A New Standard for IP Based Drive Management

Mark Carlson, Toshiba, Inc.
David Slik, NetApp, Inc.
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Abstract

A New Standard for IP Based Drive Management

This session will appeal to Software Developers, Development Managers, Data Center Managers, and those that are seeking a fundamental understanding of how IP-based storage drives can be integrated and managed in a datacenter environment. The session will delve into the benefits and challenges of the IP-based drive management approach, and will bring a clear understanding of how the DMTF RedFish standard is leveraged to provide a common management foundation.
What is an IP-Based Drive?

- An IP-based drive is a storage device accessed and managed using TCP/IP, typically connected via Ethernet.
  - IP-based drives can look like normal HDD/SSDs.
  - IP-Based drives can also be virtualized, and have other form factors.
Why IP-Based Drives?

- IP/Ethernet has become the primary data center connectivity fabric
  - Reduction in cost
  - Reduction in complexity
- Data centers are increasingly virtualized and dynamic
  - Light-weight containers and server-less computing
  - Mobile applications
  - Dynamic scaling
Why IP-Based Drives?

IP-based drives have the following advantages

- Storage Services provided by IP-based drives can be directly accessed anywhere IP connectivity is routed. This can be limited to a local storage network, data center wide, or even connected to the public Internet.
- Clients can access IP-based drives directly, reducing the overhead and complexity. This better fits with newer scale-out programming models.
- Multiple clients can access IP-based drives without an intervening controller.
Challenges of IP-Based Drives

Moving to IP-based drives means that every drive is a network endpoint on the data center IP network
- 50 PB of 10 TB disks (with protection) means 6,700 IP devices

IP-based drives must be directly managed, instead of being hidden behind storage controllers
- Discovery, provisioning, configuration, health monitoring, firmware, security, etc...

This tutorial discusses how IP-based drives are managed
IP-Based Drive Management

Management requirements are well-defined:
- As a device, how do I connect to a network?
- As a manager, how do I discover and provision devices?
- As a manager, how do I configure devices?
- As a manager, how do I monitor operations and faults?
- As a manager, how do I keep devices secure & up to date?

Fortunately, we don’t have to re-invent the wheel
The Distributed Management Task Force (DMTF) has created a standard for IP-based device management

Known as Redfish, it provides:
- A RESTful interface for device management
- A fully-featured and scalable device model
- Support for a variety of device topologies

SNIA has built on Redfish for IP-Based Drive Management

https://www.dmtf.org/sites/default/files/standards/documents/DSP0266_1.0.2.pdf
The IP-Based Drive Management Stack looks like this:

- Device management is built on top of the DMTF Redfish standard
- Network connectivity and discovery are defined by IETF standards
- Physical and electrical connectivity are defined by SFF and IEEE standards
IP-Based Drive Management Initialization

- On initial connection to a TCP/IP network
  - Physical connectivity is negotiated and established
  - DHCP is used to obtain an address
  - DHCP provides DNS and NTP configuration parameters
  - DNS is used to obtain a hostname, and resolve names
  - NTP is used to set the local clock + chain of trust for time

- At this point, the IP-based drive is on the network, reachable and discoverable by a device manager
Redfish Management

- Discovery via Simple Service Discovery Protocol (SSDP)
- Redfish uses HTTPS
  - Managers connect to a well-known “service entry point”
  - “/redfish/v1”
  - Standard HTTP GET/PUT/POST/PATCH/DELETE
- Data is in JSON format (with ODATA extensions)
- Returned JSON describes resource properties
- Returned JSON describes device resource map
Redfish Management

