



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)



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://dmtf.org/jp>



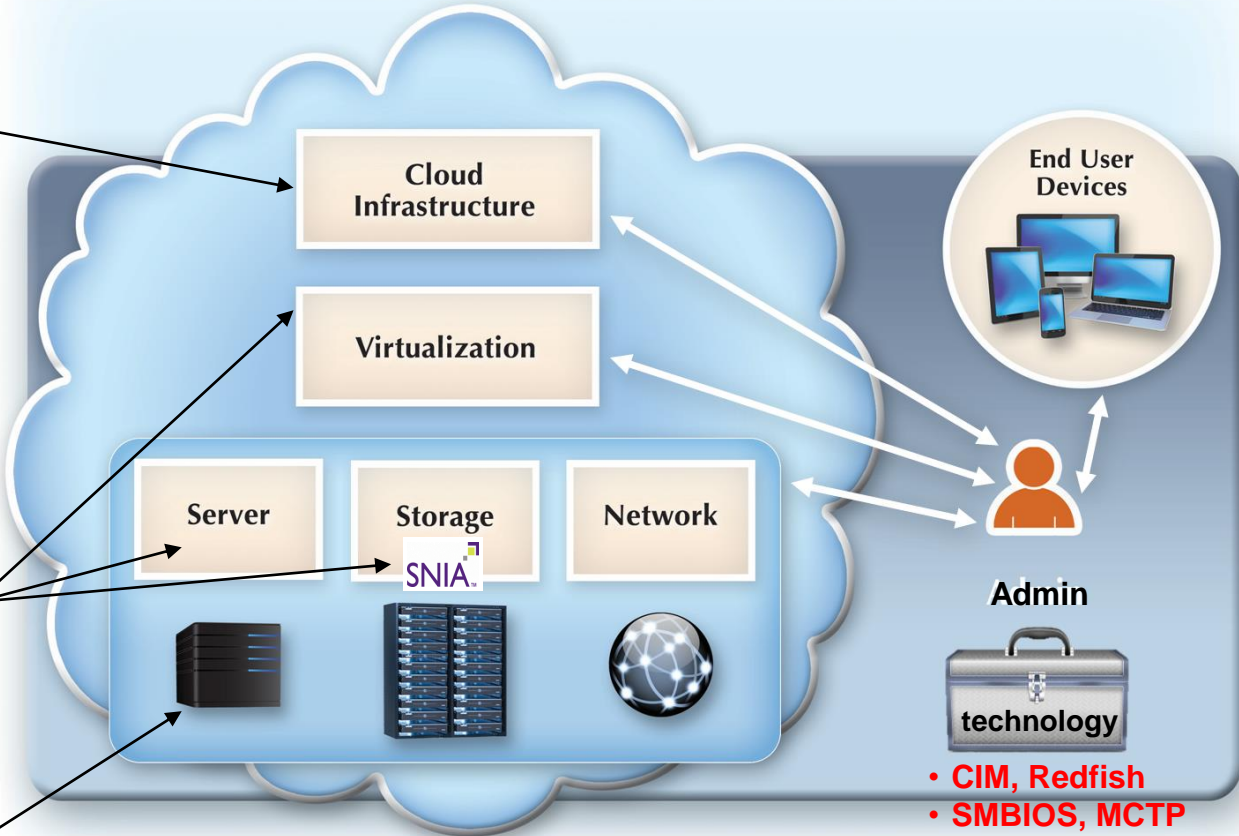
Management Domains

Infrastructure Management

Services Management

