

SDC 20
SNIA EMEA

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TEL AVIV, ISRAEL

STORAGE DEVELOPER
CONFERENCE

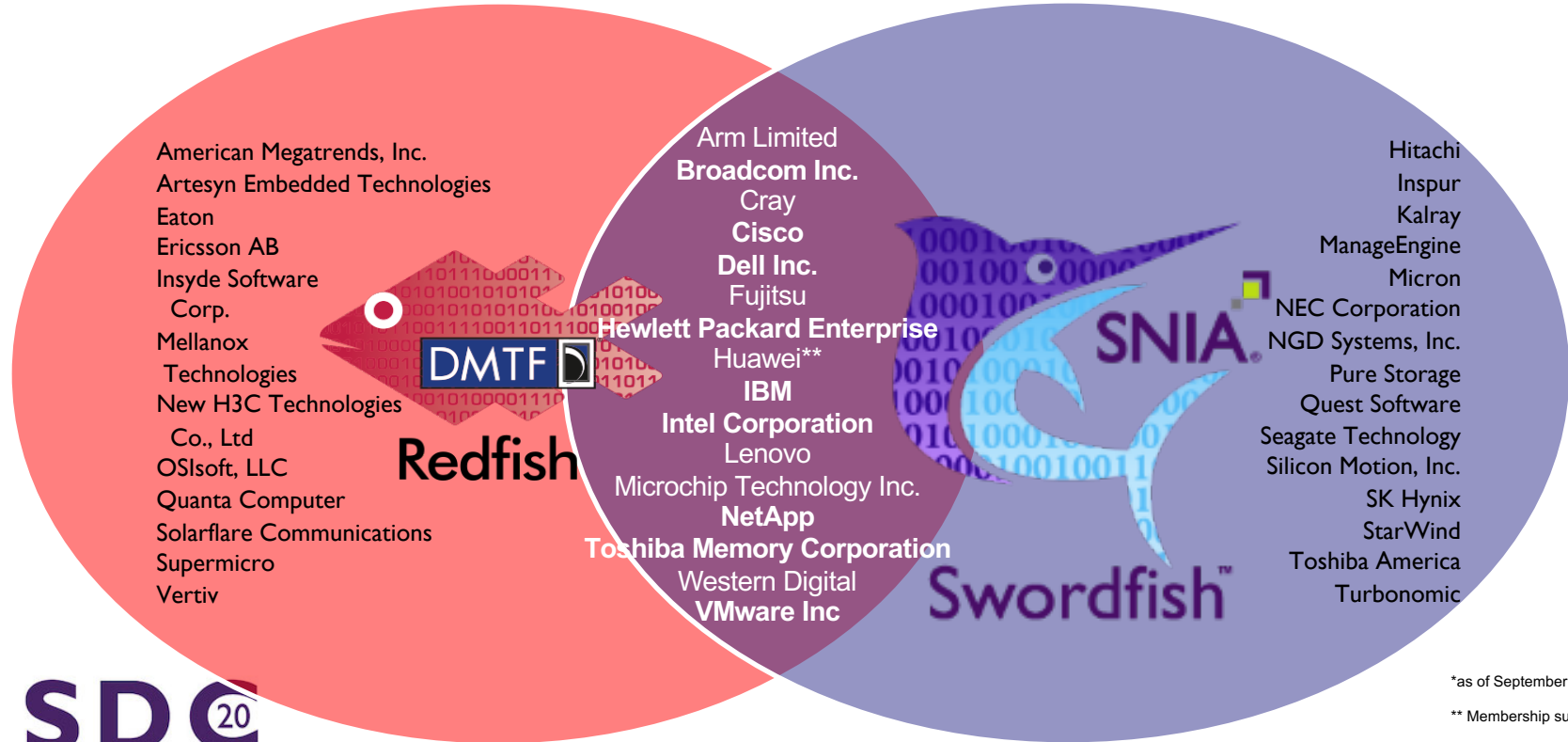
Accelerating Swordfish Implementations

Chris Lionetti
HPE

The SNIA Swordfish™ Approach

- Develop the management model
 - point-of-view of what a client needs to accomplish
 - provide information that the client needs
- Cover block, file, and object storage
- Traditional storage domain coverage & converged environments
 - covering servers, storage and fabric together
- Implement the Swordfish API as an **extension** of the Redfish API
 - Build using DMTF's Redfish technologies
 - RESTful interface over HTTPS in JSON format based on OData v4

Who is Developing Redfish and Swordfish*?



