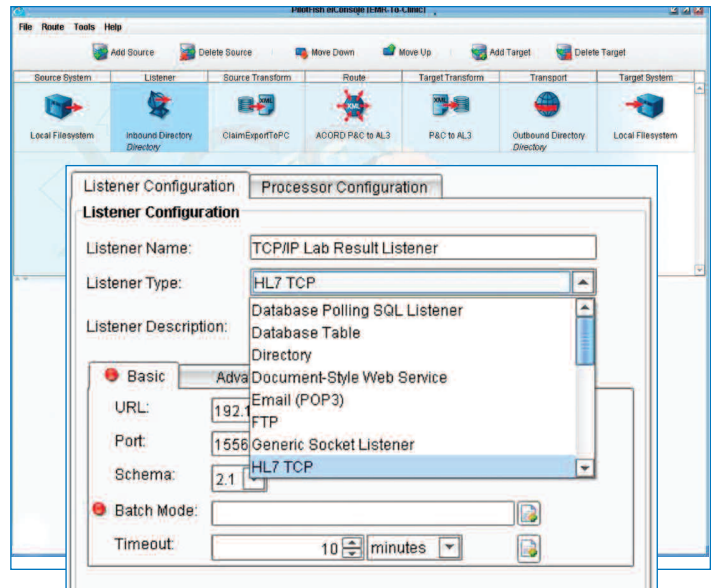
The eiConsole supports data transformation using a point, click, drag and drop visual interface. Clicking the "Source Transform" icon presents you with a two step process for the transformation of the data format output from the Source System into a common standard format.

Transformation to XML

The first step in eiConsole data transformation is to bind the incoming data into a corresponding XML representation. If the data is already in XML form, no work needs to be done. To convert data in other formats, the appropriate Transformation Module is selected from a drop-down. Among other data representations, modules exist to painlessly convert:

- HL7 v2
- Fixed Width / Delimited Files (including ANSI X.12)
- CSV
- XLS/XLSX
- Database Result Sets

Download additional transformers from PilotFish's Interface Exchange (PIE) or implement them using our open APIs. When working with HL7, the HL7 V2 Transformation Module is particularly important. It boasts a proprietary "lenient parser" capable of working with imperfect, extended or non-standard message flavors.



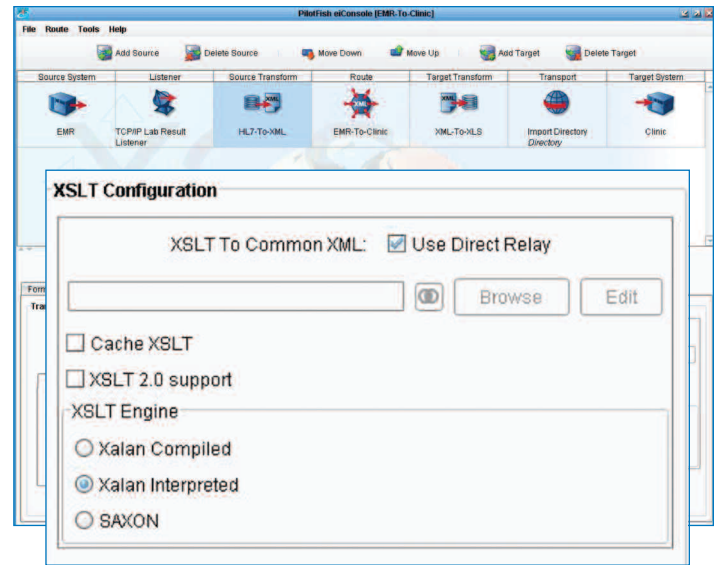
The Data Mapper

Clicking the "Edit" button on the XSLT Configuration panel opens the Data Mapper. The Data Mapper is a graphical editor used to generate the XSLT transformations that transform any data format to any other data format. Typically this is used to transform data from a proprietary format to a common format such as HL7, but can also be used to transform data to another proprietary format, a company's common model, other standards or different versions or interpretations of a standard. This is particularly useful when working with HL7 formats where custom extensions are common.

The Data Mapper utilizes a unique "triple-pane" mapper (see graphic bottom). The pane on the left represents the Source format, the pane on the right represents the Target format and the pane in the middle represents the relationship between the Source and the Target.

