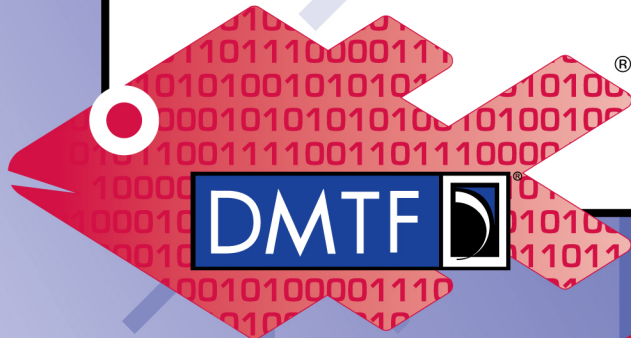




Redfish Storage Modeling

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Redfish



Agenda

- Resource Overview
- Direct Attached Storage Model Map
- Examples (of Direct Attached Storage)
 - SATA Drives with Single Storage Controller
 - Single RAID Controller
 - High Availability (HA) RAID Controllers

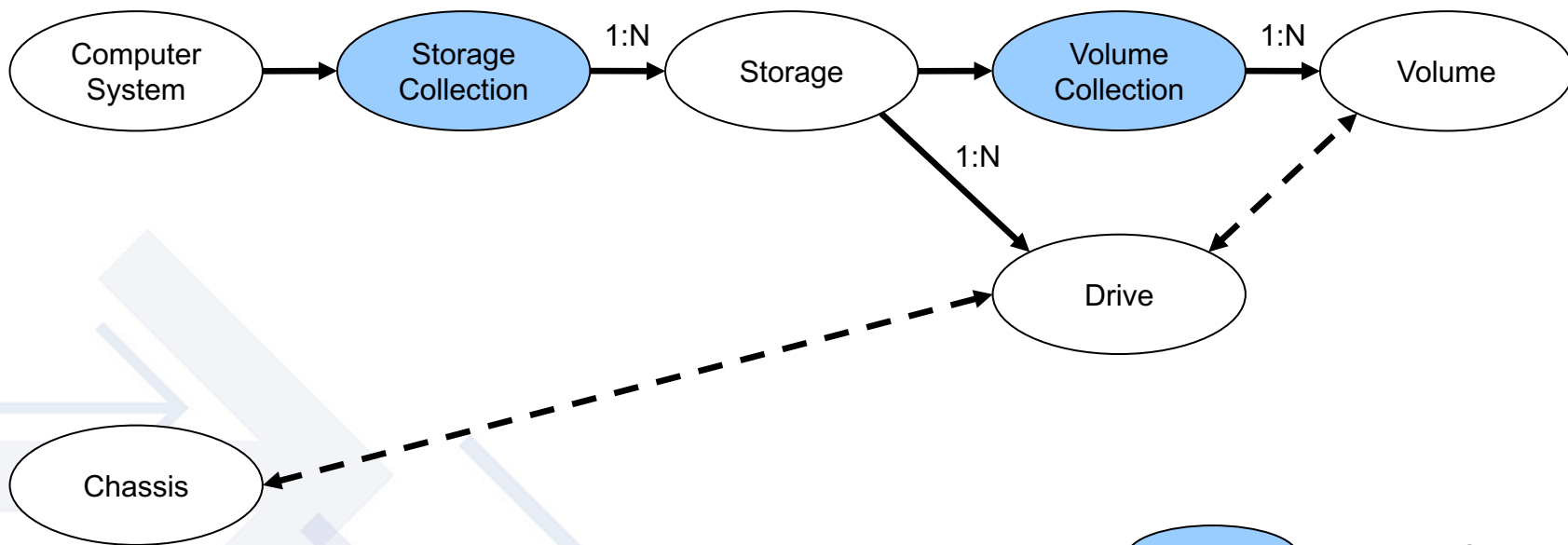






Resource Overview

- **Storage:** A representation of a storage sub-system
 - Contains sets of Volumes, Drives, and Storage Controllers
 - Storage Controller information is an array of objects in the Storage resource
 - Describes the protocols supported by the controller, the speed of the controller interface, and manufacturer information about the controller
- **Drive:** The physical media for the data
 - Manufacturer information about the drive (part number, serial number, etc)
 - Capability information about the drive (size, protocol, encryption, etc)
 - Contains control aspects (secure erase and LED setting)
- **Volume:** The logical construct used by the OS/hypervisor
 - Contains status about a volume (what drives contribute to the volume, size information, identifier information, etc)
 - Allows a client to control the volume (initialization, encryption settings, etc)



