

I2RS working group
Internet-Draft
Intended status: Informational
Expires: September 14, 2017

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March 13, 2017

RESTCONF Changes to Support I2RS Protocol
draft-hares-netconf-i2rs-restconf-01.txt

Abstract

This document describes two RESTCONF optional capabilities (control plane datastore capability, ephemeral state capabilities) that are needed to support the I2RS protocol needs. The I2RS protocol requires an ephemeral control plane datastore. as control plane datastores.

The purpose of this draft is to kick-start the discussions with NETCONF on these two capabilities.

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1. Introduction

This a proposal for the following two RESTCONF capabilities to augment RESTCONF [RFC8040] to support the first version of the I2RS protocol: Control plane datstore capability and ephemeral state capability. The yang that supports this proposal is described in [I-D.hares-netmod-i2rs-yang]. This work is based on the datastore definitions in [I-D.ietf-netmod-revised-datastores].

This draft parallels a similar proposal for NETCONF [RFC6241] is described in [I-D.hares-netconf-i2rs-protocol]. The difference is the original design is to embedded the I2RS multi-headed collision resolution in the "control plane data store capability". However

RESTCONF has edit-collision capability already which only needs a usage description. Therefore, this document has a I2RS Edit-Collision capability.

Caveat: This work is an individual draft (not an I2RS WG effort)

1.1. Background on I2RS

The I2RS architecture [RFC7921] defines the I2RS interface "a programmatic interface for state transfer in and out of the Internet routing system". The I2RS protocol is a protocol designed to a higher level protocol comprised of a set of existing protocols which have been extended to work together to support a new interface to the routing system. The I2RS protocol is a "reuse" management protocol which creates new management protocols by reusing existing protocols and extending these protocols for new uses, and has been designed to be implemented in phases [RFC7921].

1.2. Structure of draft

The structure of this document is:

Section 2 provides definitions and background on I2RS work. (If you are familiar with the I2RS architecture and requirements, you can skip this section.)

Section 3 describes the RESTCONF control plane datastore capability.

Section 4 describes the RESTCONF ephemeral state capability. .

2. Definitions and Background on I2RS

This section reviews definitions from I2RS architecture, and provides background on I2RS work for the reader.

2.1. IETF Requirements language

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 RFC 2119 [RFC2119].

2.2. I2RS Definitions

The I2RS architecture [RFC7921] defines the following terms:

ephemeral data: is data which does not persist across a reboot (software or hardware) or a power on/off condition. Ephemeral

data can be configured data or data recorded from operations of the router. Ephemeral configuration data also has the property that a system cannot roll back to a previous ephemeral configuration state. (See [RFC7921] for an architectural overview, [I-D.ietf-i2rs-ephemeral-state] for requirements, and [I-D.ietf-netmod-revised-datastores] for discussion of how the ephemeral datastore as a control plane datastore interacts with intended datastore and dynamic configuration protocols to form the applied datastore".

local configuration: is the data on a routing system which does persist across a reboot (software or hardware) and a power on/off condition. Local configuration has the ability to roll back to a pervious configuration state. Local configuration is defined as the intended datastore [I-D.ietf-netmod-revised-datastores] which is modified by dynamic configuration protocols (such as DHCP) and the I2RS ephemeral data store

dynamic configuration protocols datastore are configuration protocols such as DHCP that interact with the intended datastore (which does persist across a reboot (software or hardware) power on/off condition), and the I2RS ephemeral state control plane datastore.

control plane protocols datastore is a datastore which is loaded by control plane protocols (e.g. I2RS protocol) rather than system configuration protocols. (see [I-D.ietf-netmod-revised-datastores]).

operator-applied policy: is a policy that an operator sets that determines how the ephemeral datastore as a control plane data store interacts with applied datastore (as defined in [I-D.ietf-netmod-revised-datastores]). This operator policy consists of policy knobs that the operator sets to determine how the I2RS agent control plane ephemeral state datastore will interact with the intended configuration datastor and the dynamic configuration protocol datastore. Three policy knobs could be used to implement this policy:

- * policy knob 1: I2RS Ephemeral control-plane datastore takes precedence over the intended datastore in the routing protocols.
- * policy knob 2: Updated intended configuration datastore takes precedence over the I2RS ephemeral control-plane data store in the routing protocols

- * policy knob 3: Ephemeral control plane datastore takes precedence over any other dynamic configuration protocols datastore.

