hData RESTful API Specification v0.11

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1 Introduction

The hData RESTful API specification defines a network transport API for accessing components of a Health Record and sending messages to an EHR system. The hData Record Format (HRF) [1] describes an XML representation of the information in an electronic health record (EHR) and contains a glossary of terms used in this specification.

1.1 Namespaces

This document uses the following namespaces. This specification uses a number of namespace prefixes throughout; they are listed in Table 1. Note that the choice of any namespace prefix is arbitrary and not semantically significant.

Namespace Prefix	Namespace URI	Description
hrf	http://projecthdata.org/hdata/schemas/2009/06/core	Namespace for elements in this document
hrf-md	http://projecthdata.org/hdata/schemas/2009/11/meta	SectionDocument metadata

1.2 Notational Conventions

The keywords "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119.

When describing concrete XML schemas, this specification uses the following notation: each member of an element's [children] or [attributes] property is described using an XPath notation (e.g.,

/x:MyHeader/x:SomeProperty/@value1). The use of {any} indicates the presence of an element wildcard. The use of @{any} indicates the presence of an attribute wildcard.

2 hData Record RESTful API

2.1 Overview

Any HDR can be represented as a set of HTTP resources in a canonical way. The entire HDR is referenced by a base URL which depends on the implementation. See IETF RFC 3986, section 5 for more details. This base URL will be denoted as *baseURL* throughout this document.

2.1.1 Out of Scope

While this specification does not dictate the format of the base URL, the base URL SHOULD NOT contain a query component. All content within an HDR MUST be expressible as a HTTP resource. In the following, the minimum version for HTTP is 1.1. This specification does not define any access controls to the web resources. It is RECOMMENDED that a comprehensive access control management system is always deployed with any hData installation.

2.1.2 General Conventions

Any GET, PUT, POST, or DELETE operations on a given resource that are either (i) unspecified or (ii) not implemented MUST return an HTTP response with a status code of 405 that includes an Allow header that specifies the allowed methods. All operations may return HTTP status codes in the 5xx range if there is a server problem.

2.2 Operations on the Base URL

2.2.1 GET

If there is no HRF at the base URL, the server SHOULD return a 404 - Not found status code.

The server MUST offer an Atom 1.0 compliant feed of all child sections, as identified in the corresponding sections node in the root document. Each entry MUST contain a link to the resource for each child section.

It is RECOMMENDED that the server also offers a web user interface that allows users to access and manipulate the content of the HDR, as permitted by the policies of the system. Selecting between the two can be achieved using standard content negotiation (HTTP Accept header). This is not necessary for systems that are used by non-person entities only.

Status Code: 200, 404

2.2.2 POST – Parameters: extensionId, path, name

The request body is of type “application/x-www-form-urlencoded” and MUST contain the extensionId, path, and name parameters. The extensionId parameter MUST be a string that is equals the extensionId attribute of one of the registered <extension> nodes of the root document of the HDR identified by

baseURL. The path MUST be a string that can be used as a URL path segment. If any parameters are incorrect or not existent, the server MUST return a status code of 400.

The system MUST confirm that there is no other section registered as a child node that uses the same path name. If there is a collision, the server MUST return a status code of 409.

If the extensionId is not registered as a valid extension, the server MUST verify that it can support this extension. If it cannot support the extension it MUST return a status code of 406. It MAY provide additional entity information. If it can support that extension, it MUST register it with the root.xml of this record.

When creating the section resource, the server MUST update the root document: in the node of the parent section a new child node must be inserted. The server MUST return a 201 status code and SHOULD include the location of the new section. The name parameter MUST be used as the user-friendly name for the new section.

Status Code: 201, 400, 406, 409

2.2.3 PUT

This operation is undefined.

Status Code: 405

2.2.4 DELETE

This operation is undefined.

Status Code: 405

2.3 *baseURL*/root.xml

2.3.1 GET

This operation returns an XML representation of the current root document, as defined by the HRF specification.

Status Code: 200

2.3.2 POST, PUT, DELETE

These operations MUST NOT be implemented.

