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Registration Data Access Protocol Object Inventory Analysis
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Abstract

   WHOIS output objects from registries (including both Regional
   Internet Registries (RIRs) and Domain Name Registries (DNRs)) were
   collected and analyzed. This document describes the statistical
   analysis process and result of existing WHOIS information. The
   purpose of this document is to build an object inventory to
   facilitate discussions of data objects included in Registration Data
   Access Protocol (RDAP) responses.

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1. Introduction

   RIRs and DNRs have historically maintained a lookup service to permit
   public access to some portion of the registry database. Most
   registries offer the service via the WHOIS protocol [RFC3912], with
   additional services being offered via world wide web pages, bulk
   downloads, and other services, such as Routing Policy Specification
   Language (RPSL) [RFC2622].

   Although the WHOIS protocol is widely adopted and supported, it has
   several shortcomings that limit its usefulness to the evolving needs
   of the Internet community. Specifically,

   o It has no query and response format.

   o It does not support user authentication, access control for
      differentiated access.

   o It has not been internationalized and thus does not consistently
      support Internationalized Domain Names (IDNs, described in
      [RFC5890]).

   This document records an inventory of registry data objects to
   facilitate discussions of registration data objects. The
   Registration Data Access Protocol (RDAP) was developed using this
   inventory as input.

   In number space, there are altogether five RIRs. Although all RIRs
   provide information about IP addresses, Autonomous System Number
   (ASNs) and contacts, the data model used is different for each RIR.
   In domain name space, there are over 200 country code Top-Level
   Domains (ccTLDs) and over 400 generic Top-Level Domains (gTLDs) when
   the document is published. Different domain name registries may have
   different WHOIS response objects and formats. A common understanding
   of all these data formats is critical.

This document describes the WHOIS data collection procedures and gives a data object inventory analysis based on the collected data from five RIRs and 106 ccTLDs and 18 gTLDs from DNRs. The RIR data objects are classified into IP address, ASN, person or contact and the organization that held the resource. The DNR data objects are classified into domain, contact, nameserver and registrar related objects. Other objects that do not belong to above categories are viewed as private designed objects. In this document, there is no intent to analyze all the query and response types existed in RIRs and DNRs. The most common query objects are discussed, but other objects such as RPSL data structures used by Internet Routing Registries (IRRs) can be documented later if the community feels it is necessary.

2. Terminology

o Data element -- The name of specific response object.

o Label -- The name given to a particular data element, which may vary between registries.

o Most popular label -- The label which is most supported by the registries.

o Number of labels -- The number of different labels.

o Total count -- The number of registries that support a certain data element.

3. Methodology

WHOIS information, including port 43 response and web response data, was collected following the procedures described below.

RIR objects collection process:

(1) The process of RIR data collection was relatively easy. There are altogether five RIRs which are AFRINIC, APNIC, ARIN, LACNIC and RIPE NCC. All the RIRs provide information of IPs, ASNs and contacts. First, find the five RIR WHOIS servers.

(2) Query the corresponding IPs, ASNs, contacts and organizations registered in five RIRs and make a comparative analysis of the responses data.

(3) Data elements with the same meaning, but using different labels, were grouped together.

DNR objects collections process:

(1) A programming script was applied to collect port 43 response
     data from 294 ccTLDs. "nic.ccTLD" is used as the query string,
     which is usually registered in a domain registry. Responses of
     106 ccTLDs were received. 18 gTLDs' port 43 response data was
     collected from their contracts with ICANN. Thus, the sample
     size of port 43 WHOIS response data is 124 registries in total.

(2) WHOIS data from web was collected manually from the 124
     registries that have port 43 WHOIS responses.

(3) Some of the responses which were collected by program did not
     seem to be correct, so data of the top 10 ccTLD registries, like
     .de, .eu and .uk etc., was re-verified by querying domain names
     other than "nic.ccTLD".

