Immediate Mobility Number Portability: Cloud Database Appliance Platform to Provide Central Portability

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Abstract: The ongoing "era of data" arise challenges and issues on analysing huge volumes of data in an efficient way, developing applications and services that leverage the benefits of cloud infrastructures alongside with fast data processing services. Despite, the large number of different applications migrated in cloud, there still applications that are not frequently met on cloud infrastructures. Applications defined as time critical or data-intensive are applications of this kind. The need of high resilience alongside with high performance lead these types of applications to run on mainframes, than in cloud infrastructures, as cloud is not able to satisfy them under strict Service Level Agreements (SLAs) and with- out predictable performance. The aim of this paper is to report research issues around time critical and data-intensive applications deployed in cloud and present Immediate Mobile Number Portability (MNP) Use- Case migration to cloud infrastructure, which aim to provide portability nation-wide.

1 INTRODUCTION

Cloud services usage is growing with fast speed, offering solutions for even more complicated applications to be hosted in cloud infrastructures. Despite the growing, cloud infrastructures could not serve in an efficient way application or services that are characterised as time critical and data-intensive applications. As of the ongoing "era of data", the need of cloud infrastructures able to provide solutions to time critical and data-intensive, is even more essential.

During this paper, the authors demonstrate the MNP Use Case migration to cloud infrastructures using predictable performance suggested by EU project, to meet Key Process Indicators (KPIs) and serve application at ideal performance and high resilience. Mobile Number Portability (MNP), is a major process for mobile network operators, which is in the focus of this paper. The MNP process is taking place when a customer signs a new contract with another operator (the recipient operator). Following, the recipient operator sends the MNP request to the operator (the donator operator) where the customer is currently hosted and asks for the current customer to remove to its network. The MNP process terminates when customer is moved to the new operator. Taking into account, the lack of a centralised database

where all telephone numbers in Italy will be hosted, alongside with the high complexity of the processes taking place during the MNP process, state the whole process as an open issue. The lack of a centralised database in Italy requires strong integration between the different ICT (Information and Communication Technology) systems of the mobile network operators operated in Italy.

2 REQUIREMENT ANALYSIS

The high complexity of the process and the lack of a centralised database for the mobile phone numbers in Italy arise multiple challenges for mobile number network operators. Upcoming section tries, to give to the reader a better view of the process, the following paragraph describes the MNP process from the customer point of view as this presented in Figure 1.

- Stage 1 - Insert MNP Request: A customer signs a new contract with recipient operator asking for number portability.

- Stage 2 - Quota Restriction: At the end of each day (around 19:00 CET) and after all shops (network operator shops) are closed, a system check is performed to check if MNP requests submitted

during the day, meet the quota threshold for each operator. Quota for each operator in Italy is set from the Italian Communications authority (AG-COM,)

- Stage 3 - Request Check: During the next three days, multiple checks are made from each of the involved operators such as possibility of blocked number, unpaid bills, ongoing MNP request to third operator etc.

- Stage 4 - Port-in - Port-out: After the three days period early in the early morning (the portability of the number is complete with maximum service loss of two hours. The old SIM card is deactivated and that it cannot receive service by the donor.
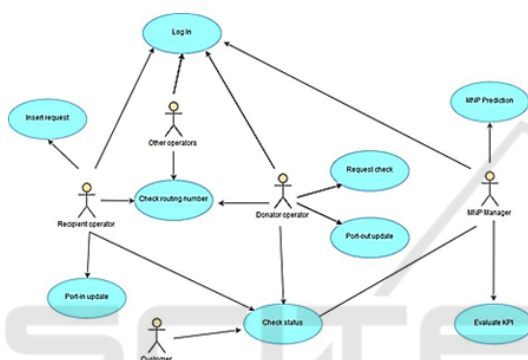

Figure 1: Mobile Number Portability Use Case Diagram.

Each of the above stages is subdivided into sub-processes running through each stage. Starting from the first stage "Insert MNP Request", the user could visit the shop of a telecommunication provider and ask to move his telephone number to the new provider filling a portability contract form. To be able to get a number portability, customer gets a Subscriber Identity Module (SIM) card from recipient operator. Most of the times, customers who sign portability contract, they already have a SIM card. The recipient operator activates the new SIM card with a "new" number, so the customer immediately is able to receive or make calls to the "new" number. During this time the old SIM card with the customer's number is operated by the donor.

Following, is the second stage "Quota Restriction", where each operator proceeds specific number of requests each day, as a regulatory requirement. All requests over quota are queued in a waiting list, as they are scheduled to be proceeded the next day. This action is taking place every day after 19:30CET, when all shops (telecommunication provider's shops) close. Coming after, the stage "Request Check", where donator operator checks if the port-out requests are reasonable before proceed them to the next step. Reasons

for decline a port-out request include unpaid bills, blocked number, ongoing number portability to another operator etc. This procedures are taking place during the next three days after the portability number request is submitted.