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

On-platform Manageability



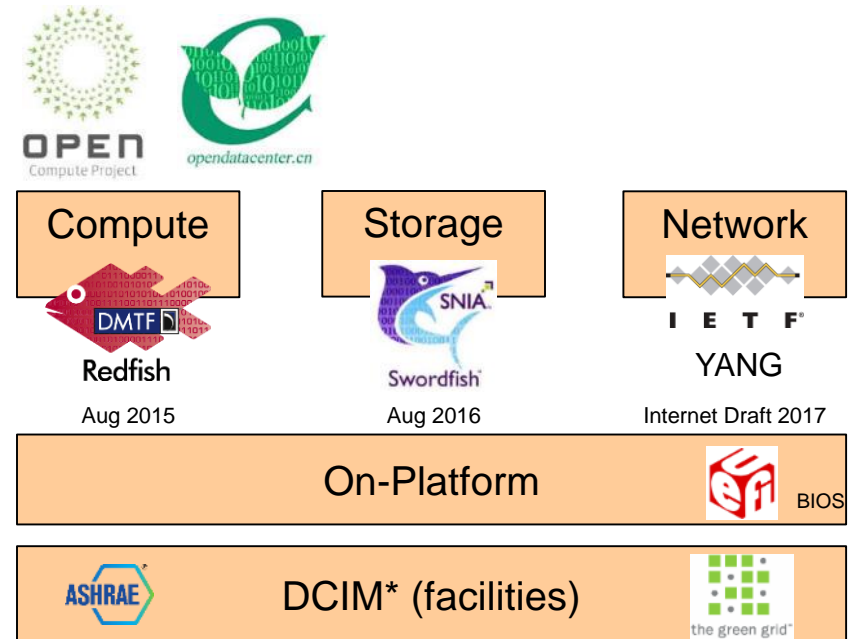
- CIM, Redfish
- SMBIOS, MCTP

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'] )
```

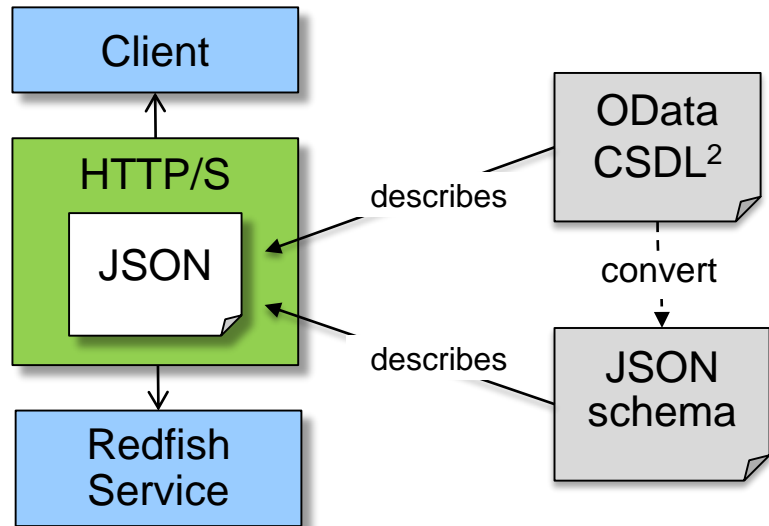
Output

