



Extensible Resource Identifier (XRI) Metadata V2.0

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Abstract:

This document is the normative technical specification for XRI metadata. It is a companion specification to *Extensible Resource Identifier (XRI) Syntax V2.0 [XRISyntax]* and *Extensible Resource Identifier (XRI) Resolution V2.0 [XRIResolution]*. For a non-normative introduction to the uses and features of XRIs, see the *Introduction to XRIs [XRIntro]*.

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This document was last revised or approved by the XRI Technical Committee on the above date. The level of approval is also listed above. Check the current location noted above for possible later revisions of this document. This document is updated periodically on no particular schedule.

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Table of Contents

38	1	Introduction	4
39	1.1	Purpose of this Specification	4
40	1.2	Related Specifications.....	4
41	1.3	Design Considerations	4
42	1.3.1	Support for Interoperability	4
43	1.3.2	Simplicity and Compactness.....	5
44	1.3.3	Minimal Processing Rules	5
45	1.4	Terminology and Notation	5
46	1.4.1	Keywords	5
47	1.4.2	Syntax Notation.....	5
48	1.4.3	Glossary.....	5
49	2	Language Metadata (\$l).....	6
50	2.1	Purpose	6
51	2.2	Namespace Restrictions	6
52	2.3	Normalization and Comparison.....	6
53	2.4	Significance in Resolution	6
54	2.5	Special Processing Rules	6
55	3	Date/Time Metadata (\$d).....	7
56	3.1	Purpose	7
57	3.2	Namespace Restrictions	7
58	3.3	Normalization and Comparison.....	8
59	3.4	Significance in Resolution	8
60	3.5	Special Processing Rules	8
61	4	Version Metadata (\$v).....	9
62	4.1	Purpose	9
63	4.2	Namespace Restrictions	9
64	4.3	Normalization and Comparison.....	9
65	4.4	Significance in Resolution	9
66	4.5	Special Processing Rules	9
67	5	Annotation Metadata (\$a)	11
68	5.1	Purpose	11
69	5.2	Namespace Restrictions	11
70	5.3	Normalization and Comparison.....	11
71	5.4	Significance in Resolution	11
72	5.5	Special Processing Rules	11
73	6	Normalization and Comparison	12
74	7	Extending XRI Metadata	13
75	7.1	Extending the \$v Namespace with \$d.....	13
76	8	Security and Data Protection	14
77	8.1	Semantic Attacks.....	14
78	9	References.....	15

79	9.1	Normative	15
80	9.2	Informative.....	15
81		Appendix A. Collected XRI Metadata	16
82		Appendix B. Acknowledgments	17
83		Appendix C. Notices	18
84			

85 1 Introduction

86 1.1 Purpose of this Specification

87 **[XRISyntax]** establishes five global context symbol (GCS) characters that may be used to begin
88 an XRI authority segment for the purpose of expressing the abstract global context of an
89 identifier. One of these GCS characters, "\$", is reserved for identifiers for which the authority is a
90 standards specification.

91 A second key XRI feature, cross-references (see section 2.2.2 of **[XRISyntax]**), allows XRIs to be
92 embedded within other XRIs in order to share identifiers across contexts. This syntactic feature
93 allows XRIs in the \$ namespace to be used as metadata to describe an XRI itself. For example,
94 the following XRI includes a cross-reference with version metadata.

```
95 xri://@example*resource*($v/3)  
96 \----/ cross-reference with XRI metadata
```

97 The purpose of this specification is to define a set of XRIs in the \$ namespace that function as
98 *identifier metadata*—attributes that may be used describe an identifier itself, as opposed to
99 attributes of the resource it identifies. This specification defines four such types of identifier
100 metadata:

- 101 • *Language metadata* that specifies the human language in which an identifier is intended to be
102 interpreted.
- 103 • *Date/time metadata* that specifies the point in time an identifier was established.
- 104 • *Version metadata* that specifies the identifier's position in a sequence of identifiers for the
105 same logical resource.
- 106 • *Annotation metadata* that allows XRI producers to add annotations to XRIs or XRI segments.

107 The definition of each metadata type also specifies comparison rules, significance in resolution,
108 and any other special processing rules specific to that type.

