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# Oracle RESTful Services

## A Primer for Database Administrators

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# Agenda

- 1 Introduction to REST
- 2 Using REST with Oracle Database Cloud Services
- 3 Writing RESTful services
- 4 Oracle REST Data Services and SODA
- 5 Summary and Q&A

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# What is REST ?

- REST is an architectural style
- Lightweight and Stateless
- REST is built on ubiquitous technologies
- REST is easy to learn and easy to use
- Focused on Resources and Collections of Resources
  - GET /rest/schema <- lists all collections in a schema
  - GET /rest/schema/collection <- get all objects in a collection
  - GET /rest/schema/collection/id <- get a specific object in a collection
  - PUT /rest/schema/collection/id <- update object with Id
  - POST /rest/schema/collection <- insert object into collection

Accessing over http(s) != REST ; RPC != REST

# Adoption

- Uses HTTP(s)
- MIME-type Standards
- Internet / Firewall “friendly”
- Developer Frameworks
- Fast, lite-weight



# REST is Everywhere

## REST APIs have become the norm

- Over a long period of time the industry has converged on HTTPS based REST APIs:
  - CORBA, RMI, XML-RPC, SOAP, all strongly protocols, have given way to loosely defined REST APIs, principally using HTTPS & JSON.
- REST is easy to learn and easy to use
  - Small uniform set of operations: GET, POST, PUT, DELETE
  - Small set of uniform status codes
  - URLs and hyperlinks encourage stateless behaviour
  - Text based protocols with simple request/response model, easy to introspect and understand
- Like HTTP, TCP & UNIX, REST has become a foundation of the computing world



# What is REST?



“**Representational State Transfer** is the software architectural style of the World Wide Web.”

Roy T. Fielding

Or put another way...

REST is an architectural style to defining, publishing and consuming APIs and services on the internet using HTTP.

# REpresentational State Transfer (REST)

## The Architectural Style of the Web

- Model resources, not actions:
  - GET /ords/hr/employees/ ...GOOD
  - GET /ords/hr/GetAllEmployees/ ...BAD
  - **Use nouns, not verbs**
- Uniform operations on all resources:
  - GET, POST, PUT, DELETE, OPTIONS, HEAD
  - Many nouns, just a few uniform verbs
- Stateless requests, state transitions communicated via hyper-links.
  - IT'S ALL ABOUT THE HYPER-LINKS

# REST Model: Hypertext Transfer Protocol

Request:

**GET** /webapp/rest/collection/element HTTP/1.1

URI: Folder / File

User-Agent: Method:

Host: POST, GET, PUT, DELETE, ...

**Accept: application/json**

Mime-Type:  
Requested data format

Response:

HTTP/1.1 **200 OK**

Server  
response code

Date: ...

Transfer-Encoding: ...

Content-Type: **application/json**

Mime-Type:  
Actual data format

# REST Operations

Method:

- C** POST
- R** GET
- U** PUT
- D** DELETE
- HEAD
- OPTIONS

Purpose:

- Anything, Normally Create resource
- Retrieve resource
- Create or Replace resource
- Delete resource
- Retrieve Metadata
- Methods supported by resource

Database Operation:

- INSERT
- SELECT
- MERGE, UPDATE
- DELETE
- SELECT
- N/A

Classification:

- Unsafe
- Safe, Idempotent
- Idempotent
- Idempotent
- Safe, Idempotent
- Safe, Idempotent

# REST Status Codes

Code	Name	Description	Methods
200	Ok	Successful request	GET
201	Created	Request fulfilled, resource created	POST
204	No Content	Success, but not returning any content	GET, PUT, DELETE
400	Bad Request	Request cannot be processed by the server due to incorrect data	POST, PUT
401	Unauthorized	Authentication has failed May also be used for authorization	(ALL)
403	Forbidden	The invoker is not authorized to invoke the operation	POST
404	Not Found	The object referenced by the path does not exist	GET, PUT, DELETE
500	Internal Server Error	A generic error message	(ALL)
503	Service Unavailable	The server is currently unavailable	(ALL)

More information is available at:

