                 Extensible Provisioning Protocol (EPP) Host Mapping
                        draft-hollenbeck-rfc4932bis-01

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Abstract

   This document describes an Extensible Provisioning Protocol (EPP)
   mapping for the provisioning and management of Internet host names

stored in a shared central repository. Specified in XML, the mapping
defines EPP command syntax and semantics as applied to host names.
This document is intended to obsolete [RFC 4932](#).

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1. Introduction

This document describes an Internet host name mapping for version 1.0
of the Extensible Provisioning Protocol (EPP). This mapping is
specified using the Extensible Markup Language (XML) 1.0 as described
in [W3C.REC-xml-20040204] and XML Schema notation as described in
[W3C.REC-xmlschema-1-20041028] and [W3C.REC-xmlschema-2-20041028].
This document is intended to obsolete RFC 4932 [RFC4932].

[I-D.hollenbeck-rfc4930bis] provides a complete description of EPP
command and response structures. A thorough understanding of the
base protocol specification is necessary to understand the mapping
described in this document.

XML is case sensitive. Unless stated otherwise, XML specifications
and examples provided in this document MUST be interpreted in the
character case presented to develop a conforming implementation.

1.1. Relationship of Host Objects and Domain Objects

This document assumes that host name objects have a subordinate
relationship to a superordinate domain name object. For example,
host name "ns1.example.com" has a subordinate relationship to domain
name "example.com". EPP actions (such as object transfers) that do
not preserve this relationship MUST be explicitly disallowed.

A host name object can be created in a repository for which no
superordinate domain name object exists. For example, host name
"ns1.example.com" can be created in the ".example" repository so that
DNS domains in ".example" can be delegated to the host. Such hosts
are described as "external" hosts in this specification since the
name of the host does not belong to the name space of the repository
in which the host is being used for delegation purposes.

Whether a host is external or internal relates to the repository in
which the host is being used for delegation purposes. Whether or not
an internal host is subordinate relates to a domain within the
repository. For example, host ns1.example1.com is a subordinate host
of domain example1.com, but it is not a subordinate host of domain
example2.com. ns1.example1.com can be used as a name server for
example2.com. In this case, ns1.example1.com MUST be treated as an
internal host, subject to the rules governing operations on
subordinate hosts within the same repository.

1.2. Conventions Used in This Document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
"SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this

document are to be interpreted as described in [RFC2119].

In examples, "C:" represents lines sent by a protocol client and "S:"
represents lines returned by a protocol server. Indentation and
white space in examples are provided only to illustrate element
relationships and are not a REQUIRED feature of this protocol.

2. Object Attributes

An EPP host object has attributes and associated values that can be
viewed and modified by the sponsoring client or the server. This
section describes each attribute type in detail. The formal syntax
for the attribute values described here can be found in the "Formal
Syntax" section of this document and in the appropriate normative
references.

2.1. Host Names

The syntax for host names described in this document MUST conform to
[RFC0952] as updated by [RFC1123]. At the time of this writing, RFC
3490 [RFC3490] describes a standard to use certain ASCII name labels
to represent non-ASCII name labels. These conformance requirements
might change in the future as a result of progressing work in
developing standards for internationalized host names.

2.2. Client Identifiers

All EPP clients are identified by a server-unique identifier. Client
identifiers conform to the "clIDType" syntax described in
[I-D.hollenbeck-rfc4930bis].

2.3. Status Values

A host object MUST always have at least one associated status value.
Status values MAY be set only by the client that sponsors a host
object and by the server on which the object resides. A client can
change the status of a host object using the EPP <update> command.
Each status value MAY be accompanied by a string of human-readable
text that describes the rationale for the status applied to the
object.

A client MUST NOT alter status values set by the server. A server
MAY alter or override status values set by a client subject to local
server policies. The status of an object MAY change as a result of
either a client-initiated transform command or an action performed by
a server operator.

Status values that can be added or removed by a client are prefixed

with "client". Corresponding status values that can be added or
removed by a server are prefixed with "server". Status values that
do not begin with either "client" or "server" are server-managed.

Status Value Descriptions:

- clientDeleteProhibited, serverDeleteProhibited

  Requests to delete the object MUST be rejected.

- clientUpdateProhibited, serverUpdateProhibited

  Requests to update the object (other than to remove this status)
  MUST be rejected.

- linked

  The host object has at least one active association with another
  object, such as a domain object. Servers SHOULD provide services
  to determine existing object associations.

- ok

  This is the normal status value for an object that has no pending
  operations or prohibitions. This value is set and removed by the
  server as other status values are added or removed.

- pendingCreate, pendingDelete, pendingTransfer, pendingUpdate

  A transform command has been processed for the object (or in the
  case of a <transfer> command, for the host object's superordinate
  domain object), but the action has not been completed by the
  server. Server operators can delay action completion for a
  variety of reasons, such as to allow for human review or third-
  party action. A transform command that is processed, but whose
  requested action is pending, is noted with response code 1001.

