

DeIVAX

Accessing the HL7 Service

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Table of Contents

Change Log.....	4
Introduction to DelVAX.....	5
Purpose	5
Scope.....	5
Audience	5
Requirements.....	5
References	5
CDC WSDL Implementation Resources.....	5
NIST Immunization Test Suite (NIST IZTS).....	5
Examples	5
HL7 Web Service Definition	6
Service Overview.....	6
Table of Inputs and Outputs	6
connectivityTest()	6
submitSingleMessage()	7
Faults and Errors	7
Soap Faults	7
SOAP Fault Parameters	7
Custom Error Codes	8
Consume the Service	8
NIST Immunization Test Suite	8
Validate SOAP formatting	8
Test SOAP connectivity	10
HL7 Testing and Validation	13
Further Reading	14
Troubleshooting.....	14
The HL7 carriage return has been replaced by a line feed.	14
I’m having SOAP Header configuration issues.	14
Obtaining a Certificate	15
Appendix A: WSDL Basics.....	16
WSDL Basics	16
Related Links and References	16

Appendix B: Simple Object Access Protocol	17
Definition	17
SOAP 1.2.....	17
Envelope.....	17
Header.....	17
Body	18
SOAP Faults	18
Related Links and References	19
Appendix C: HL7 Overview and Code Samples.....	20
Overview	20
HL7 Version 2.x	20
HL7 Message Example	20
HL7 Message Encoding	20
SOAP Request and Response with HL7 Payload	20
SOAP Request with example HL7 Message and optional facility ID parameter	21
SOAP Request with example HL7 Message and Response (HL7 2.4).....	21
Successful Response(ACK) (HL7 2.4)	22

Figure 1 – Interfacing with the HL7 Service 6

Figure 7 - SOAP sender and receiver..... 17

Figure 8 - SOAP envelope structure 18

Change Log

The following table captures the progression of this document over time.

Version	Date	Description	Author
1.0	02/10/2016	Document Creation	Sarah Voegeli
1.1	02/19/2016	Added highlights for those areas that need to be modified for each customer	Claire Murchie
1.2	02/26/2016	Final edits to the document	Claire Murchie
1.3	07/26/2017	Added NIST-centric instructions, removed references to C# and Java example clients, as they are now redundant	J. Zachry Mathias

Introduction to DelVAX

DelVAX is a Web-based, database-driven immunization registry system currently implemented at multiple state and local government agencies in the US and internationally. It is designed to meet the standard requirements for tracking and administering immunizations in a public health setting. DelVAX also provides customization options and extensibility to serve the needs of sophisticated agencies. Providers may interact with the DelVAX system using a SOAP-based web service or HTTP POST.

Purpose

The purpose of this document is to define the DelVAX HL7 Web Service and to demonstrate proxies that consume the service using the HL7 message format and the SOAP/XML protocol. An example client is provided by NIST for testing purposes, called the NIST Immunization Test Suite.

Scope

This document defines and details the HL7 Service for versions **15.10+** of the DelVAX system. It provides samples and instructions for consuming the with the NIST Immunization Test Suite (NIST IZTS) client and describes additional contextual information around SOAP/XML and HL7.

Audience

This reference is intended for vendors who wish to integrate their systems with the DelVAX software.

Requirements

A modern web browser (Chrome, IE/Edge, Firefox) with current updates installed is required for interacting with the NIST IZTS.

References

CDC WSDL Implementation Resources

Information on the CDC WSDL is available at <https://www.cdc.gov/vaccines/programs/iis/technical-guidance/soap/services.html>. The WSDL defines the relationship between the sender and receiver for a Simple Object Access Protocol (SOAP) based web service and can be used to generate proxies that consume the service. For more on WSDLs, see [Appendix A: WSDL Basics](#).

NIST Immunization Test Suite (NIST IZTS)

A client application that consumes a given HL7 service is available from NIST here: <https://hl7v2-iz-r1.5-testing.nist.gov/iztool/#/home>. You can use this client to test the HL7 messages sent to and received from the DelVAX service, and to test the validity and syntactic accuracy of SOAP messages.

Examples

Additional examples of service clients are available through the following resources.

- [Creating and Accessing XML Web Service with C#/C++](#)

- [Example .Net Web Service Client](#)
- [Example Java Web Service Client](#)
- [CDC SOAP Web Services Overview](#)

HL7 Web Service Definition

Service Overview

The purpose of the HL7 Service is to send an HL7 message to the DeIVAX system. The service contains two methods: **submitSingleMessage** and **connectivityTest**. The **submitSingleMessage** method passes a username, password, optional facilityID, and HL7 message as a payload. The **connectivityTest** method is a secondary method that exists to confirm connectivity with the service. It submits a string parameter that is echoed back by the service when connectivity has been achieved.