(4) In accordance with the specification 4 of new gTLD applicant
     guide book [ICANN.AGB-201206] and the Extensible Provisioning
     Protocol (EPP) ([RFC5730], [RFC5731], [RFC5732] and [RFC5733]),
     the response data objects are classified into public and other
     data objects. Public data objects are those which are defined
     in the above references. Other objects are those which are self
     designed data elements or objects in different registries.

(5) Data elements with the same meaning, but using different labels,
     were grouped together. The numbers of registries that support
     the data elements are shown in the total count column.

4. RIR Objects Analysis

4.1. WHOIS Data for Organizations Holding a Resource

The following table shows the organization objects of five RIRs.

RIR Objects	AFRINIC	APNIC	ARIN	LACNIC	RIPE NCC
Organization name	organisation	NA	Name	Owner	org-name
Organization ID	org-name	NA	Handle	owner-id	organisation
Company	NA	NA	Company	NA	NA
Name of	NA	NA	NA	responsible	NA

person responsible					
Type of organization	org-type	NA	NA	NA	org-type
Country	country	NA	country	country	country
Postal Address	address	NA	address	address	address
City	NA	NA	city	NA	address
State	NA	NA	StateProv	NA	address
Postal Code	NA	NA	PostalCode	NA	address
Phone	phone	NA	NA	phone	phone
Fax Number	fax-no	NA	NA	NA	fax-no
ID of administrative contact	admin-c	NA	Admin POC	owner-c	admin-c (multiple)
ID of technical contact	tech-c	NA	Tech POC	tech-c	tech-c (multiple)
Maintainer organization	mnt-ref	NA	NOC POC	NA	mnt-ref
Maintainer object	mnt-by	NA	Abuse POC	NA	mnt-by
Remarks	remarks	NA	NA	NA	remarks
Date of record creation	Changed	NA	RegDate	created	Changed
Date of record changed	changed	NA	Updated	changed	changed
List of resources	NA	NA	NA	list of resources	NA

```
+--------------+------------+-----+----------+----------+------------+
|    Source    |   source   | NA  |    NA    |    NA    |   source   |
+--------------+------------+-----+----------+----------+------------+
|  Reference   |     NA     | NA  |   Ref    |    NA    |     NA     |
+--------------+------------+-----+----------+----------+------------+
```

             WHOIS Data for Organizations Holding a Resource

4.2. WHOIS Data for Contacts

   The following table shows the contact objects of five RIRs.

RIR Objects	AFRINIC	APNIC	ARIN	LACNIC	RIPE NCC
Name	person	person	Name	person	person
Company	NA	NA	Company	NA	NA
Postal Address	address	address	Address	address	address
City	NA	NA	City	NA	address
State	NA	NA	StateProv	NA	address
Postal Code	NA	NA	PostalCode	NA	address
Country	NA	country	Country	country	NA
Phone	phone	phone	Mobile	phone	phone
Fax Number	fax-no	fax-no	Fax	NA	fax-no
Email	e-mail	e-mail	Email	e-mail	NA
ID	nic-hdl	nic-hdl	Handle	nic-hdl	nic-hdl
Remarks	remarks	remarks	Remarks	NA	remarks
Notify	notify	notify	NA	NA	notify
ID of maintainer	mnt-by	mnt-by	NA	NA	mnt-by
Registration Date	changed	NA	RegDate	created	changed
Registration update	changed	changed	Updated	changed	changed
Source	source	source	NA	NA	source
Reference	NA	NA	Ref	NA	NA

WHOIS Data for Contacts

4.3. WHOIS data for IP Addresses

The following table shows the IP address objects of five RIRs.