When the requested action has been completed, the pendingCreate,
pendingDelete, pendingTransfer, or pendingUpdate status value MUST be
removed. All clients involved in the transaction MUST be notified
using a service message that the action has been completed and that
the status of the object has changed.

"ok" status MAY only be combined with "linked" status.

"linked" status MAY be combined with any status.

"pendingDelete" status MUST NOT be combined with either

"clientDeleteProhibited" or "serverDeleteProhibited" status.

"pendingUpdate" status MUST NOT be combined with either
"clientUpdateProhibited" or "serverUpdateProhibited" status.

The pendingCreate, pendingDelete, pendingTransfer, and pendingUpdate
status values MUST NOT be combined with each other.

Other status combinations not expressly prohibited MAY be used.

2.4. Dates and Times

Date and time attribute values MUST be represented in Universal
Coordinated Time (UTC) using the Gregorian calendar. The extended
date-time form using upper case "T" and "Z" characters defined in
[W3C.REC-xmlschema-2-20041028] MUST be used to represent date-time
values as XML Schema does not support truncated date-time forms or
lower case "T" and "Z" characters.

2.5. IP Addresses

The syntax for IPv4 addresses described in this document MUST conform
to [RFC0791]. The syntax for IPv6 addresses described in this
document MUST conform to [RFC4291]. Practical considerations for
publishing IPv6 address information in zone files are documented in
[RFC2874] and [RFC3596]. A server MAY reject IP addresses that have
not been allocated for public use by IANA. When a host object is
provisioned for use as a DNS name server, IP addresses SHOULD be
required only as needed to generate DNS glue records.

3. EPP Command Mapping

A detailed description of the EPP syntax and semantics can be found
in [I-D.hollenbeck-rfc4930bis]. The command mappings described here
are specifically for use in provisioning and managing Internet host
names via EPP.

3.1. EPP Query Commands

EPP provides two commands to retrieve host information: <check> to
determine if a host object can be provisioned within a repository,
and <info> to retrieve detailed information associated with a host
object.

3.1.1. EPP <check> Command

The EPP <check> command is used to determine if an object can be
provisioned within a repository. It provides a hint that allows a

client to anticipate the success or failure of provisioning an object
using the <create> command as object provisioning requirements are
ultimately a matter of server policy.

In addition to the standard EPP command elements, the <check> command
MUST contain a <host:check> element that identifies the host
namespace. The <host:check> element contains the following child
elements:

- One or more <host:name> elements that contain the fully qualified
   names of the host objects to be queried.

Example <check> command:

```
C:<?xml version="1.0" encoding="UTF-8" standalone="no"?>
C:<epp xmlns="urn:ietf:params:xml:ns:epp-1.0">
C:  <command>
C:    <check>
C:      <host:check
C:       xmlns:host="urn:ietf:params:xml:ns:host-1.0">
C:        <host:name>ns1.example.com</host:name>
C:        <host:name>ns2.example.com</host:name>
C:        <host:name>ns3.example.com</host:name>
C:      </host:check>
C:    </check>
C:    <clTRID>ABC-12345</clTRID>
C:  </command>
C:</epp>
```

When a <check> command has been processed successfully, the EPP
<resData> element MUST contain a child <host:chkData> element that
identifies the host namespace. The <host:chkData> element contains
one or more <host:cd> elements that contain the following child
elements:

- A <host:name> element that contains the fully qualified name of
   the queried host object. This element MUST contain an "avail"
   attribute whose value indicates object availability (can it be
   provisioned or not) at the moment the <check> command was
   completed. A value of "1" or "true" means that the object can be
   provisioned. A value of "0" or "false" means that the object
   cannot be provisioned.

- An OPTIONAL <host:reason> element that MAY be provided when an
   object cannot be provisioned. If present, this element contains
   server-specific text to help explain why the object cannot be
   provisioned. This text MUST be represented in the response
   language previously negotiated with the client; an OPTIONAL "lang"

attribute MAY be present to identify the language if the
negotiated value is something other than the default value of "en"
(English).

Example <check> response:

```
S:<?xml version="1.0" encoding="UTF-8" standalone="no"?>
S:<epp xmlns="urn:ietf:params:xml:ns:epp-1.0">
S:  <response>
S:    <result code="1000">
S:      <msg>Command completed successfully</msg>
S:    </result>
S:    <resData>
S:      <host:chkData
S:       xmlns:host="urn:ietf:params:xml:ns:host-1.0">
S:        <host:cd>
S:          <host:name avail="1">ns1.example.com</host:name>
S:        </host:cd>
S:        <host:cd>
S:          <host:name avail="0">ns2.example2.com</host:name>
S:          <host:reason>In use</host:reason>
S:        </host:cd>
S:        <host:cd>
S:          <host:name avail="1">ns3.example3.com</host:name>
S:        </host:cd>
S:      </host:chkData>
S:    </resData>
S:    <trID>
S:      <clTRID>ABC-12345</clTRID>
S:      <svTRID>54322-XYZ</svTRID>
S:    </trID>
S:  </response>
S:</epp>
```

An EPP error response MUST be returned if a <check> command cannot be
processed for any reason.