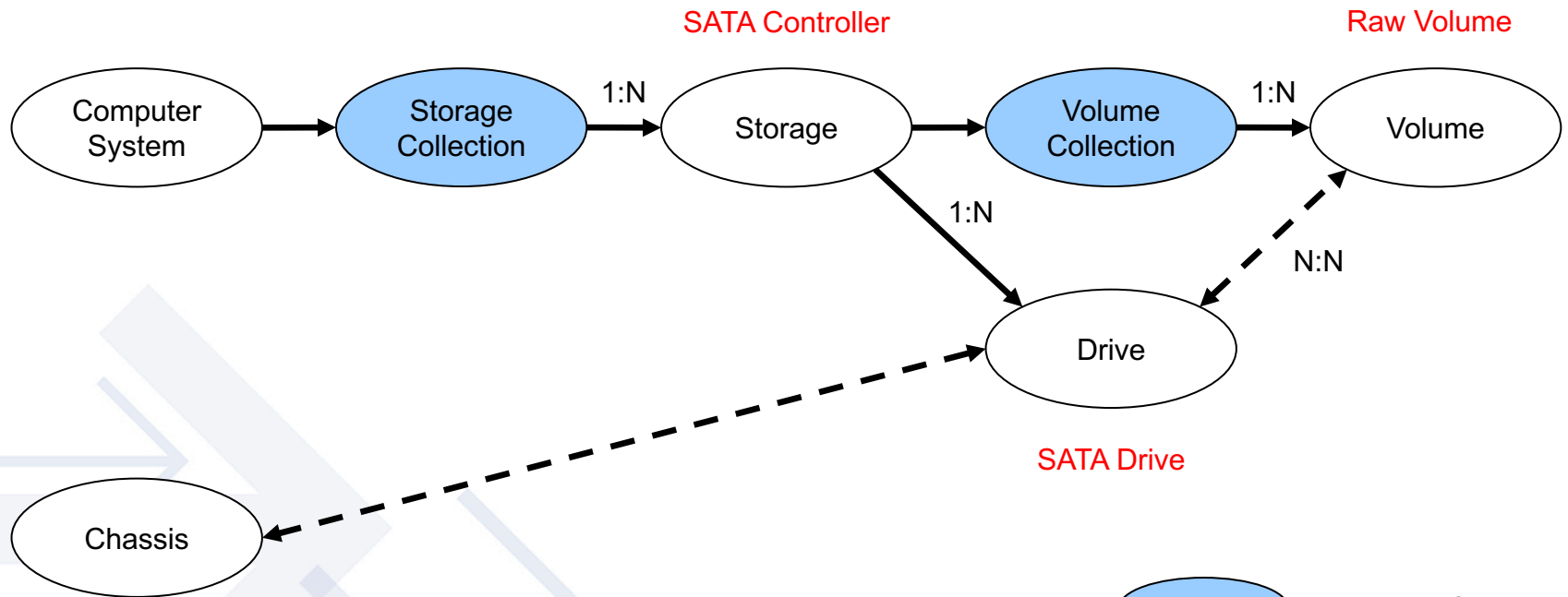
Direct Attached Storage Model Map







-  Entity Resource Collection
-  Entity Resource Instance
-  Subordinate Resource
-  Related Resource



SATA Drives with Single Storage Controller



-  Entity Resource Collection
-  Entity Resource Instance
-  Subordinate Resource
-  Related Resource



