



Extensible Resource Identifier (XRI) Resolution V2.0

Committee Draft 01, 14 March 2005

Document identifier:

xri-resolution-V2.0-cd-01

Location:

<http://docs.oasis-open.org/xri/xri/V2.0>

Editors:

Gabe Wachob, Visa International <gwachob@visa.com>

Contributors:

Drummond Reed, Cordance <drummond.reed@cordance.net>

Dave McAlpin, Epok <dave.mcalpin@epok.net>

Chetan Sabnis, Epok <chetan.sabnis@epok.net>

Peter Davis, Neustar <peter.davis@neustar.biz>

Mike Lindelsee, Visa International <mlindels@visa.com>

Abstract:

This document defines both a standard and a trusted HTTP-based resolution mechanism for Extensible Resource Identifiers (XRIs), specifically XRIs conforming to *Extensible Resource Identifier (XRI) Syntax V2.0 [XRISyntax]* or higher. For a non-normative introduction to the uses and features of XRIs, see the *Introduction to XRIs [XRIIntro]*. For the set of XRIs defined to provide metadata about other XRIs, see the *Extensible Resource Identifier (XRI) Metadata V2.0 [XRIMetadata]*.

Status:

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.

Technical Committee members should send comments on this specification to the Technical Committee's email list. Others should send comments to the Technical Committee by using the "Send A Comment" button on the Technical Committee's web page at <http://www.oasis-open.org/committees/xri>.

For information on whether any patents have been disclosed that may be essential to implementing this specification, and any offers of patent licensing terms, please refer to the Intellectual Property Rights section of the Technical Committee web page (<http://www.oasis-open.org/committees/xri/ipr.php>).

The non-normative errata page for this specification is located at <http://www.oasis-open.org/committees/xri>.

39 Table of Contents

40	1	Introduction	4
41	1.1	XRI Resolution Framework	4
42	1.2	General Format and Reader's Guide	4
43	1.3	Terminology and Notation	4
44	2	Generic Resolution	6
45	2.1	Introduction.....	6
46	2.1.1	Assumptions	6
47	2.1.2	Phases of Resolution	6
48	2.1.3	XRI vs. IRI Authorities.....	7
49	2.1.4	XRI Metadata Reserved for XRI Resolution	7
50	2.2	XRI Authority Resolution	8
51	2.2.1	Overview	8
52	2.2.2	XRI Descriptors.....	10
53	2.2.3	Starting the Chain of XRI Descriptors with the Root XRID	12
54	2.2.4	Default HTTP(S)-based Authority Resolution Service.....	13
55	2.2.5	Examples (Non-Normative)	18
56	2.2.6	Resolving Cross-References in XRI Authorities	22
57	2.2.7	XRI Redirects.....	23
58	2.3	IRI Authority Resolution	24
59	2.4	Local Access	25
60	2.4.1	Local Access Service Types.....	25
61	2.4.2	The X2R Local Access Service	26
62	2.5	HTTP Headers	27
63	2.5.1	Caching.....	27
64	2.5.2	Location	27
65	2.5.3	Content-Type	27
66	2.6	Other HTTP Features.....	27
67	2.7	Caching and Efficiency.....	27
68	3	Trusted Resolution.....	29
69	3.1	Introduction.....	29
70	3.2	Overview and Example (Non-Normative)	29
71	3.3	Trusted Resolution Protocol.....	36
72	3.3.1	XML Elements and Attributes	36
73	3.3.2	Use and Correlation of AuthorityID Elements.....	37
74	3.3.3	Client Behavior.....	38
75	3.3.4	Server Behavior	39
76	3.3.5	Additional Requirements of Authorities Offering Trusted Resolution	40
77	4	Extensibility and Versioning.....	41
78	4.1	Extensibility	41
79	4.1.1	Specific Points of Extensibility	41
80	4.2	Versioning	42
81	4.2.1	Versioning of the XRI Resolution Specification	42

82	4.2.2 Versioning of XRI Descriptor Elements	42
83	4.2.3 Versioning of Protocols	43
84	5 Security and Data Protection	44
85	5.1 DNS Spoofing.....	44
86	5.2 HTTP Security	44
87	5.3 Caching Authorities	44
88	5.4 Lookahead and Proxy Resolution	44
89	5.5 SAML Considerations	44
90	5.6 Community Root Authorities	45
91	5.7 Denial-Of-Service Attacks	45
92	5.8 Limitations of Trusted Resolution.....	45
93	6 References.....	46
94	6.1 Normative	46
95	6.2 Informative.....	46
96	Appendix A. XML Schema for XRI Descriptor (Normative)	47
97	Appendix B. RelaxNG Compact Syntax Schema for XRI Descriptor (Non-normative).....	50
98	Appendix C. Acknowledgments	53
99	Appendix D. Notices	54
100		

1 Introduction

1.1 XRI Resolution Framework

Extensible Resource Identifiers (XRIs) provide a uniform syntax for abstract identifiers as defined in **[XRISyntax]**. Because XRIs may be used across a wide variety of communities and applications (as database keys, filenames, directory keys, object IDs, XML IDs etc.), no single resolution mechanism may prove appropriate for all XRIs. However, in the interest of promoting interoperability, this specification defines a standard framework for XRI resolution consisting of two parts:

- *Generic resolution* (section 2) is a simple, flexible resolution protocol for the authority segment of an XRI that relies exclusively on HTTP/HTTPS as a transport.
- *Trusted resolution* (section 3) is an extension of the generic resolution protocol that uses SAML assertions to create a chain of trust between the participating authorities.

Both of these protocols are extensible, as described in section 4. In addition, other XRI resolution services or protocols may be defined by future versions of this specification or by other specifications.

1.2 General Format and Reader's Guide

In order to make the technical material in this specification as clear and understandable as possible, this document includes extensive examples, particularly of resolution requests and responses. The examples themselves are non-normative. In addition, certain sections devoted entirely to examples have been marked as non-normative.

Different readers, therefore, may wish to take different approaches depending on their context:

- Newcomers to XRIs and XRI resolution may wish to read the introductions and overview sections and concentrate on the examples in order to quickly gain an understanding of XRI resolution architecture.
- Technical reviewers may wish to concentrate on the normative text and skip the example sections.
- Implementers may wish to follow the examples and refer to the normative text and appendices as necessary for specific requirements.

1.3 Terminology and Notation

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

Examples look like this.

XML elements and attributes that appear in text look like this.

Throughout this document, the XML namespace prefix `saml:` stands for the Security Assertion Markup Language **[SAML]** namespace “`urn:oasis:names:tc:SAML:2.0:assertion`,” regardless of whether this namespace prefix is explicitly declared in the example or text. Similarly, the XML namespace prefix `ds:` stands for the W3C Digital Signature **[XMLDSig]** Namespace “`http://www.w3.org/2000/09/xmldsig#`”, the namespace prefix `xrid:` stands for the namespace “`xri://$res*schema/XRIDescriptor*($v%2F2.0)`”, and the namespace prefix `xs:` stands for the

142 namespace “http://www.w3.org/2001/XMLSchema”, again, whether or not they are explicitly
143 declared in the example or text. These namespace prefixes are summarized in Table 1.

saml	urn:oasis:names:tc:SAML:2.0:assertion
ds	http://www.w3.org/2000/09/xmldsig#
xrid	xri://\$res*schema/XRIDescriptor*(\$v%2F2.0)
xs	http://www.w3.org/2001/XMLSchema

144 **Table 1: XML namespace prefixes used in this specification.**

145 Terms used in this document are defined in the glossary in Appendix C of **[XRISyntax]**.

146 2 Generic Resolution

147 2.1 Introduction

148 Generic XRI resolution is the process of determining a network endpoint associated with an XRI
149 in order to obtain metadata about the resource identified by the XRI, or to further interact with the
150 resource. This specification defines a generic resolution protocol based on HTTP/HTTPS as a
151 simple, general-purpose mechanism for accomplishing this task. Other XRI resolution services
152 may be defined by future versions of this specification or by other specifications.

153 Identifier management policies are defined on a community-by-community basis. With XRIs, the
154 resolution community is specified by the authority segment of the XRI. When a resolution
155 community chooses to create a new identifier authority, it SHOULD define a policy for assigning
156 and managing identifiers under this authority. Furthermore, it SHOULD define what resolution
157 protocol(s) can be used for resolving identifiers assigned by the authority.

158 2.1.1 Assumptions

159 The generic resolution protocol makes the following minimal assumptions about the XRIs being
160 resolved:

- 161 • The endpoints representing the top-level authority for any absolute XRI are identified
162 by the authority segment (“xri-authority” or “i-authority” productions) of the XRI as
163 defined in section 2.2.1 of [XRISyntax].
- 164 • Only absolute XRIs can be resolved using this protocol. To resolve a relative XRI
165 reference, it must be converted into an absolute XRI using the procedure defined in
166 section 2.4 of [XRISyntax].
- 167 • The XRI being resolved has been converted into URI-normal form, following the rules
168 in section 2.3.1 of [XRISyntax].
- 169 • A resource represented by a single XRI may be accessed by multiple protocols at
170 multiple protocol endpoints. For example, it is possible that a resource represented
171 by a single XRI may be accessed through multiple HTTP URIs, or through both HTTP
172 and another network protocol. While only HTTP access to resources is defined by
173 this specification, an extension mechanism for specifying access via URIs in other
174 schemes is also defined.
- 175 • Each network endpoint associated with a resource identified by an XRI may present
176 a different subset, type, or representation of data or metadata associated with the
177 identified resource. For example, two separate HTTP URIs may be associated with a
178 single XRI, one for data access and the other for metadata access. This specification
179 allows XRI authorities to define multiple access types using extensible descriptor
180 fields based on content type and the semantics of the interaction.

181 2.1.2 Phases of Resolution

182 The generic resolution protocol is designed to be as simple and flexible as possible given the
183 assumptions above. Based on the structure of XRIs, it consists of two phases:

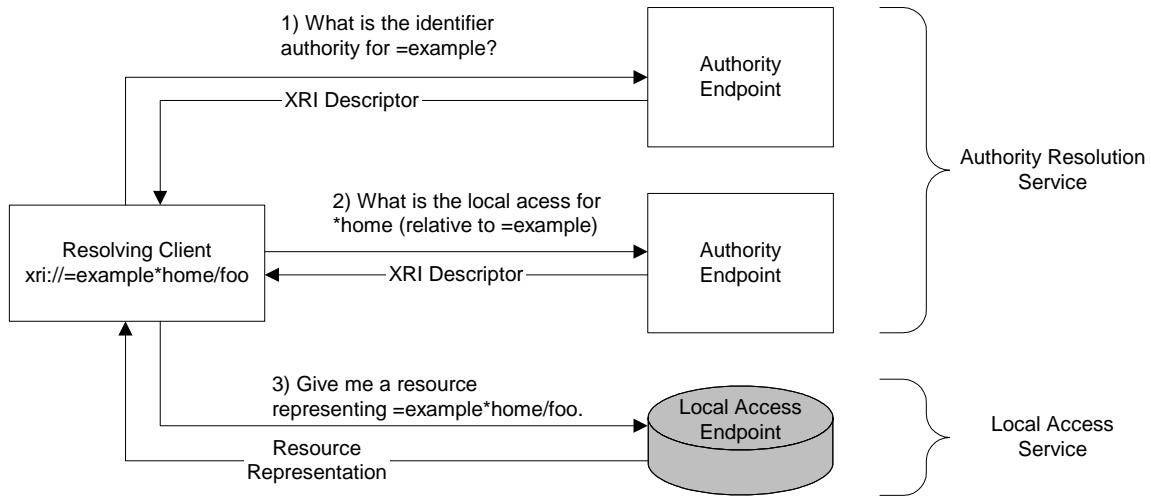
- 184 • Authority resolution
- 185 • Local access

186 Authority resolution is the process of finding the endpoint or endpoints that are authoritative for
187 access to resources under that authority’s control, or of discovering further information about the
188 authority itself. In the case where the desired goal is access to a resource, the result of authority
189 resolution will be a list of local access endpoints, identified by one or more URIs, that support at

190 least one local access protocol. The calling application may then choose one of these endpoints
 191 and access it using its choice of any supported local access protocol.

192 In the case where the goal of resolution is to discover more information about an authority, such
 193 as XRI synonyms, public keys, or other XRI resolution metadata, this information will be returned
 194 by the authority resolution process itself.

195 Figure 1 illustrates the two main phases of XRI resolution – authority resolution and local access:



196
 197

Figure 1: Phases of Resolution

198 2.1.3 XRI vs. IRI Authorities

199 As described in section 2.2.1 of [XRISyntax], XRI authorities and IRI authorities have different
 200 syntactic structures, partially due to the higher level of abstraction represented by XRI authorities.
 201 For this reason, XRI authorities are resolved to authority descriptor documents one sub-segment
 202 at a time, as described in section 2.2. IRI authorities, since they are based on DNS names or IP
 203 addresses, are resolved into an authority descriptor through a special HTTP(S) request based on
 204 the DNS name or IP address identified by the IRI authority segment.

205 2.1.4 XRI Metadata Reserved for XRI Resolution

206 As defined in section 2.2.1.2 of [XRISyntax], the GCS symbol “\$” is reserved for special
 207 identifiers assigned by XRI TC specifications, other OASIS specifications, or other standards
 208 bodies. (See also [XRIMetadata].) Within the “\$” namespace, the identifier “\$res” is reserved for
 209 identifiers assigned by this XRI resolution specification. Table 2 summarizes these identifiers.
 210

Identifier	Use	See Section
xri://\$res*schema	XML namespace for XRI resolution schema	2.2.2
xri://\$res*auth.res	Namespace for authority resolution protocol types	2.2.4
xri://\$res*local.access	Namespace for local access protocol types	2.4.1
xri://\$res*trusted	Namespace for trust mechanisms	2.2.2 and 3

211

Table 2: Special identifiers reserved for XRI resolution.

212 2.2 XRI Authority Resolution

213 2.2.1 Overview

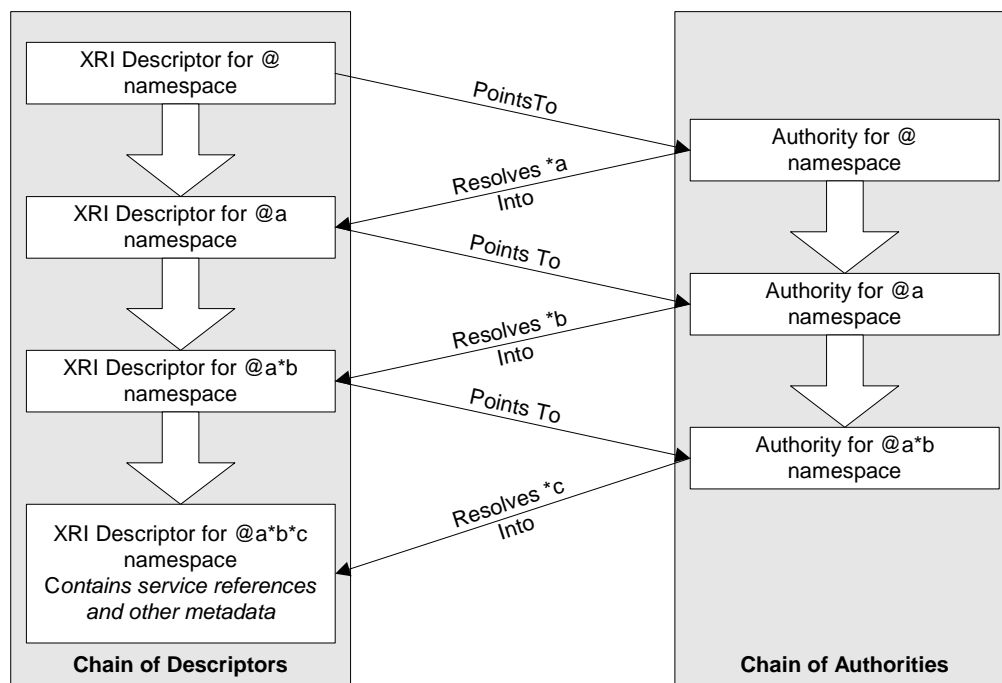
214 XRI authority resolution is an iterative process that resolves the qualified sub-segments within the
215 XRI authority segment from left to right. A qualified sub-segment is a sub-segment as defined by
216 the productions whose names start with “xri-subseg” in section 2.2.3 of [XRISyntax] including the
217 leading syntactic delimiter (“*” or “!”). Note that a qualified sub-segment always includes the
218 leading syntatic delimiter even if it was optionally omitted in the original XRI (see section 2.2.3 of
219 [XRISyntax]).

220 The first (or leftmost) component of the XRI authority segment specifies the root of the identifier
221 community. In XRI syntax this can be either:

- 222 • a global context symbol as defined by section 2.2.1.2 of [XRISyntax], or
- 223 • a cross-reference as defined by section 2.2.2 of [XRISyntax].

224 The qualified sub-segment immediately to the right of the root is resolved in the context of the
225 root, and all subsequent sub-segments are resolved in the the context of the sub-segment
226 immediately to their left.

