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From the Beginning: Your First Node.js Web Service

developer.oracle.com

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Data Access Development
Oracle Database
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Live for the Code

ORACLE

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Me

P. Venkatraman

Principal Member, Technical Staff, Oracle

- Developer in Data Access team, Oracle DB
- node-oracledb development and other APIs

The Plan Today

1. What's What
2. Installation
3. The Web Service
4. Demonstration
5. Next Steps

1 What's What

2 Installation

3 The Web Service

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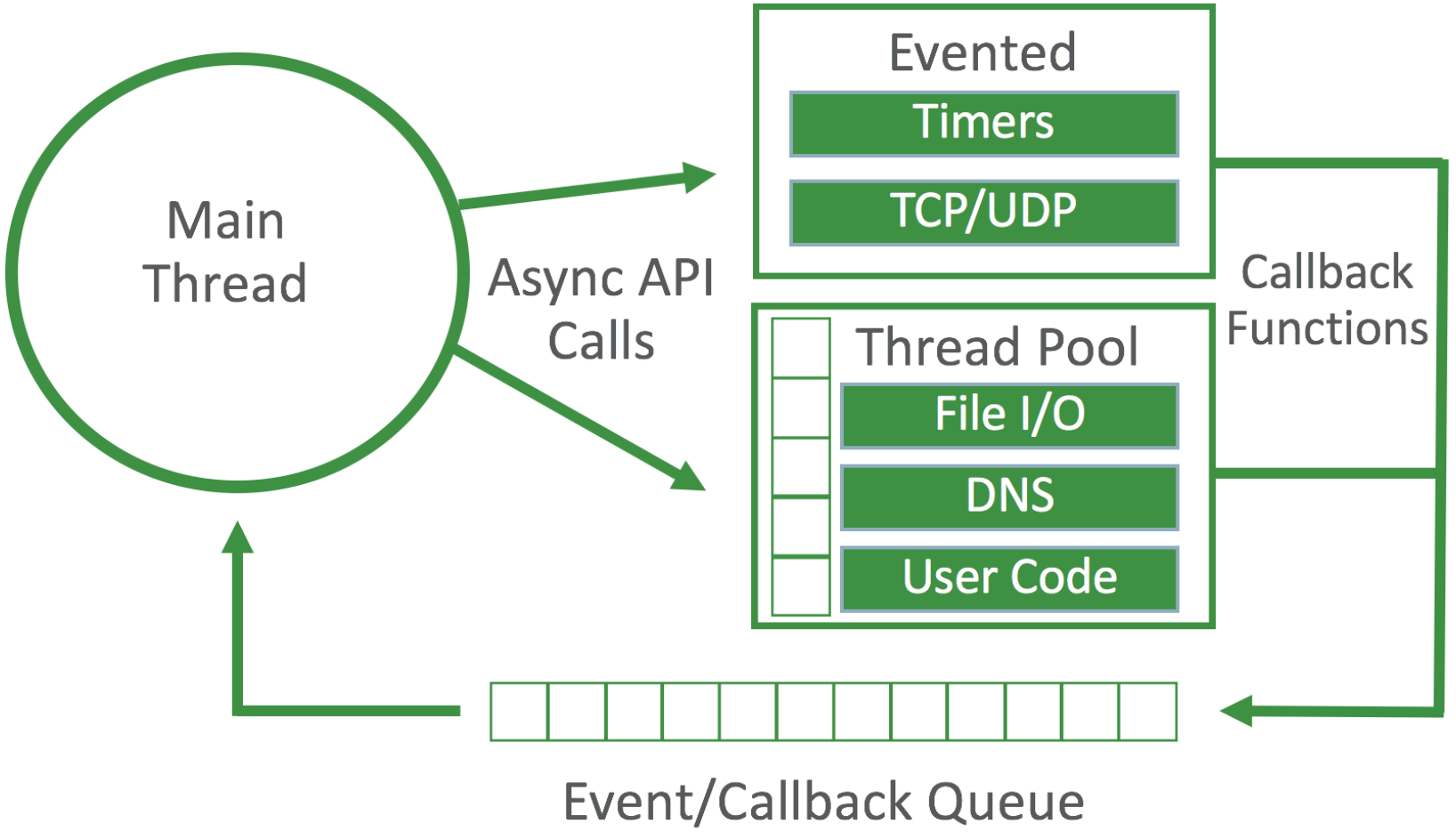
What is Node.js?

- Server-side JavaScript runtime
  - One language, front-end and back-end
- JavaScript runtime built on Chrome's V8 JavaScript engine
  - Though V8 is being decoupled to allow for other JavaScript engines
- Package ecosystem (NPM) is world's largest repo of open-source libraries
- Lightweight and efficient: event-driven, non-blocking I/O model
- Great for Web Services

Node.js architecture (not entirely accurate)



What is node-oracledb?

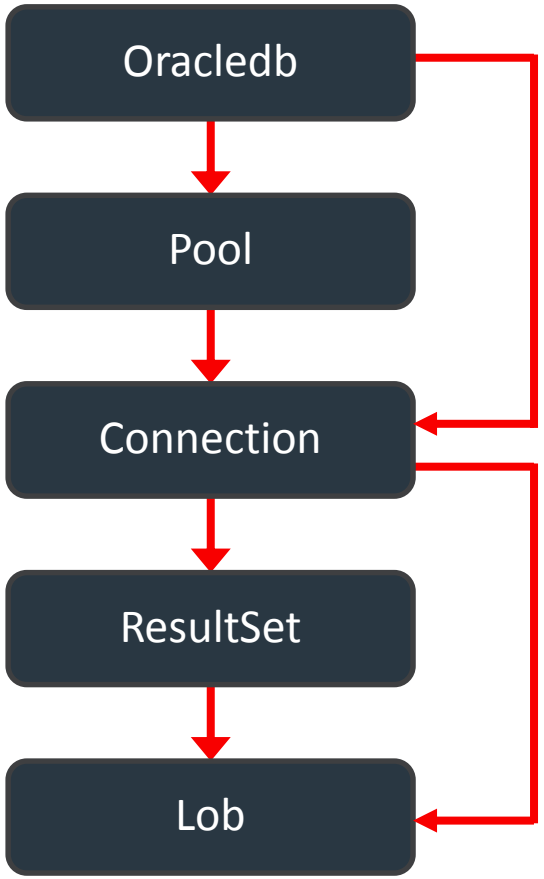
Base class
- Get connections or create pools
- Set configuration parameters

Connection Pooling
- Dramatically increases performance
- Built-in pool cache for convenience

