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Licenciado em Engenharia de Informática

**Relatório nos termos do despacho  
20/2010 para Obtenção do Grau de  
Mestre por Licenciado  
“Pré-Bolonha”**

Dissertação para obtenção do Grau de Mestre em  
Engenharia de Informática

Orientador: José Legatheaux Martins, Professor Catedrático,  
FCT-UNL

Júri:

Presidente: Prof. Doutora Carla Maria Gonçalves Ferreira  
Vogais: Prof. Doutor Vasco Miguel Moreira Amaral  
Prof. Doutor José Augusto Legatheaux Martins



**FACULDADE DE  
CIÊNCIAS E TECNOLOGIA**  
UNIVERSIDADE NOVA DE LISBOA

**Março 2013**





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## **Agradecimentos**

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Em primeiro lugar gostava de agradecer a toda a minha família e amigos pelos ensinamentos e apoio que tive até agora e que me levaram aonde estou e que com certeza me levaram aonde quero chegar quer na vida pessoal quer na carreira profissional. O caminho continua e como se costuma dizer, faz-se caminhando.

Agradeço igualmente à Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa, nomeadamente ao seu corpo docente, mais especificamente do curso de Engenharia de Informática, pelos conhecimentos científicos que me foram ensinados aquando da minha Licenciatura.

Por último gostava de agradecer ao Professor Doutor Legatheaux Martins pela orientação na aventura que foi a produção desta dissertação enquanto a minha exigente vida profissional corria em paralelo-





## **Acknowledges**

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First of all, I would like to thank all my family and friends for the support and the teachings that I had and that led me where I am and that will lead me where I'm going in my career.

I also would like thank the Faculty of Science and Technology, New University of Lisbon, namely the teachers of the Computer Engineering course for the scientific knowledge that was taught to me.

Finally I would like to thank Professor Doutor Legatheaux Martins for the guidance on the adventure which was the production of this dissertation while my demanding professional career was progressing in parallel.



## Resumo

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Esta dissertação reflecte a minha carreira profissional após a conclusão da minha licenciatura e apresenta os projectos, funções e responsabilidades profissionais que eu tive desde que trabalho na indústria. A dissertação também apresenta e analisa em detalhe um projecto onde eu estive profundamente envolvido. Este projeto foi premiado com um prémio "história de sucesso " pelo líder mundial de telecomunicações, Ericsson AB. O projecto e o seu relatório mostram a minha maturidade tecnológica e profissional adquirida após da formatura, e testemunham as competências que se espera encontrar num engenheiro maduro.

Este documento foi escrito como parte do processo de cumprimento dos requisitos para a obtenção do grau de Mestre em Engenharia Informática sob a Directiva 12-2011 da Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa, o programa chamado "Para Ser Mestre ".

Esta dissertação tem como objectivo primordial demonstrar que, através da minha formação académica e experiência profissional, eu adquiri a maturidade, as habilidades e as competências equivalentes (ou em maior nível) às que um estudante que obtém um mestrado com o actual currículo de Bolonha.

A minha carreira profissional começou quando, ainda estudante, comecei a trabalhar na Accenture, no desenvolvimento de aplicações web, como engenheiro de software, para diferentes clientes da empresa. Em termos de clientes falo do Millennium BCP, ACEGE e outros. Após minha formatura, mudei para um mundo completamente novo e que foi o sector das telecomunicações, após ter sido contratado pela Ericsson AB. Nesta nova posição comecei como arquitecto de soluções na área de messaging para todos os clientes portugueses e angolanos. Hoje em dia, eu sou um Engagement principal abrangendo mais países e clientes.

Palavras chave: Telecommunications; Ericsson; Sharepoint; WebPortals; Solution Architect; Engagement Principal



## Abstract

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This dissertation reflects my professional career after graduation and presents the projects, professional functions and responsibilities I had while working in the industry. It also presents and analyzes in detail a project where I was deeply engaged and was responsible for. That project was awarded a "Success Story Award" by the world leading telecommunications company Ericsson AB. The project and its report show the technology and professional maturity I have acquired after graduation and testify the competences one expects to find in a mature junior engineer.

This document was written as part of the process of fulfilling the requirements to obtain the degree of Master in Informatics Engineering under the Order 12-2011 of the Faculty of Science and Technology of the New University of Lisbon, the so called program "Para ser Mestre".

This dissertation aims to demonstrate that, through the academic degree and professional experience, I've acquired the maturity, skills and competencies equivalent to or even higher than a student who obtains a master's degree with the present Bologna curriculum.

My professional career started when I, yet as an undergraduate, begun working in Accenture, developing web applications, as a software engineer, for different customers of the company. These included Millennium BCP, ACEGE and others. After my graduation, I switched to a complete new world and went to the telecommunications sector, hired by the world-leading provider Ericsson AB. In this new assignment I started as a solution architect in the messaging area for all the Portuguese and Angolan customers. Nowadays, I'm an Engagement Principal covering more countries and customers.

Keywords: Telecommunications; Ericsson; Sharepoint; WebPortals; Solution Architect; Engagement Principal



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# 1. Introduction

This dissertation is divided in three parts:

- Professional career
- Use case study
- Thoughts about the pure IT and the Telecom worlds

My professional career is until now essentially divided in three main areas:

- Software Engineer
- Solution Architect
- Engagement Principal

In the first part of this dissertation I will show more in depth what I did in my career so far, showing which activities and assignments I did, while I try to show which knowledge did I got until now.

In the second part I will show a use case that received an international award as a “Success story” inside Ericsson AB, this use case is a public demonstration of technological leadership combined with a wonderful customer relationship in order to surpass a big engineering challenge.

In the third and last part of this dissertation I will make a high level study of the connection between the pure IT world and the telecommunications world, basically which similarities and differences I found in the last years.



## **2. Roles and Principal Deployed Projects**

In this chapter I describe the roles that I did so far in my professional career and the principal projects and activities which I developed, always integrated in a high level skilled professionals teams.

### **2.1 Software Engineer (2007 March - October)**

#### **2.1.1 Introduction**

Between March and October 2007 under the last course of my engineering degree (the project course) I was a software engineer in Accenture, namely in the Accenture Technology Solutions (ATS) department, firstly to develop an academic project, which was the deployment of a webportal in Microsoft Sharepoint (MSP) to be the internal Accenture employee portal.

After this portal was successfully concluded and approved to be live, I started to be involved in projects in the same technological area (web portals) but this time for external customers of Accenture like for example the Associação Cristã de Empresários e Gestores (ACEGE) and Millennium BCP.

Accenture used mainly Microsoft tools, in terms of both software engineering and development itself. The main driver for this is that the whole process of building the solution is standardized. The standardization allows the reuse of certain components for other projects, saving time in the process and allowing easy addition of new features not contemplated at the time of delivery of the final solution.

It's important when developing web portals to not forget that the download speed and content features are the web portals main factors in the respect of indicating its quality and its level of attractiveness. The graphical appearance is also important but at the time I decided to give less importance to this aspect, due to the time consumption of the implementation of the internal processing flows compared to the overall time available for the project.

#### **2.1.2 Work Done**

##### **2.1.1.1 Accenture Employee Portal**

But now back to the beginning, the idea behind this internal portal was very simple; this portal should be used by all the Accenture employees, at the time Accenture had around 1500 employees, and it should have some important functionalities in terms of interface among the employees, their direct managers and the human resources department.

This was the main page of the portal

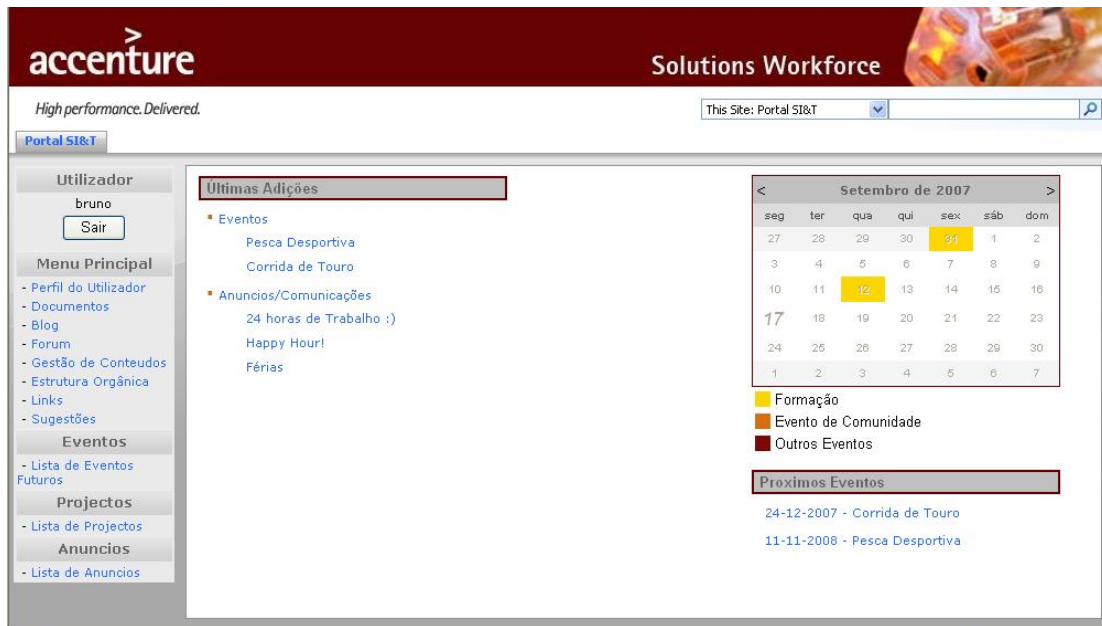


Figure 1 – Accenture employee portal main page

The portal had some of the following functionalities:

- **Characterization of resources** - The possibility of characterizing the resources in several components, like:
  - The organization inside Accenture to which the resource belongs (ATS, GBS, GTC ...)
  - The Market Unit (s) with which the resource has relations
  - The technology which the resource works with
  - The technologies for which the resource has interest
  - Comments / personal tastes (similar to what was in the notes, place, restaurant, favorite moment ...)
  - the Photo of the resource
- **"The outbursts of the Boss"** – The blog from the head of the department with comments, refresh once a month.
- **Training courses available** – The list of available training courses with the possibility of applying to them online. It also includes the possibility of reviewing these training courses after attending to them.
- **Events organized** – Listing the incoming corporate events with possibility of applying online, also able to generate alerts towards stakeholders and resources already in the participation list.
- **Communications board** – With the possibility of generating alerts to interested resources
- **The new "Smurfs"**: Photography, hobbies, personal comment and other information regarding the new resources in Accenture.



