



IBM z Analytics



Db2 Tools



Agenda


- Cloud Landscape & Provisioning
 - Continuous Integration
- Db2 Provisioning Solutions via z/OSMF
- Cloning for Provisioning
- z/OSMF Components & Operation
- Provisioning Solutions
 - Subsystem option
- Quick look at Db2 Native REST Support
- IBM System z Trial Program

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Apply Cloud/DevOps Concepts to your Db2

- Take business arguments to the data...
 - Drive down costs and outperform competitors value
 - Consumptive patterns
 - Increase resilience by enabling other business players to create complex higher value proposition on top of your interface
 - Drive loyalty in a world of openness


Scalable Data Stores

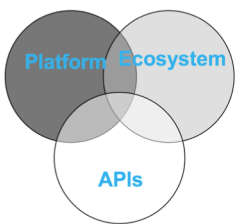


Services, APIs



Platforms & Ecosystems





- Provisioning / Refresh
 - Speed IT
 - Enabling Agile development
 - Fail fast /Shift left
- DevOps
 - Continuous Integration / Continuous Delivery (CI/CD)
 - Deploy to Production

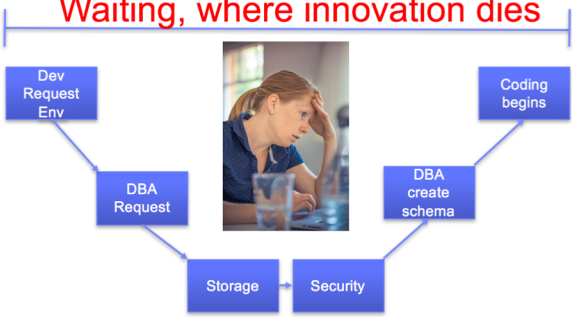
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Business will pass you by if you are waiting for...

- How can Db2 fit into this dynamic development environment?
- Provisioning and Deployment (Promotion)
- We have Tools that reverse engineer database structures and move data
- We have Tools that do schema compares and determine differences
- We need these services to be RESTful
 - Representational State Transfer
 - Light weight HTTP protocol to invoke services
- We need integration with today's CD/CI solutions

Waiting, where innovation dies



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Continuous Integration / Delivery Concepts

- Top CI/CD Tools
 - Jenkins
 - TeamCity
 - Bamboo
 - GitLab
 - Go
 - Travis CI
 - Wercker
 - AppVeyor
 - Buildbot
 - CruiseControl
 - Semaphore
 - Urbancode
 - FinalBuilder
 - Hudson
 - Chef
 - Team Foundation
 - Codeship
- REST is the key
 - Representation State Transfer
 - Lightweight HTTP protocol
 - Micro/services architecture
 - Supports composable applications / pipelines
- External REST APIs
 - Db2 Native REST support
 - z/OS Connect
 - Like an open stored procedure call
- Internal REST APIs
 - Support for operational functions
 - DevOps
 - Supports pipelines for products on left
- The focus of this presentation
 - Provisioning & Deployment
 - Tools as the microservice to CD/CI pipelines

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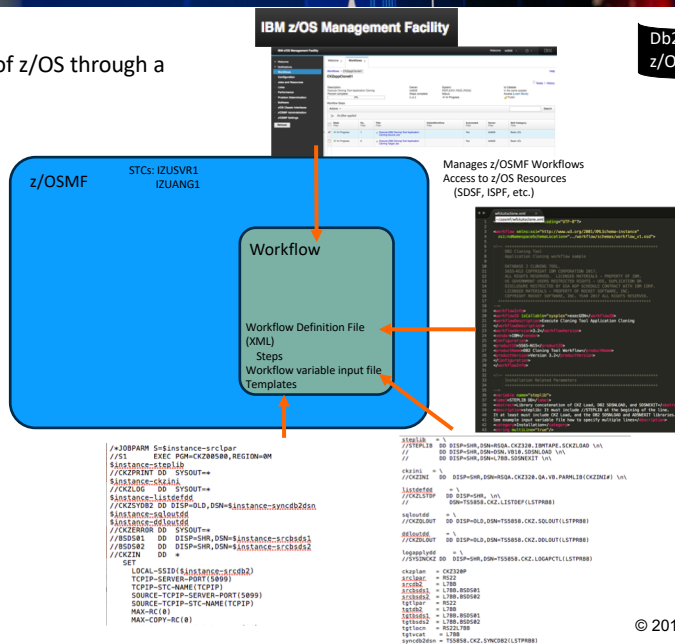
z/OSMF Workflow

A framework for managing various aspects of z/OS through a web browser interface.

Streamlining traditional tasks.

Provides automation.

- z/OSMF Workflow
 - Workflow Definition File (WDF)
 - XML
 - Structure of workflow
 - Variable definitions
 - Category Groups
 - Steps to complete a task
 - Variable Input File (VIF)
 - Defaults for variables
 - Input Variables pages
 - REST workflow create
 - VIF
 - WDF
 - Template(s)
 - JCL (REXX, UNIX Shell)
 - Executed in the steps
 - Variable substitution



