



Liberty ID-WSF Design Patterns

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Abstract:

This specification defines common design patterns that can be included in other Liberty ID-WSF specifications.

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79 **1. Introduction**

80 This specification defines common design patterns that can be included in other Liberty ID-WSF specifications.

81 **1.1. Notation and Conventions**

82 This specification uses schema documents conforming to W3C XML Schema (see [Schema1-2]) and normative text
83 to describe the syntax and semantics of XML-encoded messages.

84 The key words "MUST," "MUST NOT," "REQUIRED," "SHALL," "SHALL NOT," "SHOULD," "SHOULD NOT,"
85 "RECOMMENDED," "MAY," and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

86 These keywords are thus capitalized when used to unambiguously specify requirements over protocol and application
87 features and behavior that affect the interoperability and security of implementations. When these words are not
88 capitalized, they are meant in their natural-language sense.

89 **1.1.1. XML Namespaces**

90 The following XML namespaces are referred to in this document:

91 • The prefix *dp*: represents the Design Patterns namespace. This namespace is the default for instance fragments,
92 type names, and element names in this document. In schema listings, and in example messages and fragments
93 thereof, this is the default namespace *when* no prefix is shown:

94 *urn:liberty:dp:2007-09*

95 • The prefix *xs*: stands for the W3C XML schema namespace [Schema1-2]:

96 *http://www.w3.org/2001/XMLSchema*

97 • The prefix *xsi*: stands for the W3C XML schema instance namespace:

98 *http://www.w3.org/2001/XMLSchema-instance*

99 2. Polling

100 The *Poll* operation is used when an entity can't expose an incoming request communications channel and therefore
101 must poll its consumer(s) for requests.

102 2.1. PollType Message Type

103 The `<dp:PollType>` element defines a structure for a poll interface request which is called to return the results of a
104 previous request and/or to ask for one or more new requests.

105 The `<dp:PollType>` contains the following attributes and/or elements:

106 • `<wsa:Action>` **[Optional]** - the Action URIs for the requests that the invoking party is willing to accept in the
107 response. This is a hint to help the recipient of the `<dp:Poll>` decide which request(s) can be sent. If not
108 specified the recipient can send whatever it wants.

109 • `<dp:Response>` **[Optional]** - a container for the response element(s) from previous request(s). Note that
110 the number of response element(s) **MUST** match the number of request elements that were present in the
111 `<dp:PollResponse>`, which resulted in this `<dp:Poll>`.

112 The `<dp:Response>` element has the following attributes/elements:

113 • `<xs:any>` **[Required]** - the service level response (any response is allowed. For example, if the invoking party
114 hosted a Liberty People Service and had received a People Service request, the service level response could be
115 a `<ps:AddEntityResponse>` element in this location.

116 The individual service definitions (such as the Liberty People Service Specification) drive what is allowable
117 within this location. Essentially, anything that **MAY** be placed into the body of a typical response to an
118 invocation of the service **MAY** be placed into the `<dp:Response>` element.

119 There **MUST ONLY** be a single service response within a given `<dp:Response>` element. If multiple
120 service responses are to be included in a single `<dp:Poll>` message they **MUST** be placed into separate
121 `<dp:Response>` elements.

122 • `ref` **[required]** - a reference to the `itemID` in the request for which this response was generated.

123 • `wait` **[Required]** - an attribute indicating the number of seconds the invoker wants the recipient to wait if there
124 aren't any requests available immediately. If set to zero, no wait takes place. The recipient **MAY** limit the amount
125 of time it is willing to wait for more requests.

126 • `anyAttribute` **[Optional]** - Zero or more attributes from a namespace other than that of this specification. One
127 such possibility is an `xs:ID` type attribute such as `xml:id` or `wsu:Id`.

128 The schema for the `<dp:PollType>` is shown below.

```

129 <!-- PollType - datatype for polling the recipient for any new work -->
130
131 <xs:complexType name="PollType">
132   <xs:sequence>
133     <xs:element ref="wsa:Action" minOccurs="0" maxOccurs="unbounded" />
134     <xs:element ref="Response" minOccurs="0" maxOccurs="unbounded" />
135   </xs:sequence>
136   <xs:attribute name="wait" type="xs:integer" use="required" />
137   <xs:anyAttribute namespace="##other" processContents="lax"/>
138 </xs:complexType>
139
140 <xs:element name="Response" type="ResponseType" />
141 <xs:complexType name="ResponseType">
142   <xs:sequence>
143     <xs:any namespace="##other"
144       processContents="lax"
145       minOccurs="0"
146       maxOccurs="unbounded" />
147   </xs:sequence>
148   <xs:attribute name="ref" type="xs:string" use="required" />
149 </xs:complexType>
150

```

151 **Figure 1. `<dp:PollType>` — Schema Fragment**

152 An example message body containing a message derived from the `<dp:PollType>` follows. This indicates that the
 153 caller is willing to wait 5 minutes for any new requests and is looking for a `<shps:ProxyInvoke>` request.

```

154 <shps:Poll wait="300">
155   <wsa:Action>urn:liberty:shps:2007-09:ProxyInvoke</wsa:Action>
156 </shps:Poll>
157

```

158 **Example 1. Example request derived from the `<dp:PollType>` datatype**

159 An example message body containing a message derived from the `<dp:PollType>` with a response from a prior
 160 request follows.

```

161 <shps:Poll wait="300">
162   <wsa:Action>urn:liberty:shps:2007-09:ProxyInvoke</wsa:Action>
163   <dp:Response ref="1">
164     <shps:ProxyInvokeResponse>
165       <lu:Status code="OK" />
166       <shps:ProxyInvokeResponseItem ref="1">
167         <shps:ServiceHandle>uuid:23023-023802-2032023-0238023</shps:ServiceHandle>
168         <shps:ResponseHeaders>
169           <sb:UsageDirectives> . . . . . </sb:UsageDirectives>
170         </shps:ResponseHeaders>
171         <pp:QueryResponse>
172           . . . modification response data goes here . . .
173         </pp:QueryResponse>
174       </shps:ProxyInvokeResponseItem>
175     </shps:ProxyInvokeResponse>
176   </dp:Response>
177 </shps:Poll>
178

```

179 **Example 2. Example request derived from the `<dp:PollType>` datatype**

180 2.2. PollResponseType Message Type

181 This response type is used to define responses to messages derived from the `<dp:PollType>` message type and
182 contains the following elements:

- 183 • `<lu:Status>` [**Required**] - the status of the response. See the processing rules below for more information.
- 184 • `<dp:Request>` [**Optional**] - zero or more request container(s) each of which contain the following
185 attributes/elements:
 - 186 • `<xs:any>` [**Required**] - the service level request message. For example, if the Liberty People Service is the
187 service hosted by the polling entity, a `<ps:AddEntityRequest>` may be specified in this location.
 - 188 The individual service definitions (such as the Liberty People Service Specification) drive what is allowable
189 within this location. Essentially, anything that **MAY** be placed into the body of a typical invocation of the
190 service **MAY** be placed into the `<dp:Request>` element.
 - 191 There **MUST ONLY** be a single service request within a given `<dp:Request>` element. If multiple service
192 requests are to be included in a single `<dp:PollResponse>` message, they **MUST** be placed into separate
193 `<dp:Request>` elements.
 - 194 • `itemID` [**required**] - the identifier for this request (for correlation with the results in the response).
 - 195 • `nextPoll` [**Optional**] - the number of seconds that the caller should wait before polling again for more requests.
196 This attribute has no effect and **SHOULD NOT** be specified if a `<dp:Request>` is included in the message as the
197 polling entity **SHOULD** poll again as soon as the response for that request is ready (and, of course, include the
198 response in the poll).
 - 199 • `anyAttribute` [**Optional**] - zero or more attributes from a namespace other than that of this specification. One
200 such possibility is an `xs:ID` type attribute such as `xml:id` or `wsu:Id`.

```

201 <!-- PollResponseType - the datatype of response to a polling message -->
202
203 <xs:complexType name="PollResponseType">
204   <xs:complexContent>
205     <xs:extension base="ResponseAbstractType">
206       <xs:sequence>
207         <xs:element ref="Request" minOccurs="0" maxOccurs="unbounded" />
208       </xs:sequence>
209       <xs:attribute name="nextPoll" type="xs:integer" use="optional" />
210     </xs:extension>
211   </xs:complexContent>
212 </xs:complexType>
213
214 <xs:element name="Request" type="RequestType" />
215 <xs:complexType name="RequestType">
216   <xs:sequence>
217     <xs:any namespace="##other"
218       processContents="lax"
219       minOccurs="0"
220       maxOccurs="unbounded" />
221   </xs:sequence>
222   <xs:attribute name="itemID" type="xs:string" use="required" />
223 </xs:complexType>
224