SATA Storage Resource Example

Drives and Volumes

```
{
  "@odata.context": "/redfish/v1/$metadata#Storage.Storage",
  "@odata.type": "#Storage.v1_1_0.Storage",
  "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1",
  "Id": "1",
  "Name": "Local Storage Controller",
  "Status": { "State": "Enabled", "Health": "OK", "HealthRollup": "OK" },
  "Drives": [
    { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/35D38F11ACEF7BD3" },
    { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/3F5A8C54207B7233" },
    { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/32ADF365C6C1B7BD" },
    { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/3D58ECBC375FD9F2" }
  ],
  "Volumes": { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Volumes" },
  ...
}
```



SATA Storage Resource Example (cont)

...

```
"StorageControllers": [
```

```
{
```

```
  "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1#/StorageControllers/0",
```

```
  "@odata.type": "#Storage.v1_1_0.StorageController",
```

```
  "MemberId": "0",
```

```
  "Status": { "State": "Enabled", "Health": "OK" },
```

Identifier Info

```
  "Identifiers": [
```

```
    { "DurableNameFormat": "NAA", "DurableName": "345C59DBD970859C" }
```

```
  ],
```

```
  "Manufacturer": "Contoso",
```

```
  "Model": "3Gbps SATA",
```

```
  "SerialNumber": "2M220100SL",
```

```
  "PartNumber": "CT18754",
```

```
  "FirmwareVersion": "1.0.0.7",
```

Manufacturer Info

```
  "SpeedGbps": 3,
```

```
  "SupportedControllerProtocols": [ "AHCI" ],
```

```
  "SupportedDeviceProtocols": [ "SATA" ]
```

Capability Info

```
}
```

```
]
```

```
}
```



SATA Drive Resource Example

```
{
  "@odata.context": "/redfish/v1/$metadata#Drive.Drive",
  "@odata.type": "#Drive.v1_1_0.Drive",
  "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/3D58ECBC375FD9F2",
  "Id": "3D58ECBC375FD9F2",
  "Name": "Drive Sample",
  "IndicatorLED": "Lit",
  "Status": { "State": "Enabled", "Health": "OK" },
  "CapacityBytes": 899527000000,
  "FailurePredicted": false,
  "Protocol": "SATA",
  "MediaType": "HDD",
  "Manufacturer": "Contoso",
  "SerialNumber": "1234568",
  "PartNumber": "C123-1111",
  "Identifiers": [ { "DurableNameFormat": "NAA", "DurableName": "32ADF365C6C1B7BD" } ],
  "EncryptionAbility": "None",
  "EncryptionStatus": "Unencrypted",
  "RotationSpeedRPM": 15000,
  "BlockSizeBytes": 512,
  "CapableSpeedGbs": 3,
  "NegotiatedSpeedGbs": 3,
  "Links": {
    "Volumes": [ { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Volumes/1" } ]
  }
}
```

Manufacturer Info

Drive Capabilities

Drive Status

Volumes Using the Drive



SATA Volume Resource Example

```
{
  "@odata.context": "/redfish/v1/$metadata#Volume.Volume",
  "@odata.type": "#Volume.v1_0_0.Volume",
  "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Volumes/1",
  "Id": "1",
  "Name": "Volume 1",
  "Status": { "State": "Enabled", "Health": "OK" },
  "Encrypted": false,
  "VolumeType": "RawDevice",
  "CapacityBytes": 899527000000,
  "Identifiers": [
    { "DurableNameFormat": "UUID", "DurableName": "38f1818b-111e-463a-aa19-fa54f792e468" }
  ],
  "Links": {
    "Drives": [
      { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/3D58ECBC375FD9F2" }
    ]
  },
  "Actions": {
    "#Volume.Initialize": {
      "target": "/redfish/v1/Systems/3/Storage/RAIDIntegrated/Volumes/1/Actions/Volume.Initialize",
      "InitializeType@Redfish.AllowableValues": [ "Fast", "Slow" ]
    }
  }
}
```