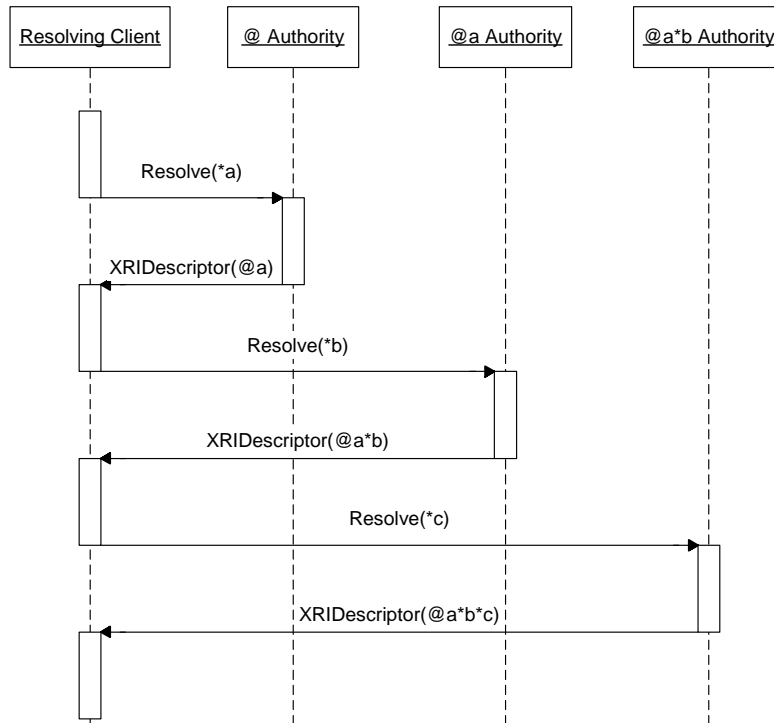
227 Each sub-segment is resolved to a corresponding XRI Descriptor (often abbreviated as “XRID”),
228 an XML document that specifies one or more network endpoints (in the case of authority
229 resolution defined here, HTTP or HTTPS URIs) that answer XRI resolution requests. As
230 resolution proceeds, the XRI resolver is building a “chain” (i.e., an ordered list) of XRID
231 documents. Resolution is complete when the resolver has followed the chain of XRIDs for all sub-
232 segments in the XRI authority segment. Figure 2 and Figure 3 below depict this resolution
233 process for the XRI authority “@a*b*c”:



234

235

Figure 2: XRI Descriptors, XRI Authorities and Authority Sub-segments for @a*b*c



236

237

Figure 3: XRI Authority Resolution Sequence Diagram

238 Any resolution request may ask for resolution of more than one sub-segment—a feature called
 239 *lookahead* resolution. If lookahead resolution is used, each response may contain one or more
 240 XRI Descriptors inside a XML container document. The number of sub-segments resolved in one
 241 resolution request depends on:

- 242 • How many sub-segments the resolving client presents to a responding XRI Authority for
 243 lookahead resolution; and
 244 • The configuration, policy, and state of the responding XRI Authority (e.g. previously
 245 cached requests).

246 Each XRI Descriptor in the chain contains one or more of four basic types of information about
 247 the XRI authority it describes:

- 248 • URIs describing network endpoints for XRI authority resolution services;
 249 • URIs describing network endpoints for local access services;
 250 • XRI synonyms (equivalent XRIs) for the resolved sub-segment.
 251 • Additional information about the XRI authority included using the extension mechanisms
 252 described in section 4.1.

253 All four types of information defined by this document—authority resolution services, local access
 254 endpoints, XRI synonyms, or additional information—may be available at each step of resolution.
 255 For example, the XRI authority identifier “@a*b*c” may be the prefix to another XRI authority with
 256 the XRI “@a*b*c*d”. “@a*b*c” may also be a local access endpoint itself, in which case its XRI
 257 Descriptor will contain references to local access services. “@a*b*c” may also present synonyms
 258 in its XRI Descriptor. One important use of synonyms is to map XRIs into “persistent XRIs”. For
 259 example, “@a*b*c” may have a persistent XRI synonym such as “xri://@!1000!2!3”, which may
 260 also be included in the XRID to indicate it is an equivalent persistent XRI.

261 2.2.2 XRI Descriptors

262 To provide a straightforward, flexible resolution mechanism, XRI authority endpoints are
263 described using a simple, flexible XML document, called an XRI Descriptor (abbreviated “XRID”).
264 While this specification defines only XRID elements necessary to support delegated resolution
265 and access of XRI-identified authorities and resources, an XRID can easily be extended to
266 publish any form of metadata about the described authority.

267 The formal XML Schema definition of an XRI Descriptor is provided in Appendix B. The following
268 example instance document illustrates the fields defined in this schema:

```
269 <XRIDescriptors xmlns="xri://$res*schema/XRIDescriptor*($v%2F2.0)">  
270   <XRIDescriptor xrid:id="first">  
271     <Resolved>*foo</Resolved>  
272     <AuthorityID>urn:uuid:c9f812f3-6544-4e3c-874e-  
273     d3ae79f4ef7b</AuthorityID>  
274     <Expires>2005-05-30T09:30:10Z</Expires>  
275     <Authority>  
276       <AuthorityID>urn:uuid:f0502a17-4503-4463-8516-  
277     f1225b330e4d</AuthorityID>  
278       <Type>xri://$res*auth.res/XRIA</Type>  
279       <URI>http://xri.example.com</URI>  
280       <URI>https://xri.example.com</URI>  
281     </Authority>  
282     <Service>  
283       <Type>xri://$res*local.access/X2R</Type>  
284       <URI>http://xri.example.com</URI>  
285       <MediaType>application/rdf+xml</MediaType>  
286     </Service>  
287     <Service>  
288       <Type>xri://$res*local.access/X2R</Type>  
289       <URI>http://pictures.xri.example.com</URI>  
290       <MediaType>image/jpeg</MediaType>  
291     </Service>  
292     <Synonyms>  
293       <Internal>xri://@!1!2!3</Internal>  
294       <External>xri://@!4!5!6</External>  
295     </Synonyms>  
296     <TrustMechanism>xri://$res*trusted/None</TrustMechanism>  
297   </XRIDescriptor>  
298   Other XRIDescriptor elements here  
299 </XRIDescriptors>
```

300 All schema elements in the basic XML Descriptor are in the XML namespace
301 “xri://\$res*schema/XRIDescriptor*(\$v%2F2.0)”. The following are the elements and attributes that
302 comprise the XRIDescriptor document type (all XPATHs are relative to the enclosing
303 xrid:XRIDescriptors document element):

304 **xrid:XRIDescriptor**

305 1 or more within the xrid:XRIDescriptors container. Has an “xrid:id” attribute to
306 uniquely identify this element within the containing xrid:XRIDescriptors document.

307 **xrid:XRIDescriptor/xrid:Resolved**

308 1 per xrid:XRIDescriptor. Required. Expresses the qualified sub-segment whose
309 resolution results in this xrid:XRIDescriptor element.

310 **xrid:XRIDescriptor/xrid:AuthorityID**

311 1 per xrid:XRIDescriptor. Required. A unique identifier of type xs:anyURI for the
312 authority that produced this XRI Descriptor. The value of this element MUST be such that
313 there is negligible probability that the same value will be assigned as an identifier to any

314 other authority. Note that the authority identified by this element is the *describing*
315 authority (the producer of the current XRID), not the authority *described* by the XRID. The
316 latter is specified in the
317 `xrid:XRIDDescriptor/xrid:Authority/xrid:AuthorityID` element (see below).

318 **xrid:XRIDDescriptor/xrid:Expires**

319 0 or 1. The date/time, in the form of `xs:dateTime`, after which this XRI Descriptor
320 cannot be relied upon. To promote interoperability, this date/time value SHOULD use the
321 UTC "Z" time zone and SHOULD NOT use fractional seconds. A resolver using this XRI
322 Descriptor MUST NOT use the XRI Descriptor after the time stated here. A resolver MAY
323 discard this Descriptor before the time indicated in this result. If the HTTP transport
324 caching semantics specify an expiry time that is earlier than the time expressed in this
325 attribute, then a resolver MUST NOT use this XRI Descriptor after the expiry time
326 declared in the HTTP headers per section 13.2 of [RFC2616].

327 **xrid:XRIDDescriptor/xrid:Authority**

328 0 or more. Describes an authority resolution service associated with the resolved
329 identifier. If there are additional sub-segments in the authority segment of the XRI being
330 resolved, they can be resolved at this service endpoint.

331 **xrid:XRIDDescriptor/xrid:Authority/xrid:AuthorityID**

332 1 per `xrid:Authority` element. Required. The unique identifier of the authority
333 *described* by this `xrid:Authority` element, of type `xs:anyURI`. The value of this
334 element MUST be such that there is negligible probability that the same value will be
335 assigned as an identifier to any other authority. This element is correlated to the
336 `xrid:XRIDDescriptor/xrid:AuthorityID` element described above. When the
337 authority *described* by this `xrid:Authority` element responds to resolution requests, it
338 will include this AuthorityID in the `xrid:XRIDDescriptor/xrid:Authority` element
339 of its response. This element is particularly important in trusted resolution (see section 3).

340 **xrid:XRIDDescriptor/xrid:Authority/xrid:Type**

341 0 or 1 per `xrid:Authority` element. Indicates the type of authority resolution service
342 described by the parent `xrid:Authority` element. This specification defines one authority
343 resolution service: "xri://\$res*auth.res/XRIA" (XRI Authority resolution as described in
344 section 2.2.4). This is the default value if this element is not present.

345 **xrid:XRIDDescriptor/xrid:Authority/xrid:URI**

346 1 or more per `xrid:Authority` element. Indicates the transport-level URI where the
347 authority resolution service described may be accessed. For the services defined in this
348 document, this URI MUST be an HTTP or HTTPS URI. Future versions of this
349 specification (or other specifications) may allow other transport protocols. Each URI
350 element has an optional attribute called "trusted" that indicates whether or not the
351 particular service endpoint provides trusted resolution (section 3). The trust mechanism is
352 described using the `xrid:TrustMechanism` element (below).

353 **xrid:XRIDDescriptor/xrid:Service**

354 0 or more. Describes a local access service endpoint provided by the described authority.

355 **xrid:XRIDDescriptor/xrid:Service/xrid:Type**

356 0 or 1 per `xrid:Service` element. Indicates the type of local service being described.
357 This specification defines one service: "xri://\$res*local.access/X2R" (the X2R local
358 access service as defined in section 2.4.2). This is the default value if this element is not
359 present.

360 **xrid:XRIDDescriptor/xrid:Service/xrid:URI**

361 1 or more per `xrid:Service` element. Indicates the transport-level URI where the
362 service described may be accessed. For the X2R local access service defined in section
363 2.4.2, this URI MUST be an HTTP or HTTPS URI. Other services may use other
364 transport protocols.

365 **xrid:XRIDDescriptor/xrid:Service/xrid:MediaType**

366 0 or more per `xrid:Service` element. The media type of content available at this
367 service. If this element is not present, then a processor of the Descriptor SHOULD NOT
368 make any assumption about the type of data available at this endpoint. The value of this
369 element must be of the form of a media type defined in [RFC2046]. This element may
370 appear multiple times to indicate all the media types available through this local access
371 service.

372 **xrid:XRIDDescriptor/xrid:Synonyms**

373 0 or 1. Contains statements about the equivalence of the resolved identifier to other XRIs.

374 **xrid:XRIDDescriptor/xrid:Synonyms/xrid:Internal**

375 0 or more. Represents another XRI assigned to the described authority by the current
376 describing authority. Must be an absolute XRI ("absolute-xri" in section 2.2 of
377 [XRISyntax]). An internal synonym may be used, for example, to assert that a XRI
378 authority known by a reassignable XRI may also be known by one or more persistent
379 XRIs, or by a different reassignable XRI than the one being resolved. Both cases may be
380 particularly useful in populating or querying a cache, since resolution of an internal
381 synonym will typically result in an XRID containing the same information as the current
382 XRID.

383 **xrid:XRIDDescriptor/xrid:Synonyms/xrid:External**

384 0 or more. Represents another XRI assigned to the described authority by an authority
385 other than the current describing authority. Must be an absolute XRI ("absolute-xri" in
386 section 2.2 of [XRISyntax]). Resolution of an external synonym will typically result in an
387 XRID containing information different from that available in the current XRID. External
388 synonyms are used, for example, in XRI redirects, described in Section 2.2.7. They can
389 also be used to identify alternative sources of local access descriptors if those in the
390 current XRID do not satisfy the needs of the client.

391 **xrid:XRIDDescriptor/xrid:TrustMechanism**

392 0 or 1. Identifies the mechanism for trusted resolution associated with this XRID. This
393 specification defines two values: "xri://\$res*trusted/XRITrusted" (for Trusted Resolution
394 as described in section 3) and "xri://\$res*trusted/None" (for generic resolution as
395 described here in section 2). If this element does not appear, the default value is
396 "xri://\$res*trusted/None".

397 XRI Descriptor documents have an "open schema" that allows other elements and attributes from
398 other namespaces to be added throughout. These points of extensibility can be used to deploy
399 new identifier authority resolution schemes, new local access resolution schemes, additional XRI
400 synonym metadata, or other metadata about the described authority. See section 4.1 for more
401 about XRID extensibility.

402 See section 3.3.1 for information about additional XRI Descriptor elements defined for trusted
403 resolution.

404 **2.2.3 Starting the Chain of XRI Descriptors with the Root XRID**

405 With an XRI authority, the first sub-segment corresponding to the community root may be either a
406 global context symbol (GCS) character or top-level cross-reference as specified in section 2.2.1.1
407 of [XRISyntax]. In either case, the corresponding root XRID (or its equivalent) specifies the top-
408 level authority resolution endpoints for that community. The root XRID, or its location, is known a
409 *priori* and is part of the configuration of a resolver, similar to the specification of root DNS servers

410 in a DNS resolver. (Note that is not strictly necessary to publish this information in an XRID—it
 411 may be supplied in any format that enables configuration of the XRI resolvers in the community—
 412 but providing an XRID at a known location simplifies the process.)

413 If the first sub-segment of an XRI authority is a GCS character and the following sub-segment
 414 does not begin with a "*" (indicating a reassignable sub-segment) or a "!" (indicating a persistent
 415 sub-segment), then a "*" is implied and must be added when constructing the qualified sub-
 416 segment. Table 3 and Table 4 illustrate the differences between parsing a reassignable sub-
 417 segment following a GCS character and parsing a cross-reference, respectively.

XRI	xri://@example*internal/foo
XRI Authority	@example*internal
Community Root Authority	@
First Qualified Sub-Segment Resolved	*example

418 **Table 3: Parsing the first sub-segment of an XRI that begins with a global context symbol.**

XRI	xri://(http://www.example.com)*internal/foo
XRI Authority	(http://www.example.com)*internal
Community Root Authority	(http://www.example.com)
First Qualified Sub-Segment Resolved	*internal

419 **Table 4: Parsing the first sub-segment of an XRI that begins with a cross-reference.**

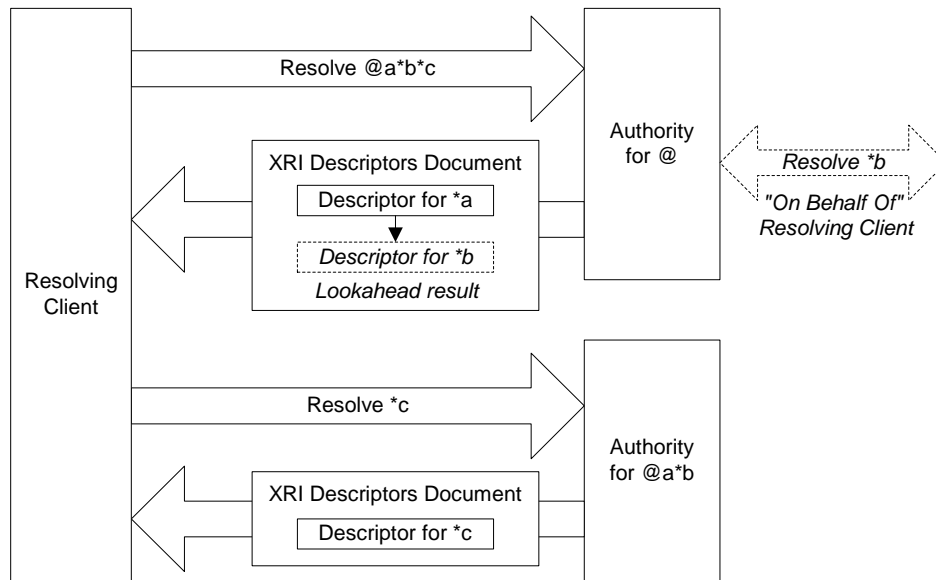
420 **2.2.4 Default HTTP(S)-based Authority Resolution Service**

421 This section defines the default authority resolution service for generic XRI resolution. When
 422 explicitly declared, it uses the `xrid:XRIDDescriptor/xrid:Authority/xrid:Type` element
 423 value "xri://\$res*auth.res/XRIA".

424 The generic (and trusted) XRI authority resolution service allows a client to request resolution of
 425 multiple authority sub-segments in one transaction (lookahead resolution). If a client makes such
 426 a request, the responding authority MAY perform the additional lookahead resolution steps
 427 requested. In this case the responding authority acts as a client to the other authorities that need
 428 to be queried for the lookahead segments. Alternatively, it may retrieve Descriptors only from its
 429 local cache until it reaches a sub-segment whose XRID is not locally cached, or it may simply
 430 lookahead only as far as it is authoritative. Any of these behaviors are reasonable, as are others
 431 not described here.