3.1.2. EPP <info> Command

The EPP <info> command is used to retrieve information associated
with a host object. In addition to the standard EPP command
elements, the <info> command MUST contain a <host:info> element that
identifies the host namespace. The <host:info> element contains the
following child elements:

- A <host:name> element that contains the fully qualified name of
  the host object for which information is requested.

Example <info> command:

C:<?xml version="1.0" encoding="UTF-8" standalone="no"?>
C:<epp xmlns="urn:ietf:params:xml:ns:epp-1.0">
C: <command>
C: <info>
C: <host:info
C: xmlns:host="urn:ietf:params:xml:ns:host-1.0">
C: <host:name>ns1.example.com</host:name>
C: </host:info>
C: </info>
C: <clTRID>ABC-12345</clTRID>
C: </command>
C:</epp>

When an <info> command has been processed successfully, the EPP
<resData> element MUST contain a child <host:infData> element that
identifies the host namespace. The <host:infData> element contains
the following child elements:

- A <host:name> element that contains the fully qualified name of
  the host object.

- A <host:roid> element that contains the Repository Object
  IDentifier assigned to the host object when the object was
  created.

- One or more <host:status> elements that describe the status of the
  host object.

- Zero or more <host:addr> elements that contain the IP addresses
  associated with the host object.

- A <host:clID> element that contains the identifier of the
  sponsoring client.

- A <host:crID> element that contains the identifier of the client
  that created the host object.

- A <host:crDate> element that contains the date and time of host
  object creation.

- A <host:upID> element that contains the identifier of the client
  that last updated the host object. This element MUST NOT be
  present if the host object has never been modified.

- A <host:upDate> element that contains the date and time of the
  most recent host object modification. This element MUST NOT be
  present if the host object has never been modified.

- A <host:trDate> element that contains the date and time of the
  most recent successful host object transfer. This element MUST
  NOT be provided if the host object has never been transferred.
  Note that host objects MUST NOT be transferred directly; host
  objects MUST be transferred implicitly when the host object's
  superordinate domain object is transferred. Host objects that are
  subject to transfer when transferring a domain object are listed
  in the response to an EPP <info> command performed on the domain
  object.

Example <info> response:

```
S:<?xml version="1.0" encoding="UTF-8" standalone="no"?>
S:<epp xmlns="urn:ietf:params:xml:ns:epp-1.0">
S:  <response>
S:    <result code="1000">
S:      <msg>Command completed successfully</msg>
S:    </result>
S:    <resData>
S:      <host:infData
S:       xmlns:host="urn:ietf:params:xml:ns:host-1.0">
S:        <host:name>ns1.example.com</host:name>
S:        <host:roid>NS1_EXAMPLE1-REP</host:roid>
S:        <host:status s="linked"/>
S:        <host:status s="clientUpdateProhibited"/>
S:        <host:addr ip="v4">192.0.2.2</host:addr>
S:        <host:addr ip="v4">192.0.2.29</host:addr>
S:        <host:addr ip="v6">1080:0:0:0:8:800:200C:417A</host:addr>
S:        <host:clID>ClientY</host:clID>
S:        <host:crID>ClientX</host:crID>
S:        <host:crDate>1999-04-03T22:00:00.0Z</host:crDate>
S:        <host:upID>ClientX</host:upID>
S:        <host:upDate>1999-12-03T09:00:00.0Z</host:upDate>
S:        <host:trDate>2000-04-08T09:00:00.0Z</host:trDate>
S:      </host:infData>
S:    </resData>
S:    <trID>
S:      <clTRID>ABC-12345</clTRID>
S:      <svTRID>54322-XYZ</svTRID>
S:    </trID>
S:  </response>
S:</epp>
```

An EPP error response MUST be returned if an <info> command cannot be
processed for any reason.

3.1.3. EPP <transfer> Query Command

Transfer semantics do not directly apply to host objects, so there is
no mapping defined for the EPP <transfer> query command.

3.2. EPP Transform Commands

EPP provides three commands to transform host objects: <create> to
create an instance of a host object, <delete> to delete an instance
of a host object, and <update> to change information associated with
a host object. This document does not define host object mappings
for the EPP <renew> and <transfer> commands.

Transform commands are typically processed and completed in real
time. Server operators MAY receive and process transform commands,
but defer completing the requested action if human or third-party
review is required before the requested action can be completed. In
such situations, the server MUST return a 1001 response code to the
client to note that the command has been received and processed, but
the requested action is pending. The server MUST also manage the
status of the object that is the subject of the command to reflect
the initiation and completion of the requested action. Once the
action has been completed, all clients involved in the transaction
MUST be notified using a service message that the action has been
completed and that the status of the object has changed. Other
notification methods MAY be used in addition to the required service
message.

Server operators SHOULD confirm that a client is authorized to
perform a transform command on a given object. Any attempt to
transform an object by an unauthorized client MUST be rejected, and
the server MUST return a 2201 response code to the client to note
that the client lacks privileges to execute the requested command.

