



z/OSMF 2.2 Advanced Programming

*Joey Zhu (zhuxiaoz@cn.ibm.com)
IBM Corporation*

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Agenda

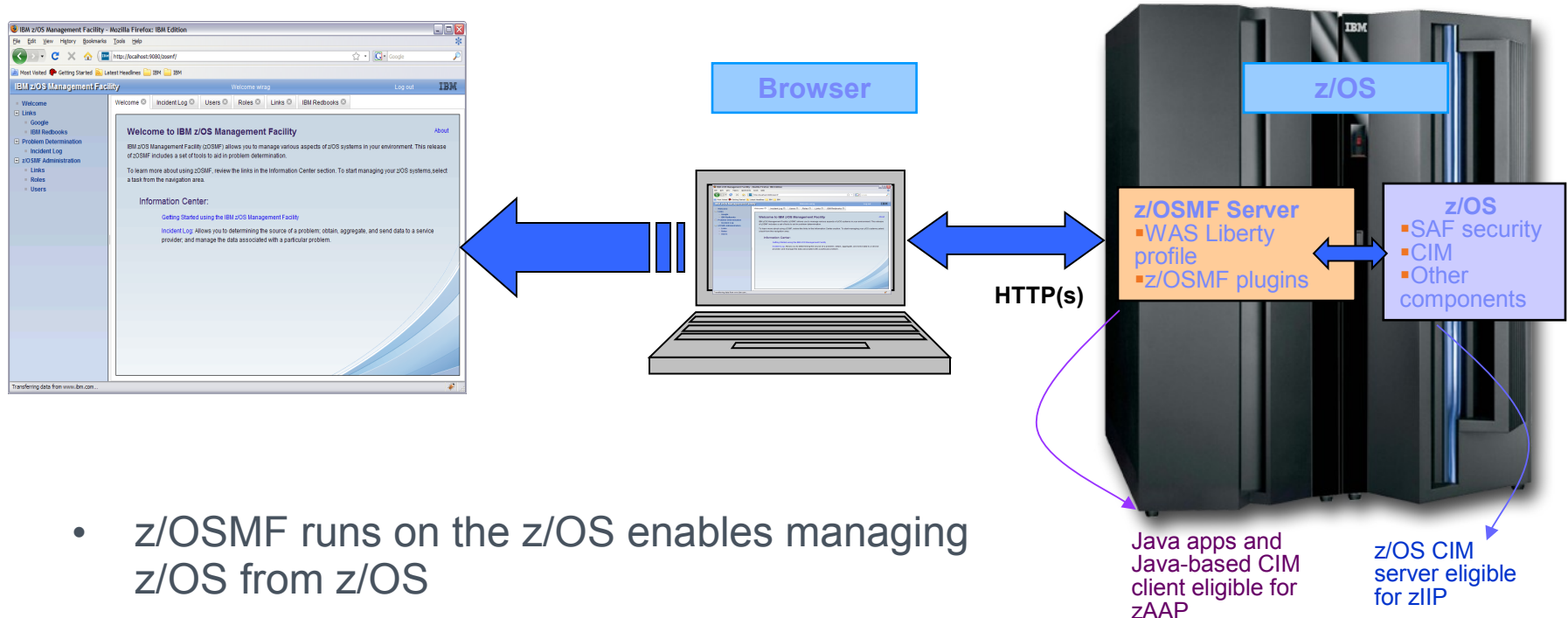
- What is z/OSMF 
- What is z/OSMF Advanced Programming
- Using z/OSMF RESTful services
 - z/OS jobs service
 - z/OS data set and file service
 - Application Linking Manager interface service
 - TSO/E address space service
 - Data persistence service
 - Application Server routing service
 - Topology service
 - Multisystem routing service
 - z/OSMF workflow service
 - Software Management service
 - Using z/OSMF RESTful services – simple demo
 - Using z/OSMF RESTful services – Simpler than Simpler
- Summary

What is z/OSMF

- IBM z/OS Management Facility (z/OSMF) delivers on IBM's strategy for mainframe simplification and modernization
 - The IBM z/OS Management Facility is now a part of z/OS V2R2 that provides support for a modern, Web-browser based management console for z/OS.
 - It helps system programmers more easily manage and administer a mainframe system by simplifying day to day operations and administration of a z/OS system.
 - More than just a graphical user interface, the z/OS Management Facility is intelligent, addressing the needs of a diversified skilled workforce and maximizing their productivity.
 - Automated tasks can help reduce the learning curve and improve productivity.
 - Embedded active user assistance (such as wizards) guide you through tasks and helps provide simplified operations.

What is z/OSMF

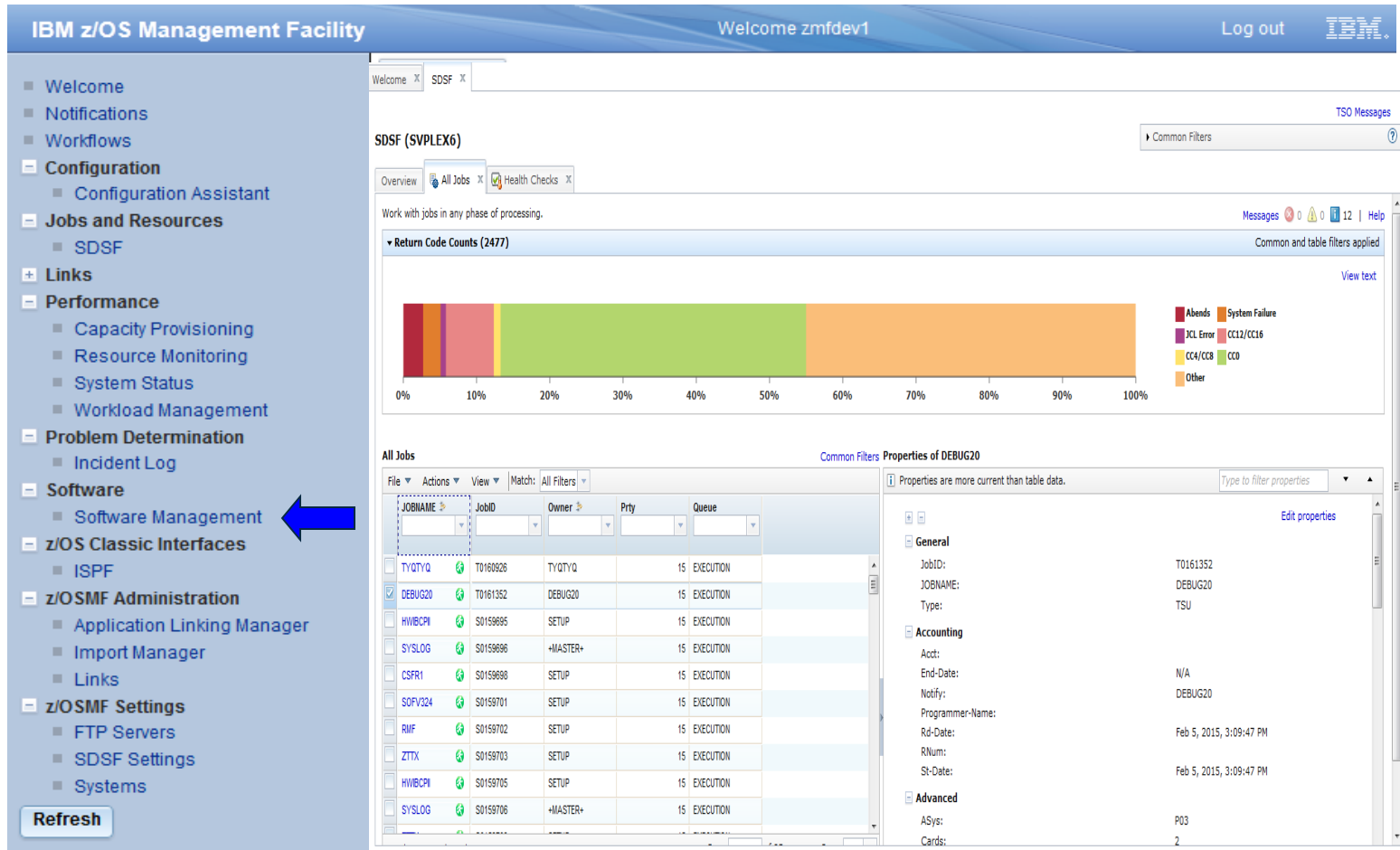
- How does z/OSMF function in the z/OS environment?



- z/OSMF runs on the z/OS enables managing z/OS from z/OS
 - UI is rendering in browser on a PC
 - No client install required

What is z/OSMF

- Gain simplification and modernization through z/OSMF plugins



IBM z/OS Management Facility Welcome zmfdev1 Log out IBM

Navigation Menu:

- Welcome
- Notifications
- Workflows
- Configuration
 - Configuration Assistant
- Jobs and Resources
 - SDSF
- Links
- Performance
 - Capacity Provisioning
 - Resource Monitoring
 - System Status
 - Workload Management
- Problem Determination
 - Incident Log
- Software
 - Software Management
- z/OS Classic Interfaces
 - ISPF
- z/OSMF Administration
 - Application Linking Manager
 - Import Manager
 - Links
- z/OSMF Settings
 - FTP Servers
 - SDSF Settings
 - Systems

Buttons: Refresh

SDSF (SVPLEX6)

Overview All Jobs Health Checks

Work with jobs in any phase of processing.

