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**Context-aware Knowledge Retrieval (Infobutton)
Knowledge Request
URL-based Implementation Guide**

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48 **1 Purpose**

49 Clinicians face numerous knowledge needs during the course of patient care and the majority of
50 these needs are not met, compromising the quality of care. Online health knowledge resources
51 that are capable of solving many of these knowledge needs are now widely available, but a series
52 of barriers hinder a more effective and frequent use of these resources at the point of care.
53 *Infobuttons* are decision support tools that integrate knowledge resources into electronic health
54 record (EHR) and personal health record (PHR) systems as an attempt to lower these barriers.
55 To facilitate the integration of knowledge resources into EHR and PHR systems, the Clinical
56 Decision Support Technical Committee developed the *Context-aware knowledge retrieval*
57 (*Infobutton*) standard specification.

58
59 This implementation guide provides a specification for URL-based implementations of the
60 *Context-aware knowledge retrieval (Infobutton)* standard. The intent of this specification is to
61 support the majority of knowledge retrieval implementations that offer URLs as the primary or
62 exclusive communication protocol. The ultimate goal is to enable a stepwise transition from URL-
63 based implementations to a services-oriented approach. This implementation guide was
64 successfully balloted as a *Draft Standard for Trial Use* in January 2008. Since then, a large
65 number of implementations became available, allowing the specification to be thoroughly
66 validated and tested. This document contains an updated specification, which includes
67 enhancements and corrections based on implementers' feedback.

68 **2 Special notes and disclaimers**

69 The URL-based specification is one alternative, not normative, implementation of the *Context-*
70 *aware Knowledge retrieval standard*. The main goal of this implementation approach is to support
71 compatibility with most EHR and knowledge resource implementations, maximizing adoption.
72 This document assumes knowledge of the *Context-aware Knowledge Retrieval (Infobutton)*
73 standard normative specification. For a detailed description of the standard, readers should refer
74 to the *Context-aware Knowledge Retrieval (Infobutton)* section in the HL7 Version 3 Standard
75 documentation.
76

77 3 URL-based implementation

78 The URL-based representation is directly derived from the *Context-aware Knowledge Retrieval*
 79 (*Infobutton*), *knowledge request* message information model. The method described in the
 80 following sections allows *knowledge request* message payloads to be converted from XML to
 81 URL-based through a simple automated process. The set of rules described below SHALL be
 82 followed to convert an XML-based *knowledge request* payload into a set of parameter names that
 83 can be transmitted through the HTTP protocol, using the GET or POST methods.

84 3.1 Conversion of XML entities into URL parameter names

85 **Rule #1:** All XML attribute and element names that contain values SHALL be converted to an
 86 HTTP parameter name. The parameter SHALL be named by concatenating the element /
 87 attribute antecessor names (2 levels up) with the element / attribute name. Element / attribute
 88 names shall be separated by a dot as follows: [name of the level 2 antecessor] + '.' + [name of
 89 the level 1 antecessor] + '.' + [name of the element or attribute]. A few of the XML element /
 90 attributes cannot be unambiguously converted to a parameter name using the proposed rule. The
 91 name translations listed in Table 1 SHALL be used to address these cases. For convenience,
 92 Appendix 1 contains an exhaustive list of XML entities and their respective parameter name
 93 translations.

94 Note: To provide backwards compatibility with the previous versions of the present
 95 implementation guide while in DSTU status, the *MainSearchCriteria.value.** and *SubTopic.value.**
 96 class attributes MAY still be converted to *mainSearchCriteria.c.** and *subtopic.c.** respectively.
 97 However, this option has been deprecated as off January 2010 and SHALL not be used in new
 98 implementations. Existing implementations SHALL plan to migrate from the previous version to
 99 the new one, in which the parameter names for those two classes SHALL be
 100 *mainSearchCriteria.v.** and *subTopic.v.**.