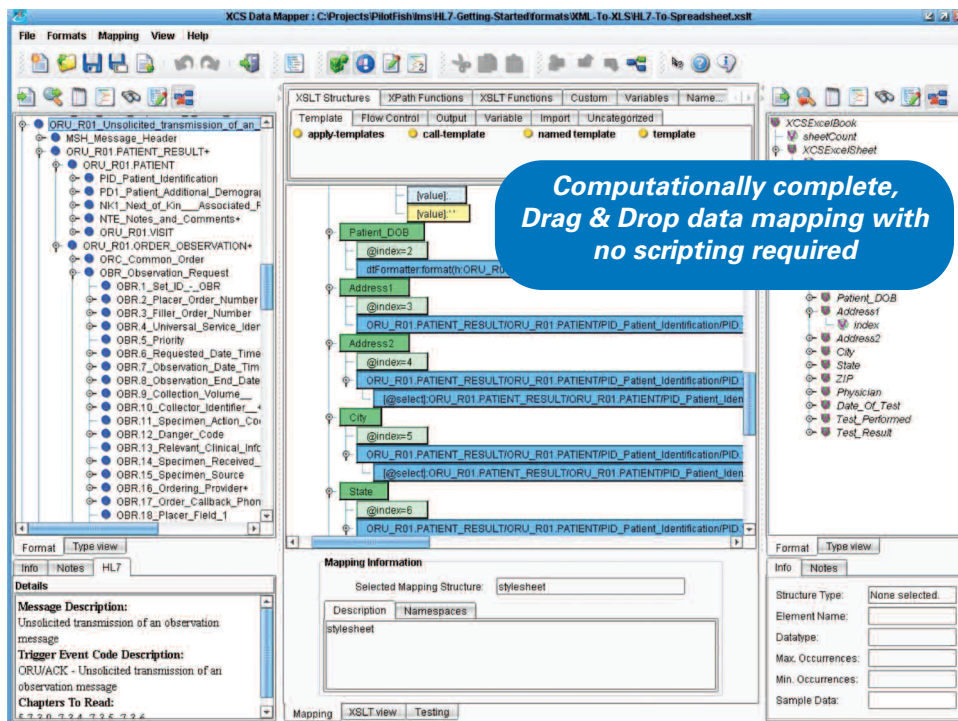
Relating Source formats to Target formats is accomplished by simply dragging the corresponding fields from the Source and the Target to the map in the middle. This approach is of particular advantage when the Source and Target have repeating or recursive elements. When mapping between two different versions of a standard such as HL7 version 2.3 and version 2.4, a Differencing Engine will automatically map matching fields so the user only needs to work with the remaining deltas.

In addition to dragging Source and Target elements onto the map, users can also take advantage of a "computationally complete" palette of XSLT Structures, Functions and custom "macros", to speed the development of high quality transformations. Developers can also switch back and forth from a graphical view of the transformation to an XSLT view.



Changes made in one are immediately and automatically reflected in the other. The XSLT Transformations created using the Data Mapper are W3C-compliant. They can be deployed to an existing Enterprise Service Bus (ESB), an "XSLT crunching" appliance or with one mouse-click, to the eiPlatform Java framework to support runtime transformations. Data formats are loaded into the Source and Target panels by clicking the "Open Source / Target" icon, selecting the format, browsing for the file and clicking "Read Format". Some of the Source and Target format readers included with the eiConsole for Healthcare are the:

- HL7 Format Builder
- XSD Format Builder
- Flat File Format Builder
- XML Format Builder
- HTML Format Builder
- SQLXML Format Builder
- WSDL Format Builder



Built-in Schema Management

Comprehensive Schema Management is available as an integrated component of the Data Mapper. Any release of any schema can be imported at the click of a button. You can then add standards-compliant extensions, provide documentation and save the extensions separately from the base schema. And because the extensions are saved separately, upgrading to a new release of the base schema without overlaying your extensions is a snap. You can also use the schema "slicing" capability to limit large unwieldy schemas to just what you need for a particular interface.

Step 5: Configure the Route

The Route stage serves several purposes: You can maintain general metadata describing the Route, specify routing rules and configure Transaction Monitoring. To configure the Route, click the Route icon, and click the appropriate tab. The "General" tab lets you turn on and off transaction logging and debug tracing. It also lets you create your own metadata describing the Route – useful for documenting the interface.

The "Routing Rules" tab enables you to route messages to the appropriate target or targets based on the content of the message. A facility for configuring XPath-based routing rules is included with the eiConsole for Healthcare. While XPath is the most commonly used means to route transactions, you can also configure your own routing rules program call out to another program, or integrate with popular workflow and message orchestration programs.

The "Transaction Monitoring" tab lets you customize the error notification system used by this interface when in production. This proactive alerting supplements the traditional, passive logging and audit trail supported and configurable in the eiPlatform runtime. A few examples of the transaction monitors included with the eiConsole for Healthcare are:

