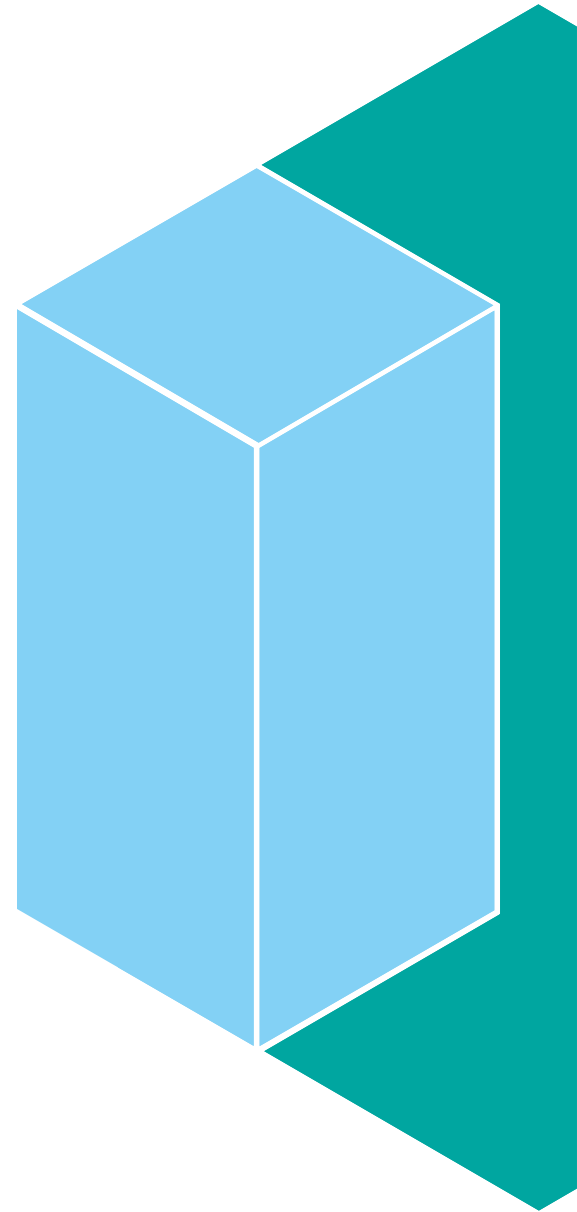


B14: APIs to the Data Prize: Discovery of IMS and DB2 Services with z/OS Connect

Haley Fung, IMS Development
hfung@us.ibm.com



Sharpen your competitive edge
2016 IMS Technical Symposium
March 7 – 10, 2016
Wiesbaden, Germany

www.ims-symposium.com

Agenda

1

Business drivers/opportunities for leveraging z Data Assets as APIs

Mobile, Cloud, API Economy, Improving consumability and governance

2

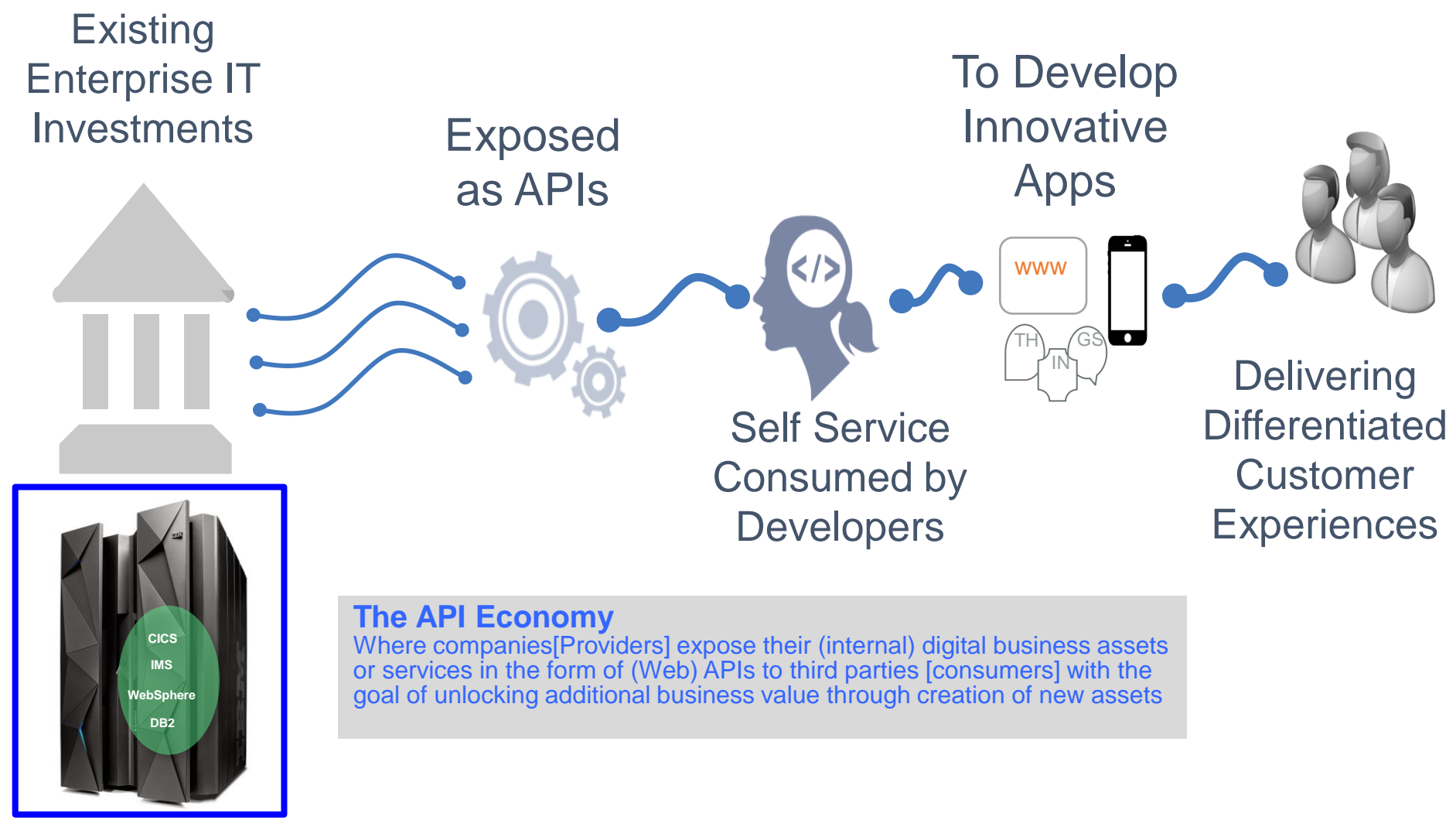
API and REST Enablement with z/OS Connect Enterprise Edition

