Update PS3.17 Section X.1.2 as follows:

... The nature of the image reference links will differ depending on the format of the report. A DICOM SR format report will use DICOM native references, and other formats may use a hyperlink to the referenced images using the Web Access to DICOM Persistent Objects URI Service (WADO) service (see PS3.18).

Update PS3.17 Section X.1.3 as follows:

... Note that the GSPS display controls can also be included in URI Service (WADO) hyperlinks and invoked from non-DICOM display stations.

Update PS3.17 Section X.3.3 as follows:

... Within the <linkHtml> markup, the value of the href Attribute is the DICOM object reference as a Web Access to Persistent DICOM Objects URI Service (WADO) specified URI (see Table X.3-1).

Note

1. When a DICOM object reference is included in an HL7 CDA document, it is presumed the recipient would not be a DICOM application; it would have access only to general Internet network protocols (and not the DICOM upper layer protocol), and would not be configured with the means to display a native
DICOM image. Therefore, the recommended encoding of a DICOM Object Reference in the CDA narrative block <linkHtml> uses the URI Service (WADO) for access by the HTTP/HTTPS network protocol (see PS3.18), using one of the formats broadly supported in Web browsers (image/jpeg or video/mpeg) as the requested content type.

2. In CDA Release 1, the markup tag for hyperlinks is <link_html> within the scope of a <link> tag.

### Table X.3-1. URI SERVICE (WADO) Reference in an HL7 CDA <linkHtml>

<table>
<thead>
<tr>
<th><strong>WADO URI Component</strong></th>
<th><strong>Source</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;scheme&gt;://&lt;authority&gt;/path&gt;</td>
<td>Configuration setting, used by the conversion process, identifying the <strong>WADO server URI Service</strong></td>
</tr>
<tr>
<td>?requestType=WADO</td>
<td>Fixed</td>
</tr>
<tr>
<td>&amp;studyUID=&lt;uid&gt;</td>
<td>Study Instance UID for referenced image obtained from the Current Requested Procedure Evidence Sequence or the Pertinent Other Evidence Sequence in the KO Instance</td>
</tr>
<tr>
<td>&amp;seriesUID=&lt;uid&gt;</td>
<td>Series Instance UID for referenced image obtained from the Current Requested Procedure Evidence Sequence or the Pertinent Other Evidence Sequence in the KO Instance</td>
</tr>
<tr>
<td>&amp;objectUID=&lt;uid&gt;</td>
<td>Referenced SOP Instance UID from IMAGE content item</td>
</tr>
<tr>
<td>&amp;frameNumber=&lt;list&gt;</td>
<td>Referenced Frame Number from IMAGE content item (if present)</td>
</tr>
<tr>
<td>&amp;presentationUID=&lt;uid&gt;</td>
<td>Referenced SOP Instance UID from Referenced SOP Sequence within IMAGE content item</td>
</tr>
<tr>
<td>&amp;presentationSeriesUID=&lt;uid&gt;</td>
<td>Series Instance UID for referenced presentation state obtained from the Current Requested Procedure Evidence Sequence or the Pertinent Other Evidence Sequence in the KO Instance</td>
</tr>
<tr>
<td>&amp;contentType=video/mpeg</td>
<td>Present if Referenced SOP Class UID from IMAGE content item is for a Multi-frame Image IOD</td>
</tr>
</tbody>
</table>

**Note**

1. Literal strings are in normal typeface, while *italic typeface within angle brackets* indicates values to be copied from the identified source.

2. The default contentType for single frame images is image/jpeg, which does not need to be specified as a URI Service (WADO) URL component. However, the default contentType for multiple frame images is application/dicom, which needs to be overridden with the specific request for video/mpeg.

3. There is not yet a standard mechanism for minimizing the potential for staleness of the <scheme>://<authority>/path> component.

**Update PS3.17 Section X.3.5 as follows:**

...  