*as of September 20, 2019

** Membership suspended

Swordfish: Walking the Model

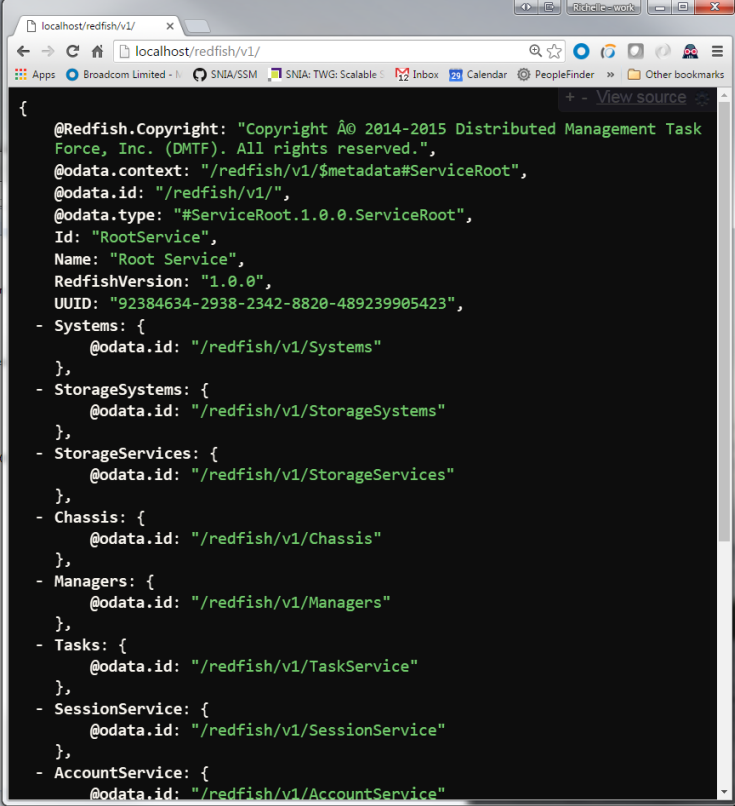
See Example Swordfish Configurations

- Technical Work Group (TWG) works with “mockups” (snapshots of a state in time) of different types of systems
- Published at <http://swordfishmockups.com> (/redfish/v1/)

Note: Mockups are representations of implementations, not normative

Overview of Swordfish Hierarchy

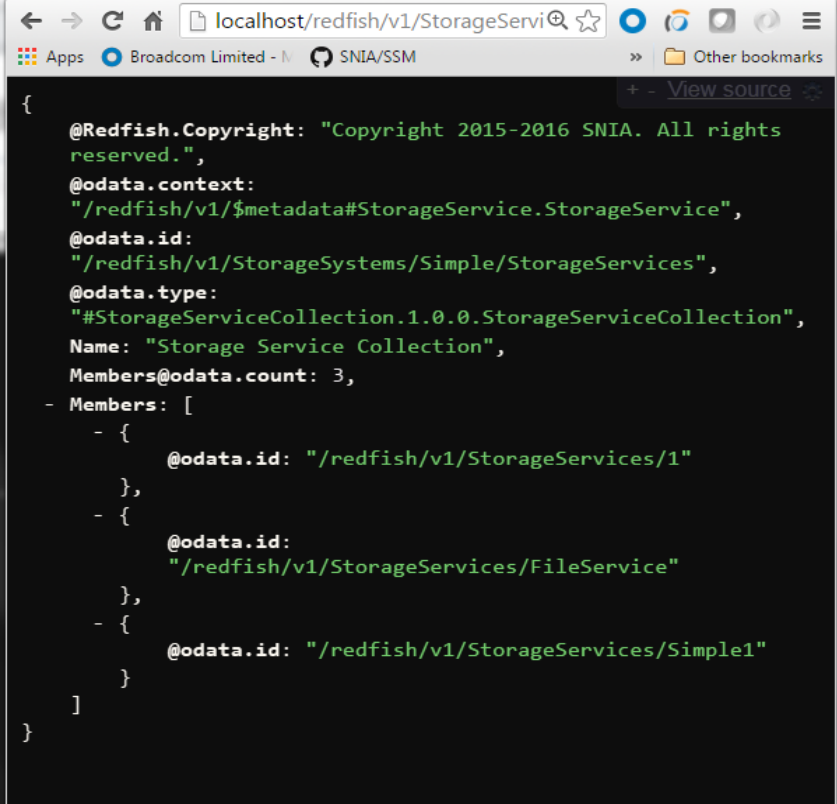
- Explore the Swordfish data model to see potential / typical implementation
- Navigate the model to learn about, and see, various resources
- SNIA mockups show examples of block storage systems
 - Simple: A small external array
 - Complex: all of the elements in the block storage model, with remote replication
- .. and an example of a file server with multiple file shares



```
{
  @Redfish.Copyright: "Copyright Â© 2014-2015 Distributed Management Task
    Force, Inc. (DMTF). All rights reserved.",
  @odata.context: "/redfish/v1/$metadata#ServiceRoot",
  @odata.id: "/redfish/v1/",
  @odata.type: "#ServiceRoot.1.0.0.ServiceRoot",
  Id: "RootService",
  Name: "Root Service",
  RedfishVersion: "1.0.0",
  UUID: "92384634-2938-2342-8820-489239905423",
  - Systems: {
    @odata.id: "/redfish/v1/Systems"
  },
  - StorageSystems: {
    @odata.id: "/redfish/v1/StorageSystems"
  },
  - StorageServices: {
    @odata.id: "/redfish/v1/StorageServices"
  },
  - Chassis: {
    @odata.id: "/redfish/v1/Chassis"
  },
  - Managers: {
    @odata.id: "/redfish/v1/Managers"
  },
  - Tasks: {
    @odata.id: "/redfish/v1/TaskService"
  },
  - SessionService: {
    @odata.id: "/redfish/v1/SessionService"
  },
  - AccountService: {
    @odata.id: "/redfish/v1/AccountService"
  }
}
```

Navigating through the Mockups...

