Oracle APEX 18.1 and the REST of the World

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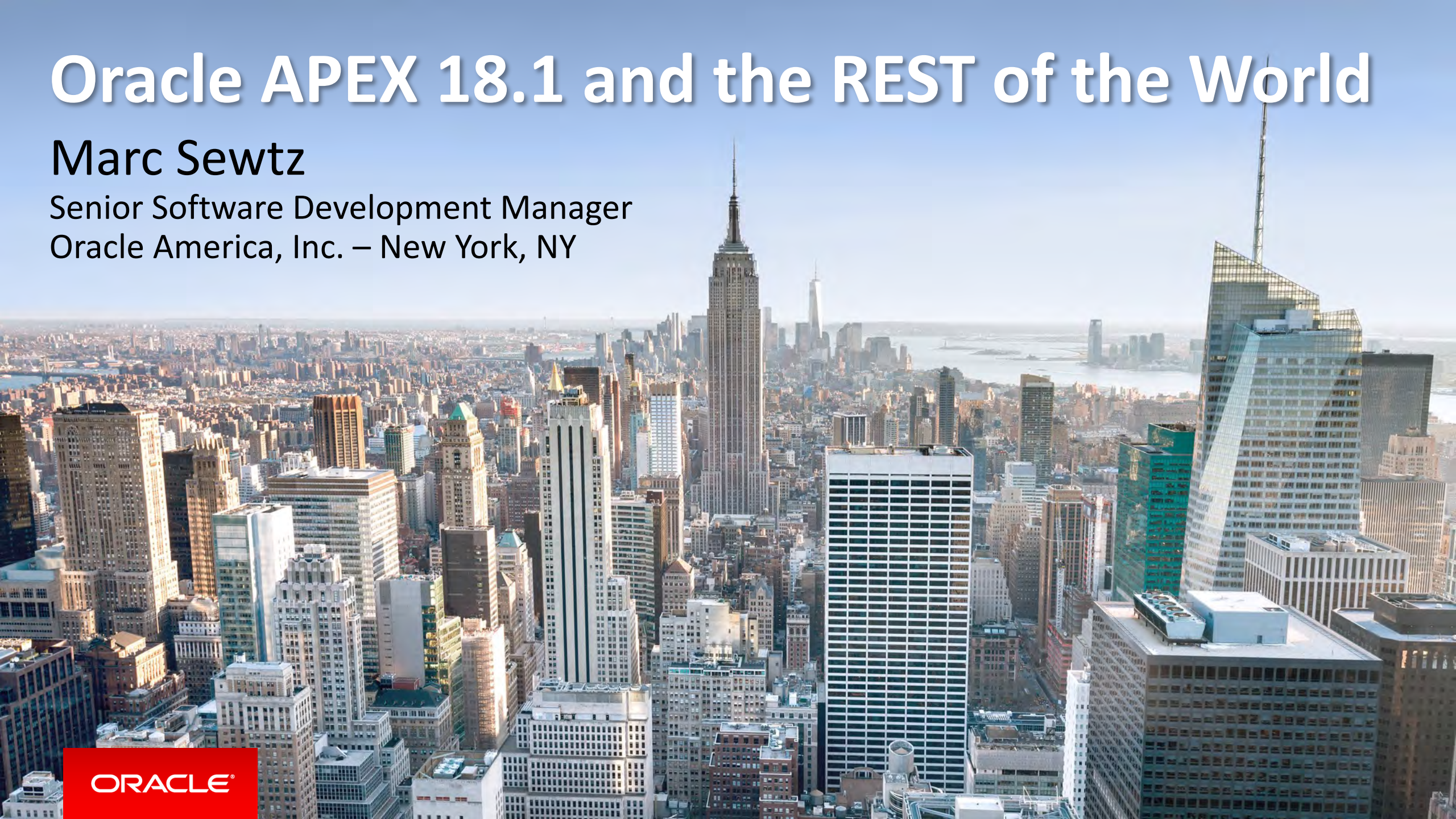

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Oracle Application Express / Database Tools

- Joined Oracle Consulting, Hamburg, Germany 1998
- Oracle Corp., New York, NY 1999 - today
- Built my first “APEX” Application in 2001
- Joined the APEX Development Team / Database Tools in 2002

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1. Oracle APEX & Oracle REST Data Services
2. REST Enabled SQL in APEX 18.1
3. REST Service Consumption in APEX 18.1

1 Oracle APEX & Oracle REST Data Services

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Oracle APEX

Database-centric web application development framework

Rapid application development of database centric applications from your web browser

Visualize and maintain database data for desktop and mobile

Extending enterprise application solutions

Use SQL and Oracle database features to develop apps

Modernizing legacy applications

Oracle APEX

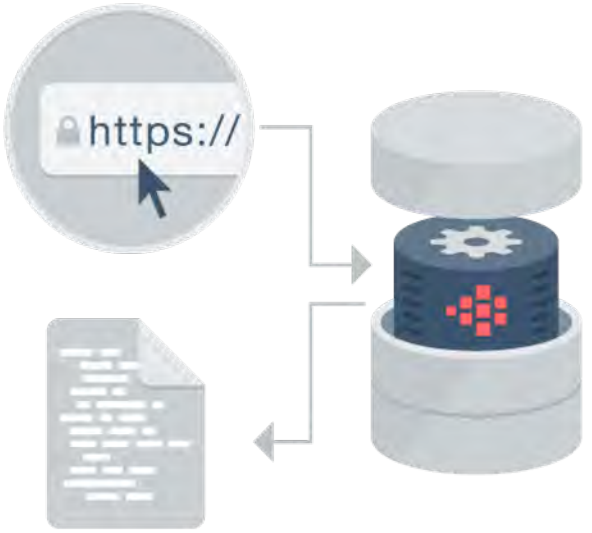
Database-centric web application development framework

App Development IDE is a web browser.