Return Code Counts (2477)

Common Filters

Messages 0 0 0 12 Help

Common and table filters applied

View text

Abends JCL Error CC4/CC8 CC12/CC16 CCO Other System Failure

All Jobs

Common Filters Properties of DEBUG20

File	Actions	View	Match	All Filters
JOBNAME	JobID	Owner	Prio	Queue
TYQTYQ	T0160926	TYQTYQ	15	EXECUTION
DEBUG20	T0161352	DEBUG20	15	EXECUTION
HWBCPI	S0159695	SETUP	15	EXECUTION
SYSLOG	S0159696	+MASTER+	15	EXECUTION
CSFR1	S0159698	SETUP	15	EXECUTION
SOPV324	S0159701	SETUP	15	EXECUTION
RMF	S0159702	SETUP	15	EXECUTION
ZTX	S0159703	SETUP	15	EXECUTION
HWBCPI	S0159705	SETUP	15	EXECUTION
SYSLOG	S0159706	+MASTER+	15	EXECUTION

Properties of DEBUG20

Properties are more current than table data.

Type to filter properties

Edit properties

General

JobID: T0161352
JOBNAME: DEBUG20
Type: TSU

Accounting

Acct: N/A
End-Date: N/A
Notify: DEBUG20
Programmer-Name: Feb 5, 2015, 3:09:47 PM
Rd-Date: Feb 5, 2015, 3:09:47 PM
RNum: Feb 5, 2015, 3:09:47 PM
St-Date: Feb 5, 2015, 3:09:47 PM

Advanced

ASys: P03
Cards: 2

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What is z/OSMF

What's more?

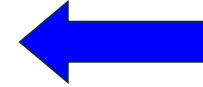
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Agenda

- What is z/OSMF
- What is z/OSMF Advanced Programming
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 - Application Linking Manager interface service
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What is z/OSMF Advanced Programming

- In addition to z/OSMF plugins with modern UI and simplified task, z/OSMF also provides services and facilities to help you write programs.
- z/OSMF Advanced Programming includes:
 - Using z/OSMF RESTful services
 - Develop workflow
 - Create your own z/OSMF plugins
- This session focus on “Using z/OSMF RESTful services”. Please refer to <IBM z/OS Management Facility Programming Guide> for more details about “Develop workflow” and “Create your own z/OSMF plugins”.

What is z/OSMF Advanced Programming

- Why would I need “z/OSMF RESTful services”
 - Representational State Transfer (REST) is a software architecture style. It defines constraints for designing services:
 - Client-Server (Scalability, Simplicity)
 - Stateless (Scalability, Reliability)
 - Uniform interface (Simplicity, Visibility)
 - Identification of resources
 - Manipulation of resources through representation
 - Hypermedia as the engine of application state
 - RESTful web service is based on HTTP channel and it's lightweight:
 - Has gained widespread acceptance across the Web. (Amazon, Twitter)
 - Easy to call
 - Could be driven remotely (via HTTPS) and securely
 - Language and platform independent
 - z/OSMF RESTful services makes z/OS and z/OSMF more approachable


What is z/OSMF Advanced Programming

- Why would I need to “develop workflow”
 - z/OSMF Workflows application provides a framework supports user (workflow provider) to define a guided flow (a.k.a. workflow) through steps to accomplish a task in z/OS.
 - z/OSMF Workflows application is useful to:
 - Assist people unfamiliar with how to perform a given task, or a task that they perform rarely
 - Ensure that all tasks are performed in the right order and only when their dependencies have been met
 - Monitor and track progress toward the completion of the task in the centralized place
 - Provide a history (audit trail) of the steps performed for a task
 - Automate a workflow without the need of interaction
 - Adjust step status dynamically according to various pre-defined condition
 - Work with workflow through REST service instead of having to logon to z/OSMF UI
 - Exploiters of workflow
 - zEDC workflow to enable zEDC on multiple systems
 - z/OS Migration workflow
 - z/OSMF Configure workflow
 - z/OSMF CA workflows

What is z/OSMF Advanced Programming

- Why would I need to “create my own z/OSMF plugins”
 - z/OSMF V2R1 provides “External application support” solution enables non-z/OSMF web application (plugin) – html and/or JavaScript applications to render their UI and run in the z/OSMF browser.
 - “External application support” solution provides:
 - z/OS TSO/E address space RESTful service allows “external application” to communicate with their back-end TSO/E application which facilitates reusing existing TSO application to serve web application.
 - Data persistence RESTful service helps “external application” to manage (read/write) their persistent data in z/OS side.
 - Import Manager plugin provides the UI interface to import “external application” into z/OSMF.
 - “Create your own z/OSMF plugins” builds centralized z/OS management portal and makes developing and deploying web application more easy.

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Using z/OSMF RESTful services

- z/OSMF provides a set of RESTful services to make z/OS and z/OSMF more approachable.
- Process overview
 - z/OSMF RESTful services can be invoked by any HTTP client application running on the z/OS local system or remote system.
 - Your application (client) issues HTTP request to the target system (z/OS).
 - z/OSMF determines if the request is valid or not. If it's valid, z/OSMF performs the requested service and returns the result.
- Security consideration
 - Authenticate to z/OSMF is required. (Certificate authentication is also supported)
 - Other authorization may be required for different RESTful services.

Using z/OSMF RESTful services

- z/OSMF provides below RESTful services:
 - z/OS jobs service
 - z/OS data set and file service
 - Application Linking Manager interface service
 - TSO/E address space service
 - Data persistence service
 - Application Server routing service
 - Topology service
 - Multisystem routing service
 - z/OSMF workflow service
 - Software Management service

z/OS jobs service – API list

- z/OS jobs RESTful service is provided for working with batch jobs on a z/OS system.
- z/OS jobs RESTful service provides below operations (APIs):

Operation	Method
Obtain the status of a job.	GET
List the jobs for an owner, prefix, or job ID.	GET
List the spool files for a job.	GET
Retrieve the contents of a job spool file.	GET
Submit a job to run on z/OS.	PUT
Hold a job.	PUT
Release a job.	PUT
Change the job class.	PUT
Cancel a job.	PUT
Delete a job (cancel a job and purge its output).	DELETE

z/OS jobs service – API example

- List the jobs for an owner, prefix or job ID

- URL format

There are various formats of the URL for this operation:

`https://host:port/zosmf/restjobs/jobs`

`https://host:port/zosmf/restjobs/jobs?owner=owner`

`https://host:port/zosmf/restjobs/jobs?prefix=prefix*`

`https://host:port/zosmf/restjobs/jobs?owner=owner&prefix=prefix*`

`https://host:port/zosmf/restjobs/jobs?jobid=jobid`

`https://host:port/zosmf/restjobs/jobs?max-jobs=nnn`

`https://host:port/zosmf/restjobs/jobs?user-correlator=correlator`

- Expected response

On completion, the z/OS jobs REST service returns an HTTP response with an Array of matching jobs, each as a JSON job document.

z/OS jobs service – API example

- List the jobs for an owner, prefix or job ID
 - Example request

In the following example, the GET method is used to list the jobs that are owned by “IBMUSER” and have a job name prefix beginning with “TESTJOB”:

```
GET /zosmf/restjobs/jobs?owner=IBMUSER&prefix=TESTJOB* HTTP/1.1
```

- Example response

```
HTTP/1.1 200 OK
Date: Fri, 17 Jan 2014 05:39:28 +0000GMT
Content-Type: application/json
Connection: close
```

```
[
  {
    "jobid": "JOB00023", "jobname": "TESTJOB2", "subsystem": null, "owner": "IBMUSER",
    "status": "OUTPUT", "type": "JOB", "class": "A", "retcode": "CC 0000",
    "url": "https://host:port/zosmf/restjobs/jobs/TESTJOB2/JOB00023",
    "files-url": "https://host:port/zosmf/restjobs/jobs/TESTJOB2/JOB00023/files",
    {
      "jobid": "JOB00024", "jobname": "TESTJOB3", "subsystem": null, "owner": "IBMUSER",
      "status": "OUTPUT", "type": "JOB", "class": "A", "retcode": "ABEND S000",
      "url": "https://host:port/zosmf/restjobs/jobs/TESTJOB3/JOB00024",
      "files-url": "https://host:port/zosmf/restjobs/jobs/TESTJOB3/JOB00024/files"
    }
  }
]
```

z/OS jobs service – API example

- Submit a job
 - URL format
`https://host:port/zosmf/restjobs/jobs{/JESB}`
 - To submit a job to secondary JES, use “-JESB” in the URL
 - The job to be submitted could be included in the request body OR resided in a data set or unix file in the host z/OS system.
 - Expected response

On completion, the z/OS jobs service returns an HTTP response with a JSON job document. The document contains information about the submitted job such as jobid, status, type, etc.

z/OS jobs service – API example

- Submit a job
 - Example request

The following request submits a job “TESTJOBX” to run on z/OS. The content of the job to be submitted is included in the request.

```
PUT /zosmf/restjobs/jobs HTTP/1.1
Content-Type: text/plain
X-IBM-Intrdr-Class: A
X-IBM-Intrdr-Recfm: F
X-IBM-Intrdr-Lrecl: 80
X-IBM-Intrdr-Mode: TEXT
```

```
//TESTJOBX JOB (),MSGCLASS=H
// EXEC PGM=IEFBR14
```

- Example response

```
HTTP/1.1 201 Created
Date: Fri, 17 Jan 2014 05:39:28 +0000GMT
Content-Type: application/json
Connection: close

{
  "jobid": "JOB00025", "jobname": "TESTJOBX", "subsystem": null, "owner": "IBMUSER",
  "status": "INPUT", "type": "JOB", "class": "A", "retcode": null,
  "url": "https://host:port/zosmf/restjobs/jobs/TESTJOBX/JOB00025",
  "files-url": "https://host:port/zosmf/restjobs/jobs/TESTJOBX/JOB00025/files"
}
```

z/OS jobs service – API exploiters

- By exploiting z/OS jobs RESTful service:
 - application could focus on implementing their own logic and be released from taking care about how to work with z/OS jobs remotely or locally
 - application can easily call these jobs API.
- Current exploiters:
 - Explorer family such as CICS Explorer, z/OS Explorer.
 - z/OSMF Software Management
 - z/OSMF SDSF UI
 - z/OSMF Workflows
 - Customer's self-developed web application

z/OS jobs service – API exploiters

- z/OSMF Software Management plugin easily gets job management capability to manage deploy jobs (1/3)

[Software Management](#) › [Deployments](#) › [Deployment Checklist](#)

Deployment Checklist

To deploy a software instance, complete the checklist.

