



Managing Network Devices with Redfish & YANG

13th International Conference on Network and Service Management
Nov 2017

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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)



DMTF Board Member Companies



Leadership Level Companies

Advanced Micro Devices | China Academy of Telecommunication Research, MIIT
China Electronics Standardization Institute | Cisco | Daten Tecnologia Ltda
Ericsson AB | Getac Technology Corp. | Huawei | Inspur | Mellanox Technologies
Microsoft Corporation | NetIQ Corporation | Positivo Informática SA | Supermicro

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)



the green grid™



Activities of Japan Regional Marketing Task Force

- Presentations

- Present DMTF technologies at exhibitions / international conferences



DMTF booth at Japan IT week autumn 2014



DMTF presentation at Japan IT week autumn 2014

- 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://dmtof.org/jp>

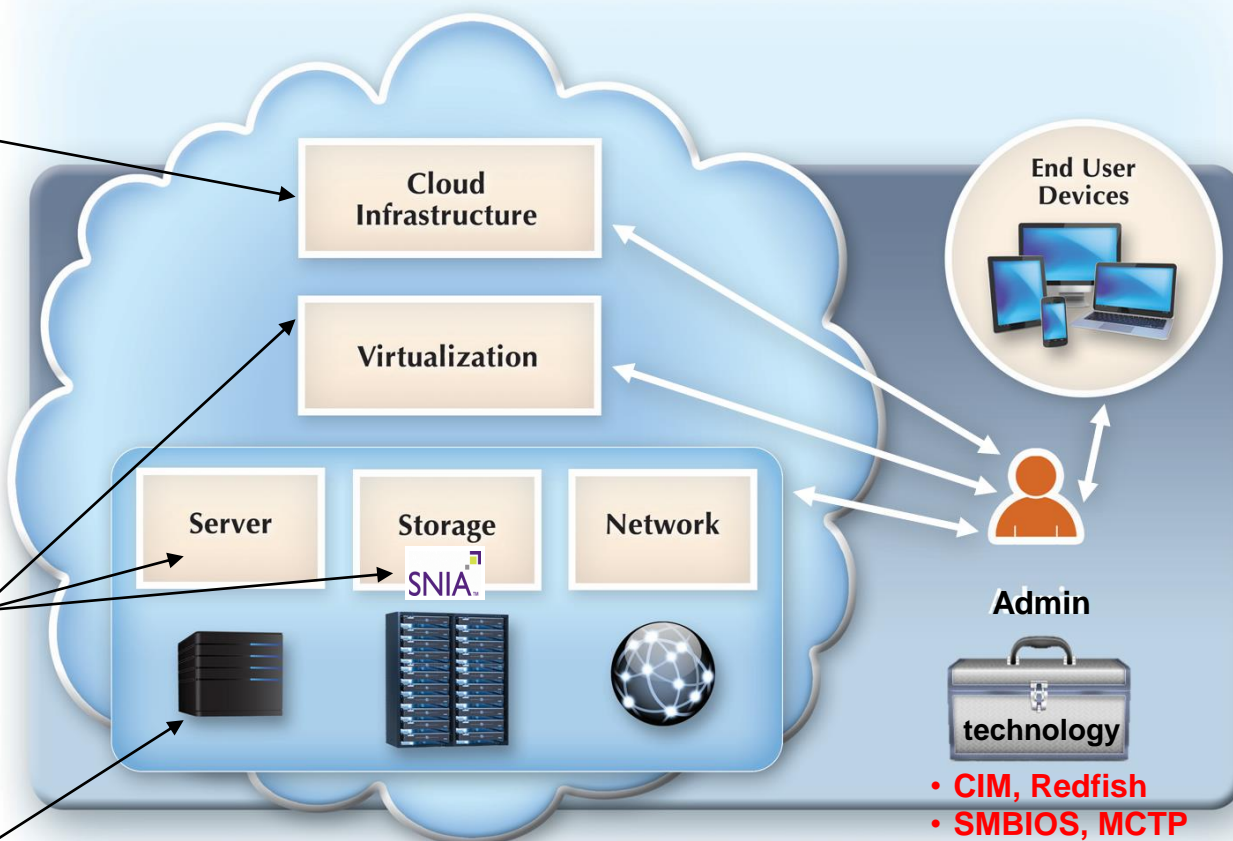
Management Domains

Infrastructure
Management

Services
Management

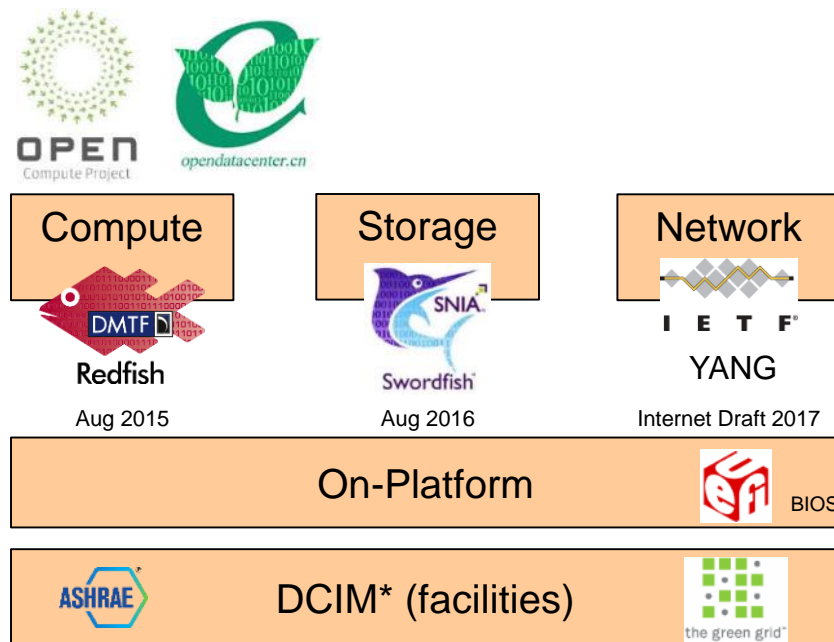
Off-platform
Manageability
(out-of-band and in-band)

