P1 P2 P3 P4 P5 P6 P7 P8

T1 T2 T3 T4 T5 T6 M1 M2

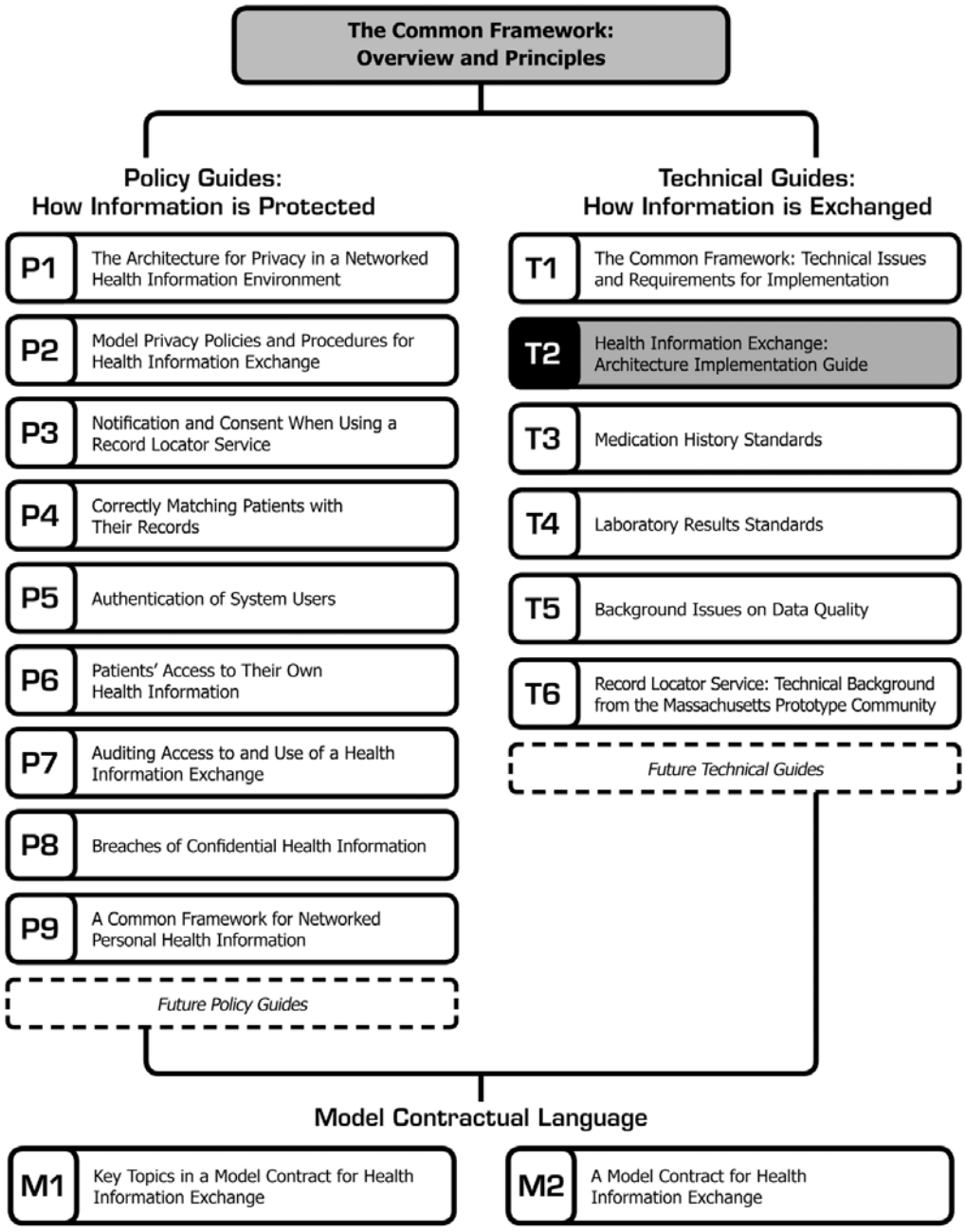
Health Information Exchange:

Architecture Implementation Guide

THE CONNECTING FOR HEALTH COMMON FRAMEWORK

Health Information Exchange: Architecture Implementation Guide

The document you are reading is part of *The **Connecting for Health** Common Framework,* which is available in full and in its most current version at: http://www.connectingforhealth.org/. The Common Framework will be revised and expanded over time. As of October 2006, the Common Framework included the following published components:



Health Information Exchange: Architecture Implementation Guide*

1 Purpose of This Document

This document specifies a technical architecture designed by **Connecting for Health** for communication of protected health information between sub-network organizations (SNOs) on a Nationwide Health Information Network (NHIN). The architecture and messaging standards discussed here make up part of **Connecting for Health's** Common Framework, a proposed collection of technical standards and policies designed to make it possible to build a NHIN that is effective and achievable in incremental steps, and supports the required discovery and transport of patient records between authorized parties while protecting those records from unauthorized access or use.

The technical goal of the Common Framework is to define a minimal set of commonly adhered to standards and policies that allow for the SNO-based implementation of health information networks that are nationally interoperable. In the **Connecting for Health** view, the National Health Information Network is an interoperable network of networks, achieved through incremental creation of Common Framework-compliant SNOs.

In addition to the messaging standards, it provides information to support the implementation of Record Locator Service (RLS) and Inter-SNO Bridge (ISB) communication services, including messaging protocols, standards, authentication, and security for the transactions. The RLS is a community Master Patient Index (MPI) that stores only the location of patient records, plus enough demographic details to match a query with the appropriate records, and is designed to let entities within a SNO locate one another's records. The ISB is the interface for communications between entities in different SNOs. The RLS and the ISB have been designed to be platform-neutral. Although the RLS will be, in practice, databases accessible through secure web servers, the definition of a Common Framework-compliant RLS or ISB has to do with interfaces, messages, and behaviors, not with any particular technology.

The NHIN assumes the use of encrypted communications over the internet among participants, and models all interactions as Web Services conversations in SOAP. (This document assumes a familiarity with the Web standards SSL, XML 1.0, and SOAP 1.1, as well as the clinical standard HL7 2.4; we do not reproduce the documentation for those standards here.) Modeling the NHIN transactions in SOAP provides a degree of flexibility to support various messaging types within a single framework. The messages described here also support exchange of some types of non-protected information. Due to the generic nature of the NHIN query message structure, we anticipate extending the architecture to support additional types of communications required by a NHIN, from additional forms of clinical information to administrative messages.

* **Connecting for Health** thanks Clay Shirky, Chair, Technical Subcommittee, and Adjunct Professor, New York University Graduate Interactive Telecommunications Program; Vinod Muralidhar and John Calladine, Computer Sciences Corporation (CSC); Lonnie Blevins and Clement McDonald, MD, Regenstrief Institute for Healthcare; and Don Grodecki, Browsersoft, Inc., for documenting this implementation guide.

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2 Interaction Overview

Technical interactions between entities in the NHIN involve transactions between software clients (typically an EHR, secure browser, or proxy server, and called NHIN clients throughout) and either the RLS or the ISB.

2.1 RLS Use Cases

The Record Locator Service (RLS) is essentially a master patient index within a SNO that refers to record locations at more than one institution within that SNO. It has two required interactions with the participating entities in a SNO: it accepts updates to patient demographics and record locations; and it accepts queries for the location of patient records and returns record locations when it finds matches.

Accepts Updates to Patient Record Location

The RLS accepts updates to patient record locations held by participating sources of clinical data. These updates contain identifying details of the patient, the identifier of the source system, and a medical record number (MRN) unique key for the location of that record within the source system. In practice, this will often be expressed as a Uniform Record Identifier (URI), but may include other formats, such as fax numbers as contact details for those queries that can't be made over the Web.

The intent of these updates is to provide the raw information necessary to accept demographic queries for patient records, and to be able to return a unique pointer to the data for patient records that do match. The four possible modes of behavior that a clinical data source may request of the RLS are: add a new record number and attendant identifying data; update an existing record; remove a record; and merge or unmerge two records (though merge is actually a composite function, acting as an atomic update+remove function acting on two records at once.) The updates will generally be in batch mode, and may in some cases even be loaded from physical media. While a rapid cycle for updating pointers to materials held in the various source systems is desirable, the loading of the data and the return of the confirmation can be asynchronous.

Because of the variability of delivery of data sources from participating entities and of the patient databases underlying any given RLS, the methods for loading records may vary SNO by SNO, and are not specified in this guide.

Accepts Queries and Returns Record Locations

The RLS accepts queries from authorized entities looking for patient records. The queries will include demographic details of the patient whose records are being sought, and, optionally, an institution ID and MRN.

The RLS must have a method for determining which patients, if any, match the demographics presented, and must guarantee that the chance of a false positive falls below the target threshold for incidental disclosures. This matching algorithm is not part of the RLS itself, but is an internal service the RLS relies on, and can vary between SNOs, so long as whatever matching algorithm is used produces sufficient accuracy of matches.

The RLS should return the locations of the records that match the submitted demographics and are above the target threshold for accuracy of match. These records will be ideally expressed as a URL that fuses the institution location with the MRN. However, other methods for requesting record information, such as phone or fax numbers of those institutions operating without an electronic health record (EHR) system may be returned when the location can't be expressed as a URL.

Patient queries will generally be in synchronous request-response mode, and should be optimized to operate as near real time as possible. It is possible that a clinic, for example, will want to submit batch or asynchronous individual queries to obtain record locations for the following day's visits, but the querying capability should be designed and optimized for real-time and synchronous requests as the principal interaction. Additionally, the SNO can allow or provide for the use of proxy servers to aggregate the clinical results on behalf of the requesting client. For a more complete description of questions of synchrony and aggregation, see “The Common Framework: Technical Issues and Requirements for Implementation document.”

The interaction between the RLS, the clinical data sources, and the requestor of data locations can be seen in the following diagram. Note that the requesting and return of the actual records does not involve the RLS directly, but is listed here for conceptual completeness:

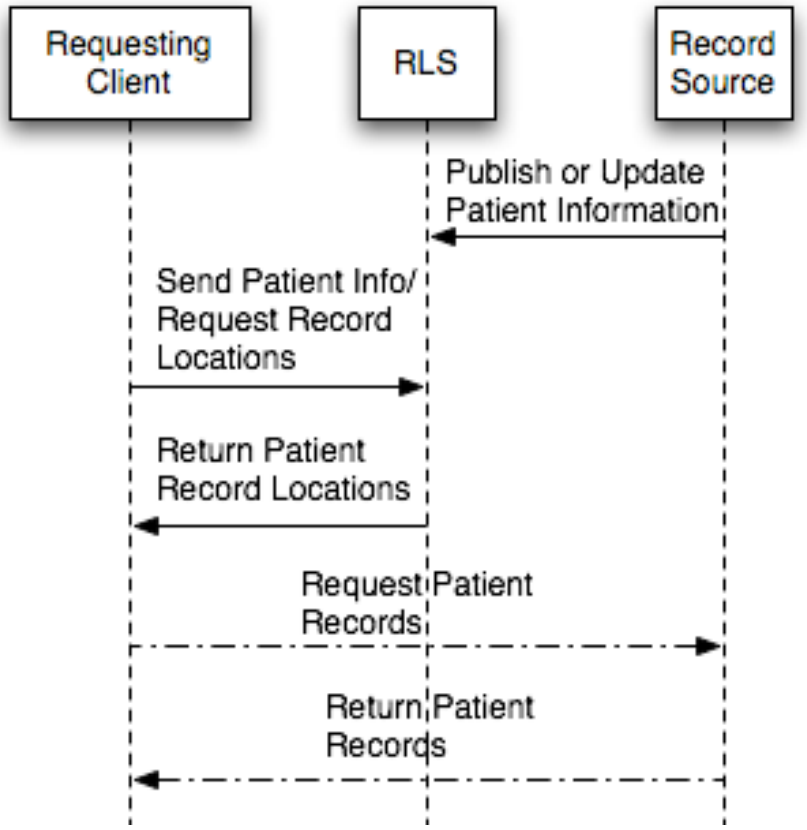

Figure 1 RLS Interactions

2.2 ISB Use Cases

The Inter-SNO Bridge (ISB) is an interface to a particular SNO, for queries originating from outside the SNO (either from another SNO, or from unaffiliated entities.) It exists to simplify conversations between remote entities, so each institution is not required to know the names of all other institutions (which would create significant problems of scale.) Instead, by routing NHIN traffic between SNOs, and by having each SNO manage its own internal traffic (which is has to do anyway), the problem becomes much smaller. In addition, it provides a highly observable point for all remote traffic, benefiting security.

The ISB has a single required interaction with outside entities -- it receives requests for patient records in exactly the same format as an RLS does, and it returns either a) the locations

of those records for further use by the requestor (the 'two-pass' pattern) or b) acts as an aggregator of the records themselves, and returns the aggregate clinical data (the 'one-pass' pattern.)

Two Pass

The ISB accepts queries from other SNOs looking for patient records. The canonical conversation is between the ISB of the requestor and the ISB being queried; both ISBs must have valid SSL certificates. Other than specifying an address of the SNO to be queried, the queries are otherwise identical to those made to an RLS, and will include demographic details of the patient whose records are being sought, and, optionally, an institution ID and MRN.

The ISB will confirm receipt of the query, record the address where the results should be returned, and then pass the query to its local RLS, exactly as if were an ordinary entity within the SNO. If the requesting SNO has requested a two-pass interaction, the ISB will receive the record locations from the RLS (or, optionally, any additional proxy servers used by the SNO), and will then initiate a second transaction with the original requestor.

The original requestor may then choose any or all of the record locations it would like to receive data from, and will dispatch a second query to the ISB listing those locations. The ISB will confirm receipt of the second query, record the address where the results should be returned, and then ask the local entities (or any optional proxies) for the records themselves, exactly as if were an ordinary entity within the SNO. The ISB will receive the records from the local entities (or proxies), and will then initiate a transaction with the original requestor to deliver the aggregate records.

Interactions with the ISB will always be asynchronous; the requestor must specify an address where the results of the query will be deposited. For a more complete description of questions of synchrony, see “The Common Framework: Technical Issues and Requirements for Implementation document.”

The two-pass interaction between the ISB, the local clinical data sources, and the requestor of data locations can be seen in the following diagram:

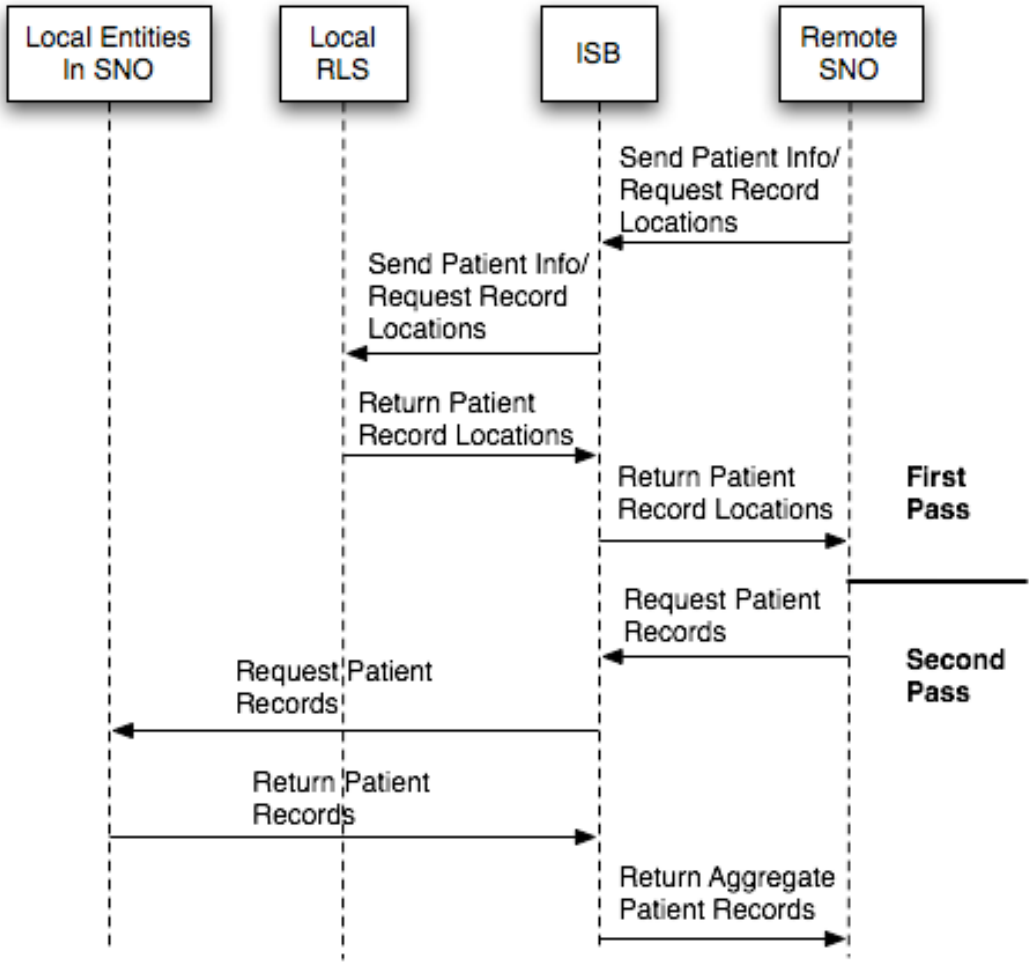

Figure 2 ISB Two Pass Interactions

One Pass

The ISB accepts queries from other SNOs looking for patient records. The canonical conversation is between the ISB of the requestor and the ISB being queried; both ISBs must have valid SSL certificates. Other than specifying an address of the SNO to be queried, the queries are otherwise identical to those made to an RLS, and will include demographic details of the patient whose records are being sought, and, optionally, an institution ID and MRN.

