



Redfish BIOS Configuration

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Redfish

www.dmtf.org

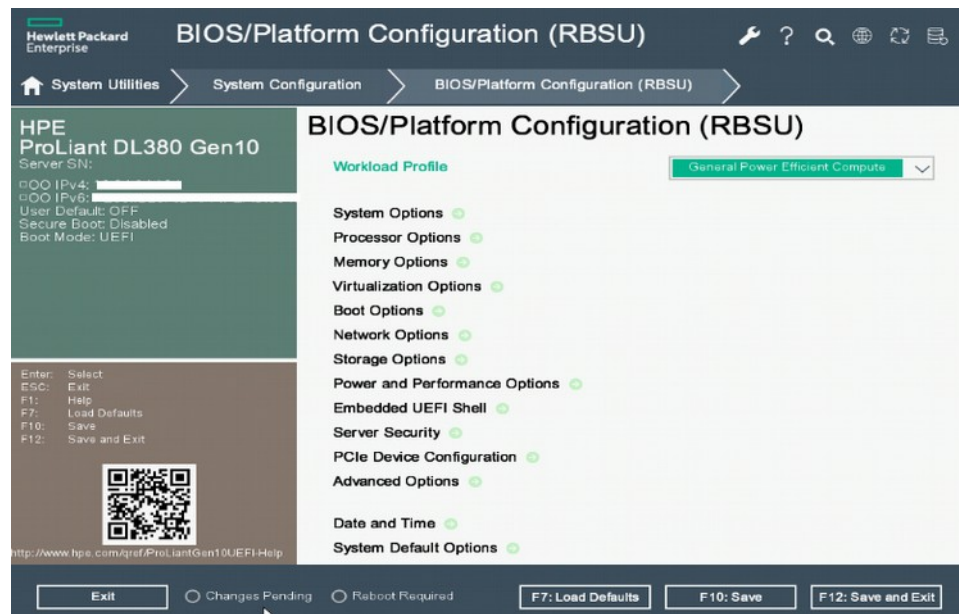


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What is BIOS

- **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



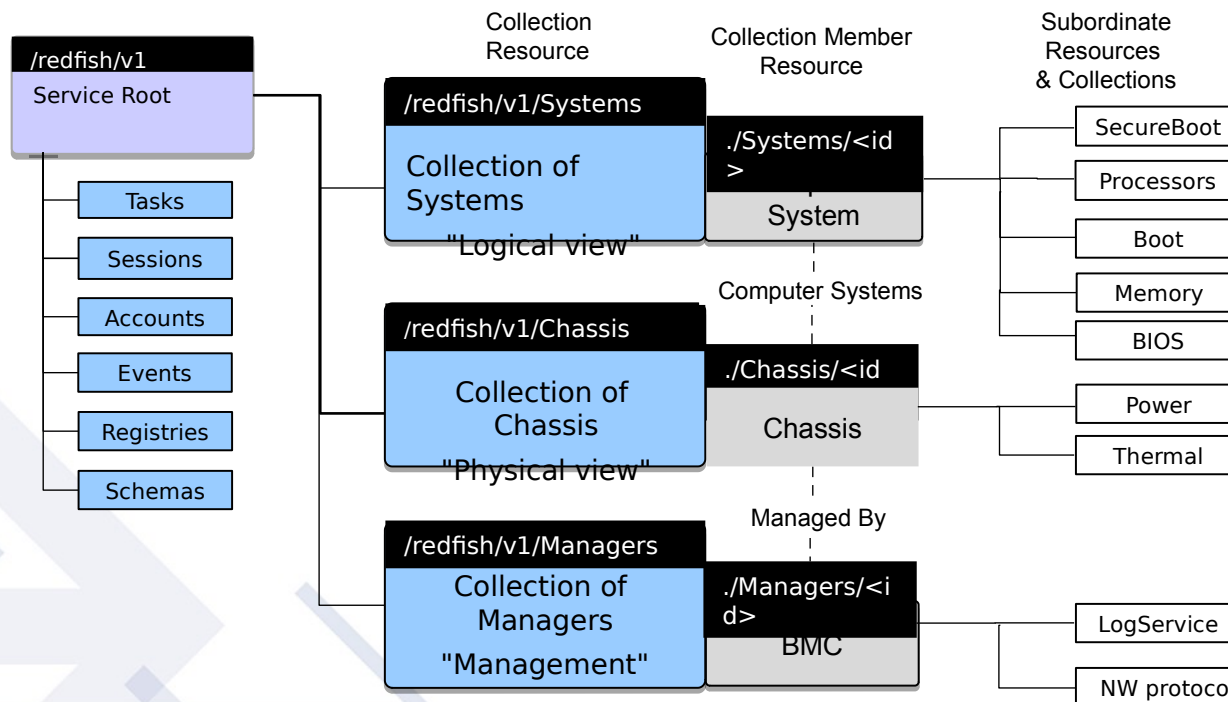


Interacting with BIOS

- 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



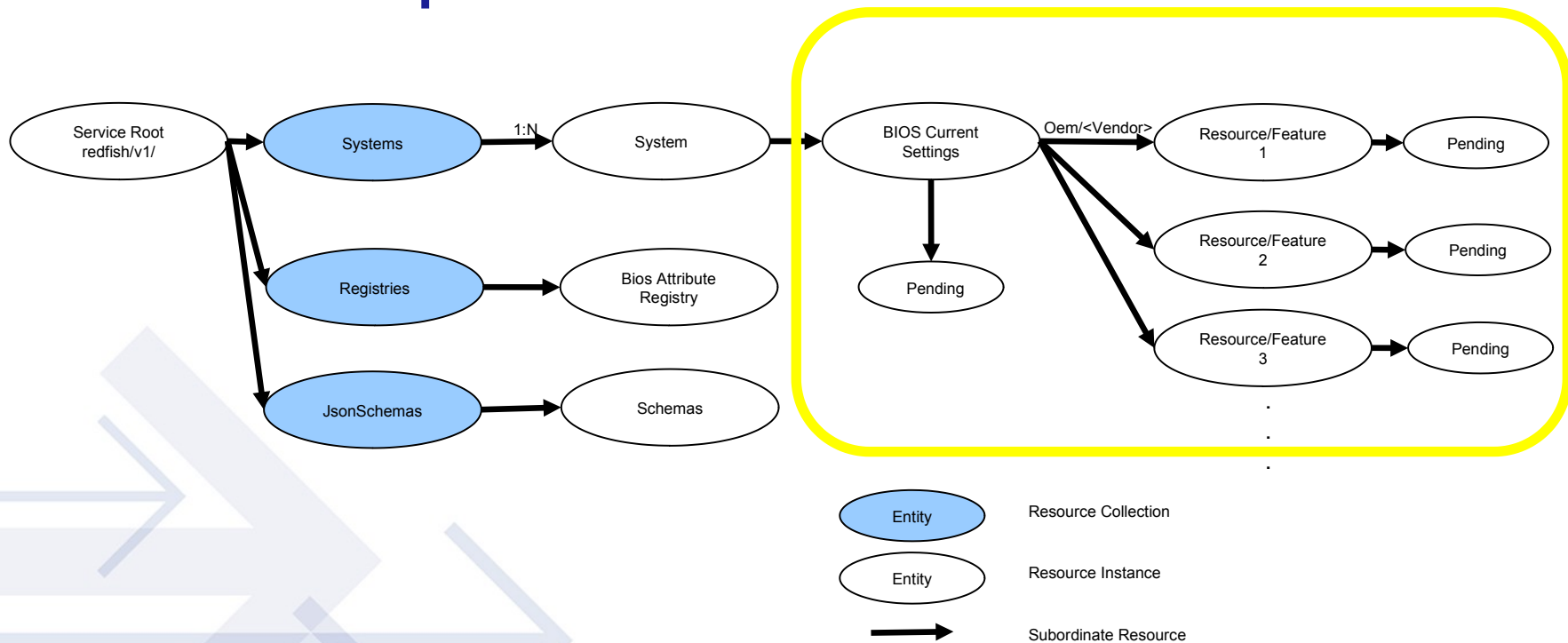
Redfish Resource Map (simplified)



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

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

BIOS Model Map





Example: Getting the Boot Mode

```
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

```
{
  "@Redfish.Copyright": "Copyright 2016-2019 DMTF. All rights reserved.",
  "@odata.id": "/redfish/v1/Systems/1/Bios",
  "@odata.type": "#Bios.v1_1_0.Bios",
  "Id": "Bios",
  "Name": "BIOS Configuration Current Settings",
  "Description": "BIOS Configuration Current Settings",
  "AttributeRegistry": "BiosAttributeRegistryP89.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/SD"
    },
    "Time": "2012-03-07T14:44.30-05:00"
  },
  "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",
    "EmbeddedSata": "Raid",
    "NicBoot1": "NetworkBoot",
    "NicBoot2": "Disabled",
    "PowerProfile": "MaxPerf",
    "ProcCoreDisable": 0,
    "ProcHyperthreading": "Enabled",
    "ProcTurboMode": "Enabled",
    "UsbControl": "UsbEnabled",
    "ConsoleBaudRate": "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"
      }
    ],
    "Oem": {}
  }
}
```



BIOS Current Settings