432 If an authority performs any lookahead resolution, it MUST return an ordered list of
 433 `xrid:XRIDDescriptor` elements in an `xrid:XRIDDescriptors` document. Each XRI
 434 Descriptor MUST correspond to a sub-segment resolved by the authority on behalf of the
 435 resolving client. The list of `xrid:XRIDDescriptor` elements in the `xrid:XRIDDescriptors`
 436 document MUST appear in the same order as the sub-segments in the original request. The
 437 responding authority MAY resolve fewer sub-segments than requested by the client. The
 438 responding authority is under no obligation to resolve more than the first sub-segment (for which
 439 it is, by definition, authoritative).

440



441
442 **Figure 4: Lookahead Resolution**

443 Figure 4 illustrates a resolving client requesting lookahead resolution for the XRI authority
 444 “@a*b*c”. The “@” authority is willing to resolve “@a*b” on behalf of the resolving client. The “@”
 445 authority can accomplish this either by acting as a resolving client itself, or by examining a cache
 446 it may have built through previous resolutions. In this example, the “@” authority it is only willing
 447 or able to resolve the descriptor for “*a” (for which it is authoritative) plus “@a*b”. Therefore the
 448 resolving client must resolve “*c” itself. The resolving client will know the “@” authority only
 449 resolved two segments (*a and *b) because it only returned two XRI Descriptors corresponding to
 450 those two sub-segments.

451 If the responding authority does not resolve the entire set of sub-segments presented, the
 452 resolving client MUST continue the authority resolution process itself. At any stage, however, the
 453 resolving client MAY request that the next authority resolve any additional unresolved sub-
 454 segments. For example, in Figure 4, if the “@” authority had refused to do any lookahead, the
 455 resolving client could have asked the “@a” authority to resolve the unresolved “*b*c” portion of
 456 the XRI authority segment.

457 **2.2.4.1 Determining the URI for the Next Resolution Step**

458 Before each authority resolution step is performed, a URI must be constructed for the next
 459 HTTP(S) request. This URI establishes the context of that authority. Initially the current context is
 460 the root authority, and the current context shifts to a new authority each time a resolution step is
 461 performed. After a lookahead resolution request, the current context is the last authority whose
 462 sub-segment was resolved by the authority performing the lookahead request.

463 This “Next Authority URI” is constructed from two strings:

- 464
- 465 • The contents of the `xrid:XRIDescriptor/xrid:Authority/xrid:URI` element extracted from the XRI Descriptor corresponding to the current context, and
 - 466 • The next qualified sub-segment to be resolved. (Note that this sub-segment must begin with an XRI syntax delimiter, i.e., “*” or “!” —see section 2.2.6.)
- 467

468 If the path portion of the first URI does not end with a forward slash (“/”), one must be appended
 469 before proceeding. Then the URI-normal form (section 2.3.1 of [XRISyntax]) of the next qualified
 470 sub-segment being resolved is appended to the path portion of this URI. For example, when
 471 resolving the “c” sub-segment of “xri://@a*b*c*d”, if the XRI Authority URI resulting from the
 472 resolution of “xri://@a*b” is “http://example.com/xri-authority/”, then the Next Authority URI is the
 473 concatenation of “http://example.com/xri-authority/” with “*c”, yielding “http://example.com/xri-

474 authority/*c”. An HTTP GET request is made to this URI, and the XRID for the context
475 “xri://@a*b*c” is retrieved.

476 For lookahead resolution (Figure 4), any portion of the remaining XRI authority segment may be
477 appended, not just the first sub-segment. For example, if the resolving client wanted to resolve
478 “*c*d”, it would append this entire string to “http://example.com/xri-authority/”, yielding
479 “http://example.com/xri-authority/*c*d”.

480 Construction of the Next Authority URI is more formally described in this pseudo-code for
481 resolving a “sub-segment-list” via an HTTP URI called “xa-uri”:

```
482 xa-uri = xri-authority-uri
483
484 if (path portion of xa-uri doesn't end in "/"):
485     append "/" to path portion of xa-uri
486
487 if (sub-segment-list isn't preceded with "*" or "!" separator):
488     prepend "*" to sub-segment-list
489
490 append uri-escape(sub-segment-list) to path portion of xa-uri
```

491 **2.2.4.2 Making HTTP(S) Resolution Requests**

492 Once the Next Authority URI is constructed, an HTTP or HTTPS GET request is made using this
493 URI. Each GET request results in either a 2XX or 304 HTTP response. The HTTP request
494 SHOULD contain an Accept header with the value of “application/xrid+xml”. See section
495 3.3.3 for a different value that may appear in the Accept header during trusted resolution.

496 The ultimate HTTP/HTTPS response for a successful resolution MUST contain either: a) a 2XX
497 response with an XRI Descriptors document containing a list of one or more
498 `xrid:XRIDescriptor` elements, or b) a 304 response signifying that the cached version on the
499 client is still valid (depending on the client’s HTTP request). HTTP caching semantics should be
500 leveraged to the greatest extent possible to maintain the efficiency and scalability of the HTTP-
501 based resolution system. The recommended use of HTTP caching headers is described in more
502 detail in section 2.5.1.

503 Any ultimate response besides an HTTP 2XX or 304 SHOULD be considered an error in the
504 resolution process. There is no restriction on intermediate redirects (i.e., 3XX result codes) or
505 other result codes (e.g., a 100 HTTP response) that eventually result in a 2XX or 304 response
506 through normal operation of **[RFC2616]**. Ultimately, the content of a successful response will be
507 an XRI Descriptors document containing one or more `xrid:XRIDescriptor` elements for the
508 qualified sub-segment(s) being resolved.

509 If there are no more sub-segments, the final context (as described by the final XRID retrieved)
510 can be used for local access services as described in section 2.4, or to obtain synonyms or other
511 metadata about the final authority.

512 **2.2.4.3 Proxied Resolution**

513 In some cases it may be desirable for a server to do fully proxied XRI resolution on behalf of a
514 client. While this is very similar to lookahead resolution, a lookahead resolution request is always
515 sent to the first sub-segment’s authority. A proxied resolution request, in contrast, may be sent to
516 any XRI proxy server that will accept the request.

517 The proxy resolution service is very simple: an HTTP GET is performed on a URI constructed by
518 concatenating the base URI for the proxy resolution service and the XRI authority segment for
519 which proxy resolution is being requested. As with standard resolution, this XRI authority segment
520 MUST be in URI-normal form. Additionally, if the base proxy URI does not contain a trailing
521 forward slash (“/”), one MUST be inserted between the base URI and the XRI authority segment.
522 The proxy answering this request MUST perform XRI authority resolution as specified in this
523 document and MUST return either an XRI Descriptors document containing a entire chain of

524 `xrid:XRIDescriptor` elements for the segments of the authority it resolves, or an HTTP error
525 code as described in section 2.2.4.4.

526 Note that because a proxy is not associated with any specific authority, proxied resolution
527 requests MUST be composed of authority segments starting with a GCS character or a cross-
528 reference identifying a community root authority. In addition, a proxy resolver MUST return an
529 XRI Descriptor chain that begins with an XRID describing the community root authority. If the
530 community root authority does not publish an XRID itself, a proxy MUST construct one from the
531 equivalent information published by the community root authority.

532 The following example illustrates a proxied resolution request for “`xri://=example*home*base`”. It
533 assumes that the URI for a local proxy server is “`http://proxy.example.com/xri-proxy`”. First the
534 following HTTP GET request is made to “`proxy.example.com`”:

```
535 GET /xri-proxy/=example*home*base HTTP/1.1  
536 <other HTTP headers>
```

537 The proxy resolver then performs authority resolution, behaving as a resolving client as described
538 in section 1. After completing this resolution process, the proxy resolver might produce the
539 following HTTP response:


```

540 200 OK HTTP/1.1
541 Content-Type: application/xrid+xml
542 Expires: Fri, 7 Nov 2003 19:43:31 GMT
543 <other HTTP headers>
544
545 <XRIDescriptors xmlns="...">
546 <XRIDescriptor>
547   <Resolved>=</Resolved>
548   ...
549 </XRIDescriptor>
550 <XRIDescriptor>
551   <Resolved>*example</Resolved>
552   ...
553 </XRIDescriptor>
554 <XRIDescriptor>
555   <Resolved>*home</Resolved>
556   ...
557 </XRIDescriptor>
558 <XRIDescriptor>
559   <Resolved>*base</Resolved>
560   <AuthorityID>
561     urn:uuid:C9FBEE76-9438-11D9-8BDE-F66BAD1E3F3A
562   </AuthorityID>
563   <Service>
564     <Type>
565       xri://$res*local.access/X2R
566     </Type>
567     <URI>
568       http://xri.other.example.com/xri-local/base/
569     </URI>
570     <URI>
571       https://xri.other.example.com/xri-local/base/
572     </URI>
573   </Service>
574   ...
575 </XRIDescriptor>
576
577 </XRIDescriptors>

```

578 The resolving client can then parse this XRI Descriptor and extract the Local Access element
579 from the last XRI Descriptor element.

580 Note that proxy resolvers are uniquely positioned to take advantage of caching and SHOULD use
581 it to resolve the same authority sub-segments for multiple clients.

582 A proxy resolution service does not provide a complete XRI-to-resource mapping service. The
583 client must still parse the returned XRID and invoke an appropriate local access service, if
584 desired. For the default X2R local access protocol, a complete mapping service could be defined
585 by sending the proxy server the complete XRI in XRI-normal form and having it return an HTTP
586 redirect to the local access URI. Alternatively, the proxy server could return the resource directly
587 by performing the local access request itself. Neither method, however, is prescribed or defined
588 by this document.

589 **2.2.4.4 Errors During Proxied and Lookahead Authority Resolution**

590 Proxies and lookahead resolvers MUST “pass through” to the resolving client any HTTP error
591 codes resulting from resolution if the proxy or lookahead resolver cannot proceed with resolution
592 due to an HTTP error condition. For example, if, during resolution on behalf of a client, a proxy is
593 returned a 404 error code by an authoritative server, it must return that 404 code to its client.

594 Upon encountering an HTTP error code that halts the proxy or lookahead resolver’s ability to
595 complete resolution, the proxy or lookahead resolver MUST return an `xrid:XRIDescriptors`

596 document in the body of the HTTP error response. This `xrid:XRIDescriptors` document
597 MUST contain the list of XRI Descriptor elements corresponding to the sub-segments
598 successfully resolved or retrieved from cache. For example, if a proxy is asked to resolve
599 `@a*b*c`, and successfully resolves `@a*b`, but receives a HTTP 404 on resolving `*c`, it will return
600 an HTTP 404 response to its client that include `xrid:XRIDescriptor` elements for `@`, `*a`, and
601 `*b`. In this way, the resolver indicates to the resolving client that `*c` is the sub-segment causing the
602 404 response.

603 This use of error codes, while slightly unusual, conforms to the requirements of [RFC2616],
604 specifically sections 10.4 and 10.5, which state that “the server SHOULD include an entity
605 containing an explanation of the error situation.” The combination of the error code and the list of
606 successfully resolved `xrid:XRIDescriptor` elements explains to the client exactly which sub-
607 segment caused the error. This should save both the client and the authority returning the error
608 code an extra HTTP request/response cycle.

609 Even when given an HTTP error response, resolving clients SHOULD consider the
610 `xrid:XRIDescriptor` elements returned in the content of the HTTP response as valid
611 cacheable responses (if the client does caching). All other rules about XRI Descriptors, including
612 those specified in Section 3 for trusted resolution, also apply.

613 **2.2.5 Examples (Non-Normative)**

614 **2.2.5.1 Authority Resolution without Lookahead**

615 In the following example, the authority portion of an XRI is resolved without lookahead. That is,
616 for each resolution step, the resolving client requests resolution of only one authority sub-
617 segment of the following XRI:

```
618 xri://=example*home*base/fo*bar
```

619 This example assumes that the URI for the “=” global context symbol is
620 `http://equals.example.org/xri-resolve`, found in
621 `xrid:XRIDescriptor/xrid:Authority/xrid:URI` of the XRID for this community.

622 ***Resolving “=example”***

623 The following HTTP request is made to “equals.example.org”:

```
624 GET /xri-resolve/*example HTTP/1.1  
625 If-Modified-Since: Fri, 31 Oct 2003 19:43:31 GMT  
626 Accept: application/xrid+xml  
627 <other HTTP headers>
```

628 The following HTTP response is received from “equals.example.org” (the content has changed
629 since “Fri, 31 Oct 2003 19:43:31 GMT”, the value specified in the the “If-Modified-Since” header):

```
630 200 OK HTTP/1.1
631 Content-Type: application/xrid+xml
632 Expires: Fri, 7 Nov 2003 19:43:31 GMT
633 <other HTTP headers>
634
635 <XRIDescriptors xmlns="...">
636 <XRIDescriptor>
637 <Resolved>*example</Resolved>
638 <AuthorityID>
639 urn:uuid:2BA56CDE-9438-11D9-8BDE-F66BAD1E3F3A
640 </AuthorityID>
641 <Authority>
642 <AuthorityID>
643 urn:uuid:925B458F-5907-7654-C3F9-BE3D8912BA73
644 </AuthorityID>
645 <URI>
646 http://xri.example.com/xri-resolve/
647 </URI>
648 </Authority>
649 <Service>...</Service>
650 </XRIDescriptor>
651 </XRIDescriptors>
```

652 **Resolving “=example*home”**

653 Appending the next qualified sub-segment “*home” to the URI “http://xri.example.com/xri-resolve/”
654 yields the URI “http://xri.example.com/xri-resolve/*home”, and the following HTTP request is
655 made to xri.example.com:

```
656 GET /xri-resolve/*home HTTP/1.1
657 If-Modified-Since: Fri, 31 Oct 2003 19:43:32 GMT
658 Accept: application/xrid+xml
659 <other HTTP headers>
```

660 The following HTTP response is received from xri.example.com:

```
661 200 OK HTTP/1.1
662 Content-Type: application/xrid+xml
663 If-Modified-Since: Fri, 31 Oct 2003 19:43:32 GMT
664 <other HTTP headers>
665
666 <XRIDescriptors xmlns="...">
667 <XRIDescriptor>
668 <Resolved>*home</Resolved>
669 <AuthorityID>
670 urn:uuid:925B458F-5907-7654-C3F9-BE3D8912BA73
671 </AuthorityID>
672 <Authority>
673 <AuthorityID>
674 urn:uuid:C9FBEE76-1288-9395-DCD8-DFE35CA9E092
675 </AuthorityID>
676 <URI>
677 http://xri.other.example.com/xri-resolve/*home/
678 </URI>
679 </Authority>
680 <Service>...</Service>
681 ...
682 </XRIDescriptor>
683 </XRIDescriptors>
```

684 **Resolving “=example*home*base”**

685 Appending the next qualified sub-segment “*base” to the URI “http://xri.other.example.com/xri-
686 resolve/*home/” gives the URI “http://xri.other.example.com/xri-resolve/*home/*base”:

```
687 GET /xri-resolve/*home/*base HTTP/1.1  
688 If-Modified-Since: Fri, 31 Oct 2003 19:43:32 GMT  
689 Accept: application/xrid+xml  
690 <other HTTP headers>
```

691 The following HTTP response is received from xri.other.example.com:

```
692 200 OK HTTP/1.1  
693 Content-type: application/xrid+xml  
694 Expires: Fri, 7 Nov 2003 19:43:33 GMT  
695 <other HTTP headers>  
696  
697 <XRIDescriptors xmlns="...">  
698 <XRIDescriptor>  
699 <Resolved>*base</Resolved>  
700 <AuthorityID>  
701 urn:uuid:C9FBEE76-1288-9395-DCD8-DFE35CA9E092  
702 </AuthorityID>  
703 <Service>  
704 <Type>  
705 xri://$res*local.access/X2R  
706 </Type>  
707 <URI>  
708 http://xri.other.example.com/xri-local/base/  
709 </URI>  
710 <URI>  
711 https://xri.other.example.com/xri-local/base/  
712 </URI>  
713 </Service>  
714 ...  
715 </XRIDescriptor>  
716 </XRIDescriptors>
```

717 The result of the final XRI authority resolution step is the set of HTTP and HTTPS URIs shown in
718 the “Service” element above that can be used for local access services (specifically, the X2R
719 local access service as identified by the xri://\$res*local.access/X2R type).

720 2.2.5.2 Authority Resolution with Lookahead

721 The next example shows the interaction between a client and server using lookahead resolution
722 for the authority portion of the following XRI:

```
723 xri://=example*home*base/foo*bar
```

724 Assume as in the previous example that the URI for the “=” global context symbol is
725 “http://equals.example.org/xri-resolve”. In this example, the client will always request lookahead
726 resolution of all unresolved authority sub-segments.

