How it Works: Understanding RDAP
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Registration Data Access Protocol

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ICANN 66
November 2019
Agenda

- Introduction
- WHOIS vs. RDAP Responses
- RDAP Protocol
- gTLD RDAP Profile
- Next Steps
- Tools
Introduction
Two parallel lines of work in ICANN aimed at introducing:

1. RDAP and eventually retiring the WHOIS protocol (triggered by user needs and technical limitations in WHOIS)

2. Policy regarding processing of registration data (e.g., collecting, transferring, displaying), and who should get access to what domain name registration data (triggered by privacy regulations)
Registration Data Directory Services

REGISTRANT
Registers a domain name through reseller, privacy/proxy service provider, or registrar.

REGISTRAR
Collects:
- Domain Name Info (nameservers, expiration date, etc.)
- Contact Info (name, phone number, email, postal address)

REGISTRY
Receives:
- Domain Name Info
- Contact Info (except for .com, .net, or .jobs)

Examples of Uses:
Registrars use the contact info to verify transfer requests. Other examples of uses include consumer protection, law enforcement, DNS abuse and security, domain administrators.

For examples of user stories see https://www.icann.org/resources/pages/gtld-registration-dataflow-matrix-2017-07-24-en

The Flow of Domain Name Registration Data (WHOIS)

Internet Users
Query domain name registration data

Third-party registration directory service
Presents data from registry/registrar

Registrar registration directory service
Domain Name Info and Contact Info

Registry registration directory service
Domain Name Info and Contact Info (except for .com, .net, .jobs)

WHOIS

RIR

EPP

Regards,
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WHOIS

RDAP

REGISTRY

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RDAP

WHOIS

RIR

EPP
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**ICANN**

**WHOIS**

**RDAP**

**RIR**

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Registration Data Access Protocol (RDAP)

- In early 2010 work began to replace WHOIS
- RIRs have been using RDAP for years now
- Some ccTLDs have been offering RDAP
- Since 26 August 2019, gTLD registries and registrars are required to implement an RDAP service
- Still more work is needed in the gTLD space to:
  - Require a common gTLD RDAP profile
  - Have an explicit, production-quality RDAP SLA
  - Have RDAP reporting requirements
  - Eventually retire WHOIS
- ICANN’s RDAP page: https://icann.org/rdap
RDAP is a protocol designed in the IETF (RFCs 7480 – 7484) to replace the existing WHOIS protocol and provides the following benefits:

- Standardized query (HTTP), response (JSON) and error messages (HTTP error codes + JSON)
- Secure access to data
  - When used over HTTPS
- Extensibility
  - Easy to add query and output elements
- Enables differentiated access
  - E.g., limited access for anonymous users; full access for authenticated users
RDAP Features [2/2]

- Bootstrapping mechanism to find the authoritative server for a given query
- Standardized redirection/reference mechanism
  - From a registry to a registrar
- Builds on top of HTTP, the well-known web protocol
- Internationalization support for registration data
- Enables searches for objects
  - Domain names registered by someone, or that have given name server, etc.
Policy Developments
In May 2018, the ICANN Board adopted a Temporary Specification for gTLD Registration Data
  - An interim measure to bring existing obligations in line with requirements of the European Union's General Data Protection Regulation (GDPR)

This triggered a policy development process to confirm it, or not, as a Consensus Policy within 12 months

The first phase of this work, known as the Expedited Policy Development Process (EPDP), published their recommendations in February 2019

Implementation is ongoing
EPDP phase 2

- Phase 2 work started in March 2019
- Will consider a System for Standardized Access to Non-Public Registration Data
  - Expected to develop policy recommendations on who gets access, to what data, under what circumstances, etc.
- Targeting publication of initial report by December 2019, followed by final report (policy recommendations) in 2020
- Implementation would follow ICANN Board adoption of policy recommendations
EPDP Sessions in Montreal

- One **EPDP phase 2 plenary session** on Monday, 10:30 - 12:00
- Four EPDP phase 2 sessions
- Two Registration Data Policy (EPDP phase 1) Implementation Review Team sessions
- Please see [https://66.schedule.icann.org](https://66.schedule.icann.org)
ICANN’s TSG

- In December 2018, ICANN launched a Technical Study Group on access to non-public registration data.

