

Network Working Group
Internet-Draft
Intended status: Standards Track
Expires: February 8, 2020

P. Hunt, Ed.
G. Wilson
Oracle
August 7, 2019

SCIM Protocol: Multi-Value Paging Extension
draft-hunt-scim-mv-paging-00

Abstract

The System for Cross-Domain Identity Management (SCIM) specifications define a profile of HTTP protocol and a schema that enable managing identities in cross-domain scenarios. This specification extends SCIM protocol resource retrieval and query functions to enable paging of SCIM resources that contain large complex multi-valued attributes such as SCIM Groups.

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[1.](#) Introduction and Overview

SCIM Protocol [[RFC7644](#)] is an application-level, HTTP protocol for provisioning and managing identity data on the web and in cross-domain environments such as enterprise to cloud, or inter-cloud scenarios. The protocol supports creation, modification, retrieval, and discovery of core identity resources such as Users and Groups, as well as custom resources and resource extensions.

The definition of resources, attributes, and overall schema are defined in the SCIM Core Schema document (see [[RFC7643](#)]).

This specification extends SCIM resource retrieval and query functions to enable paging of SCIM resources that may contain attributes with large numbers of values. For example, a SCIM Group may contain thousands or millions of members.

[1.1.](#) Intended Audience

This document is intended as a guide to extend SCIM protocol usage for both SCIM HTTP service providers and HTTP clients who may provision information to service providers or retrieve information from them.

1.2. Notational Conventions

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

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

For purposes of readability examples are not URL encoded. Implementers MUST percent encode URLs as described in [Section 2.1 of \[RFC3986\]](#).

Throughout this documents all figures may contain spaces and extra line-wrapping for readability and space limitations. Similarly, some URI's contained within examples, have been shortened for space and readability reasons.

1.3. Definitions

This specification uses the definitions from the SCIM Schema Specification [[RFC7643](#)] and the SCIM Protocol Specification [[RFC7644](#)].

2. Multi-Value Paging Extension

Detecting the availability of multi-valued attribute paging extension is covered in [Section 3](#).

When supported, returned values for multi-valued attributes can be filtered or paged using filters and/or paging parameters appended to attributes specified in the SCIM "attributes" parameter. Attributes listed in the attributes parameter MAY be appended with value qualifiers using square brackets("[]") that contains a "valFilter" (see Figure 1 [[RFC7644](#)]), paging parameters (see [Section 3.9 \[RFC7644\]](#)), or a combination of both separated by the "&" character.

In order to qualify specific attributes without changing the default list of attributes returned for a query, an asterix "*" MAY be used

in the `attributes` parameter to indicate the default set of attributes is to be returned in addition to any specific attributes listed. For example: `"attributes=*,members[type eq \"user\"]"` specifies all default attributes are to be returned and only values of `"members"` which have `"type"` set to `"user"`.

When an attribute has a multi-value filter or paging qualifier, the service provider SHALL include additional `"meta"` sub-attributes (see [Section 3.1 of \[RFC7643\]](#)). The name of the multi-valued attribute plus the String `"cnt"` is used to indicate the count of attribute values available expressed as an Integer (see [Section 2.3.4 of \[RFC7643\]](#)). When a `"valFilter"` expression is used, the number SHALL

indicate the total number of matches that may be returned based on the filter. When no filter expression is specified, the number SHALL indicate the total number of values. For an example, see `"emails.cnt"` in Figure 2. This count indicates that there is only one value with `"type"` equal to `"work "`.

When `"startIndex"` is used as an attribute paging qualifier and the value is greater than the number of values, the server SHALL omit the attribute from the result to indicate no values exist at that index.