No client software needed

App definitions are stored in the database as meta data.

Declarative – No code generation

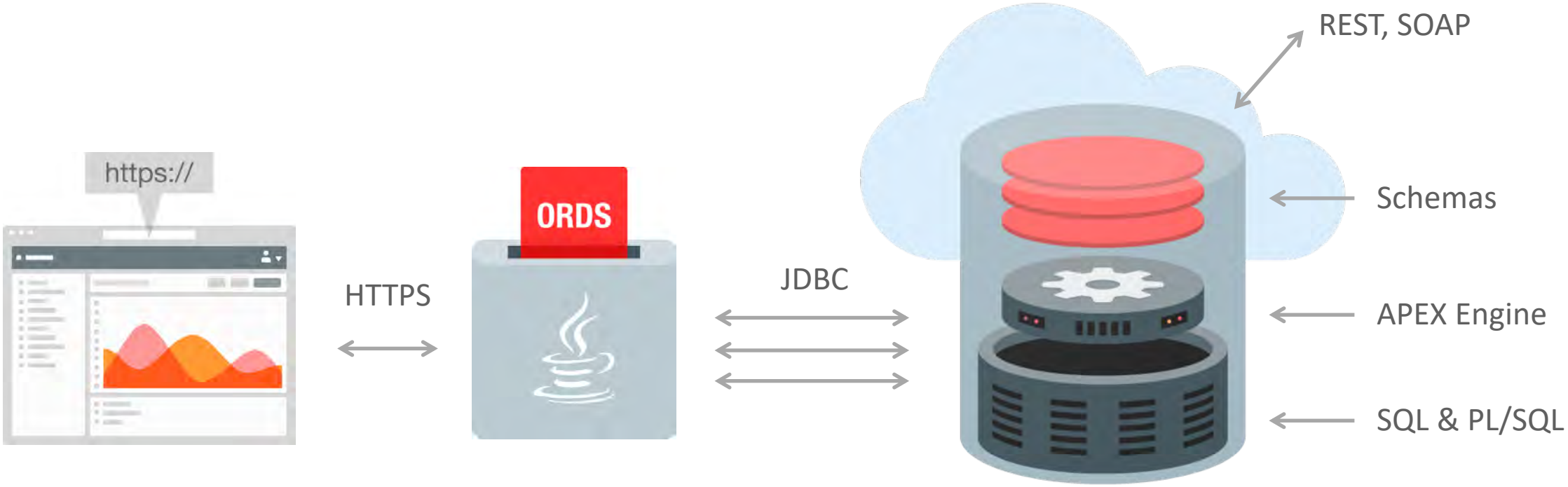


Page generation is efficient with only one request and one response.

Data processing done in the Database

Oracle APEX & Oracle REST Data Services

Database Centric Architecture



Oracle REST Data Services
(Weblogic, Jetty, Tomcat)

No Application Logic
Converts HTTP to database API calls

Oracle Database
(Pluggable or Dedicated, 11*g*, 12*c*, 18*c*)
XE, SE, EE, Exadata, RAC, DG, GG, IM…

Zero latency database data access
Dynamically driven by APEX metadata

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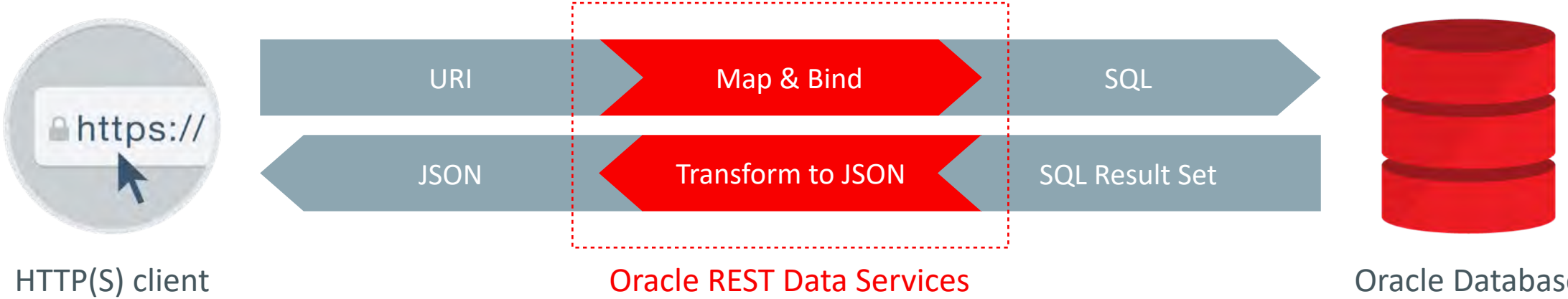
Oracle REST Data Services (ORDS)

Overview

- ORDS makes it easy to develop modern REST interfaces for relational data in the Oracle Database, JSON Document Store and Oracle NoSQL DB.
- ORDS maps HTTP(S) verbs (GET, POST, PUT, DELETE, etc.) to database transactions and returns any results formatted using JSON.
- ORDS is used as the Web listener for Oracle Application Express (APEX).