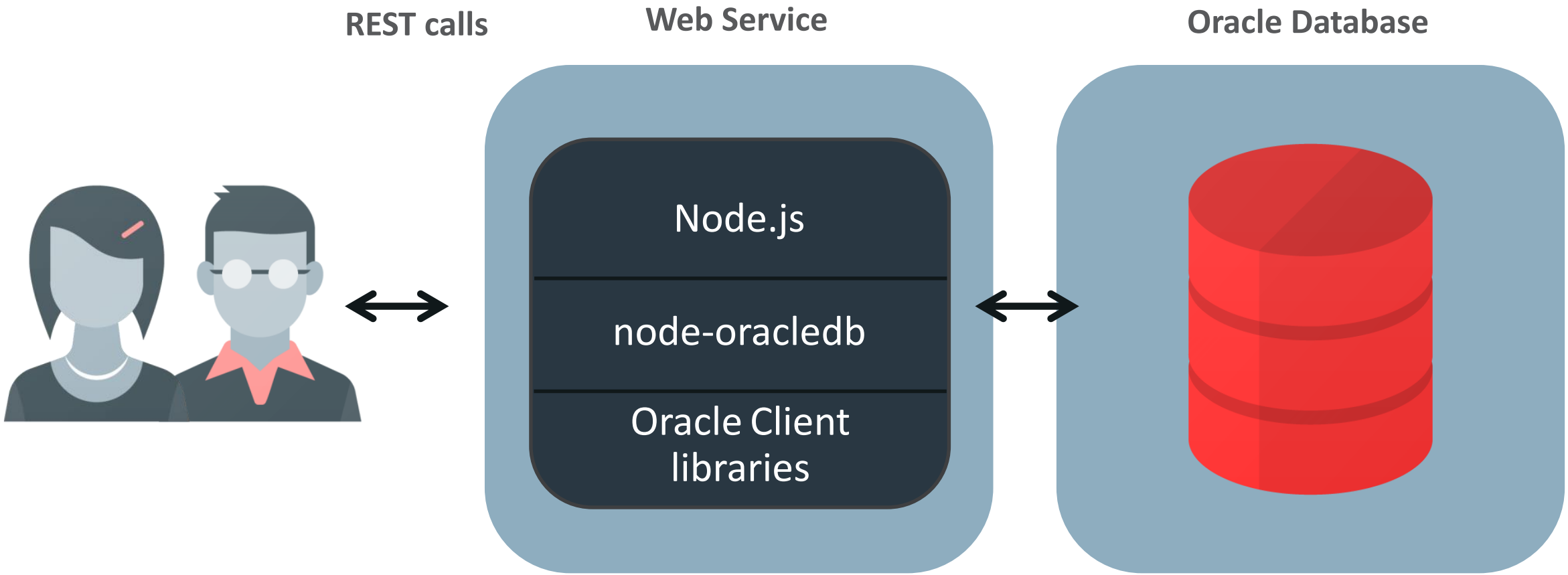
SQL and PL/SQL Execution
- Transaction support w/data type conversion
- Bind using JavaScript objects or arrays

Read-consistent, pageable cursor
- Used for large result sets
- Recursive callbacks or Node.js streams

Large object support
- Stream large LOBs with this class
- Can fetch smaller LOBs as string/buffer



The Goal Today

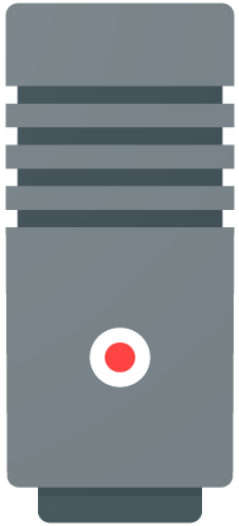


Basic ingredients for a REST API

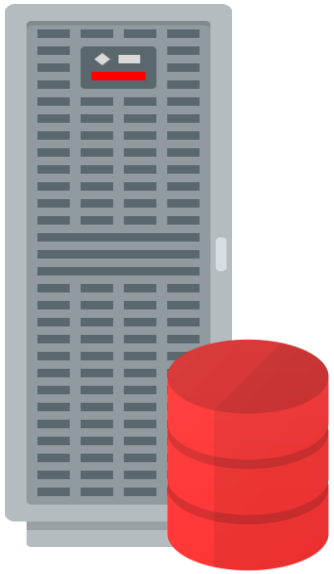
Client

Middle-tier

Web Server | Routing Logic | Controller Logic | Database Logic



Database



What features do you need to support?

- Pagination, sorting, & filtering
- Authentication & authorization
- Caching/ETag
- Doc/Swagger
- Real-time push/WebSockets
- Throttling
- Multiple representations (JSON, XML, CSV)
- CORS

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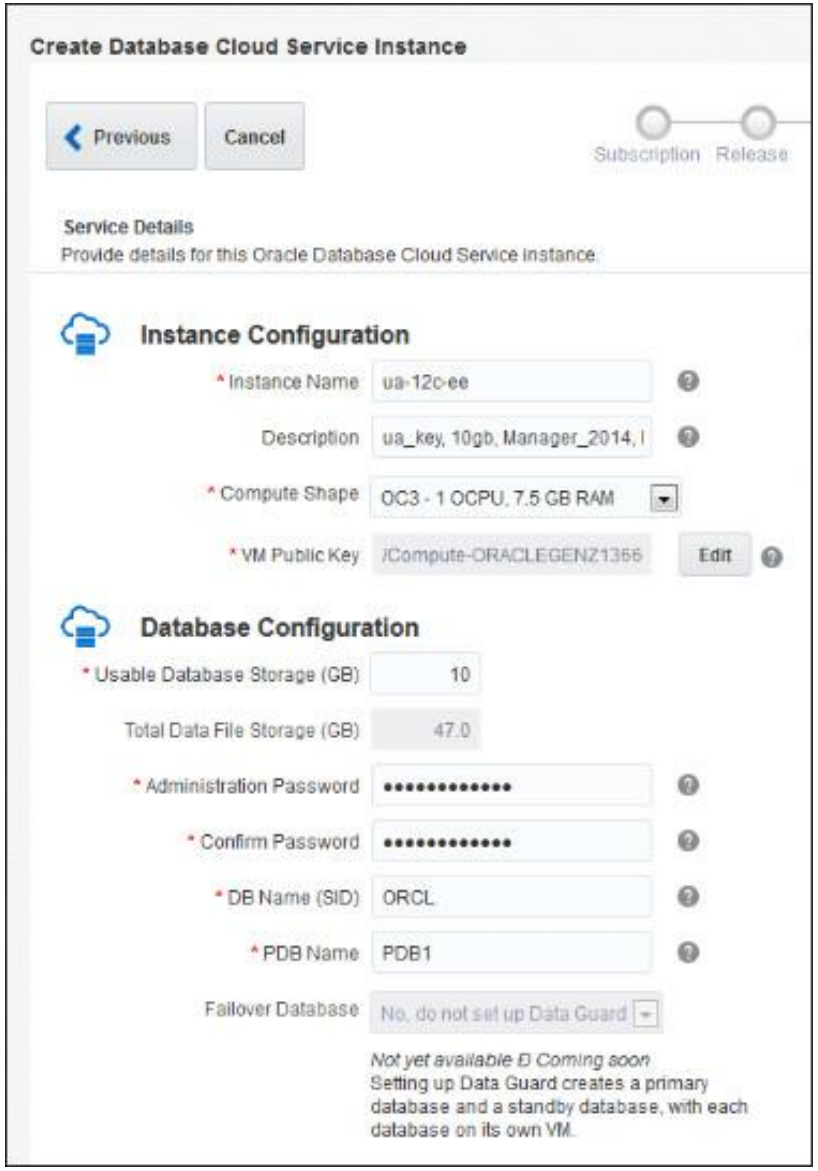
Installing Oracle DB