The ISB will confirm receipt of the query, record the address where the results should be returned, and then pass the query to its local RLS, exactly as if were an ordinary entity within the SNO. If the requesting SNO has requested a one-pass interaction, the ISB will receive the record locations from the RLS (or, optionally, any additional proxy servers used by the SNO), and will then initiate a second set of transaction with the local holders of the record specified by those locations. The ISB will receive the records from the local entities (or proxies), and will then initiate a transaction with the original requestor to deliver the aggregate records.

Interactions with the ISB will always be asynchronous; the requestor must specify an address where the results of the query will be deposited. For a more complete description of questions of synchrony, see “The Common Framework: Technical Issues and Requirements for Implementation document.”

The one-pass interaction between the ISB, the local clinical data sources, and the requestor of data locations can be seen in the following diagram:

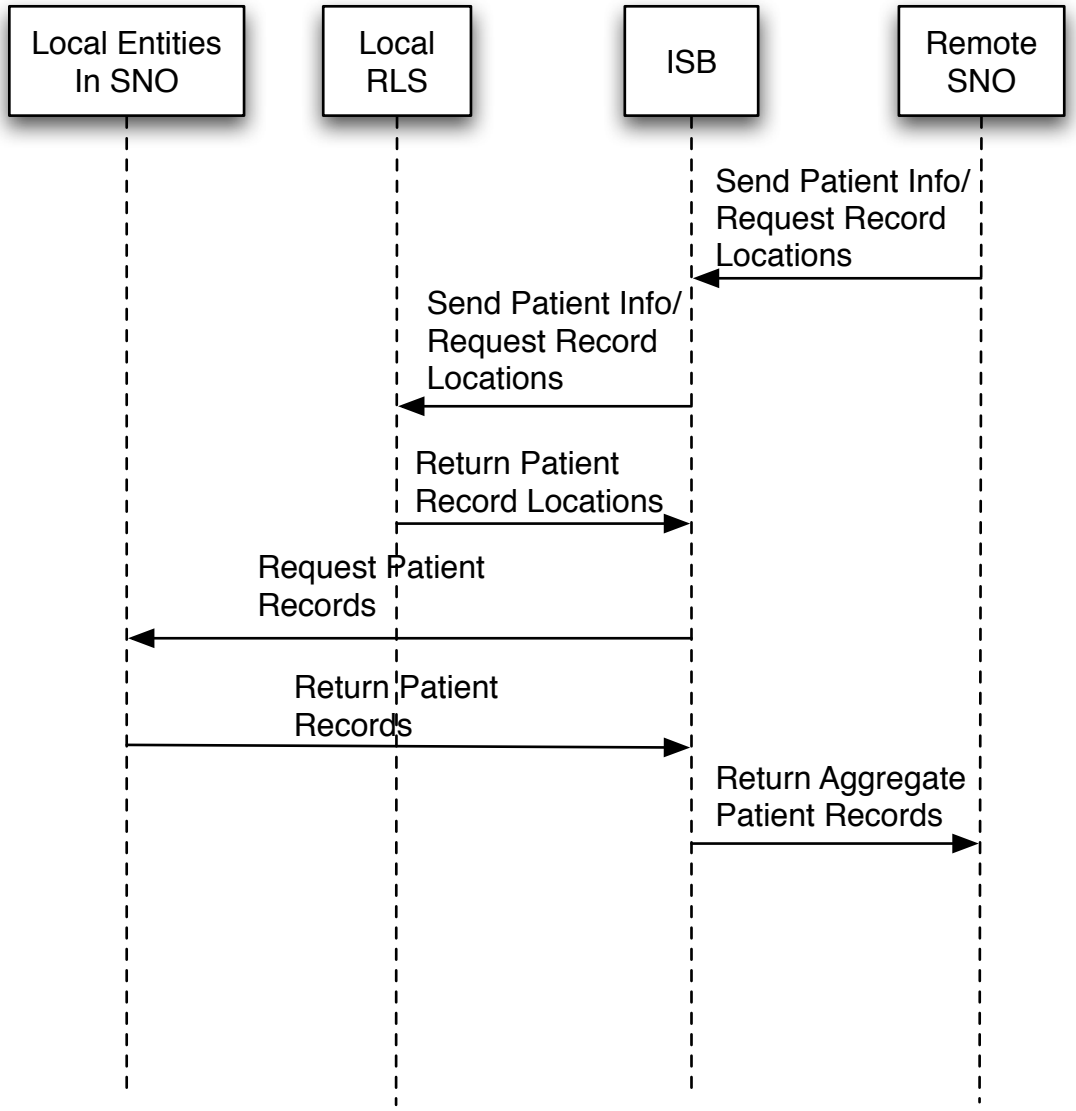

Figure 3 ISB One Pass Interactions

2.3 NHIN Data Interchange

All messages in the NHIN, whether within or between SNOs, are specified as client/server SOAP conversations. A client requesting information within a SNO of which it is a member formulates its data query and sends it to the SNO's RLS. A client requesting information from a SNO of which it is not a member formulates its data query and sends it to the remote SNO's ISB.

NHIN queries are based on the HL7 query model. A single NHIN query-and-response may consist of one SOAP conversation (a "synchronous" query-and-response) or two SOAP conversations (an "asynchronous" query-and-response, where the request and the subsequent delivery of results are two separate transactions.) In the synchronous query-and-response case, the query is sent in the SOAP request message and the query results are returned in the SOAP

response message. In the case of the asynchronous query-and-response, the query is sent as the SOAP request and simply acknowledged in the SOAP response. In a subsequent SOAP conversation, the query results are sent back to the query client as the SOAP request message and simply acknowledged in the corresponding SOAP response.

RLS Data Interchange

When a NHIN client sends the SOAP query to the ISB (the NHIN server), the ISB immediately acknowledges receipt of the query and terminates the SOAP communication. The ISB probes the databases(s) within its SNO to get the requested data. Once that is complete, the ISB generates the query response, opens a new communication channel back to the client or its designee, and returns the response information.

When the RLS receives a query, it may satisfy that query in any manner it so chooses, as long as it interprets the query according the rules set forth in his document and responds to the query in the format prescribed herein. For example, one SNO might contain a central server on which health data is aggregated from all of the other SNO members. That SNO's ISB responds to a patient-based NHIN query by reading data from its single aggregation server and responding to the NHIN client. Another SNO might have no central aggregation of data. When that SNO's ISB receives the same NHIN query, it would interrogate all of its other SNO systems to obtain the requested data. Several NHIN prototype systems have an approach somewhere in between these two paradigms. Those SNOs maintain an aggregated (community) Master Patient Index (MPI), but do not aggregate any other clinical content. For a patient-based query, the ISB for one of those SNOs would query the aggregated MPI to find out which other SNO nodes might contain the requested data and then query only the potential data-bearing nodes for information.

SNO Data Interchange

When a NHIN client sends the SOAP query to the ISB (the NHIN server), the ISB immediately acknowledges receipt of the query and terminates the SOAP communication. The ISB probes the databases(s) within its SNO to get the requested data. Once that is complete, the ISB generates the query response, opens a new communication channel back to the client or its designee, and returns the response information.

When an NHIN server receives a query, it may satisfy that query in any manner it so chooses, as long as it interprets the query according the rules set forth in his document and responds to the query in the format prescribed herein. For example, one SNO might contain a central server on which health data is aggregated from all of the other SNO members. That SNO's ISB responds to a patient-based NHIN query by reading data from its single aggregation server and responding to the NHIN client. Another SNO might have no central aggregation of data. When that SNO's ISB receives the same NHIN query, it would interrogate all of its other SNO systems to obtain the requested data. Several NHIN prototype systems have an approach somewhere in between these two paradigms. Those SNOs maintain an aggregated (community) Master Patient Index (MPI), but do not aggregate any other clinical content. For a patient-based query, the ISB for one of those SNOs would query the aggregated MPI to find out which other SNO nodes might contain the requested data and then query only the potential data-bearing nodes for information.

3 RLS/ISB Development Goals

3.1 Overall Directions

All communications are SSL-encrypted SOAP 1.1 messages.

ISB-to-ISB communication is always asynchronous. Upon receiving the SOAP query message, the ISB may immediately return an acknowledgment (ACK) message to the CLIENT. In that case, if a SOAP fault is generated, the CLIENT does not expect any further reply from the query server. If the message is accepted, the CLIENT expects to receive an asynchronous reply containing the query results. That is, the CLIENT creates a thread that will accept the eventual query results SOAP message from the ISB. The CLIENT system decides how to act if the return message does not arrive in a timely manner.

HL7 defines a parameter that defines the query as either "immediate" or "deferred". The SOAP conversations that we describe as "synchronous" are HL7 "immediate" queries. The SOAP conversations that we describe as "asynchronous" are HL7 "deferred" queries. The "immediate" or "deferred" attribute is defined in HL7 field RCP.1 (Query Priority).

Errors in message validation are reported as SOAP faults. Errors in asynchronous processing logic are reported back to the client service within the SOAP response message.

Every NHIN request message includes information about the specific user making the request. The ISB logs the requestor identity information along with the query and the response. In other words, the ISB keeps a complete log of "who, what, when, and where" for all of the NHIN queries that it processes.

Most of the patient information in the query and response messages is represented as XML-encoded version 2.4 HL7. HL7's formal specification of the XML encoding for version 2.4 resides at *http://www.hl7.org*. Patient medication dispensing history is returned in the query response message in NCPDP Scripts 8.1 format.

NHIN query messages are pure HL7, represented in XML per HL7's documentation. Responses are all HL7, except for the medication dispensing history mentioned above. SNOs should readily be able to interpret and construct these familiar messages without re-inventing their message content creation services and functions. The NHIN should also be able to take advantage of new HL7 developments without having to change this fundamental NHIN message architecture.

3.2 Directions for ISB/RLS Design

All communications are SSL-encrypted SOAP 1.1 messages.

ISB-to-ISB communication is always asynchronous. Upon receiving the SOAP query message, the ISB immediately returns an acknowledgment (ACK) message to the CLIENT. If the message is rejected (a SOAP fault is generated instead of the ACK), the CLIENT does not expect any further reply. If the message is accepted, the CLIENT expects to receive an asynchronous reply containing the query results. That is, the CLIENT creates a thread that will accept the eventual query results SOAP message from the ISB. The CLIENT system decides how to act if the return message does not arrive in a timely manner.

Errors in message validation are reported as SOAP faults. Errors in asynchronous processing logic are reported back to the client service within the SOAP response message.

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3.3 HL7 XML Background

HL7 is a well-established standard for communication of medical information between computer systems. HL7's long standing encoding of 2.x HL7 messages has been "piped" delimited ASCII, with ASCII RETURN (ASCII 13) and/or LINE FEED (ASCII 10) characters demarking the end of HL7 message "segments", and other delimiters defining the field and subfield boundaries. This is well-described in the HL7 manual available at http://www.hl7.org. HL7 has also now defined an XML encoding for version 2.x messages.

The tags for the XML encoding are defined by HL7's existing abbreviations for segment, field and subcomponent names. For example, the tags names for segments are the three character HL7 segment names. "OBX" is the tag for the observation segment. The tag names for fields and data type components are the HL7 field abbreviations, e.g. the tag for the third OBX field would be OBX.3, and e.g. the tag for the third component of a CE data type would be "CE.3". The XML schema for a given message identifies the segments and fields that are required.

Version 3 of HL7 is version 3.uses only XML encoding. However, almost all institutions currently use a 2.x version of HL7 and almost no clinical care system has adopted version 3. New 2.x HL7 versions continue to be developed in addition to the work on HL7 version 3.

We represent our messages in the widely used HL7 2.4 format so that it can be easily implemented in today's institutions and because everyone in the industry is familiar with it. Using version 2.4XML gives us the advantage of the unified methods of processing the content of SOAP messages as well as direct translatability between pipe delimited HL7 messages and their XML equivalents. The HL7 content that is relevant to this project is listed in the following HL7 manual chapters.

Chapter	Description
1	Broad description of the HL7 message format
2	defines HL7 data types and control segments
3	defines Patient Identification (PID) segments
5	defines HL7 Query messages
7	defines Observation Reporting segments for transmitting patient reports and results

We designate some HL7 fields as "not used" for this project. Those field values will be ignored in the communications. No error will be signaled if these fields are populated.

HL7 content will be sent within the "body" of our SOAP messages with standard SOAP message headers and SOAP wrappers. The SOAP standard is defined at http://www.w3.org/TR/soap/.

Appendix B contains general guidelines for formatting the HL7 content. In the near future, we hope to simply point developers to an existing HL7 implementation guide, such as the ELINCS specification, for this information.

4 General SOAP Message Structure

NHIN queries use a single SOAP service named "NHINQuery". The two SOAP query operations for this service support an XML "wrapper" for sending an HL7 query via a SOAP message and an XML "wrapper" for receiving the response back in a SOAP message. Hence, the

contents of the query message define the type of search performed and data returned rather than the SOAP operation.

The top-level SOAP <BODY> elements within the SOAP message are in the namespace "http://www.nhin.gov/messaging". The SOAP header always contains message routing information and data elements describing the user sending the query. Section 4.1 describes the contents of the SOAP header.

At the topmost level of the SOAP message <BODY>, each request contains only the <NHINQuery> node. The WS-Basic Profile 1.0 requires a single node within the SOAP <BODY>, so there will never be a second node at this level. Within the <NHINQuery> node, we find two other nodes. One contains control information about the query settings and the other contains the actual query. For example, the topmost level of the *PatientDataQuery* SOAP message <BODY> looks like:

```
<soapenv:Body>
    <nhin:NHINQuery>
        <nhin:EvaluationSettings>
            <nhin:MaxResponseInterval>60</nhin:MaxResponseInterval>
            <nhin:ResponseStyle>I</nhin:ResponseStyle>
        </nhin:EvaluationSettings>
        <nhin:Query format="HL7" version="2.4">
            <QBP_Z01 xmlns="urn:hl7-org:v2xml">
                ...
            </ QBP_Z01 >
        </nhin:Query>
    </nhin:NHINQuery>
</soapenv:Body>
```

The <Query> node defines the information that is actually being requested. The SOAP service and operation are merely wrappers in which to pass this generic "query" specification. The *format* and *version* attributes define the format in which the query is expressed. Currently, only HL7 version 2.4 queries are supported. NHIN is considering support of HL7 version 3.0 as its use becomes more widespread.

At the topmost level of the SOAP message <BODY>, each response message also contains a single node. The <NHINResponse> node contains two data-bearing nodes, just like the NHINQuery node. One echoes the CLIENT control information and the other contains the query response. For example, the topmost level of the *PatientDataQuery* SOAP message <BODY> might look like:

```
<soapenv:Body xmlns:nhin="http://www.nhin.gov/messaging" >
    <nhin:NHINResponse>
        <nhin:EvaluationSettings>
            <nhin:MaxResponseInterval>60</nhin:MaxResponseInterval>
            <nhin:ResponseStyle>I</nhin:ResponseStyle>
        </nhin:EvaluationSettings>
        <nhin:Response format="HL7" version="2.4">
            < RSP_Z01 xmlns="urn:hl7-org:v2xml">
                ...
            </ RSP_Z01 >
        </nhin:Response>
    </nhin:NHINResponse>
```

</soapenv:Body>

All NHIN queries are expressed as HL7 2.4 messages and segments. Most of the query responses are also standard HL7 messages and are represented in a single <Response> node. However, queries that return medication history do so in the NCPDP Scripts 8.1 XML format (an XML representation of NCPDP) rather than in HL7. To accommodate this, and future, mixed data representations within a query response, multiple <Response> nodes are permitted. Data formats are not mixed within one <Response> node. For example, an HL7 response will never be intermixed with an NCPDP Scripts response, although they may be wrapped within the same query response message.

Every <EvaluationSettings> node has the same schema definition across all messages, as documented in Appendix C. Values within this node define general query processing settings, like the maximum time interval before the querying system expects a response, as per the example above.

We define the following SOAP operations, which cover the current use cases:

Operation	Description
PatientDataQuery	Requests patient health data for a single patient.
PatientDataQueryResponse	Returns the requested patient health data for all registrations found for the specified person.