Checklist

Progress	Step
✓	1. Specify the properties for this deployment.
✓	2. Select the software instance to deploy.
✓	3. Select the objective for this deployment.
✓	4. Check for missing SYSMODs. <ul style="list-style-type: none"> View missing SYSMOD reports.
✓	5. Configure this deployment.
✓	6. Define the job settings. z/OSMF creates the de <ul style="list-style-type: none"> View the deployment summary.
➡	7. Submit deployment jobs.
	8. Specify the properties for the target software i

Close

[Software Management](#) › [Deployments](#) › [Deployment Checklist](#) › [Submit Deployment Jobs](#)

Submit Deployment Jobs

Review the jobs created for this deployment, and submit the jobs in sequential order. When all the jobs are complete,

JCL data set name: ZOSMFAD.DM.D140625.T162244.CNTL
Target system: PEV171

Jobs

Actions			
Sequence Filter	JCL Data Set Member Name Filter	Description [More Less] Filter	System Filter
<input checked="" type="checkbox"/>	1	IZUD01CP	Copy Data Sets: Copy the source software instance data sets to [More]
<input type="checkbox"/>	2	IZUD02RN	Jobs: Rename the target software instance data sets [More]
<input type="checkbox"/>	3	IZUD03UC	a Sets: Update the entries within the SMP/E CSI data [More]

- View
- Submit Job
- Purge...
- Cancel...
- Override Complete

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z/OS jobs service – API exploiters

- z/OSMF Software Management plugin easily gets job management capability to manage deploy jobs (2/3)

Software Management > Deployments > Deployment Checklist > Submit Deployment Jobs

Submit Deployment Jobs

▼ Messages 0 0 1

IZUD7861: Job "IZUD01CP" (JOB00080) has been submitted.

Review the jobs created for this deployment, and submit the jobs in sequential order. When all the jobs are complete, click **Close** to proceed to the next step in the deployment checklist.

JCL data set name: ZOSMFAD.DM.D140625.T162244.CNTL
Target system: PEV171

Jobs

Sequence Filter	JCL Data Set Member Name Filter	Description [More Less] Filter	System Filter	Status Filter	Messages Filter	Job Name Filter
<input type="checkbox"/> 1	IZUD01CP	Copy Data Sets: Copy the source software instance data sets to [More]	PEV171	Submitted		IZUD01CP
<input type="checkbox"/> 2	IZUD02RN	Rename Data Sets: Rename the target software instance data sets [More]	PEV171			
<input type="checkbox"/> 3	IZUD03UC	Update CSI Data Sets: Update the entries within the SMP/E CSI data [More]	PEV171			

Software Management > Deployments > Deployment Checklist > Submit Deployment Jobs

Submit Deployment Jobs

Review the jobs created for this deployment, and submit the jobs in sequential order. When all the jobs are complete, click **Close** to proceed to the next step in the deployment checklist.

JCL data set name: ZOSMFAD.DM.D140625.T162244.CNTL
Target system: PEV171

Jobs

Sequence Filter	JCL Data Set Member Name Filter	Description [More Less] Filter	System Filter	Status Filter
<input checked="" type="checkbox"/> 1	IZUD01CP	Copy Data Sets: Copy the source software instance data sets to [More]	PEV171	Complete
<input type="checkbox"/> 2	IZUD02RN	Rename Data Sets: Rename the target software instance data sets [More]	PEV171	
<input type="checkbox"/> 3	IZUD03UC	Update CSI Data Sets: Update the entries within the SMP/E CSI data [More]	PEV171	

View
Submit Job
Purge...
Cancel...
Override Complete

JCL
Job Output

z/OS jobs service – API exploiters

- z/OSMF Software Management plugin easily gets job management capability to manage deploy jobs (3/3)

[Software Management](#) ▶ [Deployments](#) ▶ [Deployment Checklist](#) ▶ [Submit Deployment Jobs](#) ▶ [View Job Output](#)

View Job Output

Name: IZUD01CP ID: JOB00082 Class: A Status: Submitted Return code:

JESMSG LG JESJCL JESYSMSG SYSPRINT SYSPRINT SYSPRINT SYSPRINT

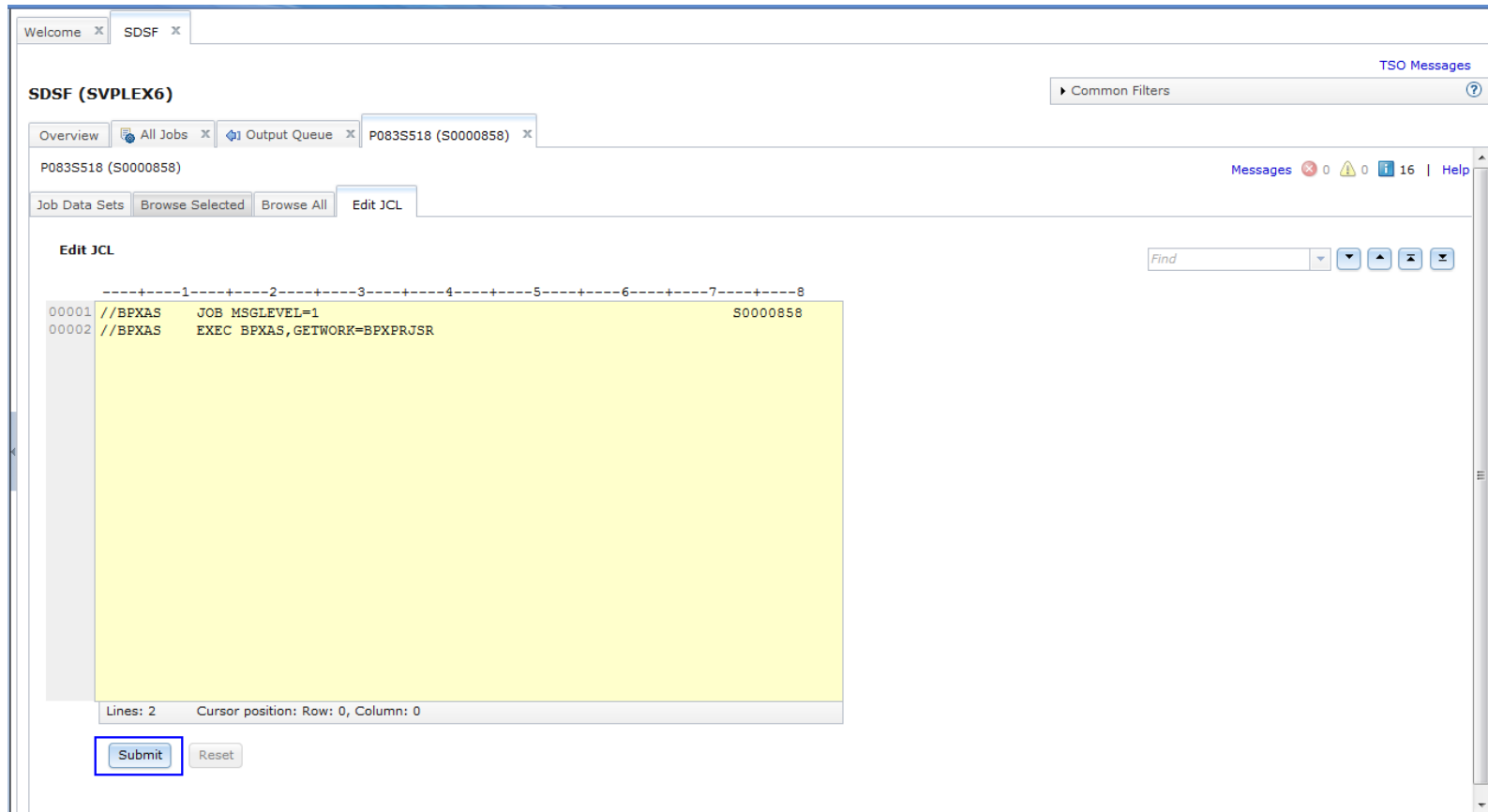
DD name:	Step name:	Procedure step name:	Dataset ID:	Class:	Record count:	Byte count:
JESMSG LG	JES2		2	A	14	524