- **Calendar Month** – The view of the calendar month shall indicate the days when there are meetings, events, corporate medical appointments and so on.
- **Dates of Community Meetings and events** – It also include external events promoted for example by Microsoft, SAP, Oracle and others.
- **The department organizational structure**
- **List of projects where our resources are involved** – Including information about the customer, the location and also a brief description.
- **Suggestion box**
- **Area with links to the Accenture Portal and other relevant**

Before I start working in the presentation of the portal, the database diagram of the portal was designed in order to be sure that the database scheme could cope with the data that will be store in it. Of course that some tables were added later on to the database scheme, as sometimes new requirements and functionalities we are asked to be implemented. Again for the database design it was used the UML design language.

Please take a look into the next picture in order to understand the complexity of the database of this portal:

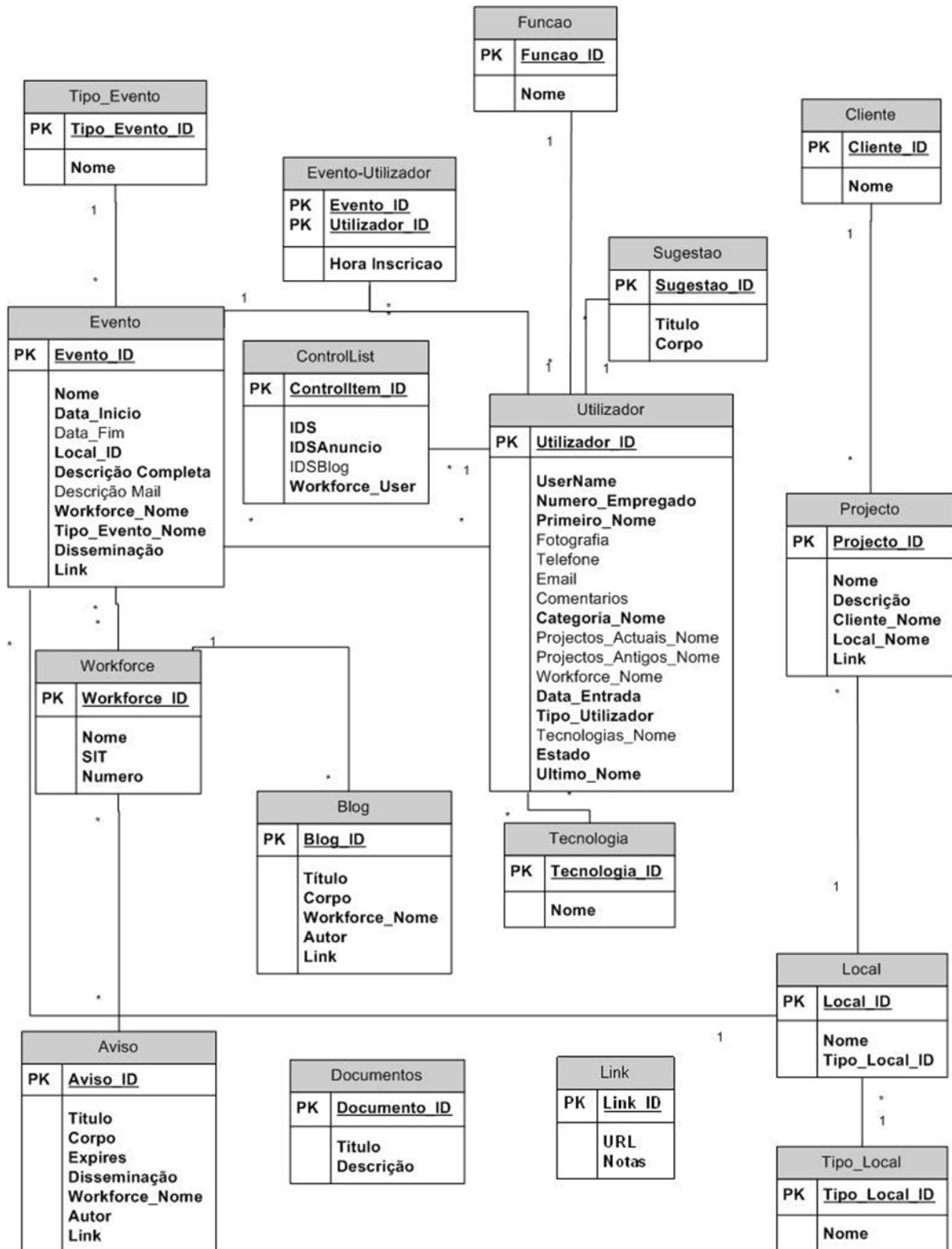


Figure 2 – Accenture internal portal database model

### **2.1.1.2 Miscellaneous**

As said before, after the Accenture employee portal was done and accepted by the owner of the project, I started to be involved in different other projects that the team, where I was included during my internship, was producing.

One of the first projects was the “Ver.pt” portal, which still today maintains the some design and organization made by me and my team colleagues. In this portal I was responsible to build a set of pages and to debug the “punch list” that was created from the testing that we were doing.

The base programming language was still C# and the tools were exactly the same I used in the previous project, the difference was that the database was much more intricate, so when making the storage procedures, more attention need to be putted in place.

After I finished my agreed part in the “Ver.pt” portal, which took a month more or less, I was moved to help in another project, this one was the most important project that I worked in while I was in Accenture, and the project was for Millennium BCP portal.

In the BCP project I worked with the team that was responsible for one important piece of the portal, the authentication part. In a bank portal the authentication is the key security point that needs to be addressed. To be honest I didn’t work for many time with them as I left the company two weeks later, but the time was already enough to understand a little the big complexity of the authentication process.

The authentication using certificates was the method used, also one important part of the process was the public and private key that was used when a customer inserted a number coming from his matrix card, this method was need for some operations which demanded a higher level of authentication.

### **2.1.2 Used tools**

The web portal was mainly built with C# components as the basic models of Microsoft Sharepoint were really pretty basic. Also different tools were used for the construction of the portal, as I said previously Microsoft was the main provider of these tools, like the following ones:

#### **Microsoft Office Visio 2003**

This tool was created by Visio Corporation and was later purchased by Microsoft as a way to suppress fault that the Redmond giant had the section of software diagrams, and Visio is powerful software that uses diagrams to draw the vectorization designs desired by the user.

Visio was instrumental in the task of analyzing and designing the solution of the desired web portal. It is very versatile and has a huge list of diagrams available and easy to use. Due to the knowledge of UML 2.0 (acquired at the university), the diagrams were used mainly in this language, and the functional reason was to show to the owners of the project the way that the web portal was going to be design.

## **Microsoft Office SharePoint Server 2007**

This was the tool that turned the portals into reality, whereas it was about that the entire portal rests. This tool includes a set of features that can be used in implementing the structural organization of navigation and appearance of the site. It may also configure the various phases of activity with the content creation, approval and publication.

The Microsoft SharePoint is a business oriented tool that facilitates enormously the immediate total control over the various aspects of managing the portal; it will also allow access to key information in business context as the case of the objectives and processes of the organization.

It facilitates the very most tasks such as: user management, handling and management of living matter the portal, i.e., its contents and the access permissions to enterprise information. Being a recent tool and with many new features from its previous version, it was necessary initially to set out to discover, which is always good, because knowledge coming from the experiment is one that lasts longer.

This tool allows you to bring many of the features already in a situation "out of the box", i.e. ready to be implemented as in the case of ready portals, search engines, forums, blogs, lists, among other content. However under the projects in which I was involved, the degree of personalization was too short for the requirements thereof, thus leading them to be seen more as a vein of inspiration than anything else. Because of that the use of coding was a must.

The way found to add new content and pages is through custom programming and adding webparts. The webparts, a subject covered in more detail later, are not more than custom content, which are made in order to respond or act on a certain particular way. These custom content may be responsible for the insertion of contents or the mode of showing that these contents are showed. The full customization of the portal is made using programming languages from the platform .NET, like C#.

The SharePoint also allows restricting access to the site providing several different levels of access, using to achieve this, user groups, where users are organized. So there are various permissions that can be associated with these same groups that let you read, write, edit and more. Thus the various aspects of the site are protected from unwanted access, these aspects can be: lists, items, general access to the portal and access to certain pages.

The management of all related aspects to the portal is possible through this tool in a much easy way since the own portal page, the administrator of the portal, or multiple users designated by him, can access these features through administrative button "site actions", this button appears embedded in the site, this button acts as the "start" button of the Microsoft Windows.

There is a high level of interaction with other tools, since Microsoft Sharepoint allows interaction with other business tools such as SAP, or other tools also from the Microsoft portfolio, like the Excel for example. The connection to business intelligence elements is ensured with the SAP and the use of spreadsheets is ensured with Excel, for example.

The Office SharePoint Server 2007 works on the Microsoft Windows SharePoint Services 3.0. This last one provides a unique and robust framework for lists, document libraries, administration and customization of the portal.