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Oracle REST Data Services (ORDS)

Overview

- Provides HTTP Access to Oracle Databases (and other databases)
  - Mid tier application
  - Maps http(s) RESTful Gets and Posts to SQL and PL/SQL
  - Declaratively returns results in JSON format
  - JavaScript friendly
  - Allows virtually every App Dev platform to access an Oracle Database
- Supported feature of the Oracle Database since 2010
- Ships with Oracle Database 12.1.0.2+
- Oracle APEX mid-tier, web toolkit applications, mod_plsql replacement

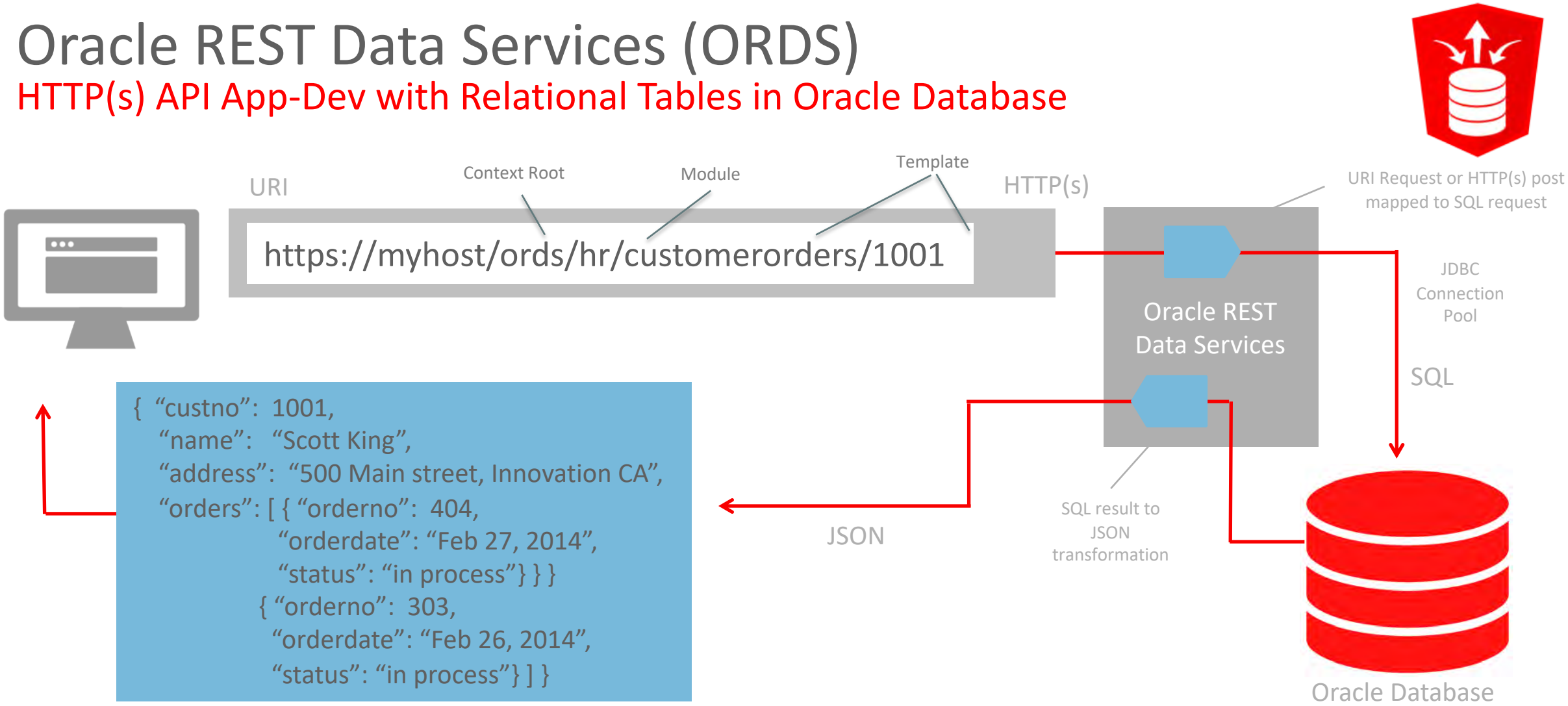
Oracle REST Data Services (ORDS)

Supports all HTTP Verbs for interacting with all resources

Method	Purpose	Classification	Database Operation
GET	Retrieve resource	Safe, Idempotent	Select
HEAD	Retrieve metadata	Safe, Idempotent	Select
OPTIONS	Methods supported by resource	Safe, Idempotent	N/A
PUT	Create or replace resource	Idempotent	Merge, Update
DELETE	Delete resource	Idempotent	Delete
POST	Anything. Normally create	Unsafe	Insert

Oracle REST Data Services (ORDS)

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 the highly popular 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.