- **IMS Assets**
- **DB2 Assets**

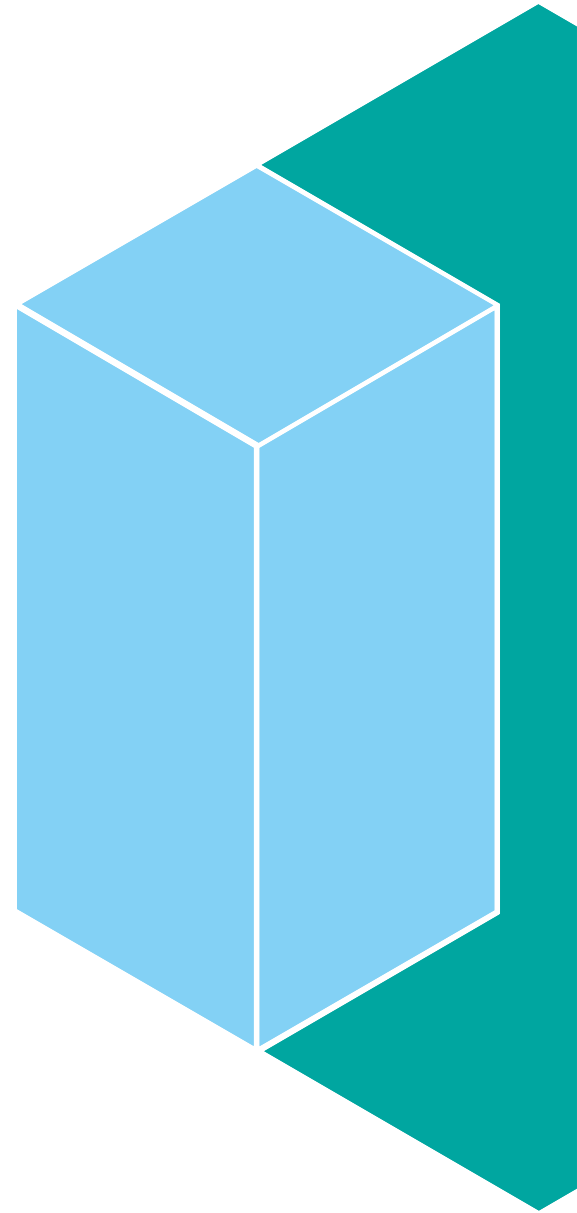
3

API Management for z and Service Discovery

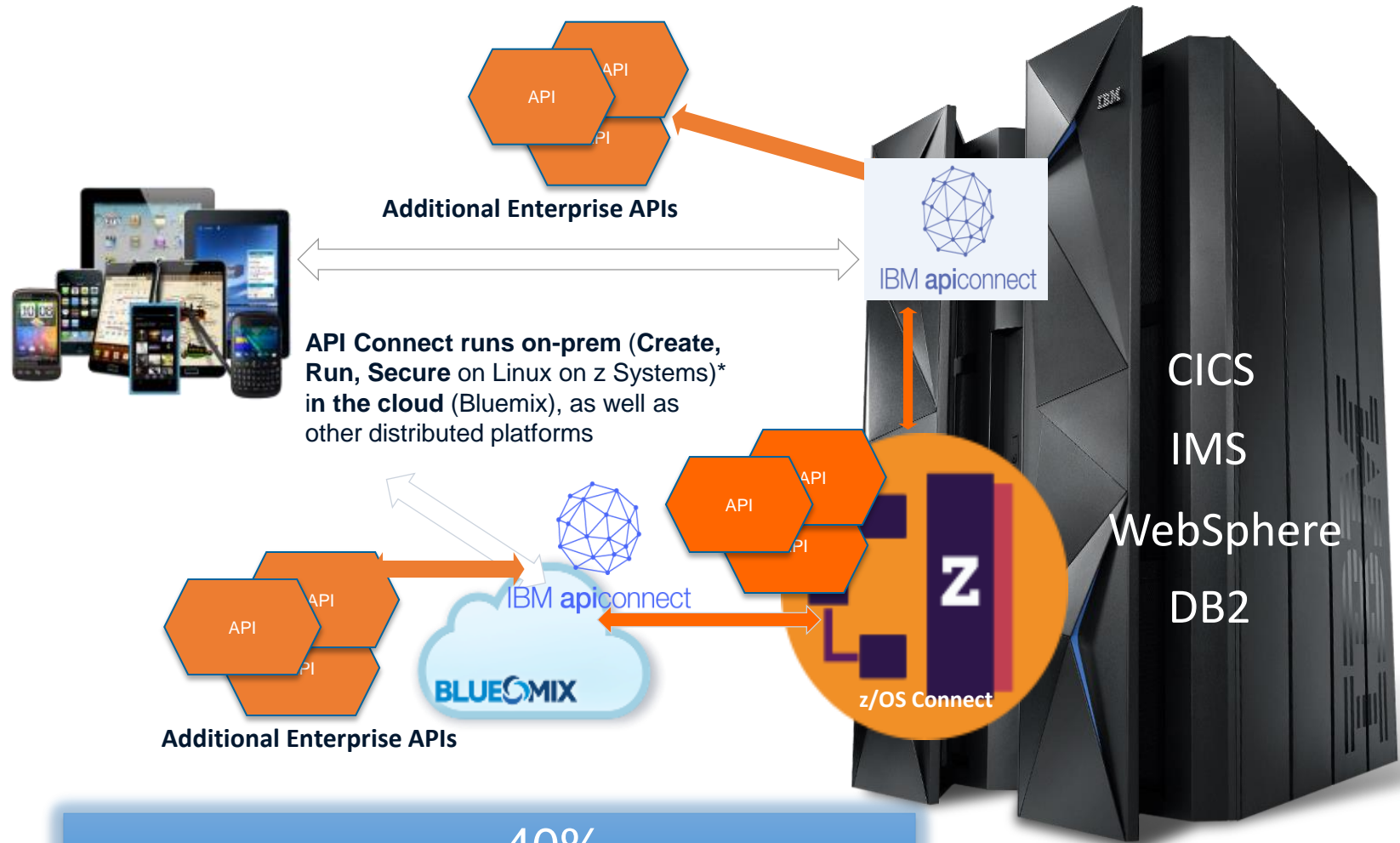
Unleash Enterprise Investments to Disrupt Competitors



API and Services enablement for z assets with z/OS Connect



z/OS Connect provides optimized infrastructure to meet the demands of the API Economy

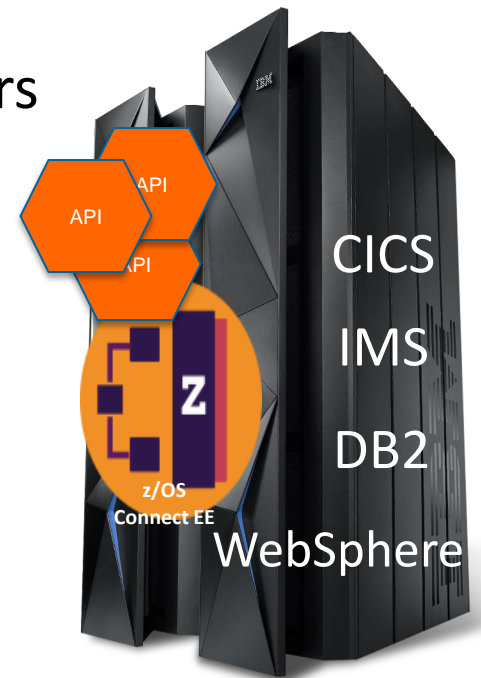


Serving mobile data directly from z/OS is **40%** less expensive than exporting to a system of engagement

*manage does not run on LoZ

z/OS Connect Enterprise Edition

- Delivers RESTful APIs as a discoverable, first-class resource with Swagger 2.0 descriptions
 - Ready for consumption by today's enterprise application developers and integration with API management solutions
- Comprehensive tooling that enables API developers to create RESTful APIs from z/OS-based assets
- Supports standard JSON message format
- Integrated with IBM API Management for enterprise-class API management
 - Consumer registration, API security controls, and version control.



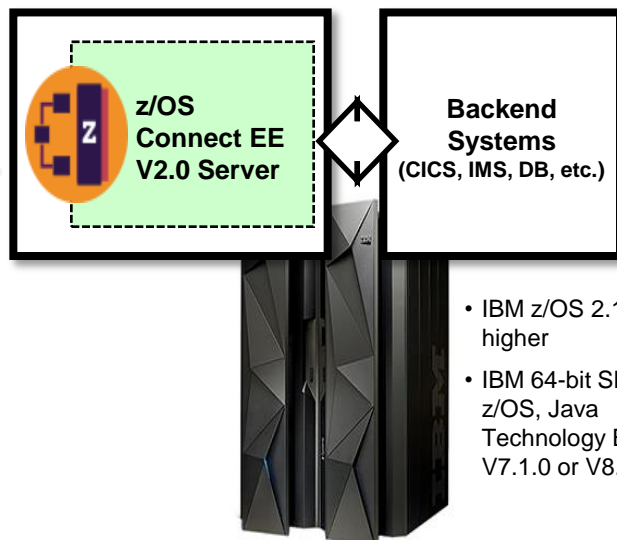
High-Level Overview of z/OS Connect EE V2.0

Runtime Server

- Runs on Liberty z/OS
- Hosts APIs you define to run in it
- Connects with backend system
- Liberty + z/OS Connect = “instance”
- You may have multiple instances

1

Liberty z/OS



Eclipse

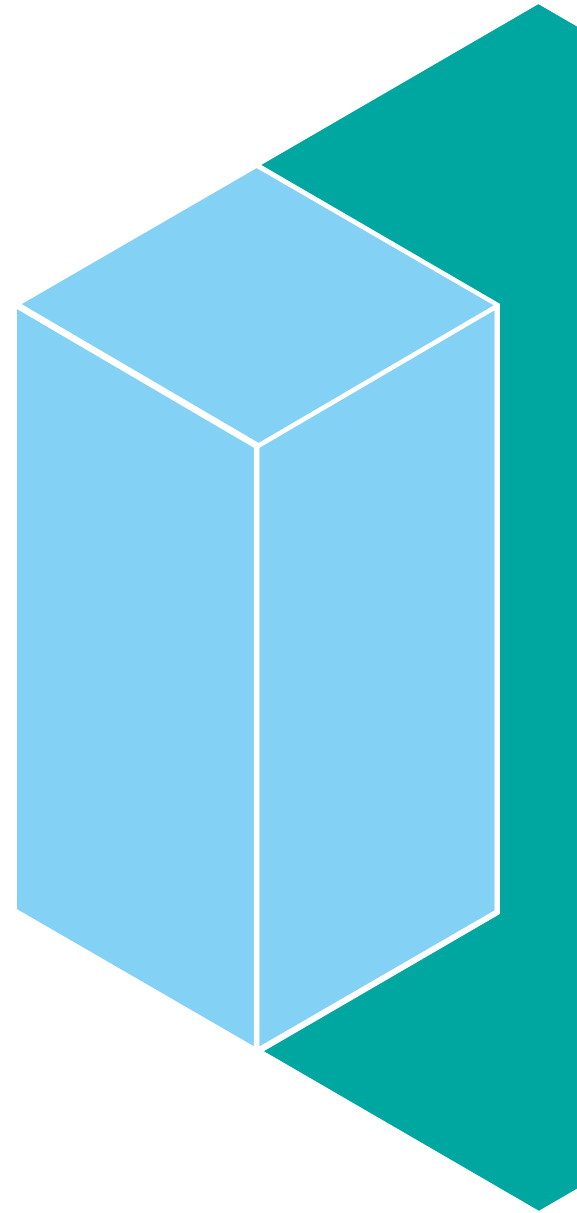


Tooling Platform

- Integrates with an Eclipse environment
- Define APIs
- Define data mapping
- Deploy APIs to runtime server
- Export API archive for other tools to deploy

2

API and REST Enablement of IMS Assets



IMS Mobile Feature Pack for z/OS Connect EE

- **Enable mobile and cloud clients to access IMS transactions as REST/JSON services**
 - Transform REST/JSON request to COBOL bytes and transform response back to JSON
 - No change to IMS applications
- **Tooling:**
 - IMS Explorer for Development to easily create RESTful services from existing IMS transactions
 - IBM zExplorer API Editor maps RESTful services as natural REST API
- **Runtime:**
 - Supports both z/OS Connect and z/OS Connect Enterprise Edition

Once published, services and APIs hosted by z/OS Connect EE can be discovered by mobile and cloud application developers

Develop a REST Service from an IMS Transaction with IMS Explorer for Development

- Select Input and Output messages in the navigation tree and import **selected fields**
- Specify a **service name** and **interaction properties**
- Specify **interface** by selecting or deselecting **check boxes** to add or remove fields from input and output messages. Default values can be provided

The screenshot displays the IMS Explorer for Development interface, showing the process of creating a REST service from an IMS transaction. The main window is titled "IMS Explorer Transaction Message Metadata Editor" and shows the transaction "IVTNOXX". The left pane shows the "IMS Gateway Navigator" with the "IMPOTxx" transaction selected. The right pane shows the "Input Messages" and "Output Messages" for the transaction. The "Input Messages" section shows "IVTNOXX - INPUT" with a "Segment 1" containing "Data Structures". The "Output Messages" section shows "IVTNOXX - OUTPUT".

Below the main window, there are two smaller windows. The left one is titled "Create an IMS Mobile Transaction Service" and shows the "Service name" as "IMPOTxx". The right one is titled "Create an IMS Mobile Transaction Service" and shows the "Input and Output Messages" table.