Status Code: 405

2.4 *baseURL*/*sectionpath*

2.4.1 GET

This operation MUST return an Atom 1.0 [3] compliant feed of all section documents and child sections contained in this section. Each entry MUST contain a link to a resource that uniquely identifies the

section document or child section. If the section document type defines a creation time, is RECOMMENDED to set the Created node to that datetime.

For section documents, the Atom Content element MUST contain the XML representation of its metadata (see [1], Section 2.4.1).

Status Code: 200

2.4.2 POST

For creating a new sub section, three additional parameters are required, and the POST will create a new child section within this section. For new documents a document MUST be sent that conforms to the business rules expressed by the extension that the section has registered.

2.4.2.1 Add new section – Parameters: extensionId, path, name

The content type MUST equal "application/x-www-form-urlencoded" for the POST method to create a new sub section. If the extensionId is not registered as a valid extension, the server MUST verify that it can support this extension. If it cannot support the extension it MUST return a status code of 406 and MAY provide additional information in the entity body. If it can support that extension, it MUST register it with the root.xml of this record. The path MUST be a string that can be used as a URL path segment. The name parameter MUST be used as the user-friendly name for the new section. If any parameters are incorrect, the server MUST return a status code of 400.

The system MUST confirm that there is no other section registered as a child node that uses the same path name. If there is a collision, the server MUST return a status code of 409.

When creating the section resource, the server MUST update the root document: in the node of the parent section a new child node must be inserted. The server MUST return a 201 status code.

Status Code: 201, 400, 409

2.4.2.2 Add new document

When adding a new section document, the request Media Type MUST be "multipart/mixed" if including metadata. In this case, the content part MUST contain the section document. The metadata part MUST contain the metadata for this section document. It is to be treated as informational, since the service MUST compute the valid new metadata based on the requirements found in the HRF specification. The content media type MUST conform to the media type of either the section or the media type identified by metadata of the section document. For XML media types, the document MUST also conform to the XML schema identified by the extensionId in for the section or the document metadata. If the content cannot be validated against the media type and the XML schema identified by the content type of this section, the server MUST return a status code of 400.

If the request is successful, the new section document MUST show up in the document feed for the section. The server returns a 201 with a Location header containing the URI of the new document.

Status Code: 201, 400.

2.4.3 PUT

This operation is not defined.

Status Code: 405

2.4.4 DELETE

This operation SHOULD be implemented, but special precaution should be taken: if a DELETE is sent to the section URL, the **entire** section, its documents, and subsections are completely deleted. Future requests to the section URL MUST return a status code of 404, unless the record is restored. Any DELETE operation MUST by logged by the underlying system.

Status Code: 204, 404

2.5 *baseURL/sectionpath/documentname*

2.5.1 GET

This operation returns a representation of the document that is identified by *documentname* within the section identified by *sectionpath*. The *documentname* is typically assigned by the underlying system and is not guaranteed to be identical across two different systems. Implementations MAY use identifiers contained within the infoset of the document as *documentnames*.

If no document of name *documentname* exists, the implementation MUST return a HTTP status code 404.

Status Codes: 200, 404

2.5.2 PUT

This operation is used to update a document. The content MUST conform to the media type identified by the document metadata or the section content type. For media type application/xml, the document MUST also conform to the XML schema that corresponds to the content type identified by the document metadata or the section. If the parameter is incorrect or the content cannot be validated against the correct media type or the XML schema identified by the content type of this section, the server MUST return a status code of 400.

If the request is successful, the new section document MUST show up in the document feed for the section. The server returns a 200.

Status Code: 200, 400.

2.5.3 POST

This operation is used to replace metadata on a section document. This operation SHOULD NOT be used unless necessary for replicating information within an organization. If a section document is copied from one system to another, a new document metadata instance MUST be constructed from the original metadata according to the rules in the HRF specification.

The request Media Type MUST be application/xml. The body MUST contain the document metadata. It MUST conform to the XML schema for the document metadata, defined in [1]. If the metadata is not of media type application/xml or it cannot be validated against the document metadata XML schema, the server MUST return a status code of 400.

If the request is successful, the document metadata for the section document MUST be updated. The server returns a 201.

Status Code: 201, 400.