- The TSG explored technical solutions built on RDAP for authenticating, authorizing, and providing access to non-public registration data for third parties with legitimate interests.

- In April 2019, the TSG finalized a technical model that can be considered for a Unified Access Model implementing the policy agreed by the community (e.g., EPDP phase 2).
WHOIS vs RDAP Responses
## WHOIS vs. RDAP Responses

<table>
<thead>
<tr>
<th>WHOIS protocol</th>
<th>RDAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain text response</td>
<td>Text based; machine parsable</td>
</tr>
<tr>
<td>Format varies per server</td>
<td>Flexible in terms of fields and functionality</td>
</tr>
<tr>
<td></td>
<td>Can be easily converted as desired</td>
</tr>
</tbody>
</table>
Example WHOIS Output

Domain Name: ICANN.COM
Registry Domain ID: 2346839_DOMAIN_COM-VRSN
Registrar WHOIS Server: whois.godaddy.com
Registrar URL: http://www.godaddy.com
Updated Date: 2019-02-25T20:26:09Z
Creation Date: 1998-09-14T04:00:00Z
Registry Expiry Date: 2027-10-19T03:59:59Z
Registrar: GoDaddy.com, LLC
Registrar IANA ID: 146
Registrar Abuse Contact Email: abuse@godaddy.com
Registrar Abuse Contact Phone: 480-624-2505
Domain Status: clientDeleteProhibited https://icann.org/epp#clientDeleteProhibited
Domain Status: clientRenewProhibited https://icann.org/epp#clientRenewProhibited
Domain Status: clientTransferProhibited https://icann.org/epp#clientTransferProhibited
Domain Status: clientUpdateProhibited https://icann.org/epp#clientUpdateProhibited
Name Server: A.IANA-SERVERS.NET
Name Server: B.IANA-SERVERS.NET
Name Server: C.IANA-SERVERS.NET
Name Server: NS.ICANN.ORG
DNSSEC: signedDelegation
DNSSEC DS Data: 50731 8 2 6912A467DC432811BD2B1C7E5C01B20E2C60049EB57833E8308FAD0FDE779511
URL of the ICANN Whois Inaccuracy Complaint Form: https://www.icann.org/wicf/
Example RDAP Output

```json
{"objectClassName":"domain","handle":"2346839_DOMAIN_COM-VRSN","ldhName":"ICANN.COM","links": [{"value":"https://rdap.verisign.com/com/v1/domain/ICANN.COM","rel":"self","href":"https://rdap.verisign.com/com/v1/domain/ICANN.COM","type":"application/rdap+json"},{"value":"https://rdap.godaddy.com/v1/domain/ICANN.COM","rel":"related","href":"https://rdap.godaddy.com/v1/domain/ICANN.COM","type":"application/rdap+json"}],"status": ["client delete prohibited","client renew prohibited","client transfer prohibited","client update prohibited"],"entities": ["objectClassName":"entity","handle":"146","roles":["registrar"],"publicIds": ["type":"IANA Registrar ID","identifier":"146"],"vcardArray":["vcard",["version",{},"text","4.0"],["fn",{},"text","GoDaddy.com, LLC"]],"entities": [{"objectClassName":"entity","roles":["abuse"],"vcardArray": ["vcard",["version",{},"text", "4.0"],["tel",{}],"voice"],"uri","tel:480-624-2505"],"email","text","abuse@godaddy.com"]}],"events": [{"eventAction":"registration","eventDate":"1998-09-14T04:00:00Z"},{"eventAction":"expiration","eventDate":"2027-10-19T03:59:59Z"},{"eventAction":"last update of RDAP database","eventDate":"2019-09-25T21:59:50Z"}],"secureDNS": {"delegationSigned":true,"dsData": [{"keyTag":50731,"algorithm":8,"digestType":2,"digest":"6912A467DC432811BD2B1C7E5C01B20E2C60049EB57833E8308FAD0FDE779511"}],"nameservers": ["objectClassName": "nameserver","ldhName": "A.IANA-SERVERS.NET"],"objectClassName": "nameserver","ldhName": "B.IANA-SERVERS.NET"],"objectClassName": "nameserver","ldhName": "C.IANA-SERVERS.NET"],"objectClassName": "nameserver","ldhName": "NS.ICANN.ORG"],"rdapConformance": ["rdap_level_0","icann_rdap_technical_implementation_guide_0","icann_rdap_response_profile_0"],"notices": [{"title": "Terms of Use","description": ["Service subject to Terms of Use."],"links": ["href": "https://www.verisign.com/domain-names/registration-data-access-protocol/terms-service/index.xhtml","type": "text/html"]}, {"title": "Status Codes","description": ["For more information on domain status codes, please visit https://icann.org/epp"],"links": ["href": "https://icann.org/epp","type": "text/html"]}, {"title": "RDDS Inaccuracy Complaint Form","description": ["URL of the ICANN RDDS Inaccuracy Complaint Form: https://icann.org/wicf"],"links": ["href": "https://icann.org/wicf","type": "text/html"]}]}}```
Example RDAP Output – formatted:

```
{
  "objectClassName": "domain",
  "handle": "2346839_DOMAIN_COM-VRSN",
  "ldhName": "ICANN.COM",
  "links": [
    {
      "value": "https://rdap.verisign.com/v1/domain/ICANN.COM",
      "rel": "self",
      "href": "https://rdap.verisign.com/v1/domain/ICANN.COM",
      "type": "application/rdap+json"
    },
    {
      "value": "https://rdap.godaddy.com/v1/domain/ICANN.COM",
      "rel": "related",
      "href": "https://rdap.godaddy.com/v1/domain/ICANN.COM",
      "type": "application/rdap+json"
    }
  ],
  "status": {
    "client_delete_prohibited": true,
    "client_renew_prohibited": false,
    "client_transfer_prohibited": false,
    "client_update_prohibited": false
  },
  "entities": [
    {
      "objectClassName": "entity",
      "handle": "146",
      "roles": [
        "registrar"
      ],
      "publicIds": [
        {
          "type": "IANA Registrar ID",
          "identifier": "146"
        }
      ],
      "vcardArray": [
        "vcard",
        {
          "version": null,
          "text": "4.0",
          "fn": null,
          "text": ".Com, LLC"
        }
      ],
      "entities": [
        {
          "objectClassName": "entity",
          "roles": [
            "abuse"
          ],
          "vcardArray": [
          ]
        }
      ]
    },
    {
      "objectClassName": "nameserver",
      "ldhName": "A.IANA-SERVERS.NET"
    },
    {
      "objectClassName": "nameserver",
      "ldhName": "B.IANA-SERVERS.NET"
    },
    {
      "objectClassName": "nameserver",
      "ldhName": "C.IANA-SERVERS.NET"
    },
    {
      "objectClassName": "nameserver",
      "ldhName": "NS.ICANN.ORG"
    }
  ],
  "rdapConformance": {
    "rdap_level": 0,
    "rcode": 0,
    "icann_rcode": 0,
    "icann_rdap_conformance": 0
  },
  "notices": [
    {
      "title": "Terms of Service",
      "description": "Service subject to Terms of Service."
    },
    {
      "title": "Status Codes",
      "links": [
        {
          "href": "https://www.verisign.com/domain-names/registration-data-access-protocol/terms-service/index.xhtml",
          "type": "text/html"
        }
      ]
    }
  ]
}
```
RDAP Web Client

Enter a domain name

icann.com

By submitting any personal data, I acknowledge and agree that the personal data submitted by me will be processed in accordance with the ICANN Privacy Policy, and agree to abide by the website Terms of Service and the Domain Name Registration Data Lookup Terms of Use.

Domain Information

Name: ICANN.COM

Registry Domain ID: 2346839_DOMAIN_COM-VRSN

Domain Status:

Nameservers:
NS.ICANN.ORG
A.IANA-SERVERS.NET
B.IANA-SERVERS.NET
C.IANA-SERVERS.NET

Dates

Registry Expiration: 2027-10-19 03:59:59 UTC
Registrar Expiration: 2027-10-18 22:59:59 UTC