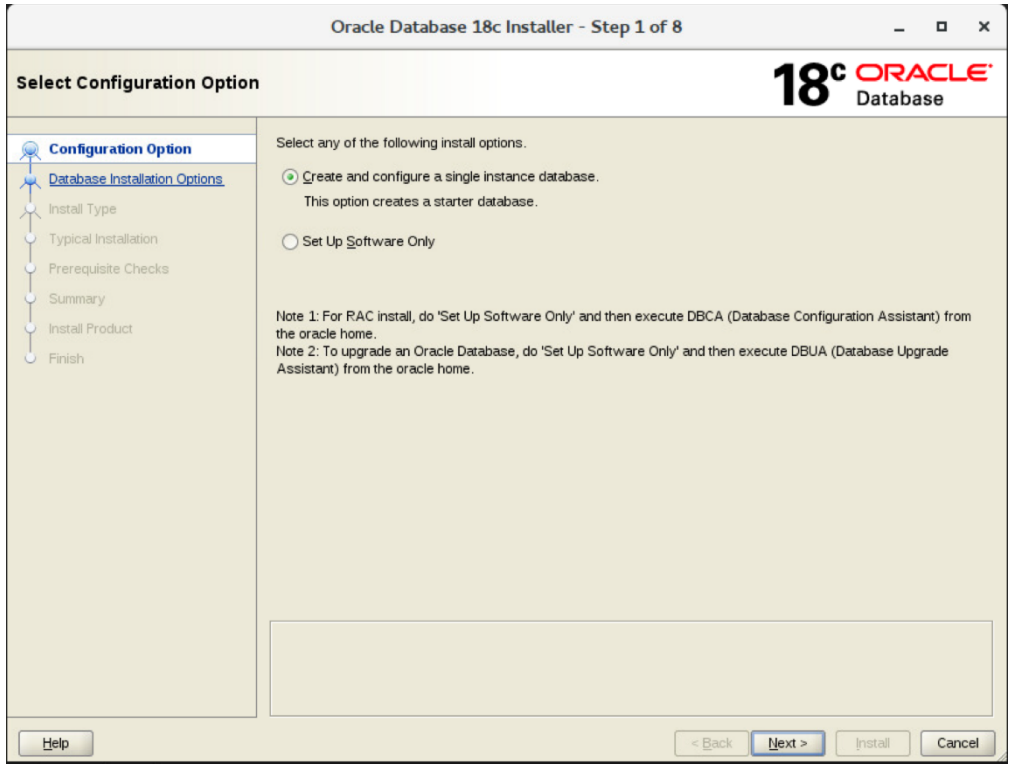
Use Oracle Cloud DBaaS

- Let someone do the install



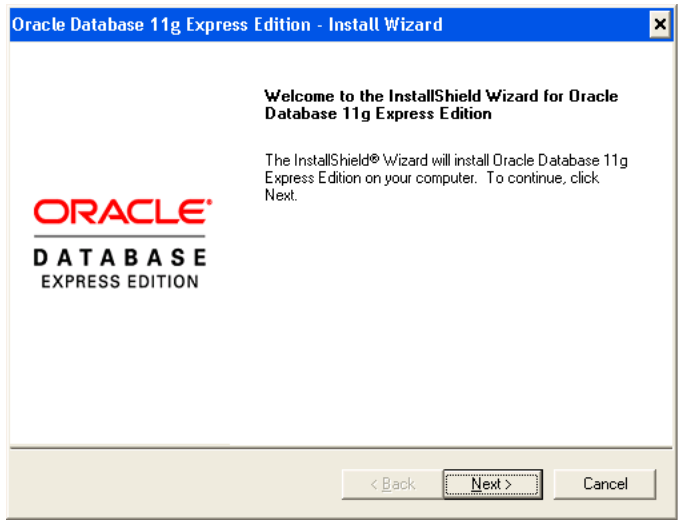
Install Oracle Enterprise Edition

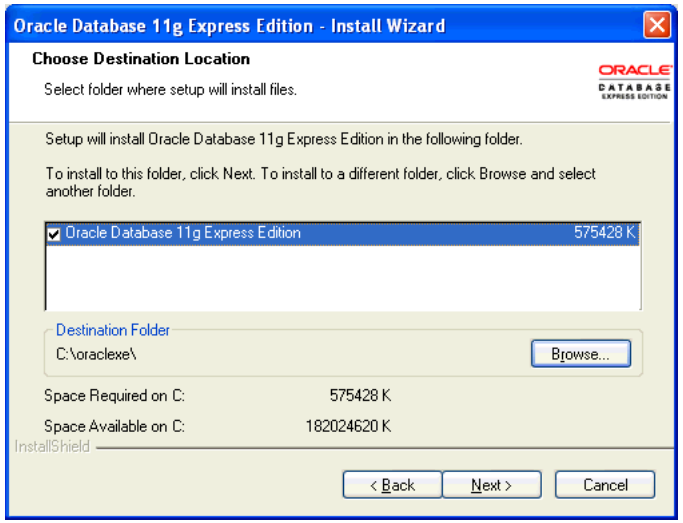
- Full Database Install
  - ./runInstaller

