Managing Network Devices with Redfish & YANG

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Disclaimer

• The information in this presentation represents a snapshot of work in progress within the DMTF.
• This information is subject to change. The Standard Specifications remain the normative reference for all information.
• For additional information, see the Distributed Management Task Force (DMTF) Web site.
What is the Distributed Management Task Force?

• An Industry Standards Organization
  • Developing manageability standards for 25 years (est. 1992)
  • Membership includes 65 companies and industry organizations
  • With active chapters in China and Japan

• Allied with
  • 14 standard development organizations (alliance partners)
  • 80+ universities and research organizations (academic alliance members)

• Focused on manageability standards
  • For the management of on-platform, off-platform, network services and datacenter infrastructure
  • Recognized nationally (ANSI/US) and internationally (ISO/IEC)

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DMTF Alliance Partners (15)

- American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
- China Communications Standards Association (CCSA)
- China Electronics Standardization Institute (CESI)
- Cloud Standards Customer Council (OMG-CSCC)
- ETSI-Network Function Virtualization (ETSI-NFV)
- The Green Grid (TGG)
- Open Compute Project (OCP)
- Open Data Center Alliance (ODCA)
- Open Data Center Committee (ODCC)
- Open Grid Forum (OGF)
- The Open Group (TOG)
- OpenStack Foundation
- Storage Networking Industry Association (SNIA)
- TeleManagement Forum (TMF)
- Unified Extensible Firmware Interface Forum (UEFI)
Activities of Japan Regional Marketing Task Force

- **Presentations**
  - Present DMTF technologies at exhibitions / international conferences

- **Document translation**
  - Translate informational documents that could be useful for marketing
  - Release Japanese documents on the DMTF Japanese web site
  - Japanese caption for YouTube Redfish school series video

- **Japanese web site**
  - http://dmtf.org/jp
Management Domains

Infrastructure Management

Services Management

Off-platform Manageability (out-of-band and in-band)

On-platform Manageability

CIM = Common Information Model
SMBIOS = System Mgmt BIOS
MCTP = Mgmt Component Transport Protocol

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Redfish – an scalable interface for the Datacenter

- **A RESTful interface**
  - For off-platform management of compute, storage, network and DCIM
  - Leverages existing Internet standards and tool chains
  - Usable by professions and amateurs

- **Resource models for management**
  - Common hardware platform mgmt tasks
  - Eg. Power, thermal, cooling, inventory, reboot, update firmware, telemetry, etc.
  - Extensible to other management domains and for proprietary differentiation

- **On-Platform**
  - Compute
  - Storage
  - Network

- **DCIM* (facilities)**
  - Internet Draft 2017

*DCIM = Data Center Infrastructure Management

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Redfish: Why a New Interface?

- Market shifting to scale-out solutions
  - Datacenters have a sea of simple servers and multi-node servers
  - Customers exhausting the functionality of current manageability interfaces
- Customers asked for a modern interface
  - A single simple interface for managing all datacenter platforms and devices
  - An interface which uses cloud/web protocols, structures, security models and tool chains
  - Schemas to allow introspect of interface and programmatic enablement

```python
HTTP GET https://<ip_addr>/redfish/v1/Systems/CS_1
rawData = urllib.urlopen('https://<ip_addr>/redfish/v1/Systems/CS_1')
jsonData = json.loads(rawData)
print( jsonData['SerialNumber'] )
```

Output: 1A87CA442K

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The Redfish Standard

- Redfish includes
  - An interface definition
  - Model schema

- Redfish interface (RESTful)
  - HTTP/HTTPS - protocol
  - JSON – format of content

- Redfish models schema
  - Schema format for JSON
  - DMTF develops the models for platforms and compute/servers
  - Other organization may create models for their management domain

1 OData is an OASIS Standard
2 CSDL = Common Schema Definition Language
Redfish Capabilities

Chassis Information
- Identification and asset information
- State and status
- Temperature sensors and fans
- Power supply, power consumption and thresholds
- Set power thresholds

Compute Manageability
- Reboot and power cycle server
- Configure BIOS settings
- Change boot order and device
- Update BIOS and firmware
- Memory and NVDIMMs
- Local network interface
- Local storage
- State and status

Management Infrastructure
- View / configure BMC network settings
- Manage local BMC user accounts
- Configure serial console access (e.g. SSH)

Discovery
- Physical hierarchy (rack/chassis/server/node)
- Compute service (servers)
- Management hierarchy (rack mgr, tray mgr, BMC)

Security
- Use HTTPS
- Map roles to privileges

Access and Notification
- Subscribe to published events
- Inspect Logs
- Access via host interface

Composition
- Specific composition
- Enumerated composition

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Compute and Platform Model (DMTF-Redfish)

- **Service Root**
  - `/redfish/v1`
  - **Root**
  - Tasks
  - Sessions
  - Accounts
  - Events
  - Registries
  - Schemas

