REST DB Links
Access Oracle Databases in the Cloud using ORDS, REST & JSON

16th June 2017

Robert Marz
Technical Architect

Robert Marz

Client	Senior Technical Architect with database centric view of the world
its-people	Portfolio Manager Database Technologies Blog Editor
DOAG	Active Member Database Community in charge of Cloud topics

 @RobbieDatabee

 blog.its-people.de

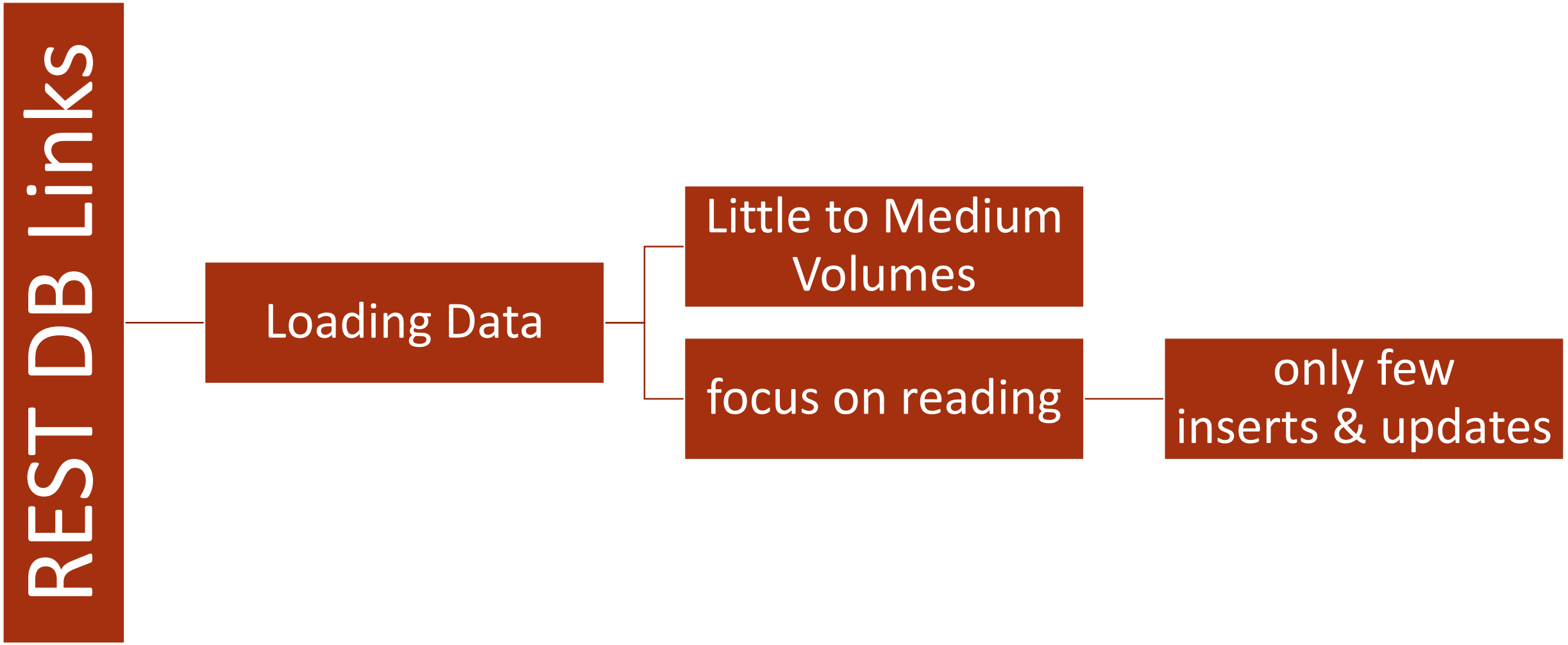
 Robert.Marz
@its-people.de

Database Links – the Issues

Database Links

- Are trapped inside the Oracle world
- Only work within local or private networks: SQLNet
- Objects are treated as local

Database Links 2.0 – Use Case



Database Links 2.0 – Architecture

3) Package rest_db_link

5) The View

2) AutoREST URL

http(s) requests
JSON documents

4) JSON_TABLE Operator

Local Database

ORDS

Remote Database

6) Generate all the things

1) REST enable

What is REST?