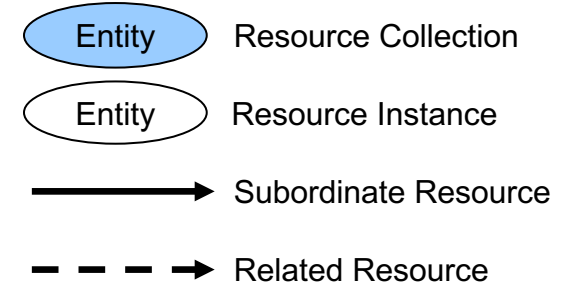
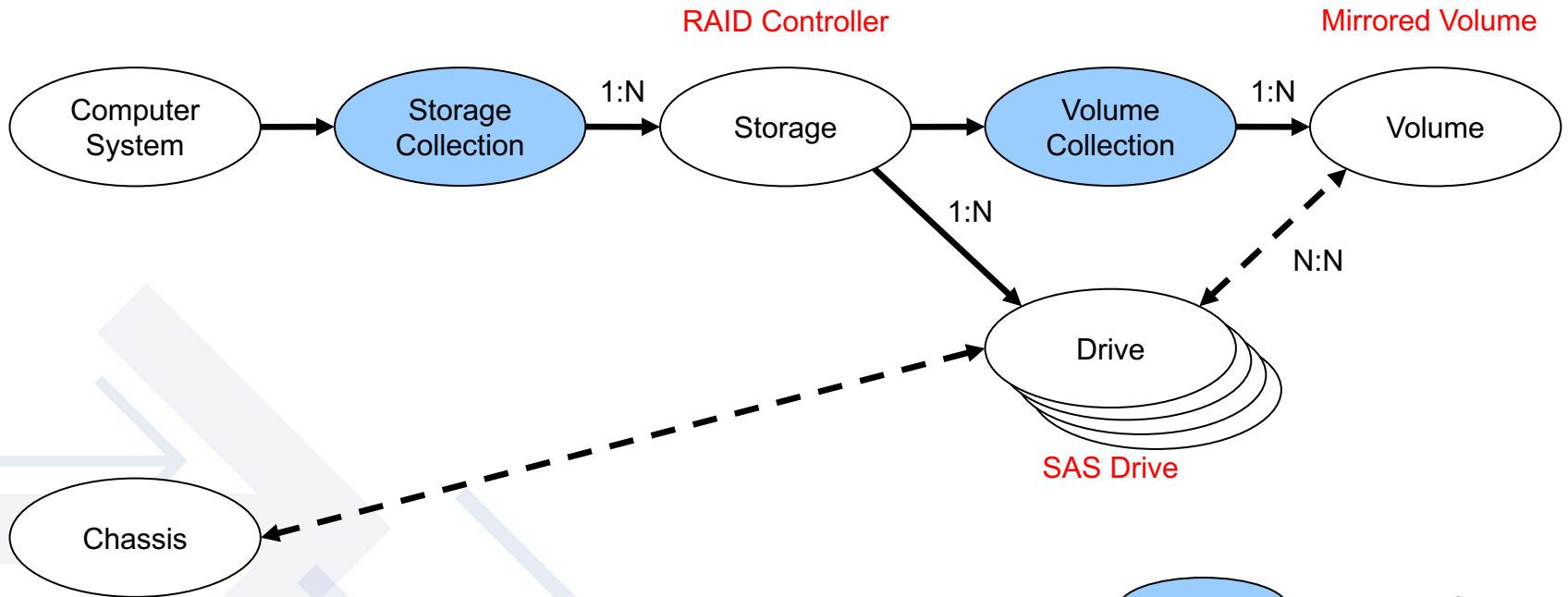
Volume Status

Drives Used by the Volume Unique Identifier of the Volume

Actions for the Volume



Single RAID Controller





Single RAID Storage Resource Example

```
{
  "@odata.context": "/redfish/v1/$metadata#Storage.Storage",
  "@odata.type": "#Storage.v1_1_0.Storage",
  "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1",
  "Id": "1",
  "Name": "Local Storage Controller",
  "Status": { "State": "Enabled", "Health": "OK", "HealthRollup": "OK" },
  "Drives": [
    { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/35D38F11ACEF7BD3" },
    { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/3F5A8C54207B7233" },
    { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/32ADF365C6C1B7BD" },
    { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/3D58ECBC375FD9F2" }
  ],
  "Volumes": { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Volumes" },
  ...
}
```