Throughout this document, the service may be referred to as the HL7 Service, HL7 Web service, or HL7Service.

Client software may interface with the HL7 Service through a proxy that connects to endpoints on the DeIVAX system.

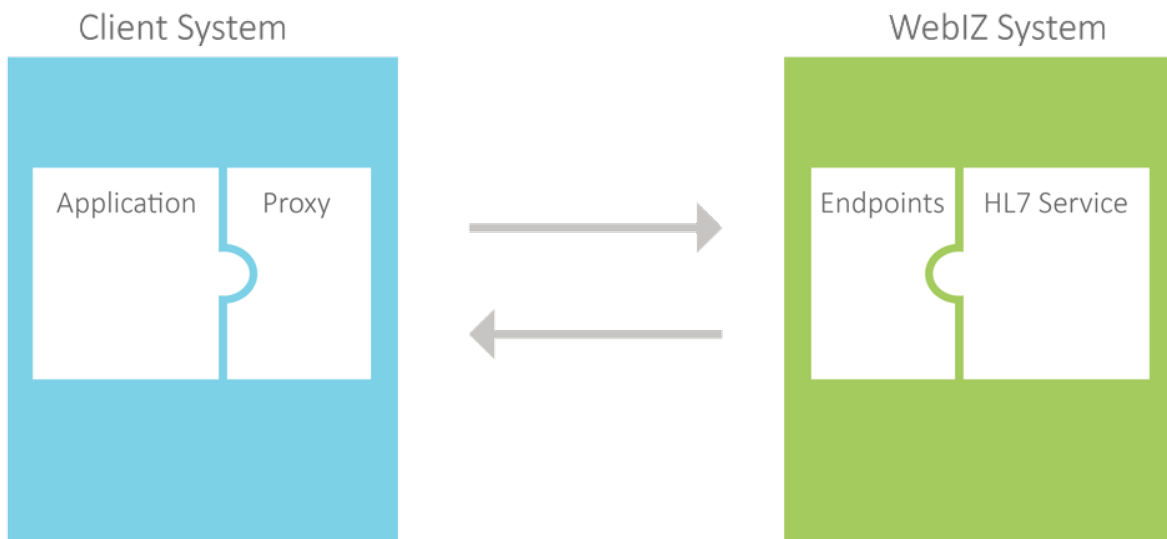


Figure 1 – Interfacing with the HL7 Service

Table of Inputs and Outputs

connectivityTest()

Parameter	Input/Output	Data type	Description
echoBack	Input	String	String to be echoed back by the test
Return	Output	String	Data sent back by the test

submitSingleMessage()

Parameter	Input/Output	Data type	Description
username	Input	String	IIS username
password	Input	String	IIS password
facilityID	Input (optional)	String	IIS Facility ID
hl7message	Input	String	HL7 version 2.3.1 or 2.5.1 message intended for IIS ¹
Return	Output	String	HL7 version 2.3.1 or 2.5.1 response from IIS ¹

Faults and Errors

SOAP faults are related to SOAP operations. They carry information about the error within a SOAP message.

There are four types of SOAP faults defined in the WSDL. All four faults are listed in the following table for convenience. However, the HL7 Service only implements the **UnknownFault_Message**.

Soap Faults

SOAP fault	Description
UnsupportedOperationFault_Message	Occurs if the client requests an operation that is not part of the service
SecurityFault_Message	Occurs if the authentication credentials in the submitSingleMessage method are invalid
MessageTooLargeFault_Message	Occurs if the HL7 message is too large
UnknownFault_Message	Occurs when a fault does not fit into the previous three categories

SOAP Fault Parameters

All SOAP faults contain the following parameters.

Parameter	Input/Output	Data type	Description
Code	Output	Integer	SOAP fault code number used by client software to identify the fault

¹ <http://www.cdc.gov/vaccines/programs/iis/technical-guidance/soap/wSDL.html>

Reason	Output	String	Human-readable explanation of the error that caused the fault
Detail	Output	String	Detailed explanation of the fault

Custom Error Codes

Errors other than those listed in the [Faults and Errors](#) section above may occur in the HL7 message body (including headers and the HL7 content). **See your local implementation guide for more information on message body (including headers and the HL7 content) errors.**