### **Microsoft Windows SharePoint Services 3.0**

The Microsoft Windows SharePoint Services 3.0 (WSS 3.0) provides a platform for building solutions on top of Microsoft SharePoint. This platform uses technology as anchors the following technologies: ASP.NET 2.0 and Microsoft .NET 2.0 runtime.

This platform is used as the basis for server applications, such as Microsoft Office Project 2007 and the one already referred above, Microsoft Office SharePoint Server 2007.

WSS 3.0 is also responsible for the connection between the webportal and the database, in order to save the pages, content and templates.

### **Microsoft Office SharePoint Designer 2007**

Microsoft Office SharePoint Designer 2007 is the tool used to interact directly with the visual aspects of the portal as well as in other various particular aspects of it. Basically this program is the Web Design Package for SharePoint sites; it's used in the construction of architecture-based Microsoft Windows SharePoint Services 3.0 (WSS 3.0).

However this application is not included in the Office suite. Basically it was used for the management of pages and folders in the portal. Their creation, editing, removal is easier using this program, since the whole process is immediate and direct.

The designer was also valuable in times when the WSS 3.0 didn't want to include the webparts on the site, since the Designer also has this feature.

To be able to "touch" with graphics and functional aspects that you want to appear on all the pages of the portal, as the case for example of a side menu, the master page is the thing that you need to touch, this page serves as the basis for all other existing ones. And to accomplish the mentioned above task, you have to resort to the designer.

### **Microsoft SQL Server 2005**

The Microsoft SQL Server 2005 is a product released by Microsoft as a powerful database manager.

The Microsoft SQL Server 2005 was used for persistently store the entire structure of the portal as well as all its contents. As mentioned above the WSS 3.0 is the one that makes the connection

between SharePoint (the design of the portal) and SQL Server (the storage of the all the portal content).

In the produced solutions was never carried out any direct instructions towards the database, therefore for the construction of the "stored procedures", which are the procedures running in order to store the information in the database, it was only used the Sharepoint provided methods. The "update" method plays an important role in this, because it is through it that a component of the portal, for example a list or an item is stored in the database.

It was also a way that I used to try my best to reduce any kind of direct and intrusive instruction on the database, which could jeopardize its integrity.

As the SQL Server has complete compatibility with any .NET programming language, such as C #, which was the one used in all my projects, SharePoint is who makes all the management of the database of the portal, therefore the only interactions with the SQL Server were upon the installation, the initial configuration and when it was necessary to make the usual backups.

### **Microsoft Visual Studio 2005**

As this is a project that involves programming languages and technologies belonging to the .NET framework, the most obvious choice as integrated development environment (IDE), was the Microsoft Visual Studio 2005 (VS).

This program allows the construction of generic applications, Websites and Web applications that will run on any platform that acknowledges the architecture .NET.

This version has this VS has compatibility and recognition of ASP. NET 2.0 which as mentioned above is one of the most important components of SharePoint. It also allows an ASP 2.0 server to run a part of the Internet Information Services (IIS). This is important because in this way it's easy to make any kinds of tests when developing the application. Finally another very important feature is that VS recognizes all types of database of the SQL Server.

Then Visual C #, which is nothing more than part of the VS package targeting solutions coded under the aegis of the C# programming language, which was the programming language used to build the various webparts. The webparts are used to customize the different webportals. For this it was created several different projects, webparts and class library objects, which produced ".dll" objects or dynamic links to VS libraries.

Also it's important for each project that begins; indicate in the header, what is the class of the project. In this case it was a SharePoint class. So I used the following instruction "Microsoft.SharePoint.WebPartPages.WebPart". Before this, it was made the addition of "Microsoft.SharePoint.dll" reference to the project.

Of course that the debugging method of Visual Studio was frequently used, sometimes it was even used a slightly more archaic method but extremely efficient, which was writing in certain outputs in files, in order to test the correctness and accuracy of the programmed class.

### **2.1.3 Lessons Learned**

Under this assignment in Accenture all my programming skills using objects were needed as the programming language used was C#, a language that as we know it's the Microsoft own interpretation of the SUN Java.

Other important point was to work in functional teams that needed to correlate between each other. The team work at a functional level was something that I didn't have the opportunity to experience in university.

Other point that rose during my internship was that I needed to really meet deadlines, if a deadline, like pass some part of the portal to production, needed to be achieved; it really meant that the date was a close date, and that my part of the work needed to be close at that time. So sometimes, as the timelines were very aggressive, I didn't have time to think in the best way to implement some function, the key of the process was to successfully implement the function not to implement it in the best way possible. With the time and the proper experience, I was able to more often select as first option, the best possible alternative, although sometimes I wasn't so successful.

Other situation that I understood in the time that I spent with this programming team is that sometimes it's better to start from scratch than to work on top of something that is already so complicated that nobody really knows how it works. It happened sometimes that I spent much more time with a blank sheet of paper trying to understand some code flows than starting to build the functional part from scratch.

This also happens because most of the time there was no time to really document what was coded, so who came behind, to improve or to debug this piece of software, was in serious problems to understand where to touch.

Also this was the first time that I had meetings with real customers and not teachers, first internal ones (the owners of the Accenture employee portal) and afterwards external customers like the Associação Cristã de Empresários e Gestores (ACEGE). The mindset and the mode of talking with them was a world that was totally obscure for me, because some questions made by the customer needed some commercial mindset, which at the time it's was a totally "green field" for me.

## **2.2 Solution Architect (2007 October – 2011 January)**

### **2.2.1 Introduction**

I joined Ericsson AB in October 2007, after I finished my internship in Accenture and in consequence my engineering degree. The role that I took in Ericsson was as solution architect for messaging solutions, at the time my customer base were the Portuguese and Angolan markets (all the telecommunications operators in Portugal and Unitel in Angola), inside the Ericsson's Multimedia department.

In the end of my tour as solution architect, I was also working for Spanish operators. This happened because the demand in the Spanish market was very high at that time.

Because of the confidentiality agreements between Ericsson and its customers, I cannot reveal too much regarding each of the projects in which I was involved, so I chose to describe in high level view my role related activities.

### **2.2.2 Work Done**

As solution architect in Ericsson AB, I started working with a team of dedicated professionals with the main objective of understanding the customer's environment and needs while addressing these needs with tailored multimedia solutions from the Ericsson portfolio and partners.

This was a big change in the working paradigm that I was used to. In the end I finished my programming career and I went to the high-level view of an architect, which the main purpose is to build the puzzle using different and complex pieces.

In Ericsson each opportunity addressed needs a core 3 of experienced people in order to build the proposal. This core 3 is composed of a Customer Solution Responsible (CSR), basically a solution architect, a Customer Fulfillment Responsible (CFR), which is a project manager and finally an account manager from the account team of the customer. As a solution architect I was always the CSR in the core 3 team.

As a CSR, I was responsible to be sure that the solution addressed in a certain opportunity was tailored to the customer needs and correctly dimensioned in order to be sure that it could deal with the traffic demand from the customer's network. As output of my work I needed also to produce technical documentation to be included in the complete proposal. Basically the solution architect is the driver of the solution to be offer to the customer.



The following cartoon image is a good way to understand the importance of a proper understanding of the requirements of a customer and the fact that these requirements should be well scoped and documented.

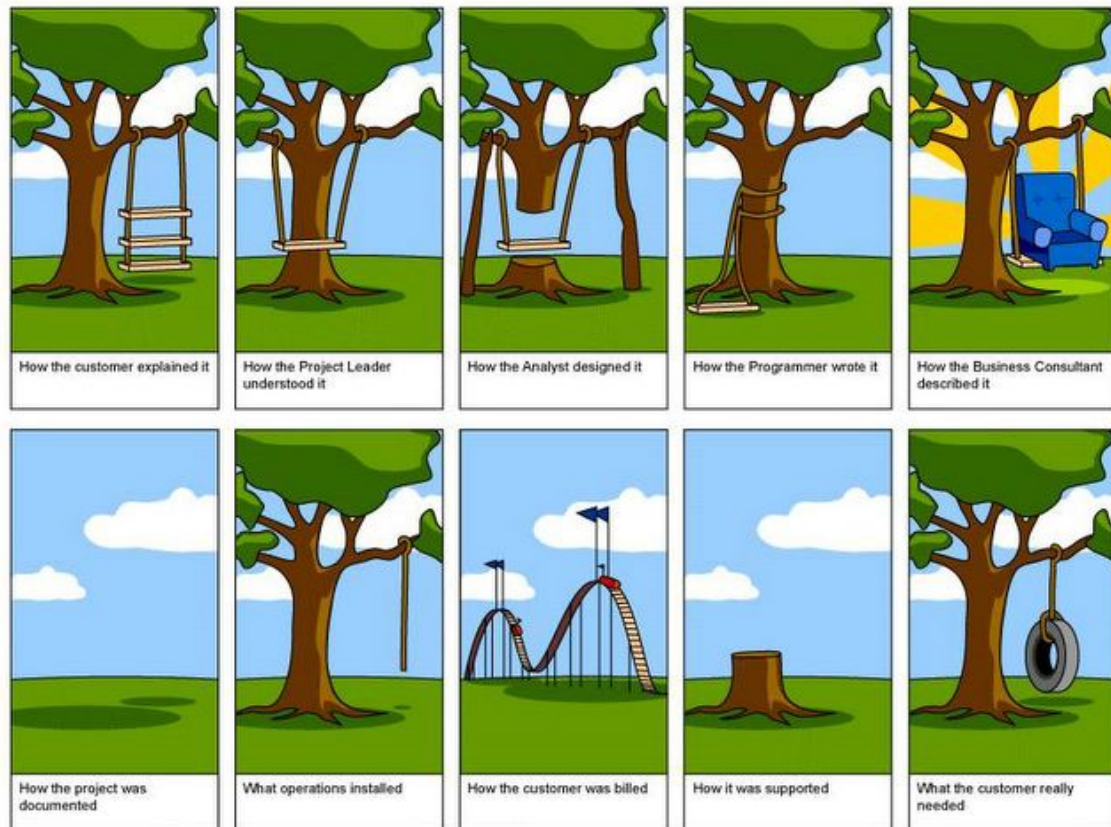


Figure 3 – The difference between the initial need of the customer and the reality.

