YANG Device Profile for Redfish Network Management

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Distributed Management Task Force
Disclaimer

• The information in this presentation represents a snapshot of work in progress within the Distributed Management Task Force (DMTF)
• This information is subject to change without notice. The standard specifications remain the normative reference for all information
• For additional information, see the DMTF website (dmtf.org)
Overview

- Redfish standard: Converged Infrastructure (CI) management interface
  - CI = rack-integrated compute, network and storage for data centers
  - CI data center networks (e.g., top of rack switches) are crucial
- Redfish network management – based on YANG module reuse
  - Translate YANG to Redfish interface schema
- Our (initial) goal: baseline data center switch/router device profile for top-of-rack CI switches
  - List of applicable YANG modules
  - Structure for how modules go together to manage a top-of-rack CI switch
- Result: IETF YANG device profile for use by IETF, DMTF, etc.
  - Device profile should not be Redfish-specific
  - Looking for help and guidance
What is Converged Infrastructure?

- Server, storage and networking:
  - Assembled into a larger system
  - Managed together via unified management
  - Usually part of an orchestrated solution
- One to four network switches per rack
- Datacenter grows by adding racks
Redfish™: Why a New Interface?

- Market shifting to scale-out solutions
  - Sea of simple servers; reliability via software
- Customers exhausting existing server management interface (IPMI)
  - IPMI = Intelligent Platform Management Interface
  - Inadequate security, limited functionality and hard to extend
- Customer requirements:
  - Single interface for managing all datacenter platforms and devices
  - Expect APIs to use cloud/web protocols, structures and security model
- DMTF released Redfish 1.0.0 in Aug 2015
  - v1.0.0 included interface spec and initial models. Released Interface Spec v1.1 on Dec 2016. Released three supplemental models in 2016.
  - Standard organizations are aligning to Redfish (SNIA, OCP, TGG, and UEFI)
  - Redfish Forum has 24 member companies, including most major server vendors

SNIA = Storage Network Industry Association
TGG = The Green Grid
UEFI = Unified Extensible Firmware Interface
OCP = Open Compute Project
Why Redfish for Networking?

Completes the converged infrastructure management API story

- A single interface protocol to manage compute, storage and network
  - CI will need common manageability for compute and networking
- Network device management reuses Redfish hardware component models
  - Chassis, thermal, power, fan, embedded compute, etc.
- Results in a common interface for inventory, control, etc.
How does Redfish manage network devices?

• Expose IETF YANG models as Redfish schema
  • YANG modules (and their "container" nodes) become Redfish resources
  • The internal node structure of each YANG module is retained
    • YANG "Lists" are transformed into Redfish collections
  • Multiple devices can be managed as elements of the network device collection
    • /redfish/v1/NetworkDevices/MySwitch1
    • /redfish/v1/NetworkDevices/MySwitch2
  • Also supports different views of the same device

• Access those models via Redfish JSON
  • Consistent with compute and storage management
DMTF Redfish Standard

- Redfish Interface (RESTful)
  - HTTP/HTTPS - protocol
  - JSON – format of content
- Redfish Models
  - JSON content described in OData CSDL\(^1\)
  - Tool converts OData CSDL to json-schema

\(^1\)OData is an OASIS Standard
\(^2\)CSDL = Common Schema Definition Language
Mapping YANG-to-CSDL

YANG data model (RFC7223)

```
+-rw interfaces
   | ++-rw interface* [name]
   | ++-rw name string
   | ++-rw description? string
   | ++-rw enabled? boolean
   | ++-rw type identityref
   | ++-rw link-up-down-trap-enable? enumeration
+-ro interfaces-state
   +---ro interface* [name]
   +---ro name string
   +---ro type identityref
   +---ro admin-status enumeration
```

