*This Session will Include Live Polling.*

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# Managing Servers with Redfish


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**The Green Grid Forum 2016**
***The Economics of Sustainable IT***

# 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

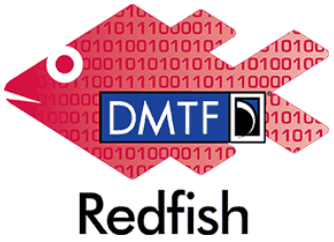

*Using the event app on your phone, answer the following:*

- *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**

```
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 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[1]

## 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

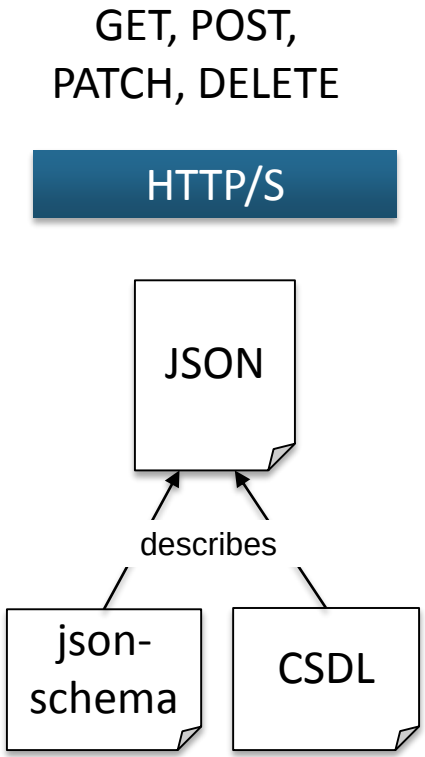
[1]From industry, DMTF or other SDOs

# "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

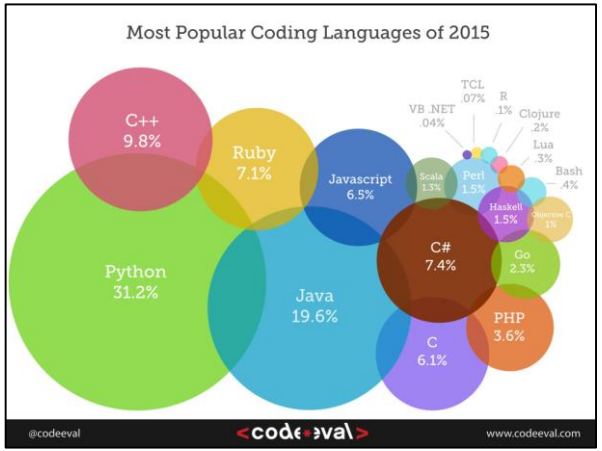
- RESTful API architectures are rapidly replacing SOAP (web services)
- HTTP/HTTPS protocol for a request and response mechanism, with alert subscription
- Data is encapsulated in JSON, and adheres to a data schema