2.3. Example for operator-applied policy

An practical example for three states of the operator-applied policy may help the reader understand the concept. Consider the following three desired outcomes with their policy knob states:

Monitoring Features only The policy knob settings are:

```
Policy knob 1=false,  
policy knob 2=true,  
Policy knob 3=false,
```

Action: I2RS protocol software feature is installed, but the operator does not want the I2RS ephemeral1 datastore to take precedence (that is be used) on any variables in the applied configuration datastore. This policy set might be valid if I2RS is only suppose to monitor data on this node through newly defined parameters.

I2RS Agent Changes win the policy knob settings would be:

```
Policy knob 1=true,  
policy knob 2=false,  
Policy knob 3=false,
```

Action: This is the normal case for the I2RS Agent where the ephemeral control-plane datastore takes precedence over the intended configuration datastore and dynamic configuration datastores. The values from the I2RS ephemeral1 datastore are used rather than the intended configuration datastore and the dynamic configuration protocol datastore. When the ephemeral data is removed by the I2RS agent, the dyanmic configuration datastore and the intended configuration datastore state is restored, combined and passed to the routing protocols for application.

Just change until next configuration update the policy knob settings would be:

```
Policy knob 1=true,
```

policy knob 2=true,

Policy knob 3=false,

Action: This case can occur if the I2RS Client write to the ephemeral control plane data store is only suppose to take precedence until the next configuration cycle from a centralized system. Suppose the local configuration is get by the centralized system at 11:00pm each night. The I2RS Client writes temporary changes to the routing system via the I2RS agent ephemeral write. At 11:00pm, the local configuration update overwrite the ephemeral. The I2RS Agent notifies the I2RS Client which is tracking which of the ephemeral changes are being overwritten.

2.4. I2RS protocol requirements

The requirements for the I2RS protocol are defined in the following documents:

- o I2RS Problem Statement [RFC7920],
- o I2RS Architecture [RFC7921],
- o I2RS Traceability [RFC7922],
- o Publication and Subscription [RFC7923],
- o I2RS Ephemeral State Requirements, ,
[I-D.ietf-i2rs-ephemeral-state]
- o I2RS Protocol Security Requirements,
[I-D.ietf-i2rs-protocol-security-requirements]

The Interface to the routing System (I2RS) creates a new capability for the routing systems, and with greater capabilities come a greater need for security. The requirements for a secure environment for I2RS is described in [I-D.ietf-i2rs-security-environment-reqs].

3. RESTCONF control plane datastore capability

capability-name: control-plane datastore

3.1. Overview

The :control-plane datastore capability enables the RESTCONF to support the following:

- o API resource that is `{+restconf/cp-data}` - the storage of control plane datastore's configuration that includes configuration (`{+restconf/cp-data/config}`) and operational state specific to the control plane datastore (`{+restconf/cp-data/opstate}`).
- o It also includes the ability to have the applied datastore and the opstate datatstore (per [I-D.ietf-netmod-revised-datastores]).

3.2. Dependencies

This protocol strawman utilizes the following existing proposed features for NETCONF and RESTCONF

- o RESTCONF [RFC8040].
- o Module library [RFC7895],
- o RESTCONF Patch Media Type [RFC8072],
- o NETCONF Support for event notifications [I-D.ietf-netconf-netconf-event-notifications],
- o Publication/Subscription via Push [I-D.ietf-netconf-yang-push],
- o NETCONF and HTTP Transport for Event Notivications [I-D.ietf-netconf-restconf-notif],
- o Publication/Subscription via Push [I-D.ietf-netconf-yang-push],
- o syslog yang module (both [RFC5424] and [I-D.ietf-netmod-syslog-model])

3.3. New Operations

none

3.4. Modified Operations

All RESTCONF methods (OPTIONS, HEAD, GET, POST, PT, PATCH, DELETE) need to work in the control plane datastores. `config=TRUE` data, and where appropriate `config=FALSE` data.

Editor's Note: Amazingly, RESTCONF is almost ready for the control plane data. The authors understanding of the I2RS protocol needs is why. The best situation is to ask the RESTCONF authors for help specifying what needs to change for the RESTCONF to allow references to datastore.