Input or Output Message	Include in Inte...	Default Field Value	Field Length	Data Type
Segment 1				
INPUT_MSG	<input checked="" type="checkbox"/>		59	STRUCT
IN_LL	<input type="checkbox"/>		2	SHORT
IN_ZZ	<input type="checkbox"/>		2	SHORT
IN_TRANCODE	<input checked="" type="checkbox"/>		10	CHAR
IN_COMMAND	<input checked="" type="checkbox"/>		8	CHAR
IN_LAST_NAME	<input checked="" type="checkbox"/>		10	CHAR
IN_FIRST_NAME	<input checked="" type="checkbox"/>		10	CHAR
IN_EXTENSION	<input checked="" type="checkbox"/>		10	CHAR
IN_ZIP_CODE	<input checked="" type="checkbox"/>		7	CHAR
IVTNO - OUTPUT				
Segment 1				
OUTPUT_AREA	<input checked="" type="checkbox"/>		93	STRUCT
OUT_LL	<input type="checkbox"/>		2	SHORT
OUT_ZZ	<input type="checkbox"/>		2	SHORT

IMS REST Services as APIs

Create API definitions using API editor to map to IMS REST services or other backends (CICS, etc.)

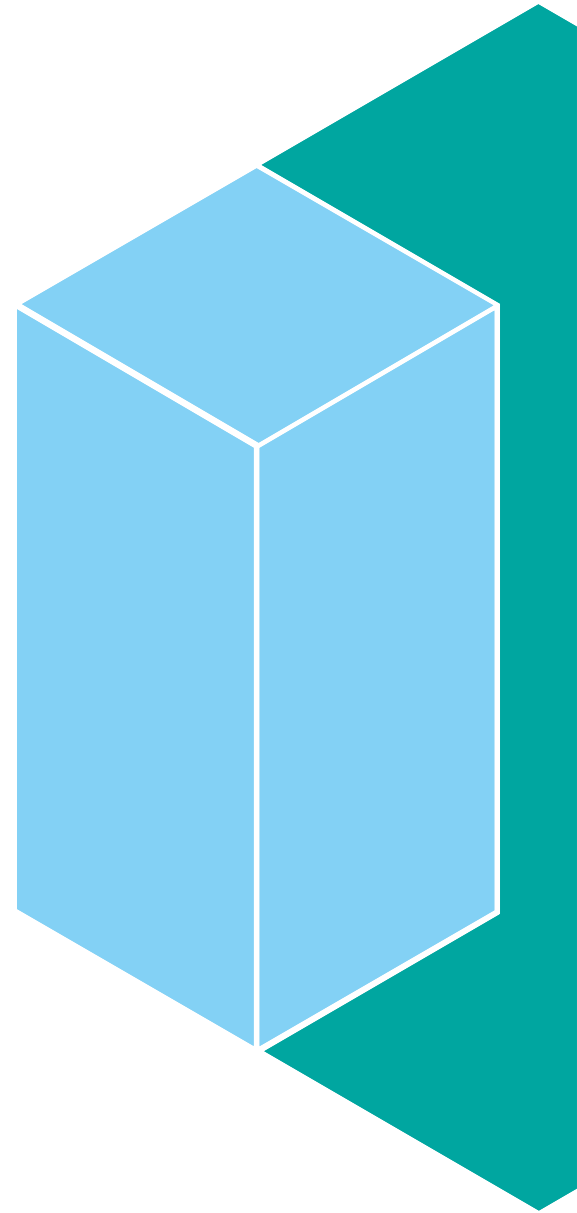
The screenshot shows the z/OS Connect API Editor interface. On the left, the Project Explorer displays a tree structure for a project named 'GoodHealth', with folders for 'api', 'api-docs', and 'services'. The 'api' folder is expanded, showing a 'patient' folder, which contains a '(patid)' folder and a 'GET' method. The 'GET' method is selected, and its associated files (mapping.xml, request.map, response.map) are listed. The main editor area shows the 'package.xml' file. The 'Describe your API' section includes a 'Description' field with the text 'CRUD api for patient details, medical threshold data.' The 'Path' field contains '/patient/{patid}?userId&zipcode'. The 'Methods' section lists four methods: POST, GET, PUT, and DELETE. The 'GET' method is selected, and its associated 'Service' and 'Mapping' buttons are visible. Three green callout boxes with black borders provide annotations: 1. 'Access query parameters from the URI' points to the 'userId' and 'zipcode' parameters in the path. 2. 'Assign API function based on HTTP verb' points to the 'GET' method button. 3. 'Provide data mapping definitions to the service' points to the 'Mapping...' button for the 'GET' method.

Access query parameters from the URI

Assign API function based on HTTP verb

Provide data mapping definitions to the service

REST Enablement DB2 Assets

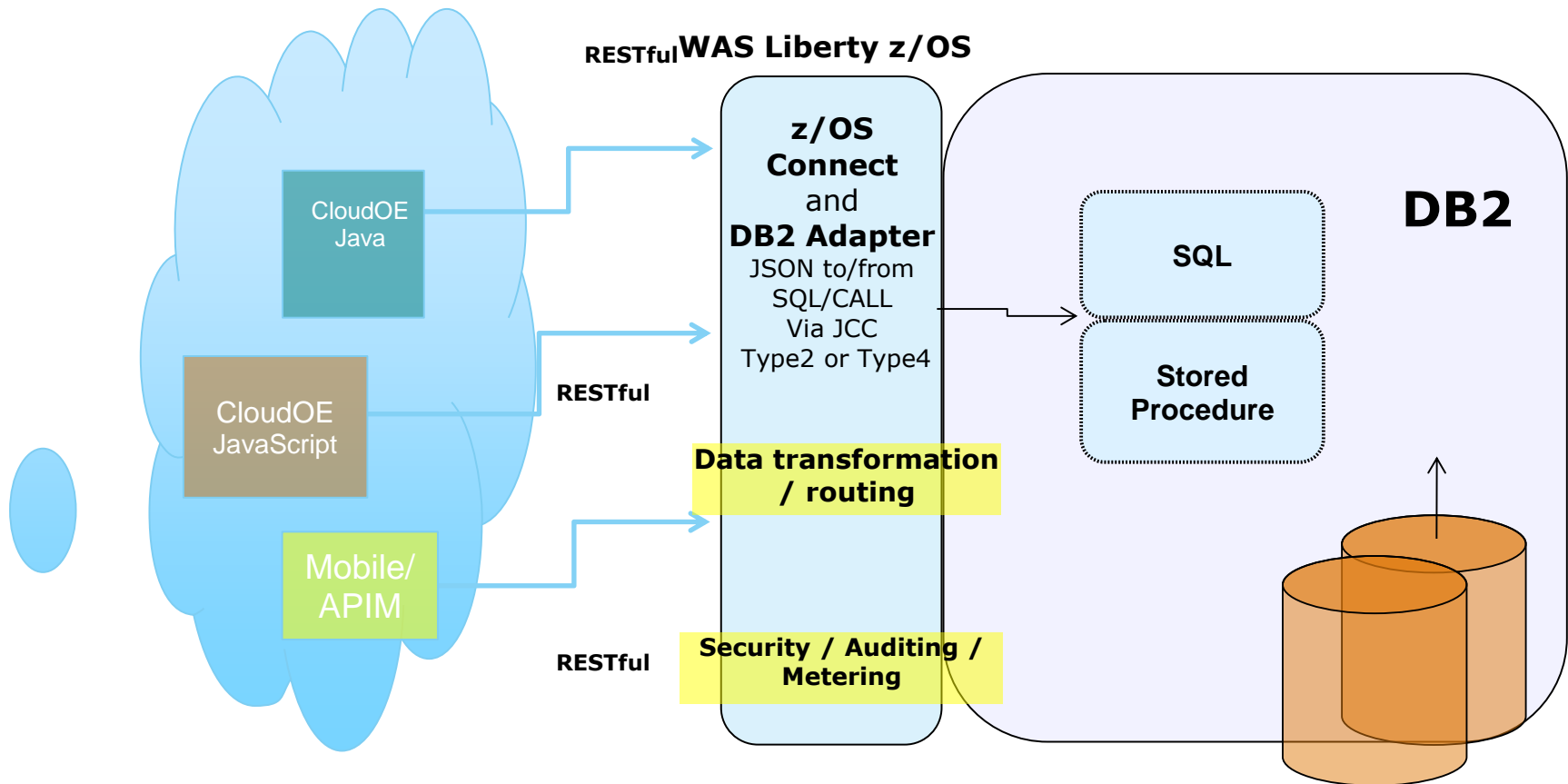


DB2 Adapter for z/OS Connect Overview

- **DB2 Adapter for z/OS Connect** is an integrated solution that enables developers to make existing DB2 assets – *SQL and Stored Procedures* – available in today's growing mobile and cloud application ecosystem via REST API
- **Consists of 3 components**
 - WLP with z/OS Connect license (Liberty 8.5.5.5 with APIM discovery)
 - DB2 Adapter for z/OS Connect V1
 - Data Studio Client 4.1.2
- **DB2 Adapter for z/OS Connect will ship via DB2 Accessories Suite for z/OS V3 R3 (12/15)**
 - SMP/E Install
 - Support DB2 10 for z/OS or later
 - Some WLP skill preferred for install and configuration
- Statement of direction: IBM intends to offer IBM DB2 for z/OS Version 11, or later, with support for the external interface delivered in z/OS Connect EE V2.0, and DB2 RESTful API support that is fully integrated into the DB2 for z/OS Distributed Data Facility