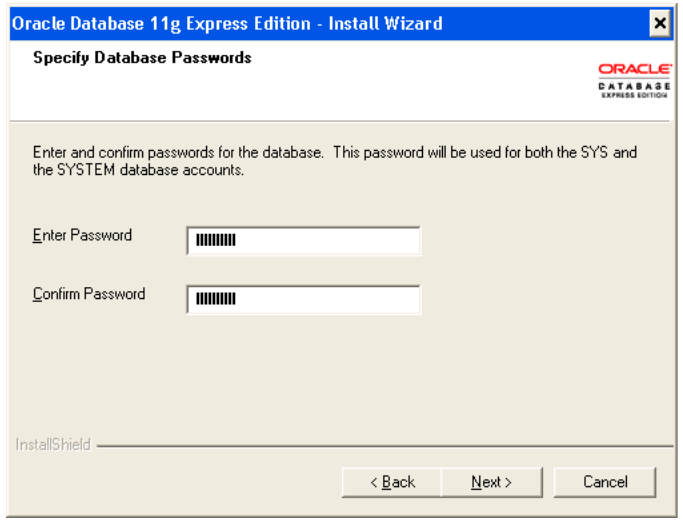


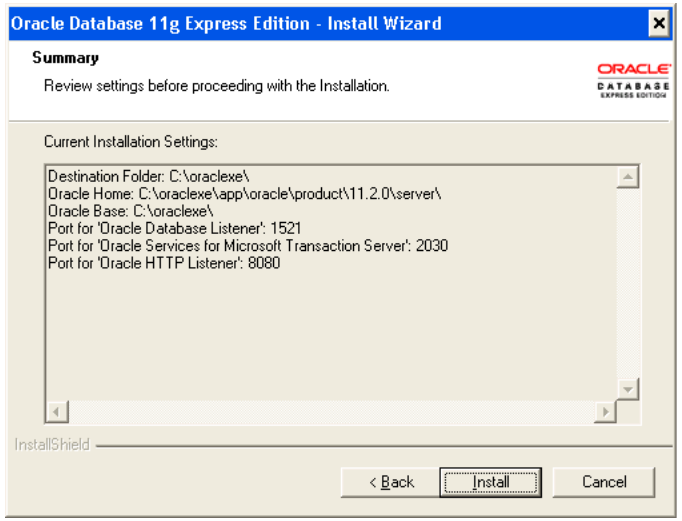
Install Oracle XE

- Linux & Windows
  - rpm or EXE
  - Simple install
- Latest is 11gR2



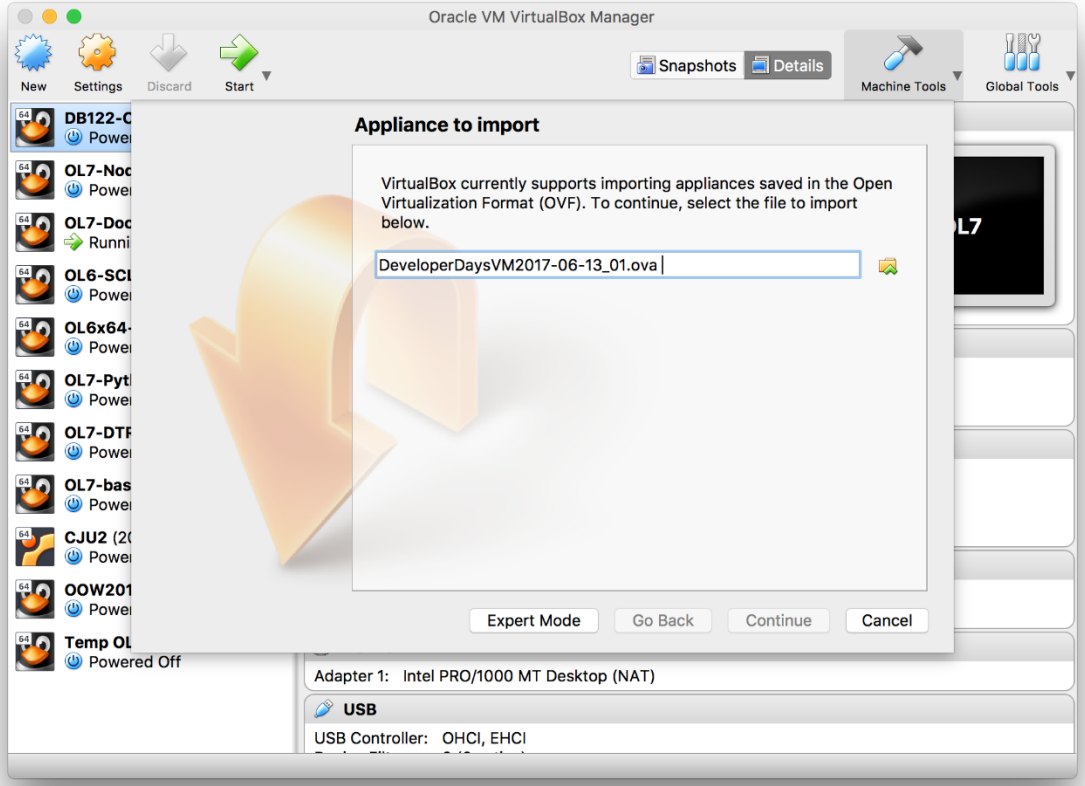


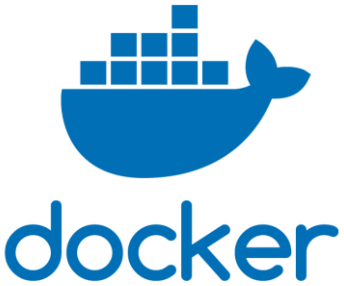




Use a Pre-built VirtualBox VM

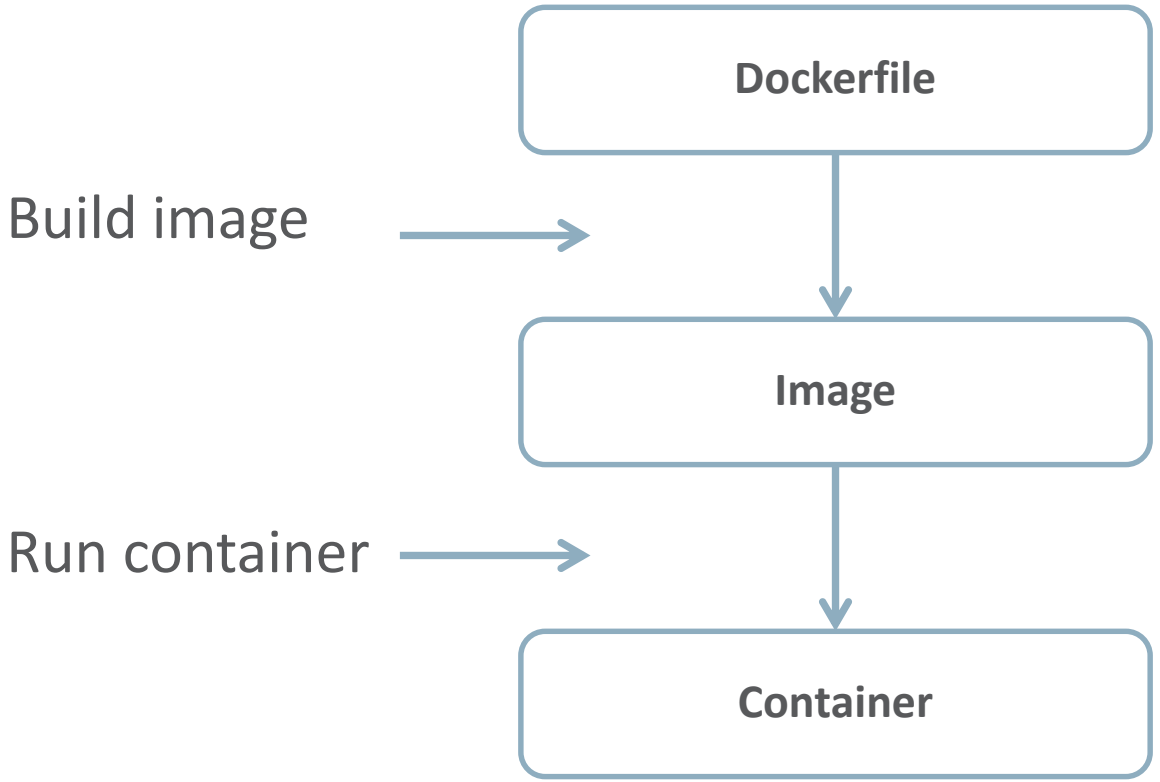
- App Development VM includes the DB and SQL Developer
  - http://www.oracle.com/technetwork/community/developer-vm/





But Let’s Use Docker!