3.2.1. EPP <create> Command

The EPP <create> command provides a transform operation that allows a
client to create a host object. In addition to the standard EPP
command elements, the <create> command MUST contain a <host:create>
element that identifies the host namespace. The <host:create>
element contains the following child elements:

- A <host:name> element that contains the fully qualified name of
   the host object to be created.

- Zero or more <host:addr> elements that contain the IP addresses to
   be associated with the host. Each element MAY contain an "ip"
   attribute to identify the IP address format. Attribute value "v4"
   is used to note IPv4 address format. Attribute value "v6" is used
   to note IPv6 address format. If the "ip" attribute is not
   specified, "v4" is the default attribute value.

Hosts can be provisioned for use as name servers in the Domain Name
System (DNS), described in [RFC1034] and [RFC1035]. Hosts
provisioned as name servers might be subject to server operator
policies that require or prohibit specification of IP addresses
depending on the name of the host and the name space in which the
server will be used as a name server. When provisioned for use as a
name server, IP addresses are REQUIRED only as needed to produce DNS
glue records. For example, if the server is authoritative for the
"com" name space and the name of the server is "ns1.example.net", the

server is not required to produce DNS glue records for the name
server and IP addresses for the server are not required by the DNS.

If the host name exists in a name space for which the server is
authoritative, then the superordinate domain of the host MUST be
known to the server before the host object can be created.

Example <create> command:

```
C:<?xml version="1.0" encoding="UTF-8" standalone="no"?>
C:<epp xmlns="urn:ietf:params:xml:ns:epp-1.0">
C:  <command>
C:    <create>
C:      <host:create
C:       xmlns:host="urn:ietf:params:xml:ns:host-1.0">
C:        <host:name>ns1.example.com</host:name>
C:        <host:addr ip="v4">192.0.2.2</host:addr>
C:        <host:addr ip="v4">192.0.2.29</host:addr>
C:        <host:addr ip="v6">1080:0:0:0:8:800:200C:417A</host:addr>
C:      </host:create>
C:    </create>
C:    <clTRID>ABC-12345</clTRID>
C:  </command>
C:</epp>
```

When a <create> command has been processed successfully, the EPP
<resData> element MUST contain a child <host:creData> element that
identifies the host namespace. The <host:creData> element contains
the following child elements:

- A <host:name> element that contains the fully qualified name of
  the host object.

- A <host:crDate> element that contains the date and time of host
  object creation.

Example <create> response:

```
S:<?xml version="1.0" encoding="UTF-8" standalone="no"?>
S:<epp xmlns="urn:ietf:params:xml:ns:epp-1.0">
S:  <response>
S:    <result code="1000">
S:      <msg>Command completed successfully</msg>
S:    </result>
S:    <resData>
S:      <host:creData
S:       xmlns:host="urn:ietf:params:xml:ns:host-1.0">
S:        <host:name>ns1.example.com</host:name>
S:        <host:crDate>1999-04-03T22:00:00.0Z</host:crDate>
S:      </host:creData>
S:    </resData>
S:    <trID>
S:      <clTRID>ABC-12345</clTRID>
S:      <svTRID>54322-XYZ</svTRID>
S:    </trID>
S:  </response>
S:</epp>
```

An EPP error response MUST be returned if a <create> command cannot
be processed for any reason.

3.2.2. EPP <delete> Command

The EPP <delete> command provides a transform operation that allows a
client to delete a host object. In addition to the standard EPP
command elements, the <delete> command MUST contain a <host:delete>
element that identifies the host namespace. The <host:delete>
element contains the following child elements:

- A <host:name> element that contains the fully qualified name of
   the host object to be deleted.

A host name object SHOULD NOT be deleted if the host object is
associated with any other object. For example, if the host object is
associated with a domain object, the host object SHOULD NOT be
deleted until the existing association has been broken. Deleting a
host object without first breaking existing associations can cause
DNS resolution failure for domain objects that refer to the deleted
host object.

Example <delete> command:

```
C:<?xml version="1.0" encoding="UTF-8" standalone="no"?>
C:<epp xmlns="urn:ietf:params:xml:ns:epp-1.0">
C:  <command>
C:    <delete>
C:      <host:delete
C:       xmlns:host="urn:ietf:params:xml:ns:host-1.0">
C:        <host:name>ns1.example.com</host:name>
C:      </host:delete>
C:    </delete>
C:    <clTRID>ABC-12345</clTRID>
C:  </command>
C:</epp>
```

When a <delete> command has been processed successfully, a server
MUST respond with an EPP response with no <resData> element.

Example <delete> response:

```
S:<?xml version="1.0" encoding="UTF-8" standalone="no"?>
S:<epp xmlns="urn:ietf:params:xml:ns:epp-1.0">
S:  <response>
S:    <result code="1000">
S:      <msg>Command completed successfully</msg>
S:    </result>
S:    <trID>
S:      <clTRID>ABC-12345</clTRID>
S:      <svTRID>54321-XYZ</svTRID>
S:    </trID>
S:  </response>
S:</epp>
```

An EPP error response MUST be returned if a <delete> command cannot
be processed for any reason.