[https://docs.oracle.com/cloud/latest/messcs\\_common/CSMES/GUID-AAB1EE32-BE4A-4ACC-BEAC-ABA85EB41919.htm#CSMES3259](https://docs.oracle.com/cloud/latest/messcs_common/CSMES/GUID-AAB1EE32-BE4A-4ACC-BEAC-ABA85EB41919.htm#CSMES3259)

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# Database Cloud Services - REST Endpoints

Task	Method	Path
Create a Service Instance	<b>POST</b>	/paas/service/dbcs/api/v1.1/instances/{identityDomainId}
Delete a Service Instance	<b>DELETE</b>	/paas/service/dbcs/api/v1.1/instances/{identityDomainId}/{serviceId}
Scale a Service Instance	<b>PUT</b>	/paas/service/dbcs/api/v1.1/instances/{identityDomainId}/{serviceId}
Stop, Start or Restart a Service Instance or Compute Node	<b>POST</b>	/paas/service/dbcs/api/v1.1/instances/{identityDomainId}/{serviceId}
View a Service Instance	<b>GET</b>	/paas/service/dbcs/api/v1.1/instances/{identityDomainId}/{serviceId}
View a Service Instance's Compute Nodes	<b>GET</b>	/paas/service/dbcs/api/v1.1/instances/{identityDomainId}/{serviceId}/servers
View All Service Instances	<b>GET</b>	/paas/service/dbcs/api/v1.1/instances/{identityDomainId}
View the Job Status of an Operation	<b>GET</b>	/paas/service/dbcs/api/v1.1/instances/{identityDomainId}/status/{requestName}/job/{jobId}

Source: <https://apicatalog.oraclecloud.com/ui/views/apicollection/oracle-public/database/1.1/serviceinstances>

# Database Cloud Service REST Endpoint

SSO Enabled dblab80245 (traditional) seanstacey ▾

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**Service Details: Oracle Database Cloud Service** [Open Service Console](#)

**Overview**

- Billing Metrics
- Monitoring Metrics
- Documents

**Additional Information**

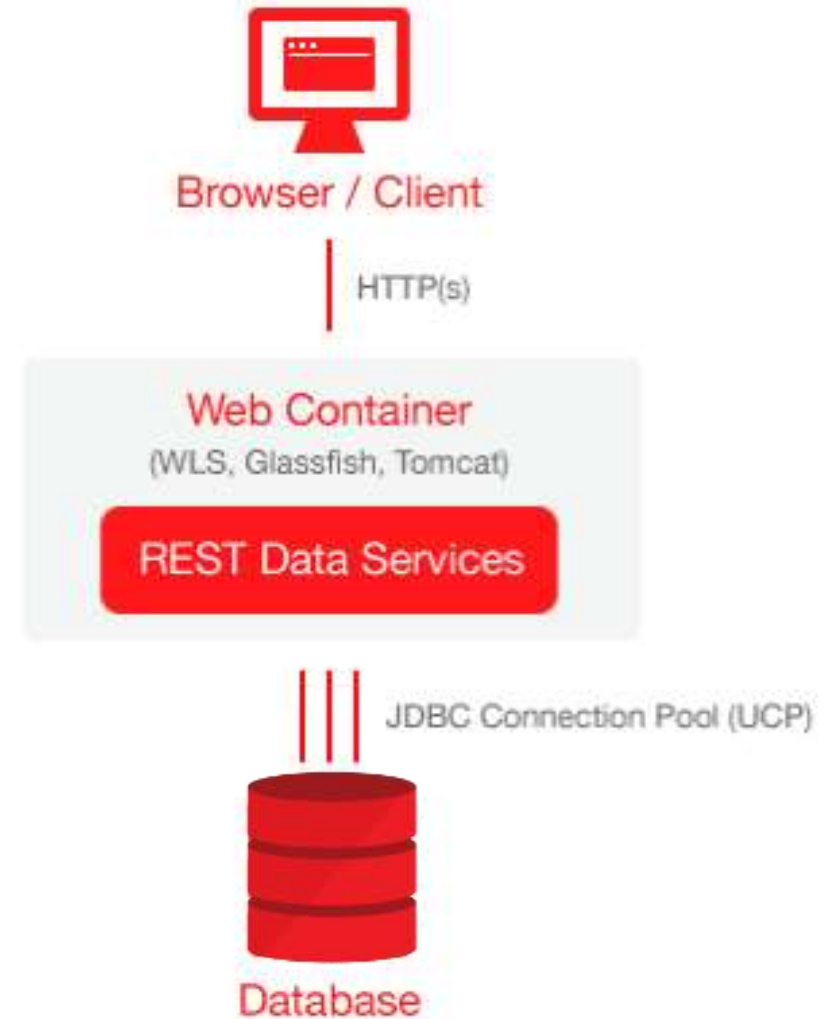
<b>Plan:</b> Oracle Database Cloud Service	<b>Data Region:</b> US Commercial 2
<b>Service Start Date:</b> 14-Mar-2017	<b>Identity Domain Name:</b> dblab80245
<b>Service End Date:</b> 9-Mar-2018	<b>Identity Domain Id:</b> dblab80245
<b>Subscription ID:</b> 567297602	<b>Status:</b> Active
<b>Service Instance ID:</b> 567298460	<b>Domain SFTP Host &amp; Port:</b> sftp.us2.cloud.oracle.com:22
<b>Customer Account:</b> Oracle (US)	<b>Domain SFTP User Name:</b> <a href="#">dblab80245</a>
<b>CSI Number:</b> Not available	<b>REST Endpoint:</b> <a href="https://dbaas.oraclecloud.co">https://dbaas.oraclecloud.co</a>