### Table X.3-5. DICOM Composite Object Reference in an HL7 V3 Act (CDA Observation Entry)

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Data Type</th>
<th>Multiplicity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>classCode</td>
<td>CS</td>
<td>1..1</td>
<td>DGIMG</td>
</tr>
<tr>
<td>moodCode</td>
<td>CS</td>
<td>1..1</td>
<td>EVN</td>
</tr>
<tr>
<td>id</td>
<td>II</td>
<td>1..1</td>
<td>&lt; SOP Instance UID (0008,0018) as root property with no extension property&gt;</td>
</tr>
<tr>
<td>Attribute</td>
<td>Data Type</td>
<td>Multiplicity</td>
<td>Value</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------</td>
<td>--------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>code</td>
<td>CD</td>
<td>1..1</td>
<td>&lt; SOP Class UID (0008,0016) as code property,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.2.840.10008.2.6.1 as codeSystem property,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DCMUID as codeSystemName property,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SOP Class UID Name (from PS3.6) as displayName property&gt;</td>
</tr>
<tr>
<td>text</td>
<td>ED</td>
<td>0..1</td>
<td>&lt;application/DICOM as mediaType property,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>URI Service (WADO) reference (see Table X.3-6) as reference property&gt;</td>
</tr>
<tr>
<td>effectiveTime</td>
<td>TS</td>
<td>0..1</td>
<td>&lt; Content Date (0008,0023) and Content Time (0008,0033) &gt;</td>
</tr>
</tbody>
</table>

Note

1. The DGIMG class is used to reference all DICOM Composite Instances, not just diagnostic images.
2. The Observation.Text reference property may alternatively use a DICOM protocol based URI, rather than the URI Service (WADO) URI, should such a URI be defined.

Table X.3-6. URI Service (WADO) Reference in an HL7 DGIMG Observation.Text

<table>
<thead>
<tr>
<th>URL WADO Component</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;scheme &gt;/ &lt;authority&gt; / &lt;path&gt;</td>
<td>Configuration setting, used by the conversion process, identifying the WADO server</td>
</tr>
<tr>
<td>?requestType=WADO</td>
<td>Fixed</td>
</tr>
<tr>
<td>&amp;studyUID=&lt;uid&gt;</td>
<td>Study Instance UID for referenced instance</td>
</tr>
<tr>
<td>&amp;seriesUID=&lt;uid&gt;</td>
<td>Series Instance UID for referenced instance</td>
</tr>
<tr>
<td>&amp;objectUID=&lt;uid&gt;</td>
<td>SOP Instance UID for referenced instance</td>
</tr>
<tr>
<td>&amp;contentType=application/DICOM</td>
<td>Fixed</td>
</tr>
</tbody>
</table>

X.4.3 X.3.6 Using The URI Service (WADO) Reference For DICOM Network Protocol Retrievals

An application that receives a CDA with image references, and is capable of using the full services of DICOM upper layer protocol directly, can use the WADO URL Query parameters in either the linkHtml or in the DGIMG Observation.Text to retrieve the object using the DICOM network services. Such an application would need to be pre-configured with the hostname/IP address, TCP port, and AE Title of the DICOM object server (C-MOVE or C-GET SCP); this network address is not part of the WADO URL string. (Note that pre-configuration of this network address is typical for DICOM applications, and is facilitated by the LDAP-based DICOM Application Configuration Management Profile; see PS3.15.)

The application would open a Query/Retrieve Service Association with the configured server, and send a C-MOVE or C-GET command using the study, series, and object instance UIDs identified in the URI Service (WADO) query parameters. Such an application might also reasonably query the server for related objects, such as Grayscale Softcopy Presentation State.

Note

When using the C-GET service, the retrieving application needs to specify and negotiate the SOP Class of the retrieved objects when it opens the Association. This information is not available in the linkHtml URI Service (WADO) URL reference; however, it is available in the DGIMG Observation.Code. It may also be obtained from the configured server using a C-FIND query on a prior Association.
Update PS3.17 Section X.4.2 as follows:

... 