727 **Resolving “=example*home*base”**

728 The following HTTP request is made to “equals.example.org”:

```
729 GET /xri-resolve/*example*home*base HTTP/1.1
730 If-Modified-Since: Fri, 31 Oct 2003 19:43:31 GMT
731 Accept: application/xrid+xml
732 <other HTTP headers>
```

733 The following HTTP response is received from “equals.example.org” (the content has changed
734 since “Fri, 31 Oct 2003 19:43:31 GMT”, the value specified in the “If-Modified-Since” header). The
735 response contains two XRI Descriptor elements, one for “*example” and one for “*home”. This
736 indicates to the resolving client that the “equals.example.org” authority has either cached or
737 performed its own resolution to retrieve the descriptor for =example*home:

```
738 200 OK HTTP/1.1
739 Content-Type: application/xrid+xml
740 Expires: Fri, 7 Nov 2003 19:43:31 GMT
741 <other HTTP headers>
742
743 <XRIDescriptors xmlns="...">
744 <XRIDescriptor>
745 <Resolved>*example</Resolved>
746 <AuthorityID>
747 urn:uuid:2BA56CDE-9438-11D9-8BDE-F66BAD1E3F3A
748 </AuthorityID>
749 <Authority>
750 <AuthorityID>
751 urn:uuid:925B458F-5907-7654-C3F9-BE3D8912BA73
752 </AuthorityID>
753 <URI>
754 http://xri.example.com/xri-resolve/
755 </URI>
756 </Authority>
757 <Service>...</Service>
758 </XRIDescriptor>
759 <XRIDescriptor xmlns="...">
760 <Resolved>*home</Resolved>
761 <AuthorityID>
762 urn:uuid:925B458F-5907-7654-C3F9-BE3D8912BA73
763 </AuthorityID>
764 <Authority>
765 <AuthorityID>
766 urn:uuid:C9FBEE76-1288-9395-DCD8-DFE35CA9E092
767 </AuthorityID>
768 <URI>
769 http://xri.other.example.com/xri-resolve/*home/
770 </URI>
771 </Authority>
772 <Service>...</Service>
773 </XRIDescriptor>
774 </XRIDescriptors>
```

775 Note that the XRI Descriptor elements must appear in resolution order, i.e. the first XRI Descriptor
776 describes the authority “*example” and the second describes the authority “*home” within the
777 “*example” namespace.

778 The resolving client, assuming it trusts the resolver’s response (see section 3 for more details on
779 trusted resolution), then resolves the “*base” authority sub-segment using the authority URI
780 “http://xri.other.example.com/xri-resolve/*home/” as identified in the last XRI Descriptor above.
781 The following HTTP request is made to “xri.other.example.com”:

```
782 GET /xri-resolve/*home/*base HTTP/1.1
783 If-Modified-Since: Fri, 31 Oct 2003 19:43:31 GMT
784 Accept: application/xrid+xml
785 <other HTTP headers>
```

786 The following HTTP response is received from xri.other.example.com:

```
787 200 OK HTTP/1.1
788 Content-type: application/xrid+xml
789 Expires: Fri, 7 Nov 2003 19:43:33 GMT
790 <other HTTP headers>
791
792 <XRIDescriptors xmlns="...">
793 <XRIDescriptor>
794 <Resolved>*base</Resolved>
795 <AuthorityID>
796 urn:uuid:C9FBEE76-1288-9395-DCD8-DFE35CA9E092
797 </AuthorityID>
798 <Service>
799 <Type>
800 xri://$res*local.access/X2R
801 </Type>
802 <URI>
803 http://xri.other.example.com/xri-local/base/
804 </URI>
805 <URI>
806 https://xri.other.example.com/xri-local/base/
807 </URI>
808 </Service>
809 ...
810 </XRIDescriptor>
811 </XRIDescriptors>
```

812 Note that the three XRI Descriptor elements in this example (two from the first HTTP resolution
813 from equals.example.org and the one from xri.other.example.com) are exactly the same three
814 XRI Descriptors retrieved from the separate resolution requests showed in section 2.2.5.1.

815 2.2.6 Resolving Cross-References in XRI Authorities

816 A sub-segment within an XRI authority segment may be a cross-reference. Cross-references are
817 resolved identically to any other sub-segment because the cross-reference is considered opaque
818 by generic XRI resolution. In other words, the value of the cross-reference (including the
819 parentheses) is the literal value of the sub-segment for the purpose of authority resolution.

820 The one exception is a cross-reference rooted on the GCS dollar sign ("\$"). The significance of
821 such a cross-reference for resolution depends on the specification that defines the value of the
822 identifier following the \$ character. For the XRI suite of specifications, the significance of \$ cross-
823 references is defined by the *XRI Metadata Specification* [**XRIMetadata**]. For example, a cross-
824 reference that begins with the GCS dollar sign ("\$") followed by the hyphen character ("-"), is
825 specified in [**XRIMetadata**] as insignificant, so this cross-reference and the delimiter that
826 precedes it **MUST** be ignored entirely during resolution. A cross-reference that begins with the
827 GCS dollar sign ("\$") followed by the letter "v", on the other hand, is specified in [**XRIMetadata**]
828 as significant, so this should be treated as a standard cross-reference for the purpose of
829 resolution.

830 Table 5 provides several examples of resolving cross-references. In each example, sub-segment
831 "lb" resolves to an XRI Authority URI of "http://example.com/xri-authority", and lookahead
832 resolution is not being requested.
833

Cross-reference type	Example XRI	Next Resolution URI after resolving "xri://@!a!b"
Absolute XRI	xri://@!a!b!(@!1!2!3)*e/f	http://example.com/xri-authority/!(@!1!2!3)
Absolute URI	xri://@!a!b*(mailto:jd@example.com)*e/f	http://example.com/xri-authority/*(mailto:jd@example.com)
Relative XRI	xri://@!a!b*(c*d)*e/f	http://example.com/xri-authority/*(c*d)
Metadata XRI (significant)	xri://@!a!b*(\$v/2.0)*e/f	http://example.com/xri-authority/*(\$v%2F2.0)
Metadata XRI (ignored)	xri://@!a!b*(\$-important)*e/f	http://example.com/xri-authority/*e

834 **Table 5: Examples of the Next Authority URIs constructed using different types of cross-references.**

835 2.2.7 XRI Redirects

836 An XRI Descriptor may contain an `xrid:XRIDescriptor/xrid:Synonyms/xrid:External`
837 element and not contain any `xri:XRIDescriptor/xrid:Authority` or
838 `xrid:XRIDescriptor/xrid:LocalAccess` elements. This is called an "XRI redirect"
839 because the XRI Descriptor is effectively redirecting to a new XRI Authority. In this case, the
840 unresolved portion of the original XRI (i.e. the XRI being resolved) is added to the contents of the
841 `/xrid:XRIDescriptor/xrid:Synonyms/xrid:External` element to create a new XRI.
842 This new XRI is then resolved in place of the original XRI.

843 The example in Section 2.2.5 demonstrates the resolution of `xri://=example*home*base/foo*bar`.
844 The first request is to "equals.example.org". The following XRI redirect could be received as a
845 response.

```

846 200 OK HTTP/1.1
847 Content-Type: application/xrid+xml
848 Expires: Fri, 7 Nov 2003 19:43:31 GMT
849 <other HTTP headers>
850
851 <XRIDescriptors xmlns="...">
852 <XRIDescriptor>
853   <Resolved>*example</Resolved>
854   <AuthorityID>
855     urn:uuid:2BA56CDE-9438-11D9-8BDE-F66BAD1E3F3A
856   </AuthorityID>
857   <Synonyms>
858     <External>
859       xri://example2
860     </External>
861   </Synonyms>
862 </XRIDescriptor>
863 </XRIDescriptors>

```

864 In this case, a new XRI would be constructed as `"xri://=example2*home*base/foo*bar"` and the
865 resolution process would begin again with this new XRI.

866 If the original XRI contains additional sub-segments in its Authority component and the
867 `xrid:XRIDescriptor/xrid:Synonyms/xrid:External` element contains a local-path
868 component, the client SHOULD consider this an error condition and fail. For example, consider if

869 the XRI redirect above had been as follows:
870

```
871 200 OK HTTP/1.1
872 Content-Type: application/xrid+xml
873 Expires: Fri, 7 Nov 2003 19:43:31 GMT
874 <other HTTP headers>
875
876 <XRIDescriptors xmlns="...">
877 <XRIDescriptor>
878   <Resolved>*example</Resolved>
879   <AuthorityID>
880     urn:uuid:2BA56CDE-9438-11D9-8BDE-F66BAD1E3F3A
881   </AuthorityID>
882   <Synonyms>
883     <External>
884       xri://@example2/path
885     </External>
886   </Synonyms>
887   ...
888 </XRIDescriptor>
889 </XRIDescriptors>
```

890 Now the resulting XRI would be “xri://@example2/path*home*base/foo”. Unless the client
891 application has specific reason to believe otherwise, this is an error.

892 2.3 IRI Authority Resolution

893 From the standpoint of generic XRI resolution, an IRI authority segment represents either a DNS
894 name or an IP address at which an XRID for the authority may be retrieved. Requesting the
895 corresponding XRID is a simple matter of making an HTTP(S) GET request using a URI
896 constructed from the IRI authority segment. The resulting XRI Descriptor is then used to
897 retrieve local access URIs or other XRI authority synonyms or metadata as described in section
898 2.2.

899 The HTTP URI is constructed by extracting the entire IRI authority segment and prepending the
900 string “http://”. Then an HTTP GET is performed using an HTTP Accept header containing only
901 the following:

```
902 Accept: application/xrid+xml
```

903 Additionally, the HTTP GET request MUST have a Host: header (as defined in section 14.23 of
904 **[RFC2616]**) containing the value of the IRI authority segment. The resolving authority MUST use
905 the value of the Host header to populate the xrid:XRIDescriptor/xrid:Resolved element
906 in the resulting xrid:XRIDescriptors document. For example:

```
907 Host: example.com
```

908 An HTTP server acting as an IRI authority SHOULD respond with the XRI Descriptors document
909 for that authority.

910 Section 3 of this document defines trusted resolution only for XRI authorities. This document does
911 not define trusted resolution for IRI Authorities. If, however, an IRI authority is known to respond
912 to HTTPS requests (by some means not described in this document) then the resolving client
913 MAY use HTTPS as the access protocol for retrieving the authority’s XRID. If the resolving client
914 is satisfied, via transport level security mechanisms, that the response is from the expected IRI
915 authority, then the resolving client may place a higher level of trust on the contents of the XRID
916 than it would have otherwise.

917 The following example demonstrates how the IRI authority segment of the XRI
918 “xri://example.com/local*path” would be resolved into an XRI Descriptor. First the IRI authority is
919 extracted (“example.com”), then the following HTTP Request is made of the server
920 “example.com”:

```
921 GET / HTTP/1.1
922 Accept: application/xrid+xml
923 Host: example.com
924 <other HTTP headers>
```

925 The HTTP server acting as the authority might provide the following HTTP response, using the
926 value of the Host header to populate the xrid:XRIDescriptor/xrid:Resolved element:

```
927 200 OK HTTP/1.1
928 Content-Type: application/xrid+xml
929 Expires: Fri, 7 Nov 2003 19:43:31 GMT
930 <other HTTP headers>
931
932 <XRIDescriptors xmlns="...">
933 <XRIDescriptor>
934   <Resolved>example.com</Resolved>
935   <AuthorityID>
936     7CF08CE4-9439-11D9-8BDE-F66BAD1E3F3A
937   </AuthorityID>
938   <Synonyms>
939     <External>
940       xri://@example2*path
941     </External>
942   </Synonyms>
943   ...
944 </XRIDescriptor>
945 </XRIDescriptors>
```

946 The use of IRI authorities provides backwards compatibility with the large installed base of DNS-
947 and IP-identifiable resources. However, because IRI authorities do not support the additional
948 layer of abstraction and extensibility represented by XRI authority syntax, IRI authorities are not
949 recommended for new deployments of XRI identifiers.

950 2.4 Local Access

951 Local access is the process of interacting with a network endpoint to retrieve a representation of
952 or metadata about a resource identified by an XRI.

953 2.4.1 Local Access Service Types

954 Any number of protocols may be used for local access. This specification defines an HTTP(S)
955 local access protocol with the name “X2R”. Other local access services could also be defined—
956 for example, an LDAP or DSML local access protocol that specified the appropriate
957 transformation of the XRI local part into an LDAP distinguished name (including normalization of
958 the XRI local path to the LDAP distinguished name syntax).

959 Work on such additional protocols is left to future specifications. To accommodate such work, this
960 specification reserves a namespace, “\$res*local.access”, for enumerating local access service
961 types. The “\$res” namespace can also be extended by other authorities besides the XRI
962 Technical Committee. See **[XRIMetadata]** for more information about extending “\$” namespaces.
963 New local access service types intended for widespread use **MUST** be identified with XRI in the
964 \$res*local.access namespace. Local access service types defined solely for use within a private
965 or closed community **MAY** have service types identified by any XRI.

966 2.4.2 The X2R Local Access Service

967 The X2R local access service is derived from the I2R service defined in section 4.3 of
968 **[RFC2483]**. X2R is the default local access service defined in this specification; it is available
969 when the associated `xrid:Descriptor/xrid:Service/xrid:Type` element is not present
970 or when it explicitly contains the value “`xri://$res*local.access/X2R`”.

971 X2R is defined as the use of HTTP to interact with a resource using the full extent of the HTTP
972 semantics as defined in **[RFC2616]**. Special attention should be paid to the semantics of the four
973 main HTTP verbs: GET, PUT, POST, and DELETE. For example, clients performing local access
974 typically will use GET to retrieve representations of a resource on the network.

975 This specification does not impose particular semantics beyond what is defined in **[RFC2616]**, but
976 users of this specification are encouraged to review the **[REST]** architecture when building
977 applications using XRI. Local access is not, however, limited to the REST model of interaction.
978 HTTP local access could be leveraged for the delivery of SOAP messages over HTTP POST, for
979 example, or via use of the GET HTTP verb as a generic read-only operation.

980 The HTTP/HTTPS local access binding defined in this section is flexible enough to be used for a
981 variety of resources. By itself it makes no assumptions about the type of resource identified by
982 the XRI being resolved. However, such metadata can be supplied using the
983 `xrid:XRIDescriptor/xrid:Service/xrid:MediaType` element in an XRID. The resource
984 type may also be established through the context in which the XRI was originally used (e.g., an
985 XML document) or discovered through the HTTP Content-Type header.

986 2.4.2.1 Constructing a Local Access HTTP(S) URI

987 The HTTP(S) URI for X2R local access service is constructed by concatenating the value of any
988 `xrid:XRIDescriptor/xrid:Service/xrid:URI` element in the XRI Descriptor with the
989 URI-normal form of the path portion (matching the “`xri-path-absolute`” production described in
990 section 2.2.3 of **[XRISyntax]**) of the XRI. If the URI from the XRI Descriptor ends in a forward
991 slash (“/”), this slash **MUST** be removed before concatenating the path portion.

992 The following pseudocode describes the process for creating, from the local access URI in the
993 XRID, the concrete HTTP(S) URI to which a local access request is made:

```
994 if (local-access-uri ends in "/"):
995     remove trailing "/" in local-access-uri
996
997 local-access-uri = local-access-uri + uri-escape(absolute-path)
```

998 The verb used in the resulting HTTP/(S) request may be any of the verbs defined in **[RFC2616]**,
999 though not all verbs may be supported at every endpoint. All X2R local access endpoints
1000 **SHOULD** support at least the GET verb, and this should return either a representation of the
1001 identified resource or metadata about the resource.

1002 The full suite of HTTP content negotiation features is available to clients when performing local
1003 access. For example, if the local access service URI is “`http://xri.example.com/xri-local`”, then the
1004 following local access HTTP request for “`xri://=example*home/foo*bar`” could be made to
1005 “`xri.example.com`”:

```
1006 GET /xri-local/foo*bar HTTP/1.1
1007 If-Modified-Since: Fri, 31 Oct 2003 19:43:33 GMT
1008 <other HTTP headers>
```

1009 The following HTTP response might then be received from `xri.example.com`:

```
1010 200 OK HTTP/1.1
1011 Expires: Sat, 1 Nov 2003 19:43:33 GMT
1012 Content-Type: text/plain
1013 <other HTTP headers>
1014
1015 This is the result of a local access request.
```

1016 2.5 HTTP Headers

1017 2.5.1 Caching

1018 The HTTP caching capabilities described by **[RFC2616]** should be leveraged for both the default
1019 authority resolution service and the X2R local access service. Specifically, implementations of
1020 XRI resolution SHOULD implement the caching model described in section 13 of **[RFC2616]**. In
1021 particular, the “Expiration Model” of section 13.2 SHOULD be used, as this requires the fewest
1022 round-trip network connections.

1023 All servers providing identifier authority lookup responses SHOULD send the Cache-Control or
1024 Expires headers per section 13.2 of **[RFC2616]** unless there are overriding security or policy
1025 reasons to omit them.

1026 Note that HTTP Cache headers SHOULD NOT conflict with expiration information in an XRID.
1027 That is, the expiration date specified by HTTP caching headers SHOULD NOT be later than any
1028 of the expiration dates for any of the `xrid:XRIDescriptor/xrid:Expires` elements returned
1029 in the HTTP response. This implies that lookahead and proxy resolvers SHOULD compute the
1030 “soonest” expiration date for the XRI Descriptors in a resolution chain and ensure a later date is
1031 not specified by the HTTP caching headers for the HTTP response.

1032 2.5.2 Location

1033 During authority resolution HTTP interaction, “Location” headers may be present per **[RFC2616]**
1034 (i.e., during 3XX redirects). Redirects SHOULD be made cacheable through appropriate HTTP
1035 headers, as specified in section 2.5.1.

1036 2.5.3 Content-Type

1037 For default authority resolution, the “Content-type” header in the 2XX responses MUST contain
1038 the value “application/xrid+xml” or “application/xrid-t-saml+xml” specifying that
1039 the content is an XRI Descriptor (section 2.2.2) or a trusted XRI Descriptor (section 3.3.1)
1040 respectively.

