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.

www.dmtf.org

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

DMTF Board Member Companies

BROADCOM

ca technologies

DELL

Hewlett Packard Enterprise

HITACHI Inspire the Next

hp

intel

Lenovo

NetApp

software AG

VERTIV

vmware

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)

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://dmtf.org/jp

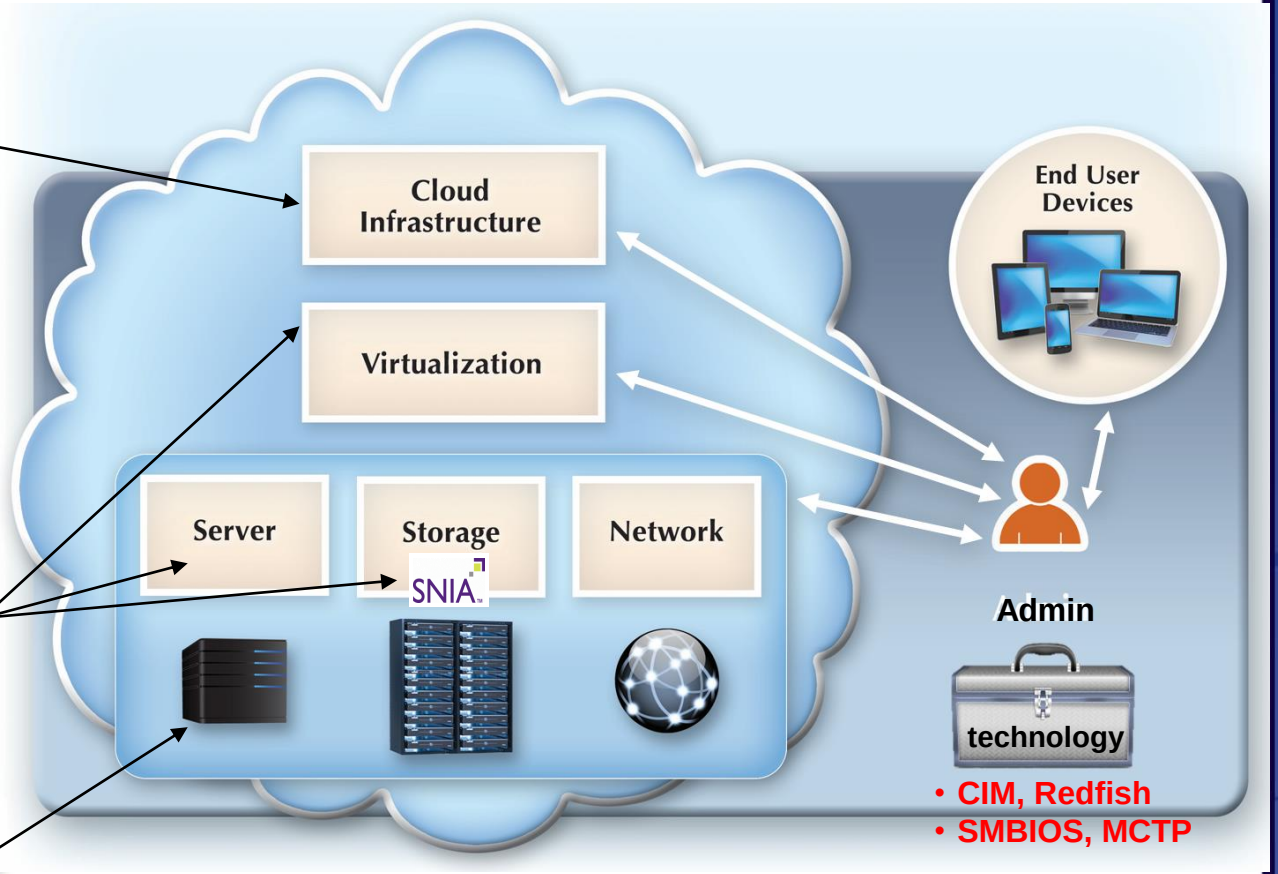
Management Domains

Infrastructure Management

Services Management