Note

1. The Study and Series Instance UIDs would be encoded in the URI Service (WADO) URL reference in the Act.Text ED data type.
2. CDA Release 1 does not provide a standard for the relatedDocument relationship to another document.

Update PS3.17 Section kk.5 as follows:

KK.5 Independent URI Service (WADO) Server

A hospital has a large PACS (that supports multi-frame objects) that does not support the URI Service (WADO). The hospital installs a separate URI Service (WADO) server that obtains images from the PACS using DICOM. The URI Service (WADO) has the means to request individual frames, supporting many of the above use cases.

Update PS3.17 Section HHH as follows:

HHH Transition from URI Service (WADO) to RESTful Services (Informative)

This annex discusses the design considerations that went into the definition of the WADO extension to Web and RESTful Studies Service services.

HHH.1 Request and Response Parameters

HHH.1.1 Request Parameters

The Studies Retrieve (WADO-RS) and Studies Store (STOW-RS) requests have no parameters because data is requested through well-defined URLs and content negotiation through using HTTP headers.

Table HHH.1-1. Summary of DICOM/Rendered URI Service Based (WADO) Query Parameters

... 

Update PS3.17 Section HHH.1.2.1 as follows:

HHH.1.2.1 URI Service (WADO)-URI

In the URI based Service (WADO), the response is the single payload returned in the HTTP Get response. It may be the DICOM object in a DICOM format or in a rendered format.

HHH.1.2.2 Retired

See PS3.17-2017b.

HHH.1.2.3 Studies Retrieve Transaction (WADO-RS)

The Studies WADO-RS Service Retrieve Transaction (WADO-RS) is a transport service, as opposed to a rendering service, which provides resources that enable machine to machine transfers of binary instances, pixel...
data, bulk data, and metadata, and rendered Instances. These services are not primarily intended to be directly displayable in a browser.

Update PS3.17 Section HHH.1.2.4 as follows:

**HHH.1.2.4 Studies Service Store Transaction (STOW-RS)**

The **STOW-RS Studies Service Store Transaction** (STOW-RS) provides the ability to **STore Over the Web store** Instances in a DICOM Media Type using RESTful Services (i.e., HTTP based functionality equivalent to C-Store).

- For the "DICOM Creator", one or more multipart/related parts are stored (posted to a STOW-RS Service) containing one or more DICOM Composite SOP Instances.
- For the "Metadata and Bulk Data Creator", one or more multipart/related parts are stored (posted to a STOW-RS Service) containing the XML encoded metadata defined in PS3.19 and one or more parts containing the bulk data of a Study, Series or SOP Instance.

Update PS3.17 Section HHH.2 as follows:

... The **Studies Service Retrieve** (WADO-RS) response payload will be provided as a list of XML and/or binary instances in a multipart/related response in a DICOM or Rendered media type. The type of response depends on the media types listed in the Accept header.

The **Studies Service Store** (STOW-RS) response is a standard HTTP status line and possibly an XML response message body. The meaning of the success, warning, or failure statuses codes are is defined in PS3.18.

Update PS3.17 Section HHH.3.2 as follows:

... Web clients, including mobile ones, retrieving Instance XML and bulk data **Bulkdata from a WADO-RS Service** and adding new instances to a study **using the Studies Service**.

Update PS3.17 Section HHH.3.3.1 as follows:

**HHH.3.3.1 URI Service Based (WADO) Use Case**

... 

Update PS3.17 Section HHH.3.3.9 as follows:

**HHH.3.3.9 DICOM Creator Studies Store Transaction User Agent**

A. The requesting system is an application capable of making HTTP Service requests and able to process data encoded as **PS3.10 binary instances in DICOM Media Types.**

B. The request specifies

1. **The Studies Service (STOW-RS) URL Service to store POST requests.**
2. Optionally, it may also specify a Study Instance UID indicating all POST that all instances contained in the requests payload are for the indicated study.
3. SOP Instances, **per DICOM PS3.10 encoding in a DICOM Media Type**.