3.2.3. EPP <renew> Command

Renewal semantics do not apply to host objects, so there is no
mapping defined for the EPP <renew> command.

3.2.4. EPP <transfer> Command

Transfer semantics do not directly apply to host objects, so there is
no mapping defined for the EPP <transfer> command. Host objects are
subordinate to an existing superordinate domain object, and as such
they are subject to transfer when a domain object is transferred.

[3.2.5](#). EPP <update> Command

   The EPP <update> command provides a transform operation that allows a
   client to modify the attributes of a host object. In addition to the
   standard EPP command elements, the <update> command MUST contain a
   <host:update> element that identifies the host namespace. The <host:
   update> element contains the following child elements:

   - A <host:name> element that contains the fully qualified name of
      the host object to be updated.

   - An OPTIONAL <host:add> element that contains attribute values to
      be added to the object.

   - An OPTIONAL <host:rem> element that contains attribute values to
      be removed from the object.

   - An OPTIONAL <host:chg> element that contains object attribute
      values to be changed.

   At least one <host:add>, <host:rem>, or <host:chg> element MUST be
   provided if the command is not being extended. All of these elements
   MAY be omitted if an <update> extension is present. The <host:add>
   and <host:rem> elements contain the following child elements:

   - One or more <host:addr> elements that contain IP addresses to be
      associated with or removed from the host object. IP address
      restrictions described in the <create> command mapping apply here
      as well.

   - One or more <host:status> elements that contain status values to
      be associated with or removed from the object. When specifying a
      value to be removed, only the attribute value is significant;
      element text is not required to match a value for removal.

   A <host:chg> element contains the following child elements:

   - A <host:name> element that contains a new fully qualified host
      name by which the host object will be known.

   Host name changes MAY require the addition or removal of IP addresses
   to be accepted by the server. IP address association MAY be subject
   to server policies for provisioning hosts as name servers.

   Host name changes can have an impact on associated objects that refer
   to the host object. A host name change SHOULD NOT require additional
   updates of associated objects to preserve existing associations, with
   one exception: changing an external host object that has associations

with objects that are sponsored by a different client. Attempts to
update such hosts directly MUST fail with EPP error code 2305. The
change can be provisioned by creating a new external host with a new
name and needed new attributes and subsequently updating the other
objects sponsored by the client.

Example <update> command:

```
C:<?xml version="1.0" encoding="UTF-8" standalone="no"?>
C:<epp xmlns="urn:ietf:params:xml:ns:epp-1.0">
C:  <command>
C:    <update>
C:      <host:update
C:       xmlns:host="urn:ietf:params:xml:ns:host-1.0">
C:        <host:name>ns1.example.com</host:name>
C:        <host:add>
C:          <host:addr ip="v4">192.0.2.22</host:addr>
C:          <host:status s="clientUpdateProhibited"/>
C:        </host:add>
C:        <host:rem>
C:          <host:addr ip="v6">1080:0:0:0:8:800:200C:417A</host:addr>
C:        </host:rem>
C:        <host:chg>
C:          <host:name>ns2.example.com</host:name>
C:        </host:chg>
C:      </host:update>
C:    </update>
C:    <clTRID>ABC-12345</clTRID>
C:  </command>
C:</epp>
```

When an <update> command has been processed successfully, a server
MUST respond with an EPP response with no <resData> element.

Example <update> response:

```
S:<?xml version="1.0" encoding="UTF-8" standalone="no"?>
S:<epp xmlns="urn:ietf:params:xml:ns:epp-1.0">
S:  <response>
S:    <result code="1000">
S:      <msg>Command completed successfully</msg>
S:    </result>
S:    <trID>
S:      <clTRID>ABC-12345</clTRID>
S:      <svTRID>54321-XYZ</svTRID>
S:    </trID>
S:  </response>
S:</epp>
```

An EPP error response MUST be returned if an <update> command could
not be processed for any reason.

3.3. Offline Review of Requested Actions

Commands are processed by a server in the order they are received
from a client. Though an immediate response confirming receipt and
processing of the command is produced by the server, a server
operator MAY perform an offline review of requested transform
commands before completing the requested action. In such situations,
the response from the server MUST clearly note that the transform
command has been received and processed, but the requested action is
pending. The status of the corresponding object MUST clearly reflect
processing of the pending action. The server MUST notify the client
when offline processing of the action has been completed.

Examples describing a <create> command that requires offline review
are included here. Note the result code and message returned in
response to the <create> command.

```
S:<?xml version="1.0" encoding="UTF-8" standalone="no"?>
S:<epp xmlns="urn:ietf:params:xml:ns:epp-1.0">
S:  <response>
S:    <result code="1001">
S:      <msg>Command completed successfully; action pending</msg>
S:    </result>
S:    <resData>
S:      <host:creData
S:       xmlns:host="urn:ietf:params:xml:ns:host-1.0">
S:        <host:name>ns1.example.com</host:name>
S:        <host:crDate>1999-04-03T22:00:00.0Z</host:crDate>
S:      </host:creData>
S:    </resData>
S:    <trID>
S:      <clTRID>ABC-12345</clTRID>
S:      <svTRID>54322-XYZ</svTRID>
S:    </trID>
S:  </response>
S:</epp>
```

The status of the host object after returning this response MUST
include "pendingCreate". The server operator reviews the request
offline, and informs the client of the outcome of the review either
by queuing a service message for retrieval via the <poll> command or
by using an out-of-band mechanism to inform the client of the
request.