```

225 **Figure 2.** `<dp:PollResponseType>` — Schema Fragment

226 An example message body containing a message derived from the `<dp:PollResponseType>` follows. This is a
227 successful SHPS response with no new requests and a request for the caller to wait 10 minutes before polling again.

```
228 <shps:PollResponse nextPoll="600">
229   <lu:Status code="OK" />
230 </shps:PollResponse>
231
```

232 **Example 3. Example message derived from the `<dp:PollResponseType>` Message Type**

233 Another example message body containing a message derived from the `<dp:PollResponseType>` follows. This
234 is a successful response message with a `<shps:ProxyInvoke>` request.

```
235 <shps:PollResponse>
236   <lu:Status code="OK" />
237   <dp:Request itemID="1">
238     <shps:ProxyInvoke>
239       <shps:ProxyInvokeItem itemID="1">
240         <shps:ServiceHandle>uuid:23023-023802-2032023-0238023</shps:ServiceHandle>
241         <shps:InvocationContext>
242           <shps:InvokingProvider>http://services.corp.com</shps:InvokingProvider>
243           <shps:InvokingPrincipal
244             Format="urn:oasis:tc:SAML:2.0:namid-format:persistent"
245             NameQualifier="http://idps-r-us.com" >
246             uuid:23923-023843-230932-230923
247           </shps:InvokingPrincipal>
248           <disco:SecurityMechID>urn:liberty:ds:2006-08:TLS:SAMLV2</disco:SecurityMechID>
249         </shps:InvocationContext>
250         <shps:RequestHeaders>
251           <sb:ProcessingContext>
252             urn:liberty:sb:2003-08:ProcessingContext:PrincipalOffline
253           </sb:ProcessingContext>
254         </shps:RequestHeaders>
255         <pp:Query>
256           ... query data goes here ...
257         </pp:Query>
258       </shps:ProxyInvokeItem>
259     </shps:ProxyInvoke>
260   </dp:Request>
261 </shps:PollResponse>
262
```

263 **Example 4. Example message derived from the `<dp:PollResponseType>` Message Type**

264 2.3. Poll Processing Rules

- 265 • If the request includes one or more `<wsa:Action>` elements, the recipient MUST NOT include request
266 elements in the response that are not associated with the specified action value(s).
- 267 • If the request includes the `wait` attribute, the recipient SHOULD respond immediately when it has requests for
268 the invoker (including any that arrive after the recipient has started waiting for new requests). The recipient MAY
269 use the specified amount of time on the `wait` to determine how long it is willing to wait before responding with
270 no request.
- 271 • A single poll response SHOULD NOT include multiple requests which make use of Delayed Notification
272 (Section 4) as this can result in indeterminate results when the results are subsequently returned in different
273 notification using the same `ref` attribute value.
- 274 Requests making use of Delayed Notification SHOULD be sent in separate poll response messages.
- 275 • If the response is to be sent without an embedded request, the response should still be treated as a successful
276 response. The lack of a `<dp:Request>` is sufficient to determine that there is no request and the poll operation
277 itself was successful.

-
- 278 • If the response includes a `nextPoll` attribute, the invoker SHOULD NOT poll the recipient again until that amount
279 of time has passed.
- 280 The `nextPoll` SHOULD NOT be specified on responses that include an incoming request as the invoker should
281 issue a new poll containing the response to the request as soon as it has completed processing the request. If the
282 attribute is specified in such cases, the invoker MAY ignore it.
- 283 If a poll is received too soon following a response with a `nextPoll` attribute, the recipient MAY reject the request
284 and in doing so, MAY indicate a secondary status code of "*PollTooSoon*."
- 285 • If request processing succeeded, the top-level status code MUST be "OK." Otherwise, the top-level status code
286 MUST be "*Failed*".
- 287 • If the top-level status code is "*Failed*," the response MAY also contain *Forbidden* as a second-level status code.
288 The SHP Service instance may not wish to reveal the reason for failure, in which case no second-level status code
289 will appear.

290 3. Pagination

291 Pagination is an add-on functionality to an interface to allow the requester to page through results rather than forcing
292 the entire set of results into a single response. This capability is very useful when a large set of results may be returned
293 in response to a request.

294 Pagination also brings up the issue of transactional consistency. This is due to the fact that time passes between the
295 request for the first page and the request for the second page and there may have been changes made to the data during
296 that time (even if the time was very small).

297 For example, after reading the first page of 10 items, a new item is added that would be sorted into the results as item
298 3 (and therefore would have been on the first page if it had been three at the time the first page was requested). With
299 the subsequent request for the next 10 items, which items are returned – the original items 11-20, or the original items
300 10-19 (which are now 11-20 because of the new item in position 3).

301 Transactional consistency is **not** always a problem. Many operations are either static in nature, (such as reading a
302 static document like the one you're reading now), in other cases it just doesn't matter, especially considering that the
303 likelihood of the collision is relatively small and the ramifications are minimal – such as listing web pages that contain
304 a particular term.

305 Of course, there are situations where transactional consistency is important and so we need to support both situations.
306 Therefore we have defined two attribute groups to support both situations:

307 • **Basic** - support for basic pagination with no explicit support for consistency control. This is typically used when
308 the data is static or consistency just doesn't matter. If a caller is still concerned about consistence, they can just
309 read the entire data set in a single operation.

310 • **Extended** - support for basic pagination and support for a snapshot type of consistency control (the server collects
311 the data that would be included in the response at the start of the pagination of results and guarantees that only
312 those records are included in subsequent pages through the result set).

313 In all cases, pagination refers to accessing a limited set of the *item* that may be in the result set. The interface that
314 adopts this design pattern **MUST** define what is considered an *item*. In many cases, the *item* will be the native object
315 or record that the request is attempting to access. In other cases, the *item* will equate to a byte of data in the response.

316 3.1. Basic Pagination

317 3.1.1. Basic Pagination - Request attributes

318 Basic pagination provides for paging through results of an operation without any support for consistency level controls.
319 The attribute group `dp:PaginationBasicAttributeGroup` contains the following attributes:

320 • `count` [**Optional**] - the maximum number of *items* to be included in the response to this request. The actual
321 number returned **MAY** be smaller if the number of *items* remaining in the result set is less than the specified count
322 or at the discretion of the service.

323 If this attribute is not specified, the request **MUST** be interpreted as if the entire remaining set of *items* are
324 requested.

325 • `offset` [**Optional**] - the starting location in the result set for the *items* to be returned for this request. The first
326 *item* has the offset zero.

