STORAGE DEVELOPER CONFERENCE

SDC 21

BY Developers FOR Developers

Virtual Conference
September 28-29, 2021

A SNIA Event

Expanding Development of Swordfish Implementations Using Open Source Tools

Presented by

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Agenda

- SNIA Swordfish™ and Open Source Projects
- Swordfish Related Open Source Projects
- SNIA Swordfish Conformance Testing and Open Source
- Where to Find More Information

SNIA Swordfish™ and Open Source Projects

SNIA Swordfish™ and Open Source Projects

- Swordfish comes from the SNIA Scalable Storage Management Technical Work Group (SSM TWG)
- Swordfish is an extension of DMTF Redfish®
- The SSM TWG maintains several open source projects that can help accelerate the development of Swordfish implementations
- These open source projects are kept in open repositories under github.com/SNIA

SNIA Swordfish Open Source Projects

- Swordfish API Emulator
- Swordfish Basic Web Client
- Swordfish PowerShell Toolkit
- Swordfish Datadog Sample Dashboard Integration
- Swordfish Power BI Sample Dashboard Integration

SNIA Swordfish Mockups

- Mockups are important for understanding how different situations can be handled by Swordfish
  - Point-in-time representations of modeled systems
  - Show the types of information that can be modeled
- Example Swordfish mockups are at: swordfishmockups.com
  - Several different Swordfish storage configurations are shown
    - Standalone, Integrated, Service-Based, NVMe and NVMe-oF
  - Each mockup includes a brief description of the storage system modeled
  - Mockups can be explored using a browser that has a JSON viewing plugin
  - Mockups show representations of implementations, and are *not normative*

SNIA Swordfish Mockups (Continued)

- Swordfish mockups on swordfishmockups.com can be explored with a browser that has a JSON viewing plugin

Not secure | swordfishmockups.com/nvmeof-mockups/redfish/v1/


```
{
    @Redfish.Copyright: "Copyright 2015-2021 SNIA. All rights reserved.",
    @odata.context: "/redfish/v1/$metadata#ServiceRoot.ServiceRoot",
    @odata.id: "/redfish/v1/",
    @odata.type: "#ServiceRoot.v1_10_0.ServiceRoot",
    Id: "RootService",
    Name: "Root Service",
    RedfishVersion: "1.12.0",
    UUID: "92384634-2938-2342-8820-489239905423",
  - Chassis: {
        @odata.id: "/redfish/v1/Chassis"
    },
  - Fabrics: {
        @odata.id: "/redfish/v1/Fabrics"
    },
  - NVMeDomains: {
        @odata.id: "/redfish/v1/NVMeDomains"
    },
  - Storage: {
        @odata.id: "/redfish/v1/Storage"
    },
  - StorageSystems: {
        @odata.id: "/redfish/v1/StorageSystems"
    },
  - Systems: {
        @odata.id: "/redfish/v1/Systems"
    }
}
```


SNIA Swordfish Mockups (Continued Again)

- Mockups are stored as hierarchical directory structures
- Each directory corresponds to a Redfish/Swordfish object
- A file named *index.json* within each directory describes the state elements (properties, links, etc) for the object
- The top-most directory in the hierarchical directory structure represents the Redfish root (/redfish/v1)
- The directory structure reflects the Redfish/Swordfish object hierarchy

Swordfish API Emulator

Swordfish API Emulator

- Emulates a Swordfish storage system
- Responds to create, read, update, and delete operations
  - POST, GET, PUT, PATCH, DELETE
- Extends the DMTF Redfish Interface Emulator
  - Adds code for handling Swordfish resources
- Link: https://github.com/SNIA/Swordfish-API-Emulator
- Includes installation, user, and developer documentation

Swordfish API Emulator Console Output
(Default Configuration)

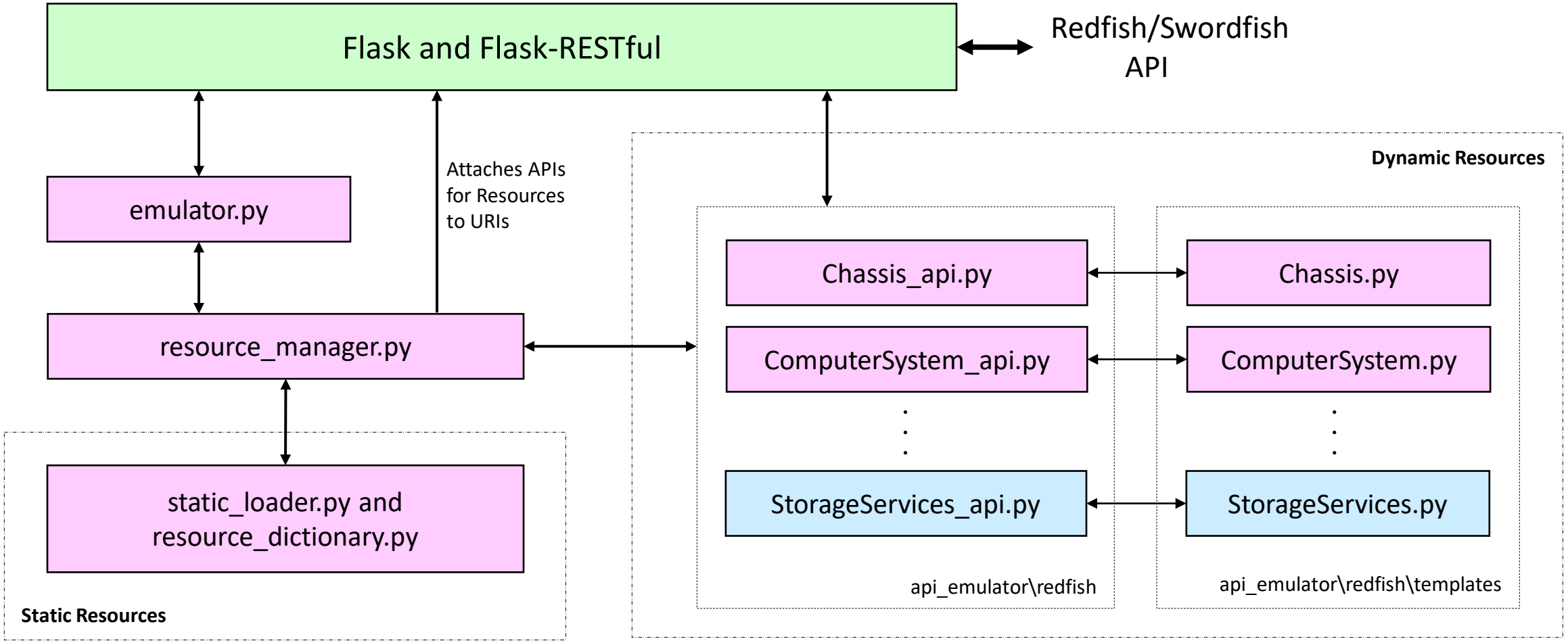
```
$ python ./emulator.py
INFO:root:Mockup folders
['Mockups']
 * Redfish endpoint at localhost:5000
 * Using dynamic emulation
INFO:root:Init ResourceDictionary.
INFO:root:Init ResourceDictionary.
 * Use HTTP
 * Running in Redfish mode
 * Serving Flask app "g" (lazy loading)
 * Environment: production
   WARNING: This is a development server. Do not use it in a production deployment.
   Use a production WSGI server instead.
 * Debug mode: off
INFO:werkzeug: * Running on http://0.0.0.0:5000/ (Press CTRL+C to quit)
```


