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Digital Imaging and Communications in Medicine (DICOM)

Supplement 194: RESTful Services for Non-Patient Objects

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DICOM Standards Committee, Working Group 27: Web Technologies

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TODO:

1. ~~Status details~~
 2. ~~References to query parameters by IOD~~
 3. ~~References to attributes in response payload by IOD~~
 4. Figure out a good reference for status codes
- 30

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6.10.4 Conformance

Error! Bookmark not defined.

1 Scope and Field of Application

This supplement defines Restful Services (RS) for retrieving, storing, and searching for non-patient related objects such as hanging protocols, color palettes, procedure protocols, etc.

90 The transactions defined for this service are very similar to those defined for the RS Studies Service. They allow a user agent to retrieve, store, and search for non-patient related objects from an origin server in DICOM Media Types.

Security is beyond the scope of the RESTful services defined in this supplement. However generic Web security mechanisms are fully compatible.

2 Normative References

95 *Insert the following in Section 2 at the appropriate place:*

3 Terms and Definitions

Insert the following in Section 4 at the appropriate place:

4 Symbols and Abbreviated Terms

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Insert the following in Section 4 at the appropriate place:

5 Conventions

Insert the following in Section 4 at the appropriate place:

105

6 Conformance

Insert the following in Section 4 at the appropriate place:

6.10 RS Non-Patient Object (NPO) Service

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Closed Issues

| # | Description |
|---|---|
| 1 | Should the service allow retrieving multiple instances in the same transaction? No , for symmetry |
| 2 | Should the service all storing multiple instances in the same transaction? |

| | |
|----|--|
| | Yes , for symmetry. |
| 3 | Do we want accept and charset query parameters? Yes , for symmetry with other services. |
| 4 | Do we need to support any transfer syntax other than EVRLE? Yes , for symmetry (deflate). |
| 5 | Is the distinction between Metadata and Bulkdata necessary? Yes , for symmetry and because some objects could be large (e.g. implants). |
| 6 | Should any other IODs be included? No . |
| 7 | Do we want/need a notification API for create, retrieve, update, events? Maybe for some, such as procedure protocols (need longer lived notifications), or could use search? No , not yet. |
| 8 | Should this service support only DICOM Media Types? Yes . |
| 9 | Do any of these IODs have Transfer Syntaxes that are specific to them? No , except 'deflate' and EVRLE which applies to all of them. |
| 10 | Is there any reason to Search inside individual Instances? No . |
| 11 | Should all DICOM Media Types ('application/dicom', 'application/dicom+xml', 'application/dicom+json') be supported? Yes . |
| 12 | Should we define the attributes that must be supported for search or leave them unspecified? Should each NPO IOD define its own Search attributes? What does CP 1550 do? No . Use the attributes defined in PS3.4. |

Open Issues

| # | Description | Status |
|---|---|--------|
| 1 | Should support for the Store transaction be required? Tentative: no. | |
| 2 | | |
| | | |

115

The RS Non-Patient Objects (NPO) Services define a set of RESTful transactions that enable a user agent to retrieve, store, and search an origin server for non-patient related objects in DICOM Media Types.

6.10.1 Conformance

An implementation conforming to the RS Non-Patient Objects service shall specify all NPO resources it supports.

120 An implementation conforming to the RS Non-Patient Objects service shall support the Retrieve Capabilities, Retrieve, and Search transactions for all supported NPO resources.

It shall also document all supported transactions, and whether it plays the role of origin server or user agent, or both.

For each transaction supported, an implementation shall document in its Conformance Statement the resources supported (see PS3.4), and any other conformance requirements defined by the transaction.

6.10.2 Resources

125 An NPO Service manages one or more collections of NPO resources. Each collection contains Instances from one IOD. The target resource URIs has the following templates:

```
/{npo-name}
```

```
/{npo-name}/{uid}
```

130 Where

```
npo-name = "color-palettes"
           / "defined-procedure-protocols"
           / "hanging-protocols"
           / "generic-implant-template"
135         / "implant-assembly-templates"
           / "implant-template-groups"
uid       ; is the Unique Identifier of an NPO Instance
```

The npo-name is the name of a collection resource that corresponds to a single IOD.

140 **Table 6.10.2-1** contains the names and templates for the NPO resources. It also includes the PS3.3 Section in which the corresponding IOD is defined.