Redfish JSON HTTP GET response

```
{
   "Id": "ethernet1",
   "Name": "ethernet1",
   "Description": "Ethernet interface on slot 1",
   "type": "iana_if_type:ethernetCsmacd",
   "enabled": "true",
   "link_up_down_trap_enable": "true"

   "@odata.context": "…",
   "@odata.type": "#interface_v1_0_0.interfaces",
   "@odata.id": "/redfish/v1/NetworkDevices/Switch1/ietf_interfaces/interfaces/ethernet1"
}
```
Example Mapping – Resultant Resources

Complete YANG structure reuse

/redfish/v1/NetworkDevices/{id}/ietf_interfaces
/redfish/v1/NetworkDevices/{id}/ietf_interfaces/interfaces
/redfish/v1/NetworkDevices/{id}/ietf_interfaces/interfaces/{id}
/redfish/v1/NetworkDevices/{id}/ietf_interfaces/interfaces_state
/redfish/v1/NetworkDevices/{id}/ietf_interfaces/interfaces_state/{id}
/redfish/v1/NetworkDevices/{id}/ietf_interfaces/interfaces_state/{id}/statistics

/redfish/v1/NetworkDevices/{id}/ietf_system/system
/redfish/v1/NetworkDevices/{id}/ietf_system/system/authentication
/redfish/v1/NetworkDevices/{id}/ietf_system/system/clock
/redfish/v1/NetworkDevices/{id}/ietf_system/system/dns_resolver
/redfish/v1/NetworkDevices/{id}/ietf_system/system/dns_resolver/options
/redfish/v1/NetworkDevices/{id}/ietf_system/system/ntp
/redfish/v1/NetworkDevices/{id}/ietf_system/system/ntp/udp
/redfish/v1/NetworkDevices/{id}/ietf_system/system_state
/redfish/v1/NetworkDevices/{id}/ietf_system/system_state/clock
/redfish/v1/NetworkDevices/{id}/ietf_system/system_state/platform

RFC7223 (interfaces)
RFC7224 (IANA)
RFC7277 (IPv4/v6)

RFC7317 (system)
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Backup
Redfish Capabilities (v1.0+)

Discovery
• Chassis
• Computer systems
• Managers

Server/Platform Information
• Server identification and asset info
• Host network MAC addresses
• Local storage
• Power supply and fans
• State and Status

Common Manageability
• Change boot order / device
• Reboot / power cycle server
• Power usage and thresholds
• Temperature
• Config serial console access via SSH

BMC Infrastructure
• View / configure BMC network settings
• Manage local BMC user accounts

Eventing, Logs, Accounts
• Subscribe/publish event model
• Logs and entries
• Accounts

New Manageability¹
• BIOS
• Memory
• Disk drives, Storage & Volume
• Endpoints & fabric
• PCIe switch, device & zone
• Firmware/Software inventory & Update

¹Via three model releases in 2016
DMTF Redfish Tools

- Open sourced DMTF tools
- Redfish files
- YANG RFCs

- YANG RFC
  - YANG-to-Redfish
  - describes
    - CSDL
      - OData CSDL
      - CSDL to JSON-schema Converter
      - json-schema
      - Document Generator
      - Redfish Documentation
  - describes
    - JSON (mockup)
      - Mockup Creator
      - Mockup Server (GET)
      - Profile Simulator
      - Interface Emulator
      - Working Service
      - Redfish Service implementations
      - Service Validator
      - Service Conformance
      - Command Line
Redfish Resource Map

GET http://<ip-addr>/redfish/v1/Systems/{id}/Processors/{id}

The Redfish Resource Explorer (redfish.dmtf.org) allows exploration the resource map

www.dmtf.org
Mapping Guidelines

- Retain all naming (spelling and capitalization)
- When required, synthesize names to retain YANG scoping
- Align to Redfish string convention
  - Convert dashes ("-") to underlines ("_"), when used in an identifier
  - Convert colons (":") to periods ("."), when used in an identifier
- Map RFC's as-is - suppress desire to optimize
- Convert everything in the RFC – don't worry about feature exposure exclusion
- Treat some YANG statements as a pre-processor style directive (e.g. uses, grouping)