

Data Transformation Engine

Using HealthCast's Data Transformation Engine to Upgrade Legacy System Applications and Transform Data into Usable Information, Anytime, Anywhere

October 3, 2001

INTRODUCTION

HealthCast LLC has developed a proprietary and unique **Data Transformation Engine (DTE)** to provide two-way interaction at the patient data level with health care legacy systems. XML and proprietary Terminal Adapters are the foundation of DTE's technology. However, because DTE uses XML in fundamentally new ways, DTE interacts with legacy systems at the discrete data element level, not simply the application screen level. As a result, this powerful approach to accessing information provides significant new functionality to health care organizations without changing their back-end IT systems.

Discrete pieces of data can be accessed through DTE and "re-assembled" in applications such as HealthCast's Patient Data Browser in new and different ways to better support care delivery, and enable health care providers to more effectively use information in their work. Patient-level information can be simultaneously accessed from disparate legacy systems and data sources (whether or not these are integrated through messaging or other gateways), and made available in a visually integrated fashion without requiring the creation of any data repository. And, because DTE creates a bi-directional environment, clinicians can be given the capability to "write-back" into legacy systems from their homes and offsite offices.

This document is intended for the reader(s) interested in gaining a general understanding of how DTE, with its proprietary Terminal Adapters, can be utilized to transform information on terminal application screens into usable XML data sources. The examples and illustrations used in this document are based on DTE in combination with HealthCast's proprietary 3270 Terminal Adapter. However, HealthCast's other terminal application adapters (e.g., VT, 5250) and its adapters for databases or other middleware objects function in fundamentally the same way.

Three main software components -Terminal Adapters, XML, and DTE - are used in the data transformation process. This document explains each of the components and discusses how they are used together to transform discrete data elements from application screens into useful information. Terminal Adapters are proprietary software components that HealthCast has developed to allow DTE to interact with legacy applications, and extract and enter information into application screens. Terminal Adapters work by sending instructions to a terminal screen - providing an interface or "virtual operator" to instruct the terminal to perform the desired functions such as, "enter" or "extract" information.

Essentially, the Adapters provide an object interface that allows DTE to programmatically drive a legacy application. Terminal Adapters bring a number of advantages to the process of interacting with legacy systems. They:

- ***Accelerate Implementation Time and Reduce Effort***

Terminal Adapters provide an interface or 'virtual operator' capable of instructing the terminal to perform the desired function(s). This enables automated integration of other applications with legacy systems, without any application modification.

- ***Eliminate Point-to-Point Interfaces***

Terminal Adapters eliminate the need to write interface code to connect applications. Once field layouts have been specified in the DTE tool, data in legacy applications can be accessed and XML results obtained.

- ***Leverage Current Legacy System Investments***

Terminal Adapters require no back-end system changes, so hospitals can extract the full value of the data stored and extending the usable life of their current legacy systems.

- ***Lower Impact on IT Staff Resources***

Because screen-based interfacing requires no coding or modification to your legacy system, your staff is free to focus on business process issues.

- ***Connect Major Enterprise Source and Target Applications***

HealthCast's proprietary Terminal Adapters can interface with any number of health care applications and data sources, providing a new and efficient way to visually integrate information that supports better patient care.

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Terminal Adapters

XML - Extensible Mark-up Language

XML (Extensible Mark-up Language) is a method for putting structured data into a text-based file format to facilitate data exchange. The text-based file format enables data access without interacting with the program that produced the data.

XML is a set of rules often referred to as “mark-up rules” for structuring the data. The embedded mark-up rules in XML documents are based on a design that produces files that are easy for a computer to generate and read. These files are unambiguous, and avoid extensibility limits and platform-dependency. HealthCast’s XML-based solutions control data representation by creating and using a vocabulary of elements and attributes that “make sense” to a particular application, yet remain interchangeable.

In the following example, markup tags (e.g., “<LASTNAME>” or “<Allergies>”) put data in a format that is human-readable and easy to parse.

```
- <!-- Allergies XML Document -->
- <ALLERGIES>
  <LASTNAME>Jones</LASTNAME>
  <FIRSTNAME>Sam</FIRSTNAME>
  <PHYSICIAN>MARK THOMAS</PHYSICIAN>
  <ALLERGY>EES,KEFLEX,DURACEF,CODEINE</ALLERGY>
  <LABORATORY NAME="Levin & Levin Labs.">LABS COMPLETED</LABORATORY>
</ALLERGIES>
```

Using this open standard to structure data, HealthCast solutions transform data on application screens into a format that end users find more effective.

