EPP Extensibility and Extension Analysis

IETF RPP (RESTful Provisioning Protocol) Working Group

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Abstract

This document analyzes the extensibility mechanisms of the Extensible Provisioning Protocol (EPP) and the existing EPP extensions. The goal is to provide recommendations for the design of the RESTful Provisioning Protocol (RPP) to ensure it meets and exceeds EPP's extensibility, supports existing extensions where applicable, and introduces new forms of extensibility based on practical experience.

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1. Introduction

With the creation of a new provisioning protocol built on REST, referred to as RESTful Provisioning Protocol (RPP), the experience of the Extensible Provisioning Protocol (EPP) is needed to make recommendations on the desired forms of extensibility and what to do with the existing set of EPP extensions. The forms of extensibility are formally defined in the EPP RFC 5730 with Guidelines for EPP in RFC 3735, and additional forms have been created in practice that are identified in this analysis. The EPP extensions registered in the Extensions for the EPP IANA Registry is the starting point for the analysis of existing EPP extensions. Additional EPP extensions that are known but not registered are included in the analysis. A common set of attributes is defined to be captured for each of the EPP extensions. An EPP extension specification can be associated with more than one form of EPP extensibility.

Based on the analysis of the EPP extensibility and the existing EPP extensions, recommendations are provided for both EPP and RPP. The goal is to meet and exceed the usable forms of EPP extensibility in RPP and to build EPP extensions into the base RPP protocol, mapping EPP extensions to RPP extensions, or identifying EPP extensions as not being applicable for standardization in RPP. Proprietary EPP extensions should be supported by the RPP extensibility, but defining the RPP extension will be up to the organization that created the EPP extension. New forms of RPP extensibility are recommended based on practical experience in defining and implementing the EPP extensions.

2. Extensibility Analysis

The IETF STD 69 for EPP defines the following forms of extensibility. These are referred to as EPP-defined Extensibility, which are typically mutually exclusive per EPP extension. The **bolded** labels represent the set of EPP-defined Extensibility :

1. **Transport Mapping**
    1. An EPP Transport Mapping follows the Transport Mapping Considerations in Section 2.1 of RFC 5730. A concrete EPP Transport Mapping is defined for TCP in RFC 5734 "EPP Transport over TCP". Additional Transport Mappings have been defined for HTTPS with draft-ietf-regext-epp-https and for QUIC with draft-ietf-regext-epp-quic. A layered approach between the transport (EPP Transport Mapping) and the application protocol (EPP XML) provides for maximum flexibility for future technology advances or trends. The following considerations MUST be addressed by any transport mapping defined for EPP:
        1. The transport mapping MUST preserve command order
        2. The transport mapping MUST address the relationship between sessions and the client-server connection concept.
        3. The transport mapping MUST preserve the stateful nature of the protocol.
        4. The transport mapping MUST frame data units.
        5. The transport mapping MUST be onto a transport, such as TCP [RFC0793] or Stream Control Transmission Protocol (SCTP) [RFC4960], that provides congestion avoidance that follows RFC 2914 [RFC2914]; or, if it maps onto a protocol such as SMTP [RFC5321] or Blocks Extensible Exchange Protocol (BEEP) [RFC3080], then the performance issues need to take into account issues of overload, server availability, and so forth.
        6. The transport mapping MUST ensure reliability.
        7. The transport mapping MUST explicitly allow or prohibit pipelining.
2. **Protocol Extension Framework** - EPP provides specific extension points within the XML schema that serves multiple extensibility needs at the protocol, object, and command-response levels. The "epp:extAnyType" element, with the "`<any namespace="##other"/>`" element is used at the extension points.
    1. **Protocol Extension**
        1. The Protocol Extension, defined in Section 2.7.1 of RFC 5730, is the most generic form of extensibility, where the extension rides inside the EPP packet directly under the `<epp><extension>` element. The protocol extension has its own XML namespace that uniquely identifies it in the EPP Greeting and the EPP Login services for signaling.
        2. There are 3 Protocol Extensions identified with the DK Hostmaster local data extensions (Section 3.23), the FRED protocol extension (Credit Info) (Section 3.56), and the Cancel Delete - SIDN (Section 3.65).
    2. **Object Extension**
        1. The Object Extension, defined in Section 2.7.2 of RFC 5730, provides an extension point within the EPP command and response for a new object, which is defined by an object mapping. The EPP commands (check, info, transfer query, create, delete, renew, transfer, and update) supported by the object are delegated to the object mapping specification. Each object

mapping has its own XML namespace that uniquely identifies it in the EPP Greeting and the EPP Login services for signaling. IETF STD 69 for EPP consists of three predefined object mappings, which include the EPP Domain Name Mapping in RFC 5731, the EPP Host Mapping in RFC 5732, and the EPP Contact Mapping in RFC 5733.
    2. Many EPP object mappings have been defined and implemented in Production, with 21 Object Extensions with 8 using the Function Extension special form and 15 extensions without the Function Extension special form.
3. **Command-Response Extension**
    1. The Command-Response Extension, defined in Section 2.7.3 in RFC 5730, provides an extension point to add attributes to any command and response. It is up to the Command-Response Extension specification to define what objects, what commands, and what responses the extension applies to. This is a very flexible extension point that has its own XML namespace that uniquely identifies it in the EPP Greeting and the EPP Login service for signaling. Some Command-Response Extensions could be required and some could be optional based on the server policy. A client does need to understand the syntax of a Command-Response Extension as well as the server policy in how it's implemented.
    2. Most of the EPP extensions are defined as Command-Response Extensions, with 41 of 67 extensions (61%) in this analysis.
3. **Authorization Information Extension**
    1. Both the Object Extensions EPP Domain Name Mapping in RFC 5731 and EPP Contact Mapping in RFC 5733 define an extension point for the Authorization Information, which is supported in the “eppcom” XML schema. The Authorization Information supports either a password based value or an extension that can have its own XML namespace and XML schema to define the structure. The URI of the XML namespace can uniquely identify it in the EPP Greeting and the EPP Login services for signaling.
    2. The AuthCodeSEC "extending EPP with public key authentication to make domain transfer faster and safer" by Victor Zhou, Namefi.io is a potential use case for the use of an Authorization Information Extension.

In practice, special forms of extensibility have been defined using one of the extensibility forms defined in the Extensible Provisioning Protocol (EPP) RFC 5730. These special forms have been created to solve specific business needs, and are referred to as Special Extensibility. An EPP extension will typically have a single EPP-defined Extensibility form and can have many Special Extensibility forms:

1. **Command Type Extension**

    1. The Command Type Extension is a special form of a Command-Response Extension that is not formally defined in EPP RFC 5730, but in practice has been used to define new EPP command types by extending empty or near-empty EPP commands that are closest to the desired new EPP command type. An example of this is the Restore Command in RFC 3915 "Domain Registry Grace Period

Mapping for EPP" by extending an empty Domain Update Command. There are other examples of where the base set of EPP commands in EPP RFC 5730 did not meet the needs, so a Command-Response Extension is used to define a new Command Type.

2. **Function Extension**

    1. The Function Extension is a special form of an Object Extension that defines a new function, such as defining a Registry Info Command to obtain Registry features and policies or a Suggestion Info Command to get new domain name suggestions given input parameters.

    2. The Function Extension can be also realised through Protocol Extension by defining a new function on a protocol level together with a custom response. Note that in this case some elements of the core protocol, like transaction identifiers have to be omitted or done anew in the extension, so this approach is less preferred compared to Object Extension.

3. **Poll Message Extension**

    1. The Poll Message Extension defines a new type of EPP poll message, which is typically represented using the info response.

4. **Key Value Pair Extension**

    1. The Key Value Pair Extension is a special form of a Command-Response Extension for providing a conduit for an extensible set of string keys with values that can be attached to objects.

5. **Operational Practice**

    1. The Operational Practice defines a client and/or server policy of implementing the existing set of EPP RFCs and extensions. This is not a formal method of extensibility, but does provide for a practice that includes a URI that can uniquely identify support for it in the EPP Greeting and the EPP Login services.

6. **Object Property Extension**

    1. It is a specific use-case of Command-Response Extension, where the purpose of an extension is to add additional persistent properties to an existing object type. Typically such extensions would cover the entire CRUD operation space (create, info, delete, and update in EPP terms) in EPP commands and responses. EPP operators specifying such extensions typically would make these additional properties required to perform these operations on the affected object types.

7. **Enumeration Value Space Extension**

1. It is a specific use-case of Command-Response Extension, where the purpose of an extension is to extend the value space of an enumeration already defined in EPP. Typically it would extend the EPP info command response and depending on the use case be combined with Command Type Extension or generic EPP CRUD operations (e.g. create, update) to manage the new value space.

3. Extension Analysis

This section performs analysis of the known EPP extensions, which consist of EPP extensions formally registered in the Extensions for the Extensible Provisioning Protocol (EPP) IANA Registry, EPP extension Internet Drafts (I-Ds) that are not or have not progressed to an RFC, and other EPP extensions provided for analysis. The following attributes is an extension of the Extensions for the Extensible Provisioning Protocol (EPP) IANA Registry attributes defined in RFC 7451:

1. **Name**
    1. Name of the EPP Extension
2. **Type**
    1. "Standards Track RFC" - For a generic extension that is an IETF RFC
    2. "Standards Track Draft" - For a generic extension that is an IETF Internet Draft
    3. "Informational" - For a non-generic EPP extension
    4. "Experimental" - For an experimental EPP extension
    5. “Private” - Private extensions of registries not published in IANA registry
3. **Reference**
    1. A publicly available reference to the specification of the extension
4. **Extensibility**
    1. List of extensibility forms defined in the Extensibility Analysis section. The Extensibility forms include:
        1. "Transport Mapping"
        2. "Protocol Extension"
        3. "Object Extension"
        4. "Command-Response Extension"
        5. “Authorization Information Extension”
        6. "Command Type Extension"
        7. "Function Extension"
        8. “Poll Message Extension”
        9. "Key Value Pair Extension"
        10. “Operational Practice”
        11. “Object Property Extension”
5. **TLDs**
    1. "Any" or list of TLDs actively using or historically used the extension
6. **IPR**
    1. "None" or publicly available references to the Intellectual Property Rights (IPR) documents for the extension.
7. **Status**
    1. "Active" - Extensions that are currently implemented and in use
    2. "Inactive" - Extensions that are not implemented or are otherwise not being used
8. **Analysis**
    1. Reference to the detailed analysis of the extension or a high-level analysis description.
9. **Usage**

1. Used percentage based on the CENTR survey. No value means that the extension was not included in the CENTR survey.

10. **Recommendation**
    1. Recommendation for extension in RPP with the following high-level values:
        1. **"Embed"** - Embed support directly into the standard RPP mappings, such as the RPP domain name mapping.
        2. **"Extension"** - Define a standard RPP extension that means that it needs to be supported in the RPP design and with the plan of eventually defining it as a standard RPP extension.
        3. **"Design"** - Don't include in the RPP mappings and don't define a standard RPP extension, but verify that the RPP extensibility will support the features of the EPP extension.
        4. **"Not Applicable"** - The extension is not applicable to RPP and does not need to be considered for support. Some aspects of the extensions may be useful for defining the forms of RPP extensibility.
    2. An additional "Enhance" label can be added for the "Embed" and "Extension" recommendations to reflect the desire to make enhancements to what is currently supported in the EPP extension. The "Enhance" recommendation is not mutually exclusive with the "Embed" and"Extension" recommendations.
    3. Recommendations for EPP are prefixed by "EPP:" with the following values:
        1. **"EPP:Standardize"** - The extension or a combination of extensions could be standardized
        2. **"EPP:Consolidate (Extensions+)"** - The extension can be combined with other extensions either for the same purpose or a related purpose. The list of Extensions to consolidate should be included.

	Name	Type	Reference	Extensibility	TLDs	IPR	Status	Analysis	Usage	Recommendation
1	Domain Registry Grace Period Mapping for the Extensible Provisioning Protocol (EPP)	Standards Track RFC	RFC3915	Command-Response Extension Command Type Extension Enumeration Value Space Extension	Any	None	Active	Section 3.1	38.9%	Embed Enhance EPP:Standardize (update) EPP:Consolidate (RGP Poll - If two step restore, .SE EPP deactivation)
2	E.164 Number Mapping for the Extensible Provisioning Protocol (EPP)	Standards Track RFC	RFC4114	Command-Response Extension	Any	None	Active	Section 3.2	2.8%	Design
3	ENUM Validation Information Mapping for the Extensible	Standards Track RFC	RFC5076	Command-Response Extension Command-Type Extension Object Property Extension	Any	None	Active	Section 3.3		Design

4	Domain Name System (DNS) Security Extensions Mapping for the Extensible Provisioning Protocol (EPP)	Standards Track RFC	RFC5910	Command-Response Extension	Any	None	Active	Section 3.4	80.6%	Embed
5	Common Object Attribute (COA) Extension for the Extensible	Informational	http://www.verisign.com/assets/epp-sdk/verisign_epp-extension_coa_v00.html	Command-Response Extension Key Value Pair Extension	Any	None	Inactive	Section 3.5		Not Applicable
6	RGP Poll Mapping for the Extensible Provisioning Protocol (EPP)	Informational	http://www.verisign.com/assets/epp-sdk/verisign_epp-extension_rgp-poll_v00.html	Object Extension Poll Message Extension	Any	None	Active	Section 3.6		Embed Enhance EPP:Standardize EPP:Consolidate (RGP) - If two step restore
7	ConsoliDate Mapping for the Extensible Provisioning Protocol	Informational	http://www.verisign.com/assets/consolidate-mapping.txt	Command-Response Extension Command Type Extension	Any	None	Active	Section 3.7		Design

8	IDN Language Tag for the Extensible Provisioning Protocol (EPP)	Informational	http://www.verisign.com/assets/epp-sdk/verisign_epp-extension_idn-lang_v00.html	Command-Response Extension	Any	None	Active	Section 3.8		Extension EPP:Standardize EPP:Consolidate (IDN Mapping Tag, IDN Mapping - Identity Digital, IDN Table, IDN TANGO)
9	Extensible Provisioning Protocol Mapping: WhoWas	Informational	http://www.verisign.com/assets/epp-whowas-mapping.pdf	Object Extension Function Extension	Any	None	Inactive	Section 3.9		Not Applicable
10	Extensible Provisioning Protocol Mapping: Email Forwarding	Informational	http://www.verisign.com/assets/email-forwarding-mapping.pdf	Object Extension	.name	None	Active	Section 3.10		Design
11	Extensible Provisioning Protocol Mapping: Defensive Registration	Informational	http://www.verisign.com/assets/defensive-registration-mapping.pdf	Object Extension	.name	None	Active	Section 3.11		Design

12	Extensible Provisioning Protocol Mapping: NameWatch	Informational	http://www.verisign.com/assets/namewatch-mapping.pdf	Object Extension	.name	None	Active	Section 3.12		Design
13	Extensible Provisioning Protocol Mapping: Personal Registration	Informational	http://www.verisign.com/assets/personal-registration-extension.pdf	Command-Response Extension	.name	None	Active	Section 3.13		Design
14	Extensible Provisioning Protocol Mapping: Suggestion	Informational	http://www.verisign.com/assets/epp-sdk/EPP-Suggestion-Mapping.pdf	Object Extension Function Extension	Any	None	Inactive	Section 3.14		Not Applicable
15	Whois Info Extension for the Extensible Provisioning Protocol (EPP)	Informational	http://www.verisign.com/assets/epp-sdk/verisign_epp-extension_whois-info_v00.html	Command-Response Extension	Any	None	Inactive	Section 3.15		Not Applicable
16	Extensible Provisioning Protocol Extension Mapping: Jobs Contact	Informational	http://www.verisign.com/assets/epp-jobscontact-extension.pdf	Command-Response Extension Object Property Extension	.jobs	None	Inactive	Section 3.16		Not Applicable

17	Low Balance Mapping for the Extensible Provisioning Protocol (EPP)	Informational	http://www.verisign.com/assets/epp-sdk/verisign_epp-extension_low-balance_v00.html	Object Extension Poll Message Extension	Any	None	Active	Section 3.17		Extension EPP:Standardize EPP:Consolidate (Balance, Finance, FRED Credit Info)
18	Premium Domain Extension for the Extensible Provisioning Protocol (EPP)	Informational	http://www.verisign.com/assets/epp-sdk/verisign_epp-extension_premium-domain_v00.html	Command-Response Extension	Any	None	Inactive	Section 3.18		Not Applicable
19	Balance Mapping for the Extensible Provisioning Protocol (EPP)	Informational	http://www.verisign.com/assets/epp-sdk/verisign_epp-extension_balance_v00.html	Object Extension Function Extension	Any	None	Active	Section 3.19		Extension EPP:Standardize EPP:Consolidate (Low Balance, Finance, FRED Credit Info)
20	Verisign Registry Mapping for the Extensible Provisioning Protocol (EPP)	Informational	http://www.verisign.com/assets/epp-sdk/verisign_epp-extension_registry_v00.html	Object Extension Function Extension	Any	None	Active	Section 3.20		Design

21	Related Domain Extension for the Extensible Provisioning Protocol (EPP)	Informational	http://www.verisign.com/assets/epp-sdk/verisign_epp-extension_related-domain_v00.html	Command-Response Extension	Any	https://datatracker.ietf.org/ipr/2553/	Inactive	Section 3.21		Extension EPP:Standardize EPP:Consolidate (Strict Bundling, IDN - TANGO, Domain Variant)
22	.SE EPP Extensions	Informational	https://support.registry.se/file.php/3013699GPNMHCSYKBHKMZM0PD/EPP-Rules-Policies-and-Protocol-description-v1.9.pdf	Command-Response Extension	.se .nu	None	Active	Section 3.22		Design EPP:Standarization EPP:Consolidate (RGP for deactivation, Change Poll for what action led to the notification)
23	DK Hostmaster local data extensions	Informational	https://github.com/DK-Hostmaster/epp-service-specification	Command-Response Extension (many extensions) Object Property Extension Protocol Extension	.dk	None	Active	Section 3.23		Design

24	Key Relay Mapping for the Extensible Provisioning Protocol	Standards Track RFC	RFC8063	Object Extension Poll Message Extension	Any	https://datatracker.ietf.org/ipr/2393/	Active	Section 3.24	5.6%	Design
25	Launch Phase Mapping for the Extensible Provisioning Protocol (EPP)	Standards Track RFC	RFC8334	Command-Response Extension Command Type Extension Poll Message Extension	Any	None	Active	Section 3.25	19.4%	Extension
26	Allocation Token Extension for the Extensible Provisioning Protocol (EPP)	Standards Track RFC	RFC8495	Command-Response Extension	Any	None	Active	Section 3.26	2.8%	Extension
27	Extensible Provisioning Protocol (EPP) Organization Mapping	Standards Track RFC	RFC8543	Object Extension Poll Message Extension	Any	None	Active	Section 3.27	5.6%? Org Mapping is used with Org Ext	Embed
28	Organization Extension for the Extensible Provisioning Protocol (EPP)	Standards Track RFC	RFC8544	Command-Response Extension	Any	None	Active	Section 3.28	5.6%	Embed
29	Change Poll Extension for the Extensible Provisioning Protocol (EPP)	Standards Track RFC	RFC8590	Command-Response Extension Poll Message Extension	Any	None	Active	Section 3.29	8.3%	Extension

30	Registry Fee Extension for the Extensible Provisioning Protocol (EPP)	Standards Track RFC	RFC8748	Command-Response Extension	Any	None	Active	Section 3.30	19.4%	Extension
31	Login Security Extension for the Extensible Provisioning Protocol (EPP)	Standards Track RFC	RFC8807	Command-Response Extension	Any	None	Active	Section 3.31	2.8%	Embed
32	Extensible Provisioning Protocol (EPP) Unhandled Namespaces	Standards Track RFC	RFC9038	Operational Practice	Any	None	Active	Section 3.32	8.3%	Embed
33	Domain Name Mapping Extension for Strict Bundling Registration	Informational	RFC9095	Command-Response Extension	Any	https://datatracker.ietf.org/ipr/2479	Active	Section 3.33		Extension EPP:Standardize EPP:Consolidate (Related Domain, IDN - TANGO, Domain Variant)