109 1.2 Related Specifications

110 This document is a companion specification to *XRI Syntax 2.0* **[XRISyntax]** and *XRI Resolution*
111 **[XRIResolution]**. **[XRISyntax]** specifies the normative ABNF and processing rules for XRIs
112 (including the GCS "\$" character). **[XRIResolution]** specifies both a standard and a trusted
113 resolution protocol for XRIs. It also establishes a branch of the \$ namespace, "\$res", for
114 identifiers used by XRI resolution.

115 The *Introduction to XRIs* **[XRIIntro]** provides a non-normative introduction to the uses and
116 features of XRIs.

117 1.3 Design Considerations

118 This section briefly enumerates the primary design criteria for XRI metadata.

119 1.3.1 Support for Interoperability

120 The primary factor in selecting the metadata types included in this specification is the degree to
121 which they are useful across multiple domains and applications. The four types of identifier
122 metadata included in this specification have appeared repeatedly in use cases considered by the
123 XRI TC since its inception.

124 1.3.2 Simplicity and Compactness

125 To keep XRI metadata as simple and as lightweight as possible, all top-level \$ identifiers defined
126 in this specification are single ASCII letters. (Note that this is not a requirement of \$ identifiers
127 defined in other specifications; for example, the XRI Resolution specification **[XRIResolution]**
128 establishes a multi-character identifier, "\$res", for use in XRI resolution.) Because \$ identifiers
129 match the xri-authority production in section 2.2.1 of **[XRISyntax]**, they are normalized to
130 lowercase per the recommendations in section 2.5.5 of **[XRISyntax]**. In addition, although this
131 specification does not explicitly designate these \$ identifiers as persistent using "!" syntax (see
132 section 2.2.3 of **[XRISyntax]**), they should be considered effectively persistent.

133 1.3.3 Minimal Processing Rules

134 The final design principle is that \$ metadata defined in this specification (as opposed to
135 extensions, as described in section 6) must require only minimal processing rules to be useful.
136 Note that these processing rules, including the order in which \$ cross-references are placed in an
137 XRI, are specific to each type of \$ metadata.

138 1.4 Terminology and Notation

139 1.4.1 Keywords

140 The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD
141 NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as
142 described in **[RFC2119]**. When these words are not capitalized in this document, they are meant
143 in their natural language sense.

144 1.4.2 Syntax Notation

145 This specification uses the same syntax notation employed in **[XRISyntax]**, i.e., Augmented
146 Backus-Naur Form (ABNF), defined in **[RFC2234]**. The following core ABNF productions are
147 used by this specification as defined by section 6.1 of **[RFC2234]**: ALPHA, CR, CTL, DIGIT,
148 DQUOTE, HEXDIG, LF, OCTET, and SP.

149 Also note that because the prefix "xri://" is optional in absolute XRIs (which can be recognized by
150 a leading global context symbol—see section 2.2.1.1 of **[XRISyntax]**), some example XRIs may
151 be shown without this prefix.

152 `ABNF that is reproduced from an external specification looks like this.`

153 `ABNF that is defined by this specification looks like this.`

154 1.4.3 Glossary

155 The normative glossary for the XRI 2.0 suite of specifications is in Appendix C of **[XRISyntax]**.

156 2 Language Metadata (\$I)

157 2.1 Purpose

158 The purpose of the \$I namespace is to provide a standard means of representing the human
159 language in which an XRI, or a sub-segment of an XRI, is intended to be understood, interpreted,
160 or pronounced. The many uses and applications of language tags are well articulated in *Tags for*
161 *Identification of Languages* [RFC3066] and its successor, *Tags for Identifying Languages*,
162 [RFC3066bis]. (Note that the latter is a work-in-progress and is subject to change.).

163 2.2 Namespace Restrictions

164 In the absence of an extension (see section 7), the identifier in the local path immediately
165 following the XRI authority "\$I" (i.e., "\$I/...") MUST be a language tag conforming to the ABNF
166 defined in Section 2.1 of [RFC3066]. For convenience, this ABNF is reproduced below:

```
167     Language-Tag      = Primary-subtag *( "-" Subtag )  
168     Primary-subtag   = 1*8ALPHA  
169     Subtag           = 1*8(ALPHA / DIGIT)
```

170 In a future version of this specification, the XRI Technical Committee intends to incorporate
171 [RFC3066bis] when it is approved. The language tags in [RFC3066bis] are intended to be
172 backward-compatible with [RFC3066].