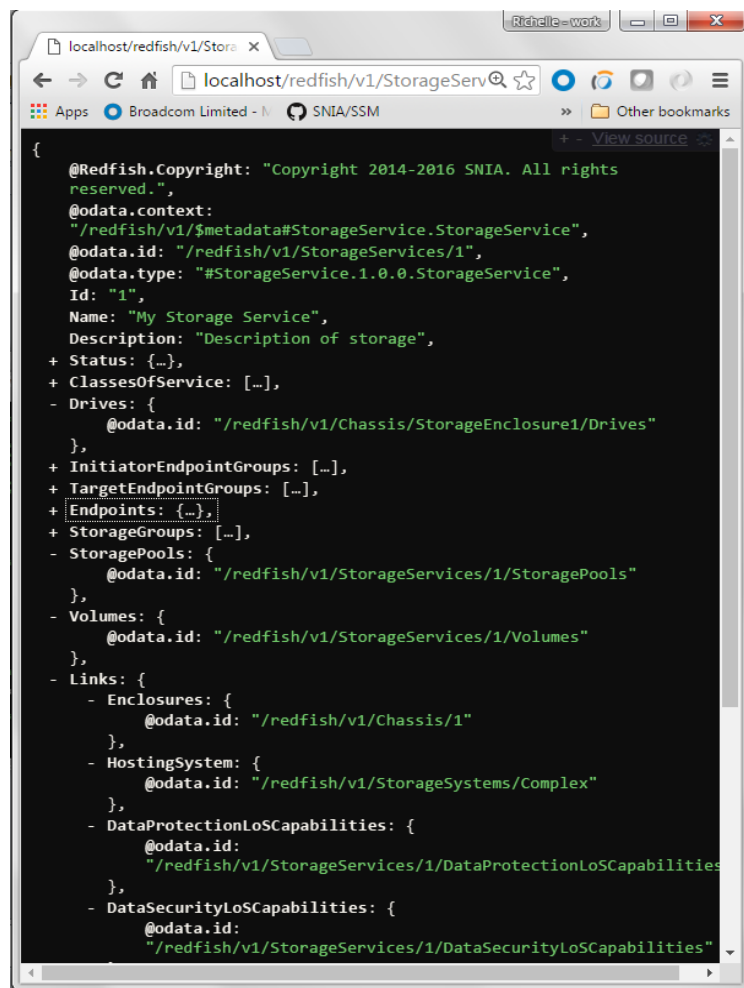
- ❑ Select the [.../redfish/v1/StorageServices](#) or [.../redfish/v1/StorageSystems](#) link to see the “Collection” of Storage Services or Systems
- ❑ Click the “[.../StorageSystems/Simple](#)” link to see the details of the Simple mockup
“[.../StorageSystems/1](#)” to see the details of the complex storage service mockup
“[.../StorageSystems/FileService](#)” to see the filesystem mockup
“[.../StorageSystems/ISC](#)” to see the ISC mockup (look for links to the hosting system)



```
{
  @Redfish.Copyright: "Copyright 2015-2016 SNIA. All rights reserved.",
  @odata.context:
    "/redfish/v1/$metadata#StorageService.StorageService",
  @odata.id:
    "/redfish/v1/StorageSystems/Simple/StorageServices",
  @odata.type:
    "#StorageServiceCollection.1.0.0.StorageServiceCollection",
  Name: "Storage Service Collection",
  Members@odata.count: 3,
  - Members: [
    - {
      @odata.id: "/redfish/v1/StorageServices/1"
    },
    - {
      @odata.id:
        "/redfish/v1/StorageServices/FileService"
    },
    - {
      @odata.id: "/redfish/v1/StorageServices/Simple1"
    }
  ]
}
```

What's in a Storage Service/System? (Block)

- ❑ Classes Of Service (if using Service)
 - ❑ Lines of Service that are used to compose the Classes of Service
- ❑ Volumes
- ❑ Pools
- ❑ Groups
- ❑ Endpoints
- ❑ ...
- ❑ Pointer to related resources (system, chassis,...)