327 If this attribute is not specified, the request **MUST** be interpreted as if zero had been specified.

328 The schema for the `dp:BasicPagingAttributeGroup` is shown below.

```
329 <!--BasicPagingAttributeGroup - basic request pagination support -->
330
331 <xs:attributeGroup name="BasicPagingAttributeGroup" >
332   <xs:attribute name="count" use="optional" type="xs:nonNegativeInteger"/>
333   <xs:attribute name="offset" use="optional" type="xs:nonNegativeInteger" />
334 </xs:attributeGroup>
335
336
```

337 **Figure 3. `dp:BasicPagingAttributeGroup` — Schema Fragment**

338 3.1.2. Basic Pagination - Response Attributes

339 The attributes defined for the pagination feature on response messages are used to provide the invoking party with the
340 information that they may need to build the subsequent request. The `dp:BasicPagingResponseAttributeGroup`
341 attribute group includes the following attributes:

- 342 • `remaining` [**Optional**] - the number of *items* remaining to be read **after** the results returned in this response.
343 While this attribute is optional in the schema, the attribute **MUST** be specified in the response if the associated
344 request included either the `count` or `offset` attributes.
345 The value zero in the `remaining` attribute indicates that there are no further items available for this request (i.e.,
346 we're done).
347 The special value -1 in the `remaining` attribute indicates that the service does not have a definitive count of the
348 number of remaining entries and so the caller should come back for more. This is frequently used for cases where
349 the caller is reading a variable length stream of data (such as a stock ticker).
350 The number of items in the result set can change as the result set is read, resulting in a different total number of
351 items than originally calculated. So, after a read of the first 10 items and with a remaining count of 11, the read of
352 the next 10 items may get back a remaining count of 2 instead of the expected 1. This can be prevented if static
353 set processing is supported by the service and invoked by the caller (see [Section 3.2](#)).
354 • `nextOffset` [**Optional**] - the offset in the result set for the first *item* of the remaining *items*.
355 While `nextOffset` is defined as optional in the schema, the attribute **MUST** be specified on a response when the
356 `remaining` attribute is present and has a non-zero value.
357 The recipient of the response, would place the value of the `nextOffset` attribute into the `offset` attribute in a
358 subsequent request to read the next page of *items*.
359 • `maxCount` [**Optional**] - the maximum number of items that the service will return in a single response. This
360 attribute is normally only specified when a *ResultsTooLarge* error code is being returned (see [Section 3.4](#) below).

```
361 <!-- BasicPagingResponseAttributeGroup - basic response pagination support -->
362
363 <xs:attributeGroup name="BasicPagingResponseAttributeGroup">
364   <xs:attribute name="remaining" use="optional" type="xs:integer"/>
365   <xs:attribute name="nextOffset" use="optional" type="xs:nonNegativeInteger" />
366   <xs:attribute name="maxCount" use="optional" type="xs:nonNegativeInteger" />
367 </xs:attributeGroup>
368
```

369 **Figure 4. dp:BasicPagingResponseAttributeGroup Schema Fragment**

370 3.2. Extended Pagination

371 Extended pagination includes all the attributes and features of basic pagination and adds the ability to define and
372 reference static result sets (so that the results are consistent across multiple read operations). With a static set defined,
373 the results would be the same as if the requester had read them in a single read operation.

374 Static sets do place a burden on the server to maintain the result set across multiple invocations. This may not even
375 make sense with certain types of data. Therefore, when adopting pagination for a service definition, the authors
376 should evaluate whether static sets are necessary and if not, simply use the attributes and features of Basic Pagination
377 (see [Section 3.1](#) above).

378 3.2.1. Extended Pagination - Request attributes

379 Extended pagination builds upon the attributes defined for Basic Pagination. the attribute group
380 dp:ExtendedPagingAttributeGroup contains all of the attributes (including their rules and interpretations) in
381 the dp:BasicPagingAttributeGroup as well as the following added attributes:

382 • **setID [Optional]** - the identity of the result set being accessed. This attribute **MUST ONLY** be specified when
383 the setID was returned on a previous response to a request that established the result set.

384 If this attribute is specified, the normal parameters for the operation **MUST NOT** be specified as the parameters
385 used when the result set was established control the ongoing responses using this result set. Only the pagination
386 attributes (and, potentially, an identity attribute for signing purposes) **SHOULD** be present on such requests.

387 • **setReq [Optional]** - a controlling attribute used to indicate the desire for a new set, or ask the server to delete an
388 established set. This attribute **MUST** have one of the following values:

389 • *Static* - a new static results set is to be created using the parameters specified on this operation. The setID
390 attribute **MUST NOT** be specified on the request when this value is specified.

391 • *DeleteSet* - the existing result set indicated by the setID attribute are to be deleted. This is usually only
392 necessary when the caller wants to abort reading the entire result set as the result set is automatically deleted
393 when the last item is read.

394 The schema for the `dp:ExtendedPagingAttributeGroup` is shown below.

```
395 <!-- ExtendedPagingAttributeGroup - adds set support -->
396
397 <xs:attributeGroup name="ExtendedPagingAttributeGroup" >
398   <xs:attributeGroup ref="BasicPagingAttributeGroup" />
399   <xs:attribute name="setID" use="optional" type="xs:string"/>
400   <xs:attribute name="setReq" use="optional">
401     <xs:simpleType>
402       <xs:restriction base="xs:string">
403         <xs:enumeration value="Static"/>
404         <xs:enumeration value="DeleteSet"/>
405       </xs:restriction>
406     </xs:simpleType>
407   </xs:attribute>
408 </xs:attributeGroup>
409
410
```

411 **Figure 5. `dp:ExtendedPagingAttributeGroup` Schema Fragment**

412 3.2.2. Extended Pagination - Response Attributes

413 Like the request attributes defined above, the response attributes for Extended Pagination are built atop the Basic
414 Pagination response attributes. The attribute group `dp:ExtendedPagingResponseAttributeGroup` contains
415 all of the attributes (including their rules and interpretations) in the `dp:BasicPagingResonseAttributeGroup`
416 as well as the following added attributes:

- 417 • `setID` [**Optional**] - the identity of the result set to which these results belong. This attribute **MUST** be specified
418 when the results are associated with a static result set.
 - 419 • `setExpires` [**Optional**] - the time at which this set will no longer be valid. This attribute **MUST** be specified in
420 the initial response that creates the `setID` and **MAY** be specified in subsequent responses.
- 421 The WSP is telling the WSC that it will maintain the static result set until this point in time and afterwards requests
422 using that `setID` will fail.

```
423 <!-- ExtendedPagingResponseAttributeGroup - adds support for sets -->
424
425 <xs:attributeGroup name="ExtendedPagingResponseAttributeGroup">
426   <xs:attributeGroup ref="BasicPagingResponseAttributeGroup" />
427   <xs:attribute name="setID" use="optional" type="xs:string"/>
428   <xs:attribute name="setExpires" use="optional" type="xs:dateTime"/>
429 </xs:attributeGroup>
430
```

431 **Figure 6. `dp:ExtendedPagingResponseAttributeGroup` Schema Fragment**

432 3.3. Pagination Examples

433 3.3.1. Pagination Schema Example

434 This example shows how the pagination attributes can be included into a schema (and is the schema that we use for
435 the remaining examples).

```
436 <?xml version="1.0" encoding="UTF-8"?>
437 <xs:schema targetNamespace="urn:liberty:ex:getdata"
438   xmlns:xs="http://www.w3.org/2001/XMLSchema"
439   xmlns:dp="urn:liberty:dp:2007-09"
440   xmlns="urn:liberty:ex:getdata"
441   elementFormDefault="qualified"
442   attributeFormDefault="unqualified"
443 >
444   <xs:import namespace="urn:liberty:dp:2007-09" schemaLocation="liberty-idwsf-dp-v1.0.xsd"/>
445
446   <xs:element name="GetData" type="GetDataType" />
447   <xs:complexType name="GetDataType" mixed="true">
448     <xs:attributeGroup ref="dp:ExtendedPagingAttributeGroup" />
449   </xs:complexType>
450
451   <xs:element name="GetDataResponse" type="GetDataResponseType" />
452   <xs:complexType name="GetDataResponseType" mixed="true">
453     <xs:attributeGroup ref="dp:ExtendedPagingResponseAttributeGroup" />
454   </xs:complexType>
455
456 </xs:schema>
457
458
```

459 **Example 5. GetData Schema incorporating pagination attributes**

460 3.3.2. Basic Pagination Example

461 An example sequence of request and response messages using the pagination attributes to read 21 items from a data
462 service, 10 items at a time.