- Email Alert
- SNMP Trap
- Error Route Trigger

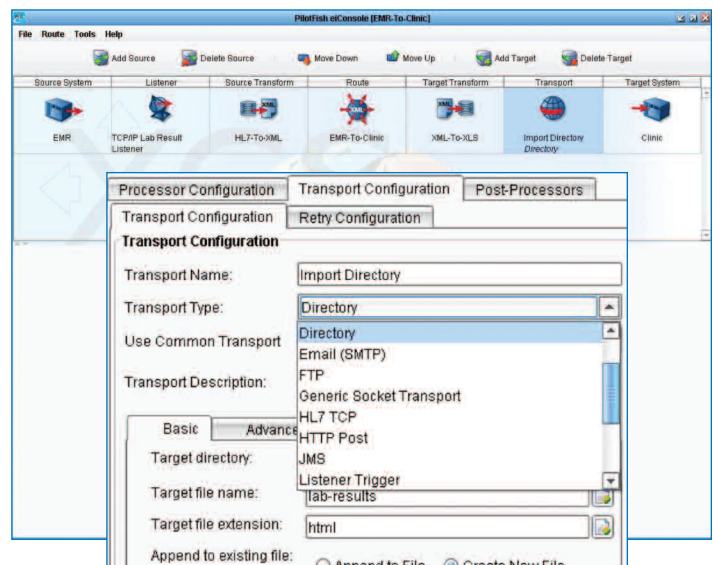
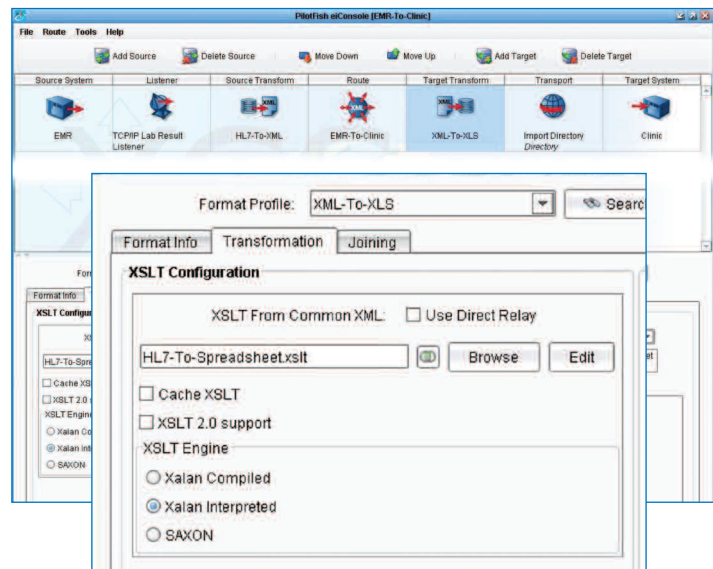
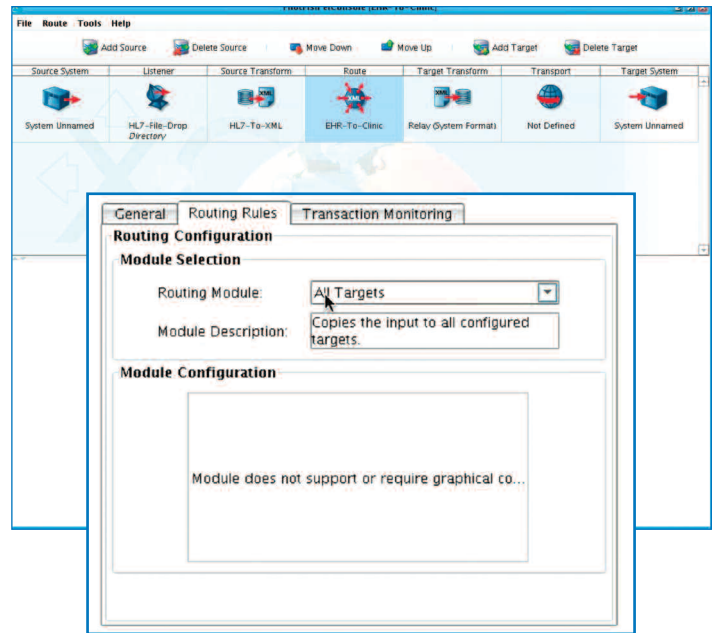
Step 6: Map the Data to the Exact Format Required by the Target System

Clicking the "Target Transform" icon will again present you with the two step process for transformation. This time, however, the purpose is to transform the current or canonical format to the format of the Target System. If the Target System is capable of accepting the industry-standard, simply click the "Use Direct Relay" check box and no data transformation will occur.

Step 7: Configure the Transport

Click the "Transport" icon, select a Transport method from the drop-down list and fill in the configuration information for the type of Transport selected. Transport types for the eiConsole for Healthcare include:

- TCP/IP (including LLP)
- RDBMS (all modern database systems)
- Local/Network File System
- FTP/SFTP/FTPS
- Email (POP3)
- HTTP/S
- Web Services
- Message Queues (MQ, MSMQ, JMS)
- Command Line Invocation
- API Call
- Synchronous Response
- Workflow/Process Orchestration



Processor Configuration Tab

As with the Listener stage, Processors can also be configured at this stage. Here the Processors perform operations that affect all of the outgoing data and may be layered in any order. The same processors are available in the Transport stage as they are in the Listener stage. Note that just as Processors can be used to perform a variety of tasks on inbound data prior to processing, they can be included to modify the data stream before final transmission – to validate, compress or encrypt the outbound payload. Clean-up tasks can also be implemented using post-processors.