```
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



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

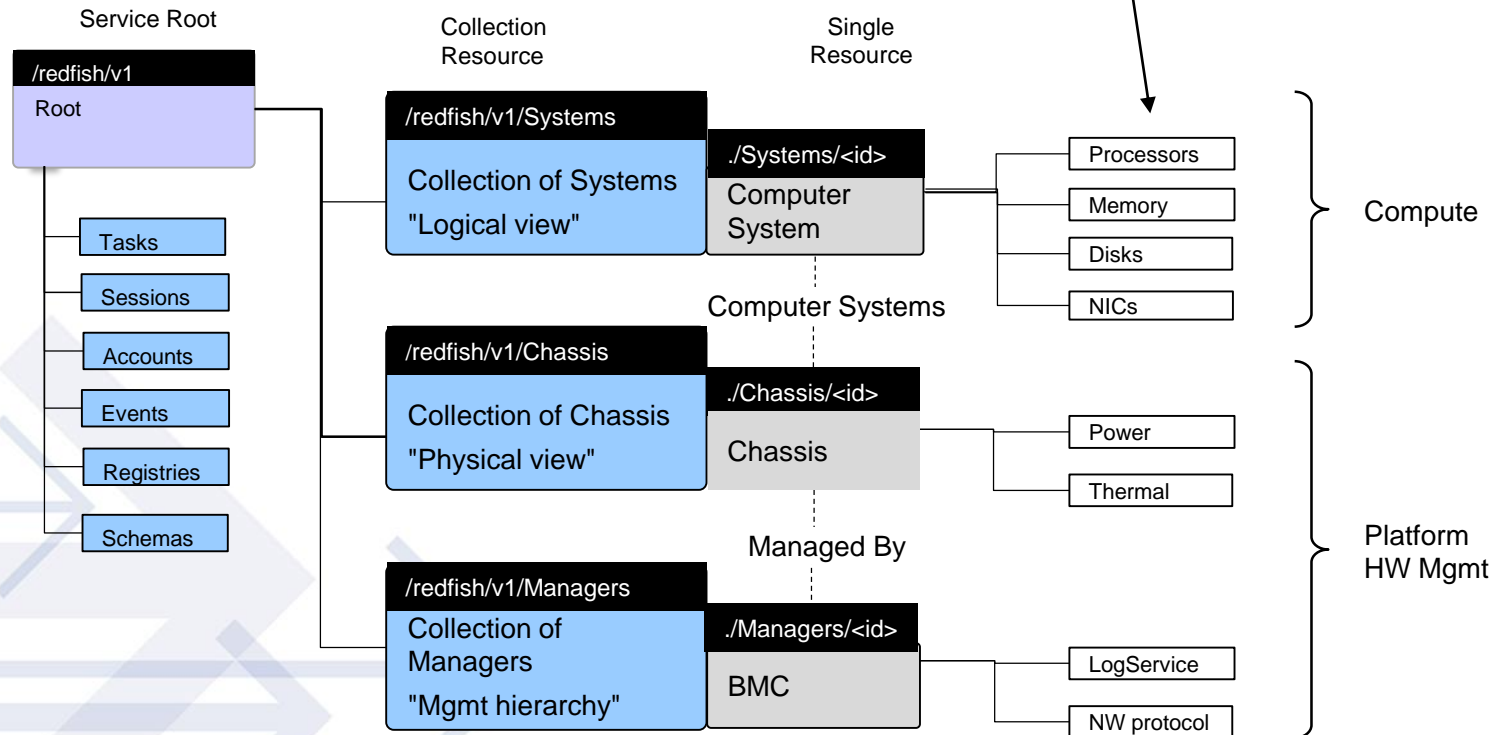
Composition

- 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" },
  "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"
    }
  }
}
```

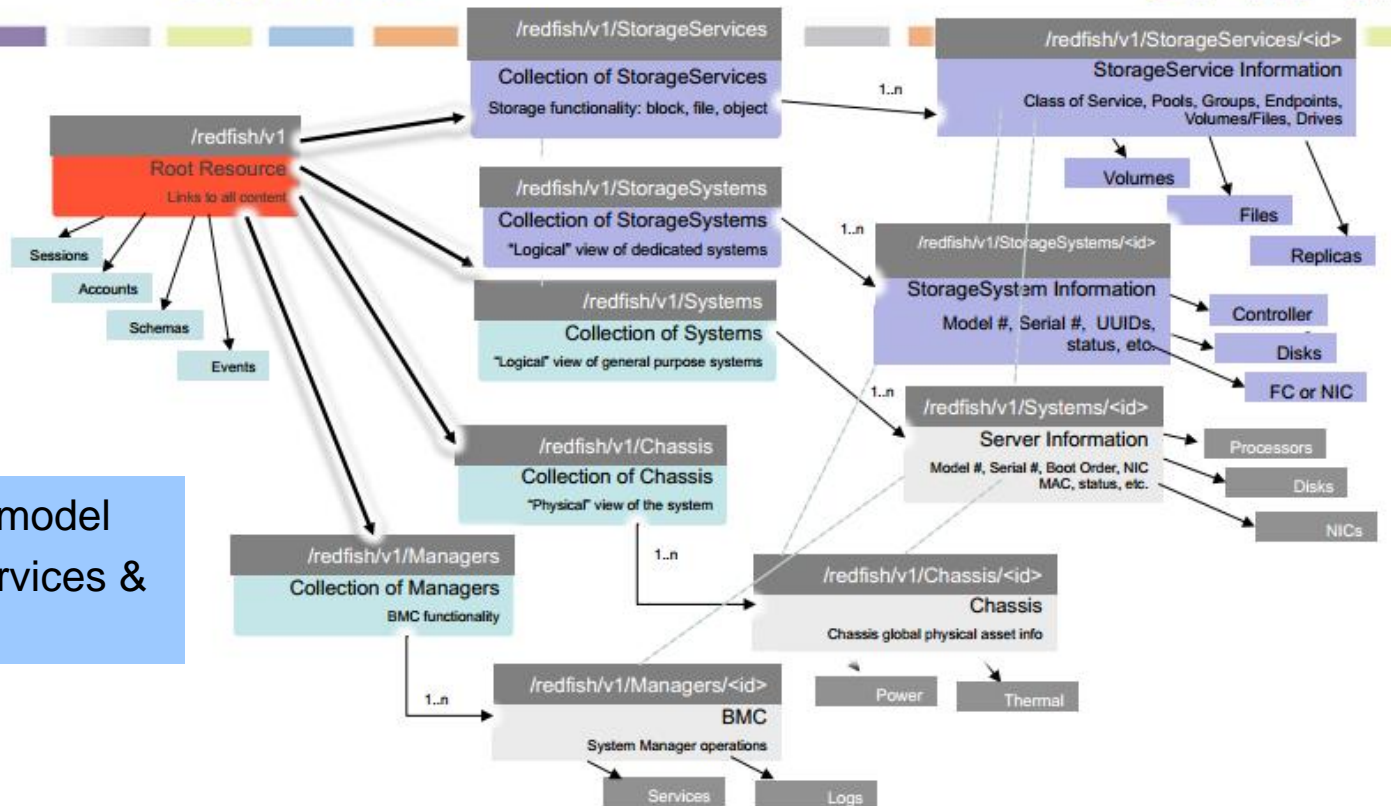
HTTP GET



Storage Model (Swordfish)



Adding Storage to Redfish: Swordfish



- Reuses chassis model
- Adds StorageServices & StorageSystems

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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

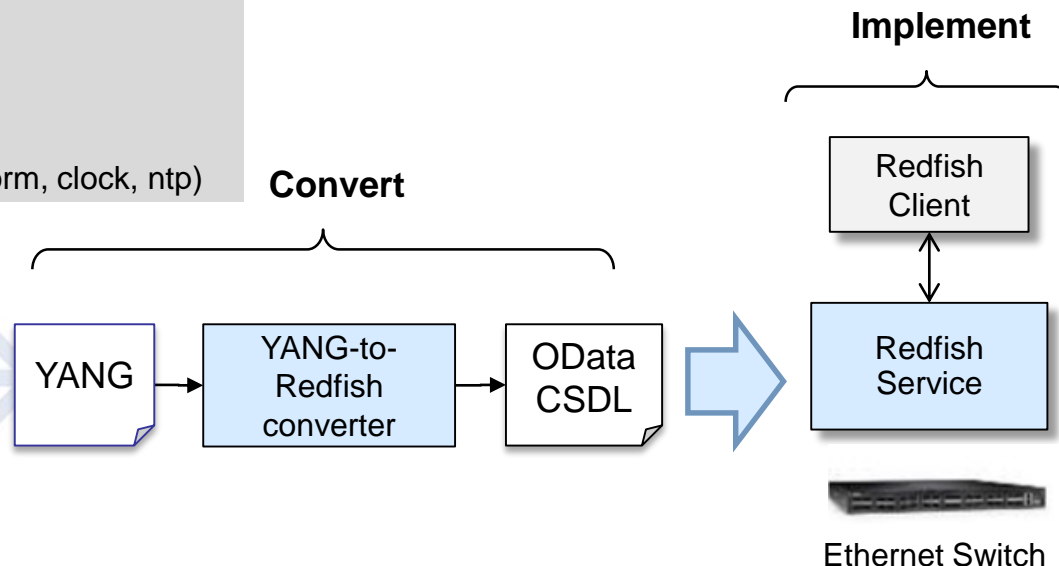
Network Switch Model

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)

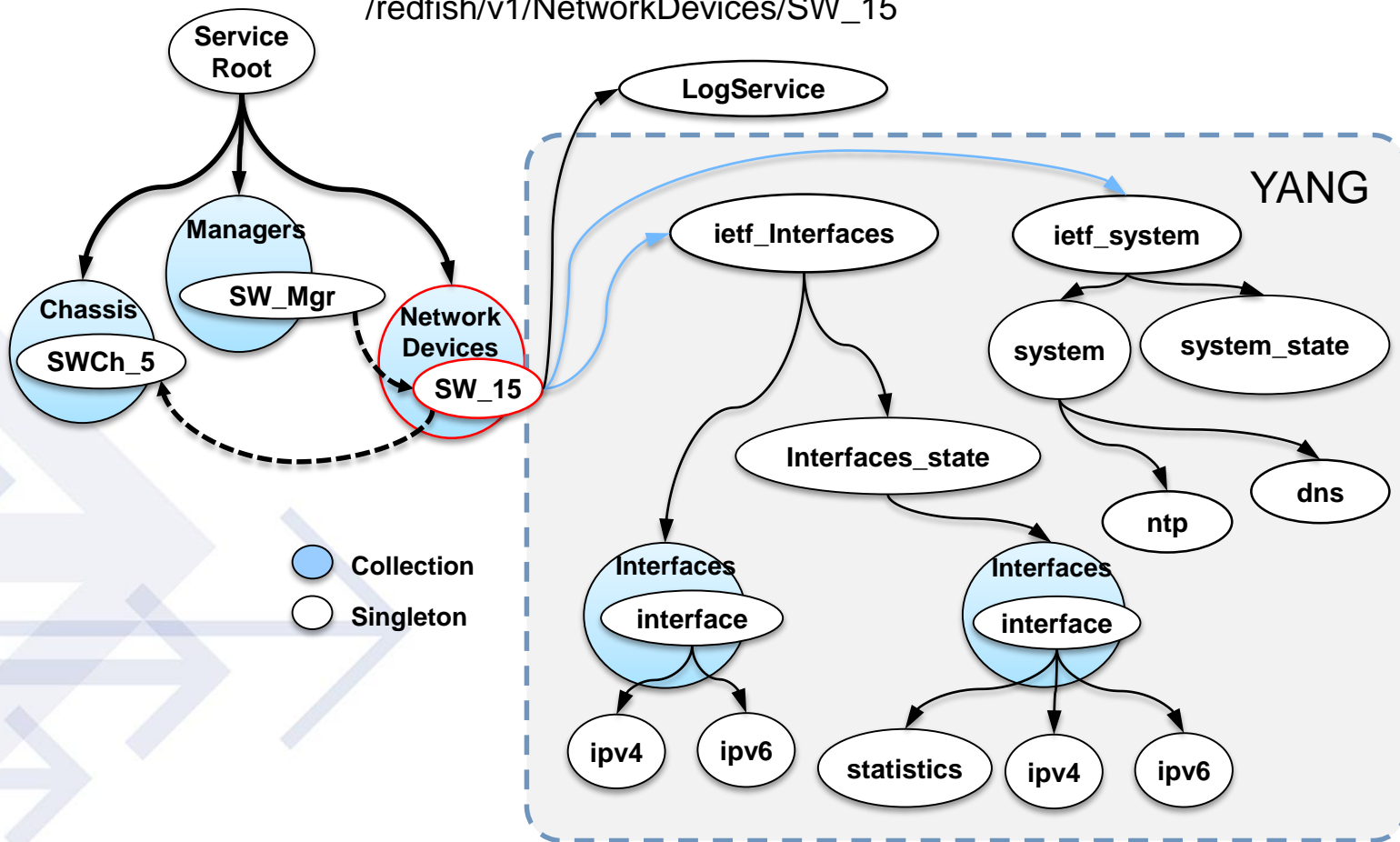




The NetworkDevice Resource

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)

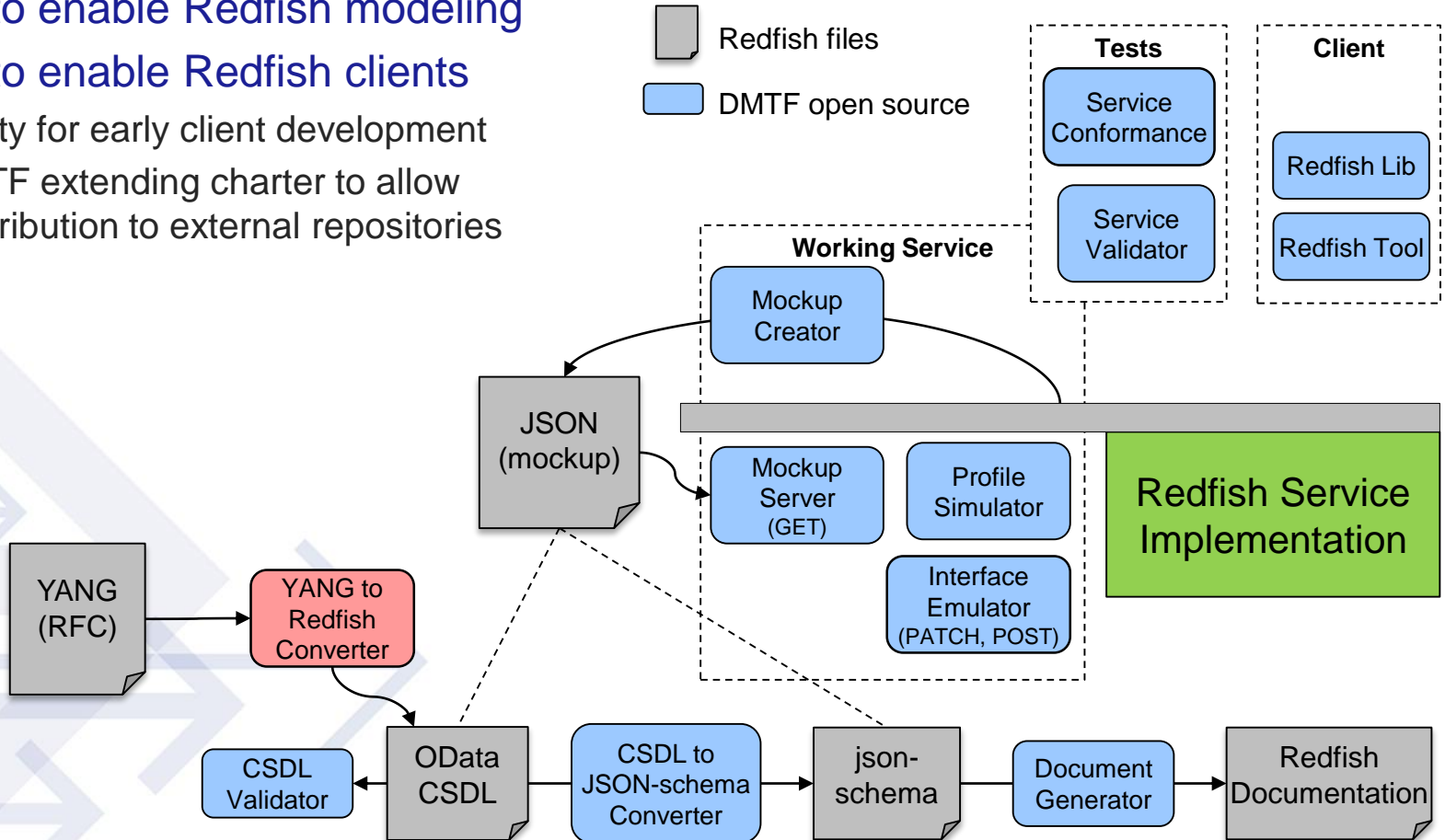


Redfish Tool chains