173 2.3 Normalization and Comparison

174 The rules for normalization of language tags are specified in [RFC3066]. For comparison, the
175 general equivalence rules in section 6 of this XRI Metadata specification apply.

176 2.4 Significance in Resolution

177 \$I language tags are significant in XRI resolution. See section 2.2.6 of [XRIResolution].

178 2.5 Special Processing Rules

179 If an XRI contains \$I metadata as a standalone sub-segment, the \$I language tag MUST be
180 interpreted as describing all subsequent sub-segments of that XRI until another \$I cross-
181 reference is encountered.

```
182     xri://@France*($I/fr)*pays*place  
183         \-----/ applies to sub-segments "*pays" and "*place"  
184     xri://@($I/fr)*Français*pays*place  
185         \-----/ applies to all following sub-segments
```

186 However, if an XRI contains \$I metadata within another cross-reference, the \$I language tag
187 MUST be interpreted as only applying within that cross-reference.

```
188     xri://@France*((($I/fr)/pays)*place  
189         \-----/ $I/fr applies only to "/pays"  
190     xri://@((($I/fr)*Français)*pays*place  
191         \-----/ $I/fr applies only to "Français"
```

192 3 Date/Time Metadata (\$d)

193 3.1 Purpose

194 The purpose of the \$d namespace is to provide a standard means of representing the date and
195 time that an XRI, or a sub-segment of an XRI, was assigned to a resource.

196 3.2 Namespace Restrictions

197 In the absence of an extension (see section 7), the identifier in the local path immediately
198 following the XRI authority "\$d" (i.e., "\$d/...") MUST be a date/time value conforming to the
199 specifications in Section 3.2.7 of [XMLSchema2] for the simple XML datatype identified as
200 <http://www.w3.org/TR/xmlschema-2/#dateTime>. In addition, to promote interoperability, this
201 date/time value SHOULD use the canonical UTC "Z" time zone and SHOULD NOT use fractional
202 seconds.

203 For convenience, the relevant text of section 3.2.7 of [XMLSchema2] is reproduced below.

204 The *lexical space* of **dateTime** consists of finite-length sequences of characters of the form:
205 `'-'? yyyy '-' mm '-' dd 'T' hh ':' mm ':' ss ('.' s+)?`
206 `(zzzzzz)?`, where

- 207 • `'-'? yyyy` is a four-or-more digit optionally negative-signed numeral that represents the year; if
208 more than four digits, leading zeros are prohibited, and '0000' is prohibited (see the Note
209 above (§3.2.7); also note that a plus sign is **not** permitted);
- 210 • the remaining `'-'`s are separators between parts of the date portion;
- 211 • the first `mm` is a two-digit numeral that represents the month;
- 212 • `dd` is a two-digit numeral that represents the day;
- 213 • `'T'` is a separator indicating that time-of-day follows;
- 214 • `hh` is a two-digit numeral that represents the hour; '24' is permitted if the minutes and
215 seconds represented are zero, and the **dateTime** value so represented is the first instant of
216 the following day (the hour property of a **dateTime** object in the *value space* cannot have a
217 value greater than 23);
- 218 • `':'` is a separator between parts of the time-of-day portion;
- 219 • the second `mm` is a two-digit numeral that represents the minute;
- 220 • `ss` is a two-integer-digit numeral that represents the whole seconds;
- 221 • `'.' s+` (if present) represents the fractional seconds;
- 222 • `zzzzzz` (if present) represents the timezone (as described below).

224 For example, 2002-10-10T12:00:00-05:00 (noon on 10 October 2002, Central Daylight Savings
225 Time as well as Eastern Standard Time in the U.S.) is 2002-10-10T17:00:00Z, five hours later
226 than 2002-10-10T12:00:00Z.

227 The definition of a timezone is as follows:

228 Timezones are durations with (integer-valued) hour and minute properties (with the hour
229 magnitude limited to at most 14, and the minute magnitude limited to at most 59, except that if the
230 hour magnitude is 14, the minute value must be 0); they may be both positive or both negative.