A good way to show my daily activities as solution architect is to pick my first opportunity in which I worked. This opportunity later on turned into a project as the customer acquired the project, in this case, the expansion of an SMS Center.

This first assignment happened after the first three weeks immediately after I joined the company, in which I had intense training in Sweden and in an Estoril hotel in order to learn the internal processes of the company and the main technologies that I was going to work with.

My first assignment in Ericsson was to redesign the entire SMS enabler's network from Unitel in Angola. Unitel at the time was having a dramatic increase in the load of their SMSC's (SMS centers), also the demanding Christmas holidays was coming, so a new expansion (hardware and software licenses) and upgrade needed to be proposed. I started figuring out how many more licenses, which were measured in messages per second (MPS), were needed to cope with the new additional traffic

demand. Using some extrapolation models based on the number of active subscribers I reached a figure that would imply the increase of the installed hardware.

So the next step was to dimension the new hardware that needed to be installed in the customer sites, two of them as the solution was geographical redundant. Collect the costs and build the technical proposal in order to finish my part of composing the proposal. The solution architect is responsible to write the solution description document, which goes attached to the offer, to build the bill of quantities in terms of hardware and software and to scope the services that need to be included in the project.

After the submission of the proposal, a final presentation at the customer premises needed to be done just to be sure that the figures proposed were aligned with Unitel's expectations. For the workshop I built a set of slides with information regarding the new scenario in terms of hardware delivery and licenses expansion. The new features included in the new release of the software to be installed in the upgrade were also shown.

After receiving the Purchase Order (PO), the proposal went to a project phase, where all the high level integration design made at the solution description document, which was attached to the offer, needed to be detailed, this detail included for example, information regarding the low level integration architecture. As solution architect my role continues to be the umbrella for all the technical information inside the project team, so the low level design (LLD) needed to be done by me. Other task on my shoulders was to define the acceptance tests that would be agreed between Ericsson and the customer, the objective of these tests is to ensure that the solution is working properly, and as result ready for live traffic.

Some other opportunity processes took a different route as the customers issue a Request for Proposal (RFP) or Request for Quotation (RFQ) process. These selection processes were different from the previous one in a way that the customer sends to different pre-selected vendors the requirements that the solution must meet (commercial and technically wise). After this step, each vendor has a limited time window to submit its answers. So basically Ericsson would receive a set of documents from the customer, with the main intention of ranking the vendors by price, by the compliance rate to technical requirements and by the quality of services included in the proposal.

As customer solution responsible (CSR) for the opportunities under this special selection process, it was very time consuming because firstly I needed to face the huge amount of technical requirements to which I needed to be one hundred percent certain in order to say if the solution was compliant

with that requirement (fully, partially or not) and explain the reason for my answer. After that I needed to correctly assess the scope of the solution and dimensioned it accordingly.

Of course that further iterations were needed in this kind of processes, first some clarifications were requested to the customer in order to clear out any remaining points of doubt on my side, then at the evaluation phase (done by the customer) a workshop presentation was done to sum up all the proposal components (Hardware, Software, Services and Support). To finish, and before any final decision from the customer, some clarifications were provided to certify that our answer was properly understood by the customer.

Also as a solution architect it was important to not only be reactive, when a solution was requested by the customers, but also to be proactive, attending to meetings and workshops with the objective to present to the customers, new technologies that Ericsson had in its portfolio. These activities were always based on my knowledge of each customer network and of course of the possible points of interest of each could have.

Also important was to do relationship management with the customers; this was a key activity in order to be aware of the business environment and of what was happening in the customer's mind. This could involve for example lunches or even attending conferences together with the customer.

Different projects passed through my hands and my personal portfolio grew a lot since my first assignment. In the end of this journey as a solution architect, I was already responsible for all the multimedia enablers of the Ericsson portfolio, covering different areas like Consumer and Business Applications, Digital Media, Device Management, Service Delivery Platforms and Satellite Transmission Solutions for Telecom and TV.

One of the projects that I most enjoyed, at this phase, was the design and implementation of the ZAP TV in Angola; we are talking about the ZON operation in Angola that started from scratch. This process started from a RFQ process that was won by Ericsson and in which I was one of the solution architects. The project included a base of uplink in Portugal and an Angolan station to downlink the content (could also be the inverse flow), the satellite used for this was the Eutelsat W7.

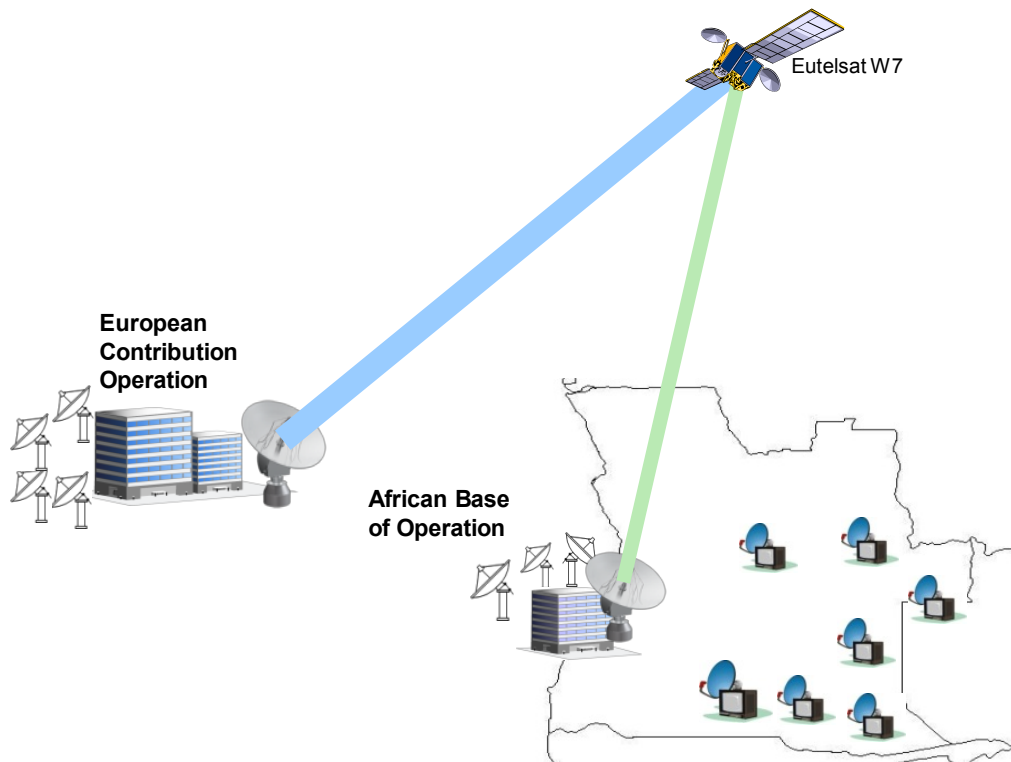


Figure 4 – ZAP high level diagram

As an overview, these were some of the opportunities and projects in which I was involved as solution architect over this period of time:

- Unitel Angola - SMSC infrastructure
- Unitel Angola - Satellite transmission solution
- **Unitel Angola - Automatic Device Configuration solution**
- Unitel Angola - Ring back tone solution
- ZON - Satellite TV deployment in Angola and Portugal
- TMN - Mobile Backup Solution
- Among others...

To finish, just refer that is from this period of my career that comes the use case project that I selected to be shown in more depth in the use case chapter (the selected project is in bold in the above list). Also this project was selected for the use case as it was selected by Ericsson AB as one project success story. This selection is done over different Ericsson projects that happened all over the world.

### **2.2.3 Lessons Learned**

For me, this period of time was the toughest tour of my short career, as I changed from a totally IT world for a more precise and standardized telecommunications world.

The main learning point at this role, besides all the telecom network environment reality, was how to improve my soft skills like consultative selling, customer facing strategies or even negotiation in order to properly address the role that I was performing.

Also as my knowledge of a telecom operator was very short at the time, a new world of protocols, nodes and integrations points opened to me. The macro vision that was needed when approaching the solutions from a solution architect point of view was also something new to me. At the time, I only had the precision and the low level vision of a programmer, which was the role that I performed in university and in my internship.

Also another point of extreme importance was the business vision, something that in most of the times for a “techie” guy (like me) it’s missing. I needed to be sure that my propositions were profitable and that I was pursuing something that it was really an opportunity that could generate money later on. The statement “show me the money” gain a lot of importance to me.

## **2.3 Engagement Principal (2011 January- Present)**

### **2.3.1 Introduction**

In the beginning of 2011, Ericsson changed some part of its organization, creating in the process two new departments: the engagement practices, a smaller nimble team, more focused in the customer facing and in hunting new opportunities, and the competence domain, larger in resources, with the main focus on the project delivery and in the recurrent business, so basically with a more “farming” oriented business model.

Again, because of the confidentiality agreements between Ericsson and its customers, I cannot reveal too much regarding each of the projects in which I was involved, so I chose to describe in high level view my role related activities.

### **2.3.2 Work Done**

After the Ericsson reorganization mentioned above, I was included in the engagement practices for the communication services area. So I started to work in new projects and opportunities that demanded special attention and care like for example the Rich Communications Suite and the Voice over 4G (VoLTE).