RIR Objects	AFRINIC	APNIC	ARIN	LACNIC	RIPE NCC
IP address range	inetnum	inetnum	NetRange	NA	inetnum
IPV6 address range	inet6num	inet6num/ inetnum	CIDR	inetnum	inet6num/ inetnum
Description	descr	descr	NetName	NA	descr
Remarks	remarks	remarks	NA	NA	remarks
Origin AS	NA	origin (on route/6)	OriginAS	OriginAS (future)	origin (on route/6)
Network name/ID	netname	netname	NetHandle	inetrev	netname
Maintainer	mnt-by	NA	NA	NA	mnt-by
Maintainer	mnt-lower	NA	NA	NA	NA
Administrative contact	admin-c	admin-c	OrgId	ownerid	admin-c
Parent range	parent	NA	Parent	NA	NA
Status	status	status	NetType	status	status
Registration Date	changed	NA	RegDate	created	changed
Registration update	changed	changed (multiple)	Updated	changed	changed
Reference	NA	NA	Ref	NA	NA

ID organization holding the resource	org	NA	OrgId	owner	organisation
Referral server	NA	NA	ReferralServer	NA	NA
Technical contact	tech-c	tech-c	OrgTechHandle	tech-c	tech-c (multiple)
Abuse contact	NA	NA	OrgAbuseHandle	abuse-c	abuse-mailbox
Referral technical contact	NA	NA	RTechHandle	NA	NA
Referral abuse contact	mnt-irt	mnt-irt	RAbuseHandle	NA	NA
Referral NOC contact	NA	NA	RNOCHandle	NA	NA
Name server	NA	NA	NA	nserver	NA

WHOIS Data for IP Addresses

4.4. WHOIS data for ASNs

RIR Objects	AFRINIC	APNIC	ARIN	LACNIC	RIPE NCC
ID	aut-num	aut-num	ASNumber	aut-num	aut-num
Description	descr	descr	NA	NA	descr
Organization	org	NA	OrgId	owner	org
Comment	remarks	NA	Comment	NA	remarks
Administrative contact ID	admin-c	admin-c	ASHandle	owner-id	admin-c
Technical contact ID	tech-c	tech-c	OrgTechHandle	routing-c	tech-c (multiple)
Organization ID	NA	nic-hdl	NA	owner-c	organisation
Notify	notify	notify	NA	NA	NA
Abuse contact	NA	NA	OrgAbuseHandle	abuse-c	NA
Maintainer	mnt-by	mnt-by	NA	NA	mnt-by
Maintainer	mnt-lower	mnt-lower	NA	NA	mnt-lower
Maintainer	NA	NA	NA	NA	mnt-ref
Registration Date	changed	NA	RegDate	created	NA
Registration update	changed	changed (multiple)	Updated	changed	NA
Source	source	source	NA	NA	source

WHOIS Data for ASNs

4.5. Conclusion

   As it can be observed, for each object (Organization, Contact Person,
   Net-num and ASN) there are fields that are unique to only one or a
   set of RIRs and there are fields that have the same meaning but are
   labeled differently for each RIR. In order to construct a single
   data model for each object, a selection of the most common and useful
   fields was made. That initial selection was the starting point for
   [I-D.ietf-weirds-json-response].

5. DNR Objects Analysis

5.1. Overview

   WHOIS data was collected from 124 registries, including 106 ccTLDs
   and 18 gTLDs. All the 124 registries support domain queries. Among
   124 registries, eight ccTLDs and 15 gTLDs support queries for
   specific contact persons or roles. 10 ccTLDs and 18 gTLDs support
   queries by nameserver. four ccTLDs and 18 gTLDs support registrar
   queries. Domain WHOIS data contain 68 data elements that use a total
   of 550 labels. There is a total of 392 other objects for domain
   WHOIS data. The raw data can be accessed at WHOIS Statistics Data
   File [Stat-Data-File].

5.2. Public Objects

   As mentioned above, public objects are those data elements selected
   according to the new gTLD applicant guide book and EPP protocols.
   They are generally classified into four categories: domain, contact,
   nameserver and registrar related information.

5.2.1. WHOIS Data for Domains

   WHOIS replies about domains include "Domain Name", "Creation Date",
   "Domain Status", "Expiration Date", "Updated Date", "Domain ID",
   "DNSSEC" and "Last Transferred Date". The following table gives the
   element name, most popular label and corresponding numbers of TLDs
   and labels.