Created: 1998-09-14 04:00:00 UTC

Contact Information
RDAP Protocol
RDAP RFCs

- RFC 7480 – HTTP Usage in RDAP
- RFC 7481 – Security Services for RDAP
- RFC 7482 – RDAP Query Format
- RFC 7483 – JSON Responses for RDAP
- RFC 7484 – Finding the Authoritative Registration Data RDAP Service
- RFC 8056 – EPP and RDAP Status Mapping
- RFC 8521 – RDAP Object Tagging
- RFC 8605 – vCard Format Extensions: ICANN Extensions for RDAP
The mission of the IETF is to produce high quality, relevant technical and engineering documents that influence the way people design, use, and manage the Internet in such a way as to make the Internet work better.

Any interested person can participate in the work, know what is being decided, and make his or her voice heard on the issue.

The IETF make standards based on the combined engineering judgement of our participants and our real-world experience in implementing and deploying our specifications.
IETF’s REGEXT Working Group

- The technical work of the IETF is done in working groups, which are organized by topic
- The REGEXT WG is the RDAP protocol is maintained and extended
- RIRs, registries and registrars participate in the REGEXT WG
Lookup vs. Search

- Lookup is a query for a specific object, e.g., a query for the domain name "icann.org"

- Search is a query for objects with shared characteristics, e.g., domain names registered by the organization “ACME Inc”, or the registrant “John Smith”, or that contain the word “acme”, etc.
# RDAP Lookup URL Specification

<table>
<thead>
<tr>
<th>Category</th>
<th>URL Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domain</td>
<td>domain/&lt;domain name&gt;</td>
</tr>
<tr>
<td>Nameserver</td>
<td>nameserver/&lt;nameserver name&gt;</td>
</tr>
<tr>
<td>Entity</td>
<td>entity/&lt;handle&gt;</td>
</tr>
<tr>
<td>ASN</td>
<td>autnum/&lt;autonomous system number&gt;</td>
</tr>
<tr>
<td>IP Network</td>
<td>ip/&lt;IP address&gt;</td>
</tr>
<tr>
<td></td>
<td>ip/&lt;CIDR prefix&gt;/&lt;CIDR length&gt;</td>
</tr>
</tbody>
</table>
Domain Queries

Domain query: `<baseUrl>/domain/<domain name>`

- Used to identify a domain name and associated data referenced.
- The `<domain name>` is a fully qualified domain name.
  - A-label and U-label format are both supported.
- Examples:
  - `https://rdap.nic.example/domain/foo.example`
  - `https://rdap.nic.example/domain/网站.域名`
  - `https://rdap.nic.example/domain/xn--fo-5ja.example`
JSON – JavaScript Object Notation

- RDAP responses are provided using JSON (RFC 7159)
- JSON objects are unordered sets of name/value pairs
  - E.g. { “name” : “value” }
- JSON defines the following data types for the values:
  - Number
  - String
  - Boolean (true or false)
  - Array
  - Object
  - Null
Example