101

102

Table 1 – Exceptions to the parameter name translation rule.*

Xpath	URL parameter name
//assignedEntity/ representedOrganization/id@root	assignedEntity.representedOrganization.id.root
//performer/healthCareProvider/code@code	performer.healthCareProvider.c.c
//performer/healthCareProvider/code@codeSystem	performer.healthCareProvider.c.cs
//performer/healthCareProvider/code@displayName	performer.healthCareProvider.c.dn
//informationRecipient /healthCareProvider/code@code	informationRecipient.healthCareProvider.c.c
//informationRecipient /healthCareProvider/code@codeSystem	informationRecipient.healthCareProvider.c.cs
//informationRecipient /healthCareProvider/code@displayName	informationRecipient.healthCareProvider.c.dn
//performer//languageCommunication/ languageCode@code	performer.languageCode.c
//performer//languageCommunication/ languageCode@codeSystem	performer.languageCode.cs

//performer//languageCommunication/ languageCode@displayName	performer.languageCode.dn
//informationRecipient// languageCommunication/ languageCode@code	informationRecipient.languageCode.c
//informationRecipient// languageCommunication/ languageCode@codeSystem	informationRecipient.languageCode.cs
//informationRecipient// languageCommunication/ languageCode@displayName	informationRecipient.languageCode.dn
//informationRecipient/ healthCareProvider/	informationRecipient=PROV ¹
//informationRecipient/patient/	informationRecipient=PAT ¹
//performer/healthCareProvider/	performer=PROV ¹
//performer/patient/	performer=PAT ¹

103 * Note that some of the parameter names listed above are abbreviated according to abbreviation
 104 rules defined below in Table 3.

3.2 Parameter cardinality

105
 106 **Rule #2:** Parameter cardinality SHALL follow the same restrictions defined in the *Knowledge*
 107 *request* RMIM with two exceptions in which attributes MAY be omitted: 1) attributes that are
 108 bound to one single fixed code in the *knowledge request* message information model; and 2)
 109 *codeSystem* attributes that are bound at the universal realm level to a value set that contains
 110 concepts from one particular code system. This code system SHALL be assumed by the
 111 knowledge request fulfiller in case the *codeSystem* attribute is not included in a knowledge
 112 request.

113 **Rule #3:** Multiple instance parameters SHALL be suffixed with a sequential integer that denotes
 114 the cardinality of a particular parameter instance: the first instance in a given sequence SHALL
 115 not be suffixed; the second element SHALL be suffixed with the integer "1," the third element
 116 SHALL be suffixed with "2," and so forth. Table 2 shows an example with three instances of the
 117 *mainSearchCriteria* element.

118

119 Table 2 – Conversion example of multiple *mainSearchCriteria* elements*.

XML node	URL parameter name
<mainSearchCriteria> <value code="1202" codeSystem="2.16.840.1.113883.6.88" displayName="atenolol"> </value> </mainSearchCriteria>	mainSearchCriteria.v.c=1202& mainSearchCriteria.v.cs=2.16.840.1.113883.6.88& mainSearchCriteria.v.dn=atenolol
<mainSearchCriteria> <value code="401.1">	mainSearchCriteria.v.c1=401.1& mainSearchCriteria.v.cs1=2.16.840.1.113883.6.103& mainSearchCriteria.v.dn1=Benign+essential+ hypertension
	mainSearchCriteria.v.c2=250& mainSearchCriteria.v.cs2=2.16.840.1.113883.6.103&

¹ The concept codes *PROV* and *PAT* originate respectively from the RoleClassHealthcareProvider [2.16.840.1.113883.1.11.20161] and RoleClassPatient [2.16.840.1.113883.1.11.20155] value sets.

<pre>codeSystem="2.16.840.1.113883.6.103" displayName="Benign essential hypertension"> </value> </mainSearchCriteria> <mainSearchCriteria> <value code="250" codeSystem="2.16.840.1.113883.6.103" displayName="Diabetes mellitus"> </value> </mainSearchCriteria></pre>	<pre>mainSearchCriteria.v.dn2=Diabetes+mellitus</pre>
---	---

120 * Note that some of the parameter names listed above are abbreviated according to abbreviation
121 rules defined below in Table 3.

122 3.3 Addressing length limitations of HTTP GET

123 **Rule #4:** To address URL length limitations imposed by the HTTP GET protocol, the attribute /
124 element names listed in Table 3 SHALL be abbreviated. This list is intended to be immutable
125 regardless of changes to the normative *knowledge request* RMIM.

126

127

Table 3 – List of required entity abbreviations.