As engagement principal my work was not totally different from when I was a solution architect, I still continued to be the CSR for some opportunities and helped in the project delivery phase. The main difference is that the number of opportunities in which I worked, was selected based on the complexity and difficulty of implementation. Normally new offerings never implemented before, in which the local Ericsson had very little experience and know-how. To summarize I started to work mainly in first implementations and complex solutions.

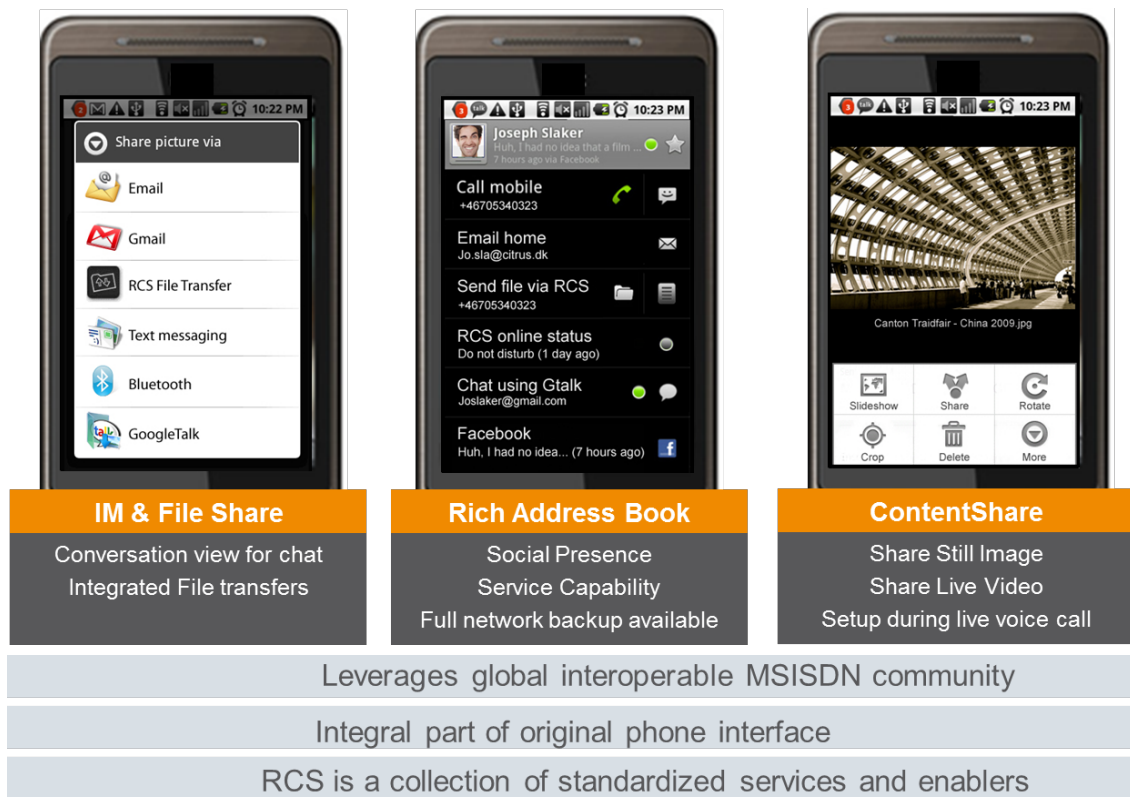
Also in my working scope were some opportunities that were transversal to different countries. This happened because global operators, like Vodafone, Portugal Telecom or Telefonica, have different operations in different countries and in order to align technologies and to use the mass effect to lower the prices, they tend to submit global tenders.

One of the areas in which I spent most of my time was the IP Multimedia Subsystem (IMS) based solutions. This happened as well because the new generation of services is based on this new telecom IP core technology. This new core solution is totally IP based so it was more similar with the knowledge that I learned at my university degree than the previous (and still highly used) circuit switch core technology.

The IMS is a complex world as it has different nodes speaking to each other, with standardized functionalities and interfaces between them. All the new services are running in top of this new core environment, so an activity as simple as an upgrade includes a deep network impact analysis in all the surrounding nodes of the system.

One of the services that I designed and included higher level of complexity was the integration and installation of Rich Communications Suite (RCS) in two of the Portuguese operators, and then the

interconnection between them. The RCS is an enriched chat and multimedia service like the Whatsapp, Vibber, LINE and other over the top (OTT) players. In the image below it's easy to spot the main functionalities of the service.



**Figure 5 – Rich Communications Suite functionalities**

As a side role in this job position, I was frequently invited to represent Ericsson in a public relations manner among different occasions, for example at university presentations and conferences in order to share some “state of the art” solution knowledge with the students, while bringing at the same time, brand awareness to the company.

Under this same role, another objective was to show Ericsson leadership and technological know-how. This was achieved not only through public presentations, like the ones mentioned above, but also when writing technical articles to the specialized Portuguese printed press. The subjects addressed in these articles covered a wide area of technological matters; some of the articles that I wrote touched paradigms like Machine to Machine or more application based solutions like video-conferencing.

In a customer relationship scheme, I also helped different customers, bringing new technologies to important events and fairs, like in the case of Unitel in the FILDA fair. The main idea was to show technological leadership through innovative services and propositions. In order to achieve this main objective, I needed to select what to present, assemble the demo, specify which use cases to use and then implement the demo in the customer stand in the fair.

One important point to highlight is that at the time my interactions with the customer side already included first line directors or even CXO level (so administration board members). This implied that the complexity and the difficulty to pass the message and to convince them increased a lot.

At this role I was included in some big business/technological opportunities, many of them approached in a program mode, so in an aggregated and consolidated way, as they were transversal to many customers. The opportunities that I'm referring were for example: Machine to Machine, Cloud Solutions and IMS related applications, like Rich Communication Suite or Business Communications.

To summarize, here is the list of some opportunities and projects in which I was involved over this period of time:

- Rich Communications Suite enhanced program (GSMA RCS-e) Portuguese telecom operators,
- Portugal Telecom's Business Communications solution
- Vodafone Business Communications solution
- Optimus Positioning solution
- Unitel Next Generation Intelligent Network (NGIN) solution



### **2.3.3 Lessons Learned**

The most important lessons learned at this role were divided in two major areas, one more in terms of business and soft skills, as I was more in a technical consultant role, and the other in more in terms of IMS core and applications.

The lessons learned in the first area were gained as it was essential not only to impress my customer with the advantages and characteristics of my solutions but also to justify the involved investment, so I frequently used business cases with studies of return on investment (ROI) and total cost of ownership (TCO). These business cases needed to be bullet proof otherwise they would fall like a castle of cards, making the opportunity vanish as easy as it appeared in the first place.

The lessons learned in the second point were related with IMS core and applications, this happened because the main business opportunities started to be related with applications running in top of this new generation of core. Services like enriched Business communications, Voice over 4G (VoLTE) and others.

Also the complexity of the subjects that I started to cover, like Voice over 4G (VoLTE), increased a lot when compared with the previous role. This complexity increased due to many more call cases than for example a more simple service running in top of an application server (AS). VoLTE is also going to have massive adoption in a two or three years, everyone will use it, so the solutions needed to be very robust and scalable. Nobody is going to accept the impossibility to make a simple voice call, as this is one of the most basic telecom services that a mobile operator can offer.

The difficulty of managing a global tender was other lesson learned. A global tender or in other words a tender that includes different countries with different realities like for example different traffic profiles make your job not easy. You always need to have in mind the totally different realities of each of the involved countries.

As my career at this stage is very time demanding, also because of the high level of trips involved, I needed to be very precise in my time management, so time management was clearly another important lesson that I took. The first step and a good start, was clearly convincing myself that I cannot do everything.



## 3. Use Case

### 3.1 Introduction

In the end of 2009, Unitel, the leading Angolan mobile telecommunications operator, needed a solution to solve a big issue that their subscribers were facing: how to configure the mobile devices in the network in a way that it should be totally automatic and transparent to the subscriber.

In this way Unitel could improve the usage of data traffic and Multimedia Messaging Service (MMS) in its network, while at the same time the subscribers were more satisfied with the easy usage of the services. This could facilitate that Unitel could focus on what really matters, the service itself.

Another important saving for Unitel was the reduction in calls for the call center, because less remote configuration activities were needed, so fewer problems would surface.

One important constraint to the project time plan was the fact that Unitel wanted to launch the MMS service for the Christmas of 2009 and the Automatic Device Configuration (ADC) was a key component in this important commercial launch because it would facilitate the adoption of the service. But the reality was that the tender timeframe was very long, so Ericsson was already short in time to deliver the solution according with the customer aspirations.

This project, as almost all Telecom projects, was divided in five parts:

- The tender – When Ericsson together with other suppliers presented the ADC, through a commercial and technical proposal and subsequent workshops. This technical activities were led by me as a solution architect.
- The low level design – When I as a solution architect went deep in detail in order to ensure the smooth integration of ADC in Unitel's network.
- The integration – When Ericsson system integration team, which was led by me, implemented my design, integrating the ADC in the network.
- The acceptance tests – When Ericsson together with Unitel fully tested the solution and were sure that it's already totally functional to go live. The acceptance tests list was agreed between me and the customer.
- Live – When the ADC solution is already processing live traffic in the Unitel's network.

### 3.1 Solution Description

Ericsson's ADC solution provides network-based detection of subscriber terminal relation. The solution can automatically detect new combinations of the unique triplet IMSI/IMEI/MSISDN (basically, the unique ID of a SIM card/ the unique ID of a telephone/the telephone number) when a subscriber attaches to the network and classifies the device capabilities for each subscriber.

Using its inbuilt support for service provisioning and activation it can ensure that all relevant services are correctly activated in the service network, always matching with the specific device capabilities of the subscriber's mobile phone.