1041 For X2R local access, clients and servers MAY negotiate content type using standard HTTP
1042 content negotiation features. Regardless of whether this feature is used, however, the server
1043 MUST respond with an appropriate media type in the “Content-type” header if the resource is
1044 found and an appropriate content type is returned.

1045 2.6 Other HTTP Features

1046 HTTP provides a number of other features including transfer-coding, proxying, validation-model
1047 caching, and so forth. All these features may be used insofar as they do not conflict with the
1048 required uses of HTTP described in this document.

1049 2.7 Caching and Efficiency

1050 In addition to HTTP-level caching, resolution clients are encouraged to perform caching at the
1051 application level. For best results, however, resolution clients SHOULD be conservative with
1052 caching expiration semantics, including cache expiration dates. This implies that in a series of

1053 HTTP redirects, for example, the results of the entire process SHOULD only be cached as long
1054 as the shortest period of time allowed by any of the intermediate HTTP responses.

1055 Because not all HTTP client libraries expose caching expiration to applications, identifier
1056 authorities and local access servers SHOULD NOT use cacheable redirects with expiration times
1057 that are sooner than the expiration times of other HTTP responses in the authority resolution
1058 chain or in local access interactions. In general, all XRI deployments should be mindful of
1059 limitations in current HTTP clients and proxies.

1060 For XRI Descriptors, the cache expiration time may also be shortened by the expiration time
1061 provided in the `xrid:XRIDescriptor/xrid:Expires` element (if present). That is, if the
1062 expiration time in `xrid:XRIDescriptor/xrid:Expires` is sooner than the expiration time
1063 calculated from the HTTP caching semantics, then the XRI Descriptor MUST be discarded before
1064 the expiration time in `xrid:XRIDescriptor/xrid:Expires`. Note also that the SAML
1065 assertion used in trusted resolution (section 3) may cause invalidation of a XRI Descriptor even
1066 before HTTP caching semantics or the `xrid:XRIDescriptor/xrid:Expires` element.

1067 With both application-level and HTTP-level caching, the resolution process is designed to have
1068 minimal overhead. In particular, because each qualified sub-segment of an authority identifier is
1069 described by a separate XRI Descriptor, each step of that resolution is independent, and
1070 intermediate results can typically be cached in their entirety. For this reason, resolution of higher-
1071 level (i.e., further to the left) qualified sub-segments, which are common to more identifiers, will
1072 naturally result in a greater number of cache hits than resolution of lower-level sub-segments.

1073 3 Trusted Resolution

1074 3.1 Introduction

1075 This section defines a method for performing trusted XRI authority resolution as an extension of
1076 the generic XRI resolution protocol defined in section 2 of this document.

1077 This trusted resolution protocol does not provide a means to encrypt the contents of resolution
1078 requests and responses, nor does it provide a means for a responder to provide different
1079 responses for different requestors. These services may be provided by other security protocols
1080 used in conjunction with this specification, but confidentiality and client-authentication are
1081 explicitly out of scope in this version of this specification.

1082 This section assumes the reader is familiar with, at a minimum, the ABNF defined in Appendix A
1083 of [XRISyntax] and the generic resolution protocol defined in section 2 of this document.

1084 3.2 Overview and Example (Non-Normative)

1085 Trusted XRI Authority resolution is a straightforward enhancement to generic XRI resolution. The
1086 client application requests resolution of one or more qualified sub-segments in the XRI Authority
1087 segment exactly as described in section 2 of this document with one exception: instead of using
1088 "application/xrid+xml" in the "Accept" header of the HTTP(S) request, a content type of
1089 "application/xrid-t-saml+xml" is used. The XRI Authority responds with an XRI
1090 Descriptor that contains an additional element - a digitally signed SAML [SAML] assertion that
1091 asserts the validity of the containing XRI Descriptor. If the response does not contain a valid,
1092 digitally signed SAML assertion (as defined in section 3.2 of this document), this is considered an
1093 error condition, and trusted resolution MUST NOT proceed.

1094 The following example steps through resolution of the authority portion of the same XRI used in
1095 Section 2 of this document:

1096 `xri://=example*home*base/foo.bar`

1097 As in standard resolution, there is no defined discovery process for the trusted resolution URI(s)
1098 of the community root – it must be known *a priori* and is expected to be part of the configuration
1099 of the resolver. A recommended practice is to publish an XRI Descriptor containing a valid SAML
1100 assertion signed by the community root. In this example, assume the
1101 `xrid:Authority/xrid:URI` element of the XRI Descriptor for the global community root "="
1102 specifies that the URI for the "=" global context symbol is "http://equals.example.org/xri-resolve".

1103 In trusted resolution, each XRI Authority is associated with an identifier called an AuthorityID. An
1104 AuthorityID is a URI, or an XRI in URI-normal form, uniquely associated with a particular XRI
1105 Authority. Each XRI Authority MUST have at least one AuthorityID, and no two XRI Authorities
1106 can have the same AuthorityID. The AuthorityID of the community root, like the community root's
1107 URI, is defined in the `xrid:XRIDescriptor/xrid:Authority/xrid:AuthorityID`
1108 element of the community root's XRI Descriptor (or its equivalent). For this example, assume the
1109 AuthorityID for the "=" global context symbol is "urn:uuid:498FB006-B9EF-4943-B10A-
1110 A71FC2ED1B89". For more information on `xrid:XRIDescriptor/xrid:AuthorityID`, see
1111 Section 3.3.3 below.

1112 Finally, in trusted resolution, each XRI Authority is associated with some key used to verify digital
1113 signatures. The key for the community root must be known and configured in advance. If an XRI
1114 Descriptor is used to describe the community root, information about this key may be found in the
1115 `xrid:XRIDescriptor/xrid:Authority/ds:KeyInfo` element of that document.

1116 Note that the digital signatures in the following examples are for reference only. The digest values
1117 are not valid and the signatures will not verify.

1118 **Resolving “=example”**

1119 The following HTTP request is made to “equals.example.org”:

```
1120 GET /xri-resolve/*example HTTP/1.1  
1121 If-Modified-Since: Fri, 31 Oct 2003 19:43:31 GMT  
1122 Accept: application/xrid-t-saml+xml  
1123 <other HTTP headers>
```

1124 **Example 1: Request for =example**

1125 This request contains an Accept header with the value “application/xrid-t-saml+xml”.
1126 The client is requesting a response that contains a signed SAML assertion. If the resolving client
1127 will accept either trusted or generic resolution, preferring trusted resolution, it could have used the
1128 value “application/xrid-t-saml+xml, application/xrid+xml” for the Accept header.
1129 The following HTTP response is received from “equals.example.org”:

```

1130 200 OK HTTP/1.1
1131 Content-Type: application/xrid-t-saml+xml
1132 Expires: Fri, 7 Nov 2003 19:43:31 GMT
1133 <other HTTP headers>
1134
1135 <XRIDescriptors
1136   xmlns="xri://$res*schema/XRIDescriptor">
1137 <XRIDescriptor
1138   xrid:id="baec221f3c0f17f53ca6839989632056">
1139   <Resolved>*example</Resolved>
1140   <AuthorityID>urn:uuid:498FB006-B9EF-4943-B10A-A71FC2ED1B89
1141   </AuthorityID>
1142   <Authority>
1143   <AuthorityID>urn:uuid:C5C9EFDf-A3BC-4301-88C6-B1AE0AD6DA77
1144   </AuthorityID>
1145   <URI xrid:trusted="true">http://xri.example.com/xri-resolve/</URI>
1146   <ds:KeyInfo xmlns:ds="http://www.w3.org/2000/09/xmldsig#">
1147   ...
1148   </ds:KeyInfo>
1149   </Authority>
1150   <TrustMechanism>xri://$res*trusted/XRITrusted</TrustMechanism>
1151   <saml:Assertion
1152     Version="2.0"
1153     ID="_ad9571ad-cd23-85e2-e928-abba20b6c424"
1154     IssueInstant="2004-07-01T00:46:02Z"
1155     xmlns:saml="urn:oasis:names:tc:SAML:2.0:assertion">
1156   <saml:Issuer>xri://@example</saml:Issuer>
1157   <ds:Signature xmlns:ds="http://www.w3.org/2000/09/xmldsig#">
1158     <ds:SignedInfo>
1159       <ds:CanonicalizationMethod
1160         Algorithm="http://www.w3.org/2001/10/xml-exc-c14n#" />
1161       <ds:SignatureMethod
1162         Algorithm="http://www.w3.org/2000/09/xmldsig#rsa-sha1" />
1163       <ds:Reference URI="#baec221f3c0f17f53ca6839989632056">
1164         <ds:Transforms>
1165           <ds:Transform
1166             Algorithm="http://www.w3.org/2000/09/xmldsig#enveloped-
1167             signature" />
1168           <ds:Transform Algorithm="http://www.w3.org/2001/10/xml-exc-
1169             c14n#">
1170             <ec:InclusiveNamespaces
1171               xmlns:ec="http://www.w3.org/2001/10/xml-exc-c14n#"
1172               PrefixList="#default code ds kind rw saml samlp typens" />
1173             </ds:Transform>
1174           </ds:Transforms>
1175           <ds:DigestMethod
1176             Algorithm="http://www.w3.org/2000/09/xmldsig#sha1" />
1177           <ds:DigestValue>BSSnowZG5DYV0X0C8GAeBlcvLzw=</ds:DigestValue>
1178           </ds:Reference>
1179         </ds:SignedInfo>
1180         <ds:SignatureValue>
1181         kE9p35G4mcombsqEztJMX1R3J26gwc4cbjSz5fUv3aVg3j/iLhrbf0qKywYNMLdQMjBRcCg
1182         5N1l0
1183         Kvv2UrgvQ5kgQ9dm7/563rRzKAaIQwMopZpTFli4eXw+nc8XEH+KnXdu/R9DHOg9k0BKIF6
1184         BGk07
1185         xC6Q9X+byQWenPjAZ1c=
1186         </ds:SignatureValue>
1187       </ds:Signature>
1188     <saml:Subject>
1189     <saml:NameID NameQualifier="urn:uuid:498FB006-B9EF-4943-B10A-
1190     A71FC2ED1B89">
1191     *example
1192     </saml:NameID>

```

```

1193     </saml:Subject>
1194     <saml:Conditions
1195         NotBefore="2004-06-01T00:00:00Z"
1196         NotOnOrAfter="2004-09-01T00:00:00Z" />
1197     <saml:AttributeStatement>
1198         <saml:Attribute Name="xri://$res*schema/XRIDescriptor">
1199
1200     <saml:AttributeValue>#baec221f3c0f17f53ca6839989632056</saml:AttributeV
1201     alue>
1202     </saml:Attribute>
1203     </saml:AttributeStatement>
1204 </saml:Assertion>
1205 </XRIDescriptor>
1206 </XRIDescriptors>

```

1207 **Example 2 – Response for =example**

1208 The response contains an `xrid:XRIDescriptor/saml:Assertion` element that includes an
1209 assertion about the validity of the XRI Descriptor. (For more information about SAML assertions
1210 in XRI Descriptors, see section 3.3.3.) The response also contains an
1211 `xrid:XRIDescriptor/xrid:Authority/ds:KeyInfo` element. This required element
1212 informs the client that XRI Descriptors digitally signed by the described XRI Authority are to be
1213 verified using this key.

1214 Finally, note that two instances of `xrid:AuthorityID` appear in the XRI Descriptor: one as a
1215 child of `xrid:XRIDescriptor` and the other as a child of `xrid:Authority`. The child of
1216 `xrid:XRIDescriptor` is the AuthorityID of the *current describing* authority (the one publishing
1217 this XRI Descriptor) and matches the expected AuthorityID of the community root
1218 (`urn:uuid:498FB006-B9EF-4943-B10A-A71FC2ED1B89`). The child of the `xrid:Authority`
1219 element contains the AuthorityID of the *described* XRI Authority (the authority being described
1220 within the `xrid:Authority` element). Responses from that XRI Authority will contain this
1221 AuthorityID as a child of `xrid:XRIDescriptor`.

1222 The client validates the signed SAML assertion as described in Section 3.3 before continuing.

1223 **Resolving “=example*home”**

1224 Appending the next qualified sub-segment “*home” to the URI “`http://xri.example.com/xri-resolve/`”
1225 yields the URI “`http://xri.example.com/xri-resolve/*home`”. The following HTTP request with an
1226 Accept header value of “`application/xrid-t-saml+xml`” is made to “`xri.example.com`”:

```

1227 GET /xri-resolve/*home HTTP/1.1
1228 Accept: application/xrid-t-saml+xml
1229 <other HTTP headers>

```

1230 **Example 3 – Request for *home**

1231 The following HTTP response is received from `xri.example.com`:


```

1232 200 OK HTTP/1.1
1233 Content-Type: application/xrid-t-saml+xml
1234 If-Modified-Since: Fri, 31 Oct 2003 19:43:32 GMT
1235 <other HTTP headers>
1236
1237 <XRIDescriptors
1238   xmlns="xri://$res*schema/XRIDescriptor">
1239 <XRIDescriptor
1240 xrid:id="1f81b6e0-b64b-1026-f1bc-c0a80b9d3f5b">
1241   <Resolved>*home</Resolved>
1242   <AuthorityID>urn:uuid:C5C9EFDF-A3BC-4301-88C6-B1AE0AD6DA77
1243   </AuthorityID>
1244   <Authority>
1245     <AuthorityID>urn:uuid:A9F28515-AB03-4883-8852-8EECB54CE1D5
1246     </AuthorityID>
1247   <URI xrid:trusted="true">
1248     http://xri.example.com/xri-resolve/*home/
1249   </URI>
1250   <ds:KeyInfo xmlns:ds="http://www.w3.org/2000/09/xmldsig#">
1251     ...
1252   </ds:KeyInfo>
1253 </Authority>
1254 <Service>...</Service> <!-- Local Access Service -->
1255 <TrustMechanism>xri://$res*trusted/XRITrusted</TrustMechanism>
1256 <saml:Assertion
1257   Version="2.0"
1258   ID="_66f1f3e0-b64b-1026-34a4-c0a80b9d59c1"
1259   IssueInstant="2004-05-01T00:46:03Z"
1260   xmlns:saml="urn:oasis:names:tc:SAML:2.0:assertion">
1261 <saml:Issuer>xri://example</saml:Issuer>
1262 <ds:Signature xmlns:ds="http://www.w3.org/2000/09/xmldsig#">
1263   <ds:SignedInfo>
1264     <ds:CanonicalizationMethod
1265       Algorithm="http://www.w3.org/2001/10/xml-exc-c14n#" />
1266     <ds:SignatureMethod
1267       Algorithm="http://www.w3.org/2000/09/xmldsig#rsa-sha1" />
1268     <ds:Reference URI="#1f81b6e0-b64b-1026-f1bc-c0a80b9d3f5b">
1269       <ds:Transforms>
1270         <ds:Transform
1271           Algorithm="http://www.w3.org/2000/09/xmldsig#enveloped-
1272 signature" />
1273         <ds:Transform Algorithm="http://www.w3.org/2001/10/xml-exc-
1274 c14n#">
1275           <ec:InclusiveNamespaces
1276             xmlns:ec="http://www.w3.org/2001/10/xml-exc-c14n#"
1277             PrefixList="#default code ds kind rw saml samlp typens" />
1278           </ds:Transform>
1279         </ds:Transforms>
1280         <ds:DigestMethod
1281           Algorithm="http://www.w3.org/2000/09/xmldsig#sha1" />
1282         <ds:DigestValue>BSsnowZG5DYV0X0C8GAeBlcvLzw=</ds:DigestValue>
1283       </ds:Reference>
1284     </ds:SignedInfo>
1285     <ds:SignatureValue>
1286 keE9p35G4mcombsqEztJMX1R3J26gwc4cbjSz5fUv3aVg3j/iLhrbf0qKywYNMLdQMjBRcCg
1287 5N110
1288 Kvv2UrgvQ5kgQ9dm7/563rRzKAaIQwMopZpTFli4eXw+nc8XEH+KnXdu/R9DHog9k0BKIF6
1289 BGk07
1290 xC6Q9X+byQWenPjAZ1c=
1291   </ds:SignatureValue>
1292 </ds:Signature>
1293 </saml:Subject>

```

```
1294     <saml:NameID NameQualifier="urn:uuid:C5C9EFDF-A3BC-4301-88C6-
1295 B1AE0AD6DA77">
1296 *home
1297     </saml:NameID>
1298     </saml:Subject>
1299     <saml:Conditions
1300       NotBefore="2004-06-01T00:00:00Z"
1301       NotOnOrAfter="2004-09-01T00:00:00Z" />
1302     <saml:AttributeStatement>
1303       <saml:Attribute Name="xri://$res*schema/XRIDescriptor">
1304         <saml:AttributeValue>#1f81b6e0-b64b-1026-f1bc-c0a80b9d3f5b
1305       </saml:AttributeValue>
1306     </saml:Attribute>
1307   </saml:AttributeStatement>
1308 </saml:Assertion>
1309 </XRIDescriptor>
1310 </XRIDescriptors>
```

1311 **Example 4 – Response for *home**

1312 The client validates the SAML assertion as described in Section 3.3 before continuing.

1313 ***Resolving “=example*home*base”***

1314 Appending the next qualified sub-segment “*base” to the URI

1315 “http://xri.example.com/xri-resolve/*home/” gives the URI

1316 “http://xri.example.com/xri-resolve/*home/*base”. This is the target of the next trusted resolution