Data Element	Most Popular Label	No. of TLDs	No. of Labels
Domain Name	Domain Name	118	6
Creation Date	Created	106	24
Domain Status	Status	95	8
Expiration Date	Expiration Date	81	21
Updated Date	Modified	70	20
Domain ID	Domain ID	34	5
DNSSEC	DNSSEC	14	4
Last Transferred Date	Last Transferred Date	4	3

WHOIS Data for Domains

Several statistical conclusion that obtained from above data include:

o About 95.16% of the 124 registries support a "Domain Name" data
   element.

o Nearly 85.48% of the 124 registries support a "Creation Date" data
   element.

o Almost 76.61% of the 124 registries support a "Domain Status" data
   element

o On the other hand, some elements such as "DNSSEC" and "Last
   Transferred Date" are only supported by 11.29% and 3.23% of all
   the registries seperately.

5.2.2. WHOIS Data for Contacts

In domain name space, contacts are typically divided into registrant,
administrative contact, technical contact and billing contact.

5.2.2.1. **Registrant**

The following table shows all the contact information for a
registrant. 14 data elements are listed below.

Data Element	Most Popular Label	No. of TLDs	No. of Labels
Registrant Name	Name	65	7
Registrant Email	Registrant Email	59	7
Registrant ID	Registrant ID	50	12
Registrant Phone	Registrant Phone	48	6
Registrant Fax	Registrant Fax	44	6
Registrant Organization	Registrant Organization	42	4
Registrant Country Code	Country	42	6
Registrant City	Registrant City	38	4
Registrant Postal Code	Registrant Postal Code	37	5
Registrant State/Province	Registrant State/Province	32	4
Registrant Street	Registrant Street1	31	16
Registrant Country	Registrant Country	19	4
Registrant Phone Ext.	Registrant Phone Ext.	18	2
Registrant Fax Ext	Registrant Fax Ext	17	2

                           Registrant

Among all the data elements, "Registrant Name", "Registrant Email"
and "Registrant ID" are the top three data elements.

5.2.2.2. **Admin Contact**

   The following table shows all the contact information for an
   administrative contact. 14 data elements are listed below.

Data Element	Most Popular Label	No. of TLDs	No. of Labels
Admin Street	Address	64	19
Admin Name	Admin Name	60	9
Admin Email	Admin Email	54	12
Admin ID	Admin ID	52	16
Admin Fax	Admin Fax	44	8
Admin Phone	Admin Phone	43	9
Admin Organization	Admin Organization	42	9
Admin Country Code	Country	42	7
Admin City	Admin City	35	5
Admin Postal Code	Admin Postal Code	35	7
Admin State/Province	Admin State/Province	28	5
Admin Country	Admin Country	17	5
Admin Phone Ext.	Admin Phone Ext.	17	3
Admin Fax Ext.	Admin Fax Ext.	17	3

                         Admin Contact

   Among all the data elements, "Admin Street", "Admin Name" and "Admin
   Email" are the top three data elements.

[5.2.2.3](#). **Tech Contact**

   The following table shows all the information for a domain name
   technical contact. 14 data elements are listed below.

Data Element	Most Popular Label	No. of TLDs	No. of Labels
Tech Email	Tech Email	59	9
Tech ID	Tech ID	55	16
Tech Name	Tech Name	47	6
Tech Fax	Tech Fax	45	9
Tech Phone	Tech Phone	45	10
Tech Country Code	Country	43	9
Tech Organization	Tech Organization	39	7
Tech City	Tech City	36	4
Tech Postal Code	Tech Postal Code	36	7
Tech State/Province	Tech State/Province	30	4
Tech Street	Tech Street1	27	16
Tech Country	Tech Country	18	5
Tech Fax Ext	Tech Fax Ext	18	3
Tech Phone Ext.	Tech Phone Ext.	13	3

                          Tech Contact

   Among all the data elements, "Tech Email", "Tech ID" and "Tech Name"
   are the top three data elements.