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Cloning Tool Mission

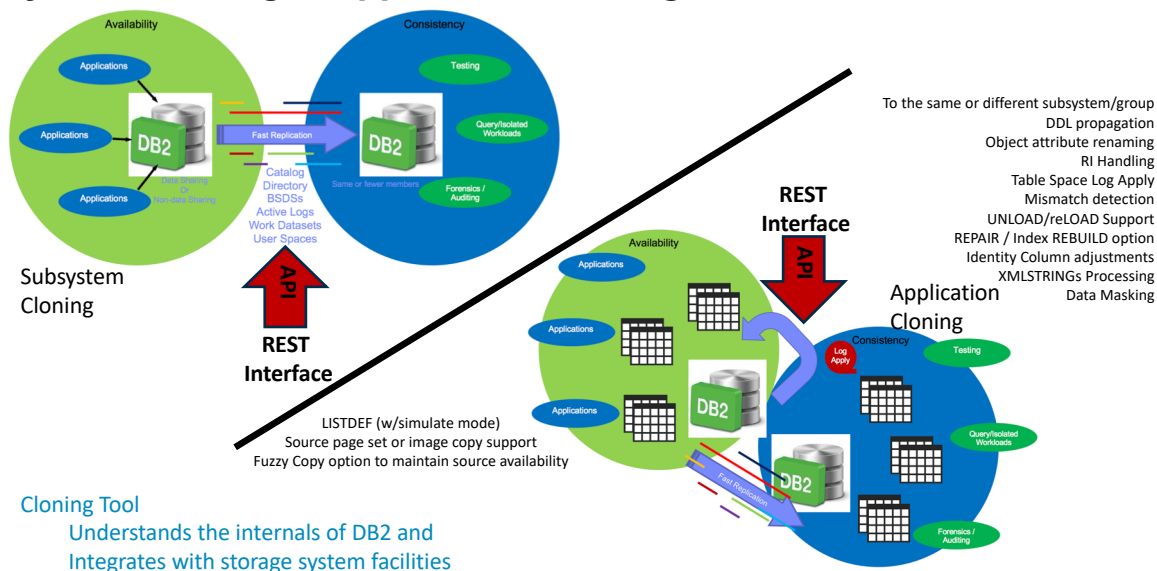
Cloning for
Provisioning

- Purpose-built tool for creation of clone environments
- Enable cloning for Production-like environments without Production impact
 - Create or refresh a QA environment
 - Life-like Development environment
 - Move workload/users to another DB2
 - Test migrations
 - Forensics / Auditing
 - Provisioning
- Efficient creation / refresh of Subsystem and Application clones
- Time savings for Administration roles (Systems, DBA, Storage)
- Maintaining source system availability during the cloning process
 - Consistency with Availability
- Expandable architecture for customer-specific situations
- A product roadmap which will bring added productivity and enhanced flexibility

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Subsystem Cloning & Application Cloning



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DB2 Application Cloning (Provisioning) / Refresh Steps

Production DB2 'Source'

Source Job

- 1 LISTDEF selection
 - RI
 - AUX
 - Include Indexes
 - EXPLODE_OBJECTS
- 2 Verify object compatibility
- 3 Create target objects if they don't exist
 - Translation rules
- 4 Stop table space or fuzzy copy
- 5 Perform copy process
- 6 Start, if stopped

Target DB2

Target Job

- 7 Object ID translation, data masking and log apply
 - Drive REPAIR &/or Index REBUILD if needed
- 8 Update identity columns
 - XML conditioning
- 9 Start target table and index spaces

FUZZY-COPY YES (Yes/No)
L - Set LOG-APPLY

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Application Cloning Sources & Targets

- DB2 Source VSAM dataset
 - Log apply possible
- DB2 regular DB2 Image Copy
 - Log apply possible
- Consistent Flash Copy Image
 - Copy of TS (and IX)
- System Level Backup
 - Recovery Expert produces ICs from the SLB

- Within the same DB2 system or to another DB2 system
- In the same LPAR or another LPAR
- Name and DDL Attribute Translations

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Data Masking

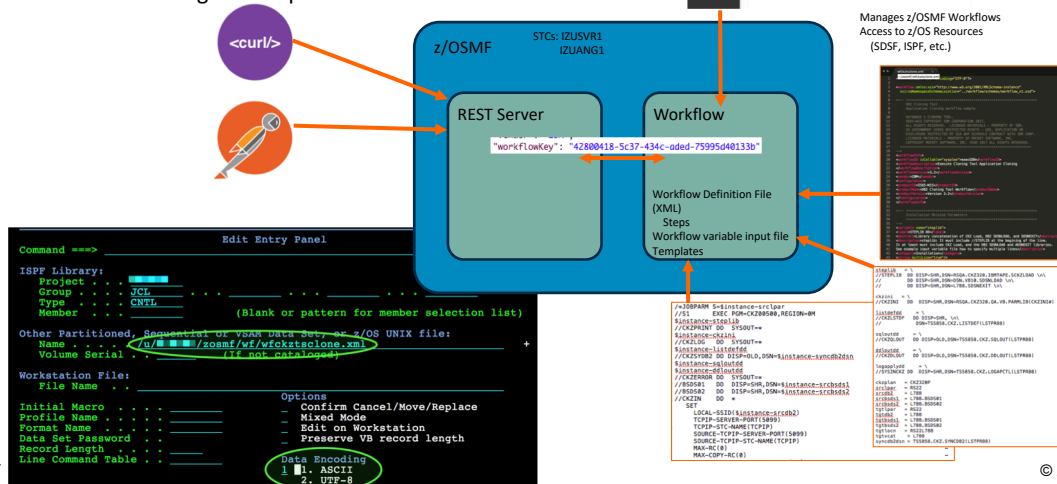
- Protect sensitive production data on test systems
- Cloning Tool is not a data masking / privacy product
 - Will not work with compressed data or LOB, XML, or graphic types
 - Does not consider the context of the field during masking
 - For example: Credit Card Numbers
 - Could cause application validation / logic errors
- Option to mask one or more columns during the table space refresh process
 - 11 masking options from which to choose
 - Specified at the table / column level
- The masking changes are made during OBID translation step based on masking rules that are enabled during the copy
- All referential integrity columns can have same masking function applied
 - 3 of the masking options (PATTERN, SCRAMBLE, USEREXIT) applicable to RI
 - You must use the same option consistently across RI sets
- USEREXIT should be used when spanning DB2 & IMS Cloning Tools
 - Can be written in multiple languages

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z/OSMF for REST

- When using FTP to place the files in USS HFS
 - Use binary transfer
- Browse or Edit can be used to view the files with the Data Encoding: ASCII option



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Subsystem Provisioning

- ```

1 <?xml version="1.0" encoding="UTF-8"?>
2
3 <workflow xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
4 xsi:noNamespaceSchemaLocation="..\workflow\schemas\wf1.xsd">
5
6 <!-- *****
7 DR2 Cloning Tool
8 Subsystem Cloning workflow for cloning non-data sharing system
9 -->
10 DATABASE 2 CLONING TOOL.
11 SAS-AND COPYRIGHT IBM CORPORATION 2017.
12 ALL RIGHTS RESERVED. LICENSED MATERIALS - PROPERTY OF IBM.
13 US GOVERNMENT USERS RESTRICTED RIGHTS - USE, DUPLICATION OR
14 DISCLOSURE RESTRICTED BY GSA AWP SCHEDULE CONTRACT WITH IBM CORP.
15 LICENSED MATERIALS - PROPERTY OF ROCKET SOFTWARE, INC.
16 COPYRIGHT ROCKET SOFTWARE, INC. YEAR 2017 ALL RIGHTS RESERVED.
17 *****
18 -->
19 <workflowInfo>
20 <workflowId localId="sysplex">CTSubsysCloningOnDS</workflowId>
21 <workflowDescription>Cloning Tool Subsystem Cloning for non-data sharing systems via Storage Group and/or Volume mapping
22 <workflowVersion>3.2</workflowVersion>
23 <versionId>1.0</versionId>
24 <configuration>
25 <productId>S365-115</productId>
26 <productName>DR2 Cloning Tool Workflow</productName>
27 <productVersion>Version 3.2</productVersion>
28 </configuration>
29 </workflowInfo>
30
31 <!-- *****
32 Cloning Tool SS Clean Up Phase
33 -->
34 <phase>
35 <variable name="ss_Cleanup">
36 <label>Clean up a previous SS Clone target subsystem</label>
37 <abstract>Indicator to drive clean up steps. See Instructions.</abstract>
38 <description>ss_Cleanup: Indicator to drive clean up steps. See Instructions.
39 </description>
40 <category>SS Clone Clean Up</category>
41 <string>
42 <choice>YES</choice>
43 <choice>NO</choice>
44 <choice>ONLY</choice>
45 <default>NO</default>
46 </string>
47 </variable>
48

