IPMI is dead!

Long live Redfish!
Introducing myself

- Software engineering and Unixes since 1988:
  - Mostly Configuration Management Systems (CMS), **Build systems**, quality tools, on multiple commercial Unix systems
  - Discovered Free, Libre, Open Source Software & Linux (**FLOSS**) & made first contributions in 1993
  - Full time on OSL since 1995, first as HPE reseller then @HPE

- Currently:
  - WW FLOSS Technology **Strategist** in HPE, Grenoble, France
  - HPE FLOSS **Advocate** and Converged Infrastructure **Ambassador**
  - WW Linux Community Lead for the HPE **Open Source Profession**
  - AFUL and APRIL member. FLOSSITA **board chair**. Conferences at WW level at LinuxCon, Linux.conf.au, Fosdem,...
  - MondoRescue, Project-Builder.org, python-redfish, UUWL and PUSK **Project Lead**
  - LinuxCOE, mrepo, tellico, rinse, fossology, collectl, Ironic **contributor**
  - FOSSBazaar/SPDX and FLOSS **Governance** enthusiast
  - Mageia (and Fedora) **packager**

- And also:
  - Amateur singer (Alto / Tenor), recorder player since 1976 and Choir **director** since 1987, CD collector (7000+), Concerts, Photography
Some definitions
What is REST?

REST - REpresentational State Transfer

- Modern and easy to adopt Software Architectural Style for Web services
- Scalable, Stateless, Performant, Reliable
- Standardized HTTP operations (verbs)
  - GET, POST, PUT, and DELETE
  - Practical implementations also add PATCH, HEAD

See: https://en.wikipedia.org/wiki/Representational_state_transfer
What is API?

API - Application Programming Interface

- API is an interface between different software components invoked over communication networks using standards based technologies.
- Used to power orchestration, apps/tools integration.
- Exist at Firmware or OS level, software libraries, DBs, Web based system,
- Examples include POSIX, X-Window, OpenStack (RESTful)

See: https://en.wikipedia.org/wiki/Application_programming_interface
What is JSON?

- Open Standard data-serialization format based on key/value pairs
- Language independant (originated from Javascript)
- Easy for machines to parse and generate with large langage support (C, perl, python, java, ...)
- Easy for humans to read and edit
- Used to import/export data structures
- Similar standards: YAML, XML

See: https://en.wikipedia.org/wiki/JSON

```
{
  "firstName": "John",
  "lastName": "Smith",
  "isAlive": true,
  "age": 27,
  "address": {
    "streetAddress": "21 2nd Street",
    "city": "New York",
    "state": "NY",
    "postalCode": "10021-3100"
  },
  "phoneNumbers": [
    {
      "type": "home",
      "number": "212 555-1234"
    },
    {
      "type": "office",
      "number": "646 555-4567"
    },
    {
      "type": "mobile",
      "number": "123 456-7890"
    }
  ],
  "children": [],
  "spouse": null
}
```
What is OData?

- Open protocol to enable creation and consumption of REST APIs
- Provides Service and Metadata Document, Dynamic Resources
- Uses Resource Operation, which are standardized HTTP operations (verbs)
  - GET, POST, PUT, PATCH and DELETE

See also: http://docs.servicestack.net/why-not-odata
What is Redfish?

- Open industry standard specification and schema
  - Scalable Platform Management **RESTful API** specification proposal (v1.7.0) – DSP0266
  - **JSON** and **XML** (Odata CSDL) based Schemas – DSP8010 (v2019.1)
  - **Mockup** to be integrated in an existing web server to simulate a Redfish system – DSP2043
- First really interoperable management interface cross-vendors (vs SMASH), initiated by Dell, Emerson, HPE and Intel
- Built upon giant shoulders (http(s) RESTful API using JSON and OData)
- Easier, better HW support, more **secure**, more **complete** (vs IPMI) (chassis, multi-node platforms)
- Supports private extensions (like SNMP) in an Oem schema
- A way to get and set HW configuration items on physical platforms using a **RESTful API** (automation)