Element / attribute	Abbreviation
code	c
codeSystem	cs
codeSystemName	csn
displayName	dn
originalText	ot
value	v
unit	u
name	n

128

129 3.4 HTTP GET vs. POST

130 **Rule #5:** Despite the parameter abbreviations listed above, specific knowledge request payload
131 instances may still lead to URLs that exceed the length limitations imposed by the HTTP GET
132 protocol, especially when a payload contains multiple instances of a given parameter, such as
133 *mainSearchCriteria*. In these cases, the HTTP POST protocol SHOULD be the preferred
134 implementation approach.

135 3.5 Knowledge request via HTTP POST

136 The following rule should be followed to submit a knowledge request using the HTTP POST
137 protocol:

138 **Rule #6:** Create a request that includes one single parameter called *infobuttonEventNotification*.
139 The value of this parameter SHALL be set with a string that contains the entire list of parameters
140 as they would have been encoded in a GET request. This approach enables implementations
141 based on the GET protocol to seamlessly transition to POST.

142
143
144
145
146

3.6 URL translation examples

Table 4 contains examples of XML representations extracted from an *knowledge request* message payload and the equivalent URL-based representations.

Table 4 – Examples of XML representations followed by the equivalent URL-based translation.

XML representation	URL-based representation
<code><patientPerson><administrativeGenderCode code="F"></patientPerson></code>	<code>patientPerson.administrativeGenderCode.c=F</code>
<code><age><code code="30525-0"/> <value value="77" unit="a"/></age></code>	<code>age.c.c=30525-0&age.v.v=77&age.v.u=a</code>
<code><mainSearchCriteria> <value code="D018410" codeSystem="2.16.840.1.113883.6.1 77" codeSystemName="MSH" displayName="Bacterial+Pneumonia" > <originalText>Pneumonia</originalText></value> </mainSearchCriteria></code>	<code>mainSearchCriteria.v.c=D018410 mainSearchCriteria.v.cs=2.16.840.1.113883.6.177&mainSearchCriteria.v.csn=MSH mainSearchCriteria.v.dn=Bacterial+Pneumonia&mainSearchCriteria.v.ot=Pneumonia</code>

147 4 Appendix 1 – List of parameter names

148 Table 5 contains a comprehensive list of XML entities and their associated parameter name
 149 translations. Detailed descriptions of these parameters are outside the scope of this
 150 Implementation Guide. The reader should refer to the Context-aware knowledge retrieval
 151 (“Infobutton”) normative specification for a detailed description of the underlying message model
 152 and its attributes.

153 Table 5 – List of XML entities and their associated parameter name translations.

Xpath	URL parameter name
//knowledgeRequestNotification/ effectiveTime@value	knowledgeRequestNotification. effectiveTime.v
//holder/assignedEntity/name	holder.assignedEntity.n
//holder/assignedEntity/ certificateText	holder.assignedEntity.certificateText
//assignedEntity/ assignedAuthorizedPerson/id@root	assignedAuthorizedPerson.id.root
//assignedEntity/ representedOrganization/id@root	representedOrganization.id.root
//assignedEntity/ representedOrganization/name	assignedEntity. representedOrganization.n
//patientPerson/ administrativeGenderCode@code	patientPerson. administrativeGenderCode.c
//patientPerson/ administrativeGenderCode@displayName	patientPerson. administrativeGenderCode.dn
//age/code@value	age.v.v
//age/code@unit	age.v.u
//ageGroup/value@code	ageGroup.v.c
//ageGroup/value@codeSystem	ageGroup.v.cs
//ageGroup/value@displayName	ageGroup.v.dn
//taskContext/code@code	taskContext.c.c
//taskContext/code@displayName	taskContext.c.dn
//subTopic/value@code	subTopic.v.c
//subTopic/value@codeSystem	subTopic.v.cs
//subTopic/value@displayName	subTopic.v.dn
//subTopic/value@code	subTopic.c.c (deprecated)
//subTopic/value@codeSystem	subTopic.c.cs (deprecated)
//subTopic/value@displayName	subTopic.c.dn (deprecated)
//mainSearchCriteria/value@code	mainSearchCriteria.v.c