On-platform
Manageability



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



*DCIM = Data Center Infrastructure Management

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

HTTP

```
HTTP GET https://<ip_addr>/redfish/v1/Systems/CS_1
```

**Python
code**

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

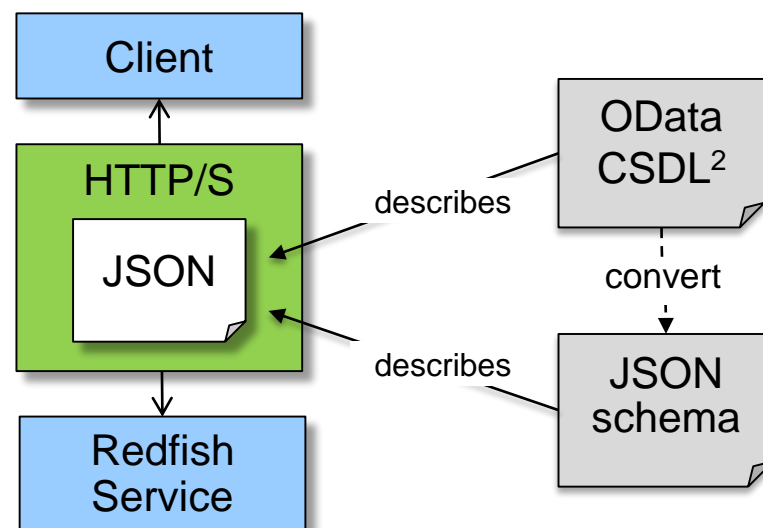
Output

```
1A87CA442K
```



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



¹OData is an OASIS Standard

²CSDL = 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

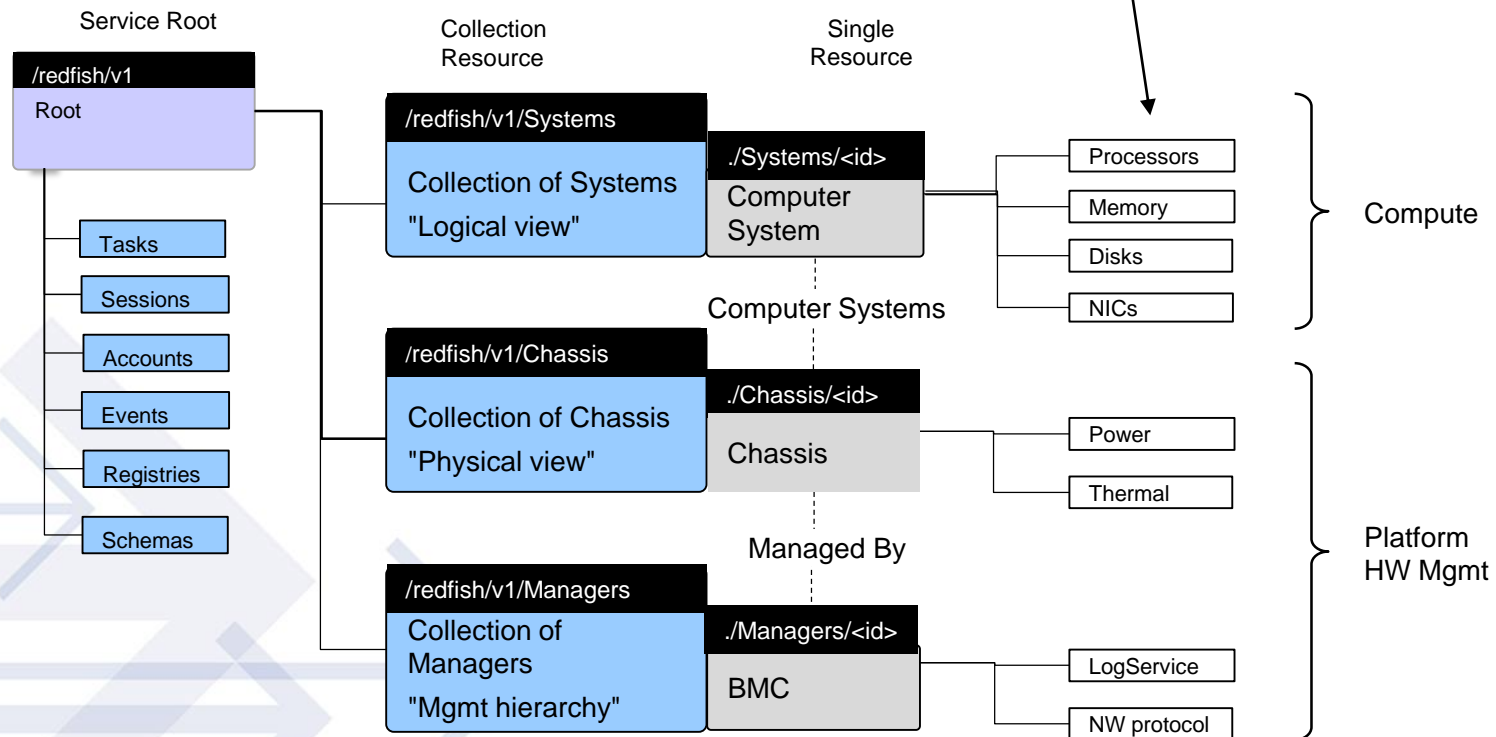
Composition

- Specific composition
- Enumerated composition



Compute and Platform Model (DMTF-Redfish)

HTTP GET /redfish/v1/Systems/CS_1/Processors/2



JSON response (example)

