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Inventory and Analysis of WHOIS Registration Objects

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 process and results of the statistical analysis 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

Regional Internet Registries (RIRs) and Domain Name Registries (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 or access control for differentiated access.
- o It has not been internationalized and thus does not consistently support Internationalized Domain Names (IDNs) as 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) ([RFC7480], [RFC7482], [RFC7483], and [RFC7484]) was developed using this inventory as input.

In the number space, there were altogether five RIRs. Although all RIRs provided information about IP addresses, Autonomous System Numbers (ASNs), and contacts, the data model used was different for each RIR. In the domain name space, there were over 200 country code Top-Level Domains (ccTLDs) and over 400 generic Top-Level Domains (gTLDs) when this document was published. Different Domain Name Registries may have different WHOIS response objects and formats. A common understanding of all these data formats was critical to construct a single data model for each object.

This document describes the WHOIS data collection procedures and gives an inventory analysis of data objects based on the collected data from the five RIRs, 106 ccTLDs, and 18 gTLDs from DNRs. The RIR data objects are classified by the five RIRs into IP address, ASN, person or contact, and the organization that held the resource. According to SPECIFICATION 4 ("SPECIFICATION FOR REGISTRATION DATA PUBLICATION SERVICES") of the new gTLD applicant guidebook [ICANN.AGB-201206] and the Extensible Provisioning Protocol (EPP) ([RFC5730], [RFC5731], [RFC5732], and [RFC5733]), the DNR data

objects are classified by whether they relate to the domain, contact, nameserver, or registrar. Objects that do not belong to the categories above are viewed as privately specified objects. In this document, there is no intent to analyze all the query and response types that exist 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 a specific response object.
- o Label - The name given to a particular data element; it may vary between registries.
- o Most popular label - The label that is most supported by the registries.
- o Number of labels - The number of different labels.
- o No. of TLDs - The number of registries that support a certain data element.

3. Methodology

WHOIS information, including port 43 response and web response data, was collected between July 9, 2012, and July 20, 2012, following the procedures described below.

- (1) First, find the RIR WHOIS servers of the five RIRs, which are AFRINIC, APNIC, ARIN, LACNIC, and RIPE NCC. All the RIRs provide information about IP addresses, ASNs, and contacts.
- (2) Query the corresponding IP addresses, ASNs, contacts, and organizations registered in the five RIRs. Then, make a comparative analysis of the response data.
- (3) Group together the data elements that have the same meaning but use different labels.

DNR object collection process:

- (1) A programming script was applied to collect port 43 response data from 294 ccTLDs. "nic.ccTLD" was used as the query string, which is usually registered in a domain registry. Responses for 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 the web was collected manually from the 124 registries that send port 43 WHOIS responses.
- (3) Some of the response that which were collected by the program did not seem to be correct, so data for the top 10 ccTLD registries, like .de, .eu, and .uk, was re-verified by querying domain names other than "nic.ccTLD".
- (4) In accordance with SPECIFICATION 4 of the new gTLD applicant guidebook [ICANN.AGB-201206] and EPP ([RFC5730], [RFC5731], [RFC5732] and [RFC5733]), the response data objects are classified into public and other data objects. Public data objects are those that are defined in the above references. Other objects are those that are privately specified data elements or objects in different registries.
- (5) Data elements with the same meaning, but using different labels, were grouped together. The number of registries that support each data element is shown in the "No. of TLDs" column.

4. RIR Objects Analysis

4.1. WHOIS Data for Organizations Holding a Resource

Table 1 shows the organization objects of the 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 person responsible	NA	NA	NA	responsible	NA
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
ID of technical contact	tech-c	NA	Tech POC	tech-c	tech-c

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

Table 1. WHOIS Data for Organizations Holding a Resource

4.2. WHOIS Data for Contacts

Table 2 shows the contact objects of the five RIRs.