463 3.3.2.1. 1. Initial request for max of 10 items.

464 This request asks for at most 10 items from the result set (and does not specify an offset, which is the same as
465 specifying an offset of zero).

```
466 <GetData xmlns="urn:liberty:ex:getdata" count="10">
467   ... get data parameters ...
468 </GetData>
469
```

470 **Example 6. Initial request, max of 10**

471 3.3.2.2. 2. Response to initial request with 11 remaining.

472 This response includes the 10 items requested and specifies that there are 11 items remaining starting at offset 10.

```
473 <GetDataResponse xmlns="urn:liberty:ex:getdata" remaining="11" nextOffset="10">
474   ... data items go here (10 of them) ...
475 </GetDataResponse>
476
```

477 **Example 7. First response, remaining 11**

478 3.3.2.3. 3. Request for 10 more items.

479 This request asks for at most 10 more items from the result set starting at offset 10 (the 11th item).

```
480 <GetData xmlns="urn:liberty:ex:getdata" count="10" offset="10">
481   ... get data parameters ...
482 </GetData>
483
```

484 **Example 8. Second request, max of 10**

485 **3.3.2.4. 4. Response to request with 1 remaining.**

486 This response includes the 10 items requested and specifies that there is 1 more item remaining starting at offset 20.

```
487 <GetDataResponse xmlns="urn:liberty:ex:getdata" remaining="1" nextOffset="20" >
488   ... GetData items go here (10 more)...
489 </GetDataResponse>
490
```

491 **Example 9. Second response, remaining 1**

492 **3.3.2.5. 5. Request for 10 more items.**

493 This request asks for at most 10 more items from the result set starting at offset 20 (the 21st item). Note that given
494 the prior response specifying that there is only 1 remaining, this request could have asked for just 1 more item. Instead
495 it chose to ask for 10 in case the count of items had changed.

```
496 <GetData xmlns="urn:liberty:ex:getdata" count="10" offset="20">
497   ... get data parameters ...
498 </GetData>
499
```

500 **Example 10. Third request, max of 10**

501 **3.3.2.6. 6. Response to request with 0 remaining.**

502 This response includes the 1 items remaining and specifies that there are no more remaining items (and as such doesn't
503 include an next offset).

```
504 <GetDataResponse xmlns="urn:liberty:ex:getdata" remaining="0" >
505   ... GetData items go here (1 this time)...
506 </GetDataResponse>
507
```

508 **Example 11. Third response, remaining 0**

509 **3.3.3. Extended Pagination Example**

510 An example sequence of request and response messages using the pagination attributes to read 21 items from a data
511 service, 10 items at a time.

512 **3.3.3.1. 1. Initial request for max of 10 items and creation of static set.**

513 This request asks for at most 10 items from the result set (and does not specify an offset, which is the same as
514 specifying an offset of zero). The request also asks the service to create a static set for the remaining operations.

```
515 <GetData xmlns="urn:liberty:ex:getdata" count="10" setReq="Static" >
516   ... get data parameters ...
517 </GetData>
518
```

519 **Example 12. Initial request, max of 10, create static result set**

520 3.3.3.2. 2. Response to initial request with 11 remaining.

521 This response includes the 10 items requested, defines the setID for the result set, and specifies that there are 11 items
522 remaining starting at offset 10.

```
523 <GetDataResponse xmlns="urn:liberty:ex:getdata" setID="38273923" setExpires="2007-01-14T17:33:11Z" remaining="11"
524   ... data items go here (10 of them) ...
525 </GetDataResponse>
526
527
```

528 **Example 13. First response, remaining 11, assigns setID**

529 3.3.3.3. 3. Request for 10 more items from static result set.

530 This request asks for at most 10 more items from the specified static result set starting at offset 10 (the 11th item).

531 Note that this request does **not** include request parameters. They were defined when the static result set was created
532 and are no longer necessary.

```
533 <GetData xmlns="urn:liberty:ex:getdata" setID="38273923" count="10" offset="10" />
534
```

535 **Example 14. Second request, max of 10, uses setID**

536 3.3.3.4. 4. Response to request with 1 remaining.

537 This response includes the 10 items requested and specifies that there is 1 more item remaining in the static result set
538 starting at offset 20.

```
539 <GetDataResponse xmlns="urn:liberty:ex:getdata" setID="38273923" remaining="1" nextOffset="20">
540   ... data items go here (10 more) ...
541 </GetDataResponse>
542
```

543 **Example 15. Second response, remaining 1, uses setID**

544 3.3.3.5. 5. Request for 10 more items from static result set.

545 This request asks for at most 1 more item from the static result set starting at offset 20 (the 21st item). Since this is
546 a static result set, there can't be more than 1 item left.

547 Note that this request does **not** include request parameters. They were defined when the static result set was created
548 and are no longer necessary.

```
549 <GetData xmlns="urn:liberty:ex:getdata" setID="38273923" count="1" offset="20" />
550
```


551 **Example 16. Third request, max of 1, uses setID**

552 **3.3.3.6. 6. Response to request with 0 remaining.**

553 This response includes the 1 items remaining and specifies that there are no more remaining items (and as such doesn't
554 include an next offset).

555 Following this response, since the caller has read the entire static result set, the `setID` is no longer valid since the
556 server will have deleted this set following the read of the last item. Any further attempts to use this `setID` will result
557 in an error.

```
558 <GetDataResponse xmlns="urn:liberty:ex:getdata" setID="38273923" remaining="0">  
559   ... GetData items go here (1 this time)...  
560 </GetDataResponse>  
561
```

562 **Example 17. Third response, remaining 0**

563 **3.4. Pagination Processing Rules**

564 • If a request includes a `count` attribute, the response **MUST NOT** include more than `count` items. The response
565 **MAY** include less items, either because there aren't any more items to respond or because the server decided on
566 its own to return a smaller number – even with more results available.

567 • If a request does **NOT** include a `count` attribute, but the number of items in the result is, at the discretion of the
568 service, too large to return in a single response, the request **MUST** fail and, if detailed error codes are provided,
569 the error code **MUST** be *ResultsTooLarge*.

570 In such cases, the service **SHOULD** specify the `maxCount` attribute on the response, indicating the largest result
571 set it is willing to return. The WSC would, in such cases, resubmit the request with `count` set to this value or a
572 lesser value.

573 • If a request includes an `offset` attribute, the data in the response must start at the specified offset into the results
574 defined by the operation's parameters. If this offset is beyond the end of the results set, the request **MUST** fail
575 and, if detailed error codes are provided, the error code **MUST** be *OffsetBeyondEnd*.

576 • If a request includes a `setReq` attribute with the value "Static," the WSP **MUST** arrange to return a static set of
577 results using the current request parameters and **MUST** identify this set with a unique identifier specified in the
578 `setID` of the response. This does **not** require a particular implementation of the static results (e.g., some WSPs
579 could cache the results, others could use backend database cursor capabilities).

580 • Following the creation of a static results set, the WSC **SHOULD NOT** specify search criteria on subsequent
581 requests related to the same set. If this criteria is specified, the WSP **MAY** return or a failure or otherwise **MUST**
582 ignore it and use the search criteria specified when the static result set was created. By search criteria, we mean
583 any operational parameters to the request that are used to control the results set (other than pagination attributes,
584 of course).

585 • The WSP **MUST** ensure that static result sets created by requests from one WSC are not made visible to other
586 WSCs.

587 • If a request includes a `setID` that is not valid (because it was not generated by that WSP, not assigned to the
588 requesting WSC, or refers to a set which has been deleted), the request **MUST** fail and, if detailed error codes are
589 provided, the error code **MUST** be *StaticSetInvalid*.

590 **4. Delayed Notification**

591 Some service interfaces provide for a delayed completion of their processing. This can occur for several reasons
592 including delayed operation (a request with a future timestamp) and/or indirect operation (a request that is forwarded
593 to another party for processing).

