Agenda

• What is BIOS?
• Interacting with Bios
• Redfish Resource Map
• BIOS Model Map
• Example: Get Boot Mode
• Schemas/Registries
• Resource/ Service
• Example of a BIOS Resource
• BIOS Current Settings
• BIOS Pending Settings
• BIOS Attribute Registry
• Updating a BIOS Setting Example
• Using Actions in BIOS Example
• Boot Options Configuration
• DMTF Tool Tacklebox

www.dmtf.org
What is BIOS

- Basic Input Output System
- A firmware stored in NV memory
- Used to configure the system
- Setup through BIOS Setup Utility
  - Usually accessed with a hot-key (F2, ESC, F10, …)
  - Can not configure thousands servers simultaneously
Interacting with BIOS

• Redfish give us the ability to configure BIOS settings
• Secure (confidentiality, integrity, identity)
  ➢ HTTPS, Connection encrypted with TLS
  ➢ Authentication is required with a BMC account that have the correct privilege,
• Scalable
• Easy to use
• Human readable
• Better way of scripting (JSON)
• Interoperable
• BIOS OEM extensions for vendors to add value/features
Redfish Resource Map (simplified)

GET https://192.168.0.100/redfish/v1/Systems/{id}/Bios/

Use the Redfish Resource Explorer (redfish.dmtf.org) to explore the resource map

www.dmtf.org
BIOS Model Map

Service Root redfish/v1/ → Systems (1:N) → System → BIOS Current Settings → Oem/<Vendor> → Resource/Feature 1 → Pending
               
Registries → Bios Attribute Registry

JsonSchemas → Schemas

Resource/Feature 2 → Pending
Resource/Feature 3 → Pending
...

Entity
Resource Collection
Entity
Resource Instance
Subordinate Resource

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Example: Getting the Boot Mode

```python
import json
import requests

username = "administrator"
password = "password"
host = "16.84.24.184"
baseuri = "https://"+host+"/redfish/v1/systems/1/"

# connect to the server and grab the BIOS resource and store
# in json formatted dictionary
bios_resource_raw = requests.get(baseuri+"BIOS", verify=False, auth=(username, password))
bios_resource = json.loads(bios_resource_raw.text)

# Get the boot mode and print it
boot_mode = bios_resource['Attributes']['BootMode']
print (boot_mode)

>> Uefi
```
Schemas/ Registries

• A **schema** is a data model. The model defines the relationship between objects in the system, and defines which objects can contain or be contained by other objects.

• **Registries** are used in Redfish to optimize data being transferred from a Redfish Service. Registry Resources are those Resources that assist the client in interpreting Redfish Resources beyond the Redfish Schema definitions.
Resource/Service

• A resource an actual object or component. Think of the resource as an object in a system, whose values and rules for each of its properties are contained in a specific Redfish JSON payload.

• A Redfish service is any product that implements the Redfish specification, and serves up responses.
Example of a BIOS Resource

```json
{
    "@odata.type": "#Bios.v1_1_0.Bios",
    "Id": "Bios",
    "Name": "BIOS Configuration Current Settings",
    "Description": "BIOS Configuration Current Settings",
    "AttributeRegistry": "BiosAttributeRegistryPS.get_v1_0_0",
    "@Redfish.Settings": {
        "@odata.type": "#Settings.v1_2_2.Settings",
        "ETag": "someetag",
        "Messages": [
            {
                "MessageId": "Base.1.0.PropertyNotWritable",
                "RelatedProperties": [
                    "#Attributes/ProcTurboMode"
                ]
            }
        ],
        "SettingsObject": {
            "@odata.id": "/redfish/v1/Systems/1/Bios/ID"
        },
        "Time": "2012-03-07T14:44.50-05:00"
    },
    "Actions": {
        "#Bios.ResetBios": {
            "target": "/redfish/v1/Systems/1/Bios/Actions/Bios.ResetBios"
        },
        "#Bios.ChangePassword": {
            "target": "/redfish/v1/Systems/1/Bios/Actions/Bios.ChangePassword"
        }
    },
    "Attributes": {
        "AdminPhone": ",",
        "BootMode": "Uefi",
        "EmbeddedData": "Reid",
        "NicBoot1": "NetworkBoot",
        "NicBoot2": "Disabled",
        "PowerProfile": "MaxPerf",
        "ProcCoreDisable": 0,
        "ProcHyperthreading": "Enabled",
        "ProcTurboMode": "Enabled",
        "UsbControl": "UsbEnabled",
        "ConsoleSaudRate": "115200"
    },
    "Links": {
        "ActiveSoftwareImage": {
            "@odata.id": "/redfish/v1/UpdateService/FirmwareInventory/BIOS"
        },
        "SoftwareImages": [
            {
                "@odata.id": "/redfish/v1/UpdateService/FirmwareInventory/BIOS"
            },
            {
                "@odata.id": "/redfish/v1/UpdateService/FirmwareInventory/BackupBIOS"
            }
        ]
    }
}
```
BIOS Current Settings

```
{
    "@odata.type": "#Bios.v1_0_3.Bios", Specifies the schema and version
    "Id": "BIOS",
    "Name": "BIOS Configuration Current Settings",
    "AttributeRegistry": "BiosAttributeRegistryP89.v1_0_0", Specifies the name of the registry
    "Attributes": {
        "AdminPhone": "",
        "BootMode": "Uefi",
        "EmbeddedSata": "Raid",
        "NicBoot1": "NetworkBoot",
        "NicBoot2": "Disabled",
        "PowerProfile": "MaxPerf",
        "ProcCoreDisable": 0,
        "ProcHyperthreading": "Enabled",
        "ProcTurboMode": "Enabled",
        "UsbControl": "UsbEnabled"
    },
    "@odata.context": "/redfish/v1/$metadata#Bios.Bios",
    "@odata.id": "/redfish/v1/Systems/437XR1138R2/BIOS/
}
```