Redfish Timeline

- DMTF published Redfish 1.0 the 4th of August 2015
  - Schemas (JSON, CSDL, YAML) Documentation, white papers, FAQ
  - Mockup to allow developers to test wrt Redfish
  - Available online at https://www.dmtf.org/standards/redfish
  - Last version is now 2019.1 (2019-05-20)
- Available in:
  - DELL iDRAC BMC with Minimum iDRAC 7/8 FW 2.40.40.40, iDRAC9 FW 3.00.00.0
  - HPE iLO BMC with minimum iLO4 FW 2.30, iLO5
  - HPE Moonshot BMC with minimum FW 1.41
  - Supermicro X10 BMC with minimum FW 3.0 and X11 with minimum FW 1.0
  - Lenovo XClarity Controller XCC FW 1.00
Co-Chairs: Jeff Autor (HPE), Mike Raineri (Dell)

**Redfish Forum Leadership Companies**

- Broadcom
- Cisco
- Dell
- Ericsson
- Hewlett Packard Enterprise
- Intel
- Lenovo
- Supermicro
- Vertiv
- VMware

**Redfish Supporting Companies**


**Redfish Industry Alliance Partners & efforts**

- OCP (Open Compute Project) – Collaborating on profile definition
- UEFI – Collaborating on Firmware Update and Host Interface work
- SNIA – Collaborating on Storage modeling / alignment between SNIA
- SSM and Redfish
- TGG – Pursuing relationship to work on Power/Cooling (existing DMTF Alliance Partner)
- IETF – working on Switch modeling (no official alliance)

ASHRAE – American Society of Heating, Refrigerating and Air Conditioning Engineers
BBF – Broadband Forum
Gen-Z – Gen-Z Consortium
PICMG – Open Modular Computing for IIoT
NVMe – NVMe-MI

www.dmtf.org
Redfish Feature set

<table>
<thead>
<tr>
<th>Collect “IPMI class” server data</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Status of <strong>server health</strong></td>
</tr>
<tr>
<td>• <strong>Temperature</strong> sensors and fans</td>
</tr>
<tr>
<td>• Server <strong>identification</strong></td>
</tr>
<tr>
<td>• Inventory <strong>CPUs, memory, disks</strong> and <strong>MAC address</strong></td>
</tr>
<tr>
<td>• Basic <strong>OS</strong> information</td>
</tr>
<tr>
<td>• Interoperability <strong>Profiles</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Perform common actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>• <strong>Power cycle</strong> and <strong>reboot</strong> server</td>
</tr>
<tr>
<td>• Change <strong>boot order</strong></td>
</tr>
<tr>
<td>• Set <strong>power thresholds</strong></td>
</tr>
<tr>
<td>• <strong>Alert</strong> notifications via <strong>Events</strong></td>
</tr>
<tr>
<td>• Access <strong>Event log</strong> and <strong>SSH Serial console</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Manage server infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>• View / configure BMC network settings</td>
</tr>
<tr>
<td>• Manage local BMC <strong>user accounts</strong></td>
</tr>
<tr>
<td>• <strong>Chassis</strong> inventory</td>
</tr>
<tr>
<td>• <strong>Swordfish</strong> SNIA ‘s extensions</td>
</tr>
<tr>
<td>• DCIM with <strong>Sensor</strong>, <strong>Facility</strong></td>
</tr>
<tr>
<td>• <strong>OCP</strong> &amp; <strong>Gen-Z</strong> support</td>
</tr>
</tbody>
</table>
Redfish toolset

– DMTF tools :
  ● https://redfish.dmtf.org/ Redfish developer Hub (mockup, docs, tools)
  ● https://github.com/DMTF Bindings (C, python, Javascript, Ruby...), CLI tools, Simulators, Validators
– Community driven projects :
  ● python-redfish library https://git.openstack.org/cgit/openstack/python-redfish
  ● python library used by Ironic https://git.openstack.org/cgit/openstack/sushy
  ● OpenStack Ironic bare metal deployment project has a Redfish driver https://docs.openstack.org/ironic/latest/admin/drivers/redfish.html
  ● Redfish Ansible module https://docs.ansible.com/ansible/latest/modules/redfish_facts_module.html
  ● Redfish Salt module https://github.com/openSUSE/salt-redfish
  ● OpenBMC Redfish webserver https://github.com/openbmc/bmcweb
  ● Redfish plugin for Nagios https://github.com/nsfcac/Nagios-Redfish-API-Integration
Data Model
Redfish Demo

https://redfish.dmtf.org/redfish/v1
Most recent new Features and Changes

2018.1:
● LDAP/AD config (ExternalAccountProvider)