Consume the Service

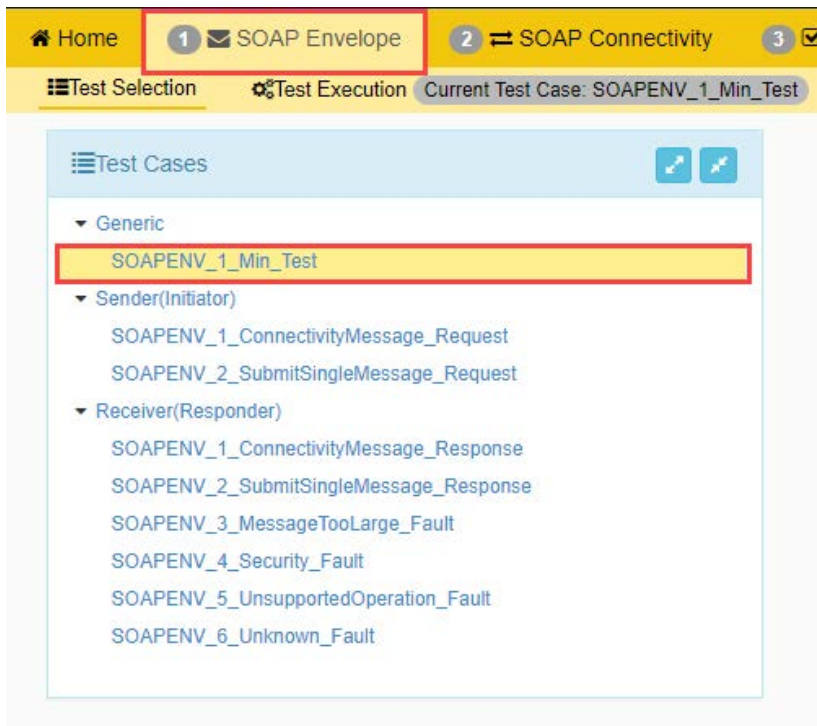
This section provides guides to consume the HL7 web service with the NIST IZTS using the test CDC endpoints publicly available on Envision’s test web server.

NIST Immunization Test Suite

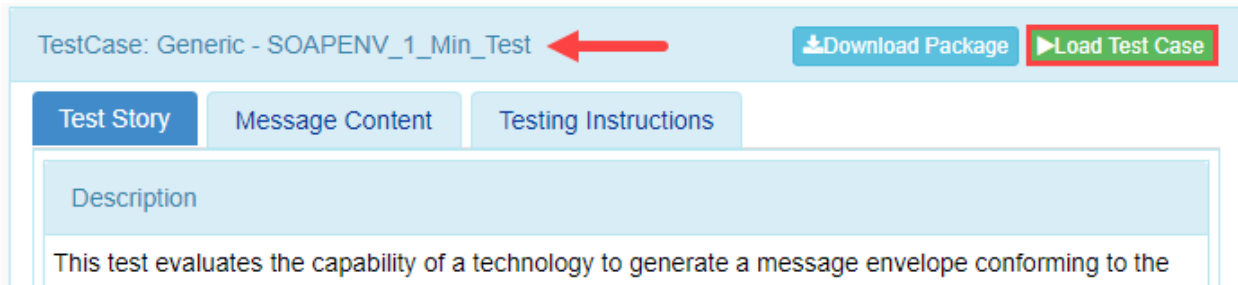
In a web browser, open <https://hl7v2-iz-r1.5-testing.nist.gov/iztool/#/home>. Once the page loads, you’ll be presented with various tools for validating and testing HL7 messages.

Validate SOAP formatting

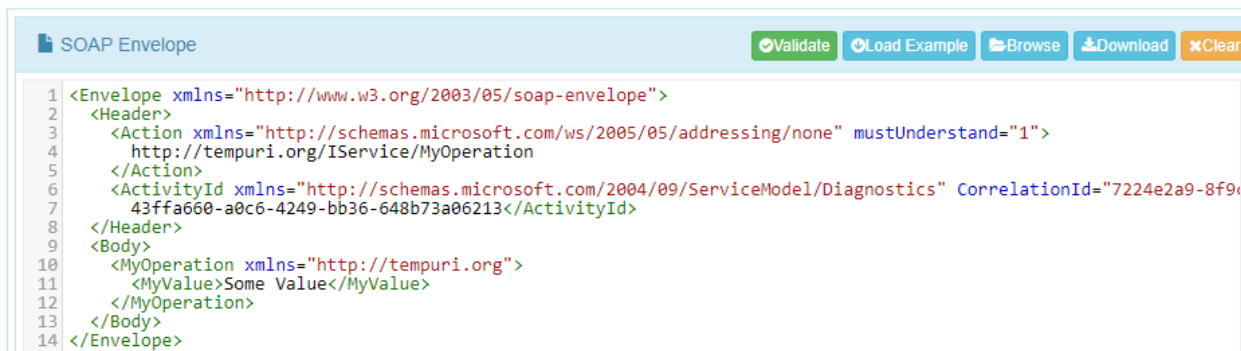
The tests in this area will validate any string against the SOAP 1.2 standard, and make sure that particular messages are formatted according to the CDC WSDL. For example, to test generic SOAP formatting, click the *SOAPENV_1_MIN_Test* test case:



Then, click the *Load Test Case* button in the upper-right corner of the screen:



From there, you can either load an example, or paste your own SOAP message in:



Finally, you can press the *Validate* button to test the formatting of the SOAP message.



