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**Registration Data Access Protocol (RDAP) Query Parameters for Result
Sorting and Paging
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Abstract

The Registration Data Access Protocol (RDAP) does not include core functionality for clients to provide sorting and paging parameters for control of large result sets. This omission can lead to unpredictable server processing of queries and client processing of responses. This unpredictability can be greatly reduced if clients can provide servers with their preferences for managing response values. This document describes RDAP query extensions that allow clients to specify their preferences for sorting and paging result sets.

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1. Introduction

The availability of functionality for result sorting and paging provides benefits to both clients and servers in the implementation of RESTful services [[REST](#)]. These benefits include:

- o reducing the server response bandwidth requirements;
- o improving server response time;
- o improving query precision and, consequently, obtaining more reliable results;
- o decreasing server query processing load;
- o reducing client response processing time.

Approaches to implementing features for result sorting and paging can be grouped into two main categories:

1. Sorting and paging are implemented through the introduction of additional parameters in the query string (i.e. ODATA protocol [[OData-Part1](#)]);
2. Information related to the number of results and the specific portion of the result set to be returned, in addition to a set of ready-made links for the result set scrolling, are inserted in the HTTP header of the request/response.

However, there are some drawbacks associated with use of the HTTP header. First, the header properties cannot be set directly from a web browser. Moreover, in an HTTP session, the information on the status (i.e. the session identifier) is usually inserted in the header or in the cookies, while the information on the resource identification or the search type is included in the query string. The second approach is therefore not compliant with the HTTP standard [[RFC7230](#)]. As a result, this document describes a specification based on use of query parameters.

Currently the RDAP protocol [[RFC7482](#)] defines two query types:

- o lookup: the server returns only one object;
- o search: the server returns a collection of objects.

While the lookup query does not raise issues in the management of large result sets, the search query can potentially generate a large result set that could be truncated according to the limits of the server. In addition, it is not possible to obtain the total number of the objects found that might be returned in a search query response [[RFC7483](#)]. Lastly, there is no way to specify sort criteria to return the most relevant objects at the beginning of the result set. Therefore, the client could traverse the whole result set to find the relevant objects or, due to truncation, could not find them at all.

The protocol described in this specification extends RDAP query capabilities to enable result sorting and paging, by adding new query parameters that can be applied to RDAP search path segments. The service is implemented using the Hypertext Transfer Protocol (HTTP) [[RFC7230](#)] and the conventions described in [RFC 7480](#) [[RFC7480](#)].

The implementation of the new parameters is technically feasible, as operators for counting, sorting and paging rows are currently supported by the major RDBMSs.

1.1. Conventions Used in This Document

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](#)].

2. RDAP Query Parameter Specification

The new query parameters are OPTIONAL extensions of path segments defined in [RFC 7482](#) [[RFC7482](#)]. They are as follows:

- o "count": a boolean value that allows a client to request the total number of objects found (that due to truncation can be different from the number of returned objects);
- o "sort": a string value that allows a client to request a specific sort order for the result set;
- o "limit" and "offset": numeric values that allow a client to request a specific portion of the entire result set;
- o "cursor": a string value representing a pointer to a specific fixed size portion of the result set. It is alternate to "limit" and "offset".

Augmented Backus-Naur Form (ABNF) [[RFC5234](#)] is used in the following sections to describe the formal syntax of these new parameters.

2.1. Sorting and Paging Metadata

According to most advanced principles in REST design, collectively known as HATEOAS (Hypermedia as the Engine of Application State) ([[HATEOAS](#)]), a client entering a REST application through an initial URI should use the server-provided links to dynamically discover available actions and access the resources it needs. In this way, the client is not requested to have prior knowledge of the service and, consequently, to hard code the URIs of different resources. This would allow the server to make URI changes as the API evolves without breaking the clients. Definitively, a REST service should be as self-descriptive as possible.

Therefore, servers implementing the query parameters described in this specification SHOULD provide additional information in their responses about both the available sorting criteria and the possible pagination. Such information is collected in two new data structures named, respectively, "sorting_metadata" and "paging_metadata".

Obviously, both the new data structures are OPTIONAL because their presence in the response not only depends on the implementation of sorting and paging query capabilities but also on some situations related to the results. For example, it is quite natural to expect that the "paging_metadata" element will not be present at the last result page when the server implements only the forward pagination.