231 The lexical representation of a timezone is a string of the form: (('+' | '-') hh ':' mm) | 'Z', where
 232 • hh is a two-digit numeral (with leading zeros as required) that represents the hours,
 233 • mm is a two-digit numeral that represents the minutes,
 234 • '+' indicates a nonnegative duration,
 235 • '-' indicates a nonpositive duration.
 236 The mapping so defined is one-to-one, except that '+00:00', '-00:00', and 'Z' all represent the
 237 same zero-length duration timezone, UTC; 'Z' is its canonical representation.
 238 When a timezone is added to a UTC dateTime, the result is the date and time "in that timezone".
 239 For example, 2002-10-10T12:00:00+05:00 is 2002-10-10T07:00:00Z and 2002-10-
 240 10T00:00:00+05:00 is 2002-10-09T19:00:00Z.

241 3.3 Normalization and Comparison

242 The rules for normalization of date/time values are specified in [XMLSchema2]. Specifically, the
 243 rules for the canonical representation of a date/time value are reproduced below.

244 Except for trailing fractional zero digits in the seconds representation, '24:00:00' time
 245 representations, and timezone (for timezoned values), the mapping from literals to values is one-
 246 to-one. Where there is more than one possible representation, the canonical representation is as
 247 follows:

- 248 • The 2-digit numeral representing the hour must not be '24';
- 249 • The fractional second string, if present, must not end in '0';
- 250 • For timezoned values, the timezone must be represented with 'Z' (All timezoned dateTime
 251 values are UTC.).

252 When comparing two date/time values, the general equivalence rules in section 6 of this XRI
 253 Metadata specification apply. In addition, the equivalence rules specified in Section 3.2.7 of
 254 [XMLSchema2] SHOULD be applied when comparing date/time values.

255 3.4 Significance in Resolution

256 \$d date/time tags are significant in XRI resolution. See section 2.2.6 of [XRIResolution].

257 3.5 Special Processing Rules

258 If two or more XRIs are equivalent except for the value of a \$d cross-reference, the rules for
 259 determining an order relation between them are specified in section 3.2.7.4 of [XMLSchema2].
 260 For example, the following XRIs form an ordered set.

```
261 xri://@example/resource*($d/1994-11-05T08:15:30-05:00Z)
262 xri://@example/resource*($d/1995-01-15T23:45:06-05:00Z)
263 xri://@example/resource*($d/2004-09-23T11:52:45-05:00Z)
264 \-----/ dateTime
```

265 The following XRIs do NOT form an ordered set because they are not equivalent outside of the
 266 \$d cross-reference.

```
267 xri://@example/resource*($d/1994-11-05T08:15:30-05:00Z)
268 xri://@example/resource*($d/1995-01-15T23:45:06-05:00Z)*subresource
269 xri://@example/resource*($d/2004-09-23T11:52:45-05:00Z)/subresource
270 \-----/ dateTime
```

271 4 Version Metadata (\$v)

272 4.1 Purpose

273 The purpose of the \$v namespace is to provide a standard means of representing the version of
274 an XRI, or of a sub-segment of an XRI.

275 4.2 Namespace Restrictions

276 In the absence of an extension (see section 7), the identifier in the local path immediately
277 following the XRI authority "\$v" (i.e., "\$v/...") MUST be a version value conforming to the following
278 ABNF.

```
279     Version      = num-segment *( ( "." / "-" ) num-segment )  
280     num-segment  = 1*DIGIT
```

281 This is a very simple versioning scheme consisting of only numeric segments that nonetheless
282 permits any level of granularity and easy version comparison. To use date/time values as version
283 values, see section 7.1 for a specific extension of the \$v namespace.

284 4.3 Normalization and Comparison

285 Due to the simplicity of the default \$v scheme, there are no special normalization rules.

286 For comparison, the general equivalence rules in section 6 apply. In addition, if two XRIs are
287 equivalent except for the value of corresponding \$v cross-references *that use the same \$v*
288 *namespace* (meaning either the default \$v namespace or the same extension to the \$v
289 namespace), then the XRIs SHOULD NOT be considered equivalent; however applications MAY
290 infer that these XRIs refer to the same resource in different states.

291 If two XRIs are equivalent except for the value of corresponding \$v cross-references but *use*
292 *different \$v namespaces for that cross-reference* (i.e., one uses the default \$v namespace and
293 one uses an extension, or each uses a different extension), applications MAY infer that these
294 XRIs refer to the same resource but MUST NOT infer that these XRIs represent different states,
295 since they may actually be referring to the same state in two different ways.