4.1 XML Namespaces

NHIN query messages currently use two namespaces for NHIN-specific elements and attributes, one for the query data and one for the header attributes used to route the asynchronous query responses (see next section of this document). The header attributes used for response routing are defined in the "http://www.nhin.gov/addressing" namespace, which is qualified as "nhinWsa:" in the examples used in this document. (Note that nhin.gov is a URI but not a URL; we have adopted it simply to guarantee uniqueness of namespace.) All other NHIN-specific elements and attributes are defined in the "http://www.nhin.gov/messaging" namespace, which we qualify with "nhin:" in the examples in this document. The SOAP envelope tags for a typical NHIN query might look like:

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
                  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
                  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
                  xmlns:nhinWsa="http://www.nhin.gov/addressing"
                  xmlns nhin="http://www.nhin.gov/messaging" >
</soapenv:Envelope>
```

4.2 Asynchronous Query-and-Response Messaging Between ISBs

We expect that the WS-Addressing 1.0 W3C Recommendation will become a W3C standard within the next year. We believe it will enjoy widespread use following standardization, and that tools for implementing it will then proliferate. Of special interest to the NHIN project are the WS-Addressing 1.0 controls (in the SOAP header) for defining an asynchronous SOAP conversation, since all initial NHIN SOAP conversations will be asynchronous.

However, NHIN is not comfortable making WS-Addressing 1.0 a requirement for initial NHIN participants. WS-Addressing is not easily implemented across SOAP server platforms, at least in the versions that are currently in wide use. Newer implementations, as they currently exist,

would make it difficult to communicate with NHIN servers on their present SOAP server platforms. Hence, NHIN defines its asynchronous conversations using a subset of the tag names that WS-Addressing would use, but in NHIN's own XML "namespace". The NHIN architecture also defines its logically asynchronous query-and-reply conversation as a pair of physically synchronous SOAP conversations, one conversation for the query and one for the response. These variances from real WS-Addressing enable immediate use of the NHIN message infrastructure, but simplify the move to full WS-Addressing in the future. For now, a WS-Addressing-style value, in the SOAP message header, defines where the asynchronous query response will be sent by the NHIN server.

In an asynchronous NHIN query and reply, a NHIN client sends a query to an NHIN server in a SOAP message. The NHIN server immediately returns a SOAP "ACK" message (see Appendix F) to the NHIN client, signifying that the query has been received and understood. This initial SOAP conversation, representing the NHIN "query", is now complete as far as the SOAP servers are concerned. Once the NHIN server has read and formatted the query results, it initiates a new SOAP conversation. The NHIN server sends the query response to the destination it found in the <ReplyTo> node of the original SOAP query message. Once the NHIN client receives the query response, it returns a SOAP "ACK" to the NHIN server. This completes the NHIN "response" SOAP conversation. To summarize, the NHIN logical query-and-respond conversation is implemented as two physical SOAP conversations: a query-and-ACK SOAP conversation followed by a separate respond-and-ACK SOAP conversation. This logically asynchronous conversation can be implemented on virtually all SOAP server platforms.

Suppose the ISB receives a message whose SOAP message begins with the following:

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
                  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
                  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
                 xmlns:nhinWsa="http://www.nhin.gov/addressing"
                 xmlns nhin="http://www.nhin.gov/messaging" >
    <soapenv:Header>
        <nhinWsa:MessageId>1234</nhinWsa:MessageId>
         <nhinWsa:ReplyTo>

    <nhinWsa:Address>https://1.2.3.4:8443/myapp/services/NHINQuery</nhinWsa:Address
>
        </nhinWsa:ReplyTo>
    </soapenv:Header>
```

The ISB will send the *NHINPatientDataResponse* query response to the URL http://1.2.3.4:8080/myapp/services/NHINPatientDataResponse .

An example of a SOAP header with full NHIN addressing information follows:

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
                  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
                  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
                 xmlns:nhinWsa="http://www.nhin.gov/addressing"
                 xmlns nhin="http://www.nhin.gov/messaging" >
    <soapenv:Header>
            <nhinWsa:MessageId>1234</nhinWsa:MessageId>
            <nhinWsa:ReplyTo>
               <nhinWsa:Address>
```

```
                https://1.2.3.4:8443/myapp/services/NHINQuery
            </nhinWsa:Address>
        </nhinWsa:ReplyTo>
    </soapenv:Header>
    <soapenv:Body>
        ...
    </soapenv:Body>
</soapenv:Envelope>
```

4.3 Identifying the Query User

Every query must identify the user who initiated the query, as per HIPAA guidelines, and log the user identification along with a description of the data that was accessed. The Inter-SNO Bridge service that receives the NHIN query trusts that the user was properly authenticated by the sending SNO. The mechanism for reaching that understanding is beyond the scope of this document.

We consulted the OASIS SAML specification to find the format in which it represents username information in the SOAP header, hoping to use their format. However, the "UsernameToken" 1.0 profile does not specify some attributes that we require, like the user's full name in any concrete manner. Instead then, NHIN queries identify the query-requesting user in an NHIN-specific <QueryRequestor> node within the SOAP header. NHIN plans to harmonize its user identification format with the SAML specification in the future. Currently though, the query user's identity in the <QueryRequestor> node is in the same data format that one would use to retrieve the access log information about that query user. That is, the query user is defined in the same format that would be found within an HL7 query or response.

NHIN queries represent the query-requesting user in a familiar HL7 2.4 XCN data type. An example follows:

```
<nhin:Security>
    <nhin:QueryRequestor>
        <XCN.1>JoeUser</CX.1>
        <XCN.2>Smith</XCN.2>
        <XCN.3>Joseph</XCN.3>
        <XCN.9>
            <HD.1>ST ELSEWHERE HOSPITAL Users</HD.1>
            <HD.2>USERID</HD.2>
            <HD.3>ST ELSEWHERE HOSPITAL</HD.3>
        </XCN.9>
        <XCN.13>EI</XCN.13>
        <XCN.14>
            <HD.1>ST ELSEWHERE HOSPITAL</HD.1>
        </XCN.14>
    </nhin:QueryRequestor>
</nhin:Security>
```

This is the same manner in which that user would have been represented within any of the HL7 2.4 messages sent across the NHIN.

4.4 NHIN SERVER ERROR HANDLING

Upon receipt of a request message from a CLIENT system, the SERVER acknowledges receipt of the message, validates the syntax of the incoming message, and asynchronously starts processing the message. If an error occurs after the "valid message" indication, the error information must be returned to the CLIENT system in the asynchronous SOAP response. If the error occurs before the SERVER validates the query message and responds with the "ACK" SOAP message, a SOAP Fault can be generated. Appendix D lists the potential fault codes returned and the information that should be included in the accompanying detail.

When an error/fault occurs after the NHIN server has sent its ACK back to the NHIN client, it is impossible (or at least very difficult) to return a SOAP Fault using a current SOAP server. Therefore, the error/fault must be sent back in the asynchronous query response message. In that message, the MSA.1 (ACKNOWLEDGMENT CODE) value is "AE" (Application Error) instead of "AA". A descriptive fault message is also returned in the MSA.3 (TEXT MESSAGE).

The NHIN SERVER can encounter different types of errors once it receives a valid query message. An application error may occur within the SERVER itself. A SOAP fault may occur when the SERVER tries to send a SOAP message to another node within its SNO when that system is down, appropriate security certificates are not in place, network communications fail, the service rejects the message due a syntax error, etc. Finally, a true application error may occur inside the SNO node that is doing the query resolution on behalf of the NHIN server.

In the first case, the NHIN Server must create its own error code and error message. In the second case, the server retrieves the SOAP fault code and error message from the SOAP fault. In the third case, the server recovers the application error information from the response message it gets back from the SNO node. In any case, the NHIN server ends up with an error code and an error message that are sent back to the CLIENT within the MSA segment of the query response.

5 HL7 Queries Within PatientDataQuery Operation

Although there is a single NHIN SOAP operation, it may contain a variety of different HL7 queries. HL7 2.4 requires a formal "Conformance Statement" be published for each of these queries. The sections that follow document the currently supported NHIN queries for patient data and their "Conformance Statements". Table 1 below lists all of the currently defined HL7 queries supported within the NHINQuery service.

Table 1 – HL7 Queries Supported by NHINQuery SOAP Service

Event Code	Query Name	Description
Z01	Observation Reporting Query	Requests clinical results and reports for one person.
Z02	Patient Identities Query	Requests demographics (PID) information for all registrations for a single person.
Z03	Access History Query	Requests history (log) of queries made for data about one person or by one person.

5.1 *Observation Reporting Query* for Patient Results and Reports

An *Observation Reporting Query* requests clinical results and reports for one person. Query "parameter" values may be used to limit the number and type of the returned results and reports. The query contains HL7's MSH, QPD, and PID, and RCP segments, in that order. The response message is an HL7 response based on the ORU^R01 message for laboratory reports and results and/or a NCPDP Scripts 8.1 element for medication dispensing history. The official HL7 query "conformance statement" for the query is defined in section below, although it does not address the medication dispensing history portion of the returned data.

Most clinical data are supported by this query-response pair. Clinical laboratory results, pathology reports, vital signs, nursing notes, radiology reports, diagnosis lists, patient questionnaire results, discharge summaries, and more are easily represented in the response message. Refer to chapter 7 of the HL7 2.4 manual for more details on the ORU^R01 message and its great flexibility.

The HL7 ORU^R01 messages are formatted according to the ELINCS 2.0 standard, described at http://www.chcf.org/topics/chronicdisease/index.cfm. The ELINCS specification contains an implementation guide for constructing HL7 ORU^R01 messages. ELINCS defines LOINC codes to be used for common laboratory tests, types of HL7 data expected in each ORU^R01 data field, and general guidelines for HL7 message construction. "Laboratory Results Standards, part of *The **Connecting for Health** Common Framework: Resources for Implementing Private and Secure Health Information Exchange*, notes the deviations we make from the ELINCS standard. For the most part, these deviations are simply the permission to populate HL7 data fields in cases where ELINCS prohibits those data fields from being valued.

The NCPDP Scripts 8.1 XML in which the medication dispensing history is returned is described in "Medication History Standards," part of *The **Connecting for Health** Common Framework: Resources for Implementing Private and Secure Health Information Exchange*.

5.1.1 Observation Reporting Query Conformance Statement

Query Statement ID:	Z01
Type:	Query
Query Name:	Observation Reporting Query
Query Trigger (= MSH-9):	QBP^Z01^QBP_Z01
Query Mode:	Both
Response Trigger (= MSH-9):	RSP^Z01^RSP_Z01
Query Characteristics:	Patient will be identified by searching the NHIN server's Master Patient Index (MPI) or MPIs based on patient attributes defined in the query's PID segment. Results and reports may be returned for zero, one, or more patient registrations found by the NHIN server.
Purpose:	Queries an NHIN server for clinical patient data. Input is list of known patient identifiers and attributes. Output is clinical results and reports for that patient, as specified in the other query parameters.
Response Characteristics:	Results and reports are returned in standard HL7 ORU message format.
Based on Segment Pattern:	R01

Query Grammar Pattern

QBP^Z01^QBP_Z01	Query Grammar:	Group Control	Comment	Support Indicator	Sec Ref
MSH	Message Header				2.16.9
QPD	Query Parameter Definition				
PID	Patient Identification				3.4.2
RCP	Response Control Parameter				5.5.5

Response Grammar Pattern

RSP^Z01^RSP_Z01	Response Grammar:	Group Control	Comment	Support Indicator	Sec Ref
MSH	Message Header				2.16.9
MSA	Message Acknowledgement				2..16.8
[ERR]	Error				2.16.5
QAK	QueryAcknowledgement				5.5.2
QPD	Query Parameter Definition				5.5.3
{			Begin Patient Result		
[		PATIENT	Begin PID Group		
PID	Patient Identification				3.4.2
[PD1]	Additional Demographics				3.4.10
[{ NK1 }]	Next of Kin/Associated Parties				3.3.5
[{ NTE }]	Notes and comments				2.16.10
[PV1	Patient Visit	PATIENT_VISIT	Begin PV1 Group		3.4.3
[PV2]]	Patient Visit – Additional Info.		Close PV1 Group		3.4.4
]			Close PID Group		
{		ORDER_OBSERVATION	Begin OBR Group		
[ORC]	Order Common				4.5.1
OBR	Observations Report ID				7.4.1
[{ NTE }]	Notes and Comments				2.16.10
{		OBSERVATION	Begin OBX Group		
[OBX]	Observation/Result				7.4.2
[{ NTE }]	Notes and Comments				
}			Close OBX Group		
{ [CTI] }	Clinical Trial Identification				7.8.4
}			Close OBR Group		
}			Close Patient Result		

QPD Input Parameter Specification

Field Seq	ColName	Key / Search	Sort	LEN	DT	Opt	RP / #	Match Op	TBL#	Segment Field Name	Service Identifier Code	Element Name
1	MessageQueryName			60	CE	R						Message Query Name
2	QueryTag			32	ST	R						Query Tag
3	WhatData				CE	O	Y		0048	QPD.9		
4	ServiceCode				CE	O				OBR.4		
5	DepartmentCode				CE	O	Y		NHIN_0001	QPD.10		
6	EarliestDataTime				TS	O	Y			OBR.7, OBX.14		
7	LatestDataTime				TS	O	Y			OBR.7, OBX.14		
8	TimeFilterDirection				ID	O	Y		NHIN_0002			

QPD Input Parameter Field Description and Commentary

Input Parameter	Comp Name	DT	Description
MessageQueryName		CE	Z01^Observation Reporting Query^NHIN Query Code
QueryTag		ST	Unique to each query message instance. This is used to relate the response back to its original query.
WhatData		CE	List specifying the broad type(s) of clinical data for which the query is being submitted. HL7 Table 0048 contains a list of the current codes. Of potential interest in the first phase of this project are at least: DEM – demographics RES – result ORD – order ROR – pharmacy prescription information
ServiceCode		CE	List of specific service codes for which data should be returned. For laboratory queries, this would include a list of LOINC codes. For pharmacy dispensing queries, this would include a list of NDC codes. If this value is left empty in the query, data for all service codes will be returned.
DepartmentCode		CE	List of departments from which data should be returned. These are broad department codes, such as CLINICAL LABORATORY, NURSING, RADIOLOGY, PHARMACY, etc. Refer to Table NHIN_0001 in Appendix B for a complete list of supported department codes.
EarliestDataTime		TS	Earliest date and time for returned data. If not valued, there is no restriction on how old the returned data may be.
LatestDataTime		TS	Latest date and time for returned data. If not valued, there is no restriction on how recent the returned data may be.
TimeFilterDirection		ID	EARLIEST – if the filter on returned number of results is applied, then return the earliest data LATEST – if the filter on returned number of results is applied, then return the most recent data If not valued, the server system decides how to apply the filter on the number of returned results

RCP Response Control Parameter Field Description and Commentary

Field Seq	Name	Component Name	LEN	DT	Description
1	Query Priority		1	ID	(D)eferred or (I)mmediate. If the query is a "D" (deferred) query, the query client will receive an immediate ACK back from the query server. The actual query results will be returned asynchronously, in a separate SOAP conversation. If the query is an "I" (immediate) query, the query client will receive the actual query results back in the current SOAP conversation.
2	Quantity Limited Request		10	CQ	
		Quantity		NM	Number of units (specified by the following component) that will be returned in each increment of the response. If no value is given, there is no limit on the number of results and reports returned.
		Units		CE	CHaracters, LInes, PaGes, or RecorDs. Should be RD, when valued.
No other RCP fields should be valued.					

5.1.2 Observation Reporting Query HL7 Message Description

The QPD segment defines the type of data, amount of data, and reporting time frame of the data being requested. The PID segment defines the patient for whom data is being requested.

HL7 Segment	Repeat	Description
MSH	N	standard HL7 message header MSH.10 (MESSAGE CONTROL ID) should contain a unique message identifier. When the requested results and reports are sent back to the CLIENT in the response message, the unique message identifier value will be echoed back in field MSA.2 (MESSAGE CONTROL ID).
QPD	N	Query Parameter Definition – defines type of reports, results, and/or observations to return
PID	N	Patient identification attributes – defines patient whose reports, results, and/or observations are to be returned We strongly encourage NHIN CLIENT systems to send as much PID data as possible, including patient middle name, alias patient names, all known address information, and all known identification numbers. NHIN servers are free to use as many of these attributes as possible in order to identify the target person in their database(s).
RCP	N	Response Control Parameters – max number of reports to return and definition of "immediate" versus "deferred" query response

5.1.3 Observation Reporting Query Response Message

This response message is based on the standard HL7 ORU^R01 message. It contains one <RSP_Z01> node for each registration for which results and/or reports exist. Each <RSP_Z01> node contains exactly one <RSP_Z01.PATIENT> node, which contains exactly one <PID> node.

Each <RSP_Z01> node also contains one or more <RSP_Z01.ORDER_OBSERVATION> nodes. Each <RSP_Z01.ORDER_OBSERVATION> node represents a single result battery or text

report, as per the HL7 Observation Reporting specification. The order of the <RSP_Z01.ORDER_OBSERVATION> nodes is not guaranteed.

The following table lists the HL7 segments that one can currently expect in the NHIN query response. Note that the HL7 specification defines additional segments for this message type; but that NHIN queries do not return those optional segments at this point in time. In fact, most of those optional segments will never be returned in NHIN query responses.

HL7 Segment	Repeat	Description
MSH	N	Standard HL7 message header MSH.10 (MESSAGE CONTROL ID) should contain a unique message identifier. When the requested results and reports are sent back to the CLIENT in the response message, the unique message identifier value will be echoed back in field MSA.2 (MESSAGE CONTROL ID).
MSA	N	The MSA (Message Acknowledgment) segment confirms that report was produced and echoes back the original query message's MESSAGE CONTROL ID so that the response can be matched up with the request.
ERR	N	Defines error information if the query response was an error rather than the expected query results.
QAK	N	HL7 Query Acknowledgement – not used, but included per HL7
QPD	N	Query Parameter Definition – copy of query parameters sent to the query server
PID	Y	Patient registration attributes. One PID is returned for each registration matching the query PID attributes. Each report, result, and/or observation is attached to exactly one PID registration in the query response.
OBR	Y	Observation Header – Each OBR represents one test panel, report, or similar unit/group of observable data returned from the query. For example, an OBR could represent a CBC panel, a surgical pathology report, an x-ray report, a panel of vital signs, a single culture, etc.
NTE	Y	Text comments about the data in an OBR or OBX.
OBX	Y	A single reportable value or observation. This might be as concise as a number plus its units, or as long as an entire, dictated text report. Refer to HL7 Chapter 7 (Observation Reporting) for a more detailed description of the OBR, NTE, and OBX HL7 segments used to represent clinical reports, results, and observations.

Note that the XML format for sending HL7 results requires some additional "grouping" tags that segregate the registration data from the reports. Our sample messages demonstrate this grouping.

5.1.4 Complete Example

Sample Query:

```
<QBP_Z01 xmlns="urn:hl7-org:v2xml" >
    <MSH>
        <MSH.1/>
        <MSH.2/>
        <MSH.3>
            <HD.1>Query Application Name</HD.1>
        </MSH.3>
        <MSH.4>
            <HD.1>ST ELSEWHERE HOSPITAL</HD.1>
        </MSH.4>
        <MSH.5>
            <HD.1>Target ISB</HD.1>
        </MSH.5>
        <MSH.6>
            <HD.1>Target SNO Name</HD.1>
        </MSH.6>
        <MSH.7>
            <TS.1>200506171410</TS.1>
        </MSH.7>
        <MSH.9>
            <MSG.1>QBP</MSG.1>
            <MSG.2>Z01</MSG.2>
            <MSG.3>QBP_Z01</MSG.3>
        </MSH.9>
        <MSH.10>123456789</MSH.10>
        <MSH.11>
            <PT.1>P</PT.1>
        </MSH.11>
        <MSH.12>
            <VID.1>2.4</VID.1>
        </MSH.12>
    </MSH>
    <QPD>
        <QPD.1>
            <CE.1>Z01</CE.1>
            <CE.2>Observation Reporting Query</CE.2>
            <CE.3>NHIN Query Code</CE.3>
        </QPD.1>
        <QPD.2>Q123456</QPD.2>
        <QPD.3>
            <CE.1>RES</CE.1>
            <CE.2>result</CE.2>
            <CE.3>0048</CE.3>
        </QPD.3>
        <QPD.5>
            <CE.1>LABORATORY</CE.1>
            <CE.2>Laboratory</CE.2>
            <CE.3>NHIN_0001</CE.3>
        </QPD.5>
        <QPD.6>
            <TS.1>19980810</TS.1>
        </QPD.6>
        <QPD.8>LATEST</QPD.8>
    </QPD>
    <PID>
        <PID.1></PID.1>
        <PID.2></PID.2>
        <PID.3></PID.3>
        <PID.5>
            <XPN.1>
                <FN.1>THOMPSON</FN.1>
            </XPN.1>
```

```
                <XPN.2>MARK</XPN.2>
                <XPN.3>Q</XPN.3>
        </PID.5>
        <PID.5>
                <XPN.1>
                        <FN.1>AliasLastName</FN.1>
                </XPN.1>
                <XPN.2>AliasFirstName</XPN.2>
                <XPN.3>AliasMiddleName</XPN.3>
        </PID.5>
        <PID.7>
                <TS.1>19090630</TS.1>
        </PID.7>
        <PID.8>M</PID.8>
        <PID.11>
                <XAD.1>
                        <SAD.1>28W 10TH Street</SAD.1>
                </XAD.1>
                <XAD.3>Metropolis</XAD.3>
                <XAD.4>IN</XAD.4>
                <XAD.5>98765</XAD.5>
        </PID.11>
        <PID.11>
                <XAD.1>
                        <SAD.1>666 Bleaker Street</SAD.1>
                </XAD.1>
                <XAD.3>QUINCY</XAD.3>
                <XAD.4>MA</XAD.4>
                <XAD.5>02171</XAD.5>
        </PID.11>
        <PID.19>9991112222</PID.19>
    </PID>
    <RCP>
        <RCP.1>I</RCP.1>
        <RCP.2><CQ.1>10</CQ.1></RCP.2>
    </RCP>
</QBP_Z01>
```

Sample Response:

```
<RSP_Z01 xmlns="urn:hl7-org:v2xml">
    <MSH>
        <MSH.1/>
        <MSH.2/>
        <MSH.3>
                <HD.1>Target ISB</HD.1>
        </MSH.3>
        <MSH.4>
                <HD.1>Target SNO Name</HD.1>
        </MSH.4>
        <MSH.5>
                <HD.1>Query Application Name</HD.1>
        </MSH.5>
        <MSH.6>
                <HD.1>ST ELSEWHERE HOSPITAL</HD.1>
        </MSH.6>
        <MSH.7>
                <TS.1>20051024074506</TS.1>
        </MSH.7>
        <MSH.9>
                <MSG.1>RSP</MSG.1>
                <MSG.2>Z01</MSG.2>
                <MSG.3>RSP_Z01</MSG.3>
        </MSH.9>
        <MSH.10>432</MSH.10>
```

```
                <MSH.11>
                        <PT.1>P</PT.1>
                </MSH.11>
                <MSH.12>
                        <VID.1>2.4</VID.1>
                </MSH.12>
        </MSH>
        <MSA>
                <MSA.1>AA</MSA.1>
                <MSA.2>123456789</MSA.2>
        </MSA>
        <QAK/>
        <QPD>
                <QPD.1>
                        <CE.1>Z01</CE.1>
                        <CE.2>Observation Reporting Query</CE.2>
                        <CE.3>NHIN Query Code</CE.3>
                </QPD.1>
                <QPD.2>Q123456</QPD.2>
                <QPD.3>
                        <CE.1>RES</CE.1>
                        <CE.2>result</CE.2>
                        <CE.3>0048</CE.3>
                </QPD.3>
                <QPD.5>
                        <CE.1>LABORATORY</CE.1>
                        <CE.2>Laboratory</CE.2>
                        <CE.3>NHIN_0001</CE.3>
                </QPD.5>
                <QPD.6>
                        <TS.1>19980810</TS.1>
                </QPD.6>
                <QPD.8>LATEST</QPD.8>
        </QPD>
        <RSP_Z01.PATIENT_RESULT>
                <RSP_Z01.PATIENT>
                        <PID>
                                <PID.3>
                                        <CX.1>MADEUP-7</CX.1>
                                        <CX.4>
                                                <HD.1>ST ELSEWHERE HOSPITAL Medical Record
Numbers</HD.1>
                                                <HD.2>MEDICAL RECORD NUMBER</HD.2>
                                                <HD.3>ST ELSEWHERE HOSPITAL</HD.3>
                                        </CX.4>
                                        <CX.5>MR</CX.5>
                                        <CX.6>
                                                <HD.1>ST ELSEWHERE HOSPITAL</HD.1>
                                        </CX.6>
                                </PID.3>
                                <PID.5>
                                        <XPN.1>
                                                <FN.1>THOMSON</FN.1>
                                        </XPN.1>
                                        <XPN.2>MARK</XPN.2>
                                </PID.5>
                                <PID.7>
                                        <TS.1>19090630</TS.1>
                                </PID.7>
                                <PID.8>M</PID.8>
                                <PID.11>
                                        <XAD.3>N. QUINCY</XAD.3>
                                        <XAD.4>MA</XAD.4>
                                        <XAD.5>02171</XAD.5>
                                </PID.11>
                        </PID>
                </RSP_Z01.PATIENT>
```

```
<RSP_Z01.ORDER_OBSERVATION>
        <OBR>
                <OBR.3>
                        <EI.1>FAKE-14454</EI.1>
                        <EI.2>ST ELSEWHERE HOSPITAL EKG System</EI.2>
                        <EI.3>FILLER ORDER NUMBER</EI.3>
                        <EI.4>ST ELSEWHERE HOSPITAL</EI.4>
                </OBR.3>
                <OBR.4>
                        <CE.1>18844-1</CE.1>
                        <CE.2>EKG</CE.2>
                        <CE.3>LN</CE.3>
                </OBR.4>
                <OBR.7>
                        <TS.1>198905191158</TS.1>
                </OBR.7>
        </OBR>
        <RSP_Z01.OBSERVATION>
                <OBX>
                        <OBX.2>NM</OBX.2>
                        <OBX.3>
                                <CE.1>8626-4</CE.1>
                                <CE.2>P-Wave Axis</CE.2>
                                <CE.3>LN</CE.3>
                        </OBX.3>
                        <OBX.4>0</OBX.4>
                        <OBX.5>75</OBX.5>
                        <OBX.11>F</OBX.11>
                        <OBX.14>
                                <TS.1>198905191158</TS.1>
                        </OBX.14>
                </OBX>
        </RSP_Z01.OBSERVATION>
        <RSP_Z01.OBSERVATION>
                <OBX>
                        <OBX.2>NM</OBX.2>
                        <OBX.3>
                                <CE.1>8632-2</CE.1>
                                <CE.2>QRS-Axis</CE.2>
                                <CE.3>LN</CE.3>
                        </OBX.3>
                        <OBX.4>0</OBX.4>
                        <OBX.5>106</OBX.5>
                        <OBX.8>HH</OBX.8>
                        <OBX.11>F</OBX.11>
                        <OBX.14>
                                <TS.1>198905191158</TS.1>
                        </OBX.14>
                </OBX>
        </RSP_Z01.OBSERVATION>
        <RSP_Z01.OBSERVATION>
                <OBX>
                        <OBX.2>NM</OBX.2>
                        <OBX.3>
                                <CE.1>8638-9</CE.1>
                                <CE.2>T-Wave Axis</CE.2>
                                <CE.3>LN</CE.3>
                        </OBX.3>
                        <OBX.4>0</OBX.4>
                        <OBX.5>-9</OBX.5>
                        <OBX.11>F</OBX.11>
                        <OBX.14>
                                <TS.1>198905191158</TS.1>
                        </OBX.14>
                </OBX>
        </RSP_Z01.OBSERVATION>
        <RSP_Z01.OBSERVATION>
```

```
        <OBX>
                <OBX.2>CE</OBX.2>
                <OBX.3>
                        <CE.1>18844-1</CE.1>
                        <CE.2>EKG</CE.2>
                        <CE.3>LN</CE.3>
                </OBX.3>
                <OBX.4>0</OBX.4>
                <OBX.5>
                        <CE.1>9327</CE.1>
                        <CE.2>normal sinus rhythm</CE.2>
                        <CE.3>Local Concept</CE.3>
                </OBX.5>
                <OBX.11>F</OBX.11>
                <OBX.14>
                        <TS.1>198905191158</TS.1>
                </OBX.14>
        </OBX>
</RSP_Z01.OBSERVATION>
<RSP_Z01.OBSERVATION>
        <OBX>
                <OBX.2>CE</OBX.2>
                <OBX.3>
                        <CE.1>18844-1</CE.1>
                        <CE.2>EKG</CE.2>
                        <CE.3>LN</CE.3>
                </OBX.3>
                <OBX.4>1</OBX.4>
                <OBX.5>
                        <CE.1>11397</CE.1>
                        <CE.2>sinus arrhythmia</CE.2>
                        <CE.3>Local Concept</CE.3>
                </OBX.5>
                <OBX.11>F</OBX.11>
                <OBX.14>
                        <TS.1>198905191158</TS.1>
                </OBX.14>
        </OBX>
</RSP_Z01.OBSERVATION>
<RSP_Z01.OBSERVATION>
        <OBX>
                <OBX.2>CE</OBX.2>
                <OBX.3>
                        <CE.1>18844-1</CE.1>
                        <CE.2>EKG</CE.2>
                        <CE.3>LN</CE.3>
                </OBX.3>
                <OBX.4>2</OBX.4>
                <OBX.5>
                        <CE.1>678</CE.1>
                        <CE.2>right bundle branch block</CE.2>
                        <CE.3>Local Concept</CE.3>
                </OBX.5>
                <OBX.11>F</OBX.11>
                <OBX.14>
                        <TS.1>198905191158</TS.1>
                </OBX.14>
        </OBX>
</RSP_Z01.OBSERVATION>
<RSP_Z01.OBSERVATION>
        <OBX>
                <OBX.2>CE</OBX.2>
                <OBX.3>
                        <CE.1>18844-1</CE.1>
                        <CE.2>EKG</CE.2>
                        <CE.3>LN</CE.3>
                </OBX.3>
```

