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Registration Data Access Protocol Lookup Format
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Abstract

This document describes uniform patterns to construct HTTP URLs that may be used to retrieve registration information from registries (including both Regional Internet Registries (RIRs) and Domain Name Registries (DNRs)) using "RESTful" web access patterns.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on October 03, 2013.

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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 RFC 2119 [RFC2119].

1.1. Acronyms and Abbreviations

IDN: Internationalized Domain Name
IDNA: Internationalized Domain Names in Applications
DNR: Domain Name Registry
RDAP: Registration Data Access Protocol
REST: Representational State Transfer State Transfer. The term was first described in a doctoral dissertation [REST].
RESTful: an adjective that describes a service using HTTP and the principles of REST.
RIR: Regional Internet Registry

2. Introduction

This document describes a specification for querying registration data using a RESTful web service and uniform query patterns. The service is implemented using the Hypertext Transfer Protocol (HTTP) [RFC2616].

The protocol described in this specification is intended to address deficiencies with the WHOIS protocol [RFC3912] that have been identified over time, including:

- Lack of standardized command structures,
- lack of standardized output and error structures,
- lack of support for internationalization and localization, and
- lack of support for user identification, authentication, and access control.

The patterns described in this document purposefully do not encompass all of the methods employed in the WHOIS and RESTful web services of all of the RIRs and DNRs. The intent of the patterns described here are to enable lookups of:

- networks by IP address,
- autonomous system numbers by number,
- reverse DNS meta-data by domain,
- name servers by name,
- registrars by name, and
- entities (such as contacts) by identifier.

It is envisioned that each registry will continue to maintain NICNAME /WHOIS and/or RESTful web services specific to their needs and those of their constituencies, and the information retrieved through the patterns described here may reference such services.

Likewise, future IETF standards may add additional patterns for additional query types (for example, "/domains" for a domain search query). And Section 4 defines a simple pattern namespacing scheme to accomodate custom extensions that will not interfere with the patterns defined in this document or patterns defined in future IETF standards.

WHOIS services, in general, are read-only services. Therefore URL [RFC3986] patterns specified in this document are only applicable to the HTTP [RFC2616] GET and HEAD methods.

This document does not describe the results or entities returned from issuing the described URLs with an HTTP GET. It is envisioned that other documents will describe these entities in various serialization formats, such as JavaScript Object Notation (JSON, [RFC4627]).

Additionally, resource management, provisioning and update functions are out of scope for this document. Registries have various and divergent methods covering these functions, and it is unlikely a uniform approach for these functions will ever be possible.

HTTP contains mechanisms for servers to authenticate clients and for clients to authenticate servers (from which authorization schemes may be built) so such mechanisms are not described in this document. Policy, provisioning, and processing of authentication and authorization are out-of-scope for this document as deployments will have to make choices based on local criteria. Specified authentication mechanisms MUST use HTTP.

3. Path Segment Specification

The uniform patterns start with a base URL [RFC3986] specified by each registry or any other service provider offering this service. The base URL is followed by a resource-type-specific path segment. The base URL may contain its own path segments (e.g. http://example.com/... or http://example.com/restful-WHOIS/...). The characters used to form a path segment are limited to those that can be used to form a URI as specified in RFC 3986 [RFC3986].

The resource type path segments are:

- 'ip': IP networks and associated data referenced using either an IPv4 or IPv6 address.
- 'autnum': Autonomous system registrations and associated data referenced using an AS Plain autonomous system number.
- 'domain': Reverse DNS (RIR) or domain name (DNR) information and associated data referenced using a fully-qualified domain name.
- 'nameserver': Used to identify a name server information query.
- 'entity': Used to identify an entity information query.

3.1. IP Network Path Segment Specification

Syntax: ip/<IP address> or ip/<CIDR prefix>/<CIDR length>

Queries for information about IP networks are of the form /ip/XXX/... or /ip/XXX/YY/... where the path segment following 'ip' is either an IPv4 [RFC1166] or IPv6 [RFC5952] address (i.e. XXX) or an IPv4 or IPv6 CIDR [RFC4632] notation address block (i.e. XXX/YY). Semantically, the simpler form using the address can be thought of as a CIDR block with a bitmask length of 32 for IPv4 and a bitmask length of 128 for IPv6. A given specific address or CIDR may fall within multiple IP networks in a hierarchy of networks, therefore this query targets the "most-specific" or smallest IP network which completely encompasses it in a hierarchy of IP networks.