The "sorting_metadata" structure contains the following properties:

- o "currentSort": "String" (OPTIONAL) either the value of sort "parameter" as specified in the query string or the sort applied by default, if any;
- o "availableSorts": "AvailableSort[]" (OPTIONAL) an array of objects each one describing an alternate available sorting criterion. Members are:
 - * "property": "String" (REQUIRED) the name that can be used by the client to request the sorting criterion;
 - * "default": "Boolean" (REQUIRED) whether the sorting criterion is applied by default;
 - * "jsonPath": "String" (OPTIONAL) the JSON Path of the RDAP field corresponding to the property;
 - * "links": "Link[]" (OPTIONAL) an array of links as described in [RFC 8288](#) [[RFC8288](#)] containing the query string that applies the sorting criterion.

At least one between "currentSort" and "availableSorts" MUST be present.

The "paging_metadata" structure contains the following fields:

- o "totalCount": "Numeric" (OPTIONAL) a numeric value representing the total number of objects found. It is provided if the query string contains the "count" parameter;
- o "pageCount": "Numeric" (OPTIONAL) a numeric value representing the number of objects returned in the current page. It is provided when the total number of objects exceeds the page size. This property is redundant for clients because the page size can be derived from the length of the search results array but it can be helpful if the end user interacts with the server through a web browser;
- o "links": "Link[]" (OPTIONAL) an array of links as described in [RFC 8288](#) [[RFC8288](#)] containing the reference to next page. In this specification, only the forward pagination is dealt because it is considered satisfactory in order to traverse the result set.

Examples of additional references are to: the previous page, the first page, the last page.

At least one between "totalCount" and "links" MUST be present.

2.2. "count" Parameter

Currently the RDAP protocol does not allow a client to determine the total number of the results in a query response when the result set is truncated. This is rather inefficient because the user cannot evaluate the query precision and, at the same time, cannot receive information that could be relevant.

The "count" parameter provides additional functionality (Figure 1) that allows a client to request information from the server that specifies the total number of elements matching a particular search pattern.

`https://example.com/rdap/domains?name=*nr.com&count=true`

Figure 1: Example of RDAP query reporting the "count" parameter

The ABNF syntax is the following:

```
count = "count" EQ ( trueValue / falseValue )
trueValue = ("true" / "yes" / "1")
falseValue = ("false" / "no" / "0")
EQ = "="
```

A trueValue means that the server MUST provide the total number of the objects in the "totalCount" field of the "paging_metadata" element (Figure 2). A falseValue means that the server MUST NOT provide this number.


```
{
  "rdapConformance": [
    "rdap_level_0",
    "paging_level_0"
  ],
  ...
  "paging_metadata": {
    "totalCount": 73
  },
  "domainSearchResults": [
    ...
  ]
}
```

Figure 2: Example of RDAP response with "paging_metadata" element containing the "totalCount" field

2.3. "sort" Parameter

The RDAP protocol does not provide any capability to specify results sort criteria. A server could implement a default sorting scheme according to the object class, but this feature is not mandatory and might not meet user requirements. Sorting can be addressed by the client, but this solution is rather inefficient. Sorting and paging features provided by the RDAP server could help avoid truncation of relevant results and allow for scrolling the result set using subsequent queries.

The "sort" parameter allows the client to ask the server to sort the results according to the values of one or more properties and according to the sort direction of each property. The ABNF syntax is the following:

```
sort = "sort" EQ sortItem *( "," sortItem )
sortItem = property-ref [ ":" ( "a" / "d" ) ]
```

"a" means that the ascending sort MUST be applied, "d" means that the descending sort MUST be applied. If the sort direction is absent, an ascending sort MUST be applied (Figure 3).

In the "sort" parameter ABNF syntax, property-ref represents a reference to a property of an RDAP object. Such a reference could be expressed by using a JSON Path. The JSON Path in a JSON document [RFC8259] is equivalent to the XPath [W3C.CR-xpath-31-20161213] in a XML document. For example, the JSON Path to select the value of the ASCII name inside an RDAP domain object is "\$.ldhName", where \$ identifies the root of the document (DOM). Another way to select a value inside a JSON document is the JSON Pointer [RFC6901]. While

JSON Path or JSON Pointer are both standard ways to select any value inside JSON data, neither is particularly easy to use (e.g. "\$.events[?(@.eventAction='registration')].eventDate" is the JSON Path expression of the registration date in an RDAP domain object).