Data Element	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
-----------	----	----	-----	----	----

Table 2. WHOIS Data for Contacts

4.3. WHOIS Data for IP Addresses

Table 4 shows the IP address objects of the five RIRs.

Note: Due to the 72-character limit on line length, strings in some cells of the table are split into two or more parts, which are placed on separate lines within the same cell. A hyphen in the final position of a string indicates that the string has been split due to the length limit.

Adminis- trative contact	admin-c	abuse-- mailbox
--------------------------------	---------	--------------------

Table 3. Example of String Splitting

For instance, the original strings in the cells of Table 3 are "Administrative contact", "admin-c", and "abuse-mailbox", respectively.

Data Element	AFRINIC	APNIC	ARIN	LACNIC	RIPE NCC
IP address range	inetnum	inetnum	NetRange	NA	inetnum
IPv6 address range	inet6num	inet6num	CIDR	inetnum	inet6num
Description	descr	descr	NetName	NA	descr
Remarks	remarks	remarks	NA	NA	remarks
Origin AS	NA	NA	OriginAS	OriginAS (future)	NA
Network name/ID	netname	netname	NetHandle	inetrev	netname
Maintainer Object	mnt-by	NA	NA	NA	mnt-by
Maintainer Sub-assignments	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	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
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

Table 4. WHOIS Data for IP Addresses

4.4. WHOIS Data for ASNs

Data Element	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
Organization ID	NA	nic-hdl	NA	owner-c	organization
Notify	notify	notify	NA	NA	NA
Abuse contact	NA	NA	OrgAbuse Handle	abuse-c	NA
Maintainer Object	mnt-by	mnt-by	NA	NA	mnt-by
Maintainer Sub-assignments	mnt-lower	mnt-lower	NA	NA	mnt-lower
Maintainer Organization	NA	NA	NA	NA	mnt-ref
Registration Date	changed	NA	RegDate	created	NA
Registration update	changed	changed	Updated	changed	NA
Source	source	source	NA	NA	source

Table 5. WHOIS Data for ASNs

4.5. Conclusion

As can be observed, some data elements were not supported by all RIRs, and some were given different labels by different RIRs. Also, there were identical labels used for different data elements by different RIRs. 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 [RFC7483].

5. DNR Object Analysis

5.1. Overview

WHOIS data was collected from 124 registries, including 106 ccTLDs and 18 gTLDs. All 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.

5.2. Public Objects

As mentioned above, public objects are those data elements selected according to the new gTLD applicant guidebook and EPP. They are generally classified into four categories by whether they are related to the domain, contact, nameserver, or registrar.

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". Table 6 gives the element name, most popular label, and the 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

Table 6. WHOIS Data for Domains

Several statistical conclusions obtained from above data are:

- o 95.16% of the 124 registries support a "Domain Name" data element.
- o 85.48% of the 124 registries support a "Creation Date" data element.
- o 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 the registries, respectively.

5.2.2. WHOIS Data for Contacts

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

5.2.2.1. Registrant

Table 7 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
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Table 7. Registrant

Among all the data elements, only "Registrant Name" is supported by more than one half of registries. Those supported by more than one third of registries are: "Registrant Name", "Registrant Email", "Registrant ID", "Registrant Phone", "Registrant Fax", "Registrant Organization", and "Registrant Country Code".

5.2.2.2. Admin Contact

Table 8 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

Table 8. Admin Contact

Among all the data elements, only "Admin Street" is supported by more than one half of registries. Those supported by more than one third of registries are: "Admin Street", "Admin Name", "Admin Email", "Admin ID", "Admin Fax", "Admin Phone", "Admin Organization", and "Admin Country Code".

5.2.2.3. Tech Contact

Table 9 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

Table 9. Tech Contact

Among all the data elements, there are no elements supported by more than one half of registries. Those supported by more than one third of registries are: "Tech Email", "Tech ID", "Tech Name", "Tech Fax", "Tech Phone", and "Tech Country Code".