REST	Representational state transfer	
	programming paradigm	distributed systems
		Web services.
RESTful Applications	implements 6 constraints most important:	Uniform Interface (API via URIs)
		Stateless
		Cacheable
Implementation	Transport protocol	http(s)
	content	JSON Documents

Oracle REST Data Services ORDS (1/2)

Java

Evolved from APEX Listener

Deploy in Application Server

- Tomcat
- Glassfish
- WebLogic

Standalone mode

- Brings own http-server

Links

Installation

- Install ORDS in less than 5 Minutes by Colm Divilly (@cdivilly): http://blog.cdivilly.com/2015/03/11/install-ords-3.0.0/

Official Homepage

- http://www.oracle.com/technetwork/developer-tools/rest-data-services/overview/index.html

Documentation

- https://docs.oracle.com/cd/E56351_01/doc.30/e56293/develop.htm

Video

- Oracle REST Data Services by Oracle Database Development Tools: https://www.youtube.com/watch?v=8XlbFRm-c6w

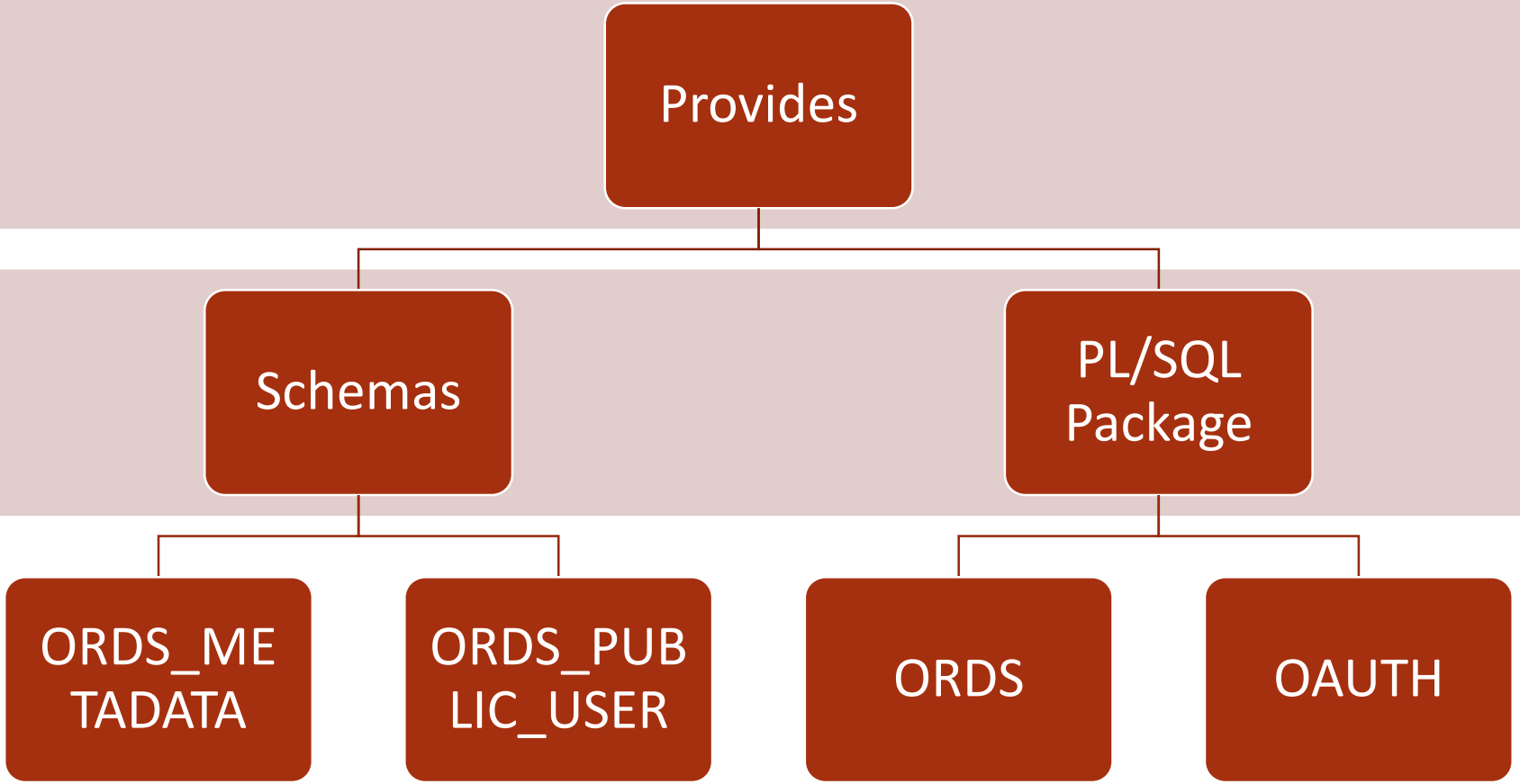
Oracle REST Data Services ORDS (2/2)