Therefore, this specification provides a definition of property-ref in terms of RDAP properties. However, not all the RDAP properties are suitable to be used in sort criteria, such as:

- o properties providing service information (e.g. links, notices, remarks, etc.);
- o multivalued properties (e.g. status, roles, variants, etc.);
- o properties modeling relationships to other objects (e.g. entities).

On the contrary, some properties expressed as values of other properties (e.g. registration date) could be used in such a context.

In the following, a list of properties an RDAP server MAY implement is presented. The properties are divided in two groups: object common properties and object specific properties.

- o Object common properties. Object common properties are derived from the merge of the "eventAction" and the "eventDate" properties. The following values of the "sort" parameter are defined:

- * registrationDate
- * reregistrationDate
- * lastChangedDate
- * expirationDate
- * deletionDate
- * reinstantiationDate
- * transferDate
- * lockedDate
- * unlockedDate

- o Object specific properties. With regard to the specific properties, some of them are already defined among the query paths. In the following the list of the proposed sorting properties, grouped by objects, is shown:

- * Domain: ldhName
- * Nameserver: ldhName, ipv4, ipv6.
- * Entity: fn, handle, org, email, voice, country, city.

In the following, the correspondence between the sorting properties and the RDAP fields is shown (Table 1):

Object class	Sorting property	RDAP property	Reference in RFC 7483	Reference in RFC 6350
Searchable objects	Common properties	eventAction values suffixed by "Date"	4.5.	
Domain	ldhName	ldhName	5.3.	
Nameserver	ldhName	ldhName	5.2.	
	ipV4	v4 ipAddress	5.2.	
	ipV6	v6 ipAddress	5.2.	
Entity	handle	handle	5.1.	
	fn	vcards fn	5.1.	6.2.1
	org	vcards org	5.1.	6.6.4
	voice	vcards tel with type="voice"	5.1.	6.4.1
	email	vcards email	5.1.	6.4.2
	country	country name in vcards adr	5.1.	6.3.1
	city	locality in vcards adr	5.1.	6.3.1

Table 1: Sorting properties definition

With regard to the definitions in Table 1, some further considerations must be made to disambiguate cases where the RDAP property is multivalued:

- o Even if a nameserver can have multiple IPv4 and IPv6 addresses, the most common configuration includes one address for each IP version. Therefore, the assumption of having a single IPv4 and/or IPv6 value for a nameserver cannot be considered too stringent.
- o With the exception of handle values, all the sorting properties defined for entity objects can be multivalued according to the definition of vCard as given in [RFC6350](#) [RFC6350]. When more than a value is reported, sorting can be applied to the preferred value identified by the parameter pref="1".

Each RDAP provider MAY define other sorting properties than those shown in this document.

The "jsonPath" field in the "sorting_metadata" section is used to clarify the RDAP field the sorting property refers to. In the following, the mapping between the sorting properties and the JSON Paths of the RDAP fields is shown (Table 2). The JSON Paths are provided according to the Goessner v.0.8.0 specification ([[GOESSNER-JSON-PATH](#)]):

Object class	Sorting property	JSON Path
Searchable objects	registrationDate	"\$.domainSearchResults[*].events[?(@.eventAction=="registration")].eventDate"
	reregistrationDate	"\$.domainSearchResults[*].events[?(@.eventAction=="reregistration")].eventDate"
	lastChangedDate	"\$.domainSearchResults[*].events[?(@.eventAction=="lastChanged")].eventDate"
	expirationDate	"\$.domainSearchResults[*].events[?(@.eventAction=="expiration")].eventDate"
	deletionDate	"\$.domainSearchResults[*].events[?(@.eventAction=="deletion")].eventDate"
	reinstantiationDate	"\$.domainSearchResults[*].events[?(@.eventAction=="reinstantiation")].eventDate"
	transferDate	"\$.domainSearchResults[*].events[?(@.eventAction=="transfer")].eventDate"
	lockedDate	"\$.domainSearchResults[*].events[?(@.eventAction=="locked")].eventDate"
	unlockedDate	"\$.domainSearchResults[*].events[?(@.eventAction=="unlocked")].eventDate"
Domain	ldhName	\$.domainSearchResults[*].ldhName
Nameserver	ldhName	\$.nameserverSearchResults[*].ldhName
	ipV4	\$.nameserverSearchResults[*].ipAddresses.v4[0]
	ipV6	\$.nameserverSearchResults[*].ipAddresses.v6[0]
Entity	handle	\$.entitySearchResults[*].handle
	fn	\$.entitySearchResults[*].vcardArray[1][?(@[0]="fn")][3]
	org	\$.entitySearchResults[*].vcardArray[1][?(@[


```

{
  "rdapConformance": [
    "rdap_level_0",
    "sorting_level_0"
  ],
  ...
  "sorting_metadata": {
    "currentSort": "ldhName",
    "availableSorts": [
      {
        "property": "registrationDate",
        "jsonPath": "$.domainSearchResults[*].events[?
(@.eventAction==\"registration\")].eventDate",
        "default": false,
        "links": [
          {
            "value": "https://example.com/rdap/domains?name=*nr.com
&sort=ldhName",
            "rel": "alternate",
            "href": "https://example.com/rdap/domains?name=*nr.com
&sort=registrationDate",
            "title": "Result Ascending Sort Link",
            "type": "application/rdap+json"
          },
          {
            "value": "https://example.com/rdap/domains?name=*nr.com
&sort=ldhName",
            "rel": "alternate",
            "href": "https://example.com/rdap/domains?name=*nr.com
&sort=registrationDate:d",
            "title": "Result Descending Sort Link",
            "type": "application/rdap+json"
          }
        ]
      }
    ],
  },
  "domainSearchResults": [
    ...
  ]
}