594 Such delayed operation raises an issue for the service in that they need a means to provide the invoker with the
595 completion status and results of the operation but do not want a request to hang about on their service interface for
596 long periods of time (tying up valuable resources).

597 At the same time, there are many cases where the service can determine if there is a problem with the request right
598 away and return such status in an immediate response to the service invocation.

599 This design pattern solves the issues by providing:

- 600 1. a means for the invoker to use to indicate that they are able to receive delayed results and where to send such
601 delayed ([Section 4.2.1](#)).
- 602 2. a means for immediate results to be returned, if available.
- 603 3. a means to indicate that immediate results are not available and will be returned later.
- 604 4. a means to deliver the delayed results to the invoker (including the definition of an interface that must be exposed
605 by the invoker to receive such delayed results).

606 **4.1. Delayed Notification Sequence**

607 The following sections describe an example sequence of events that is representative of a typical implementation of
608 this design pattern. Of course, this is not a required sequence and some implementations and/or particular invocations
609 within a given implementation will result in different sequences of steps. However, this example does explain the
610 potential steps/processing that may take place.

611 **4.1.1. Step 1: Invoker submits request with `<dp:NotifyTo>` element**

612 If the invoker supports and wants delayed notification for the completion status, they would include a `<dp:NotifyTo>`
613 element on the request which contains the [[WSAv1.0](#)] EndpointReference (EPR) for their notification endpoint.

614 The presence of this element indicates that they want the results of any delayed operation and identifies the location to
615 which such delayed operation results should be sent.

616 If this element was not present in the request, the processing rules for the service interface **MUST** define the behavior
617 of the interface. This will typically fall into one of the following three options:

- 618 • The `<dp:NotifyTo>` element is required and the request fails if not specified.
- 619 • The service makes best efforts to verify that the future/indirect processing of the request will succeed and return the
620 results of those efforts and accept that a later failure may occur without the ability to notify, directly, the invoker.
- 621 • The service waits for the completion of the process prior to returning the actual completion status and/or results to
622 the invoker. This is more likely to be used in an indirect operation.

623 The service specification MUST document which option is chosen for this case. In many cases the "best efforts"
624 solution is the simplest and probably best for such cases as the invoker is clearly indicating that they do not want the
625 results sent back separately.

626 **4.1.2. Step 2: Service instance performs initial processing**

627 The service should process and validate the results to the extent possible at this time. The service has the choice of
628 returning one of the following status codes for each request item:

629 • *OK* - the validation is complete for this item and the update will proceed as indicated (if a future operation) or has
630 completed successfully (if an indirect operation and/or an operation with a past timestamp).

631 For a delayed operation, the service is indicating that the service will complete without error (as in they know
632 that it will be successful). Since this is hard to ensure with reasonable soundness for future operations, it is not
633 recommended that this status be returned until the operation has actually completed.

634 If this status is returned, no further messages will be sent related to this request item.

635 • *WillNotify* - the request has been validated to the extent possible by the service instance and will be processed as
636 requested. The completion status of the request will be sent to the invoker when the processing is complete.

637 • *anything else* - any other status value indicates that the validation and/or processing for this item has failed (the
638 operation was not successful).

639 If this is returned, no further messages will be sent related to this request item.

640 The inclusion of multiple request items in a single request is possible in many service interfaces. In some cases, the
641 multiple operations are treated as an atomic operation and therefore the status codes above apply to the single atomic
642 operation.

643 In other cases, the service interface allows the individual request items to be processed independently and for partial
644 results to be returned. In such cases, the secondary status codes for each request item in partial operations would
645 meet the rules outlined above and the notification messages would be individual for each request item. For example,
646 a request for 5 operations could result in 2 failing validation immediately and 3 separate notifications of completion,
647 one for each other request item in the request.

648 **4.1.3. Step 3: The operation completes**

649 Upon completion of an operation, if the status code *WillNotify* was returned for that operation, the service instance
650 must generate a `<dp:Notification>` message and send it to the invoker at the destination indicated in the
651 `<dp:NotifyTo>` element that was on the request.

652 The `<dp:Notification>` message MUST contain the application response message which contains the completion
653 status of the request as well as any possible results.

654 **4.2. Delayed Notification data structures**

655 **4.2.1. `<dp:NotifyTo>` Element**

656 The `<dp:NotifyTo>` element is an ID-WSF `EndpointReference` (see [[LibertyDisco](#)]) which describes where com-
657 pletion notification messages are to be sent.

658 In the case where a `<dp:NotifyTo>` is included in a service request that is part of a polling response message,
659 the anonymous address (<http://www.w3.org/2005/08/addressing/anonymous>) may be used in the `<dp:NotifyTo>` to
660 indicate that the notification message is to be sent to the same endpoint that the poll request was submitted.

661 Service specifications which adopt this design pattern MUST include this element in the schema definitions for the
662 interfaces where the capabilities of delayed notification are desired.

663 The schema for the <dp:NotifyTo> element is shown below.

```
664 <!-- NotifyTo - element for carrying the notification destination -->
665
666 <xs:element name="NotifyTo" type="wsa:EndpointReferenceType" />
667
```

668 **Figure 7. <dp:NotifyTo> — Schema Fragment**

669 An example usage of the <dp:NotifyTo> element in a service schema for the Liberty ID-WSF Provisioning Service
670 ([LibertyPROV]) <prov:PMUpdate> interface (an indirect operation) is shown below:

```
671 <!-- PMUpdate - update the PM for a existing PM at the ProvS -->
672
673 <xs:element name="PMUpdate" type="PMUpdateType"/>
674
675 <xs:complexType name="PMUpdateType">
676   <xs:complexContent>
677     <xs:extension base="RequestAbstractType">
678       <xs:sequence>
679         <xs:element ref="PMUpdateItem" maxOccurs="unbounded" />
680         <xs:element ref="dp:NotifyTo" minOccurs="0" />
681       </xs:sequence>
682     </xs:extension>
683   </xs:complexContent>
684 </xs:complexType>
685
686 <xs:element name="PMUpdateItem" type="PMUpdateItemType" />
687
688 <xs:complexType name="PMUpdateItemType">
689   <xs:sequence>
690     <xs:element ref="PMDescriptor"/>
691   </xs:sequence>
692   <xs:attribute name="type" type="xs:anyURI" use="required"/>
693   <xs:attribute name="itemID" type="xs:string" use="required"/>
694   <xs:attribute name="at" type="xs:dateTime" use="optional"/>
695 </xs:complexType>
696
```

697 **Example 18. Example schema inclusion of <dp:NotifyTo> element**

698 An example message which includes the <dp:NotifyTo> element.

```
699 <prov:PMUpdate>
700   <prov:PMUpdateItem itemID="1" type="urn:liberty:prov:2007-09:ut:engine">
701     <prov:PMDescriptor xs:id="2323923900239" >
702       <prov:PMID issuer="http://provs-r-us.com">uuid:778349-283920-88379-5448739</prov:PMID>
703       <prov:PMEngineRef>https://pmsRus.org/VeryTrustedModule/4.0</prov:PMEngineRef>
704       <ds:Signature>
705         ... signature data goes here ...
706       </ds:Signature>
707     </prov:PMDescriptor>
708   </prov:PMUpdateItem>
709   <dp:NotifyTo>
710     <wsa:Address>https://provider.com/notifications</wsa:Address>
711     <wsa:Metadata>
712       <ds:ProviderID>http://provider.com/</ds:ProviderID>
713       <ds:ServiceType>urn:liberty:dp:2007-09:notification</ds:ServiceType>
714       <ds:Framework version="2.0" />
715       <ds:SecurityContext>
716         <ds:SecurityMechID>urn:liberty:security:2005-02:TLS:null</ds:SecurityMechID>
717       </ds:SecurityContext>
718     </wsa:Metadata>
719   </dp:NotifyTo>
720 </prov:PMUpdate>
721
```

722 **Example 19. Example message inclusion of `<dp:NotifyTo>` element**

723 **4.3. Delayed Notification Operations**

724 **4.3.1. Operation: *Notification***

725 The *Notification* operation is reverse channel service interface exposed by a web services consumer (WSC) acting as a
726 web service provider (WSP) in order to receive a delayed notification message from another service provider that the
727 WSC had invoked.