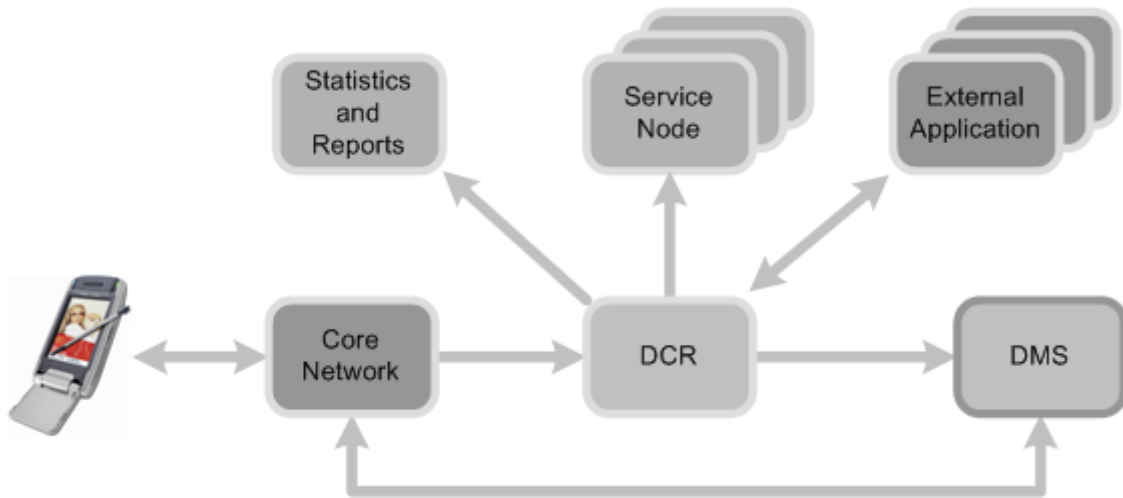


Figure 6 - ADC Overview – Functional Flow

ADC also includes all operations that are necessary in order to over-the-air manage a mobile device. This enables automatic provisioning of network access point settings, such as WAP Gateway, 3G/4G data access, Multimedia Messaging System, and Internet settings, etc. on user's mobile phone, regardless of type and brand of the mobile terminal.

Device management will be invisible to the mobile user, except for authorization and acceptance of sessions and new settings, and even so in some device models it's totally transparent.

It can also relay subscriber and terminal information to external applications and 3rd parties, ensuring that services and content is adjusted and streamlined for the user's particular device.

The system includes high performance subscriber and device databases which can be used for several purposes including statistical reporting and business intelligence.

## 2.5.2 Supported Device Settings

The following settings are supported (configurable) by ADC. For some of these services it will be necessary to retrieve user unique information and ADC supports various methods to accomplish this.

- Browser settings – all necessary settings for WAP browsing (HTTP or WSP) using a GPRS or CSD bearer
- Bookmarks – Bookmarks for the browser
- MMS settings – all necessary settings for MMS capabilities (send/receive)
- Internet settings – Internet is configured to set the preferred access point which will be used by e.g. online Java applets. GPRS and WiFi access can be configured
- Java settings – Java settings are sent to configure the Java access point in SonyEricsson OSE 3 devices only. For other devices the default access point is used

- Streaming settings
- E-mail settings – e-mail server and account settings (SMTP, IMAP & POP)
- Positioning settings – positioning settings are sent to configure the device for Secure User Plane Location (SUPL)
- SyncML DS settings – settings necessary for successful establishment of SyncML DS session between server and client (mobile device)
- SyncML DM settings – settings necessary for successful establishment of SyncML DM session between OMA-DM server and client (mobile device)
- SIP settings – settings needed for Voice over IP (VoIP) or other services based on SIP. GPRS and WiFi access can be configured
- VoIP settings including the following needed services
- VoIP account settings – settings needed for Voice over IP
- VoIP general settings – generic settings needed for Voice over IP
- NAT/FW Traversal – NAT/FW Traversal is configured to allow VoIP calls to get through firewalls. This is achieved by NAT traversal using STUN
- UMA and WiFi settings – to allow device connection via unlicensed radio media
- Wireless Village settings – Instant Messaging, presence and chat settings based on IMPS
- Push-to-Talk settings
- IMS settings – IP Multimedia Subsystem (IMS) is configured so subscribers can enjoy Presence or other services based on IMS
- Presence settings – IMS based presence settings
- Mobile TV settings

### 2.5.3 Components in the ADC solution

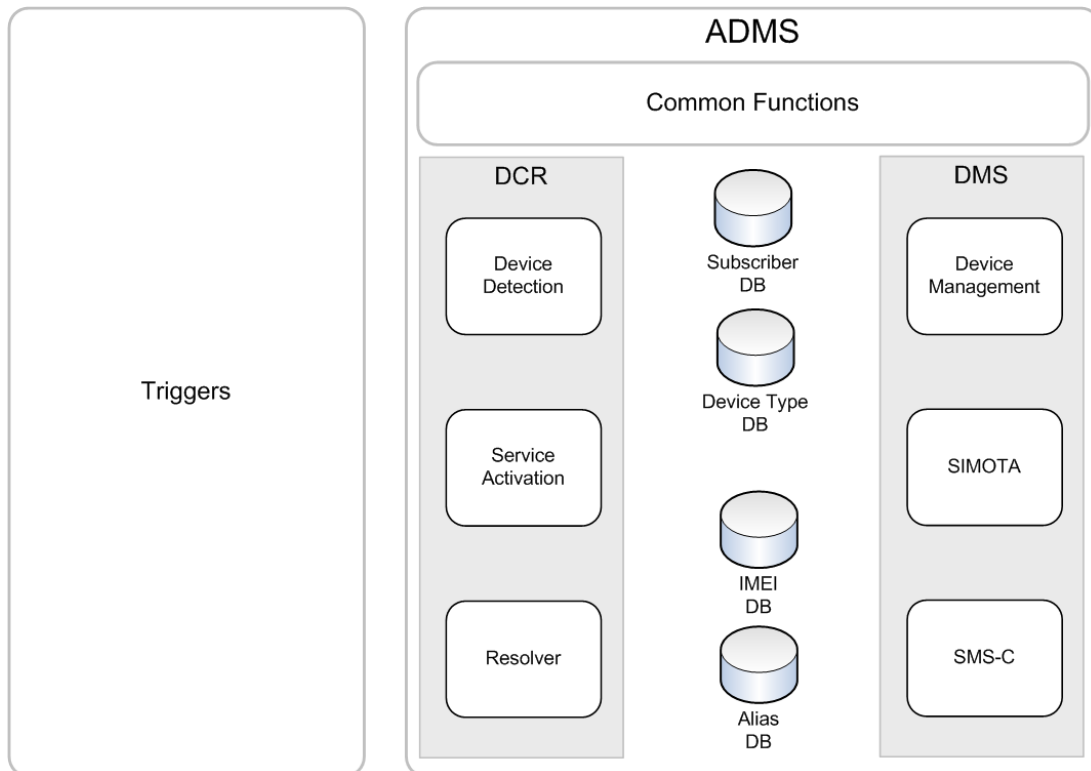


Figure 7 - ADC Architecture

The Ericsson ADC consists of the following system components:

- Triggers
- Automatic Device Management System (ADMS)
  - Device Configuration Register (DCR)
    - Device Detection
    - Service Activation
    - Resolver (not part of the project)
  - Device Management System (DMS)
    - Device Management
    - SIM Card Management
    - Short Message Service Center
  - Subscriber and Device Database
  - Preconfigured IMEI Database

- Alias Database
- CommonFunctions, a concatenation of a number of common features valid for ADMS.

### 2.5.3.1 MSC/HLR Trigger (MT)

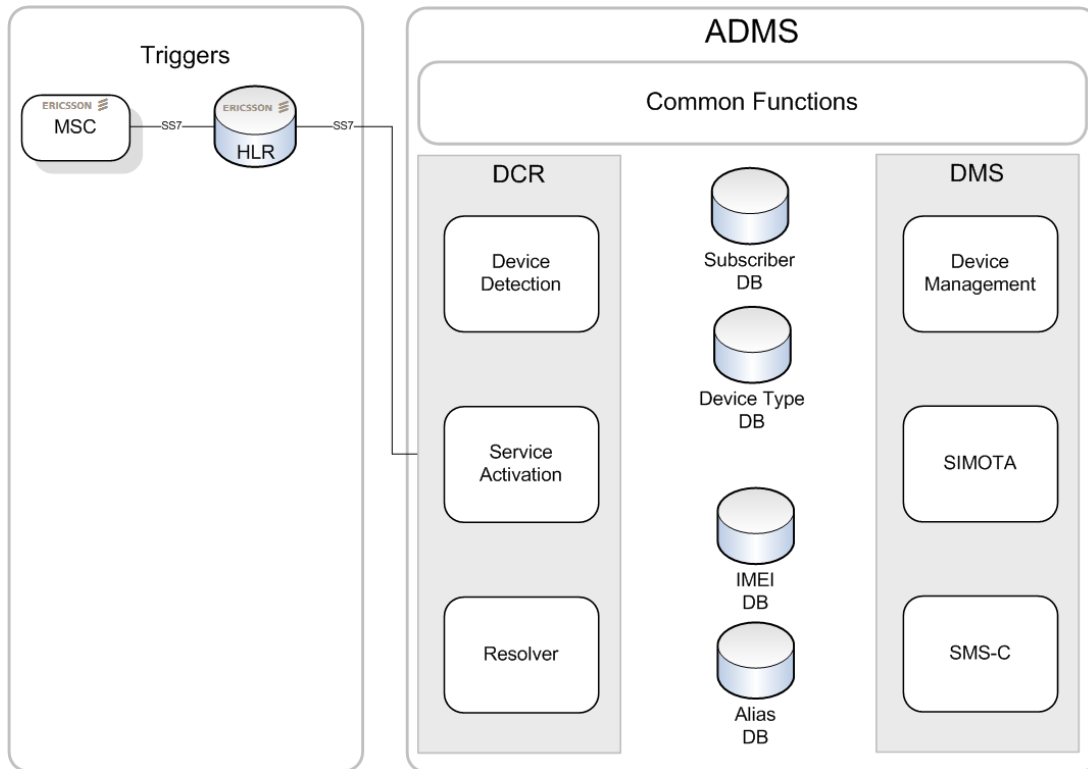


Figure 8 - MT Trigger

Ericsson provides an integrated device detection triggering method (MT) for Unitel which is the far best due to following facts; the method is utilizing existing functionality within the Mobile Switching Centre (MSC) and Home Location Register (HLR) equipment to forward triggering events to the DCR component of ADC. The additional execution has very limited impact on both the MSC and HLR nodes from a performance perspective (less than 2%). This method is also standardized in 3GPP release 6, which makes this method future compliant. This method requires Mobile Application Part protocol v3 signaling between the Unitel's MSC and HLR.