# Oracle Database Cloud Service

## Oracle REST Data Services

- Included and automatically installed in Cloud with Glassfish web server
- Turns Database Service into an REST API service
- Fully provisioned and functional in all cloud editions
- Available in both 11g and 12c, no extra cost
- Allows publishing of URI based access to Oracle database over REST
- Results in JSON or CSV
- Mapping of URI to SQL or PL/SQL
- All HTML methods GET, PUT, POST, DELETE, PATCH
- Oauth2 integration
- Highly scalable, can use all feature of database



# Oracle REST Data Services

## ORDS powers the Schema Service, A Quick Detour

- Provides data access consistent with modern App Dev frameworks
  - Mid tier application
  - Can map standard http(s) RESTful gets and posts to SQL
  - Can declaratively returns results in JSON format
  - JavaScript friendly
  - Can support high numbers of end users
- Services
  - HTTP(s) relational data access
  - Oracle JSON collection based schema-less access
  - Oracle NoSQL access over HTTP
  - Oracle APEX mid-tier, web toolkit applications, mod\_plsql replacement
- Formally known as Oracle APEX Listener
- Supported feature of the Oracle Database since 2010
- Ships with Oracle Database 12.1.0.2



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# REST: Search

```
curl --include GET --user dba@acme.com:Pa55_word --header "X-ID-TENANT-NAME:acme999" \  
https://dbaas.oraclecloud.com/paas/service/dbcs/api/v1.1/instances/acme999
```

HTTP/1.1 200 OK

Server: Oracle-Application-Server-11g

Strict-Transport-Security: max-age=31536000; includeSubDomains

Content-Language: en

Content-Type: application/json

Vary: user-agent

Date: Mon, 20 Nov 2017 14:38:55 GMT

Content-Length: 1120

Connection: keep-alive

```
{  
  "uri": "https://dbaas.oraclecloud.com:443/paas/service/dbcs/api/v1.1/instances/acme999",  
  "service_type": "dbaas",  
  "implementation_version": "1.0",  
  "services": [  
    {"service_name": "My_Database",  
     "version": "12.2.0.1",  
     "status": "Running",  
     "description": "Demo database service instance",  
     "identity_domain": "acme999",  
     "creation_time": "Mon Feb 22 11:59:29 UTC 2016",  
     "last_modified_time": "Mon Feb 22 11:59:29 UTC 2016",  
     "created_by": "dba@acme.com",  
     "sm_plugin_version": "17.3.5-539",  
     "tools_version": "17.3.5-539",  
     "service_uri": "https://dbaas.oraclecloud.com:443/paas/service/dbcs/api/v1.1/instances/acme999/My_Database",  
     "database_id": "0"  
    }  
  ],  
  "subscriptions": [ ]  
}
```