728 **4.3.1.1. `wsa:Action` values for Notification Messages**

729 `<Notification>` request messages MUST include a `<wsa:Action>` SOAP header with the value of
730 "urn:liberty:dp:2007-09:Notification."

731 `<NotificationResponse>` messages MUST include a `<wsa:Action>` SOAP header with the value of
732 "urn:liberty:dp:2007-09:NotificationResponse."

733 **4.3.1.2. Notification Message**

734 The `<Notification>` request is called to send a delayed completion response to a provider.

735 The `<dp:Notification>` request contains one or more service level response messages associated with a prior
736 service request at the invoker's WSP. Note that for the `<dp:Notification>` message, the invoker is the recipient of
737 the referenced message and the recipient of this `<dp:Notification>` message is the invoker of the former message
738 that caused this notification to be sent.

739 In other words, the two parties have switched roles.

740 The `<dp:Notification>` element contains the following elements and attributes:

741 • `<xs:any>` **[Required]** - a catch-all element to allow the insertion of a service response message (the complete
742 contents of what would normally be in the body of a response message to a service request).

743 For example, if this message was a delayed notification for the completion of a `<PMDUpdate>` request, this element
744 would be a `<PMDUpdateResponse>`.

745 The contents of this element are controlled by the service specification which contains the request that is being
746 responded to. Typically, Liberty specifications require that the body of a response have exactly one element and
747 so there will typically be exactly one element in this location.

748 • `ref` **[Required]** - the message ID from the request message which resulted in this notification being sent.

749 • `anyAttribute` **[Optional]** - zero or more attributes from a namespace other than that of this specification. One
750 such possibility is an `xs:ID` type attribute such as `xml:id` or `wsu:Id`.

751 The schema for the `<dp:Notification>` is shown below.

```
752 <!-- Notification - interface for receiving the delayed completion status -->
753
754 <xs:element name="Notification" type="NotificationType"/>
755
756 <xs:complexType name="NotificationType">
757   <xs:complexContent>
758     <xs:extension base="RequestAbstractType">
759       <xs:sequence>
760         <xs:any namespace="##other"
761           processContents="lax"
762           maxOccurs="unbounded" />
763       </xs:sequence>
764       <xs:attribute name="ref" type="xs:string" use="required" />
765     </xs:extension>
766   </xs:complexContent>
767 </xs:complexType>
768
```

769 **Figure 8. `<dp:Notification>` — Schema Fragment**

770 An example message body containing a `<dp:Notification>` message follows. This contains a completion
771 notification for a `<prov:PMDUpdate>` operation.

```
772 <dp:Notification ref="...messageID-of-request...">
773   <prov:PMUpdateResponse>
774     <lu:Status code="OK"/>
775   </prov:PMUpdateResponse>
776 </dp:Notification>
777
```

778 **Example 20. Example `<dp:Notification>` Message**

779 4.3.1.3. NotificationResponse Message

780 This response to the `<dp:Notification>` request contains the following elements/attributes:

- 781 • `<lu:Status>` **[Required]** - the completion status of the request. See the processing rules below for more
782 information.
- 783 • `anyAttribute` **[Optional]** Zero or more attributes from a namespace other than that of this specification. One
784 such possibility is an **xs:ID** type attribute such as `xml:id` or `wsu:Id`.

```
785 <!-- NotificationResponse - the response to a Notification message -->
786
787 <xs:element name="NotificationResponse" type="NotificationResponseType" />
788
789 <xs:complexType name="NotificationResponseType">
790   <xs:complexContent>
791     <xs:extension base="ResponseAbstractType" />
792   </xs:complexContent>
793 </xs:complexType>
794
```

795 **Figure 9. <dp:NotificationResponse> — Schema Fragment**

796 An example message body containing a <NotificationResponse> message follows.

```
797 <dp:NotificationResponse>
798   <lu:Status code="OK" />
799 </dp:NotificationResponse>
800
```

801 **Example 21. Example <dp:NotificationResponse> Message**

802 4.3.1.4. Notification Processing Rules

- 803 • If the recipient is unable to locate a pending request with the message id specified in the `ref` attribute, the call
804 MUST be treated as a failure. In such cases, if detailed status codes are being included, the detailed status code for
805 this error MUST be *NotFound*.
- 806 • Each <dp:Notification> MUST ONLY include response data for a single request (the sender MAY NOT
807 combine results from different requests).
- 808 • When building a notification message, if there are still outstanding operations for which the completion data or
809 status is not available, the sender MUST indicate the current status of those items using the "WillNotify" status
810 code.
- 811 • For multiple item requests that allow partial results, the sender MAY include the status of some or all of the pending
812 items on a notification. So a single request with multiple request items could result in a single delayed notification,
813 several delayed notifications, or even one delayed notification for each and every request item.
- 814 • When multiple item requests are supported, the same method used to match results in the non-delayed response
815 MUST be used to match results in the delayed notification. Typically, the request items from the request would
816 have an identifier that is placed to a `ref` attribute in the service level response item (note that this is different from
817 the `ref` attribute in the <dp:NotificationResponse> element).
- 818 On the other hand, if the normal service request uses order of elements in the response to match them to the request
819 items, the sender MUST wait to accumulate the results for all items prior to returning any. This method is NOT
820 RECOMMENDED.
- 821 • If request processing succeeded, the top-level status code MUST be "OK." Otherwise, the top-level status code
822 MUST be "Failed."
- 823 • If the top-level status code is "Failed," the response MAY also contain *NotFound* as a second-level status code.
824 The service instance may not wish to reveal the reason for failure, in which case no second-level status code will
825 appear.

826 **4.4. Delayed Notification Examples (Non-Normative)**

827 This section walks through a fictitious sequence of events in a delayed notification environment. This sequence is
828 made particularly complex in order to highlight the possible messages one could observe while most real-world usages
829 are likely to be simpler.