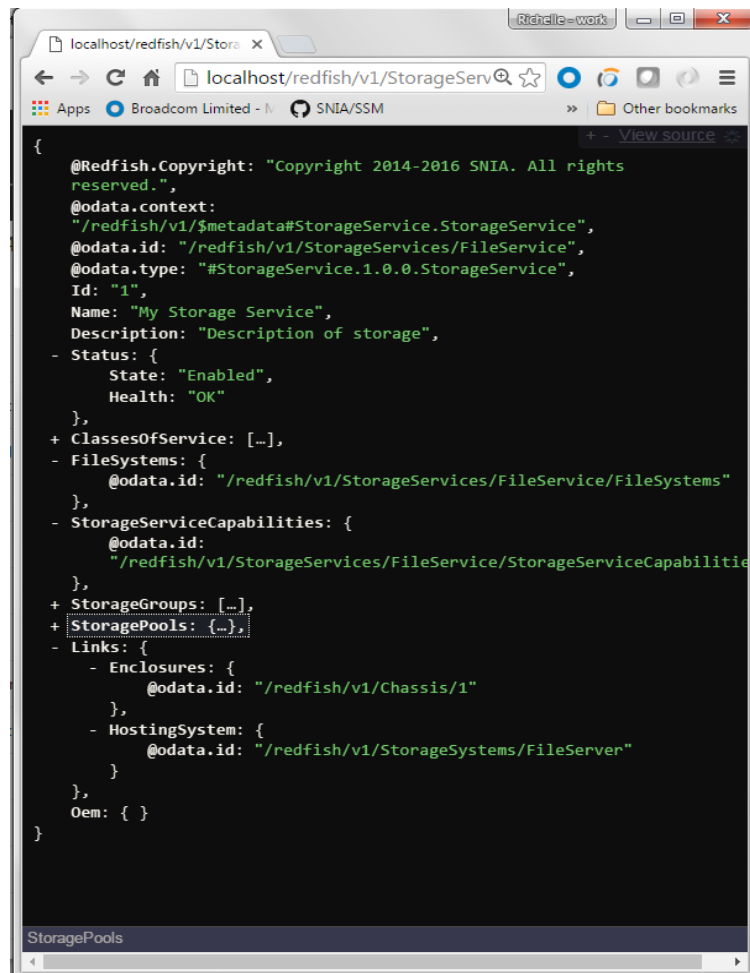


```
localhost/redfish/v1/StorageServ
localhost/redfish/v1/StorageServ
Apps Broadcom Limited - SNIA/SSM
View source
{
  @Redfish.Copyright: "Copyright 2014-2016 SNIA. All rights reserved.",
  @odata.context: "/redfish/v1/$metadata#StorageService.StorageService",
  @odata.id: "/redfish/v1/StorageServices/1",
  @odata.type: "#StorageService.1.0.0.StorageService",
  Id: "1",
  Name: "My Storage Service",
  Description: "Description of storage",
  + Status: {...},
  + ClassesOfService: [...],
  - Drives: {
    @odata.id: "/redfish/v1/Chassis/StorageEnclosure1/Drives"
  },
  + InitiatorEndpointGroups: [...],
  + TargetEndpointGroups: [...],
  + Endpoints: {...},
  + StorageGroups: [...],
  - StoragePools: {
    @odata.id: "/redfish/v1/StorageServices/1/StoragePools"
  },
  - Volumes: {
    @odata.id: "/redfish/v1/StorageServices/1/Volumes"
  },
  - Links: {
    - Enclosures: {
      @odata.id: "/redfish/v1/Chassis/1"
    },
    - HostingSystem: {
      @odata.id: "/redfish/v1/StorageSystems/Complex"
    },
    - DataProtectionLoSCapabilities: {
      @odata.id: "/redfish/v1/StorageServices/1/DataProtectionLoSCapabilities"
    },
    - DataSecurityLoSCapabilities: {
      @odata.id: "/redfish/v1/StorageServices/1/DataSecurityLoSCapabilities"
    }
  }
}
```


What's in a Storage Service/System? (File)

Same structure:

- ❑ Classes Of Service (if using Service)
- ❑ *File systems*
- ❑ Pools
- ❑ Groups
- ❑ Endpoints
- ❑ ...
- ❑ Pointer to related resources (system, chassis, **block service** or drives)