C. The response is a standard HTTP status line and an **XML** response message body. The meaning of the success, warning, or failure statuses **are codes** is defined in PS3.18.

---

**Delete PS3.17 Section HHH.3.3.10:**

**HHH.3.3.10 Metadata and Bulk Data Creator**

A. The requesting system is an application capable of making HTTP requests and able to process data encoded as PS3.19 XML metadata.

B. The request specifies

1. The STOW-RS Service to store POST requests.
2. Optionally, it may also specify Study Instance UID indicating all POST requests are for the indicated study.
3. XML metadata, per DICOM PS3.19 encoding, and bulk data.

C. The response is a standard HTTP status line and an XML response message body. The meaning of the success, warning, or failure statuses *are codes* is defined in PS3.18.

---

**Update PS3.17 Section HHH.4 as follows:**

**HHH.4 Uses Ffor Studies Service Search (QIDO-RS) Services**

---

**Update PS3.17 Section HHH.4.2 as follows:**

**HHH.4.2 Analysis of Use Cases**

Examples of use cases / clinical scenarios, used as the basis for the development of the [Studies Service Search Transaction](QIDO-RS) requirements, include:

- ...

**Update PS3.17 Section HHH.4.2.1 as follows:**

**HHH.4.2.1 Search From EMR**

A General Practitioner (GP) in a clinic would like to check for imaging studies for the current patient. These studies are stored in a PACS, Vendor Neutral Archive (VNA) or HIE that supports [Studies Service Search (QIDO-RS)] requirements. The GP launches an Electronic Medical Record (EMR) application, and keys in the patient demographics to search for the patient record within the EMR. Once the record is open, the EMR, using Search (QIDO-RS), makes requests to the back-end systems, supplying Patient ID (including issuer) and possibly other parameters (date of birth, date range, modality, etc.). That system returns the available studies along with meta-data for each study that will help the GP select the study to open. The meta-data would include, but is not limited to, Study Description, Study Date, Modality, and Referring Physician.

**Update PS3.17 Section HHH.4.2.3 as follows:**

**HHH.4.2.3 Worklist in Viewer**

A Radiologist is reading studies in the office, using software that maintains diagnostic orders for the facility. This system produces the radiology worklist of studies to be read and provides meta-data about each scheduled procedure, including the Study Instance UID. When the next study is selected to be read on the worklist, the system, using the Study Instance UID, makes a [Studies Service Search (QIDO-RS)] request to the local archive to discover the instances and relevant study meta-data associated with the procedure to display. Subsequent Search (QIDO-RS) requests are made to the local archive and to connected VNA archives to discover candidate relevant prior studies for that patient.
For each candidate relevant prior, the full study metadata will be retrieved using the Studies Service Retrieve Transaction (WADO-RS) and processed to generate the list of relevant priors.

Update PS3.17 Section HHH.4.2.4 as follows:

**HHH.4.2.4 Multiple Systems Query Search**

A Radiologist is working in a satellite clinic, which has a system with Studies Service Search (QIDO-RS) functionality and small image cache. The main hospital with which the clinic is affiliated has a system with Search (QIDO-RS) functionality and a large historical image archive or VNA. The viewing software displays a worklist of patients, and a study is selected for viewing. The viewer checks for prior studies, by making Search (QIDO-RS) requests to both the local cache and remote archive using the Patient ID, Name and Date of Birth, if available. If the Patient Identifier isn't available, other means (such as by other demographics, or a Master Patient Index) could be utilized. Any studies that meet relevant prior criteria can be pre-fetched.

Update PS3.17 Section HHH.4.2.5 as follows:

**HHH.4.2.5 Clinical Reconstruction**

A Neurologist is preparing a surgical plan for a patient with a brain tumor using three-dimensional reconstruction software, which takes CT images and builds a 3D model of various structures. After supplying the patient demographics (or Patient Identifier), the software requests a list of appropriate studies for reconstruction (based on Study Date, Body Region and Modality). Once the user has selected a study and series, the software contacts uses the Studies Service Search request (QIDO-RS) server again, requesting the SOP Instance UIDs of all images of a certain thickness (specified in specific DICOM tags) and frame of reference to be returned. The software then uses this information to retrieve, using the WADO-RS Studies Service Retrieve request (WADO-RS), the appropriate DICOM objects Instances needed to prepare the rendered volume for display.