2.5.4 DELETE

This operation SHOULD be implemented, but special precaution should be taken: if a DELETE is sent to the document URL, the document is completely deleted. Future requests to the section URL MAY return a status code of 410, unless the record is restored. Any DELETE operation MUST by logged by the underlying system.

Status Code: 204, 410

3 Message API

The Message API in this section MAY be used for sending and receiving messages through services that do not map directly to the document API described in section 2.

In the following sub-sections, 7 different patterns are described to allow (i) sending traditional messages (such as HL7 v2/v3 messages) and (ii) lightweight messages to EHR systems.

3.1 General Requirements

It is RECOMMENDED to use transport layer security for all transactions. It is RECOMMENDED to use server and client authentication in TLS. If a method is not supported by any resource, it MUST return a 405 status code, including a list of allowed methods.

3.2 Simple Patterns

3.2.1 Default Operations

All patterns in this section MUST support the following methods.

3.2.1.1 POST

All messages MUST be sent to a single endpoint through a POST, identified by a URL. The endpoint MUST process the input and determine if it can process the message. If successful, the service MUST return a 201 status code. It MAY include a location header with a URL to identify a persistent record for the message.

If the message cannot be processed, the service should return a 400 status code.

Status Code: 200, 400

3.2.1.2 GET, PUT, DELETE

These methods SHOULD NOT be allowed.

Status Code: 405

3.2.2 Single Endpoint Pattern

This pattern is intended for easy integration with existing message processors. It exposes a message endpoint directly as a resource. All message processing including validation is performed by the resource.

There is no guidance on the naming of the resource. It is RECOMMENDED to use a simple URL without any parameters.

Pattern: *baseURL*

Example (non-normative): https://example.com/input - All messages for Example Corp. go to a single endpoint and the service needs to triage all messages to the correct destination.

Example (non-normative): https://example-hie.com/example_com/input - In this case, all messages for Example Corp. would be managed by Example HIE, Inc. Everything else would be the same as above.

3.2.3 Standard Restricted Pattern

This pattern SHOULD be used if the message processor is specific to some message format standard. As long as the message POSTed to this resource is compliant with the standard identified through the standard identifier, the resource MUST return a 200 status code. If the message cannot be processed because it is not implemented by the message processor, it is RECOMMENDED that the message processor return a response in the HTTP body that indicates failure to process.

Pattern: *baseURL*/<standard>

The <standard> identifies the message format. The following table contains the REQUIRED <standard> identifiers for HL7 standards:

Standard	Identifier	Example (non-normative)
HL7 v2	hl7v2	https://example.com/hl7v2
HL7 v3	hl7v3	https://example.com:8080/base/hl7v3
muITS	muITS-<subidentifier>	https://example.com/muITS-hdata

The subidentifier for the muITS identifier MUST be specified by the muITS.

3.2.4 Standard and Content Class Restricted Pattern

This pattern SHOULD be used to simplify processing. The message processor at this resource MUST process messages compliant to the specified standard. It MUST only process messages that fall within the content class of the standard.

Patterns: *baseURL*/<standard>/<content class>

The content class identifier is out of the scope of this document.

For HL7 v2 and HL7 v3 messages the content class identifier MAY be identical to the message name. It is case sensitive. If the message name contains characters that are not allowed in a URI (per IETF RFC 3986), these characters MUST be percent-encoded.

For HL7 v2 messages, the Accept header MAY be set to "application/xml" or "application/text" to indicate preference for XML or ASCII encoding.

Systems MAY allow URL parameters to provide processing guidance to the message processor. All resources SHOULD support the following guidance parameters:

URL Parameter	Use
version	Indicate a specific version of a standard or content class

Examples (non-normative):

https://example.com/hl7v2/ADT%5EA01/?version=2.5 -- admit discharge transfer in xml

https://example.com/hl7v3/PRPA%5FRM201301UV02 -- patient activate

https://example.com/muITS-hdata/admitPatient -- admit discharge transfer

3.2.5 Content Class Only Restricted Pattern

This pattern is very similar to the one described in section 3.2.4, but the standard identifier is omitted. The message processor MUST process messages belonging to the identified content class, only.