34	Extensible Provisioning Protocol (EPP) Secure Authorization Information for Transfer	Standards Track RFC	RFC9154	Operational Practice	Any	None	Active	Section 3.34	8.3%	Embed
35	Verification Code Extension for the Extensible Provisioning Protocol (EPP)	Informational	https://www.iana.org/go/draft-ietf-regext-verificationcode-06	Command-Response Extension	Any	https://datatracker.ietf.org/ipr/2694 https://datatracker.ietf.org/ipr/2703	Active	Section 3.35		Design
36	.at EPP Verification Extension	Private	https://github.com/nic-at/epp-verification-extension	Command-Response Extension Object Property Extension	.at	None	Active	Section 3.36		Design
37	Extensible Provisioning Protocol (EPP) mapping for DNS Time-To-Live (TTL) values	Standards Track Draft	RFC9803	Command-Response Extension	Any	None	Active	Section 3.37		Embed

38	Additional Email Address Extension for the Extensible Provisioning Protocol (EPP)	Standards Track RFC	RFC9873	Command-Response Extension	Any	None	Active	Section 3.38		Embed
39	Extensible Provisioning Protocol (EPP) Transport over HTTPS	Standards Track Draft	https://datatracker.ietf.org/doc/html/draft-ietf-regext-epp-https	Transport Mapping	Any	None	Active	Section 3.39		Not Applicable
40	Extensible Provisioning Protocol (EPP) Transport over QUIC	Standards Track Draft	https://datatracker.ietf.org/doc/html/draft-ietf-regext-epp-quic	Transport Mapping	Any	None	Active	Section 3.40		Not Applicable
41	Extensible Provisioning Protocol (EPP) China Name Verification Mapping	Informational	https://datatracker.ietf.org/doc/html/draft-ietf-regext-nv-mapping	Object Extension		https://datatracker.ietf.org/ipr/2694 https://datatracker.ietf.org/ipr/2704	Active	Section 3.41		Design
42	Registry Mapping for the Extensible Provisioning Protocol (EPP)	Standards Track Draft	https://datatracker.ietf.org/doc/html/draft-gould-carney-regext-registry	Object Extension Function Extension	Any	https://datatracker.ietf.org/ipr/3201	Inactive	Section 3.42		Design

43	Launch Phase Policy Extensions Mapping for the Extensible Provisioning Protocol (EPP)	Standards Track Draft	https://datatracker.ietf.org/doc/html/draft-gould-regext-launch-policy	Command-Response Extension	Any	None	Inactive	Section 3.43		Design
44	Login Security Policy Extensions Mapping for the Extensible Provisioning Protocol (EPP)	Standards Track Draft	https://datatracker.ietf.org/doc/html/draft-gould-regext-login-security-policy	Command-Response Extension	Any	None	Inactive	Section 3.44		Design
45	Internationalized Domain Name Mapping for the Extensible Provisioning Protocol (EPP)	Experimental	https://datatracker.ietf.org/doc/html/draft-ietf-eppext-idnmap	Command-Response Extension	Any	None	Inactive	Section 3.45		Extension EPP:Standardize EPP:Consolidate (IDN Language Tag, IDN Mapping - Identity Digital, IDN Table, IDN TANGO)

46	Extensible Provisioning Protocol (EPP) Internationalized Domain Name (IDN) Table Name	Standards Track Draft	https://datatracker.ietf.org/doc/html/draft-gould-idn-table	Object Extension	Any	None	Inactive	Section 3.46		Extension EPP:Standardize EPP:Consolidate (IDN Language Tag, IDN Mapping, IDN Mapping - Identity Digital, IDN TANGO)
47	Validate Mapping for the Extensible Provisioning Protocol (EPP)	Standards Track Draft	https://datatracker.ietf.org/doc/html/draft-ietf-regext-validate	Object Extension Function Extension	Any	None	Inactive	Section 3.47		Design
48	Autonomous System Number Mapping for the Extensible Provisioning Protocol (EPP)	Informational	https://ftp.registro.br/pub/libepp-nicbr/draft-neves-epp-asn-02.txt	Object Extension	N/A NIR related	None	Active	Section 3.48		Design
49	IP Network Mapping for the Extensible Provisioning Protocol (EPP)	Informational	https://ftp.registro.br/pub/libepp-nicbr/draft-neves-epp-ipnetwork-02.txt	Object Extension	N/A NIR related	None	Active	Section 3.49		Design

50	BR Domain Mapping for the Extensible Provisioning Protocol (EPP)	Informational	https://ftp.registro.br/pub/libepp-nicbr/draft-neves-epp-brdomain-05.txt	Command-Response Extension	.br	None	Active	Section 3.50		Design
51	BR Organization Mapping for the Extensible Provisioning Protocol (EPP)	Informational	https://ftp.registro.br/pub/libepp-nicbr/draft-neves-epp-brorg-06.txt	Command-Response Extension Object Property Extension	.br and NIR related	None	Active	Section 3.51		Design
52	.NO EPP Extensions	Informational	https://teknisk.norid.no/uploads/2019/11/EPP_Interface_Specification.1e1.pdf	Command-Response Extension Command Type Extension	.no	None	Active	Section 3.52		Design
53	Namestore Extension Mapping for the Extensible Provisioning Protocol (EPP)	Informational	http://www.verisigninc.com/assets/epp-sdk/verisign_epp-extension_namestoreext_v00.html	Command-Response Extension	Any	https://datatracker.ietf.org/ipr/2551/	Active	Section 3.53		Design
54	LvContact extension	Private	https://www.nic.lv/epp/extensions/lvcontact.html	Command-Response Extension Object Property Extension	.lv	None	Active	Section 3.54		Design

55	LvDomain extension	Private	https://www.nic.lv/epp/extensions/lvdomain.html	Command-Response Extension Enumeration Value Space Extension	.lv	None	Active	Section 3.55		Design
56	FRED (Free Registry for ENUM and Domains) protocol extension (Credit Info)	Private	https://fred.nic.cz/documentation/html/EPPReference/CommandStructure/CreditInfo.html	Protocol Extension	.cz	None	Active	Section 3.56		Design EPP:Standardize EPP:Consolidate (Low Balance, Balance, Finance)
57	FRED (Free Registry for ENUM and Domains) object extension (Domain)	Private	https://fred.nic.cz/documentation/html/EPPReference/ManagedObjects/Domains.html	Object Extension Object Property Extension Enumeration Value Space Extension	.cz	None	Active	Section 3.57		Design
58	Registry Maintenance Notification for the Extensible Provisioning Protocol (EPP)	Standards Track RFC	RFC9167	Object Extension Poll Message Extension Function Extension	Any	None	Active	Section 3.58	2.8%	Extension

59	Domain Charge Extension for the Extensible Provisioning Protocol (EPP)	Informational	https://files.identity.digital/epp-extensions/EPP-Charge-Extension.pdf	Command-Response Extension	Any	None	Active	Section 3.59		Not Applicable EPP:Consolidate(Registry Fee)
60	Finance Mapping for the Extensible Provisioning Protocol (EPP)	Informational	https://files.identity.digital/epp-extensions/EPP-Finance-Mapping.pdf	Object Extension Function Extension	Any	None	Active	Section 3.60		Extension EPP:Standardize EPP:Consolidate(Low Balance, Balance, FRED Credit Info)
61	Internationalized Domain Name Mapping for the Extensible Provisioning Protocol (EPP) - Identity Digital	Informational	https://files.identity.digital/epp-extensions/EPP-IDN-Extension.pdf	Command-Response Extension	Any	None	Active	Section 3.61		Extension EPP:Standardize EPP:Consolidate (IDN Language Tag, IDN Mapping, IDN Table, IDN TANGO)

62	Scheduled Delete - SIDN	Private	https://rxsd.domain-registry.nl/sidn-ext-epp-scheduled-delete-1.0	Command-Response Extension	.nl	None	Active	Section 3.62		Design
63	Reseller - SIDN	Private	https://rxsd.domain-registry.nl/sidn-reseller-1.0.xsd https://rxsd.domain-registry.nl/sidn-ext-epp-reseller-1.0.xsd	Object Extension (Reseller Mapping) Command-Response Extension (Reseller Extension0	.nl	None	Active	Section 3.63		Design EPP:Consolidate (Organization Mapping and Organization Extension)
64	Removal of Unlinked Contacts - SIDN	Private	https://rxsd.domain-registry.nl/sidn-ext-epp-registry-contacts-delete-1.0.xsd	Object Extension Poll Message Extension	.nl	None	Active	Section 3.64		Design EPP:Consolidate (Change Poll Extension)
65	Cancel Delete - SIDN	Private	https://rxsd.domain-registry.nl/sidn-ext-epp-1.0.xsd	Protocol Extension (Cancel Command) Command-Response Extension (Domain Name/Host/Contact Properties)	.nl	None	Active	Section 3.65		Design EPP:Consolidate (RGP Extension)

66	IDN EPP Extension for the TANGO Registration System	Private	https://www.tango-rs.com/epp/tango-idn-epp-extension.pdf	Command-Response Extension	Any	None	Active	Section 3.66		Extension EPP:Standardize EPP:Consolidate (IDN Language Tag, IDN Mapping, IDN Mapping - Identity Digital, IDN Table, Related Domain, Strict Bundling, IDN - TANGO, Domain Variant)

67	Domain Variant	Standards Track Draft	https://datatracker.ietf.org/doc/html/draft-galvin-regext-epp-variants	Command-Response Extension	Any	None	Active	Section 3.67		Design EPP:Standardize EPP:Consolidate (IDN Language Tag, IDN Mapping, IDN Mapping - Identity Digital, IDN Table, IDN - TANGO, Related Domain, Strict Bundling, IDN - TANGO, Domain Variant)

The following sections will provide a detailed analysis of each of the EPP extensions using the following template table, which extends on the column values in the table above. The *italic* text needs to be replaced with non-italic text.

Attribute	Value
Name	*Name of the EPP Extension*
Description	*Description of the EPP Extension. This can provide a high-level along with a detailed description.*
Type	*"Standards Track RFC" - For a generic extension that is an IETF RFC* *"Standards Track Draft" - For a generic extension that is an IETF Internet Draft* *"Informational" - For a non-generic EPP extension.*
Reference	*A publicly available reference to the specification of the extension*
Registrant	*Registrant of the extension, which is "IESG" for an IETF draft or RFC*
Extensibility	*List of extensibility forms defined in the Extensibility Analysis section. The Extensibility forms include:* • *"Transport Mapping"* • *"Protocol Extension"* • *"Object Extension"* • *"Command-Response Extension"* • "Authorization Information Extension" • *"Command Type Extension"* • *"Function Extension"* • *"Poll Message Extension"* • *"Key Value Pair Extension"* • *"Operational Practice"* • *"Object Property Extension"*
TLDs	*"Any" or list of TLDs actively using or historically used the extension*
IPR	*"None" or publicly available references to the Intellectual Property Rights (IPR) documents for the extension.*
Status	*"Active" - Extensions that are currently implemented and in use* *"Inactive" - Extensions that are not implemented or are otherwise not being used*
Usage	*Used percentage based on the CENTR survey. No value means that the extension was not included in the CENTR survey.*
Object(s)	*"Any" or list of objects that the extension is associated with. An Object Extension defines the object and the Command-Response Extension can extend the attribute or one or more objects.*

Command(s)	*"None" if no commands are extended, "Any" if all commands are extended, or list of commands that the extension extends or supports. An Object Extension defines the set of commands supported by the object and the Command-Response Extension can extend zero or more commands.*
Response(s)	*"None" if no responses are extended, "Any" if all responses are extended, or list of responses that the extension extends or supports. An Object Extension defines the set of responses supported by the object and the Command-Response Extension can extend zero or more responses.*
Unique Aspects	*Provide any unique aspects (e.g., form of extensibility, policy, or behavior) of consideration for RPP. Set with "N/A" if there are no unique elements.*
Notes	*Provide any relevant analysis notes that don't belong in the Description.*
Recommendation	*Recommendation for extension in RPP* *The following are high-level recommendation values for quick reference:* • *"Embed" - Embed support directly into the standard RPP mappings, such as the RPP domain name mapping* • *"Extension" - Defined as an optional extension of one or more RPP object mappings, such as defining an RPP command response extension.* • *"Design" - Don't include in an RPP specification, but verify that the RPP extensibility would support the features of the EPP extension* • *"Not Applicable" - The extension is not applicable to RPP and does not need to be considered for support. Some aspects of the extensions may be useful for defining the forms of RPP extensibility.* *Additional recommendation text can be provided for guidance.*

3.1. Domain Registry Grace Period Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Domain Registry Grace Period Mapping for the Extensible Provisioning Protocol (EPP)

Description	The Domain Registry Grace Period (RGP) Mapping provides for the following features for domain names in the Domain Name Mapping of RFC5731:
	
	1. Add new grace period statuses that are based on billing command grace periods returned in the Domain Info Response. The grace period statuses include:
	    1. addPeriod - The domain name is in the add grace period
	    2. autoRenewPeriod - The domain name is in the auto renew grace period
	    3. renewPeriod - The domain name is in the renew grace period
	    4. transferPeriod - The domain name is in the transfer grace period
	2. Add new pendingDelete sub-statuses
	    1. redemptionPeriod - The domain name can be restored with the Domain Name Restore Command defined in the extension
	    2. pendingRestore - The domain name has received the Domain Name Restore (Request) Command and needs to complete the restore by submitting the Domain Name Restore (Report) Command.
	    3. pendingDelete - The domain name will be purged at the end of the pendingDelete period.
	3. Add a new Command Type with the Domain Name Restore Command
	    1. Extends an empty Domain Name Update Command and has two operations that include "request" for a Restore Request and "report" for a Restore Report to complete the restore. The Domain Name Restore Command can be submitted when the domain name has the RGP redemptionPeriod status.

Type	Standards Track RFC
Reference	RFC3915
Registrant	IESG (iesg@ietf.org)
Extensibility	Command-Response Extension Command Type Extension Enumeration Value Space Extension
TLDs	Any
IPR	None
Status	Active

Usage	38.9%
Object(s)	Domain Name in RFC5731
Command(s)	Domain Name Restore Command (Restore Request and Restore Report) as an extension of an empty Domain Name Update Command
Response(s)	Domain Name Info Response Domain Name Restore Response (only for the Restore Request Response)
Unique Aspects	1. First Command Type Extension by defining the Domain Name Restore Command (RestoreRequest and Restore Report) as an extension of an empty Domain Name Update Command.
Notes	The extension is required by all ICANN regulated TLDs, so it is heavily implemented The two step restore process of the restore request and restore report originated with the ICANN Redemption Grace Periods for Deleted Names Proposal, dating back to June 7, 2002.
Recommendation	Embed Include support for the RGP statuses (grace period statuses and pendingDelete sub-statuses) directly in RPP domain name mapping Include support for the RGP restore command (request and report) in the RPP domain name mapping. Enhance There is the desire to include the expiry of the RGP statuses (grace period and pendingDelete sub-statuses), since servers have different grace periods and pendingDelete sub-status periods. Make the restore a single command by combining the request and the report into a single command, instead of having a two step process of request and report to complete the restore. There is a question of the value of the restore report attributes, since they are simply stored with no additional processing or reporting. EPP:Standardization (update) Update RFC3915 to include the expiry of the RGP statuses (grace period and pendingDelete sub-statuses), since servers have different grace periods and pendingDelete sub-status periods. Make the restore a single command by combining the request and the report into a single command, instead of having a two step process of request and report to complete the restore. If the two step restore must remain, then consolidate with the RGP Poll extension. EPP:Consolidate (RGP Poll) - If two step restore Update RFC3915 to consolidate the RGP Poll extension if the two step restore process remains.

3.2. E.164 Number Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	E.164 Number Mapping for the Extensible Provisioning Protocol (EPP)
Description	The E.164 Number Mapping describes how the Domain Name System (DNS) can be used to identify services associated with an E.164 number. The domain name in RFC5731 is represented as a E.164 number that has been translated to conform to the domain name syntax, as described in the ENUM specification (RFC3761 that has been obsoleted by RFC6166 and RFC6117). The following are the features for domain names in the Domain Name Mapping of RFC5731: 1. Add support for an E.164 domain name conforming to the domain name syntax in RFC5731 2. Add support for the definition of Naming Authority Pointer (NAPTR) resource records used to identify available ways for contacting a specific node identified by a domain name created from the translation of a E.164 number. The NAPTR resource records can be provisioned using an extension to the Domain Name Create Command and the Domain Name Update Command. The Domain Name Info Response is extended to return the provisioned NAPR resource records.
Type	Standards Track RFC
Reference	RFC4114
Registrant	IESG (iesg@ietf.org)
Extensibility	Command-Response Extension
TLDs	Any
IPR	None
Status	Active
Usage	2.8%
Object(s)	Domain Name in RFC5731
Command(s)	Domain Name Create Command Domain Name Update Command
Response(s)	Domain Name Info Response
Unique Aspects	1. Adds more specific domain name format rules for an E.164 number

Notes	
Recommendation	Design Foresee interface for zone RRs provisioning.

3.3. ENUM Validation Information Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	ENUM Validation Information Mapping for the Extensible
Description	An Extensible Provisioning Protocol (EPP) extension framework for mapping information about the validation process that has been applied for the E.164 number (or number range) that the E.164 Number Mapping (ENUM) domain name is based on. Usually only the Assignee of the E.164 number (or number range) has the right to register the corresponding ENUM domain name. Therefore, an ENUM validation process has to be applied before the ENUM domain name can be inserted into the DNS. The validation process shall ensure that the holder of the ENUM domain name coincides with the Assignee of the corresponding E.164 number (or number range). The EPP extension described in this document specifies a framework for the mapping of information about the ENUM validation process. As the local legislation or the validation procedures may vary, the content of the validation information itself is not part of this specification.
Type	Standards Track RFC
Reference	RFC5076
Registrant	IESG (iesg@ietf.org)
Extensibility	Command-Response Extension Command-Type Extension Object Property Extension
TLDs	Any
IPR	None
Status	Active
Usage	
Object(s)	Domain Name in RFC5731

Command(s)	Domain Name Info Command Domain Name Create Command Domain Name Renew Command Domain Name Transfer (Request) Command Domain Name Update Command
Response(s)	Domain Name Info Response

Unique Aspects	1. Includes an extension point for the ENUM Validation Information under the <e164val:validationInfo> element.
	    1. No signaling of the concrete ENUM Validation Information with the XML Namespace URI is defined for the Greeting Services and the Login Services. I believe that the ENUM Validation Information XML Namespace URI could be included in the Greeting and Login Extension Services.
	    2. An example simple validation schema is provided with the XML Namespace URI "urn:ietf:params:xml:ns:e164valex-1.1"

Notes	It's unknown what servers support the ENUM Validation Information Mapping for the Extensible
Recommendation	Design foresee generic key/(object)value extensibility point for provisioning objects (Object Property Extension type in EPP)

3.4. Domain Name System (DNS) Security Extensions Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Domain Name System (DNS) Security Extensions Mapping for the Extensible Provisioning Protocol (EPP)

Description	The Domain Name System (DNS) Security Extensions Mapping provides for the following features for domain names in the Domain Name Mapping of RFC5731:
	
	1. Support for either the DS Data Interface or the Key Data Interface
	  1. DS Data Interface - The client is responsible for creation of the DS information from the DNSSEC Key to provide to the server.
	  1. Support for the DNS DS elements (keyTag, alg, digestType, digest)
	  2. Support for a list of DS elements with the maximum number of elements up to server policy
	  3. Support for optional key data associated with the DS data.
	  2. Key Data Interface - The client is responsible for passing the key data information and the server is responsible for creation of the DS data from the key data
	  1. Support for the DNS Key elements (flags, protocol, alg, pubKey)
	  2. Support for a list of Key elements with the maximum number of elements up to server policy
	2. Support for an optional maximum signature lifetime

Type	Standards Track RFC
Reference	RFC5910
Registrant	IESG (iesg@ietf.org)
Extensibility	Command-Response Extension
TLDs	Any
IPR	None
Status	Active
Usage	80.6%
Object(s)	Domain Name in RFC5731
Command(s)	Domain Name Create Command Domain Name Update Command
Response(s)	Domain Name Info Response
Unique Aspects	
Notes	The extension is required by all ICANN regulated TLDs, so it is heavily implemented