Docker Images and Containers



Installing Docker

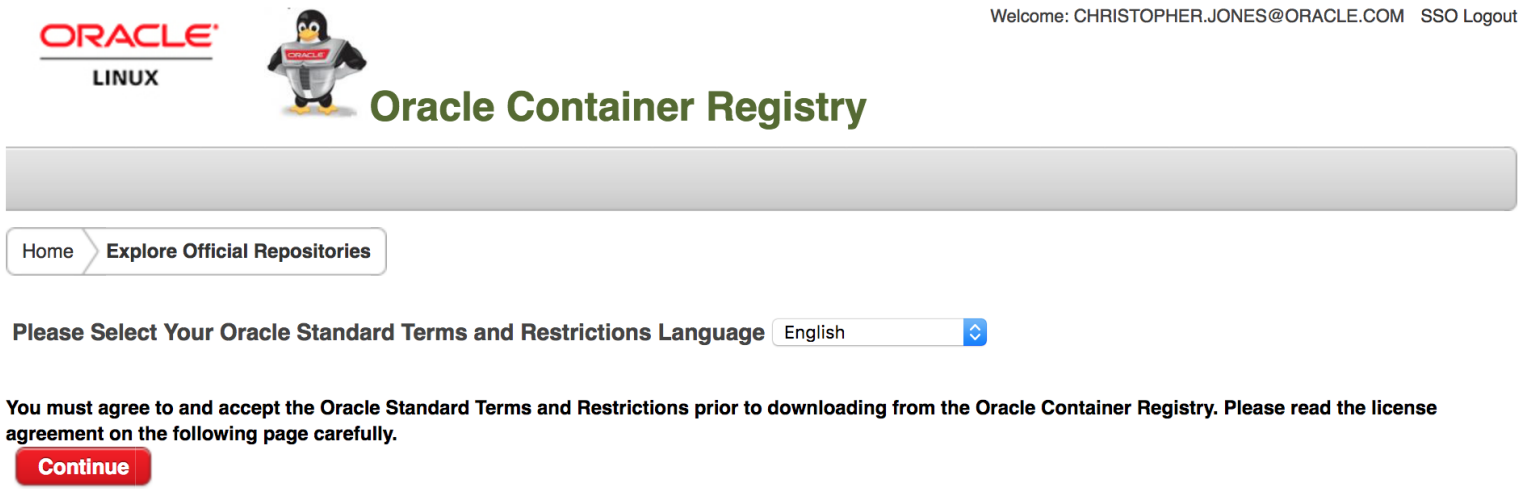
Install Docker on your Platform

- I'll use Oracle Linux 7
  - This has the ol7_latest and ol7_uekr4 channels already enabled
- Run (as the 'root' user)

```
# yum-config-manager --enable ol7_addons
# yum install docker-engine
# systemctl enable docker
# systemctl start docker
```

Oracle Docker Images

- Oracle images are available from
  - https://store.docker.com/
  - https://container-registry.oracle.com
- Accept the container-registry license



Get Oracle Docker Images

- Login from the host where Docker is installed

```
# docker login container-registry.oracle.com
```

- Oracle Database Enterprise Edition

```
# docker pull container-registry.oracle.com/database/enterprise:12.2.0.1
```

- Oracle Instant Client

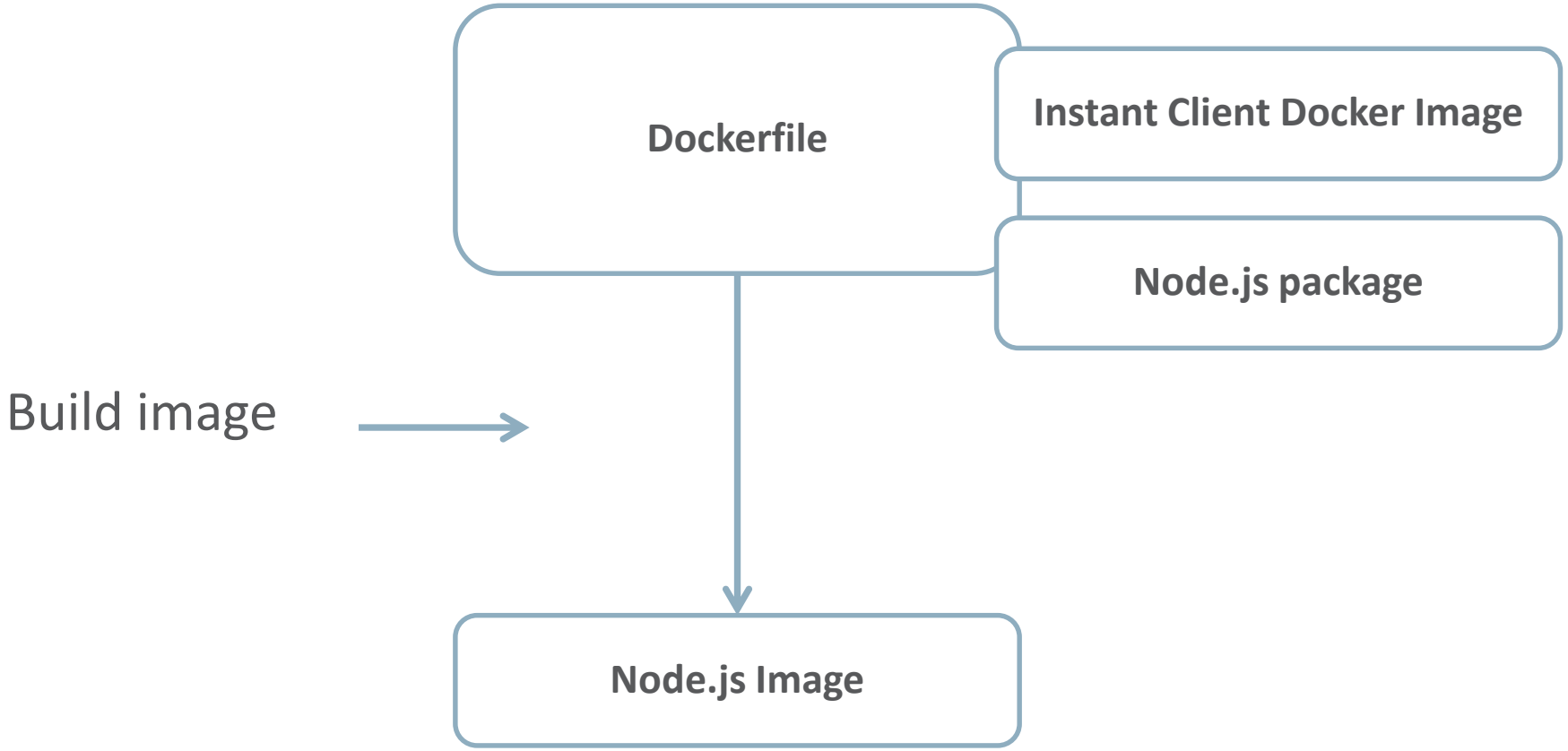
```
# docker pull container-registry.oracle.com/database/instantclient:12.2.0.1
```

- View the installed images

```
# docker images
REPOSITORY                                                TAG          IMAGE ID       CREATED          SIZE
container-registry.oracle.com/database/enterprise         12.2.0.1     12a359cd0528   7 months ago     3.44GB
container-registry.oracle.com/database/instantclient      12.2.0.1     fda46de41de3   7 months ago     407MB
```

Installing Node.js

Create a Node.js Docker Image



Create a Node.js Docker Image

- Oracle Linux RPM for several Node.js versions are in yum channels on

  http://yum.oracle.com/oracle-linux-nodejs.html

- Create ~cjones/nodejs-scripts/Dockerfile:

```
FROM container-registry.oracle.com/database/instantclient:12.2.0.1
ADD ol7_developer_nodejs8.repo /etc/yum.repos.d/ol7_developer_nodejs8.repo
RUN echo proxy=http://www-proxy.us.oracle.com:80 >> /etc/yum.conf
RUN yum -y install nodejs
```

- Create the new Node.js image based on the Instant Client image:

```
docker build -t cjones/nodejs-image ~cjones/nodejs-scripts/
```

Our Docker Images

```
# docker images
REPOSITORY                                                TAG          IMAGE ID       CREATED          SIZE
cjones/nodejs-image                                       latest       e048b739bb63   29 minutes ago   1.51GB
container-registry.oracle.com/database/enterprise         12.2.0.1     12a359cd0528   7 months ago     3.44GB
container-registry.oracle.com/database/instantclient      12.2.0.1     fda46de41de3   7 months ago     407MB
```

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Banana Farmers

The Node.js Web Service

The Scenario

- Shipments of bananas from farmers are recorded
- Shipments have a farmer name, ripeness, and weight
- Shipments can be inserted, queried, updated or deleted

Banana Color Guide

1 

ALL GREEN

As received at your warehouse from Central and South America

2 

LIGH

3 

4 

5 

6 

FU

Firm fruit with great eating flavor. Easily bruised – handle with extra care.