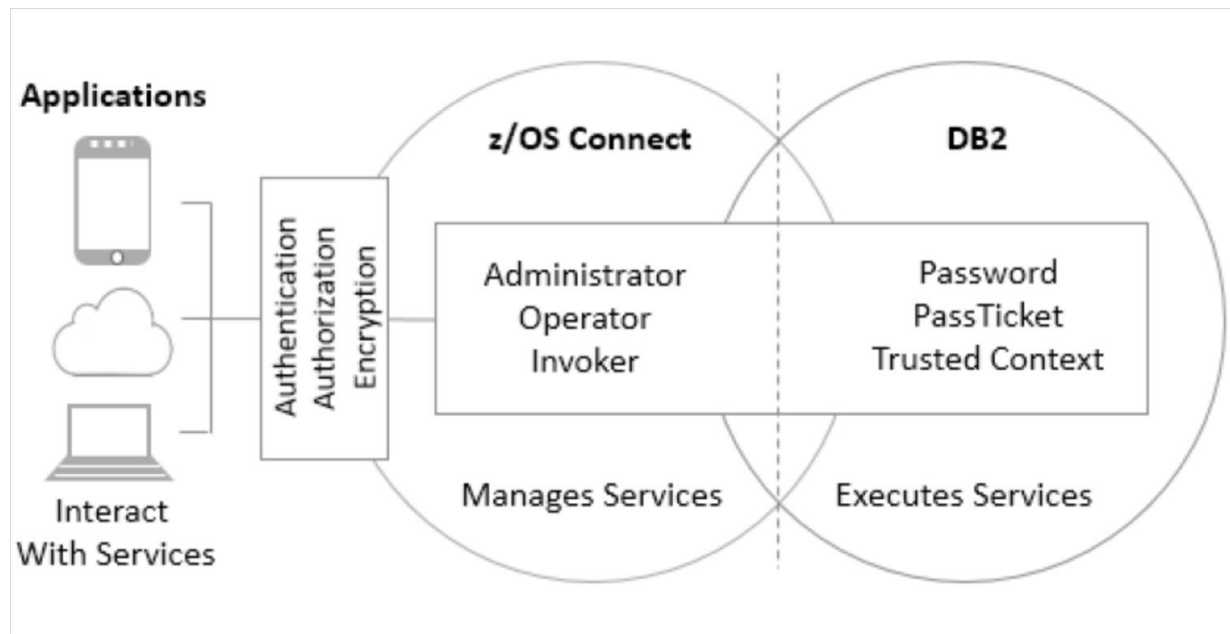
DB2 Adapter for z/OS Connect

- z/OS Connect address space is coupled with a single DB2 system
- REST API
- JSON request and response



Security of DB2 Adapter for z/OS Connect

- **Leverages the security strengths of DB2 and z/OS Connect**
- **DB2 Adapter service access control by z/OS Connect**
 - Administrator → query services, perform operational tasks on services and invoke them
 - Operator → perform tasks on services, but cannot invoke them
 - Invoker → invoke the services, but do not have authority over them

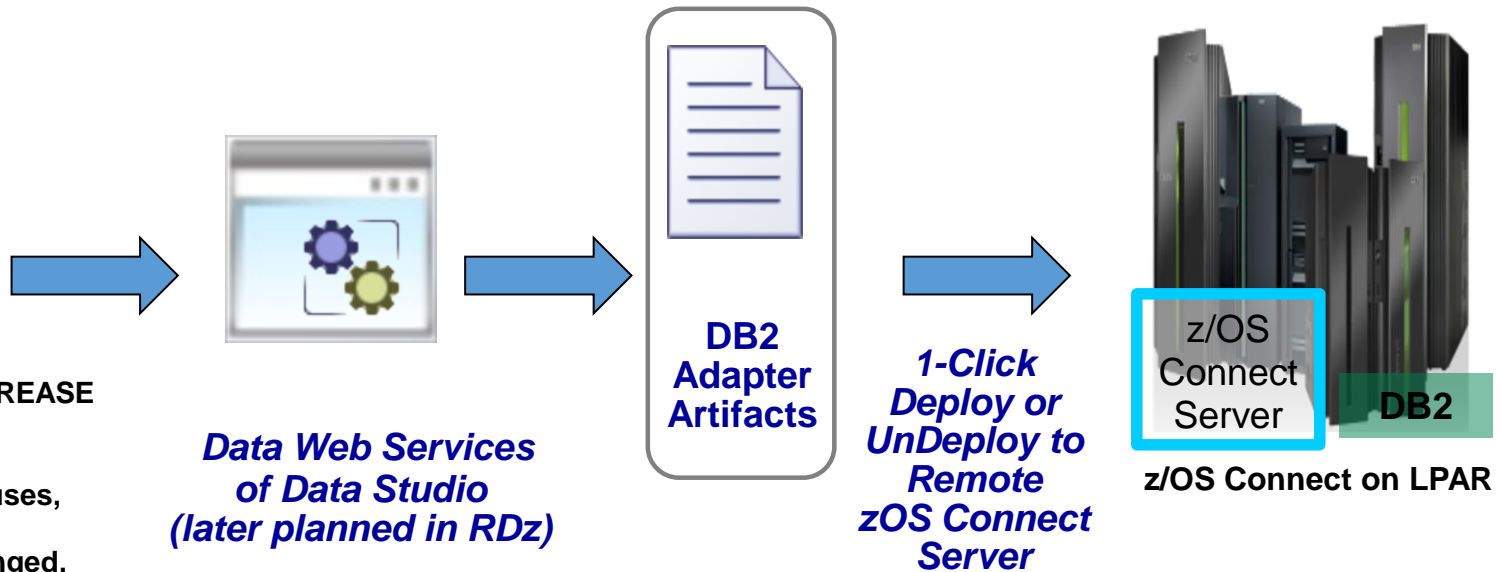


REST API - Develop a DB2 Adapter service with Data Studio Client

```
UPDATE MY.EMPLOYEE  
SET FIRSTNAME = :FIRSTNAME  
WHERE EMPNO = :EMPNO
```

```
SELECT *  
FROM MY.EMPLOYEE  
WHERE EMPNO = ?
```

```
CALL DEPTS.BONUS_INCREASE  
(:factor,  
:maxSumForDept,  
:deptsWithoutNewBonuses,  
:countDeptsViewed,  
:countDeptsBonusChanged,  
:errorMsg)
```



Database SQL Operations

Data Studio Client UI

New Connection

Connection Parameters

Select the database manager and a JDBC driver, and specify required connection parameters.

Connection identification

☒ Use default naming convention

Connection Name: STLEC1

Local Connection Cc

Select a database manager:

- Big SQL for InfoSphere BigIn
- DB2 for i
- DB2 for Linux, UNIX, and Windows
- DB2 for z/OS**
- Derby
- Generic JDBC
- HSQldb
- Informix
- MaxDB
- MySQL
- Oracle
- SQL Server
- Sybase

JDBC driver: IBM Data Server Driver for JDBC and SQLJ

Properties

General Tracing Optional

Location: STLEC1

Host: utec001.vmec.svl.ibm.com

Port number: 446

☐ Retrieve objects created by this user only

User name: user01

Password:

☒ Save password

Default schema: user01

Connection URL: jdbc:db2://utec001.vmec.svl.ibm.com:446/STLEC1:retrieveMessagesFromServerOnGetMessage=true;emulat

Test Connection

☒ z/OS Connect Server

< Back Next > Finish Cancel

1. Setup DataSource Connection and 2. z/OS Connect Server Connection

- Database Connection setup is same as before
- New check box to enable z/OS Connect Server
- New z/OS Connect Server Connection setup panel
- One way or two way SSL

New Connection

z/OS Connect Server Parameters

Specify required z/OS Connect server parameters.

☒ z/OS Connect Server

Properties

Port: 9443

☐ Use client certificate authentication

Certificate name: Browse...

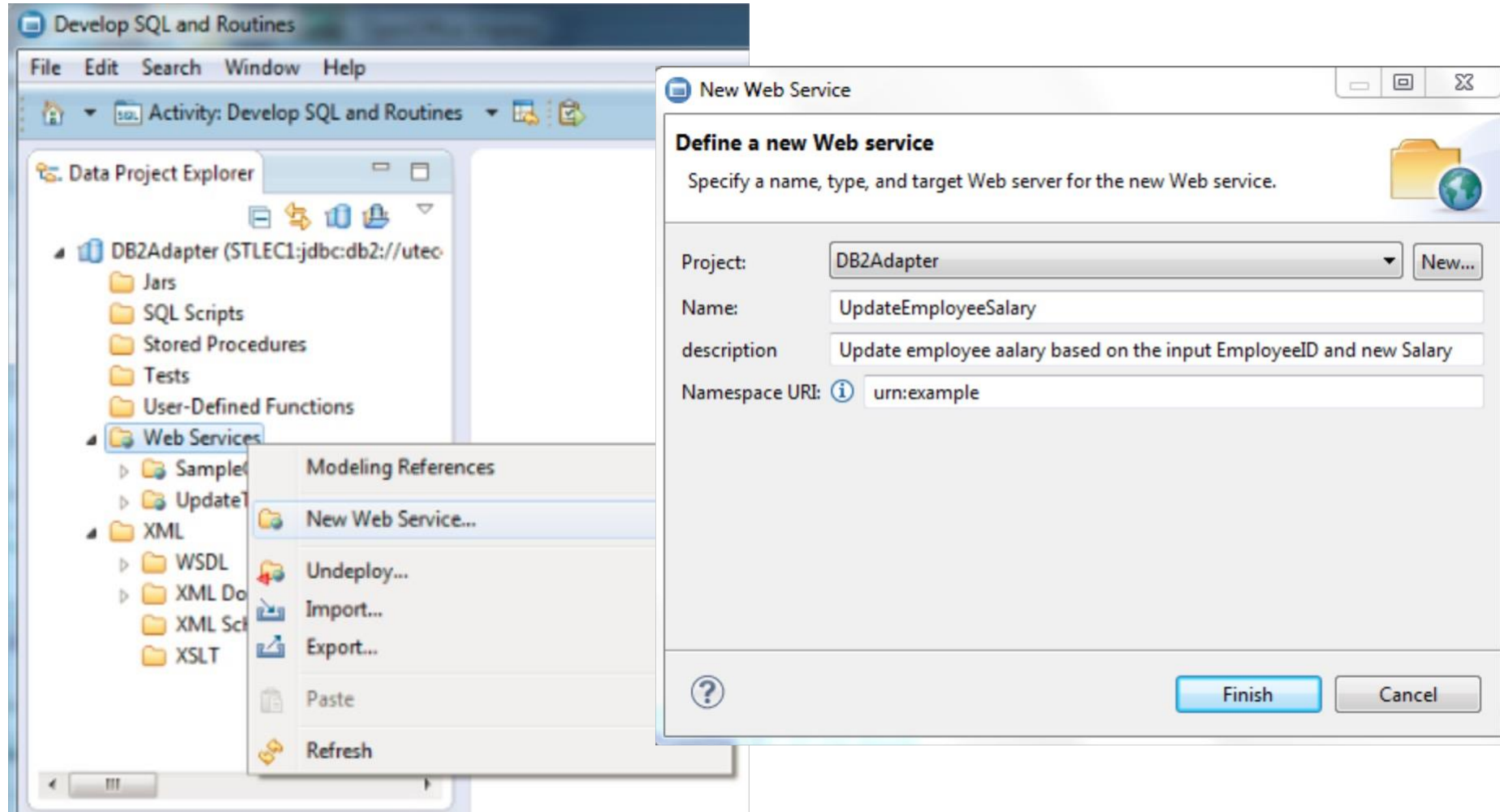
User name: admf001

Password:

