List Pagination Mechanisms for NETCONF and RESTCONF

draft-ietf-netconf-list-pagination-00
draft-ietf-netconf-list-pagination-nc-00
draft-ietf-netconf-list-pagination-rc-00

NETCONF Meeting (Hybrid) 7/25/2022
on behalf of NETCONF List Pagination Design Team
(Kent Wasten, Qin Wu, Olof Hagsand, Hongwei Li, Per Andersson)
Motivation and Goal:

• To better support user-facing client interfaces to retrieve large number of entries from lists or leaf-lists.
  • Applicable to both config data and state data.
  • Examples: traffic logs, interfaces, ACLs, etc.

• Server-side processing reduces latency, bandwidth, and client-resources.

• Enables servers to leverage “indexes” maintained by their backend storage systems.
List Pagination Suite Overview

• **List Pagination (LP):** draft-ietf-netconf-list-pagination-00
  - A standard mechanisms to control the filtering, sorting, and retrieval of entries of list or leaf-list.

• **NETCONF List Pagination (LP-NC):** draft-ietf-netconf-list-pagination-nc-00
  - NETCONF Extensions to Support List Pagination

• **RESTCONF List Pagination (LP-RC):** draft-wwlh-netconf-list-pagination-rc-00
  - RESTCONF Extensions to Support List Pagination
# List or Leaf-list Pagination

- **Query Parameters:**

<table>
<thead>
<tr>
<th>Query Parameters</th>
<th>Target Data object</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where</td>
<td>List or leaf-list</td>
<td>Filter expression for result set entries to match</td>
</tr>
<tr>
<td>Sort-by</td>
<td>List or leaf-list</td>
<td>Node to sort result set entries</td>
</tr>
<tr>
<td>Direction</td>
<td>List or leaf-list</td>
<td>The direction of result set entries to be returned</td>
</tr>
<tr>
<td>Offset</td>
<td>List or leaf-list</td>
<td>The number of entries to be skipped in the result set</td>
</tr>
<tr>
<td>Limit</td>
<td>List or leaf-list</td>
<td>The number of entries returned</td>
</tr>
<tr>
<td>Sublist-limit</td>
<td>Descendant List or leaf-list</td>
<td>The number of entries returned. For descendant list or leaf-list, the target can be any node or a datastore</td>
</tr>
</tbody>
</table>

- **Server Processing order:**
  - Where > Sort-by > Direction > Offset > Limit.

- **MetaData attribute - remaining:**
  - Used together with limit or sublimit.
  - Return the number of entries not included due to the limit operation.
List or Leaf-list Pagination Example

Combination of 6 query parameters used in the Request/Response message pair to guide how list or leaf-list should be returned

A.3.7 of draft-wwlh-netconf-list-pagination
Example

Example1: Target node: '/example-social:members/member=alice' in the <intended> datastore without sublist-limit parameter set.

Example2: Target node: '/example-social:members/member=alice' in the <intended> datastore with sub-limit parameter set.

A.3.6.1 of draft-wwlh-netconf-list-pagination
Server List Pagination Constraint Discovery

Only for 'config=false' lists and leaf-lists, since interactions with their content may be limited

• Constraints parameters Definition:
  • Constrained: indicate which "config false" list and/or "leaf-list" nodes are constrained.
  • Indexed: and, if so, which nodes may be used in "where and "sort-by" expressions.

• Constraints parameters Extensibility:
  o There may be other constraints that need to be added in this module, e.g., not supporting 100% of the XPath 1.0 syntax or derived-from() and derived-from-or-self() not supported.

Section 4.2.1 of draft-wwlh-netconf-list-pagination
LP NC Protocol Extension

RFC6241
Augment 3 NETCONF RPC statement <get>,<getconfig>,<get-data>.
Aligned with LP draft for query parameters.
LP NC Protocol Extension

List Pagination NC with all parameters in the Request/Response message pair.