Recommendation	Embed

3.5. Common Object Attribute (COA) Extension for the Extensible

Attribute	Value
Name	Common Object Attribute (COA) Extension for the Extensible
Description	Supports the a list of key, value pair of strings that can be set on any object The key is a "token" with a maximum length of 50 characters The value is a "token" with a maximum length of 1000 characters The set of allowed keys is up to server policy on a per-object basis.
Type	Informational
Reference	http://www.verisign.com/assets/epp-sdk/verisign_epp-extension_coa_v00.html
Registrant	Verisign (epp-registry@verisign.com)
Extensibility	Command-Response Extension Key Value Pair Extension
TLDs	Any
IPR	None
Status	Inactive
Usage	
Object(s)	Any
Command(s)	<Any Object> Create Command <Any Object> Update Command
Response(s)	<Any Object> Info Response
Unique Aspects	1. Provides a general key, value pair extension that can be applied to any object.
Notes	The server needs to define the key policy on a per-object basis. In the case of the Production implementation, the allowed keys are defined by the server. Case after case found that it was better to define a specific EPP extension than to leverage a set of string keys and values to provision additional object attributes.
Recommendation	Not Applicable

3.6. RGP Poll Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	RGP Poll Mapping for the Extensible Provisioning Protocol (EPP)
Description	Defines a poll message when an RGP restore request in RFC3915 is submitted, but the restore report in RFC3915 has not been submitted, since the restore will fail if the restore report is not received. This poll message is meant to provide an alert to the client that the restore report is needed to complete the restore. The restore command is a two step process, starting with the restore request and ending with the restore report. The restore report must be submitted within the "pendingRestore" period, which when it expires the restore will fail and the domain name will return to the "redemptionPeriod". The following information is included in the poll message: • Domain Name (<rgp-poll:name>) • RGP Status at defined in RFC3915 (<rgp-poll:rgpStatus>) • RGP restore request date and time (<rgp-poll:reqDate>) • RGP restore report due date and time (<rgp-poll:reportDueDate>)
Type	Informational
Reference	http://www.verisign.com/assets/epp-sdk/verisign_epp-extension_rgp-poll_v00.html
Registrant	Verisign (epp-registry@verisign.com)
Extensibility	Object Extension Poll Message Extension
TLDs	Any
IPR	None
Status	Active
Usage	
Object(s)	RGP Poll
Command(s)	None
Response(s)	Poll Response
Unique Aspects	

Notes	This extension was created in parallel with RFC3915, where it was too late in the process for RFC3915 to add the poll message.
Recommendation	Embed Include with the embedding of the RGP extension in the RPP domain name mapping if restore needs to stay a two step process Enhance Include as a poll message for the RPP domain name mapping if the restore needs to stay a two step process. If the restore command can be a single command, then there is no need for the RGP poll message. EPP:Standardize If the RGP EPP extension in RFC3915 is updated and the two step restore stays in place, then the RGP poll message can be included. If the RGP EPP extension in RFC3915 is not updated, then the RGP poll message extension can be separately standardized. The preference is to remove the two step restore process. EPP:Consolidate (RGP) - If two step restore If the RGP EPP extension in RFC3915 is updated and the two step restore stays in place, then the RGP poll message can be included. If the RGP EPP extension in RFC3915 is not updated, then the RGP poll message extension can be separately standardized. The preference is to remove the two step restore process.

3.7. ConsoliDate Mapping for the Extensible Provisioning Protocol

Attribute	Value
Name	ConsoliDate Mapping for the Extensible Provisioning Protocol
Description	Provides means to synchronize renewals for large group of domain names, or even simply set a desired expiration date for a single domain name. The expiration date can only be adjusted forward to a month and day within one calendar year of the current expiration date. The extension adds a new sync command to the Domain Name Mapping of RFC5731 by extending an empty update like what has been done for the restore command in RFC3915. The only element provided in the extension is the desired month and day for the new expiration date with the <sync:expMonthDay> element.
Type	Informational
Reference	https://www.verisign.com/assets/consolidate-mapping.txt

Registrant	Verisign (epp-registry@verisign.com)
Extensibility	Command-Response Extension Command Type Extension
TLDs	Any
IPR	None
Status	Active
Usage	
Object(s)	Domain Name in RFC5731
Command(s)	Domain Name Sync Command as an extension of an empty Domain Name Update Command
Response(s)	None
Unique Aspects	1. Command Type Extension by defining the Domain Name Sync Command as an extension of an empty Domain Name Update Command.
Notes	
Recommendation	Design foresee generic interface for extending RPP objects with additional process triggers. Consider of the extension point shall only consider general purpose processes, or also uncoordinated extensibility of provider processes (conflict avoidance in naming conventions)

3.8. IDN Language Tag for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	IDN Language Tag for the Extensible Provisioning Protocol (EPP)
Description	Enables passing the 3-letter language tag with a domain name create command for an Internationalized Domain Name (IDN).
Type	Informational
Reference	http://www.verisign.com/assets/epp-sdk/verisign_epp-extension_idn-lang_v00.html
Registrant	Verisign (epp-registry@verisign.com)
Extensibility	Command-Response Extension
TLDs	Any

IPR	None
Status	Active
Usage	
Object(s)	Domain Name in RFC5731
Command(s)	Domain Name Create Command
Response(s)	None
Unique Aspects	
Notes	Use of language tag instead of table identifier in the Internationalized Domain Name Mapping for the Extensible Provisioning Protocol (EPP).
Recommendation	Design See what comes out of the IDN standardization work to incorporate into RPP. The IDN Language Tag extension is unlikely to be the chosen extension for IDN registrations, since it's proprietary. EPP:Standardize Standardize the IDN extensions used to support the registration of IDN domain names. EPP:Consolidate (IDN Mapping Tag, IDN Mapping - Identity Digital, IDN Table)

3.9. Extensible Provisioning Protocol Mapping: WhoWas

Attribute	Value
Name	Extensible Provisioning Protocol Mapping: WhoWas
Description	Add a query command to get the history of a registry object with the passing of the object type, which would likely be set to "domain". The name or Registry Object Identifier (ROID) could be passed and the transaction history of the object would be returned, with the attributes per transaction: • Transaction date and time • Object name • Object Registry Object Identifier (ROID) • Operation • Client identifier (e.g., Registrar identifier) • Client name (e.g., Registrar name)
Type	Informational

Reference	http://www.verisign.com/assets/epp-whowas-mapping.pdf
Registrant	Verisign (epp-registry@verisign.com)
Extensibility	Object Extension Function Extension
TLDs	Any
IPR	None
Status	Inactive
Usage	
Object(s)	WhoWas
Command(s)	WhoWas Info Command
Response(s)	WhoWas Info Response
Unique Aspects	1. Defined a who was info function as a WhoWas object with an info command and info response. One of the first uses of a Function Extension.
Notes	Was implemented for a period of time, but was removed due to the lack of usage.
Recommendation	Not Applicable

3.10. Extensible Provisioning Protocol Mapping: Email Forwarding

Attribute	Value
Name	Extensible Provisioning Protocol Mapping: Email Forwarding
Description	Defines an email forwarding object mapping in the form <first>@<last>.name that forwards e-mail to a defined e-mail address. The email forwarding object supports all of the command and response types defined for the domain name in RFC5731 along with a similar set of generic attributes. There are extra server policy rules that are linked to 3rd level domain name objects, in the form <first>.<last>.name, and defensive registration objects, in the form <first>.<last> or <name>. The Personal Registration Extension provides for some of the server policy features and information that links the domain name, email forward, and defensive registration objects, such as bundling and enforcement of the corresponding service.
Type	Informational

Reference	http://www.verisign.com/assets/email-forwarding-mapping.pdf
Registrant	Verisign (epp-registry@verisign.com)
Extensibility	Object Extension
TLDs	.name
IPR	None
Status	Active
Usage	
Object(s)	Email Forwarding
Command(s)	Email Forwarding Check Command Email Forwarding Info Command Email Forwarding Transfer Query Command Email Forwarding Create Command Email Forwarding Delete Command Email Forwarding Renew Command Email Forwarding Transfer Command Email Forwarding Update Command
Response(s)	Email Forwarding Check Response Email Forwarding Info Response Email Forwarding Transfer Response Email Forwarding Create Response Email Forwarding Renew Response
Unique Aspects	
Notes	
Recommendation	Design Extensibility of new object types (Object Extension in EPP)

3.11. Extensible Provisioning Protocol Mapping: Defensive Registration

Attribute	Value
Name	Extensible Provisioning Protocol Mapping: Defensive Registration

Description	Defines a defensive registration object mapping in the form <first>@<last> for a standard defensive registration and the form <name> for a premium defensive registration. A defensive registration blocks the registration of a matching email forwarding object or domain name (3rd-level standard or premium and 2nd level for premium) without the use of consent. There can be overlapping defensive registration strings that are handled using the defensive registration Registry Object Identifier (ROID), such as two premium defensive registrations of the string "trademark" with unique ROIDs for management. A defensive registration cannot be created if there is an existing matching email forwarding or domain name object. The Personal Registration Extension provides for some of the server policy features and information that links the domain name, email forwarding, and defensive registration objects, such as bundling and enforcement of the corresponding service.
Type	Informational
Reference	http://www.verisign.com/assets/defensive-registration-mapping.pdf
Registrant	Verisign (epp-registry@verisign.com)
Extensibility	Object Extension
TLDs	.name
IPR	None
Status	Active
Usage	
Object(s)	Defensive Registration
Command(s)	Defensive Registration Check Command Defensive Registration Info Command Defensive Registration Transfer Query Command Defensive Registration Create Command Defensive Registration Delete Command Defensive Registration Renew Command Defensive Registration Transfer Command Defensive Registration Update Command
Response(s)	Defensive Registration Check Response Defensive Registration Info Response Defensive Registration Transfer Response Defensive Registration Create Response Defensive Registration Renew Response

Unique Aspects	1. Supports overlapping registration of matching string values, so post create provisioning is handled via the Registry Object Identifier (ROID) 2. Only supports an optional registrant contact and admin contact, but not the other types of contacts (e.g., tech, and billing) 3. Support for blocking of multiple types of objects (e.g., domain names and email forwarding) and an override blocking consent feature
Notes	
Recommendation	Design Extensibility of new object types (Object Extension in EPP)

3.12. Extensible Provisioning Protocol Mapping: NameWatch

Attribute	Value
Name	Extensible Provisioning Protocol Mapping: NameWatch
Description	Defines a NameWatch object that provides email notifications based on the registration of corresponding services that include domain names and email forwarding objects matching a name label that functions as a wildcard value (*<name>*). Post the creation of the NameWatch object, provisioning is handled using the NameWatch Registry Object Identifier (ROID), since there can be overlapping NameWatch name labels. The email to send the report to and the frequency can be set.
Type	Informational
Reference	http://www.verisign.com/assets/namewatch-mapping.pdf
Registrant	Verisign (epp-registry@verisign.com)
Extensibility	Object Extension
TLDs	.name
IPR	None
Status	Active
Usage	
Object(s)	NameWatch

Command(s)	NameWatch Info Command NameWatch Transfer Query Command NameWatch Create Command NameWatch Delete Command NameWatch Renew Command NameWatch Transfer Command NameWatch Update Command
Response(s)	NameWatch Info Response NameWatch Transfer Response NameWatch Create Response NameWatch Renew Response
Unique Aspects	1. Supports overlapping registration of matching string values, so post create provisioning is handled via the Registry Object Identifier (ROID) 2. Only supports an optional registrant contact and not the other types of contacts (e.g., admin, tech, and billing)
Notes	
Recommendation	Design Extensibility of new object types (Object Extension in EPP)

3.13. Extensible Provisioning Protocol Mapping: Personal Registration

Attribute	Value
Name	Extensible Provisioning Protocol Mapping: Personal Registration

Description	Personal Registration is a term that applies to domain name and email forwarding objects. The Personal Registration Extension supports the additional server policy features and information associated with the registration of Personal Registrations (domain name and email forwarding objects). The following elements are supported by the extension:
	
	1. Bundling flag that indicates whether a bundling discount was applied to the billable commands of create, renew, and transfer.
	2. Ability to pass a Content Identifier with a domain name or email forwarding create to override the defensive registration block.
	3. Return specific Personal Registration error information for a domain name or email forwarding create that includes:
	    1. "Corresponding service exists" - A corresponding service (domain name for an email forwarding create or vice-versa) exists that prohibits the create.
	    2. "Conflicting defensive registration exists" - A defensive registration conflicts with the personal registration string and consent must be obtained.

Type	Informational
Reference	http://www.verisign.com/assets/personal-registration-extension.pdf
Registrant	Verisign (epp-registry@verisign.com)
Extensibility	Command-Response Extension
TLDs	.name
IPR	None
Status	Active
Usage	
Object(s)	Domain Name and Email Forwarding
Command(s)	Domain Name Create Command Email Forwarding Create Command
Response(s)	EPP Response (error response) Domain Name Info Response Email Forwarding Info Response Domain Name Create Response Email Forwarding Create Response Domain Name Renew Response Email Forwarding Renew Response Domain Name Transfer Response Email Forwarding Transfer Response

Unique Aspects	1. Extending the EPP error response information (EPP 2305 "Object association prohibits operation") with more fine-grained error information 2. Provides discount information for billable operations (e.g., bundling flag) 3. Provides for an override feature that applies to defensive registrations
Notes	
Recommendation	Design - foresee extensibility design pattern of additional process result information, like “Bundling flag”, which is not a part of persistent resource representation - foresee extensibility design pattern of providing additional provisioning information, like “Content Identifier” - foresee extensibility for additional or more specific error codes and messages related to extensions

3.14. Extensible Provisioning Protocol Mapping: Suggestion

Attribute	Value
Name	Extensible Provisioning Protocol Mapping: Suggestion
Description	Defines a domain name suggestion, referred to as Suggestion, function that provides suggestion options in the info command that are returned in the info response. Features include: • String (key) to search • Language for the suggestions, with English as the default language • Filter based on multiple options, such as TLDs, geo-location, and content filtering. • Format of the response as either a "table" or "grid"
Type	Informational
Reference	http://www.verisign.com/assets/epp-sdk/EPP-Suggestion-Mapping.pdf
Registrant	Verisign (epp-registry@verisign.com)
Extensibility	Object Extension Function Extension
TLDs	Any
IPR	None
Status	Inactive

Usage	
Object(s)	Suggestion
Command(s)	Suggestion Info Command
Response(s)	Suggestion Info Response
Unique Aspects	1. Defined a suggestion info function as a Suggestion object with an info command and info response. One of the first uses of a Function Extension.
Notes	Was implemented for an extended period of time, but was removed a while ago. The API transitioned to use REST. The primary question is whether Name Suggestion should be separate or merged with the provisioning protocol being EPP or RPP (REST).
Recommendation	Not Applicable

3.15. Whois Info Extension for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Whois Info Extension for the Extensible Provisioning Protocol (EPP)
Description	Defines the option to get additional registrar information for the domain name that is typically available in WHOIS. There is a flag that needs to be set to true ("true" or "1") in the domain name info command to get the additional information that includes: • Registrar Name • Registrar WHOIS Server • Registrar URL
Type	Informational
Reference	http://www.verisign.com/assets/epp-sdk/verisign_epp-extension_whois-info_v00.html
Registrant	Verisign (epp-registry@verisign.com)
Extensibility	Command-Response Extension
TLDs	Any
IPR	None
Status	Inactive
Usage	

Object(s)	Domain Name in RFC5731
Command(s)	Domain Name Info Command
Response(s)	Domain Name Info Response
Unique Aspects	
Notes	Use of the Organization Mapping in RFC8543 and the Organization Extension in RFC8544 is a standard alternative.
Recommendation	Not applicable

3.16. Extensible Provisioning Protocol Extension Mapping: Jobs Contact

Attribute	Value
Name	Extensible Provisioning Protocol Extension Mapping: Jobs Contact
Description	Defines a custom set of contact attributes for .jobs contacts that include: • Title (Optional)g • Website (Required) • Industry (Optional) • Admin Contact Flag (Required) • Association Member Flag (Optional)
Type	Informational
Reference	http://www.verisign.com/assets/epp-jobscontact-extension.pdf
Registrant	Verisign (epp-registry@verisign.com)
Extensibility	Command-Response Extension Object Property Extension
TLDs	.jobs
IPR	None
Status	Inactive
Usage	
Object(s)	Contact in RFC5733
Command(s)	Contact Create Command Contact Update Command
Response(s)	Contact Info Response

Unique Aspects	
Notes	This EPP extension is no longer supported
Recommendation	Not Applicable No longer active, so there is no need to analyze it further.

3.17. Low Balance Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Low Balance Mapping for the Extensible Provisioning Protocol (EPP)
Description	Poll message inserted by the server when the client goes below the client's credit threshold. The following attributes are included in the poll message: ● Account Full Name ● Credit Limit ● Credit Threshold (fixed amount or percent of credit limit) ● Available Credit (remaining credit using the equation Available Credit = Credit Limit - Balance)
Type	Informational
Reference	http://www.verisign.com/assets/epp-sdk/verisign_epp-extension_low-balance_v00.html
Registrant	Verisign (epp-registry@verisign.com)
Extensibility	Object Extension Poll Message Extension
TLDs	Any
IPR	None
Status	Active
Usage	
Object(s)	Low Balance
Command(s)	
Response(s)	Low Balance Poll Response
Unique Aspects	
Notes	The Low Balance Mapping could be combined with the Balance Mapping to support on-demand as well as a low balance poll message, using a common info response.

Recommendation	Extension Could be combined with the Balance Mapping in a single extension, where the balance could be requested on-demand and also provided via a poll message when the low credit threshold is hit. EPP:Standardize Receiving low balance notifications from the server is a basic function that can be standardized. EPP:Consolidate (Balance, Finance, FRED Credit Info) The Low Balance Mapping that returns the balance information in a poll message can be merged with the Balance Mapping and the Finance Mapping that retrieves the balance information on-demand.

3.18. Premium Domain Extension for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Premium Domain Extension for the Extensible Provisioning Protocol (EPP)
Description	Extension provides an indication whether a domain name is a premium domain name and provides the premium create fee and the premium renew fee in a domain name check response. Additionally, the extension provided the ability to assign the domain name to a premium domain name registrar in a domain name update command. The concept of having a premium domain name registrar was a custom feature that does not apply with the Registry Fee Extension.
Type	Informational
Reference	http://www.verisign.com/assets/epp-sdk/verisign_epp-extension_premium-domain_v00.html
Registrant	Verisign (epp-registry@verisign.com)
Extensibility	Command-Response Extension
TLDs	Any
IPR	None
Status	Inactive
Usage	

Object(s)	Domain Name in RFC5731
Command(s)	Domain Name Check Command Domain Name Update Command
Response(s)	Domain Name Check Response
Unique Aspects	
Notes	This EPP extension is no longer supported and the Registry Fee Extension should be used instead.
Recommendation	Not Applicable

3.19. Balance Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Balance Mapping for the Extensible Provisioning Protocol (EPP)
Description	Ability for the client to receive their financial information using the Balance Info Command. This is the same information inserted by the server when the client is below their credit threshold with the Low Balance Poll Message, which includes: ● Account Full Name ● Credit Limit ● Credit Threshold (fixed amount or percent of credit limit) ● Available Credit (remaining credit using the equation Available Credit = Credit Limit - Balance)
Type	Informational
Reference	https://www.verisign.com/assets/epp-sdk/verisign_epp-extension_balance_v01.html
Registrant	Verisign (epp-registry@verisign.com)
Extensibility	Object Extension Function Extension
TLDs	Any
IPR	None
Status	Active
Usage	
Object(s)	Balance
Command(s)	Balance Info Command

Response(s)	Balance Info Response
Unique Aspects	N/A
Notes	The Balance Mapping could be combined with the Finance Mapping and the Low Balance Mapping to support on-demand as well as a low balance poll message, using a common info response.
Recommendation	Extension Could be combined with the Low Balance Mapping in a single extension, where the balance could be requested on-demand and also provided via a poll message when the low credit threshold is hit. EPP:Standardize Receiving balance information is a basic function that can be standardized. EPP:Consolidate (Low Balance, Finance, FRED Credit Info) The Balance Mapping that retrieves the balance information on-demand can be merged with the Identity Digital Finance Mapping, the FRED Credit Info, and the Verisign Low Balance Mapping that returns the balance information in a poll message.