Output (0.51 of 0.51 KB shown)

```
1          J E S 2  J O B  L O G  --  S Y S T E M  S Y 1  --  N O D E  S Y 1
0
05.04.28 JOB00082 ---- WEDNESDAY, 25 JUN 2014 ----
05.04.28 JOB00082 IRR010I USERID ZOSMFAD IS ASSIGNED TO THIS JOB.
05.04.28 JOB00082 ICH70001I ZOSMFAD LAST ACCESS AT 04:46:53 ON WEDNESDAY, JUNE 25, 2014
05.04.28 JOB00082 $HASP373 IZUD01CP STARTED - INIT 1 - CLASS A - SYS SY1
05.04.36 JOB00082 $HASP395 IZUD01CP ENDED
0----- JES2 JOB STATISTICS -----
- 25 JUN 2014 JOB EXECUTION DATE
- 102 CARDS READ
- 271 SYSOUT PRINT RECORDS
- 0 SYSOUT PUNCH RECORDS
- 14 SYSOUT SPOOL KBYTES
- 0.46 SECONDS EXECUTION TIME
```


z/OS jobs service – API exploiters

- z/OSMF SDSF UI exploits “z/OS jobs RESTful service” to submit job.



z/OS data set and file service – API list

- z/OS data set and file service is provided for working with data sets and unix files on a z/OS system.
- z/OS data set and file RESTful service provides below operations (APIs):

Operation	Method
List the data sets on a z/OS system. You can filter the returned list of data set names through the specification of high-level qualifiers and wildcards.	GET
List the members of a z/OS partitioned data set (PDS or PDSE). You can filter the returned list of member names through the specification of wildcards.	GET
List the files and directories in a UNIX file path on a z/OS system.	GET
Retrieve the contents of a sequential data set, or a member of a PDS or PDSE.	GET
Retrieve the contents of a z/OS UNIX file.	GET
Write data to a sequential data set or a member of a PDS or PDSE.	PUT
Write data to a z/OS UNIX file.	PUT

z/OS data set and file service – API example

- List the z/OS data sets on a system
 - URL format
 - `https://host:port/zosmf/restfiles/ds/?dslevel=filter-criteria`
 - `https://host:port/zosmf/restfiles/ds/?dslevel=filter-criteria&volser=volume-serial`
 - Expected response
- On completion, the service returns an HTTP response, which includes a status code indicating whether your request completed. Status code 200 indicates success. A status code of 4nn or 5nn indicates that an error has occurred.
- For a successful request, the HTTP response includes an array of matching data sets, each as a JSON list document.

z/OS data set and file service – API example

- List the z/OS data sets on a system
 - Example request

The following request is used to list all of the cataloged data sets that match the partial name "sys1.*lib". That is, the data sets that have a name beginning with "sys1". and a last qualifier that ends in "lib".

```
GET https://zosmf1.yourco.com/zosmf/restfiles/ds/?dslevel=sys1.*lib HTTP/1.1
```

- Example response

```
HTTP/1.1 200 OK
Date: Wed, 23 Oct 2013 00:43:49 GMT
Content-Type: application/json
Connection: close
{ "items": [ { "dsname": "SYS1.AUXLIB" }, { "dsname": "SYS1.BDTLIB" }, { "dsname": "SYS1.CHSLIB" },
{ "dsname": "SYS1.CMDLIB" }, { "dsname": "SYS1.COBLIB" }, { "dsname": "SYS1.CSSLIB" },
{ "dsname": "SYS1.FDEFLIB" }, { "dsname": "SYS1.FONTLIB" }, { "dsname": "SYS1.FORTLIB" },
{ "dsname": "SYS1.GRSLIB" }, { "dsname": "SYS1.IMAGELIB" }, { "dsname": "SYS1.JES3LIB" },
{ "dsname": "SYS1.KANLIB" }, { "dsname": "SYS1.LINKLIB" }, { "dsname": "SYS1.LPALIB" },
{ "dsname": "SYS1.MACLIB" }, { "dsname": "SYS1.MIGLIB" }, { "dsname": "SYS1.NCPLIB" },
{ "dsname": "SYS1.NFSLIB" }, { "dsname": "SYS1.OVERLIB" }, { "dsname": "SYS1.PARMLIB" },
{ "dsname": "SYS1.PARMLIB.CB" }, { "dsname": "SYS1.PARMLIB.INSTALL" },
{ "dsname": "SYS1.PARMLIB.MSYS" }, { "dsname": "SYS1.PARMLIB.PD" }, { "dsname": "SYS1.PROCLIB" },
{ "dsname": "SYS1.PROCLIB.CB" }, { "dsname": "SYS1.PROCLIB.INSTALL" },
{ "dsname": "SYS1.PROCLIB.MSYS" }, { "dsname": "SYS1.PROCLIB.PD" },
{ "dsname": "SYS1.PROCLIB.TEST" }, { "dsname": "SYS1.PSEGLIB" }, { "dsname": "SYS1.PSPMLIB" },
{ "dsname": "SYS1.SADRYLIB" }, { "dsname": "SYS1.SAMPLIB" }, { "dsname": "SYS1.SIATLIB" },
{ "dsname": "SYS1.SICETLIB" }, { "dsname": "SYS1.SIFALIB" }, { "dsname": "SYS1.SISTCLIB" },
{ "dsname": "SYS1.SORTLIB" }, { "dsname": "SYS1.SVCLIB" }, { "dsname": "SYS1.VTAMLIB" },
{ "dsname": "SYS1.XCFLIB" } ], "returnedRows": 43 }
```

z/OS data set and file service – API example

- Retrieve the contents of a z/OS data set or member
 - URL format
 - For a request to retrieve data from a sequential data set:
`https://host:port/zosmf/restfiles/ds/<data-set-name>`
 - For a request to retrieve data from a member of a PDS or PDSE:
`https://host:port/zosmf/restfiles/ds/<data-set-name>(<member-name>)`
 - For a request to retrieve data from an uncataloged sequential data set:
`https://host:port/zosmf/restfiles/ds/-(volser)/<data-set-name>`
 - For a request to retrieve data from a member of an uncataloged PDS or PDSE:
`https://host:port/zosmf/restfiles/ds/-(volser)/<data-set-name>(<member-name>)`
 - Expected response
 - On completion, the service returns an HTTP response, which includes a status code indicating whether your request completed. Status code 200 indicates success.

z/OS data set and file service – API example

- Retrieve the contents of a z/OS data set or member

- Example request

The following request is used to retrieve the contents of the member SMFPRM00 in data set SYS1.PARMLIB:

```
GET https://zosmf1.yourco.com/zosmf/restfiles/ds/SYS1.PARMLIB(SMFPRM00) HTTP/1.1
```

- Example response

```
200 OK
Etag: B5C6454F783590AA8EC15BD88E29EA63
Content-Type: text/plain; charset=UTF-8
Content-Language: en-US
Content-Length: 1944
Date: Fri, 07 Nov 2014 02:13:07 GMT
Connection: close
```

```
ACTIVE                /*ACTIVE SMF RECORDING*/          00010000
DSNAME(SYS1.&SMFDSN1, SYS1.&SMFDSN2, /*SMF ON 3390 */          00020000
SYS1.&SMFDSN3)          /*FT: SYSAQ3, TS: SYSAQ4 */          00030000
NOPROMPT              /*PROMPT THE OPERATOR FOR OPTIONS*/      00040000
REC(perm)             /*TYPE 17 PERM RECORDS ONLY*/          00050000
MAXDORM(3000)         /* WRITE AN IDLE BUFFER AFTER 30 MIN*/    00060000
MEMLIMIT(256M)        /* 256M FOR 64 BIT APPS */              00061005
STATUS(003000)        /* WRITE SMF STATS AFTER HALF HOUR*/     00070000
JWT(0700)             /* INVOKE EXIT IEFUTL AFTER 7HR 00M*/    00080002
SID(&SYSNAME),        /* SYSTEM ID FOR 3084 - SINGLE IMAGE*/    00090000
LISTDSN              /* LIST DATA SET STATUS AT IPL*/         00100000
INTVAL(30)            /* INTVAL OPTION SP430 */               00110000
SYNCVAL(00)           /* SYNCVAL OPTION SP430 */              00120000
SYS(NOTYPE(19,40,92), EXITS(IEFU83,IEFU84,IEFACTRT,IEFUJV,IEFUJI, 00140000
IEFUSI,IEFUTL,IEFU29),INTERVAL(010000),DETAIL)          00150000
/* WRITE ALL RECORDS AS THE SYSTEM DEFAULT, TAKE ALL KNOWN 00160000
EXITS, NOTE: JES EXITS CONTROLLED BY JES , THERE IS NO 00170000
DEFAULT INTERVAL RECORDS WRITTEN AND ONLY SUMMARY T32 00180000
RECORDS AS A DEFAULT FOR TSO */          00190000
00200000
00210000
SUBSYS(STC,NOTYPE(19,40,92), EXITS(IEFU29,IEFU83,IEFU84,IEFUTL), 00220001
INTERVAL(SMF,SYNC),DETAIL) /*SP430*/          00230000
00240000
00250000
/* WRITE ALL RECORDS AS BY SYSTEM DEFAULT, TAKE ONLY THREE 00260000
EXITS, NOTE: IEFU29 EXECUTES IN THE MASTER ASID WHICH IS A 00270000
STC ADDRESS SPACE SO IEFU29 MUST BE ON FOR STC. USE ALL OTHER 00280000
SYS PARAMETERS AS A DEFAULT */          00290000
```

