



Nationwide Health Information Network (NHIN)

Web Services Registry
Web Service Interface Specification

V 2.0

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1 Preface

1.1 Introduction

The Nationwide Health Information Network (NHIN) Web Service Interface specifications define the core set of standard services to be implemented by each node on the NHIN network in order exchange interoperable health information over the Internet. Health Information Organizations (HIOs) which act as nodes on the NHIN are termed NHIOs. These functional services provide discovery and information exchange capabilities and rest upon a foundational set of messaging, security, and privacy services.

This document presents the NHIN Web Services Registry Web Service Interface Specification. This specification enables nodes to discover each other through interactions with the NHIN Web Services Registry, which lists NHIN nodes, the NHIN web services supported by each node, and how to reach those service end points.

1.2 Intended Audience

The primary audience for this NHIN Specification is the individuals responsible for implementing software solutions that will interact and utilize the NHIN Web Services Registry at Health Information Organizations (HIOs) who are, or seek to be, nodes on the NHIN network. This specification document is intended to provide an understanding of the context in which the web service interface is meant to be used, the behavior of the interface, the Web Services Description Language (WSDLs) used to define the service, and any Extensible Markup Language (XML) schemas used to define the content.

1.3 Business Needs Supported by this Specification

Example business uses of the NHIN Web Services Registry are described below:

1. *Get all NHIO data*

In this use case, an NHIO has been approved for participation within the NHIN and chooses to retrieve all information available in the Web Services Registry. It requests a list of all other NHIO's currently registered, and all the web services they support. This new NHIO will maintain its local cache of this information for use in responding to local requests to share and retrieve data. This NHIO will need to be notified when new NHIO's are added to the Web Services Registry or when an existing NHIO entry is changed. To do this the new NHIO will provide a subscription to the Web Services Registry requesting notification of updates.

It is envisioned that NHIOs will query a registry to obtain connection information for another NHIO, but then cache that information locally for subsequent communication with the other NHIOs, in order to improve performance and minimize network bandwidth. However, the means and frequency of local caching of this information is within the discretion of individual NHIOs and outside the scope of this specification. This specification does define a Subscription interface that NHIOs can use to be notified when changes are made to the registry which should cause them to flush their local cache and then re-query the Registry to obtain updated information.

2. *Get data about NHIO's by state*

In this use case, an NHIO has been approved for participation within the NHIN. Given the scope of this NHIO it does not request all NHIO's registered, but instead desires a subset of all NHIO's in a particular region or state. The new NHIO queries the Web Services Registry and specifies a list of states to restrict the results.

A similar use case comes up when a patient requests that records from an NHIO in a particular state be retrieved and the local NHIO has not previously searched for NHIO's in that state. In both these cases



the requesting NHIO will want to subscribe for updates to its locally cached information, or new NHIO entries matching its original query.

3. *Getting data by homeCommunityId*

There are several potential use cases which would require the ability to query the Web Services Registry by a specific homeCommunityId to retrieve the service connection information for the corresponding NHIO. For instance, the patient may have a printed paper, generated by an NHIO, which includes a homeCommunityId, perhaps even in a form that could be scanned. Another case is a notification may have been received which identifies the homeCommunityId which contains the record of interest and the NHIO receiving the notification may not have previously retrieved the service connection information for that NHIO. For these, and potentially others, the NHIO submits a query to the Web Services Registry specifying the homeCommunityId and receives the details about that community that have been saved in the Web Services Registry.

1.4 Referenced Documents and Standards

The following documents and standards were referenced during the development of this specification. Deviations from or constraints upon these standards are identified below.

1) **Org/SDO name:** OASIS

Reference # / Spec Name: Universal Discovery and Description Interface (UDDI)

Version #: v3.0.2

Underlying Specs:

NHIN Deviations or Constraints: None

Link: <http://www.oasis-open.org/committees/uddi-spec/doc/spec/v3/uddi-v3.0.2-20041019.htm>

1.5 Relationship to Other NHIN Specifications

This specification is related to other NHIN specifications as described below.