To learn more about XML, web resources are listed below:

- W3 Consortium (www.w3c.org)
- www.xml.com

HealthCast’s Data Transformation Engine (DTE) is the environment in which the Terminal Adapters and XML are utilized together to create an XML result. DTE includes two major components:

- **DTE Development Environment:** creates the scripts that use adapters to create XML results.
- **DTE Runtime Environment:** executes the scripts and the corresponding adapters to transform information from underlying systems into a useful XML result.

Within DTE’s environment, Adapters are available to access data from many different sources:

- Direct database access, using API’s like ODBC, KSQL, OLE-DB, or ADO.
- Host terminal sessions with HealthCast’s proprietary terminal adapters.
- Message exchange using industry-standard messaging protocols, such as HL7.

In DTE’s development environment, a developer can create scripts that interact with legacy systems and other data sources. The scripts created in this environment are a VBA - compatible language, much like Visual Basic. Developers use Terminal Adapters in DTE’s development environment to access fields and data elements located on any screen in the application. As was described earlier, Terminal Adapters provide methods to navigate through application screens. DTE also provides objects to help developers create XML documents. The following is an example script in which the Adapter object is named “Host.” Host is a 3270-host adapter:

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```
' Author: HealthCast, L.L.C.  
' Date: 10/1/1999  
' Purpose: Allergies DTE Script Example  
-----
```

```
Public Sub Main ()
```

```
On Error GoTo ErrorHandler
```

```
'Login to Host System  
If Not Login() Then  
    Call Logout()  
    Exit Sub  
End If
```

```
'Navigate to Desired Screens  
Host.SendKeyString( "21@E" )  
If Not Host.WaitScreenChange( "Admission Assessment", 1, 3, 21 ) Then  
    NavError InvalidScreenFound( "Admission Assessment - Allergy" )  
    Exit Sub  
End If
```

```
'Extract Data and Load XML Object  
With XML  
    .CreateNodePersist( branchSubordinate, "ALLERGIES" )  
    .CreateNodePersist( branchPeer, "LASTNAME", Host.ScreenToString( 2, 2, 26 )  
    .CreateNodePersist( branchPeer, "FIRSTNAME", Host.ScreenToString( 2, 2, 26 )  
    .CreateNodePersist( branchPeer, "PHYSICIAN", Host.ScreenToString( 6, 10, 26 )  
    .CreateNodePersist( branchPeer, "ALLERGY", Host.ScreenToString( 9, 10, 50 )  
    .CreateNodePersist( branchPeer, "LABORATORY NAME", Host.ScreenToString(10,18, 1 )  
.MoveBack  
End With
```

```
'Final Exit Navigation  
Host.SendKeyString( Host.GetCommand( "ENTER" ) )  
Host.WaitScreenChange()
```