No changes from SATA example



Single RAID Storage Resource Example (cont)

...

```
"StorageControllers": [  
  {  
    "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1#/StorageControllers/0",  
    "@odata.type": "#Storage.v1_1_0.StorageController",  
    "MemberId": "0",  
    "Status": { "State": "Enabled", "Health": "OK" },  
    "Identifiers": [  
      { "DurableNameFormat": "NAA", "DurableName": "345C59DBD970859C" }  
    ],  
    "Manufacturer": "Contoso",  
    "Model": "12Gbs Integrated RAID",  
    "SerialNumber": "2M220100SL",  
    "PartNumber": "CT18754",  
    "FirmwareVersion": "1.0.0.7",  
    "SpeedGbps": 12,  
    "SupportedControllerProtocols": [ "PCIe" ],  
    "SupportedDeviceProtocols": [ "SAS", "SATA" ]  
  }  
]
```

Changes from SATA
example



Single RAID Drive Resource Example

```
{
  "@odata.context": "/redfish/v1/$metadata#Drive.Drive",
  "@odata.type": "#Drive.v1_1_0.Drive",
  "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/3D58ECBC375FD9F2",
  "Id": "3D58ECBC375FD9F2",
  "Name": "Drive Sample",
  "IndicatorLED": "Lit",
  "Status": { "State": "Enabled", "Health": "OK" },
  "CapacityBytes": 899527000000,
  "FailurePredicted": false,
  "Protocol": "SAS",
  "MediaType": "HDD",
  "Manufacturer": "Contoso",
  "SerialNumber": "1234568",
  "PartNumber": "C123-1111",
  "Identifiers": [ { "DurableNameFormat": "NAA", "DurableName": "32ADF365C6C1B7BD" } ],
  "EncryptionAbility": "SelfEncryptingDrive",
  "EncryptionStatus": "Unlocked",
  "RotationSpeedRPM": 15000,
  "BlockSizeBytes": 512,
  "CapableSpeedGbs": 12,
  "NegotiatedSpeedGbs": 12,
  "Links": {
    "Volumes": [ { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Volumes/1" } ]
  }
}
```