Table 6.10.2-1: Resources, URI Templates and Descriptions

| Resource Type (IOD) | URI Template and Description | IOD (PS3.3) | Storage Class (PS3.4) |
|----------------------------|------------------------------------|----------------|-----------------------|
| Color Palette | /color-palettes{/uid} | A.58 | W |
| Defined Procedure Protocol | /defined-procedure-protocols{/uid} | Supplement 121 | U.2 |
| Hanging Protocol | /hanging-protocols{/uid} | A.44. | T |
| Generic Implant Template | /generic-implant-templates{/uid} | A.61. | BB.6.1.2.1 |
| Implant Assembly Template | /implant-assembly-templates{/uid} | A.62. | BB.6.1.2.2 |
| Implant Template Group | /implant-template-groups{/uid} | A.63 | BB.6.1.2.3 |

6.10.3 Query Parameters

6.10.3.1 Accept

All NPO transactions support the Accept query parameter. See Section 6.1.1.5.

145 **6.10.3.2 Character Set Query Parametre**

All NPO transactions support the Charset query parameter. See Section 6.1.2.2.

6.10.4 Transactions

The NPO Service defines the transactions specified in the following table:

Table 6.10.4-1: NPO Service Transactions

| Transaction | Method | Resource | Payload | | Description |
|-----------------------|---------|------------------------|-------------|---------------------------------|--|
| | | | Request | Response | |
| Retrieve Capabilities | OPTIONS | / | N/A | Capabilities Description | Retrieves a description of the capabilities of the NPO Service, including transactions, resources, query parameters, etc. |
| Retrieve | GET | /{npo-name}/{uid} | N/A | Instance and/or Status Details | Retrieves an Instance, specified by the target resource in an Acceptable DICOM Media Type. |
| Store | POST | /{npo-name}/{uid} | Instance(s) | Status Details | Stores one or more DICOM Instances, contained in the request payload, in the location referenced by the target resource URL. |
| Search | GET | /{npo-name} ?{params*} | N/A | Result(s) and/or Status Details | Searches the target resource for Instances that match the search parameters and returns a list of |

| | | | | | |
|--|--|--|--|--|--------------------------------------|
| | | | | | matches in an Acceptable Media Type. |
|--|--|--|--|--|--------------------------------------|

150

Table 6.10.4-2 shows the target resources permitted for each transaction.

Table 6.10.4-2 Resources by Transaction

| Resource | Retrieve | Store | Search | Capabilities |
|---------------|----------|-------|--------|--------------|
| NPO Service | | | | X |
| All Instances | | X | X | |
| Instance | X | X | | |

6.10.4.1 Retrieve Capabilities Transaction

See **Section X.Y**.

6.10.4.2 Retrieve DICOM Transaction

The Retrieve DICOM transaction retrieves the target resource in a DICOM Media Type. If non-DICOM Media Types are present in the Acceptable Media Types of the request, the origin server shall return a 400 (Bad Request) response with an appropriate Status Details document in the payload.

6.10.4.2.1 Request

The Retrieve request has the following syntax:

```
GET SP /{npo-name}/{uid} SP version CRLF
Accept: 1#dicom-media-type CRLF
[If-None-Match: entity-tag CRLF]
*(header-field CRLF)
CRLF
```

165

6.10.4.2.1.1 Resources

The target resources for the Retrieve transaction are listed in **Table 6.10.4-3** under the URI Template column. An origin server it shall specify all supported resources in its conformance statement and in its response to the Retrieve Capabilities transaction.

Table 6.10.4-3 shows the resources and URI Templates supported by the Retrieve DICOM transaction.

Table 6.10.4-3: Resources and URI Templates

| Resource | URI Template |
|----------|----------------------|
| Instance | / {npo-name} / {uid} |

6.10.4.2.1.2 Query Parameters

There are no query parameters.

6.10.4.2.1.3 Request Header Fields

Table 6.10.4-4 shows the most common Mandatory, Conditional, and common Optional header fields for this transaction. See **Section 5.4** and **Section 7.6**.

Table 6.10.4-4: URI Request Header Fields

| Header Field | Value | Usage |
|--------------|------------------|-------|
| Accept | dicom-media-type | M |

6.10.4.2.1.4 Request Payload

The request shall have no payload.

6.10.4.2.2 Behavior

The origin server locates the target resource and returns it in an Acceptable DICOM Media Type. If the resource cannot be located, an appropriate Status Details response shall be returned.

180

6.10.4.2.3 Response

The response has the following syntax:

```

185   version SP status-code SP reason-phrase CRLF
      Content-Type: dicom-media-type CRLF
      [ETag: entity-tag CRLF]
      [Last-Modified: HTTP-date CRLF]
      *(header-field CRLF)
190   CRLF
      payload

```

6.10.4.2.3 Status Codes

The following status codes are the most common for the Retrieve Transaction. See [Section 7.7 for other status codes](#).