3.20. Verisign Registry Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Verisign Registry Mapping for the Extensible Provisioning Protocol (EPP)
Description	Provides the list of TLDs authorized to a client with the EPP server and provides the ability for the client to query for the features and policies of each of the authorized TLDs. Additional provisioning commands are supported by the extension, but the only command that is leveraged is the Registry Info Command and Registry Info Response.
Type	Informational
Reference	http://www.verisign.com/assets/epp-sdk/verisign_epp-extension_registry_v00.html
Registrant	Verisign (epp-registry@verisign.com)
Extensibility	Object Extension Function Extension
TLDs	Any
IPR	https://datatracker.ietf.org/ipr/2552/

Status	Active
Usage	
Object(s)	Registry (Zone)
Command(s)	Registry Check Command Registry Info Command Registry Create Command Registry Update Command Registry Delete Command
Response(s)	Registry Check Response Registry Info Response Registry Create Response
Unique Aspects	1. Provides capability of a client (registrar) to discover the list of TLDs (zones) that they are authorized for and the features and policy details of each authorized TLD.
Notes	An attempt was made to standardize the Registry Mapping with draft-gould-carney-regext-registry, but for multiple reasons (e.g., variety of registry policies) the draft was abandoned by the working group. The only Registry Mapping command and response implemented is the Registry Info Command and Registry Info Response, so in practice it is a Function Extension.
Recommendation	Design Extensibility of new object types (Object Extension in EPP) or special “non provisioning” readonly resources (discoverability aspect)

3.21. Related Domain Extension for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Related Domain Extension for the Extensible Provisioning Protocol (EPP)
Description	Managing client-side and server-side domain name relationships. A client-side domain name relationship can be managed by using the extension to the transform commands that enable transforming more than one domain name in a single transform command. A server-side domain name relationship (across top-level domains "tld" or variants for an IDN domain name) is reflected in the extension to the info response, and can be managed by using the extension to the transform commands.
Type	Informational

Reference	http://www.verisign.com/assets/epp-sdk/verisign_epp-extension_related-domain_v00.html
Registrant	Verisign (epp-registry@verisign.com)
Extensibility	Command-Response Extension
TLDs	Any
IPR	https://datatracker.ietf.org/ipr/2553/
Status	Inactive
Usage	
Object(s)	Domain Name in RFC5731
Command(s)	Domain Name Info Command Domain Name Create Command Domain Name Delete Command Domain Name Renew Command Domain Name Transfer Command Domain Name Update Command
Response(s)	Domain Name Info Response Domain Name Create Response Domain Name Delete Response Domain Name Renew Response Domain Name Transfer Response Domain Name Update Response
Unique Aspects	Extending the domain name commands to support multiple domains, where the related domain names need to be updated at once. An example is changing the registrant for all of the related domain names or performing a registrar transfer so that the sponsorship always stays consistent.
Notes	Both intra and inter TLD domain name relationships can be managed via the Related Domain Extension.

Recommendation	Extension Includes some unique EPP extensibility aspects that needs to be confirmed in RPP EPP:Standardize Support for related domain names in EPP can be standardized with association (client-side defined and server unknown), aggregate (server known with some shared attributes), and potentially composite relationship types (server known with share all or most and with enablement). Considering that the extension was de-activated due to lack of adoption, aspects could be reused for standardization, but the recommendation is not to standardize it as defined. EPP:Consolidate (Strict Bundling, IDN - TANGO, Domain Variant) Consolidate with the Strict Bundling (if possible) to support all three forms for domain name relationships with association (client-side defined and server unknown), aggregate (server known with some shared attributes), and composite relationship types (server known with share all or most and with enablement). A new Domain Variant extension has been defined as an IETF draft with draft-galvin-regext-epp-variants, which can reuse aspects of the Related Domain Extension.

3.22. .SE EPP Extensions

Attribute	Value
Name	.SE EPP Extensions

Description	Two command-response extensions are defined that include:
	
	1. "iis" with the URI urn:se:iis:xml:epp:iis-1.2
	    1. It's unclear what "iis" stands for other than potentially Internet Infrastructure Service.
	    2. The extension applies to the Domain Name Mapping by adding the attributes
	        1. Server generated authinfo value with the <iis:pw> element in the create or update response. The generation is triggered by the client passing the "auto" value to the <domain:authInfo><domain:pw> element.
	        2. Client delete feature, that enables cancellation immediately or at expiry, where the cancelled domain name is put on the pendingDelete status and the serverHold status and purged 60 days later.
	        3. Setting name servers with a transfer using the <iis:transfer> element with child <iis:ns><iis:hostObj> elements, which will replace the name servers along with deleting all DS. All transfers are done immediately.
	        4. Extra domain information provided in the domain info response:
	            1. clientDelete - clientDelete state
	            2. deactDate - Date when the domain will be deactivated
	            3. delDate - Date when the domain will be deleted (purged assumed)
	            4. relDate - Date when the domain will be released (available for re-registration assumed)
	            5. state - State of the domain
	    3. The extension applies to the Contact Mapping by adding the attributes
	        1. orgno with the <iis:orgno> element for the personal or organizational number
	        2. vatno with the <iis:vatno> element for the VAT number
	    4. Four tags in a poll message for domain, host, and contact, which is included directly under the <resData> element, which is technically not an object and should be moved under the <extension> element or the Change Poll Message can be used in RFC8590.
	        1. <createNotify/> - Sent when a host, contact or domain has been created, contains infData for the created object
	        2. <updateNotify/> - Sent when a host, contact or domain has been updated, contains infData for the updated object
	        3. <deleteNotify/> - Sent when a host, contact or domain has been deleted, contains host:delete, domain:delete or contact:delete.

	4. <transferNotify/> - Sent to the former registrar when a domain has been transferred, contains trnData for a domain or host 2. "rl" with the URI "urn:se:iis:xml:epp:registryLock-1.0" 1. The extension is optional and applies to the Domain Name Mapping to support registry locking and unlocking. 2. The <rl:lock> and <rl:unlock> elements are supported on create and update, where the <rl:unlock> can specify that the unlock can only be done "outofband". 3. The <rl:locked> and <rl:unlockedUntil> elements are supported in the info response to indicate whether the domain name uses registry lock and whether it's unlocked until a date and time.
Type	Informational
Reference	https://support.registry.se/file.php/3013699GPNMHCSYKBHKMZM0PD/EPP-Rules-Policies-and-Protocol-description-v1.9.pd
Registrant	Internet Infrastructure Foundation (hostmaster@iis.se)
Extensibility	Command-Response Extension Two command-response extensions with the "iis" extension and the "rl" extension. Object Property Extension
TLDs	.se and .nu
IPR	None
Status	Active
Usage	
Object(s)	Domain Name, Host, and Contact for "iis" extension Domain Name for the "rl" extension
Command(s)	"iis" extension: Domain Name Create Command Domain Name Update Command Domain Name Transfer Command Contact Create Command Contact Update Command "rl" extension: Domain Name Create Command Domain Name Update Command

Response(s)	"iis" extension: Domain Name Info Response Host Name Info Response (poll message) Contact Info Response (poll and non-poll message) "rl" extension: Domain Name Info Response

Unique Aspects	1. Domain name life cycle with deactivation and the option for a scheduled deactivation at expiry
	    1. This could be considered with the RGP extension in RFC3915.
	2. Server generated authorization information with the use of the "auto" value by the client on create and update.
	    1. The management of authorization information could be considered with the Secure Authorization Information for Transfer extension in RFC9154.
	3. Immediate transfer; although I believe there are other registries that support immediate transfer.
	4. Poll message tags with the purpose to let the receiver of the message know what kind of action led to the notification, which resides under the <resData> element.
	    1. This could be considered with the Change Poll extension in RFC8590
	5. Use of domain authorization information using the "roid" attribute to authorize a non-sponsoring registrar to get contact information for domains. I've seen the use of the "roid" attribute to authorize a domain transfer using the registrants authorization information, but not the other way around.

Notes	The extension registration references an EPP Rules, Policies and Protocol description, which includes details of the command-response extensions and the features implemented in the base EPP RFCs.

Recommendation	Design Ensure the RPP extensibility covers the features and policies implemented by .su and .nu with the "iis" and "rl" extensions, and the base EPP RFCs.: • either build in (Embed) or allow extensibility for server-generated auth-code, to avoid hacks like hard-coded trigger password • allow extensibility of standard commands (like delete) to alter lifecycle behaviour (here: delete pending till expire) • foresee option for immediate transfer (as Embed or extensibility) • foresee option for DNS update with transfer (update of NS, removal or update of DNSSEC configuration) (as Embed or extensibility) EPP:Standardize Standardize some aspects, such as deactivation, immediate transfer, server generated auth-info, and aspects of the poll message with the Change Poll extension in RFC8590. EPP:Consolidate (RGP for deactivation, Change Poll for what action led to the notification) Some aspects can be considered for inclusion to updates for RGP and the Change Poll extensions.

3.23. DK Postmaster local data extensions

Attribute	Value
Name	DK Postmaster local data extensions
Description	This extension includes a number of domain, host and contact object extension elements for use with the dk ccTLD. The extensions to the host objects were included with the revision 2.0 of the XSD implemented by the dk registry. The base EPP RFC XML schemas are leveraged and extensions to the various EPP objects (domain, host, and contact) are supported by a single command-response extension XML schema with versioning of the XML namespace URI, such as "urn:dkhm:params:xml:ns:dkhm-4.4" with the dkhm-4.4.xsd XML schema.
Type	Informational
Reference	https://github.com/DK-Hostmaster/epp-service-specification

Registrant	Punktum dk
Extensibility	Command-Response Extension (many extensions) Object Property Extension Protocol Extension
TLDs	.dk
IPR	None
Status	Active
Usage	
Object(s)	Domain Name in RFC5731 Host in RFC5732 Contact in RFC5733
Command(s)	
Response(s)	
Unique Aspects	1. Support for a single step restore command, which only uses the restore report, and does perform a validation. 2. Support for a withdraw command that pushes a domain name from its portfolio to Punktum dk. 3. Customization of epp-1.0.xsd with dkhm-epp-1.0.xsd to change the minimum and maximum password length from 6 to 16 characters to 8 to 64 characters. The alternative approach would be to implement the Login Security Extension. 4. Customizations done of the base EPP RFCs based on the use of keywords and existing EPP fields and without having to modify the EPP RFC XML schemas, with the exception of dkhm-epp-1.0.xsd. 5. Reuse of the Verisign Balance Extension as is.

Notes	Punktum dk offers two management models: ● Registrar managed, where the registrar takes the administrative role of the domain name and administers the assets with Punktum dk "registrar management". The clID is set to the registrar. ● Registrant managed, where the registrant administers the assets directly with Punktum dk, also referred to as: "registrant management". The clID is set to Punktum dk (“DKHM1-DK”).. The EPP service is the same, but the capabilities and business roles vary depending on choice of administrative model. Implementation elements: 1. We rely on the client transaction id to be unique. This is unique as per client id. 2. The contact-id is assigned by Punktum dk, where keywords are used by the client with “auto” and “force”.. 3. Domain Update, Host Update, and Contact Update does not support setting the status, which is assigned by Punktum dk. 4. Punktum dk does not support the extension of a period via a transfer. Therefore all client statuses are not supported. The RGP grace period statuses are not supported. 5. Contact Delete not supported, where unlinked contacts are automatically deleted. 6. Contact Transfer not supported, where contacts are transferred with their domain name. 7. The domain name inactive status is not supported, since domain names must have name servers. 8. Supports a waiting list service for domain names. 9. EPP sessions include a 5 minute idle timeout, which can be kept alive with the hello command, and an 8 hour absolute timeout. 10. Uses the Balance Extension directly. 11. The Domain Renew response example looks odd or incorrect, since it doesn’t include the new expiration date and includes poll queue information. I assume it’s an error in the documentation. 12. The Domain Update does not adhere to RFC 5731, where the authInfo is used to handle AuthInfo tokens, but it looks like the schema is adhered to. The client provided AuthInfo uses the keywords “autoredel” (change name servers) and “autotransfer” (registrar transfer) values. The authorization holds a lifespan of 14 days. The AuthInfo tokens currently support the operations of Domain Transfer and Domain Update for changing name servers. The server generated AuthInfo can be retrieved via the Domain Info. 13. Domain Delete results in a 30 day suspension (redemptionPeriod), with support for the restore command.

	14. Single step Restore, but not via the Restore Request, but via submitting the Restore Report, but validation is performed. 15. The contacts are cloned with the successful Domain Transfer. 16. Transition Period enables registrars to transfer without providing the required AuthInfo token, with defined restrictions. 17. Support for a Domain Withdraw that enables the registrar to push a domain name from its portfolio to Punktum dk, which uses a Protocol Extension. 18. Contacts can be assigned a user type, such as “company”, “individual”, “public organization”, and “association”. 19. Concept of a name server administrator by extending the Host with a contact object reference. 20. Change of the host name is not supported. 21. I don’t see the RGP extension namespace included in the EPP Greeting services, but I believe it should be based on support for restore command (restore report only). 22. The XSD implementation preserves the original namespace and does not make alterations to this apart from adding the already described XML elements, which include the existing XML schemas: epp-1.0.xsd, eppcom-1.0.xsd, domain-1.0.xsd, host-1.0.xsd, contact-1.0.xsd, rgp-1.0.xsd, secDNS-1.1.xsd, balance-1.0.xsd. Added the proprietary XML schemes: dkhm-4.4.xsd (Object Property Extensions), dkhm-domain-4.4.xsd (Withdraw Command, using a Protocol Extension). 23. Found dkhm-epp-1.0.xsd that redefines the “pwType” to be a minimum length of 8 and a maximum length of 64 instead of a minimum of 6 characters and a maximum length of 16 characters. They could have implemented the Login Security Extension to support longer passwords. List of extensions: 1. authInfo - This extension is used to expose any currently valid AuthInfo tokens for a domain name. The information includes the purpose and expiration date of the token. 2. autoRenew - This extension is used to expose the auto-renewal flag for a domain name. Supports auto-renewal and auto-expire, with the default being auto-renewal. 3. contact_validated - Contact objects related to the role of registrant have to be validated, this field is used to indicate the status of a validation of a contact object. 4. CVR - The CVR extension is for transporting VAT registration numbers. The number is used for validation and VAT accounting. 5. domain_confirmed - Domain names registered with Punktum dk, has to be confirmed by the registrant, this can either be done using pre-application agreement to Punktum dk's Terms and Conditions.

	6. domainAdvisory - Any special circumstances in relation to a domain name, can be communicated using this special field, with two advisories currently communicated: a. pendingDeletionDate, indicating that a given domain name is scheduled for deletion b. offeredOnWaitingList, indicating that a given domain name has been offered to a designated registrant 7. EAN - The EAN extension, holds the EAN number associated with public organizations in Denmark. The field is mandatory for this type of contact objects and is required for electronic invoicing. 8. management - The choice of administration model is based on the registrar account default for the specific registrar account. The default can be overridden per request or application using the extension. 9. mobilephone - Contact objects can have a mobile phone number in addition to voice. 10. orderconfirmationToken - This is a special field for supporting the business flow where the agreement for a domain name is accepted by the registrant with the registrar. 11. pnumber - The p-number extension is for holding production-unit numbers, used for validation for Danish companies, with more physical addresses related to a single VAT number. 12. registrant_validated - Contact objects related to the role of registrant has to be validated and possibly ID-controlled, this field is used to indicate the status of a validation object. 13. requestedNsAdmin - The extension is used to request another name server administrator than the authenticated user. 14. secondaryEmail - Contact objects can have a secondary email address in addition to email. 15. trackingNo - A unique tracking number for a domain registration for uniformity with RP. EPP it not the only channel of domain registration and in order to handle registrations via multiple channels, a unique tracking-id is assigned to every request. 16. userType - The userType extension is used to categorize a contact type, since the requirements for data differs between the different user types. 17. vid - This extension is used to expose the VID service flag for a domain name.
Recommendation	Design Ensure that the dk ccTLD specific extension is supported

3.24. Key Relay Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Key Relay Mapping for the Extensible Provisioning Protocol
Description	Mapping for a key relay object that relays DNSSEC key material between EPP clients using the poll queue defined in RFC 5730. The DNSSEC key material is passed via the Key Relay Create Command and provided to the other client via the poll queue using the Key Relay Info Response.
Type	Standards Track RFC
Reference	RFC8063
Registrant	IESG (iesg@ietf.org)
Extensibility	Object Extension Function Extension Poll Message Extension
TLDs	Any
IPR	None
Status	Active
Usage	5.6%
Object(s)	Key Relay
Command(s)	Key Relay Create Command
Response(s)	Key Relay Info Response (for poll message)
Unique Aspects	
Notes	Used in Production, but sparingly. Implemented at .nl registry, but it is almost never used. Creating an RPP extension for this should be a low priority. Will be removed in the next version of the NL registration system. only 11 times transaction in 1,5 years. Not sure if these succeeded. Registrars are not asking for this.
Recommendation	Design - Based on lack of use of the RFC

3.25. Launch Phase Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Launch Phase Mapping for the Extensible Provisioning Protocol (EPP)

Description	Launch Phase Mapping is an Extensible Provisioning Protocol (EPP) extension mapping for the provisioning and management of domain name registrations and applications during the launch of a domain name registry. The extension supports synchronous (registration) and asynchronous (application) Create Commands in pre-defined launch phases (“sunrise”, “landrush”, “claims”, “open”) and custom launch phases. Features like multiple mark validation models used in the “sunrise” launch phase and claims check and claims notice in the “claims” launch phase are included. This extension is used to support the launching of new ICANN accredited TLDs.
Type	Standards Track RFC
Reference	RFC8334
Registrant	IESG (iesg@ietf.org)
Extensibility	Command-Response Extension Command Type Extension Poll Message Extension
TLDs	Any
IPR	None
Status	Active
Usage	19.4%
Object(s)	Domain Name in RFC5731
Command(s)	Domain Name Check Command Claims Check Form Availability Check Form Trademark Check Form Domain Name Info Command Domain Name Create Command Sunrise Create Form Claims Create Form General Create Form Mixed Create Form Domain Name Update Command Domain Name Delete Command
Response(s)	Domain Name Check Response Domain Name Info Response Domain Name Create Response

Unique Aspects	1. Definition of the new check commands Claims Check Form Command, Availability Check Form Command, and Trademark Check Form Command. These are specialized forms of checks needed to implement the launch registration flow. 2. Definition of new create command Sunrise Create Form Command, Claims Create Form Command, General Create Form Command, and Mixed Create Form Command. These are specialized forms of domain name create commands needed to implement the launch registration flow. 3. Support for pluggability for marks, signed marks, and encoded signed marks that reference concrete types in RFC7848.
Notes	The launch phase extension is flexible and extensible to support many different types of launch phases with a concrete example of implementing an ICANN accredited TLD launch, with the “sunrise” and “claims” phases supported by RFC7848 and the ICANN TMCH.
Recommendation	Extension Based on the complexity and the limited timeframe needed to support the extension when launching a TLD, I believe it’s best to make this an RPP extension that can be optionally supported by servers and clients. Support for digital signatures on a set of attributes will be needed.