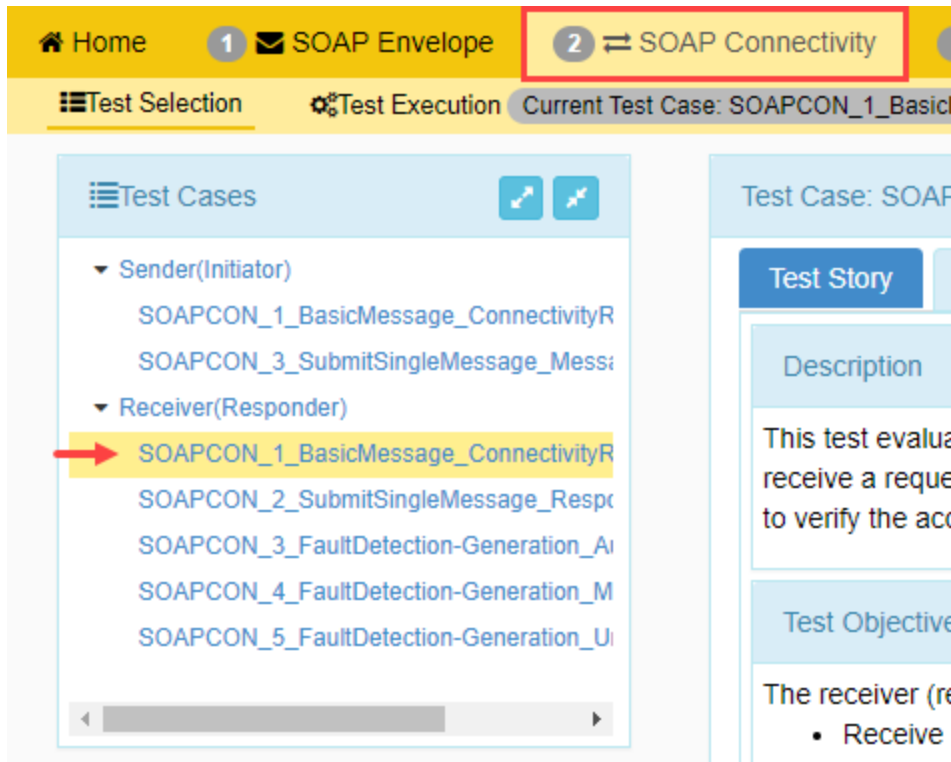
You will receive a description of the error if any part of the message is malformed.

Test SOAP connectivity

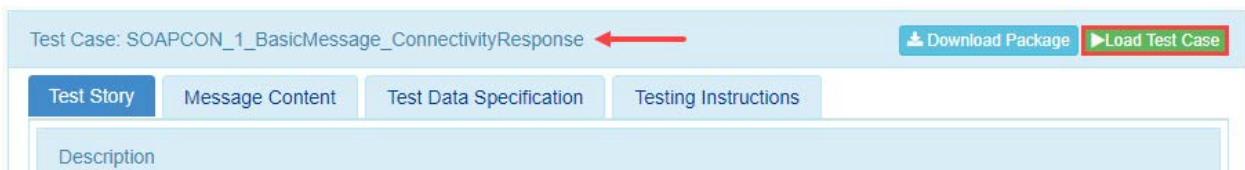
The tests in this area will help validate incoming and outgoing soap messages, as well as test specific endpoints.