In the following example, a user is returned, but only `"work"` emails are to be returned.

```
GET /Users/2819c223-7f76-453a-919d-413861904646?  
  attributes=*,emails[type eq \"work\"]  
Host: example.com  
Accept: application/scim+json  
Authorization: Bearer h480djs93hd8
```

Figure 1: Using a filter to return only work email values

The service provider responds with:

HTTP/1.1 200 OK

Content-Type: application/scim+json

Location:

<https://example.com/v2/Users/2819c223-7f76-453a-919d-413861904646>

ETag: W/"f250dd84f0671c3"

```
{
  "schemas":["urn:ietf:params:scim:schemas:core:2.0:User"],
  "id":"2819c223-7f76-453a-919d-413861904646",
  "externalId":"bjensen",
  "meta":{
    "resourceType":"User",
    "created":"2011-08-01T18:29:49.793Z",
    "lastModified":"2011-08-01T18:29:49.793Z",
    "location":
"https://example.com/v2/Users/2819c223-7f76-453a-919d-413861904646",
    "version":"W\/"f250dd84f0671c3\"",
    "emails.cnt":1
  },
  "name":{
```

```

    "formatted":"Ms. Barbara J Jensen III",
    "familyName":"Jensen",
    "givenName":"Barbara"
  },
  "userName":"bjensen",
  "phoneNumbers":[
    {
      "value":"555-555-8377",
      "type":"work"
    }
  ],
  "emails":[
    {
      "value":"bjensen@example.com",
      "type":"work"
    }
  ]
}

```

Figure 2: Response with filtered emails attribute

In the following example, all Groups are searched and only Groups whose name starts with "Group" are selected. Additionally, the members attribute values are filtered return only member values with "type" equal to "groups" (as in sub-groups) returning only the first 5 values using the attributes paging qualifying parameters.

```

GET /v2/Groups?filter=displayName sw 'Group'&attributes=*,members[type
  eq \"Group\"&count=5&startIndex=1]
Host: example.com
Accept: application/scim+json
Authorization: Bearer h480djs93hd8

```

Figure 3: Querying multiple groups with attribute qualifiers

The server responds with 2 matched resources. The first resource

only has one Group member value, while the second resource has 7 member values and has been limited to the first 5 members per the "count" paging parameter .

HTTP/1.1 200 OK

Content-Type: application/scim+json

```
{
  "schemas": ["urn:ietf:params:scim:api:messages:2.0:ListResponse"],
  "totalResults": 2,
  "Resources": [
    {
      "id": "c3a26dd3-27a0-4dec-a2ac-ce211e105f97",
      "schemas": ["urn:ietf:params:scim:schemas:core:2.0:Group"],
      "displayName": "Group A",
      "meta": {
        "resourceType": "Group",
        "created": "2011-08-01T18:29:49.793Z",
        "lastModified": "2011-08-01T18:29:51.135Z",
        "location":
"https://example.com/v2/Groups/c3a26dd3-27a0-4dec-a2ac-ce211e105f97",
        "version": "W\/"mvwNGaxB5SDq074p\"",
        "members.cnt":1
      },
      "members": [
        {
          "value": "6c5bb468-14b2-4183-baf2-06d523e03bd3",
          "$ref":
"https://example.com/v2/Groups/6c5bb468-14b2-4183-baf2-06d523e03bd3",
          "type": "Group"
        }
      ]
    },
  ],
}
```

```
{
  "id": "6c5bb468-14b2-4183-baf2-06d523e03bd3",
  "schemas": ["urn:ietf:params:scim:schemas:core:2.0:Group"],
  "displayName": "Group B",
  "meta": {
    "resourceType": "Group",
    "created": "2011-08-01T18:29:50.873Z",
    "lastModified": "2011-08-01T18:29:50.873Z",
  }
}
```

```

    "location":
"https://example.com/v2/Groups/6c5bb468-14b2-4183-baf2-06d523e03bd3",
    "version": "W\\\\"wGB85s2QJMjiNnuI\\",
    "members.cnt":7
  },
  "members": [
    {
      "value": "c3a26dd3-27a0-4dec-a2ac-ce211e105f97",
      "$ref":
"https://example.com/v2/Groups/c3a26dd3-27a0-4dec-a2ac-ce211e105f97",
      "type": "Group"
    }
    {
      "value": "596ec090-2f66-4d3e-ad4c-68d9ac05ad53",
      "$ref":
"https://example.com/v2/Groups/596ec090-2f66-4d3e-ad4c-68d9ac05ad53",
      "type": "Group"
    }
    {
      "value": "aaf4c421-ceba-4ce0-a119-3d62418f5f9f",
      "$ref":
"https://example.com/v2/Groups/aaf4c421-ceba-4ce0-a119-3d62418f5f9f",
      "type": "Group"
    }
    {
      "value": "58b64358-82e7-4a77-a8eb-9c6d644f9752",
      "$ref":
"https://example.com/v2/Groups/58b64358-82e7-4a77-a8eb-9c6d644f9752",
      "type": "Group"
    }
    {
      "value": "3e32ee8c-246c-42ab-a750-2c2e84d57f1f",
      "$ref":
"https://example.com/v2/Groups/3e32ee8c-246c-42ab-a750-2c2e84d57f1f",
      "type": "Group"
    }
  ]
}
]
}