```

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- The workflow XML file

- ```
<step name="ckzappclones">
  <title>Execute Db2 Cloning Tool App Cloning Source Job</title>
  <description>
    Execute the Db2 Cloning Tool Application Cloning Source Job.
  </description>
  <variableValue name="stepb1" required="true"/>
  <variableValue name="ckzplan" required="true"/>
  <variableValue name="srcplan" required="true"/>
  <variableValue name="srcdb2" required="true"/>
  <variableValue name="srcdb51" required="true"/>
  <variableValue name="srcdb52" required="true"/>
  <variableValue name="tgtplan" required="true"/>
  <variableValue name="tgtcat" required="true"/>
  <variableValue name="ckzini" required="true"/>
  <variableValue name="tgtb2" required="true"/>
  <variableValue name="objdest" required="true"/>
  <variableValue name="dcldest" required="true"/>
  <variableValue name="objstat" required="true"/>
  <variableValue name="syncdb2dsn" required="true"/>
  <variableValue name="sqloutd" required="true"/>
  <variableValue name="dcloutd" required="true"/>

  <instructions substitution="false">
    </instructions>
    <weight>10</weight>
    <skills>Basic JCL</skills>
    <autoEnable=true</autoEnable>
  </template>
  <fileTemplate substitution="true">
    ckzaps.template
  </fileTemplate>
  <submitAs maxRc="4">JCL</submitAs>
  <maxRc>80</maxRc>
</template>
```

```
<?xml version='1.0' encoding='UTF-8' ?>
<workflowInfo>
  <workflowID isCallable="sysplex">CTappCloning</workflowID>
  <workflowDescription>Execute Cloning Tool Application Cloning
  </workflowDescription>
  <workflowVersion>3.2</workflowVersion>
  <vendor>IBM Db2 Cloning Tool</vendor>
  <configuration>
    <productID>S565-NIS</productID>
    <productName>Db2 Cloning Tool-App Clone Workflow</productName>
    <productVersion>Version 3.2</productVersion>
  </configuration>
</workflowInfo>
```

```
<variable name="ckzplan">
<label>Cloning Tool Plans</label>
<abstract>Plan name of Cloning Tool</abstract>
<description>ckzplan: Plan name of Cloning Tool</description>
<category>Installation</category>
<string>
</string>
</variable>

<!--
CKZ Application Cloning Program Specific Parameters
-->

<variable name="srcldpar">
<label>Source LPAR</label>
<abstract>Source LPAR</abstract>
<description>srcldpar: The Source LPAR associated with the Source DB2.</description>
<category>CT App Cloning Params</category>
<string>
</string>
</variable>
```

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z/OSMF Workflow Use Overview

- Create the workflow
 - Via z/OSMF web pages or a REST API
 - Make sure steps are assigned
 - Steps should be in a “Ready” status if AutoEnabled
- Start workflow
 - Via the z/OSMF Step, Perform tab
 - If the step is Completed successfully and the next step is Ready the workflow continues
- Once a workflow is Completed
 - A step can be executed individually
 - z/OSMF management facility, Perform tab
 - REST API with the stepname JSON attribute
- For repeated service requests
 - Like Provisioning & Deployment
 - Create a workflow for each request instance
 - Execute the workflow
 - Optionally clean up the workflow

Ready

3

Source Db2 Suspend log when FC CONSISTENT(NO)

Complete

1

Cloning Tool Parameters

```
{
  "stepName": "ckzappclones"
}
```

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Creating a z/OSMF Workflow

SDSF OUTPUT DISPLAY IZUSVR1 S0654391 DSID 107 LINE 41
 COMMAND INPUT ==>
 IZUG349I: The z/OSMF Server home page can be accessed at
 : https://Fxxxx.yyyyyyyyyyyyyy.com :11443/zosmf
 : after the z/OSMF server is started on your system.

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Creating a z/OSMF Workflow

Create Workflow

Type or select a workflow definition file to use for creating a new workflow.
For a z/OS data set, specify a fully qualified name, with no quotes.



* Workflow definition file:

Type or select a variable input file to populate the new workflow. For a z/OS data set, specify a fully qualified name, with no quotes.

Workflow variable input file:

* System:
 - Local

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Creating a z/OSMF Workflow

Create Workflow

Workflow definition file:

Variable input file:

Description:
 Execute Cloning Tool Application Cloning

Vendor: IBM Db2 Cloning Tool Version: 3.2 Is Callable:  In the same sysplex

* Workflow name:

* Owner user ID:
 System: - Local

Comments:

* Access [\(Learn More\)](#):

☒ Open workflow on finish ☒ Assign all steps to owner user ID

```

<workflowInfo>
  <workflowID isCallable="sysplex">CTappCloning</workflowID>
  <workflowDescription>Execute Cloning Tool Application Cloning
  </workflowDescription>
  <workflowVersion>3.2</workflowVersion>
  <vendor>IBM Db2 Cloning Tool</vendor>
  <configuration>
    <productID>S565-N15</productID>
    <productName>DB2 Cloning Tool Workflow</productName>
    <productVersion>Version 3.2</productVersion>
  </configuration>
</workflowInfo>
    
```

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z/OSMF Workflow Steps

Welcome

Workflows

Workflows

Execute Cloning Tool Application Cloning - Workflow_0

Execute Cloning Tool Application Cloning - Workflow_0

Description:

Execute Cloning Tool Application Cloning

Percent complete:

0%

Owner:

ts5858

Steps complete:

0 of 2

System:

RSPLEX01.RS22 (RS22)

Status:

In Progress

Is Callable:

In the same sysplex

Access (Learn More):

Public

Workflow Steps

Actions

No filter applied

Search

State Filter	No. Filter	Title Filter	Called Workflow Filter	Automated Filter	Owner Filter	Skill Category Filter	Assignees
Ready	1	Cloning Tool Parameters		Yes	ts5858	Installation Information	ts5858
Ready	2	Variable customization		Yes	ts5858	REXX	ts5858
Ready	3	Execute Db2 Cloning Tool App Cloning Source Job		Yes	ts5858	Basic JCL	ts5858
	4	Execute Db2 Cloning Tool App Cloning		Yes	ts5858	Basic JCL	ts5858

<title>Execute Db2 Cloning Tool App Cloning Source Job</title>

<description>

Execute the Db2 Cloning Tool Application Cloning Source Job.