4. RESTCONF protocol extensions for the ephemeral datastore

capability-name: ephemeral-state

4.1. Overview

This capability defines the RESTCONF protocol extensions for control plane protocols that support control plane data stores with ephemeral data.

Ephemeral state is not unique to I2RS work.

The ephemeral capability is the ability to support control plane datastores which are entirely ephemeral or have ephemeral state modules, or ephemeral statements within objects in a modules. These objects can be configuration state (config=TRUE) or operational state (config=FALSE).

Ephemeral state in datastores, ephemeral modules or ephemeral objects within a module have one key characteristics: the data does not persist across reboots. The ephemeral configuration state must be restored by a client, and the operational state will need to be regenerated.

The entire requirements for ephemeral state for the I2RS control plane protocol are listed in [I-D.ietf-i2rs-ephemeral-state]. Compared to RESTCONF functionality there are 4 groups of additional changes:

Constraints The ability to enforce the constraints for references (to/from) the {+restconf/data} datastore, and a {+restconf/cp-data} control plane datastore. ((see Ephemeral-REQ-02, Ephemeral-REQ-03, and Ephemeral-REQ-04 in [I-D.ietf-i2rs-ephemeral-state])). The "validation" yang statement in [I-D.hares-netmod-i2rs-yang] could encode specific validation for the ephemeral case per datastore or per object. [Editor's note: Aid is needed from NETCONF authors to determine the best way to enforce the constraints.]

Library Tracking of Ephemeral Yang modules must identify Yang objects (modules, submodules or objects within yang modules which are ephemeral and augment other nodes) and allow an "ephemeral=TRUE" feature.

Roll-back an ephemeral node cannot roll-back to its previous value,

4.2. Dependencies

The ephemeral capabilities have the following dependencies:

- o Yang modules must support the following:
 - * identifying datastores, modules, and objects as ephemeral. (ephemeral=True)
 - * Ability to have control plane datastores which are ephemeral.
- o The following features must be supported by RESTCONF
 - * Module library [RFC7895],
 - * RESTCONF Protocol [RFC8040],
 - * RESTCONF Patch Media Type [RFC8072],
 - * NETCONF Support for event notifications [I-D.ietf-netconf-netconf-event-notifications],
 - * Publication/Subscription via Push [I-D.ietf-netconf-yang-push],
 - * NETCONF and HTTP Transport for Event Notifications [I-D.ietf-netconf-restconf-notif],
 - * Subscribing to Yang datastore push updates [I-D.ietf-netconf-yang-push],

4.3. Capability identifier

The ephemeral-datastore capability is identified by the following capability string: ephemeral (TBD URI)

4.4. New Operations

none

4.5. modification to data resources

RESTCONF must be able to support the ephemeral data in a control plane datastore

RESTCONF library functions must be able to store an indication that a data module has ephemeral state.

4.6. Modification to existing operations

The current operations in RESTCONF are: OPTIONS, HEAD, GET, POST, PUT, PATCH, and DELETE.

Editor's note: From here is not solutions but a list of features to discuss with the RESTCONF team.

The operations must support the following things about ephemeral The ephemeral data store has the following general qualities:

1. The ephemeral datastore is never locked. (RESTCONF does not use a locking mechanism.)
2. The ephemeral portion of the intended configuration, applied state, and derived state does not persist over a reboot,
3. an ephemeral node cannot roll-back to its previous value,
4. Since ephemeral data store is just data that does not persist over a reboot, then in theory any node or group of nodes in a YANG data model could be ephemeral. The YANG data module must indicate what portion of the data model (if any) is ephemeral.
 - * A YANG data module could be all ephemeral (e.g. [I-D.ietf-i2rs-rib-data-model]) with no directly associated configuration models,
 - * A YANG model could be all ephemeral but associated with a configuration model
 - * or a single data node or data tree could be made ephemeral.
5. The management protocol (NETCONF/RESTCONF) needs to signal which portions of a data model (node, tree, or data model) are ephemeral in the module library [RFC7895].

5. IANA Considerations

This is a protocol strawman - nothing is going to IANA.

6. Security Considerations

The security requirements for the I2RS protocol are covered in [I-D.ietf-i2rs-protocol-security-requirements]. The security environment the I2RS protocol is covered in [I-D.ietf-i2rs-security-environment-reqs]. Any person implementing

or deploying the I2RS protocol should consider both security requirements.

7. Acknowledgements

TBD

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