Swordfish API Emulator Browser Output
(Default Configuration)

localhost:5000/redfish/v1/


```
{
    @odata.context: "/redfish/v1/$metadata#ServiceRoot",
    @odata.type: "#ServiceRoot.1.0.0.ServiceRoot",
    @odata.id: "/redfish/v1/",
    Id: "RootService",
    Name: "Root Service",
    ServiceVersion: "1.0.0",
    UUID: "79ea8662-0349-4390-883c-b917c8f65e6b",
  - Links: {
      - Chassis: {
            @odata.id: "/redfish/v1/Chassis"
        },
      - Managers: {
            @odata.id: "/redfish/v1/Managers"
        },
      - TaskService: {
            @odata.id: "/redfish/v1/TaskService"
        },
      - SessionService: {
            @odata.id: "/redfish/v1/SessionService"
        },
      - StorageServices: {
            @odata.id: "/redfish/v1/StorageServices"
        },
      - StorageSystems: {
            @odata.id: "/redfish/v1/StorageSystems"
        },
      - AccountService: {
            @odata.id: "/redfish/v1/AccountService"
        },
      - EventService: {
            @odata.id: "/redfish/v1/EventService"
        },
      - Registries: {
            @odata.id: "/redfish/v1/Registries"
        },
      - Systems: {
            @odata.id: "/redfish/v1/Systems"
        },
      - CompositionService: {
            @odata.id: "/redfish/v1/CompositionService"
        }
    }
}
```