All Bios settings

Uri of the resource, a self pointer

Is used to separate vendor extensions from the standard

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BIOS Current Settings

{ "@Redfish.Settings": {
  "@odata.type": "#Settings.v1_0_0.Settings",
  "ETag": "9234ac83b9700123cc32",
  "Messages": [
    {
      "MessageId": "Base.1.0.PropertyValueNotInList",
      "RelatedProperties": [
        
      ],
      "MessageArgs": [
        "Hello",
        "BootMode"
      ],
    },
  ],
  "SettingsObject": {
    "@odata.id": "/redfish/v1/Systems/437XR1138R2/BIOS/Settings/"
  },
  "Time": "2018-03-07T14:44.30-05:00"
},
"Actions": {
  "#Bios.ResetBios": {
    "target": "/redfish/v1/Systems/437XR1138R2/BIOS/Actions/Bios.ResetBios"
  },
  "#Bios.ChangePassword": {
    "target": "/redfish/v1/Systems/437XR1138R2/BIOS/Actions/Bios.ChangePassword"
  }
}
Pending Settings

- A Settings Resource is used to represent the future intended state of a Resource
  https://<IP>/redfish/v1/systems/1/bios/settings/

- PATCH /redfish/v1/systems/1/bios/settings/
  Current AdminName = Fox, Pending AdminName = Dana

  - GET /redfish/v1/systems/1/bios/
    AdminName: Fox

  - GET /redfish/v1/systems/1/bios/settings/
    AdminName: Dana
Bios Attribute Registry

- **@odata.type**: #AttributeRegistry.v1_0_0.AttributeRegistry
- **Description**: This registry defines a representation of BIOS Attribute instances
- **Id**: BiosAttributeRegistryU30.v1_2_00
- **Language**: en
- **Name**: U30 BIOS Attribute Registry
- **OwningEntity**: HPE

- **RegistryEntries**
  - **Attributes**
  - **Dependencies**
  - **Menus**
  - **RegistryVersion**: v1_2_00
  - **SupportedSystems**

- **Dependency**

```json
{
  "Dependency": {
    "Dependency": {
      "MapFrom": {
        "UefiOptimizedBoot": "CurrentValue",
        "MapCondition": "EQU",
        "MapValue": "Disabled"
      }
    },
    "MapToAttribute": "UefiOptimizedBoot",
    "MapToProperty": "CurrentValue",
    "MapToValue": "Disabled"
  }
}
```
Bios Attribute Registry

An Attribute Field

Menu

```
<table>
<thead>
<tr>
<th>AttributeName</th>
<th>TpmType</th>
</tr>
</thead>
<tbody>
<tr>
<td>DisplayName</td>
<td>Current TPM Type</td>
</tr>
<tr>
<td>HelpText</td>
<td>Current TPM device type.</td>
</tr>
<tr>
<td>ReadOnly</td>
<td>true</td>
</tr>
<tr>
<td>GrayOut</td>
<td>false</td>
</tr>
<tr>
<td>Immutable</td>
<td>true</td>
</tr>
<tr>
<td>Type</td>
<td>Enumeration</td>
</tr>
<tr>
<td>MenuPath</td>
<td>./ServerSecurity/TpmOptions</td>
</tr>
<tr>
<td>DisplayOrder</td>
<td>307</td>
</tr>
<tr>
<td>CurrentValue</td>
<td>null</td>
</tr>
</tbody>
</table>

Value:

0
- ValueName: NoTpm
  - ValueDisplayName: No TPM

1
- ValueName: Tpm12
  - ValueDisplayName: TPM 1.2

2
- ValueName: Tpm20
  - ValueDisplayName: TPM 2.0
```

```
<table>
<thead>
<tr>
<th>DisplayName</th>
<th>Serial Port Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>DisplayOrder</td>
<td>4</td>
</tr>
<tr>
<td>GrayOut</td>
<td>false</td>
</tr>
<tr>
<td>MenuName</td>
<td>SerialPortOptions</td>
</tr>
<tr>
<td>MenuPath</td>
<td>./SystemOptions/SerialPortOptions</td>
</tr>
<tr>
<td>ReadOnly</td>
<td>false</td>
</tr>
</tbody>
</table>
```
Updating a BIOS Setting Example