1317 request, again with the Accept header value “application/xrid-t-saml+xml”:

```
1318 GET /xri-resolve/*home/*base HTTP/1.1
1319 If-Modified-Since: Fri, 31 Oct 2003 19:43:32 GMT
1320 Accept: application/xrid-t-saml+xml
1321 <other HTTP headers>
```

1322 **Example 5 – Request for *base**

1323 The following HTTP response is received from xri.example.com:

```

1324 200 OK HTTP/1.1
1325 Content-type: application/xrid-t-saml+xml
1326 Expires: Fri, 7 Nov 2003 19:43:33 GMT
1327 <other HTTP headers>
1328
1329 <XRIDescriptors
1330   xmlns="xri://$res*schema/XRIDescriptor">
1331 <XRIDescriptor
1332   xrid:id="7600e1a0-b64d-1026-ea89-c0a80b9d3814">
1333   <Resolved>*base</Resolved>
1334   <AuthorityID>urn:uuid:A9F28515-AB03-4883-8852-8EECB54CE1D5
1335   </AuthorityID>
1336   <Service>
1337     <Type>xri://$res*local.access/X2R</Type>
1338     <URI>http://xri.example.com/xri-local/base/</URI>
1339     <URI>https://xri.example.com/xri-local/base/</URI>
1340   </Service>
1341   <TrustMechanism>xri://$res*trusted/XRITrusted</TrustMechanism>
1342 <saml:Assertion
1343   Version="2.0"
1344   ID="_1a6a12d0-b64d-1026-c1ba-c0a80b9db964"
1345   IssueInstant="2004-06-03T00:46:03Z"
1346   xmlns:saml="urn:oasis:names:tc:SAML:2.0:assertion">
1347   <saml:Issuer>xri://@example</saml:Issuer>
1348   <ds:Signature xmlns:ds="http://www.w3.org/2000/09/xmldsig#">
1349     <ds:SignedInfo>
1350       <ds:CanonicalizationMethod
1351         Algorithm="http://www.w3.org/2001/10/xml-exc-c14n#" />
1352       <ds:SignatureMethod
1353         Algorithm="http://www.w3.org/2000/09/xmldsig#rsa-sha1" />
1354       <ds:Reference URI="#7600e1a0-b64d-1026-ea89-c0a80b9d3814">
1355         <ds:Transforms>
1356           <ds:Transform
1357             Algorithm="http://www.w3.org/2000/09/xmldsig#enveloped-
1358 signature" />
1359           <ds:Transform Algorithm="http://www.w3.org/2001/10/xml-exc-
1360 c14n#">
1361             <ec:InclusiveNamespaces
1362               xmlns:ec="http://www.w3.org/2001/10/xml-exc-c14n#"
1363               PrefixList="#default code ds kind rw saml samlp typens" />
1364             </ds:Transform>
1365           </ds:Transforms>
1366           <ds:DigestMethod
1367             Algorithm="http://www.w3.org/2000/09/xmldsig#sha1" />
1368           <ds:DigestValue>BSsnowZG5DYV0X0C8GAeBlcvLzw=</ds:DigestValue>
1369         </ds:Reference>
1370       </ds:SignedInfo>
1371       <ds:SignatureValue>
1372 kE9p35G4mcombsqEztJMX1R3J26gwc4cbjSz5fUv3aVg3j/iLhrbf0qKywYNMLdQMjBRcCg
1373 5N110
1374 Kvv2UrgvQ5kgQ9dm7/563rRzKAaIQwMopZpTFli4eXw+nc8XEH+KnXdu/R9DHOg9k0BKIF6
1375 BGk07
1376 xC6Q9X+byQWenPjAZ1c=
1377       </ds:SignatureValue>
1378     </ds:Signature>
1379     <saml:Subject>
1380       <saml:NameID NameQualifier="urn:uuid:A9F28515-AB03-4883-8852-
1381 8EECB54CE1D5">
1382 *example
1383 </saml:NameID>
1384 </saml:Subject>
1385     <saml:Conditions
1386       NotBefore="2004-06-03T00:46:03Z"

```

```

1387     NotOnOrAfter="2004-12-01T00:00:00Z" />
1388     <saml:AttributeStatement>
1389       <saml:Attribute Name="xri://$res*schema/XRIDescriptor">
1390         <saml:AttributeValue>#7600e1a0-b64d-1026-ea89-
1391         c0a80b9d3814</saml:AttributeValue>
1392       </saml:Attribute>
1393     </saml:AttributeStatement>
1394   </saml:Assertion>
1395   ...
1396 </XRIDescriptor>
1397 </XRIDescriptors>

```

1398 Example 6 – Response for *base

1399 The SAML assertion is validated as described in Section 3.3 before proceeding. The result of the
1400 final XRI Authority resolution step is the set of HTTP and HTTPS URIs shown in the
1401 `xrid:XRIDescriptor/xrid:Service` element above that can be used for local access
1402 services (in this case, X2R service).

1403 3.3 Trusted Resolution Protocol

1404 This section normatively defines client and server behavior in trusted resolution.

1405 3.3.1 XML Elements and Attributes

1406 Three elements of an XRI Descriptor defined in section 2.2.2 have limited usage in generic
1407 resolution but play a critical role in trusted resolution.

1408 **xrid:XRIDescriptor/xrid:AuthorityID**

1409 Always required, but critical in trusted resolution for identification of the current describing
1410 authority.

1411 **xrid:XRIDescriptor/xrid:Authority/xrid:AuthorityID**

1412 Always required, but critical for trusted resolution for identification of the target described
1413 authority.

1414 **xrid:XRIDescriptor/xrid:TrustMechanism**

1415 Required when providing trusted resolution. A URI or XRI in URI-normal form that
1416 specifies the mechanism used to provide trusted resolution. The URI for the trust
1417 mechanism defined in this specification is "xri://\$res*trusted/XRITrusted".

1418 In addition, one element from the SAML [**SAML**] namespace is also critical for verifying the
1419 results of trusted resolution.

1420 **xrid:XRIDescriptor/saml:Assertion**

1421 Required when providing trusted resolution. A SAML assertion from the *describing*
1422 Authority (the one providing the XRI Descriptor) that asserts that the describing authority
1423 believes the information contained in the enclosing XRI Descriptor is correct. Because
1424 the assertion is digitally signed and the digital signature encompasses the containing XRI
1425 Descriptor, it also provides a mechanism for the recipient to detect unauthorized changes
1426 since the time the XRI Descriptor was published.

1427 Note that while a `saml:Issuer` element is required within a `saml:Assertion` element,
1428 this specification makes no requirement as to the value of the `saml:Issuer` element. It
1429 is up to the community root to place restrictions, if any, on the `saml:Issuer` element. A
1430 suitable approach is to use an XRI in URI-Normal Form that describes the organization
1431 providing responses for the XRI Authority (e.g. `xri://@example`).

1432 Finally, trusted resolution adds several new elements and attributes to XRI Descriptors to assist
 1433 in verifying XRIDs produced by the described authority (i.e., the next authority in the resolution
 1434 chain that is being described by the `xrid:XRIDDescriptor/xrid:Authority` element of the
 1435 current XRID).

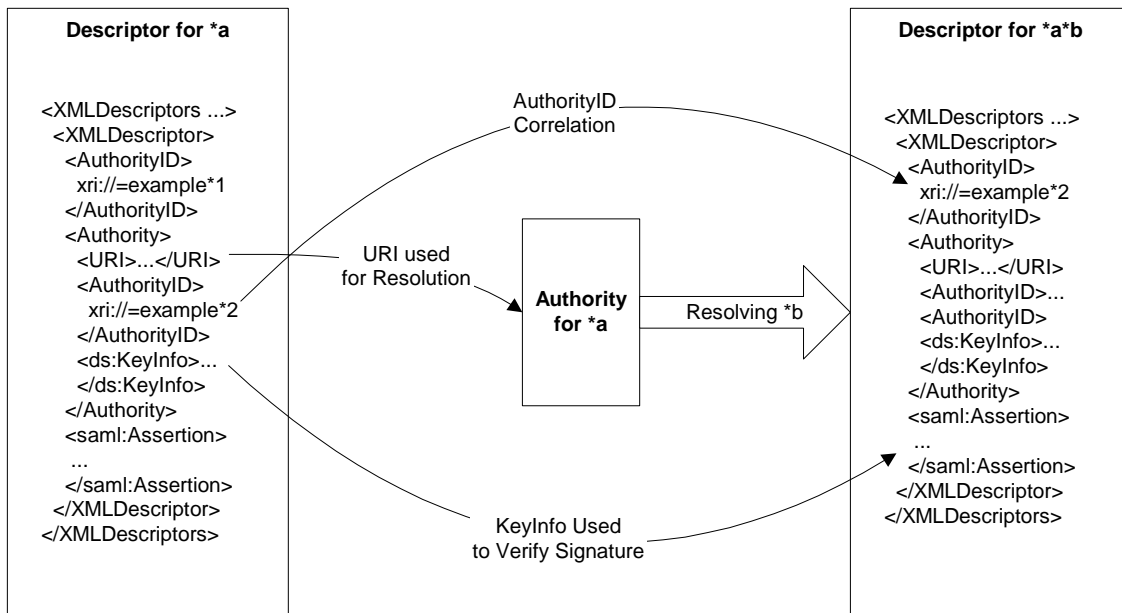
1436 **xrid:XRIDDescriptor/xrid:Authority/xrid:URI/@trusted**

1437 Optional. Default value of "false" (or "0"). Indicates whether this service endpoint is
 1438 capable of returning trusted resolution results. If the value is "1" or "true", the *described*
 1439 authority is willing to return signed XRI Descriptors at this URI.

1440 **xrid:XRIDDescriptor/xrid:Authority/ds:KeyInfo**

1441 Required when providing trusted resolution. Provides the key data needed to validate an
 1442 XRI Descriptor provided by the *described* Authority as a result of resolution at the
 1443 described Authority. This element comprises the key distribution method for trusted XRI
 1444 resolution.

1445 Figure 5 below demonstrates the relationship between these elements for two descriptors in a
 1446 resolution chain: one describing an authority, and one produced by the authority being described.



1447

1448

Figure 5: Correlation of XRI Elements for Trusted Resolution

1449 **3.3.2 Use and Correlation of AuthorityID Elements**

1450 Each XRI Authority participating in trusted resolution MUST be associated with at least one
 1451 AuthorityID, and this AuthorityID MUST NOT ever be assigned to any other XRI Authority. In
 1452 other words, AuthorityID is a persistent unique identifier for a particular XRI Authority.

1453 An AuthorityID may be any valid URI that meets the requirements of permanence and
 1454 uniqueness described above. Examples of appropriate URIs include URNs as defined by
 1455 [RFC2141] and fully persistent XRIs converted to URI-Normal Form as defined by [XRISyntax].

1456 Conceptually, AuthorityID assures a resolving client that the returned XRI Descriptor has not
 1457 been maliciously replaced with a similar XRI Descriptor from a second, and possibly
 1458 unauthorized, XRI Authority. To prevent this type of attack, the XRI Descriptor must be explicitly
 1459 associated with a specific unique XRI Authority, and the client must have some means of
 1460 verifying this association. The `xrid:XRIDDescriptor/xrid:AuthorityID` element provides
 1461 this explicit association.

1462 There is no defined discovery process for the AuthorityID of the community root; it must be
1463 published in the root XRID (or other equivalent description document) and verified independently.
1464 The AuthorityID for an XRI Authority other than the community root is furnished by the
1465 `xrid:XRIDDescriptor/xrid:Authority/xrid:AuthorityID` element in the XRI
1466 Descriptor that describes the authority.

1467 3.3.3 Client Behavior

1468 From a client's perspective, trusted resolution is identical to the generic resolution protocol
1469 described in section 2 of this document with the addition of the following REQUIRED behavior:

- 1470 • The client MUST indicate to the resolving server that a signed XRI Descriptor is desired.
1471 This is accomplished by adding an HTTP Accept header with the media type identifier
1472 "application/xrid-t-saml+xml". Clients willing to accept either trusted or untrusted
1473 resolution descriptors may use a combination of "application/xrid-t-saml+xml" and
1474 "application/xrid+xml" in the Accept header as described in section 14.1 of
1475 **[RFC2616]**. Media type identifiers SHOULD be ordered according to the client's preference
1476 for the media type of the response.
- 1477 • The client SHOULD NOT request trusted resolution from an authority unless the
1478 corresponding `xrid:Descriptor/xrid:Authority/xrid:URI` element has a "trusted"
1479 attribute with the value of "true" or "1".
- 1480 • Each XRI Descriptor in a resolution chain MUST be individually validated using the rules
1481 described in this section. When `xrid:XRIDDescriptor` elements may come both from
1482 freshly-retrieved XRID documents and from a local cache, an implementation MUST ensure
1483 that these requirements are satisfied each time a resolution request is performed.

1484 The client MUST confirm that each `xrid:XRIDDescriptor` element contains a
1485 `saml:Assertion` element as an immediate child, and that this assertion is valid per the
1486 processing rules described by **[SAML]**. In addition, the following requirements MUST be met:

- 1487 • The `saml:Assertion` must contain a valid enveloped digital signature as defined by
1488 **[XMLDSig]** and constrained by Section 5.4 of **[SAML]**.
- 1489 • The signature must apply to the `xrid:XRIDDescriptor` element that contains the
1490 signed SAML assertion. Specifically, the signature must contain a single
1491 `ds:SignedInfo/ds:Reference` element, and the `URI` attribute of this reference must
1492 refer to the `id` (`xrid:id` attribute) of the `xrid:XRIDDescriptor` element that is the
1493 immediate parent of the signed SAML assertion.
- 1494 • If the digital signature enveloped by the SAML assertion contains a `ds:KeyInfo`
1495 element, the client MAY reject the signature if this key does not match the signer's expected
1496 key, as specified by the `ds:KeyInfo` element present in the XRI Descriptor that was used to
1497 describe the current authority. For example, if Authority A provides an XRI Descriptor
1498 describing Authority B, and this XRID has an
1499 `xrid:XRIDDescriptor/xrid:Authority/ds:KeyInfo` element that describes the key
1500 used to validate descriptors produced by Authority B, this key is Authority B's "expected key"
1501 and should be used when validating XRI Descriptor elements produced by Authority B. For a
1502 community root authority, the expected key is known *a priori* as part of the configuration in
1503 the client for that particular community root.
- 1504 • The client confirms that the value of the `xrid:XRIDDescriptor/xrid:Resolved`
1505 element matches the sub-segment whose resolution resulted in the current XRI Descriptor.
- 1506 • The client confirms that the value of the `xrid:XRIDDescriptor/xrid:AuthorityID`
1507 element matches the XRI Authority's "expected AuthorityID". As with the key information, the
1508 "expected AuthorityID" is the value of
1509 `xrid:XRIDDescriptor/xrid:Authority/xrid:AuthorityID` in the XRI Descriptor
1510 that describes the current Authority. As before, for a community root authority, the XRI

1511 Authority's expected AuthorityID is known *a priori* and is part of the configuration in the client
1512 for that particular community root.

1513 • The client confirms that the value of the `xrid:XRIDescriptor/xrid:AuthorityID`
1514 element matches the value of the `NameQualifier` attribute of the
1515 `xrid:XRIDescriptor/saml:Assertion/saml:Subject/saml:NameID` element.

1516 • The client confirms that the value of the `xrid:XRIDescriptor/xrid:Resolved` element
1517 matches the value of the `xrid:XRIDescriptor/saml:Assertion/saml:Subject/saml:NameID`
1518 element.

1519 • The client confirms that the value of the
1520 `xrid:XRIDescriptor/xrid:TrustMechanism` is "`xri://$res*trusted/XRITrusted`".

1521 • The client confirms the existence of exactly one
1522 `xrid:XRIDescriptor/saml:Assertion/saml:AttributeStatment` with exactly one
1523 `saml:Attribute` element that has a `Name` attribute of "`xri://$res*schema/XRIDescriptor`".
1524 This `saml:Attribute` element must have exactly one `saml:AttributeValue` element
1525 whose text value is a URI reference to the `xrid:id` attribute of the `xrid:XRIDescriptor`
1526 element that is the immediate parent of the signed SAML assertion.

1527 If any of the above requirements are not met for an XRI Descriptor in the resolution chain, the
1528 result MUST NOT be considered a valid trusted resolution response as defined by this document.
1529 Note that this does not preclude a client from considering alternative resolution paths. For
1530 example, if two URIs are listed under an `xrid:Authority` element and the response from one
1531 fails to meet the requirements above, the client may repeat the validation process using the
1532 second URI. If the second URI passes the tests, it may be considered a trusted resolution
1533 response as defined by this document and trusted resolution may continue.

1534 3.3.4 Server Behavior

1535 From the server's perspective, trusted resolution is identical to the generic resolution protocol
1536 described in section 2 of this document with the addition of the following behavior. This behavior
1537 is REQUIRED if a resolution client requests trusted resolution as described in section 3.2 and the
1538 server intends to honor the client's request.

1539 If, during the HTTP(S) request/response interaction, the server agrees to return a trusted
1540 resolution response (indicated by the content type of "`application/xrid-t-saml+xml`"), the
1541 XRI Descriptor returned by the server must contain a `saml:Assertion` element as an
1542 immediate child of `xrid:XRIDescriptor` that is valid per the processing rules described by
1543 **[SAML]**. In addition, the following requirements MUST be met:

1544 • The SAML Assertion MUST contain a valid enveloped digital signature as defined by
1545 **[XMLDSig]** and as constrained by section 5.4 of **[SAML]**.