REST

- Restful Services: Implement full
- SODA: Simple Oracle Document Access

AutoRest

- Rest enable tables
  - very easy
  - some limitations



Database Links 2.0 – Architecture

3) Package rest_db_link

5) The View

2) AutoREST URL

http(s) requests
JSON documents

4) JSON_TABLE Operator

Local Database

ORDS

Remote Database

6) Generate all the things

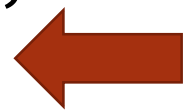
1) REST enable

Preparing the Server: Step 1 ORDS enable Schema (simple)

```
begin
   ords.enable_schema;
   commit;  -- This commit is important!
end;
/
```

Preparing the Server: Step 1 ORDS enable Schema (with Options)

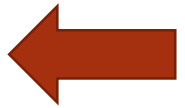
```
BEGIN
    ORDS.ENABLE_SCHEMA
      (   p_schema => 'RESTDBLINKSPROV',
          p_url_mapping_type => 'BASE_PATH',
          p_url_mapping_pattern => 'rdbl',
          p_auto_rest_auth => false );
    commit;  -- This commit is important!
END;
/
```



Schema Part of URL

Preparing the Server: Step 2 ORDS enable Object

```
begin
   ords.enable_object (
      P_ENABLED          => true,
      P_SCHEMA           => 'RESTDBLINKSPROV',
      P_OBJECT           => 'STOCKTICKER',
      P_OBJECT_TYPE      => 'TABLE',
      P_OBJECT_ALIAS     => 'tab-StockTicker',
      P_AUTO_REST_AUTH => false
   );
   commit;  -- This commit is important, too!
end;
/
```



Case Sensitive

Database Links 2.0 – Architecture

3) Package rest_db_link

5) The View

2) AutoREST URL

http(s) requests
JSON documents

4) JSON_TABLE Operator

Local Database

ORDS

Remote Database

6) Generate all the things

1) REST enable

Anatomy of a ORDS AutoREST URL

ORDS Base Table Parameter

```
http://192.168.56.101:8080/ords/rdbl/Tab-StockTicker/?offset=55&limit=100
                                                    /ORCL,2016-01-08
                                                     PKCol1,PKCol2
```

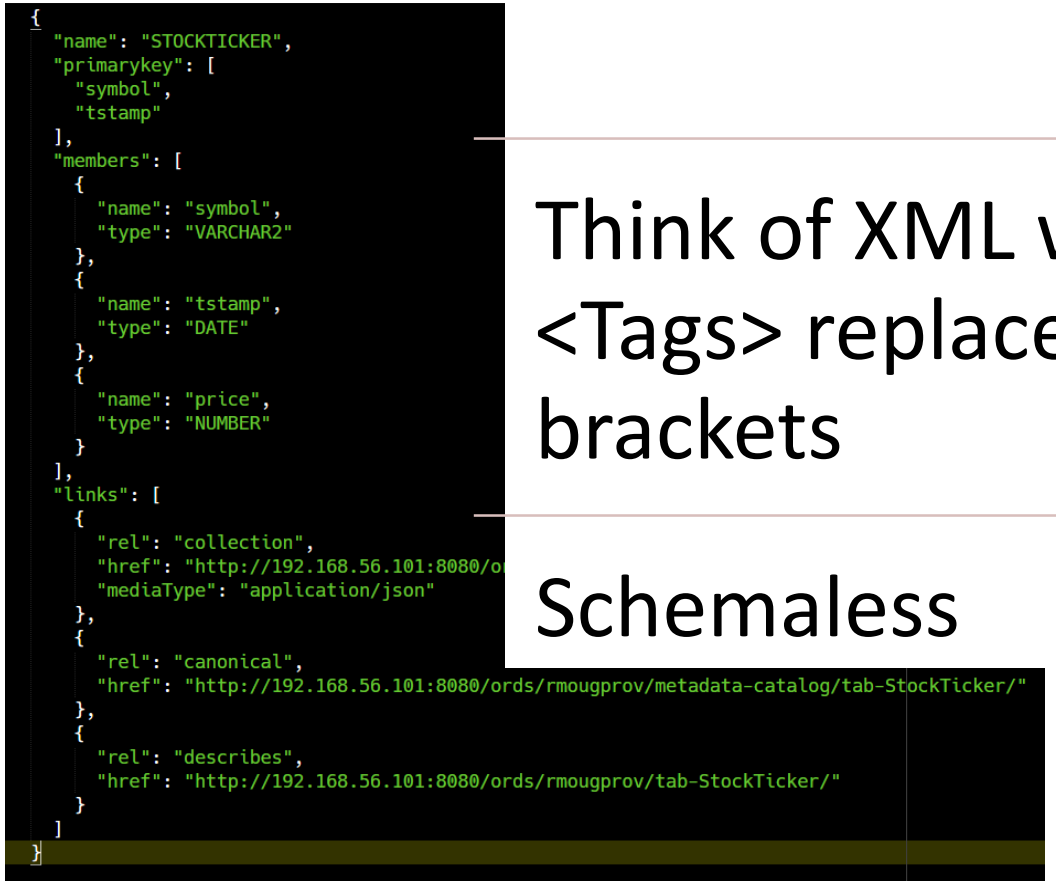
Protocol Host:Port Schema or Primary Key