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

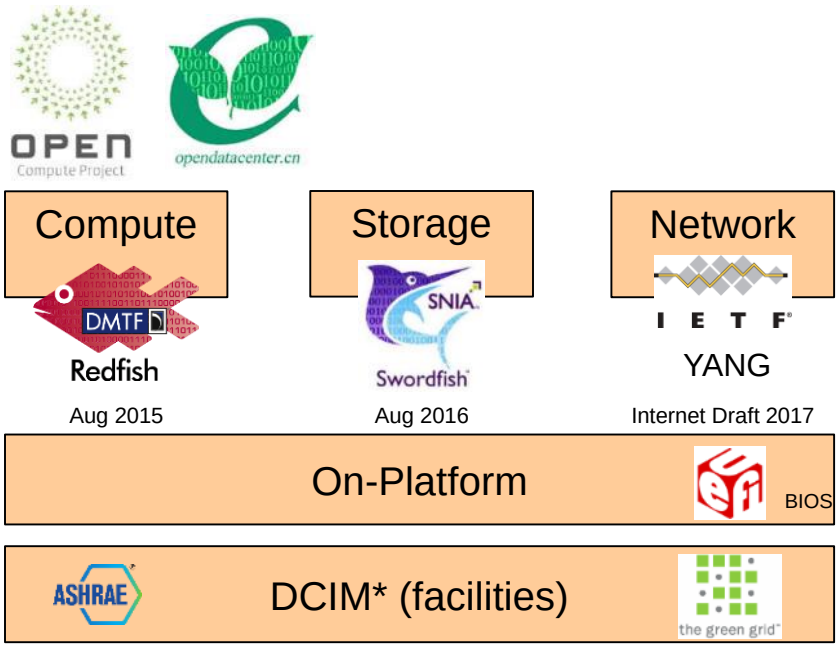
On-platform Manageability



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

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

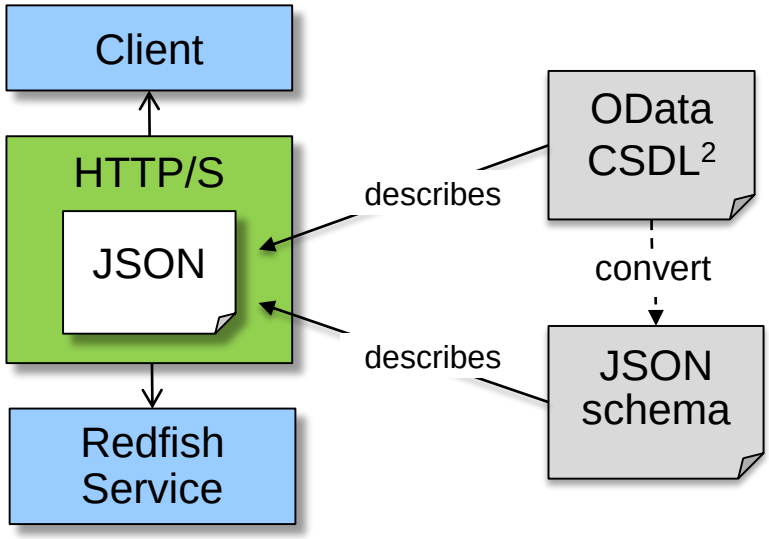
```
rawData = urllib.urlopen('https://<ip_addr>/redfish/v1/Systems/CS_1'
jsonData = json.loads(rawData)
print( jsonData['SerialNumber'] )
```

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



[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)