```

Figure 4: Example of a "sorting_metadata" instance to implement result sorting

2.4. "limit" and "offset" Parameters

An RDAP query could return a response with hundreds of objects, especially when partial matching is used. For that reason, two parameters addressing result pagination are defined to make responses

easier to handle:

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[Page 12]

- o "limit": means that the server MUST return the first N objects of the result set in the response;
- o "offset": means that the server MUST skip the first N objects and MUST return objects starting from position N+1.

The ABNF syntax is the following:

```
EQ = "="  
limit = "limit" EQ positive-number  
offset = "offset" EQ positive-number  
positive-number = non-zero-digit *digit  
non-zero-digit = "1" / "2" / "3" / "4" / "5" / "6" / "7" / "8" /  
"9"  
digit = "0" / non-zero-digit
```

When limit and offset are used together, they allow implementation of result pagination. The following examples illustrate requests to return, respectively, the first 5 objects, the set of objects starting from position 6, and first 5 objects starting from position 11 of the result set (Figure 5).

`https://example.com/rdap/domains?name=*nr.com&limit=5`

`https://example.com/rdap/domains?name=*nr.com&offset=5`

`https://example.com/rdap/domains?name=*nr.com&limit=5&offset=10`

Figure 5: Examples of RDAP query reporting the "limit" and "offset" parameters

2.4.1. Representing Offset Pagination Links

An RDAP server SHOULD use the "links" array of the "paging_metadata" element to provide a ready-made reference [[RFC8288](#)] to the next page of the result set (Figure 6). Examples of additional "rel" values a server MAY implements are "first", "last", "prev".


```
{
  "rdapConformance": [
    "rdap_level_0",
    "paging_level_0"
  ],
  ...
  "notices": [
    {
      "title": "Search query limits",
      "type": "result set truncated due to excessive load",
      "description": [
        "search results for domains are limited to 10"
      ]
    }
  ],
  "paging_metadata": {
    "totalCount": 73,
    "pageCount": 10,
    "links": [
      {
        "value": "https://example.com/rdap/domains?name=*nr.com",
        "rel": "next",
        "href": "https://example.com/rdap/domains?name=*nr.com&limit=10
                &offset=10",
        "title": "Result Pagination Link",
        "type": "application/rdap+json"
      }
    ]
  },
  "domainSearchResults": [
    ...
  ]
}
```

Figure 6: Example of a "paging_metadata" instance to implement result pagination based on offset and limit

2.5. "cursor" Parameter

The use of limit and offset operators represents the most common way to implement results pagination. However, when offset has a very high value, scrolling the result set could take some time. In addition, offset pagination may return inconsistent pages when data are frequently updated (i.e. real-time data) but this is not the case of registration data. An alternative approach to offset pagination is the keyset pagination, a.k.a. seek-method [[SEEK](#)] or cursor pagination. This method has been taken as the basis for the implementation of a "cursor" parameter [[CURSOR](#)] by some REST API

providers (e.g. [[CURSOR-API1](#)],[[CURSOR-API2](#)]). The cursor is an opaque URL-safe string representing a logical pointer to the first result of the next page (Figure 7).

```
https://example.com/rdap/domains?  
name=*nr.com&cursor=wJlCDLI16KTWypN7T6vc6nWEmEYe99Hjf1XY1xmQV-M=
```

Figure 7: An example of RDAP query reporting the "cursor" parameter

However cursor pagination raises some drawbacks with respect to offset pagination:

- o it needs at least one key field;
- o it does not allow to sort by any field and paginate the results because sorting has to be made on the key field;
- o it does not allow to skip pages because they have to be scrolled in sequential order starting from the initial page;
- o it makes very hard the navigation of the result set in both directions because all comparison and sort operations have to be reversed.