Step 8: Identify the Target System

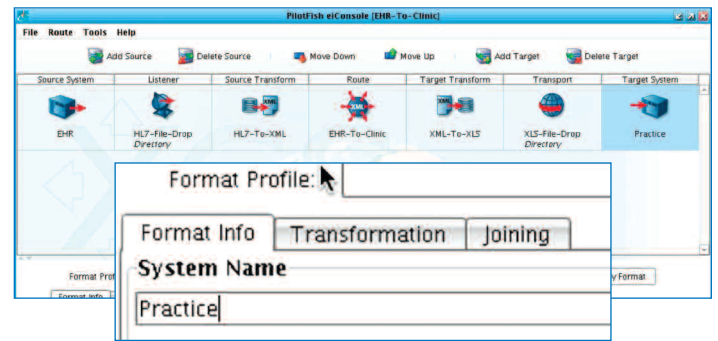
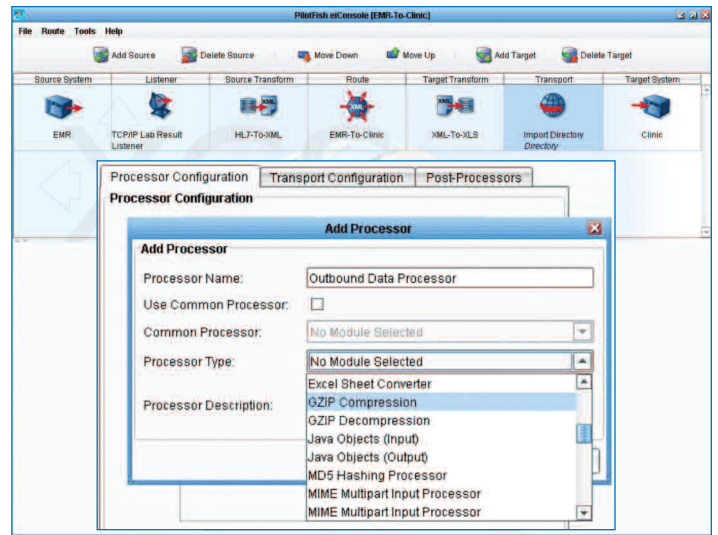
Click the “Target System” icon and fill in descriptive information about the system receiving the interface data. This information is user defined and can be used later to search for interfaces maintained in the eiConsole.

Step 9: Test the Interface

The eiConsole allows end-to-end testing and debugging directly within the application, with no extra hardware and no “wait time” for compilation and deployment. You begin testing by selecting “Switch to Testing Mode”. The testing module opens where you can unit test any single stage, or integration test any number of stages together.

In test mode you are presented with a set of arrows indicating the stages that might be run. The Testing mode also allows you to click on each Stage to see the output as the data undergoes the transformation and delivery process.

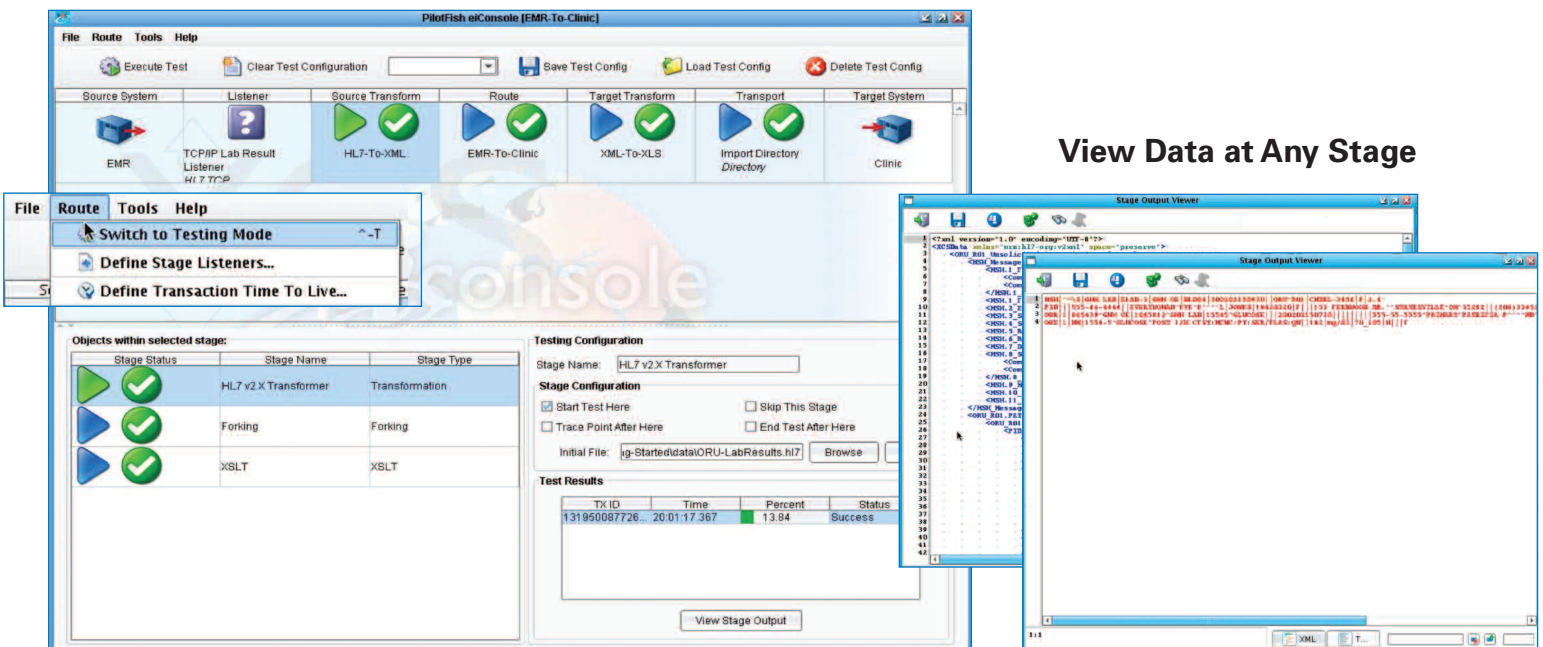
You can click the Stage where you want to end the test or let it run all the way through. You can also establish a “live” connection to the Target system to test the interface end-to-end. Stages that complete successfully have a green checkmark and those that fail have a red “X”. Any Stages that fail provide detailed error messages allowing the failures to be quickly corrected and retested.