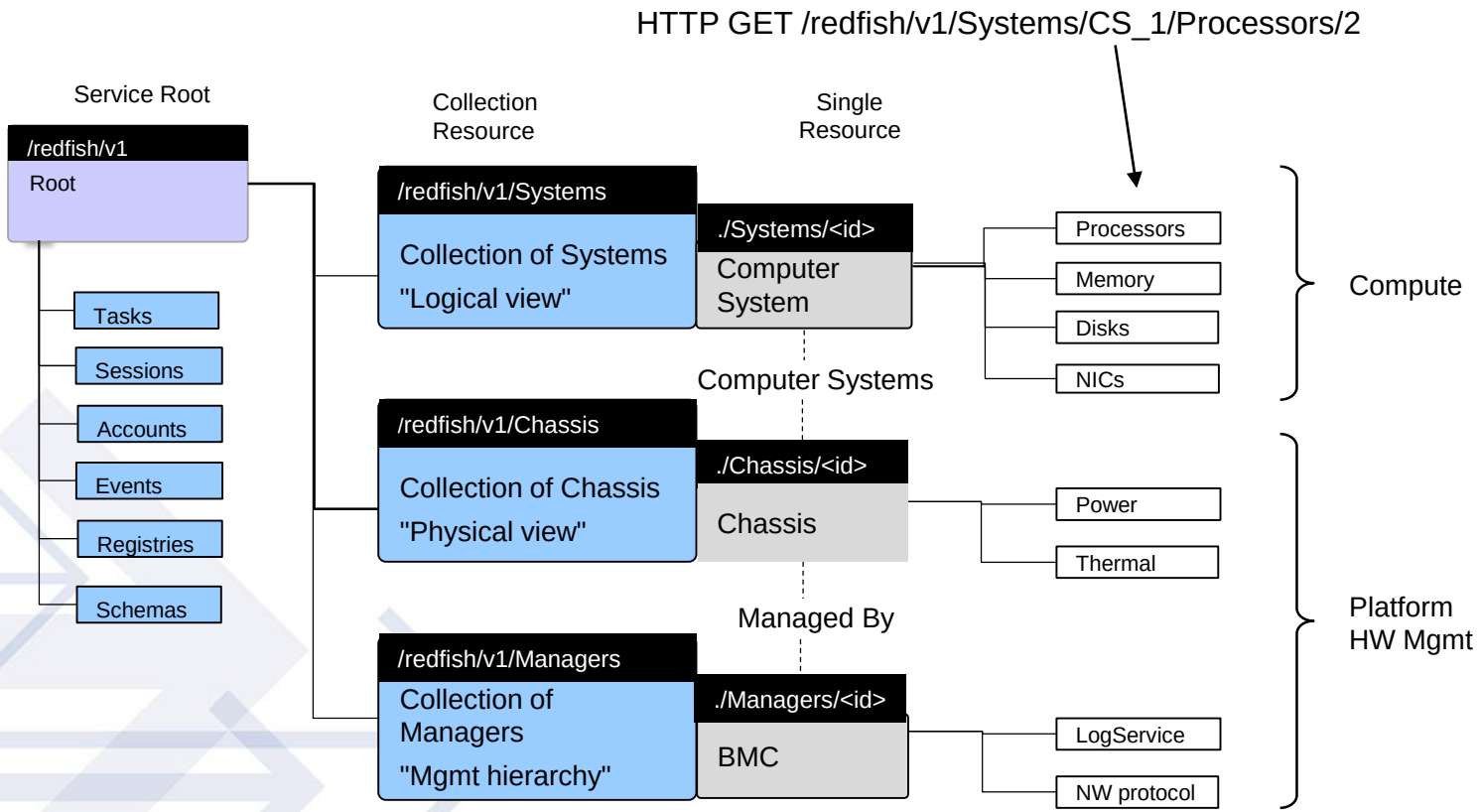
Discovery
- Physical hierarchy (rack/chassis/server/node)
- Compute service (servers)
- Management hierarchy (rack mgr, tray mgr, BMC)

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

Compute and Platform Model
(DMTF-Redfish)



JSON response (example)