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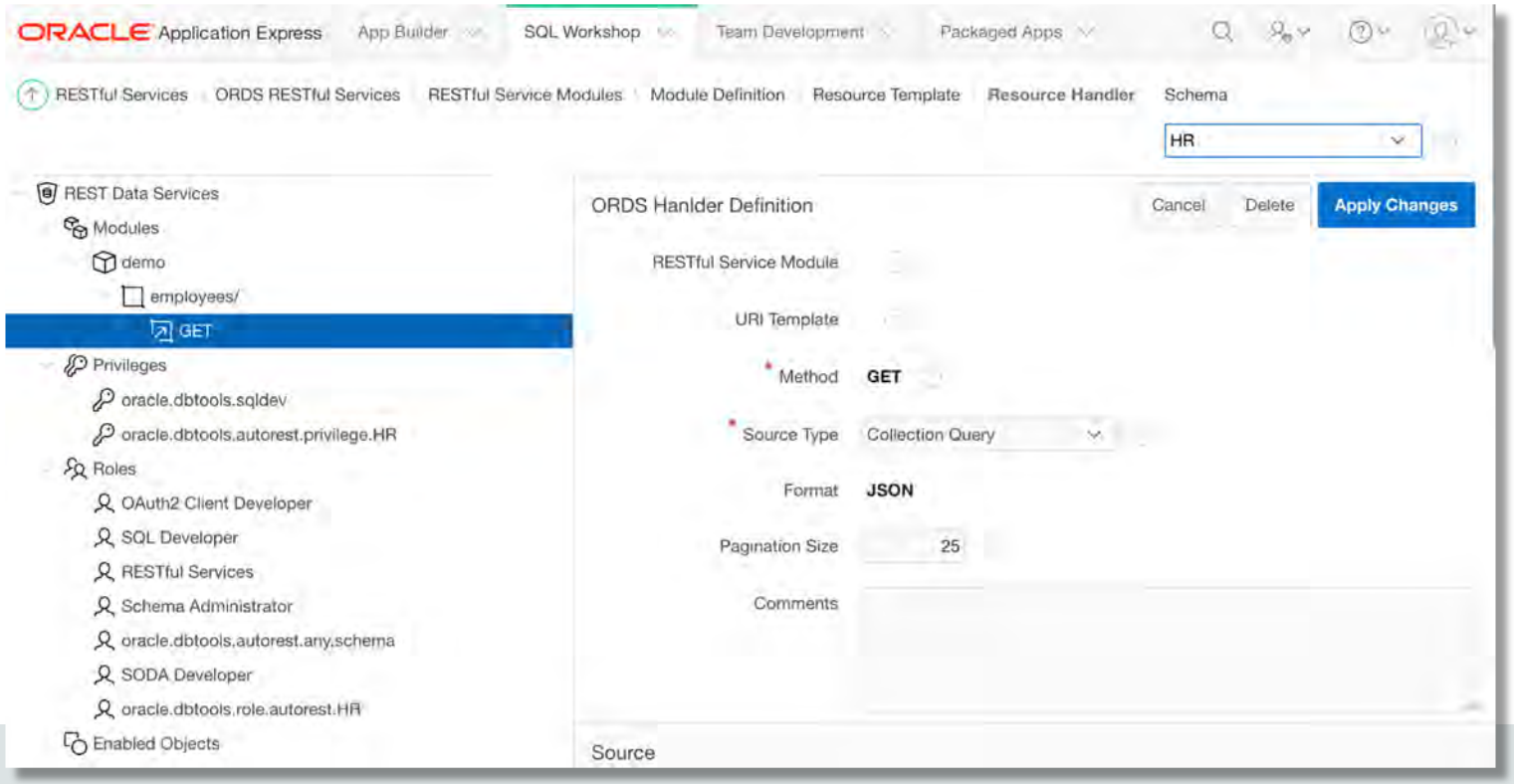
New REST Workshop in Oracle APEX 18.1

Based on the ORDS Repository

- Declarative REST service support for ORDS-enabled REST services.
- New REST workshop will support REST web services developed using the ORDS repository.
- Provides super-set of functionality available with current repository.
- Existing APEX-based REST services will be migrated.