Step 10: Deploy the Interface to the eiPlatform

Once an interface has been tested from end-to-end, the final step is deployment to an eiPlatform runtime environment. The completed interface is saved as a set of discrete, easily shared, easily managed configuration files. Promotion of an interface can be achieved by simply copying the configuration files, or through the Route File Management's point-and-click synchronization to an eiPlatform server. With the eiConsole for Healthcare your interface can be built and deployed into production 10x faster!

View Data at Any Stage



Configure Your Interfaces with the eiConsole Then Deploy Them on the eiPlatform in Seconds

Once an interface has been tested from end-to-end, the final step is deployment to an eiPlatform runtime environment. The completed eiConsole interfaces are saved as a set of discrete, easily shared and easily managed configuration files. Promotion of an eiConsole interface to production can be achieved by simply copying the configuration files to the eiPlatform, or with just a few mouse clicks, using the eiConsole's eiPlatform synchronization feature.

Each configurable stage in the eiConsole IDE has a corresponding stage in the eiPlatform integration engine, a process that provides virtually unlimited flexibility. Each transaction being processed by the eiPlatform integration engine moves through five distinct stages (See below).

1. The Listener Stage "listens" for information being output by the Source system. After a Listener has received a transaction, but before it is passed to the next stage, the transaction can be passed to a sequence of Processors. The Processors perform various operations over the data before sending it on to the Transform stage.

2. The Transform Stage transforms the data from the proprietary format of the system it came from into a common format – typically a healthcare industry standard such as HL7.