5.2.2.4. Billing Contact

Table 10 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

Table 10. Billing Contact

Among all the data elements, there are no elements supported by more than one half of registries. Those supported by more than one third of registries are "Billing Name", "Billing Fax", and "Billing Email".

5.2.3. WHOIS Data for Nameservers

114 registries (about 92% of the 124 registries) have the "nameserver" data element in their WHOIS responses. However, there are 63 different labels for this element, as shown in Table 11. The top three labels for this element are "Name Server" (which is supported by 25% of the registries), "Name Servers" (which is supported by 16% of the registries), and "nserver" (which is supported by 12% of the registries).

Data Element	Most Popular Label	No. of TLDs	No. of Labels
NameServer	Name Server	114	63

Table 11. 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 TLDs	No. of Labels
Sponsoring Registrar	Registrar	84	6
Created by Registrar	Created by	14	3
Updated by Registrar	Last Updated by Registrar	11	3

Table 12. WHOIS Data for Registrars

67.7% of the registries have the "Sponsoring Registrar" data element. The elements "Created by Registrar" and "Updated by Registrar" are supported by 11.3% and 8.9% of the registries, respectively.

5.3. Other Objects

So-called "other objects" are those data elements that are privately specified or are difficult to be classified. There are 392 other objects altogether. Table 13 lists the top 50 other objects found during data collection.

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
nsi-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

Table 13. 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" did 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", 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, that have technical and

billing contact information. Only seven of 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: nic.example.com
Status: Delegated
Created: 17 Apr 2004
Modified: 14 Nov 2010
Expires: 31 Dec 9999
Name Servers: ns.example.net
ns1.na.example.net
ns2.na.example.net
...
```

Example of data block format:

```
WHOIS database
domain nic.example.org

Domain Name nic.example.org
Registered 1998-09-02
Expiry 2012-09-02
```

Resource Records

```
a 198.51.100.1
mx 10 test.example.net
www a 198.51.100.10
```

Contact details

```
Registrant,
Technical Contact,
Billing Contact,
Admin. Contact AdamsNames Reserved Domains (i)
These domains are not available for registration
United Kingdom
Identifier: test123
```

Servidor WHOIS de NIC-Example

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

Titular:

John (nic.example.org) john@nic.example.org

NIC Example

Av. Veracruz con calle Cali, Edif Aguila, Urb. Las Mercedes

Caracas, Distrito Capital VE

0212-1234567 (FAX) +582123456789

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

5.4.2. Data Element Analysis

The top 10 data elements are listed in Table 14.

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

Table 14. 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 is 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 111 registries (i.e., 90%).
- (2) About 30% of the data elements discovered by the inventory work are supported by 44 registries (i.e., 35%).
- (3) About 60% of the data elements discovered by the inventory work are supported by 32 registries (i.e., 26%).
- (4) About 90% of the data elements discovered by the inventory work are supported by 14 registries (i.e., 11%).

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

5.4.3. Label Analysis

The top 10 labels of different data elements are listed in Table 15.

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

Table 15. The Top 10 Labels

As explained above, the "Name Server" label is a unique example because many registries define the name server elements from "nameserver 1" through "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. Analysis of Other Objects

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 Table 13 in Section 5.3. 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 lists the limitations of the survey and some assumptions that were made in the execution of this work.

- o The input "nic.ccTLD" may not be a good choice, for the term "nic" is often specially used by the corresponding ccTLD, so the collected WHOIS data may be customized and different from the common data.
- o Since the programming script queried the "nic.ccTLD" in an anonymous way, only the public WHOIS data from WHOIS servers having nic.ccTLD were collected. So, the private WHOIS data were not covered by this document.
- 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 [RFC7483]. 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 - a list of IPv4 addresses, IPv6 addresses, and Autonomous System numbers.
- o referral NOC contact - the Network Operations 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 identifier 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. Security Considerations

This document does not provide any security services or introduce additional considerations to those discussed in [RFC7481].

8. Informative References

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