



# Refactor of Rota application using modern developer techniques:

Oracle Restful Data Services & Oracle Jet

AUGUST 2017

**AUTHOR:**

Rebekka Alvsvåg

**SUPERVISOR:**

Luis Rodríguez Fernández





## PROJECT SPECIFICATION

---

The Rota application schedules the support activities of all the members of the CERN IT-DB group. This system is used by the database, middleware, storage and systems administrators. Nowadays the application is highly tied to the database due to its implementation (Oracle APEX).

Oracle Restful Data Services (ORDS) makes it easy to develop modern REST interfaces for relational data in Oracle Databases (Oracle 2017). Oracle JavaScript Extension Toolkit (JET) is a collection of open source JavaScript libraries along with a set of Oracle contributed JavaScript libraries, that make it as simple and efficient as possible to build applications that consume and interact with Oracle products and services (Oracle 2017).

The goal of the project is to design a new web user interface for the DB Rota tool with these objectives in mind:

- Improve the User experience.
- Separate the back-end services from the user interface.
- Make the application portable, modular and open to extensions.
- Test and evaluate some of the latest Oracle technologies and frameworks.

The student will get familiar with the full cycle of project development: from analyzing and getting the user requirements to the implementation and deployment of a final solution.

---



## ABSTRACT

---

The purpose of this report is to document the project that Rebekka Alvsvåg was working on during the CERN openlab Summer Student Programme of 2017. For 9 weeks, she was working in the IT-DB-IMS group at CERN. During the programme she got experience and knowledge from a full cycle IT project. She also got to attend relevant IT lectures, as well as giving presentations about the project.

The objective of the project was to refactor an application called the DB Rota Tool, using Oracle Restful Data Services and Oracle Jet. The DB Rota Tool is a web application for scheduling the support activities for the CERN IT-DB-IMS group.

The main goal of the project is to make a new web application by improving the user experience, and make it modular, portable and open to extensions. The project is based on a collaboration between CERN openlab and Oracle. Therefore, the project focuses on testing, evaluation and providing feedback about some of the latest Oracle technologies and frameworks, as well as contribution to the Oracle Community.

The first part of the report includes an introduction to CERN openlab Summer Student Programme, the IT-DB-IMS group, the development team and the objective of the project. In the main part of the report the system architecture, workflow and the use of Oracle Jet Cookbook and oAuth2 are explained. The last chapter includes the results and the conclusions for the project.



# TABLE OF CONTENTS



## 1. INTRODUCTION

A. CERN OPENLAB SUMMER STUDENT PROGRAMME

B. THE IT-DB-IMS GROUP

C. THE DEVELOPMENT TEAM

D. THE OBJECTIVE OF THE PROJECT

06



## 2. SYSTEM ARCHITECTURE

09



## 3. WORKFLOW

10



## 4. OAUTH2

11



## 5. ORACLE JET COOKBOOK

A. CALENDAR COMPONENT

12



## 6. RESULTS & CONCLUSIONS

14



## 7. REFERENCES

16





## ACKNOWLEDGMENTS

I want to express my sincere thanks to my supervisor Luis Rodríguez Fernández and the IT-DB-IMS team for giving me helpful tips and insights on my project, and making me feel very welcome during my two months as a Summer Student at CERN. As well I want to thank CERN openlab and Oracle for giving me the opportunity to join the international environment at CERN, and work on interesting and challenging topics.

During the programme I have gotten valuable experiences and knowledge that I can use in my future studies and career. The programme have also given me many good memories and friends from all around the world. I am very grateful for the opportunity and I truly recommend it for others! The programme exceeded all my expectations, and it has been an amazing and memorable summer!