The IPv4 and IPv6 address formats supported in this query are described in section 3.2.2 of [RFC3986], as IPv4address and IPv6address ABNF definitions. Any valid IPv6 text address format [RFC4291] can be used, compressed or not compressed. The restricted

rules to write a text representation of an IPv6 address [RFC5952] are not mandatory. However, the zone id [RFC4007] is not appropriate in this context and therefore prohibited.

This is an example URL for the most specific network containing 192.0.2.0:

/ip/192.0.2.0

This is an example of a URL the most specific network containing 192.0.2.0/24:

/ip/192.0.2.0/24

This is an example URL for the most specific network containing 2001:db8:1:1::1:

/ip/2001:db8:1:1::1

3.2. Autonomous System Path Segment Specification

Syntax: autnum/<autonomous system number>

Queries for information regarding autonomous system number registrations are of the form /autnum/XXX/... where XXX is an asplain autonomous system number [RFC5396]. In some registries, registration of autonomous system numbers is done on an individual number basis, while other registries may register blocks of autonomous system numbers. The semantics of this query are such that if a number falls within a range of registered blocks, the target of the query is the block registration, and that individual number registrations are considered a block of numbers with a size of 1.

For example, to find information on autonomous system number 65551, the following path would be used:

/autnum/65551

The following path would be used to find information on 4-byte autonomous system number 65538:

/autnum/65538

3.3. Domain Path Segment Specification

Syntax: domain/<domain name>

Queries for domain information are of the form /domain/XXXX/..., where XXXX is a fully-qualified domain name [RFC4343] in either the in-addr.arpa or ip6.arpa zones (for RIRs) or a fully-qualified domain name in a zone administered by the server operator (for DNRs). Internationalized domain names represented in either A-label or U-label format [RFC5890] are also valid domain names. IDN labels SHOULD NOT be represented as a mixture of A-labels and U-labels.

If the client sends the server an IDN in U-label format, servers that support IDNs MUST convert the IDN into A-label format and perform IDNA processing as specified in RFC 5891 [RFC5891]. The server should perform an exact match lookup using the A-label.

The following path would be used to find information describing the zone serving the network 192.0.2/24:

/domain/2.0.192.in-addr.arpa

The following path would be used to find information describing the zone serving the network 2001:db8:1::/48:

/domain/1.0.0.0.8.b.d.0.1.0.0.2.ip6.arpa

The following path would be used to find information for the example.com domain name:

/domain/example.com

The following path would be used to find information for the xn--xemple-9ua.example IDN:

/domain/xn--xemple-9ua.example

3.4. Name Server Path Segment Specification

Syntax: nameserver/<name server name>

The <name server name> parameter represents a fully qualified name as specified in RFC 952 [RFC0952] and RFC 1123 [RFC1123]. Internationalized names represented in either A-label or U-label format [RFC5890] are also valid name server names. IDN labels SHOULD NOT be represented as a mixture of A-labels and U-labels.

If the client sends the server an IDN in U-label format, servers that support IDNs MUST convert the IDN into A-label format and perform IDNA processing as specified in RFC 5891 [RFC5891]. The server should perform an exact match lookup using the A-label.

The following path would be used to find information for the ns1.example.com name server:

/nameserver/ns1.example.com

The following path would be used to find information for the ns1.xn--xemple-9ua.example name server:

/nameserver/ns1.xn--xemple-9ua.example

3.5. Entity Path Segment Specification

Syntax: entity/<handle>

The <handle> parameter represents an entity (such as a contact, registrant, or registrar) identifier. For example, for some DNRs contact identifiers are specified in RFC 5730 [RFC5730] and RFC 5733 [RFC5733].

The following path would be used to find information for the entity associated with handle CID-4005:

/entity/CID-4005

4. Extensibility

This document describes path segment specifications for a limited number of objects commonly registered in both RIRs and DNRs. It does not attempt to describe path segments for all of the objects registered in all registries. Custom path segments can be created for objects not specified here using the process described in Section TBD of "Using HTTP for RESTful Whois Services by Internet Registries" [I-D.ietf-weirds-using-http].