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

Simple properties

Complex properties

Subordinate resources

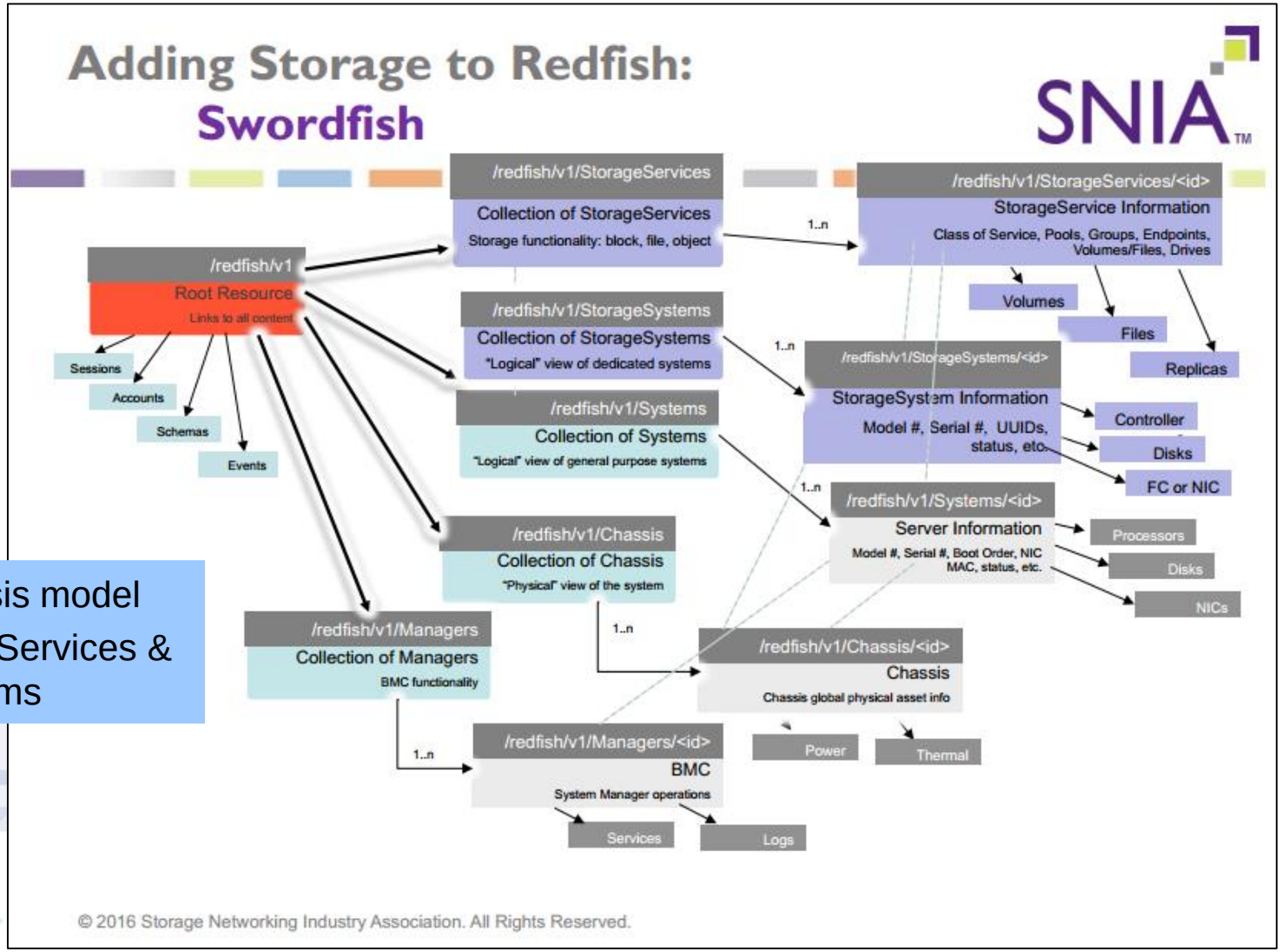
Associated resources

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" },
   "PCIeDevices":         [ {"@odata.id": "/redfish/v1/Chassis/CS_1/PCIeDevices/NIC"} ],
   "PCIeFunctions":       [ {"@odata.id": "/redfish/v1/Chassis/CS_1/PCIeDevices/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/PCIe/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