## 1. INTRODUCTION

*This chapter includes an introduction to the project with the description of the CERN openlab Summer Student Programme, the Development Team, the CERN IT-DB-IMS Group and the Objective of the Project.*

### a. CERN openlab Summer Student Programme

The CERN openlab Summer Student Programme is a yearly programme where around 30 – 37 students are chosen from all over the world, to work on a research project on cutting edge technologies for two months during the summer. CERN openlab is a partnership between CERN and external ICT companies like Oracle, Intel and others. The CERN openlab Summer Student projects are based on this collaboration, which makes an interesting and unique package for the programme.

As well as working on their projects, the CERN openlab Summer Students also get the opportunity to attend interesting IT lectures on relevant topics given by experts in their fields. They also get to visit the CERN experimental areas and accelerators like the Compact Muon Solenoid (CMS) and ATLAS. Another highlight of the programme is the visits to external companies like for instance the visit to Google in Zürich, Switzerland.

### b. CERN IT-DB-IMS Group

The Summer Student Rebekka Alvsvåg worked as a member of the IT-DB-IMS Group at CERN for the duration of two months of the CERN openlab Summer Student Programme. The mandate of the CERN IT-DB-IMS Group is to take care of the infrastructure (Linux boxes), middleware (Oracle WebLogic and apache-tomcat) and storage for the CERN Databases (Oracle, MySQL, PostgreSQL), as well as web applications from many different CERN departments and services: e.g. administration, engineer, etc. (IT-DB 2017).





### c. The Development Team

The development team of the project consists of the CERN openlab Summer Student Rebekka Alvsvåg, and the CERN supervisor Luis Rodríguez Fernández.

Name	E-mail address	Role
Rebekka Alvsvåg	rebekka.alvsvag@gmail.com	Web Developer
Luis Rodríguez Fernández	luis.rodriguez.fernandez@cern.ch	Supervisor

*Figure 1. Names and contact information of the team members*

Alvsvåg is a web developer from Norway and has a Bachelor of Science in Informatics from The Norwegian University of Science and Technology (NTNU).

Fernández is a Java developer and middleware specialist with over 10 years experience in building portals, web applications and systems integrations. He works at CERN in the IT-DB-IMS group and is a member of the CERN openlab program (CERN 2017).





#### d. The Objective of the Project

The project involves refactoring of an application called the DB Rota tool. This is a web application for scheduling the support activities for the members of the CERN IT-DB Group. It is based in a technology called Oracle APEX or Oracle Application Express. As the name states, it is a technology that allows you to develop applications quickly. But it has some disadvantages, for example that it is highly tightened to the database and it is not modular.

The objective of the project is to make a new DB Rota tool based in Oracle Jet and Oracle ORDS. Oracle Jet stands for Oracle JavaScript Extension Toolkit, and it is an open source JavaScript framework which is very good for developing hybrid applications (Oracle 2017). The Oracle ORDS stands for Oracle Rest Data services and it is a java application that maps HTTP verbs to database transactions (Oracle 2017).

When putting the two technologies together you see that they are quite easily combined and they have many advantages as shown in the figure below (See Figure 2).

The Oracle Jet is open source and it makes your application modular, portable and open to extensions (Oracle 2017). The Oracle ORDS is simple and it allows you to expose a rest API with nearly zero code (Oracle 2017).

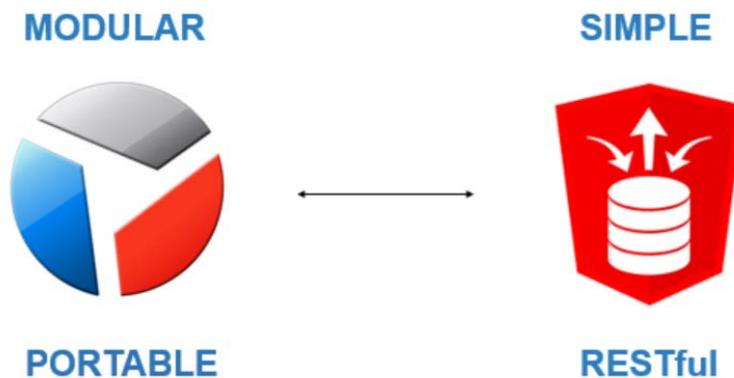


Figure 2. Oracle Jet and Oracle ORDS





## 2. SYSTEM ARCHITECTURE

This chapter includes the System Architecture of the project.