```json
{
  "title" : "Introduction to JSON",
  "isbn" : "123456-ABC",
  "author" : "John Doe",
  "pages" : 80,
  "published" : true,
  "tableOfContents" : [
    { "section" : "Introduction", "page" : 2 },
    { "section" : "Chapter 1", "page" : 8 },
    { "section" : "Chapter 2", "page" : 31 },
    { "section" : "Epilogue", "page" : 57 },
    { "section" : "Appendix A", "page" : 70 }
  ]
}
```
## Domain Response

<table>
<thead>
<tr>
<th>Member</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>handle</td>
<td>String</td>
<td>The unique identifier of the domain object response</td>
</tr>
<tr>
<td>ldhName</td>
<td>String</td>
<td>The domain name in LDH form</td>
</tr>
<tr>
<td>unicodeName</td>
<td>String</td>
<td>The domain with U-labels</td>
</tr>
<tr>
<td>variants</td>
<td>Object array</td>
<td>An array of objects, each with the following values:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• relation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• idnTable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• variantNames</td>
</tr>
<tr>
<td>nameservers</td>
<td>Object array</td>
<td>Name</td>
</tr>
<tr>
<td>entities</td>
<td>Object array</td>
<td>Entity objects related to this domain object</td>
</tr>
<tr>
<td>network</td>
<td>Object array</td>
<td>The IP network for which a reverse DNS domain is referenced</td>
</tr>
</tbody>
</table>
### Domain Response

<table>
<thead>
<tr>
<th>Member</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>secureDNS</td>
<td>Object</td>
<td>DNSSEC related info with the following members:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• zoneSigned</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• delegationsigned</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• maxSigLife</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• dsData</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• flags</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• keyTag</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• algorithm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• digest</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• digestType</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• events</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• links</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• keyData</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• flags</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• protocol</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• publicKey</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• algorithm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• events</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• links</td>
</tr>
</tbody>
</table>
## Entity Response

<table>
<thead>
<tr>
<th>Member</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>handle</td>
<td>String</td>
<td>The unique identifier of the entity</td>
</tr>
<tr>
<td>vcardArray</td>
<td>Object</td>
<td>A jCard (RFC 7095) with the entity's contact information</td>
</tr>
<tr>
<td>roles</td>
<td>String array</td>
<td>The relationship an object would have with it's closes containing object.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Role values defined in the IANA registry for RFC 7483</td>
</tr>
<tr>
<td>entities</td>
<td>Object array</td>
<td>Entity objects related to this entity object</td>
</tr>
<tr>
<td>asEventActor</td>
<td>Object array</td>
<td>Same as the “events” common data structure, denoting this entity as the event actor for the given events.</td>
</tr>
<tr>
<td>networks</td>
<td>Object array</td>
<td>ipNetwork objects related to this entity</td>
</tr>
<tr>
<td>autnums</td>
<td>Object array</td>
<td>autnum objects related to this entity</td>
</tr>
</tbody>
</table>
Entity Response – jcard Example

Jcard Properties
- version
- fn
- kind
- lang
- org
- title
- role
- adr
- tel
- email
- lang
- geo
- gender
- ...

"vcardArray": [
  "vcard",
  [
    "version", {}, "text", "4.0" ],
  [ "fn", {}, "text", "John Doe" ],
  [ "org", {}, "text", "ICANN" ],
  [ "tel", {}, "uri", "tel:+1-123-456-7890" ],
  [ "adr", {}, "text", [ "6 Rond-Point Schuman", "Brussels", "B-1040", "Belgium" ]
  ],
]
Nameserver Queries