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

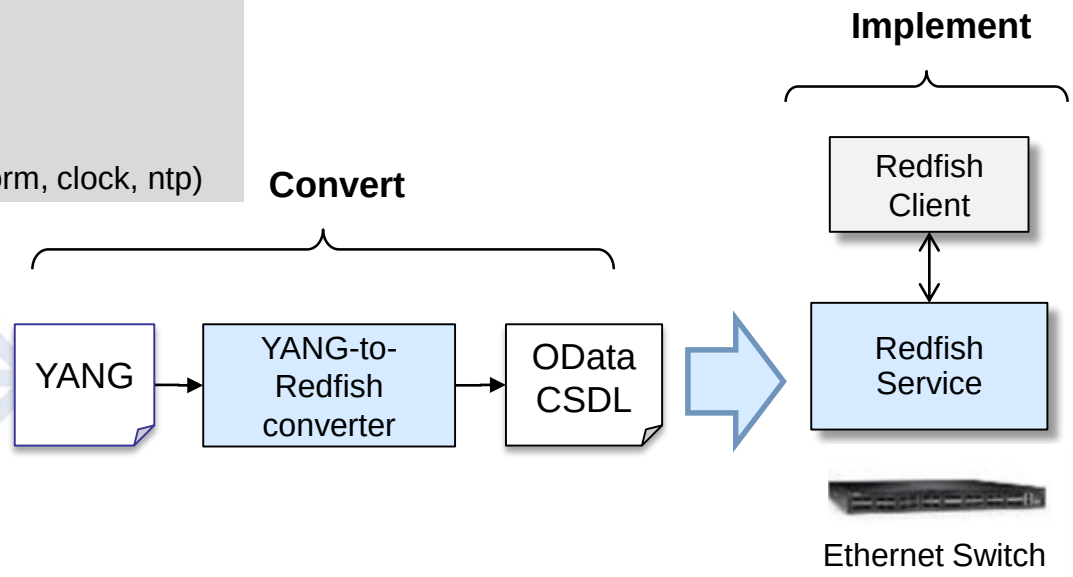
Network Switch Model

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)