The service message MUST contain text in the <response>, <msgQ>,

<msg> element that describes the notification. In addition, the EPP
<resData> element MUST contain a child <host:panData> element that
identifies the host namespace. The <host:panData> element contains
the following child elements:

- A <host:name> element that contains the fully qualified name of
   the host object. The <host:name> element contains a REQUIRED
   "paResult" attribute. A positive boolean value indicates that the
   request has been approved and completed. A negative boolean value
   indicates that the request has been denied and the requested
   action has not been taken.

- A <host:paTRID> element that contains the client transaction
   identifier and server transaction identifier returned with the
   original response to process the command. The client transaction
   identifier is OPTIONAL and will only be returned if the client
   provided an identifier with the original <create> command.

- A <host:paDate> element that contains the date and time describing
   when review of the requested action was completed.

Example "review completed" service message:

```
S:<?xml version="1.0" encoding="UTF-8" standalone="no"?>
S:<epp xmlns="urn:ietf:params:xml:ns:epp-1.0">
S:  <response>
S:    <result code="1301">
S:      <msg>Command completed successfully; ack to dequeue</msg>
S:    </result>
S:    <msgQ count="5" id="12345">
S:      <qDate>1999-04-04T22:01:00.0Z</qDate>
S:      <msg>Pending action completed successfully.</msg>
S:    </msgQ>
S:    <resData>
S:      <host:panData
S:       xmlns:host="urn:ietf:params:xml:ns:host-1.0">
S:        <host:name paResult="1">ns1.example.com</host:name>
S:        <host:paTRID>
S:          <clTRID>ABC-12345</clTRID>
S:          <svTRID>54322-XYZ</svTRID>
S:        </host:paTRID>
S:        <host:paDate>1999-04-04T22:00:00.0Z</host:paDate>
S:      </host:panData>
S:    </resData>
S:    <trID>
S:      <clTRID>BCD-23456</clTRID>
S:      <svTRID>65432-WXY</svTRID>
S:    </trID>
S:  </response>
S:</epp>
```