Since the core network nodes already contain all necessary information, it will not be needed to fetch additional information to create a complete triggering event. The trigger provides the following parameters: MSISDN, IMSI, IMEI, a list of all Access Point Name's (APN) defined in the HLR as well as indication whether the subscriber is removed or if a IMSI change-over is ordered. This means that the HLR will also generate the event when the APN list or the IMSI is changed.

In this way, Ericsson provided to Unitel a triggering method which both provides a 100% hit rate of all possible events and gives the opportunity to utilize future advantages when the standard is implemented by other vendors.

The proposed triggering method can be realized by enabling the automatic device detection feature in Ericsson's MSC's and HLR's.

Function of MSC/HLR (MT) triggers is quite simple. Upon "IMSI attach" or "normal Location Updating" the MSC will fetch the IMEI from the Mobile Station (MS, the radio base station). The MSC will compare the IMEI fetched with the stored IMEI for the same IMSI if available. If the fetched IMEI is different from the already stored IMEI or the subscriber is new in the MSC service area, the MSC will send an "Update Location Message", including the fetched IMEI information in the normal extension Fields of this MAP v3 message, to the HLR. The HLR will store the IMEI. The HLR will compare the IMEI information received for this subscriber with the IMEI previously stored if available. If there is an IMEI mismatch or first time occurrence of IMEI for the subscriber then a proprietary MAP message "Update Device Configuration Data" (UDCD) will be composed and sent (note: the UDCD message is not and is not planned to be standardized). This MAP message will contain the following information:

- The subscriber's IMSI
- The new subscriber's IMSI (for IMSI changeovers)
- The subscriber's Main MSISDN
- The IMEI stored in the HLR
- The list of APNs the subscriber is using
- The remove user indicator
- The "all information sent indicator"

Using the ADC triggering method will result in the DCR to collect ALL subscribers and their devices in the network when performing a GSM attach, and it is the most convenient method.

### **2.5.3.2 Device Configuration Register (DCR)**

#### ***Device Detection***

Device Configuration Register (DCR) is a module that collects and stores information about the terminal identity and terminal attributes of each mobile subscriber in Unitel's network in a subscriber database. The DCR runs within the Unitel's trusted network domain.

The DCR receives device change events (new subscriber/terminal combinations) from the network in real-time. The DCR has extensive configurable business logic to control what actions should be applied on incoming events, e.g. whether events should be filtered out, what service nodes to provision etcetera.

The DCR also includes features capable of extracting business intelligence and data mining. This enabled Unitel to keep close track on which devices all subscribers is using as well as trends in device usage. In addition external applications can query the DCR databases for which device individual subscribers are using as well as what capabilities that device has.

#### ***Service Activation***

DCR may also provision relevant service nodes prior to settings submission by initiating a provisioning request to the Unitel's Provisioning System for the requested services over the HTTP interface.

If the event has passed through the filters and is decided to result in a provisioning request the correct provisioning backend(s) are selected. Using filters on IMSI, MSISDN, Manufacture and Model



and subscriber groups certain back-ends are selected. Multiple provisioning back-ends can be selected to provision multiple services.

This enabled Unitel to decide whether a certain group of subscribers shall be MMS provisioned via e.g. Corba interface and for another group via HTTP interface and for a third group no action.

DCR can receive device configuration requests as well as subscriber data modifications from the provisioning layer.

**Resolver**

Upon detection of a new IMEI-IMSI combination, DCR may query the HLR, in order to know the user type (prepaid/postpaid) as well as the MSISDN (if not part of trigger), through the Provisioning system over the HTTP interface. For resolution of prepaid/postpaid as well as subscriber grouping the system offers a flat file import as well as a telnet command line interface to allow Unitel to assign correct subscriber information for use in the business logic.

**2.5.3.3 Device Management System (DMS)**

The Ericsson ADC includes a comprehensive DMS as an integrated component, with full Over the Air (OTA) capabilities. The main function of the DMS is to analyze the received information, compare it with the subscriber database and (if needed) initiate over-the-air updates as appropriate.

The business logic assures bundled offerings to devices customized in real-time to the individual subscriber preferences and current used device capabilities. The bundled offerings may consist of a Firmware update, device configurations, bookmarks and Welcome messages. This assures that a device has the right firmware and the right settings and information to function well upon first power on.

**Device Management**

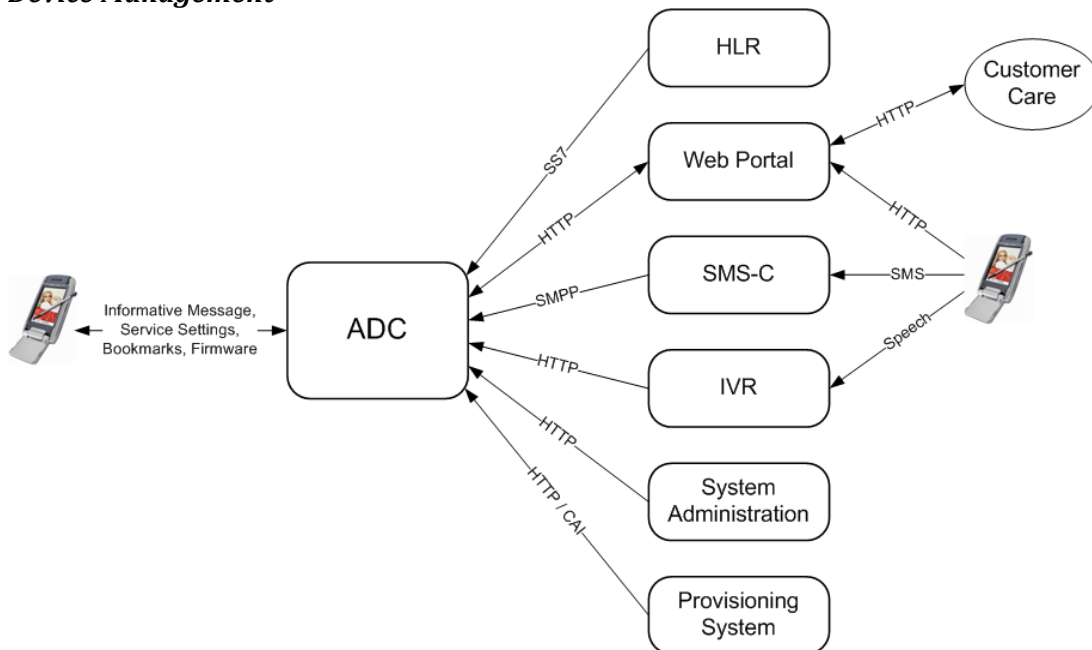


Figure 9 - Service Requests Interaction Diagram

Ericsson's ADC solution supports a large number of possible methods for setup of subscriber's devices:

- **Automatic Management**  
One of the main features and key benefits of ADC is the capability of automatic detection of new subscribers and changed SIM Card/devices combinations. ADC supports different methods to derive the information from the network. ADC is able to detect a new device in the network, detect its capabilities (GPRS, MMS, WAP or Email) as well as firmware level, and then send out the correct offerings to that subscriber. ADC cover the complete lifecycle of the device, from the moment when the subscriber gets a new device or changes his device, or a new subscriber comes into the network with a new device.
- **User initiated via end-user web portal**  
through integration with the provisioning, Unitel can integrate with a subscriber self-care portal through which the subscribers can be able to manually initiate device configuration. By accessing the web pages and providing the needed information (MSISDN number, mobile device brand and model and service for which configuration is to be sent) the subscriber will manually initiate the configuration process for the mobile device. Web pages may be completely integrated in the existing Unitel's web space, conforming to the existing "look-and-feel" layout.
- **User initiated directly from the device via short message service**  
The system provides ability to request new configuration by sending an SMS to predefined short number containing a command (i.e. MMS ON). The command is completely configurable by Unitel, providing possibility for localization. Through SMS configuration initiation, it is possible to request only one particular service (i.e. MMS settings), resulting in sending a few settings or all, resulting in sending of a whole bunch of settings.
- **User initiated directly from the device via Interactive Voice Response (IVR)**  
There is also a possibility to order configuration by contacting Unitel's IVR system, which will guide subscriber through configuration process. IVR and ADC may be interconnected through HTTP API integration.
- **Initiated via Unitel's customer care**  
ADC offers intuitive Web based interface for customer care agents. That interface enables all necessary actions (view subscriber information, enable/disable service, send settings and firmware updates etc) for swift and high-quality subscriber support. Customer Care operators are able to view all relevant information about a subscriber and his/her device(s), such are device type and supported capabilities, current configuration, configuration history etc.
- **Initiated via Unitel's point of sale**  
Similar to the subscriber initiated configuration via Unitel's Web pages, Unitel employees at Point of Sale can access intranet web pages and, upon request from the subscriber at the Point of Sale, initiate configuration of subscriber's mobile device through OTA interface.