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Demo

Oracle REST Data Services

1 Oracle APEX & Oracle REST Data Services

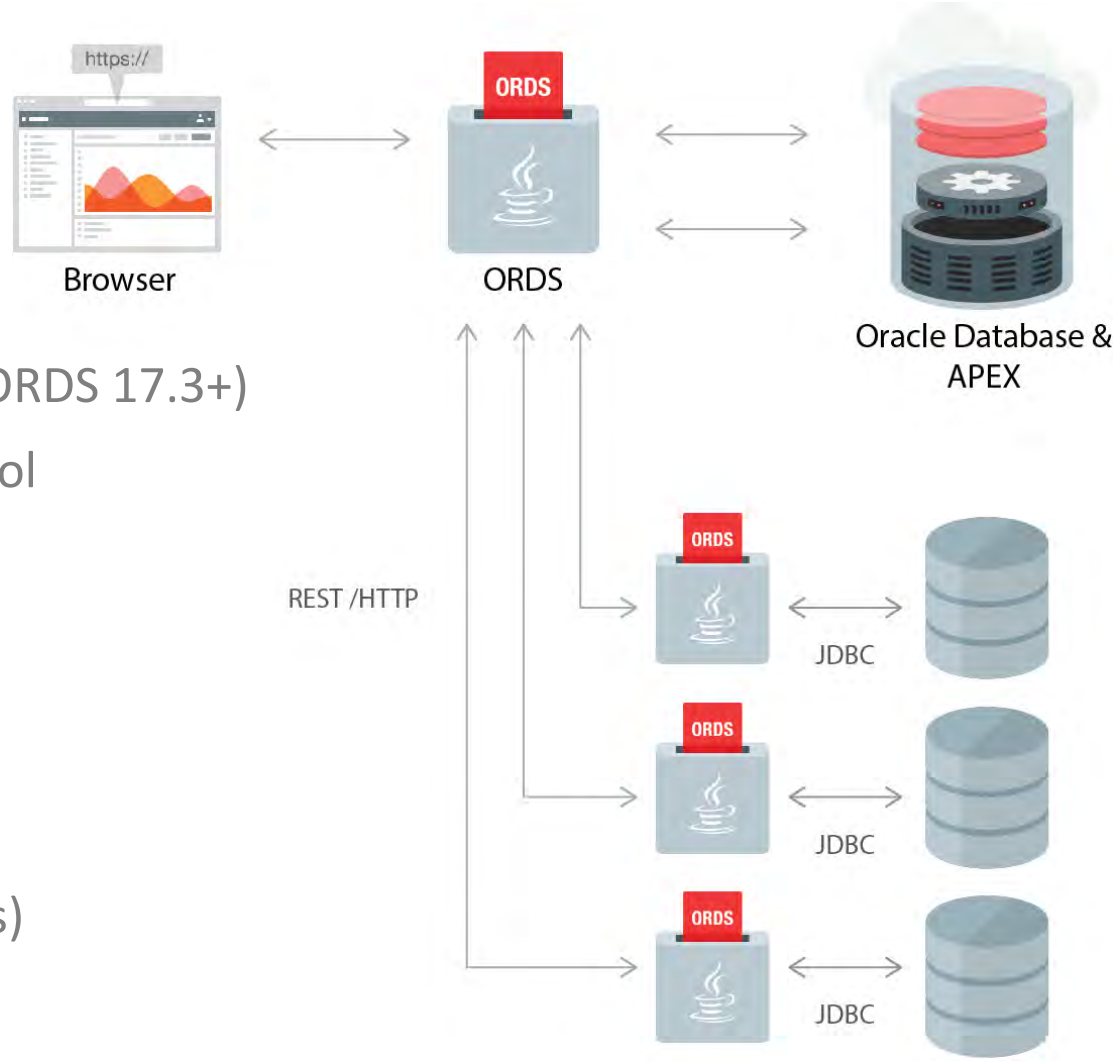
2 REST Enabled SQL in APEX 18.1

3 REST Service Consumption in APEX 18.1

REST Enabled SQL

Remote Database Connections

- Executing dynamic SQL or PL/SQL on remote databases using ORDS and REST
  - Relies on the ORDS REST enabled SQL feature (ORDS 17.3+)
  - Requires ORDS instance having a connection pool configured for target database.
- APEX passes SQL query to ORDS over REST.
- Self-describing JSON response.
- Response contains a JSON object with:
  - Result set meta data (column names, data types)
  - The result data
  - Information about pagination



REST Enabled SQL

Remote Database Connections

- Based on SQL Developer Core SQL engine
- Needs to be enabled in defaults.xml configuration file:

  <entry key="restEnabledSql.active">true</entry>

- Once enabled, REST endpoint available for every REST enabled schema:

  http://localhost:8080/ords/hr/_/sql

```
$ curl   -X "POST" "http://localhost:9090/ords/hr/_/sql"  \
         -H "Content-Type: application/sql"               \
         -u HR:oracle                                     \
         -d $'select * from emp; '
```

REST Enabled SQL

Parsing JSON and generating row / column result set

ORDS REST Enabled SQL returns a self-describing result set as follows:

```
{
    "items": [
        {
            "statement-id": 1,
            "statement-type": "query",
            "statement-pos": {
                "start-line": 1,
                "end-line": 1
            },
            "statement-text": "select 'hello world' as colname from dual",
            "metadata": [
                {
                    "column-name": "COLNAME",
                    "column-type-name": "CHAR",
                    "precision": 11,
                    "scale": 0,
                    "is-nullable": 1
                }
            ],
...
```

REST Enabled SQL

Parsing JSON and generating row / column result set

ORDS REST Enabled SQL returns a self-describing result set as follows:

```
...
            "result-set": {
                "items": [
                    {
                        "colname": "hello world"
                    }
                ],
                "hasMore": false,
                "limit": 25,
                "offset": 0,
                "count": 1,
                "$asof": {"$scn": "1273919"}
            }
        }
    ]
}
```

Demo

Using ORDS REST Enabled SQL

REST Enabled SQL & REST Service Consumption

New Architecture in APEX 18.1

- Data source for APEX components:
  - Local Database
  - REST Enabled SQL
  - Web Source (REST Service)
- Database
  - Table / View (stores table and column information in meta data)
  - SQL Query
  - PL/SQL Function returning SQL Query

REST Enabled SQL

Parsing JSON and generating row / column result set

Building a "Data Parsing Profile”:

```
select rownum col_sequence,
       column_name,
       col_selector,
       precision,
       scale,
       data_type
  from json_table(
          dynquery_rest.get_data,
          '$.items[*].resultSet.metadata[*]'
          columns (
              column_name   varchar2(128)   path '$.columnName',
              col_selector  varchar2(255)   path '$.jsonColumnName',
              data_type     varchar2(30)    path '$.columnTypeName',
              precision     number          path '$.precision',
              scale         number          path '$.scale'
          )
       )
```