830 **4.4.1. Step 1: Single request to update several PMDs**

831 This request involves an update of several PMDs that have previously been provisioned to a multitude of PMMs in
832 different locations. Since this is an indirect operation through the Provisioning Service that may not complete right
833 away, the caller includes a `<dp:NotifyTo>` element in the request.


```

834 <prov:PMUpdate>
835   <prov:PMUpdateItem itemID="1" type="urn:liberty:prov:2007-09:ut:engine">
836     <prov:PMDescriptor xs:id="2323923900239" >
837       <prov:PMID issuer="http://provs-r-us.com">uuid:cf5fab69-3092-4ef3-a7c0-f97e70ad769b<
838 /prov:PMID>
839       <prov:PMEngineRef>https://pmsRus.org/VeryTrustedModule/4.0</prov:PMEngineRef>
840     </prov:PMDescriptor>
841   </prov:PMUpdateItem>
842   <prov:PMUpdateItem itemID="2" type="urn:liberty:prov:2007-09:ut:engine">
843     <prov:PMDescriptor xs:id="2323923900239" >
844       <prov:PMID issuer="http://provs-r-us.com">uuid:20643542-3f8c-4281-a4a6-
845 54b07d07ddab</prov:PMID>
846       <prov:PMEngineRef>https://pmsRus.org/VeryTrustedModule/4.0</prov:PMEngineRef>
847     </prov:PMDescriptor>
848   </prov:PMUpdateItem>
849   <prov:PMUpdateItem itemID="3" type="urn:liberty:prov:2007-09:ut:engine">
850     <prov:PMDescriptor xs:id="2323923900239" >
851       <prov:PMID issuer="http://provs-r-us.com">uuid:ee059d84-8819-48c9-a46d-f7fbbc52866c</pro
852 v:PMID>
853       <prov:PMEngineRef>https://pmsRus.org/VeryTrustedModule/4.0</prov:PMEngineRef>
854     </prov:PMDescriptor>
855   </prov:PMUpdateItem>
856   <prov:PMUpdateItem itemID="4" type="urn:liberty:prov:2007-09:ut:engine">
857     <prov:PMDescriptor xs:id="2323923900239" >
858       <prov:PMID issuer="http://provs-r-us.com">uuid:bf3cbd82-23c2-486e-b34b-301f
859 07827b61</prov:PMID>
860       <prov:PMEngineRef>https://pmsRus.org/VeryTrustedModule/4.0</prov:PMEngineRef>
861     </prov:PMDescriptor>
862   </prov:PMUpdateItem>
863   <prov:PMUpdateItem itemID="5" type="urn:liberty:prov:2007-09:ut:engine">
864     <prov:PMDescriptor xs:id="2323923900239" >
865       <prov:PMID issuer="http://provs-r-us.com">uuid:7091b77c-b7e7-42d0-8fba-d6ddac45991e</prov:P
866 MID>
867       <prov:PMEngineRef>https://pmsRus.org/VeryTrustedModule/4.0</prov:PMEngineRef>
868     </prov:PMDescriptor>
869   </prov:PMUpdateItem>
870   <prov:PMUpdateItem itemID="6" type="urn:liberty:prov:2007-09:ut:engine">
871     <prov:PMDescriptor xs:id="2323923900239" >
872       <prov:PMID issuer="http://provs-r-us.com">uuid:e711fd21-10ba-41a9-bf46-5dfed4c0
873 441a</prov:PMID>
874       <prov:PMEngineRef>https://pmsRus.org/VeryTrustedModule/4.0</prov:PMEngineRef>
875     </prov:PMDescriptor>
876   </prov:PMUpdateItem>
877 <dp:NotifyTo>
878   <wsa:Address>https://provider.com/notifications</wsa:Address>
879   <wsa:Metadata>
880     <ds:ProviderID>http://provider.com/</ds:ProviderID>
881     <ds:ServiceType>urn:liberty:dp:2007-09:notification</ds:ServiceType>
882     <ds:Framework version="2.0" />
883     <ds:SecurityContext>
884       <ds:SecurityMechID>urn:liberty:security:2005-02:TLS:null</ds:SecurityMechID>
885     </ds:SecurityContext>
886   </wsa:Metadata>
887 </dp:NotifyTo>
888 </prov:PMUpdate>
889

```

890 **Example 22. Step 1: request to update several PMDs**

891 This request is attempting to update 6 different PMs to the same new version of a pmengine.

892 **4.4.2. Step 2: Initial response from the Provisioning Service**

893 Of the 6 requested items, the Provisioning service is able to process, immediately, one of them and one of them fails.

894 The service returns the partial results shown below.

```
895 <prov:PMUpdateResponse>
896   <lu:Status code="Partial">
897     <lu:Status ref="1" code="WillNotify" />
898     <lu:Status ref="2" code="OK" />
899     <lu:Status ref="3" code="WillNotify" />
900     <lu:Status ref="4" code="WillNotify" />
901     <lu:Status ref="5" code="NotFound" />
902     <lu:Status ref="6" code="WillNotify" />
903   </lu:Status>
904 </prov:PMUpdateResponse>
905
```

906 **Example 23. Step 2: Initial response**

907 A possible alternative at this stage is that none of the results are currently available. In this case, the response would
908 have returned a primary status code of "WillNotify." An example of such a return is below.

```
909 <prov:PMUpdateResponse>
910   <lu:Status code="WillNotify" />
911 </prov:PMUpdateResponse>
912
```

913 **Example 24. Initial response with no completed operations**

914 **4.4.3. Step 3: First Notification**

915 After some time, one of the remaining 4 items completes processing and a notification is sent. Note that the special
916 status "Notify," which indicates that this is a limited status report that only includes the remaining outstanding items
917 (some of which are still in the "WillNotify" state), is used.

```
918 <dp:Notification ref="uuid:2376bf6d-9cf6-420e-a438-436a30f7d3f1" >
919   <prov:PMUpdateResponse>
920     <lu:Status code="Notify">
921       <lu:Status ref="1" code="WillNotify" />
922       <lu:Status ref="3" code="OK" />
923       <lu:Status ref="4" code="WillNotify" />
924       <lu:Status ref="6" code="WillNotify" />
925     </lu:Status>
926   </prov:PMUpdateResponse>
927 </dp:Notification>
928
```

929 **Example 25. Step 3: First Notification**

930 **4.4.4. Step 4: Second Notification**

931 After some additional time, two of the remaining 3 items completes processing and a notification is sent. Note that the
932 special status "Notify," which indicates that this is a limited status report that only includes the remaining outstanding
933 items (the last of which is still in the "WillNotify" state), is used.

```
934 <dp:Notification ref="uuid:2376bf6d-9cf6-420e-a438-436a30f7d3f1" >
935   <prov:PMUpdateResponse>
936     <lu:Status code="Notify">
937       <lu:Status ref="1" code="OK" />
938       <lu:Status ref="4" code="Failed" />
939       <lu:Status ref="6" code="WillNotify" />
940     </lu:Status>
941   </prov:PMUpdateResponse>
942 </dp:Notification>
943
```

944

Example 26. Step 4: Second Notification

945 **4.4.5. Step 5: Final Notification**

946 After some additional time, the last remaining item completes processing and a notification is sent. Note that the
947 special status "*Notify*," which indicates that this is a limited status report that only includes the remaining outstanding
948 items (and no other items are still outstanding since none are still in the "*WillNotify*" state), is used.

```
949 <dp:Notification ref="uuid:2376bf6d-9cf6-420e-a438-436a30f7d3f1" >  
950   <prov:PMUpdateResponse>  
951     <lu:Status code="Notify">  
952       <lu:Status ref="6" code="OK" />  
953     </lu:Status>  
954   </prov:PMUpdateResponse>  
955 </dp:Notification>  
956
```

957

Example 27. Step 5: Final Notification

958 5. ID-WSF Design Patterns Schema

```

959 <?xml version="1.0" encoding="UTF-8"?>
960 <xs:schema targetNamespace="urn:liberty:dp:2007-09"
961   xmlns:lu="urn:liberty:util:2006-08"
962   xmlns:xs="http://www.w3.org/2001/XMLSchema"
963   xmlns:wsa="http://www.w3.org/2005/08/addressing"
964   xmlns="urn:liberty:dp:2007-09"
965   elementFormDefault="qualified"
966   attributeFormDefault="unqualified"
967 >
968
969 <xs:import namespace="urn:liberty:util:2006-08"
970   schemaLocation="liberty-idwsf-utility-v2.0.xsd"/>
971
972 <xs:import namespace="http://www.w3.org/2005/08/addressing"
973   schemaLocation="http://www.w3.org/2005/08/addressing/ws-addr.xsd" />
974
975 <!--*****-->
976 <!--      -->
977 <!--      Polling design pattern schema defs      -->
978 <!--      -->
979 <!--*****-->
980
981
982 <!-- PollType - datatype for polling the recipient for any new work -->
983
984 <xs:complexType name="PollType">
985   <xs:sequence>
986     <xs:element ref="wsa:Action" minOccurs="0" maxOccurs="unbounded" />
987     <xs:element ref="Response" minOccurs="0" maxOccurs="unbounded" />
988   </xs:sequence>
989   <xs:attribute name="wait" type="xs:integer" use="required" />
990   <xs:anyAttribute namespace="##other" processContents="lax" />
991 </xs:complexType>
992
993 <xs:element name="Response" type="ResponseType" />
994 <xs:complexType name="ResponseType">
995   <xs:sequence>
996     <xs:any namespace="##other"
997       processContents="lax"
998       minOccurs="0"
999       maxOccurs="unbounded" />
1000   </xs:sequence>
1001   <xs:attribute name="ref" type="xs:string" use="required" />
1002 </xs:complexType>
1003
1004
1005 <!-- PollResponseType - the datatype of response to a polling message -->
1006
1007 <xs:complexType name="PollResponseType">
1008   <xs:complexContent>
1009     <xs:extension base="ResponseAbstractType">
1010       <xs:sequence>
1011         <xs:element ref="Request" minOccurs="0" maxOccurs="unbounded" />
1012       </xs:sequence>
1013       <xs:attribute name="nextPoll" type="xs:integer" use="optional" />
1014     </xs:extension>
1015   </xs:complexContent>
1016 </xs:complexType>
1017
1018 <xs:element name="Request" type="RequestType" />
1019 <xs:complexType name="RequestType">
1020   <xs:sequence>
1021     <xs:any namespace="##other"
1022       processContents="lax"
1023       minOccurs="0"