The Web Services Registry specification addresses underlying infrastructure requirements for connection management among NHIOs. It, along with the Certificate Authority is one of the main components of the NHIN Operational Infrastructure.

- **Messaging Platform** – specifies a base set of messaging standards and web service protocols which must be implemented by each NHIN node and applies to all transactions. All NHIN inter-nodal messages are SOAP messages over HTTP using web services, must be encrypted and digitally signed. This specification supports the Messaging Platform.
- **Authorization Framework** – defines the exchange of metadata used to characterize each NHIN request. The purpose of that exchange is to provide the responder with the information needed to make an authorization decision for the requested function. Each initiating message must convey information regarding end user attributes and authentication using SAML 2.0 assertions.

Together, the Messaging Platform and the Authorization Framework define the foundational messaging, security and privacy mechanisms for the NHIN.



2 Registry Description

2.1 Definition

The NHIN Web Services Registry Interface allows NHIOs to communicate with the NHIN Web Services Registry in order to locate and utilize the appropriate services offered by other NHIOs in a controlled, secure manner.

The NHIN Web Services Registry supports privacy and trust by restricting access only to NHIOs. The registry facilitates interoperability, by cataloging and advertising in real-time which services are supported by each organization.

2.2 Design Principles and Assumptions

The following assumptions or design principles underlie this specification:

- The NHIN Web Services Registry utilizes the OASIS UDDI v 3.0.2 specification for defining the capabilities of the registry
- The NHIN Web Services Registry supports a federated replication model allowing other organizations to operate their own NHIN Web Services Registry implementation.
- As per the OASIS UDDI v 3.0.2 specification all exchanges are via standard web services interfaces.
- All communications to the NHIN UDDI Web Services Registry is done over 2-way SSL implemented with Public Key certificates.

2.3 Triggers

The NHIN Web Services Registry Interface is invoked whenever a NHIO wishes to locate information about another NHIO, including its service end point and supported services. Scenarios describing when the Web Services Registry might be used are described in section 1.3 “Business Needs”.

2.4 Transaction Standard

This document focuses on the implementation and use of a NHIN Web Services Registry based on the OASIS specification for Universal Description and Discovery Interface (UDDI) registry version 3.0.2. In particular this specification describes the following:

- Inquiry and Subscription Interfaces and Capabilities
- The Data Model to be used by to store registry entries
- The hierarchical replication strategy to be used by the NHIN for services registries.

2.5 Technical Pre-conditions

The following technical pre-conditions exist for this interface specification:

- Prior to having their services information entered into the NHIN Web Services Registry, candidate NHIO’s must complete an on-boarding process specified by the NHIN program office and the NHIN Coordinating Committee. This process includes:
 - Ensuring the organization is a valid organization and its sole intention is in line with the purposes of the NHIN
 - Ensuring the organization has appropriate policies and governance agreements to protect the data it is given
 - Ensuring the organization is able to reliably and securely provide the minimum NHIN services



Only through this bootstrapping process can a candidate HIO have its information saved in the Web Services Registry. Thus the users of the Web Services Registry can be assured that organizations listed within it are in fact validated NHIOs.

2.6 Technical Post-conditions

The following technical post-conditions will result after the execution of this interface specification:

- An instance of the NHIN Web Services Registry will be established with the required information meta-models and an implementation of the interfaces defined in this specification.

3 Registry Definition

3.1 Supported NHIN Web Services Registry Interfaces

3.1.1 Inquiry API (Client discovery API)

The UDDI V3.0.2 inquiry APIs (http://uddi.org/pubs/uddi-v3.00-published-20020719.htm#_Toc42047277) provide a simple and complete set of programming interfaces, these interfaces can be used to:

- Search the UDDI registry to locate registry entries pertaining to the given search criteria
- Drill down queries to retrieve further details of a given registry entry.
- Add qualifiers to queries based on information such as unique key values, categories, identifiers, etc.

Note that for the NHIN Web Services Registry the APIs are invoked over a SSL transport layer and the authentication/authorization mechanism is based on PKI/X509.