In the figure below you can see the building blocks of the application (see Figure 3). The Oracle Jet application is deployed in OpenShift which is a platform as a service. The front-end is secured with CERN SSO which stands for CERN Single Sign On. With Oracle ORDS we can expose the REST API, and it is served in an Oracle WebLogic server. The backend is secured with OAUTH2 (See chapter 4).

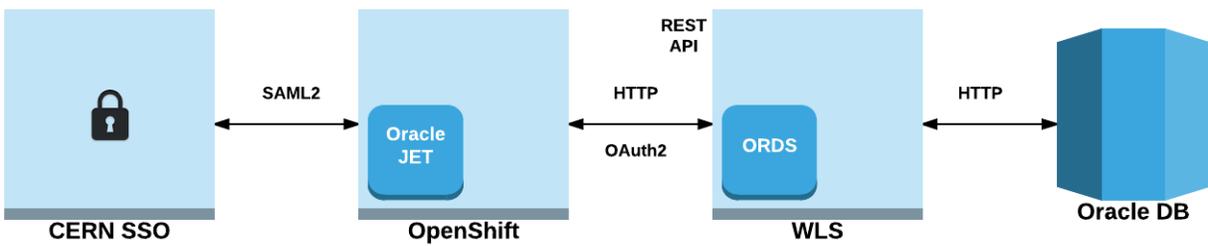


Figure 3. The building blocks of the DB Rota Tool





### 3. WORKFLOW

*This chapter includes the Workflow of the project.*

In the figure below you can see the workflow of the project (see Figure 4). In the first stage the developer is writing the code in a NetBeans IDE and she is using Docker (Docker 2017). Then the developer is running the unit tests, and when she is happy with the code, she pushes it to GitLab (WorldVectorLogo 2017). Here the integration tests are run, and she does the build with CI which stands for Continuous Integration. Next she deploys the application to OpenShift and puts it to production (WorldVectorLogo 2017).

