Managing Servers with Redfish

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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)
Agenda

1. Redfish, DMTF, SPMF
2. Design and protocol suite
3. Redfish API and model
4. Power and cooling
Audience Poll

Using the event app on your phone, answer the following:

• **Question #1** Have you heard of Redfish?
  - [ ] Yes
  - [ ] No
  **Results**

• **Question #2** If you’ve heard of Redfish, were you already interested in more detail?
  - [ ] Yes
  - [ ] No
  **Results**
What is Redfish?

- A DMTF standard
  - Released v1.0 as Standard on Aug 2015
  - Included in OCP, SNIA, and UEFI Forum in their work registers with the DMTF
- For managing multi-node servers via a RESTful interface
- Built on a modern tool-chain (HTTPS, JSON, OData)
- For users to easily obtain telemetry and exert control on servers

Client Python code

```python
rawData = urllib.urlopen('https://<ip_addr>/redfish/v1/Systems/1')
jsonData = json.loads(rawData)
print(jsonData['SerialNumber'])
```

Output

```
1A87CA442K
```
DMTF

• Distributed Management Task Force (DMTF)
  – An industry standards organization composed of 65 companies and industry organizations; with chapters in China and Japan
  – Creating internationally recognized standards for managing network-accessible platforms and technologies (including compute and network infrastructure, cloud, and virtualization)

• Scalable Platform Management Forum (SPMF)
  – A forum within the DMTF composed of 22 companies (separate budget)
  – Released Redfish v1.0, eleven months after forming Forum (three WIP releases)
SPMF's Redfish Design Process

To create a modern interface, the SPMF adopted modern tools and processes

• Tools and Processes
  – DMTF members website (meetings, release)
  – GitHub (issues, proposal, pull requests), Markdown (text format)

• Collateral Produced
  – Specification, schema, mockup
  – On-line Resource explorer
  – Tools for standards development (schema validators and converters)
Expected Open Source Efforts

Client Library
- Common utility support functions
  - Discovery, Enumeration, etc.
  - Event subscription
- Typical tasks
  - Power on/off/reboot
  - Gather thermal data

Command Line Utility
- Similar to IPMItool
- Designed for end users
- Calls Client library
- Likely written in Python

Conformance Test Suite
- Schema-aware tool for testing
- Checklist for vendors and customers
- Avoid spec interpretation conflicts

1From industry, DMTF or other SDOs
"Managing multi-node servers via a RESTful interface"

- The industry doesn't want to learn a tool chain to perform basic management tasks on a platform

- Design
  - Leverages existing Internet standards and tool chains
  - Usable by pros and amateurs
  - A secure replacement for IPMI-over-LAN to manage multi-node servers
  - Intended to meet OCP Remote Machine Management requirements
  - Deployable on existing management controllers
Protocol Suite

- RESTful API architectures are rapidly replacing SOAP (web services)
- HTTP/HTTPS protocol for a request and response mechanism, with alert subscription
- Data is encapsulated in JSON, and adheres to a data schema
- Data schema is expressed in json-schema and OData CSDL\(^1\)
- Device discovery using SSDP/uPnP (optional)

\(^1\)OData is an OASIS Standard
CSDL = Common Schema Definition Language
Why HTTP and JSON?

- **HTTP(S):** The Web protocol
  - Well-understood by admins
  - Known security model
  - Known network configuration

- **JSON:** A modern data format
  - Human-readable
  - Simpler than XML
  - Modern language support

- IT can use their existing DEV/OPS skill set and tool chain to perform system management tasks
Why JSON schema and OData CSDL?

Both describe the structure of the JSON resource which is returned in the HTTP response

<table>
<thead>
<tr>
<th></th>
<th>JSON schema</th>
<th>CSDL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>De facto</td>
<td>OASIS (v4)</td>
</tr>
<tr>
<td>File format</td>
<td>JSON</td>
<td>XML</td>
</tr>
<tr>
<td>Tool-chain</td>
<td>Large</td>
<td>Growing</td>
</tr>
</tbody>
</table>

DMTF uses an CSDL-to-JSON-schema tool to generate JSON schema files from CSDL metadata files
Redfish v1.0 Scope

- **Retrieve “IPMI class” data**
  - Basic server identification and asset info
  - Health state
  - Temperature sensors and fans
  - Power supply, power consumption and thresholds

- **Discovery**
  - Service endpoint (network-based discovery)
  - System topology (rack/chassis/server/node)

- **Basic I/O infrastructure data**
  - Host NIC MAC address(es) for LOM devices
  - Simple hard drive status / fault reporting

- **Security**
  - Session-based leverages HTTPS

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**Perform Common Actions**

- Change boot order / device
- Reboot / power cycle server
- Set power thresholds

**Access and Notification**

- Serial console access via SSH
- Event notification method(s)
- Logging method(s)

**BMC infrastructure**

- View / configure BMC network settings
- Manage local BMC user accounts

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red text = possible interest to TGG
Redfish API