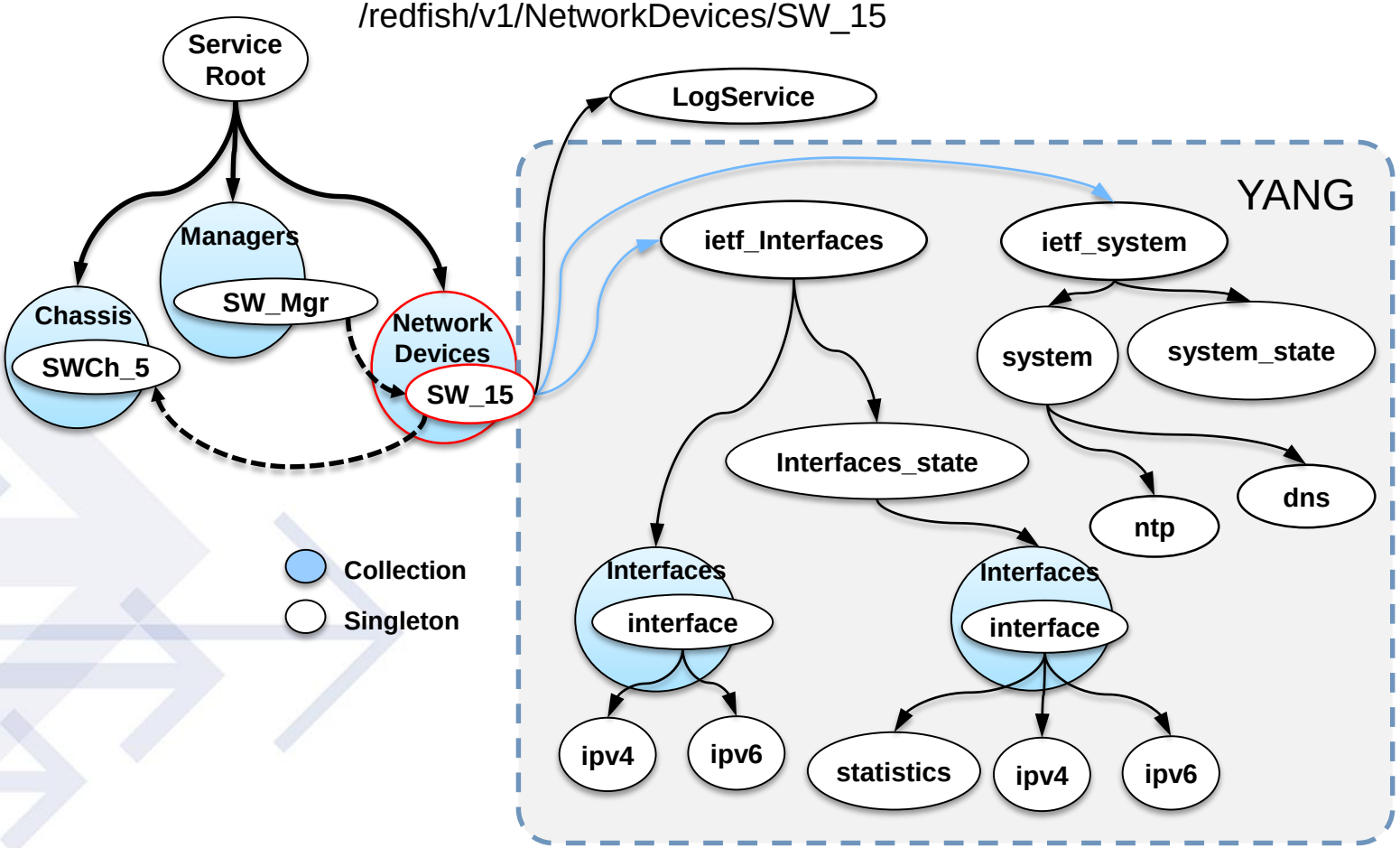
- RFC7223 (Interfaces)
- RFC7224 (IANA Interface types)
- RFC7277 (IPv4 and IPv6)
- RFC7317 (system, system_state, platform, clock, ntp)