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

Simple properties

Complex properties

Subordinate resources

Associated resources

Actions

```
{
  "@odata.context": "/redfish/v1/$metadata#ComputerSystem.ComputerSystem",
  "@odata.id": "/redfish/v1/Systems/CS_1",
  "Id": "CS_1",
  "Name": "My Computer System",
  "SystemType": "Physical",
  "AssetTag": "free form asset tag",
  "Manufacturer": "Manufacturer Name",
  "Model": "Model Name",
  "SerialNumber": "2M220100SL",
  "PartNumber": "78899498CLF-7",
  "Description": "Description of server",
  "UUID": "00000000-0000-0000-0000-000000000000",
  "HostName": "web-srv344",
  "IndicatorLED": "Off",
  "PowerState": "On",
  "BiosVersion": "P79 v1.00 (09/20/2013)",
  "Status": { "State": "Enabled", "Health": "OK", "HealthRollup": "OK" },
  "Boot": { . . . },
  "ProcessorSummary": { . . . },
  "MemorySummary": { . . . },
  "TrustedModules": [ { . . . } ],
  "Processors": { "@odata.id": "/redfish/v1/Systems/CS_1/Processors" },
  "Memory": { "@odata.id": "/redfish/v1/Systems/CS_1/Memory" },
  "EthernetInterfaces": { "@odata.id": "/redfish/v1/Systems/CS_1/EthernetInterfaces" },
  "SimpleStorage": { "@odata.id": "/redfish/v1/Systems/CS_1/SimpleStorage" },
  "LogServices": { "@odata.id": "/redfish/v1/Systems/CS_1/LogServices" },
  "SecureBoot": { "@odata.id": "/redfish/v1/Systems/CS_1/SecureBoot" },
  "Bios": { "@odata.id": "/redfish/v1/Systems/CS_1/Bios" },
  "PCleDevices": [ { "@odata.id": "/redfish/v1/Chassis/CS_1/PCleDevices/NIC" } ],
  "PCleFunctions": [ { "@odata.id": "/redfish/v1/Chassis/CS_1/PCleDevices/NIC/Functions/1" } ],
  "Links": {
    "Chassis": [ { "@odata.id": "/redfish/v1/Chassis/Ch_1" } ],
    "ManagedBy": [ { "@odata.id": "/redfish/v1/Managers/Mgr_1" } ],
    "Endpoints": [ { "@odata.id": "/redfish/v1/Fabrics/PCle/Endpoints/HostRootComplex1" } ],
  },
  "Actions": {
    "#ComputerSystem.Reset": {
      "target": "/redfish/v1/Systems/CS_1/Actions/ComputerSystem.Reset",
      "@Redfish.ActionInfo": "/redfish/v1/Systems/CS_1/ResetActionInfo"
    }
  }
}
```

