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Databases in Cloud Computing Architecture using Oracle

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Abstract:

In this paper we are investigating which is the optimal solution for the storage of large sets of data collected from various sources such as modern utility-scale wind turbines systems, photovoltaic systems, weather prediction sources, human operators and others. The challenge is not only to identify the best solution for storage but also for processing and securing the data, all this with minimum costs.

Keywords — **cloud computing, database architecture, cloud database management system.**

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I. INTRODUCTION

In the past years there have been large efforts made and there was good progress in the development and dissemination of a new paradigm: "Cloud Computing". It is a modern concept, representing an ensemble of computing services, applications, access to information and data storage without the user needing to know the physical location and configuration of the systems providing these services. [1]

While a traditional database system would usually be installed on site, using a server which is in the property and maintenance of an organization, with data being stored and accessed directly or over LAN (local area network), a cloud database management system, runs on a cloud provider's platform. The downside of this approach is that data can be stored or accessed only when there is an Internet connection. On the other hand, in this era, when we can estimate a 99.99% up time regarding the internet connection, this is not a real issue to be concerned with.

Having the above in mind, and having to work with Big Data, using a cloud DBMS (cloud database management system) solution rapidly became a serious option to consider.

1.1. Cloud services

Cloud services can be classified as follows [2]:

By activity:

- ***Software as a service*** - remote computer, performing complex operations to be sent to the client;
- ***Platform as a service*** - an operating system that supports execution for various applications;
- ***Infrastructure as a service*** - storage for databases, files etc.

By property type:

- Public cloud;
- Private cloud;
- Hybrid Cloud;
- Community Cloud.

Cloud technology offers ***many advantages*** [3]: synchronization of data for a user which is using multiple devices connected to the Cloud (Ex; *Figure 1. A smartphone, tablet, notebook and PC*) is simplified; Online documents can be processed in the cloud using web applications; computing speed and storage capacity increased, but without investing in your own configuration, automated tasks can be achieved; the possibility of dynamic scaling depending on the computing power required, data cannot be stolen, the data carrier

cannot be damaged etc. A cloud solution also offers possibilities to monitor traffic, usability and performance of the applications, the ability to generate alerts when an error occurs or in case of an unusual behavior. Another *major pro argument* is that there is a low maintenance cost for very large databases. [2]

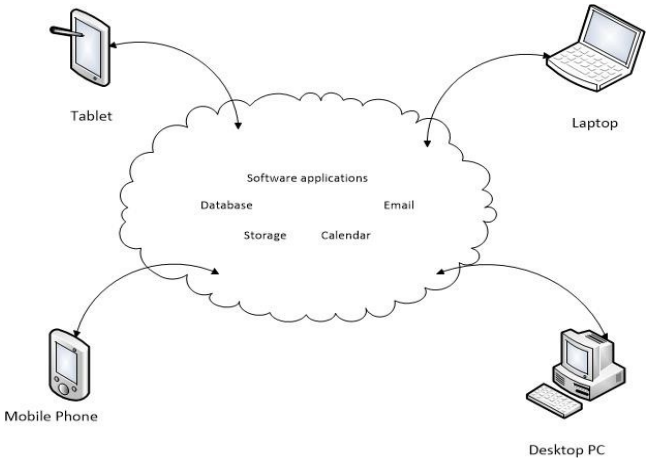


Fig.1 A smartphone, tablet, notebook and PC

As ***main disadvantages*** we have identified the loss of control performance for a local network and the possibility of a very high latencies, which can lead to errors in the application, but probably the most important risk to take into account is the lack of physical access to the database and not being able to assign specific hardware components for each part of the database.