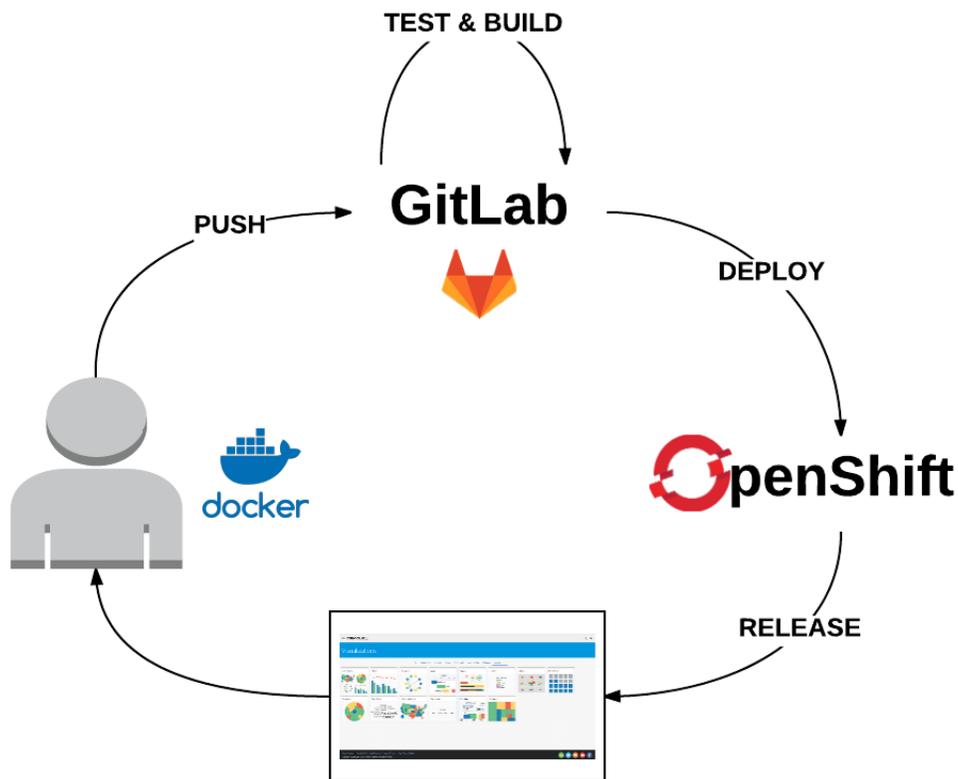


Figure 4. The workflow of the project



## 4. OAUTH2

*This chapter includes a description of the use of oAuth2 in the development process of the web application.*

During the project the developer investigated how to best secure the front-end. The team explored the possibility of using CERN Central oAuth2 for the front-end, but got feedback that it does not support Implicit Grant Flow, which is what you want to use for web applications.

The developer has been experimenting with different types of OAuth2 for authorization of the application. She discovered that Oracle Jet doesn't really provide OAuth2 for Implicit Flow, which is the type of grant flow that should be used for web applications. The Oracle Jet has a helper class called `oj.oauth2`, but it only works for Client Credentials Flow. She discovered that the `oj.oauth2` does not provide anything for Implicit Flow. Therefore, the developer explored different open source JavaScript libraries for Implicit oAuth2 (OAuth 2017).

The developer gave feedback about the issue to Oracle and made a post in the Oracle Jet Community, about the missing oAuth2 Implicit Grant Flow in the Oracle Jet (Alvsvåg 2017). In relation to this, the developer updated the CERN TWiki with a tutorial on how to define the OAuth2 Implicit Flow for Oracle REST Data Services (Alvsvåg 2017).

The supervisor Luis Rodríguez Fernández has made an implementation of the oAuth2 Implicit flow, which works for Oracle Jet and Oracle ORDS. It is a possible alternative to use for the application.



Figure 5. oAuth2: Missing Implicit Grant Flow in Oracle Jet and CERN SSO





## 5. ORACLE JET COOKBOOK

This chapter includes a description of the Oracle JET Cookbook and how it is used in the project. It also includes an issue related to a missing Calendar Component in the Cookbook, and the testing of external components.

A good feature of the Oracle Jet, is that it includes a Cookbook, which is a collection of many nice GUI components (Oracle 2017). You can choose a component from the cookbook and easily integrate it in your Oracle JET application (See Figure 6).

In the beginning of the CERN openlab Summer Student programme, the developer started to learn about Oracle Jet through a MOOC, which stands for Massive Open Online Course (Oracle 2017). This was a very good place to start learning about the framework, since it follows you through the different aspects of the framework and explains how to make your first hello world application.

The MOOC for Oracle Jet explains well how to use the Cookbook to integrate the GUI components into your first application, as well as how to tweak the components to fit to the needs of your application.