< Back Next > Finish Cancel

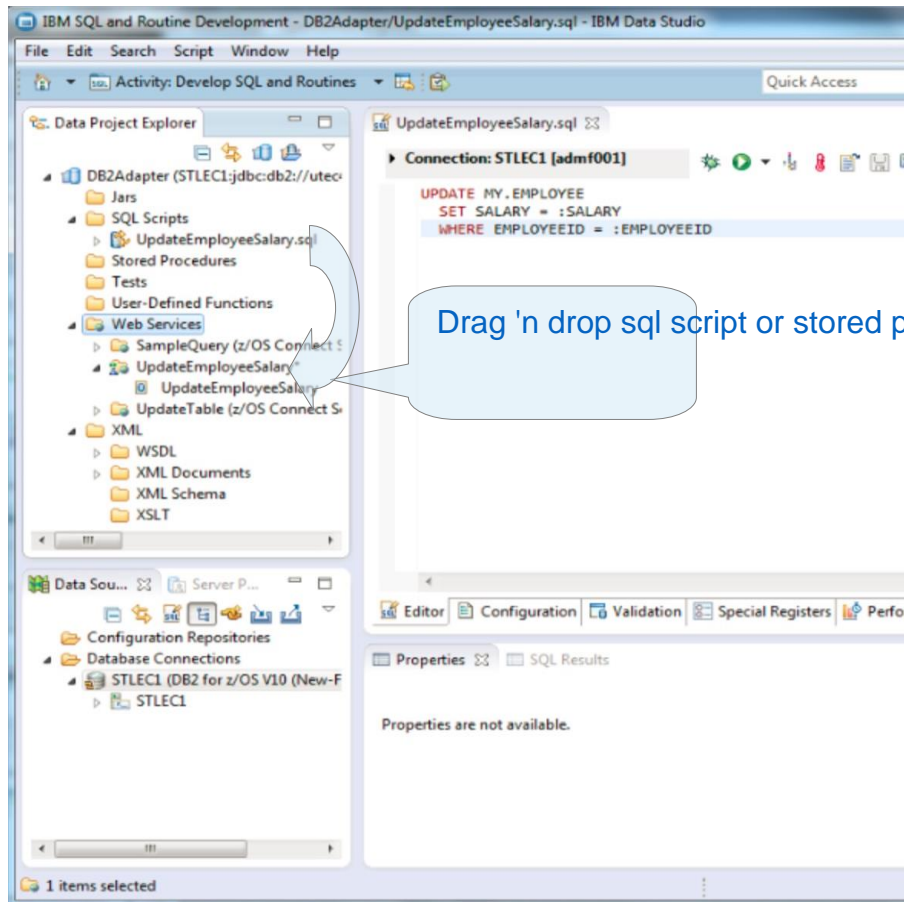
Data Studio Client UI (continued)

2. Create a new DB2 Adapter service by right click on the Web Services folder

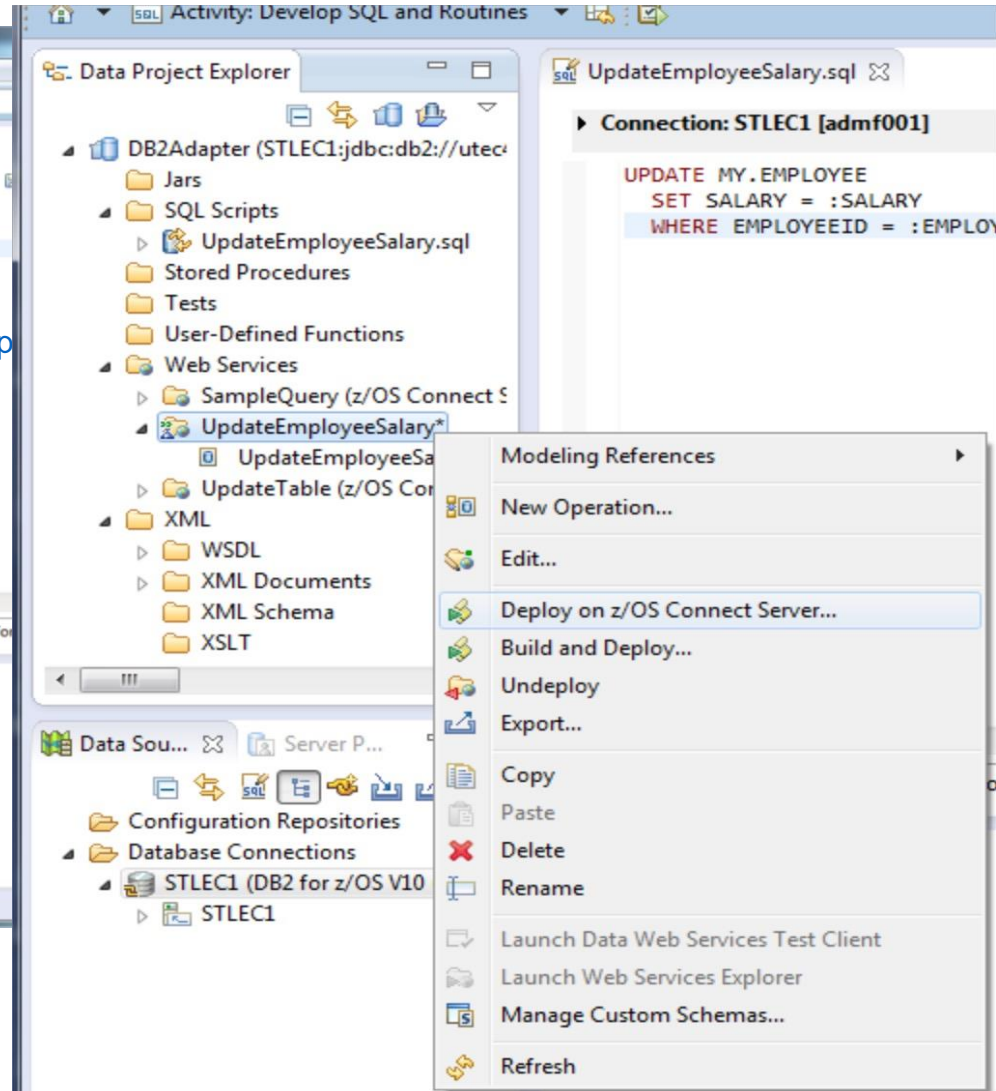


Data Studio Client UI (continued)

3. Drag 'n drop sql statement including call statement into the Web Service
4. Right click to Deploy or UnDeploy DB2 Adapter service in z/OS Connect Server



Service definition is dynamically deployed in z/OS Connect Server

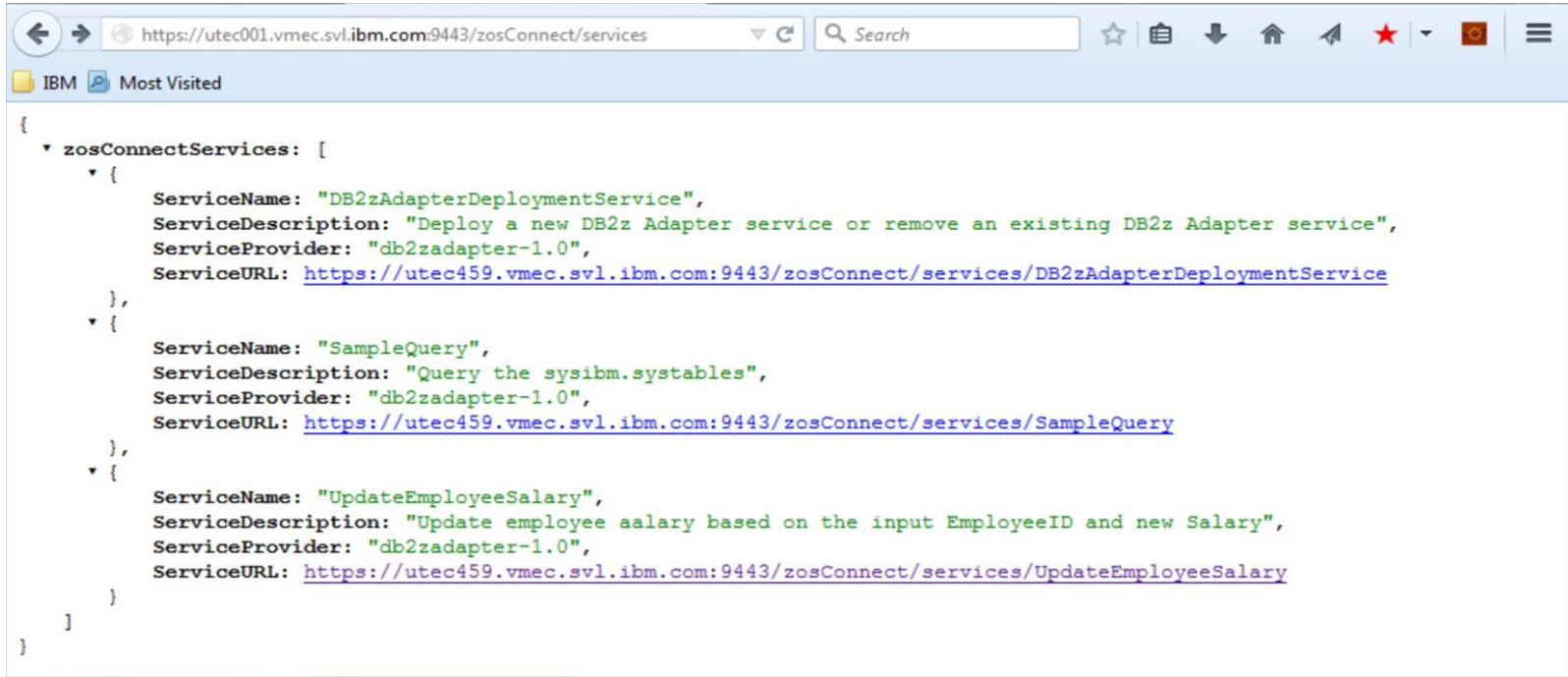


REST API

Working with DB2 Adapter services

Discovering available DB2 Adapter services

GET <https://<host>:<port>/zosConnect/services>



Retrieving the details of a DB2 Adapter service

GET https://<host>:<port>/zosConnect/services/<service_name>

•Service Name, Descritption, Provider, URLs, Status, Request Schema, and Response Schema