```
                        <OBX.4>3</OBX.4>
                        <OBX.5>
                                <CE.1>18557</CE.1>
                                <CE.2>abnormal ECG</CE.2>
                                <CE.3>Local Concept</CE.3>
                        </OBX.5>
                        <OBX.11>F</OBX.11>
                        <OBX.14>
                                <TS.1>198905191158</TS.1>
                        </OBX.14>
                </OBX>
        </RSP_Z01.OBSERVATION>
        <RSP_Z01.OBSERVATION>
                <OBX>
                        <OBX.2>NM</OBX.2>
                        <OBX.3>
                                <CE.1>8637-1</CE.1>
                                <CE.2>RR Interval</CE.2>
                                <CE.3>LN</CE.3>
                        </OBX.3>
                        <OBX.4>0</OBX.4>
                        <OBX.5>998</OBX.5>
                        <OBX.11>F</OBX.11>
                        <OBX.14>
                                <TS.1>198905191158</TS.1>
                        </OBX.14>
                </OBX>
        </RSP_Z01.OBSERVATION>
        <RSP_Z01.OBSERVATION>
                <OBX>
                        <OBX.2>NM</OBX.2>
                        <OBX.3>
                                <CE.1>8634-8</CE.1>
                                <CE.2>QT Interval</CE.2>
                                <CE.3>LN</CE.3>
                        </OBX.3>
                        <OBX.4>0</OBX.4>
                        <OBX.5>436</OBX.5>
                        <OBX.11>F</OBX.11>
                        <OBX.14>
                                <TS.1>198905191158</TS.1>
                        </OBX.14>
                </OBX>
        </RSP_Z01.OBSERVATION>
        <RSP_Z01.OBSERVATION>
                <OBX>
                        <OBX.2>NM</OBX.2>
                        <OBX.3>
                                <CE.1>8625-6</CE.1>
                                <CE.2>PR Interval</CE.2>
                                <CE.3>LN</CE.3>
                        </OBX.3>
                        <OBX.4>0</OBX.4>
                        <OBX.5>160</OBX.5>
                        <OBX.11>F</OBX.11>
                        <OBX.14>
                                <TS.1>198905191158</TS.1>
                        </OBX.14>
                </OBX>
        </RSP_Z01.OBSERVATION>
    </RSP_Z01.ORDER_OBSERVATION>
  </RSP_Z01.PATIENT_RESULT>
</RSP_Z01>
```

5.2 Patient Identities Query Message

A *Patient Identities Query* identifies a person of interest (person attributes are specified in an HL7 PID segment) and requests the NHIN server to find all of the known patient registrations for that person, across that SNO. The SOAP request message is an HL7 Query By Parameter (QBP) message with event code Z02. It contains HL7's MSH, QPD, PID, and RCP segments, in that order. The response message will contain one PID segment for each registration found in one of the SNO's Master Patient Index tables.

5.2.1 Patient Identities *Query Conformance Statement*

Query Statement ID:	Z02
Type:	Query
Query Name:	Patient Identities Query
Query Trigger (= MSH-9):	QBP^Z02^QBP_Z02
Query Mode:	Both
Response Trigger (= MSH-9):	RSP^Z02^RSP_Z02
Query Characteristics:	Patient will be identified by searching the NHIN server's Master Patient Index (MPI) or MPIs based on person attributes defined in the query's PID segment. The response will contain one PID segment for each registration instance found.
Purpose:	Queries an NHIN server for person demographics. Input is list of known person identifiers and attributes. Output is the list of registration instances found for the target person.
Response Characteristics:	Demographics and identifiers are returned in standard PID segments, one per registration instance found.
Based on Segment Pattern:	A19

Query Grammar Pattern

QBP^Z02^QBP_Z02	Query Grammar:	Group Control	Comment	Support Indicator	Sec Ref
MSH	Message Header				2.16.9
QPD	Query Parameter Definition				
PID	Patient Identification				3.4.2
RCP	Response Control Parameter				5.5.5

Response Grammar Pattern

RSP^Z02^RSP_Z02	Response Grammar:	Group Control	Comment	Support Indicator	Sec Ref
MSH	Message Header				2.16.9
MSA	Message Acknowledgement				2..16.8
[ERR]	Error				2.16.5
QAK	QueryAcknowledgement				5.5.2
QPD	Query Parameter Definition				5.5.3
{			Begin Patient Result		
[		QUERY_RESPONSE	Begin PID Group		
PID	Patient Identification				3.4.2
[PD1]	Additional Demographics				3.4.10
[{ NK1 }]	Next of Kin/Associated Parties				3.3.5
[{ NTE }]	Notes and comments				2.16.10
]			Close PID Group		
}			Close Patient Result		

Only the PID segment is currently valued, but other segments might be valued in future releases.

QPD Input Parameter Specification

Field Seq	ColName	Key / Search	Sort	LEN	DT	Opt	RP / #	Match Op	TBL#	Segment Field Name	Service Identifier Code	Element Name
1	MessageQueryName			60	CE	R						Message Query Name
2	QueryTag			32	ST	R						Query Tag

QPD Input Parameter Field Description and Commentary

Input Parameter	Comp. Name	DT	Description
MessageQuery Name		CE	Z02^Patient Identitities Query^NHIN Query Code
QueryTag		ST	Unique to each query message instance. This is used to relate the response back to its original query.

RCP Response Control Parameter Field Description and Commentary

Field Seq	Name	Component Name	LEN	DT	Description
1	Query Priority		1	ID	(**D**)eferred or (**I**)mmediate. If the query is a "D" (deferred) query, the query client will receive an immediate ACK back from the query server. The actual query results will be returned asynchronously, in a separate SOAP conversation. If the query is an "I" (immediate) query, the query client will receive the actual query results back in the current SOAP conversation.
2	Quantity Limited Request		10	CQ	
		Quantity		NM	Number of units (specified by the following component) that will be returned in each increment of the response. If no value is given, there is no limit on the number of results and reports returned.
		Units		CE	**CH**aracters, **LI**nes, **P**a**G**es, or **R**ecor**D**s. Should be **RD**, when valued.
No other RCP fields should be valued.					

5.2.2 Patient Identities Query Message Description

HL7 Segment	Repeat	Description
MSH	N	standard HL7 message header
QPD	N	Query Parameter Definition – required by HL7 standard, but not used
PID	N	Patient identification attributes
RCP	N	Response Control Parameters – max number of reports to return and definition of "immediate" versus "deferred" query response

5.2.3 Patient Identities Response Message Format

This response contains a list of HL7 PID segments, one for each patient registration that matches the attributes specified in the query. In the case where no matches are found, the return message contains no PID segments. "No matches" is **not** considered an error condition.

The response is an HL7 ADT Response ADR message with event code A19. It contains only the HL7 MSH, MSA, and PID segments, in that order. There is one PID segment per registration match found.

HL7 Segment	Repeat	Description
MSH	N	standard HL7 message header
MSA	N	HL7 message acknowledgment. It confirms that registration search was performed without error. It echoes back the *Patient Identities Query* message's MESSAGE CONTROL ID so that the response can be matched up with the request.
QAK	N	HL7 query acknowledgement
QPD	N	Query Parameter Definition – required by HL7 standard, but not used
PID	Y	One PID segment is returned per registration match. Each PID segment represents a single registration instance found within the target SNO's database(s). The NHIN server is free to populate as much of the PID segment as it wants to; however, the required values are an institutional medical record number along with its assigning authority. The institutional medical record number must be in <PID.3>. The medical record number itself will be in the child node <CX.1>. Child Node <CX.5> will contain the value "MR" signifying that the identifier is a medical record number. Child Node <CX.6> must contain the agreed upon institutional identifier for the institution at which the patient is registered. Each PID XML node must be a child of an HL7 RSP_Z02.QUERY_RESPONSE node. In other words, each <RSP_Z02.PATIENT> node contains exactly one <PID> node, but there may be any number of <RSP_Z02.PATIENT> nodes.
RCP	N	Response Control Parameters – max number of reports to return and definition of "immediate" versus "deferred" query response

5.2.4 *Sample* Patient Identities *Query Message Dialogue*

Sample Query:

```
<QBP_Z02 xmlns="urn:hl7-org:v2xml">
    <MSH>
        <MSH.1/>
        <MSH.2/>
        <MSH.3>
            <HD.1>Query Application Name</HD.1>
        </MSH.3>
        <MSH.4>
            <HD.1>ST ELSEWHERE HOSPITAL</HD.1>
        </MSH.4>
        <MSH.5>
            <HD.1>Target ISB</HD.1>
        </MSH.5>
        <MSH.6>
            <HD.1>Target SNO Name</HD.1>
        </MSH.6>
        <MSH.7>
            <TS.1>200506171410</TS.1>
        </MSH.7>
        <MSH.9>
            <MSG.1>QBP</MSG.1>
            <MSG.2>Z02</MSG.2>
            <MSG.3>QBP_Z02</MSG.3>
        </MSH.9>
        <MSH.10>987654321</MSH.10>
        <MSH.11>
            <PT.1>P</PT.1>
        </MSH.11>
        <MSH.12>
            <VID.1>2.4</VID.1>
        </MSH.12>
    </MSH>
    <QPD>
        <QPD.1></QPD.1>
        <QPD.2></QPD.2>
    </QPD>
    <PID>
        <PID.1></PID.1>
        <PID.2></PID.2>
        <PID.3></PID.3>
        <PID.5>
            <XPN.1>
                <FN.1>THOMPSON</FN.1>
            </XPN.1>
            <XPN.2>MARK</XPN.2>
            <XPN.3>Q</XPN.3>
        </PID.5>
        <PID.5>
            <XPN.1>
                <FN.1>AliasLastName</FN.1>
            </XPN.1>
            <XPN.2>AliasFirstName</XPN.2>
            <XPN.3>AliasMiddleName</XPN.3>
        </PID.5>
        <PID.7>
            <TS.1>19090630</TS.1>
        </PID.7>
        <PID.8>M</PID.8>
        <PID.11>
            <XAD.1>
                <SAD.1>28W 10TH Street</SAD.1>
            </XAD.1>
```

```
                    <XAD.3>Metropolis</XAD.3>
                    <XAD.4>IN</XAD.4>
                    <XAD.5>98765</XAD.5>
               </PID.11>
               <PID.11>
                    <XAD.1>
                         <SAD.1>666 Bleaker Street</SAD.1>
                    </XAD.1>
                    <XAD.3>QUINCY</XAD.3>
                    <XAD.4>MA</XAD.4>
                    <XAD.5>02171</XAD.5>
               </PID.11>
               <PID.19>9991112222</PID.19>
     </PID>
     <RCP/>
</QBP_Z02>
```

Sample Response:

```
<RSP_Z02 xmlns="urn:hl7-org:v2xml">
     <MSH>
               <MSH.1/>
               <MSH.2/>
               <MSH.3>
                    <HD.1>Target ISB</HD.1>
               </MSH.3>
               <MSH.4>
                    <HD.1>Target SNO Name</HD.1>
               </MSH.4>
               <MSH.5>
                    <HD.1>Query Application Name</HD.1>
               </MSH.5>
               <MSH.6>
                    <HD.1>ST ELSEWHERE HOSPITAL</HD.1>
               </MSH.6>
               <MSH.7>
                    <TS.1>20051024074505</TS.1>
               </MSH.7>
               <MSH.9>
                    <MSG.1>QBP</MSG.1>
                    <MSG.2>Z02</MSG.2>
                    <MSG.3>QBP_Z02</MSG.3>
               </MSH.9>
               <MSH.10>2</MSH.10>
               <MSH.11>
                    <PT.1>P</PT.1>
               </MSH.11>
               <MSH.12>
                    <VID.1>2.4</VID.1>
               </MSH.12>
     </MSH>
     <MSA>
               <MSA.1>AA</MSA.1>
               <MSA.2>123456789</MSA.2>
     </MSA>
     <QAK/>
     <QPD>
               <QPD.1></QPD.1>
               <QPD.2></QPD.2>
     </QPD>
     <RSP_Z02.QUERY_RESPONSE>
               <PID>
                    <PID.1/>
                    <PID.2/>
                    <PID.3>
```

```
                        <CX.1>MADEUP-7</CX.1>
                        <CX.4>
                                <HD.1>ST ELSEWHERE HOSPITAL Medical Record Numbers</HD.1>
                                <HD.2>MEDICAL RECORD NUMBER</HD.2>
                                <HD.3>ST ELSEWHERE HOSPITAL</HD.3>
                        </CX.4>
                        <CX.5>MR</CX.5>
                        <CX.6>
                                <HD.1>ST ELSEWHERE HOSPITAL</HD.1>
                        </CX.6>
                </PID.3>
                <PID.5>
                        <XPN.1>
                                <FN.1>THOMSON</FN.1>
                        </XPN.1>
                        <XPN.2>MARK</XPN.2>
                </PID.5>
                <PID.7>
                        <TS.1>19090630</TS.1>
                </PID.7>
                <PID.8>M</PID.8>
                <PID.11>
                        <XAD.3>N. QUINCY</XAD.3>
                        <XAD.4>MA</XAD.4>
                        <XAD.5>02171</XAD.5>
                </PID.11>
        </PID>
    </RSP_Z02.QUERY_RESPONSE>
    <RSP_Z02.QUERY_RESPONSE>
        <PID>
                <PID.1/>
                <PID.2/>
                <PID.3>
                        <CX.1>MADEUP-8</CX.1>
                        <CX.4>
                                <HD.1>ST ELSEWHERE HOSPITAL Medical Record Numbers</HD.1>
                                <HD.2>MEDICAL RECORD NUMBER</HD.2>
                                <HD.3>ST ELSEWHERE HOSPITAL</HD.3>
                        </CX.4>
                        <CX.5>MR</CX.5>
                        <CX.6>
                                <HD.1>ST ELSEWHERE HOSPITAL</HD.1>
                        </CX.6>
                </PID.3>
                <PID.5>
                        <XPN.1>
                                <FN.1>THOMSON</FN.1>
                        </XPN.1>
                        <XPN.2>MARCUS</XPN.2>
                </PID.5>
                <PID.7>
                        <TS.1>19090630</TS.1>
                </PID.7>
                <PID.8>M</PID.8>
                <PID.11>
                        <XAD.3>BOSTON</XAD.3>
                        <XAD.4>MA</XAD.4>
                        <XAD.5>02171</XAD.5>
                </PID.11>
        </PID>
    </RSP_Z02.QUERY_RESPONSE>
</RSP_Z02>
```

5.3 Access History Query – Reporting NHIN Accesses Made and Attempted

Access History Query requests data from the SNO's log of access attempts. This information could be used to obtain data about whose information a particular user has been accessing, which users have been accessing a particular person's data, or a combination of those conditions. HL7 supports this type of query with its QBP/RTB pattern (query by parameter and tabular response). The QPD elements can also be used to limit the returned access log data by time. The RCP elements can limit the response data to a maximum number of rows.

5.3.1 Access History *Query Conformance Statement*

Query Statement ID:	Z03
Type:	Query
Query Name:	Access History Query
Query Trigger (= MSH-9):	QBP^Z03^QBP_Z03
Query Mode:	Both
Response Trigger (= MSH-9):	RTB^Z03^RTB_Z03
Query Characteristics:	If a patient is specified, the patient will be identified by searching the NHIN server's Master Patient Index (MPI) or MPIs based on person attributes defined in the query PID segment and only accesses to that patient's data will be returned.
Purpose:	Queries an NHIN server for data from the patient data access log.
Response Characteristics:	Tabular data response from the patient data access log. Each logical row represents a single patient access through the NHIN.
Based on Segment Pattern:	

Query Grammar Pattern

QBP^Z03^QBP_Z03	Query Grammar: QBP Message	Group Control	Comment	Support Indicator	Sec Ref
MSH	Message Header				2.16.9
QPD	Query Parameter Definition				
PID	Patient Identification				3.4.2
RCP	Response Control Parameter				5.5.5

Response Grammar Pattern

RTB^Z03^RTB_Z03	Response Grammar:	Group Control	Comment	Support Indicator	Sec Ref
MSH	Message Header				2.16.9
MSA	Message Acknowledgement				2..16.8
[ERR]	Error				2.16.5
QAK	QueryAcknowledgement				5.5.2
QPD	Query Parameter Definition				5.5.3
[		ROW_DEFINITIO			

		N			
RDF	Table Row Definition Segment				5.5.6
[{ RDT }]	Table Row Data Segment				5.5.7
]					

QPD Input Parameter Specification

Field Seq	ColName	Key / Search	Sort	LEN	DT	Opt	RP / #	Match Op	TBL#	Segment Field Name	Service Identifier Code	Element Name
1	MessageQueryName			60	CE	R						Message Query Name
2	QueryTag			32	ST	R						Query Tag
3	AccessingUser			100	XCN	O						Accessing User
4	EarliestAccess			26	TS	O						Earliest Access
5	LatestAccess			26	TS	O						Latest Access

QPD Input Parameter Field Description and Commentary

Input Parameter	Comp. Name	DT	Description
MessageQuery Name		CE	Z03^Access History Query^NHIN Query Code
QueryTag		ST	Unique to each query message instance. This is used to relate the response back to its original query.
AccessingUser		XCN	Specifies the user whose accesses are to be returned. If this is left empty, then the response is not limited to accesses made by a single user.
Earliest Access		TS	If specified, this indicates the date and time of the earliest access log entry of interest.
Latest Access		TS	If specified, this indicates the date and time of the latest access log entry of interest.

RCP Response Control Parameter Field Description and Commentary

Field Seq	Name	Component Name	LEN	DT	Description
1	Query Priority		1	ID	(**D**)eferred or (**I**)mmediate. If the query is a "D" (deferred) query, the query client will receive an immediate ACK back from the query server. The actual query results will be returned asynchronously, in a separate SOAP conversation. If the query is an "I" (immediate) query, the query client will receive the actual query results back in the current SOAP conversation.
2	Quantity Limited Request		10	CQ	
		Quantity		NM	Number of units (specified by the following component) that will be returned in each increment of the response. If no value is given, there is no limit on the number of results and reports returned.
		Units		CE	**CH**aracters, **LI**nes, **PaGe**s, or **R**ecor**D**s. Should be **RD**, when valued.
No other RCP fields should be valued.					

Input/Output Specification: Virtual Table

ColName	Key/ Search	Sort	LEN	TYPE	Opt	Rep	Match Op	TBL	Segment Field Name	Service Identifier Code	Element Name
QueryUser			100	XCN							QueryUser
QueryURL			100	ST							QueryURL
QueryTag			40	ST							QueryTag
QueryBegin			26	TS							QueryBegin
QueryEnd			26	TS							QueryEnd
QueryServiceCode			200	CE		Y					QueryServiceCode
QueryDepartmentCode			200	CE		Y					QueryDepartmentCode
Patient			200	XCN		Y					Patient

Virtual Table Field Description and Commentary

ColName	Comp. Name	DT	Description
QueryUser		XCN	Defines user who submitted the NHIN query.
QueryURL		ST	URL from which the query was submitted.
QueryTag		ST	HL7 query name for the submitted query.
QueryBegin		TS	Date and time the query was received by the NHIN server.
QueryEnd		TS	Date and time the query was completed by the NHIN server.
QueryServiceCode		CE	List of types of data the query asked for. This comes from the QPD.4 (ServiceCode) value specified in the query
QueryDepartment Code		CE	List of departments from which data was being requested. This comes from QPD.5 (DepartmentCode).

Patient		XCN	List of registered patients whose data was returned by the query

5.3.2 Access History *Query HL7 Message Segments*

HL7 Segment	Repeat	Description
MSH	N	standard HL7 message header
QPD	N	Query Parameter Definition – can limit query to a range of access times and /or accesses by a specific user
PID	N	Patient identification attributes for patient of interest. Can be left empty to get all accesses by a specific user
RCP	N	Response Control Parameters – max number of reports to return and definition of "immediate" versus "deferred" query response

5.3.3 Access History *Query Response Message Format*

This response contains a list of the virtual "rows", one per user access returned from the user access log. "No matches" is **not** considered an error condition. No rows are simply returned.

HL7 Segment	Repeat	Description
MSH	N	standard HL7 message header
MSA	N	HL7 message acknowledgment. It confirms that registration search was performed without error. It echoes back the *Patient Identities Query* message's MESSAGE CONTROL ID so that the response can be matched up with the request.
QAK	N	HL7 query acknowledgement
QPD	N	Query Parameter Definition – required by HL7 standard, but not used
RDF	N	Defines the list of "virtual columns" returned by this query
RDT	Y	One row data segment for each row of data returned; that is, one for each user access returned

5.3.4 *Sample* Access History *Message Dialogue*

Sample Query:

```
<QBP_Z03 xmlns="urn:hl7-org:v2xml">
    <MSH>
        <MSH.1/>
        <MSH.2/>
        <MSH.3>
            <HD.1>Query Application Name</HD.1>
        </MSH.3>
        <MSH.4>
            <HD.1>ST ELSEWHERE HOSPITAL</HD.1>
        </MSH.4>
        <MSH.5>
            <HD.1>Target ISB</HD.1>
        </MSH.5>
        <MSH.6>
            <HD.1>Target SNO Name</HD.1>
        </MSH.6>
        <MSH.7>
            <TS.1>200506171410</TS.1>
        </MSH.7>
```

```
            <MSH.9>
                        <MSG.1>QBP</MSG.1>
                        <MSG.2>Z03</MSG.2>
                        <MSG.3>QBP_Z03</MSG.3>
            </MSH.9>
            <MSH.10>987654321</MSH.10>
            <MSH.11>
                        <PT.1>P</PT.1>
            </MSH.11>
            <MSH.12>
                        <VID.1>2.4</VID.1>
            </MSH.12>
      </MSH>
      <QPD>
            <QPD.1>
                        <CE.1>Z03</CE.1>
                        <CE.2>Access History Query</CE.2>
                        <CE.3>NHIN Query Code</CE.3>
            </QPD.1>
            <QPD.2>Q987654321</QPD.2>
            <QPD.4>
                        <TS.1>200602241030</TS.1>
            </QPD.4>
      </QPD>
      <PID>
            <PID.1></PID.1>
            <PID.2></PID.2>
            <PID.3></PID.3>
            <PID.5>
                        <XPN.1>
                                    <FN.1>THOMPSON</FN.1>
                        </XPN.1>
                        <XPN.2>MARK</XPN.2>
                        <XPN.3>Q</XPN.3>
            </PID.5>
            <PID.5>
                        <XPN.1>
                                    <FN.1>AliasLastName</FN.1>
                        </XPN.1>
                        <XPN.2>AliasFirstName</XPN.2>
                        <XPN.3>AliasMiddleName</XPN.3>
            </PID.5>
            <PID.7>
                        <TS.1>19090630</TS.1>
            </PID.7>
            <PID.8>M</PID.8>
            <PID.11>
                        <XAD.1>
                                    <SAD.1>28W 10TH Street</SAD.1>
                        </XAD.1>
                        <XAD.3>Metropolis</XAD.3>
                        <XAD.4>IN</XAD.4>
                        <XAD.5>98765</XAD.5>
            </PID.11>
            <PID.11>
                        <XAD.1>
                                    <SAD.1>666 Bleaker Street</SAD.1>
                        </XAD.1>
                        <XAD.3>QUINCY</XAD.3>
                        <XAD.4>MA</XAD.4>
                        <XAD.5>02171</XAD.5>
            </PID.11>
            <PID.19>9991112222</PID.19>
      </PID>
      <RCP/>
</QBP_Z03>
```

Sample Response:

```
<RTB_Z03 xmlns="urn:hl7-org:v2xml">
    <MSH>
        <MSH.1/>
        <MSH.2/>
        <MSH.3>
            <HD.1>Target ISB</HD.1>
        </MSH.3>
        <MSH.4>
            <HD.1>Target SNO Name</HD.1>
        </MSH.4>
        <MSH.5>
            <HD.1>Query Application Name</HD.1>
        </MSH.5>
        <MSH.6>
            <HD.1>ST ELSEWHERE HOSPITAL</HD.1>
        </MSH.6>
        <MSH.7>
            <TS.1>20051024074505</TS.1>
        </MSH.7>
        <MSH.9>
            <MSG.1>RSP</MSG.1>
            <MSG.2>Z03</MSG.2>
            <MSG.3>RSP_Z03</MSG.3>
        </MSH.9>
        <MSH.10>2</MSH.10>
        <MSH.11>
            <PT.1>P</PT.1>
        </MSH.11>
        <MSH.12>
            <VID.1>2.4</VID.1>
        </MSH.12>
    </MSH>
    <MSA>
        <MSA.1>AA</MSA.1>
        <MSA.2>123456789</MSA.2>
    </MSA>
    <QAK/>
    <QPD>
        <QPD.1>
            <CE.1>Z03</CE.1>
            <CE.2>Access History Query</CE.2>
            <CE.3>NHIN Query Code</CE.3>
        </QPD.1>
        <QPD.2>Q987654321</QPD.2>
        <QPD.4>
            <TS.1>200602241030</TS.1>
        </QPD.4>
    </QPD>
    <RTB_Z03.ROW_DEFINITION>
        <RDF>
            <RDF.1>8</RDF.1>
            <RDF.2>
                <RCD.1>QueryUser</RCD.1>
                <RCD.2>XCN</RCD.2>
                <RCD.3>100</RCD.3>
            </RDF.2>
            <RDF.2>
                <RCD.1>QueryURL</RCD.1>
                <RCD.2>ST</RCD.2>
                <RCD.3>100</RCD.3>
            </RDF.2>
            <RDF.2>
                <RCD.1>QueryTag</RCD.1>
```

```
                <RCD.2>ST</RCD.2>
                <RCD.3>40</RCD.3>
        </RDF.2>
        <RDF.2>
                <RCD.1>QueryBegin</RCD.1>
                <RCD.2>DT</RCD.2>
                <RCD.3>26</RCD.3>
        </RDF.2>
        <RDF.2>
                <RCD.1>QueryEnd</RCD.1>
                <RCD.2>DT</RCD.2>
                <RCD.3>26</RCD.3>
        </RDF.2>
        <RDF.2>
                <RCD.1>QueryServiceCode</RCD.1>
                <RCD.2>CE</RCD.2>
                <RCD.3>200</RCD.3>
        </RDF.2>
        <RDF.2>
                <RCD.1>QueryDepartmentCode</RCD.1>
                <RCD.2>CE</RCD.2>
                <RCD.3>200</RCD.3>
        </RDF.2>
        <RDF.2>
                <RCD.1>Patient</RCD.1>
                <RCD.2>XCN</RCD.2>
                <RCD.3>200</RCD.3>
        </RDF.2>
</RDF>
<RDT>
        <RDT.1>
                <XCN.1>JoeUser</XCN.1>
                <XCN.2>
                        <FN.1>Smith</FN.1>
                </XCN.2>
                <XCN.3>Joseph</XCN.3>
                <XCN.9>
                        <HD.1>ST ELSEWHERE HOSPITAL Users</HD.1>
                        <HD.2>USERID</HD.2>
                        <HD.3>ST ELSEWHERE HOSPITAL</HD.3>
                </XCN.9>
                <XCN.13>EI</XCN.13>
                <XCN.14>
                        <HD.1>ST ELSEWHERE HOSPITAL</HD.1>
                </XCN.14>
        </RDT.1>
        <RDT.2>https://www.myisb.org</RDT.2>
        <RDT.3>Observation Reporting Query</RDT.3>
        <RDT.4>
                <TS.1>200602230831</TS.1>
        </RDT.4>
        <RDT.5>
                <TS.1>200602230832</TS.1>
        </RDT.5>
        <RDT.8>
                <XCN.1>123456-7</XCN.1>
                <XCN.2>
                        <FN.1>Patient</FN.1>
                </XCN.2>
                <XCN.3>Example</XCN.3>
                <XCN.9>
                        <HD.1>Brigadoon Emergency Care Patients</HD.1>
                        <HD.2>MR</HD.2>
                        <HD.3>Brigadoon Emergency Care</HD.3>
                </XCN.9>
                <XCN.13>MR</XCN.13>
                <XCN.14>
```

```
                                        <HD.1>Brigadoon Emergency Care</HD.1>
                                    </XCN.14>
                                </RDT.8>
                            </RDT>
                        </RTB_Z03.ROW_DEFINITION>
                    </RTB_Z03>
```

6 Using Registration Data from the *Patient Identities Query* Response in a Subsequent *Observation Reporting Query*

An NHIN query client may choose not to obtain the results, reports, and/or medications from all registrations, only from selected ones. To support this type of query, NHIN queries recognize the <IdentifyPatient> attribute within the query <EvaluationSettings>. When <IdentifyPatient> is set to "no", the query must already contain one or more fully identified patient registrations, usually from the response to a previous *Patient Identities* query. Let us define how such a combination of queries and responses might look.

First, the client makes a *Patient Identities* query, just like the one described in section 5.2. For brevity, we do not repeat that sample query here. Refer to section 5.2.4 for that example. Suppose that the NHIN client now determines that it wants the results and reports stored for the MADEUP-8 medical record number rather than the results and reports stored for all identified medical record numbers. The NHIN client constructs the *Observation Report Query* listed below. Note that the PID segment included in this query message is **identical** to the PID segment returned in the *Patient Identities Query* response. The response to this query is like any other *Observation Reporting Query* response.

Sample Query:

```
<soapEnv:Body>
<nhin:EvaluationSettings>
    <nhin:IdentifyPatient>no</nhin:IdentifyPatient>
</nhin:EvaluationSettings>
<nhin:Query>

<QBP_Z01 xmlns="urn:hl7-org:v2xml" >
    <MSH>
            <MSH.1/>
            <MSH.2/>
            <MSH.3>
                    <HD.1>Query Application Name</HD.1>
            </MSH.3>
            <MSH.4>
                    <HD.1>ST ELSEWHERE HOSPITAL</HD.1>
            </MSH.4>
            <MSH.5>
                    <HD.1>Target ISB</HD.1>
            </MSH.5>
            <MSH.6>
                    <HD.1>Target SNO Name</HD.1>
            </MSH.6>
            <MSH.7>
                    <TS.1>200506171410</TS.1>
            </MSH.7>
            <MSH.9>
                    MSG.1>QBP</MSG.1>
                    <MSG.2>Z01</MSG.2>
                    <MSG.3>QBP_Z01</MSG.3>
            </MSH.9>
            <MSH.10>123456789</MSH.10>
            <MSH.11>
                    <PT.1>P</PT.1>
            </MSH.11>
            <MSH.12>
                    <VID.1>2.4</VID.1>
            </MSH.12>
    </MSH>
    <QPD>
```

```
                <QPD.1>
                        <CE.1>Z01</CE.1>
                        <CE.2>Observation Reporting Query</CE.2>
                        <CE.3>NHIN Query Code</CE.3>
                </QPD.1>
                <QPD.2>Q123456</QPD.2>
                <QPD.3>
                        <CE.1>RES</CE.1>
                        <CE.2>result</CE.2>
                        <CE.3>0048</CE.3>
                </QPD.3>
                <QPD.5>
                        <CE.1>LABORATORY</CE.1>
                        <CE.2>Laboratory</CE.2>
                        <CE.3>NHIN_0001</CE.3>
                </QPD.5>
                <QPD.6>
                        <TS.1>19980810</TS.1>
                </QPD.6>
                <QPD.8>LATEST</QPD.8>
        </QPD>
        <PID>
                <PID.1></PID.1>
                <PID.2></PID.2>
                <PID.3>
                        <CX.1>MADEUP-8</CX.1>
                        <CX.4>
                                <HD.1>ST ELSEWHERE HOSPITAL Medical Record Numbers</HD.1>
                                <HD.2>MEDICAL RECORD NUMBER</HD.2>
                                <HD.3>ST ELSEWHERE HOSPITAL</HD.3>
                        </CX.4>
                        <CX.5>MR</CX.5>
                        <CX.6>
                                <HD.1>ST ELSEWHERE HOSPITAL</HD.1>
                        </CX.6>
                </PID.3>
                <PID.5>
                        <XPN.1>
                                <FN.1>THOMSON</FN.1>
                        </XPN.1>
                        <XPN.2>MARCUS</XPN.2>
                </PID.5>
                <PID.7>
                        <TS.1>19090630</TS.1>
                </PID.7>
                <PID.8>M</PID.8>
                <PID.11>
                        <XAD.3>BOSTON</XAD.3>
                        <XAD.4>MA</XAD.4>
                        <XAD.5>02171</XAD.5>
                </PID.11>
        </PID>
        <RCP>
                <RCP.1>I</RCP.1>
                <RCP.2><CQ.1>10</CQ.1></RCP.2>
        </RCP>
</QBP_Z01>

</nhin:Query>
</soapenv:Body>
```

7 Response Containing Non-HL7 Data

Currently, the only non-HL7 response from an NHIN *PatientDataQuery* is the medication dispensing history. This data is returned in NCPDP Scripts 8.1 format. Complete documentation of that format can be found at "Medication History Standards," part of part of *The **Connecting for Health** Common Framework: Resources for Implementing Private and Secure Health Information Exchange*.

Note that there are two <Response> nodes, one for a brief HL7 response and one for the NCPDP Scripts 8.1 data. If the query had requested both LABORATORY and MEDICATIONS DISPENSED data, the HL7-style <Response> node would have also contained the LABORATORY results data.

Sample Query:

```
<Query>
  <QBP_Z01 xmlns="urn:hl7-org:v2xml" >
    <MSH>
          <MSH.1/>
          <MSH.2/>
          <MSH.3>
                <HD.1>Query Application Name</HD.1>
          </MSH.3>
          <MSH.4>
                <HD.1>ST ELSEWHERE HOSPITAL</HD.1>
          </MSH.4>
          <MSH.5>
                <HD.1>Target ISB</HD.1>
          </MSH.5>
          <MSH.6>
                <HD.1>Target SNO Name</HD.1>
          </MSH.6>
          <MSH.7>
                <TS.1>200506171410</TS.1>
          </MSH.7>
          <MSH.9>
                <MSG.1>QBP</MSG.1>
                <MSG.2>Z01</MSG.2>
                <MSG.3>QBP_Z01</MSG.3>
          </MSH.9>
          <MSH.10>123456789</MSH.10>
          <MSH.11>
                <PT.1>P</PT.1>
          </MSH.11>
          <MSH.12>
                <VID.1>2.4</VID.1>
          </MSH.12>
    </MSH>
    <QPD>
          <QPD.1>
                <CE.1>Z01</CE.1>
                <CE.2>Observation Reporting Query</CE.2>
                <CE.3>NHIN Query Code</CE.3>
          </QPD.1>
          <QPD.2>Q123456</QPD.2>
          <QPD.3>
                <CE.1>RES</CE.1>
                <CE.2>result</CE.2>
                <CE.3>0048</CE.3>
          </QPD.3>
          <QPD.5>
                <CE.1>MEDICATIONS DISPENSED</CE.1>
```

```
                <CE.2>Medications Dispensed</CE.2>
                <CE.3>NHIN_0001</CE.3>
            </QPD.5>
            <QPD.6>
                <TS.1>19980810</TS.1>
            </QPD.6>
            <QPD.8>LATEST</QPD.8>
    </QPD>
    <PID>
            <PID.1></PID.1>
            <PID.2></PID.2>
            <PID.3></PID.3>
            <PID.5>
                <XPN.1>
                    <FN.1>THOMPSON</FN.1>
                </XPN.1>
                <XPN.2>MARK</XPN.2>
                <XPN.3>Q</XPN.3>
            </PID.5>
            <PID.5>
                <XPN.1>
                    <FN.1>AliasLastName</FN.1>
                </XPN.1>
                <XPN.2>AliasFirstName</XPN.2>
                <XPN.3>AliasMiddleName</XPN.3>
            </PID.5>
            <PID.7>
                <TS.1>19090630</TS.1>
            </PID.7>
            <PID.8>M</PID.8>
            <PID.11>
                <XAD.1>
                    <SAD.1>28W 10TH Street</SAD.1>
                </XAD.1>
                <XAD.3>Metropolis</XAD.3>
                <XAD.4>IN</XAD.4>
                <XAD.5>98765</XAD.5>
            </PID.11>
            <PID.11>
                <XAD.1>
                    <SAD.1>666 Bleaker Street</SAD.1>
                </XAD.1>
                <XAD.3>QUINCY</XAD.3>
                <XAD.4>MA</XAD.4>
                <XAD.5>02171</XAD.5>
            </PID.11>
            <PID.19>9991112222</PID.19>
    </PID>
    <RCP>
            <RCP.1>I</RCP.1>
            <RCP.2><CQ.1>10</CQ.1></RCP.2>
    </RCP>
  </QBP_Z01>
</Query>
```

Sample Response(s):

This response assumes that the following namespace has been defined:

xmlns:ns0="http://www.ncpdp.org"

```
<Response>
  <RSP_Z01 xmlns="urn:hl7-org:v2xml">
    <MSH>
            <MSH.1/>
            <MSH.2/>
```