# REST: Create Database

```
curl --include --request POST --user dba@acme.com:Pa55_word --header "X-ID-TENANT-NAME:acme999" \  
--header "Content-Type:application/json" --data @create_my_database.json \  
https://dbaas.oraclecloud.com/paas/service/dbcs/api/v1.1/instances/acme999
```

create\_my\_database.json :

```
{  
  "serviceName": "My-DB",  
  "version": "12.2.0.1",    "level": "PAAS",    "edition": "EE",  
  "subscriptionType": "MONTHLY",    "description": "Seans REST Demo",    "shape": "oc3",  
  "vmPublicKeyText": "ssh-rsa BAQDH71kLNPVRu9MrMBSLFL8.....thd+LdJdGVWxbnUfSwVfiHuJrUms31lv",  
  "parameters": [  
    { "type": "db",    "usableStorage": "25",    "adminPassword": "Welcome_1",    "sid": "ORCL",    "pdb": "PDB1",  
      "failoverDatabase": "no",    "backupDestination": "NONE"  
    }  
  ]  
}
```

HTTP/1.1 **200 OK**

Location: <http://dbaas.oraclecloud.com/paas/service/dbcs/api/v1.1/instances/acme999/>

# REST: Read

```
curl -X GET --user dba@acme.com:PA55_word \  
--header "X-ID-TENANT-NAME:acme999 \  
https://dbaas.oraclecloud.com/paas/service/dbcs/api/v1.1/instances/acme999
```

HTTP/1.1 200 OK

Date: Wed, 15 Nov 2017 21:42:10 GMT

...

Content-Type: application/json

```
{  
  "uri":"https://dbaas.oraclecloud.com:443/paas/service/dbcs/api/v1.1/instances/acme999",  
  "service_type":"dbaas",  
  "implementation_version":"1.0",  
  "services": [  
    {"service_name":"My-DB",  
     "version":"12.1.0.2",  
     "status":"Running",  
     "description":"Seans REST Demo",  
     "identity_domain":"acme999","creation_time":"Mon Nov 13 3:53:39 UTC 2017",  
     "last_modified_time":"Mon Nov 13 6:59:6 UTC 2017",  
     "created_by":"dba@acme.com",  
     "service_uri":"https://dbaas.oraclecloud.com:443/paas/service/dbcs/api/v1.1/instances/acme999/My-DB"}},  
    {"subscriptions":[]}  
  ]  
}
```

# REST: Update

```
curl -include -request PUT --user dba@acme.com:Pa55_word --header "X-ID-TENANT-NAME:acme999" \  
--header "Content-Type:application/json" --data '{"shape":"oc4"}' \  
https://dbaas.oraclecloud.com/paas/service/dbcs/api/v1.1/instances/acme999/My-DB
```

HTTP/1.1 **202 Accepted**

Date: Mon, 13 Nov 2017 20:58:10 GMT

Server: Oracle-Application-Server-11g

Location:

<https://dbaas.oraclecloud.com:443/paas/service/dbcs/api/v1.1/instances/acme999/status/scale/job/573748>

Content-Length: 0

X-ORACLE-DMS-ECID: 005BdLQgjVq6uHFpR0H7id0001UZ000Cfz

X-ORACLE-DMS-ECID: 005BdLQgjVq6uHFpR0H7id0001UZ000Cfz

Service-URI: <https://dbaas.oraclecloud.com:443/paas/service/dbcs/api/v1.1/instances/acme999/acme999/My-DB>

Vary: Accept-Encoding,User-Agent

Retry-After: 60

Content-Language: en

Content-Type: application/json

# REST: Delete

```
curl -X DELETE --header 'Accept: application/json' --header 'Authorization: Basic l3kjdsd5gf123lksjdfh4jlaig 123=' \
--header 'X-ID-TENANT-NAME: acme999' \
https://psm.us.oraclecloud.com:443/paas/service/dbcs/api/v1.1/instances/acme999/My-DB?deleteBackup=true'
```