How the Emulator Works

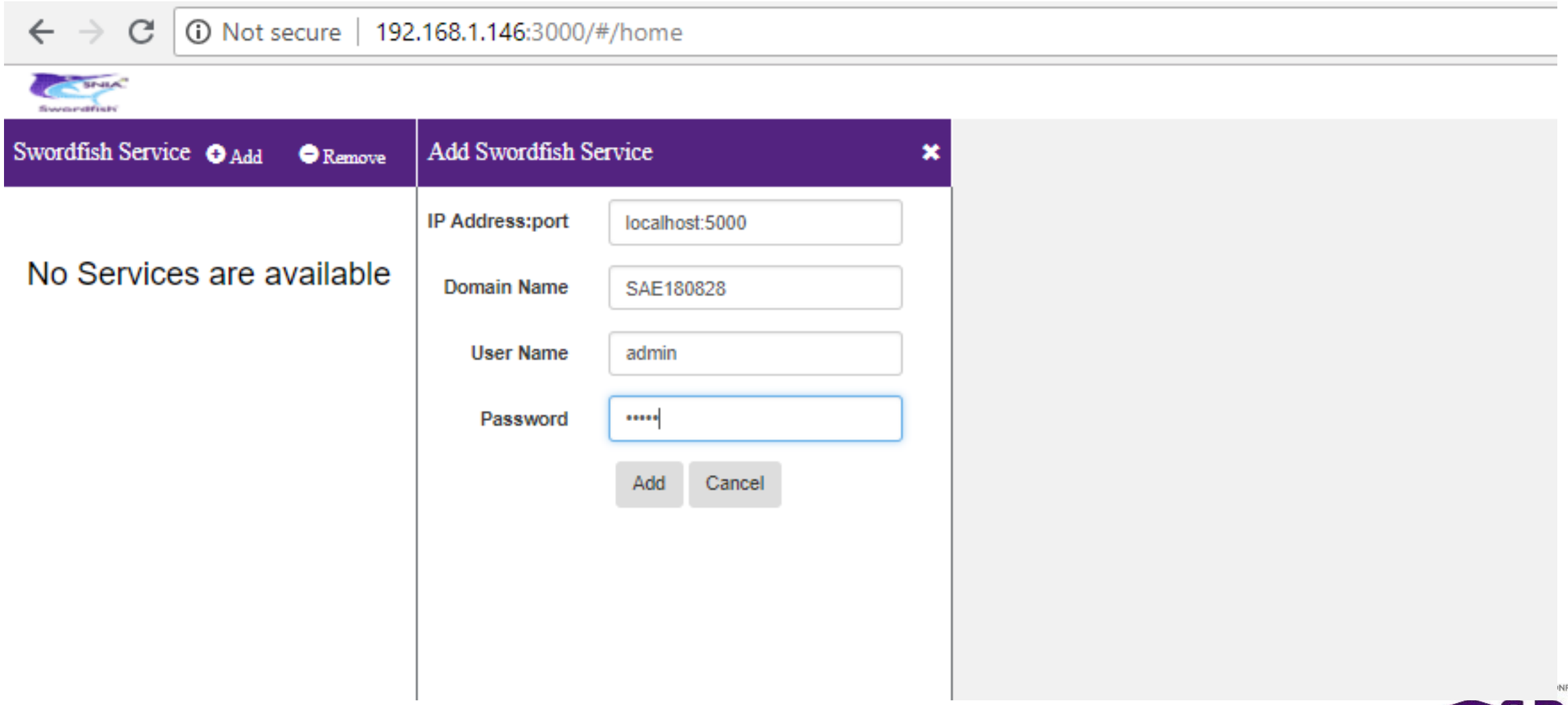


Swordfish Basic Web Client

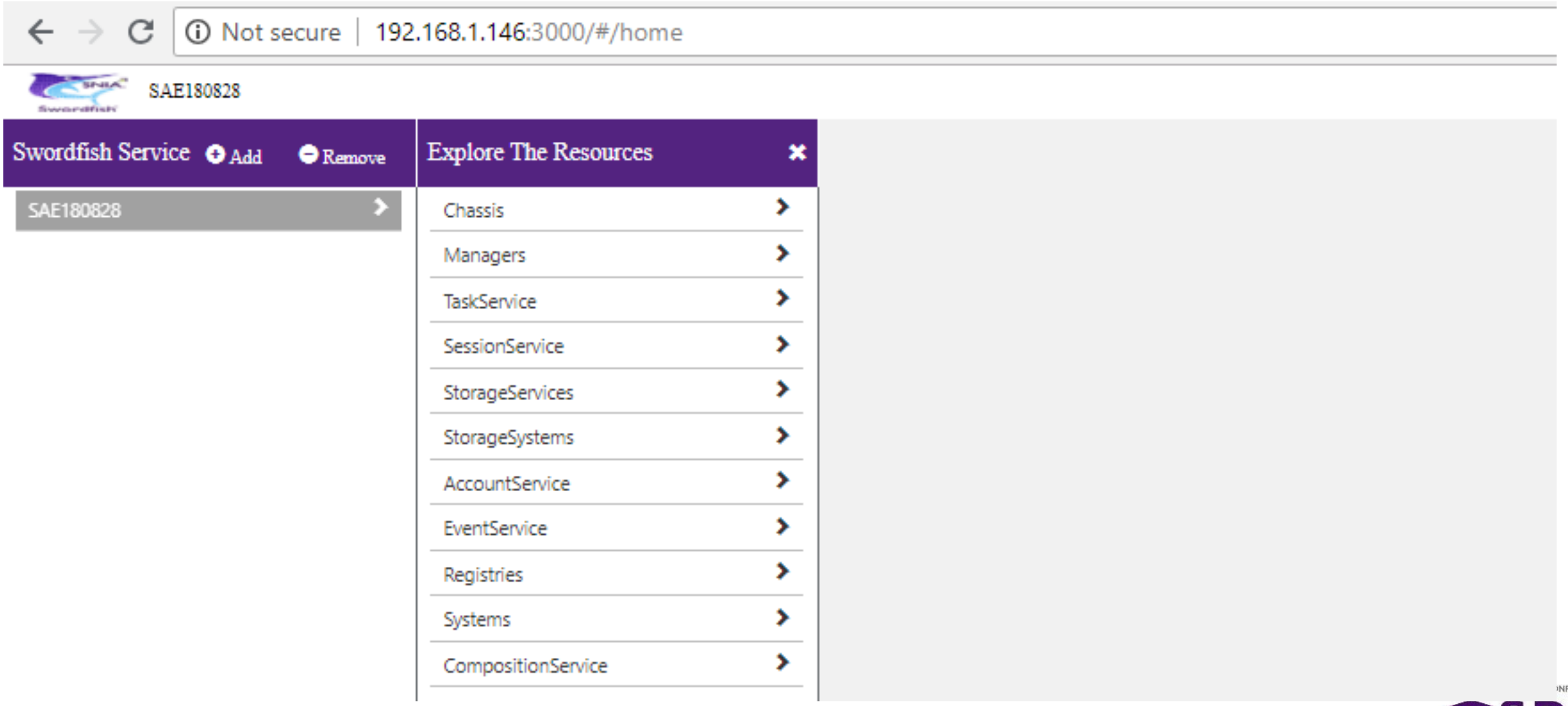
Swordfish Basic Web Client

- Web client that can connect to multiple Redfish and/or Swordfish services simultaneously
- Presents the Redfish and Swordfish hierarchy in a browser web frame
- Provides basic capabilities for viewing resources and updating properties that are writeable
- Link: https://github.com/SNIA/Swordfish-basic-web-client
- Includes installation, user, and developer documentation

Swordfish Basic Web Client Screen Output
(Service Login)



Swordfish Basic Web Client Screen Output
(Service Root)



Swordfish Basic Web Client Screen Output
(StorageServices)

Not secure | 192.168.1.146:3000/#/home

SAE180828 > StorageServices

Swordfish Service Add Remove

- SAE180828

Explore The Resources

- Chassis
- Managers
- TaskService
- SessionService
- StorageServices
- StorageSystems
- AccountService
- EventService
- Registries
- Systems
- CompositionService