</description>

<variableValue name="steplib" required="true"/>

<variableValue name="ckzplan" required="true"/>

<variableValue name="srcipar" required="true"/>

<variableValue name="srcdb2" required="true"/>

<variableValue name="srcbds1" required="true"/>

<variableValue name="srcbds2" required="true"/>

<variableValue name="tgtipar" required="true"/>

<variableValue name="tgtlocn" required="true"/>

<variableValue name="tgtvcst" required="true"/>

<variableValue name="ckzini" required="true"/>

<variableValue name="tgtddb2" required="true"/>

<variableValue name="listdef" required="true"/>

<variableValue name="ddlattr" required="true"/>

<instructions substitution="false">

</instructions>

<weight>10</weight>

<skills>Basic JCL</skills>

<autoEnable>true</autoEnable>

<template>

<fileTemplate substitution="true">

ckzapps.template

</fileTemplate>

<submitAs maxRc="4">JCL</submitAs>

<maxRec>50</maxRec>

</template>

</step>

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z/OSMF Workflow Steps ... Drill into the first step

Welcome

Workflows

Workflows

Execute Cloning Tool Application Cloning - Workflow_0

1. Execute Db2 Cloning Tool App Cloning Source Job

Properties for Workflow Step 1. Execute Db2 Cloning Tool App Cloning Source Job

General

Details

Dependencies

Notes

Perform

Status

Input Variables

Feedback

Title:

Execute Db2 Cloning Tool App Cloning Source Job

Description:

Execute the Db2 Cloning Tool Application Cloning Source Job.

<step name="ckzappclones">

<title>Execute Db2 Cloning Tool App Cloning Source Job</title>

<description>

Execute the Db2 Cloning Tool Application Cloning Source Job.

</description>

<variableValue name="steplib" required="true"/>

<variableValue name="ckzplan" required="true"/>

<variableValue name="srcipar" required="true"/>

<variableValue name="srcdb2" required="true"/>

<variableValue name="srcbds1" required="true"/>

<variableValue name="srcbds2" required="true"/>

<variableValue name="tgtipar" required="true"/>

<variableValue name="tgtlocn" required="true"/>

<variableValue name="tgtvcst" required="true"/>

<variableValue name="ckzini" required="true"/>

<variableValue name="tgtddb2" required="true"/>

<variableValue name="listdef" required="true"/>

<variableValue name="ddlattr" required="true"/>

<variableValue name="objxlat" required="true"/>

<variableValue name="syncdb2dsn" required="true"/>

<variableValue name="sqloutdd" required="true"/>

<variableValue name="ddoutdd" required="true"/>

</variableValue>

</step>

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z/OSMF Workflow Steps

Welcome x Workflows x

Workflows > Application Cloning Provisioning > 1. Cloning Tool Parameters

Properties for Workflow Step 1. Cloning Tool Parameters

General Details Dependencies Notes **Perform** Status Input Variables Feedback

Input Variables - Source Object Params

Enter the variable values for this input category.

* LISTDEF Control Records: **Identify the Source objects for cloning:**

```
LISTDEF CKZSAMP
INCLUDE TABLESPACES
DATABASE DSNB010A
RI ALL
```

* Include All RI: **Add RI keyword to all LISTDEF definitions:**

N

* Explode Objects: **Include dependent objects:**

N

```
<variable name="listdef">
<label>CKZ LISTDEF Control Records</label>
<abstract>CKZ LISTDEF Control Records</abstract>
<description>The LISTDEF control records to chose source objects. Use the Cloning Tool UI to develop a proper set of control records.
</description>
<category>Cloning Tool Object Handling</category>
<string multiLine="true">
</variable>

<variable name="ddlattr">
<label>CKZ DDL-ATTRIBUTE-CHANGE</label>
<abstract>CKZ DDL-ATTRIBUTE-CHANGE</abstract>
<description>These records drive the DDL-ATTRIBUTE-CHANGE for CKZ. Use the Cloning Tool UI to develop a proper set of control records. Attributes include STOGROUP, DBPCACHE, LOG, PRIORITY, SECURITY, TRACKMOD, CLOSE, DATACAPTURE, and BUFFERPOOL; and can be applied to DATABASE, TABLESPACE, TABLEPART, TABLE, INDEX, INDEXPART, or all objects.
--Attribute-name,Source-attribute-or=,Target-value-to-be-used,Target-type,Source-object-name-or-blank,--
</description>
<category>Cloning Tool Object Handling</category>
<string multiLine="true">
</variable>

<variable name="objxlat">
<label>CKZ OBJECT-TRANSLATE</label>
<abstract>CKZ OBJECT-TRANSLATE</abstract>
<description>These records drive the OBJECT-TRANSLATE for CKZ. Use the Cloning Tool UI to develop a proper set of control records. Attributes include CREATOR, DATABASE, TABLESPACE, INDEX, INDEXSPACE, TABLE, and VCAT; and wildcarding can be used. --Object-type,Source-name,Target-name--
</description>
<category>Cloning Tool Object Handling</category>
<string multiLine="true">
</variable>

listdef = \
LISTDEF PRBSAMPL \n\
INCLUDE TABLESPACES \n\
DATABASE PRB8011A \n\
RI ALL \n\

ddlattr = \
STOGROUP,*,SYSDEFLT,,, - \n\

objxlat = \
DATABASE,PRB8*,ABC8* - \n\
CREATOR,PRB8*,ABC8* - \n\
VCAT,L78B,L78B - \n\

sqloutdd = \
//CKZQLOUT DD DISP=OLD,DSN=TS5858.CKZ.SQLOUT(LSTPRB8)

ddloutdd = \
//CKZDLOUT DD DISP=OLD,DSN=TS5858.CKZ.DDLOUT(LSTPRB8)

logaplydd = \
//SYSINCKZ DD DISP=SHR,DSN=TS5858.CKZ.LOGAPCTL(LSTPRB8)

ckzplan = CKZ320P
srcldpar = R522
```

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z/OSMF Workflow Job Customization & Submission

Welcome x Workflows x

Workflows > Application Cloning Provisioning > 3. Execute Db2 Cloning Tool App Cloning Source Job