REST API

Working with DB2 Adapter services (continued)

Starting a DB2 Adapter service

POST `https://<host>:<port>/zosConnect/services/<service_name>?action=start`

Stopping a DB2 Adapter service

POST `https://<host>:<port>/zosConnect/services/<service_name>?action=stop`

Invoking a DB2 Adapter service

POST `https://<host>:<port>/zosConnect/services/<service_name>?action=invoke`

The screenshot shows the RESTClient interface in Firefox. The Method is set to POST and the URL is `https://utec001.vmec.svl.ibm.com:9443/zosConnect/services/UpdateEmployeeSalary?action=invoke`. The Body contains a JSON object: `{"SALARY": 98765.43, "EMPLOYEEID": 1234567}`. The Response section is expanded, showing the Response Body (Raw) as `{"UpdateCount":1,"StatusDescription":"Execution Successful","StatusCode":200}`.

Method	URL
POST	<code>https://utec001.vmec.svl.ibm.com:9443/zosConnect/services/UpdateEmployeeSalary?action=invoke</code>

Body

```
{ "SALARY": 98765.43,
  "EMPLOYEEID": 1234567 }
```

[+] Response

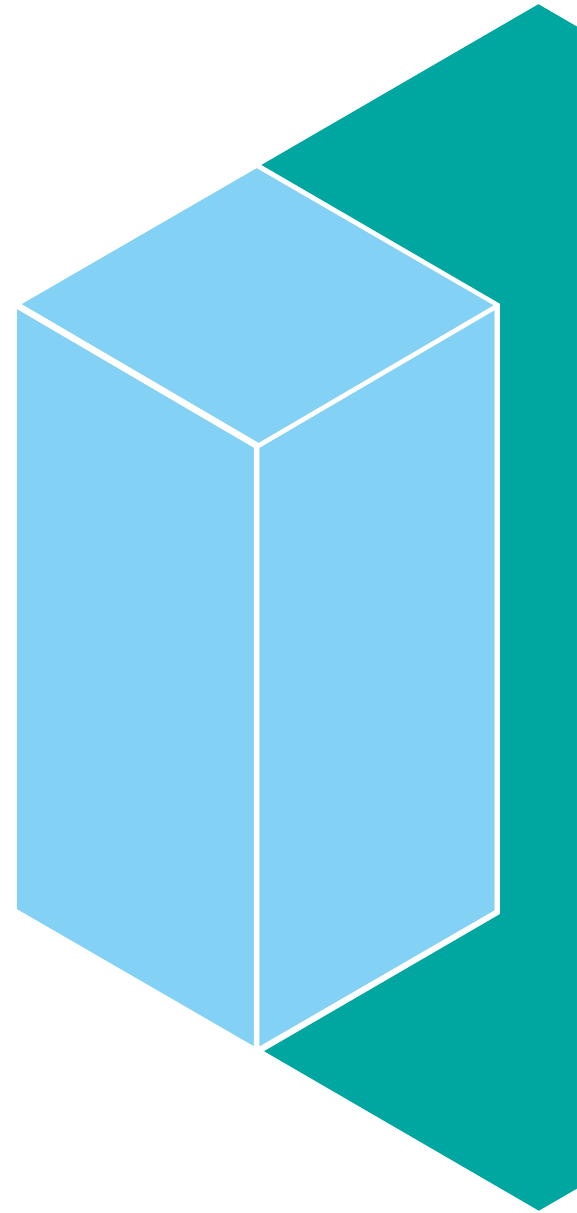
Response Headers Response Body (Raw) Response Body (Highlight) Response Body (Preview)

```
{ "UpdateCount":1, "StatusDescription":"Execution Successful", "StatusCode":200 }
```

Example using RESTClient on Firefox

API Management

Secure, scale, manage, monitor, and socialize APIs

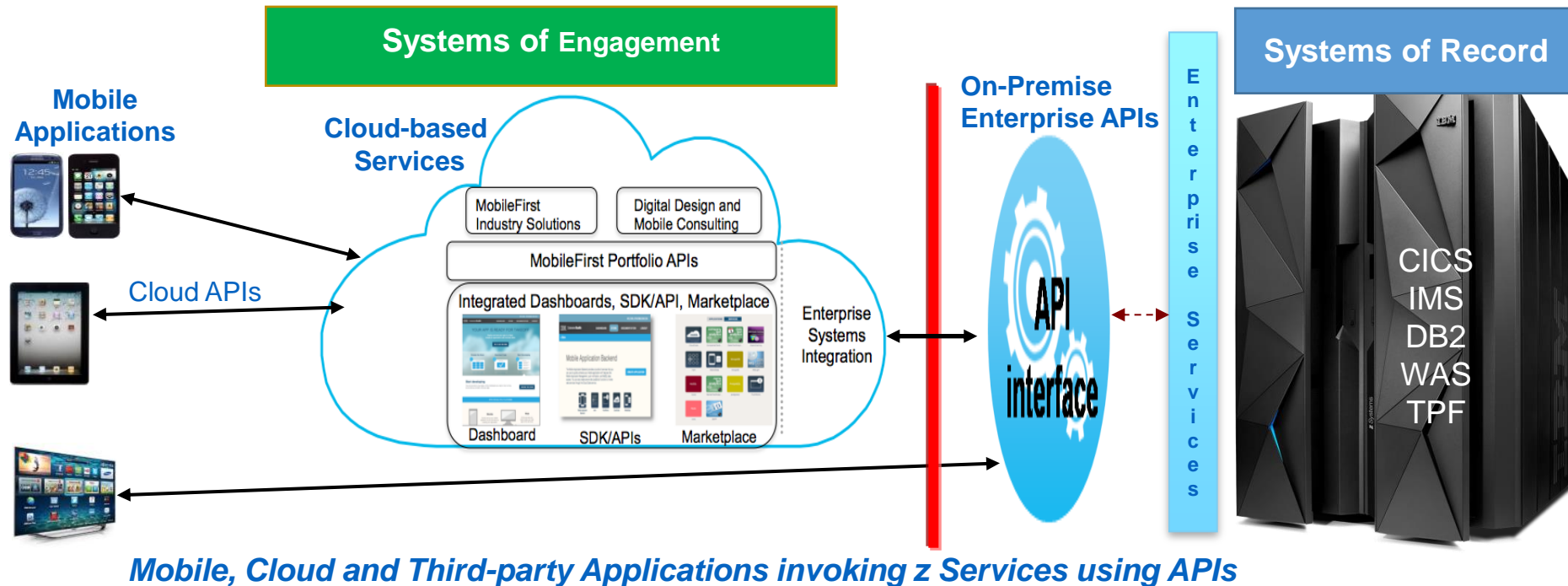


Why API Management for z?

- **APIs hosted on a zEE server are not “managed”, therefore an API management (APIm) solution should be used.**
- **IBM APIm enhances zEE APIs with the following capabilities:**
 - Secure and scale
 - manage access to APIs by using API keys and secret keys.
 - Manage and monitor
 - extract API usage and analytics data to quickly react to new opportunities.
 - Administration portal
 - self-registration, quotas, key management and security policies.
 - Developer portal
 - engage application developers and foster use of published APIs.
 - customize with branding to advertise, market, socialize and sell APIs.

Why API Management for z?

Business challenges addressed with APIM in exposing z based services/assets

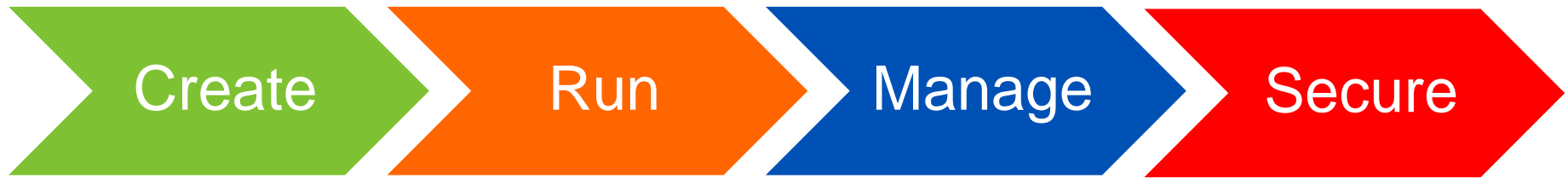


Enterprise APIs are the **building blocks** for new application development improving delivery of existing business services (e.g., with Mobile and Cloud apps) and/or reaching new customers through partners

- ❑ **Consumability via catalogs:** easy to browse and subscribe
- ❑ **Control and Insight** over accesses to existing z assets and SOA based Enterprise Services, including new **z/OS Connect** based REST services for access to various sub-systems

API Connect: Simplified & Comprehensive API foundation

to jumpstart your entry into the API Economy



Unified experience across API Lifecycle; not a collection of piece parts.

