SNIA Global Education Tutorial

A New Standard for IP Based Drive Management

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About the Instructor

- Mark A. Carlson, Principal Engineer, Industry Standards at Toshiba, has more than 35 years of experience with Networking and Storage development and more than 18 years experience with Java technology.
- Mark was one of the authors of the CDMI Cloud Storage standard.
- Mark is the co-chair of the SNIA Cloud Storage and Object Drive technical working groups, and serves as co-chair of the SNIA Technical Council.

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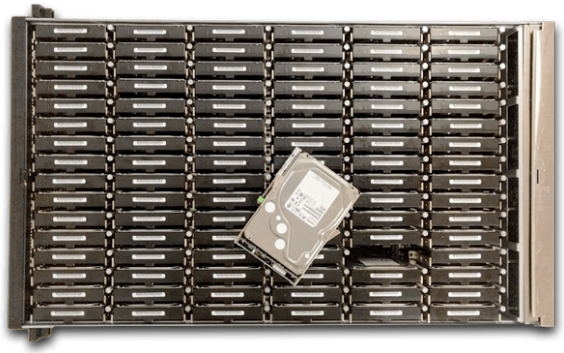
Abstract

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

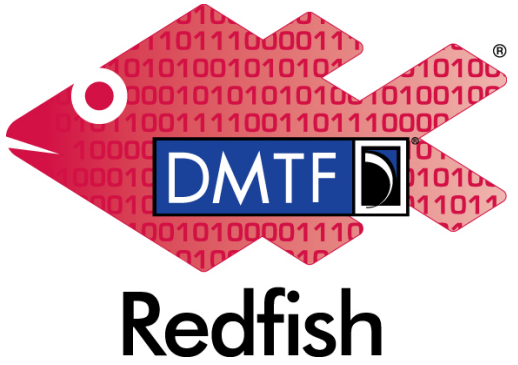
IP-Based Drive Management

- 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

IP-Based Drive Management

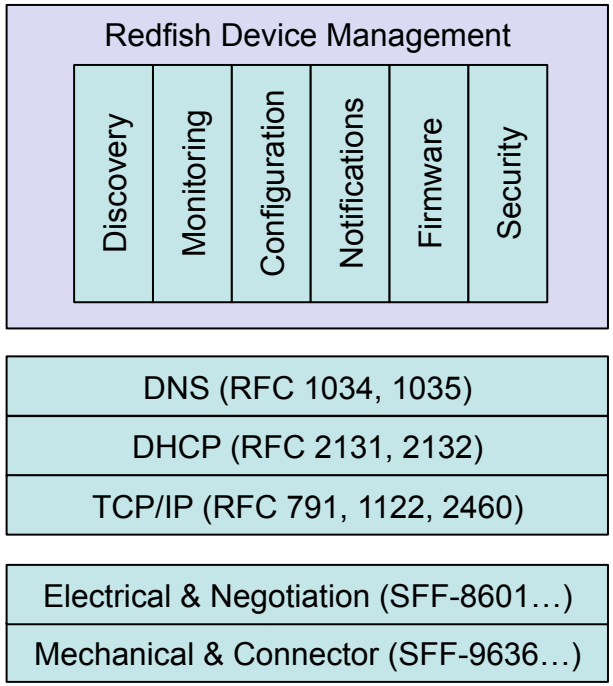
- The Distributed Management Task Force (DMTF) has created a standard for IP-based device management
- Known as Redfish, it provides:
  - A RESTful interface for device management
  - A fully-featured and scalable device model
  - Support for a variety of device topologies
- SNIA has built on Redfish for IP-Based Drive Management