StorageServices Add Remove

- 1
- 2
- AFF-1

Properties

Name :	Storage Service Collection

ODATA

LINKS

Swordfish PowerShell Toolkit

Swordfish PowerShell Toolkit

- Basic framework for querying a Swordfish service
- Supported on Microsoft Windows, Windows Server, Linux, and MacOS
- Works with a Swordfish target, emulator, or swordfishmockups.com
- PowerShell wrapper for REST API calls to Redfish and Swordfish
- Link: https://github.com/SNIA/Swordfish-Powershell-Toolkit
- Includes installation, user, and developer documentation

Swordfish PowerShell Toolkit Example One

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/

@odata.context : /redfish/v1/$metadata#ServiceRoot
@odata.type    : #ServiceRoot.1.0.0.ServiceRoot
@odata.id      : /redfish/v1/
Id             : RootService
Name           : Root Service
ServiceVersion : 1.0.0
UUID           : 427b01db-06bd-4f53-9ecc-4cbc48a8e635
Links          : @{Chassis=; Managers=; TaskService=; SessionService=; StorageServices=; StorageSystems=; AccountService

PS C:\Users\Administrator\Desktop\Swordfish-Powershell-Toolkit>
```


Swordfish PowerShell Toolkit Example Two

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

@Redfish.Copyright : Copyright 2014-2019 Distributed Management Task Force, Inc. (DMTF). All rights reserved.
@odata.context     : /redfish/v1/$metadata#ServiceRoot.ServiceRoot
@odata.id          : /redfish/v1/
@odata.type        : #ServiceRoot.v1_3_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/Systems}
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}
EventService       : @{@odata.id=/redfish/v1/EventService}
Links              : @{Sessions=}

PS C:\Users\Administrator\Desktop\Swordfish-Powershell-Toolkit>
```


Swordfish PowerShell Toolkit Objects

- Everything is returned as objects (and nested objects)
  - Cast to variable

```
$MyVols = Get-SwordFishVolume
```

  - Can access like an array, or filter by properties

```
$MyVols[4]
$MyVols | where {$_.name -eq 'Volume 5'}
```

  - Can dig deeper into single values

```
$MyVols[4].status

   State   Health
   -----   ------
   Enabled OK
```


Swordfish PowerShell Toolkit Objects (Continued)

- Can cast the variable back to JSON format

```
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"
```


Swordfish PowerShell cmdlets (current list)

- Connect-SwordFishTarget
- Connect-SwordFishMockup
- Get-SwordfishSessionToken

- Get-SwordfishStorage
- Get-SwordfishStorageService
- Get-SwordfishSystem
- Get-SwordfishChassis
- Get-SwordfishSessionService
- Get-SwordfishZone
- Get-SwordfishTask

- Get-SwordfishSession
- Get-SwordFishChassisPower
- Get-SwordFishChassisThermal

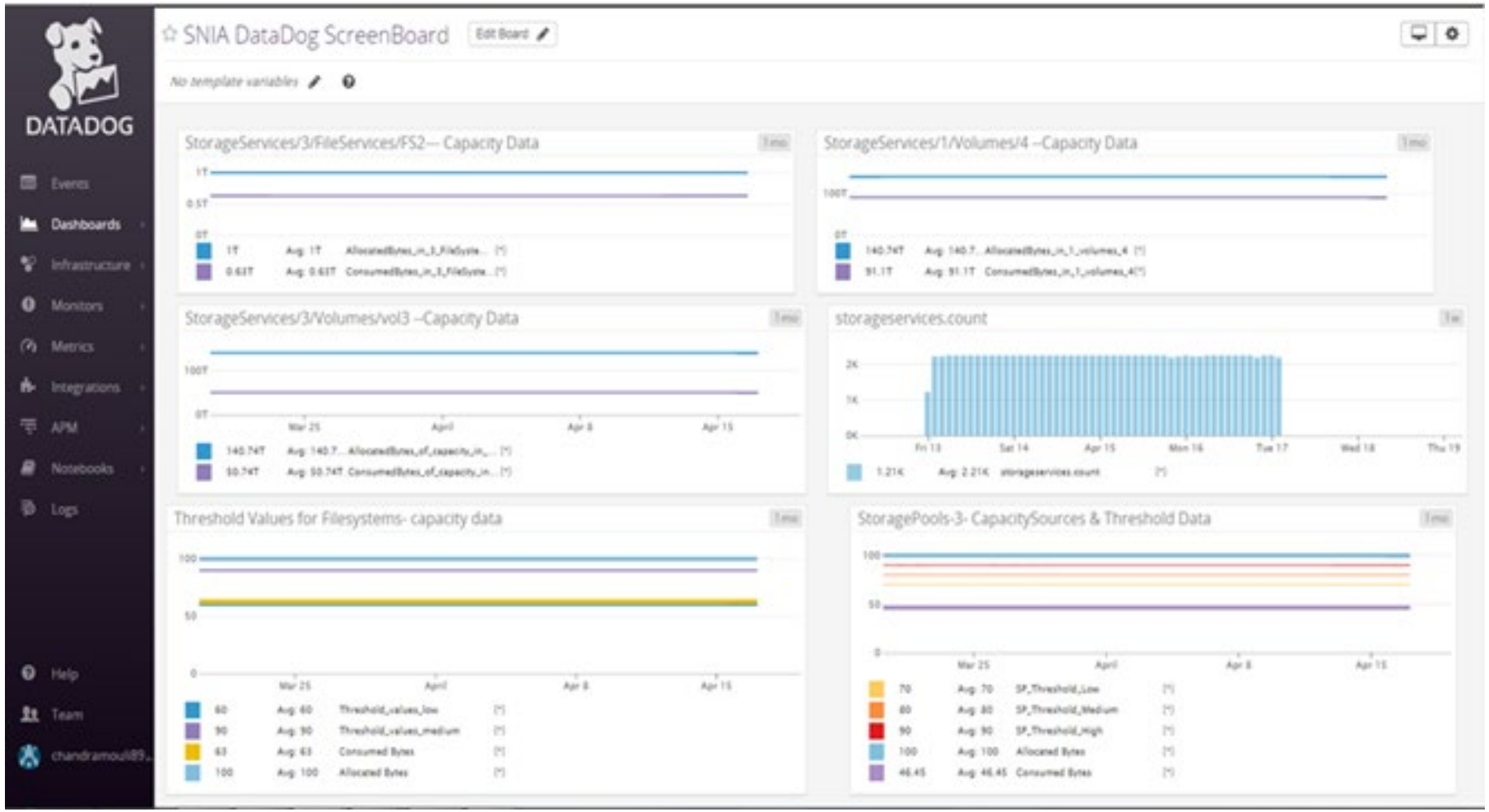
- Get-SwordfishConnection
- Get-SwordfishController
- Get-SwordfishDrive
- Get-SwordfishEndpoint
- Get-SwordfishEthernetInterface
- Get-SwordfishGroup
- Get-SwordFishPool
- Get-SwordfishVolume
- Get-SwordfishSession
- Get-SwordfishManager
- Get-SwordfishClassOfService
- Get-SwordfishDataStorageLinesOfService
- Get-SwordfishDataStorageLoSCapabilities
- Get-SwordfishIOConnectivityLoSCapabilities