3.26. Allocation Token Extension for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Allocation Token Extension for the Extensible Provisioning Protocol (EPP)
Description	Allocation Token in "query" and "transform" commands. The Allocation Token is used as a credential that authorizes a client to request the allocation of a specific object from the server using one of the EPP transform commands, including "create" and "transfer". The Allocation Token is a simple XML "token" type. The exact format of the Allocation Token is up to server policy. The server MAY have the Allocation Token for each object to match against the Allocation Token passed by the client to authorize the allocation of the object. The Allocation Token is of particular value during the launching of a TLD to support a Founders Program or as a mechanism to auction domain names with server-generated allocation tokens.
Type	Standards Track RFC

Reference	RFC8495
Registrant	IESG (iesg@ietf.org)
Extensibility	Command-Response Extension
TLDs	Any
IPR	None
Status	Active
Usage	2.8%
Object(s)	Any, but the Domain Name in RFC5731 is used as the example
Command(s)	<Any Object> Check Command <Any Object> Info Command <Any Object> Create Command <Any Object> Transfer Command
Response(s)	<Any Object> Info Response
Unique Aspects	1. Defines a conduit for allocation tokens to be defined by servers. I'm not aware of any of the allocation token formats defined and published by the servers.
Notes	The extension covers a more specialized use case in launching of TLDs and auctioning domain names by 3rd parties. This does not make it a good candidate for embedding, but as a good candidate for defining a standard RPP extension.
Recommendation	Extension

3.27. Extensible Provisioning Protocol (EPP) Organization Mapping

Attribute	Value
Name	Extensible Provisioning Protocol (EPP) Organization Mapping
Description	Object mapping for provisioning and management of organization objects that are linked to provisioning objects via the Organization Extension. The object mapping supports the definition of organizations that can have many roles and the ability to define a hierarchy of organizations with a parent, child relationship. Each organization has a generic set of attributes (e.g., name, address, e-mail, contacts) along with a unique organization identifier that can be used to link to the provisioning objects.
Type	Standards Track RFC
Reference	RFC8543

Registrant	IESG (iesg@ietf.org)
Extensibility	Object Extension Poll Message Extension
TLDs	Any
IPR	None
Status	Active
Usage	5.6%? - Organization Mapping is used along with Organization Extension
Object(s)	Organization
Command(s)	Organization Check Command Organization Info Command Organization Create Command Organization Delete Command Organization Update Command
Response(s)	Organization Check Response Organization Create Response Organization Pending Action Response
Unique Aspects	1. Enable the definition of non-registrar organizations that are managed by the registrars, where an organization can have a set of roles. 2. Enable the definition of a hierarchy of organizations (e.g., registrar -> N-tier reseller -> reseller) that can be linked to provisioning objects.
Notes	
Recommendation	Embed At a minimum support the ability to query for registrar information as an organization. Support for other types of organizations managed by a registrar can also be supported if registrars are looking to define them and tag provisioning objects with them in the registry.

3.28. Organization Extension for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Organization Extension for the Extensible Provisioning Protocol (EPP)

Description	Supports assigning an organization in the Organization Mapping of RFC8543 to any existing object (domain, host, contact) as well as any future objects.
Type	Standards Track RFC
Reference	RFC8544
Registrant	IESG (iesg@ietf.org)
Extensibility	Command-Response Extension
TLDs	Any
IPR	None
Status	Active
Usage	5.6%
Object(s)	Any
Command(s)	<Any Object> Create Command <Any Object> Update Command
Response(s)	<Any Object> Info Response
Unique Aspects	1. Supports linking an extensible set of organizations with roles to provisioning objects.
Notes	
Recommendation	Embed At a minimum support the ability to query for registrar information as an organization. Support for other types of organizations managed by a registrar can also be supported if registrars are looking to define them and tag provisioning objects with them in the registry.

3.29. Change Poll Extension for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Change Poll Extension for the Extensible Provisioning Protocol (EPP)
Description	Defines a poll message for any EPP object of a server side operation with the metadata of what, when, who, and why.
Type	Standards Track RFC
Reference	RFC8590

Registrant	IESG (iesg@ietf.org)
Extensibility	Command-Response Extension Poll Message Extension
TLDs	Any
IPR	None
Status	Active
Usage	8.3%
Object(s)	Any
Command(s)	None
Response(s)	<Any Object> Info Response
Unique Aspects	
Notes	This extension enables clients to more easily keep their registration data up to date with the registry data, which will reduce customer support issues. An issue such as the registry locking or holding a domain name due to complying with a court-directed action.
Recommendation	Extension This covers a specific use case of server-side changes that the client needs to be notified of. It applies to any object extension defined, so it would work well as an Extension in RPP.

3.30. Registry Fee Extension for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Registry Fee Extension for the Extensible Provisioning Protocol (EPP)
Description	Provides a method for EPP clients to query EPP servers for the fees and credits associated with various billable transactions and provide expected fees and credits for certain commands and objects.
Type	Standards Track RFC
Reference	RFC8748
Registrant	IESG (iesg@ietf.org)
Extensibility	Command-Response Extension
TLDs	Any

IPR	None
Status	Active
Usage	19.4%
Object(s)	Any (billable)
Command(s)	<Any Object> Check Command <Any Object> Create Command <Any Object> Renew Command <Any Object> Transfer Command
Response(s)	<Any Object> Check Response <Any Object> Create Response <Any Object> Delete Response <Any Object> Renew Response <Any Object> Update Response (command type extensions of update) <Any Object> Transfer Response
Unique Aspects	1. Revises behavior of extended billable command by having the billable command fail if the provided fee is less than the actual fee.
Notes	The Registry Fee Extension also provides the option for the account balance that is similar to the Balance Extension (on-demand balance) and the Low Balance Extension (poll message triggered by low balance threshold).
Recommendation	Extension This extension is required for TLDs with premium domain names, since the client needs to be aware of the fee variance. This extension can also be used for TLDs without premium domain names to help clients proactively reconcile their balance.

3.31. Login Security Extension for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Login Security Extension for the Extensible Provisioning Protocol (EPP)

Description	An EPP extension that allows longer passwords to be created and adds additional security features to the EPP login command and response. RFC 5730 set the maximum password length to 16 characters, which the Login Security Extension addressed with the use of predefined placeholder text for the existing password field and a new password field to provide the longer password. The additional security features include the client providing user agent information (app, tech, and os) in the EPP login command and the server providing security events in the EPP login response.
Type	Standards Track RFC
Reference	RFC8807
Registrant	IESG (iesg@ietf.org)
Extensibility	Command-Response Extension
TLDs	Any
IPR	None
Status	Active
Usage	
Object(s)	N/A
Command(s)	Login Command
Response(s)	Login Response
Unique Aspects	1. Use of placeholder text to override an existing field with a new field. Placeholder text is used only as a last resort, as is the case for the Login Security Extension.
Notes	
Recommendation	Embed If user identifier and password is supported, don't include a predefined maximum length to the password. Other aspects of the extension could be considered, such as inclusion of the user agent information (application, technical, os) and support for security events in the authentication response.

3.32. Extensible Provisioning Protocol (EPP) Unhandled Namespaces

Attribute	Value

Name	Extensible Provisioning Protocol (EPP) Unhandled Namespaces
Description	Defines an operational practice that enables the server to return information associated with unhandled namespace URIs and that maintains compliance with the negotiated services defined in RFC 5730 (e.g., EPP greeting and EPP login command services). The primary use case is poll messaging, where the server does not know ahead of time what services the client supports when consuming the poll messages. The server can return the poll message for extensions (objects and command-response) that the client does not support without causing an XML validation error.
Type	Standards Track RFC
Reference	RFC9038
Registrant	IESG (iesg@ietf.org)
Extensibility	Operational Practice
TLDs	Any
IPR	None
Status	Active
Usage	8.3%
Object(s)	N/A
Command(s)	N/A
Response(s)	Any Response
Unique Aspects	1. Leverages a special feature of the XML parser with namespace="##any" and processContents="skip" to insert formatted content that will not be processed by the XML parser and fail validation due to the lack of support by the client (e.g., lack of inclusion of the XML schema). 2. Addresses poll queue issue of a poison message that can't be processed due to the lack of client support. The server does not know ahead of time what extensions a client supports when inserting the poll messages.
Notes	
Recommendation	Embed Support the ability for the server to return information to the client that does not run the risk of breaking the client due to validation. The key use case is for poll messaging, where the extensions supported by the client are not known at the time that the poll message is added and during consumption the top poll message cannot become a poison message due to lack of client support.

3.33. Domain Name Mapping Extension for Strict Bundling Registration

Attribute	Value
Name	Related Domain Extension for the Extensible Provisioning Protocol (EPP)
Description	An extension of Extensible Provisioning Protocol (EPP) domain name mapping for the provisioning and management of strict bundling registration of domain names. This mapping extends the EPP domain name mapping to provide additional features required for the provisioning of bundled domain names. Bundled domain names normally share some attributes. Policy-wise bundling can be implemented in three ways. The first one is strict bundling (composite relationship), which requires all bundled names to share many of the same attributes. When creating, updating, or transferring any of the bundled domain names, all bundled domain names will be created, updated, or transferred atomically. The second one is partial bundling (aggregate relationship), which requires the bundled domain names to be registered by the same registrant. The third one is relaxed bundling, which has no specific requirements on the domain registration (association relationship). This mapping addresses the strict bundling name registration.
Type	Informational
Reference	RFC9095
Registrant	IESG (iesg@ietf.org)
Extensibility	Command-Response Extension
TLDs	Any
IPR	
Status	Active
Usage	
Object(s)	Domain Name in RFC5731
Command(s)	Domain Name Create Command Domain Name Update Command

Response(s)	Domain Name Info Response Domain Name Create Response Domain Name Delete Response Domain Name Renew Response Domain Name Transfer Response Domain Name Update Response
Unique Aspects	1. Implementation of a variant policy, where there is a Registered Domain Name (RDN) with a Bundled Domain Name (BDN) that is produced based on the server policy. The number of BDN's per RDN is usually kept to one. 2. The server implicitly creates the BDNs and bundles them with the RDN, and the BDNs share the same properties (expiration date, registrar, contacts, name servers, statues). 3. Either the RDN or the BDN can be used in the EPP commands to apply to all of the domains in the bundle.
Notes	1. What happens if the client does not signal in the EPP login session support for the Strict Bundle extension? a. The assumption is that the BDN(s) will be created independent of the client signaling support for the client will not be aware of the BDN(s) implicitly created. b. The use of the Unhandled Namespaces in RFC 9038 is an option to include the Strict Bundling extension in the response for non-supporting clients. 2. What happens with DNSSEC, where is the Key Data Interface required when using the Strict Bundling extension, since the DS is unique per domain name and would need to be set separately for the RDN and the BDN? a. The assumption is that the Key Data Interface in the DNSSEC Extension of RFC 5910 is required to support sharing all client-supplied properties across the RDN and the BDNs. 3. The XML schema does support a list of BDNs, so a policy of one BDN per RDN is not required.

Recommendation	Extension Supporting the ability to manage strict bundled name registrations. EPP:Standardize Support for related domain names in EPP can be standardized with association (client-side defined and server unknown), aggregate (server known with some shared attributes), and potentially composite relationship types (server known with share all or most and with enablement). EPP:Consolidate (Related Domain, IDN - TANGO, Domain Variant) Consolidate with the Related Domain Extension (if possible) to support all three forms for domain name relationships with association (client-side defined and server unknown), aggregate (server known with some shared attributes), and composite relationship types (server known with share all or most and with enablement). A new Domain Variant extension has been defined as an IETF draft with draft-galvin-regext-epp-variants, which can reuse aspects of the Strict Bundling extension.

3.34. Extensible Provisioning Protocol (EPP) Secure Authorization Information for Transfer

Attribute	Value
Name	Extensible Provisioning Protocol (EPP) Secure Authorization Information for Transfer
Description	Defines an operational policy, using the EPP RFCs, that leverages the use of strong random authorization information values that are short lived, not stored by the client, and stored by the server using a cryptographic hash that provides for secure authorization information that can safely be used for object transfers. The RFC doesn't add any new XML elements, but does add inclusion of a new URI that is included in the EPP greeting and the EPP login services to indicate support for the operational policy.
Type	Standards Track RFC
Reference	RFC9154
Registrant	IESG (iesg@ietf.org)
Extensibility	Operational Practice
TLDs	Any

IPR	None
Status	Active
Object(s)	Any transferable object with authorization information
Command(s)	<Any Transferable Object> Info Command <Any Transferable Object> Create Command <Any Transferable Object> Transfer Request Command <Any Transferable Object> Update Command
Response(s)	<Any Transferable Object> Info Response
Unique Aspects	
Notes	
Recommendation	Embed Leverage short-lived and strong random authorization information values that are stored securely only where necessary to support the transfer of a transferable object, unless another form of transfer authorization is better suited.

3.35. Verification Code Extension for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Verification Code Extension for the Extensible Provisioning Protocol (EPP)
Description	Extension for including a verification code for marking the data for a transform command as being verified by a 3rd party, which is referred to as a Verification Service Provider (VSP). The verification code is digitally signed by the VSP using XML Signature and is “base64” encoded. The XML Signature includes the VSP signer certificate, so the server can verify that the verification code originated from the VSP.
Type	Informational
Reference	https://www.iana.org/go/draft-ietf-regext-verificationcode-06
Registrant	IESG (iesg@ietf.org)
Extensibility	Command-Response Extension
TLDs	Any
IPR	https://datatracker.ietf.org/ipr/2694
Status	Active

Object(s)	Domain Name in RFC5731
Command(s)	Domain Name Info Command Domain Name Create Command Domain Name Delete Command Domain Name Renew Command Domain Name Transfer Command Domain Name Update Command
Response(s)	Domain Name Info Response
Unique Aspects	1. Used for digitally signed content to provide proof of verification by a 3rd party. The Launch Phase Extension also leveraged the use of digitally signed content for the signed marks.
Notes	The draft was abandoned by the REGEXT working group.
Recommendation	Design Support for digital signatures on a set of attributes will be needed.

3.36. .at EPP Verification Extension

Attribute	Value
Name	.at EPP Verification Extension
Description	This Extensible Provisioning Protocol (EPP) Extension provides the EPP protocol transport for the verificationReport and the corresponding, required status values associated to Domain and Contact objects.
Type	Private
Reference	https://github.com/nic-at/epp-verification-extension
Registrant	Alexander Mayrhofer <alexander.mayrhofer@nic.at>
Extensibility	Command-Response Extension Object Property Extension
TLDs	.at
IPR	
Status	Active
Object(s)	Contact in RFC5733 Domain Name in RFC5731

Command(s)	Contact Create Command Contact Update Command Domain Name Renew Command
Response(s)	Domain Name Info Response
Unique Aspects	
Notes	Some aspects of the extension are left to server policy, such as the notification method by the server of the verification status.
Recommendation	Design Support adding additional (complex) properties to both contact and domain representation

3.37. Extensible Provisioning Protocol (EPP) mapping for DNS Time-To-Live (TTL) values

Attribute	Value
Name	Extensible Provisioning Protocol (EPP) mapping for DNS Time-To-Live (TTL) values
Description	Allows a sponsor of a domain or host object to change TTL values for resource records associated with them.
Type	Standards Track Draft
Reference	RFC9803
Registrant	IESG
Extensibility	Command-Response Extension
TLDs	Any
IPR	None
Status	Active
Object(s)	Domain Name in RFC5731 Host in RFC5732
Command(s)	<Domain Name|Host> Info Command <Domain Name|Host> Create Command <Domain Name|Host> Update Command
Response(s)	<Domain Name|Host> Info Response
Unique Aspects	

Notes	
Recommendation	Embed Add support in the Domain Name Mapping and the Host Mapping

3.38. Additional Email Address Extension for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Additional Email Address Extension for the Extensible Provisioning Protocol (EPP)
Description	A command-response extension that adds support for associating an additional email address with an EPP contact object. That additional email address can be either an internationalized email address or an all-ASCII address.
Type	Standards Track RFC
Reference	RFC9873
Registrant	IESG (iesg@ietf.org)
Extensibility	Command-Response Extension
TLDs	Any
IPR	None
Status	Active
Object(s)	Contact in RFC5733
Command(s)	Contact Create Command Contact Update Command
Response(s)	Contact Info Response
Unique Aspects	
Notes	
Recommendation	Embed Add support for internalized email addresses in the RPP Contact Mapping.

3.39. Extensible Provisioning Protocol (EPP) Transport over HTTPS

Attribute	Value
Name	Extensible Provisioning Protocol (EPP) Transport over HTTPS
Description	Describes how an Extensible Provisioning Protocol (EPP) connection is mapped onto a Hypertext Transport Protocol (HTTP) session. EPP over HTTP (EoH) requires the use of Transport Layer Security (TLS) to secure EPP information (i.e. HTTPS).
Type	Standards Track Draft
Reference	https://datatracker.ietf.org/doc/html/draft-ietf-regext-epp-https
Registrant	IESG
Extensibility	Transport Mapping
TLDs	Any
IPR	None
Status	Active
Object(s)	N/A
Command(s)	N/A
Response(s)	N/A
Unique Aspects	
Notes	
Recommendation	Not Applicable RPP will define its own HTTPS transport layer

3.40. Extensible Provisioning Protocol (EPP) Transport over QUIC

Attribute	Value
Name	Extensible Provisioning Protocol (EPP) Transport over QUIC
Description	Describes how an Extensible Provisioning Protocol (EPP) session is mapped onto a QUIC connection. EPP over QUIC (EoQ) leverages the performance and security features of the QUIC protocol as an EPP transport.
Type	Standards Track Draft
Reference	https://datatracker.ietf.org/doc/html/draft-ietf-regext-epp-quic
Registrant	IESG

Extensibility	Transport Mapping
TLDs	Any
IPR	None
Status	Active
Object(s)	N/A
Command(s)	N/A
Response(s)	N/A
Unique Aspects	
Notes	
Recommendation	Not Applicable HTTPS transport is a key aspect of REST and RPP. The RPP packet protocol could leverage other transports, but that is out of scope for RPP.

3.41. Extensible Provisioning Protocol (EPP) China Name Verification Mapping

Attribute	Value
Name	Extensible Provisioning Protocol (EPP) China Name Verification Mapping
Description	Defines an object extension for the provisioning and management of Name Verification (NV) stored in a shared central repository in China. The object extension produces verification codes compliant with the Verification Code Extension, which can be passed as proof of verification for objects stored outside of China. There are two types of NV that include Domain Name Verification (DNV) and Real Name Verification (RNV), that set the verification code "type" attribute to the values of "domain" and "real-name", respectively.
Type	Informational
Reference	https://datatracker.ietf.org/doc/html/draft-ietf-regext-nv-mapping
Registrant	IESG (iesg@ietf.org)
Extensibility	Object Extension
TLDs	Any
IPR	https://datatracker.ietf.org/ipr/2694 https://datatracker.ietf.org/ipr/2704
Status	Active

Object(s)	Name Verification (NV) with types: Domain Name Verification (DNV) and Real Name Verification (RNV)
Command(s)	DNV Check Command NV Info Command NV (DNV and RNV) Create Command NV Update Command
Response(s)	DNV Check Response NV Info Response - Includes verification code from draft-ietf-regext-verificationcode NV Create Response - Includes verification code from draft-ietf-regext-verificationcode
Unique Aspects	1. Used for digitally signed content to provide proof of verification, referred to as Name Verification (NV) by a Verification Service Provider (VSP). 2. This object mapping is specific to the NV performed in the region of China with DNV and RNV to produce proof of verification in the form of a Verification Code that can be used outside the region without disclosing any of the private data. The Verification Code includes a value that represents a pointer to the verification data stored in the VSP.
Notes	The draft worked with the Verification Code Extension and was abandoned by the REGEXT working group.
Recommendation	Design Support for digital signatures on a set of attributes will be needed.

3.42. Registry Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Registry Mapping for the Extensible Provisioning Protocol (EPP)

Description	Attempt to standardize the Verisign Registry Mapping for the Extensible Provisioning Protocol (EPP). Provides the list of TLDs authorized to a client with the EPP server and provides the ability for the client to query for the features and policies of each of the authorized TLDs. Additional provisioning commands are supported by the extension, but the only practical command leveraged is the Registry Info Command. The information and capabilities extended upon what is defined in the Verisign Registry Mapping in the following ways: 1. System-level information, such as maximum connection and timeout policies. 2. Batch job information, such as the list of batch jobs and their schedule. 3. Unsupported data policy, such as failing a command with unsupported data or ignoring the unsupported data. 4. Enable the client to identify which zones to return (accessible, available, or both). 5. Broke out elements associated with EPP extensions into separate policy extensions, with Launch Phase Policy Extension and Login Security Policy Extension as being concrete examples.
Type	Standards Track Draft
Reference	https://datatracker.ietf.org/doc/html/draft-gould-carney-regext-registry
Registrant	IESG (iesg@ietf.org)
Extensibility	Object Extension Function Extension
TLDs	Any
IPR	https://datatracker.ietf.org/ipr/3201
Status	Inactive
Object(s)	Registry (Zone)
Command(s)	Registry Check Command Registry Info Command Registry Create Command Registry Update Command Registry Delete Command
Response(s)	Registry Check Response Registry Info Response Registry Create Response

Unique Aspects	1. Provides capability of a client (registrar) to discover the list of TLDs (zones) that are available and/or are authorized for with the features and policy details of each TLD.
Notes	The draft was abandoned by the REGEXT working group, based on issues of meeting the variety of implemented server policies. Some server policies explicitly did not match the EPP RFCs, which posed an issue in providing a standardized set of features and policies to clients. Leveraged the Command Response Extension as a framework for EPP Command Response Extensions to define the server policy via a Policy Extension of the Registry Mapping. The concrete examples include the Launch Phase Policy Extension for the Launch Phase Extension and the Login Security Policy Extension for the Login Security Extension.
Recommendation	Design ● in generic term: ○ allow creation of additional provisioning objects or read-only informational resources ○ include aspects of server policy discoverability as part of the protocol ● specific: Determine if and how registry policy can be returned for discovery by the client.