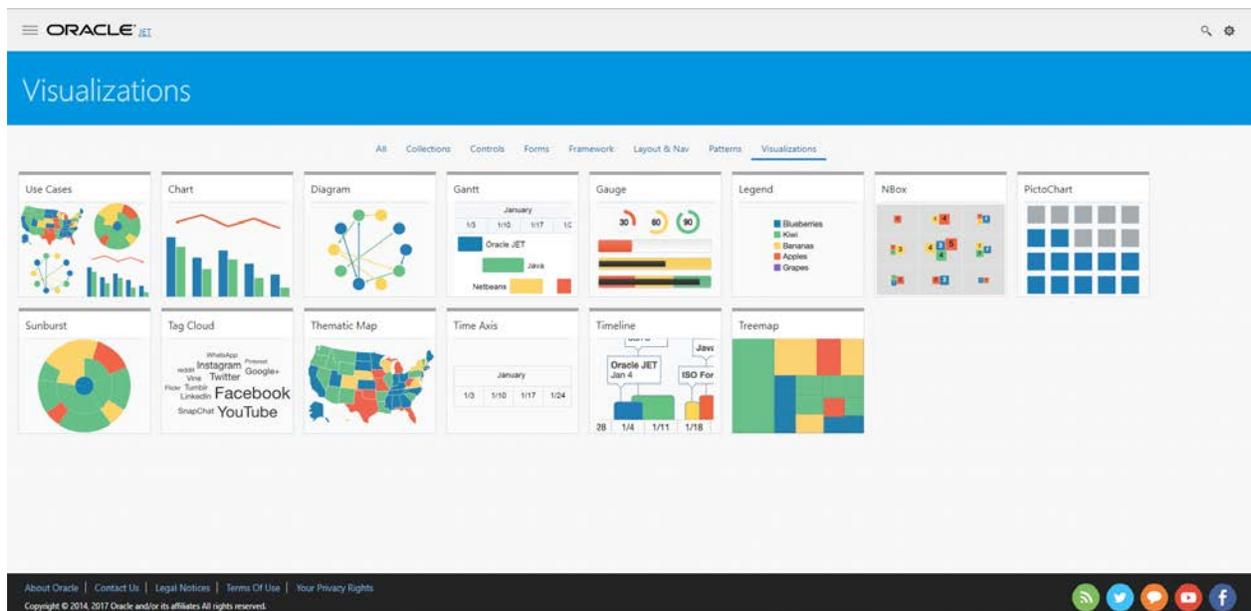


Figure 6. Screenshot of the Oracle Jet Cookbook





### a. CALENDAR COMPONENT

The developer discovered that the Oracle Jet Cookbook does not include a normal calendar component, which was needed for the DB Rota application. Because of this the developer investigated many different external calendar components. The fullcalendar.io was a suitable choice for DB Rota tool, for showing the scheduling of the support activities for the IT-DB-IMS group (FullCalendar 2017) (See Figure 7).

She also wrote a post in the Oracle Jet Community about the missing calendar component in the Oracle Jet Cookbook (Alvsvåg 2017).