REST Enabled SQL

Parsing JSON and generating row / column result set

Building a "Data Parsing Profile”:

```
select rownum col_sequence,
       column_name,
       col_selector,
       precision,
       scale,
       data_type
  from json_table(
          dynquery_rest.get_data,
          '$.items[*].resultSet.metadata[*]'
          columns (
              column_name   varchar2(128)   pat
              col_selector  varchar2(255)   pat
              data_type     varchar2(30)    pat
              precision     number          pat
              scale         number          pat
          )
       )
```

Column name	Col selector	Precision	Scale	Data type
SAL	$.sal	7	2	NUMBER
MGR	$.mgr	4	0	NUMBER
JOB	$.job	9	0	VARCHAR2
HIREDATE	$.hiredate	0	0	DATE
ENAME	$.ename	10	0	VARCHAR2
EMPNO	$.empno	4	0	NUMBER
DEPTNO	$.deptno	2	0	NUMBER
COMM	$.comm	7	2	NUMBER

REST Enabled SQL

Parsing JSON and generating row / column result set

Constructing a SQL query, based on data parsing profile, to return the actual data:

```
select
     j."EMPNO",
     j."ENAME",
     j."JOB",
     j."MGR",
     to_date( j."HIREDATE", 'YYYY-MM-DD"T"HH24:MI:SS"Z"' ) as "HIREDATE",
     j."SAL",
     j."COMM",
     j."DEPTNO”
from apex_collections c, json_table(
    c.clob001,
    '$.items[*].resultSet.items[*]’
    columns (
        "EMPNO"      NUMBER          path '$.empno',
        "ENAME"      VARCHAR2(10)    path '$.ename',
        "JOB"        VARCHAR2(9)     path '$.job',
        "MGR"        NUMBER          path '$.mgr',
        "HIREDATE"   VARCHAR2(4000)  path '$.hiredate',
        "SAL"        NUMBER          path '$.sal',
        "COMM"       NUMBER          path '$.comm',
        "DEPTNO"     NUMBER          path '$.deptno’
    )) j
where c.collection_name = 'REST_COLLECTION'
```

REST Enabled SQL

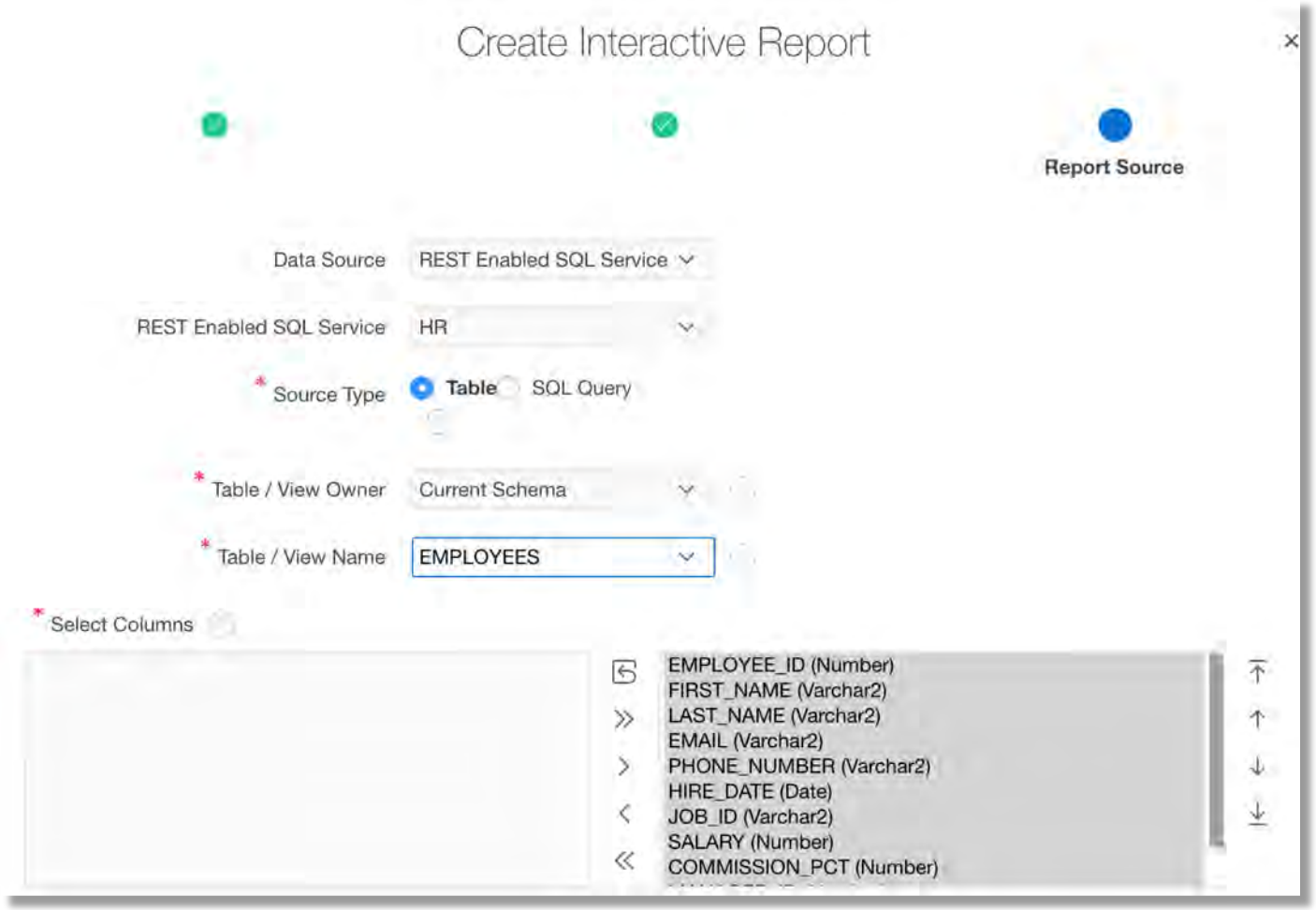
Using Remote Database Connections in APEX