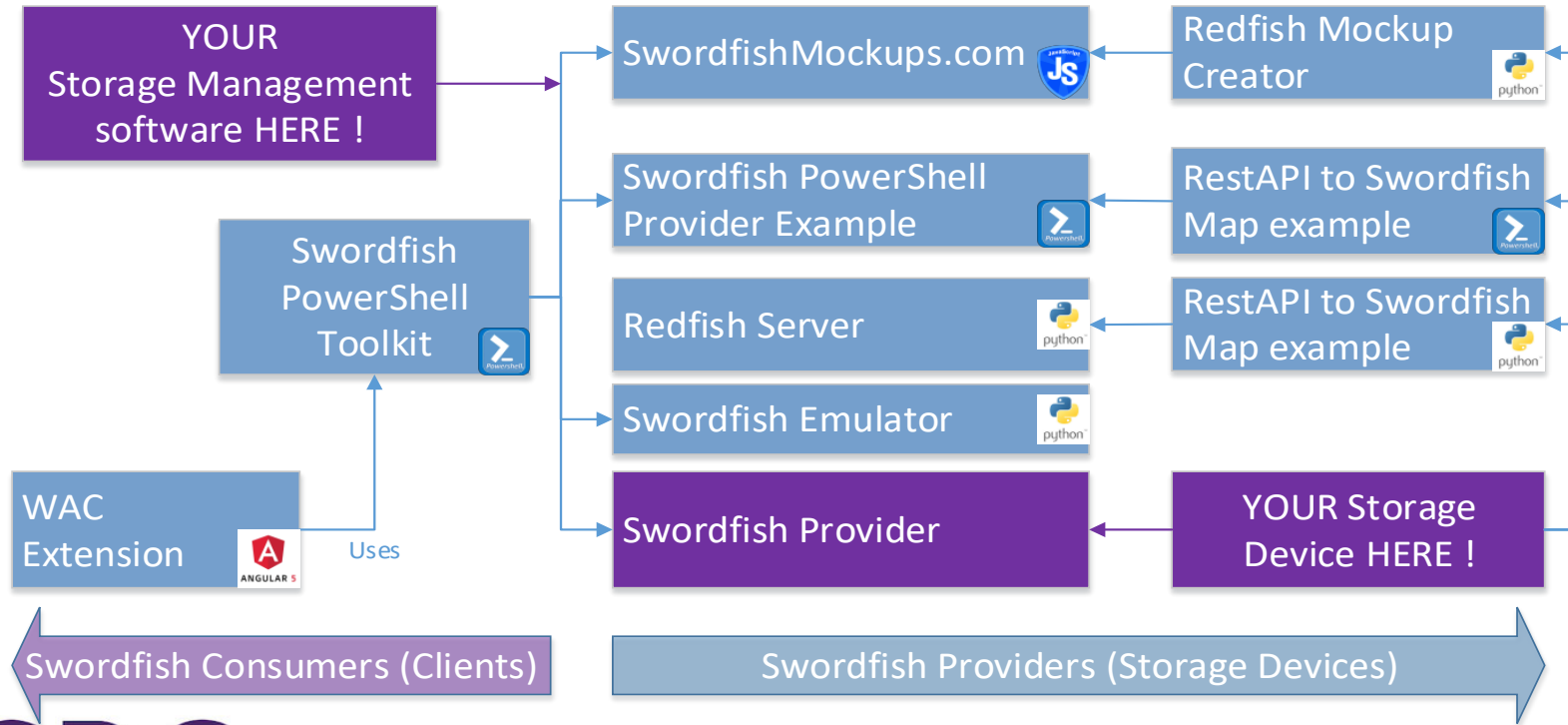


```
localhost/redfish/v1/Storage x
localhost/redfish/v1/StorageServ
Apps Broadcom Limited - h SNIA/SSM
Other bookmarks
View source
{
  @Redfish.Copyright: "Copyright 2014-2016 SNIA. All rights reserved.",
  @odata.context: "/redfish/v1/$metadata#StorageService.StorageService",
  @odata.id: "/redfish/v1/StorageServices/FileService",
  @odata.type: "#StorageService.1.0.0.StorageService",
  Id: "1",
  Name: "My Storage Service",
  Description: "Description of storage",
  - Status: {
    State: "Enabled",
    Health: "OK"
  },
  + ClassesOfService: [...],
  - FileSystems: {
    @odata.id: "/redfish/v1/StorageServices/FileService/FileSystems"
  },
  - StorageServiceCapabilities: {
    @odata.id: "/redfish/v1/StorageServices/FileService/StorageServiceCapabilities"
  },
  + StorageGroups: [...],
  + StoragePools: {...},
  - Links: {
    - Enclosures: {
      @odata.id: "/redfish/v1/Chassis/1"
    },
    - HostingSystem: {
      @odata.id: "/redfish/v1/StorageSystems/FileServer"
    }
  },
  Oem: { }
}
```

Which Tools are right for you!

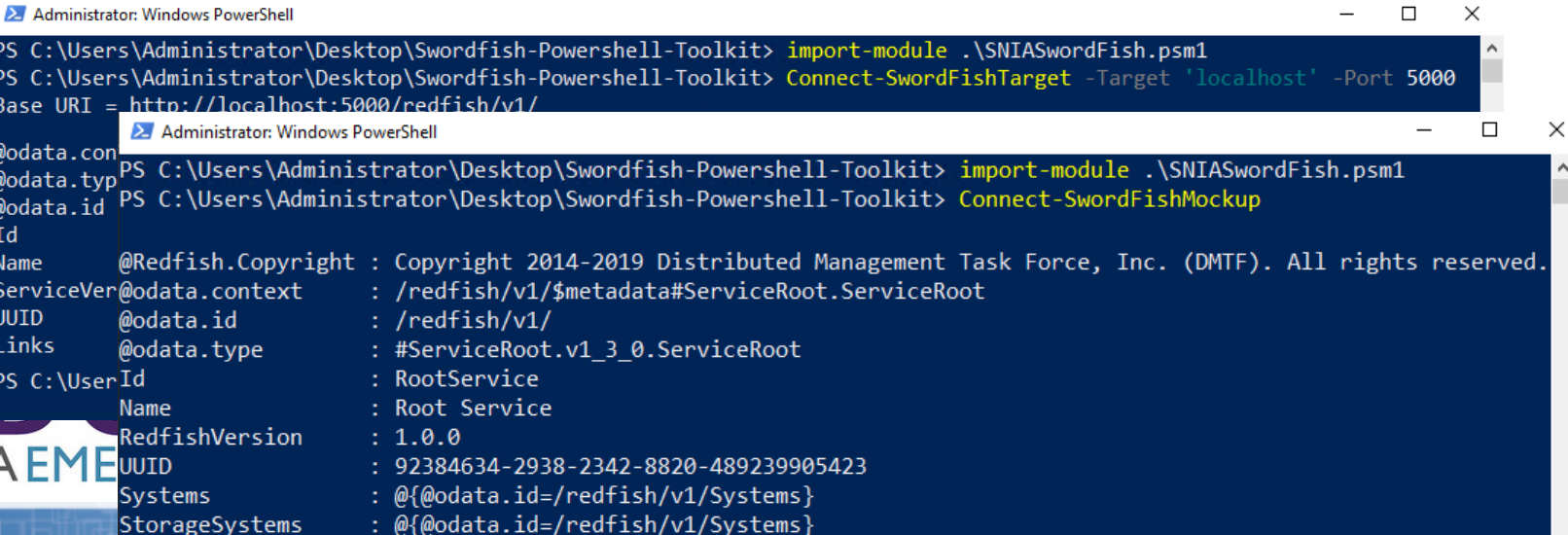
- ❑ Swordfish PowerShell Toolkit
- ❑ Swordfish to RestAPI Map
- ❑ Swordfish PowerShell Provider Framework
- ❑ Swordfish Emulator
- ❑ Swordfish Mockup website
- ❑ Redfish Mockup Creator

Which Tools are right for you!