```
            <MSH.3>
                  <HD.1>Target ISB</HD.1>
            </MSH.3>
            <MSH.4>
                  <HD.1>Target SNO Name</HD.1>
            </MSH.4>
            <MSH.5>
                  <HD.1>Query Application Name</HD.1>
            </MSH.5>
            <MSH.6>
                  <HD.1>ST ELSEWHERE HOSPITAL</HD.1>
            </MSH.6>
            <MSH.7>
                  <TS.1>20051024074506</TS.1>
            </MSH.7>
            <MSH.9>
                  <MSG.1>RSP</MSG.1>
                  <MSG.2>Z01</MSG.2>
                  <MSG.3>RSP_Z01</MSG.3>
            </MSH.9>
            <MSH.10>432</MSH.10>
            <MSH.11>
                  <PT.1>P</PT.1>
            </MSH.11>
            <MSH.12>
                  <VID.1>2.4</VID.1>
            </MSH.12>
      </MSH>
      <MSA>
            <MSA.1>AA</MSA.1>
            <MSA.2>123456789</MSA.2>
      </MSA>
      <QAK/>
      <QPD>
            <QPD.1>
                  <CE.1>Z01</CE.1>
                  <CE.2>Observation Reporting Query</CE.2>
                  <CE.3>NHIN Query Code</CE.3>
            </QPD.1>
            <QPD.2>Q123456</QPD.2>
            <QPD.3>
                  <CE.1>RES</CE.1>
                  <CE.2>result</CE.2>
                  <CE.3>0048</CE.3>
            </QPD.3>
            <QPD.5>
                  <CE.1>MEDICATIONS DISPENSED</CE.1>
                  <CE.2>Medications Dispensed</CE.2>
                  <CE.3>NHIN_0001</CE.3>
            </QPD.5>
            <QPD.6>
                  <TS.1>19980810</TS.1>
            </QPD.6>
            <QPD.8>LATEST</QPD.8>
      </QPD>
   </RSP_Z01>
</Response>
<Response>
      <ns0:UIB>
            <ns0:syntaxIdentifier>
                  <ns0:syntaxIdentifier>UNOA</ns0:syntaxIdentifier>
                  <ns0:syntaxVersionNumber>0</ns0:syntaxVersionNumber>
            </ns0:syntaxIdentifier>
            <ns0:transactionReference>
                  <ns0:transactionControlReference>1</ns0:transactionControlReference>
            </ns0:transactionReference>
            <ns0:interchangeSender>
```

```
                        <ns0:senderIdentificationLevelOne>3</ns0:senderIdentificationLevelOne>
                        <ns0:levelOneIdentificationCodeQualifier>SID</ns0:levelOneIdentificationCodeQualifier>
                </ns0:interchangeSender>
                <ns0:interchangeRecipient>
                        <ns0:recipientIdentificationLevelOne>57c42842-25e9-4b57-b93f-
4e8e99bcfabc</ns0:recipientIdentificationLevelOne>
                        <ns0:levelOneIdentificationCodeQualifier>SID</ns0:levelOneIdentificationCodeQualifier>
                        <ns0:recipientIdentificationLevelTwo>JohnD</ns0:recipientIdentificationLevelTwo>
                        <ns0:levelTwoIdentificationCodeQualifier>ZZZ</ns0:levelTwoIdentificationCodeQualifier>
                        <ns0:recipientIdentificationLevelThree>HR Staff</ns0:recipientIdentificationLevelThree>

        <ns0:levelThreeIdentificationCodeQualifier>ROL</ns0:levelThreeIdentificationCodeQualifier>
                </ns0:interchangeRecipient>
                <ns0:dateTimeOfInitiation>
                        <ns0:date>20051114</ns0:date>
                        <ns0:eventTime>013045</ns0:eventTime>
                        <ns0:offSet>-0700</ns0:offSet>
                </ns0:dateTimeOfInitiation>
        </ns0:UIB>
        <ns0:UIH>
                <ns0:messageType>Response</ns0:messageType>
                <ns0:messageVersionNumber>008</ns0:messageVersionNumber>
                <ns0:messageReleaseNumber>001</ns0:messageReleaseNumber>
                <ns0:messageFunction>RxHRES</ns0:messageFunction>
                <ns0:messageReferenceNumber>123</ns0:messageReferenceNumber>
                <ns0:dialogueReference>
                        <ns0:initiatorControlReference>1</ns0:initiatorControlReference>
                </ns0:dialogueReference>
        </ns0:UIH>
        <ns0:RES>
                <ns0:responseTypeCode>A</ns0:responseTypeCode>
        </ns0:RES>
        <ns0:PTT>
                <ns0:birthdate>19090630</ns0:birthdate>
                <ns0:name>
                        <ns0:partyName>THOMSON</ns0:partyName>
                        <ns0:firstName>MARK</ns0:firstName>
                </ns0:name>
                <ns0:genderCode>M</ns0:genderCode>
                <ns0:referenceNumber>
                        <ns0:referenceNumber>http://ceide4/CDX/CDX_MH.asmx</ns0:referenceNumber>
                        <ns0:referenceQualifier>UR</ns0:referenceQualifier>
                </ns0:referenceNumber>
                <ns0:communicationNumber/>
        </ns0:PTT>
        <ns0:PVD>
                <ns0:providerCode>PC</ns0:providerCode>
                <ns0:referenceNumber>
                        <ns0:referenceNumber>12343</ns0:referenceNumber>
                        <ns0:referenceQualifier>0B</ns0:referenceQualifier>
                </ns0:referenceNumber>
                <ns0:communicationNumber>
                        <ns0:communicationNumber/>
                        <ns0:codeListQualifier>TE</ns0:codeListQualifier>
                </ns0:communicationNumber>
                <ns0:name>
                        <ns0:partyName/>
                        <ns0:firstName/>
                        <ns0:middleName/>
                        <ns0:nameSuffix/>
                        <ns0:namePrefix/>
                </ns0:name>
        </ns0:PVD>
        <ns0:DRU>
                <ns0:drug>
                        <ns0:itemDescriptionIdentification>D</ns0:itemDescriptionIdentification>
                        <ns0:itemDescription>Docusate Sodium</ns0:itemDescription>
```

```
                <ns0:itemNumber>51079001920</ns0:itemNumber>
                <ns0:codeListResponsibiltyAgency>ND</ns0:codeListResponsibiltyAgency>
                <ns0:measurementValue>100MG CAP</ns0:measurementValue>
                <ns0:form>1 CAP</ns0:form>
        </ns0:drug>
        <ns0:quantity>
                <ns0:quantityQualifier>EA</ns0:quantityQualifier>
                <ns0:quantity>1.00</ns0:quantity>
        </ns0:quantity>
        <ns0:directions>
                <ns0:dosage>100 mg</ns0:dosage>
        </ns0:directions>
        <ns0:date>
                <ns0:dateTimePeriod>20030817200000-0400</ns0:dateTimePeriod>
                <ns0:dateTimePeriodFormatQualifier>126</ns0:dateTimePeriodFormatQualifier>
                <ns0:dateTimePeriodQualifier>07</ns0:dateTimePeriodQualifier>
        </ns0:date>
        <ns0:date>
                <ns0:dateTimePeriod>20030815150000-0400</ns0:dateTimePeriod>
                <ns0:dateTimePeriodFormatQualifier>126</ns0:dateTimePeriodFormatQualifier>
                <ns0:dateTimePeriodQualifier>36</ns0:dateTimePeriodQualifier>
        </ns0:date>
        <ns0:date>
                <ns0:dateTimePeriod>20030819111354-0400</ns0:dateTimePeriod>
                <ns0:dateTimePeriodFormatQualifier>126</ns0:dateTimePeriodFormatQualifier>
                <ns0:dateTimePeriodQualifier>LD</ns0:dateTimePeriodQualifier>
        </ns0:date>
        <ns0:productSubstitutionCode>0</ns0:productSubstitutionCode>
        <ns0:refillQuantity>
                <ns0:quantityQualifier>R</ns0:quantityQualifier>
                <ns0:quantity>0</ns0:quantity>
        </ns0:refillQuantity>
</ns0:DRU>
<ns0:DRU>
        <ns0:drug>
                <ns0:itemDescriptionIdentification>D</ns0:itemDescriptionIdentification>
                <ns0:itemDescription>Oxycodone-Acetaminophen</ns0:itemDescription>
                <ns0:itemNumber>00054865024</ns0:itemNumber>
                <ns0:codeListResponsibiltyAgency>ND</ns0:codeListResponsibiltyAgency>
                <ns0:measurementValue>5mg/325mg Tab</ns0:measurementValue>
                <ns0:form>1-2 TAB</ns0:form>
        </ns0:drug>
        <ns0:quantity>
                <ns0:quantityQualifier/>
                <ns0:quantity/>
        </ns0:quantity>
        <ns0:directions>
                <ns0:dosage>1-2 TAB</ns0:dosage>
        </ns0:directions>
        <ns0:date>
                <ns0:dateTimePeriod>20030817200000-0400</ns0:dateTimePeriod>
                <ns0:dateTimePeriodFormatQualifier>126</ns0:dateTimePeriodFormatQualifier>
                <ns0:dateTimePeriodQualifier>07</ns0:dateTimePeriodQualifier>
        </ns0:date>
        <ns0:date>
                <ns0:dateTimePeriod>20030815150000-0400</ns0:dateTimePeriod>
                <ns0:dateTimePeriodFormatQualifier>126</ns0:dateTimePeriodFormatQualifier>
                <ns0:dateTimePeriodQualifier>36</ns0:dateTimePeriodQualifier>
        </ns0:date>
        <ns0:productSubstitutionCode>0</ns0:productSubstitutionCode>
        <ns0:refillQuantity>
                <ns0:quantityQualifier>R</ns0:quantityQualifier>
                <ns0:quantity>0</ns0:quantity>
        </ns0:refillQuantity>
</ns0:DRU>
<ns0:DRU>
        <ns0:drug>
```

```
                <ns0:itemDescriptionIdentification>D</ns0:itemDescriptionIdentification>
                <ns0:itemDescription>Ibuprofen</ns0:itemDescription>
                <ns0:itemNumber>51079028220</ns0:itemNumber>
                <ns0:codeListResponsibiltyAgency>ND</ns0:codeListResponsibiltyAgency>
                <ns0:measurementValue>600MG TAB</ns0:measurementValue>
                <ns0:form>1 TAB</ns0:form>
        </ns0:drug>
        <ns0:quantity>
                <ns0:quantityQualifier>EA</ns0:quantityQualifier>
                <ns0:quantity>1.00</ns0:quantity>
        </ns0:quantity>
        <ns0:directions>
                <ns0:dosage>600 mg</ns0:dosage>
        </ns0:directions>
        <ns0:date>
                <ns0:dateTimePeriod>20030817200000-0400</ns0:dateTimePeriod>
                <ns0:dateTimePeriodFormatQualifier>126</ns0:dateTimePeriodFormatQualifier>
                <ns0:dateTimePeriodQualifier>07</ns0:dateTimePeriodQualifier>
        </ns0:date>
        <ns0:date>
                <ns0:dateTimePeriod>20030815150000-0400</ns0:dateTimePeriod>
                <ns0:dateTimePeriodFormatQualifier>126</ns0:dateTimePeriodFormatQualifier>
                <ns0:dateTimePeriodQualifier>36</ns0:dateTimePeriodQualifier>
        </ns0:date>
        <ns0:date>
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                <ns0:dateTimePeriodFormatQualifier>126</ns0:dateTimePeriodFormatQualifier>
                <ns0:dateTimePeriodQualifier>LD</ns0:dateTimePeriodQualifier>
        </ns0:date>
        <ns0:productSubstitutionCode>0</ns0:productSubstitutionCode>
        <ns0:refillQuantity>
                <ns0:quantityQualifier>R</ns0:quantityQualifier>
                <ns0:quantity>0</ns0:quantity>
        </ns0:refillQuantity>
</ns0:DRU>
<ns0:DRU>
        <ns0:drug>
                <ns0:itemDescriptionIdentification>D</ns0:itemDescriptionIdentification>
                <ns0:itemDescription>Codeine</ns0:itemDescription>
                <ns0:itemNumber>00054815624</ns0:itemNumber>
                <ns0:codeListResponsibiltyAgency>ND</ns0:codeListResponsibiltyAgency>
                <ns0:measurementValue>30mg Tab</ns0:measurementValue>
                <ns0:form>1-2 TAB</ns0:form>
        </ns0:drug>
        <ns0:quantity>
                <ns0:quantityQualifier/>
                <ns0:quantity/>
        </ns0:quantity>
        <ns0:directions>
                <ns0:dosage>30-60 mg</ns0:dosage>
        </ns0:directions>
        <ns0:date>
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                <ns0:dateTimePeriodFormatQualifier>126</ns0:dateTimePeriodFormatQualifier>
                <ns0:dateTimePeriodQualifier>07</ns0:dateTimePeriodQualifier>
        </ns0:date>
        <ns0:date>
                <ns0:dateTimePeriod>20030815150000-0400</ns0:dateTimePeriod>
                <ns0:dateTimePeriodFormatQualifier>126</ns0:dateTimePeriodFormatQualifier>
                <ns0:dateTimePeriodQualifier>36</ns0:dateTimePeriodQualifier>
        </ns0:date>
        <ns0:productSubstitutionCode>0</ns0:productSubstitutionCode>
        <ns0:refillQuantity>
                <ns0:quantityQualifier>R</ns0:quantityQualifier>
                <ns0:quantity>0</ns0:quantity>
        </ns0:refillQuantity>
</ns0:DRU>
```

```
<ns0:DRU>
	<ns0:drug>
		<ns0:itemDescriptionIdentification>D</ns0:itemDescriptionIdentification>
		<ns0:itemDescription>Acetaminophen</ns0:itemDescription>
		<ns0:itemNumber>51079039620</ns0:itemNumber>
		<ns0:codeListResponsibiltyAgency>ND</ns0:codeListResponsibiltyAgency>
		<ns0:measurementValue>500MG TAB</ns0:measurementValue>
		<ns0:form>1-2 TAB</ns0:form>
	</ns0:drug>
	<ns0:quantity>
		<ns0:quantityQualifier>EA</ns0:quantityQualifier>
		<ns0:quantity>2.00</ns0:quantity>
	</ns0:quantity>
	<ns0:directions>
		<ns0:dosage>500-1000 mg</ns0:dosage>
	</ns0:directions>
	<ns0:date>
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		<ns0:quantityQualifier>R</ns0:quantityQualifier>
		<ns0:quantity>0</ns0:quantity>
	</ns0:refillQuantity>
</ns0:DRU>
<ns0:DRU>
	<ns0:drug>
		<ns0:itemDescriptionIdentification>D</ns0:itemDescriptionIdentification>
		<ns0:itemDescription>Bisacodyl (Rectal)</ns0:itemDescription>
		<ns0:itemNumber>51079055271</ns0:itemNumber>
		<ns0:codeListResponsibiltyAgency>ND</ns0:codeListResponsibiltyAgency>
		<ns0:measurementValue>10MG SUPP</ns0:measurementValue>
		<ns0:form>1 SUPP</ns0:form>
	</ns0:drug>
	<ns0:quantity>
		<ns0:quantityQualifier/>
		<ns0:quantity/>
	</ns0:quantity>
	<ns0:directions>
		<ns0:dosage>10 mg</ns0:dosage>
	</ns0:directions>
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	</ns0:date>
	<ns0:date>
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		<ns0:dateTimePeriodFormatQualifier>126</ns0:dateTimePeriodFormatQualifier>
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	<ns0:refillQuantity>
		<ns0:quantityQualifier>R</ns0:quantityQualifier>
		<ns0:quantity>0</ns0:quantity>
```

```
        </ns0:refillQuantity>
</ns0:DRU>
<ns0:DRU>
        <ns0:drug>
                <ns0:itemDescriptionIdentification>D</ns0:itemDescriptionIdentification>
                <ns0:itemDescription>Milk Of Magnesia</ns0:itemDescription>
                <ns0:itemNumber>51079036430</ns0:itemNumber>
                <ns0:codeListResponsibiltyAgency>ND</ns0:codeListResponsibiltyAgency>
                <ns0:measurementValue>30ML UDCUP</ns0:measurementValue>
                <ns0:form>1 UDCUP</ns0:form>
        </ns0:drug>
        <ns0:quantity>
                <ns0:quantityQualifier/>
                <ns0:quantity/>
        </ns0:quantity>
        <ns0:directions>
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        </ns0:directions>
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        </ns0:date>
        <ns0:productSubstitutionCode>0</ns0:productSubstitutionCode>
        <ns0:refillQuantity>
                <ns0:quantityQualifier>R</ns0:quantityQualifier>
                <ns0:quantity>0</ns0:quantity>
        </ns0:refillQuantity>
</ns0:DRU>
<ns0:DRU>
        <ns0:drug>
                <ns0:itemDescriptionIdentification>D</ns0:itemDescriptionIdentification>
                <ns0:itemDescription>Dibucaine</ns0:itemDescription>
                <ns0:itemNumber>00168004631</ns0:itemNumber>
                <ns0:codeListResponsibiltyAgency>ND</ns0:codeListResponsibiltyAgency>
                <ns0:measurementValue>30GM TUBE 1%</ns0:measurementValue>
                <ns0:form>0.1 TUBE</ns0:form>
        </ns0:drug>
        <ns0:quantity>
                <ns0:quantityQualifier>EA</ns0:quantityQualifier>
                <ns0:quantity>1.00</ns0:quantity>
        </ns0:quantity>
        <ns0:directions>
                <ns0:dosage>1 Appl</ns0:dosage>
        </ns0:directions>
        <ns0:date>
                <ns0:dateTimePeriod>20030817200000-0400</ns0:dateTimePeriod>
                <ns0:dateTimePeriodFormatQualifier>126</ns0:dateTimePeriodFormatQualifier>
                <ns0:dateTimePeriodQualifier>07</ns0:dateTimePeriodQualifier>
        </ns0:date>
        <ns0:date>
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        </ns0:date>
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        </ns0:date>
        <ns0:productSubstitutionCode>0</ns0:productSubstitutionCode>
        <ns0:refillQuantity>
```