3.43. Launch Phase Policy Extensions Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Launch Phase Policy Extensions Mapping for the Extensible Provisioning Protocol (EPP)

Description	Defines the server policy of the Launch Phase EPP extension. The server policy of the Launch Phase EPP extension includes the MAYs, SHOULDs, and options implemented by the server. This is a Command-Response Extension of the Registry Mapping. For each of the launch phases of a zone, the Launch Phase Policy Extension include server policies, such as: 1. Type (e.g., “sunrise”, “landrush”, “claims”, “open”) 2. Mode (e.g., “fcfs”, “pending-registration”, “pending-application”) 3. Start Date and End Date 4. Validator ID for signed marks 5. Supported launch phase statuses 6. Poll messaging policy 7. Mark validation policy 8. Supported mark types 9. Supported check forms and create forms
Type	Standards Track Draft
Reference	https://datatracker.ietf.org/doc/html/draft-gould-regext-launch-policy
Registrant	IESG
Extensibility	Command-Response Extension
TLDs	Any
IPR	None
Status	Inactive
Object(s)	Registry (Zone) in draft-gould-carney-regext-registry
Command(s)	Registry Create Command Registry Update Command
Response(s)	Registry Info Response
Unique Aspects	1. Concrete example of providing the server policy of the MAYs, SHOULDs, and options of an EPP Extension, which in this case is the Launch Phase Extension.
Notes	Not adopted by the REGEXT working group due to its dependency on the abandoned Registry Mapping. Defining the server policy of an EPP extension, such as the Launch Phase Extension demonstrated the complexity for clients in discovering and implementing EPP extensions using out-of-band means.

Recommendation	Design ● in generic term: ○ allow creation of additional provisioning objects or read-only informational resources ○ include aspects of server policy discoverability as part of the protocol ● specific: ○ Determine if and how registry policy can be returned for discovery by the client.

3.44. Login Security Policy Extensions Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Login Security Policy Extensions Mapping for the Extensible Provisioning Protocol (EPP)
Description	Defines the server policy of the Login Security EPP extension. The server policy of the Login Security EPP extension includes the MAYs, SHOULDs, and options implemented by the server. This is a Command-Response Extension of the Registry Mapping. For Registry System, the Login Security Policy Extension include server policies, such as: 1. Password password format policy 2. Whether user agent is supported 3. Set of security events supported
Type	Standards Track Draft
Reference	https://datatracker.ietf.org/doc/html/draft-gould-regext-login-security-policy
Registrant	IESG
Extensibility	Command-Response Extension
TLDs	Any
IPR	None
Status	Inactive
Object(s)	Registry (System) in draft-gould-carney-regext-registry
Command(s)	Registry Create Command Registry Update Command
Response(s)	Registry Info Response

Unique Aspects	1. Concrete example of providing the server policy of the MAYs, SHOULDs, and options of an EPP Extension, which in this case is the Login Security Extension.
Notes	Not adopted by the REGEXT working group due to its dependency on the abandoned Registry Mapping. Defining the server policy of an EPP extension, such as the Login Security Extension demonstrated the complexity for clients in discovering and implementing EPP extensions using out-of-band means.
Recommendation	Design ● in generic term: ○ allow creation of additional provisioning objects or read-only informational resources ○ include aspects of server policy discoverability as part of the protocol ● specific: ○ Determine if and how registry policy can be returned for discovery by the client.

3.45. Internationalized Domain Name Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Internationalized Domain Name Mapping for the Extensible Provisioning Protocol (EPP)
Description	Extends the EPP domain name mapping to provide additional features required to implement registration of IDN domain names (character sets other than ASCII).
Type	Standards Track Draft
Reference	https://datatracker.ietf.org/doc/html/draft-ietf-eppext-idnmap
Registrant	IESG
Extensibility	Command-Response Extension
TLDs	Any
IPR	None
Status	Active (based on Identity Digital implementation)
Object(s)	Domain Name in RFC5731
Command(s)	Domain Name Create Command

Response(s)	Domain Name Info Response
Unique Aspects	
Notes	One element that came out of the IDN Extension was the metadata associated with the IDN Table Identifier, which was the reason for the definition of the IDN Table Extension.
Recommendation	Extension enable additional attributes on domain objects classic “Object Property Extension” EPP:Standardize EPP:Consolidate (IDN Language Tag, IDN Mapping - Identity Digital, IDN Table, IDN - TANGO)

3.46. Extensible Provisioning Protocol (EPP) Internationalized Domain Name (IDN) Table Name

Attribute	Value
Name	Extensible Provisioning Protocol (EPP) Internalized Domain Name (IDN) Table Name

Description	Provides Internationalized Domain Name (IDN) table information for the registration of IDNs, using the EPP Domain Name Mapping, and optionally the IDN mapping extension. An IDN Table defines the valid set of characters (code points) that can be used in a domain name. Code points may overlap across IDN Tables and the IDN Tables supported by the servers are up to server policy. This mapping provides the information clients need to register IDNs across a variety of servers with differing IDN policies. The IDN Table Mapping can be used for the following: 1. Validate IDN Domain Name - Validate that an IDN meets the server IDN policy. The validation can be done prior to submitting a Domain Name Create, per the EPP Domain Name Mapping. 2. Get IDN Tables Matching IDN Domain Name Along with Meta-Data - Since IDN Table codes points may overlap, the mapping can be used to identify the matching set of IDN Tables (language or script), along with the IDN Table meta-data. 3. Cache IDN Table Code Points - Clients can query for the complete list of IDN Tables and can get the IDN Table meta-data, based on server policy, to support pre-validation in the client. 4. Get the IDN Table Identifier to Pass with a Domain Create - Each IDN Table includes a server unique IDN Table Identifier that may be used as a value in the IDN mapping extension. A flag indicates whether the IDN mapping extension is needed for the domain name.
Type	Standards Track Draft
Reference	https://datatracker.ietf.org/doc/html/draft-gould-idn-table
Registrant	IESG
Extensibility	Object Extension
TLDs	Any
IPR	None
Status	Inactive
Object(s)	Internationalized Domain Name (IDN) Table
Command(s)	IDN Table Check Command IDN Table Info Command
Response(s)	IDN Table Check Response IDN Table Info Response

Unique Aspects	1. Provide meta-data about IDN tables in the server 2. Provide the ability for a client to validate an IDN domain name prior to submitting the Domain Name Create Command. 3. Provide the ability to get the entire list of IDN Tables from the server for a client to pre-validate an IDN.
Notes	The IDN Table Extension was created to help with the IDN mapping extension, but upon further review it provides some useful features that may help registrars with the registration of IDN domain names with supporting servers with a variety of IDN policies.
Recommendation	Extension Could be standardized as an extension. Standardizing the extension in EPP first. EPP:Standardize EPP:Consolidate (IDN Language Tag, IDN Mapping, IDN Mapping - Identity Digital, IDN - TANGO)

3.47. Validate Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Validate Mapping for the Extensible Provisioning Protocol
Description	Adds a mapping for the validation of a contact and eligibility data.
Type	Informational
Reference	https://datatracker.ietf.org/doc/html/draft-ietf-regext-validate
Registrant	IETF Doc -
Extensibility	Object Extension Function Extension
TLDs	Any
IPR	None
Status	Inactive
Object(s)	Validate
Command(s)	Check
Response(s)	None

Unique Aspects	Draft extends the check command adding a “validate” element that describes a contact that is to be validated by the registry to determine if the contact could be created in the registry without any errors.
Notes	
Recommendation	Design Foresee RPP extensibility, where additional (read-only) functions can be added, which are only loosely related to an existing or future resource. In this particular case, it is contact representation(s) being checked, with additional context information (tld, contact type), which might render different results of the check depending on this context.

3.48. Autonomous System Number Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Autonomous System Number Mapping for the Extensible Provisioning Protocol (EPP)
Description	An Extensible Provisioning Protocol (EPP) mapping for the provisioning and management of Autonomous Systems Numbers stored in a shared central repository.
Type	Private
Reference	https://ftp.registro.br/pub/libepp-nicbr/draft-neves-epp-asn-02.txt
Registrant	NIC.br
Extensibility	Object Extension
TLDs	N/A
IPR	None
Status	Active
Object(s)	Autonomous System Number (ASN)
Command(s)	ASN Check Command ASN Info Command ASN Transfer Query Command ASN Create Command ASN Delete Command ASN Renew Command ASN Transfer Command ASN Update Command

Response(s)	ASN Check Response ASN Info Response ASN Transfer Response ASN Create Response ASN Renew Response
Unique Aspects	1. EPP extension is not related to Domain Name Registries (DNR), but to Regional Internet Registries (RIRs) or National Internet Registries (NIRs). 2. Linkage of a separate organization object to the ASN object, which replaces the registrant in other EPP object extensions. The organization is provisioned by the sponsoring client, similar to what can be done with the organization object mapping in RFC 8543, and the organization extension in RFC 8544. The BR Organization Mapping could potentially be replaced with the use of organization object mapping in RFC 8543 and applied to the ASN object using the organization extension in RFC 8544. 3. Use of a different set of contact types with the "routing" and "security" contact types instead of the "admin", "tech", and "billing".
Notes	The object extension is a straight forward object mapping for EPP, reusing much of the concepts from the Domain Name Object Mapping in RFC 5731, but with some unique features outlined in the Unique Aspects. There is an error in the text that doesn't match the XML schema, where the text states that the "asn:creation_date" can be updated in the <asn:chg> element, but the XML schema only allows changing the <asn:organization> and a list of <asn:contact> elements. The assumption is that the <asn:add> and <asn:rem> elements support incremental changes and the <asn:chg> replaces all contacts.
Recommendation	Design Allow extensibility for provisioning other object types

3.49. IP Network Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Autonomous System Number Mapping for the Extensible Provisioning Protocol (EPP)
Description	An Extensible Provisioning Protocol (EPP) mapping for the provisioning and management of IP Networks stored in a shared central repository.
Type	Private

Reference	https://ftp.registro.br/pub/libepp-nicbr/draft-neves-epp-ipnetwork-02.txt
Registrant	NIC.br
Extensibility	Object Extension
TLDs	N/A
IPR	None
Status	Active
Object(s)	IP Network
Command(s)	IP Network Check Command IP Network Info Command IP Network Transfer Query Command IP Network Create Command IP Network Delete Command IP Network Renew Command IP Network Transfer Command IP Network Update Command
Response(s)	IP Network Check Response IP Network Info Response IP Network Transfer Response IP Network Create Response IP Network Renew Response
Unique Aspects	1. EPP extension is not related to Domain Name Registries (DNR), but to Regional Internet Registries (RIRs) or National Internet Registries (NIRs). 2. Linkage of a separate organization object to the IP Network object, which replaces the registrant in other EPP object extensions. The organization is provisioned by the sponsoring client, similar to what can be done with the organization object mapping in RFC 8543, and the organization extension in RFC 8544. The BR Organization Mapping could potentially be replaced with the use of organization object mapping in RFC 8543 and applied to the IP Network object using the organization extension in RFC 8544. 3. Provides for a parent to child relationship between registered objects that are identified via the ROID. The IP Network Info Response provides information on both the parent and child IP Network Objects. 4. Support for aggregating IP Networks

Notes	1. The IP Network Range is not a server unique identifier, so there can be many overlapping registrations for a given IP Network Range, based on having a parent and child network. The IP Network ROID can be used to uniquely identify the registration in the IP Network Info Command. 2. The IP Network may have a validity period based on server policy. 3. The IP Network may be associated with an ASN, using the Autonomous System Number Mapping for the Extensible Provisioning Protocol (EPP) 4. Support for DNSSEC over IP Network, which provisions DS data for an IP Network Range. 5. Support for provisioning the reverse DNS information
Recommendation	Design Allow extensibility for provisioning other object types

3.50. BR Domain Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	BR Domain Mapping for the Extensible Provisioning Protocol (EPP)
Description	An Extensible Provisioning Protocol (EPP) extension mapping for the provisioning and management of .br Internet domain names stored in a shared central repository. This mapping extends the EPP domain name mapping to provide additional features required for the provisioning of .br domain names.
Type	Private
Reference	https://ftp.registro.br/pub/libepp-nicbr/draft-neves-epp-brdomain-05.txt
Registrant	NIC.br
Extensibility	Command-Response Extension
TLDs	.br
IPR	None
Status	Active
Object(s)	Domain
Command(s)	Domain Name Check Command Domain Name Info Command Domain Name Create Command Domain Name Update Command

Response(s)	Domain Name Check Response Domain Name Info Response Domain Name Create Response Domain Name Renew Response Domain Name Update Response Domain Name Pending Action Response
Unique Aspects	1. Requirement to use an organization as an alternative to the registrant. The “tech”, “admin”, and “billing” contacts are supported in addition to the setting of the organization. 2. Returns additional data about existing or equivalent domain names, domain registration requests (tickets), and release process status in the check response. 3. Extension uses the concept of tickets to represent a registration request that is equivalent to a Launch Application in the Launch Phase Extension of RFC 8334. 4. Includes a signal for the needed documentation that is sent offline. 5. Name servers must resolve the domain name prior to a registration being accepted. 6. Provides a reason that a domain name has been placed on the hold (e.g., serverHold) status. 7. Includes the option for auto renewing the domain name by the Registry, which means that some domain names may auto expire. 8. Extends the domain pending action poll message (e.g., <domain:panData>) to include the ticket number of the registration request and the optional reason for denying the request.
Notes	1. The extension looks to require the inclusion of the xsi:schemaLocation attribute, which poses an issue for XML external entity (XXE) injection. 2. There is a dependency to the BR organization that may be associated as the domain name registrant.
Recommendation	Design - Allow extensions to define new contact types - Allow additional properties for the domain names - Allow extensions to define new associations (aggregation). Here: existing or equivalent domain names - Allow extensions to define additional information to statuses

3.51. BR Organization Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	BR Organization Mapping for the Extensible Provisioning Protocol (EPP)

Description	An Extensible Provisioning Protocol (EPP) mapping for the provisioning and management of Autonomous Systems Numbers stored in a shared central repository.
Type	Private
Reference	https://ftp.registro.br/pub/libepp-nicbr/draft-neves-epp-brorg-06.txt
Registrant	NIC.br
Extensibility	Command-Response Extension Object Property Extension
TLDs	.br and NIC.br NIR
IPR	None
Status	Active
Object(s)	Contact
Command(s)	Contact Check Command Contact Info Command Contact Create Command Contact Delete Command Contact Update Command
Response(s)	Contact Check Response Contact Info Response Contact Create Response Contact Pending Action Response
Unique Aspects	1. Extends the domain pending action poll message (e.g., <contact:panData>) to include the organization and the optional reason for the rejection.
Notes	The EPP <delete> Command references the EPP <info> command instead of the EPP <delete> command.
Recommendation	Design Allow extensions to define new properties to the existing objects

3.52. .NO EPP Extensions

Attribute	Value
Name	.NO EPP Extensions

Description	.NO has a set of command-response extensions, referred to as the NORID extension, of the EPP RFC mappings (Domain Name, Host, and Contact) with some unique policies associated with the EPP RFC mappings. The unique features include: 1. Share policy for all hosts (internal and external) are per registrar (See <registry:zone><registry:host>(<registry:internal> or <registry:external>)<registry:sharePolicy> in draft-gould-carney-regext-registry) 2. Domain name transfer process includes the use of a combination of authorization information and a one time token generated by the registry sent to the registrant, and the use of a new command "transfer execute". 3. Added new "withdraw" command with an alternative to the Redemption Grace Period (RGP) in RFC3915 with the concept of a quarantine date (deleteFromDNS) and a deletion date (deleteFromRegistry) 4. Mix of synchronous commands and pending commands, based on server policy like reserved domain names. 5. Registrar DNSSEC enabled setting that drives what happens with DNSSEC enabled domain names 6. Contacts have a type that drives server policy 7. Use of special "reg0" registrar
Type	Informational
Reference	https://teknisk.norid.no/uploads/2019/11/EPP_Interface_Specification.1e1.pdf
Registrant	Private
Extensibility	Command-Response Extension Command Type Extension
TLDs	.no
IPR	None
Status	Active
Object(s)	Domain Name, Host, and Contact

Command(s)	Domain Name Info Command Domain Name Create Command Domain Name Update Command Domain Name Transfer Command (query, request, cancel, and the new execute) Domain Name Withdraw Command (new) Host Info Command Host Create Command Host Update Command Contact Info Command Contact Create Command Contact Update Command
Response(s)	Domain Name Info Response Domain Name Create Response Domain Name Transfer Response (query, request, cancel, and the new execute) Host Info Response Host Create Response Host Update Response Contact Info Response Contact Create Response Contact Update Response
Unique Aspects	1. Share policy for all hosts (internal and external) are per registrar (See <registry:zone><registry:host>(<registry:internal> or <registry:external>)<registry:sharePolicy> in draft-gould-carney-regext-registry) 2. Domain name transfer process includes the use of a combination of authorization information and a one time token generated by the registry and sent to the registrant and the use of a new command "transfer execute". 3. Added new "withdraw" command with an alternative to the Redemption Grace Period (RGP) in RFC3915 with the concept of a quarantine date (deleteFromDNS) and a deletion date (deleteFromRegistry) 4. Mix of synchronous commands and pending commands based on server policy like reserved domain names. 5. Registrar DNSSEC enabled setting that drives what happens with DNSSEC enabled domain names 6. Contacts have a type that drives server policy
Notes	The link to the XML schemas (https://teknisk.norid.no/registrar/system/dokumentasjon/EPP-XML-Schemas-1.0.2.no.tar.gz) is not available.

Recommendation	Design - Foresee extensions to define alternative transfer authorization methods (here: authorization information + one time token) - Foresee extensions to define additional parameters to the standard processes (here: quarantine date + deletion date for DELETE) or new processes commands (withdraw)

3.53. Namestore Extension Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Namestore Extension Mapping for the Extensible Provisioning Protocol (EPP)
Description	Namestore Extension is a generic routing extension that enables a client to specify the TLD that an EPP command is associated with to enable a single connection to route to the TLD registry system. This reduces the number of EPP connections that need to be made to a registry platform that supports many TLDs, where a client can connect to a single EPP gateway and submit commands that are authorized and routed on a per-TLD basis.
Type	Informational
Reference	http://www.verisign.com/assets/epp-sdk/verisign_epp-extension_namestoreext_v00.html
Registrant	Verisign (epp-registry@verisign.com)
Extensibility	Command-Response Extension
TLDs	Any
IPR	https://datatracker.ietf.org/ipr/2551/
Status	Active
Object(s)	N/A
Command(s)	Any Command
Response(s)	Any Response
Unique Aspects	1. Supports the concept of command routing in EPP, where a single registry connection can indirectly interface with many independent backend registry systems leveraging the same authenticated session.