Swordfish Datadog
Sample Dashboard Integration

Swordfish Datadog
Sample Dashboard Integration

- Basic dashboard for the Datadog monitoring service
- Connects to a Swordfish service and provides an integration to the Datadog User Interface
- Displays storage system capacity information and the available storage capacity thresholds
- Can be a starting point for a customized Datadog plugin
- Link: https://github.com/SNIA/Swordfish-datadog-sample-dashboard-integration
- Includes installation, user, and developer documentation

Swordfish Datadog Sample Dashboard Output

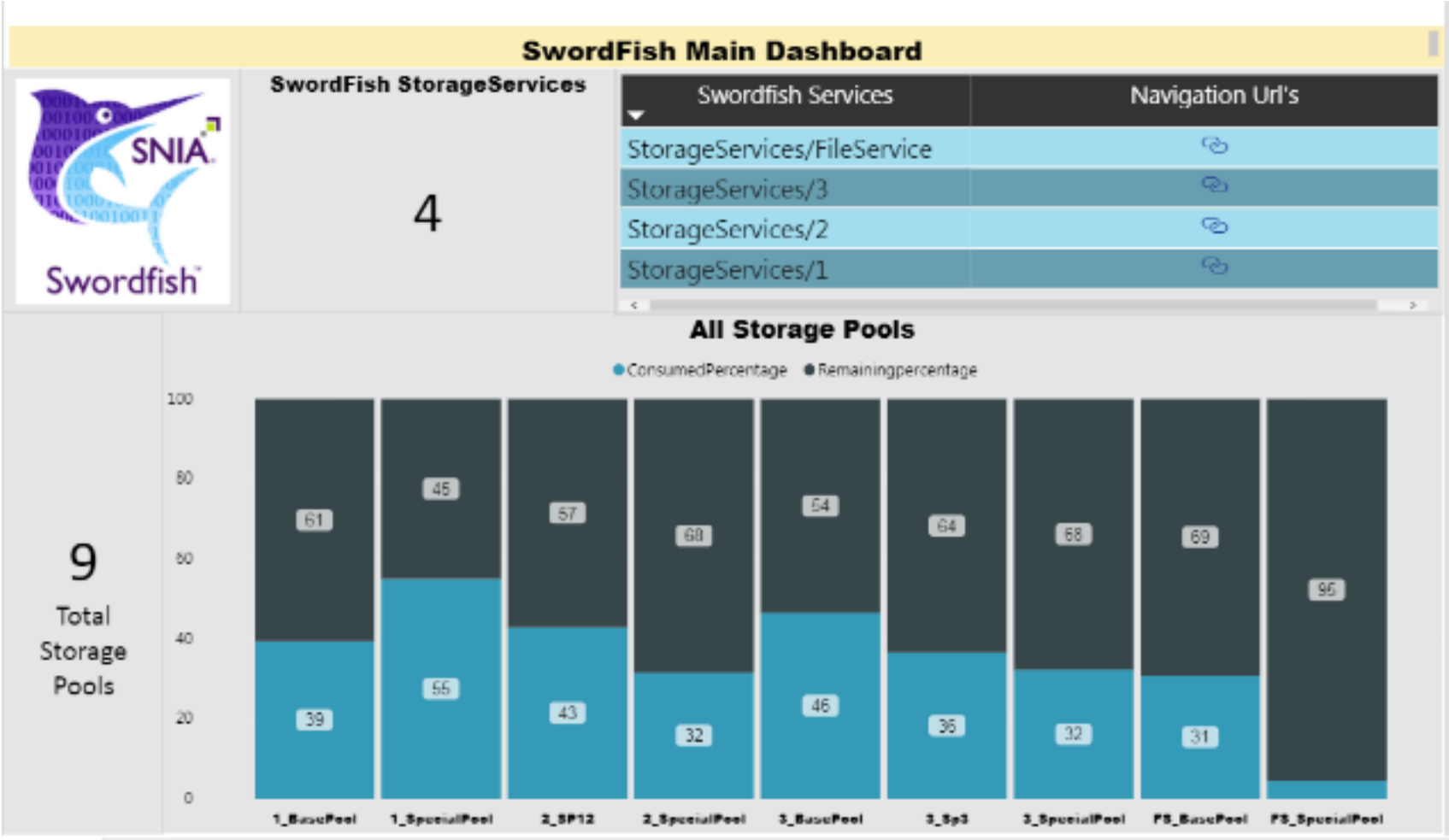


Swordfish Power BI Sample Dashboard Integration

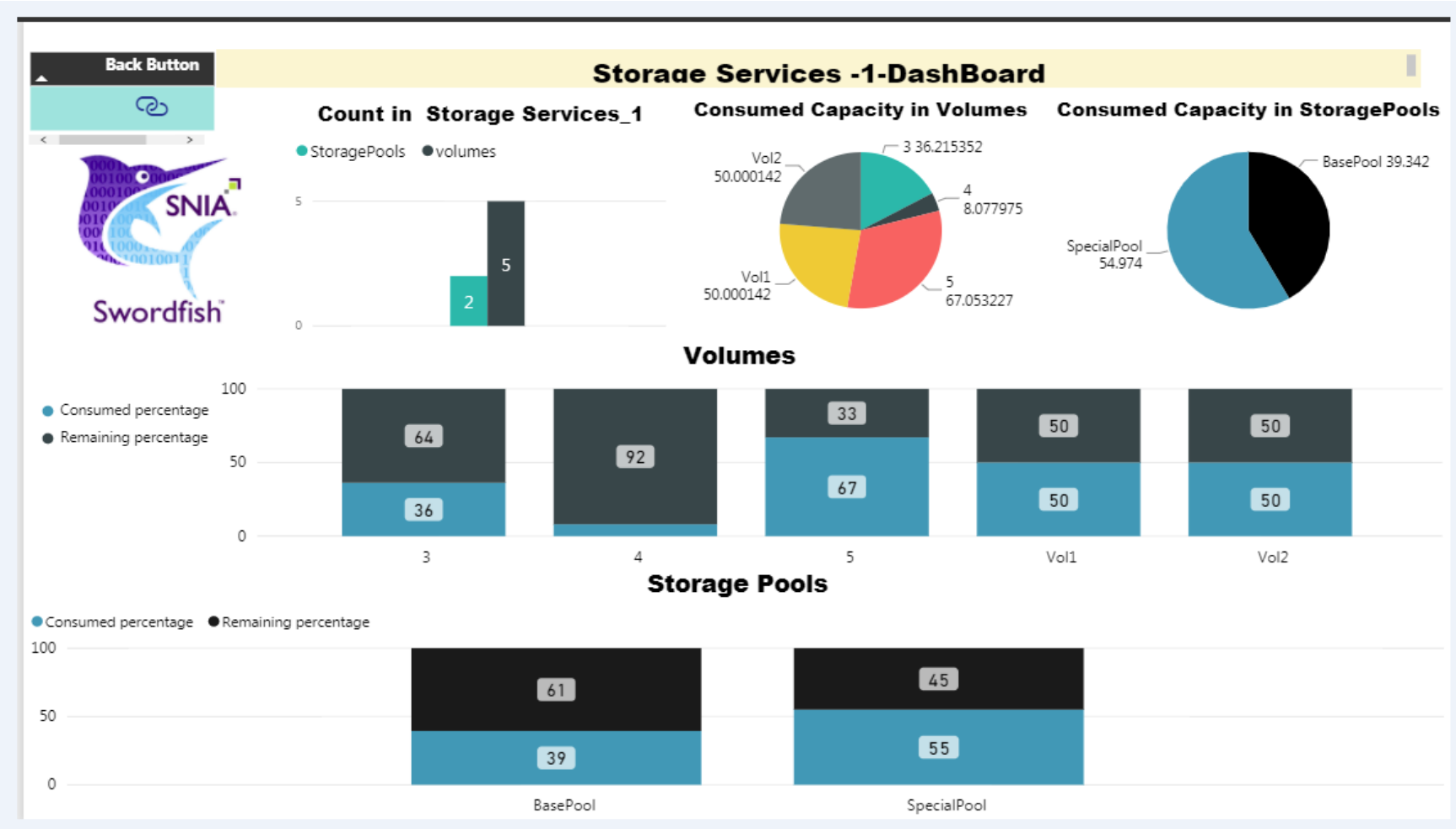
Swordfish Power BI
Sample Dashboard Integration

- Basic dashboard for the Power BI monitoring system
- Connects to a Swordfish service and provides an integration to the Power BI User Interface
- Displays storage system capacity information and the available storage capacity thresholds
- Can be a starting point for a customized Power BI plugin
- Link: https://github.com/SNIA/Swordfish-powerBI-sample-dashboard-integration
- Includes installation, user, and developer documentation

Swordfish Power BI Sample Dashboard (Main)



Swordfish Power BI Sample Dashboard (Child)



Swordfish Related Open Source Projects

Swordfish Related Open Source Projects

- DMTF Redfish Open Source Projects
  - Several useful tools for working with Redfish (and Swordfish)
- fishem
  - An emulator that brings Redfish and Swordfish mockups to life