Furthermore, in the RDAP context, some additional considerations can be made:

- o an RDAP object is a conceptual aggregation of information collected from more than one data structure (e.g. table) and this makes even harder for the developers the implementation of the seek-method that is already quite difficult. In fact, for example, the entity object can gather information from different data structures (registrars, registrants, contacts, resellers, and so on), each one with its own key field mapping the RDAP entity handle;
- o depending on the number of the page results as well as the number and the complexity of the properties of each RDAP object in the response, the time required by offset pagination to skip the previous pages could be much faster than the processing time needed to build the current page. In fact, RDAP objects are usually formed by information belonging to multiple data structures and containing multivalued properties (i.e. arrays) and, therefore, data selection is a time consuming process. This situation occurs even though the data selection process makes use of indexes;
- o depending on the access levels defined by each RDAP operator, the increase of complexity and the decrease of flexibility of cursor pagination with respect to the offset pagination could be considered impractical.

Finally, the cursor pagination seems to be a bit inconsistent with some capabilities described in this document like sorting and the implementation of paging links other than the usual "next page" link. But, while the provisioning of more paging links can be superfluous, dropping the sorting capability seems quite unreasonable.

Ultimately, both pagination methods have benefits and drawbacks. Therefore, since the "paging_metadata" element keeps the same structure and clients merely make use of the paging links as they are provided, this RDAP specification lets operators to implement a method according to their needs, the user access levels, the submitted queries.

2.5.1. Representing Cursor Pagination Links

The same considerations made for offset pagination links are applied to cursor pagination links (Figure 8).


```
{
  "rdapConformance": [
    "rdap_level_0",
    "paging_level_0"
  ],
  ...
  "notices": [
    {
      "title": "Search query limits",
      "type": "result set truncated due to excessive load",
      "description": [
        "search results for domains are limited to 10"
      ]
    }
  ],
  "paging_metadata": {
    "totalCount": 73,
    "pageCount": 10,
    "links": [
      {
        "value": "https://example.com/rdap/domains?name=*nr.com",
        "rel": "next",
        "href": "https://example.com/rdap/domains?name=*nr.com
              &cursor=wJlCDLI16KTWypN7T6vc6nWEmEYe99Hjf1XY1xmqV-M=",
        "title": "Result Pagination Link",
        "type": "application/rdap+json"
      }
    ]
  },
  "domainSearchResults": [
    ...
  ]
}
```

Figure 8: Example of a "paging_metadata" instance to implement cursor pagination

3. Negative Answers

The value constraints for the parameters are defined by their ABNF syntax. Therefore, each request providing an invalid value for a parameter SHOULD obtain an HTTP 400 (Bad Request) response code. The same response SHOULD be returned if the client provides an unsupported value for the "sort" parameter in both single and multi sort.

The server can provide a different response when it supports the "limit" and/or "offset" parameters and the client submits values that are out of the valid ranges. The possible cases are:

- o If the client submits a value for the "limit" parameter that is greater than the number of objects to be processed, it is RECOMMENDED that server returns a response including only the processed objects.
- o If the client submits a value for the "offset" parameter that is greater than the number of objects to be processed as well as an invalid value for the "cursor" parameter, it is RECOMMENDED that server returns an HTTP 404 (Not Found) response code.

Optionally, the response MAY include additional information regarding the negative answer in the HTTP entity body.

4. RDAP Conformance

Servers returning the "paging_metadata" element in their responses MUST include "paging_level_0" in the rdapConformance array as well as servers returning the "sorting_metadata" element MUST include "sorting_level_0".

5. Implementation Considerations

The implementation of the new parameters is technically feasible, as operators for counting, sorting and paging are currently supported by the major RDBMSs.