195

Table 6.10.4-5: Status Codes

| Status | Code | Phrase | Description |
|---------|---------------------------------|--------------|--|
| Success | 200 | OK | Indicates that all instances were successfully retrieved. |
| | 304 | Not Modified | Indicates that the user agent's current representation is up to date, so no payload was returned. This status code shall only be returned for a Conditional Retrieve request containing an If-None-Match header field. |
| Failure | See Table 7.7-1 | | |

6.10.4.2.3.2 Response Header Fields

[Table 6.10.4-6](#) lists the most common Mandatory, Conditional, and common Optional header fields for the response. See [Sections 5.4 and Section 7.6](#).

Table 6.10.4-6: Request Header Fields

| Header Field | Value | Usage | Description |
|--------------|------------------|-------|---|
| Content-Type | dicom-media-type | M | The media type of the payload |
| ETag | entity-tag | C | If the response status code is 200 or 206, the entity tag associated with the representation contained in the payload |

6.10.4.2.3.3 Response Payload

A success response shall have a payload containing the DICOM instances specified by the target resource in an Acceptable DICOM Media Type. The payload may be single part or multipart depending on the media type.

If there are any errors or warnings encountered by the origin server, the response shall contain a Status Details document describing them.

6.10.4.2.4 Media Types

A success response payload shall contain a representation in a DICOM Media Type as specified in [Section 6.1.1.8](#).

A warning or failure response payload shall contain a Status Details document.

6.10.4.2.5 Conformance

210 An implementation of an NPO Service shall support the Retrieve transaction and the Conformance Statement shall document:

The Conformance Statement shall document:

- Supported IODs
- Implementations role: one of origin server or user agent, or both
- Supported DICOM Media Types
- 215 • Supported character sets (if other than UTF-8)

**** WG-06 review stopped here ****

6.10.4.3 Store Transaction

This transaction requests that the origin server store the representations of the NPOs contained in the request payload so that they may be retrieved in the future using the Instance UIDs.

220 The Store Service shall support only DICOM Media Types.

6.10.4.3.1 Request

Transactions in this service use the POST method. The request syntax is:

```

225 POST SP /{npo-name}/{uid} SP version CRLF
Content-Type: dicom-media-type CRLF
*(header-field CRLF)
CRLF
payload

```

6.10.4.3.1.1 Resources

230 The target URL shall reference either the All Instances or Instance resource. [Table 6.10.4-7](#) shows the resources and URI Templates supported by the Store DICOM transaction.

Table 6.10.4-7: Resources and URI Templates

| Resource | URI Template | Description |
|---------------|------------------|---|
| All Instances | /npo-name} | Stores a set of representations with different Instance UIDs. |
| Instance | /npo-name}/{uid} | Stores a representation of an Instance with a UID equal to uid. |

6.10.4.3.1.2 Query Parameters

The Store Service has no query parameters.

6.10.4.3.1.3 Request Header Fields

235 [Table 6.10.4-8](#) lists the Mandatory, Conditional, and common Optional header fields for this transaction. See [Sections 5.4](#) and [Section 7.6](#).

Table 6.10.4-8: Store Request Header Fields

| Header Field | Value | Usage | Description |
|-------------------|------------|-------|---|
| Content-Type | media-type | M | The DICOM Media Type of the request payload |
| Accept | media-type | M | One or more media types acceptable in the response |
| Content-Length | uint | C | If no transfer coding has been applied to the payload |
| Transfer-Encoding | encoding | C | If a transfer coding has been applied to the payload |

6.10.4.3.1.4 Request Payload

240 The request payload shall be present and shall contain one or more representations in the DICOM Media Type specified by the Content-Type header field.

6.10.4.3.2 Behavior

The origin server stores the representations contained in the request payload so that they may be retrieved later using the Retrieve transaction.

245 Before storing the representations, the origin server may coerce or replace the values of data elements. The origin server may also fix incorrect values.

If any element is coerced or corrected, the Original Attribute Sequence (0400,0561) shall be included in the stored DICOM objects, and shall be included in the Status Details document returned in the response. [See Section X.Y.](#)

Note

For more information on populating the Original Attribute Sequence see [PS3.3, Section C.12.1.](#)

250 6.10.4.3.3 Response

The response shall have the following format:

```

version SP status-code SP reason-phrase CRLF
*(header-field CRLF)
CRLF
payload

```

255

The response shall contain an appropriate status code and a payload containing a Status Details document, as defined in [Section X](#), in an Acceptable Media Type. The Status Details document shall describe the success, warning, or failure status for each Instance contained in the request payload.