Basic Connectivity Test

To test for basic connectivity of a given endpoint, click on the *SOAPCON_1_BasicMessage_ConnectivityResponse* test case:



Then, click the *Load Test Case* button in the upper right-hand corner of the window,



The basic echoBack message is preloaded for you in the outgoing SOAP envelope, and you cannot change it. Click on the *Configure* button to input the desired IIS endpoint. In this case, the Envision AART/Testing endpoint:

http://testing.envisiontechnology.com/HL7Engine_AART_Testing_20160425/CDC/V1/IISService.svc:

Receiver Configuration Panel

Endpoint

http://testing.envisiontechnology.com/HL7Engine_AART_Testing_20160425/CDC/V1/IIS

✓ Save ✕ Cancel

Click *Save* to save the endpoint destination for this test. Click the *Send* button to send the connectivity test to the endpoint specified. If the endpoint specified was a valid, publicly available endpoint, a response will be sent back to the NIST IZTS and will be displayed in the Incoming SOAP Envelope window:

The screenshot displays the Receiver Configuration Panel and the Incoming SOAP Envelope window. The configuration panel shows the endpoint URL and a 'Send' button. The Incoming SOAP Envelope window shows the received XML response and a validation error table.

```
<?xml version='1.0' encoding='UTF-8'><Envelope xmlns="http://www.w3.org/2003/05/soap-envelope"><Header/><Body><connectivityTestResponse xmlns="urn:cdc:iisb:2011"><return>Hello world!</return></connectivityTestResponse></Body></Envelope>
```

Validation Result

1 Errors 0 Warnings 0 Alerts 0 Affirmatives

Path	Description	Line #
/Envelope[1]/Body[1]/connectivityTestResponse[1]	No return element found	3

Any errors in the SOAP response or the CDC specifications for an echoBack will be displayed in the errors section. Note that at the time of this writing, it appears that the NIST IZTS might have a small bug, as it appears to be looking for the 'retun' element, rather than the proper 'return' element.

Submit Single Message Test

To test a message submittal to a given endpoint, click on the *SOAPCON_2_SubmitSingleMessage_Response* test case:



The test message is preloaded for you and you cannot change it. Click the *Configure* button, and input a valid user, password, and facility, and endpoint URL:

A screenshot of a "Receiver Configuration Panel" form. It has a light blue header with the title "Receiver Configuration Panel". Below the header are four sections, each with a label and a text input field: "Username" with a placeholder "Username", "Password" with a placeholder "Password", "FacilityID" with a placeholder "Facility Id", and "Endpoint" with the value "http://testing.envisiontechnology.com/HL7Engine_AART_Testing_20160425/CDC/V1/IIS". At the bottom right are two buttons: a blue "Save" button with a checkmark and an orange "Cancel" button with an 'x'.

Click *Save* to save the configuration for this test case, then click the *Send* button to send the test message to the specified endpoint. If the endpoint specified was a valid, publicly available endpoint, a response will be sent back to the NIST IZTS and will be displayed in the Incoming SOAP Envelope window:

← Incoming SOAP Envelope Validate Download

```

1 <s:Envelope xmlns:s="http://www.w3.org/2003/05/soap-envelope">
2   <s:Body>
3     <s:Fault>
4       <s:Code>
5         <s:Value>s:Sender</s:Value>
6       </s:Code>
7       <s:Reason>
8         <s:Text xml:lang="en-US">Invalid userName/password.
9
10 Original HL7 Response:
11 MSH|^~\&|WebIZ.16.9.20170728|EnvisionAlpha||X68|20170728104702-0006||ACK^V04^ACK|EnvisionAlpha201707284702
12   </s:Reason>
13   <s:Detail>
14     <SecurityFault xmlns="urn:cdc:iisb:2011" xmlns:i="http://www.w3.org/2001/XMLSchema-instance">
15       <Code>10</Code>
16       <Reason>Security</Reason>
17       <Detail>Invalid userName/password</Detail>
18     </SecurityFault>
19   </s:Detail>
20 </s:Fault>
21 </s:Body>

```

Validation Result

1 Errors 0 Warnings 0 Alerts 0 Affirmatives

Path	Description	Line #
/s:Envelope[1]/s:Body[1]	ERROR: CDC_WSDL1.0: The Body element must contain one 'submitSingleMessageResponse' element	-1

In this example, an incorrect username/password combination was provided, and the NIST IZTS displays the response from the endpoint and from the validation result.

HL7 Testing and Validation

Testing an Individual HL7 Message

The NIST IZTS is also capable of testing discreet HL7 messages, either in free of context or context-based. This section will focus on context-free testing. For this section, you'll need an HL7 message to test with. The message content window supports cut-and-paste. Additionally, if you have a message saved on your computer, you may click the *Browse* button, or you may also load a generic example message by clicking the *Load Example*

Click on the *HL7 Context-free* tab, select the profile group that your message belongs to, then paste into the *Message Content* window or select it from your filesystem by clicking the *Browse* button:

Home SOAP Envelope SOAP Connectivity HL7 Context-free HL7 Context-based Documentation About Hello Guest