4. Formal Syntax

An EPP object mapping is specified in XML Schema notation. The
formal syntax presented here is a complete schema representation of
the object mapping suitable for automated validation of EPP XML
instances. The BEGIN and END tags are not part of the schema; they
are used to note the beginning and ending of the schema for URI
registration purposes.

```
BEGIN
<?xml version="1.0" encoding="UTF-8"?>

<schema targetNamespace="urn:ietf:params:xml:ns:host-1.0"
        xmlns:host="urn:ietf:params:xml:ns:host-1.0"
        xmlns:epp="urn:ietf:params:xml:ns:epp-1.0"
        xmlns:eppcom="urn:ietf:params:xml:ns:eppcom-1.0"
        xmlns="http://www.w3.org/2001/XMLSchema"
        elementFormDefault="qualified">
```

```
<!--
Import common element types.
-->
 <import namespace="urn:ietf:params:xml:ns:eppcom-1.0"/>
 <import namespace="urn:ietf:params:xml:ns:epp-1.0"/>

 <annotation>
   <documentation>
     Extensible Provisioning Protocol v1.0
     host provisioning schema.
   </documentation>
 </annotation>

<!--
Child elements found in EPP commands.
-->
 <element name="check" type="host:mNameType"/>
 <element name="create" type="host:createType"/>
 <element name="delete" type="host:sNameType"/>
 <element name="info" type="host:sNameType"/>
 <element name="update" type="host:updateType"/>

<!--
Child elements of the <create> command.
-->
 <complexType name="createType">
   <sequence>
     <element name="name" type="eppcom:labelType"/>
     <element name="addr" type="host:addrType"
      minOccurs="0" maxOccurs="unbounded"/>
   </sequence>
 </complexType>

 <complexType name="addrType">
   <simpleContent>
     <extension base="host:addrStringType">
       <attribute name="ip" type="host:ipType"
        default="v4"/>
     </extension>
   </simpleContent>
 </complexType>

 <simpleType name="addrStringType">
   <restriction base="token">
     <minLength value="3"/>
     <maxLength value="45"/>
   </restriction>
 </simpleType>
```

```
   <simpleType name="ipType">
     <restriction base="token">
       <enumeration value="v4"/>
       <enumeration value="v6"/>
     </restriction>
   </simpleType>

  <!--
  Child elements of the <delete> and <info> commands.
  -->
   <complexType name="sNameType">
     <sequence>
       <element name="name" type="eppcom:labelType"/>
     </sequence>
   </complexType>

  <!--
  Child element of commands that accept multiple names.
  -->
   <complexType name="mNameType">
     <sequence>
       <element name="name" type="eppcom:labelType"
        maxOccurs="unbounded"/>
     </sequence>
   </complexType>
  <!--
  Child elements of the <update> command.
  -->
   <complexType name="updateType">
     <sequence>
       <element name="name" type="eppcom:labelType"/>
       <element name="add" type="host:addRemType"
        minOccurs="0"/>
       <element name="rem" type="host:addRemType"
        minOccurs="0"/>
       <element name="chg" type="host:chgType"
        minOccurs="0"/>
     </sequence>
   </complexType>

  <!--
  Data elements that can be added or removed.
  -->
   <complexType name="addRemType">
     <sequence>
       <element name="addr" type="host:addrType"
        minOccurs="0" maxOccurs="unbounded"/>
       <element name="status" type="host:statusType"
```

```
         minOccurs="0" maxOccurs="7"/>
      </sequence>
    </complexType>

  <!--
  Data elements that can be changed.
  -->
    <complexType name="chgType">
      <sequence>
        <element name="name" type="eppcom:labelType"/>
      </sequence>
    </complexType>

  <!--
  Child response elements.
  -->
    <element name="chkData" type="host:chkDataType"/>
    <element name="creData" type="host:creDataType"/>
    <element name="infData" type="host:infDataType"/>
    <element name="panData" type="host:panDataType"/>

  <!--
  <check> response elements.
  -->
    <complexType name="chkDataType">
      <sequence>
        <element name="cd" type="host:checkType"
         maxOccurs="unbounded"/>
      </sequence>
    </complexType>

    <complexType name="checkType">
      <sequence>
        <element name="name" type="host:checkNameType"/>
        <element name="reason" type="eppcom:reasonType"
         minOccurs="0"/>
      </sequence>
    </complexType>

    <complexType name="checkNameType">
      <simpleContent>
        <extension base="eppcom:labelType">
          <attribute name="avail" type="boolean"
           use="required"/>
        </extension>
      </simpleContent>
    </complexType>
```

```
    <!--
    <create> response elements.
    -->
     <complexType name="creDataType">
       <sequence>
         <element name="name" type="eppcom:labelType"/>
         <element name="crDate" type="dateTime"/>
       </sequence>
     </complexType>

    <!--
    <info> response elements.
    -->
     <complexType name="infDataType">
       <sequence>
         <element name="name" type="eppcom:labelType"/>
         <element name="roid" type="eppcom:roidType"/>
         <element name="status" type="host:statusType"
          maxOccurs="7"/>
         <element name="addr" type="host:addrType"
          minOccurs="0" maxOccurs="unbounded"/>
         <element name="clID" type="eppcom:clIDType"/>
         <element name="crID" type="eppcom:clIDType"/>
         <element name="crDate" type="dateTime"/>
         <element name="upID" type="eppcom:clIDType"
          minOccurs="0"/>
         <element name="upDate" type="dateTime"
          minOccurs="0"/>
         <element name="trDate" type="dateTime"
          minOccurs="0"/>
       </sequence>
     </complexType>

    <!--
    Status is a combination of attributes and an optional human-readable
    message that may be expressed in languages other than English.
    -->
     <complexType name="statusType">
       <simpleContent>
         <extension base="normalizedString">
           <attribute name="s" type="host:statusValueType"
            use="required"/>
           <attribute name="lang" type="language"
            default="en"/>
         </extension>
       </simpleContent>
     </complexType>
```

```
  <simpleType name="statusValueType">
    <restriction base="token">
      <enumeration value="clientDeleteProhibited"/>
      <enumeration value="clientUpdateProhibited"/>
      <enumeration value="linked"/>
      <enumeration value="ok"/>
      <enumeration value="pendingCreate"/>
      <enumeration value="pendingDelete"/>
      <enumeration value="pendingTransfer"/>
      <enumeration value="pendingUpdate"/>
      <enumeration value="serverDeleteProhibited"/>
      <enumeration value="serverUpdateProhibited"/>
    </restriction>
  </simpleType>

<!--
Pending action notification response elements.
-->
 <complexType name="panDataType">
   <sequence>
     <element name="name" type="host:paNameType"/>
     <element name="paTRID" type="epp:trIDType"/>
     <element name="paDate" type="dateTime"/>
   </sequence>
 </complexType>
 <complexType name="paNameType">
   <simpleContent>
     <extension base="eppcom:labelType">
       <attribute name="paResult" type="boolean"
        use="required"/>
     </extension>
   </simpleContent>
 </complexType>

<!--
End of schema.
-->
</schema>
END
```

5. Internationalization Considerations

EPP is represented in XML, which provides native support for encoding
information using the Unicode character set and its more compact
representations including UTF-8. Conformant XML processors recognize
both UTF-8 and UTF-16 [RFC2781]. Though XML includes provisions to
identify and use other character encodings through use of an
"encoding" attribute in an <?xml?> declaration, use of UTF-8 is

RECOMMENDED in environments where parser encoding support
incompatibility exists.