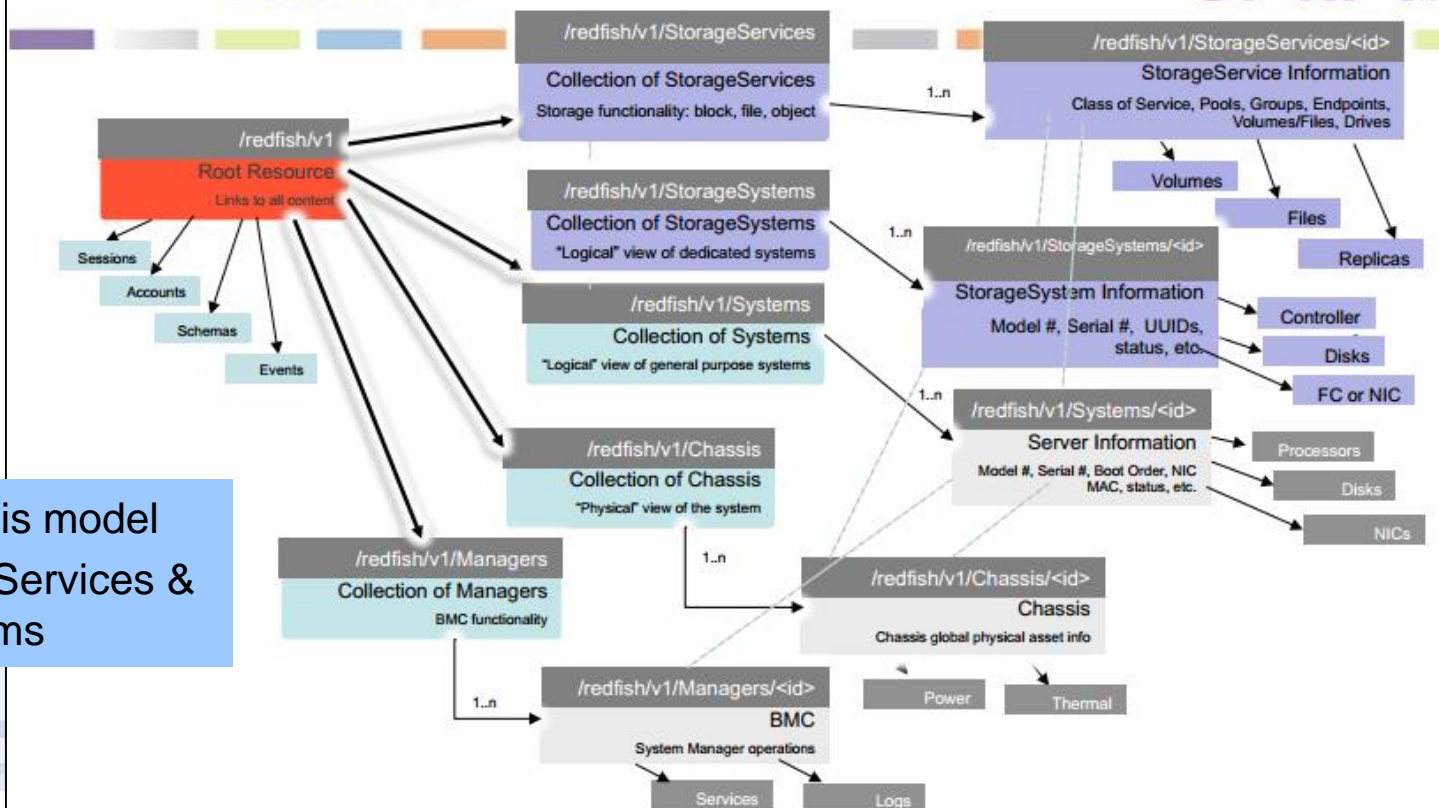
HTTP GET

Storage Model (Swordfish)



- Reuses chassis model
- Adds StorageServices & StorageSystems

Adding Storage to Redfish: Swordfish



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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

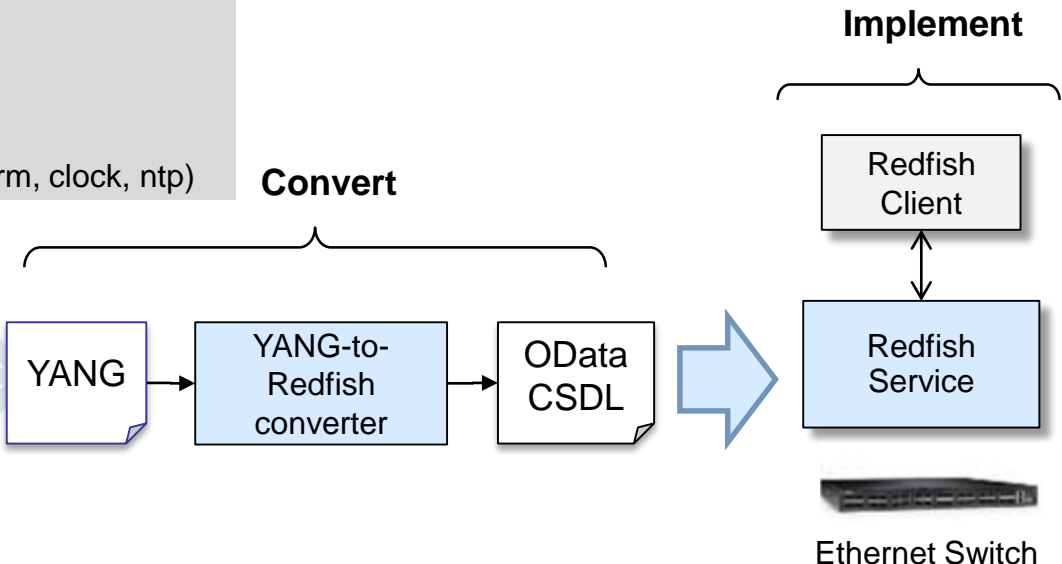
Network Switch Model

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)