WHAT IS THE POWERSHELL TOOLKIT?

- ❑ Open source project between HPE and Pure Storage
 - ❑ <https://github.com/SNIA/Swordfish-Powershell-Toolkit>
- ❑ Supported on Windows Server, Linux and macOS
 - ❑ Can query a Swordfish Target, A simulator, or even SwordFishMockup.com
- ❑ PowerShell wrapper for REST API calls to Redfish and Swordfish



```
Administrator: Windows PowerShell
PS C:\Users\Administrator\Desktop\Swordfish-Powershell-Toolkit> import-module .\SNIASwordFish.psm1
PS C:\Users\Administrator\Desktop\Swordfish-Powershell-Toolkit> Connect-SwordFishTarget -Target 'localhost' -Port 5000
Base URI = http://localhost:5000/redfish/v1/

Administrator: Windows PowerShell
PS C:\Users\Administrator\Desktop\Swordfish-Powershell-Toolkit> import-module .\SNIASwordFish.psm1
PS C:\Users\Administrator\Desktop\Swordfish-Powershell-Toolkit> Connect-SwordFishMockup

@odata.context : /redfish/v1/$metadata#ServiceRoot.ServiceRoot
@odata.id      : /redfish/v1/
Name           : RootService
RedfishVersion : 1.0.0
UUID           : 92384634-2938-2342-8820-489239905423
Systems        : @{@odata.id=/redfish/v1/Systems}
StorageSystems : @{@odata.id=/redfish/v1/Systems}
Copyright      : Copyright 2014-2019 Distributed Management Task Force, Inc. (DMTF). All rights reserved.
```

PowerShell Tools

- Everything is returned as object
 - Cast to Variable `$MyVols`
 - Can filter by properties, `$MyVols`
 - Can dig deeper into single object `$MyVols`
 - And you can even cast to JSON

```
PS C:\> $MyVols[4] | convertto-json
{
  "@Redfish.Copyright": "Copyright 2014-2019 SNIA. All rights reserved.",
  "@odata.context": "/redfish/v1/$metadata#Volume.Volume",
  "@odata.id": "/redfish/v1/StorageServices/1/Volumes/5",
  "@odata.type": "#Volume.v1_4_0.Volume",
  "Name": "Volume 5",
  "Id": "5",
  "Description": "Volume 5.",
  "Identifiers": [
    {
      "DurableNameFormat": "NAA",
      "DurableName": "65456765456761001244076100123487"
    }
  ],
  "Manufacturer": "SuperDuperSSD",
  "Model": "Drive Model string",
  "Status": {
    "State": "Enabled",
    "Health": "OK"
  },
  "AccessCapabilities": [
    "Read",
    "Write",
    "Append",
    "Streaming"
  ],
  "BlockSizeBytes": 512,
  "CapacitySources": [
    {
      "@odata.id": "/redfish/v1/StorageServices/1/Volumes/5#/CapacitySources/0",
      "MemberId": "0",
      "ProvidedCapacity": "@{ConsumedBytes=0; AllocatedBytes=10737418240; GuaranteedBytes=536870912; ProvisionedBytes=109951162776}",
      "ProvidingPools": ""
    }
  ],
  "Capacity": {
    "Data": {
      "ConsumedBytes": 0,
      "AllocatedBytes": 10737418240,
      "GuaranteedBytes": 536870912,
      "ProvisionedBytes": 109951162776
    }
  }
}
```

PowerShell Command Help

- ❑ Get a list of valid commands
- ❑ Get Help on a specific command
 - ❑ Option to show examples
 - ❑ Option to show All
- ❑ Verbose option to see raw transaction

```
Administrator: Windows PowerShell
PS C:\> get-help Get-SwordFishVolume -Full

NAME
    Get-SwordFishVolume
SYNOPSIS
    Retrieve The list of valid Volumes from the SwordFish Target.
SYNTAX
    Get-SwordFishVolume [[-StorageServiceID] <String>] [[-VolumeId] <String>] [<CommonParameters>]
DESCRIPTION
    This command will either return the a complete collection of Volumes that exist across
    the Storage Services, unless a specific Storage Service ID is used to limit it, or a s
    Volume ID is directly requested.
PARAMETERS
    -StorageServiceID <String>
        The Storage Service ID name for a specific Storage Service, otherwise the command
        will return Storage Groups for all Storage Services.
    -VolumeId <String>
        The Storage Group ID will limit the returned data to the type specified, otherwise
        will return all Volumes.
----- EXAMPLE 1 -----
PS C:\>Get-SwordFishStorageVolume
----- EXAMPLE 2 -----
PS C:\>Get-SwordFishStorageVolume -StorageServiceId AC-102345
----- EXAMPLE 3 -----
PS C:\>Get-SwordFishStorageVolume -StorageServiceId AC-102345 -VolumeId 2
----- EXAMPLE 4 -----
PS C:\>Get-SwordFishStorageVolume -VolumeId 1
RELATED LINKS
    http://redfish.dmtf.org/schemas/swordfish/v1/Volume.v1_2_0.json
```