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//mainSearchCriteria/value@codeSystem	mainSearchCriteria.v.cs
//mainSearchCriteria/value@displayName	mainSearchCriteria.v.dn
//mainSearchCriteria/value/originalText	mainSearchCriteria.v.ot
//mainSearchCriteria/value@code	mainSearchCriteria.c.c (deprecated)
//mainSearchCriteria/value@codeSystem	mainSearchCriteria.c.cs (deprecated)
//mainSearchCriteria/value@displayName	mainSearchCriteria.c.dn (deprecated)
//mainSearchCriteria/value/originalText	mainSearchCriteria.c.ot (deprecated)
//severityObservation/interpretationCode@code	severityObservation.interpretationCode.c
//severityObservation/interpretationCode@codeSystem	severityObservation.interpretationCode.cs
//severityObservation/interpretationCode@displayName	severityObservation.interpretationCode.dn
//informationRecipient/patient/	informationRecipient=PAT
//informationRecipient/ healthCareProvider/	informationRecipient=PROV
//performer/patient/	performer=PAT
//performer/healthCareProvider/	performer=PROV
//performer/healthCareProvider/ healthCarePerson/code@code	performer.healthCareProvider.c.c
//performer/healthCareProvider/ healthCarePerson/code@codeSystem	performer.healthCareProvider.c.cs
//performer/healthCareProvider/ healthCarePerson/code@displayName	performer.healthCareProvider.c.dn
//informationRecipient/healthCareProvider/ healthCarePerson/code@code	informationRecipient.healthCareProvider.c.c
//informationRecipient/healthCareProvider/ healthCarePerson/code@codeSystem	informationRecipient.healthCareProvider.c.cs
//informationRecipient/healthCareProvider/ healthCarePerson/code@displayName	informationRecipient.healthCareProvider.c.dn
//performer//languageCommunication/ languageCode@code	performer.languageCode.c
//informationRecipient// languageCommunication/ languageCode@code	informationRecipient.languageCode.c
//encounter/code@code	encounter.c.c
//encounter/code@codeSystem	encounter.c.cs
//encounter/code@displayname	encounter.c.dn
//serviceDeliveryLocation/id@root	serviceDeliveryLocation.id.root

155 5 Appendix 2 - Examples

156 Each of the following examples contains an *Infobutton event notification* XML message payload
157 and its equivalent URL-based representation.

158 5.1 Example 1

159 In this example the user is looking at a coded problem list of a male, 77 years-old patient with
160 Bacterial Pneumonia. The user clicks on an infobutton that presents a series of questions. The
161 user selects "How do I treat Bacterial Pneumonia?" The following message payload represents
162 the communication between the EHR systems and knowledge resources.
163

164 *XML representation:*

```
165 <?xml version="1.0" encoding="UTF-8"?>
166 <infobuttonEventNotification>
167   <effectiveTime value="20060706001023" />
168   <subject1>
169     <patientContext>
170       <patientPerson>
171         <administrativeGenderCode code="M" codeSystem="2.16.840.1.113883.5.1"
172         codeSystemName="AdministrativeGender" displayName="Male" />
173       </patientPerson>
174     </subjectOf>
175     <age>
176       <code code="30525-0" codeSystem="2.16.840.1.113883.6.1"
177       codeSystemName="LN" displayName="AGE" />
178       <value value="77" unit="a" />
179     </age>
180   </subjectOf>
181   <subjectOf>
182     <ageGroup>
183       <code code="46251-5" codeSystem="2.16.840.1.113883.6.1"
184       codeSystemName="LN" displayName="Age Groups" />
185       <value code="D000368" codeSystem="2.16.840.1.113883.6.177"
186       codeSystemName="MSH" displayName="Aged" />
187     </ageGroup>
188   </subjectOf>
189   </patientContext>
190 </subject1>
191 <holder>
192   <assignedEntity>
193     <name>Organization-Username</name>
194     <certificateText>organization-password</certificateText>
195   </assignedEntity>
196 </holder>
197 <subject2>
198   <taskContext>
199     <code code="PROBLISTREV" codeSystem="2.16.840.1.113883.1.11.19846"
200     codeSystemName="ActTaskCode" displayName="Problem List Review" />
201   </taskContext>
202 </subject2>
203 <subject3>
204   <subTopic>
205     <value code="Q000628" codeSystem="2.16.840.1.113883.6.177"
206     codeSystemName="MSH" displayName="therapy" />
207   </subTopic>
208 </subject3>
209 <subject4>
210   <mainSearchCriteria>
211     <value code="D018410" codeSystem="2.16.840.1.113883.6.177"
212     codeSystemName="MSH" displayName="Bacterial Pneumonia" >
213       <originalText>Pneumonia</originalText>
214     </value>
215   </mainSearchCriteria>
```

```

216     </subject4>
217 </infobuttonEventNotification>
218
219 URL representation (643 characters):
220 http://www.e-resource.com/api?
221   infobuttonEventNotification.effectiveTime.v=20060706001023&
222   holder.assignedEntity.n=Organization-
223     Username&holder.assignedEntity.certificateText=organization-password&
224   patientPerson.administrativeGenderCode.c=M&patientPerson.administrativeGenderCode
225     .dn=Male&
226   age.v.v=77&age.v.u=a&
227   ageGroup.v.c=D000368&ageGroup.v.cs=2.16.840.1.113883.6.177&ageGroup.v.dn=Aged&
228   taskContext.c.c=PROBLISTREV&taskContext.c.dn=Problem+list+review&
229   subTopic.v.c=Q000628&subTopic.v.cs=2.16.840.1.113883.6.177&subTopic.v.dn=therapy&
230   mainSearchCriteria.v.c=D018410&mainSearchCriteria.v.cs=2.16.840.1.113883.6.177&
231     mainSearchCriteria.v.dn=Bacterial+Pneumonia&
232     mainSearchCriteria.v.ot=Pneumonia