3.1.2 Subscription API

Subscription provides clients, known as subscribers, with the ability to register their interest in receiving information concerning changes made in a UDDI registry. Any UDDI registry user can subscribe to a set of UDDI entities and monitor their creation, modification and deletion. The subscription is defined using standard UDDI get or find API calls. The UDDI registry notifies the user whenever any entity that matches the subscription query changes even if the change causes the entity to not match the query anymore. It also notifies about entities that were changed in a way that after the change they match the subscription query.

Subscription allows subscribers to "monitor" a particular subset of data within a registry. Two patterns are defined. UDDI nodes MAY support either or both: The notification might be synchronous or asynchronous. Synchronous notification occurs when the interested party explicitly asks for all changes that have happened since the last notification. Asynchronous notifications are run periodically in a configurable interval and the interested party is notified whenever the matched entity is created, modified, or deleted. In case of an NHIO, it is recommended to use asynchronous notification from a performance point of view.

The duration, or life of a subscription is also a matter of node policy, but subscribers can renew existing subscriptions periodically instead of having to create new ones. Subscribers may also create multiple subscriptions. Each subscription request is treated independently.

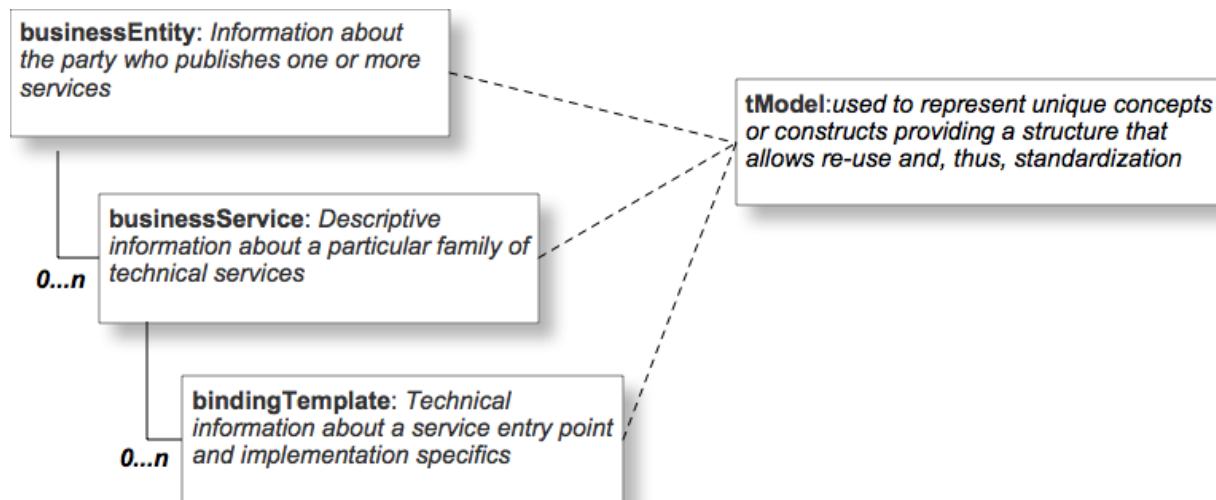
NHIO gateways will implement an HTTP/SOAP based web services as subscription listeners. The UDDI registry will send a notification to this web service endpoint.



Please see the UDDI specification on Inter-Node Operations (http://uddi.org/pubs/uddi-v3.00-published-20020719.htm#_Toc42047327) for more details.

3.2 NHIN Data Model

The UDDI data model is composed of four primary "top-level" entities each identified by a unique identifier (UUID).



These four elements provide the meta-model used to describe the NHIO entities and services they offer on the NHIN within the NHIN Web Services Registry. The tables below describe each of the data items used to describe a NHIO and their services. Note that **bold** elements represent containers for one or more sub-elements such as identifier or categorization elements. Items marked <<item>> represent information that is provided by the NHIO. All other information is standardized within the NHIN Web Services Registry and will be managed by the appropriate administration personnel.