Response from the NETCONF server:

```xml
<lpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="42">
  <get-config>
    <source/>
    <filter type="xpath" select="/es:members/es:member">
      <list-pagination>
        <where><![CDATA[states/joined[starts-with(@timestamp, '2020')]]]]></where>
        <sort-by>timestamp</sort-by>
        <direction>backwards</direction>
        <offset>2</offset>
        <limit>2</limit>
        <context-limit>1</context-limit>
      </list-pagination>
    </filter>
  </get-config>
</lpc>
```

D.1 of draft-ww lh-netconf-list-pagination-nc
Update RESTCONF to Support List Pagination

3 Protocol Extensions (RFC8040):
1. Add list and leaf-list as valid resource target for the GET and DELETE operations.
2. Add new media type "application/yang-data+xml-list".
3. Add 6 new query parameters "limit", "offset", "direction", "sort", "where", and "sublist-limit".

<table>
<thead>
<tr>
<th>Name</th>
<th>Methods</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>limit</td>
<td>GET, HEAD</td>
<td>Limits the number of entries returned. If not specified, the number of entries that may be returned is unbounded.</td>
</tr>
<tr>
<td>offset</td>
<td>GET, HEAD</td>
<td>Indicates the number of entries in the result set that should be skipped over when preparing the response. If not specified, then no entries in the result set are skipped.</td>
</tr>
<tr>
<td>direction</td>
<td>GET, HEAD</td>
<td>Indicates the direction that the result set is to be traversed. If not specified, then the result set is traversed in the &quot;forwards&quot; direction.</td>
</tr>
<tr>
<td>sort-by</td>
<td>GET, HEAD</td>
<td>Indicates the node name that the result set should be sorted by. If not specified, then the result set's default order is used, per YANG's &quot;ordered-by&quot; statement.</td>
</tr>
<tr>
<td>where</td>
<td>GET, HEAD</td>
<td>Specifies a filter expression that result set entries must match. If not specified, then no entries are filtered from the result set.</td>
</tr>
<tr>
<td>sublist-limit</td>
<td>GET, HEAD</td>
<td>Limits the number of entries returned returned for descendents lists and leaf-lists. If not specified, the number of entries that may be returned is unbounded.</td>
</tr>
</tbody>
</table>

Deletion of a list

DELETE /restconf/das/ietf-datastores:running/example-social:members/m\ember=bob/favorites/decimal16-numbers HTTP/1.1
Host: example.com
Accept: application/yang-data+xml

Response from the RESTCONF server:

HTTP/1.1 204 No Content
Date: Thu, 26 Jan 2017 20:56:30 GMT
Server: example-server

C.2 of draft-wwlh-netconf-list-pagination-rc
Status of list pagination Suite of drafts
List Pagination Mechanisms for NETCONF and RESTCONF

• Since IETF 112
  • 2022-03-08
    • WG adoption call on 3 companion documents was initiated by Mahesh
    • Thanks for Andy, Qiufang, Wei Wang, Gyan Mishra, Tom petch, Jurgen, Balazs, Michael, Kent, etc for comments and inputs.
    • It was discussed whether Edit operation extension should be in the scope and suggest to see it as post-WG open issue.
    • It was suggested to progress client and server drafts before moving this work forward.
      • Completion of the client-server suite of drafts has been announced on the list on July 18
  • 2022-02-10
    • List Pagination Status Update on the list
    • The resolution on 2 open issues have been confirmed on the list
  • 2021-12-22
    • open issue on Cursor support and solution was brought up and closed on the list
    • Open issue on ‘remaining’ annotation was discussed and closed on the list with William’s suggested change.
  • 2021-11-08
    • Three companion documents presented by Design team member in IETF 112
      • draft-wwlh-netconf-list-pagination-00
      • draft-wwlh-netconf-list-pagination-rc-02
      • draft-wwlh-netconf-list-pagination-nc-02
    • Motivation, Goal and Solution was introduced
    • Two open issues raised in the presentation
  • Two minor changes are required
    • Can be done after v-00 comes up.
  • Awaiting approval of WG chairs on WG v-00.
Comments, Questions, Concerns?