

I2RS working group  
Internet-Draft  
Intended status: Informational  
Expires: September 30, 2017

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March 29, 2017

RESTCONF Changes to Support I2RS Protocol  
draft-hares-netconf-i2rs-restconf-02.txt

Abstract

This document describes two RESTCONF optional capabilities (i2rs-control plane capability, ephemeral state capabilities) that are needed to support the I2RS protocol needs.

The purpose of this draft is to kick-start the discussions with I2RS Working Group and NETCONF WG 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]. One difference between the proposed capabilities for i2rs control-plane capability additions to NETCONF and the proposed capabilities for i2rs control-plane for RESTCONF is write-collection. RESTCONF has edit-collision capability already which only needs a usage description.

### 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 previous 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 datastore 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. 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: i2rs-control-plane

#### 3.1. Overview

The i2rs-control-plane datastore capability enables the RESTCONF to support the following dynamic control plane datastore.

- o API resource that is `{+restconf}/datastore/<datastore-name>/data/` 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 datastore (per [I-D.ietf-netmod-revised-datastores]) with the ability to return meta-data with the following information:
  - \* Entity-Tag encoding of `<client-id><priority>` or any portion of the filter.
  - \* "with defaults"
  - \* "with validation" - Yang specified validation (Unclear if this is the best way for validation.)

Ability to provide read access for the configuration datastore

Ability to provide read access for other dynamic 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 Notifications [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.

## 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 a dynamic 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 get (aka read) references (to/from) the {+restconf/data} datastore, and {+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 datatstore or per object. [Editor's note: Aid is needed to determine how validation occurs.]

**Ephemeral in Data Modules** 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 an an control-plane dynamic datastore. This is any API resource that is `{+restconf}/datastore/<datastore-name>/data/` and operational state specific to the control plane datastore (`{+restconf/cp-data/opstate}`).

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

#### 4.6. Modification to existing operations

RESTCONF operations of GET, POST, PUT, PATCH, and DELETE must be able to filter on meta-data with "ephemeral" flag. (Should this be only read).

The operations must support the following things about ephemeral.

1. The ephemeral does not persist over a reboot,
2. an ephemeral node cannot roll-back to its previous value,

## 5. IANA Considerations

TBD -

## 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.

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TBD

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