The final stage of the MNP process called "Port-in Port-out", includes the sub- processes of port-in and port-out. As a result of the successful "Request Check", all proceeded requests are submitted to the final step. The recipient operator imports all successfully checked numbers to its system. After the completion of port-in, recipient operator informs the donor operator for the completion. Then, the donator remove (port-out), all those numbers from its systems. Actions in this final step are taking place early in the morning (06:00 - 08:00CET), with two hours of maximum service lost for the customer.

Previously presented stages compose the MNP process, which is currently running in Italy including high complexity between different systems with the need for strong integration between telecommunication providers in Italy. The current status is very time consuming and costly for telecommunication providers, looking ways to reduce cost, time and service failures.

To address this issue, a Database as a Service is proposed through EU project called European Cloud Database Appliance (CDBA) (CDBA,). The reliable cloud database appliance deriving from the EU project is proposing a new cloud architecture, which is focused on visualisation on service level instead of hardware level. One of the innovations derived from the proposed cloud architecture is that the setup for physical resources that will be consumed by each query/ client will be managed during run-time, providing predictable performance for data- intensive applications. To achieve that beyond others, the project behind CDBA will investigate research results form five real-life use cases in three different sectors: Banking , Telecommunication and Retail.
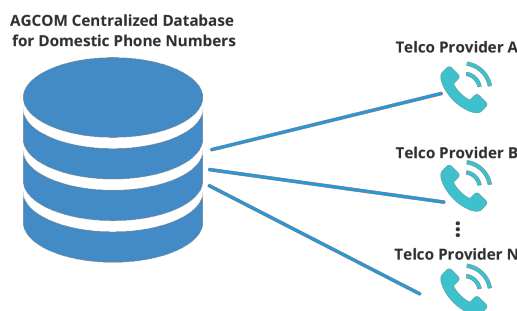

Figure 2: AGCOM Centralised Database for Domestic Phone Numbers.

3 CLOUD DATABASE APPLIANCE PLATFORM

The mission of the database appliance is to provide an ultra-scalable operational database with analytical capabilities leveraging an efficient storage engine and be able to scale up on advance hardware platform. Below a brief presentation of cloud database appliance main components is made.

- Operational Database: the ultra-scalable operational database is based on a new version of LeanXcale (LeanXcale,) operational database with a new storage engine able to run efficiently in-memory, with full NUMA (Non-uniform Memory Access) awareness.

- Multi-core hardware platform: the hardware where the cloud database appliance will be hosted, will be provided by ATOS (ATOS,). The hardware platform will be equipped with 32CPUs (896 Cores) able to scale up, alongside with120TB of main memory in a single computer.

- Analytical Database: An in-memory analytical engine will be designed and provided by Active-Viam (ACTIVEVIAM,), which will be able to scale up efficiently based on NUMA architecture, integrated with LeanXcale to supply fast analytical queries over operational data.

- Streaming Analytics Engine: Data streaming engine is designed able to scale up to several 1000s of cores and well integrated with LeanXcale supports real-time analytics algorithms over the operational data.

- Incremental Parallel Analytics Algorithms: A set of incremental analytic algorithms are designed to run over operational data.

4 MOBILE NUMBER PORTABILITY SERVICE IN CLOUD DATABASE APPLIANCE

Deployment of Mobile Number Portability Service in cloud database appliance embraces risks in time and service failures. Following, a description of main risks and requirements for MNP service to run on cloud database appliance.

Current status in Italy for mobile phone numbers is confusing and complicated. Before moving to cloud platform a major altering has to be made in current processes around mobile phone numbers hosting.

According to that, the authors propose a centralised database (Fig.2), where all mobile phone numbers will be hosted and operated by AGCOM (AGCOM,), who will be responsible to keep references for all mobile numbers operated by Italian telecommunication providers.

Following, is a description of MNP service functionalities and KPIs (Key Performance Indicator) to be met on cloud database appliance platform. The centralised database where all domestic phone numbers hosted, will be able to handle about 100 million phone numbers with references for operations by telecommunication providers. Based on that the cloud database appliance should meet the following terms:

- MNP Service process should end in less than 24 hours

- Availability of the service must be 99,9%

- Able to manage 100.000 MNP requests per day and online check validation (time for response to queries less than 2 seconds)

- Able to check the status of 1.000.000 requests per day (response-time less than1 second)

- Able to handle 1 billion requests per hour for check routing number (response time less than 0.1 second)

All the above requirements should lead to Reduces TCO (Total Cost of Ownership) and Operations and improve customer experience in MNP service.

4.1 Conclusions

Mobile Number Portability is a challenging process for the Italian telecommunication providers. In this work, the description and design of the MNP process, which constitute one of the five use case of CloudDBAppliance project presented. The primary objective for this use case is the migration of the use case cloud infrastructure as this will be provided by the CloudDBAppliance platform with predictable performance, alongside with the supply of a centralised database where all the Italian telephone numbers will be hosted, eliminating confusions and complex of the portability process.

ACKNOWLEDGEMENTS

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