```

```

1024         maxOccurs="unbounded" />
1025     </xs:sequence>
1026     <xs:attribute name="itemID" type="xs:string" use="required" />
1027 </xs:complexType>
1028
1029
1030 <!--*****-->
1031 <!-- -->
1032 <!--   Pagination of results design pattern schema defs   -->
1033 <!-- -->
1034 <!--*****-->
1035
1036
1037 <!--BasicPagingAttributeGroup - basic request pagination support -->
1038
1039 <xs:attributeGroup name="BasicPagingAttributeGroup" >
1040     <xs:attribute name="count" use="optional" type="xs:nonNegativeInteger"/>
1041     <xs:attribute name="offset" use="optional" type="xs:nonNegativeInteger" />
1042 </xs:attributeGroup>
1043
1044
1045
1046 <!-- BasicPagingResponseAttributeGroup - basic response pagination support -->
1047
1048 <xs:attributeGroup name="BasicPagingResponseAttributeGroup">
1049     <xs:attribute name="remaining" use="optional" type="xs:integer"/>
1050     <xs:attribute name="nextOffset" use="optional" type="xs:nonNegativeInteger" />
1051     <xs:attribute name="maxCount" use="optional" type="xs:nonNegativeInteger" />
1052 </xs:attributeGroup>
1053
1054
1055 <!-- ExtendedPagingAttributeGroup - adds set support -->
1056
1057 <xs:attributeGroup name="ExtendedPagingAttributeGroup" >
1058     <xs:attributeGroup ref="BasicPagingAttributeGroup" />
1059     <xs:attribute name="setID" use="optional" type="xs:string"/>
1060     <xs:attribute name="setReq" use="optional">
1061         <xs:simpleType>
1062             <xs:restriction base="xs:string">
1063                 <xs:enumeration value="Static"/>
1064                 <xs:enumeration value="DeleteSet"/>
1065             </xs:restriction>
1066         </xs:simpleType>
1067     </xs:attribute>
1068 </xs:attributeGroup>
1069
1070
1071
1072 <!-- ExtendedPagingResponseAttributeGroup - adds support for sets -->
1073
1074 <xs:attributeGroup name="ExtendedPagingResponseAttributeGroup">
1075     <xs:attributeGroup ref="BasicPagingResponseAttributeGroup" />
1076     <xs:attribute name="setID" use="optional" type="xs:string"/>
1077     <xs:attribute name="setExpires" use="optional" type="xs:dateTime"/>
1078 </xs:attributeGroup>
1079
1080
1081 <!--*****-->
1082 <!-- -->
1083 <!--   Delayed Notification design pattern schema defs   -->
1084 <!-- -->
1085 <!--*****-->
1086
1087
1088 <!-- NotifyTo - element for carrying the notification destination -->
1089
1090 <xs:element name="NotifyTo" type="wsa:EndpointReferenceType" />
    
```

```
1091
1092
1093 <!-- Notification - interface for receiving the delayed completion status -->
1094
1095 <xs:element name="Notification" type="NotificationType"/>
1096
1097 <xs:complexType name="NotificationType">
1098   <xs:complexContent>
1099     <xs:extension base="RequestAbstractType">
1100       <xs:sequence>
1101         <xs:any namespace="##other"
1102           processContents="lax"
1103           maxOccurs="unbounded" />
1104       </xs:sequence>
1105       <xs:attribute name="ref" type="xs:string" use="required" />
1106     </xs:extension>
1107   </xs:complexContent>
1108 </xs:complexType>
1109
1110 <!-- NotificationResponse - the response to a Notification message -->
1111
1112 <xs:element name="NotificationResponse" type="NotificationResponseType" />
1113
1114 <xs:complexType name="NotificationResponseType">
1115   <xs:complexContent>
1116     <xs:extension base="ResponseAbstractType" />
1117   </xs:complexContent>
1118 </xs:complexType>
1119
1120 <!-- RequestAbstractType - common request message structure -->
1121
1122 <xs:complexType name="RequestAbstractType" abstract="true">
1123   <xs:anyAttribute namespace="##other" processContents="lax"/>
1124 </xs:complexType>
1125
1126 <!-- ResponseAbstractType - common message response structure -->
1127
1128 <xs:complexType name="ResponseAbstractType" abstract="true">
1129   <xs:sequence>
1130     <xs:element ref="lu:Status"/>
1131   </xs:sequence>
1132   <xs:anyAttribute namespace="##other" processContents="lax"/>
1133 </xs:complexType>
1134
1135 </xs:schema>
1136
1137
1138
1139
1140
```

1141 6. Notification Endpoint WSDL (non-normative)

```
1142 <?xml version="1.0"?>
1143 <definitions name="notify-svc"
1144   targetNamespace="urn:liberty:notify:2007-09"
1145   xmlns:tns="urn:liberty:notify:2007-09"
1146   xmlns="http://schemas.xmlsoap.org/wsdl/"
1147   xmlns:xsd="http://www.w3.org/2001/XMLSchema"
1148   xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
1149   xmlns:wsaw="http://www.w3.org/2006/02/addressing/wsdl"
1150   xmlns:dp="urn:liberty:dp:2007-09"
1151   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
1152   xsi:schemaLocation="http://schemas.xmlsoap.org/wsdl/
1153     http://schemas.xmlsoap.org/wsdl/
1154     http://www.w3.org/2006/02/addressing/wsdl
1155     http://www.w3.org/2006/02/addressing/wsdl/ws-addr-wsdl.xsd">
1156
1157   <types>
1158     <xsd:schema>
1159       <xsd:import namespace="urn:liberty:dp:2007-09"
1160         schemaLocation="liberty-idwsf-dp-v1.0.xsd"/>
1161     </xsd:schema>
1162   </types>
1163
1164   <message name="Notification">
1165     <part name="body" element="dp:Notification"/>
1166   </message>
1167   <message name="NotificationResponse">
1168     <part name="body" element="dp:NotificationResponse"/>
1169   </message>
1170
1171   <portType name="NotifyPort">
1172
1173     <operation name="Notification">
1174       <input message="tns:Notification"
1175         wsaw:Action="urn:liberty:dp:2007-09:Notification" />
1176       <output message="tns:NotificationResponse"
1177         wsaw:Action="urn:liberty:dp:2007-09:NotificationResponse" />
1178     </operation>
1179
1180   </portType>
1181
1182   <!--
1183   An example of a binding and service that can be used with this
1184   abstract service description is provided below.
1185   -->
1186
1187   <binding name="NotifyBinding" type="tns:NotifyPort">
1188
1189     <soap:binding style="document"
1190       transport="http://schemas.xmlsoap.org/soap/http"/>
1191
1192     <operation name="Notification">
1193       <input> <soap:body use="literal"/> </input>
1194       <output> <soap:body use="literal"/> </output>
1195     </operation>
1196
1197   </binding>
1198
1199   <service name="NotifyService">
1200
1201     <port name="NotifyPort" binding="tns:NotifyBinding">
1202
1203       <!-- Modify with the REAL SOAP endpoint -->
1204
1205       <soap:address location="http://example.com/notify"/>
1206
```

```
1207     </port>
1208
1209     </service>
1210
1211 </definitions>
1212
```


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