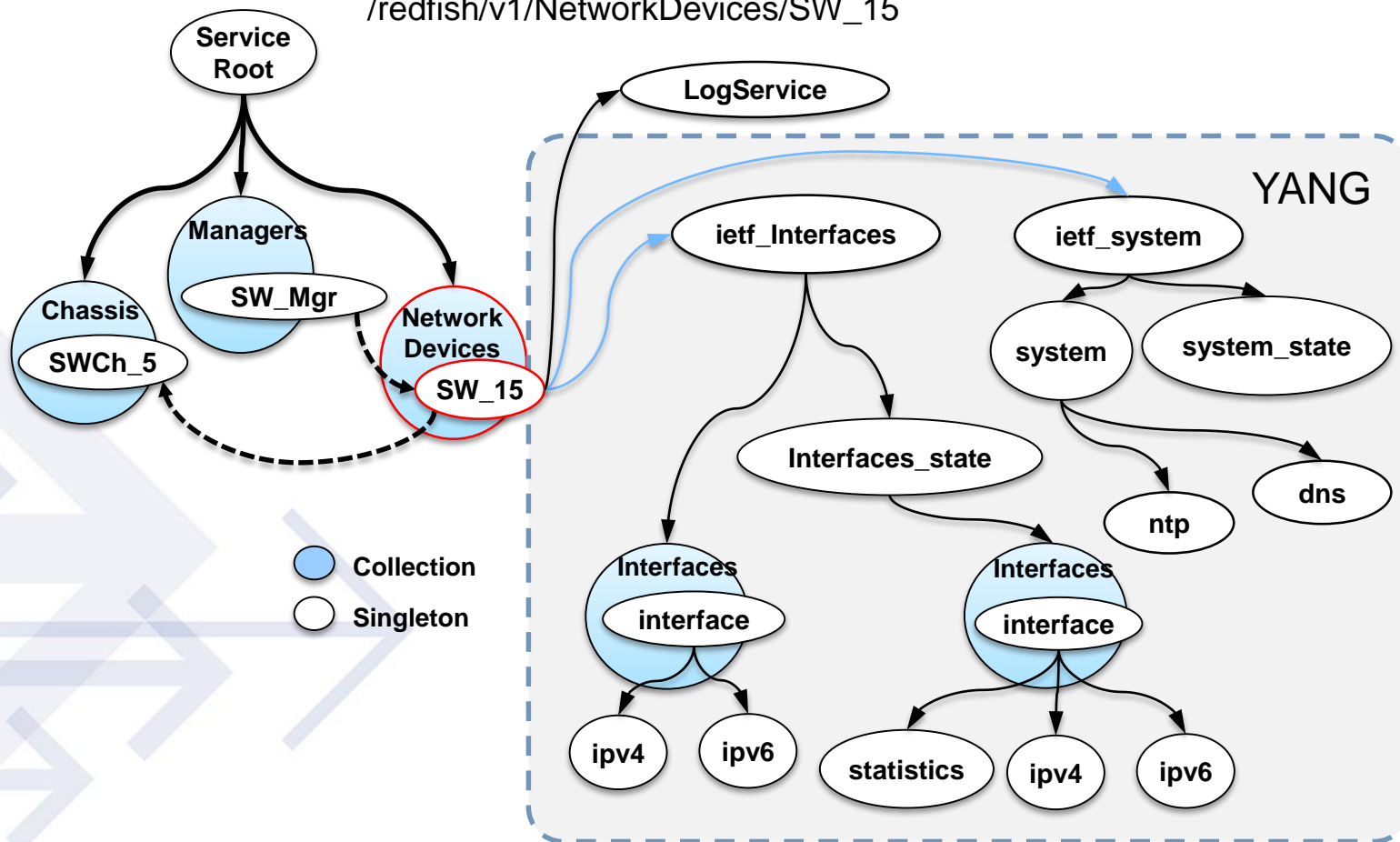
- RFC7223 (Interfaces)
- RFC7224 (IANA Interface types)
- RFC7277 (IPv4 and IPv6)
- RFC7317 (system, system_state, platform, clock, ntp)