```
'Disconnect Host Session  
Call Logout()  
Exit Sub
```

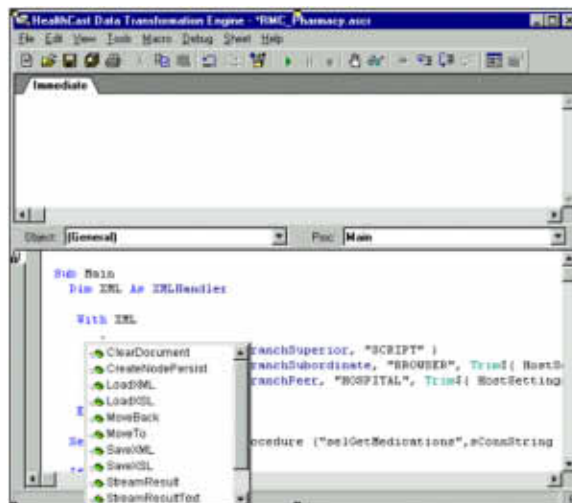
```
ErrorHandler:  
    HandleError Err.Number, Err.Description & " Error in Main"  
    Call Logout()  
End Sub
```

DTE scripts can be invoked by Web requests from any application engine, and are then processed against the appropriate data sources. The script code ultimately converts the data retrieved from legacy systems into an XML document. In transparent mode on the server, navigation keys and commands are passed to the application to simulate a user moving through the screens. While moving through multiple screens, data can be extracted from the screens, accumulated, and ultimately consolidated into an XML document

DTE's powerful integrated development environment provides features that make script development a straightforward process.

Features:

- Source Code Editor
- Auto Listing
- Color Coding of Syntax
- Variable Watch
- Visual Debugger

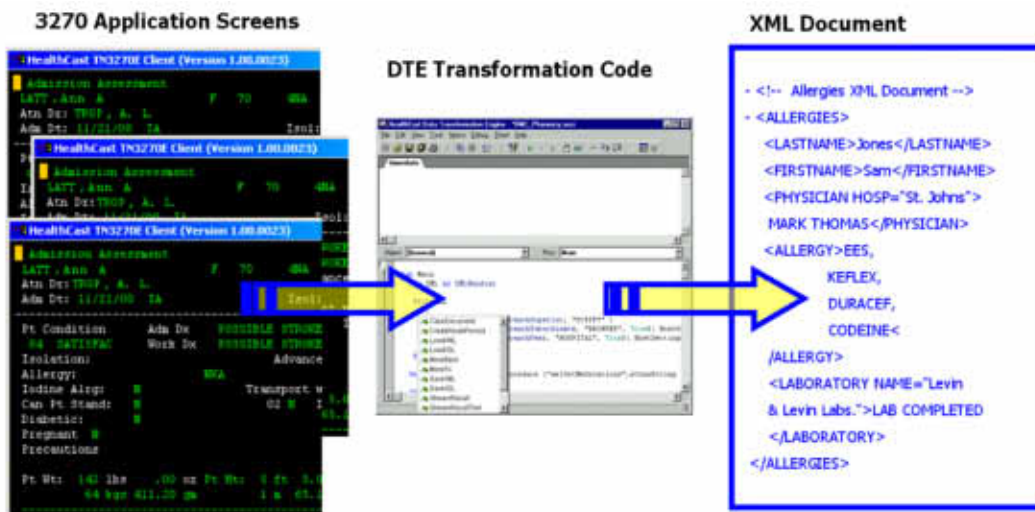


Once a script has been created in DTE, HealthCast's eXactACCESS product is utilized to manage security. Each script that is created has sign-on credentials forwarded to the terminal application that the Adapter is driving. This approach to security is especially valuable for health care organizations because terminal adapters gain access into system(s) in the same way in which a user would complete a system login.

eXactACCESS is a single sign-on access control product with a robust, open architecture that supports today's complex maze of web-based and desktop applications, data sources, and legacy systems without limiting future choices. New applications, new directory services (such as LDAP), and any authentication technologies, e.g., biometrics or smart cards, can be easily integrated as each organization's needs evolve.

By combining each of the components described above and their functionality, DTE can "drive" a terminal application to map application data and create an XML document. The following diagram illustrates this approach:

Using DTE to Transform Data from Application Screens to XML



DTE creates a two-way conduit to legacy applications

This powerful approach to interaction with legacy applications creates a DTE environment that is bi-directional. This means that when DTE is integrated with a web-based application, such as HealthCast's Patient Data Browser, it can extract and integrate patient data from disparate systems AND it can allow data to be entered back into legacy systems or other data sources. DTE creates a unique two-way conduit for interacting with legacy system(s). Physicians and other clinicians can now be given web-based access to the patient information they need to direct care from their offsite offices and homes, and they can enter information back into legacy systems, facilitating timely treatment and better quality of care.

DTE is much more than screen scraping technology

DTE's approach to data transformation is more than simply "screen scraping." Screen scraping is a fundamentally different approach to extracting data from legacy systems that is limited to accessing screens and their data. HealthCast's DTE provides a unique environment in which to define and manage discrete data elements independent of their screen placement or location.

DTE's approach to data transformation is not limited to accessing data only from application screens. Within the DTE environment, HealthCast adapters can be used to access data from many different sources, e.g. information stored in organizational databases or information from messaging protocols such as HL7. DTE provides a robust technology foundation on which to create new applications that are user-friendly, easy to implement and manage, and support work flow improvements. DTE, using HealthCast's proprietary Terminal Adapters and XML, provides a quick and non-intrusive method to integrate information from disparate legacy applications and upgrade system functionality.

DTE is flexible and scalable

HealthCast's DTE and proprietary Terminal Adapters provide health care organizations with the flexibility and scalability to meet future needs. Any number of Terminal Adapters can be utilized in DTE simultaneously. And, because DTE conforms to an open standard and structured XML format, it easily accommodates transitions to new back-end systems or additional Adapter choices in the future. The work done in any application is re-usable, leveraging investments in new technology.

e-Integration

HealthCast's e-integration suite of software solutions includes the following three products.

1) **eXactACCESS** a comprehensive single sign-on solution with role-based access control designed to work as a stand-alone product in private or public desktop environments, or as an integrated component in HealthCast's web-based solution, Patient Data Browser.

2) **Patient Data Browser** is a bi-directional portal application that securely integrates patient information from disparate legacy systems and data sources, enabling clinicians to view, print, and enter patient data from their homes and offices.

3) **Data Transformation Engine** is HealthCast's technology solution to the problem of accessing data from legacy applications and transforming it into useful information. It is an integrated component of Patient Data Browser. DTE is also available as a stand-alone product to populate data repositories with information from disparate legacy systems or interact with other web-based applications.

Interested?

For more information on any of these solutions, please contact HealthCast (Ray Madril, Director of Product Research, 208/327-8878, ext. 105) or review these products at www.gohealthcast.com.

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