The NetworkDevice Resource

The attachment point for Redfish models mapped from the YANG models

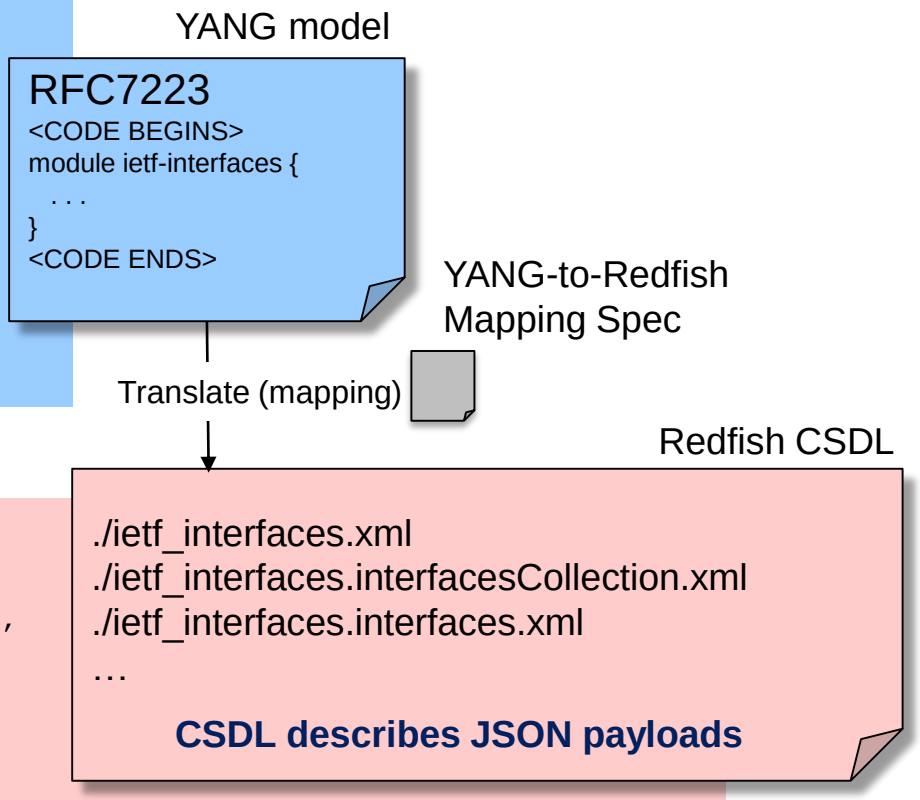
/redfish/v1/NetworkDevices/SW_15



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
```



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"
}
```

Presentations, Internet Drafts & models

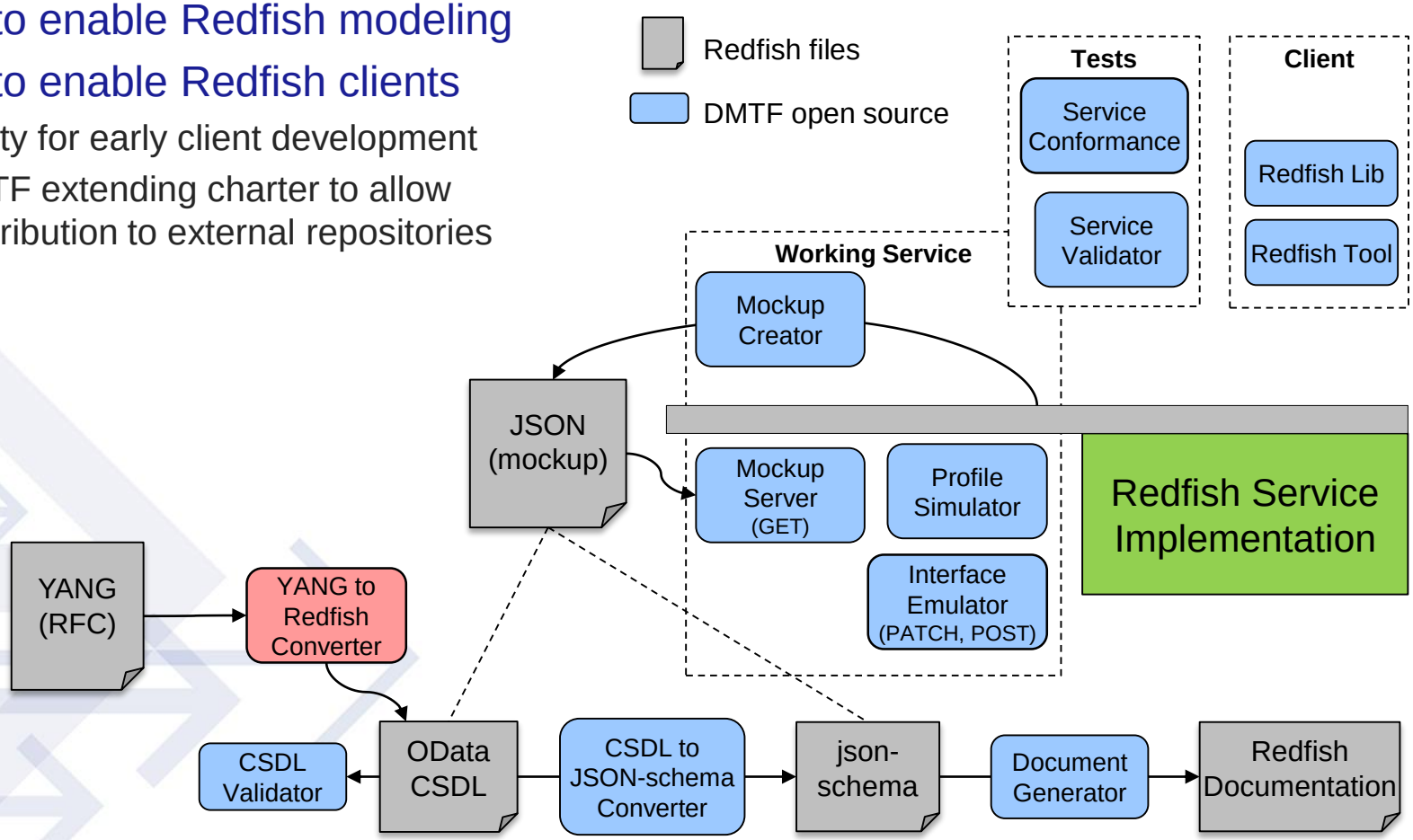
- Presentation to IETF 98 to Routing Working Group (RTGWG) and Operations and Management Area WG (OPSAWG)
  - https://datatracker.ietf.org/meeting/98/materials/slides-98-rtgwg-yang-device-profile-for-redfish-network-management-draft-wbl-rtgwg-baseline-switch-model-draft-wbl-rtgwg-yang-ci-profile-bkgd
- 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)