Complete your session evaluations online at www.SHARE.org/Orlando-Eval

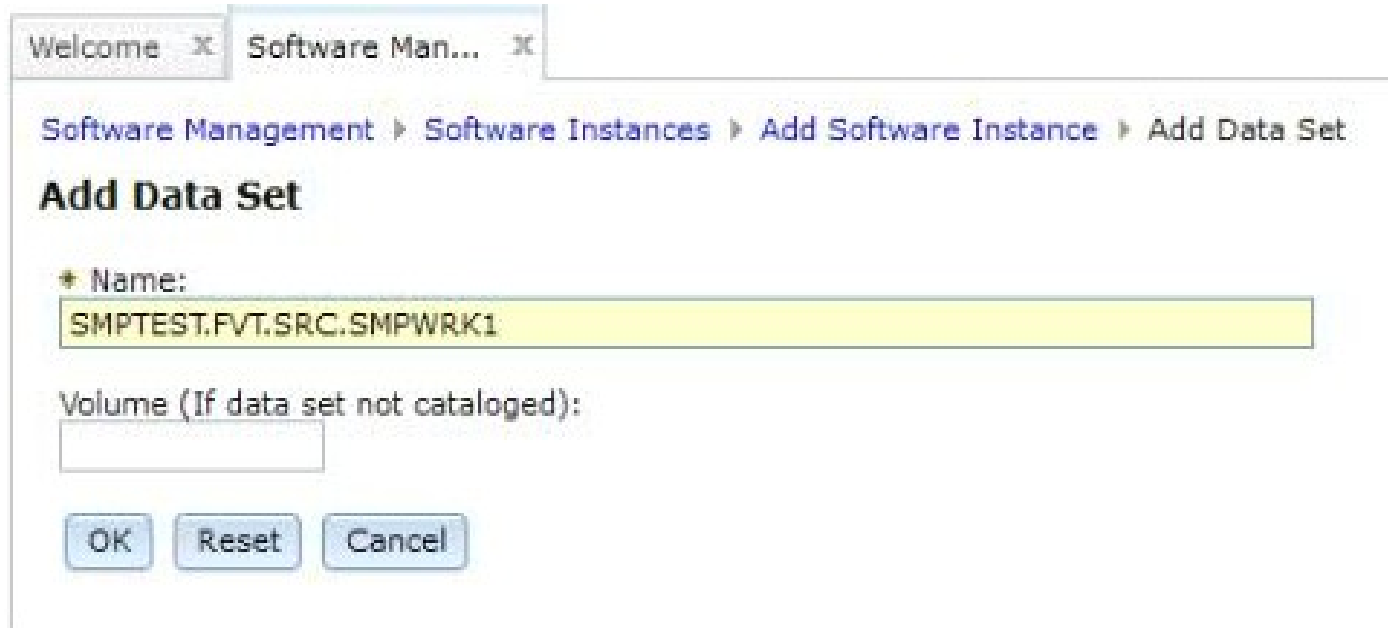
z/OS data set and file service – API exploiters



- By exploiting z/OS data set and file RESTful service, application could easily get the capability of managing data set and unix files remotely or locally.
- Current exploiters:
 - z/OSMF Software Management
 - Customer's self-developed web application

z/OS data set and file service – API exploiters

- z/OSMF Software Management plugin simplifies the process of adding data set into software instance.
- Previously, user has to enter data set name manually, and, therefore, one data set at a time.



The screenshot shows a web-based interface for z/OSMF Software Management. At the top, there are two tabs: 'Welcome' and 'Software Man...'. Below the tabs is a breadcrumb trail: 'Software Management > Software Instances > Add Software Instance > Add Data Set'. The main heading is 'Add Data Set'. Underneath, there is a label 'Name:' followed by a text input field containing the value 'SMPTTEST.FVT.SRC.SMPWRK1'. Below this is a label 'Volume (If data set not cataloged):' followed by an empty text input field. At the bottom, there are three buttons: 'OK', 'Reset', and 'Cancel'.

z/OS data set and file service – API exploiters

- With exploiting “z/OS data set and file service”, Software Management plugin provides searching data set function. User can select multiple data sets returned by the search operation and add them once.

Software Management > Software Instances > Modify Software Instance > Add Data Set

Help

Add Data Set

To identify the data sets to be added to the software instance, specify a data set name qualifier, volume, or both, and click Search. Then, select the data sets you want to add. For valid data set name qualifiers, select [Learn more...](#)

Data set name qualifier:

JOEY.*

Volume:

Select or type

*Maximum data sets:

750

Search

Select Data Sets to Add

Actions		
Data Set Name		
Filter		
Volume		
Filter		
<input type="checkbox"/>	JOEY.DEMO.WLMLOG1	9SX805
<input type="checkbox"/>	JOEY.DEMO.WASLOG1	9SX80A
<input type="checkbox"/>	JOEY.DEMO.USSLOG1	9SX801
<input type="checkbox"/>	JOEY.DEMO.SDSFLOG1	9SX807
<input type="checkbox"/>	JOEY.DEMO.RMMLOG1	9SX801
<input type="checkbox"/>	JOEY.DEMO.LOG1	X6TSO7
<input type="checkbox"/>	JOEY.DEMO.LDAPLOG1	9SX806
<input type="checkbox"/>	JOEY.DEMO.USMLOG1	9SX80A

Total: 11, Selected: 0

OK

Cancel

z/OS data set and file service – API exploiters

- Build something cool by exploiting “z/OS data set and file service”:

Search for and list z/OS data sets and files.

Resource type:

☒ z/OS data sets ☐ z/OS UNIX files

Name:

Volume:

Select or type. ▼

Search

IBMUSER.

▲ Back

IBMUSER.HOSTS.ADDRINFO

IBMUSER.HOSTS.SITEINFO

IBMUSER.ISPFWEB.EXEC

IBMUSER.ISPFWEB.LOAD.OLD

IBMUSER.ISPFWEB.LOAD.OLD2

IBMUSER.ISPFWEB.LOAD.OLD3

IBMUSER.SPFWEB.MSGTYPES.LOAD

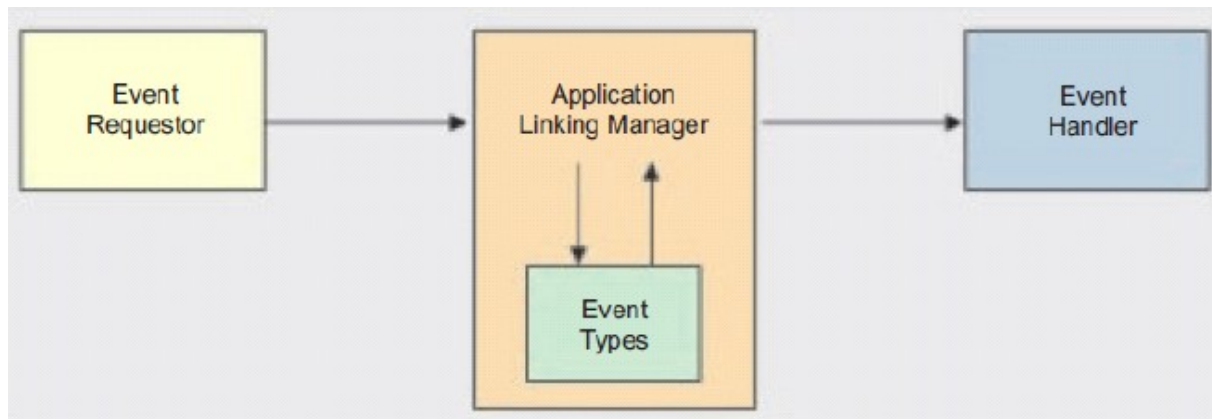
IBMUSER.SPFWEB.PANELS

IBMUSER.SPFWEB.SISPMENU

▼ Next

Application Linking Manager service

- To perform traditional system management tasks in z/OS, you might interact with several different interfaces.
- In z/OSMF, it is possible to link or connect some of these tasks and external applications together for a smoother user experience via the Application linking Manager service.
- Key components:
 - Event Requestor: z/OSMF task or external application
 - Event: Action requested by the “Event Requestor”
 - Event type: Object that contains an “Event Requestor” to an “Event Handler”
 - Event handler: z/OSMF task or external application



Application Linking Manager service – API list

- Application Linking Manager service provides below operations (APIs):

Operation	Method
Register an event type.	POST
Register a handler for an event type	POST
List all tasks that are eligible to be handlers	GET
List the registered handlers for an event type	GET
Unregister a handler	DELETE
Unregister an event type	DELETE

Application Linking Manager service – API example

- Register a handler for an event type

- URL format

`https://{host}:{port}/zosmf/izual/rest/handler?eventTypeId={eventTypeId}`

Request content:

type: handler type. “INTERNAL” for z/OSMF plug-in, “EXTERNAL” for external application.

Id: Unique identifier for a launch point within the handler task or application.

applID: Identifier assigned to z/OSMF plugin

displayName: handler name

URL: URL to be used for accessing the handler.

options: indicates how the handler will be displayed when it process events.