HTTP Method	ORDS AutoREST Action
GET	Retrieve Data – Single Row or Rowset
PUT	Insert or Modify Row
POST	Bulk Insert csv-data
DELETE	Delete Row

What is JSON?

JSON

Java **S**cript
Object **N**otation



Think of XML with <Tags> replaced by brackets

Schemaless

"Key":"Value" Pairs

{} – Groupings

[] - Arrays

no constraints for your implementation

Developers hell when dealing with documents not produced by your code

Interpreting the ORDS AutoREST Responses (1)


```
{
    "items": [
        {
            "symbol": "TDC",
            "id1": 56,
            "tstamp": "2017-05-06T23:27:00Z",
            "price": 20.625,
            "links": [
                {
                    "rel": "self",
                    "href": "http://127.0.0.1:8080/ords/rdbl/Tab-StockTicker/56"
                }
            ]
        },
        {
            "symbol": "ORCL",
            "id1": 57,
            "tstamp": "2017-05-06T23:28:00Z",
            "price": 42,
```

Interpreting the ORDS AutoREST Responses (2)


```
{
    "items": [↔],
    "hasMore": true,
    "limit": 2,
    "offset": 55,
    "count": 2,
    "links": [
        {↔},
        {↔},
        {↔},
        {↔},
        {
            "rel": "next",
            "href": "http://127.0.0.1:8080/ords/rdbl/Tab-StockTicker/?offset=57&limit=2"
        },
        {↔}
    ]
}
```

The JSON produced by ORDS is NOT schemaless

Oracle has defined a new Media Type

application/vnd.oracle.resource+json

Whitepaper

http://www.oracle.com/webfolder/technetwork/tutorials/appdevinfo/New%20REST%20Media%20Type.pdf