- **Collection Resource**
  - `/redfish/v1/Systems`
    - Collection of Systems "Logical view"
      - `/Systems/<id>`
      - Computer System
      - Managed By
      - Computer Systems
      - Chassis
      - `/Chassis/<id>`
      - Chassis
      - Managed By
      - Manager
      - `/Managers/<id>`
      - Manager
      - Managed By
      - BMC
      - `/BMC`
  
  - `/redfish/v1/Chassis`
    - Collection of Chassis "Physical view"
      - `/Chassis/<id>`
      - Chassis
      - Managed By
      - Computer Systems
      - `/Systems/<id>`
      - Computer System
      - Managed By
      - Manager
      - `/Managers/<id>`
      - Manager
      - Managed By
      - BMC
      - `/BMC`

- **Single Resource**
  - `/redfish/v1/Systems/CS_1/Processors/2`
    - HTTP GET
    - Processors
    - Memory
    - Disks
    - NICs
    - Power
    - Thermal
    - LogService
    - NW protocol

- **Compute**
  - `/redfish/v1/Systems/CS_1/Processors/2`

- **Platform HW Mgmt**
Redfish is hyper-text
Cannot presume a resource hierarchy
Schema contains the enumerations, descriptions

```
HTTP GET
```
Storage Model (Swordfish)

- Reuses chassis model
- Adds StorageServices & StorageSystems
Network Model – status of manageability

• Complex and disparate toolsets, protocols and systems
• Resource intensive and time consuming
• Proprietary vendor implementations
• Poor portability of skillsets across compute, storage and networking
• Lack of interoperability with rest of infrastructure
Proposal: Redfish models based on YANG models

- YANG is a model driven approach to network management
- Basis for general network industry manageability
  - IETF – YANG is the standard for network management modeling
  - IEEE – Adopted YANG as modeling language
  - Other consortiums and bodies have also adopted YANG for network models (e.g. OpenConfig, OpenDaylight, etc.)
- Large body of existing work
  - Extensive coverage from multiple SDOs
  - Many vendor proprietary YANG models
  - Many man-years of work by industry experts across all networking feature sets
- DMTF wants to leverage the networking industry's expertise
Why use Redfish for Managing Network?

- Completes the converged infrastructure management API story
  - Switches have platform components common to servers and storage
  - Rapid expansion of open Network Operating System (NOS) solutions
  - NFV will need common manageability for compute and networking
- Orchestrator systems can use a common interface for inventory and control
- Allows partnerships with networking standard orgs
  - Specify a prescriptive baseline of YANG models for network switch
  - Reduce overlap and clarify manageability domains
Network Switch Model
Convert from YANG models

✓ Phase 1 - convert a small set of YANG models to Redfish models
  • Proves the process, and validates the converter
  • dmtf.org/sites/default/files/standards/documents/DSP-IS0004_0.9a.zip

• Phase 2 – additional YANG models

Ethernet Switch (Phase 1)
• RFC7223 (Interfaces)
• RFC7224 (IANA Interface types)
• RFC7277 (IPv4 and IPv6)
• RFC7317 (system, system_state, platform, clock, ntp)
The NetworkDevice Resource

The attachment point for Redfish models mapped from the YANG models

/redfish/v1/NetworkDevices/SW_15
Converting YANG to Redfish

YANG outline (RFC7223)

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

YANG model

```
RFC7223
<CODE BEGINS>
module ietf-interfaces {
    ...
}  
<CODE ENDS>
```

Redfish resource (GET response, JSON)

```
{
    "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"
}
```

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Presentations, Internet Drafts & models

- Presentation to IETF 98 to Routing Working Group (RTGWG) and Operations and Management Area WG (OPSAWG)
- Internet-draft “Redfish for Networking”
- Internet-draft “Baseline Ethernet Switch”
- “YANG-to-Redfish Mapping Specification” (WIP)
  - http://www.dmtf.org/sites/default/files/standards/documents/DSP0271_0.5.6.pdf
- Redfish Ethernet Switch model proposal (WIP, Phase 1)
  - http://www.dmtf.org/sites/default/files/standards/documents/DSP-IS0004_0.9a.zip (mockup & CSDL)

WIP = work-in-progress
Redfish Tool chains

1. Tools to enable Redfish modeling
2. Tools to enable Redfish clients
   - Ability for early client development
   - DMTF extending charter to allow contribution to external repositories
Public Redfish Collateral

- Youtube videos: youtube.com/dmtforg
- Open source tools: github.com/DMTF
- Community Forum: redfishforum.com
- Developer's Hub: redfish.dmtf.org
- Specs, presentation: dmtf.org/standards/redfish
- Redfish Forum (SPMF): dmtf.org/standards/spmf
Summary

With Redfish models of YANG, the data center can

• Manage network devices with the same interface managing compute, storage and facilities equipment, as the infrastructure converges
• Leverage modern tool chains to enable manageability

If you are interested…

• Use the Redfish interface for out-of-band manageability in your research
• Provide feedback on issues your discover
• Contribute to and influence Redfish advances
Thank you