Profile Groups: Profile Group 1

Profiles: Profile Group 1

- VXU-Z22
- ACK-Z23
- QBP-Z34
- QBP-Z44**
- RSP-Z31
- RSP-Z32
- RSP-Z33
- RSP-Z42

Profile: QBP-Z44

Validation Report Profile Viewer ValueSets

Message Tree

Message Content 4s Validate Load Example Browse Download Clear

After the message has been loaded, click the *Validate* button, and the NIST IZTS will analyze the message and report any errors it finds:

The screenshot displays the NIST IZTS validation tool interface. At the top, the profile is identified as 'QBP-Z44'. The main navigation bar includes 'Validation', 'Report', 'Profile Viewer', and 'ValueSets'. The 'Validation' tab is active, showing a 'Message Tree' on the left with three items: 'MSH[1]:Message Header R[1,1]', 'QPD[1]:Query Parameter Definition R[1,1]', and 'RCP[1]:Response Control Parameter R[1,1]'. The 'Message Content' area on the right shows the following message structure:

```
1 MSH|^~\&|EnvisionMonitor|AART|Registry|EnvisionAlpha|20170728191256-0600||QBP^Q11^QBP
2 QPD|Z44^Request Evaluated History and Forecast^CDCPHINVS|querytag||SIMPSON^BART^^^^^L
3 RCP|I|5^RD&records&HL70126|R^real-time^HL70394
4
```

Below the message content, there are buttons for 'Validate', 'Load Example', 'Browse', 'Download', and 'Clear'. The 'Message Validation Result' section shows a summary: 0 Errors, 10 Warnings, and 13 Alerts. A 'No errors found.' message is displayed in the results area.

Further Reading

For more information on how to use the NIST IZTS, or for further information on guidelines, etc. visit <https://hl7v2-iz-r1.5-testing.nist.gov/iztool/#/doc>.

Troubleshooting

The HL7 carriage return has been replaced by a line feed.

The HL7 standard requires that all lines end with a carriage return, whereas the XML standard used by SOAP requires that all end of line terminators be normalized to a line feed. Therefore, carriage returns in the HL7 message payload may be converted to line feeds during transmission. The HL7 service will accept either terminator, but the discrepancy may cause errors within the HL7 message body (including headers and the HL7 content) and response. **For more information, please see your local implementation guide.**

I'm having SOAP Header configuration issues.

SOAP Header information may differ between systems. Please verify the following parameters:

- Host: URL or Hostname here. You may need to include the port number.
- Content-Type: text/xml; charset=utf-8 | application/soap+xml; charset=utf-8
- Action/SOAPAction: URL of method here, e.g. http://tempuri.org/HL7Service

In SOAP 1.2, it is best practice to always pass in active headers and to define the SOAP action.

Obtaining a Certificate

Depending on system configuration, you may need to obtain a certificate. Check with your system administrator to learn if a certificate is required.

Appendix A: WSDL Basics

WSDL Basics

A Web Services Description Language (WSDL) document uses an XML structure to describe a Web service and its functionality. WSDL documents can be used to auto-generate proxies that consume a Web service.

WSDL documents define services as network endpoints (ports). A **port** is a single endpoint consisting of a binding and a network address.

Types are containers for data type definitions.

A **port type** defines an abstract set of operations supported by one or more endpoints.

Bindings consist of a protocol and data format specification for a particular port type.

A **message** is a typed definition of the data being communicated.

An **operation** is an abstract definition of an action supported by the service.²

Related Links and References

More information on WSDLs can be found through the following resources.

- [WSDL Specification](#)
- [W3Schools: XML WSDL](#)
- [CDC Transport Specification](#)

² <https://www.w3.org/TR/wsdl>

Appendix B: Simple Object Access Protocol

Definition

The Simple Object Access Protocol (SOAP) is a lightweight information exchange protocol that uses XML as a message structure. SOAP can be used for communication between systems regardless of programming language, and it can be used over any transport protocol (e.g. TCP, HTTP, SMTP).³

This reference focuses on SOAP version 1.2, which differs from SOAP 1.1 in certain cases of syntax and semantics. For more on the differences between the two versions, visit <https://www.w3.org/TR/soap12-part0/%2314697#L4697>.

In SOAP 1.2, the client is referred to as the sender, and the service is referred to as the receiver.



Figure 2 - SOAP sender and receiver

SOAP 1.2

Envelope

In SOAP 1.2, the envelope must be present with a local name of **Envelope** and the namespace **http://www.w3.org/2003/05/soap-envelope**. It may optionally include attribute information; however, **env:encodingStyle** can no longer appear on the **env:Envelope** element.