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)

```

+--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>
  
```

YANG-to-Redfish Mapping Spec

Translate (mapping)

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"
}
  
```

Redfish CSDL

```

./ietf_interfaces.xml
./ietf_interfaces.interfacesCollection.xml
./ietf_interfaces.interfaces.xml
...
  
```

CSDL describes JSON payloads

Presentations, Internet Drafts & models

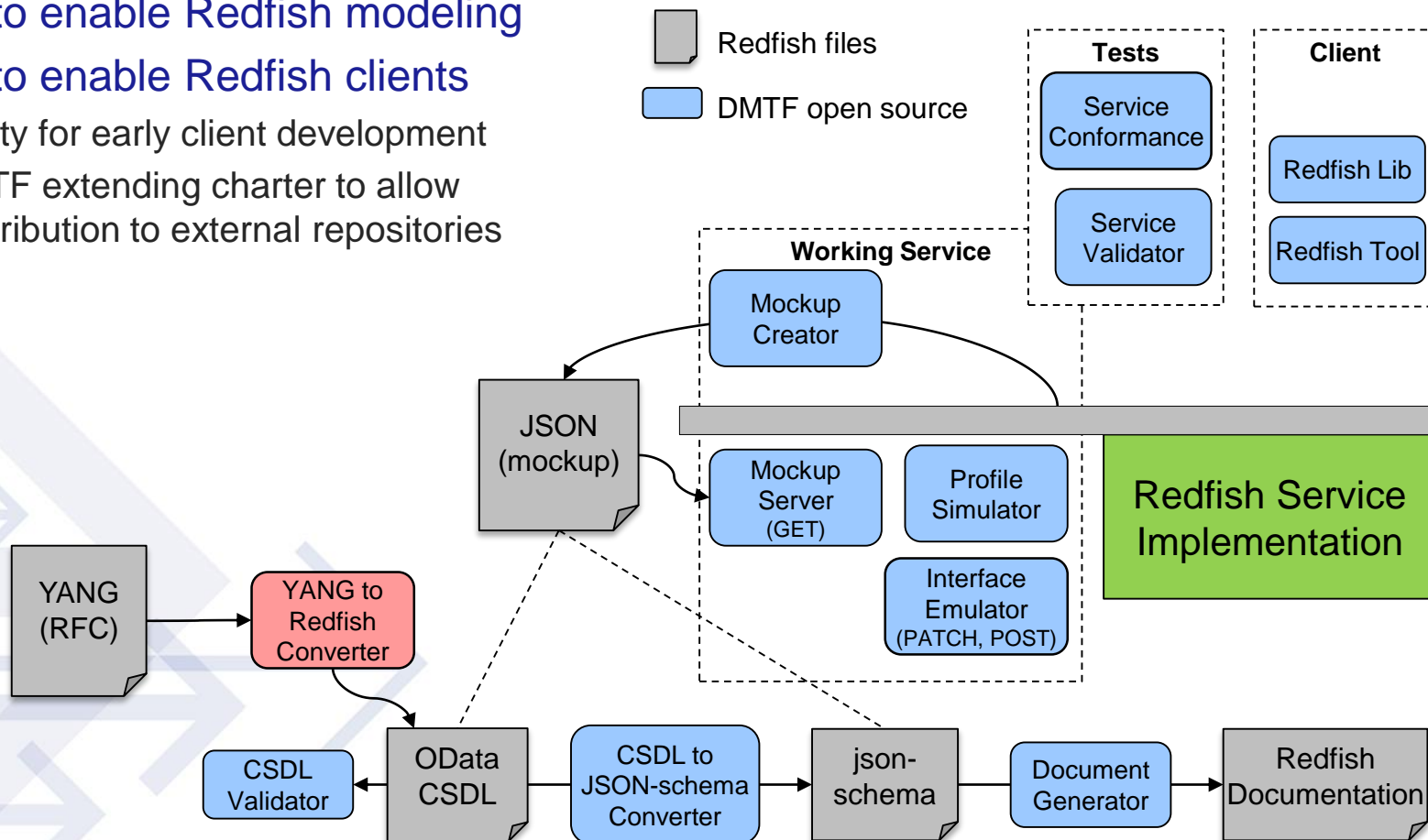
- Presentation to IETF 98 to Routing Working Group (RTGWG) and Operations and Management Area WG (OPSAWG)
 - <https://datatracker.ietf.org/meeting/98/materials/slides-98-rtgwg-yang-device-profile-for-redfish-network-management-draft-wbl-rtgwg-baseline-switch-model-draft-wbl-rtgwg-yang-ci-profile-bkgd>
- Internet-draft “Redfish for Networking”