Pattern: *baseURL*/<content class>

Example (non-normative):

https://example.com/ADT%5EA01/?version=2.5 -- admit discharge transfer

https://example.com/PRPA%5FRM201301UV02 -- patient activate

https://example.com/muITS-hdata/admitPatient -- admit discharge transfer

3.3 Broadcast Messaging

This pattern is RECOMMENDED for situations where a sender needs to notify more than one service. It MUST use the Atom 1.0 publishing protocol, which requires the recipient of messages to subscribe to the sender's publication feed. This pattern cannot be applied to situations where a sender initiated "push" is required, or where it is impractical to publish the sender's messages at a well-known URL.

Example (non-normative):

https://example.com/admitPatient/newPatient.feed

3.4 Complex Messaging Example (Non-Normative)

3.4.1 Reserve New Bed Example (Non-Normative)

URL: https://example.com/beds/ward1

Sender: POST <<Request for a new bed>>

Response: HTTP 200

location-header: https://example.com/beds/ward1/32

```
<bed>
  <ward>1</ward<
  <number>32</number>
  <occupant>https://example.com/beds/ward1/32/occupant</occupant>
</bed>
```

Sender:

PUT https://example.com/beds/ward1/32/occupant

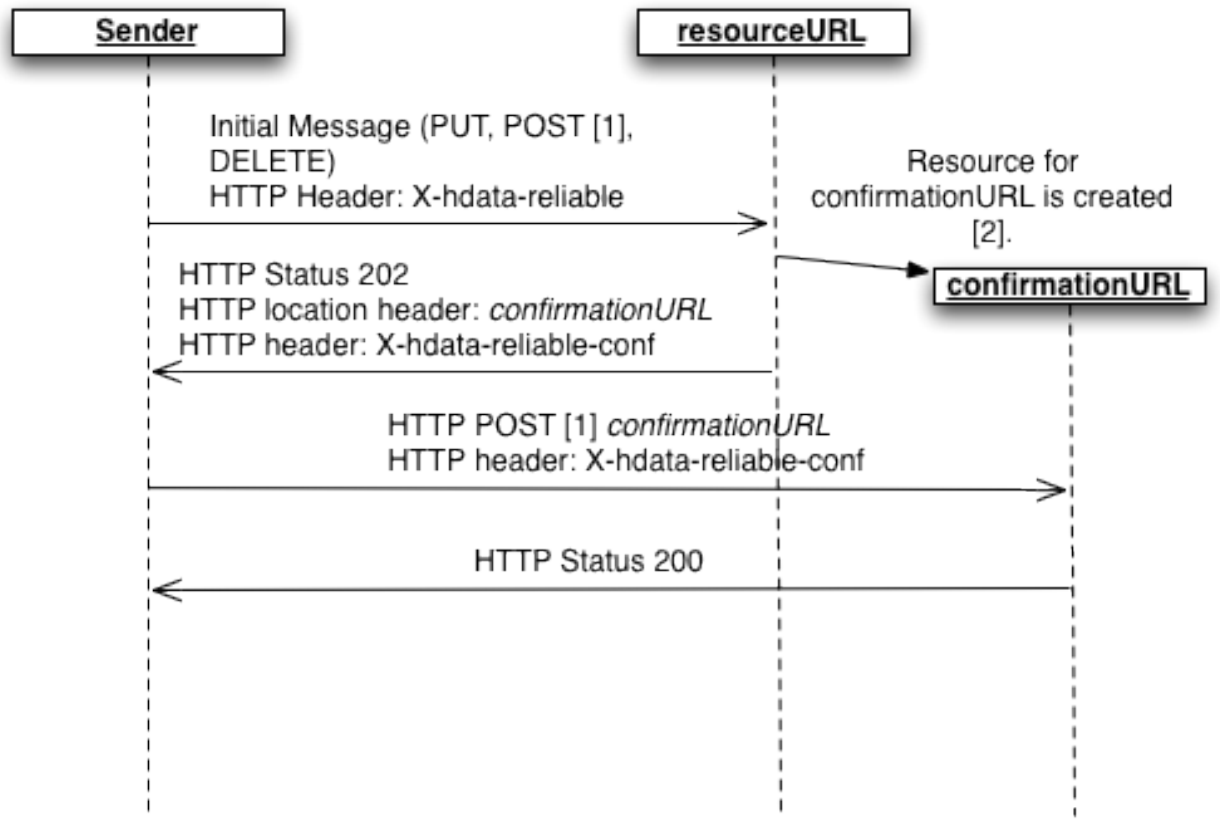
```
<patient>
  <name>John Doe</name>
  <identifier>http://example.com/patients/12345</identifier>
</patient>
```