Header

The header element may be present with local name **Header**. If present, the header must include the namespace property and may have character, element, or attribute information as item children.

Although not required, it is best practice to include an active Header element and to define the SOAP action.

³ <https://www.w3.org/TR/soap12-part0/%2314697>

The following code shows a Header attribute example with an element identifier of **Transaction** and a value of **5**.

```
<env:Header xmlns:env="http://www.w3.org/2003/05/soap-envelope" >  
  <t:Transaction xmlns:t="http://example.org/2001/06/tx" env:mustUnderstand="true" >  
    5  
  </t:Transaction>  
</env:Header>
```

Body

The Body element must be present in SOAP 1.2 with the local name **Body**. It may have character, element, or attribute information as item children. SOAP 1.2 does not permit any element after the body.

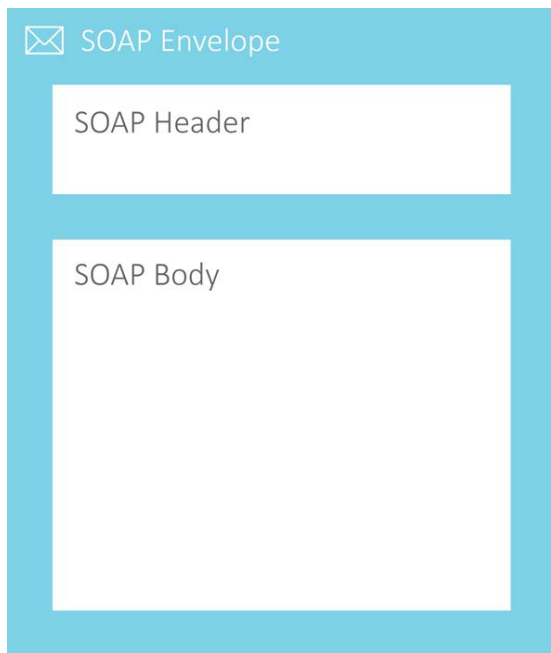


Figure 3 - SOAP envelope structure

SOAP Faults

SOAP faults are returned as HTTP 500 errors and can occur in the following instances:

- The SOAP envelope is not valid, (e.g. parse error, missing elements)
 - This issue is the most common cause of HTTP 500 errors. Verify that the SOAP header and envelope are properly formatted. See above example.
- Out of memory conditions during parsing.
- SQL Server login failures.
- Unsupported SOAP operation, unknown operation or stored procedure specified.
- Invalid number of parameters for the specified operation.

- Some HL7 message submission operations may require an HL7 Facility ID as a parameter, while other systems may not.

The following code sample demonstrates a SOAP 1.2 fault.

```
<env:Envelope xmlns:env="http://www.w3.org/2003/05/soap-envelope"
  xmlns:m="http://www.example.org/timeout"
  xmlns:xml="http://www.w3.org/XML/1998/namespace">
  <env:Body>
    <env:Fault>
      <env:Code>
        <env:Value>env:Sender</env:Value>
        <env:Subcode>
          <env:Value>m:MessageTimeout</env:Value>
        </env:Subcode>
      </env:Code>
      <env:Reason>
        <env:Text xml:lang="en">Sender Timeout</env:Text >
      </env:Reason>
      <env:Detail>
        <m:MaxTime>P5M</m:MaxTime>
      </env:Detail>
    </env:Fault>
  </env:Body>
</env:Envelope>
```

Related Links and References

More information on SOAP can be found through the following resources.

- [Understanding SOAP](#)
- [SOAP 1.1 Spec Doc](#)
- [SOAP 1.2 Spec Doc](#)
- [Namespaces in XML](#)
- [SOAP Fault Message Structure](#)

Appendix C: HL7 Overview and Code Samples

Overview

The Health Level Seven (HL7) standards provide for the exchange, integration, sharing, and retrieval of electronic health information between healthcare systems. These standards define how information is packaged and communicated from one party to another. They set the language, structure and data types required for integration between different systems on the application layer.⁴

HL7 Version 2.x

HL7 version 2.x (Pipehat) use non-XML encoding with single character delimiters to separate composites (fields), sub-composites (components), and sub-sub-composites (sub-components). All HL7 2.x versions are backwards compatible.

HL7 2.x messages are broken into segments that contain specific types or categories of data. All 2.x messages begin with **MSH**, the message header segment where the message type is declared. The message type determines the remaining segments.