7 

YELLOW FLECKED WITH BROWN

Sweet eating flavor. Perfect texture and consistency for blender drinks and baking.

The Schema

```
CREATE TABLE bananas (shipment VARCHAR2(4000) CHECK (shipment IS JSON));


INSERT INTO bananas VALUES (
       '{ "farmer": "Gita", "ripeness": "All Green", ”kilograms": 100 }');
INSERT INTO bananas VALUES (
       '{ "farmer": "Ravi", "ripeness": "Full Yellow", ”kilograms": 90 }');
INSERT INTO bananas VALUES (
       '{ "farmer": "Mindy", "ripeness": "More Yellow than Green", ”kilograms": 92 }');
```

Manipulating the JSON Schema

- **`SELECT b.shipment FROM bananas b WHERE b.shipment.farmer = 'Gita'`**
  - Gives **`{"farmer" : "Gita", "ripeness" : "All Green", "kilograms" : 100 }`**
  - This is a REST GET
- **`INSERT INTO bananas (shipment) VALUES (:s)`**
  - This is a REST POST
- **`UPDATE bananas b SET shipment = :s WHERE b.shipment.farmer = :f`**
  - This is a REST PUT
- **`DELETE FROM bananas b WHERE b.shipment.farmer = :f`**
  - This is a REST DELETE

The Web Service

File ‘package.json’

```
. . .
"dependencies": {
   "body-parser": "^1.18.2",
   "express": "^4.16.0",
   "oracledb": "^2.2.0"
 },
 "main": "server.js
. . .
```

The Web Service

File ‘server.js’

```
var express = require('express');
var bodyParser = require('body-parser');
var oracledb = require('oracledb');
var dbConfig = require('./dbconfig.js');

var app = express();
app.use(bodyParser.json());

. . .
```

Connection

```
oracledb.createPool({
      user: dbConfig.user,
      password: dbConfig.password,
      connectString: dbConfig.connectString
    }, . . .
```

Connection Helper

```
function doGetConnection(res, cb) {
  oracledb.getConnection(function (err, connection) {
    if (err) {
      res.set('Content-Type', 'application/json');
      res.status(500).send(JSON.stringify({
        status: 500,
        message: "Error getting DB connection",
        detailed_message: err.message
      }));
    } else
      cb(err, connection);
  });  }
```

The GET handler (1)

/bananas/:FARMER

```
app.get('/bananas/:FARMER', function (req, res) {
  doGetConnection(res, function(err, connection) {
    if (err)
      return;
    connection.execute(
      "SELECT b.shipment FROM bananas b WHERE b.shipment.farmer = :f",
      { f: req.params.FARMER },
      function (err, result) {
       . . .
```

The GET handler (2)

/bananas/:FARMER

```
if (err) {
  res.set('Content-Type', 'application/json');
  res.status(500).send(JSON.stringify({
    status: 500,  message: "Error getting the farmer's profile",
    detailed_message: err.message
  }));
} else if (result.rows.length < 1) {
  res.set('Content-Type', 'application/json');
  res.status(404).send(JSON.stringify({
    status: 404, message: "Farmer doesn't exist", detailed_message: ""
  })); }
```

The GET handler (3)

/bananas/:FARMER

```
        else {
          res.contentType('application/json');
          res.status(200).send(JSON.stringify(result.rows));
        }
        doRelease(connection, "GET /bananas/" + req.params.FARMER);
        });
    });
});
```

All Web Service Routes

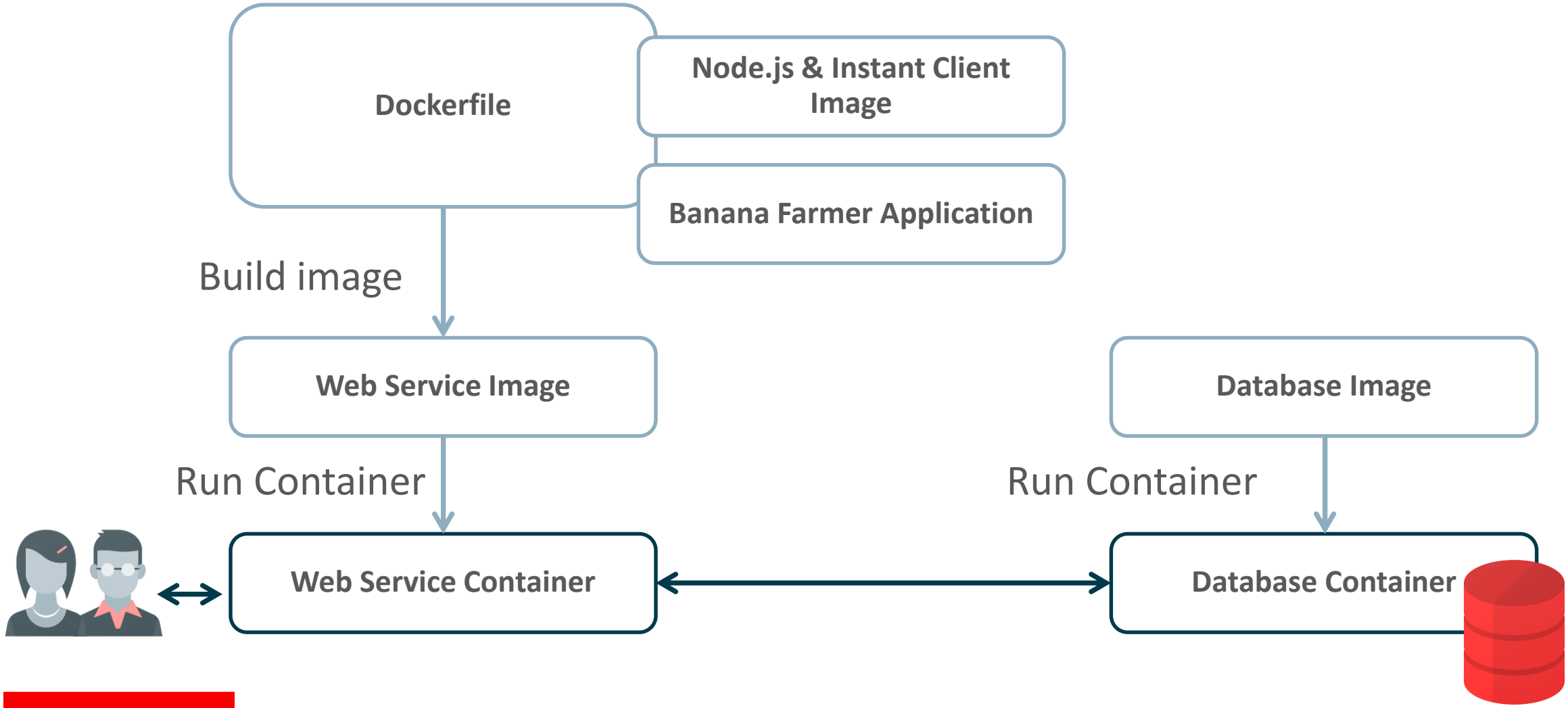
```
// GET: Get all banana shipments
app.get('/bananas', function (req, res) { . . . }

// GET: Get the banana shipment for a farmer
app.get('/bananas/:FARMER', function (req, res) { . . . }

// POST: Create a new banana shipment for a farmer
app.post('/bananas', function (req, res) { . . . }

// PUT: Update the banana shipment for a farmer
app.put('/bananas/:FARMER', function (req, res) { . . . }

// DELETE: Delete banana shipments for a farmer
app.delete('/bananas/:FARMER', function (req, res) { . . . }
```