Changes from SATA
example



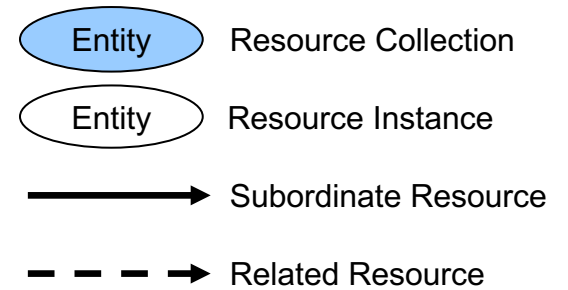
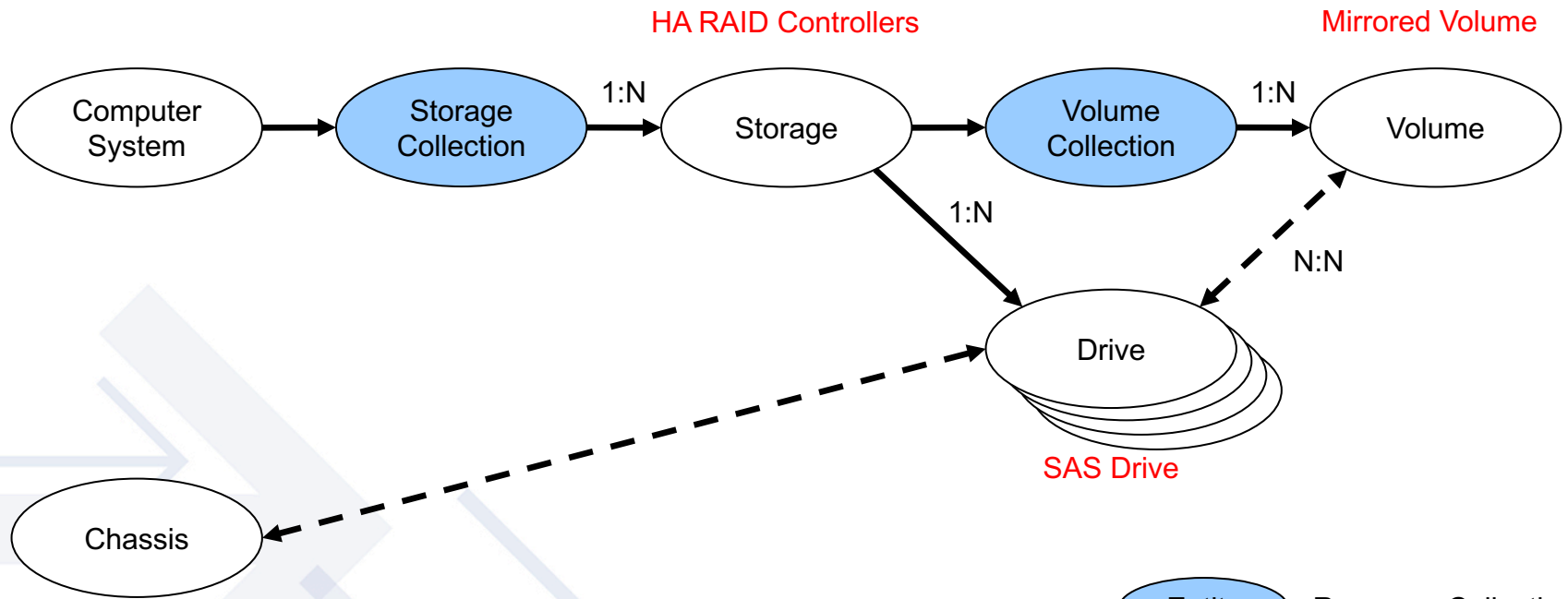
Single RAID Volume Resource Example

```
{
  "@odata.context": "/redfish/v1/$metadata#Volume.Volume",
  "@odata.type": "#Volume.v1_0_0.Volume",
  "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Volumes/1",
  "Id": "1",
  "Name": "Volume 1",
  "Status": { "State": "Enabled", "Health": "OK" },
  "Encrypted": false,
  "VolumeType": "Mirrored",
  "CapacityBytes": 899527000000,
  "Identifiers": [ { "DurableNameFormat": "UUID", "DurableName": "38f1818b-111e-463a-aa19-fa54f792e468" } ],
  "Links": {
    "Drives": [
      { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/3D58ECBC375FD9F2" },
      { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/3F5A8C54207B7233" },
      { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/32ADF365C6C1B7BD" },
      { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/3D58ECBC375FD9F2" },
    ]
  },
  "Actions": {
    "#Volume.Initialize": {
      "target": "/redfish/v1/Systems/3/Storage/RAIDIntegrated/Volumes/1/Actions/Volume.Initialize",
      "InitializeType@Redfish.AllowableValues": [ "Fast", "Slow" ]
    }
  }
}
```

Changes from SATA example



High Availability RAID





HA RAID Storage Resource Example

```
{
  "@odata.context": "/redfish/v1/$metadata#Storage.Storage",
  "@odata.type": "#Storage.v1_1_0.Storage",
  "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1",
  "Id": "1",
  "Name": "Local Storage Controller",
  "Status": { "State": "Enabled", "Health": "OK", "HealthRollup": "OK" },
  "Drives": [
    { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/35D38F11ACEF7BD3" },
    { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/3F5A8C54207B7233" },
    { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/32ADF365C6C1B7BD" },
    { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/3D58ECBC375FD9F2" }
  ],
  "Volumes": { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Volumes" },
  ...
}
```

No changes from Single RAID



HA RAID Storage Resource Example (cont)

...