6.10.4.3.3.1 Status Codes

260

The origin server shall return an appropriate status code. The most common status codes are:

Table 6.10.4-9: Common Status Codes

| Status | Code | Description |
|---------|------------------------------|--|
| Success | 200 (OK) | Indicates that the origin server has successfully received, processed, and stored at least one of the representations contained in the request payload. The response shall include a Status Details document detailing the disposition of all representations contained in the request. |
| | 202 (Accepted) | Indicates that the origin server successfully received and validated the request message, but may not have validated, processed, or stored the representations in the request payload. The response shall include a Status Details document detailing the disposition of all representations contained in the request. The user agent can use a Query or Retrieve transaction at a later time to determine if the request has completed. Alternatively, if the Service supports notifications, and the user agent has a subscription for newly created resources, it will receive an event notification when the transaction has completed. |
| Error | 409 (Conflict) | Indicates that the origin server did not store any of the representations contained in the request payload because of representation specific errors. For example, unsupported IOD, or Study Instance UID mismatch. |
| | 415 (Unsupported Media Type) | Indicates that the origin server does not support the media type specified in the Content-Type header field of the request, and none of the representations contained in the request were processed or stored |

For additional information on status codes see [Section 7.7](#).

The response shall not contain the 201 (Created) or 204 (No Content) status codes. The reason for this is that the response shall always contain a Status Details document describing the status of each instance contained in the request payload.

265

6.10.4.3.3.2 Response Header Fields

[Table 6.10.4-10](#) lists the Mandatory, Conditional, and common Optional header fields for this transaction. See [Sections 5.4](#) and [Section 7.6](#).

Table 6.10.4-10: Store Response Header Fields

| Header Field | Value | Usage | Description |
|-------------------|------------|-------|---|
| Content-Type | media-type | M | The DICOM media type of the request payload |
| Content-Length | uint | C | If no transfer coding has been applied to the payload |
| Transfer-Encoding | encoding | C | If a transfer coding has been applied to the payload |

270

All success responses shall contain the Representation Header Fields (see [Section 7.6.3](#)) and Payload Header Fields (see [Section 7.6.4](#)) with appropriate values.

It is recommended that the text returned in the Warning header field (see [RFC7234, Section 5.5](#) <https://tools.ietf.org/html/rfc7234#section-5.5>) contain a DICOM Status Code and descriptive reason as defined in [Section 10.6.4.2.1](#). For example,

275

```
Warning: A700: Out of memory
```

See [Section 6.X.Y.](#)

6.10.4.3.3 Response Payload

The response payload shall contain a Status Details document describing any additions, modifications, or deletions to the stored representations. See Section X.

280 6.10.4.3.4 Media Types

The request payload shall be encoded in a DICOM Media Type as specified in [Section 6.1.1.8.](#)

The response payload shall be a Status Details document in an Acceptable Media Type. See Section X.

6.10.4.3.5 Conformance

285 An implementation supporting the Store transaction shall support storing one or more of the Non-Patient Information Objects specified in Section 6.10.1.

The Conformance Statement shall include whether it supports the role of origin server, user agent, or both; and the Information Objects supported.

6.10.4.4 Search Transaction

290 The Search transaction searches the collection of NPO Instances contained in the target resource. A successful response shall contains details of the matching Instances. The search criteria are specified in the query parameters. Each match includes the default and requested attributes from the matching Instance.

6.10.4.4.1 Request

The Search service uses the GET method and has the following message format:

```
295 GET SP /{npo-name} {?parameter*} SP version CRLF
Accept: 1#dicom-media-type CRLF
*(header-field CRLF)
CRLF
```

6.10.4.4.1.1 Resources

300 The target URI shall reference the All Instances resource. [Table 6.10.4-11](#) shows the resources and URI Templates supported by the Search transaction. An origin server that supports the Search transaction shall support the resources specified in [Table 6.10.4-11.](#)

Table 6.10.4-11: Resources and URI Templates

| Resource | URI Template | Description |
|---------------|--------------|---|
| All Instances | /npo-name} | Searches the set of resources with different Instance UIDs. |

6.10.4.4.1.2 Query Parameters

305 The parameters in the query component of the target URL specify the matching criteria, the attribute values to be returned, and the results to be returned. The URI template for the query parameters is:

```
{?parameter*} = "?" {&match*} {&include*} {&offset} {&limit}
```

See [Section 7.5.3](#) for details of Search Query Parameters.

6.10.4.4.1.2.1 Required Attributes for Query Parameters

The origin server shall support the attributes specified in [Table 6.10.4-12](#) for all NPO IOD matching.