Nameserver query

<baseUrl>/nameserver/<nameserver name>

- Used to identify a nameserver information query using a host name.

- The <nameserver name> is a fully qualified host name.
  - A-label and U-label format are both supported
  - Some examples:
    - ns1.example.com
    - ns1.xn--fo-5ja.example
    - ns1.网站.域名
# Nameserver Response

<table>
<thead>
<tr>
<th>Member</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>handle</td>
<td>String</td>
<td>The unique identifier of the nameserver object response</td>
</tr>
<tr>
<td>ldhName</td>
<td>String</td>
<td>The nameserver in LDH form</td>
</tr>
<tr>
<td>unicodeName</td>
<td>String</td>
<td>The DNS Unicode name of the nameserver</td>
</tr>
<tr>
<td>ipAddresses</td>
<td>Object array</td>
<td>An object array with the following members:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• v6: as an array of strings with IPv6 addresses of the nameserver</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• v4: as an array of strings with IPv4 addresses of the nameserver</td>
</tr>
<tr>
<td>entities</td>
<td>Object array</td>
<td>Entity objects related to this nameserver object</td>
</tr>
</tbody>
</table>
IP Network Queries

- Used to identify IP networks and associated data referenced using either an IPv4 or IPv6 address.

- Query targets the smallest IP network that encompasses the provided address in a hierarchy of IP networks.

- The `<IP address>` may be IPv4 dotted decimal or IPv6 address (RFC 4291)
  - IPv6 recommended text representation per RFC 5952.
  - IPv6 zone_id not supported and must not be used (RFC 6874).

- CIDR notation address blocks prefix and length are defined in RFC 4632.

- Some examples
  - 192.0.2.0
  - 192.0.2.0/24
  - 2001:db8::0
## IP Network Response

<table>
<thead>
<tr>
<th>Member</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>handle</td>
<td>String</td>
<td>The RIR-unique identifier of the network registration</td>
</tr>
<tr>
<td>startAddress</td>
<td>String</td>
<td>Starting v4 or v6 IP address of the network</td>
</tr>
<tr>
<td>endAddress</td>
<td>String</td>
<td>Ending v4 or v6 IP address of the network</td>
</tr>
<tr>
<td>ipVersion</td>
<td>String</td>
<td>the IP protocol version (&quot;v4&quot; or &quot;v6&quot;)</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>identifier assigned to the network registration by the registration holder</td>
</tr>
<tr>
<td>type</td>
<td>String</td>
<td>RIR-specific classification of the network</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>2-character country code of the network</td>
</tr>
<tr>
<td>parentHandle</td>
<td>String</td>
<td>RIR-unique identifier of the parent network of this registration</td>
</tr>
<tr>
<td>entities</td>
<td>Object array</td>
<td>Entity objects related to this network</td>
</tr>
</tbody>
</table>
Autonomous System Number Queries

ASN query: `<baseUrl>/autnum/<autonomous system number>`

- Used to identify Autonomous System number registrations and associated data referenced
- The `<autonomous system number>` is an autonomous system number
  - Format as specified in RFC 5396
  - Target of the query is the ASN block registration that includes the queried number
## Autonomous System Number Response

<table>
<thead>
<tr>
<th>Member</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>handle</td>
<td>String</td>
<td>RIR-unique identifier of the ASN registration</td>
</tr>
<tr>
<td>startAutnum</td>
<td>Number</td>
<td>A number representing the starting number in the block of ASNs</td>
</tr>
<tr>
<td>endAutnum</td>
<td>Number</td>
<td>A number representing the ending number in the block of ASNs</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Identifier assigned to the ASN registration by the registration holder</td>
</tr>
<tr>
<td>type</td>
<td>String</td>
<td>RIR-specific classification of the ASN</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>The 2-character country code of the ASN</td>
</tr>
<tr>
<td>entities</td>
<td>Object array</td>
<td>Entity objects related to this ASN</td>
</tr>
</tbody>
</table>
Error responses have a basic structure that allows the response to include information describing the error.
- **errorCode** value is based on the HTTP response code