Properties for Workflow Step 3. Execute Db2 Cloning Tool App Cloning Source Job

General Details Dependencies Notes **Perform** Status Input Variables Feedback

Review JCL

Review the generated JCL, then click **Next** to proceed. Optionally, you can edit the JCL. To do so, click the **Edit JCL** link.

```
//TS5858EL JOB CLASS=A,MUCLAS8=X,MUCLVEL=(1,1),REGION=0M,
//      USER=TS5858,NOTIFY=TS5858
//
/*JOBPARM SYSAFF=R502
//
/*JOBPARM S=R501
//S1 EXEC PGM=CKZ00500,REGION=0M
//STEPL1 DD DISP=SHR,DSN=BSDMO.CKZ320.IMTAPSE.SCKELOAD
//      DD DISP=SHR,DSN=BSRTE.DSN.VCLO.SCKELOAD
//      DD DISP=SHR,DSN=BSR.P01.SCKEKIT
//CKEPRINT DD SYSOUT=*
//CKEINT DD DISP=SHR,DSN=CKSDMO.CKZ320.SCKEPARM(CKEINT32)
//CKELOAD DD SYSOUT=*
//CKELOAD DD SYSOUT=*
//CKELOAD DD SYSOUT=*
//LISTDEF CKZSAMP
//INCLUDE TABLESPACES
//DATABASE DSNB010A
//RI ALL
//EXCLUDE TABLESPACES
//TABLESPACE DSNB010A.DSNB010R
```

Edit JCL Maximum record length: 80

```
/*
/*
/*JOBPARM S=instance-srcldpar
//S1 EXEC PGM=CKZ00500,REGION=0M
//STEPL1 DD DISP=SHR,DSN=instance-srcldpar
//CKEPRINT DD SYSOUT=*
//CKEINT DD SYSOUT=*
//CKZLISTDF DD *
//CKZSYNOB DD DISP=OLD,DSN=instance-synodb2dsn
//instance-sqloutdd
//instance-ddloutdd
//CKZERORR DD SYSOUT=*
//BSDS01 DD DISP=SHR,DSN=instance-srcbds01
//BSDS02 DD DISP=SHR,DSN=instance-srcbds02
//CKZIN DD *
SET
LOCAL-SSID(instance-srcbds2)
TCP/IP-SERVER-PORT(5899)
TCP/IP-STC-NAME(TCP/IP)
SOURCE-TCP/IP-SERVER-PORT(5899)
SOURCE-TCP/IP-STC-NAME(TCP/IP)
MAX-RC(8)
MAX-COPY-AC(8)
DB2-COMMAND-RESPONSE-WAIT(60)
DB2-PLAN(CKZ320P)
IP-VERSION(4)
MAX-SUBTASKS(1)
SUBTASK-DATASET-EXTENSIONS(N)
SUBTASK-TERMINATION-WAIT(60)
HEAP-PRINT(Y)
USE-RUNTIME-REPOSITORY(N)
TARGET-JOB-REPAIR-EXECUTE(N)
TARGET-JOB-REPAIR-SELECT(N)
TARGET-JOB-REPAIR-TEST(N)
REBUILD-INDEXES-EXECUTE(Y)
PROCESS-UNMATCHED-TARGET-INDEXES(Y)
REBUILD-UNMATCHED-TARGET-INDEXES(Y)
INTELLIGENT-REBUILD(Y)
REBUILD-INDEXES-REPORT(Y)
UTILITY-COMMAND-EXECUTE-PERCENT(8)
COPY
TARGET-DB2(SSID(instance-tgtbds2)
LOC(instance-tgtlocn)
DEFVCAT(instance-tgtvcat)
PORT(5899)
}
LOG-APPLY(
```

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z/OSMF REST – How to get the Workflow Key

- Get the Workflow Key

```

GET https://11443/zosmf/workflow/rest/1.0/workflows?owner= Params Send
Pretty Raw Preview JSON
21 {
22   "workflowKey": "05065db0-b5e3-450d-bad0-9ed01de09b47",
23   "workflowName": "Execute Admin reverse engineering program - Workflow_0",
24   "workflowVersion": "1.3",
25   "workflowDescription": "Execute Admin reverse engineering program\n",
26   "workflowID": "execGEN"
27 },
28 {
29   "owner": " ",
30   "workflowDefinitionFileMD5Value": "535b9ce03c8c50f322dd24862efe0cab",
31   "instanceURI": "/zosmf/workflow/rest/1.0/workflows/806395b4-f00f-43dc-a956-2c0a255f6be2",
32   "access": null,
33   "vendor": "IBM Admin-OC",
34   "workflowKey": "806395b4-f00f-43dc-a956-2c0a255f6be2",
35   "workflowName": "Execute Admin Batch Restart Program For Deployment - ",
36   "workflowVersion": "1.1",
37   "workflowDescription": "Execute Admin Batch Restart Program For Deployment\n",
38   "workflowID": "RunDDL"
39 },
40 {
41   "owner": " ",
42   "workflowDefinitionFileMD5Value": "ea8c768b78840069bb6a1264602df9b1",
43   "instanceURI": "/zosmf/workflow/rest/1.0/workflows/9d8b7b46-8019-4b35-9f0e-9edeb58bf16b",
44   "access": null,
45   "vendor": "IBM Db2 Cloning Tool",
46   "workflowKey": "9d8b7b46-8019-4b35-9f0e-9edeb58bf16b",
47   "workflowName": "Execute Cloning Tool Application Cloning - Workflow_0",
48   "workflowVersion": "3.2",
49   "workflowDescription": "Execute Cloning Tool Application Cloning\n",
50   "workflowID": "CTappCloning"
51 }
  
```

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z/OSMF REST – Call the Workflow via REST

- Call the service

```

PUT https://11443/zosmf/workflow/rest/1.0/workflows/9d8b7b46-8019-4b35-9f0e-9edeb58bf16b/operations/start Params Send
Authorization Headers (2) Body Pre-request Script Tests
form-data x-www-form-urlencoded raw binary Text
1 {
2   "stepName": "ckzappclones"
3 }
  
```

Workflow History

Automate Step Skipped	IZUWF0166I:During automation processing, the step "Execute Db2 Cloning Tool App Cloning Source Job" was skipped because it is in one of the following states: Complete, Override Complete, or Skipped.
Automate Step Skipped	IZUWF0166I:During automation processing, the step "Execute Db2 Cloning Tool App Cloning Target Job" was skipped because it is in one of the following states: Complete, Override Complete, or Skipped.