- Connect API to data sources
- Develop & Compose API
- Generate API consumer SDK

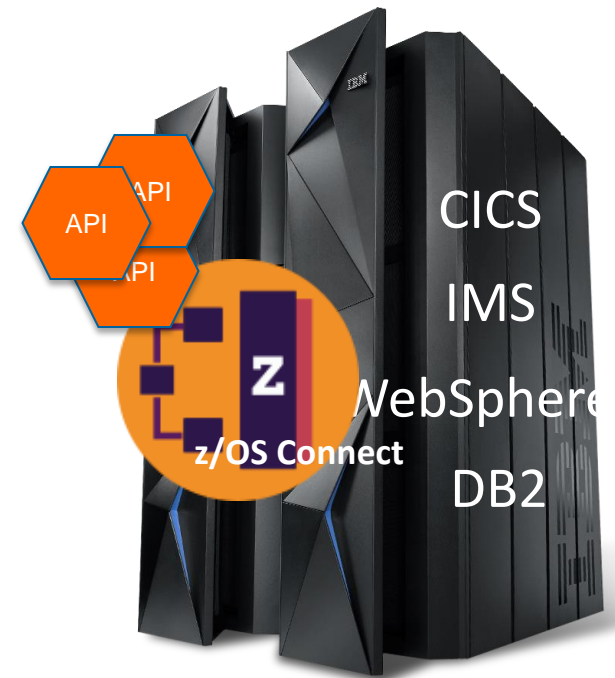
- Build, debug, deploy, Node.js microservice apps
- Build, debug, deploy Java microservice apps
- Node.js & Java common management & scaling
- Stage to cloud or on-prem catalog

- API Discovery
- API Policy Management
- Publish to Developer Portal
- Self-service Developer Portal
- Subscription Management
- Social Collaboration
- Community Management
- API Monitoring & Analytics
- Lifecycle Mgmt & Governance

- API Policy Enforcement
- Security & Control
- Connectivity & Scale
- Traffic control & mediation
- Workload optimization
- Monitoring/Analytics Collection

API Connect and z/OS Connect Enterprise Edition

- Create APIs and microservices that consume z Systems APIs
 - Manage and secure z System APIs created by z/OS Connect
 - *Intend to support: connect to and discover z/OS Connect APIs and generate LoopBack models (1Q 2016)*
-
- Comprehensive tooling that enables API developers to create RESTful APIs from z/OS-based assets
 - Delivers APIs as a discoverable resource using the OpenAPI specification (formerly swagger)
 - *Intend to support: push APIs directly to API Connect catalog (2Q 2016)*



What is Service Discovery?

Identifying an existing service for performing a specific intended business function, and getting detailed definition of the service

1. *Identifying:* Searching, browsing, understanding and eventually, selecting a service from a set of services

- Querying to retrieve a list of matching services
- Browsing information on retrieved services
- Getting additional details as necessary in understanding a service
- Selecting a service when a service is deemed a good match

2. *Getting detailed service definition:* Retrieving various details of a selected service

- Service schema and description (e.g., WSDL or JSON) for API definition
- Getting additional technical details for API assembly including details on runtime invocation and security protocols

zAPI and Service Discovery with API management

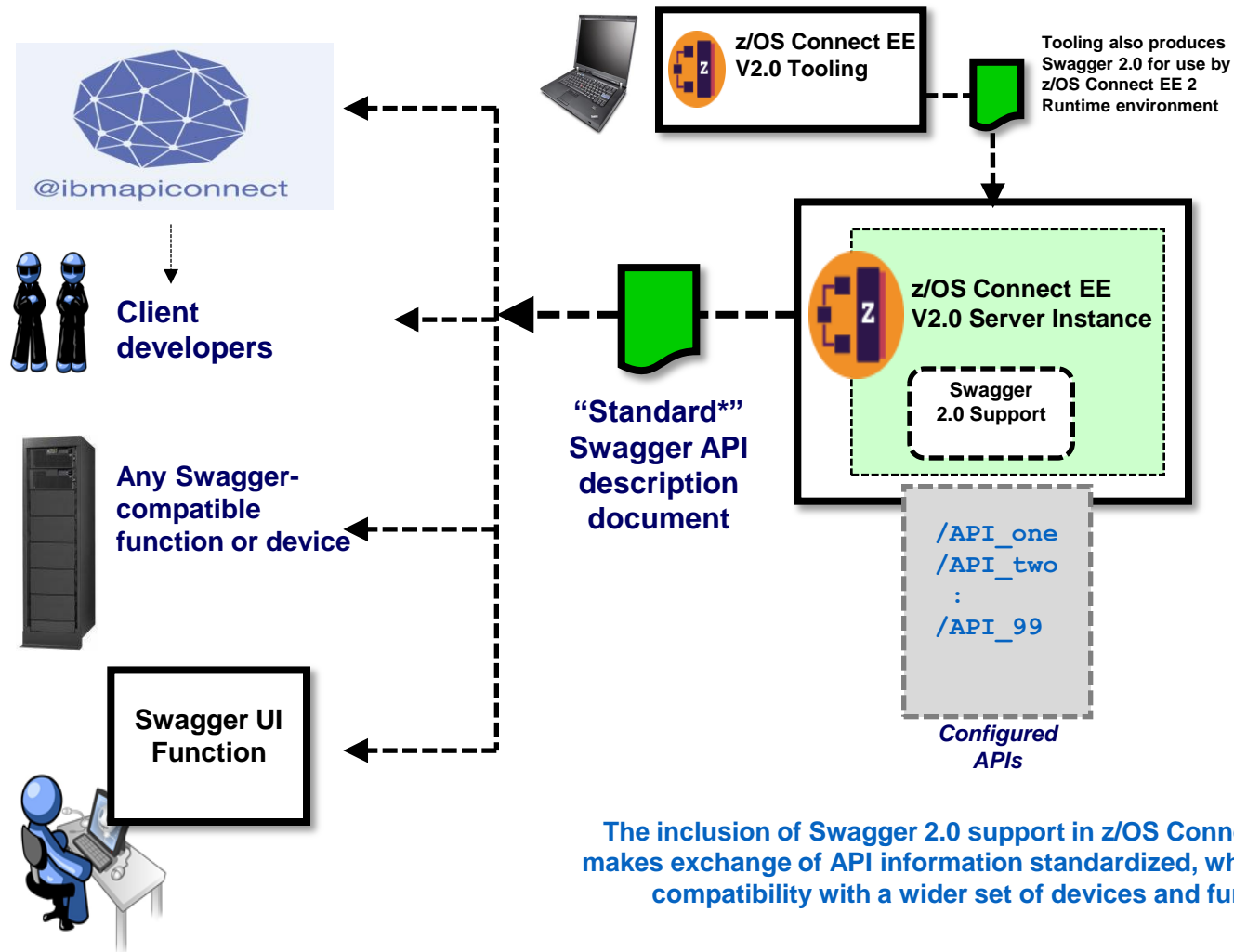
1

zAPI Discovery with Swagger

2

zService Discovery with Registry

zAPI Discovery with Swagger



* An emerging accepted industry standard, but not an official open standard



Dashboard - IBM Bluemix x API Manager x +

https://apim.ibmcloud.com/apimanager/?org=556ccdf00cf2b1386a11d212®ion=us-southi Search

IBM Most Visited

IBM Bluemix DASHBOARD SOLUTIONS CATALOG PRICING DOCS COMMUNITY Region:

/apimanagement cipresso@us.ibm.com (dev) ?

Add API From Swagger Definition

Load a Swagger File Find in a Registry

Upload File
No file selected
Select a File

Load from URL
https://zserveros.demos.ibm.com:33622/contacts/api-docs
dds3716
Load

Provide the location of the Swagger definition on the zEE server.

Add Cancel

Dashboard - IBM Bluemix x API Manager x +

https://apim.ibmcloud.com/apimanager/?org=556ccdf00cf2b1386a11d212®ion=us-southi Search

IBM Most Visited

IBM Bluemix DASHBOARD SOLUTIONS CATALOG PRICING DOCS COMMUNITY Region:

Load a Swagger File Find in a Registry

Upload File
No file selected
Select a File

Load from URL
https://zserveros.demos.ibm.com:33622/contacts/api-docs
dds3716
Load

API Title (Revision)	Base Path	Description
contacts (1)	/contacts	This is an API for managing contacts.

Operations

Method ▲	Path	Description
PUT	/work/{lastname}?firstname&extension&zipcode	
GET	/work/{lastname}	

The Swagger definition is parsed and shown for confirmation.

Add Cancel

Dashboard - IBM Bluemix x API Manager x +

https://apim.ibmcloud.com/apimanager/?org=556ccdf00cf2b1386a11d212®ion=us-southi Search

IBM Most Visited

IBM Bluemix DASHBOARD SOLUTIONS CATALOG PRICING DOCS COMMUNITY Region:

APIs

1 API + API

Find

contacts

REST +

Title	Version	Last Modified	Actions
contacts This is an API for managing contacts.	1.0.0 (revision 1)	a few seconds ago	

The zEE API is now imported into APIm and can be managed.