296 For example, an application cannot make a direct state comparison between an XRI that uses the
297 default \$v namespace to specify a numeric version of a resource and an otherwise-identical XRI
298 that uses the \$v/(\$d) extension (defined in section 7.1) to specify a date/time version of the
299 resource. Equivalence or ordering of XRIs that use different \$v namespaces to describe versions
300 can only be defined in the context of a specific mapping algorithm, domain, or application.

301 4.4 Significance in Resolution

302 \$v version tags are significant in XRI resolution. See section 2.2.6 of [XRIResolution].

303 4.5 Special Processing Rules

304 If two XRIs are equivalent except for the value of a \$v cross-reference using the default numeric
305 scheme, an order relation between these XRIs can be determined by comparing the value of
306 each numeric segment beginning with the most significant (leftmost) and proceeding to the least
307 significant (rightmost). The XRI containing the greater value in the first non-equivalent version
308 segment is the later version. If one XRI contains more version segments than the other, and the

309 segments that exist in both XRIs (comparing left to right) are equivalent, the XRI with more
310 version segments is the later version.

311 For example, the following XRIs form an ordered set.

```
312 xri://example/resource*($v/3.04.2)
313 xri://example/resource*($v/3.04.3)
314 xri://example/resource*($v/3.05)
315 xri://example/resource*($v/3.05.1)
316 xri://example/resource*($v/3.05.1.7)
317 xri://example/resource*($v/4)
318 \-----/ version
```

319 The following XRIs do NOT form an ordered set because they are not equivalent outside of the \$v
320 cross-reference.

```
321 xri://example/resource*($v/3.04.2)
322 xri://example/resource*($v/3.04.2)*subresource
323 xri://example/resource*($v/3.04.2)/subresource
324 \-----/ version
```

325

5 Annotation Metadata (\$-)

326

5.1 Purpose

327

The purpose of the \$- namespace is to provide a standard means for XRI producers to provide human-readable annotations in an XRI, or an XRI sub-segment, without affecting resolution or comparison. It is essentially the XRI equivalent of a comment or remark, a concept found in most programming and markup languages.

328

329

330

331

5.2 Namespace Restrictions

332

Because the \$- namespace is reserved for human-readable annotations, there are no restrictions on this namespace other than that it must conform to valid XRI cross-reference syntax as defined in section 2.2.2 of [XRISyntax].

333

334

335

5.3 Normalization and Comparison

336

Because they are intended for human-readable annotations, there are no normalization rules specified for \$- cross-references.

337

338

For the purposes of comparison, cross-references that begin with \$- are NOT significant and SHOULD be ignored. That is, if two XRIs are equivalent except for the presence of a \$- cross-reference, the XRIs SHOULD be considered equivalent.

339

340

341

Note that this rule must be applied recursively to cross-references contained inside other cross-references.

342

343

5.4 Significance in Resolution

344

\$- annotation tags are not significant in XRI resolution. See section 2.2.6 of [XRIResolution].

345

5.5 Special Processing Rules

346

An XRI-aware application MAY make special use of an \$- annotation when displaying an XRI to a human user. The application MAY attempt to decode a percent-encoded XRI as appropriate for the interface, particularly whitespace characters such as <space> (%20), in order to faithfully reproduce the intended presentation.

347

348

349

350

```
xri:///!!1000*($-Example%20Corp.)!5678*($-West%20Coast)/resource
```

351

```
\-----/ \-----/
```

352

```
display form: "Example Corp." "West Coast"
```

353

However, to help prevent semantic attacks (see section 8), an XRI-aware application SHOULD inform the user that this is only an annotation and SHOULD NOT lead the user to infer anything about the described XRI or XRI sub-segment that cannot be independently confirmed by the application.

354

355

356

357 6 Normalization and Comparison

358 If two XRI metadata describing one or more sub-segments, the general rules for
359 determining XRI equivalence in section 2.5 of **[XRISyntax]** apply. In other words, two XRI
360 containing \$ metadata of any type are equivalent if they are character-for-character equivalent
361 after normalization.

362 If two XRI metadata are equivalent *except* for one or more cross-references containing XRI metadata
363 defined as significant for comparison, and that XRI metadata is of the same type in both XRI, the
364 Normalization and Comparison rules for that type of XRI metadata apply. Note that \$- annotation
365 metadata is explicitly defined as not significant for comparison (see section 5.3).