- Data schema is expressed in json-schema and OData CSDL[1]
- Device discovery using SSDP/uPnP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




[1]OData is an OASIS Standard
CSDL = Common Schema Definition Language

# Why HTTP and JSON?

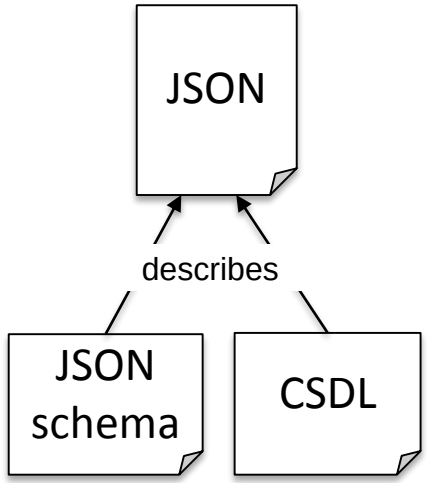
- **HTTP(S):** The Web protocol
  - Well-understood by admins
  - Known security model
  - Known network configuration
- **JSON:** A modern data format
  - Human-readable
  - Simpler than XML
  - Modern language support
- IT can use their existing DEV/OPS skill set and tool chain to perform system management tasks



# Why JSON schema and OData CSDL?

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

| | JSON schema | CSDL |
|---|---|---|
| Standard | De facto | OASIS (v4) |
| File format | JSON | XML |
| Tool-chain | Large | Growing |




DMTF uses an CSDL-to-JSON-schema tool to generate JSON schema files from CSDL metadata files

# Redfish v1.0 Scope

red text = possible interest to TGG