Database Links 2.0 – Architecture

3) Package rest_db_link

5) The View

2) AutoREST URL

http(s) requests
JSON documents

4) JSON_TABLE Operator

Local Database

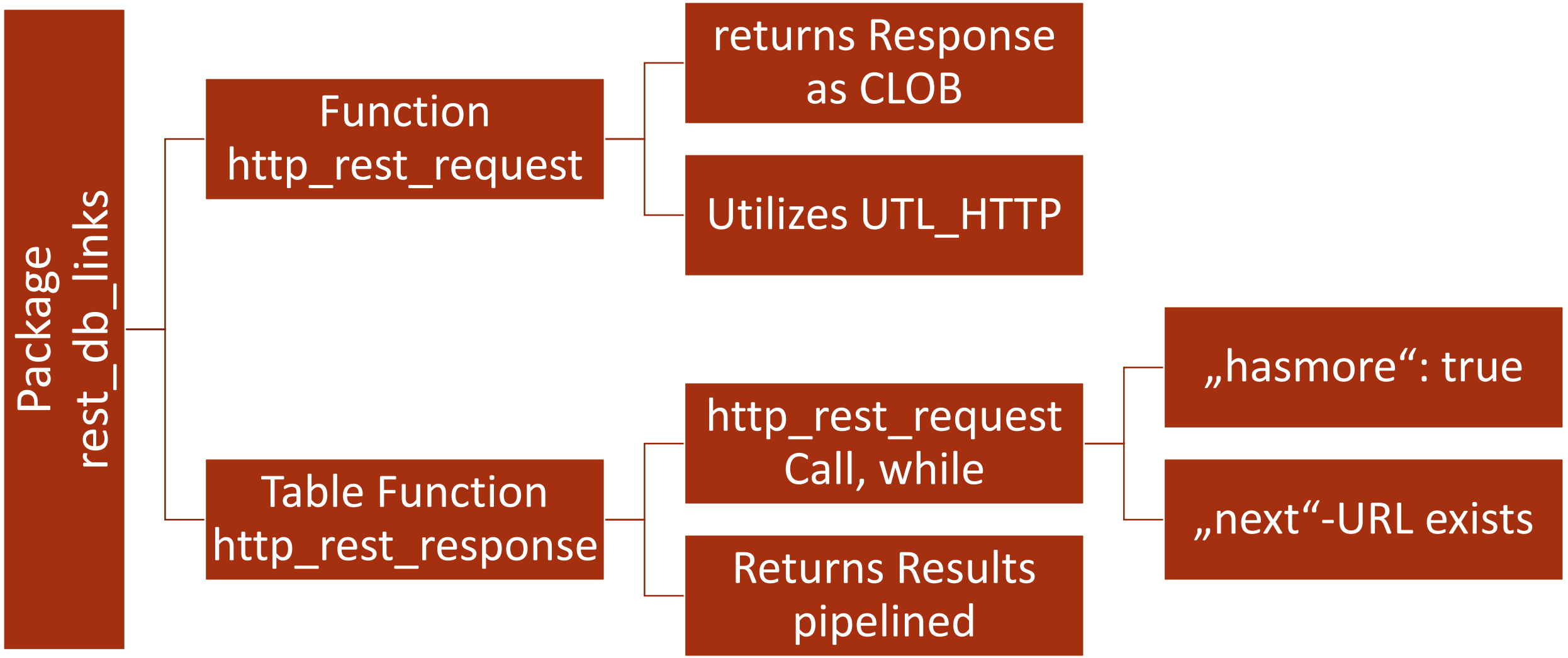
ORDS

Remote Database

6) Generate all the things

1) REST enable

Building the Client – Step 1: Fetch all the data



Building the Client – UTL_HTTP needs ACL (1/2)

```
begin
  DBMS_NETWORK_ACL_ADMIN.create_acl (
    acl             => 'local_rest_acl_file.xml',
    description     => 'Grant Access to REST
Services on Host 127.0.0.1',
    principal       => upper('restdblinksCONS'),
    is_grant        => TRUE,
    privilege       => 'connect',
    start_date      => SYSTIMESTAMP,
    end_date        => NULL);
end;
/
```

Building the Client – UTL_HTTP needs ACL (2/2)

```
begin
   DBMS_NETWORK_ACL_ADMIN.assign_acl (
      acl          => 'local_rest_acl_file.xml',
      host         => '127.0.0.1',
      lower_port   => 8080,
      upper_port   => NULL);
end;
/

commit;
```