```
                        <ns0:quantityQualifier>R</ns0:quantityQualifier>
                        <ns0:quantity>0</ns0:quantity>
                </ns0:refillQuantity>
        </ns0:DRU>
        <ns0:UIT>
                <ns0:messageReferenceNumber>0</ns0:messageReferenceNumber>
        </ns0:UIT>
        <ns0:UIZ>Text</ns0:UIZ>
</ns0:RXHRES>
</Response>
```

APPENDIX A – HL7 Implementation Guidelines

1. Populating the PID Values for a Patient Search

The system sending an *Observation Reporting Query* request should populate as many of the PID segment values as it knows. Each SNO that receives the search query uses its own search algorithm and decides which of the incoming PID values it will use. The only values that are guaranteed to be used are the patient name, birth date, and gender.

2. CX Identifier Values

When HL7 messages are being sent between systems, CX values may present difficult implementation issues. CX values as used for institutional medical record numbers, ancillary system order numbers, physician order entry order numbers, insurance policy numbers, driver license numbers, credit card numbers, billing account numbers, patient visit numbers, etc. Our HL7 implementation pays attention to the CX.1 (*Identifier)*, CX.2 (*Check digit*), CX.4 (*Assigning authority*), and CX.5 (*Identifier type code*) sub-component values. We generate CX.6 (*Assigning facility*) component values in our outgoing messages, when appropriate.

We concatenate the incoming CX.1 (*Identifier*) and CX.2 (*Check digit*) components, strip off leading zeroes, and consider the result as the CX identifier/number value. On HL7 output, we value the *Identifier* component with the identifier value defined above. The *Check digit* component is always empty in our outgoing message.

The CX.4 (*Assigning authority*) value defines the identifier "pool" or "namespace" in which the *Identifier* was generated. We require it to be valued because we represent every patient, order, account, and visit identifier (etc.) as a pair: the actual identifier/number plus the "namespace" within which that identifier is unique. In the HL7 message, the *Assigning authority* is an HL7 HD data type. HL7 defines two different ways in which it can be valued. A value in the first HD sub-component (*Namespace ID*) is a universally agreed upon label for the identifier "pool" or "namespace". It is conceptually similar to an HL7 OID. Alternatively, the second (*Universal ID*) and third (*Universal ID type*) HD sub-components may combine to specify the identifier namespace. When we receive an HL7 CX value to be stored in our database, we look into our table of valid *Assigning authority* values. If we find a match for the *Namespace ID* sub-component value, all is well and we look no further. If *Namespace ID* is not valued or we do find a match for it, we try to match on the combined *Universal ID* and *Universal ID type* component values. Our database contains all three HD sub-component values for every *Assigning authority*. When we generate a CX value in an outgoing HL7 message, we value all three CX.4 (HD) sub-components,

The CX.5 (*Identifier type code*) value defines the type or category of the identifier. Across HL7 messages and fields, we place importance on "AN" to indicate a billing account number, "DN" to indicate a doctor number, "MR" to indicate a medical record number, "SS" to indicate a social security number, and "VN" to indicate a patient visit number.

3. OBR (Order) and OBX (Observation result) Service Codes

We strongly suggest that LOINC codes be used for OBR.4 (*Universal Service ID)* and OBX.3 (*Observation identifier*) CE values.

4. PID.8 (Sex) Codes

We support values of "M", "F", and "U". The CE.2 (*Text*) and CE.3 (*Name of coding system*) component values can be supplied but we ignore them when performing a patient lookup.

5. CE Code Values

Each HL7 CE data value contains up to six components. The first three are *Identifier, Text,* and *Name of coding system.* When supplying a coded value, these three components should always be valued. In particular, the *Text* component should be valued even for well-known codes. By doing so, a system that receives a CE value will always be able to display that value, even if it does not understand the code. The fourth through sixth CE components should likewise either all be valued or all be left empty. They represent an alternative code with the same meaning as the code represented in the first three components.

Appendix B – NHIN Code Tables

Table NHIN_0001 -- Reporting Department Codes

Code	Name	Description
MEDICATIONS DISPENSED	Pharmacy-dispensed medications	Medication dispensing transactions
LABORATORY	Clinical Laboratory	Clinical laboratory results and reports.
NURSING	Nursing	Nursing observations
RADIOLOGY	Radiology	X-Ray reports and images
VITAL SIGNS	Vital Signs	Recorded vital signs.

Table NHIN_0002 – Time Filter Direction

Code	Name	Description
EARLIEST	Earliest	When a limit is placed on the number of returned results and reports, the limit N will cause the N earliest (oldest) values to be returned by the query.
LATEST	Latest	When a limit is placed on the number of returned results and reports, the limit N will cause the N latest (most recent) values to be returned by the query

Appendix C – EvaluationSettings Elements in SOAP Header

Element Name	Data Type	Default	Description
MaxResponseInterval	Integer	unlimited	The server is instructed to wait no longer than this number of seconds before responding to the client query. If the server cannot respond fully with this interval, it should return whatever partial results it has gathered so far. If no query data has been gathered so far, the server should generate the SOAP fault "Server.WAIT INTERVAL EXPIRED".
PatientIdentified	yes/no	no	Value of "yes" indicates patient registration information has already been resolved to a single registration instance, probably by a previous "*Patient Identities"* query. In the case of a "yes" value here, all PID(s) supplied in the query must already contain valid medical record numbers and institution identifiers.
ResponseStyle	String	D	D = deferred (asynchronous) I = immediate (synchronous) This value is a copy of RCP.1 value from the HL7 query. It is duplicated in the message header for convenience.

Appendix D – NHIN-Specific SOAP 1.1 Faults

SOAP faultcode	SOAP faultstring	Description
Client	INVALID QUERY DATA	The fault message text will describe the query data value that could not be understood.
Client	INVALID QUERY FORMAT	The *format* and/or *version* specified in the <Query> node is not supported by this NHIN server.
Client	INVALID QUERY NAME	The HL7 query name was not in the list of supported queries.
Server	WAIT INTERVAL EXPIRED	The NHIN server was not able to respond to the query within the specified response interval.

The SOAP "faultstring" specifies the type of fault/error that occurred, but does not tell one the exact data value that was responsible for the fault. Fortunately, SOAP provides a way to do so. Consider the following example. An NHIN server receives a "*Patient Identities"* query. No person first name is specified in the query message and the target person's date of birth is not a valid date. The NHIN server returns the following SOAP fault:

```
<?xml version="1.0" encoding="UTF-8"?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://schemas.xmlsoap.org/soap/envelope/
https://connectingforhealth.regenstrief.org:8443/NHIN/services/NHINQueryEnvelope.xsd">
    <soapenv:Body>
      <soapenv:Fault>
        <faultcode>Client</faultcode>
        <faultstring>INVALID QUERY DATA</faultstring>
        <detail>
            <NHINFault xmlns="http://www.nhin.gov/messaging">
              <ErrorMessage>No person name was specified.<br/>Person date of birth was not a valid
date.</ErrorMessage>
              <ErrorData>
                  <Field>PID.5 XPN.2</Field>
                   <Reason>Person first name missing</Reason>
              </ErrorData>
              <ErrorData>
                  <Field>PID.7 TS.1</Field>
                  <Value>19009999</Value>
                  <Reason>Invalid person date of date</Reason>
              </ErrorData>
            </NHINFault>
        </detail>
      </soapenv:Fault>
    </soapenv:Body>
</soapenv:Envelope>
```

Any number of <ErrorData> elements can be added to the NHIN SOAP fault <detail>. Each <ErrorData> node must contain a <Reason> element defining the exact fault or error. When applicable, the <Field> node defines exactly what field in the message contained the invalid, missing, incomplete, or incompatible value. The value itself appears in the <Value> element.

Appendix E – Query Response Format and Version Identifiers

The table below describes the currently recognized contents of the *format* and *version* attributes used in the XML representation of a <nhin:Response> node.

Format	Version	Description
HL7	2.4	XML representation of HL7 2.4
HL7	3.0	HL7 3.0 (natively XML)
NCPDP Scripts	8.1	XML version of NCPDP medication dispensing information

Appendix F – ACK/NAK Soap Message

NHIN's asynchronous queries are implemented as two separate SOAP conversations. The NHIN client sends its query message in a SOAP message to the NHIN server, which responds with the "ACK" SOAP message defined in this Appendix. Later on, the NHIN server sends the actual query response back to the NHIN client, or its designee, in a new SOAP conversation. The NHIN client responds with a SOAP "ACK" message of its own. From the SOAP server's point of view, this "ACK" message **is** the response to the query SOAP message and the response to the query response SOAP message.

The ACK message is returned as an HL7 "original mode" ACK within an "NHINResponse" message. The HL7 MSH and MSA "segments" are defined in the remainder of this Appendix.

F.1 *PatientDataRequestACKNAK*.MSH (Message Header)

The message is type ACK with no event code.

F.2 *PatientDataRequestACKNAK*.MSA (Message Acknowledgement)

The MSA segment returns the Acknowledgment Code value "AA" and echoes the original query's MSH.MESSAGE CONTROL ID value in MSA.MESSAGE CONTROL ID.

F.3 Complete Example

```
<ACK xmlns="urn:hl7-org:v2xml">
    <MSH>
            <MSH.1/>
            <MSH.2/>
            <MSH.3>
                    <HD.1>Query Result Locator</HD.1>
            </MSH.3>
            <MSH.4>
                    <HD.1>Query Facility Name</HD.1>
            </MSH.4>
            <MSH.5>
                    <HD.1>Query Application Name</HD.1>
            </MSH.5>
            <MSH.6>
                    <HD.1>ST ELSEWHERE HOSPITAL</HD.1>
            </MSH.6>
            <MSH.7>
                    <TS.1>20051026130205</TS.1>
            </MSH.7>
            <MSH.9>
                    <MSG.1>ACK</MSG.1>
            </MSH.9>
            <MSH.10>24</MSH.10>
            <MSH.11>
                    <PT.1>P</PT.1>
            </MSH.11>
            <MSH.12>
                    <VID.1>2.4</VID.1>
            </MSH.12>
    </MSH>
    <MSA>
            <MSA.1>AA</MSA.1>
            <MSA.2>123456789</MSA.2>
```

```
    </MSA>
</ACK>
```

Appendix G – Prototype Servers

In order to test the Connecting for Health Common Framework prototype, we set up a series of Record Locator Service (RLS) and Inter-SNO Bridge (ISB) test servers in the three participating communities. The RLS servers provide access to a matching algorithm for determining when an existing patient record matches a query, and to database of accurate but anonymized demographic details (names, dates of birth, and addresses were scrambled to prevent any "test" patient from having a real patient's identity), plus associated record locations for those patients. Incoming test requests were then run through the matching algorithm to determine which record locations in the database, if any, were matched. Each of the ISB servers provides access to the RLS from entities outside the SNO.

In order to make the basic workings of the prototype visible, we have left the test servers running and accessible for those who would like to experiment with formatting valid queries and parsing the results. In addition, each region is making the source code used to handle the incoming queries available for download from the same server hosting the test interface. The source code covers those functions created by each of the three regions, built on a variety of technical platforms:

CA:
Operating System: Linux Red Hat Enterprise Linux ES 4
Application Server: Apache Tomcat, 5.0
Web Services: Apache Axis, 1.3

IN:
Operating System: Red Hat Enterprise Linux AS 4
Application Server: Apache Tomcat, 4.1.31
Web Services: Apache Axis, 1.1

MA:
Operating System: Windows Server 2003
Application Server: IIS 5/BizTalk 2004 as EAI tool
Web Services: .NET framework 1.1

You can find pointers to the regional servers hosting the test interface for the prototype, plus the source code and related files, at:

http://www.connectingforhealth.org/commonframework/prototypes.html.

Acknowledgements

The working groups in the three regions of the **Connecting for Health** prototype and the Technical Subcommittee have worked for over two years to create a prototype of a decentralized, standards-based, and privacy-protecting architecture for the exchange of health records. During that time, we have been fortunate to work with respected experts in the fields of health and information technology, all of whom have contributed their time, energy, and expertise to the transition from a basic set of principles to a working prototype. Our consultants and volunteers have worked long hours in meetings and conference calls to negotiate high-level questions of architectural design and low-level details of particular technical protocols. We offer them our heartfelt thanks for taking on this journey with us, and look forward to the remaining work ahead.

In addition, we would like to offer special thanks to the working groups who took the conceptual technical model and instantiated it as running code: for the Massachusetts test, John Halamka, Greg DeBor, Gail Fournier, Vinod Muralidhar, and John Calladine; for the Indiana test, J. Marc Overhage, Clement McDonald, Lonnie Blevins, and Andrew Martin; and for the California test, Will Ross and Don Grodecki.

Finally, we must note that none of this work would have been possible without the leadership and inspiration of Clay Shirky, who encouraged us to turn theory into practice, and whose unmatched skills at navigating and then capturing each progressive phase of our work over the last two years allowed us to do so.

Connecting for Health Technology Subcommittee

Clay Shirky, New York University, (Chair)

Laura Adams, Rhode Island Quality Institute

Steve Adams, RMD Networks

William Braithwaite, MD, eHealth Initiative, (Co-Chair, Policy Subcommittee)

Deleys Brandman, First Consulting Group

Bryan Breen, Cisco Systems, Inc.

Sophia Chang, MD, MPH, California HealthCare Foundation

Art Davidson, MD, MSPH, Denver Public Health

Didi Davis, Eclipsys, Healthcare Information and Management Systems Society, and Integrating the Healthcare Enterprise

Greg DeBor, Computer Sciences Corporation

Lyman Dennis, Partnership HealthPlan of California, Healthcare Information and Management Systems Society, and Integrating the Healthcare Enterprise

George Eisenberger, IBM Corporation

David A. Epstein, IBM Software Group

Linda Fischetti*, RN, MS, Veterans Health Administration

Mark Frisse, MD, MBA, MSc, Vanderbilt Center for Better Health (Co-Chair, Policy Subcommittee)

Don Grodecki, Browsersoft, Inc.

John Halamka, MD, CareGroup Healthcare System

Bob Hedgcock, Wisconsin Health Information Exchange

Noreen Hurley, Tufts Health Plan

Charles Jaffe, MD, PhD, Intel Corporation

Timothy Kenney, GE Healthcare

Josh Lemieux, Omnimedix Institute

J.P. Little, RxHub

Christopher Lindop, Eastman Kodak Company

David Lubinski, Microsoft Corporation

Janet Marchibroda, eHealth Initiative

Gregory Andre Marinkovich*, MD, FAAP LTC, Marine Corps, Office of Secretary of Defense/Health Affairs

Patrick McMahon, Microsoft Corporation

Omid Moghadam, Intel Corporation

Don Mon, PhD, American Health Information Management Association

Bruno Nardone, IBM Corporation

J. Marc Overhage, MD, PhD, Indiana Health Information Exchange; Indiana University School of Medicine, Regenstrief Institute for Healthcare

George Peredy, MD, Kaiser Permanente, HealthConnect

Nick Ragouzis, Enosis Group, LLC

Rick Ratliff, SureScripts

Jere Retzer, Oregon Health and Science University

Wes Rishel, Gartner Group

Barry Rhodes*, PhD, Center for Disease Control, United States Department of Health and Human Services

Scott Schumacher, PhD, Initiate Systems, Inc.

Raymond W. Scott, Axolotl Corporation

Don Simborg, MD, American Medical Informatics Association

Geoff Smith, Meditech

Jonathan Teich, MD, PhD, Healthvision

Micky Tripathi, Massachusetts eHealth Collaborative

Charlene Underwood, Healthcare Information and Management Systems Society, EHR Vendor Association

Karen Van Hentenryck, HL-7

Jukka Valkonen, California HealthCare Foundation

Cynthia Wark*, CAPT, United States Public Health Service Commissioned Corps, Centers for Medicare and Medicaid Services, United States Department of Health and Human Services

Jon White*, MD, Agency for Healthcare Research and Quality, United States Department of Health and Human Services

Scott Williams, MD, MPH, HealthInsight

Amy Zimmerman-Levitan, MPH, Rhode Island Department of Health

**Note: Federal employees participate in the Subcommittee but make no endorsement*