PowerShell Toolkit Work Items

The PowerShell Toolkit commands;

- ❑ Get-SwordFishChassis (+ Power, +Thermal)
- ❑ Get-SwordFishDrive
- ❑ Get-SwordFishEndpoint
- ❑ Get-SwordFishEndpointGroup
- ❑ Get-SwordFishStoragePool
- ❑ Get-SwordFishStorageService
- ❑ Get-SwordFishVolume
- ❑ Get-SwordFishClassOfService
- ❑ Connect-SwordFishTarget
- ❑ Connect-SwordfishMockup

Command sets that need to be written; (in order of priority)

- ❑ New/Set/Remove-SwordFishEndpoint
- ❑ New/Set/Remove-SwordFishEndpointGroup
- ❑ New/Set/Remove-SwordFishStoragePool
- ❑ New/Set/Remove-SwordFishStorageGroup
- ❑ New/Set/Remove-SwordFishConsistencyGroup
- ❑ New/Set/Remove-SwordFishVolume
- ❑ Set-SwordFishStorageService
- ❑ Set-SwordFishChassis
- ❑ Get/New/Set/Remove-*LoS
- ❑ New/Set/Remove-SwordFishClassOfService

- ❑ Common Nomenclature
 - ❑ RestAPI vs PowerShell. Create = New, Read = Get, Update = Set, Delete = Remove
- ❑ All Commands must have inline help before being checked into the build
- ❑ All Commands must work against BOTH the Swordfish Targets (directly) and SwordFishMockups.com
- ❑ All Commands are open source, no compiled code or external DLL dependencies

What you

- ❑ RestAPI Documentation
- ❑ PowerShell Toolkit that e
- ❑ Basic PowerShell knowle

Steps

1. Retrieve the Volume O
2. Hold it side-by-side to a
3. Look for Matches and c similarities
i.e. You may show the s
need to know to multiply
4. Go through the rest of t
using your results.

Administrator: Windows PowerShell

```
PS C:\> Get-NSVolume -name SCSCOM2019 | convertto-json
```

```
"agent_type": "none",  
"app_category": "Other",  
"app_uuid": "",  
"avg_stats_last_5mins": {  
  "combined_iops": 0,  
  "combined_latency": 66,  
  "combined_throughput": 692,  
  "read_iops": 0,  
  "read_latency": 0,  
  "read_throughput": 0,  
  "write_iops": 0,  
  "write_latency": 66,  
  "write_throughput": 692  
},  
"base_snap_id": "",  
"base_snap_name": "",  
"block_size": 4096,  
"cache_needed_for_pin": 107374182400,  
"cache_pinned": false,  
"cache_policy": "normal",  
"caching_enabled": true,  
"cksum_last_verified": 0,  
"clone": false,  
"content_repl_errors_found": false,  
"creation_time": 1559321039,  
"dedupe_enabled": false,  
"description": "Data Volume for SCOM 2019",  
"multi_initiator": false,  
"name": "SCSCOM2019",  
"needs_content_repl": false,  
"num_connections": 2,  
"num_fc_connections": 0,  
"num_iscsi_connections": 2,  
"num_snaps": 69,  
"offline_reason": null,  
"online": true,  
"online_snaps": null,  
"owned_by_group": "Firefly",  
"owned_by_group_id": "002b4bd8361b856bbc00000000000000000000000001",  
"parent_vol_id": "",  
"parent_vol_name": "",  
"perfpolicy_id": "032b4bd8361b856bbc00000000000000000000000010",  
"perfpolicy_name": "Other Workloads",  
"pinned_cache_size": 0,  
"pool_id": "0a2b4bd8361b856bbc00000000000000000000000001",  
"pool_name": "default",  
"previously_deduped": false,
```

JSON Raw Data Headers

```
① swordfishmockups.com/redfish/v1/StorageServices/ISC/Volumes/1/
```

```
{  
  "@Redfish.Copyright": "Copyright 2015-2019 SNIA. All rights reserved.",  
  "@odata.context": "/redfish/v1/$metadatas#Volume.Volume",  
  "@odata.id": "/redfish/v1/StorageServices/ISC/Volumes/1",  
  "@odata.type": "#Volume.v1_2_1.Volume",  
  "Id": "1",  
  "Name": "Logical Disk 1",  
  "Identifiers": [{  
    "DurableNameFormat": "UUID",  
    "DurableName": "123e4567-a12b-12a3-a123-123456789000"  
  }],  
  "Manufacturer": "BEST Chipco",  
  "Status": {  
    "State": "Enabled",  
    "Health": "Ok"  
  },  
  "BlockSizeBytes": 512,  
  "VolumeType": "Mirrored",  
  "Capacity": {  
    "Data": {  
      "ConsumedBytes": 1099511627776,  
      "AllocatedBytes": 1190027440128  
    }  
  },  
  "CapacitySources": [{  
    "@odata.id": "/redfish/v1/StorageServices/ISC/Volumes/1#/CapacitySources/0",  
    "MemberId": "0",  
    "ProvidedCapacity": {  
      "AllocatedBytes": 1190027440128,  
      "ConsumedBytes": 1190027440128  
    }  
  },  
  "ProvidingPools": [{  
    "@odata.id": "/redfish/v1/StorageServices/ISC/StoragePools/SASPool"  
  }]  
}]
```