• Example Curl code to change “AdminName”

```json
{
    "Attributes": {
        "AdminName": "New Name"
    }
}
```

curl -H "Content-Type: application/json" -X PATCH --data @name.json https://IP/redfish/v1/Systems/1/bios/settings/ -u user:psw

• The “AdminName” Property will change to “New Name”
Using Actions in BIOS Example

• Example Curl code to reset Bios settings:

```json
{
    "ResetType": "default"
}
```

```bash
curl -H "Content-Type: application/json" POST --data @Action.json https://IP/redfish/v1/systems/1/bios/settings/Actions/Bios.ResetBios/ -u user:password
```

• This Action will restore all the Bios system settings to default
Boot Options configuration

• Difficult and inconvenient
• Traditional BIOS
  ➢ F2, F10, DEL ….
• UEFI BIOS
  ➢ Windows Settings > Update & Security > Recovery Advanced Startup
  ➢ click on Restart now.
  ➢ Advanced Options

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>BIOS Setup Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acer</td>
<td>F2</td>
</tr>
<tr>
<td>ASAS</td>
<td>DEL/F2</td>
</tr>
<tr>
<td>Dell</td>
<td>F2</td>
</tr>
<tr>
<td>HP</td>
<td>F10</td>
</tr>
<tr>
<td>HPE</td>
<td>F9</td>
</tr>
</tbody>
</table>

Advanced options

System Restore
Use a restore point recorded on your PC to restore Windows

Command Prompt
Use the Command Prompt for advanced troubleshooting

System Image Recovery
Recover Windows using a specific system image file

Startup Settings
Change Windows startup behavior

Startup Repair
Fix problems that keep Windows from loading

Go back to the previous version
Boot Options configuration


```
"BootOptions": {
    "@odata.id": "/redfish/v1/System.Embedded.1/BootOptions/"

    "BootOrder": [
        "Boot0011",
        "Boot0008",
        "Boot0006",
        "Boot0004",
        "Boot0002",
        "Boot0000",
        "Boot000E",
        "Boot000C",
        "Boot000A",
        "Boot0008",
        "Boot0006",
        "Boot0004",
        "Boot0002",
        "Boot0000",
        "Boot0011",
        "Boot0010",
        "Boot0012"
    ],

    "Members": [
        {
            "@odata.context": "/redfish/v1/$metadata#BootOption.BootOption",
            "@odata.id": "/redfish/v1/systems/1/BootOptions/1/",
            "@odata.type": "#BootOption.v1_0_1.BootOption",
            "Id": "1",
            "Alias": "None",
            "BootOptionReference": "Boot0001",
            "DisplayName": "Embedded UEFI Shell",
            "Name": "Boot Option",
            "UefiDevicePath": "Fv(CDBB7B35-6833-4ED6-9AB2-57D2ACDDF6F0)/FvFile(C57AD687-0515-40A8-9D21-551652854E37)"
        },

        {
            "@odata.context": "/redfish/v1/$metadata#BootOption.BootOption",
            "@odata.id": "/redfish/v1/systems/1/BootOptions/3/",
            "@odata.type": "#BootOption.v1_0_1.BootOption",
            "Id": "3",
            "Alias": "Hdd!",
            "BootOptionReference": "Boot0008",
            "DisplayName": "Windows Boot Manager",
            "Name": "Boot Option",
            "UefiDevicePath": "HD(2,GPT,6F6D981A-B977-47F7-9478-788163429A7,0x96800,0x32000)/\EFI\Microsoft\Boot\"
        }
    ]
```

"Members@odata.count": 11
Boot Options configuration

- Patch URI [https://16.84.24.184/redfish/v1/systems/1/](https://16.84.24.184/redfish/v1/systems/1/)
Boot Options configuration

- An Action to set boot order “SetDefaultBootOrder”

- The option to set Boot order based on device/boot type (such as PXE, USB, CD, etc..) “AliasBootOrder”

- One-time boot "BootNext"

- Regular Boot Order “BootOrder” Array
Thank you for watching!

- Redfish Standards
  - Schemas, Specs, Mockups, White Papers, FAQ, Educational Material & more
  - [http://www.dmtf.org/standards/redfish](http://www.dmtf.org/standards/redfish)
- Redfish Developer Hub
  - Redfish Interactive Explorer, Hosted Schema at Namespace & other links
  - [http://redfish.dmtf.org](http://redfish.dmtf.org)
- Redfish Forum (WG that defines Redfish)
  - Companies involved, Upcoming Schedules & Future work, Charter, Information on joining.
  - [http://www.dmtf.org/standards/spmf](http://www.dmtf.org/standards/spmf)
Bios Oem Links (Backup)

• OEMs and other third parties can extend the Redfish data model by creating new resource types.
• This is accomplished by defining an OEM schema for each resource type, and connecting instances of those Resources to the Resource Tree.
• The information and semantics of the OEM resources are not defined in the Redfish Standards but the schema representing the data and the resource itself should conform to the specification.