- Expected response

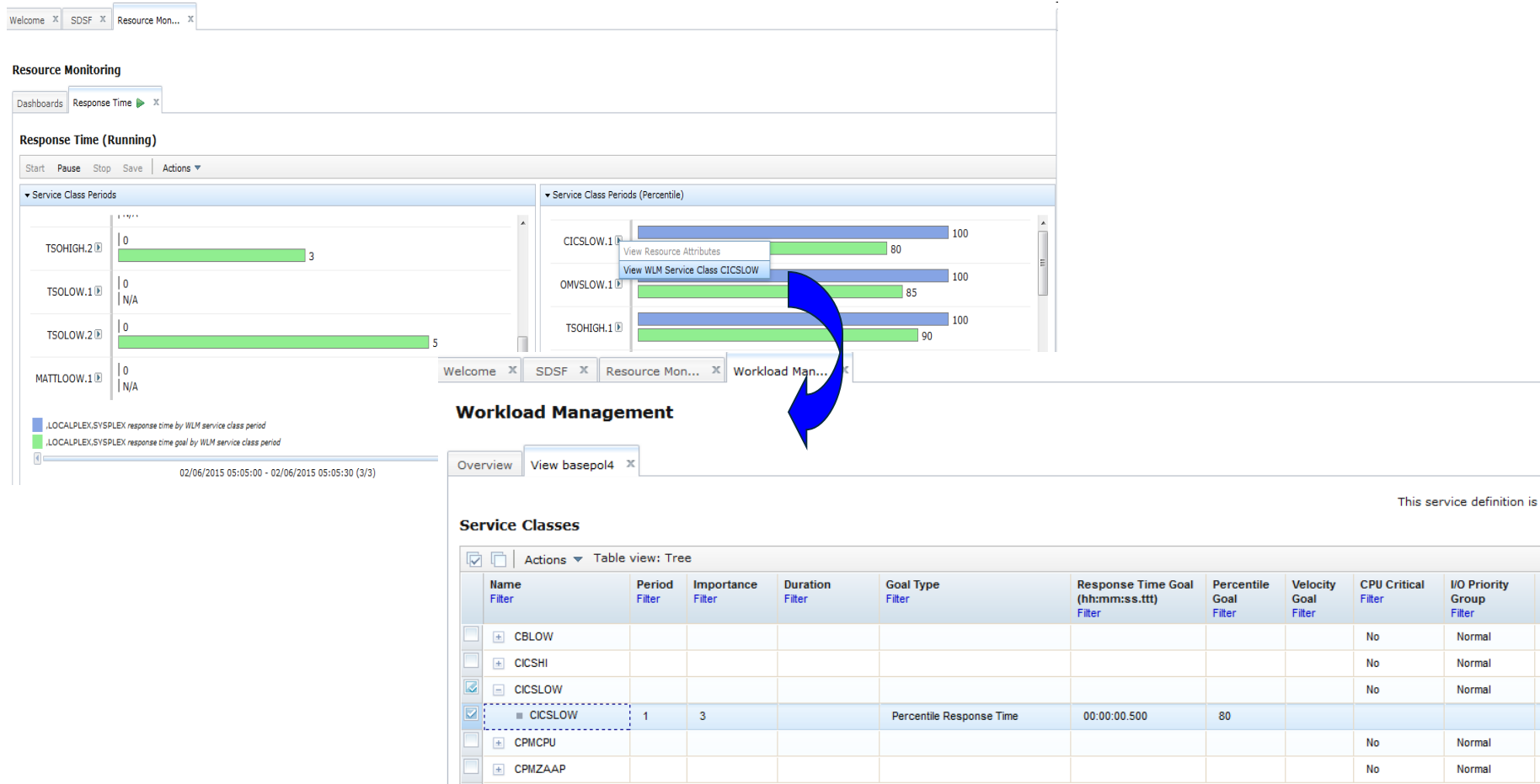
On completion, the Application Linking Manager interface returns an HTTP response, which includes a status code indicating whether your request completed. Status code 200 indicates success. A status code of 4nn or 5nn indicates that an error has occurred.

Application Linking Manager service – API exploiters

- z/OSMF WLM plugin is used to define performance policy. z/OSMF RMF plugin is used to monitor performance. By exploiting “Application Linking Manager service”, WLM and RMF provide a smooth user experience when there is need to switch between these two plugins.
- Example of linkage between z/OSMF RMF plugin and z/OSMF WLM plugin (1/2)
 - Event Requestor: z/OSMF RMF plugin
 - Event type:
IBM.ZOSMF.VIEW_ACTIVE_WLM_SERVICE_DEFINITION.SERVICE_CLASS
 - Event Handler: z/OSMF WLM plugin

Application Linking Manager service – API exploiters

- Example of linkage between z/OSMF RMF plugin and z/OSMF WLM plugin (2/2)



Complete your session evaluations online at www.SHARE.org/Orlando-Eval

TSO/E address space service – API list

- TSO/E address space service is provided for web application (especially for external web application) to communicate with their back-end TSO/E application running on the z/OS system.
- TSO/E address space RESTful service provides below operations (APIs):

Operation	Method
Start or reconnect to a TSO/E address space	POST
Start an application on a TSO/E address space	POST
Receive messages from a TSO/E address space	GET
Receive messages from an application running in a TSO/E address space	GET
Send messages to a TSO/E address space	PUT
Send messages to an application running in a TSO/E address space	PUT
Ping a TSO/E address space	PUT
End a TSO/E address space	DELETE

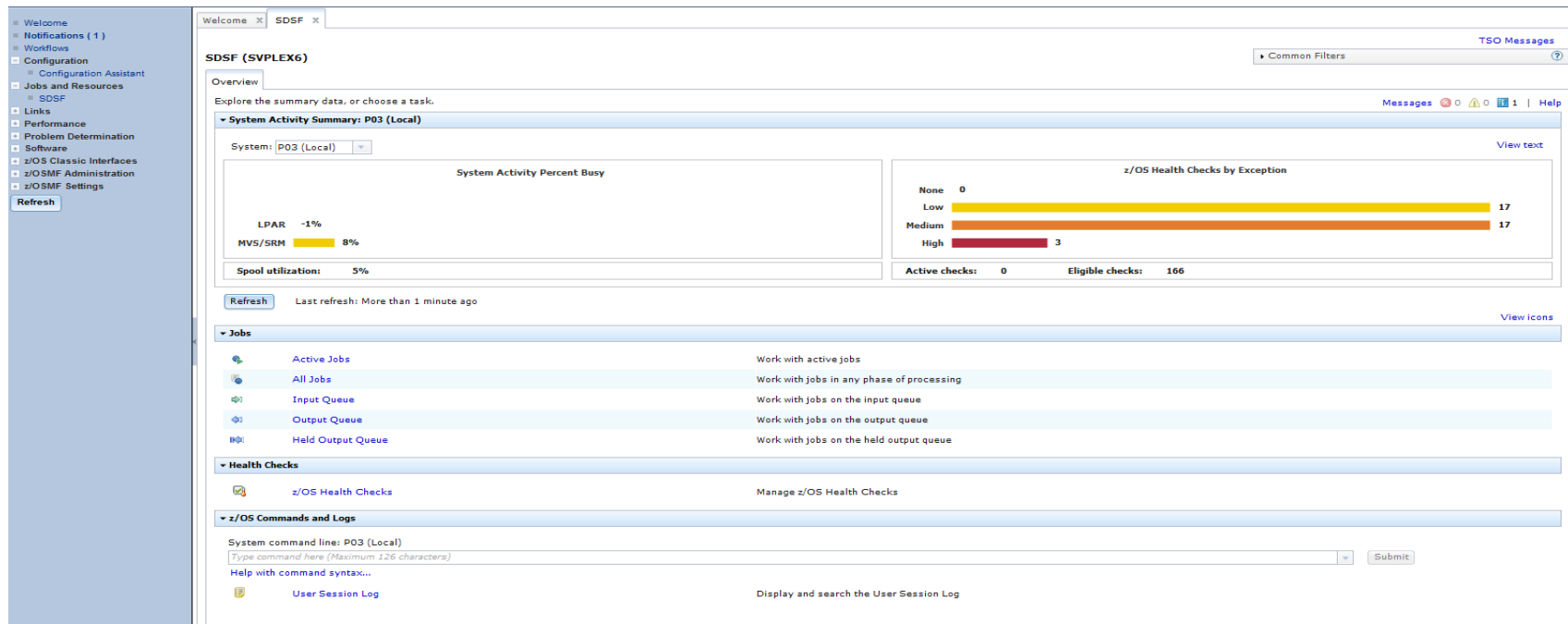
Data persistence service – API list

- Data persistence service is provided for web application (especially for external web application) to manage their persistent data in z/OS system.
- Data persistence service provides below operations (APIs):

Operation	Method
Persist user-specific and global application data	PUT
Retrieve user-specific and global application data	GET
Delete user-specific and global application data	DELETE

TSO/E address space service & Data persistence service – API Exploiter

- Exploiters (not only web application) could easily get the capability of communicating with TSO/E application and managing persistence data in the z/OS system such that they can focus on implementation of business logic.
- z/OS SDSF created their own z/OSMF plugin (a.k.a. external plugin) “SDSF UI” by exploiting these RESTful services.