- Components like Reports, JET Charts, or Calendars will be able to use these extended Remote Databases as a data source.
- A Remote Server consists of:
  - A name
  - An endpoint URL
  - Authorization credential store
- Remote Databases configured via Shared Components.
- Remote Server and Credentials stored at Workspace level.

REST Enabled SQL

Using Remote Database Connections in APEX

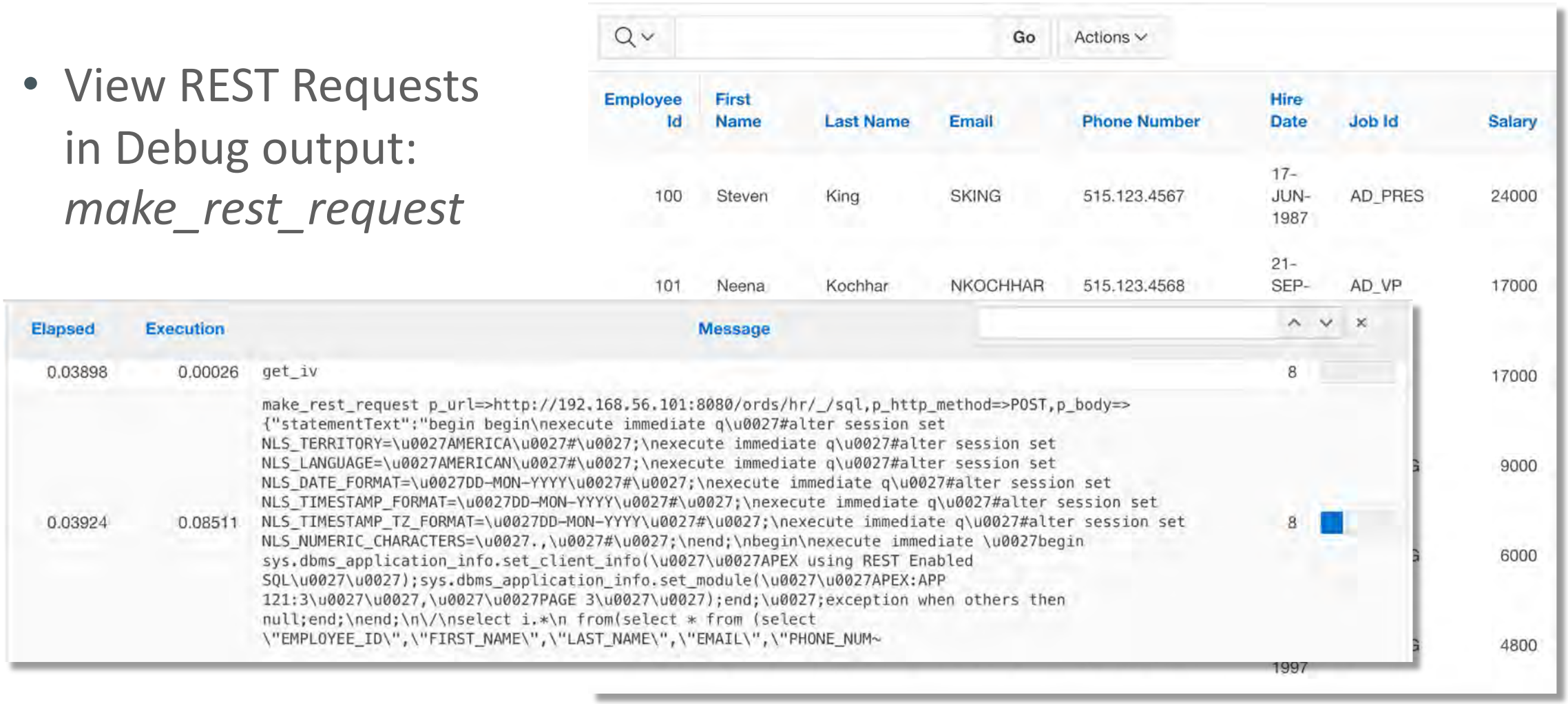
- Select “REST Enabled SQL Service” as Data Source
- Choose Table or SQL Query as Source Type
- Initially available for Interactive and Classic Reports, Calendars and JET Charts



REST Enabled SQL

Using Remote Database Connections in APEX

- View REST Requests in Debug output: *make_rest_request*



Demo

REST Enabled SQL in APEX

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REST Service Consumption

Web Sources

- New data source type called “**Web Source**”
- Declarative method to define references to external REST APIs and generic JSON data feeds.
- Stores metadata about how to parse response data and map it as a virtual table with rows and columns.
- Web Sources will be stored on Workspace level and Shared Components.
- Usable as data sources for APEX components such as Interactive Grids, Reports, Charts, Forms, etc.