Standalone Testing

- **`npm install`**
- Edit **`dbconfig.js`** and set credentials and connection string
- **`npm start`** (which runs '**`node server.js`**')
- Use the Web Service

Putting it Together

Putting it Together



Web Service File Overview

`ws-demo-scripts` directory:

`Dockerfile`	The recipe to build a Docker image
`package.json`	Node.js application configuration
`server.js`	Web Service Code
`dbconfig.js`	Connection credentials
`run.sh`	The command to start the WS
`envfile.list`	Credential environment variables
`createschema.sql`	Bootstrap data values

Build the Web Service Image

```
# docker build -t cjones/ws-demo ~cjones/ws-demo-scripts
```

~cjones/ws-demo-scripts/Dockerfile contains:

```
FROM cjones/nodejs-image
ENV http_proxy=http://www-proxy.us.oracle.com:80 \
    https_proxy=http://www-proxy.us.oracle.com:80
RUN mkdir workdir
WORKDIR workdir
COPY package.json package.json
COPY server.js server.js
COPY dbconfig.js dbconfig.js
COPY run.sh run.sh
RUN npm install
CMD ["./run.sh"]
```

Our Docker Images

```
# docker images
REPOSITORY                                                TAG          IMAGE ID       CREATED              SIZE
cjones/ws-demo                                            latest       31cbe6d2ea4e   21 seconds ago       1.51GB
cjones/nodejs-image                                       latest       e048b739bb63   29 minutes ago       1.51GB
container-registry.oracle.com/database/enterprise         12.2.0.1     12a359cd0528   7 months ago         3.44GB
container-registry.oracle.com/database/instantclient      12.2.0.1     fda46de41de3   7 months ago         407MB
```

The Database Container

- Start the Database Container:

```
# docker run –d --name demodb -P \
        container-registry.oracle.com/database/enterprise:12.2.0.1
```

- Check status until it shows ‘(healthy) ’:

```
# docker ps
```

- Find the IP address so we can connect the Web Service to the DB:

```
# docker inspect -f "{{ .NetworkSettings.IPAddress }}" demodb
```

- The Container can be stopped/started as desired with:

```
# docker stop demodb
# docker start demodb
```

Create the Banana Farmer Schema

```
# sqlplus -l sys/Oradoc_db1@172.17.0.2/orclpdb1.localdomain as sysdba \
    @ createschema.sql

SQL> CREATE USER scott IDENTIFIED BY tiger;
SQL> GRANT CONNECT, RESOURCE TO scott;
SQL> ALTER USER scott QUOTA UNLIMITED ON USERS;
SQL> CREATE TABLE scott.bananas (
  2  shipment VARCHAR2(4000) CHECK (shipment IS JSON));
SQL> INSERT INTO scott.bananas VALUES (
  2  '{"farmer": "Gita", "ripeness": "All Green", "kilograms": 100}');
. . .
```

The Web Service Container

- Set DB IP in the connect string environment variable in
  ~cjones/ws-demo-scripts/envfile.list:

```
NODE_ORACLEDB_CONNECTIONSTRING=172.17.0.2/orclpdb1.localdomain
```

  – This is used in dbconfig.js when the container runs
- Start the Web Service Container:

```
# docker run -d --name nodejs -P \
    --env-file ~cjones/ws-demo-scripts/envfile.list cjones/ws-demo
```

- Find the Web Service IP address:

```
# docker inspect -f "{{ .NetworkSettings.IPAddress }}" nodejs
```

- The Container can be stopped/started as desired:

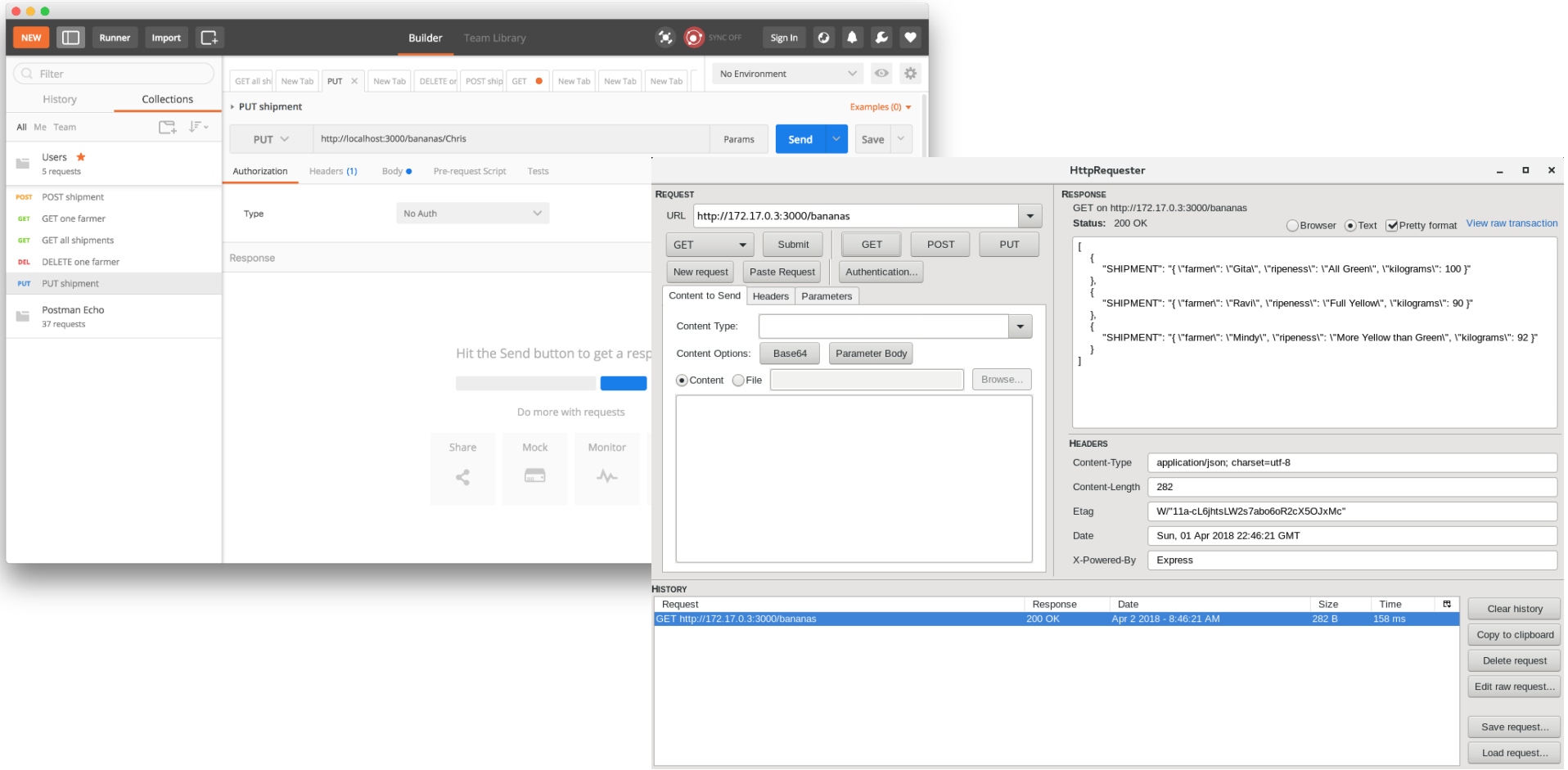
  docker stop nodejs or **docker start nodejs**