- Gofish
  - Golang client library for interacting with DMTF Redfish and SNIA Swordfish
- Swordfish Ember Client
  - Frontend client for the Swordfish stack, written in Emberjs
- Open Fabrics Alliance: Open Fabrics Management Framework
  - Using mockups and the Swordfish API Emulator for OFMF development

DMTF Redfish Open Source Projects

- Redfish-Mockup-Creator
  - Creates a Mockup from a live Redfish or Swordfish service
- Redfish-Interface-Emulator
  - Emulates a Redfish service statically or dynamically
- Redfish-Tacklebox
  - Python utilities for common management operations on a Redfish service
- python-redfish-library
  - Python library for interacting with a Redfish service
- libredfish
  - C client library for interacting with a Redfish service
- DMTF open source projects are at https://github.com/DMTF

fishem -- Fish Emulator

- Brings Redfish and Swordfish mockups to life
  - Reads in a mockup to set the initial state of the emulator, then handles REST operations on all objects in the mockup
  - Basic handling of allowed GET, PUT, POST, PATCH and DELETE operations for all URI-accessible objects defined by Redfish and Swordfish schema
  - Basic handling of Actions defined by Redfish and Swordfish schema
    - Detected, responded to with HTTP responses, and reported to the console
  - Can capture the final state of an emulator run as an output mockup
- Link: https://github.com/ddeel/fishem
- Includes installation, user, and developer documentation