REST Service Consumption

Use Cases

- Access data from other Oracle Databases using REST
  - Similar use case to Remote SQL, however Remote SQL requires privileges to directly access tables on target database via SQL.
  - Many databases do not allow this type of access but do provide standardized REST services.
- Access internal systems (non Oracle DB) within an APEX application
  - Writing extensions to third-party in-house systems that provide REST APIs.
- Access Oracle SaaS functionality from within APEX applications.
  - Customers using Oracle Cloud SaaS applications use APEX to extend these systems.

REST Service Consumption

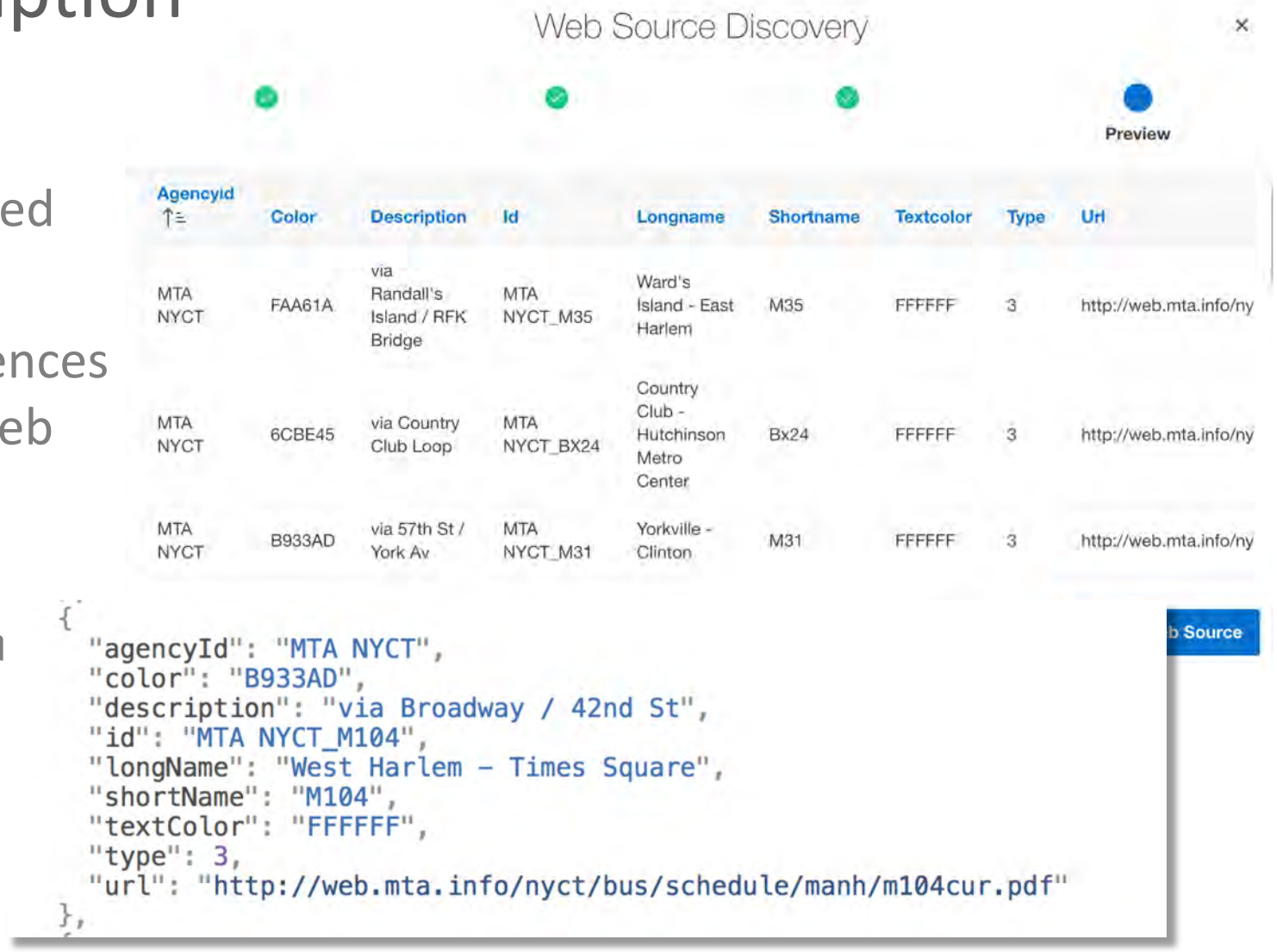
Use Cases

- Access external APIs (non Oracle Databases)
  - Augmenting APEX applications, while the processing happens on local tables.
  - Usage is likely to increase due to increasing public REST API availability and usage in business applications.
  - Similar functionality is provided today with the REST Client Assistant Packaged App, which allows for generating the SQL to fetch JSON data and to display it within a classic report.

REST Service Consumption

New Architecture in APEX 18.1

- Create Web Source in Shared Components
- Web Source Module references to one or more external Web Services
- Modules can contain one or many Operations, which are the references to a concrete external Web Service



Demo

REST Service Consumption

Integrated Cloud

Applications & Platform Services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