Done!

```
# docker images
REPOSITORY                                          TAG          IMAGE ID       CREATED             SIZE
cjones/ws-demo                                      latest       25caede29b17   12 minutes ago      1.51GB
cjones/nodejs-image                                 latest       138f2b76ffe7   13 minutes ago      1.51GB
container-registry.oracle.com/database/enterprise   12.2.0.1     12a359cd0528   7 months ago        3.44GB
container-registry.oracle.com/database/instantclient 12.2.0.1    fda46de41de3   7 months ago        407MB

# docker ps
CONTAINER ID  IMAGE                COMMAND                  STATUS                PORTS                                                 NAMES
2924e1225290  cjones/ws-demo       "./run.sh"               Up 3 hours                                                                  nodejs
9596bc2345d3  [...]/database/[...] "/bin/sh -c '/bin/..." Up 3 hours (healthy) 0.0.0.0:32803->1521/tcp, 0.0.0.0:32802->5500/tcp demodb
```

- The Web Service (in 'nodejs') knows the connection string for the database (in 'demodb')
  - **`172.17.0.2/orclpdb1.localdomain`**
- We know the IP of the web service from the 'docker inspect' command
  - **`172.17.0.3`**
- We know the Web Service port and endpoints (coded in **`server.js`**)
  - **`http://172.17.0.3:3000/bananas`**

Install Postman or HttpRequester Browser Extension



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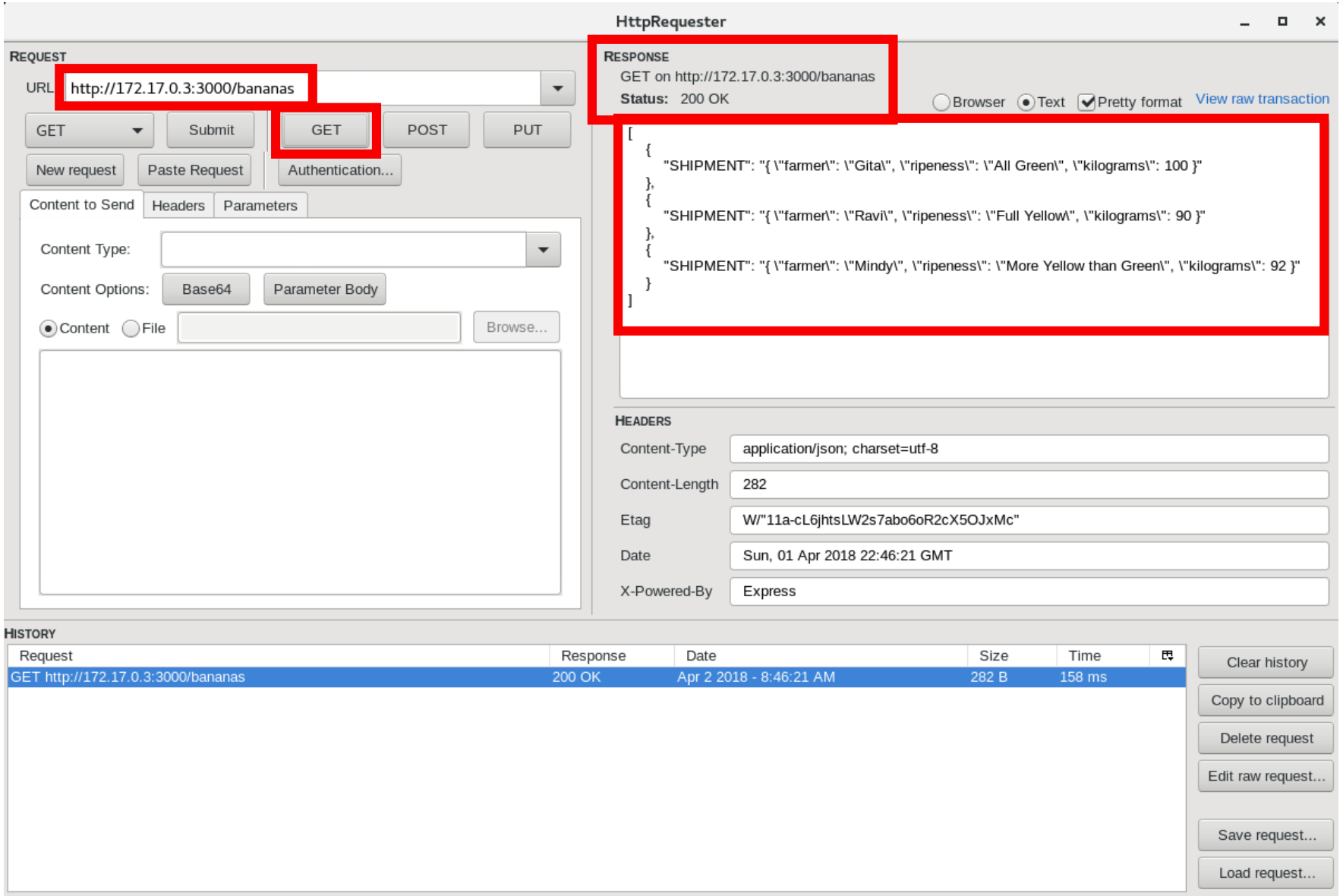

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Next Steps

- Explore node-oracledb features
  - https://oracle.github.io/node-oracledb/
- Customize your own Database image from Oracle Docker scripts
  - https://github.com/oracle/docker-images
- Read the Blog series “Creating a REST API with Node.js and Oracle Database”
  - https://jsao.io/2018/03/creating-a-rest-api-with-node-js-and-oracle-database/
- Explore Sails, Loopback, GraphQL, . . .

References

Homepage	**https://oracle.github.io/node-oracledb/**
Help	**https://github.com/oracle/node-oracledb/issues**
Christopher Jones	**@ghrd**
	https://blogs.oracle.com/opal
Dan McGhan	**@dmcghan**
	https://jsao.io/
Anthony Tuininga	**@AnthonyTuininga**
P. Venkatraman	**@pvenkatraman**

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