fishem Example Console Output
(Startup with an input mockup)

```
(env) C:\Users\Don\Documents\GitHub\fishem>python fishem.py -im temp\nvmeof-mockups
fishem initialization -----------------------------------
Loaded the mockup in "temp\nvmeof-mockups"
fishem starting -----------------------------------------
........................................ (210 API modules)
fishem running ------------------------------------------
 * Serving Flask app 'fishem' (lazy loading)
 * Environment: production
   WARNING: This is a development server. Do not use it in a production deployment.
   Use a production WSGI server instead.
 * Debug mode: off
 * Running on all addresses.
   WARNING: This is a development server. Do not use it in a production deployment.
 * Running on http://192.168.1.7:5000/ (Press CTRL+C to quit)
127.0.0.1 - - [05/Sep/2021 12:11:46] "GET /redfish/v1 HTTP/1.1" 200 -
```


fishem Example Client Browser Output
(Service root at /redfish/v1)

localhost:5000/redfish/v1


```
{
    @Redfish.Copyright: "Copyright 2014-2020 SNIA. All rights reserved.",
    @odata.context: "/redfish/v1/$metadata#ServiceRoot.ServiceRoot",
    @odata.id: "/redfish/v1/",
    @odata.type: "#ServiceRoot.v1_10_0.ServiceRoot",
    Id: "RootService",
    Name: "Root Service",
    RedfishVersion: "1.12.0",
    UUID: "92384634-2938-2342-8820-489239905423",
  - Chassis: {
        @odata.id: "/redfish/v1/Chassis"
    },
  - Fabrics: {
        @odata.id: "/redfish/v1/Fabrics"
    },
  - NVMeDomains: {
        @odata.id: "/redfish/v1/NVMeDomains"
    },
  - Storage: {
        @odata.id: "/redfish/v1/Storage"
    },
  - StorageSystems: {
        @odata.id: "/redfish/v1/StorageSystems"
    },
  - Systems: {
        @odata.id: "/redfish/v1/Systems"
    }
}
```


SNIA Swordfish Conformance Testing and Open Source

SNIA Swordfish™ Conformance Test Program

- SNIA's Storage Management Initiative (SMI) Conformance Testing Programs allow manufacturers to test their products with a vendor neutral, open source test suite to validate conformance to SNIA's storage management specifications
- The SNIA Swordfish™ Conformance Test Program (Swordfish CTP) validates that a company's products conform to a particular version of the Swordfish specification using the new Swordfish CTP Test Suite
- Swordfish CTP is based upon an open source framework that leverages common test tools that support the DMTF Redfish® Specification, which is extended by the Swordfish™ specification
  - **Redfish-Protocol-Validator**, **Redfish-Service-Validator**
  - **Redfish-Interop-Validator**, **Redfish-URI-Validator**, **etc.**

SNIA Swordfish™ Conformance Test Program (Continued)

- Swordfish CTP includes extensions to cover storage-specific use cases and validate conformance to Swordfish profiles
  - Uses the Swordfish Features Registry to determine which profiles to test
  - Can also test specific profiles
- Companies with products that pass Swordfish CTP testing can be listed on the public SNIA web site, with information that includes:
  - Version of test taken
  - Software product tested
  - Hardware manageable by the tested software product
- The Swordfish v1.2.2 CTP Test Suite is now available

Where to Find More Information

Where to Find More Information

SNIA Swordfish™

- Swordfish Standards
  - Schemas, Specs, Mockups, User and Practical Guides, … https://www.snia.org/swordfish
- Swordfish Specification Forum
  - Ask and answer questions about Swordfish
  - http://swordfishforum.com/
- Scalable Storage Management (SSM) TWG
  - Technical Work Group that defines Swordfish
  - Influence the next generation of the Swordfish standard
  - Join SNIA & participate: https://www.snia.org/member_com/join-SNIA
- Join the SNIA Storage Management Initiative
  - Unifies the storage industry to develop and standardize interoperable storage management technologies
  - https://www.snia.org/forums/smi/about/join

DMTF Redfish™

- Redfish Standards
  - Specifications, whitepapers, guides,… https://www.dmtf.org/standards/redfish

Open Fabric Management Framework

- OFMF Working Group (OFMFWG)
  - Description & Links https://www.openfabrics.org/working-groups/
- OFMFWG mailing list subscription
  - https://lists.openfabrics.org/mailman/listinfo/ofmfwg
- Join the Open Fabrics Alliance
  - https://www.openfabrics.org/membership-how-to-join/

NVM Express

- Specifications https://nvmexpress.org/developers/
- Join: https://nvmexpress.org/join-nvme/

Please take a moment to rate this session.

Your feedback is important to us.

More About the Swordfish API Emulator

More About the Swordfish API Emulator

- Emulator Python Environment
- Installing the Emulator
- Notes About the Emulator
- How the Emulator Works
- Adding New Dynamic Resources

Emulator Python Environment

- Python 3.6 or above
- Virtual environment recommended but not required
- Python packages
  - flask flask_restful flask_httpauth
  - requests aniso8601 markupsafe pytz
  - itsdangerous StringGenerator urllib3

Installing the Emulator
(Default Configuration)

- Create a folder/directory for the Emulator
- Copy in the Redfish Interface Emulator
- Copy in the Swordfish API Emulator on top of it
- Install the necessary Python packages
- Run with “python emulator.py”

- There is a *setup.sh* to handle these steps

Swordfish API Emulator Console Output
(Default Configuration)

```
$ python ./emulator.py
INFO:root:Mockup folders
['Mockups']
 * Redfish endpoint at localhost:5000
 * Using dynamic emulation
INFO:root:Init ResourceDictionary.
INFO:root:Init ResourceDictionary.
 * Use HTTP
 * Running in Redfish mode
 * Serving Flask app "g" (lazy loading)
 * Environment: production
   WARNING: This is a development server. Do not use it in a production deployment.
   Use a production WSGI server instead.
 * Debug mode: off
INFO:werkzeug: * Running on http://0.0.0.0:5000/ (Press CTRL+C to quit)
```