- The Service Root is the top level document
  - GET http://<ip_addr>/redfish/v1
- From Service Root, one can reach the rest of the resources
  - Chassis
  - Systems
  - Managers
  - Account Service
  - Event Service
  - Session Service
  - Task Service
  - metadata (CSDL)
  - JSON schemas
  - Registries
Redfish Resource Map

Service Root

- /redfish/v1
  - Root
  - Links to all content

Collection

- /redfish/v1/Systems
  - Collection of Systems
    - "Logical view"

- /redfish/v1/Chassis
  - Collection of Chassis
    - "Physical view"

- /redfish/v1/Managers
  - Collection of Managers
    - "OOB manageability"

Singleton

- /redfish/v1/Systems/<id>
  - Server System
    - "Logical computer system"

- /redfish/v1/Chassis/<id>
  - Chassis
    - "Physical asset info"

- /redfish/v1/Managers/<id>
  - Baseboard mgmt ctrlr (BMC)

ManagedBy

- Processes
- Disks
- NICs
- Power
- Thermal
- LogService
- NW protocol

Other

- Tasks
- Sessions
- Accounts
- Events
- Registries
- Schemas

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Chassis Collection Resource

- Redfish uses the Chassis resource to represent a container
  - The ChassisType property designates the scope of the container
  - Examples: Row, Pod, Drawer, Blade, Zone
  - Chassis resources can be associated to each other by the Contains and ContainedBy links (creating a containment hierarchy)

```
/redfish/v1/Chassis
/redfish/v1/Chassis/{id}
```
Power and Thermal Modeling

• SPMF and Redfish
  – SPMF members modeled power and thermal resources sufficient to support data center workload management

• The Green Grid...
  – Could provide feedback to the DMTF on existing Redfish power and thermal models
  – Could extend Redfish to manage DCIM platforms
  – Could update the TGG-DMTF work register to describe desired interactions and alignment
Power and Thermal Resources

- The Power and Thermal resources are associated with the Chassis resource
  - A Chassis resource's flexibility allows it to represent a zone smaller than a rack, tray, etc.
- The Power resource
  - Contains power supplies, voltage sensors and control properties
  - Is associated to the Chassis via a PoweredBy link property
- The Thermal resource
  - Contains fans, temperature sensors, and redundancy properties
  - Is associated to a Chassis via a CooledBy link property

/redfish/v1/Chassis
/redfish/v1/Chassis/{id}/Power
/redfish/v1/Chassis/{id}/Thermal
Power Resource

"Voltages": [
    { "MemberId": "0",
      "Name": "VRM1 Voltage",
      "SensorNumber": 11,
      "PhysicalContext": "VoltageRegulator",
      "ReadingVolts": 12,
      "UpperThresholdNonCritical": 12.5,
      "UpperThresholdCritical": 13,
      "UpperThresholdFatal": 15,
      "LowerThresholdNonCritical": 11.5,
      "LowerThresholdCritical": 11,
      "LowerThresholdFatal": 10,
      "MinReadingRange": 0,
      "MaxReadingRange": 20,
      "Status": {
        "State": "Enabled",
        "Health": "OK"
      },
      "RelatedItem": ["/redfish/v1/Systems/CS_2", "/redfish/v1/Chassis/1U"]
    }
]
Audience Poll

Using the event app on your phone, answer the following:

• **Question #3**
  
  Are you interested in looking into Redfish in more detail?
  
  - Very Interested
  - Somewhat Interested
  - Not Interested

**Result**
Redfish Links

• Redfish collateral
  – Documents: [http://www.dmtf.org/standards/redfish](http://www.dmtf.org/standards/redfish) (spec, mockup, whitepapers)
  – Schemas: [http://redfish.dmtf.org/schemas/](http://redfish.dmtf.org/schemas/)
  – Resource Explorer: [http://redfish.dmtf.org/redfish/v1](http://redfish.dmtf.org/redfish/v1)
  – Feedback: [http://www.dmtf.org/standards/feedback](http://www.dmtf.org/standards/feedback)
  – Webinars: [http://www.dmtf.org/education/webinars](http://www.dmtf.org/education/webinars) (3 videos)

• The SPM Forum
  – [http://www.dmtf.org/standards/spmf](http://www.dmtf.org/standards/spmf)

• DMTF Alliance Partners
  – [http://www.dmtf.org/aboutregisters](http://www.dmtf.org/about/registers)
Thank you

www.thegreengrid.org
Redfish Resource Explorer

- Browser-based educational tool, accessible from the DMTF Redfish web site
- Explore “mockups” of the Redfish data model
- Navigate via links through the model to other resources
- Text descriptions are taken directly from the schema files for consistency

http://redfish.dmtf.org/redfish/v1
Chassis Resource

{
    "@odata.context": "/redfish/v1/$metadata#Chassis/Links/Members/entity",
    "@odata.id": "/redfish/v1/Chassis/Blade1",
    "@odata.type": "#Chassis.1.0.0.Chassis",