- Use the SDSF services to monitor the job status
- Understand Workflow design for subsequent steps

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z/OSMF REST – Creating a Workflow via REST

- Automation & job control
 - jobStatement
 - deleteCompletedJobs
- Workflow customization
 - variables

POST https://rs01.rocketsoftware.com:11443/zosmf/workflow/rest/1.0/workflows

Authorization Headers (3) Body Pre-request Script Tests

form-data x-www-form-urlencoded raw binary JSON (application/json)

```

1 - {
2   "workflowName": "Provisioning via Appl Cloning",
3   "workflowDefinitionFile": "/u/ts5858/zosmf/wf/wfckztsclone.xml",
4   "system": "RS01",
5   "owner": "TS5858",
6   "variableInputFile": "/u/ts5858/zosmf/wf/ckzapclone.txt",
7   "jobStatement": "TS5858R8 JOB CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1),REGION=0M, \n// USER=TS5858,NOTIFY=TS5858 \n//",
8   "deleteCompletedJobs": "false",
9   "variables":
10  {
11    { "name": "srcIpar", "value": "RS01" },
12    { "name": "srcdb2", "value": "PCA1" },
13    { "name": "LAdotasharing", "value": "DATA-SHARING-MEMBERS( - \n1,PCA1,PCA1PARM, - \n2,PCB1,PCB1PARM - \n) -" },
14    { "name": "srcIpar", "value": "RS01" },
15    { "name": "tgtdb2", "value": "PCA1" },
16    { "name": "fuzzycopy", "value": "Y" },
17    { "name": "LAenable", "value": "N" },
18    { "name": "ddlproc", "value": "Y" },
19    { "name": "listdef", "value": "LISTDEF RBSSAMPL \nINCLUDE TABLESPACES \nTABLE PRBSAMPL * \nRI ALL" },
20    { "name": "objxlat", "value": "DATABASE,PRB8*,RBS8* - \nCREATOR,PRB*,RBS* - \nVCAT,POS1,POS1 -" },
21    { "name": "useDDLsqlid", "value": "TS5858" }
22  }
23 }
  
```

Override Variable Input File values

Status: 201 Created Time: 380 ms Size: 931

Body Cookies (1) Headers (9) Test Results

```

1 - {
2   "vendor": "IBM Db2 Cloning Tool",
3   "workflowKey": "7c0de1c1-8e08-4140-9aed-273fe74b3e45"
  
```

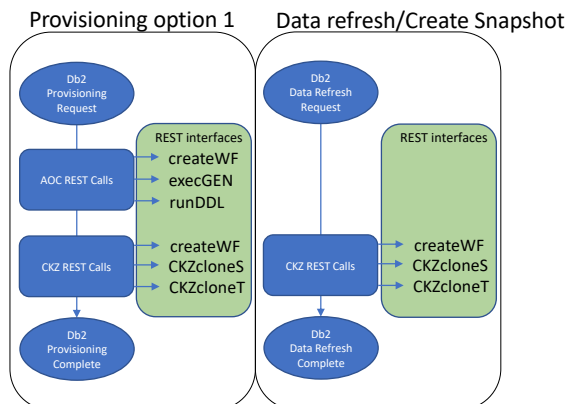
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Provisioning/Refresh Flows

Provisioning Solutions

- Provision
- Snapshot
- Refresh
- Restore
- Deploy

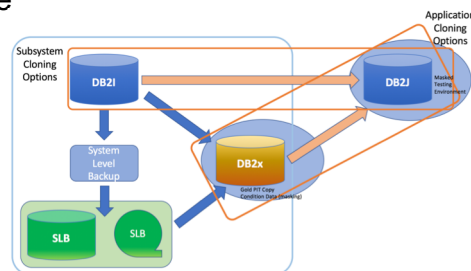


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Subsystem Cloning as a Design Option

- Based on the portion of the subsystem being cloned
 - A Subsystem Clone may be advisable
 - Includes the Catalog, Directory, BSDSs, and Active Logs
 - No ID translations
 - Some more difficult compatibility issues disappear
 - Simple Table Spaces
 - XML MV TS increase to 10 bytes
- Regular creation of a “Gold” production clone
 - Then used to create application specific clones
 - Can perform additional conditioning
 - Sampling
 - More complex masking



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Subsystem Provisioning

- Workflow Definition File
 - 32 Variables across 5 Categories
 - SS Clone Clean Up
 - Cloning Tool Data Sets
 - Db2 Source Environment
 - Db2 Target Environment
 - Flashcopy Parameters
 - Source / Target Mapping
- Variable Input File
 - 32 Variable defaults
 - Would require customization into the client environment
- Templates
 - 14 jobs

```

1 <?xml version="1.0" encoding="UTF-8"?>
2
3 <workflow xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
4   xsi:schemaLocation="http://www.ibm.com/db2/workflow/schemas/workflow_v1.xsd">
5
6   <!-- *****
7     DB2 Cloning Tool
8     Subsystem Cloning workflow for cloning non-data sharing system
9   -->
10  <workflowInfo>
11    <workflowID>SSCloneTool
12    <workflowDescription>Subsystem Cloning workflow for cloning non-data sharing system
13    <workflowVersion>3.2</workflowVersion>
14    <vendor>IBM</vendor>
15  </workflowInfo>
16
17  <!-- *****
18    DATABASE 2 CLONING TOOL
19    SS-CLONE COPYRIGHT IBM CORPORATION 2017.
20    ALL RIGHTS RESERVED. LICENSED MATERIALS - PROPERTY OF IBM.
21    US GOVERNMENT USERS RESTRICTED RIGHTS - USE, DUPLICATION OR
22    DEVELOPMENT RESTRICTED BY USA AIP SCHEDULE CONTRACT WITH IBM CORP.
23    LICENSED MATERIALS - PROPERTY OF ROCKET SOFTWARE, INC.
24    COPYRIGHT ROCKET SOFTWARE, INC. YEAR 2017 ALL RIGHTS RESERVED.
25  -->
26  <configuration>
27    <productID>SS-CLONE</productID>
28    <productVersion>3.2</productVersion>
29    <productName>DB2 Cloning Tool Workflow</productName>
30  </configuration>
31
32  <!-- *****
33    Cloning Tool SS Clean Up Params
34  -->
35  <variable name="ss_Cleanup">
36    <label>Clean up a previous SS Clone target subsystem</label>
37    <abstractIndicator>Indicator to drive clean up steps. See Instructions.</abstractIndicator>
38    <description>Indicator to drive clean up steps. See Instructions.</description>
39    <category>SS Clone Clean Up</category>
40    <choice>YES</choice>
41    <choice>NO</choice>
42    <choice>ONLY</choice>
43    <default>NO</default>
44  </variable>
45
46  <!-- *****
47    Cloning Tool SS Clean Up Params
48  -->
49  <variable name="ss_Cleanup">
50    <label>Clean up a previous SS Clone target subsystem</label>
51    <abstractIndicator>Indicator to drive clean up steps. See Instructions.</abstractIndicator>
52    <description>Indicator to drive clean up steps. See Instructions.</description>
53    <category>SS Clone Clean Up</category>
54    <choice>YES</choice>
55    <choice>NO</choice>
56    <choice>ONLY</choice>
57    <default>NO</default>
58  </variable>
59
60  <!-- *****
61    Cloning Tool SS Clean Up Params
62  -->
63  <variable name="ss_Cleanup">
64    <label>Clean up a previous SS Clone target subsystem</label>
65    <abstractIndicator>Indicator to drive clean up steps. See Instructions.</abstractIndicator>
66    <description>Indicator to drive clean up steps. See Instructions.</description>
67    <category>SS Clone Clean Up</category>
68    <choice>YES</choice>
69    <choice>NO</choice>
70    <choice>ONLY</choice>
71    <default>NO</default>
72  </variable>
73
74  <!-- *****
75    Cloning Tool SS Clean Up Params
76  -->
77  <variable name="ss_Cleanup">
78    <label>Clean up a previous SS Clone target subsystem</label>
79    <abstractIndicator>Indicator to drive clean up steps. See Instructions.</abstractIndicator>
80    <description>Indicator to drive clean up steps. See Instructions.</description>
81    <category>SS Clone Clean Up</category>
82    <choice>YES</choice>
83    <choice>NO</choice>
84    <choice>ONLY</choice>
85    <default>NO</default>
86  </variable>
87
88  <!-- *****
89    Cloning Tool SS Clean Up Params
90  -->
91  <variable name="ss_Cleanup">
92    <label>Clean up a previous SS Clone target subsystem</label>
93    <abstractIndicator>Indicator to drive clean up steps. See Instructions.</abstractIndicator>
94    <description>Indicator to drive clean up steps. See Instructions.</description>
95    <category>SS Clone Clean Up</category>
96    <choice>YES</choice>
97    <choice>NO</choice>
98    <choice>ONLY</choice>
99    <default>NO</default>
100 </variable>
101
102 </workflow>