- **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

**Perform Common Actions**

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

**Access and Notification**

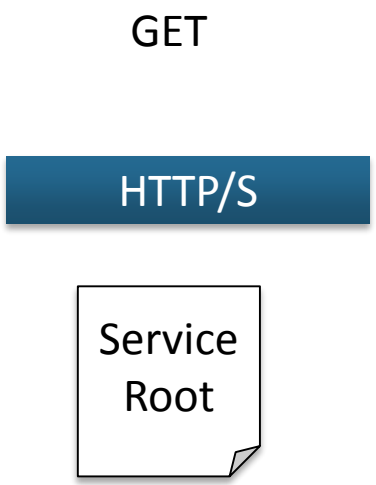
- Serial console access via SSH
- Event notification method(s)
- Logging method(s)

**BMC infrastructure**

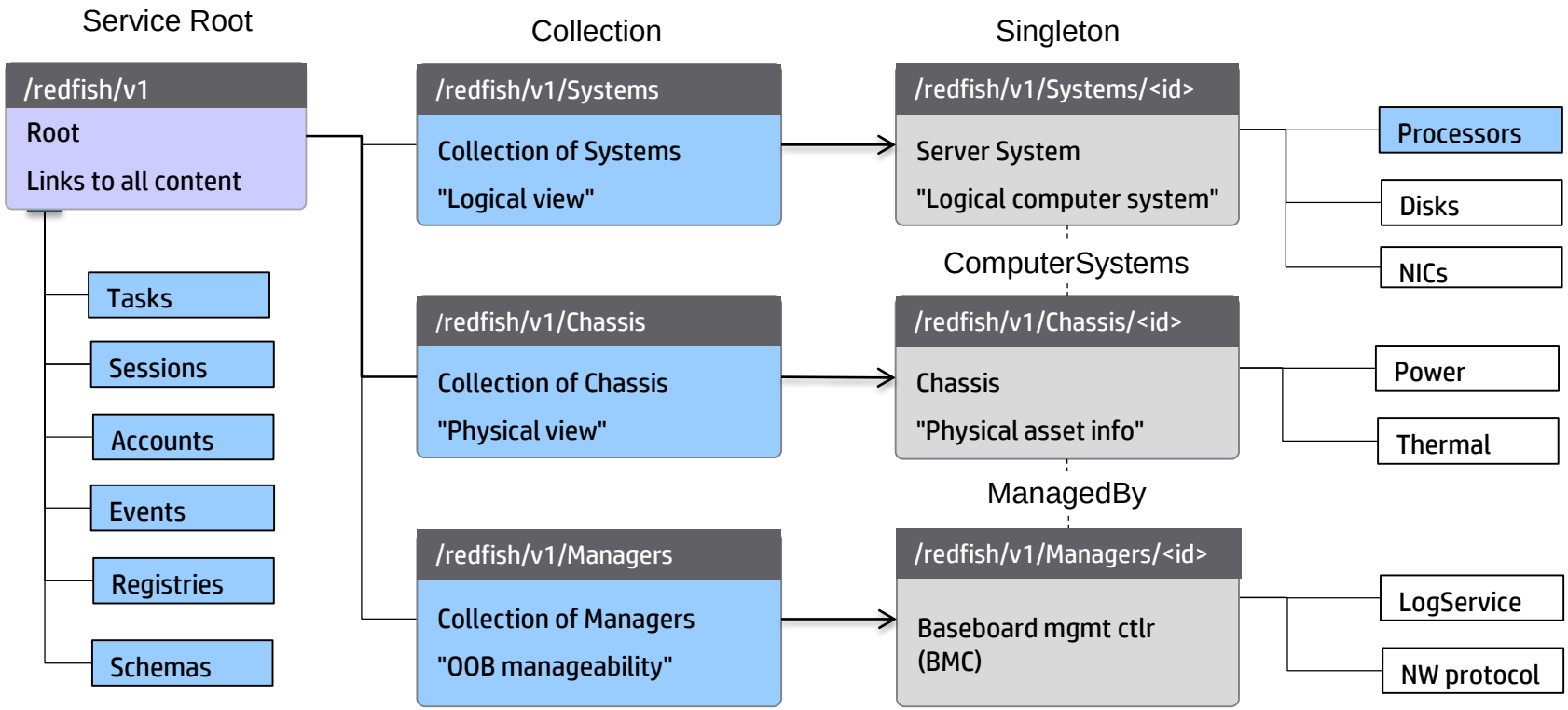
- View / configure BMC network settings
- Manage local BMC user accounts

# 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



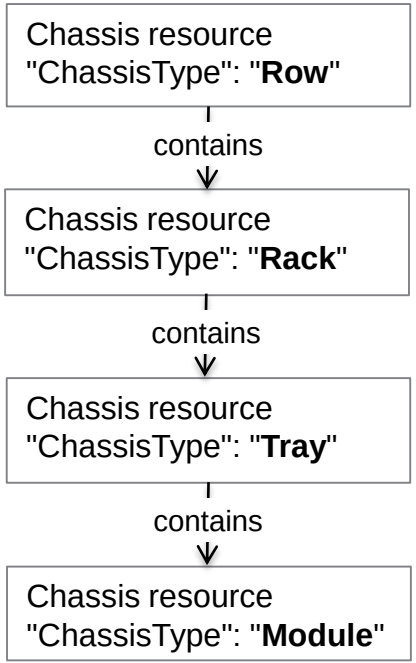
# Redfish Resource Map



# 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}



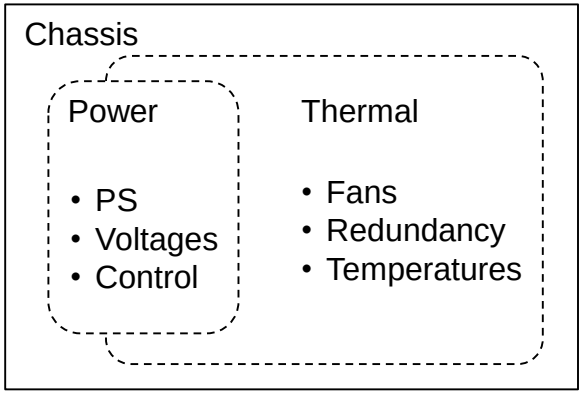
# Power and Thermal Modeling

- 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

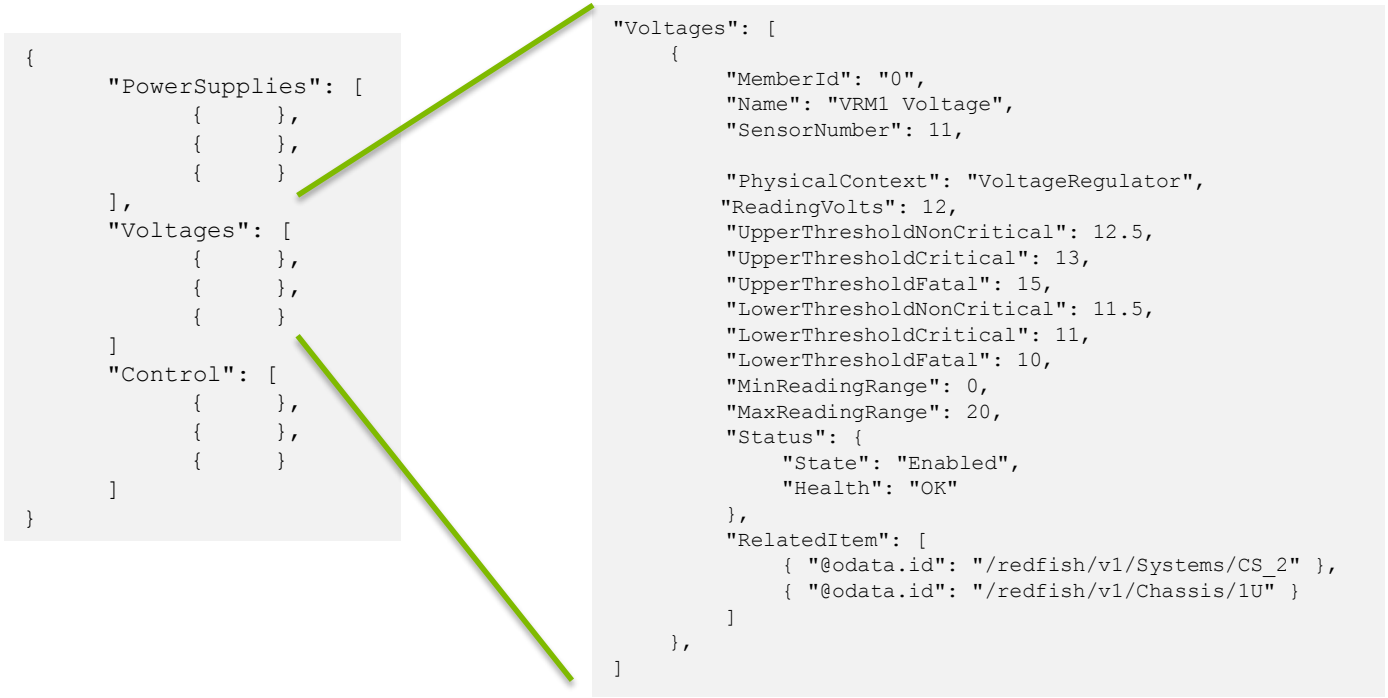
# Power and Thermal Resources

- The Power and Thermal resources are associated with the Chassis resource
  - A Chassis resource's flexibility allows its 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