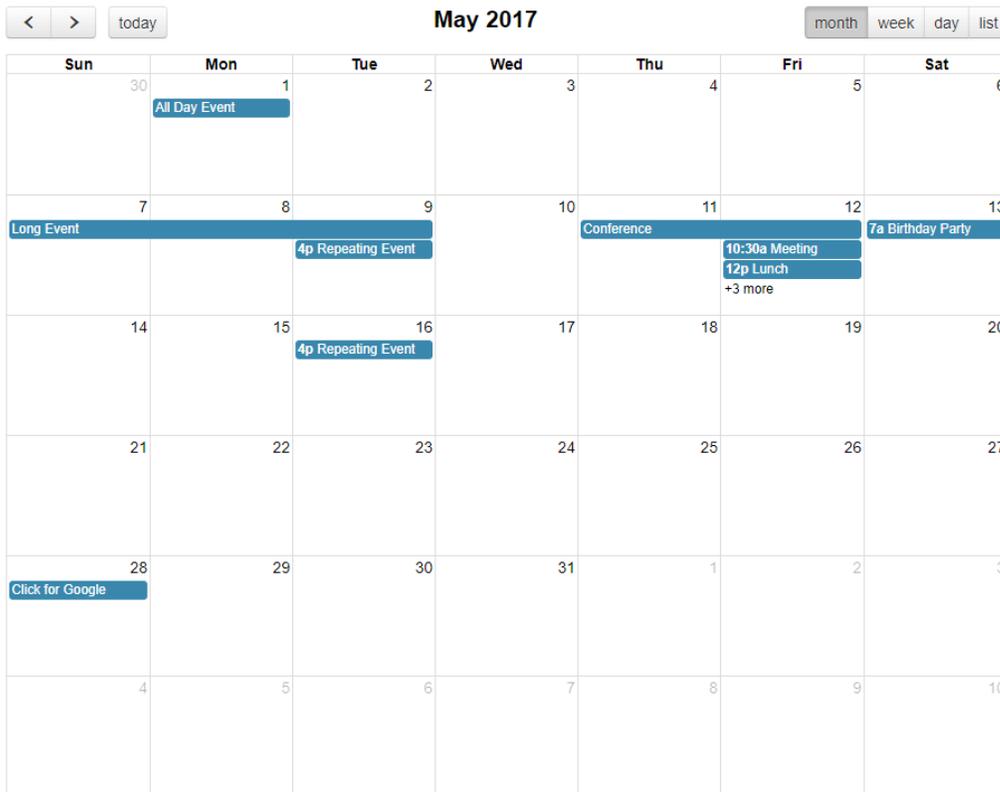


Figure 7. External Calendar Component - <https://fullcalendar.io>

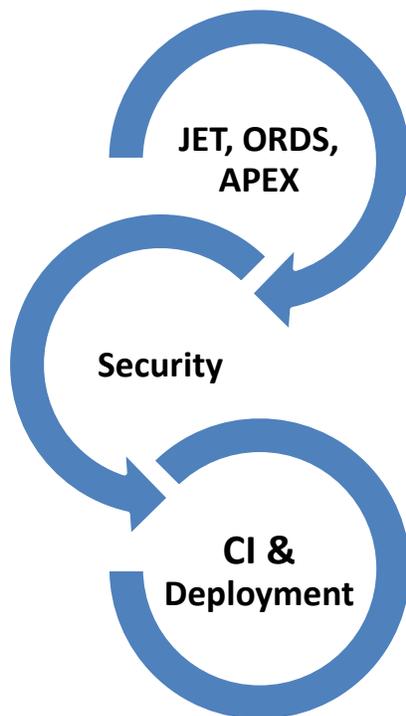




## 6. RESULTS AND CONCLUSIONS

*This chapter includes the Results and Conclusions about the project.*

During the two months of the CERN openlab Summer Student Programme, the developer has gained valuable experience and knowledge from a hands-on and full cycle IT development project. She has also attended relevant IT lectures, as well as held presentations about the project (CERN Openlab Summer Students' lightning talks 2017). She has worked with new technologies and real-world problems, in a very inspiring, motivating and international environment with colleagues from all around the world.



The project has allowed the developer and the colleagues to learn about many new tools and technologies. The developer has been able to take part in the whole development cycle with analyzing and getting the user requirements, as well as development, testing, security, continuous integration and deployment (See Figure 8).

She has also been able to test the development process of two different types of Oracle Jet applications; a normal web application and a hybrid application.

You can find the GitLab repositories for the two applications below.

*Figure 8. The full development cycle*

GitLab - normal web application (Alvsvåg 2017): <https://gitlab.cern.ch/ralvsvaa/db-rota-refactor>

GitLab - hybrid application (Alvsvåg 2017): <https://gitlab.cern.ch/ralvsvaa/rota-playground>



The goal for the project was to improve the user experience and add a more modern look and feel to the application. It is important to highlight the focus point for the project concerning the collaboration between CERN openlab and Oracle (See Figure 9). The developer had the opportunity to focus on testing, evaluation and exploration of different features of the Oracle JET and other Oracle technologies. She was able to give feedback and contribute to the Oracle Community.

As a future work and further feedback, it is a possibility to deploy the Oracle Jet application in Oracle Cloud instead of OpenShift which is the current solution.

If you have any questions or comments related to the project, feel free to send an email to the developer Rebekka Alvsvåg.