5.2.2.4. **Billing Contact**

   The following table shows all the information for a domain name
   billing contact. 14 data elements are listed below.

Data Element	Most Popular Label	No. of TLDs	No. of Labels
Billing Name	Name	47	5
Billing Fax	Fax	43	6
Billing Email	Email Address	42	7
Billing Country Code	Country	38	4
Billing Phone	Phone Number	34	6
Billing ID	Billing ID	28	9
Billing City	Billing City	28	4
Billing Organization	Billing Organization	28	5
Billing Postal Code	Billing Postal Code	27	4
Billing State/Province	Billing State/Province	21	4
Billing Street	Billing Street1	19	13
Billing Country	Billing Country	13	5
Billing Phone Ext.	Billing Phone Ext.	10	2
Billing Fax Ext	Billing Fax Ext	10	2

                          Billing Contact

   Among all the data elements, "Billing Name", "Tech Fax" and "Billing
   Email" are the top three data elements.

5.2.3. **WHOIS Data for Nameservers**

   114 registries (about 92% of all the 124 registries) have the
   "nameserver" data element in their WHOIS responses. However, there
   are 63 different labels for this element. The top three labels for
   this element are "Name Server" which is supported by 25% of all the
   registries, "Name Servers" which is supported by 16% of all the
   registries and "nserver" which is supported by 12% of all the
   registries.

```
  +--------------+-------------------+------------+--------------+
  | Data Element | Most Popular Label | No. of TLDs | No. of Labels |
  +--------------+-------------------+------------+--------------+
  |  NameServer  |    Name Server    |    114     |      63      |
  +--------------+-------------------+------------+--------------+
```

                     WHOIS Data for Nameservers

   Some registries have nameserver elements such like "nameserver 1",
   "nameserver 2" till "nameserver n". Thus, there are more labels than
   of other data elements.

5.2.4. **WHOIS Data for Registrars**

   There are three data elements about registrar information.

```
  +------------------+--------------------+----------+------------+
  |   Data Element   |  Most Popular Label |  No. of  |   No. of   |
  |                  |                     |   TLDs   |   Labels   |
  +------------------+--------------------+----------+------------+
  |    Sponsoring    |      Registrar      |    84    |     6      |
  |    Registrar     |                     |          |            |
  +------------------+--------------------+----------+------------+
  |    Created by    |     Created by      |    14    |     3      |
  |    Registrar     |                     |          |            |
  +------------------+--------------------+----------+------------+
  |    Updated by    |   Last Updated by   |    11    |     3      |
  |    Registrar     |     Registrar       |          |            |
  +------------------+--------------------+----------+------------+
```

                     WHOIS Data for Registrars

   67.7% of the registries have "Sponsoring Registrar" data element.
   Elements such as "Created by Registrar" and "Updated by Registrar"
   are supported by 11.3% and 8.9% of the registries.

5.3. Other Objects

So-called "other objects" are those data elements that are self-
designed or are difficult to be classified. There are 392 other
objects altogether. The following tables lists the top 50 other
objects according to the data collection result.

Data Element	No. of TLDs
Registrant	41
Phone	32
Technical contact	26
Administrative contact	15
source	14
fax-no	13
nic-hdl	13
Billing Contact	12
referral url	11
e-mail	10
WHOIS server	9
Admin Contact	9
Type	9
Website	9
zone-c	8
remarks	7
Registration URL	6
anonymous	6
anniversary	6

hold	6
nsl-id	6
obsoleted	6
Customer Service Contact	5
Customer Service Email	4
Registrar ID	4
org	4
person	4
Maintainer	4
Nombre	3
Sponsoring Registrar IANA ID	3
Trademark Number	3
Trademark Country	3
descr	3
url	3
Postal address	3
Registrar URL	3
International Name	3
International Address	3
Admin Contacts	2
Contractual Language	2
Date Trademark Registered	2
Date Trademark Applied For	2
IP Address	2

Keys	2
Language	2
NIC handle	2
Record maintained by	2
Registration Service Provider	2
Registration Service Provided By	2
Registrar URL (registration services)	2

The Top 50 Other Objects

Some registries returned things that looked like labels, but were not. For example, in this reply:

```
      Registrant:
        Name:
        Email:
        ...
```

"Name" and "Email" appeared to be data elements, but "Registrant" was not. The inventory work proceeded on that assumption, i.e., there were two data elements to be recorded in this example.