Changes from Single RAID

```
"StorageControllers": [  
  {  
    "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1#/StorageControllers/0",  
    ...  
  },  
  {  
    "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1#/StorageControllers/1",  
    ...  
  }  
],  
"Redundancy": [  
  {  
    "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1#/Redundancy/0",  
    "MemberId": "Redundancy",  
    "Mode": "Failover",  
    "MaxNumSupported": 2,  
    "MinNumNeeded": 1,  
    "Status": { "State": "Enabled", "Health": "OK" },  
    "RedundancySet": [  
      { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1#/StorageControllers/0" },  
      { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1#/StorageControllers/1" }  
    ]  
  }  
]  
}
```



HA RAID Drive Resource Example

```
{
  "@odata.context": "/redfish/v1/$metadata#Drive.Drive",
  "@odata.type": "#Drive.v1_1_0.Drive",
  "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/3D58ECBC375FD9F2",
  "Id": "3D58ECBC375FD9F2",
  "Name": "Drive Sample",
  "IndicatorLED": "Lit",
  "Status": { "State": "Enabled", "Health": "OK" },
  "CapacityBytes": 899527000000,
  "FailurePredicted": false,
  "Protocol": "SAS",
  "MediaType": "HDD",
  "Manufacturer": "Contoso",
  "SerialNumber": "1234568",
  "PartNumber": "C123-1111",
  "Identifiers": [ { "DurableNameFormat": "NAA", "DurableName": "32ADF365C6C1B7BD" } ],
  "EncryptionAbility": "SelfEncryptingDrive",
  "EncryptionStatus": "Unlocked",
  "RotationSpeedRPM": 15000,
  "BlockSizeBytes": 512,
  "CapableSpeedGbs": 12,
  "NegotiatedSpeedGbs": 12,
  "Links": {
    "Volumes": [ { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Volumes/1" } ]
  }
}
```

No changes from Single RAID



HA RAID Volume Resource Example

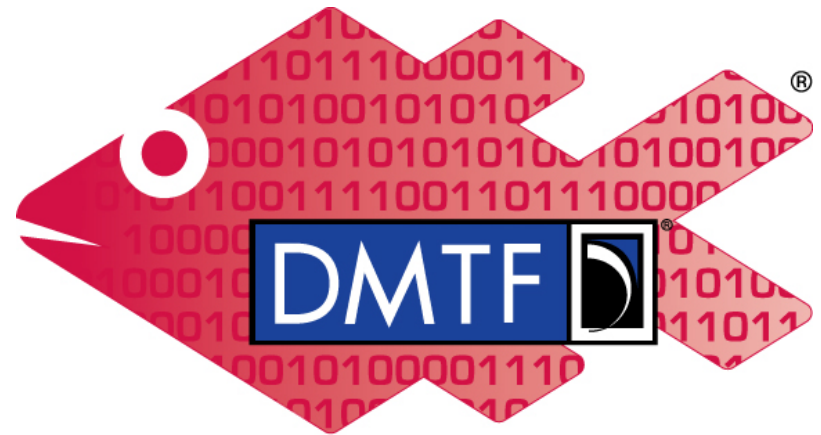
```
{
  "@odata.context": "/redfish/v1/$metadata#Volume.Volume",
  "@odata.type": "#Volume.v1_0_0.Volume",
  "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Volumes/1",
  "Id": "1",
  "Name": "Volume 1",
  "Status": { "State": "Enabled", "Health": "OK" },
  "Encrypted": false,
  "VolumeType": "Mirrored",
  "CapacityBytes": 899527000000,
  "Identifiers": [ { "DurableNameFormat": "UUID", "DurableName": "38f1818b-111e-463a-aa19-fa54f792e468" } ],
  "Links": {
    "Drives": [
      { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/3D58ECBC375FD9F2" },
      { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/3F5A8C54207B7233" },
      { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/32ADF365C6C1B7BD" },
      { "@odata.id": "/redfish/v1/Systems/437XR1138R2/Storage/1/Drives/3D58ECBC375FD9F2" },
    ]
  },
  "Actions": {
    "#Volume.Initialize": {
      "target": "/redfish/v1/Systems/3/Storage/RAIDIntegrated/Volumes/1/Actions/Volume.Initialize",
      "InitializeType@Redfish.AllowableValues": [ "Fast", "Slow" ]
    }
  }
}
```

No changes from Single RAID



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>
- SPMF (WG that defines Redfish)
 - Companies involved, Upcoming Schedules & Future work, Charter, Information on joining.
 - <http://www.dmtf.org/standards/spmf>



Redfish