```
{
  "@odata.type": "#Bios.v1_0_3.Bios",
  "Id": "BIOS",
  "Name": "BIOS Configuration Current Settings",
  "AttributeRegistry": "BiosAttributeRegistryP89.v1_0_0",
  "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/",
  "Oem": {}
}
```

Specifies the schema and version

Specifies the name of the registry

All Bios settings

Uri of the resource, a self pointer

Is used to separate vendor extensions from the standard



BIOS Current Settings

```
{
  "@Redfish.Settings": {
    "odata.type": "#Settings.v1_0_0.Settings",
    "ETag": "9234ac83b9700123cc32",
    "Messages": [
      {
        "MessageId": "Base.1.0.PropertyValueNotInList",
        "RelatedProperties": [
          "#/Attributes/BootMode"
        ]
        "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/"
      }
    }
  },
}
```

An annotation that tell the client this resource is not writable

Specifies a Message returned by the Redfish service

Points to the resource where changes should be made

The time settings were applied

Contain the list of actions supported



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

JSON

- @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 :
 - 0

Registry Layout

```
{
  "DependencyFor": "BootMode",
  "Type": "Map",
  "Dependency": {
    "MapFrom": [
      {
        "MapFromAttribute": "BootMode",
        "MapFromProperty": "CurrentValue",
        "MapFromCondition": "EQU",
        "MapFromValue": "LegacyBios"
      }
    ],
    "MapToAttribute": "UefiOptimizedBoot",
    "MapToProperty": "CurrentValue",
    "MapToValue": "Disabled"
  }
}
```

Dependency

Bios Attribute Registry

306	AttributeName : TpmType
	DisplayName : Current TPM Type
	HelpText : Current TPM device type.
	ReadOnly : true
	GrayOut : false
	Immutable : true
	Type : Enumeration
	MenuPath : ./ServerSecurity/TpmOptions
	DisplayOrder : 307
	CurrentValue : null
	Value :
0	ValueName : NoTpm
	ValueDisplayName : No TPM
1	ValueName : Tpm12
	ValueDisplayName : TPM 1.2
2	ValueName : Tpm20
	ValueDisplayName : TPM 2.0

```
... DisplayName : Serial Port Options
... DisplayOrder : 4
... GrayOut : false
... MenuName : SerialPortOptions
... MenuPath : ./SystemOptions/SerialPortOptions
... ReadOnly : false
```

Menu

An Attribute Field

Updating a BIOS Setting Example

- Example Curl code to change “AdminName”

```
{  
  "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:

POST URI: [redfish/v1/Systems/1/Bios/Settings/Actions/Bios.ResetBios/](https://IP/redfish/v1/Systems/1/Bios/Settings/Actions/Bios.ResetBios/)

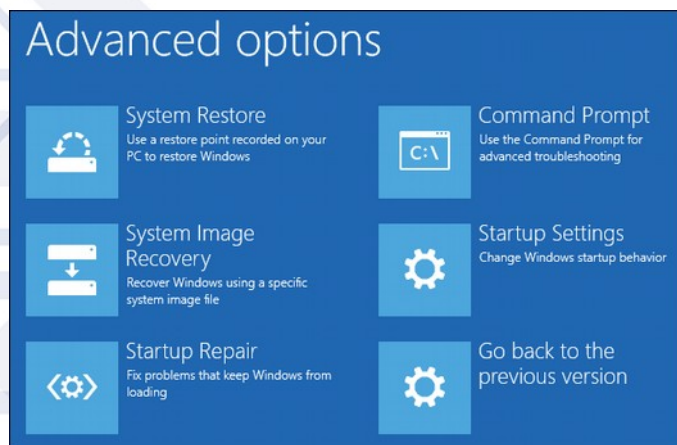
```
{  
  "ResetType": "default"  
}
```