Custom path segments can be created by prefixing the segment with a unique identifier followed by an underscore character (0x5F). For example, a custom entity path segment could be created by prefixing "entity" with "custom_", producing "custom_entity". Servers MUST return an appropriate failure status code for a request with an unrecognized path segment.

5. Internationalization Considerations

There is value in supporting the ability to submit either a U-label (Unicode form of an IDN label) or an A-label (ASCII form of an IDN label) as a query argument to an RDAP service. Clients capable of processing non-ASCII characters may prefer a U-label since this is more visually recognizable and familiar than A-label strings, but clients using programmatic interfaces might find it easier to submit and display A-labels if they are unable to input U-labels with their keyboard configuration. Both query forms are acceptable.

Internationalized domain and name server names can contain character variants and variant labels as described in RFC 4290 [RFC4290]. Clients that support queries for internationalized domain and name server names MUST accept service provider responses that describe variants as specified in "JSON Responses for the Registration Data Access Protocol" [I-D.ietf-weirds-json-response].

6. IANA Considerations

This document does not specify any IANA actions.

7. Security Considerations

Security services for the operations specified in this document are described in "Security Services for the Registration Data Access Protocol" [I-D.ietf-weirds-rdap-sec]. As we identify specific use cases for which security services are needed they will be described here.

8. Acknowledgements

This document is derived from original work on RIR query formats developed by Byron J. Ellacott of APNIC, Arturo L. Servin of LACNIC, Kaveh Ranjbar of the RIPE NCC, and Andrew L. Newton of ARIN. Additionally, this document incorporates DNR query formats originally described by Francisco Arias and Steve Sheng of ICANN and Scott Hollenbeck of Verisign.

The authors would like to acknowledge the following individuals for their contributions to this document: Francisco Arias, Marc Blanchet, Jean-Philippe Dionne, Behnam Esfahbod, Edward Lewis, and John Levine.

9. References

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Appendix A. Path Segment Specification for Search Queries

All of the path segments described in this document identify patterns for exact-match lookups of data elements. We have explicitly omitted specifications for search queries in the interest of first focusing on more basic protocol operations. Once we understand how exact-match queries will work we will attempt to define specifications for search queries in other documents.

It is important to note that there are already multiple implementations of RESTful RDAP-like prototypes that provide search capabilities. For example:

ARIN: The American Registry for Internet Numbers (ARIN) has published an API [1] (see Section 4.4.2) that describes using plural forms of path segment identifiers (e.g. "domains") and Matrix URIs [2] to indicate that a client is requesting a list of values when searching for RIR registration data. A prototype service [3] that implements this API is up and running.

Verisign: Verisign has deployed a prototype service [4] that implements searches for DNR registration data using HTML query strings (e.g. "?_PRE") to identify search parameters. For example, "http://dnrd.verisignlabs.com/dnrd-ap/domain/verisign?_PRE" performs a search for domain names with a "verisign" prefix.

Appendix B. Change Log

Initial -00: Adopted as working group document.

-01: Added "Conventions Used in This Document" section. Added normative reference to draft-ietf-weirds-rdap-sec and some wrapping text in the Security Considerations section.

-02: Removed "unified" from the title. Rewrote the last paragraph of section 2. Edited the first paragraph of section 3 to more clearly note that only one path segement is provided. Added "bitmask" to "length" in section 3.1. Changed "lowest IP network" to "smallest IP network" in section 3.1. Added "asplain" to the description of autonomous system numbers in section 3.2. Minor change from "semantics is" to "semantics are" in section 3.2. Changed the last sentence in section 4 to more clearly specify error response behavior. Added acknowledgements. Added a paragraph in the introduction regarding future IETF standards and extensibility.

-03: Changed 'query' to 'lookup' in document title to better describe the 'exact match lookup' purpose of this document. Included a multitude of minor additions and clarifications provided by Marc Blanchet and Jean-Philippe Dionne. Modified the domain and name server sections to include support for IDN U-labels.

-04: Updated the domain and name server sections to use .example IDN U-labels. Added text to note that mixed IDN labels SHOULD NOT be used. Fixed broken sentences in Section 5.

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