1.2. SIPAMER selected solution

After analyzing all possible solutions and bearing in mind that the data volume that needs to be processed is expected to be very big, with no actual limit, we can conclude that a plug and play solution, a solution which will not require maintenance from behalf of the development team, a solution that allows hot plug such that when necessary we can add more resources, is not only the best solution for SIPAMER but it actually must be the only viable solution. The relationships between the entities part of the SIPAMER project and the cloud structures are exemplified in *Figure 2.*

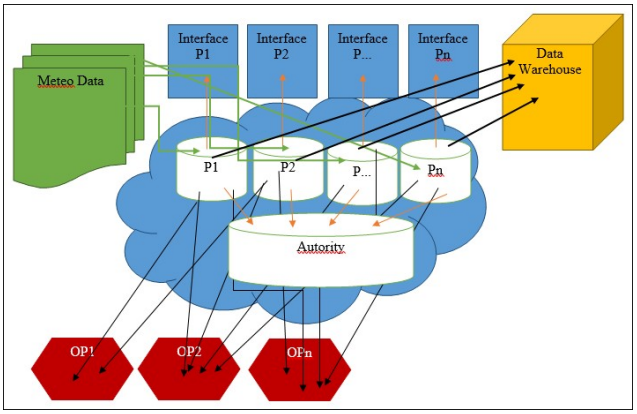


Fig.2 Entities and relationships between them and the cloud structure

Also, as stated in the beginning, the challenge is not only to identify the best solution for storage, processing and securing the data but all this must be done with minimum costs. Using a cloud storage solution is the optimum solution from a pecuniary aspect and will supply us with the desired outcome for a rather low price if we are to compare the same results with an own solution plus maintenance cost plus the remuneration of a system administrator.

II. Setting up a database solution in Cloud computing architecture

2.1. Setting up a DbaaS with Oracle

Creating a database in the cloud generally involves completing the fields and settings, the necessary time required to complete all this actions being approximately 30 minutes according to Oracle [4].

It offers two services DBaaS - Private Cloud, which provides a standardized environment for databases with intelligent resource management for multiple platforms and users, and DbaaS - Public Cloud, which is a complete package of services for the Oracle database in a virtual machine. Creating a database in Oracle Service DBaaS does not differ much from creating any local Oracle database. The only big difference is the actual creation of the database to which the developer will have to connect later with a subsequently classic tool.

To achieve this, you need to have already paid access to the desired service, have PuTTY installed, the latest version of Oracle SQL Developer and a

compatible browser. The necessary steps to create the VM are described briefly below.

- Generate .ssh using PuTTY;
- Creating the cloud instance is represented in *Figure 3*

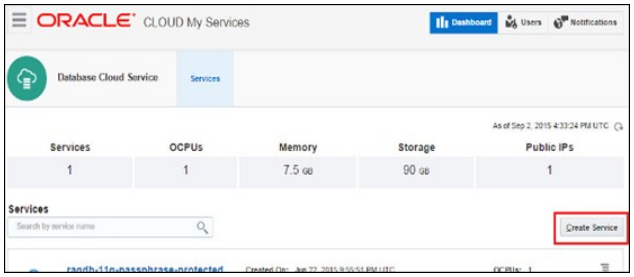


Fig.3 Steps for creating a new database instance, in the Database Cloud Service console click **Create Service**

- Service administrator must enter the Oracle Database Cloud Service and create a new service. This is done by completing the required data and inserting the .ssh generated at the first point;
- Identifying login details into the database cloud, which are found in the same interface where the instance was created;
- Enabling secure connection to the database;
- Connecting from SQL Developer to the cloud database;
- Use SQL Developer as seen in *Figure 4* and as you normally would with an on-premises database [4].