1546 • The signature MUST apply to the `xrid:XRIDescriptor` element that contains the
1547 signed SAML assertion. Specifically, the signature must contain a single
1548 `ds:SignedInfo/ds:Reference` element, and the URI attribute of this reference MUST
1549 refer to the `xrid:XRIDescriptor` element that is the immediate parent of the signed SAML
1550 assertion. The URI reference MUST NOT be empty; it MUST refer to the identifier contained
1551 in the `xrid:id` attribute of the `xrid:XRIDescriptor` element.

1552 • The digital signature enveloped by the SAML assertion is allowed to contain a
1553 `ds:KeyInfo` element. If it is included, it MUST describe the key used to verify the digital
1554 signature element. Because the signing key is known in advance by the resolution client, the
1555 `ds:KeyInfo` element SHOULD be omitted from the digital signature. Because the client is
1556 required to verify the digital signature using the key obtained from the `xrid:Authority`
1557 element describing the current authority, it is important that the server sign such that the
1558 signature can be verified using the `ds:KeyInfo` element registered in the XRI Descriptor(s)
1559 that describes this authority.

- 1560 • The `xrid:Resolved` element MUST be present, and the value of this field MUST match
1561 the XRI Authority sub-segment requested by the client.
 - 1562 • The `xrid:XRIDescriptor` element MUST have an `xrid:AuthorityID` element as
1563 an immediate child. The value of the `xrid:AuthorityID` element MUST be the Authority
1564 ID, as described in Section 3.2, of the responding XRI Authority.
 - 1565 • The `xrid:XRIDescriptor/xrid:TrustMechanism` MUST be present and the value
1566 MUST be “`xri://$res*trusted/XRITrusted`”.
 - 1567 • The `xrid:XRIDescriptor/saml:Subject/saml:NameID` element MUST be
1568 present and equal to the `xrid:XRIDescriptor/xrid:Resolved` element.
 - 1569 • The `NameQualifier` attribute of the
1570 `xrid:XRIDescriptor/saml:Assertion/saml:Subject/saml:NameID` element
1571 MUST be present and equal to the `xrid:XRIDescriptor/xrid:AuthorityID` element.
 - 1572 • There MUST be exactly one `saml:AttributeStatement` present in the
1573 `xrid:XRIDescriptor/saml:Assertion` element. It MUST contain exactly one
1574 `saml:Attribute` element with a `Name` attribute of “`xri://$res*schema/XRIDescriptor`”. This
1575 `saml:Attribute` element MUST contain exactly one `saml:AttributeValue` element
1576 whose text value is a URI reference to the `xrid:id` attribute of the `xrid:XRIDescriptor`
1577 that is an immediate parent of the `saml:Assertion` element.
- 1578 If a resolving client requests trusted resolution *and* lookahead resolution, the responding authority
1579 SHOULD attempt to perform trusted resolution on behalf of the client as described in section 3.
1580 However, the server providing lookahead resolution MUST NOT return untrusted XRIDs if the
1581 client requests trusted resolution. If the server cannot obtain trusted XRIDs for the additional
1582 lookahead sub-segments, it SHOULD return only the trusted XRIDs it has obtained and allow the
1583 client to continue.

1584 3.3.5 Additional Requirements of Authorities Offering Trusted 1585 Resolution

- 1586 The `xrid:XRIDescriptor/xrid:Authority` element that describes an authority
1587 participating in trusted resolution as defined by this specification (“the described XRI Authority”)
1588 has the following requirements:
- 1589 • The `trusted` attribute of the `xrid:XRIDescriptor/xrid:Authority/xrid:URI`
1590 element MUST contain the value “1” or “true”.
 - 1591 • The `xrid:XRIDescriptor/xrid:Authority` element MUST contain a `ds:KeyInfo`
1592 element as an immediate child. The value of this element MUST be the key that validates
1593 digital signatures created by the described XRI Authority.
 - 1594 • The `xrid:XRIDescriptor/xrid:Authority` element MUST contain an
1595 `xrid:AuthorityID` element as an immediate child. The value of this field MUST be the
1596 AuthorityID of the described XRI Authority, i.e. the value that will appear in the
1597 `xrid:Descriptor/xrid:AuthorityID` element of an XRI Descriptor returned from the
1598 described XRI Authority.
 - 1599 • In addition, an identifier community SHOULD publish an XRI Descriptor for the
1600 community root that meets the requirements listed above and it SHOULD make that XRI
1601 Descriptor easily available to relevant parties.

1602

4 Extensibility and Versioning

1603

4.1 Extensibility

1604

XRI Descriptors use an an open-content schema because they are designed to be extended with other metadata. In a number of places, extension elements and attributes from namespaces other than “xri://\$res*schema/XRIDescriptor*(\$v%2F2.0)” are explicitly allowed. These extension points are designed to simplify default processing of XRI Descriptors using a “Must Ignore” rule. The base rule is that unrecognized elements and attributes, and the content and child elements of unrecognized elements, MUST be ignored. As a consequence, elements that would normally be recognized by a processor MUST be ignored if they appear as descendants of an unrecognized element.

1612

Extension elements MUST NOT require new interpretation of elements defined in this document. That is, if an extension element is present, a processor must be able to ignore it and still correctly process the Descriptor document.

1613

1614

1615

Extension specifications MAY simulate “Must Understand” behavior by applying an “enclosure” pattern. Elements defined by the XRI Descriptor schema whose meaning or interpretation are to be modified by extension elements can be wrapped in a extension container element that is defined by the extension specification. This extension container element SHOULD be in the same namespace as the extension elements that must be understood by the consumer of the XRI Descriptor. All elements whose interpretations are modified by the extension will now be contained in an element (the extension container element) that will be ignored by consumers unable to process the extension.

1623

The following example illustrates this pattern using an extension container element from an extension namespace (“other:SuperAuthority”) that contains an extension element (“other:ExtensionElement”):

1624

1625

1626

```
<XRIDescriptor>
  <other:SuperAuthority>
    <Authority>
      ...
      <other:ExtensionElement>...</other:ExtensionElement>
    </Authority>
  </other:SuperAuthority>
</Service>
...
</Service>
</XRIDescriptors>
```

1627

1628

1629

1630

1631

1632

1633

1634

1635

1636

1637

In this example, the other:ExtensionElement modifies the interpretation or processing rules for the parent xrid:Authority element and therefore must be understood by the consumer for the proper interpretation of the parent xrid:Authority element. To preserve the correct interpretation of the xrid:Authority element in this context, the xrid:Authority element is “wrapped” so only consumers that understand elements in the other:SuperAuthority namespace will attempt to process the xrid:Authority element.

1638

1639

1640

1641

1642

1643

4.1.1 Specific Points of Extensibility

1644

The use of HTTP and XML in the design of the generic resolution service, the trusted resolution service, and the X2R local access service provide the following specific points of extensibility:

1645

1646

- Specification of new authority resolution service types (xrid:Authority/xrid:Type in the XRI Descriptor).

1647

- 1648 • Specification of new local access service types (`xrid:Service/xrid:Type` in the XRI
1649 Descriptor).
- 1650 • Specification of new trust mechanisms (`xrid:TrustMechanism` in the XRI Descriptor).
1651 For example, an existing secure private network in which resolution is intrinsically trustworthy
1652 may wish to express its own trust mechanism explicitly.
- 1653 • HTTP negotiation of content types, language, encoding, etc.
- 1654 • Use of HTTP verbs such as POST, PUT and DELETE during local access.
- 1655 • Use of HTTP redirects (3XX) or other response codes defined by [RFC2616] during
1656 identifier authority resolution or X2R local access.
- 1657 • Use of cross-references within XRIs, particularly for associating new types of metadata
1658 with a resource.

1659 4.2 Versioning

1660 Versioning of the XRI specification set is expected to be occur infrequently. Experience, however,
1661 demonstrates that such versioning is eventually inevitable. For this reason, this section describes
1662 versioning guidelines.

1663 When version information is expressed as both a Major and Minor version, it is expressed in the
1664 form *Major.Minor*. The version number *Major_B.Minor_B* is higher than the version number
1665 *Major_A.Minor_A* if and only if:

1666 $Major_B > Major_A \text{ OR } ((Major_B = Major_A) \text{ AND } Minor_B > Minor_A)$

1667 4.2.1 Versioning of the XRI Resolution Specification

1668 New releases of the XRI Resolution specification may specify changes to the resolution protocol
1669 and/or to resolution data structures. When changes affect either of these, the resolution
1670 specification version number will be changed. Where changes are purely editorial, the version
1671 number will not be changed.

1672 In general, if a change is backward-compatible, the new version will be identified using the
1673 current major version number and a new minor version number. If the change is not backward-
1674 compatible, the new version will be identified with a new major version number.

1675 4.2.2 Versioning of XRI Descriptor Elements

1676 Both the `xrid:XRIDescriptors` element and the `xrid:XRIDescriptor` element have
1677 Version attributes. The value of these attributes MUST be the version value of the specification to
1678 which their containing elements conform.

1679 When new versions of the XRI Resolution specification are released, the namespace for the XRI
1680 Descriptor schema may or may not be changed. If there is a major version number change, the
1681 namespace for the `xrid:XRIDescriptors` document is likely to change. If there is only a minor
1682 version number change, the namespace for the `xrid:XRIDescriptors` document may remain
1683 unchanged.

1684 In general, maintaining namespace stability and adding to or changing the content of a schema
1685 are competing goals. While certain design strategies can facilitate such changes, it is difficult to
1686 predict how existing implementations will react to any given change, making forward compatibility
1687 difficult to achieve. Nevertheless, the right to make such changes in minor revisions is reserved.
1688 Except in special circumstances (for example, to correct major deficiencies or to fix errors),
1689 implementations should expect forward-compatible schema changes in minor revisions, allowing
1690 new messages to validate against older schemas.

1691 Implementations SHOULD expect, and be prepared to deal with, new extensions and message
1692 types in accordance with the processing rules laid out for those types. Minor revisions may

1693 introduce new types that leverage the extension facilities described in Section 4.1. Older
1694 implementations SHOULD reject such extensions gracefully when they are encountered in
1695 contexts with specific semantic requirements.

1696 **4.2.3 Versioning of Protocols**

1697 Both the authority resolution and local access protocols defined in this document may also be
1698 versioned by future releases of the XRI Resolution specification. If these protocols are not
1699 backward-compatible with older implementations, they will likely get a new XRI for use in
1700 identifying them in XRI Descriptors.

1701 Note that it is possible for version negotiation to happen in the protocol itself. For example, HTTP
1702 provides a mechanism to negotiate the version of the HTTP protocol being used. If and when an
1703 authority resolution or local access protocol provides its own version-negotiation mechanism, the
1704 specification is likely to continue to use the same XRI to identify the protocol as was used in
1705 previous versions of the XRI Resolution specification.

1706 **5 Security and Data Protection**

1707 Significant portions of this specification deal directly with security issues, and these will not be
1708 summarized again here. In addition, basic security practices and typical risks in resolution
1709 protocols are well-documented in many other specifications. Only security considerations directly
1710 relevant to XRI resolution are included here.

1711 **5.1 DNS Spoofing**

1712 As the specified resolution mechanism is dependent on DNS, the accuracy of the XRI resolution
1713 response is dependent on the accuracy of the original DNS query. When trustable, unambiguous
1714 and authoritative responses are required, trusted resolution as defined by this specification is
1715 recommended. With trusted resolution as defined by this specification, resolution results can be
1716 evaluated independently of DNS resolution results. While this does not solve the problem of DNS
1717 spoofing, it does allow the client to detect an error condition and reject the resolution result as
1718 untrustworthy. For environments that require higher confidence in the result of DNS resolution,
1719 DNSSEC [DNSSEC] is recommended as a supplement to trusted resolution as defined by this
1720 specification.

1721 **5.2 HTTP Security**

1722 Many of the security considerations set forth in HTTP/1.1 [RFC2616] apply to XRI Resolution
1723 protocols defined here. In particular, confidentiality of the communication channel is not
1724 guaranteed by HTTP. Server-authenticated HTTPS should be considered in cases where
1725 confidentiality of resolution requests and responses is desired.

1726 Special consideration should be given to proxy and caching behaviors to ensure accurate and
1727 reliable responses from resolution requests. For various reasons, network topologies increasingly
1728 have transparent proxies, some of which may insert VIA and other headers as a consequence, or
1729 may even cache content without regard to caching policies set by a resource's HTTP authority.

1730 Implementations of XRI Proxies and caching authorities should also take special note of the
1731 security recommendations in HTTP/1.1 [RFC2616] section 15.7

1732 **5.3 Caching Authorities**

1733 In addition to traditional HTTP caching proxies, XRI resolution authority proxies may be a part of
1734 the resolution topology. Such proxies should take special precautions against cache poisoning,
1735 as these caching entities may represent trust decision points within a deployment's resolution
1736 architecture.

1737 **5.4 Lookahead and Proxy Resolution**

1738 During proxy resolution, some or all of the XRI Authority is provided to the proxy resolver. During
1739 lookahead resolution, sub-segments of the XRI Authority for which the resolving network endpoint
1740 is not authoritative may be revealed to that endpoint.

1741 In both cases, privacy considerations should be evaluated before disclosing such information.

1742 **5.5 SAML Considerations**

1743 Trusted resolution must adhere to the rules defined by the SAML 2.0 Core Specification.
1744 Particularly noteworthy are the XML Transform restrictions on XML Signature defined in SAML
1745 and the enforcement of the SAML Conditions element regarding the validity period.

1746 **5.6 Community Root Authorities**

1747 The XRI Authority information for a community root needs to be well-known to the clients that
1748 request resolution within that community. For trusted resolution, this includes the URIs, the
1749 `AuthorityID`, and the `ds:KeyInfo` information. An acceptable means of providing this
1750 information is for the community root authority to produce a self-signed XRI Descriptor and
1751 publish it to a server-authenticated HTTPS endpoint. Special care should be taken to ensure the
1752 correctness of such an XRID; if this information is incorrect, an attacker may be able to convince
1753 a client of an incorrect result during trusted resolution.

1754 **5.7 Denial-Of-Service Attacks**

1755 XRI Resolution, including trusted resolution, is vulnerable to denial-of-service (DOS) attacks
1756 typical of systems relying on DNS and HTTP.

1757 **5.8 Limitations of Trusted Resolution**

1758 While the trusted resolution mechanism specified in this document provides a way to verify the
1759 integrity of a successful XRI resolution, it does not provide a way to verify the integrity of a
1760 resolution failure. Reasons for this limitation include the prevalence of non-malicious network
1761 failures, the existence of denial-of-service attacks, and the ability of a man-in-the-middle attacker
1762 to modify HTTP responses when resolution is not performed over HTTPS.

1763 Additionally, there is no revocation mechanism for the keys used in trusted resolution. Therefore,
1764 a signed resolution's validity period should be limited appropriately to mitigate the risk of an
1765 incorrect or invalid resolution.

1766

6 References

1767

6.1 Normative

- 1768 [DNSSEC] D. Eastlake, *Domain Name System Security Extensions*,
1769 <http://www.ietf.org/rfc/rfc2535>, RFC 2535, March 1999.
- 1770 [RFC2046] N. Borenstein, N. Freed, *Multipurpose Internet Mail Extensions (MIME)*
1771 *Part Two: Media Types*, <http://www.ietf.org/rfc/rfc2046.txt>, RFC 2046,
1772 November 1996.
- 1773 [RFC2119] S. Bradner, *Key words for use in RFCs to Indicate Requirement Levels*,
1774 <http://www.ietf.org/rfc/rfc2119.txt>, RFC 2119, March 1997.
- 1775 [RFC2141] R. Moats, *URN Syntax*, <http://www.ietf.org/rfc/rfc2141.txt>, IETF RFC
1776 2141, May 1997.
- 1777 [RFC2483] M. Mealling, R. Daniel Jr., *URI Resolution Services Necessary for URN*
1778 *Resolution*, <http://www.ietf.org/rfc/rfc2483.txt>, RFC 2483, January 1999.
- 1779 [RFC2616] R. Fielding, J. Gettys, J. Mogul, H. Frystyk, L. Masinter, P. Leach, T.
1780 Berners-Lee, *Hypertext Transfer Protocol -- HTTP/1.1*,
1781 <http://www.ietf.org/rfc/rfc2616.txt>, RFC 2616, June 1999.
- 1782 [SAML] S. Cantor, J. Kemp, R. Philpott, E. Maler, *Assertions and Protocols for the*
1783 *OASIS Security Assertion Markup Language (SAML) V2.0*,
1784 <http://www.oasis-open.org/committees/security>, March 2005.
- 1785 [XMLDSig] D. Eastlake, J. Reagle, D. Solo et al., *XML-Signature Syntax and*
1786 *Processing*, World Wide Web Consortium, [http://www.w3.org/TR/xmlldsig-](http://www.w3.org/TR/xmlldsig-core/)
1787 [core/](http://www.w3.org/TR/xmlldsig-core/), February 12, 2002.
- 1788 [XRIMetadata] D. Reed, *Extensible Resource Identifier (XRI) Metadata V2.0*,
1789 <http://docs.oasis-open.org/xri/xri/V2.0/xri-metadata-V2.0-cd-01.pdf>,
1790 March 2005.
- 1791 [XRISyntax] D. Reed, D. McAlpin, *Extensible Resource Identifier (XRI) Syntax V2.0*,
1792 <http://docs.oasis-open.org/xri/xri/V2.0/xri-syntax-V2.0-cd-01.pdf>, March
1793 2005.