Some other data elements, like "Remarks", "anniversary" and "Customer service Contact" etc., are designed particularly for their own purpose by different registries.

5.4. Conclusion

5.4.1. Preliminary Statistics

Some preliminary conclusions could be drawn from the raw data.

o All of the 124 domain registries have the object names in their responses although they are in various formats.

o Of the 118 WHOIS services contacted, 65 registries show their registrant contact. About half of the registries (60 registries) support admin contact information. There are 47 registries, which is about one third of the total number, have technical and billing

contact information. Only seven of all the 124 registries give
their abuse email in a "remarks" section. No explicit abuse
contact information is provided.

o There are mainly two presentation formats. One is key:value, the
   other is data block format. Example of key-value format:

Domain Information
Query: na-nic.com.na
Status: Delegated
Created: 17 Apr 2004
Modified: 14 Nov 2010
Expires: 31 Dec 9999
Name Servers: oshikoko.omadhina.net
ns1.na.afrisp.net
ns2.na.afrisp.net
...

   Example of data block format:

     WHOIS database
     domain nic.vg

     Domain Name nic.vg
     Registered 1998-09-02
     Expiry 2012-09-02

     Resource Records

     a   195.153.6.27
     mx 10 terpsichore.william.org
     www a   195.153.6.27

     Contact details

     Registrant,
     Technical Contact,
     Billing Contact,
     Admin. Contact AdamsNames Reserved Domains (i)
     These domains are not available for registration
     United Kingdom
     Identifier: neams048s

     Servidor WHOIS de NIC-Venezuela (.VE)

     Este servidor contiene informacion autoritativa exclusivamente
     de dominios .VE Cualquier consulta sobre este servicio, puede
     hacerla al correo electronico whois@nic.ve

     Titular:
     Jhonny Valera (nic.ve-dom) jhovalera@conatel.gob.ve
     Comision Nacional de Telecomunicaciones
     Av. Veracruz con calle Cali, Edif Aguila, Urb. Las Mercedes
     Caracas, Distrito Capital VE
     0212-9090493 (FAX) +582127718599

   o 11 registries give local script responses. The WHOIS information
      of other registries are all represented in English.

5.4.2. Data Elements Analysis

   The top 10 data elements are as follows:

Data Element	No. of TLDs
Domain Name	118
Name Server	114
Creation Date	106
Domain Status	95
Sponsoring Registrar	84
Expiration Date	81
Updated Date	70
Registrant Name	65
Admin Street	64
Admin Name	60

The Top 10 Data Elements

Most of the domain related WHOIS information is included in the top
10 data elements. Other information like name server and registrar
name are also supported by most registries.

A cumulative distribution analysis of all the data elements was done.

(1) About 5% of the data elements discovered by the inventory work
     are supported by over 111 (90%) registries.

(2) About 30% of the data elements discovered by the inventory work
     are supported by over 44 (35%) registries.

(3) About 60% of the data elements discovered by the inventory work
     are supported by over 32 (26%) registries.

(4) About 90% of the data elements discovered by the inventory work
     are supported by over 14 (11%) registries.

From the above result, it is clear that only a few registries support
all the public objects, most of the registries support just parts of
all the objects.