```

Figure 4: Returning multiple results with paged attribute values

In Figure 3 the client may observe that the number of matches available for the second Group (whose "id" is "6c5bb468-14b2-4183-baf2-06d523e03bd3") is 7. In Figure 4, the client may return the second page, by repeating the query with "startIndex" set to 6.

In the following example, paging of member values of a specific group is requested.

```
GET /v2/Groups/6c5bb468-14b2-4183-baf2-06d523e03bd3?attributes=*,members[type
    eq \"Group\"&count=5&startIndex=6]
Host: example.com
Accept: application/scim+json
Authorization: Bearer h480djs93hd8
```

Figure 5: Query returning the second page of values for an attribute

```
HTTP/1.1 200 OK
Content-Type: application/scim+json
Location:
  https://example.com/v2/Groups/e9e30dba-f08f-4109-8486-d5c6a331660a
ETag: W/"lha5bbazU3fNvfe5"

{
  "id": "6c5bb468-14b2-4183-baf2-06d523e03bd3",

  "schemas": ["urn:ietf:params:scim:schemas:core:2.0:Group"],
  "displayName": "Group B",
  "meta": {
    "resourceType": "Group",
    "created": "2011-08-01T18:29:50.873Z",
    "lastModified": "2011-08-01T18:29:50.873Z",
    "location":
"https://example.com/v2/Groups/6c5bb468-14b2-4183-baf2-06d523e03bd3",
    "version": "W\\\\"wGB85s2QJMjiNnuI\\\"",
    "members.cnt":7
  },

  "members": [
    {
      "value": "596ec090-2f66-4d3e-ad4c-68d9ac05ad53",
      "$ref":
"https://example.com/v2/Groups/596ec090-2f66-4d3e-ad4c-68d9ac05ad53",
      "type": "Group"
    }
    {
      "value": "2e6afed5-282d-4563-83dc-9ef7183b0003",
      "$ref":
"https://example.com/v2/Groups/2e6afed5-282d-4563-83dc-9ef7183b0003",
      "type": "Group"
    }
  ]
}
```

Figure 6: Returning the second page of values for an attribute

[3.](#) Service Provider Configuration Feature Discovery

Multi-value paging support may be determined by querying the `/ServiceProviderConfig` endpoint and looking up the Boolean attribute `mvpaging` indicating support for multi-valued paging.

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4. Security Considerations

To be completed

5. Privacy Considerations

To be completed.

6. IANA Considerations

No IANA considerations.

7. Normative References

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- [RFC7644] Hunt, P., Ed., Grizzle, K., Ansari, M., Wahlstroem, E., and C. Mortimore, "System for Cross-domain Identity Management: Protocol", [RFC 7644](#), DOI 10.17487/RFC7644, September 2015, <<https://www.rfc-editor.org/info/rfc7644>>.

Appendix A. Acknowledgments

The editors would like to acknowledge the contribution and work of the past draft editors:

[Appendix B.](#) Change Log

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Authors' Addresses

Phil Hunt (editor)
Oracle Corporation

Email: phil.hunt@yahoo.com

Gregg Wilson
Oracle Corporation

Email: gregg.wilson@oracle.com