- **GET /redfish/v1**
  - JSON properties
    - "Id"
    - "Name"
    - "UUID", etc
  - JSON links
    - "Systems"
    - "Chassis"
    - "Managers", etc
  - Links have URIs that return lists of resources

```json
{
    "@odata.type":"#ServiceRoot.v1_0_2.ServiceRoot",
    "Id":"RootService",
    "Name":"Root Service",
    "RedfishVersion":"1.0.2",
    "UUID":view details "92384634-2938-2342-8820-489239905423",
    "Systems": {
        "@odata.id": "/redfish/v1/Systems"
    },
    "Chassis": {
        "@odata.id": "/redfish/v1/Chassis"
    },
    "Managers": {
        "@odata.id": "/redfish/v1/Managers"
    },
    "Tasks": {
        "@odata.id": "/redfish/v1/TaskService"
    },
    ...
}```
GET /redfish/v1/Systems/

- JSON properties
  - ODATA metadata
  - Count of systems

- JSON links
  - Array of “Members”
  - Each member has link to the corresponding system
GET /redfish/v1/Systems/43

- JSON properties
  - Based on System schema
  - Details on system device
  - Model, Serial Number, Type, etc.

- JSON links
  - Based on System schema
  - Provides further properties, plus configuration capabilities
  - Bios, Processors, Memory, EthernetInterfaces, SimpleStorage, LogServices, etc.
Redfish Management

- By drilling down through these discoverable JSON documents, a manager can discover and monitor characteristics of a device.
- Redfish also provides mechanisms by which configuration parameters can be modified via PUT, POST or PATCH.
- Redfish also defines a standard for push-based notifications, and for management security functions.
The SNIA Object Drive Technical Working Group (TWG) has created an IP-based drive management specification based on Redfish.

This is a SNIA Technical Position (standard):

http://www.snia.org/sites/default/files/technical_work/IPdrive/IPBasedDriveMgmtSpecV1.0.pdf
The following Redfish Services are mandatory
- Account Service
- Session Service
- Chassis Collection
- Manager Collection
- Computer System Collection

The following Redfish Services are recommended
- Update Service
For IP-based drives, a new “ChassisType” property of “IPBasedDrive” is defined.

The Chassis resources should support the following properties:

- “Status”, “Manufacturer”, “Model”, “SKU”, “PartNumber”, “SerialNumber”, “AssetTag”, “IndicatorLED”.

As IP-based drives have an integrated computer, they shall implement a “Computer System” collection

Each Computer System shall contain an Ethernet Interface Collection, used to manage the Ethernet port(s)

The Computer System resources should support the following properties:

- “Status”, “Manufacturer”, “Model”, “SKU”, “PartNumber”, “SerialNumber”, “AssetTag”, “IndicatorLED”.
As IP-based drives have a storage device, they shall implement a “Drive” entity.

The Drive resources should support the following properties:


Redfish for IP-Based Drives
Redfish for IP-Based Drives

Putting this together:

- **Root resource**
  - Links to all content
  - `/redfish/v1`

- **Collection of Systems**
  - Logical view of the system
  - `/redfish/v1/Systems`

- **Collection of Chassis**
  - Physical view of the system
  - `/redfish/v1/Chassis`

- **/redfish/v1/Systems/<id>**
  - Server information
    - Model#, Serial#, Boot order, NIC MAC, status etc

- **/redfish/v1/Chassis/<id>**
  - Chassis information
    - Chassis global physical asset information

- **Sessions**
- **Accounts**
- **Schemas**
- **Events**

- **Processors**
- **Disks**
- **NICs**

- **Power**
- **Thermal**
Call to action

- Read the IP Based Drive Management specification
  - Drill down and understand Redfish
- Investigate using some open source for risk reduction activities
  - [https://www.dmtf.org/standards/opensource](https://www.dmtf.org/standards/opensource)
  - [https://www.snia.org/opensource](https://www.snia.org/opensource)
More Resources

SNIA IP-Based Drives:
- [https://www.snia.org/object-drives](https://www.snia.org/object-drives) - Standard home page
- [https://www.snia.org/education/tutorials/fms2015](https://www.snia.org/education/tutorials/fms2015) - Tutorial
- [https://www.brighttalk.com/webcast/663/249213](https://www.brighttalk.com/webcast/663/249213) - Webcast

DMTF Redfish:
- [http://redfish.dmtf.org](http://redfish.dmtf.org) - Standard home page
- [http://redfish.dmtf.org/redfish/v1](http://redfish.dmtf.org/redfish/v1) - Mockup
- [http://redfish.dmtf.org/education](http://redfish.dmtf.org/education) - Whitepapers & presentations
The SNIA Education Committee thanks the Object Drive TWG and the following Individuals for their contributions to this Tutorial.

Authorship History

July 2017, Mark Carlson, David Slik

Updates: Alex McDonald

Additional Contributors

Please send any questions or comments regarding this SNIA Tutorial to tracktutorials@snia.org