2018.2:
● TelemetryService support for CPU utilization with Metric*
● OpenAPI v3.0 support

2018.3:
● Certificate Management
● DCIM/IoT Sensor

2019.1:
● Documentation Cleanups
● Host interface aka VirtualNIC

2019.2 (coming soon):
● Push-style Software updates

2019.3 (coming later):
● Work on SMTP (event delivery) / SNMP (configure managed devices) / SecureBoot certificates/keys
● IPMI Removal Task Force (TF) / DCIM TF / Tools TF – Tackle Box
HPE Redfish Demo

https://ilorestfulapiexplorer.ext.hpe.com/
Security with Redfish

GET /redfish/v1/Systems/1/SecureBoot

```
{
    "@odata.context": "/redfish/v1/$metadata#SecureBoot.SecureBoot",
    "@odata.etag": "W/"4A4CB737"",
    "@odata.id": "/redfish/v1/Systems/1/SecureBoot/",
    "@odata.type": "#SecureBoot.v1_0_0.SecureBoot",
    "Actions": {
        "#SecureBoot.ResetKeys": {
            "target": "/redfish/v1/Systems/1/SecureBoot/Actions/SecureBoot.ResetKeys/"
        }
    },
    "Id": "SecureBoot",
    "Name": "SecureBoot",
    "SecureBootCurrentBoot": "Enabled",
    "SecureBootEnable": true,
    "SecureBootMode": "UserMode"
}
```

SecureBoot setup is now part of the standard as well as TPM and Physical Security (removed from Oem part)

GET /redfish/v1/Chassis/1

```
{
    "PhysicalSecurity": {
        "IntrusionSensor": "HardwareIntrusion"
    }
}
```
Security with Redfish

GET /redfish/v1/Managers/1/SecurityService

These parameters are HPE specific for now.

The security state setting is readable and settable via the HPE iLO RESTful API.
Virtual NIC Support

- Secure access into the iLO from the OS
- Accessed via internal IP address
  - 16.1.15.1
- Connect using
  - Web browser (SMH replacement)
  - iLOREST tool
  - SSH
- No HPE-provided driver required
  - Uses in-box USB-EEM network driver

- Supported Oses
  - Windows Server 2016, 2019
  - SLES 12, 15
  - RHEL 7.6
Virtual NIC with Redfish

The Virtual NIC (also known as the Redfish Host API) is disabled by default but may be enabled either through the Web GUI or by a Redfish operation. An iLO reset is required for this change to take effect.

```
PATCH /redfish/v1/Managers/{managerId}/

{
    "Oem": {
        "Hpe": {
            "VirtualNICEnabled": true
        }
    }
}
```

This parameter is HPE specific for now.

When enabled, software running on the server operating system may access the iLO 5 Web GUI or Redfish API using IP address 16.1.15.1. Normal authentication is required.
Redfish for OpenAPI™ Specification v3.0

- OpenAPI Specification
  - Community-driven open spec from the OpenAPI Initiative (OAI), The Linux Foundation® Collaborative Project
  - Describes API services in a YAML-format definition document
  - Rich ecosystem of tools for developers and end users
- Supported by Redfish Specification v1.6.0 – Released August 2018
  - Added support for OpenAPI schema files (YAML)
  - Requires use of standardized URIs
    - Fixed URIs for all Redfish resources (Does not affect clients traversing the Data Model)
    - Construct path to Collection member using “Id”
- Redfish Schema (DSP8010) bundle 2018.2
  - Now includes OpenAPI YAML files
  - Along with JSON Schema and CSDL files
python-redfish description