Database Links 2.0 – Architecture

3) Package rest_db_link

5) The View

2) AutoREST URL

http(s) requests
JSON documents

4) JSON_TABLE Operator

Local Database

ORDS

Remote Database

6) Generate all the things

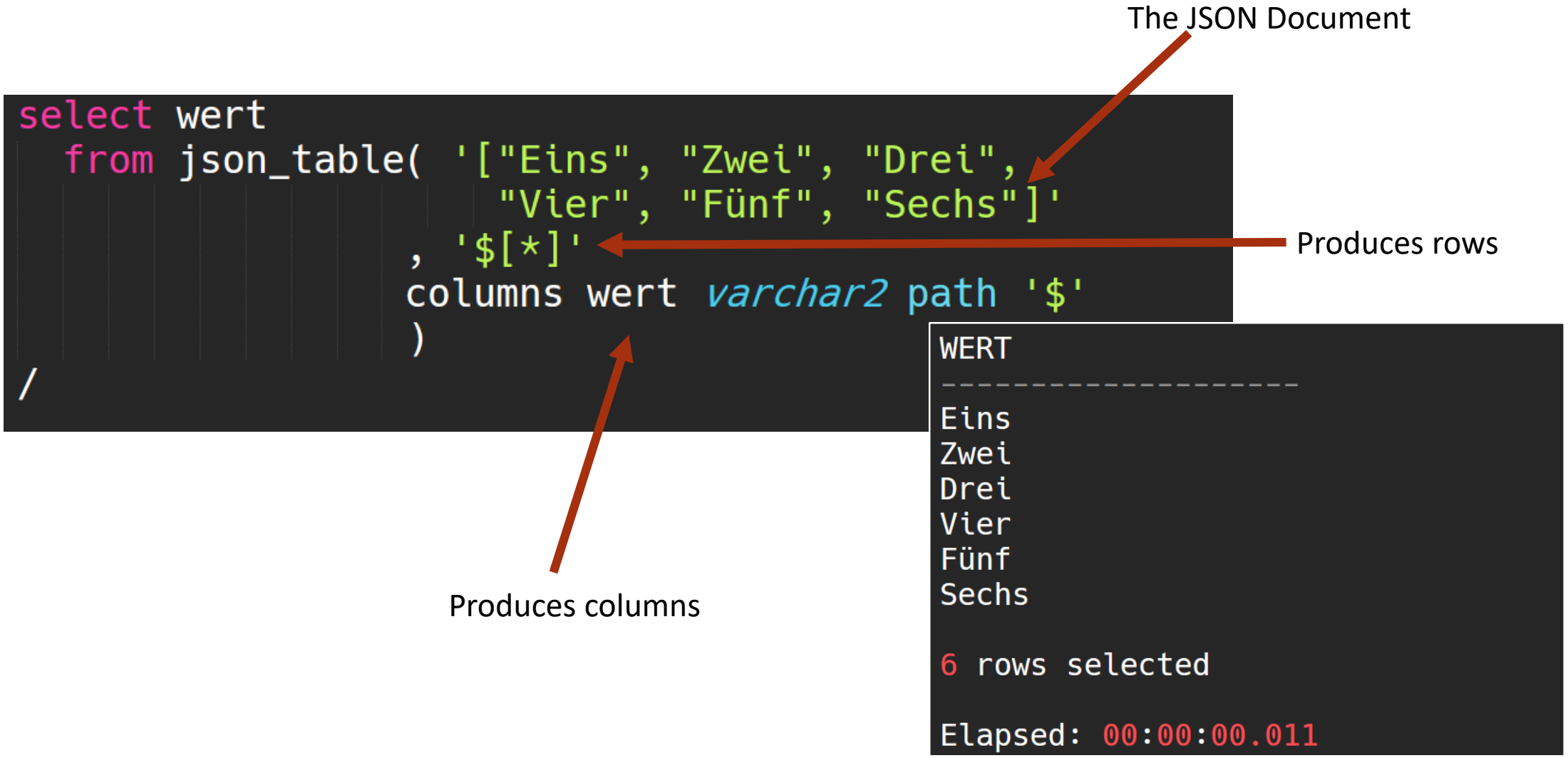
1) REST enable

Building the Client – JSON_TABLE Operator (1/2)

JSON_TABLE

- Lives inside the SQL-From-Clause
- Produces **Rows** and **Columns**
- Accepts CLOBs with JSON data
- Included in SQL:2016 Standard

Building the Client – JSON_TABLE Operator (2/2)



Database Links 2.0 – Architecture

3) Package rest_db_link

5) The View

2) AutoREST URL

http(s) requests
JSON documents

4) JSON_TABLE Operator

Local Database

ORDS

Remote Database

6) Generate all the things

1) REST enable

Building the Client – Produce Rows and Columns

```
select j.*
     , t.*
  from table(rest_db_links.http_rest_response('http://…') ) t
     , json_table( t.response, '$.items[*]'
                   columns
                   ( symbol  varchar2 path '$.symbol'
                   , tstamp  varchar2 path '$.tstamp'
                   , price   number   path '$.price,
                   , selfurl varchar2 path '$.links[0].href'
                   )
                 ) j
  ;
```

Building the Client – Casting Datatypes

Numbers

JSON numbers come in US Locale: Decimal Point and thousand separator is comma

Get varchar2 JSON columns, cast explicit

```
to_number( price
         , '9999999999D99999999‘
         , 'nls_numeric_characters=''.,''' )  price
```

Dates

JSON Dates are ISO 8601 Zulu (UTC) Time

```
cast( to_timestamp_tz
      ( to_char(
          to_date(tstamp, 'YYYY-MM-DD"T"HH24:MI:SS"Z"')
          , 'YYYY-MM-DD HH24:MI:SS "UTC"')
      , 'YYYY-MM-DD HH24:MI:SS TZR')
      at time zone sessiontimezone as date ) tstamp
```

Building the Client – View DML

```
create or replace trigger StockTicker_ORDS_IUD
     instead of insert or update or delete
     on StockTicker_ORDS
     for each row

          rest_db_links.http_rest_request();
```

Operation	REST URL	HTTP-Method	Payload (JSON)
deleting	:old.selfurl	DELETE	empty
updating	:old.selfurl	PUT	all columns & values
inserting	ORDS-Table-URL||'/'||PKCol1||','||PKCol2	PUT	all columns & values

Database Links 2.0 – Architecture

3) Package rest_db_link

5) The View

2) AutoREST URL

http(s) requests
JSON documents

4) JSON_TABLE Operator

Local Database

ORDS

Remote Database

6) Generate all the things

1) REST enable

Generator

Use from sqlcl.