Complete your session evaluations online at www.SHARE.org/Orlando-Eval

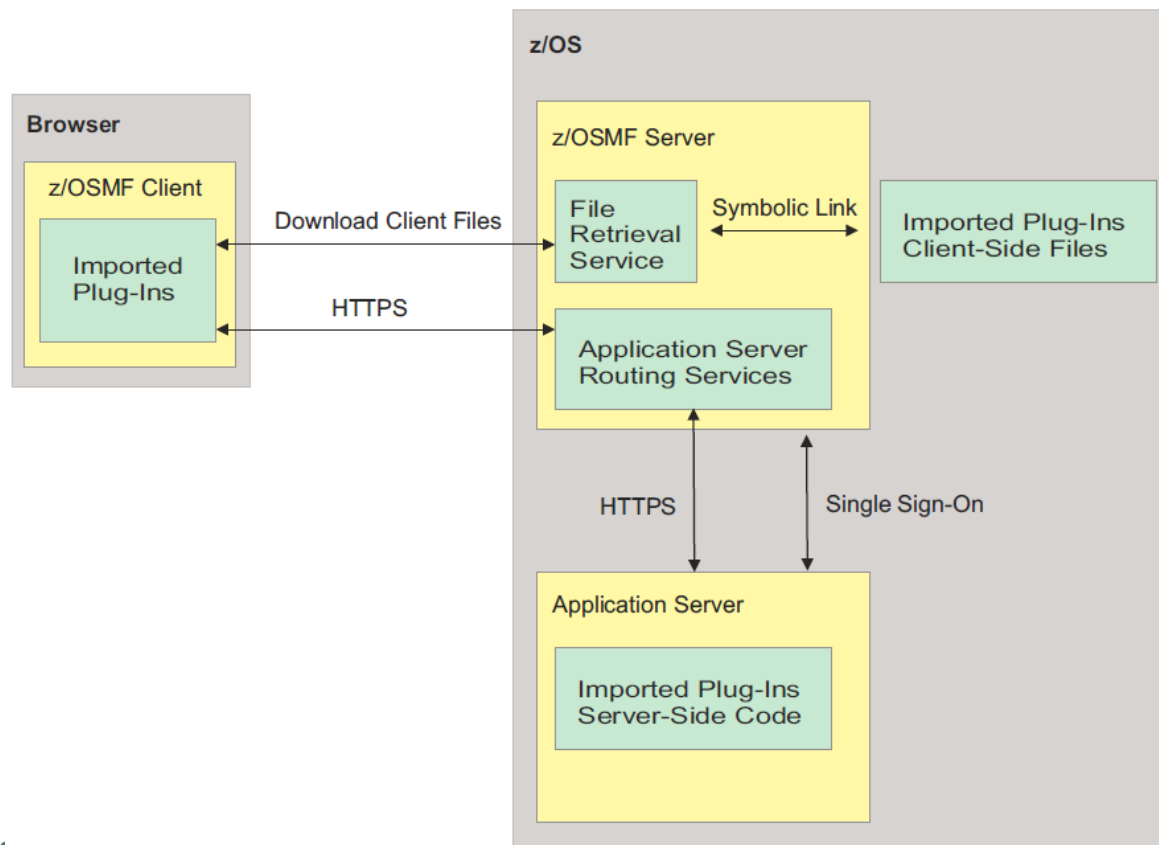
TSO/E address space service & Data persistence service – API Exploiter



- Questions:
 - What if my server-end code needs to be run in an application server?
 - Can I have my java code running in z/OSMF server?

Application server routing service – Overview

- Application server routing service supports routing requests and responses between client-side and server-side code for any z/OSMF plug-ins you created where the server-side code is hosted on an application server other than the z/OSMF server.



Application server routing service – API list & example

- API list

Operation	Method
Retrieve data from an application server	GET
Update data for an application server	POST or PUT
Delete data from an application server	DELETE

- API example

You client-side code which is rendered in z/OSMF window is about to add *objectC* on the application server identified in system entry “appServer1”, which is defined in the z/OSMF Systems task, submit the following request:

```
POST /zosmf/externalgateway/system HTTP/1.1
```

```
Host: appname.yourco.com
```

```
{ "target": "appServer1", "resourcePath": "/testApp/objectC", "content": {
  "attribute1": "value11", "attribute2": "value12", "attribute3": "value13",
  "attribute4": "value14", "attribute5": "value15" } }
```

Topology service – API list

- Topology RESTful service is provided for working with the groups, sysplexes and the systems that are defined to z/OSMF.
- Topology RESTful service provides below operations (APIs):

Operation	Method
List the systems defined to z/OSMF	GET
List the groups defined to z/OSMF	GET
List the systems included in a group	GET
List the sysplexes defined to z/OSMF	GET
List the systems included in a sysplex	GET

Multisystem routing service – API list

- To communicate with and transfer data between systems within your enterprise, z/OSMF uses z/OSMF-to-z/OSMF communication. Multisystem routing service plays key role in the z/OSMF-to-z/OSMF model. It has the capability of:
 - Forwarding request to single remote z/OSMF instance and return the response (Basic-Proxy mode)
 - Forwarding request to a group of remote z/OSMF instances, packaging the responses and return it. (Aggregation mode)
- Multisystem routing service provides below operations (APIs):

Operation	Method
Retrieve data from one system, a list of systems, or all the systems in a group.	GET
Update data for one system, a list of systems, or all the systems in a group.	POST or PUT
Delete data from one system, a list of systems, or all the systems in a group.	DELETE
Authenticate with a secondary z/OSMF instance.	POST

Topology service & Multisystem routing service – API Exploiter

- Exploiters could:
 - Retrieve topology information through “Topology service”
 - Manage multiple systems with only connected to primary z/OSMF which runs “Multisystem routing service”.
 - Get the aggregation capability by specifying target systems/groups when accessing the “Multisystem routing service”.
- z/OS V2.2 z/OSMF allows you to obtain an aggregated display of incidents across z/OSMF instances within your enterprise

Workflow service – API list

- Workflow RESTful service allows user to create, start and manage work flow in z/OS through programmatic way instead of having to operate in z/OSMF UI.
- Workflow RESTful service provides below operations (APIs):

Operation	Method
Create a workflow	POST
Start a workflow	PUT
Lists workflows by search criteria	GET
Delete a workflow	DELETE
Cancel workflow	PUT
Retrieve workflow definition	GET

Workflow service – API exploiter

- User scenario
 - Product (workflow provider) ships workflow which intends to accomplish a task in z/OS system.
 - End user of the product (or even the product itself) could build application which (remotely or locally) calls workflow RESTful service to:
 - Create workflow on demand
 - Perform the workflow to accomplish the task in an automatic way
 - Activities of performing workflow is recorded by z/OSMF workflows application for future review

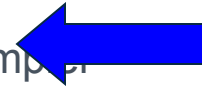
Software management service – API list

- Software management RESTful service allows a client application to interact with the z/OSMF Software Management task.
- Software management RESTful service provides below operations (APIs):

Operation	Method
List the software instances defined to z/OSMF.	GET
Retrieve the properties of a software instance.	GET
List the data sets included in a software instance	GET
Load the products, features, and FMIDs for a software instance	GET
Add a new software instance.	POST
Modify the properties of a software instance	PUT
Delete a software instance	DELETE

Agenda

- What is z/OSMF
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Using z/OSMF RESTful services – simple demo



- Experience z/OSMF RESTful services with a simple html page (1/3)

```
<body>
  <div>
    <button id="getMyJobs" onclick="getMyJobs()">List my jobs</button>
  </div><br/>
  <hr />
  <div id="submitArea">
    <textarea id="jclArea" style="width: 400px">//TESTJOBW JOB (),MSGCLASS=H
// EXEC PGM=IEFBR14</textarea>
  </div><br/>
  <button id="subbtn" onclick="submit()">Submit a job</button><br/><br/>
  <hr/>
  <div id="getJobArea">
    <label>Job Name:</label><input id="jobname" />
    <label>Job ID:</label><input id="jobid" />
  </div><br />
  <button id="getbtn" onclick="getJobStatus()">Get job status</button><br/><br/>
  <div id="resultArea">
    <div><h4>Result:</h4></div>
    <div id="result"></div>
  </div>
</body>
</html>
```

Using z/OSMF RESTful services – simple demo

- Experience z/OSMF RESTful services with a simple html page (2/3)

```
<head>
<title>Demo of REST zOS Jobs service</title>
<script type="text/javascript">
function submit(){
    var jcl=document.getElementById("jclArea").value;
    var xhrs = new XMLHttpRequest();
    xhrs.open("PUT", "https://mvs1.centers.ihost.com/zosmf/restjobs/jobs", true);
    xhrs.setRequestHeader("Content-Type", "text/plain");
    xhrs.onreadystatechange = function () {
        if(xhrs.readyState == 4){
            document.getElementById("result").innerHTML = xhrs.responseText;
        }
    }
    xhrs.send(jcl);
}

function sendGetRequest(url) {
    var xhrget = new XMLHttpRequest();
    xhrget.open("GET", url, true);
    xhrget.onreadystatechange = function () {
        if(xhrget.readyState == 4){
            document.getElementById("result").innerHTML = xhrget.responseText;
        }
    }
    xhrget.send();
}

function getJobStatus(){
    var xhrg = new XMLHttpRequest();
    var jobname = document.getElementById("jobname").value;
    var jobid = document.getElementById("jobid").value;
    var url = "https://mvs1.centers.ihost.com/zosmf/restjobs/jobs/"+jobname+"/"+jobid;
    sendGetRequest(url);
}

function getMyJobs() {
    var url = "https://mvs1.centers.ihost.com/zosmf/restjobs/jobs";
    sendGetRequest(url);
}
</script>
</head>
```

Construct the URL

Access the RESTful service with JCL to be submitted

Construct the URL

Access the RESTful service

Construct the URL

Access the RESTful service

Using z/OSMF RESTful services – simple demo



- Experience z/OSMF RESTful services with a simple html page (3/3)

List my jobs

```
//TESTJOBW JOB (),MSGCLASS=H  
// EXEC PGM=IEFBR14
```

Submit a job

Job Name: TESTJOBW

Job ID: JOB27785

Get job status

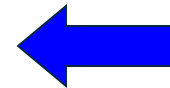
Result:

```
{ "jobname": "TESTJOBW", "retcode": "CC 0000", "subsystem": "JES2", "url": "https://mvs1.centers.ihost.com:443/zosmf/restjobs/jobs/J0027785N1.....CE96D4ED.....%3A", "status": "OUTPUT", "owner": "SHARA01", "jobid": "JOB27785", "class": "A", "job-correlator": "J0027785N1.....CE96D4ED.....", "files-url": "https://mvs1.centers.ihost.com:443/zosmf/restjobs/jobs/J0027785N1.....CE96D4ED.....%3A/files", "type": "JOB", "phase": 20, "phase-name": "Job is on the hard copy queue" }
```