```

233 *HTTP POST example:*

```

234 <input name="InfobuttonEventNotification"
235   value="infobuttonEventNotification.effectiveTime.v=20060706001023&holder.assi
236   gnedEntity.n=Organizationusername&holder.assignedEntity.certificateText=orga
237   nizationpassword&patientPerson.administrativeGenderCode.c=M&patientPerson.ad
238   ministrativeGenderCode.dn=Male&age.v.v=77&age.v.u=a&ageGroup.v.c=D000368&ageG
239   roup.v.cs=2.16.840.1.113883.6.177&ageGroup.v.dn=Aged&taskContext.c.c=PROBLIST
240   REV&taskContext.c.dn=Problem+list+review&subTopic.v.c=Q000628&subTopic.v.cs=2
241   .16.840.1.113883.6.177&subTopic.v.dn=therapy&mainSearchCriteria.v.c=D018410&m
242   ainSearchCriteria.v.cs=2.16.840.1.113883.6.177&mainSearchCriteria.v.dn=Bacter
243   ial+Pneumonia&mainSearchCriteria.v.ot=Pneumonia"/>

```

244 **5.2 Example 2**

245 The user (an RN) is looking at a medications list of a female, Spanish speaker, 8 years-old
 246 patient who came for an outpatient appointment. The user clicks on the infobutton next to
 247 "albuterol sulfate" and is presented with a series of links. The user selects the "patient education"
 248 link.

249 *XML representation:*

```

250 <?xml version="1.0" encoding="UTF-8"?>
251 <infobuttonEventNotification>
252   <effectiveTime value="20060706001023"/>
253   <subject1>
254     <patientContext>
255       <patientPerson>
256         <administrativeGenderCode code="F" codeSystem="2.16.840.1.113883.5.1"
257         codeSystemName="AdministrativeGender" displayName="Female"/>
258       </patientPerson>
259       <subjectOf>
260         <age>
261           <code code="30525-0" codeSystem="2.16.840.1.113883.6.1" codeSystemName="LN"
262           displayName="AGE"/>
263           <value value="8" unit="a"/>
264         </age>
265       </subjectOf>
266       <subjectOf>
267         <ageGroup>
268           <code code="46251-5" codeSystem="2.16.840.1.113883.6.1" codeSystemName="LN"
269           displayName="Age Groups"/>
270           <value code="D002648" codeSystem="2.16.840.1.113883.6.177"
271           codeSystemName="MSH" displayName="Child"/>