- A python library to manage Redfish compliant systems
- Open Source project under the Apache License v2.0
- Initiated the 25\textsuperscript{th} March 2015 during the 7\textsuperscript{th} HPE TES in Grenoble.
- Now an OpenStack project
- Available at:
  - https://opendev.org/x/python-redfish/
  - Discussions on python-redfish@mondorescue.org
  - Bugs at https://launchpad.net/python-redfish
- Python dependencies: python-requests, python-tortilla, python-futures, python-json, python-urllib, python-simplejson, ...
- Packages available at ftp://ftp.mondorescue.org/centos/7/x86_64 and also for Ubuntu 18.04. Ask for your preferred distro!

- Easy integration of Redfish support into python based applications
- Potential consumers: a Redfish client tool based on that library (preliminary work done as part of the project), OpenStack Ironic (to provide Redfish support now superseded by Sushy), python scripts for Lab setup, SDI demos, Alexandria (CMDB as a Service) ...

Kick-off at TES 2015 (left to right): Bruno Cornec, Samer El-Haj Mahmoud, Devananda van der Veen, Scott Hinchley, René Ribaud, Vincent Misson (not on screen)
python-redfish Status & Roadmap

- Status:
  - Project at v0.4.1 – Usable for PoC
  - Core library ready:
    - Bios info,
    - Power management
    - Demos scripts available
  - Client tool
  - Asset tool
  - Tests performed with:
    - DMTF mockups (0.95+) https://redfish.dmtf.org/redfish/mockups/v1/
    - ILO4 and iLO5 based ProLiant servers (0.95+)
    - Moonshot chassis Managers (0.95)
    - iLO4 based Moonshot cartridges m510 (1.0+)
    - HPE iLO simulator https://ilorestfulapiexplorer.ext.hpe.com/
    - Python dependencies already available in Mageia and Fedora, CentOS 7, Ubuntu and Debian on our ftp server.
    - Packages built with project-builder.org (rpm and deb)

- Roadmap:
  - Fix reported enhancement requests
  - Work on Alexandria needed interfaces (inventory)
Python-Redfish Demo
Getting involved in Redfish

- Redfish Standards page
  - Schemas, Specs, Mockups, White Papers & more
  - http://www.dmtf.org/standards/redfish
- Redfish Developer Portal
  - Redfish Interactive Resource Explorer
  - Educational material, documentation & other links
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  - User forum for questions, suggestions and discussion
  - http://www.redfishforum.com
- DMTF Feedback Portal
  - Provide feedback or submit proposals for Redfish
  - https://www.dmtf.org/standards/feedback
- DMTF Redfish Forum
  - Join the DMTF to get involved in future work
  - http://www.dmtf.org/standards/spmf

End customers should drive the Redfish effort
- What tools are needed?
- What environments/scripts/tasks do they operate in?
- What prevents transition from legacy tools and protocols (especially IPMI)?

Download, use, contribute to tools on Github: http://www.github.com/DMTF
Edit the Wikipedia page
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Edit the Wikipedia page

Attend a Redfish Workshop!

- OSS NA, San Diego: August 20th, 2019
  - Details & Pres at:
    - http://trac.project-builder.org/wiki/RedfishWSNA2019
- OSS EMEA, Lyon France: October 31st 2019
- LinuxConf Australia TBC
- SUSECon 2020 TBC
"Changes are never easy to make. There is comfort and safety in tradition, but change must come, no matter how painful or expensive it may be."

Bill Hewlett
Redfish Tool chains

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

2. Tools to enable Redfish clients
   - JSON (mockup)
   - json-schema
   - OData
   - CSDL
   - CSDL to JSON-schema Converter
   - json-schema
   - YANG to Redfish Converter
   - YANG (RFC)
   - CSDL Validator
   - Redfish Lib
   - Redfish Tool
   - DMTF open source
   - Redfish files
   - Redfish Service Implementation
   - Tests
     - Service Conformance
     - Service Validator
     - Profile Simulator
     - Interface Emulator (PATCH, POST)
   - Client
     - Redfish Lib
     - Redfish Tool