E-mail Rebekka Alvsvåg: [rebekka.alvsvag@gmail.com](mailto:rebekka.alvsvag@gmail.com)

FEEDBACK

COLLABORATION



Figure 9. Collaboration between CERN openlab and Oracle





## 7. REFERENCES

1. Alvsvåg, R. (2017). "GitLab Repository: DB Rota Tool refactor. Oracle JET & ORDS." Retrieved 05.09.2017, from <https://gitlab.cern.ch/ralvsvaa/db-rota-refactor>.
2. Alvsvåg, R. (2017). "GitLab: Hybrid DB Rota Tool refactor. Oracle JET & ORDS." Retrieved 05.09.2017, from <https://gitlab.cern.ch/ralvsvaa/rota-playground>.
3. Alvsvåg, R. (2017, 07.08.2017). "No event calendar component in Cookbook?". Retrieved 05.09.2017, from <https://community.oracle.com/thread/4070268>.
4. Alvsvåg, R. (2017, 18.07.2017). "oAuth tutorial ". Retrieved 05.09.2017, from <https://community.oracle.com/thread/3997032>.
5. Alvsvåg, R. (2017, 06.07.2017). "ORDS & OAuth 2 : Implicit." Retrieved 05.09.2017, from [https://twiki.cern.ch/twiki/bin/view/DB/DevelopingOracleRestfulServices#ORDS\\_OAuth\\_2\\_Implicit](https://twiki.cern.ch/twiki/bin/view/DB/DevelopingOracleRestfulServices#ORDS_OAuth_2_Implicit).
6. CERN (2017). "CERN Openlab: Luis Rodriguez Fernandez." Retrieved 05.09.2017, from <http://openlab.cern/about/people/luis-rodriguez-fernandez>.
7. CERN Openlab Summer Students' lightning talks, R. A. (2017). "Refactor of Rota application using modern developer techniques: Oracle Restful Data Services & Oracle Jet." Retrieved 05.09.2017, from <https://indico.cern.ch/event/635481/contributions/2685021/>.
8. Docker (2017). "Docker Logo." Retrieved 09.08.2017, from [https://www.docker.com/sites/default/files/mono\\_vertical\\_large.png](https://www.docker.com/sites/default/files/mono_vertical_large.png).
9. FullCalendar (2017). "A JavaScript event calendar. Customizable and open source." Retrieved 05.09.2017, from <https://fullcalendar.io>.
10. IT-DB, C. (2017). "Infrastructure, Management & Storage Services: Mandate." Retrieved 05.09.2017, from <http://information-technology.web.cern.ch/about/organisation/infrastructure-management-storage-services>.





11. OAuth (2017). "OAuth 2.0." Retrieved 05.09.2017, from <https://oauth.net/2/>.
12. Oracle (2017). "Oracle JET Logo." Retrieved 09.08.2017, from [https://pbs.twimg.com/profile\\_images/65665222512521216/kj3zG0jH.png](https://pbs.twimg.com/profile_images/65665222512521216/kj3zG0jH.png).
13. Oracle (2017). "Oracle JET Online Training Course." Retrieved 05.09.2017, from <http://www.oracle.com/webfolder/technetwork/jet/globalExamples-Course.html>.
14. Oracle (2017). "Oracle ORDS Logo." Retrieved 09.08.2017, from <http://www.oracle.com/technetwork/developer-tools/rest-data-services/dataservices-2373780.png>.
15. Oracle (2017). "Oracle REST Data Services." Retrieved 05.09.2017, from <http://www.oracle.com/technetwork/developer-tools/rest-data-services/overview/index.html>.
16. Oracle (2017). "Visualizations." Retrieved 05.09.2017, from <http://www.oracle.com/webfolder/technetwork/jet/jetCookbook.html?component=home&demo=rootVisualizations>.
17. Oracle (2017). "What is JET?". Retrieved 05.09.2017, from <http://www.oracle.com/webfolder/technetwork/jet/index.html>.
18. WorldVectorLogo (2017). "GitLab Logo." Retrieved 09.08.2017, from <https://cdn.worldvectorlogo.com/logos/gitlab.svg>.
19. WorldVectorLogo (2017). "OpenShift Logo." Retrieved 09.08.2017, from <https://cdn.worldvectorlogo.com/logos/openshift.svg>.