366 If two XRI metadata are equivalent except for one or more cross-references containing XRI metadata
367 defined as significant for comparison, and that XRI metadata is of different types in both XRI, or if
368 one XRI includes XRI metadata where the other does not, the rules for comparison are
369 application-specific.

370 For example, if one XRI includes \$I metadata to describe one or more sub-segments and another
371 XRI does not include \$I metadata to describe the same segments, it is up to the processing
372 application to determine equivalence.

```
373 xri://@example*($l/en)*standards  
374 \-----/ language tag  
375 xri://@example*standards  
376 same XRI with no language tag - only application-  
377 specific logic can determine equivalence
```

378

7 Extending XRI Metadata

379 The \$ namespaces defined in this specification may be extended using the standard XRI
380 extensibility mechanism, i.e., cross-references. This approach permits any authority, of any type,
381 to extend any XRI namespace.

382 The general format of such an extension is:

383 `$namespace/(xref/value)`

384 Note that the local path portion of the extension ("/value") is optional—an extension may consist
385 of only the cross-reference itself.

386 An extension MUST be globally qualified, i.e., it must be an XRI, IRI, or URI in absolute (not
387 relative) form. For example, if an organization with the absolute XRI "@example" desired to
388 extend the \$v namespace to define a new alphabetical versioning scheme, an XRI using this
389 extension might look like:

```
390 xri://example/resource*($v/(@example/C.AB.F))  
391 \-----/ extension
```

392 "@example" could further extend its extension, e.g. to create an alphanumeric versioning
393 scheme, by appending additional sub-segments to its extension XRI as follows:

```
394 xri://example/resource*($v/(@example*alphanum/10A.2E))  
395 \-----/ extension
```

7.1 Extending the \$v Namespace with \$d

397 One example of a globally-defined extension is extending the \$v namespace (section 4) with the
398 \$d namespace (section 3). Since date/time stamps are the default versioning values used in
399 many repositories, including most file systems, this is a natural way to avoid redefining date/time
400 syntax in the \$v namespace.

401 To use a date/time value as a version, the \$v namespace is extended using the \$d namespace
402 as follows:

403 `$v/($d/value)`

404 Example:

```
405 xri://example/resource*($v/($d/1994-11-05T08:15:30-05:00Z))  
406 \-----/  
407 $d extension of $v
```

408

8 Security and Data Protection

409

First, all security and data protection considerations in [XRISyntax] and [XRIResolution] apply to XRI metadata.

410

411

Second, as a general rule, the addition of \$ metadata defined in this specification to an XRI should not introduce new security and data protection considerations with the exception of semantic attacks.

412

413

414

8.1 Semantic Attacks

415

As discussed in section 3.5 of [XRISyntax], XRI metadata can be subject to the same types of semantic attacks as URIs and IRIs. There are many variations of these attacks (e.g. malicious construction, usage of homographic characters, use of name variants), all of which are designed to trick an end user into believing a identifier represents one resource when in fact it resolves to another.

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Because \$ metadata adds another dimension to the expressiveness of XRI metadata, it can potentially be used as an additional element in semantic attacks. For example, if an application disregarded the normative instructions in section 5 and displayed \$- annotation metadata to a user as if it were authoritative for an XRI (especially a persistent XRI that was otherwise not human-readable), this could be used to deceive the user into believing the XRI represented a different resource than it actually does.

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For this reason, an application responsible for interpreting and displaying XRI metadata or XRI sub-segments to a user SHOULD NOT lead the user to infer anything about the described XRI or XRI sub-segment that cannot be independently confirmed by the application. In addition, the application SHOULD warn the user if the XRI contains \$ metadata that the application does not understand or expect.

426

427

428

429

430 9 References

431 9.1 Normative

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453

Appendix A. Collected XRI Metadata

Namespace	Description	Significant for Resolution and Comparison?
\$l	Language metadata (language tags) per [RFC3066]	Yes
\$d	Date/time metadata per [XMLSchema2]	Yes
\$v	Version metadata using simple numeric hierarchy or a cross-reference to the \$d namespace	Yes
\$-	Annotation metadata (similar to XML comments)	No

454

Table 1: XRI Metadata Namespaces Summary

455

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