5.4.3. Labels Analysis

The top 10 labels of different data elements include:

```
        +-------------------+--------------+
        |       Labels      | No. of Labels |
        +-------------------+--------------+
        |    Name Server    |      63      |
        +-------------------+--------------+
        |   Creation Date   |      24      |
        +-------------------+--------------+
        |  Expiration Date  |      21      |
        +-------------------+--------------+
        |    Updated Date   |      20      |
        +-------------------+--------------+
        |    Admin Street   |      19      |
        +-------------------+--------------+
        |      Tech ID      |      18      |
        +-------------------+--------------+
        | Registrant Street |      16      |
        +-------------------+--------------+
        |      Admin ID     |      16      |
        +-------------------+--------------+
        |    Tech Street    |      16      |
        +-------------------+--------------+
        |   Billing Street  |      13      |
        +-------------------+--------------+
```

                    The Top 10 Labels

As explained above, the "Name Server" label is a unique example that
many registries define the name server elements from "nameserver 1"
till "nameserver n". Thus, the count of labels for name servers is
much higher than other elements. Data elements representing dates
and street addresses were also common.

A cumulative distribution analysis of label numbers was done. About
90% of data elements have more than two labels. It is therefore
necessary to specify a standard and unified format for object names
in a WHOIS response.

5.4.4. Other Objects Analysis

The results indicate that there are 392 other data objects in total
that are not easy to be classified or are privately defined by
various registries. The top 50 other objects are listed in the table
in section 4.3. It is clear that various different objects are
designed for some particular purpose. In order to ensure uniqueness

of JSON names used in the RDAP service, establishment of an IANA
registry is advised.

5.5. Limitations

This section enumerates limitations of the survey and some
assumptions that were made in the execution of this work.

o The input "nic.ccTLD" maybe is not a good choice.

o 11 registries did not provide responses in English. The
   classification of data elements within their responses may not be
   accurate.

o The extension data elements are used randomly by different
   registries. It is difficult to do statistical analysis.

o Sample sizes of contact, name server and registrar queries are
   small.

   * Only WHOIS queries for contact ID, nameserver and registrar
      were used.

   * Some registries may not support contact, name server or
      registrar queries.

   * Some may not support query contact by ID.

   * Contact information of some registries may be protected.

6. Reference Extension Objects

There are some objects that are included in the existing WHOIS system
but not mentioned in [I-D.ietf-weirds-json-response]. This document
is intended to give a list of reference extension objects for
discussion.

6.1. RIR Reference Extension Objects

o company -- the company name registered by the registrant.

o maintainer -- authentication information that identifies who can
   modify the contents of this object.

o list of resources -- include a list of all the Internet resources
   assigned to this organization.

o referral NOC contact -- the Network Operation Center contact.

6.2. DNR Reference Extension Objects

   The following objects are selected from the top 50 other objects in
   section 5.3 that are supported by more than five registries. These
   objects are considered as possible extension objects.

   o zone-c -- The handle of a 'role' object with authority over a
      zone.

   o maintainer -- authentication information that identifies who can
      modify the contents of this object.

   o Registration URL -- typically the website address of a registry.

   o anonymous -- whether the registration information is anonymous or
      not.

   o hold -- whether the domain is "on hold" or not.

   o nsl-id -- nameserver list ID.

   o obsoleted -- whether a domain is obsoleted or not.

   o Customer Service Contact -- a kind of contact.

7. IANA Considerations

   This document does not specify any IANA actions. [RFC Editor: Please
   delete this section prior to publication.]

8. Security considerations

   This document does not provide any other security services or
   introduce any additional considerations.

9. Acknowledgements

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   Murray Kucherawy and Edward Lewis.

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Appendix A. Change Log

   Initial -00: Adopted as working group document.

   -01:

   * Added Change Log section.

   * Added RIR data objects.

   * Exchanged section 2 and section 3.

   -02:

   * Modified some object names in the section of RIR Objects
      Analysis.

   * Added reference extension objects.

   -03:

   * Updated to the keep-alive version. Changed the expiry dates
      and the draft number.

   -04:

   * Updated based on Murray's and Edward's comments during the WG
      last call.

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