WIP = work-in-progress

Redfish Tool chains

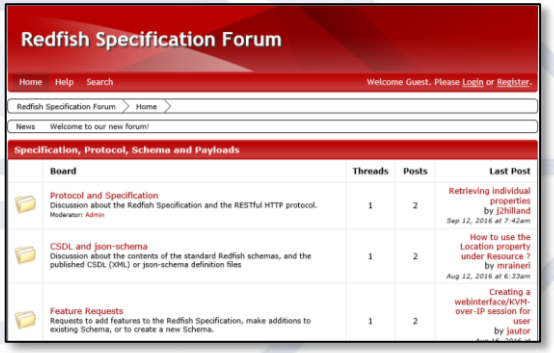
http://github/DMTF

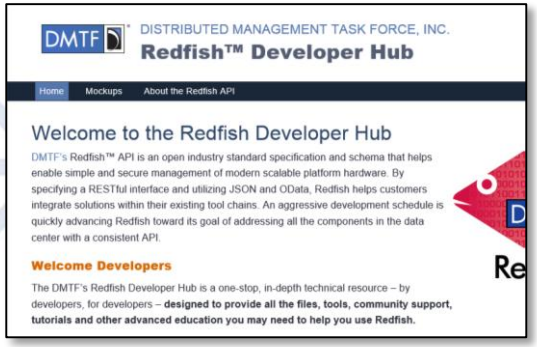
1. Tools to enable Redfish modeling
2. Tools to enable Redfish clients
   - Ability for early client development
   - DMTF extending charter to allow contribution to external repositories

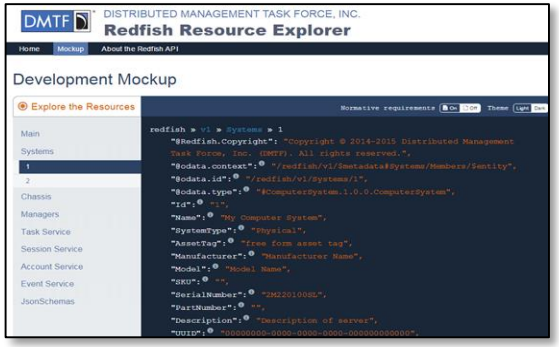


Public Redfish Collateral

- Youtube videos — 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