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

- 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



Manufacturer	BIOS Setup Key
Acer	F2
ASAS	DEL/F2
Dell	F2
HP	F10
HPE	F9

Boot Options configuration

https://16.84.24.184/redfish/v1/systems/1/

```

"BootOptions": {
  "@odata.id": "/redfish/v1/Systems/1/BootOptions/"
},
"BootOrder": [
  "Boot0001",
  "Boot0009",
  "Boot000B",
  "Boot000A",
  "Boot000D",
  "Boot000E",
  "Boot000C",
  "Boot000F",
  "Boot0011",
  "Boot0010",
  "Boot0012"
],

```

https://16.84.24.184/redfish/v1/Systems/1/BootOptions/?\$expand=

```

"Members": [
  {
    "@odata.context": "/redfish/v1/$metadata#BootOption.BootOption",
    "@odata.id": "/redfish/v1/Systems/1/BootOptions/1/",
    "@odata.type": "#BootOption.v1_0_1.BootOption",
    "Id": "1",
    "Alias": "None",
    "BootOptionReference": "Boot0001",
    "DisplayName": "Embedded UEFI Shell",
    "Name": "Boot Option",
    "UefiDevicePath": "Fv(CDBB7B35-6833-4ED6-9AB2-57D2ACDDF6F0)/FvFile(C57AD6B7-0515-40A8-9D21-551652854E37)"
  },
  {
    "@odata.context": "/redfish/v1/$metadata#BootOption.BootOption",
    "@odata.id": "/redfish/v1/Systems/1/BootOptions/3/",
    "@odata.type": "#BootOption.v1_0_1.BootOption",
    "Id": "3",
    "Alias": "Hdd",
    "BootOptionReference": "Boot000B",
    "DisplayName": "Windows Boot Manager",
    "Name": "Boot Option",
    "UefiDevicePath": "HD(2,GPT,6F6D9B1A-B977-47F7-9478-78B1634C29A7,0x96800,0x32000)\\EFI\\Microsoft\\Boot\\l
  },
  {
    "@odata.context": "/redfish/v1/$metadata#BootOption.BootOption",
    "@odata.id": "/redfish/v1/Systems/1/BootOptions/4/",
    "@odata.type": "#BootOption.v1_0_1.BootOption",
    "Id": "4",
    "Alias": "Hdd",
    "BootOptionReference": "Boot000B",
    "DisplayName": "Windows Boot Manager",
    "Name": "Boot Option",
    "UefiDevicePath": "HD(2,GPT,6F6D9B1A-B977-47F7-9478-78B1634C29A7,0x96800,0x32000)\\EFI\\Microsoft\\Boot\\l
  },
  {
    "@odata.context": "/redfish/v1/$metadata#BootOption.BootOption",
    "@odata.id": "/redfish/v1/Systems/1/BootOptions/5/",
    "@odata.type": "#BootOption.v1_0_1.BootOption",
    "Id": "5",
    "Alias": "Hdd",
    "BootOptionReference": "Boot000B",
    "DisplayName": "Windows Boot Manager",
    "Name": "Boot Option",
    "UefiDevicePath": "HD(2,GPT,6F6D9B1A-B977-47F7-9478-78B1634C29A7,0x96800,0x32000)\\EFI\\Microsoft\\Boot\\l
  },
  {
    "@odata.context": "/redfish/v1/$metadata#BootOption.BootOption",
    "@odata.id": "/redfish/v1/Systems/1/BootOptions/6/",
    "@odata.type": "#BootOption.v1_0_1.BootOption",
    "Id": "6",
    "Alias": "Hdd",
    "BootOptionReference": "Boot000B",
    "DisplayName": "Windows Boot Manager",
    "Name": "Boot Option",
    "UefiDevicePath": "HD(2,GPT,6F6D9B1A-B977-47F7-9478-78B1634C29A7,0x96800,0x32000)\\EFI\\Microsoft\\Boot\\l
  },
  {
    "@odata.context": "/redfish/v1/$metadata#BootOption.BootOption",
    "@odata.id": "/redfish/v1/Systems/1/BootOptions/7/",
    "@odata.type": "#BootOption.v1_0_1.BootOption",
    "Id": "7",
    "Alias": "Hdd",
    "BootOptionReference": "Boot000B",
    "DisplayName": "Windows Boot Manager",
    "Name": "Boot Option",
    "UefiDevicePath": "HD(2,GPT,6F6D9B1A-B977-47F7-9478-78B1634C29A7,0x96800,0x32000)\\EFI\\Microsoft\\Boot\\l
  },
  {
    "@odata.context": "/redfish/v1/$metadata#BootOption.BootOption",
    "@odata.id": "/redfish/v1/Systems/1/BootOptions/8/",
    "@odata.type": "#BootOption.v1_0_1.BootOption",
    "Id": "8",
    "Alias": "Hdd",
    "BootOptionReference": "Boot000B",
    "DisplayName": "Windows Boot Manager",
    "Name": "Boot Option",
    "UefiDevicePath": "HD(2,GPT,6F6D9B1A-B977-47F7-9478-78B1634C29A7,0x96800,0x32000)\\EFI\\Microsoft\\Boot\\l
  },
  {
    "@odata.context": "/redfish/v1/$metadata#BootOption.BootOption",
    "@odata.id": "/redfish/v1/Systems/1/BootOptions/9/",
    "@odata.type": "#BootOption.v1_0_1.BootOption",
    "Id": "9",
    "Alias": "Hdd",
    "BootOptionReference": "Boot000B",
    "DisplayName": "Windows Boot Manager",
    "Name": "Boot Option",
    "UefiDevicePath": "HD(2,GPT,6F6D9B1A-B977-47F7-9478-78B1634C29A7,0x96800,0x32000)\\EFI\\Microsoft\\Boot\\l
  },
  {
    "@odata.context": "/redfish/v1/$metadata#BootOption.BootOption",
    "@odata.id": "/redfish/v1/Systems/1/BootOptions/10/",
    "@odata.type": "#BootOption.v1_0_1.BootOption",
    "Id": "10",
    "Alias": "Hdd",
    "BootOptionReference": "Boot000B",
    "DisplayName": "Windows Boot Manager",
    "Name": "Boot Option",
    "UefiDevicePath": "HD(2,GPT,6F6D9B1A-B977-47F7-9478-78B1634C29A7,0x96800,0x32000)\\EFI\\Microsoft\\Boot\\l
  },
  {
    "@odata.context": "/redfish/v1/$metadata#BootOption.BootOption",
    "@odata.id": "/redfish/v1/Systems/1/BootOptions/11/",
    "@odata.type": "#BootOption.v1_0_1.BootOption",
    "Id": "11",
    "Alias": "Hdd",
    "BootOptionReference": "Boot000B",
    "DisplayName": "Windows Boot Manager",
    "Name": "Boot Option",
    "UefiDevicePath": "HD(2,GPT,6F6D9B1A-B977-47F7-9478-78B1634C29A7,0x96800,0x32000)\\EFI\\Microsoft\\Boot\\l
  },
],
"Members@odata.count": 11