All date-time values presented via EPP MUST be expressed in Universal
Coordinated Time using the Gregorian calendar. XML Schema allows use
of time zone identifiers to indicate offsets from the zero meridian,
but this option MUST NOT be used with EPP. The extended date-time
form using upper case "T" and "Z" characters defined in
[W3C.REC-xmlschema-2-20041028] MUST be used to represent date-time
values as XML Schema does not support truncated date-time forms or
lower case "T" and "Z" characters.

This document requires host name syntax as specified in [RFC0952] as
updated by [RFC1123]. At the time of this writing, RFC 3490
[RFC3490] describes a standard to use certain ASCII name labels to
represent non-ASCII name labels. These conformance requirements
might change as a result of progressing work in developing standards
for internationalized host names.

6. IANA Considerations

This document uses URNs to describe XML namespaces and XML schemas
conforming to a registry mechanism described in [RFC3688]. Two URI
assignments have been registered by the IANA.

Registration request for the host namespace:

URI: urn:ietf:params:xml:ns:host-1.0

Registrant Contact: See the "Author's Address" section of this
document.

XML: None. Namespace URIs do not represent an XML specification.

Registration request for the host XML schema:

URI: urn:ietf:params:xml:schema:host-1.0

Registrant Contact: See the "Author's Address" section of this
document.

XML: See the "Formal Syntax" section of this document.

7. Security Considerations

The object mapping described in this document does not provide any
security services or introduce any additional considerations beyond
those described by [I-D.hollenbeck-rfc4930bis] and protocol layers

used by EPP.

8. Acknowledgements

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9. References

9.1. Normative References

   [I-D.hollenbeck-rfc4930bis]
             Hollenbeck, S., "Extensible Provisioning Protocol (EPP)",
             draft-hollenbeck-rfc4930bis-01 (work in progress),
             May 2009.

   [RFC0791] Postel, J., "Internet Protocol", STD 5, RFC 791,
             September 1981.

   [RFC0952] Harrenstien, K., Stahl, M., and E. Feinler, "DoD Internet
             host table specification", RFC 952, October 1985.

   [RFC1034] Mockapetris, P., "Domain names - concepts and facilities",
             STD 13, RFC 1034, November 1987.

   [RFC1035] Mockapetris, P., "Domain names - implementation and
             specification", STD 13, RFC 1035, November 1987.

   [RFC1123] Braden, R., "Requirements for Internet Hosts - Application
             and Support", STD 3, RFC 1123, October 1989.

   [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
             Requirement Levels", BCP 14, RFC 2119, March 1997.

   [RFC3688] Mealling, M., "The IETF XML Registry", BCP 81, RFC 3688,
             January 2004.

   [RFC4291] Hinden, R. and S. Deering, "IP Version 6 Addressing
             Architecture", RFC 4291, February 2006.

   [W3C.REC-xml-20040204]
             Sperberg-McQueen, C., Maler, E., Yergeau, F., Paoli, J.,
             and T. Bray, "Extensible Markup Language (XML) 1.0 (Third
             Edition)", World Wide Web Consortium FirstEdition REC-xml-
             20040204, February 2004,
             <http://www.w3.org/TR/2004/REC-xml-20040204>.

   [W3C.REC-xmlschema-1-20041028]
             Beech, D., Thompson, H., Mendelsohn, N., and M. Maloney,
             "XML Schema Part 1: Structures Second Edition", World Wide
             Web Consortium Recommendation REC-xmlschema-1-20041028,
             October 2004,
             <http://www.w3.org/TR/2004/REC-xmlschema-1-20041028>.

   [W3C.REC-xmlschema-2-20041028]

Malhotra, A. and P. Biron, "XML Schema Part 2: Datatypes Second Edition", World Wide Web Consortium Recommendation REC-xmlschema-2-20041028, October 2004, <http://www.w3.org/TR/2004/REC-xmlschema-2-20041028>.

9.2. Informative References

[RFC2781]   Hoffman, P. and F. Yergeau, "UTF-16, an encoding of ISO 10646", RFC 2781, February 2000.

[RFC2874]   Crawford, M. and C. Huitema, "DNS Extensions to Support IPv6 Address Aggregation and Renumbering", RFC 2874, July 2000.

[RFC3490]   Faltstrom, P., Hoffman, P., and A. Costello, "Internationalizing Domain Names in Applications (IDNA)", RFC 3490, March 2003.

[RFC3596]   Thomson, S., Huitema, C., Ksinant, V., and M. Souissi, "DNS Extensions to Support IP Version 6", RFC 3596, October 2003.

[RFC4932]   Hollenbeck, S., "Extensible Provisioning Protocol (EPP) Host Mapping", RFC 4932, May 2007.

Appendix A. Changes from RFC 4932

1. Changed "This document obsoletes RFC 3732" to "This document is intended to obsolete RFC 4932".
2. Replaced references to RFC 1886 with references to 3596.
3. Removed references to RFC 3152 since both it and 1886 have been obsoleted by 3596.
4. Replaced references to RFC 3732 with references to 4932.
5. Replaced references to RFC 4930 with references to 4930bis.
6. Added "Other notification methods MAY be used in addition to the required service message" in Section 3.2.
7. Added 2201 response code text in Section 3.2.

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