```json
{
    "errorCode": 400,
    "title": "Incorrect path segment",
    "description": [
        "Error processing this request.",
        "Please try again."
    ]
}
```
Internationalization in RDAP

- Internationalized domain names are supported in both the query and the response
- Internationalized contact information is also supported
- Contact information supports language tags in order to identify the language/script of data fields
- Replies are JSON formatted, which supports and by default requires UTF-8
- UTF-8 is a Unicode encoding. Unicode supports most of the world's writing systems.
Bootstrapping

- RDAP includes a standard mechanism that allows a client to find the authoritative server for a domain name, IP address, etc.
- RDAP specification explains how to form direct queries and basic search queries
- IANA maintains a list of the “base RDAP URLs” at:
  - https://data.iana.org/rdap/
  - Base URL example: https://rdap.nic.example/
Extensibility in RDAP

- RDAP was defined with extensibility in mind
- An RDAP extension augments the features of the RDAP protocol
  - [https://www.iana.org/assignments/rdap-extensions/rdap-extensions.xhtml](https://www.iana.org/assignments/rdap-extensions/rdap-extensions.xhtml)
- Several IANA Registries are used to easily extend the values defined in RDAP
  - Adds value to the RDAP related IANA Registries
  - Lightweight process that involves sending an email to IANA. Next an expert does a quick review and approves or rejects the addition
Current Proposed RDAP Extensions

gTLD RDAP Profile

RDAP Responses in the gTLD Space
gTLD RDAP Profile

- RDAP is a flexible protocol that allows implementers to choose from different features

- The gTLD RDAP Profile defines the features to be supported by gTLD registries and registrars implementing an RDAP service

- The profile intends to map current policy requirements to the RDAP implementation
A discussion group of gTLD registries and registrars developed a gTLD-RDAP Profile consisting of two documents:

1) RDAP Technical Implementation Guide

2) RDAP Response Profile

For now, compliance with the profile is recommended but not required from gTLD registries and registrars.
What is Prescribed by the Profile

- What fields are to be included in a response
  - Adding fields without further approval from ICANN
- Object queries to be supported (e.g., domains, name servers, contacts, registrars)
- Supporting both IPv4 and IPv6 transport
- HTTP headers enabling web clients (like ICANN’s)
- DNSSEC
- Rejecting queries for IDNs mixing A- and U-labels
What is Prescribed by the Profile

- Registrars providing to ICANN their base RDAP URLs
- Inclusion of “Terms of Service”
- Support for “Help” queries
- Truncated responses having to indicate reason
- Use of country code instead of country name
- URI to facilitate communication with a contact
- URL for AWIP compliance
What is Prescribed by the Profile

- Requirement to register RDAP extensions with IANA
- Inclusion of DNSSEC elements
- Registrars only responding for their sponsored names
- Using registrar identifier for contacts in thin registries
- Allows for unredacted responses on the basis of a legitimate interests pursued by third party (Temp spec)
A registry provides in the RDAP response a URL to the registrar’s RDAP service that allows obtaining authoritative information maintained by the Registrar.

- In today’s thin registry environments (e.g., .com, and .net), the registry does not collect domain contact data.

- The URL provided by the registry allows the user to obtain the (contact data) that is only available in the registrar.
Data Confidentiality and Integrity

- Hypertext Transfer Protocol Secure (HTTPS) is the security protocol of choice on the Internet.

- HTTPS create an encrypted channel between the client and service provider.

- HTTPS uses Transport Layer Security (TLS) as the basis for providing the security services.
Redaction Requirements

- When applicable per policy, fields to be redacted are **not** to be included in the response.

- A remarks element is to be included within the redacted contact, including:
  - a **specific** type ("object redacted due to authorization")
  - a **specific** description ("Some of the data in this object has been removed")
  - a title **substantially similar** to ("REDACTED FOR PRIVACY")
Differentiated Access

- Differentiated access refers to showing different subsets of data fields based on the permissions of who is asking.

- The Temporary Specification for gTLD Registration Data defines a minimum output and also requires providing access to further data on the basis of legitimate interest.

- Further policy work/requirements have to be developed in order to have a Unified Access Model that would provide for this access in a consistent way in gTLDs.
ICANN is working with gTLD registries and registrars to:

- Adopt a gTLD-RDAP service-level agreement (SLA)
- Adopt reporting requirements for registries (e.g., how many RDAP queries were received in a month)
- Require adherence to a common gTLD RDAP profile
- Retire WHOIS
RDAP Tools
RDAP Client Implementations Available

- ICANN's RDAP web client
- CentralNIC
- DNSBelgium
- NicInfo
- OpenRDAP
Demonstration

- ICANN org’s web client
  - For now, only supports domain object lookups
    - https://lookup.icann.org/

- Command line RDAP client
One World, One Internet

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