Notes	
Recommendation	Design Foresee RPP-proxy scenario in RPP design to enable TLD-based routing (can be an extensibility scenario, but also a “no brainer” through URL routing and HTTP based mechanisms)

3.54. LvContact extension (EPP)

Attribute	Value
Name	LvContact extension
Description	The extension adds 2 fields to the contact schema: ● regNr: for private persons, residents of Latvia, holds their personal code (Latvian identification number for individuals); for companies and other legal entities, registered in Latvia keeps registration number issued by the Latvian Register of Enterprises. ● vatNr: VAT number for foreign legal entities registered within European Union countries (this includes also Latvian companies).
Type	Private
Reference	https://www.nic.lv/epp/extensions/lvcontact.html
Registrant	
Extensibility	Command-Response Extension Object Property Extension
TLDs	.lv
IPR	
Status	Active
Object(s)	Contact in RFC5733
Command(s)	Contact Create Contact Update
Response(s)	Contact Info Response
Unique Aspects	None
Notes	VAT number / Registration number seem like a very generic fields, which may re-appear for different registries

Recommendation	Design: Foresee extensions to add additional properties

3.55. LvDomain extension (EPP)

Attribute	Value
Name	LvDomain extension
Description	The extension adds a new status to a domain clientAutoRenewProhibited which prevents the domain to autorenew
Type	Private
Reference	https://www.nic.lv/epp/extensions/lvdomain.html
Registrant	n/a
Extensibility	Command-Response Extension Enumeration Value Space Extension
TLDs	.lv
IPR	
Status	Active
Object(s)	Domain
Command(s)	Info, Update
Response(s)	Responses to Info, Update commands are extended with the added status.
Unique Aspects	None
Notes	This one seems to be a very generic functionality.
Recommendation	Design: Foresee extensions to add new statuses and lifecycle transformations to existing objects

3.56. FRED protocol extension (Credit Info)

Attribute	Value
Name	FRED (Free Registry for ENUM and Domains) protocol extension (Credit Info)¶

Description	A credit info command is used to find out about the current credit amounts of the authenticated registrar in all zones for which the registrar is accredited. This command is a part of the protocol extension defined by the FRED EPP server.
Type	Private
Reference	https://fred.nic.cz/documentation/html/EPPReference/CommandStructure/CreditInfo.html
Registrant	CZ.NIC
Extensibility	Protocol Extension Function Extension
TLDs	.cz (and others that use FRED)
IPR	
Status	Active
Object(s)	n/a
Command(s)	n/a
Response(s)	A simple command fred:creditInfo is defined with a custom response structure fred:resCreditInfo.
Unique Aspects	1. Here a Function Extension was realized through Protocol Extension and not as Object Extension. 2. Credit is supported per zone (e.g., TLD). Support for the finances per client account or per zone (e.g., TLD) could be built into a standardized Balance Mapping.
Notes	Function Extension shall be considered for RPP in a way that the protocol extenders have preferably only one way of doing it. Removal of Protocol Extension may be a way to reach this goal. Credit info is per account and per zone Single credit attribute that matches the Available Credit in the Balance Mapping and Low Balance Mapping No thresholds or poll message
Recommendation	Design design protocol in such a way, that there is one way of extending certain functionalities, or at least the “standard way”

	is way more compelling (e.g. adding alternative relations or new properties to already defined object types instead of “hard forking” object types) EPP:Standardize EPP:Consolidate (Low Balance, Balance, Finance)

3.57. FRED object extension (Domain)

Attribute	Value
Name	FRED (Free Registry for ENUM and Domains) object extension (Domain)
Description	FRED extends domain object by defining a new domain object type in own namespace, which mimics the original EPP domain object, but has additional properties as Object Property Extension: - nsset - keyset - admin as property instead of contact In the responses it also defines its own object type domain:creData, with properties like crDate or exDate. On domain:info command the custom domain object type also defines additional values on top of standard EPP status values as Enumeration Value Space Extension: • serverRegistrantChangeProhibited • serverBlocked • serverOutzoneManual • serverInzoneManual • expired • outzone • deleteCandidate
Type	Private
Reference	https://fred.nic.cz/documentation/html/EPPReference/ManagedObjects/Domains.html
Registrant	CZ.NIC

Extensibility	Object Extension Enumeration Value Space Extension Object Property Extension
TLDs	.cz (and others that use FRED)
IPR	
Status	Active
Object(s)	n/a
Command(s)	n/a
Response(s)	A simple command fred:creditInfo is defined with a custom response structure fred:resCreditInfo.
Unique Aspects	Here a Function Extension was realised through Protocol Extension and not as Object Extension.
Notes	This extension embeds DNSSEC as a built-in feature (keyset). Also important to consider as an extension point is to have other ways of expressing nameserver information on top of NS objects and NS attributes -> here NS sets. The forking of the Domain Name Object in RFC 5731 is concerning here. The question is what required the forking, since the EPP extensibility via the Command-Response Extension does support additive extensions, such as adding support for a new feature like a keyset of NS sets. The driver I would imagine is the need to remove or replace features in the core protocol, which can be mitigated by minimizing the set of required object attributes. If the model defined in the core protocol cannot be supported, making that model required requires the implementer to fork the entire object mapping. A discussion may be worthwhile with the designer of the FRED extensions to find out more about the driver of the approach.
Recommendation	Design - Design protocol in such a way, that there is one way of extending certain functionalities, or at least the "standard way" is way more compelling (e.g. adding alternative relations or new properties to already defined object types instead of "hard forking" object types) - Allow extensions to define alternative NS objects (here NS sets) with the same expression level as pre-defined NS-Objects and NS-Attributes

3.58. Registry Maintenance Notification for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Registry Maintenance Notification for the Extensible Provisioning Protocol (EPP)
Description	"Registry Maintenance Notification", which is used by EPP servers to notify EPP clients and allow EPP clients to query EPP servers regarding maintenance events. The document defines a new object type “maint” with info and poll command responses about current and future registry maintenance accordingly.
Type	Standards Track RFC
Reference	RFC9167
Registrant	IESG
Extensibility	Object Extension Poll Message Extension Function Extension
TLDs	all
IPR	None
Status	Active
Object(s)	Maintenance
Command(s)	Maintenance Info Command
Response(s)	Maintenance Info Response Maintenance Poll Response
Unique Aspects	
Notes	
Recommendation	Extension

3.59. Domain Charge Extension for the Extensible Provisioning Protocol (EPP)

Attribute	Value

Name	Domain Charge Extension for the Extensible Provisioning Protocol (EPP)
Description	The EPP extension returns pricing information for domain names as an extension of the EPP domain name mapping [RFC5731].
Type	Informational
Reference	https://files.identity.digital/epp-extensions/EPP-Charge-Extension.pdf
Registrant	Identity Digital (registry-tech@identity.digital)
Extensibility	Command-Response Extension
TLDs	Any
IPR	None
Status	Active
Usage	
Object(s)	Domain Name in RFC5731
Command(s)	Domain Name Create Command Domain Name Renew Command Domain Name Transfer (Request) Command Domain Name Update Command
Response(s)	Domain Name Check Response Domain Name Info Response Domain Name Create Response Domain Name Renew Response Domain Name Update Response
Unique Aspects	
Notes	Overlaps with the Registry Fee Extension. Use of the term agreement to apply to the passing of the charge in the billable commands (create, renew, transfer request, and update extensions such as restore) with additional attributes than what is provided in the Registry Fee Extension, such as a list of charge sets with each set including a category, a type, and a command with an amount. All that's included in the billable commands in the Registry Fee Extension is the currency and the expected fee. .

Recommendation	Not Applicable The recommendation is to transition to use the Registry Fee Extension. EPP:Consolidate (Registry Fee) - Transition to use the Registry Fee Extension

3.60. Finance Mapping for the Extensible Provisioning Protocol (EPP)

Attribute	Value
Name	Finance Mapping for the Extensible Provisioning Protocol (EPP)
Description	This EPP finance mapping enables a client to retrieve financial information for their account.
Type	Informational
Reference	https://files.identity.digital/epp-extensions/EPP-Finance-Mapping.pdf
Registrant	Identity Digital (registry-tech@identity.digital)
Extensibility	Object Extension Function Extension
TLDs	Any
IPR	None
Status	Active
Usage	
Object(s)	Finance
Command(s)	Finance Info Command
Response(s)	Finance Info Response
Unique Aspects	1. Includes the concept of a wallet with a required wallet code identifier that is a string (token) 2. Supports optional thresholds with a “type” attribute that is defined as a token. The examples of the “type” attribute values include “notification”, “restricted”, and “final”. The Balance Mapping and the Low Balance Mapping supports a single threshold with no “type” attribute

Notes	The Finance Mapping could be combined with the Balance Mapping and the Low Balance Mapping to support on-demand as well as a low balance poll message, using a common info response.
Recommendation	Extension Could be combined with the Balance Mapping and the Low Balance Mapping in a single extension, where the balance could be requested on-demand and also provided via a poll message when the low credit threshold is hit. EPP:Standardize Receiving finance information is a basic function that can be standardized. EPP:Consolidate (Balance, Low Balance) The Finance Mapping that retrieves the balance information on-demand can be merged with the Verisign Balance Mapping and the Low Balance Mapping that returns the balance information in a poll message.

3.61. Internationalized Domain Name Mapping for the Extensible Provisioning Protocol (EPP) - Identity Digital

Attribute	Value
Name	Internationalized Domain Name Mapping for the Extensible Provisioning Protocol (EPP) - Identity Digital
Description	This extension adds two data elements to the EPP domain name mapping [RFC5731] to allow for association of a domain name to an IDN table identifier, and a domain name in Unicode Normalization Form C. This is a duplicate of the extension draft-ietf-eppext-idnmap draft by the same, which uses the same XML schema and same XML URI.
Type	Informational
Reference	https://files.identity.digital/epp-extensions/EPP-IDN-Extension.pdf
Registrant	Identity Digital (registry-tech@identity.digital)
Extensibility	Command-Response Extension
TLDs	Any
IPR	None

Status	Active
Usage	
Object(s)	Domain Name in RFC5731
Command(s)	Domain Name Create Command
Response(s)	Domain Name Info Response
Unique Aspects	
Notes	1. Proprietary version of draft-ietf-eppext-idnmap 2. One element that came out of the IDN Extension was the metadata associated with the IDN Table Identifier, which was the reason for the definition of the IDN Table Extension.
Recommendation	Extension Same as other IDN extensions EPP:Standardize EPP:Consolidate (IDN Language Tag, IDN Mapping, IDN Table)

3.62. Scheduled Delete - SIDN

Attribute	Value
Name	Scheduled Delete - SIDN
Description	This extension adds a new command that allows a registrar to schedule future deleted
Type	Private
Reference	https://rxsd.domain-registry.nl/sidn-ext-epp-scheduled-delete-1.0
Registrant	
Extensibility	Command-Response Extension
TLDs	.nl
IPR	None
Status	Active
Usage	
Object(s)	Domain Name in RFC5731

Command(s)	Domain Name Create Command Domain Name Info Command Domain Name Update Command
Response(s)	Domain Name Create Response Domain Name Info Response Domain Name Update Response
Unique Aspects	
Notes	Will be removed in the next version of the .nl registration system. Defines a scheduledDelete:update element that three enumerated operations: 1. setDate - Set date of the delete of the domain name 2. setDateToEndOfSubscriptionPeriod - Set date of delete of the domain name at the expiration date 3. cancel - Cancel the scheduled delete The assumption is that this extension is attached to the Domain Name Create Command, Domain Name Info Response, and the Domain Update Command. It's unclear what would be returned in the Domain Name Create Response and the Domain Name Update Response.
Recommendation	Design: Foresee extensions to add new statuses and lifecycle transformations to existing objects

3.63. Reseller - SIDN

Attribute	Value
Name	Reseller - SIDN
Description	This extension adds a new reseller object that can be linked to a domain to support (whitelabel) registrars using resellers
Type	Private
Reference	https://rxsd.domain-registry.nl/sidn-reseller-1.0.xsd https://rxsd.domain-registry.nl/sidn-ext-epp-reseller-1.0.xsd
Registrant	SIDN
Extensibility	Object Extension (Reseller Mapping) Command-Response Extension (Reseller Extension)

TLDs	.nl
IPR	None
Status	Active
Usage	
Object(s)	Reseller (Reseller Mapping) Any (Reseller Extension) - Used with domain name objects
Command(s)	Reseller Check Command Reseller Info Command Reseller Create Command Reseller Delete Command Reseller Update Command <Any Object> Create Command <Any Object> Update Command
Response(s)	Reseller Check Response Reseller Create Response Reseller Pending Action Response <Any Object> Info Response
Unique Aspects	
Notes	Will be removed in the next version of the .nl registration system. probably replaced by the Organisation mapping extension. Can leverage and extend the Organization Mapping with new object properties and use the Organization Extension with the “reseller” role in place of the Reseller Extension to link to the other objects.
Recommendation	Design: Foresee extensions to add new statuses and lifecycle transformations to existing objects EPP:Consolidate (Organization Mapping, Organization Extension)

3.64. Removal of Unlinked Contacts - SIDN

Attribute	Value
Name	Removal of Unlinked Contacts - SIDN
Description	This extension is used to add a poll message to the poll queue to let the registrar know that 1 or more contacts have been deleted because they became unlinked after a previous transaction

Type	Private
Reference	https://rxsd.domain-registry.nl/sidn-ext-epp-registry-contacts-delete-1.0.xsd
Registrant	SIDN
Extensibility	Object Extension Poll Message Extension
TLDs	.nl
IPR	None
Status	Active
Usage	
Object(s)	
Command(s)	
Response(s)	Poll Response
Unique Aspects	Poll message that contains a list of objects changed, in place of a message per object.
Notes	The Change Poll message could be used for this purpose; although it does a single poll message per deleted unlinked contact. The same applies to unlinked hosts, where a Change Poll message can be used to notify the registrar of the deletion of the unlinked object, where the Change Poll provides the attributes of the deleted contact prior to the delete.
Recommendation	Design: Foresee extensions to add new statuses and lifecycle transformations to existing objects EPP:Consolidate (Change Poll Message)

3.65. Cancel Delete - SIDN

Attribute	Value
Name	Cancel Delete - SIDN

Description	Extension includes the following features: 1. Support for canceling a domain delete while the domain name is in redemption grace period using a protocol extension. This protocol extension adds a new domainCancelDelete command. 2. Additional domain name, host, and contact object properties in the form of a Command-Response Extension. The following object properties are added: a. Domain name “optOut”, “limited”, “period”, and “scheduleDeleteDate” properties. b. Host “limited” property c. Contact “legalForm”, “legalFormRegNo”, and “limited” properties. 3. Special poll message with the following properties: a. command b. data that includes a list of freeform messages 4. General response extension that includes a list of freeform messages
Type	Private
Reference	https://rxsd.domain-registry.nl/sidn-ext-epp-1.0.xsd
Registrant	SIDN
Extensibility	Protocol Extension (Cancel Delete) Command-Response Extension (Domain/Host/Contact Properties) Object Property Extension Poll Message Extension
TLDs	.nl
IPR	None
Status	Active
Usage	
Object(s)	Domain Name in RFC5731 Host in RFC5732 Contact in RFC5733
Command(s)	Domain Name domainCancelDelete Command (protocol extension) <Domain Name|Host|Contact> Create Command Domain Name|Contact> Update Command

Response(s)	Domain Name domainCancelDelete Response (protocol extension) <Domain Name|Host|Contact> Info Response Domain Name Transfer Response <Any Object> Response Poll Response
Unique Aspects	
Notes	Will be removed in the next version of the .nl registration system. probably replaced by the RGP extension. This is more command across registries, see for example also DNS.BE. https://docs.dnsbelgium.be/be/epp/reactivatedomain.html There is more in the XML schema than the new command, so it's a mix of a command-response extension and a protocol extension. The protocol extension could have taken the approach of the restore command in the RGP extension to use a command-response extension instead of a protocol extension.
Recommendation	Design: Design could apply to support the additional domain name, host, contact object properties. Foresee extensions to add new statuses and lifecycle transformations to existing objects EPP:Consolidate (RGP Extension) for Cancel Delete

3.66. IDN EPP Extension for the TANGO Registration System

Attribute	Value
Name	IDN EPP Extension for the TANGO Registration System
Description	The extension serves the purpose of supplying and querying information for internationalized domain names. In particular, the language or script used and domain name variants are addressed. The extension distinguishes between the two modes of handling variants, namely "Domain Variants as Attributes" ("attribute mode") and "Domain Variants as Objects" ("object mode"). Each mode, however, requires slightly different input from the registrars and generates slightly different output to the registrars. Each TLD will support one of the two modes of variant handling.

Type	Informational
Reference	https://www.tango-rs.com/epp/tango-idn-epp-extension.pdf
Registrant	TANGO Registry Services
Extensibility	Command-Response Extension
TLDs	Any
IPR	None
Status	Active
Object(s)	Domain Name in RFC5731
Command(s)	Domain Name Check Command Domain Name Create Command Domain Name Update Command
Response(s)	Domain Name Info Response (poll and non-poll message) Domain Name Create Response Domain Name Transfer Response Domain Name Update Response
Unique Aspects	1. Support for IDN variant "object mode" and "attribute mode". The mode drives whether the variants are child attributes of the domain name or are separate domain name objects that are part of a bundle. The commands and responses vary based on the variant mode. The "attribute mode" is a composite relationship with the domain name and the enabled variants where all of the attributes are shared (name servers and DNSSEC keys). The "object mode" treats the domain name and the variants as independent objects, where there are some attributes that must be synchronized such as the registrar and the registrant. 2. Support for both a language (ISO 639-1) or a script (ISO 15924) that is used with the Domain Name Check Command, Domain Name Create Command. 3. The language (ISO 639-1) or script (ISO 15924) can be changed using the Domain Name Update Command 4. Mixing the IDN needs for IDN registrations and IDN variant needs in a single extension.
Notes	This extension is a mix of the IDN Language Tag by supporting the passing of a language, the IDN Mapping by supporting the passing of a language to represent the language table and a script to represent the script table, Related Domain to support independent related domain names that have some shared attributes, and Strict Bundling when running in variant "attribute mode".

Recommendation	Design Enable additional IDN attributes on domain objects EPP:Standardize EPP:Consolidate (IDN Language Tag, IDN Mapping, IDN Mapping - Identity Digital, IDN Table, Related Domain, Strict Bundling, IDN - TANGO, Domain Variant)

3.67. Domain Variant

Attribute	Value
Name	Domain Variant support for EPP
Description	Allowing clients to learn about and manipulate variant groups of domains, ie. groups of domains whose names are equivalent in a registry-defined way and are tied to a single registrant.
Type	Standards Track Draft
Reference	https://datatracker.ietf.org/doc/html/draft-galvin-regext-epp-variants
Registrant	IESG
Extensibility	Command-Response Extension
TLDs	Any
IPR	None
Status	Active (Draft but not implemented)
Object(s)	Domain Name in RFC5731
Command(s)	Domain Name Check Command Domain Name Create Command Domain Name Transfer Command Domain Name Update Command
Response(s)	Domain Name Check Response Domain Name Info Response Domain Name Transfer Response (poll and non-poll message) Domain Name Update Response Domain Name Delete Response
Unique Aspects	

Notes	This draft is new and is actively being worked on. Added to the analysis since there are many IDN extensions that are being recommended for consolidation and standardization.
Recommendation	Extension Enable additional IDN attributes on domain objects EPP:Standardize EPP:Consolidate (IDN Language Tag, IDN Mapping, IDN Mapping - Identity Digital, IDN Table, Related Domain, Strict Bundling, IDN TANGO, Domain Variant)

4. Recommendations

Based on EPP Extensibility and Extension Analysis in Section 3, below are recommendations grouped by the protocols of EPP and RPP. Enhancements can be made to EPP that consolidates and standardizes the EPP extensions that have been defined or that defines new EPP extensions that addresses known gaps in functionality. RPP can be split into two categories of the RPP Core that supports the required extensibility to support RPP extensions that align with the EPP extension functionality and the RPP Extensions that leverage the RPP Core extensibility to define the extensions.