```

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Subsystem Workflow Creation

POST

https://rs01.rocketsoftware.com:11443/zosmf/workflow/rest/1.0/workflows

Params

Send

Save

Authorization

Headers (3)

Body

Pre-request Script

Tests

Cookies

Code

form-data

x-www-form-urlencoded

raw

binary

JSON (application/json)

```

1 {
2   "workflowName": "Cloning Tool Subsystem Cloning with CleanUp NO LU-IPName Error",
3   "workflowDefinitionFile": "/u/ts5858/zosmf/ssnonds-sgvol/nonds_sgvol_wf.xml",
4   "system": "RS01",
5   "owner": "TS5858",
6   "variableInputFile": "/u/ts5858/zosmf/ssnonds-sgvol/nonds_sgvol.txt",
7   "jobStatement": "//CKZSSFCY JOB CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1),REGION=0M, \n//
  \n/*",
8   "variables":
9   [
10    { "name": "ss_CleanUp", "value": "NO"},
11    { "name": "flashcopy_CG", "value": "YES"},
12    { "name": "flashcopy_Incr", "value": "NO"}
13  ]
14 }

```

Body

Cookies (1)

Headers (6)

Test Results

Status: 201 Created

Time: 490 ms

Size: 519 B

Pretty

Raw

Preview

JSON

Save Response

```

1 {
2   "vendor": "IBM",
3   "workflowKey": "a20150e4-92b5-4650-a3a3-d6d6b78b0210",
4   "workflowVersion": "3.2",
5   "workflowDescription": "Cloning Tool Subsystem Cloning for non-data sharing systems via Storage Group and-or Volume
  mapping\n",
6   "workflowID": "CTSubSysCloningNonDS"
7 }

```

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Subsystem Provisioning Workflow

Description:

Cloning Tool Subsystem Cloning for non-data sharing systems via Storage Group and-or Volume mapping

Owner:

ts5858

System:

RS01

Is Callable:

In the same sysplex

Access (Learn More):

Public

Steps complete:

14 of 14

Status:

Complete

Workflow Steps

Actions

No filter applied

Search

State Filter	No. Filter	Title Filter	CalledWorkflow Filter	Automated Filter	Owner Filter	Skill Category Filter	Assignees Filter
Complete	1	Cloning Tool Parameters		Yes	ts5858	Installation Information	ts5858
Complete	2	Clean up of a previous SS clone		Yes	ts5858	Basic JCL	ts5858
Complete	3	Source Db2 Suspend log when FC CONSISTENT(NO)		Yes	ts5858	Basic JCL	ts5858
Complete	4	Issue the requested COPY using Storage Group and-or Volume mapping		Yes	ts5858	Basic JCL	ts5858
Complete	5	Source Db2 Resume log when FC CONSISTENT(NO)		Yes	ts5858	Basic JCL	ts5858
Complete	6	Rename and Catalog the copied data sets to Target names		Yes	ts5858	Basic JCL	ts5858
Complete	7	Issue DB2UPDATE command for target subsystem		Yes	ts5858	Basic JCL	ts5858
Complete	8	Start Target Db2 with Special ZPARMS		Yes	ts5858	Basic JCL	ts5858
Complete	9	Resolve LPL and GRECP statuses on the Db2 Catalog and Directory		Yes	ts5858	Basic JCL	ts5858
Complete	10	Update the Catalog with SQL		Yes	ts5858	Basic JCL	ts5858
Complete	11	Resolve LPL and GRECP statuses on the application databases		Yes	ts5858	Basic JCL	ts5858
Complete	12	Stop Db2		Yes	ts5858	Basic JCL	ts5858
Complete	13	Issue DB2UTILCLEAN command		Yes	ts5858	Basic JCL	ts5858
Complete	14	Start Target Db2 with Normal ZPARMS		Yes	ts5858	Basic JCL	ts5858

REXX only exec to check parm compat

Conditional, check for needed data sets

End workflow if CLEANUP=ONLY

flashcopy_CG(NO)

flashcopy_CG(NO)

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Db2 Native REST Support - quick positioning

Db2 Native REST

- Built into DDF
 - Db2 V11 + PI66828, PI70477
 - Db2 V12 + PI70652
 - Data Studio 4.1.2 (or create via REST call)
 - II14827, DSNTIJRS
- Use the IP Address/Domain Name & Port for Db2 DDF
- Drives a SQL statement or call to a Stored Procedure
- JSON payload mapped to the statement host variables
- DIS THREAD shows "DB2_REST" as the correlation ID

```
POST https://<host>:<port>/services/<serviceCollectionID>/<serviceName>
```

POST Params

Key	Value	Description
New key	Value	Description

Authorization Headers (3) Body Pre-request Script Tests

form-data x-www-form-urlencoded raw binary JSON (application/json)

```
1 {
2   "DATABASE": "PRB",
3   "CREATOR": "PRB",
4   "NAME": "DEPT"
5 }
```