Update PS3.17 Section HHH.4.2.6 as follows:

**HHH.4.2.6 Mobile Device Access**

A General Practitioner (GP) has left the medical ward for a few hours, and is paged with a request to look at a patient X-Ray image in order to grant a discharge. The GP carries a smart phone that has been pre-loaded with credentials and secured. The device makes a Studies Service Search (QIDO-RS) request to the server, to look for studies from the last hour that list the GP as the Referring Physician. The GP is able to retrieve and view the matching studies, and can make a determination whether to return to the ward for further review or to sign the discharge order using the phone.

Update PS3.17 Section HHH.4.3.1 as follows:

**HHH.4.3.1 XML Study Search Use Case**

A. The requesting web-based application can make a Studies Service Search (QIDO-RS) requests, parse the XML response and then make Studies Service Retrieve (WADO-RS) requests

B. The request specifies:

1. Multipart XML

2. Search parameters, including:

   a. Patient ID
   b. Issuer of Patient ID
   c. Patient Name
   d. Study Description
   e. Study Date
f. Modalities in Study

g. Referring Physician

h. etc.

C. The Response provides

1. One PS3.19 XML NativeDicomModel element for each matching Study

2. All requested DICOM Attributes for each matching Study

3. **Studies Service [WADO-RS]** Retrieve ([WADO-RS]) URL for each matching Study

D. The requesting system identifies the Study of interest and uses the **Studies Service Retrieve** request ([WADO-RS]) to retrieve data

**Update PS3.17 Section HHH.4.2.5 as follows:**

### HHH.4.3.2 XML Study, Series and Instance Search Use Case

A. The requesting system is a simple web-based application that can make **Studies Service Search** (QIDO-RS) requests and parse the **XML** response and then make **Studies Service Retrieve** (WADO URL) requests

B. The request specifies:

1. Multipart XML

2. Search parameters, including:
   a. Patient ID
   b. Issuer of Patient ID
   c. Patient Name
   d. Patient Date of Birth
   e. Study Description
   f. Study Date
   g. Modalities in Study
   h. Referring Physician

C. The Response provides

1. One PS3.19 XML NativeDicomModel element for each matching Study

2. All requested DICOM Attributes for each matching Study

D. The requesting system identifies the Study of interest and uses Search For Series to identify a series of interest

E. [repeat B-D for Series, Instance]

F. The requesting system uses **the Studies Service Retrieve** request ([WADO-RS]) **URL** to retrieve specific instances

**Update PS3.17 Section HHH.4.2.5 as follows:**

### HHH.4.3.3 JSON Use Case

A. The requesting system is a mobile application that can make **Studies Service Search** (QIDO-RS) requests, parse the **JSON** response and then make **Studies Service Retrieve** (WADO URL) requests.

B. The request specifies:
1. JSON
2. Search parameters, including:
   a. Patient ID
   b. Issuer of Patient ID
   c. Patient Name
   d. Patient Date of Birth
   e. Study Description
   f. Study Date
   g. Modalities in Study
   h. Referring Physician
C. The Response provides
   1. One DICOM JSON element containing all matching Studies
   2. All requested DICOM Attributes for each matching Study
D. The requesting system identifies the Study of interest and uses Search For Series to identify a series of interest
E. [repeat B-D for Series, Instance]
F. The requesting system uses Studies Service Retrieve request (WADO-RS) URL to retrieve specific instances

Update PS3.17 Section HHH.7.1 as follows:

**HHH.7.1 WADL Example (XML)**

The following WADL XML example contains all the required elements for an origin-server that supports the Studies Service Retrieve (WADO-RS), Search (QIDO-RS) and Store (STOW-RS) requests with all required services and parameters.