 - <https://tools.ietf.org/html/draft-wbl-rtgwg-yang-ci-profile-bkgd-00>
- Internet-draft “Baseline Ethernet Switch”
 - <https://tools.ietf.org/html/draft-wbl-rtgwg-baseline-switch-model-00>
- “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)

Redfish Tool chains

<http://github/DMTF>

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
- Open source tools
- Community Forum
- Developer's Hub
- Specs, presentation
- Redfish Forum (SPMF)

youtube.com/dmtforg

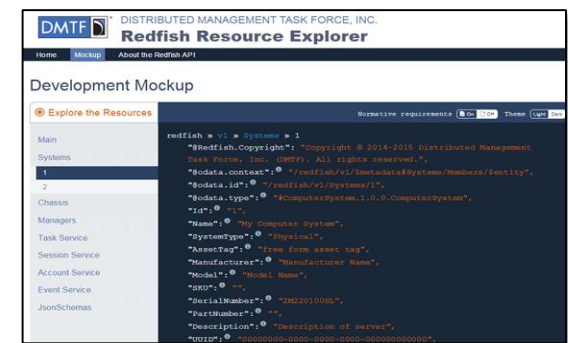
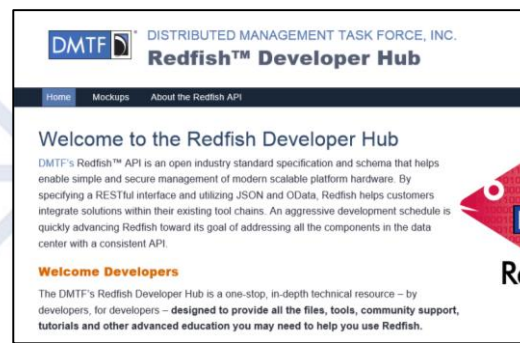
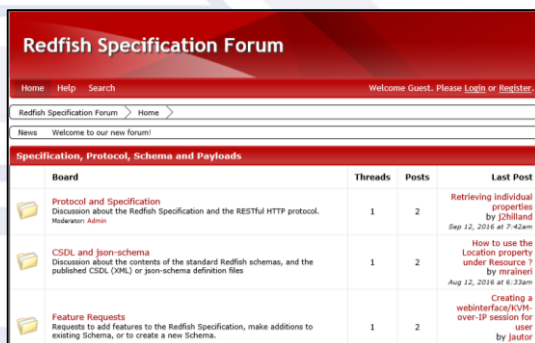
github.com/DMTF

redfishforum.com

redfish.dmtf.org

dmtof.org/standards/redfish

dmtof.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 you discover
- Contribute to and influence Redfish advances



Thank you