https://www.dmtf.org/sites/default/files/standards/documents/DSP0266_1.0.2.pdf



IP-Based Drive Management

- 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



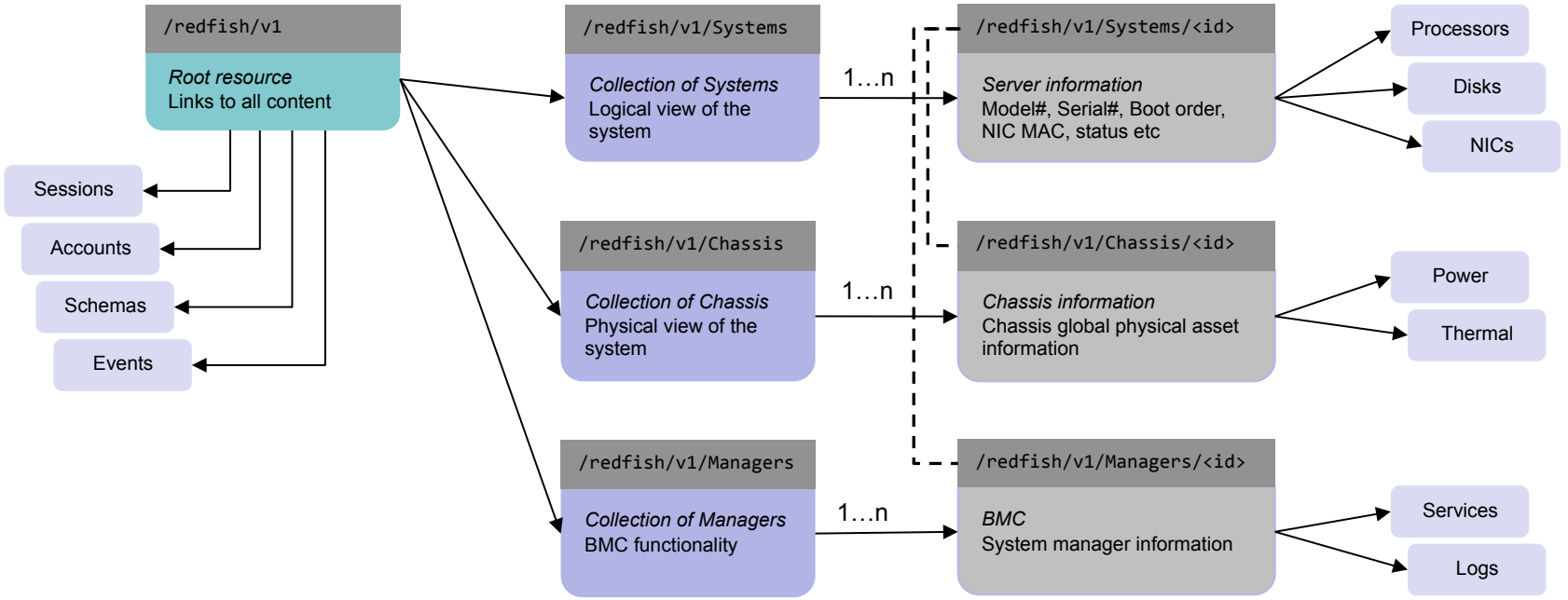
IP-Based Drive Management Initialization

- 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



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

```
{
    "@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”
    },
   …
```

Redfish Management

- GET /redfish/v1/Systems/
  - JSON properties
    - ODATA metadata
    - Count of systems
  - JSON links
    - Array of “Members”
    - Each member has link to the corresponding system

```
{
    "@odata.type":"#ComputerSystemCollection.<snip>",
    "Name":"Computer System Collection",
    "Members@odata.count":1,
    "Members": [
        {
            "@odata.id":"/redfish/v1/Systems/43”
        }
    ],
    "@odata.context":"/redfish/v1/$metadata#<snip> ",
    "@odata.id":"/redfish/v1/Systems”
}
```

Redfish Management

- 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.

```
{
    "@odata.type":"#ComputerSystem.v1_1_0.ComputerSystem",
    "Id":"43",
    "Name":”Descriptive Name",
    "SystemType":"Physical",
    "AssetTag":”C1-42",
    "Manufacturer":"Contoso",
    "Model":"3500RX",
    "SKU":"8675309",
    "SerialNumber":"437XR1138R2",
    "PartNumber":"224071-J23",
    …
    "Bios": {
        "@odata.id":"/redfish/v1/Systems/43/BIOS”
    } ,
    “Processors": {
        "@odata.id":"/redfish/v1/Systems/43/Processors”
    } ,
    …
```

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

Redfish for IP-Based Drives

- 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

Redfish for IP-Based Drives

- 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

Redfish for IP-Based Drives

- 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”.