In the following, the match between the new defined parameters and the SQL operators is shown (Table 3):

New query parameter	SQL operator
count	count(*) query without offset, limit and order by [MYSQL-COUNT] , [POSTGRES-COUNT] , [ORACLE-COUNT]
sort	order by [MYSQL-SORT] , [POSTGRES-SORT] , [ORACLE-SORT]
limit	limit n (in MySql [MYSQL-LIMIT] and Postgres [POSTGRES-LIMIT]) FETCH FIRST n ROWS ONLY (in Oracle [ORACLE-LIMIT])
offset	offset m (in Postgres) OFFSET m ROWS (in Oracle)
limit + offset	limit n offset m (in MySql and Postgres) OFFSET m ROWS FETCH NEXT n ROWS ONLY (in Oracle)

Table 3: New query parameters vs. SQL operators

With regard to Oracle, Table 3 reports only one of the three methods that can be used to implement "limit" and "offset" parameters. The others are described in [\[ORACLE-ROWNUM\]](#) and [\[ORACLE-ROW-NUMBER\]](#).

In addition, similar operators are completely or partially supported by the most known NoSQL databases (MongoDB, CouchDB, HBase, Cassandra, Hadoop) so the implementation of the new parameters seems to be practicable by servers working without the use of an RDBMS.

6. Implementation Status

NOTE: Please remove this section and the reference to [RFC 7942](#) prior to publication as an RFC.

This section records the status of known implementations of the protocol defined by this specification at the time of posting of this Internet-Draft, and is based on a proposal described in [RFC 7942](#) [[RFC7942](#)]. The description of implementations in this section is intended to assist the IETF in its decision processes in progressing drafts to RFCs. Please note that the listing of any individual implementation here does not imply endorsement by the IETF. Furthermore, no effort has been spent to verify the information presented here that was supplied by IETF contributors. This is not

intended as, and must not be construed to be, a catalog of available implementations or their features. Readers are advised to note that other implementations may exist.

According to [RFC 7942](#), "this will allow reviewers and working groups to assign due consideration to documents that have the benefit of running code, which may serve as evidence of valuable experimentation and feedback that have made the implemented protocols more mature. It is up to the individual working groups to use this information as they see fit".

[6.1.](#) IIT-CNR/Registro.it

Responsible Organization: Institute of Informatics and Telematics of National Research Council (IIT-CNR)/Registro.it

Location: <https://rdap.pubtest.nic.it/>

Description: This implementation includes support for RDAP queries using data from the public test environment of .it ccTLD. The RDAP server implements both offset and cursor pagination (the latter only when "sort" and "offset" parameters are not present in the query string).

Level of Maturity: This is a "proof of concept" research implementation.

Coverage: This implementation includes all of the features described in this specification.

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[6.2.](#) Google Registry

Responsible Organization: Google Registry

Location: <https://www.registry.google/rdap/>

Description: This implementation includes support for RDAP queries for TLDs such as .GOOGLE, .HOW, .SOY, and .xn--q9jyb4c . The RDAP server implements cursor pagination. The link used to request the next page is included in the notice section of the response.

Level of Maturity: Production.

Coverage: This implementation includes the "cursor" parameter described in this specification.

Contact Information: Brian Mountford, mountford@google.com

[7.](#) Security Considerations

Security services for the operations specified in this document are described in [RFC 7481](#) [[RFC7481](#)].

Search query typically requires more server resources (such as memory, CPU cycles, and network bandwidth) when compared to lookup query. This increases the risk of server resource exhaustion and

subsequent denial of service due to abuse. This risk can be mitigated by either restricting search functionality and limiting the rate of search requests. Servers can also reduce their load by truncating the results in the response. However, this last security policy can result in a higher inefficiency if the RDAP server does not provide any functionality to return the truncated results.

The new parameters presented in this document provide the RDAP operators with a way to implement a secure server without penalizing its efficiency. The "count" parameter gives the user a measure to evaluate the query precision and, at the same time, return a significant information. The "sort" parameter allows the user to obtain the most relevant information at the beginning of the result set. In both cases, the user doesn't need to submit further unnecessary search requests. Finally, the "limit" and "offset" parameters enable the user to scroll the result set by submitting a sequence of sustainable queries according to the server limits.

8. IANA Considerations

This document has no actions for IANA.

9. Acknowledgements

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Appendix A. Change Log

- 00: Initial working group version ported from [draft-loffredo-regext-rdap-sorting-and-paging-05](#)
- 01: Removed both "offset" and "nextOffset" to keep "paging_metadata" consistent between the pagination methods. Renamed "Considerations about Paging Implementation" section in "'cursor" Parameter". Removed "FOR DISCUSSION" items. Provided a more detailed description of both "sorting_metadata" and "paging_metadata" objects.

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