HL7 Message Example

The following code sample demonstrates an HL7 2.5.1 message containing a search for the record of Bart Simpson, DOB 01/01/1999. It is a Query by Parameter (QBP) message.

```
MSH|^~\&|TestApplication|DE9999|De1VAX|DE0000|20060201||QBP^Q11^QBP_Q11|DE99993885400000232|T|2.5.1||NE|AL|||Z34^CDCPHINVS
QPD|Z34^Request Immunization History^CDCPHINVS||SIMPSON^BART^^^^^L||19990101||
RCP|I|5^RD^HL70126|R^real-time^HL70394
CDCPHINVS
```

HL7 Message Encoding

Depending on system configuration, an HL7 message may need to be encrypted. The HL7 standard requires that all lines end with a carriage return (ASCII 13, \r, or #xD). The XML standard used by SOAP requires that lines end with a line feed (ASCII 10, \n, or #xA), which can cause discrepancies. For more information, see the [Troubleshooting](#) guide.

SOAP Request and Response with HL7 Payload

The following code samples demonstrate a SOAP request and response with HL7 messages as the payload.

⁴ <http://www.hl7.org/>

SOAP Request with example HL7 Message and optional facility ID parameter

```
<soap:Envelope xmlns:soap="http://www.w3.org/2003/05/soap-envelope" xmlns:urn="urn:cdc:iisb:2011"
>
  <soap:Header/>
  <soap:Body>
    <urn:submitSingleMessage>
      <!--Optional:-->
      <urn:username>MYUSER</urn:username>
      <!--Optional:-->
      <urn:password>MYPW</urn:password>
      <!--Optional:-->
      <urn:facilityID>MYFACILITY</urn:facilityID>
      <urn:hl7Message>MSH|^~\&|PWx|MYFACILITY|MYORG|MYORG|20140101145954||VXU^V04^VXU_V04|
Q851945368T67857795|P|2.5.1||AL|AL PID|&lt;PHI PHI PHI&gt;
PID|1||84055037^^^MR||TEST^VERIFIED||20090222|M||^ ^^ ^US^|||||||||||||||||N
IN1|1|||||||||||||||||||||20141105|||||||||||||||||
IN2|1|
ORC|RE||2060759^HMS|||||
RXA|0|1|20140101144100|20140101144100|62^HPV, quadrivalent^CVX|0.5|mL^Milliliter^ISO+||00^NEW IMM
UNIZATION RECORD^NIP001|^Lastname^Firstname|||j011272|20160421|MSD^Merck and Co., Inc.^MVX||CP
||20140101145952
RXR|IM^im^HL70162|RA^right arm^HL70163
OBX|1|CE|64994-7^eligibility category^LN|1|V02^Medicaid^HL70064^V02^Medicaid^ORG_IMM_RT_251_SRC^^
^Medicaid|||||F||20140101||VXC40^Eligibility captured at the Immunization level^CDCPHINVS
</urn:hl7Message>
    </urn:submitSingleMessage>
  </soap:Body>
</soap:Envelope>
```

SOAP Request with example HL7 Message and Response (HL7 2.4)

```
<soap:Envelope
xmlns:soap="http://www.w3.org/2003/05/soap-envelope" xmlns:urn="urn:cdc:iisb:2011">
  <soap:Header/>
  <soap:Body>
    <urn:submitSingleMessage>
      <urn:username>MYUSER</urn:username>
      <urn:password>MYPW </urn:password>
      <urn:facilityID>MYFACILITY</urn:facilityID>
      <urn:hl7Message>MSH|^~\&|MYORG|||20100115104114||VXU^
V04|20100115MP091688|P|2.4|||USA|ENG
PID|1||11020783^^^MR||Lastname^Firstname||19690120|M||ADDR LINE 1^DENVER^CO^ZIP ||PHONE|||||
|NH|^ ^^MN^^| || || ||
```

```
RXA|0|1|20100115|20101015|^^^90715^TDAP^CPT|1.0
mL|||00|^Last^First|||AHABB140AA|PFR^Pfizer,
Inc.^MVX||CP||20100115104114
RXR|IM^Intramuscular^HL70162|LD^Left Deltoid^HL70163
</urn:submitSingleMessage>
</soap:Body>
</soap:Envelope>
```

Successful Response(ACK) (HL7 2.4)

```
<S:Envelope xmlns:S="http://www.w3.org/2003/05/soap-envelope">
<S:Body>
<submitSingleMessageResponse xmlns="urn:cdc:iisb:2011">
<return>MSH|^~\&|MYORG
5.1.17^^|MYORG^^||20130117||ACK^|20100115MP091688|P^|2.4^^||ER
MSA|AA|20100115MP091688||0||0^Message Accepted^HL70357^^^</return>
</submitSingleMessageResponse>
</S:Body>
</S:Envelope>
```