```

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```
273         </ageGroup>
274     </subjectOf>
275 </patientContext>
276 </subject1>
277 <performer>
278     <healthCareProvider>
279         <code code="163W00000X" codeSystem="2.16.840.1.113883.6.101" codeSystemName="NUCC
280 Health Care Provider Taxonomy" displayName="Registered Nurse"/>
281     <healthCarePerson>
282         <languageCommunication>
283             <languageCode code="en" codeSystem="2.16.840.1.113883.6.121"
284 codeSystemName="Tags for the Identification of Languages" displayName="English"/>
285         </languageCommunication>
286     </healthCarePerson>
287 </healthCareProvider>
288 </performer>
289 <!--This indicates that the recipient of the content is a patient who speaks Spanish.
290 Therefore, knowledge resources SHOULD interpret the following as a request for patient
291 education content -->
292 <informationRecipient>
293     <patient>
294         <patientPerson>
295             <languageCommunication>
296                 <languageCode code="es" codeSystem="2.16.840.1.113883.6.121"
297 codeSystemName="Tags for the Identification of Languages" displayName="Spanish"/>
298             </languageCommunication>
299         </patientPerson>
300     </patient>
301 </informationRecipient>
302 <subject2>
303     <taskContext>
304         <code code="MEDLISTREV" codeSystem="2.16.840.1.113883.5.4" codeSystemName="ActionCode"
305 displayName="Medication List Review"/>
306     </taskContext>
307 </subject2>
308 <subject4>
309     <mainSearchCriteria>
310         <value code="49502-693-03" codeSystem="2.16.840.1.113883.6.69"
311 codeSystemName="NDC" displayName="Albuterol sulfate">
312             <originalText>Albuterol sulfate inhalation solution 1.25 mg</originalText>
313         </value>
314     </mainSearchCriteria>
315 </subject4>
316 </infobuttonEventNotification>
```

317

318 *URL representation (874 characters):*319 `http://www.e-resource.com/api?`320 `infobuttonEventNotification.effectiveTime.v=20060706001023&`321 `holder.assignedEntity.n=Organization-`322 `Username&holder.assignedEntity.certificateText=organization-password&`323 `patientPerson.administrativeGenderCode.c=F&patientPerson.administrativeGenderCode`324 `.dn=Female&`325 `age.v.v=8&age.v.u=a&`326 `ageGroup.v.c=D002648&ageGroup.v.cs=2.16.840.1.113883.6.177&`327 `taskContext.c.c=MEDLISTREV&`328 `performer=PROV&`329 `informationRecipient=PAT&`330 `performer.languageCode.c=en&`331 `informationRecipient.languageCode.c=es&`332 `performer.healthCareProvider.c.c=163W00000X&performer.healthCareProvider.c.dn=Reg`333 `istered Nurse&`334 `mainSearchCriteria.v.c=49502-693-03&mainSearchCriteria.v.cs=`335 `2.16.840.1.113883.6.69&mainSearchCriteria.v.dn=Albuterol+sulfate&`336 `mainSearchCriteria.v.ot=Albuterol+sulfate+inhalation+solution+1.25+mg`337 *HTTP POST example:*338 `<input`339 `name="InfobuttonEventNotification" value="infobuttonEventNotification.effectiv`340 `eTime.v=20060706001023&holder.assignedEntity.n=OrganizationUsername&holder.a`341 `ssignedEntity.certificateText=organizationpassword&patientPerson.administrat`342 `iveGenderCode.c=F&patientPerson.administrativeGenderCode.dn=Female&age.v.v=8&`343 `age.v.u=a&ageGroup.v.c=D002648&ageGroup.v.cs=2.16.840.1.113883.6.177&taskCont`344 `ext.c.c=MEDLISTREV&performer=PROV&informationRecipient=PAT&performer.healthCa`345 `reProvider.languageCode.c.c=en&informationRecipient.patientPerson.languageCod`346 `e.c=es&performer.healthCareProvider.c.c=163W00000X&performer.healthCareProvid`347 `er.c.dn=Registered Nurse&mainSearchCriteria.v.c=49502-693-`348 `03&mainSearchCriteria.v.cs=2.16.840.1.113883.6.69&mainSearchCriteria.v.dn=Albu`349 `terol+sulfate&`350 `mainSearchCriteria.v.ot=Albuterol+sulfate+inhalation+solution+1.25+mg"/>`

351