Entities	Data Item	Type/Format/Value	Notes
<i>businessEntity</i>	businessKey	uddi:<nhiename>:<nhie homeCommunityID>	nhiename is based on the businessEntity name provided by the NHIO and is intended to provide human readable to the keys. more than one name permitted
	name	<<String>>	
	description	<<String>>	
	discoveryURL	<<valid URI>>	a link to additional descriptive information about a provider (ex homepage)
	identifierBag		Unique identifiers for a Business Entity
	tModelKey keyValue	uddi:nhin:nhie:homecommunityid <<nhie homeCommunityID>>	
categoryBag		Categories for a Business Entity	



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	tModelKey keyValue	uddi:nhin:nhie:publickey	String of the NHIO public key
	tModelKey keyValue	uddi:uddi.org:ubr:categorization:iso3166 <<State Name/"US-XX">>	more than one permitted
	contacts		more than one contact permitted
	personName	<<String>>	
	phone	<<xxx-xxx-xxxx>>	
	email	<<valid email address>>	
	address	<<String (multi-line)>>	
businessService	serviceKey	uddi:<nhiename>:<uniformservicename>	
	name	String	
	description	String	
	categoryBag		Categories for Business Service
	tModelKey keyValue	uddi:nhin.standard-servicenames Value Set of service names	
bindingTemplate	accessPoint	<<valid URI>>	Endpoint for the web service
	categoryBag		
	tModelKey keyValue	uddi:nhin:versionofservice <<#. #>>	The validated version of the service provided

3.2.1 NHIN Custom tModels

Below are the custom tModels used in the NHIN data model to provide standardized values for certain data items.

tModel	keyNames	keyValues
uddi:nhin:standard-servicenames	PatientDiscovery QueryForDocuments RetrieveDocuments	PatientDiscovery QueryForDocuments RetrieveDocuments



3.2.2 Sample NHIN Web Services Registry Entry

```
<businessEntity businessKey="uddi:testnhieonode:urn:oid:2.16.840.1.113883.3.166.4">
  <name xml:lang="en">Test NHIE One</name>
  <name xml:lang="en">TestNHIE_1</name>
  <contacts>
    <contact useType="">
      <personName xml:lang="en">John Doe</personName>
      <phone>111-111-1111</phone>
      <email>john.doe@testnhieone.com</email>
      <address xml:lang="en" useType="" sortCode="">
        <addressLine>112 W. Main Street</addressLine>
        <addressLine>Somewhere, AL 21111</addressLine>
      </address>
    </contact>
  </contacts>
  <businessServices>
    <businessService serviceKey="uddi:testnhieonode:PatientDiscovery"
      businessKey="uddi:testnhieonode:urn:oid:2.16.840.1.113883.3.166.4">
      <name xml:lang="en">PatientDiscovery</name>
      <bindingTemplates>
        <bindingTemplate bindingKey="uddi:00f27b20-c31e-11de-a851-5adf7990a84c"
          serviceKey="uddi:testnhieonode:PatientDiscovery">
          <accessPoint useType="endPoint">https://testonenhie.com/PatientDiscoveryRespondingGatewayService</accessPoint>
          <categoryBag>
            <keyedReference tModelKey="uddi:nhin:versionofservice" keyName="" keyValue="2.0"/>
          </categoryBag>
        </bindingTemplate>
      </bindingTemplates>
    </businessService>
  </businessServices>
  <identifierBag>
    <keyedReference tModelKey="uddi:nhin:nhie:homecommunityid" keyName="" keyValue="urn:oid:2.16.840.1.113883.3.166.4"/>
  </identifierBag>
  <categoryBag>
    <keyedReference tModelKey="uddi:nhin:nhie:publickey" keyName="" keyValue="305C300D06092A864886F70D01010500034B003048024100D1565D698FA304 19CED840497E346F00F3F451D6C43315 850B13C639AE25EEE009FD9A574251127A2F9A14A047ADBB2DC39253D2858E8F 4A0BC6DDF7D09DEE7F0203010001"/>
    <keyedReference tModelKey="uddi:uddi.org:ubr:categorization:iso3166" keyName="Alabama" keyValue="US-AL"/>
  </categoryBag>
</businessEntity>
```