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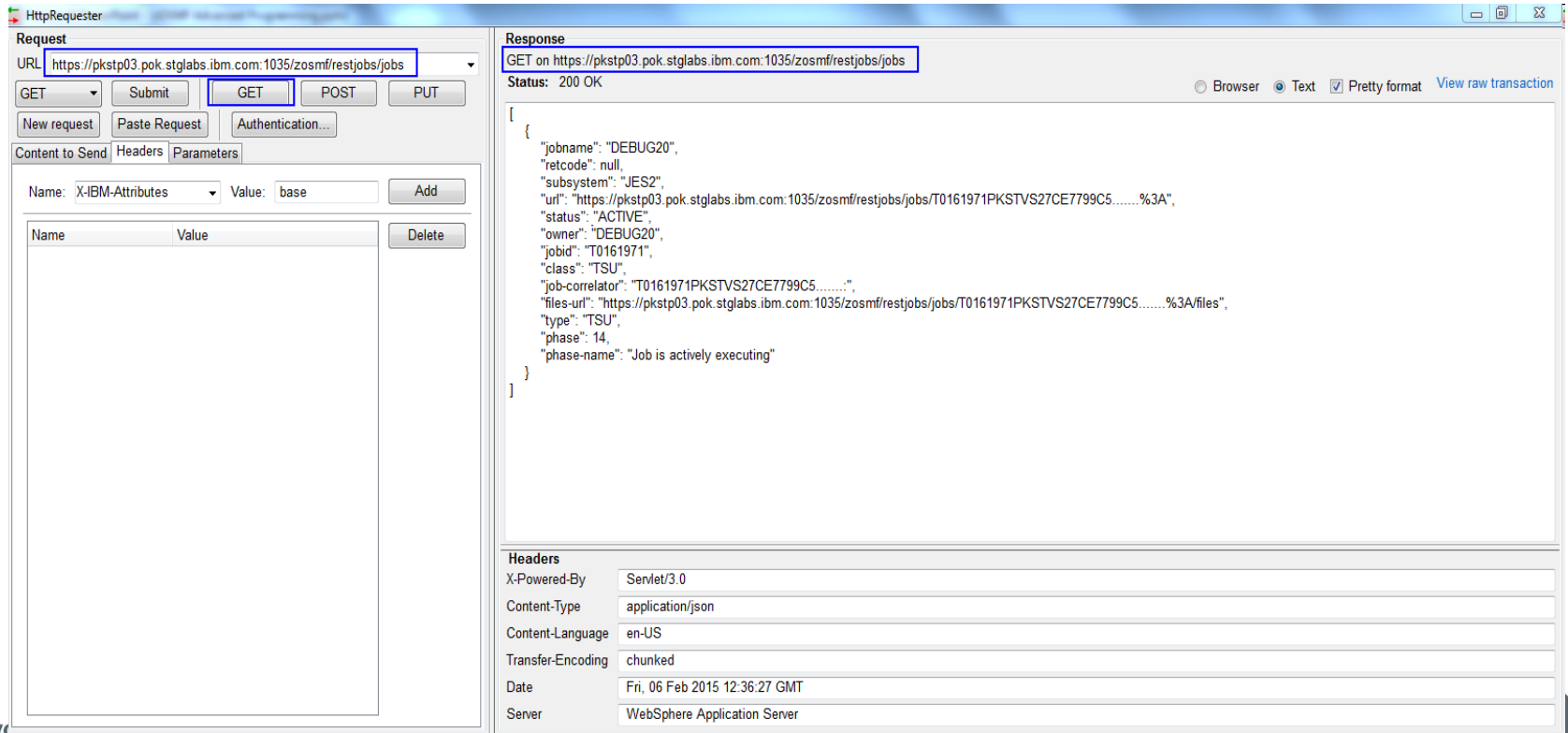


** available for z/OSMF V2R1 with APAR PI32148

Complete your session evaluations online at www.SHARE.org/Orlando-Eval

Using z/OSMF RESTful services - Simpler than Simpler

- Experience z/OSMF RESTful services without the need to write any code:
What you need are just:
 - Valid z/OSMF user id and password
 - Firefox browser with “HttpRequester” plugin installed
- Example 1 – list jobs owned by your logon user



The screenshot displays the HttpRequester plugin interface within a browser. The 'Request' tab is active, showing the URL `https://pkstp03.pok.stglabs.ibm.com:1035/zosmf/restjobs/jobs` and the method `GET`. The 'Response' tab shows the status `200 OK` and a JSON response. The 'Headers' tab is also visible, showing various response headers.

Request

URL: `https://pkstp03.pok.stglabs.ibm.com:1035/zosmf/restjobs/jobs`

Method: `GET`

Response

Status: 200 OK

```
{
  "jobname": "DEBUG20",
  "retcode": null,
  "subsystem": "JES2",
  "url": "https://pkstp03.pok.stglabs.ibm.com:1035/zosmf/restjobs/jobs/T0161971PKSTVS27CE7799C5.....%3A",
  "status": "ACTIVE",
  "owner": "DEBUG20",
  "jobid": "T0161971",
  "class": "TSU",
  "job-correlator": "T0161971PKSTVS27CE7799C5.....",
  "files-url": "https://pkstp03.pok.stglabs.ibm.com:1035/zosmf/restjobs/jobs/T0161971PKSTVS27CE7799C5.....%3A/files",
  "type": "TSU",
  "phase": 14,
  "phase-name": "Job is actively executing"
}
```

Headers

Header	Value
X-Powered-By	Servlet/3.0
Content-Type	application/json
Content-Language	en-US
Transfer-Encoding	chunked
Date	Fri, 06 Feb 2015 12:36:27 GMT
Server	WebSphere Application Server

Complete y

Using z/OSMF RESTful services - Simpler than Simpler



- Example 2 – list data set names matches the criteria of “SYS1.*lib”

The screenshot displays the z/OSMF RESTful services interface. On the left, the 'Request' section shows a GET request to the URL `/pkstp03.pok.stglabs.ibm.com:1035/zosmf/restfiles/ds/?dslevel=sys1.*lib`. The 'Response' section on the right shows the result of the GET request, which is a JSON array of data set names. The response is displayed in 'Text' format, and the 'Pretty format' checkbox is checked. The JSON response lists the following data set names: SYS1.BKPTLIB, SYS1.CHSLIB, SYS1.CMDLIB, SYS1.COBLIB, SYS1.COB2CLIB, SYS1.COB2MLIB, SYS1.COB2PLIB, and SYS1.CSSLIB. Below the response, the 'Headers' section shows the following information: X-Powered-By: Servlet/3.0, Content-Type: application/json; charset=UTF-8, Content-Language: en-US, Transfer-Encoding: chunked, Date: Fri, 06 Feb 2015 12:39:19 GMT, and Server: WebSphere Application Server.

Request

URL: `/pkstp03.pok.stglabs.ibm.com:1035/zosmf/restfiles/ds/?dslevel=sys1.*lib`

GET Submit GET POST PUT

New request Paste Request Authentication...

Content to Send Headers Parameters

Content Type:

Content Options: Base64 Parameter Body

☒ Content ☐ File Browse...

Response

GET on `https://pkstp03.pok.stglabs.ibm.com:1035/zosmf/restfiles/ds/?dslevel=sys1.*lib`

Status: 200 OK

☐ Browser ☒ Text ☒ Pretty format View raw transaction

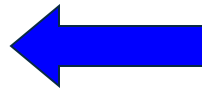
```
{
  "items": [
    {
      "dsname": "SYS1.BKPTLIB"
    },
    {
      "dsname": "SYS1.CHSLIB"
    },
    {
      "dsname": "SYS1.CMDLIB"
    },
    {
      "dsname": "SYS1.COBLIB"
    },
    {
      "dsname": "SYS1.COB2CLIB"
    },
    {
      "dsname": "SYS1.COB2MLIB"
    },
    {
      "dsname": "SYS1.COB2PLIB"
    },
    {
      "dsname": "SYS1.CSSLIB"
    }
  ]
}
```

Headers

X-Powered-By	Servlet/3.0
Content-Type	application/json; charset=UTF-8
Content-Language	en-US
Transfer-Encoding	chunked
Date	Fri, 06 Feb 2015 12:39:19 GMT
Server	WebSphere Application Server

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Summary

- In addition to z/OSMF plugins with modern UI and simplified task, z/OSMF also provides services and facilities to help you write programs.
- z/OSMF Advanced Programming consists of:
 - Using z/OSMF RESTful services
 - Develop workflow
 - Create your own z/OSMF plugins
- z/OSMF RESTful services make z/OS and z/OSMF more approachable:
 - z/OS jobs service
 - z/OS data set and file service
 - Application Linking Manager interface service
 - TSO/E address space service
 - Data persistence service
 - Application Server routing service
 - Topology service
 - Multisystem routing service
 - z/OSMF workflow service
 - Software Management service

Advertisements

- Possible missed opportunities (handouts available for download):
 - Session 17795 What's new in z/OSMF 2.2?
 - Session 17236 z/OSMF 2.2 Implementation and Configuration
 - Session 17841z/OSMF Roundtable
 - Session 17422 z/OSMF Hands-on Labs - Choose Your Own I
 - Session 17909 z/OSMF Hands-on Labs - Choose Your Own - II

Thank You



Complete your session evaluations online at www.SHARE.org/Orlando-Eval

Appendix

- z/OSMF Home Page

<http://www-03.ibm.com/systems/z/os/zos/features/zosmf/index.html>

- z/OSMF V2R1 Programming Guide

http://www-01.ibm.com/support/knowledgecenter/SSLTBW_2.1.0/com.ibm.zos.v2r1.izua700/toc.htm