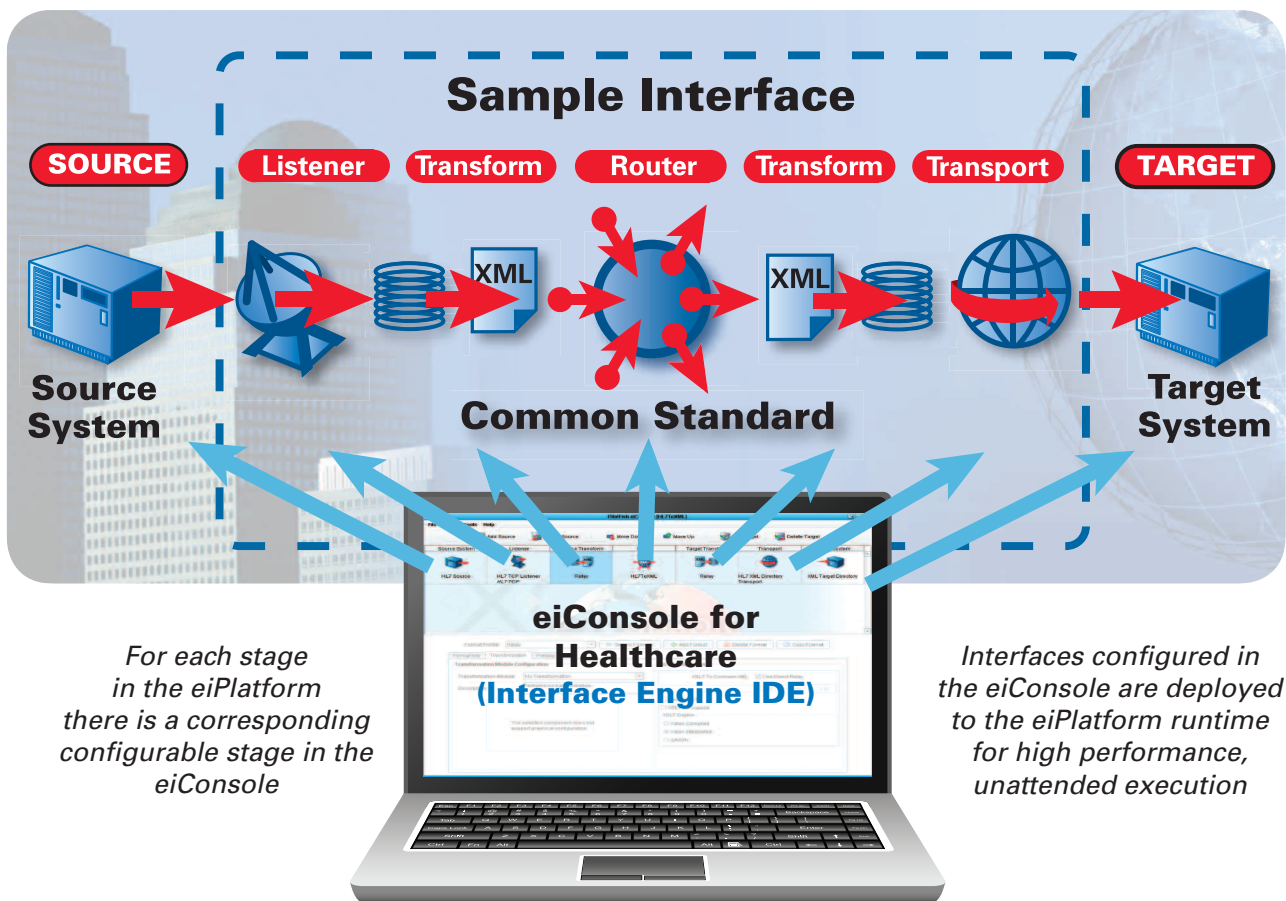
3. The Router Stage routes the data to the Target system or systems using a routing rules engine. The Router also captures and reports transaction detail, audit information and errors.

4. The Second Transform Stage transforms the data from the industry standard XML format to the format(s) of the Target system or systems. If the Target system is capable of receiving the industry standard format, the data is "relayed" without further transformation.

5. The Transport Stage is responsible for the delivery of the data to the Target system or systems in the exact format and transport method required.

Any interface deployed to the eiPlatform can have unlimited Source and Target systems, and any number of interfaces can be deployed to a single instance of the eiPlatform.

eiPlatform (Interface Engine)



For each stage in the eiPlatform there is a corresponding configurable stage in the eiConsole

Interfaces configured in the eiConsole are deployed to the eiPlatform runtime for high performance, unattended execution

Enable Interoperability with All Entities in the Healthcare Ecosystem with the eiPlatform

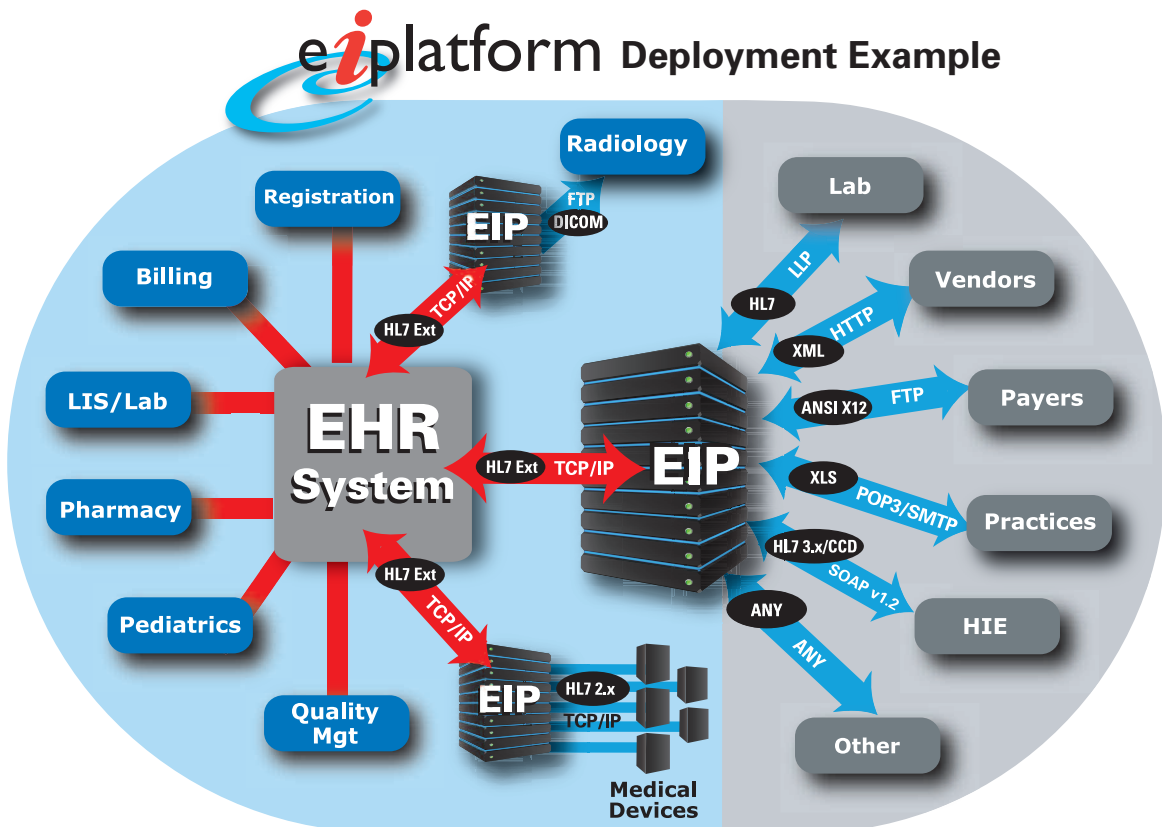
The eiPlatform leverages application server technology and healthcare industry standards to enable the interoperability of any system with any other system regardless of computer platform, operating system, database, data format or data standard.