310 **Table 6.10.4-12: Search Parameters**

| Name | Tag |
|------------------|-------------|
| SOP Class UID | (0008,0016) |
| SOP Instance UID | (0008,0018) |

[Table 6.10.4-13](#) contains links to the Query Parameter Attributes for each NPO IOD.

Table 6.10.4-13: NPO Resource Search Attributes

| Resource Name (IOD) | Search Attributes (PS3.3) |
|----------------------------|---------------------------|
| Color Palette | X.6.1.2 |
| Defined Procedure Protocol | Supplement 121 |
| Hanging Protocol | U.6.1.2 |
| Generic Implant Template | BB.6.1.2.1 |
| Implant Assembly Template | BB.6.1.2.2 |
| Implant Template Group | BB.6.1.2.3 |

315 Each implementation shall specify any additional search parameters it supports in its conformance statement and in its response to the Retrieve Capabilities transaction.

6.10.4.4.1.3 Request Header Fields

Table 6.10.4-14 lists the Mandatory, Conditional, and common Optional header fields for this transaction. See **Section 7.6**.

Table 6.10.4-14: Store Request Header Fields

| Header Field | Value | Usage | Description |
|--------------|------------------|-------|--|
| Accept | dicom-media-type | M | One or more media types acceptable in the response |

320 6.10.4.4.1.4 Request Payload

The request has no payload.

6.10.4.4.2 Behavior

The origin server shall perform the search indicated by the request, using the matching rules below, and return a response containing the specified number of search results, or an appropriate failure response.

325 The matching and paging rules are specified in **Section 7.5.3**.

6.10.4.4.3 Response

A success response shall have a status code of 200 (OK) and a payload containing the search results in-the Selected Media Type.

A failure response should contain a payload describing the error(s) encountered.

330 6.10.4.4.3.1 Status Codes

A successful transaction will have a 200 (OK) status code. Unsuccessful transactions will have one of the failure status codes listed in **Section 7.7**.

6.10.4.4.3.2 Response Header Fields

335 **Table 6.10.4.15** lists the Mandatory, Conditional, and most common Optional header fields for this transaction. See **Sections 5.4** and **Section 7.6**.

Table 6.10.4.15: Search Response Header Fields

| Header Field | Value | Usage | Description |
|-------------------|------------|-------|---|
| Content-Type | media-type | M | The DICOM Media Type of the response payload |
| Content-Length | uint | C | If no transfer coding has been applied to the payload |
| Transfer-Encoding | encoding | C | If a transfer coding has been applied to the payload |

All success responses shall contain the Content Representation Header Fields (**see Section 7.6.3**) and Payload Header Fields (**see Section 7.6.4**) with appropriate values.

6.10.4.4.3.3 Response Payload

340 The response payload will contain the following information in the Selected Media Type.

6.10.4.4.3.3.1 Search for Instances Payload

For each matching Instance, the origin server shall return all attributes listed in Table 6.10.6-16, if present in the Instance.

Table 6.10.4-16: Search for Instance Response Payload

| Attribute Name | Tag | Notes |
|------------------------|-------------|-------|
| SOP Class UID | (0008,0016) | |
| SOP Instance UID | (0008,0018) | |
| Specific Character Set | (0008,0005) | |

345 Table 6.10.4-17 contains references to the supported attributes in the response payload by IOD.

Table 6.10.4-17: Supported Response Attributes

| Non-Patient Object IOD | PS3.4 Section |
|-------------------------------------|------------------|
| Color Palette Instance | Annex X.6.1.2 |
| Defined Procedure Protocol Instance | Supplement 121 |
| Hanging Protocol Instance | Annex U.6.1.2 |
| Generic Implant Template | Annex BB.6.1.2.1 |
| Implant Assembly Template Instance | Annex BB.6.1.2.2 |
| Implant Template Group Instance | Annex BB.6.1.2.3 |

6.10.4.4.4 Media Types

A success response payload shall contain the Search results in a DICOM Media Type as specified in Section 6.1.1.8.

350 The failure response payload shall be a Status Details document in an Acceptable Media Type. See Section X.

6.10.4.4.5 Conformance

The Conformance Statement for implementations supporting the Search transaction shall document whether it plays the role of origin server, user agent, or both.

The Conformance Statement for an origin server shall include the following:

- 355
- The supported resources
 - Paging limit / offset
 - Optional resources supported
 - Optional Attributes supported

6.10.5 Media Types

360 The origin server shall support DICOM Media Types:

Table 6.10.5-1: Default, Required, and Recommended Media Types

| Media Type | Usage |
|---|----------|
| application/dicom | Optional |
| application/dicom+json | Required |
| multipart/related; type="application/dicom+xml" | Optional |