<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



Redfish Specification Forum

Home Help Search Welcome Guest, Please Login or Register.

Redfish Specification Forum > Home >

News Welcome to our new forum!

Specification, Protocol, Schema and Payloads

Board	Threads	Posts	Last Post
Protocol and Specification Discussion about the Redfish Specification and the RESTful HTTP protocol. Moderator: Admin	1	2	Retrieving Individual properties By IDilland Sep 12, 2016 at 7:42am
CSDL and json-schema Discussion about the contents of the standard Redfish schemas, and the published CSDL (XML) or json-schema definition files	1	2	How to use the Location property under Resource ? By Miralmeit Aug 12, 2016 at 6:23am
Feature Requests Requests to add features to the Redfish Specification, make additions to existing Schema, or to create a new Schema.	1	2	Creating a webinterface/KVP-over-IP session for user By javior

DMTF DISTRIBUTED MANAGEMENT TASK FORCE, INC.
Redfish™ Developer Hub

Home Mockups About the Redfish API

Welcome to the Redfish Developer Hub

DMTF's Redfish™ API is an open industry standard specification and schema that helps enable simple and secure management of modern scalable platform hardware. By specifying a RESTful interface and utilizing JSON and OData, Redfish helps customers integrate solutions within their existing tool chains. An aggressive development schedule is quickly advancing Redfish toward its goal of addressing all the components in the data center with a consistent API.

Welcome Developers

The DMTF's Redfish Developer Hub is a one-stop, in-depth technical resource – by developers, for developers – designed to provide all the files, tools, community support, tutorials and other advanced education you may need to help you use Redfish.

DMTF DISTRIBUTED MANAGEMENT TASK FORCE, INC.
Redfish Resource Explorer

Home Mockup About the Redfish API

Development Mockup

Explore the Resources

redfish > v1 > systems > 1

```

{
  "@Redfish.Copyright": "Copyright © 2014-2015 Distributed Management Task Force, Inc. All rights reserved.",
  "@odata.context": "/redfish/v1/$metadata#/schemas/Managers/Security",
  "@odata.id": "/redfish/v1/systems/1",
  "@odata.type": "#ComputerSystem.1.0.0.computersystem",
  chassis: {
    "@odata.type": "#ComputerSystem",
    "name": "My Computer System",
    "systemType": "Desktop",
    "assetTag": "Free form asset tag",
    "manufacturer": "Manufacturer Name",
    "model": "Model Name",
    "part": {
      "serialNumber": "992010000",
      "partNumber": "1",
      "description": "Description of part",
      "UUID": "99201000-0000-0000-0000-000000000000"
    }
  }
}

```



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