```

Boot Options configuration

- Patch URI <https://16.84.24.184/redfish/v1/systems/1/>

```
{  
  "Boot": {  
    "BootOrder": [  
      "Boot000B",  
      "Boot0009",  
      "Boot0001",  
      "Boot000A",  
      "Boot000D",  
      "Boot000E",  
      "Boot000C",  
      "Boot000F",  
      "Boot0011",  
      "Boot0010",  
      "Boot0012"  
    ]  
  }  
}
```




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

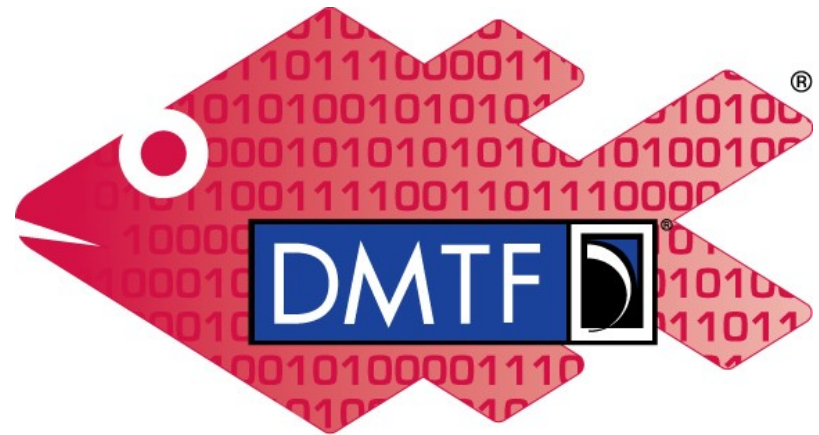


DMTF Tool Tacklebox



Thank you for watching!

- Redfish Standards
 - Schemas, Specs, Mockups, White Papers, FAQ, Educational Material & more
 - <http://www.dmtf.org/standards/redfish>
- Redfish Developer Hub
 - Redfish Interactive Explorer, Hosted Schema at Namespace & other links
 - <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>



Redfish

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