```
{
      "PowerSupplies": [
            {     },
            {     },
            {     }
      ],
      "Voltages": [
            {     },
            {     },
            {     }
      ]
      "Control": [
            {     },
            {     },
            {     }
      ]
}
```

```
"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": [
            { "@odata.id": "/redfish/v1/Systems/CS_2" },
            { "@odata.id": "/redfish/v1/Chassis/1U" }
        ]
    },
]
```

More Power and Thermal mockup examples in backup

# 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 (spec, mockup, whitepapers)
  - Schemas: http://redfish.dmtf.org/schemas/
  - Resource Explorer: http://redfish.dmtf.org/redfish/v1
  - Feedback: http://www.dmtf.org/standards/feedback
  - Webinars: http://www.dmtf.org/education/webinars (3 videos)
- The SPM Forum
  - http://www.dmtf.org/standards/spmf
- DMTF Alliance Partners
  - http://www.dmtf.org/about/registers

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# Thank you

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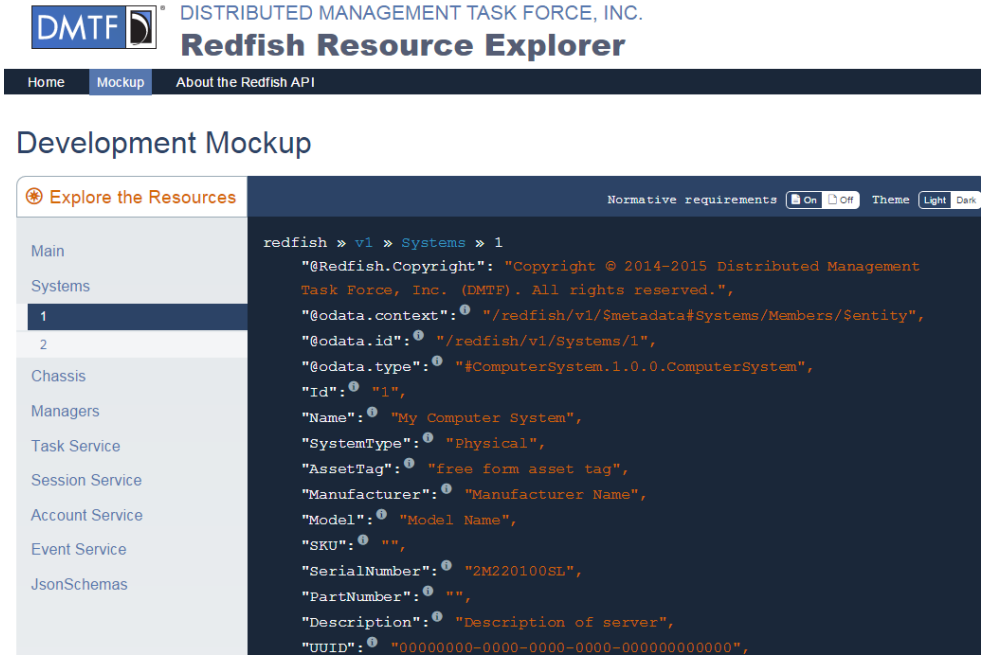
# Redfish Resource Explorer

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

- 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



# 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)
      ]
  }
}
```

# Power Resource


```
"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"
            },
        }
    ],
```

# Thermal Resource


```
"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"
                }
            ]
        },
```

# Thermal Resource (cont.)


```
"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
  }
]
```