3.4.2 Admission Message Example (Non-Normative)

TBD

4 Reliable Messaging

This pattern is a complex multi step exchange, which is applicable to situations where a multi-phase commit is required. This pattern MAY be combined when interacting with an hData Record or with other message patterns, as long as there is no overloading of HTTP methods.



[1] All POST methods must be implemented to support idempotency, e.g. through mechanisms like "Post Once Exactly" (POE).

[2] The confirmationURL may be identical to the resourceURL for document transactions.

The flow of the patterns is as follows:

1. The sender accesses the *resourceURL* resource using PUT, POST, or DELETE. To indicate that it wants to use the reliable message pattern, it sets the HTTP message header "X-hdata-reliable".
2. If the *resourceURL* is capable of performing the reliable message pattern, it will create a new resource for a message at *confirmationURL*, and return an HTTP status code of 202. The HTTP result MUST contain the *confirmationURL* in the HTTP location header and a confirmation secret in the "X-hdata-reliable-conf" header. This secret SHOULD be a simple string of sufficient length to prevent guessing. The service MUST NOT process the message at this stage.
   If the *resourceURL* does not implement the reliable messaging pattern, it MUST return an HTTP status code of 405 and discard the message.
3. The sender MUST then POST an empty request body to the resource at *confirmationURL* and set the "X-hdata-reliable-conf" header to the value provided in step 2. Upon receipt, the service –

listening at the *confirmationURL* – MUST validate the confirmation secret. Once the GET secret is validated, the service processor MUST process the message immediately.

4. If the validation is successful, the *confirmationURL* returns an HTTP result with the expected status code for the operation. If the validation is not successful, the service MUST return an HTTP status code of 409. The sender MUST retry the POST until it receives either a different HTTP status code.

Remarks:

1. Since POST is not idempotent, the service MUST implement a safe guard against duplicity of requests for all posts in this flow. It is RECOMMENDED that the service implements "POST Once Exactly" (POE), as described in http://www.mnot.net/drafts/draft-nottingham-http-poe-00.txt.
2. The *confirmationURL* resource MAY be destroyed after the reliable message pattern flow is complete. The service MAY maintain the *confirmationURL* after the pattern flow completes. It MAY provide the content of the message through the GET method.
3. There is no default for how long the *confirmationURL* resource is available for confirmation (step 3). The service MAY destroy the *confirmationURL* resource and discard the message if the sender does not complete step 3 of the pattern flow. It is strongly RECOMMENDED to advertise the maximum time for confirming the message to the developer of the sender in the documentation for the service. If the service discards the message after timing out the confirmation step, it MUST return a status code of 404 at the *confirmationURL* permanently.
4. For operations on hData Records (as described in section 2) special provision MUST be taken to prevent alteration of the resource once the reliable message pattern is initiated. The service MUST provide the old status of the resource until step 3 completes. It is RECOMMENDED to use the resource URL (which is different from the URL for the meta datametadata for the resource URL) also as the *confirmationURL*.

5 Security Considerations

While not required by this standard, it is RECOMMENDED that all HTTP methods on resources are properly protected.

6 Bibliography

[1] G. Beuchelt, R. Dingwell, A. Gregorowicz, and H. Sleeper, "hData Record Format," The MITRE Corporation, 2009.

[2] PKWare, Inc. .ZIP Application Note. [Online]. http://www.pkware.com/support/zip-application-note

[3] IETF Network Working Group. (2005, Dec.) IETF. [Online]. http://www.ietf.org/rfc/rfc4287.txt

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