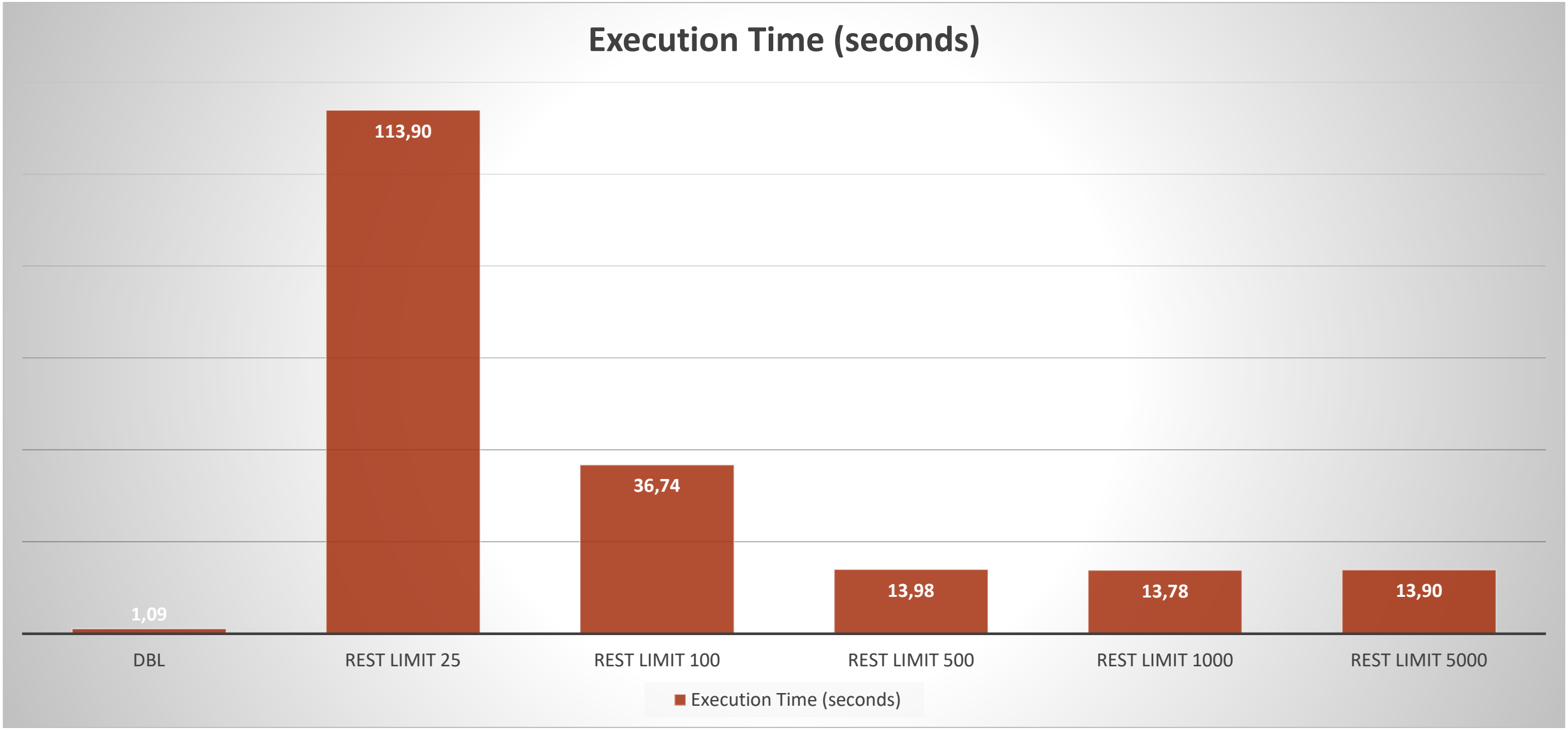
JavaScript based

Parameter:

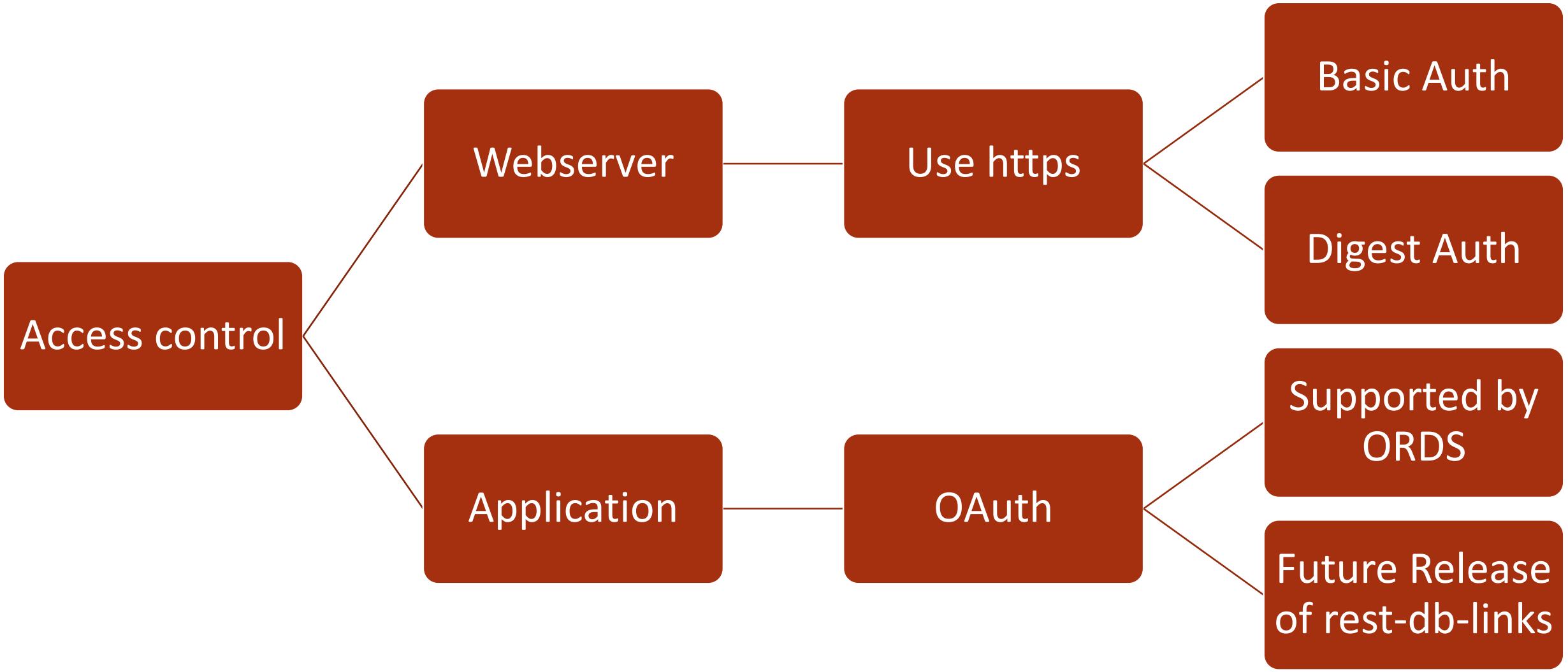
- View Name
- ORDS Metadata URL
- opional: Parameter for URL

```
script ../generator/generator
          v_stock
          http://localhost:8080/ords/rdbl/metadata-catalog/Tab-StockTicker/
          ?limit=5
-- call from single line
```

Performance Analysis



Security


Access control
Webserver
Use https
Basic Auth
Digest Auth
Application
OAuth
Supported by ORDS
Future Release of rest-db-links

DEMO Environment

OTN Developer Day VM

- Virtual Box Appliance (March 2nd, 2017)
  - Oracle Linux 7
  - Oracle Database 12cR2 EE (12.2.0.1 with In-Memory Option)
  - Oracle Application Express 5.1
  - Oracle REST Data Services 3.0.9
  - http://www.oracle.com/technetwork/database/enterprise-edition/databaseappdev-vm-161299.html

Schemas

- restdblinksCons: Consumer: Local Database
- restdblinksProv: Provider: Remote Database (Data Source)

Client

- Browser: Google Chrome
- REST Client: Insomnia
- SQL Developer
- sqlcl

Limitations / Future enhancements

Limitations

simple data types only

- No Spatial
- No Object Types

Planned enhancements

- OAuth
- Complex data types
- Move from AutoREST to custom implementation
- Integrate into SQLDeveloper (oddgen)

How do you get it?

conference website	Slides and scripts uploaded to
	http://apex.doag.org
GitHub	Latest version always here
	You can help enhance the generator – I'm accepting pull requests
	https://github.com/its-people/rest-db-links
notification	Twitter: @RobbieDatabee
	Blog: http://www.its-people.de/blog

Conclusion

Only a little magic is needed.

Performance is worse, but acceptable in most cases.

With REST and JSON, you can reach out from your database to the Internet.

Database Links can be replaced by a modern Architecture.

we make the difference
www.its-people.de

Herzlichen Dank für Ihre Aufmerksamkeit !

Questions ?

its-people GmbH
Frankfurt Tel. 069 2475 2100
Hamburg Tel. 040 2360 8808
Köln Tel. 0221 1602 5204
München Tel. 089 5484 2401

its-people ERP Beratungsgesellschaft mbH
Frankfurt Tel. 069 2475 1980

www.its-people.de **info@its-people.de**