HTTP/1.1 202 Accepted

```
{
  "date": "Mon, 13 Nov 2017 23:59:56 GMT",
  "server": "Oracle-Application-Server-11g",
  "cache-control": "no-cache",
  "pragma": "no-cache",
  "strict-transport-security": "max-age=31536000;includeSubDomains",
  "location": "https://psm.us.oraclecloud.com:443/paas/service/dbcs/api/v1.1/instances/acme999/status/delete/job/15442111",
  "content-language": "en",
  "retry-after": "30",
  "x-oracle-dms-ecid": "005MFAtd4BW4ioW_Pxk3yd00018s001JpZ, 005MFAtd4BW4ioS_Pxk3yd00019s001JpZ",
  "service-uri": "https://psm.us.oraclecloud.com:443/paas/service/dbcs/api/v1.1/instances/acme999/My-DB?deleteBackup=true",
  "vary": "Accept-Encoding,User-Agent",
  "x-frame-options": "DENY",
  "content-encoding": "gzip",
  "content-type": "application/json",
  "content-length": "318",
  "keep-alive": "timeout=5, max=500",
  "connection": "Keep-Alive"
}
```

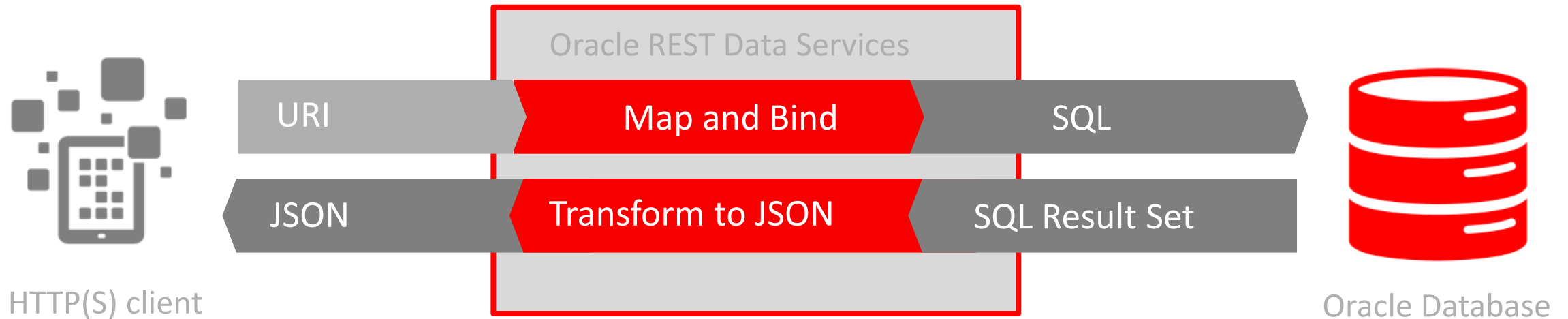


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# Oracle REST Data Services

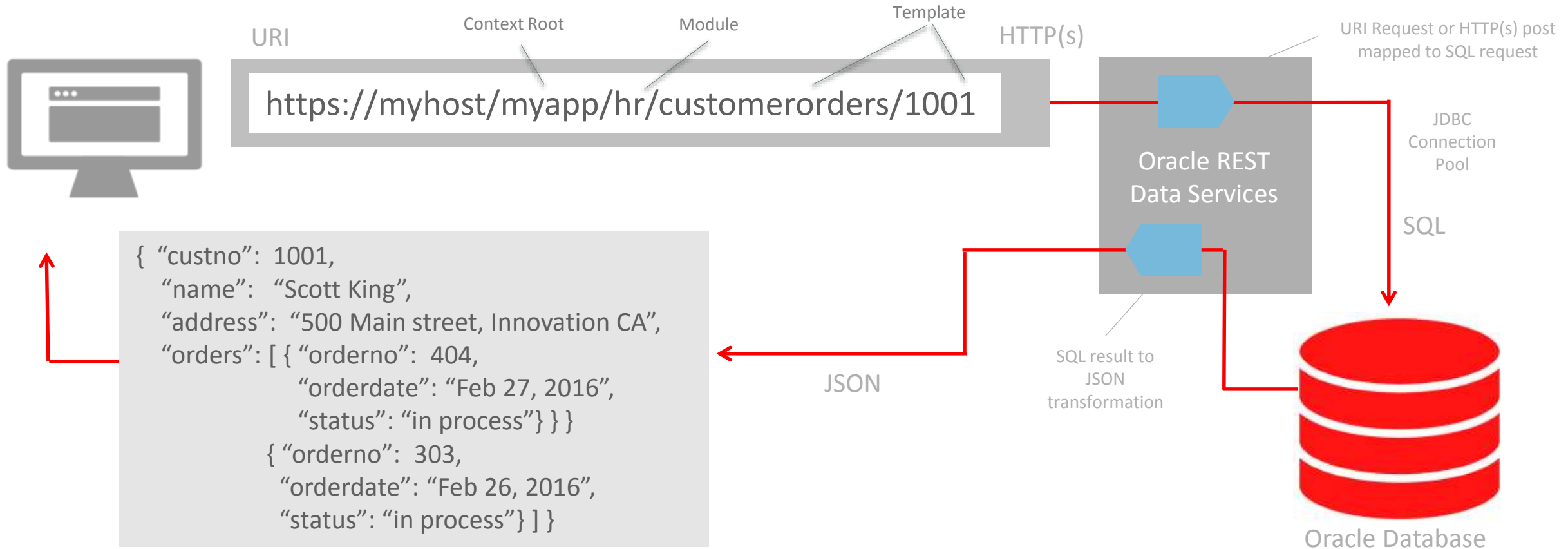
Serving JSON results from relational data