Some values are hardcoded per spec

Other values are partially hardcoded with known values added

Create a File Structure to match Swordfish

- ❑ Using PowerShell you can create a function for each thing you wish to express in SwordFish.
- ❑ Make a master script that runs you function against all things in your device.
- ❑ Create PowerShell Objects that can be converted to JSON as saved as Index.json files.
- ❑ In example to right, Variables all start with '\$' and constants are shown in brown.

```
$VolObj = @{ '@Redfish.Copyright' = $RedfishCopyright;  
            '@odata.context' = '/redfish/v1/$metadata#Volumes/' + $NimbleSerial + '/Volumes/' + $Snapshot.name;  
            '@odata.id' = '/redfish/v1/$metadata#Volumes/' + $NimbleSerial + '/Volumes/' + $Snapshot.name;  
            '@odata.type' = '#Volumes_1_4_0.Volume';  
            Id = $Snapshot.id;  
            Name = $Snapshot.name;  
            Description = $Snapshot.description;  
            Capacity = @{ AllocatedBytes = ($Snapshot.Size * 1024)  
                        };  
            Status = @{ State = $SnapStatus_state;  
                       Health = $SnapStatus_health;  
                     };  
            BlockSizeBytes = $Volume.block_size;  
            MaxBlockSizeBytes = $Volume.block_size;  
            OptimumIOSizeBytes = $Volume.block_size;  
            Manufacturer = 'HPENimbleStorage';  
            Encrypted = $Vol_Encryption;  
            EncryptionTypes = 'ControllerAssisted';  
            ProvisioningPolicy = 'thin';  
            Compressed = 'true';  
            Deduplicated = $Volume.dedupe_enabled;  
            DisplayName = $Volume.Full_name + ' + $Snap.name;  
            LowSpaceWarningThresholdPercents = $Volume.warn_level;  
            VolumeType = 'Snapshot';  
            VolumeUsageType = 'Data';  
            ReadCachePolicyType = $Vol_CachePolicy;  
            WriteCacheState = 'Enabled'  
            WriteCachePolicyType = 'ProtectedWriteBack';  
            WriteCacheStateType = 'Protected';  
            WriteHoleProtectionPolicyType = 'Journaling';
```

How to Serve Swordfish...It's a Cookbook!

- ❑ Codebase Assumes that you have created a Mockup that runs against the output of that mockup.
 - ❑ The Mockup can be directed to pull live information for each Swordfish request.
- ❑ Code is hidden command in the Mockup called 'Listener.ps1'



```
# Create a listener on port 5000
$listener = New-Object System.Net.HttpListener
$listener.Prefixes.Add('http://+:5000/')
$listener.Start()
write-host 'Listening ...To end this session connect to the IP Address with the action end'
# Run until you send a GET request to /end
```

Swordfish Info: www.snia.org/swordfish



- Resources
 - Specifications
 - User's Guide
 - GitHub for Swordfish Tools
 - Practical Guide
 - Other Documentation
- Swordfish Mockups Site
 - ISC and HSC configurations
 - Block vs file configurations
 - Small and large configurations
- Education/Community
 - Whitepapers, Presentations
 - YouTube shorts & Webinars
- Participate
 - Join SNIA and the SSM TWG Implement

The screenshot shows the SNIA website's 'Swordfish' page. The header includes the SNIA logo, search, login, and join buttons, and a navigation menu with categories like 'ABOUT', 'TECHNICAL WORK AND STANDARDS', 'EDUCATION', 'TECHNOLOGY COMMUNITIES', 'MEDIA', 'EVENTS', and 'MEMBERSHIP'. A left sidebar lists various SNIA initiatives such as 'Cloud Storage Technologies Initiative', 'Conformance Testing Programs', and 'Storage Management Initiative'. The main content area features the 'SNIA Swordfish™' logo, a description of the specification, and a list of member companies including Cisco, Dell, and HPE. A 'DMTF Redfish' logo is also visible.

Next Steps

- Develop a Swordfish Mockup of your own & submit it to the Swordfish forum;
 - Feedback on spec adherence to validate your mockup.
 - Will be posted as an additional example in the SwordfishMockups.com site.
- Join SNIA and the SSM TWG & help define the Schema;
 - Ensure the Schema is defined sufficiently to represent your desired implementation
 - WE ARE ALWAYS LOOKING FOR FEEDBACK REGARDING YOUR IMPLEMENTATION MAPING TO SWORDFISH !
 - Full NVMe Enablement: Functionality alignment across DMTF, NVMeExpress/NVMe-MI and SNIA for NVMe use cases
 - Enhanced profile support for SNIA Alliance partner organizations
- Help define the future of this Swordfish Consumer.
 - [SwordFish™ PowerShell Toolkit](#) and follow-on Windows Admin Client Module.
 - notable projects; Swordfish DataDog implementation & PowerBI
 - A GoLang Client library called [GoFish](#); An [EmberJS](#) Client
 - Looking for more integration points (what can you come up with)
- Attend the SDC Swordfish Mockathon at this event.
 - BYOAPI (Bring Your Own API), walk out with working provider that you can build upon.

Q&A