The eiPlatform is a secure, high performance and production proven interface engine capable of handling a virtually limitless array of data transformations, transmission protocols, service orchestrations and other manipulations. Coupled with the productivity-enhancing interface development environment, the eiConsole for Healthcare, the products represent a comprehensive solution to all of the healthcare industry's integration requirements.

Whether you are deploying a simple point-to-point interface, implementing a comprehensive Service Oriented Architecture or something in between, the configurability and flexibility of the eiPlatform together with the eiConsole satisfies any deployment model requirements. Healthcare providers, software vendors, equipment manufacturers, government entities and labs can all leverage these integration solutions to keep pace with the rapidly changing and ever-evolving healthcare technology landscape.

Benefits Realized by Implementing the eiPlatform

- Connectivity between any number of systems through configuration, not custom code
- Flexibility of deployment, with a solution lightweight enough for a device and scalable enough for the cloud
- Agility of execution, with an HL7 parsing engine capable of supporting any message format in any version – even non-standard or customized implementations
- Future-proofing out of the box, through an XML-centric architecture pre-positioned for HL7 v3 and web services
- Scalability to meet your needs, with an engine optimized for high transaction volumes and large batch payloads
- Security, with an array of industry-accepted message and transport-layer encryption mechanisms at your disposal
- Manageability, with configurable message logging and proactive error notifications
- Extensibility, through a growing library of components and templates on the PilotFish Interface Exchange, or using our open APIs



The eiPlatform (EIP) mediates the differences in data formats and communications protocols between systems for which "out of the box" interfaces are not available.

Extend the Power of the eiConsole With the PilotFish Interface Exchange (PIE) "App Store"

The PIE is a cloud-based application that enables any entity in the web universe to easily and rapidly share interfaces, interface templates and components developed using the eiConsole. The PIE encourages reuse and collaboration between all members of the healthcare ecosystem. With it, each member need only be responsible for the "tweaks" particular to their business without having to reinvent what is common and can be shared throughout our industry.

The PIE has a free and growing library of Healthcare interoperability templates based on healthcare standards. These templates are preconfigured for producing or consuming a healthcare message that is conformant to a specific healthcare standard (e.g. HL7 v2.x, v3.x, DICOM etc.). eiConsole users can download these templates directly into their eiConsole project to get a head start on configuring an interface. Within the eiConsole the templates can be tweaked, shared or deployed just like any other interface..

Organizations and individuals can publish on the PIE for free. The PIE Wizard makes the process of sharing or publishing simply a matter of minutes. In addition to product details, descriptions and contact information the user can upload any kind of attachments.

The PIE offers multiple publishing options:

- Information Only – everyone can see it on the PIE, but can't download it
- Public – everyone can see it and download it
- Commercial – information is visible to all, but only users that you specify can download it
- Private – product information is only visible to what individuals or group you specify

Publishers can also determine if they wish to charge a license fee or offer free access. After you have followed the Wizard, completed the screens and clicked "Finish" the interface is instantly published to the PIE.

The screenshot shows the PilotFish Interface Exchange (PIE) website. At the top, there are navigation tabs: "About the PIE", "Developer Network", "Pilotfish Home", and "Contacts", along with a "LOGIN" button. The main header features the "PilotFish Interface Exchange (PIE)" logo and a description: "A Cloud Marketplace for Pre-Developed Interfaces, Industry Bundled Interfaces and Interface Components That Can Be Easily Tweaked and Shared Using the XCS eiConsole IDE." Below this is a "PRE-REQUISITE PRODUCT" section for "XCS eiplatform" and a "Developers!" section with a "Learn More" button. A navigation bar includes "SHOW ALL", "PRODUCTS", "BUNDLES", "COMPONENTS", "INTERFACES", and a "SEARCH" field. The main content area is divided into three columns: "SUMMARY", "PRODUCT DETAILS", and "DOCUMENTATION". The "PRODUCT DETAILS" column highlights the "HL7 V2.x Template: Public Health: Reporting to Public Health ORU_R01 Lead Lab Result (version 1.0)" with a "Free Download" button. The "SUMMARY" column lists contact information for PilotFish Technology. The "DOCUMENTATION" column provides links to sample data and a written tutorial.