Redfish for IP-Based Drives

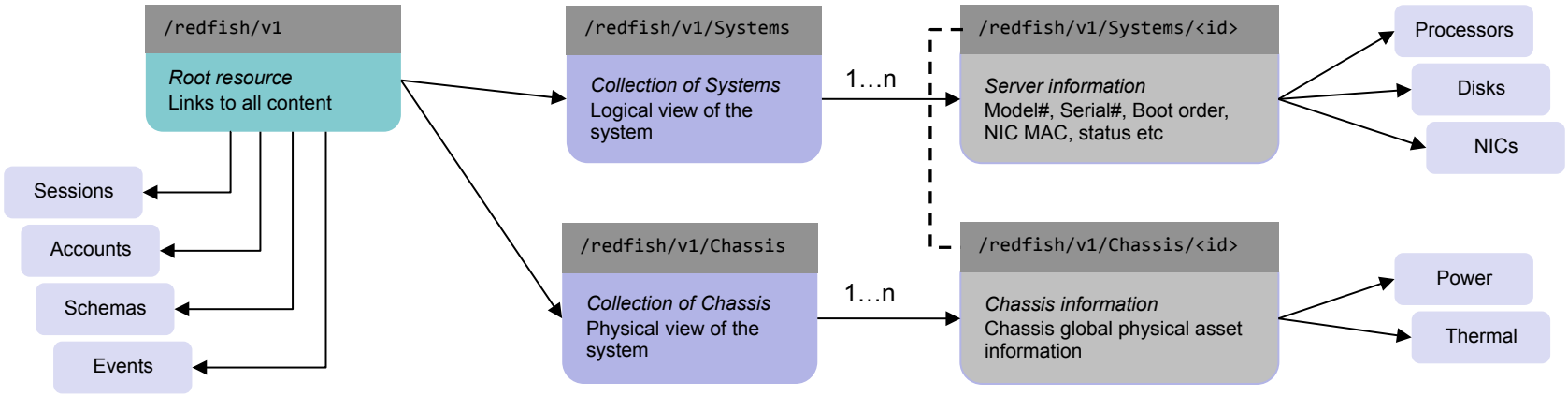
- As IP-based drives have an integrated computer, they shall implement a “Computer System” collection
- Each Computer System shall contain an Ethernet Interface Collection, used to manage the Ethernet port(s)
- The Computer System resources should support the following properties:
  - “Status”, “Manufacturer”, “Model”, “SKU”, “PartNumber”, “SerialNumber”, “AssetTag”, “IndicatorLED”.

Redfish for IP-Based Drives

- As IP-based drives have a storage device, they shall implement a “Drive” entity.
- The Drive resources should support the following properties:
  - “Status”, “Manufacturer”, “Model”, “SKU”, “PartNumber”, “SerialNumber”, “AssetTag”, “IndicatorLED”, “BlockSizeBytes”.

Redfish for IP-Based Drives

- Putting this together:



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.snia.org/opensource

More Resources

- SNIA IP-Based Drives:
  - https://www.snia.org/object-drives - Standard home page
  - https://www.snia.org/education/tutorials/fms2015 - Tutorial
  - https://www.brighttalk.com/webcast/663/249213 - Webcast
- DMTF Redfish:
  - http://redfish.dmtf.org - Standard home page
  - http://redfish.dmtf.org/redfish/v1 - Mockup
  - http://redfish.dmtf.org/education - Whitepapers & presentations

Attribution & Feedback

The SNIA Education Committee thanks the Object Drive TWG and the following Individuals for their contributions to this Tutorial.

Authorship History

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