1794

6.2 Informative

- 1795 [REST] <http://internet.conveyor.com/RESTwiki/moin.cgi/FrontPage>
- 1796 [XRIntro] D. Reed, D. McAlpin, *Introduction to XRIs*, [http://docs.oasis-](http://docs.oasis-open.org/xri/xri/V2.0/xri-intro-V2.0.pdf)
1797 [open.org/xri/xri/V2.0/xri-intro-V2.0.pdf](http://docs.oasis-open.org/xri/xri/V2.0/xri-intro-V2.0.pdf), Work-In-Progress, March 2005.
- 1798 [XRIReqs] G. Wachob, D. Reed, M. Le Maitre, D. McAlpin, D. McPherson,
1799 *Extensible Resource Identifier (XRI) Requirements and Glossary v1.0*,
1800 [http://www.oasis-](http://www.oasis-open.org/apps/org/workgroup/xri/download.php/2523/xri-requirements-and-glossary-v1.0.doc)
1801 [open.org/apps/org/workgroup/xri/download.php/2523/xri-requirements-](http://www.oasis-open.org/apps/org/workgroup/xri/download.php/2523/xri-requirements-and-glossary-v1.0.doc)
1802 [and-glossary-v1.0.doc](http://www.oasis-open.org/apps/org/workgroup/xri/download.php/2523/xri-requirements-and-glossary-v1.0.doc), June 2003.

1803

Appendix A. XML Schema for XRI Descriptor (Normative)

1804

```

1805 <?xml version="1.0" encoding="UTF-8"?>
1806 <xs:schema targetNamespace="xri://$res*schema/XRIDescriptor*($v%2F2.0)"
1807 xmlns:xs="http://www.w3.org/2001/XMLSchema"
1808 xmlns:xrid="xri://$res*schema/XRIDescriptor*($v%2F2.0)" elementFormDefault="qualified">
1809   <!-- Utility patterns -->
1810   <xs:attributeGroup name="otherattribute">
1811     <xs:anyAttribute namespace="##other" processContents="lax"/>
1812   </xs:attributeGroup>
1813   <xs:group name="otherelement">
1814     <xs:choice>
1815       <xs:any namespace="##other" processContents="lax"/>
1816       <xs:any namespace="##local" processContents="lax"/>
1817     </xs:choice>
1818   </xs:group>
1819   <xs:complexType name="URIPattern">
1820     <xs:simpleContent>
1821       <xs:extension base="xs:anyURI">
1822         <xs:attributeGroup ref="xrid:otherattribute"/>
1823       </xs:extension>
1824     </xs:simpleContent>
1825   </xs:complexType>
1826   <xs:complexType name="Stringpattern">
1827     <xs:simpleContent>
1828       <xs:extension base="xs:string">
1829         <xs:attributeGroup ref="xrid:otherattribute"/>
1830       </xs:extension>
1831     </xs:simpleContent>
1832   </xs:complexType>
1833   <!-- Patterns for elements -->
1834   <xs:element name="XRIDescriptors">
1835     <xs:complexType>
1836       <xs:sequence>
1837         <xs:element ref="xrid:XRIDescriptor"
1838           maxOccurs="unbounded"/>
1839         <xs:group ref="xrid:otherelement" minOccurs="0"
1840           maxOccurs="unbounded"/>
1841       </xs:sequence>
1842       <xs:attributeGroup ref="xrid:otherattribute"/>
1843       <xs:attribute ref="xrid:version"/>
1844     </xs:complexType>
1845   </xs:element>
1846   <xs:element name="XRIDescriptor">
1847     <xs:complexType>
1848       <xs:sequence>
1849         <xs:element ref="xrid:Resolved" />
1850         <xs:element ref="xrid:AuthorityID" />
1851         <xs:element ref="xrid:Expires" minOccurs="0"/>
1852         <xs:element ref="xrid:Authority" minOccurs="0"
1853           maxOccurs="unbounded"/>
1854         <xs:element ref="xrid:Service" minOccurs="0"
1855           maxOccurs="unbounded"/>
1856         <xs:element ref="xrid:Synonyms" minOccurs="0"/>
1857         <xs:element ref="xrid:TrustMechanism" minOccurs="0"/>
1858         <xs:group ref="xrid:otherelement" minOccurs="0"
1859           maxOccurs="unbounded"/>
1860       </xs:sequence>
1861       <xs:attribute ref="xrid:id"/>
1862       <xs:attributeGroup ref="xrid:otherattribute"/>
1863       <xs:attribute ref="xrid:version"/>
1864     </xs:complexType>
1865   </xs:element>
1866   <xs:element name="Resolved" type="xrid:Stringpattern"/>
1867   <xs:element name="Expires">

```

```

1868         <xs:complexType>
1869             <xs:simpleContent>
1870                 <xs:extension base="xs:dateTime">
1871                     <xs:attributeGroup ref="xrid:otherattribute"/>
1872                 </xs:extension>
1873             </xs:simpleContent>
1874         </xs:complexType>
1875     </xs:element>
1876     <xs:element name="Authority">
1877         <xs:complexType>
1878             <xs:sequence>
1879                 <xs:element ref="xrid:AuthorityID" minOccurs="0"/>
1880                 <xs:element ref="xrid:Type" minOccurs="0"/>
1881                 <xs:group ref="xrid:TrustableURI" maxOccurs="unbounded"/>
1882                 <xs:group ref="xrid:otherelement" minOccurs="0"
1883 maxOccurs="unbounded"/>
1884             </xs:sequence>
1885             <xs:attributeGroup ref="xrid:otherattribute"/>
1886         </xs:complexType>
1887     </xs:element>
1888     <xs:element name="AuthorityID" type="xrid:URIpattern"/>
1889     <xs:element name="Type" type="xrid:URIpattern"/>
1890     <xs:group name="TrustableURI">
1891         <xs:sequence>
1892             <xs:element name="URI">
1893                 <xs:complexType>
1894                     <xs:simpleContent>
1895                         <xs:extension base="xrid:URIpattern">
1896                             <xs:attribute ref="xrid:trusted"/>
1897                         </xs:extension>
1898                     </xs:simpleContent>
1899                 </xs:complexType>
1900             </xs:element>
1901         </xs:sequence>
1902     </xs:group>
1903     <xs:element name="Service">
1904         <xs:complexType>
1905             <xs:sequence>
1906                 <xs:element ref="xrid:Type" minOccurs="0"/>
1907                 <xs:group ref="xrid:URI" maxOccurs="unbounded"/>
1908                 <xs:element ref="xrid:MediaType" minOccurs="0"
1909 maxOccurs="unbounded"/>
1910                 <xs:group ref="xrid:otherelement" minOccurs="0"
1911 maxOccurs="unbounded"/>
1912             </xs:sequence>
1913             <xs:attributeGroup ref="xrid:otherattribute"/>
1914         </xs:complexType>
1915     </xs:element>
1916     <xs:group name="URI">
1917         <xs:sequence>
1918             <xs:element name="URI" type="xrid:URIpattern"/>
1919         </xs:sequence>
1920     </xs:group>
1921     <xs:element name="MediaType" type="xrid:Stringpattern"/>
1922     <xs:element name="Synonyms">
1923         <xs:complexType>
1924             <xs:sequence>
1925                 <xs:choice minOccurs="0" maxOccurs="unbounded">
1926                     <xs:element ref="xrid:Internal"/>
1927                     <xs:element ref="xrid:External"/>
1928                 </xs:choice>
1929                 <xs:group ref="xrid:otherelement" minOccurs="0"
1930 maxOccurs="unbounded"/>
1931             </xs:sequence>
1932             <xs:attributeGroup ref="xrid:otherattribute"/>
1933         </xs:complexType>
1934     </xs:element>
1935     <xs:element name="Internal" type="xrid:URIpattern"/>
1936     <xs:element name="External" type="xrid:URIpattern"/>
1937     <xs:element name="TrustMechanism" type="xrid:URIpattern"/>
1938     <xs:attribute name="version" type="xs:string" fixed="2.0"/>

```



```
1939         <xs:attribute name="trusted" type="xs:boolean"/>
1940         <xs:attribute name="id" type="xs:ID"/>
1941 </xs:schema>
```

1942

Appendix B. RelaxNG Compact Syntax Schema for XRI Descriptor (Non-normative)

1943

```
1944 namespace xrid="xri://$res*schema/XRIDescriptor*($v%2F2.0)"
1945 namespace xml="http://www.w3.org/XML/1998/namespace"
1946 namespace local=""
1947
1948
1949 start=XRIDescriptors
1950
1951 # Utility patterns
1952 anything = ( element * {anything} | attribute * {text} | text ) *
1953 otherattribute = attribute *-(xrid:*|local:*) {text}
1954 otherelement = element *-xrid:* {anything}
1955 URIPattern = (xsd:anyURI, otherattribute *)
1956 Stringpattern = (xsd:string, otherattribute *)
1957 versionattribute = attribute xrid:version {text}
1958 idattribute = attribute xrid:id {xsd:ID}
1959
1960 #####
1961 # XRIDescriptors Container
1962 XRIDescriptors = element xrid:XRIDescriptors {
1963     versionattribute,
1964     XRIDescriptor+,
1965     XRIDescriptors-ex-elem,
1966     XRIDescriptors-ex-attr
1967 }
1968
1969 # XRIDescriptors Extension
1970 XRIDescriptors-ex-elem = otherelement *
1971 XRIDescriptors-ex-attr = otherattribute *
1972
1973 #####
1974 # XRIDescriptor Definition
1975 XRIDescriptor = element xrid:XRIDescriptor {
1976     attribute xrid:id {xsd:ID}?,
1977     versionattribute,
1978     Resolved,
1979     AuthorityID,
1980     Expires ?,
1981     Authority *,
1982     Service *,
1983     Synonyms ?,
1984     TrustMechanism ?,
1985     XRIDescriptor-ex-elem,
1986     XRIDescriptor-ex-attr
1987 }
1988
1989 # XRIDescriptor Extension
1990 XRIDescriptor-ex-elem = otherelement *
1991 XRIDescriptor-ex-attr = otherattribute *
1992
1993 #####
1994 # Resolved Definition
1995 Resolved = element xrid:Resolved { Resolved-content }
1996
1997 # Resolved Extension
1998 Resolved-content = Stringpattern
1999
2000 #####
2001 # Expires Definition
2002 Expires = element xrid:Expires {
2003     xsd:dateTime,
2004     Expires-ex-attr
2005 }
2006
```

```

2007 # Expires Extension
2008 Expires-ex-attr = otherattribute *
2009
2010 #####
2011 # Authority Definition
2012 Authority = element xrid:Authority {
2013     AuthorityID?,
2014     Type?,
2015     TrustableURI+,
2016     Authority-ex-attr,
2017     Authority-ex-elem
2018 }
2019
2020 # Authority Extension
2021 Authority-ex-attr = otherattribute *
2022 Authority-ex-elem = otherelement *
2023
2024 #####
2025 # AuthorityID Definition
2026 AuthorityID = element xrid:AuthorityID { AuthorityID-content }
2027
2028 # AuthorityID extension
2029 AuthorityID-content = URIpattern
2030
2031 #####
2032 # Type Definition
2033 Type = element xrid:Type { Type-content }
2034
2035 # Type Extension
2036 Type-content = URIpattern
2037
2038 #####
2039 # Trustable URI Definition
2040 TrustableURI = element xrid:URI { TrustableURI-content }
2041
2042 TrustableURI-content = (
2043     URIpattern,
2044     attribute xrid:trusted {xsd:boolean}?
2045 )
2046
2047 #####
2048 # Service Definition
2049 Service = element xrid:Service {
2050     Type?,
2051     URI+,
2052     MediaType *,
2053     Service-ex-attr,
2054     Service-ex-elem
2055 }
2056 # Service Extension
2057 Service-ex-attr = otherattribute *
2058 Service-ex-elem = otherelement *
2059
2060 #####
2061 # URI Definition (for Service element)
2062 URI = element xrid:URI { URI-content }
2063
2064 # URI Extension
2065 URI-content = URIpattern
2066
2067 #####
2068 # MediaType Definition
2069 MediaType = element xrid:MediaType { MediaType-content }
2070
2071 # MediaType Extension
2072 MediaType-content = URIpattern
2073
2074 #####
2075 # Synonyms Definition
2076 Synonyms = element xrid:Synonyms {
2077     (

```

```

2078         Internal &
2079         External
2080     )+,
2081     Synonyms-ex-attr,
2082     Synonyms-ex-elem
2083 }
2084
2085 Synonyms-ex-attr = otherattribute *
2086 Synonyms-ex-elem = otherelement *
2087
2088 #####
2089 # Internal Definition
2090 Internal = element xrid:Internal { Internal-content }
2091
2092 # Internal Extension
2093 Internal-content = URIpattern
2094
2095 #####
2096 # External Definition
2097 External = element xrid:External { External-content }
2098
2099 # External Extension
2100 External-content = URIpattern
2101
2102 #####
2103 # TrustMechanism Definition
2104
2105 TrustMechanism = element xrid:TrustMechanism { TrustMechanism-content }
2106
2107 # TrustMechanism Extension
2108 TrustMechanism-content = URIpattern

```

Appendix C. Acknowledgments

2110 The editors would like to acknowledge the contributions of the OASIS XRI Technical Committee,
2111 whose voting members at the time of publication were:

- 2112 • Geoffrey Strongin, Advanced Micro Devices
- 2113 • Ajay Madhok, AmSoft Systems
- 2114 • Jean-Jacques Dubray, Attachmate
- 2115 • William Barnhill, Booz Allen and Hamilton
- 2116 • Drummond Reed, Cordance Corporation
- 2117 • Marc Le Maitre, Cordance Corporation
- 2118 • Dave McAlpin, Epok
- 2119 • Loren West, Epok
- 2120 • Peter Davis, NeuStar
- 2121 • Masaki Nishitani, Nomura Research
- 2122 • Nat Sakimura, Nomura Research
- 2123 • Tetsu Watanabe, Nomura Research
- 2124 • Owen Davis, PlaNetwork
- 2125 • Victor Grey, PlaNetwork
- 2126 • Fen Labalme, PlaNetwork
- 2127 • Mike Lindelsee, Visa International
- 2128 • Gabriel Wachob, Visa International
- 2129 • Dave Wentker, Visa International
- 2130 • Bill Washburn, XDI.ORG

2131 The editors also would like to acknowledge the following people for their contributions to previous
2132 versions of the OASIS XRI specifications (affiliations listed for OASIS members):

2133 Thomas Bikeev, EAN International; Krishna Sankar, Cisco; Winston Bumpus, Dell; Joseph
2134 Moeller, EDS; Steve Green, Epok; Lance Hood, Epok; Adarbad Master, Epok; Davis McPherson,
2135 Epok; Chetan Sabnis, Epok; Phillipe LeBlanc, GemPlus; Jim Schreckengast, Gemplus; Xavier
2136 Serret, Gemplus; John McGarvey, IBM; Reva Modi, Infosys; Krishnan Rajagopalan, Novell;
2137 Tomonori Seki, NRI; James Bryce Clark, OASIS; Marc Stephenson, TSO; Mike Mealling,
2138 Verisign; Rajeev Maria, Visa International; Terence Spielman, Visa International; John Veizades,
2139 Visa International; Lark Allen, Wave Systems; Michael Willett, Wave Systems; Matthew Dovey;
2140 Eamonn Neylon; Mary Nishikawa; Lars Marius Garshol; Norman Paskin; Bernard Vatant.

- 2141 • A special acknowledgement to Jerry Kindall (Epok) for a full editorial review.

2142

Appendix D. Notices

2143 OASIS takes no position regarding the validity or scope of any intellectual property or other rights
2144 that might be claimed to pertain to the implementation or use of the technology described in this
2145 document or the extent to which any license under such rights might or might not be available;
2146 neither does it represent that it has made any effort to identify any such rights.

2147 Information on OASIS's procedures with respect to rights in OASIS specifications can be found at
2148 the OASIS website. Copies of claims of rights made available for publication and any assurances
2149 of licenses to be made available, or the result of an attempt made to obtain a general license or
2150 permission for the use of such proprietary rights by implementors or users of this specification,
2151 can be obtained from the OASIS President.

2152 OASIS invites any interested party to bring to its attention any copyrights, patents or patent
2153 applications, or other proprietary rights which may cover technology that may be required to
2154 implement this specification. Please address the information to the OASIS President.

2155 **Copyright © OASIS Open 2005. All Rights Reserved.**

2156 This document and translations of it may be copied and furnished to others, and derivative works
2157 that comment on or otherwise explain it or assist in its implementation may be prepared, copied,
2158 published and distributed, in whole or in part, without restriction of any kind, provided that the
2159 above copyright notice and this paragraph are included on all such copies and derivative works.
2160 However, this document itself does not be modified in any way, such as by removing the
2161 copyright notice or references to OASIS, except as needed for the purpose of developing OASIS
2162 specifications, in which case the procedures for copyrights defined in the OASIS Intellectual
2163 Property Rights document must be followed, or as required to translate it into languages other
2164 than English.

2165 The limited permissions granted above are perpetual and will not be revoked by OASIS or its
2166 successors or assigns.

2167 This document and the information contained herein is provided on an "AS IS" basis and OASIS
2168 DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO
2169 ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE
2170 ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A
2171 PARTICULAR PURPOSE.