- Data stored in standard relational tables and columns
- Oracle REST Data Services (ORDS) Developer defines URI<>SQL mapping
- App Developer calls named URI over HTTP(S) gets and posts

# Oracle REST Data Services

## HTTP(s) API App-Dev with Relational Tables in Oracle Database



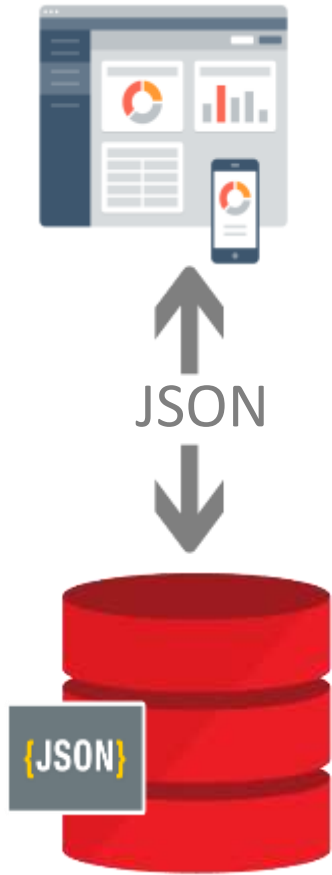
ORDS maps standard URI requests to corresponding relational SQL (not schemaless): e.g. SQL SELECT from customers and orders table.

ORDS also transforms the SQL results into JavaScript Object Notation (JSON), other formats include HTML, binary and CSV.

Fully committed to supporting any and all standards required by Fusion / SaaS / FMW; we are actively engaged in the ongoing dialog.

# Oracle SODA

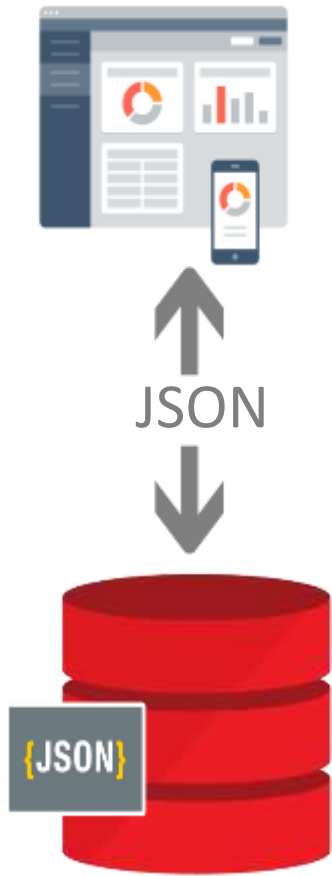
## Simple Oracle Document Access



- Provides a simple set of APIs (methods) to work with Documents stored in the Oracle database
- Supports both JSON and REST
- Leverages native 12c database JSON features
- Allows developers to combine the ease of use of document development and relational model
- SQL analytics can be used on JSON documents
- Full PL/SQL API

# Oracle SODA

## Simple Oracle Document Access



- SODA for REST Provides a set of services that provide a document store interface based on the SODA specification.
- It is delivered as part of ORDS 3.0
- SODA for REST can be invoked from any programming or scripting language that is capable of making HTTP calls
- HTTP verbs such as PUT, POST, GET, and DELETE map to CRUD operations on JSON documents.
- Operations such as LIST, QBE and indexing are performed using POST operations.