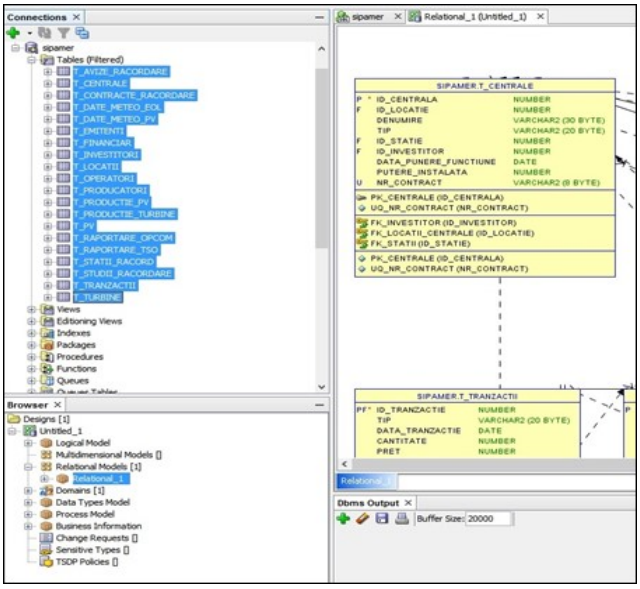


Fig.4 Connecting to a cloud computing database instance

2.2. Database schema development

After analyzing the existing solutions and opportunities in the IT market in Romania and after weighing the advantages and disadvantages presented by such a solution, we decided that the best approach for fulfilling all the needs raised by the large amount of data to be handles is the use of Cloud solutions using Oracle Database 12c.

The reasoning behind this decision is based on several factors. Both in terms of technology and functionality but also in terms of monetization product after completion of stages of development and launch, the Cloud solution requires low maintenance costs, ensuring availability in the work 99.999% - spectacular reliability factor, impossible to reach is we were to use classic technology service, maintenance (or even increasing) speed access, under a stream of data circulating continuously rising, increasing operability due to the process of interconnection of databases (same Web portal interface can provide consultation of information increasing both as variety as well as in complex), enabling all stakeholders to have immediate access to information anywhere and more comprehensive, increase data security, etc.

2.3 SIPAMER Database schema

After analyzing the data sources in the producing units and periodic technical reporting requirements for ANRE and the STO it has been found that these reports are done manually due to the heterogeneity of data and computer applications that are processing this kind of data. For this reason it is necessary to use techniques in order to supply feature for loading data in a coherent way in a centralized database where they can be subsequently used for technical reporting and for predictions, simulations and analysis at the aggregate level .

For example, XSD *CONTRACTE* schema contains attributes identifying the connection contracts: data_emitere, data_expirare, stare, putere instalată

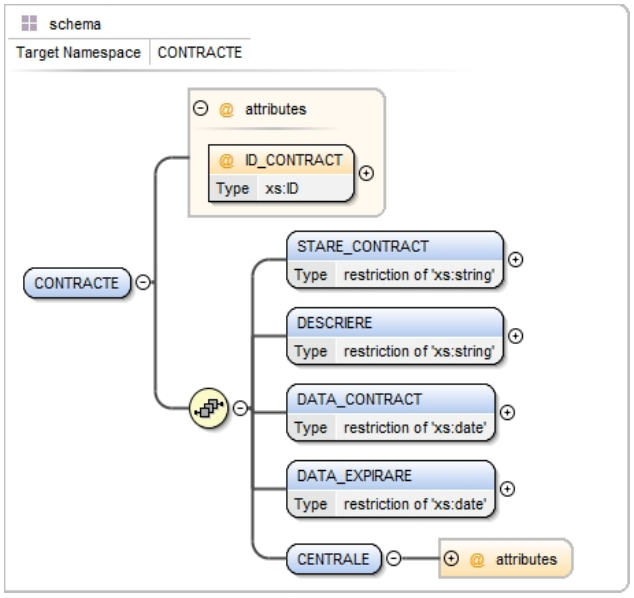
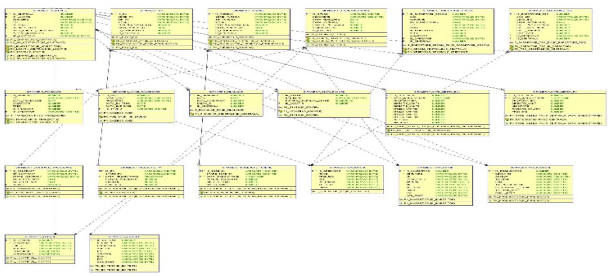


Fig.5 XSD CONTRACTE schema



The entity-association diagram is shown in *Figure 6*.

Fig.6 Centralized database schema

III. CONCLUSIONS

For SIPAMER prototype, the solution developed consists in setting up a cloud computing database on Oracle Database 12c, design and implement the schema and create a dedicated and secured instance for each client. By choosing a cloud computing database management system we have the strong belief that this will give the necessary framework to develop a robust solution, secure and with cost output significantly lower than with conventional technology service.

ACKNOWLEDGMENT

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