Categories

All None

☒ Favorite

☒ No category

https://apim.ibmcloud.com/apimanager/?org=556ccdf00cf2b1386a11d212®ion=us-south&spaceId=...&authUrl=https://mccp.ng.bluemix.net/login#/author/apis/56b30c370cf2406417263fc7/revision/1

zService Discovery with Registry

1. Define custom registries in APIM for discovering z based services

- For Web Services define IMS SOAP GW, and/or CICS Discovery Agent
- For REST services define z/OS Connect instance

2. Search a custom registry from APIM while defining a new API

- Search for a keyword matching service name or description
- Full list is returned if no keyword is entered

3. Select a service definition to import

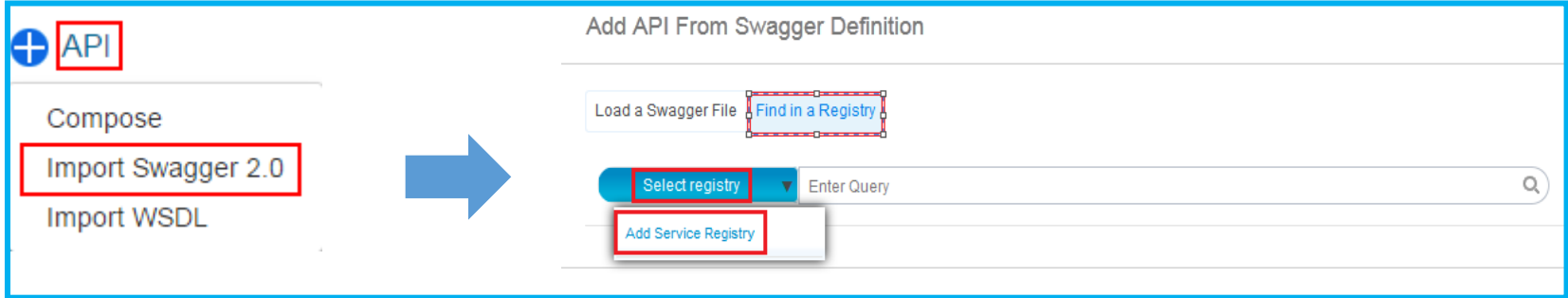
- Select a service to import its definition
- Continue defining APIs with the imported Resource or Web service operation definition

4. Define an API with imported service definition

- Continue defining APIs with the imported Resource or Web service operation definition

Step 1: Define Service Registry in APIM: REST or SOAP

Importing from a registry or Defining a new registry



API

Compose

Import Swagger 2.0

Import WSDL

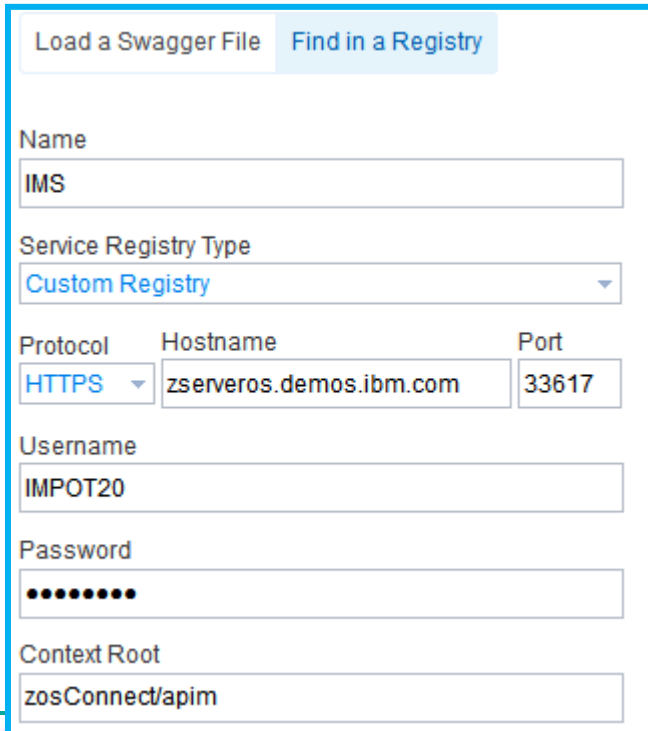
Add API From Swagger Definition

Load a Swagger File Find in a Registry

Select registry Enter Query

Add Service Registry

Defining a new custom registry in APIM for REST Services



Load a Swagger File Find in a Registry

Name

IMS

Service Registry Type

Custom Registry

Protocol Hostname Port

HTTPS zserveros.demos.ibm.com 33617

Username

IMPOT20

Password

Context Root

zosConnect/apim

- Add IMS Mobile z/OS Connect server as a custom registry in APIM
- Specify host, port and the context root of the service registry
- Test and save connection

Steps 2 and 3: Discover, Search and Add API for z System Services

The screenshot shows a web interface titled "Add API From Swagger Definition". It has two buttons at the top: "Load a Swagger File" and "Find in a Registry". Below these is a search bar with a dropdown menu. The dropdown is open, showing "IMS" selected and "IMSPhone" highlighted. A red circle highlights the search bar, and a blue callout box points to it with the text "2a. Specify text to search for specific service or leave blank for all services". To the right of the search bar is a magnifying glass icon, also circled in red, with a blue callout box pointing to it that says "Click icon to Search". Below the search bar, it says "1 results found". A table lists the results with columns "API Name (Version)", "Path", and "Description". The first row is "IMSPhoneBook", "IMSPhoneBook", and "IMS Phone Book Service". A red box highlights the "IMSPhoneBook" text, with a blue callout box pointing to it that says "2c. Select the desired service to create API". At the bottom right of the table are "Add" and "Cancel" buttons. A blue callout box points to the table with the text "2b. A list of service containing the search text 'IMS' is returned".

2a. Specify text to search for specific service or leave blank for all services

Click icon to Search

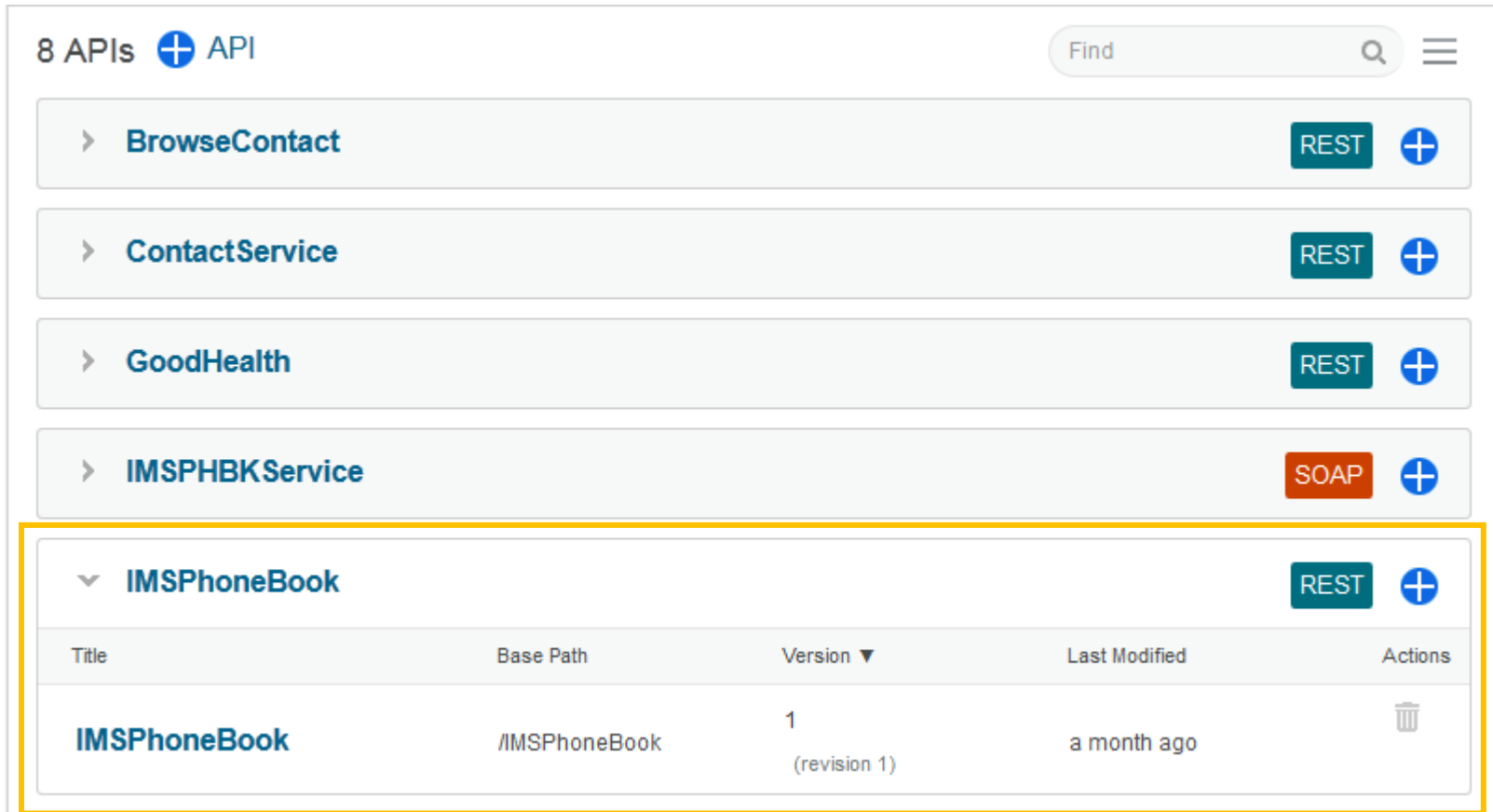
2c. Select the desired service to create API


2b. A list of service containing the search text "IMS" is returned



API Name (Version)	Path	Description
IMSPhoneBook	IMSPhoneBook	IMS Phone Book Service






- With the IMS Mobile z/OS Connect server registry selected, discover services by clicking the search icon
- You can specify a text string to search for specific service. Or leave the search field blank to retrieve all services.
- Once the list of matching services returned, select check box for the desired service to create API.


Step 4: API for z Service is created



8 APIs  API

Find  

- > BrowseContact REST 
- > ContactService REST 
- > GoodHealth REST 
- > IMSPHBKService SOAP 
- ▼ IMSPhoneBook REST 

Title	Base Path	Version ▼	Last Modified	Actions
IMSPhoneBook	/IMSPhoneBook	1 (revision 1)	a month ago	

- A new API is created for the IMS REST service and added to the list of APIs managed by APIM
- APIs can be published and make visible publicly for internal or external users

z/OS Connect Resources

- **Product Page**

- <http://www.ibm.com/software/products/en/zos-connect-enterprise-edition>

- **Product Documentation**

- ibm.biz/zosconnect20_kc

- **White paper and Getting Started Guide**

- <https://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP102604>

- **IMS Mobile Feature Pack**

- <http://www.ibm.com/software/products/en/ims-mobile-solution>
 - http://www.ibm.com/support/knowledgecenter/SS9NWR_3.2.0/com.ibm.ims.mobilezc32.doc/mobilezc_intro.htm

- **DB2 Adapter for z/OS Connect**

- http://www.ibm.com/support/knowledgecenter/SSEPEK_10.0.0/com.ibm.db2z.doc.adapter/src/adapter/dasz_adapter.dita

API Management Resources

- **Product Page**
 - ibm.com/apimanagement
- **API developer community**
 - developer.ibm.com/api
- **Follow us on Twitter**
 - @ibmapimgt
- **YouTube Channel**
 - youtube.com/ibmapimanagement



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