# Oracle SODA

## Creating and Using Collections

- Application developers can create collection objects without any knowledge of SQL.
- A collection is simply a container for a set of (related) documents.
- Under the covers, collections are relational tables containing a set of documents.
- Collection tables have a minimum of two columns: a unique ID for each document and the document itself.

```
curl --digest -X PUT --write-out "%{http_code}\n" -u SCOTT:tiger http://localhost:8080/DBJSON/SCOTT/MyCollection
```

```
SQL> desc "MyCollection"
```

Name	Null?	Type
-----	-----	-----
ID	NOT NULL	VARCHAR2(255)
CREATED_ON	NOT NULL	TIMESTAMP(6)
VERSION	NOT NULL	VARCHAR2(255)
JSON_DOCUMENT	BLOB	

```
SQL>
```

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# For More Information

## About Oracle Database Cloud Service

<https://cloud.oracle.com/database>

## Online Documentation – REST API for Database Cloud

[http://docs.oracle.com/cloud/latest/dbcs\\_dbaas/CSDBR/toc.htm](http://docs.oracle.com/cloud/latest/dbcs_dbaas/CSDBR/toc.htm)

## Join the Conversation



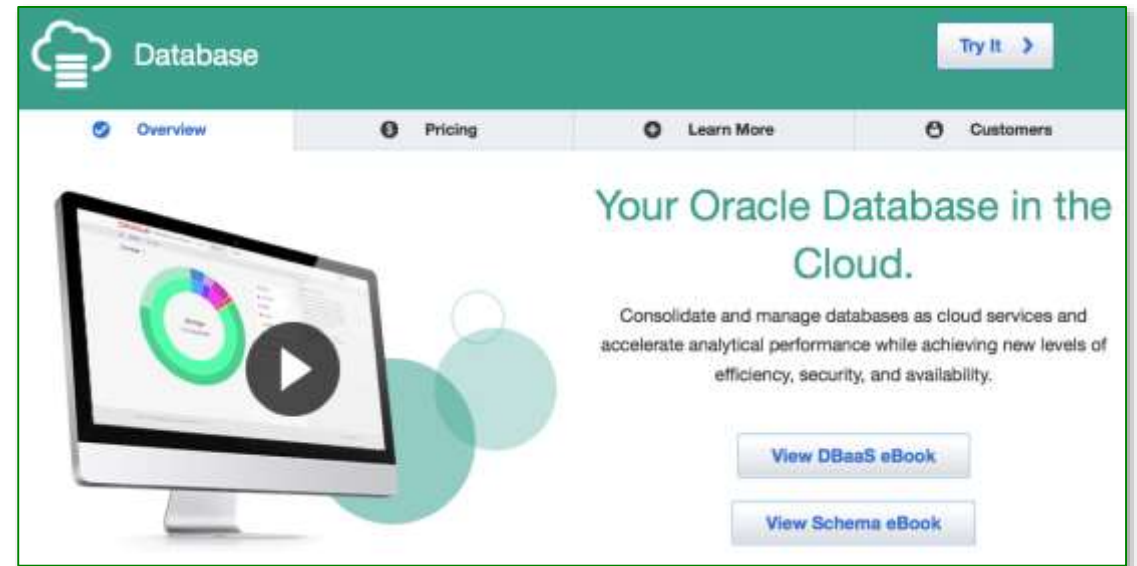
<https://blogs.oracle.com/dbaas>



[www.facebook.com/OracleCloudComputing](http://www.facebook.com/OracleCloudComputing)



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**...It's free**



# Integrated Cloud

## Applications & Platform Services

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