    "Thermal": { "@odata.id": "/redfish/v1/Chassis/Enc1/Thermal" }, (thermal zone)
    "Power": { "@odata.id": "/redfish/v1/Chassis/Enc1/Power" }, (power zone)

    "Links": { 
        "PoweredBy": [ 
            { "@odata.id": "/redfish/v1/Chassis/Enc1/Power#/PowerSupplies/0" } (individual)
        ],
        "CooledBy": [ 
            { "@odata.id": "/redfish/v1/Chassis/Enc1/Thermal#/Fans" } (collection)
        ]
    }
}
"PowerSupplies": [  
  {  
    "@odata.id": "/redfish/v1/Chassis/1U/Power#/PowerSupplies/0",  
    "MemberId": "0",  
    "Name": "Power Supply Bay",  
    "Status": {  
      "State": "Enabled",  
      "Health": "Warning"  
    },  
    "Oem": {},  
    "PowerSupplyType": "AC",  
    "LineInputVoltageType": "ACLowLine",  
    "LineInputVoltage": 120,  
    "PowerCapacityWatts": 800,  
    "LastPowerOutputWatts": 325,  
    "Model": "499253-B21",  
    "FirmwareVersion": "1.00",  
    "SerialNumber": "1Z0000001",  
    "PartNumber": "0000001A3A",  
    "SparePartNumber": "0000001A3A",  
    "RelatedItem": [  
      {  
        "@odata.id": "/redfish/v1/Chassis/1U"  
      }  
    ],  
  }  
],  

"PowerControl": [  
  {  
    "@odata.id": "/redfish/v1/Chassis/1U/Power#/PowerControl/0",  
    "MemberId": "0",  
    "Name": "Server Power Control",  
    "PowerConsumedWatts": 344,  
    "PowerRequestedWatts": 800,  
    "PowerAvailableWatts": 0,  
    "PowerCapacityWatts": 800,  
    "PowerAllocatedWatts": 800,  
    "PowerMetrics": {  
      "IntervalInMin": 30,  
      "MinConsumedWatts": 271,  
      "MaxConsumedWatts": 489,  
      "AverageConsumedWatts": 319  
    },  
    "PowerLimit": {  
      "LimitInWatts": 500,  
      "LimitException": "LogEventOnly",  
      "CorrectionInMs": 50  
    },  
    "RelatedItem": [  
      {  
        "@odata.id": "/redfish/v1/Systems/437XR1138R2"  
      },  
      {  
        "@odata.id": "/redfish/v1/Chassis/1U"  
      }  
    ],  
    "Status": {  
      "State": "Enabled",  
      "Health": "OK"  
    }  
  }  
]}
"Fans": [ 
    
    "@odata.id": "/redfish/v1/Chassis/1U/Thermal#/Fans/0",
    "MemberId": "0",
    "FanName": "BaseBoard System Fan",
    "PhysicalContext": "Backplane",
    "Status": {
        "State": "Enabled",
        "Health": "OK"
    },
    "Reading": 2100,
    "ReadingUnits": "RPM",
    "LowerThresholdFatal": 0,
    "MinReadingRange": 0,
    "MaxReadingRange": 5000,
    "Redundancy": [ 
        "@odata.id": "/redfish/v1/Chassis/1U/Thermal#/Redundancy/0"
    ],
    "RelatedItem": [ 
        { "@odata.id": "/redfish/v1/Systems/437XR1138R2"},
        { "@odata.id": "/redfish/v1/Chassis/1U" }
    ]
] 

"Temperatures": [ 
    
    "@odata.id": "/redfish/v1/Chassis/1U/Thermal#/Temperatures/0",
    "MemberId": "0",
    "Name": "CPU1 Temp",
    "SensorNumber": 5,
    "Status": { 
        "State": "Enabled",
        "Health": "OK"
    },
    "ReadingCelsius": 41,
    "UpperThresholdNonCritical": 42,
    "UpperThresholdCritical": 45,
    "UpperThresholdFatal": 48,
    "MinReadingRange": 0,
    "MaxReadingRange": 60,
    "PhysicalContext": "CPU",
    "RelatedItem": [ 
        { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Processors/CPU1"
    } 
] 
]
"Redundancy": [
  {
    "@odata.id": "/redfish/v1/Chassis/1U/Thermal#/Redundancy/0",
    "MemberId": "0",
    "Name": "BaseBoard System Fans",
    "RedundancySet": [
      { "@odata.id": "/redfish/v1/Chassis/1U/Thermal#/Fans/0" },
      { "@odata.id": "/redfish/v1/Chassis/1U/Thermal#/Fans/1" }
    ],
    "Mode": "N+m",
    "Status": {
      "State": "Enabled",
      "Health": "OK"
    },
    "MinNumNeeded": 1,
    "MaxNumSupported": 2
  }
]