Above an example of a free interface template offered on the PIE. The PIE "Wizard" ensures that publishing on the PIE is fast, information is well organized and the user has access to everything they need – product descriptions, licensing terms, any pre-requisites, associated documentation and contact information, general, technical or for licensing.

PilotFish Interface Engine Solutions Checklist

SUPPORTED PLATFORMS
Windows
Linux
Mac
Unix / AIX / HP-UX
SUPPORTED APPLICATION SERVERS
Apache Tomcat
Glassfish
WebSphere
JBoss
WebLogic
Windows Service / No App Server
SUPPORTED DATABASES
Microsoft SQL Server
Oracle
DB2
MySQL
PostgreSQL
Access DB
H2
Based on open standards
SUPPORTED PROTOCOLS
RDBMS (all modern database systems)
Email (POP3 / SMTP)
Local / Network File System
FTP / SFTP / FTPS
TCP / IP (including LLP)
HTTP / S
Messaging (JMS / MQ / MSMQ)
API-Call
Java RMI
Web Services (SOAP, REST)
Command-line invocation (CLI)
LDAP / Directory Services
Custom Connectors
Workflow / Process Orchestration
VALIDATION
Data format conformance (XSD, HL7 spec, etc.)
Business rules / Schematron Lookup validation against external sources
Custom validators
DEPLOYMENT MODELS
Appliance / Virtual appliance
Hosted
Deploy to own server
Total / Suite solution

WORKFLOW PATTERNS SUPPORT
Sequencing
Splitting
Merging
Branching
Conditional Logic
Iteration
DATA TRANSFORMATIONS
Graphical, drag & drop data mapping
Codeless / Scriptless data transformations
Generates W3C compliant XSLT
Computationally complete
ERROR HANDLING
Passive handling for errors, including logging, database reporting, real-time responses, etc.
Pro-active handling for errors, including sending e-mails, sending SOAP messages, etc.
Customizable logging and database reporting
TESTING
Graphical "Test Mode" for rapid step-by-step debugging
View the content of each stage
Skip stages or modify data in-flight
Connect to interface endpoints or bypass as required
Embedded "eiPlatform emulator"
SUPPORTED STANDARDS
HL7 2.x / 3.x
CCD / CDA
EDI (ANSI X.12)
Positional Flat Files
Delimited Files
CSV
XLS / XLSX
DICOM
Semi-Structured Text
XML
Binary (.pdf, .wav, .jpg)
ARCHITECTURE
Consistent "assembly line" pattern
Configuration over code
Component-driven
Extensible via Open APIs
LICENSING MODEL
Installation-based licensing
No per channel or per connection fees
Production server license includes unlimited number of development, test and backup copies

Note: This is a partial listing. If you have specific requirements not shown above please contact us.

PilotFish Middleware and Cloud Solutions for Achieving Healthcare Interoperability

eiConsole for Healthcare –

An interface engine IDE for the creation, deployment and management of interfaces. Configure interfaces end-to-end using a graphical “Assembly Line”. Perform codeless, drag & drop data mapping. Download pre-configured interface templates or share your interfaces on our PIE (“App Store” for Interfaces). Debug and test at any stage in a graphical test mode and promote interfaces to production on the eiPlatform runtime.

eiPlatform –

A high performance, secure, runtime complement to the eiConsole for Healthcare. Interfaces developed in the eiConsole can be deployed to production on the eiPlatform with a few mouse-clicks where they will run in unattended mode.

PilotFish Interface Exchange or “PIE”–

A cloud-based exchange or “App Store” for eiConsole users. Download, share or publish interfaces, interface templates or components that enable collaboration and facilitate reuse. The PIE also includes a free library of Healthcare Interoperability Templates based on the HL7 standards. These preconfigured templates provide a head start for producing or consuming an HL7 message conformant to a specific HL7 implementation guide.

eiPortal for Healthcare Integration –

A cloud-based solution that provides all of the resources required to establish standardized initial and ongoing healthcare information exchange. The eiPortal links to a web repository with everything required to configure an interface to your system and a fully automated testing facility allows validation of information exchanges before going live.

eiDashboard –

An optional application component that monitors the performance of the eiPlatform and provides a wealth of Business Intelligence (BI) information.

About Applied PilotFish Healthcare Integration (APHI) –

A subsidiary of PilotFish Technology, APHI distributes PilotFish products and provides related services to the Healthcare industry. PilotFish, founded in 2001, develops comprehensive middleware that enables interoperability using industry and XML standards. PilotFish products, using a modern architecture, can dramatically shorten project timelines, reduce risk and improve the quality of deliverables.



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