Notes About the Emulator

- Read the Redfish Interface Emulator *README.md*
  - Says how to use *emulator.py* flags and *emulator-config.json*
- *api_emulator\resource_manager.py* establishes which resources are static and which are dynamic
  - Static resources are read-only
  - Dynamic resources support CRUD operations
- Swordfish resources are all dynamic, but some of the default configuration Redfish resources are static
  - AccountService, Registries, SessionService, TaskService

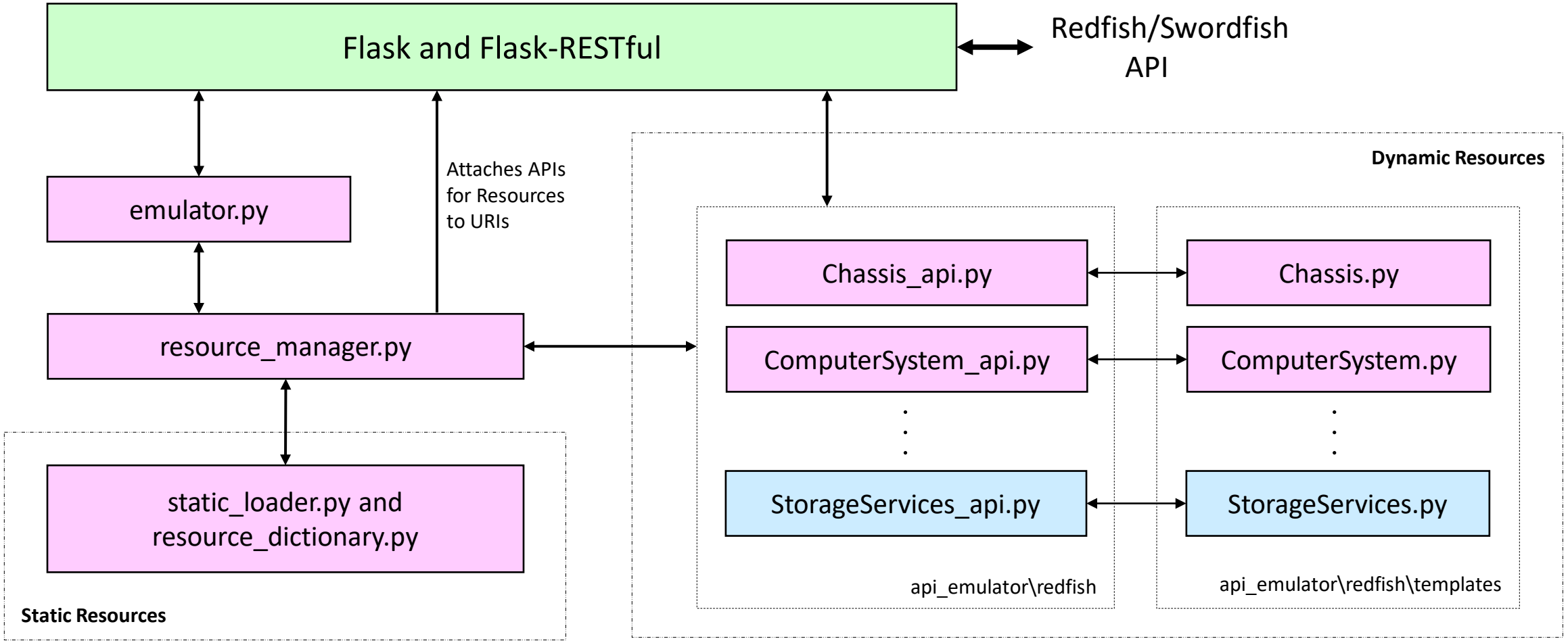
Notes About the Emulator (Continued)

- Static resources are populated by JSON mockup files in the *api_emulator\redfish\static* directory
  - Only uses static resources identified in *resource_manager.py*
  - Dynamic resources are NOT populated or initialized this way
- Dynamic resources can be populated via the emulator API using CRUD operations (POST, PUT, GET, PATCH, DELETE)
- The Redfish Interface Emulator also includes a tool called “Infragen” that can prepopulate dynamic resources
  - This tool can be used to instantiate Redfish resources in the emulator’s default configuration

Notes About the Emulator (Continued Again)

- Emulator-only operations can populate dynamic objects
  - When defined by an api file for a dynamic resource, a POST with an empty body can create a new default singleton instance: POST http://localhost:5000/redfish/v1/Chassis/NewThing {}
  - The new instance (named “NewThing” here) is defined by a template file for the dynamic resource (“Chassis” in this case)
- The Swordfish Basic Web Client uses emulator-only operations to create new Redfish and Swordfish singletons
  - It can then use PATCH operations to alter properties and customize the new dynamic object

How the Emulator Works



Adding New Dynamic Resources to the Emulator

- Dynamic resources are enabled by api/template file pairs
  - The api file sets REST behaviors for Collections and Singletons
  - The template file establishes how to create default singletons
- Example api/template files are in *api_emulator\redfish*
  - *eg_resource_api.py* and *template\eg_resource.py*
  - *eg_subresource_api.py* and *template\eg_subresource.py*
- The example api files show where to handle applicable REST commands for Collections and for Singletons
  - GET, PUT, POST, PATCH, DELETE

Adding New Dynamic Resources to the Emulator (Continued)

- The example template files show how templates are set up to allow new singleton instances to be created
  - A template is copied, with some things filled in at runtime
- When a new api/template file pair is created, it is added to the emulator by editing *resource_manager.py*
  - This will attach the new resource's APIs to URIs

Thank You!