4.1. EPP Recommendations

The following is a list of recommendations for EPP based on the EPP Extensibility and Extension Analysis in Section:

1. Enhance the RGP Extension (Section 3.1) to use a single step Restore Command and add an optional “expiry” attribute to the RGP statuses. With a one step Restore Command there is no need for the RGP Poll Mapping (Section 3.6). Elements of the .SE EPP Extensions (Section 3.22) deactivation could be merged into the enhancement to the RGP Extension, which includes the option for a scheduled deactivation at expiry.
2. Standardize and consolidate the IDN extensions, which include:
    a. IDN Language Tag (Section 3.8) that supports the passing of the language of the IDN domain name to match up with an IDN language table or apply commingling validation against the IDN script tables.
    b. Related Domain Extension (Section 3.21) that supports multi-domain commands for synchronizing client defined related domain names or server defined related domain names. The related domain names can be applied in enforcing server policies for IDN domain variants.
    c. Strict Bundling (Section 3.33) that supports strict bundling of IDN variants domain names, referred to as a Bundle Domain Name (BDN), with a primary domain name, referred to as a Registered Domain Name (RDN).
    d. IDN Mapping (Section 3.45) and IDN Mapping - Identity Digital (Section 3.61) that supports the passing of the IDN table identifier used to validate the IDN domain name code points. This extension works along with the IDN Table (Section 3.45) to help define the valid set of IDN table identifiers and determine the IDN table identifier associated with a specified IDN domain name.
    e. IDN Table Mapping (Section 3.46) that supports a set of features to enable a client to provision IDN domain names with a variety of server IDN policies. Features such as validating the IDN domain name, getting the matching IDN table identifiers for the IDN domain name, getting IDN table meta-data, and providing the IDN table identifier to use with the IDN Mapping (Section 3.45). This extension works along with the IDN Mapping (Section 3.45).
    f. IDN - TANGO (Section 3.66) that supports passing an IDN language or script and IDN domain relationships that share some attributes.
    g. Domain Varaints (Section 3.67) is a new draft that allows clients to learn about and manipulate variant groups of domains.

3. Standardize and consolidate the Finance extensions that includes the Low Balance Mapping (Section 3.17), the Balance Mapping (Section 3.19), the FRED Credit Info (Section 3.56), and the Finance Mapping (Section 3.60), to provide for on-demand retrieval of registrar finance information (available credit, credit limit, and balance) and a poll message when the available credit threshold drops below a pre-defined limit.
4. .SE EPP Extensions (Section 3.22) and Removal of Unlinked Contacts - SIDN (SECTION 3.64) to leverage the Change Poll Extension (Section 3.29) for object update notifications. Enhancements to the Change Poll Extension (Section 3.29) could be proposed based on the transition.
5. Domain Charge Extension (Section 3.59) to transition to use the Registry Fee Extension (Section 3.30). Enhancement to the Registry Fee Extension (Section 3.30) could be proposed based on the transition.

4.2. RPP Recommendations

The following is a list of recommendations for RPP based on the EPP Extensibility and Extension Analysis, which includes a list of extensibility recommendations and a list of extension recommendations grouped by the high-level recommendation values.

4.2.1. Generic Protocol Design Recommendations

1. **Design Cohesion:** Ensure the protocol design promotes a single, compelling "standard way" to extend common functionalities to prevent fragmentation and inconsistent implementations (3.56 FRED protocol extension, 3.57 FRED object extension).
2. **Proxy Clients:** The design should take into account the existence of middleboxes (proxies) which might offer multi-TLD RPP interface and route requests from a single endpoint to different servers (3.53 Namestore Extension).
3. **Data Aggregation:** Enable the ability to request additional associated data in a response, such as including registrar details in a domain query, to reduce the need for subsequent requests (3.15 Whois Info Extension, 3.30. Registry Fee Extension).
4. **Policy Discoverability:** Include a mechanism for clients to discover server policies, features, and supported extension parameters, preventing reliance on out-of-band documentation (3.42 Registry Mapping, 3.43 Launch Phase Policy Extensions, 3.44 Login Security Policy Extensions, 3.42. Registry Mapping, 3.43. Launch Phase Policy, 3.44. Login Security Policy).
5. **Policy & Profile Signaling:** Account for a method to signal operational profiles or practices that govern implementation-specific rules (e.g., secure password handling) without altering the core protocol schema (3.34 Secure Authorization Information for Transfer).

4.2.2. Extensibility Recommendations

4.2.2.1. EPP extensibility form recommendations

The following are the recommendations for each of the identified EPP extensibility forms for RPP, where the extensibility types don't need to map 1-to-1 between EPP and RPP:

1. **Transport Mapping:** Not support
    a. Statistics: 2 of 67 extensions (3%)
    b. Use of transport extensibility is new for EPP with EoH and EoQ, where clients and servers leveraged EoT for over 20 years.
    c. If RPP was designed in layers with a packet protocol (e.g., JSON Provisioning Protocol or JPP) and a RESTful transport (e.g., RPP Transport), then the packet protocol and the transports can be extensible themselves. RPP is dependent on HTTP, so supporting extensibility by transport is not necessary. The RPP packet protocol could be used on other transports, but that's not a recommended in-scope requirement.
2. **Protocol Extension:** Not support
    a. Statistics: 3 of 67 extensions (4.5%)
    b. The recommendation is to not support the concept of a Protocol Extension in RPP, since the Object Extension and the Command-Response Extension met all of the extensibility use cases with the identified special forms of extensibility.
3. **Object Extension:** Support
    a. Statistics: 21 of 67 extensions (31.4%), 13 of 67 extensions (19.4%) without Function Extension
    b. Extensibility by object is an obvious form of extensibility needed by RPP, since new types of objects (19.7% of the extensions) have been needed in EPP from the base objects of Domain Name, Host, and Contact. There is a special form of Object Extension to meet the need of defining a new function with the Function Extension that should be handled along with the Command Type Extension to define new operations from the basic CRUD operations.
4. **Command-Response Extension:** Support
    a. Statistics: 41 of 67 extensions (61.2%)
    b. Extensibility of command and response elements is to add new features to one or more objects is an important form of extensibility. For EPP, the Command-Response Extensions represent the majority of EPP extensions (60.7%). Recommended RPP Extensibility Recommendations in section 4.1.2.2 apply to Command-Response Extension form with:
        i. New Command Types
        ii. Process Information
        iii. Process Parameters
        iv. Adding Properties
        v. Read-only Resources
5. **Authorization Information Extension:** Not support
    a. Statistics: 0 of 67 extensions (0%)
    b. EPP does support extensibility of Authorization Information, but that form of extensibility has never been implemented in a Production system. The recommendation is to not build an extension point at the level of the Authorization Information field, since new forms of authorizations can be handled via a Command-Response Extension.

6. **Command Type Extension:** Support Explicitly
    a. Statistics: 4 of 67 extensions (6%)
7. **Function Extension:** Support Explicitly
    a. Statistics: 8 of 67 extensions (11.9%)
8. **Poll Message Extension:** Support Explicitly
    a. Statistics: 7 of 67 extensions (10.4%)
9. **Key Value Pair Extension:** Not support
    a. Statistics: 1 of 67 extensions (1.5%)
    b. The Key Value Pair Extension does not work, since the problem typically turns to the need for complex objects with specific types of values. A generic Key Value Pair RPP extension could be defined if the need arose.
10. **Operational Practice:** Support Explicitly
    a. Statistics: 2 of 67 extensions (3%)
    b. Even though the use of the Operational Practice is new in EPP, it's a natural evaluation of the protocol that has gained operational experience. The concept of an Operational Practice is similar to the concept of a profile in RDAP, but it's not meant to define server policy but how to implement the protocol to meet a specific goal, such as making the authorization information more secure in RFC9154.. The signaling for an Operational Practice could be merged with the signaling of server policy or what is referred to as a Profile.
11. **Object Property Extension:** Support
    a. Statistics: 7 of 67 extensions (10.4%)
    b. The Object Property Extension is a special form of a Command-Response Extension where the command and response elements are persistent. The primary question is whether there is the need to differentiate persistent or transient elements included in a Command-Response Extension, which could be handled via markers or groupings.
12. **Enumeration Value Space Extension:** Support
    a. Statistics: 3 of 67 extensions (4.5%)
    b. The Enumeration Value Space Extension is a special form of a Command-Response Extension to extend the value space of an enumeration defined in EPP. An example is the RGP extension adding new statuses (grace period status and sub-statuses of the EPP "pendingDelete" status) to the EPP core protocol statuses enumeration.

4.2.2.2. RPP Extensibility Recommendations

1. **Process Information:** The protocol must foresee mechanisms for returning additional transient, non-persistent information about the result of an operation, such as a flag indicating a bundling discount was applied or the fees are credits applied (3.13 Personal Registration, 3.18 Premium Domain, 3.25 Launch Phase, 3.30 Registry Fee, 3.59 Domain Charge)
2. **Process Parameters:** The protocol must foresee mechanisms for providing additional transient parameters or non-persistent data to the standard processes, such like delete or create (3.8 IDN Language Tag, 3.13 Personal Registration, 3.15 Whois Info, 3.25 Launch

Phase, 3.29 Change Poll, 3.30 Registry Fee, 3.45 IDN Mapping, 3.52 .NO EPP Extensions, 3.53 Namestore, 3.59 Domain Charge, 3.61 IDN Mapping - Identity Digital)

3. **Status Information:** Allow extensions to add additional information to statuses (3.50 .BR extension)
4. **Error Handling:** Support extensible and more specific error codes and messages to provide clearer feedback for extension-related operations (3.13 Personal Registration).
5. **Alternative signed data representations:** Support extensibility by inclusion of alternative representations with digitally signed attributes to provide verifiable proof of third-party data validation (3.35 Verification Code Extension, 3.41 China Name Verification Mapping) A form of digitally signed data does not need to be part of the core protocol, but interested parties could define a best practice.
6. **New Object Types:** The protocol must provide a clear mechanism for defining and provisioning entirely new and custom object types beyond the core set (3.10 Email Forwarding, 3.48 Autonomous System Number Mapping, 3.11 Defensive Registration, 3.12 NameWatch, 3.20 Verisign Registry Mapping, 3.42. Registry Mapping, 3.49. IP Network).
7. **Adding Properties:** Provide a generic and standardized extensibility point for adding new persistent properties to any existing object type, such as adding new fields to a contact or domain (3.3 ENUM Validation, 3.16 Jobs Contact, 3.36 .at EPP Verification, 3.54 LvContact extension, 3.50 .BR extension, 3.45. Internationalized Domain Name, 3.51 .BR extension).
8. **New Command Types:** Allow for the extension of objects with new commands or process triggers beyond basic CRUD operations. The extension point shall not only consider general purpose processes but also uncoordinated extensibility of provider processes including conflict avoidance in naming conventions (3.1 RGP, 3.25 Launch Phase, 3.7 ConsoliDate Mapping, 3.9 WhoWas, 3.14 Suggestion, 3.19 Balance, 3.20 Verisign Registry Mapping, 3.42 Registry Mapping, 3.47 Validate, 3.52 .NO EPP Extensions, 3.60 Finance). This would be corresponding to Command Type Extension and Function Extension of EPP.
9. **Read-only Resources:** Enable extensions to define first-class objects for read-only entities, such as a registrar account, to which related information like account balance can be logically associated as sub-resources (3.19 Balance Mapping, 3.20 Verisign Registry Mapping, 3.42. Registry Mapping, 3.43. Launch Phase Policy, 3.44. Login Security Policy).
10. **Read-only Functions:** Enable the addition of read-only functions or informational resources that can perform checks or validations without being tied to a persistent provisioning object (3.9 WhoWas, 3.14 Suggestion, 3.19 Balance, 3.47 Validate Mapping, 3.60 Finance).
11. **Alternative resource addressability:** Protocol design shall include a common pattern for extensibility allowing alternative addressing of resources. One resource can be addressed

in multiple ways (e.g., A-label and U-label domain name), and there should be one way to address the alternative forms of resources. Example: domain name addressable through IDN variant with or without IDN table or language tag (3.8 IDN Language Tag, 3.46 IDN Table Name)

12. **Object Relationships:** Define generic patterns for extensibility with managing associations between provisioning objects (aggregation), such as for variants or bundled domain registrations (3.21 Related Domain Extension, 3.27 Organization Mapping, 3.28 Organization Extension, 3.33 Strict Bundling Registration, 3.50 .BR extension).
13. **Related object(s):** Define generic patterns for extensibility with related resources and collections (composition), such as history information related to a domain name (3.9 WhoWas)

4.2.2.2. Object Specific Recommendations

The following are the recommendations associated with provisioning object extensibility. These recommendations don't need to be directly included in the core protocol, but the core protocol needs to support extensions that support these recommendations. When creating extensions, it's recommended to first create the extension in EPP and then create the extension in RPP to ensure interoperability. Some of the recommendations are specific to the domain name object.

1. **Lifecycle Management:** Allow extensions to define new object statuses and alter lifecycle behavior, such as implementing a scheduled deactivation or custom deletion processes (3.1 RGP, 3.22 .SE EPP Extensions, 3.55 LvDomain extension).
2. **Transfer Authorization:** Foresee extensions that can define alternative transfer authorization methods beyond a simple password, such as using one-time tokens (3.52 .NO EPP Extensions, 3.22 .SE EPP Extensions).
3. **Transfer Data:** Allow for DNS data (e.g., nameservers, DNSSEC) for domain names to be updated as part of a transfer operation - either as extensibility point (Process Parameters) or directly embedded in the protocol core for domain names (3.22 .SE EPP Extensions).
4. **IDN Management:** For Internationalized Domain Names (IDNs), the protocol should consider how different language variants are addressed and represented, and provide a means to discover server-side IDN policies and tables (3.8 IDN Language Tag, 3.45 IDN Mapping, 3.46 IDN Table Name, 3.61 IDN Mapping - Identity Digital, 3.66 IDN TANGO).
5. **Resource Record Provisioning:** Provide a generic and extensible interface for provisioning zone resource records (RRs) for domain names (3.2 E.164 Number Mapping).
6. **Nameserver Representation:** Allow extensions to define alternative ways of expressing nameserver information, such as using managed nameserver sets (NSsets) instead of individual host objects (3.57 FRED object extension) for domain names.
7. **Contact Types:** Allow extensions to define new contact types in a fashion reducing duplicate entries (3.50 .BR extension) Create contact types beyond the registrant, admin, tech, and billing types.

4.2.3 EPP Extension Recommendations

Below are the recommendations for the EPP Extension recommendations in RPP, with the following options:

1. **Embed** - Embed support directly into the standard RPP mappings, such as the RPP domain name mapping, in priority order.
    a. EPP Extensions
        i. Domain Registry Grace Period Mapping for the Extensible Provisioning Protocol (EPP) (Enhance)
        ii. Domain Name System (DNS) Security Extensions Mapping for the Extensible Provisioning Protocol (EPP)
        iii. RGP Poll Mapping for the Extensible Provisioning Protocol (EPP) (Enhance)
        iv. Login Security Extension for the Extensible Provisioning Protocol (EPP)
        v. Extensible Provisioning Protocol (EPP) Unhandled Namespaces
        vi. Extensible Provisioning Protocol (EPP) Secure Authorization Information for Transfer
        vii. Extensible Provisioning Protocol (EPP) mapping for DNS Time-To-Live (TTL) values
        viii. Use of Internationalized Email Addresses in the Extensible Provisioning Protocol (EPP)
        ix. Organization Mapping for the Extensible Provisioning Protocol (EPP)
        x. Organization Extension for the Extensible Provisioning Protocol (EPP)
    b. Takeaways
        i. During the design of RPP, the functions in these EPP extensions must be considered upfront and be embedded into the RPP core specifications. An RPP requirement should be created per EPP extension recommended for embedding.
        ii. The Tiger Team will perform analysis of the RPP design to ensure that the RPP core specifications satisfy the embed recommendation of the EPP extensions.
2. **Extension** - Define a standard RPP extension that means that it needs to be supported in the RPP design and with the plan of eventually defining it as a standard RPP extension.
    a. EPP Extensions
        i. Launch Phase Mapping for the Extensible Provisioning Protocol (EPP)
        ii. Allocation Token Extension for the Extensible Provisioning Protocol (EPP)
        iii. Registry Fee Extension for the Extensible Provisioning Protocol (EPP)
        iv. Change Poll Extension for the Extensible Provisioning Protocol (EPP)
        v. Registry Maintenance Notification for the Extensible Provisioning Protocol (EPP) - Extension
        vi. Balance Extensions
            1. Low Balance Mapping for the Extensible Provisioning Protocol (EPP)
            2. Balance Mapping for the Extensible Provisioning Protocol (EPP)
            3. Finance Mapping for the Extensible Provisioning Protocol (EPP)
        vii. IDN Extensions (Based on standardization in EPP)
            1. IDN Language Tag for the Extensible Provisioning Protocol (EPP)
            2. Related Domain Extension for the Extensible Provisioning Protocol (EPP)
            3. Domain Name Mapping Extension for Strict Bundling Registration

4. Internationalized Domain Name Mapping for the Extensible Provisioning Protocol (EPP)
5. Extensible Provisioning Protocol (EPP) Internationalized Domain Name (IDN) Table Name
6. Internationalized Domain Name Mapping for the Extensible Provisioning Protocol (EPP) - Identity Digital
7. IDN EPP Extension for the TANGO Registration System
8. Domain Variants

b. Takeaways
   i. During the design of RPP, the functions of these EPP extensions must be considered and a queue of corresponding RPP extensions must be defined and prioritized to be standardized on by an IETF working group.
   ii. The Tiger Team will perform analysis of the RPP design to ensure that the RPP core specifications satisfy the extension recommendation of the EPP extensions. This means that for each EPP extension, an assessment is needed to confirm the support in RPP for the creation of the standard RPP extension.

3. **Design** - Don't include in the RPP mappings and don't define a standard RPP extension, but verify that the RPP extensibility will support the features of the EPP extension.
   a. EPP Extensions
      i. E.164 Number Mapping for the Extensible Provisioning Protocol (EPP)
      ii. ENUM Validation Information Mapping for the Extensible
      iii. ConsoliDate Mapping for the Extensible Provisioning Protocol
      iv. Extensible Provisioning Protocol Mapping: Email Forwarding
      v. Extensible Provisioning Protocol Mapping: Defensive Registration
      vi. Extensible Provisioning Protocol Mapping: NameWatch
      vii. Extensible Provisioning Protocol Mapping: Personal Registration
      viii. Verisign Registry Mapping for the Extensible Provisioning Protocol (EPP)
      ix. .SE EPP Extensions
      x. DK Hostmaster local data extensions
      xi. Key Relay Mapping for the Extensible Provisioning Protocol
      xii. Verification Code Extension for the Extensible Provisioning Protocol (EPP)
      xiii. .at EPP Verification Extension
      xiv. Extensible Provisioning Protocol (EPP) China Name Verification Mapping
      xv. Registry Mapping for the Extensible Provisioning Protocol (EPP)
      xvi. Launch Phase Policy Extensions Mapping for the Extensible Provisioning Protocol (EPP)
      xvii. Login Security Policy Extensions Mapping for the Extensible Provisioning Protocol (EPP)
      xviii. Validate Mapping for the Extensible Provisioning Protocol (EPP)
      xix. Autonomous System Number Mapping for the Extensible Provisioning Protocol (EPP)
      xx. IP Network Mapping for the Extensible Provisioning Protocol (EPP)
      xxi. BR Domain Mapping for the Extensible Provisioning Protocol (EPP)
      xxii. BR Organization Mapping for the Extensible Provisioning Protocol (EPP)
      xxiii. .NO EPP Extensions
      xxiv. Namestore Extension Mapping for the Extensible Provisioning Protocol (EPP)
      xxv. FRED protocol extension (Credit Info)

xxvi. Domain Charge Extension for the Extensible Provisioning Protocol (EPP)Finance Mapping for the Extensible Provisioning Protocol (EPP)
xxvii. LvContact extension
xxviii. LvDomain extension
xxix. FRED (Free Registry for ENUM and Domains) protocol extension (Credit Info)
xxx. FRED (Free Registry for ENUM and Domains) object extension (Domain)
xxxi. Domain Charge Extension for the Extensible Provisioning Protocol (EPP)
xxxii. Scheduled Delete - SIDN
xxxiii. Reseller - SIDN
xxxiv. Removal of Unlinked Contacts - SIDN
xxxv. Cancel Delete - SIDN

b. Takeaways
   i. During the design of RPP, the functions of these EPP extensions must be considered.
   ii. The Tiger Team will perform analysis of the RPP design to ensure that RPP supports the design recommendation of the EPP extensions.
   iii. To address that the EPP extensions are supported in the design for RPP, RPP needs to ensure to support the same forms of extensibility. Below is an aggregate list of all of the forms of extensibility used by the extensions with the Design recommendation:
      1. Object Extension
      2. Command-Response Extension
      3. Function Extension
      4. Object Property Extension