Key	Value
<input checked="" type="checkbox"/> Content-Type	application/json
<input checked="" type="checkbox"/> Accept	application/json
<input checked="" type="checkbox"/> Authorization	Basic

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Db2 Native REST Support – what's out there?

```
DB2 Admin -- PCAL BROWSE SYSIBM.DSNSERVICE ----- Line 00000000 Col 001 132
Command ==>

***** Top of Data *****
NAME      COLLID  CONTOKEN  ENABLED  CREATEDTS  ALTEREDTS  DESCRIPTION
-----
RESTcatDB pbartak HTTPREST Y      2017-04-10-17.21.45.059613 2017-04-10-17.21.45.059613 Check for the RESTful Catalog DB
RESTtblList pbartak HTTPREST Y      2017-04-10-20.22.19.463533 2017-04-10-20.22.19.463533 RESTful Table Listing
getDept    pbartak HTTPREST Y      2017-09-08-17.05.24.132305 2017-09-08-17.05.24.132305 Get Department information from the PRBS
*****
```

GET Params

Pretty Raw Preview JSON

```
1 {
2   "DB2Services": [
3     {
4       "ServiceName": "DB2ServiceDiscover",
5       "ServiceCollectionID": null,
6       "ServiceDescription": "DB2 service to list all available services.",
7       "ServiceProvider": "db2service-1.0",
8       "ServiceURL": "http://[redacted]:3710/services/DB2ServiceDiscover"
9     },
10    {
11      "ServiceName": "DB2ServiceManager",
12      "ServiceCollectionID": null,
13      "ServiceDescription": "DB2 service to create, drop, or alter a user defined service.",
14      "ServiceProvider": "db2service-1.0",
15      "ServiceURL": "http://[redacted]:3710/services/DB2ServiceManager"
16    },
17    {
18      "ServiceName": "RESTcatDB",
19      "ServiceCollectionID": "pbartak",
20      "ServiceDescription": "Check for the RESTful Catalog DB",
21      "ServiceProvider": "db2service-1.0",
22      "ServiceURL": "http://[redacted]:3710/services/pbartak/RESTcatDB"
23    },
24    {
25      "ServiceName": "RESTtblList",
26      "ServiceCollectionID": "pbartak",
27      "ServiceDescription": "RESTful Table Listing",
28      "ServiceProvider": "db2service-1.0",
29      "ServiceURL": "http://[redacted]:3710/services/pbartak/RESTtblList"
30    },
31    {
32      "ServiceName": "getDept",
33      "ServiceCollectionID": "pbartak",
34      "ServiceDescription": "Get Department information from the PRBSAMPL schema",
35      "ServiceProvider": "db2service-1.0",
36      "ServiceURL": "http://[redacted]:3710/services/pbartak/getDept"
37    }
38  ]
39 }
```

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Db2 Native REST Support – creating a service

POST

http://10.10.10.10:3710/services/DB2ServiceManager

Params

Send

Key	Value	Description
New key		
	Value	Description

Authorization

Headers (3)

Body

Pre-request Script

Tests

form-data

x-www-form-urlencoded

raw

binary

JSON (application/json)

```

1 {
2   "requestType": "createService",
3   "sqlStmt": "select * from prbsmpl.dept where deptno = :DEPTNO",
4   "collectionID": "pbartak",
5   "serviceName": "getDept",
6   "description": "Get Department information from the PRBSAMPL schema"
7 }

```

Body

Cookies

Headers (7)

Tests

Pretty

Raw

Preview

JSON

```

1 {
2   "statusCode": 201,
3   "statusDescription": "DB2 Rest Service getDept was created successfully.",
4   "url": "http://10.10.10.10:3710/services/pbartak/getDept"
5 }

```

POST

http://10.10.10.10:3710/services/pbartak/getDept

Params

Send

Authorization

Headers (3)

Body

Pre-request Script

Tests

form-data

x-www-form-urlencoded

raw

binary

JSON (application/json)

```

1 {
2   "DEPTNO": "A00"
3 }

```

Body

Cookies

Headers (6)

Tests

Pretty

Raw

Preview

JSON

```

1 {
2   "ResultSet Output": [
3     {
4       "DEPTNO": "A00",
5       "DEPTNAME": "SPIFFY COMPUTER SERVICE DEV.",
6       "MGRNO": "000010",
7       "ADMDEPT": "A00",
8       "LOCATION": " "
9     }
10  ],
11   "statusCode": 200,
12   "statusDescription": "Execution Successful"
13 }

```

Status: 200 OK Time: 391 ms

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IBM z Systems Trial (zTrial)

IBM z Systems Trial Program

- Some call it: Download and Go
- Value
 - No charge, on-demand environment
 - No set up, no install
 - Hands-on tutorials
- Available today
 - Machine Learning
 - Cloud Provisioning
 - IMS
 - Db2 Administration Solution for z/OS
 - Application Discovery and Delivery Intelligence
 - z/OS Connect Enterprise Edition
 - Open Data Analytics
- Coming soon
 - Db2 Utilities Solutions
 - CICS Transaction Server
 - IBM OMEGAMON for JVM on z/OS
 - IBM ODM for z/OS
- Check it out
 - Google IBM zTrial
 - Register with your IBMID
 - Remote desktop instruction received in your e-mail

zTrial

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References

Thank You!

- IBM Db2 Cloning Tool
 - https://www.ibm.com/support/knowledgecenter/en/SSAUUE_3.2.0/topics/ckzhome.html
- IBM Db2 Administration Tool
 - https://www.ibm.com/support/knowledgecenter/en/SSAUZ9_11.2.0/topics/adbhome.html
 - REST Provisioning Enablement II14827
 - <http://www-01.ibm.com/support/docview.wss?uid=isg1II14827>
- z/OSMF V2R2 Announcement
 - http://www-01.ibm.com/common/ssi/ShowDoc.wss?docURL=/common/ssi/rep_ca/7/897/ENUS215-267/index.html&lang=en&request_locale=en
- z/OSMF REST Services
 - https://www.ibm.com/support/knowledgecenter/SSLTBW_2.1.0/com.ibm.zos.v2r1.izua700/IZUHPINFO_RESTServices.htm
- z/OSMF Workflow XML Reference
 - https://www.ibm.com/support/knowledgecenter/en/SSLTBW_2.2.0/com.ibm.zos.v2r2.izua700/izuprog_WorkflowsXML_Reference.htm#izuprog_workflowsxml_reference__StepElementsSummaryTableRestSteps
- Db2 REST Services
 - https://www.ibm.com/support/knowledgecenter/en/SSEPEK_12.0.0/restserv/src/tpc/db2z_restservices.html
- IBM z Systems Trial Program (zTrial)
 - <https://www.ibm.com/systems/z/resources/trials.html>

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