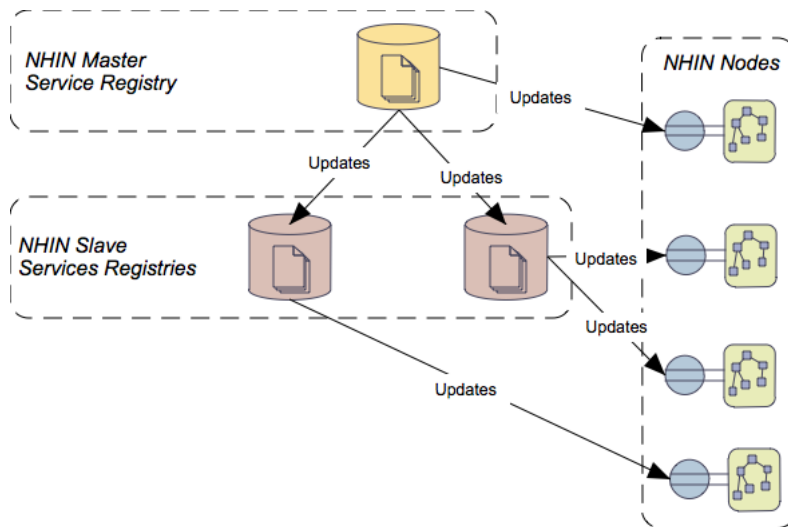
3.3 UDDI Replication

3.3.1.1 Replication Concepts

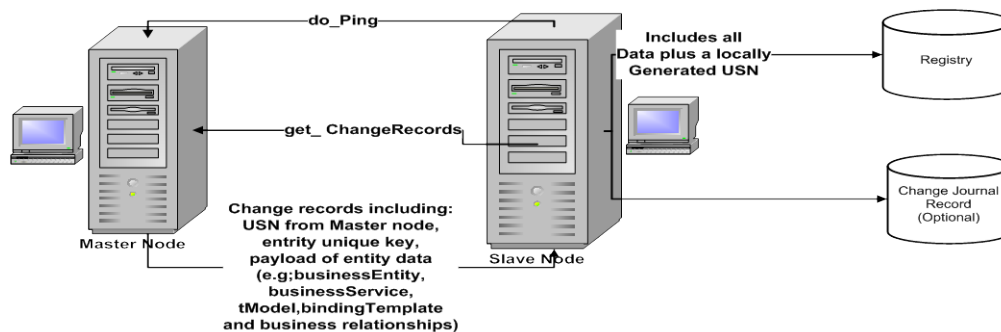
The NHIN Web Services Registry is designed to be highly scalable and redundant based on a Master/Slave replication model that is part of the UDDI v3 specifications. This model is similar to that used by the Domain Name Services (DNS) infrastructure that is part of the backbone of the Internet. All new entries or updates first occur in the master NHIN Web Services Registry. This is then propagated to all slave registries. NHIE Nodes can query whichever registry is most appropriate and likewise can subscribe to updates to those registries. The NHIN Web Services Registry architecture therefore allows updates to not only flow to other registries but to the NHIN nodes as well. This can be seen in the figure below.



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3.3.1.2 Replication Process



Following are the steps which occur during replication process:

- **Step 1** – The slave node does a “ping” to the master nodes to see if it is available.
- **Step 2**- If the master node is available then it makes a call to the master node to request information on any changed records.
- **Step 3** - Then the master node will send the changed records to the requesting node which incorporates them into it's own repository.

See the UDDI v3 replication specification (http://uddi.org/pubs/uddi-v3.00-published-20020719.htm#_Toc42047358) for more detailed information.

3.4 NHIO Web Services Registry Security Model:

NHIN will use Public Key Infrastructure (PKI) technologies to encrypt messages sent between participating entities. Digital certificates are issued and managed using a managed PKI infrastructure (mPKI) service which ensures that all certificates used on the NHIN contain a common intermediary identifier. These digital certificates are only given to NHIN participating organizations after they have completed the on-boarding processes required by the NHIN governance bodies. This ensures that only NHIN nodes can encrypt/decrypt messages sent over the network. As with all other communication between NHIN nodes, communication with the NHIN Web Services Registry depends on the exchange of these issued digital keys. This includes all inquiry, subscription and replications exchanges.