- Initiated via Unitel’s provisioning systems or applications  
As the operators support system such as mediation or provisioning systems adds services to the subscriber they can as well order ADC to send relevant settings to the subscriber to complete the service activation process.

### ***SIM Card Management (SIMOTA)***

The Ericsson ADC also provides a SIM card management feature where it is possible to deliver custom commands to groups of SIM cards over-the-air. The feature supports Remote Application Management (RAM) and Remote File Management (RFM) over the air to the SIM-card, enabling management of all fields stored on the SIM-card, such as preferred roaming list and Service Provide Name (also called “logo replacement” that allows changing the name of Unitel shown on the device).

Note: This feature is used to manage SIM cards, it is not intended to download SIM toolkit applications.

### ***SMS-C***

ADC offers the possibility to use either an existing external SMS-C or, the recommended integrated SMS-C.

## **2.5.3.4 Subscriber and Device Database**

### ***Device Capability Repository***

The Ericsson ADC currently holds information for more than 35,000 mobile devices available on the market. This comprehensive collection of data about available devices does not only allow flawless configuration of the device fleet in the network, but also serves other purposes, as it has interface for queries upon data collected.

This solution has an HTTP and a CAI interface through which 3<sup>rd</sup> party systems can query the database and take advantage of data collected and stored within. As an example, applications such as logo and ring tone ordering may query the database for device and brand providing MSISDN. This is just an example of how data collected can make it much easier for end-users to order ring tones and logos (no need to put brand and model in order to get the content). Additionally it will save a lot of advertising costs since the advertisements can be generic (instead of having to provide examples of how to order for Nokia, Siemens etc.). New device information files can be loaded directly into the device database using File transfer point (FTP) via a command line interface (normally as part of regular maintenance) and it is also possible to edit and add selected device information via the web graphical user interface (GUI).

There is a standard set of queries that can be run upon the database, but it is open to extend with specific queries to suite the special customer case:

- Retrieve subscriber attributes
- Modify subscriber attributes
- Retrieve IMEI and Make/Model with IMSI or MSISDN as input
- Retrieve all device capabilities with IMEI or IMSI or MSISDN as input

- Order sending of settings/welcome MMS

DCR data repository also holds the history of last used devices, in case that previous devices are included in the history, no new setting will be sent. In this way a user can have more than one device that he uses with the same SIM card, without automatic reconfiguration on every mobile device change.

Unitel will be able to add custom data fields to Device Data Capability Repository in order to store and display device data specific for the relevant services.

### ***Data in Device Capability Repository***

The Device Database contains data about terminal models including information on device capabilities and device attributes. The purposes of the data repository are:

- Recognize all terminals in the network.
- Determine device capabilities (especially those that require settings) such as MMS, GPRS etc.
- Collect device attributes\* (sound formats, image formats etc.) of interest to different applications and sub-systems.

Data within ADC is collected at run-time and it will be most reliable source of information regarding current situation of mobile devices within Unitel's network. This information, besides configuration, can be used in all kinds of business intelligence purposes.

The system collects following run-time information:

- Subscribers MSISDN, IMSI and current IMEI
- List of APN's
- History of IMEI/Software Version (with configurable depth)
- Provisioning status
- OTA configured status

The repository also comes with a database that includes a large number of unique models in the database. The device content, per device, includes the following quality ensured information:

- Device Make and Model names
- List of Type Allocation Codes
- OTA-capabilities and OTA-drivers for device configuration
- Device Capabilities:
  - GPRS/CSD support
  - MMS support
  - WAP/WAP Push support
  - Streaming support
  - Data Sync support
  - Email support
  - Various device attributes\*

*\* Several device attributes (including picture of the device) are provided "as is". This content is sourced from information provided by terminal manufactures and other open sources. If the customer would like additional quality ensured information an additional commercial agreement needs to be arranged.*

### ***Device Database Update Subscription***

In today's fast growing mobile device market, everyday new devices are introduced. In order to support those mobile devices with automatic or manual service configuration, system needs to get information about newly introduced devices.

All terminals in the network are detected and the system recognizes typically over 99% of all terminals in a network are recognized by the DCR. Devices that cannot be recognized are typically prototype or “hacked” terminals where the IMEI has been manipulated so that it only contains “zeros”.

#### ***Add Specific Device to Device Repository***

New device information files can be loaded directly into the device database over FTP using the command line interface, normally as part of regular support or special device update service agreement. For Unitel, it is possible to edit and add selected device information via specially designed intuitive web GUI.

After addition of a new brand or model mobile device, it is possible for the ADC administrator to define different capabilities and details or add new attributes for the newly added mobile device.

All changes in the device database performed by Unitel are kept when importing a central update to the device database.

#### **2.5.3.5 Preconfigured IMEI Database**

This feature provides a possibility to handle preconfigured devices. The system will not send settings to devices present in the IMEI Database.

In the IMEI Database, Unitel pre-configured devices can be loaded automatically from a file fetched at regular intervals from an ftp area. The file format is flexible and can be specified in the web based GUI.

#### **2.5.3.6 Alias Database**

The alias database enables support for reprogrammed (“flashed”) devices allowing Unitel to manage mobiles that have non-official or invalid TAC identity.

### **3.1 Hardware**

As a normal engineering project, new hardware was included in the proposal, the hardware that supported this proposal was not proprietary and from a well-known vendor, SUN now Oracle.

This is the information regarding the hardware included in the proposal, just to give an overview of the solution physical footprint.



ADC MID END CLUSTER SERVERS	
Supplier Part Number	Description
B13-UE2-EC-8GB-KD6	Two Quad-Core Intel(R) Xeon(R) X5460 processor (2x6MB L2, 3.16 GHz, 1333 MHz FSB, 120W), 8GB of memory (4x2GB PC2-5300 667 MHz ECC fully buffered DDR2 DIMMs), 4x 146GB 10K RPM 2.5" SAS drives, internal SAS RAID PCI-Express HBA, DVD+/-RW drive, 2x PSU, embedded LOM, 4x 10/100/1000 Ethernet ports, 5x USB 2.0 ports, 3x 8-lane PCI-Express slots, no power cord, order Geo-specific x-option. Solaris 10 and Java ES preinstall. Standard Configuration. RoHS-5.
X6326A	Slide Rail Kit for X4150/X4450
X312L	Continental Europe Power Cord
07-6463	Ethernet cables Cat. 6
X4446A-Z	Sun x4 PCI Express Quad Gigabit Ethernet UTP low profile adapter, low profile bracket on board, standard bracket included. RoHS-6 compliant, IntelOEM card

Table 1 – ADC Mid End Cluster servers



ADC CLUSTER STORAGE	
Supplier Part Number	Description
XTA2530R01A1D365	Sun StorageTek(TM) 2530 SAS Array, Rack-Ready Controller Tray, 365GB, 5 * 73GB 15Krpm SAS drives, 1 * 512MB cache SAS HW RAID controller, 2 * redundant AC power supplies, 2 * redundant cooling fans; Includes Sun StorageTek(TM) Common Array Manager software and 2 * storage domains using Sun StorageTek(TM) Storage Domains software; RoHS-5
SG-XPCIE8SAS-E-Z	Sun StorageTek (TM) 8-port external SAS PCI-Express Host Bus Adapter
XTA25X0-0.5M-SAS-Z	Sun StorageTek 0.5m, mini, shielded, SAS cable; For connection between array and host; RoHS-6
XTA-2500-2URK-19U	Sun StorEdge(TM) 2500 2U universal rack, sliding rail kit; RoHS-5

Table 2 – ADC Cluster Storage



ADC SS7 Cards	
Supplier Part Number	Description
ADAX SS7 Card	ADAX SS7 card for use with internal SS7 stack.

Table 3 – ADC SS7 Cards



ADC CLUSTER SWITCHES	
Supplier Part Number	Description
GS725T	Prosafe 24-Port Gigabit Smart Switch

Table 4 – ADC Cluster Switches

The ADC cluster is very “talkative” so it is imperative that the IP communications between the cluster nodes is not broadcasted in the rest of the IP network, as well as the switches must be able to cope with very high data bust rates with minimum delays. Hence, they need to support full duplex Gigabit operation and gratuitous ARP.



ADC CLUSTER RACK KITS	
Supplier Part Number	Description
XTA-3000-2URK-19U	NTM 101 943/1 R2A Rack Kit, 2U, 19" Cab 22-28"

Table 5 – ADC Cluster rack

## Environmental and Space Requirements

Sun Fire X4150	
Quantity	Description
Power Supply	Two for redundancy with separate power cords, hot-swappable
AC Power	100-120/200-240 V AC, 12/6 A, 50-60 Hz
Operating temperature	5° C to 35° C (41° F to 95° F) 10% to 90% relative humidity, noncondensing short term -5° C to 55° C (23° F to 131° F) 5% to 90% relative humidity, noncondensing, but not to exceed 0.024 kg water/kg dry air (0.053 lb water/2.205 lb dry air)
Nonoperating temperature	-40° C to 70° C (-40° F to 158° F), up to 93% relative humidity noncondensing, 38° C (100.4° F) max wet bulb
Altitude (operating)	Up to 3048 m
ETSI	EN 300 019-2-1, Table 3.1 and Table 3.1E, except for: -5° C Cold start Condensing humidity Rain
Space	Description
Height	44 mm
Width	426 mm
Depth	714 mm
Weight	18.4 kg (40.66 lb.) maximum assuming PCI-Express card weighs 0.12 kg (0.25 lb) each and without rack mounting slide rail kit

Table 6 – ADC servers space requirements

Sun StorageTek 2530 Array	
Environment	Description
Power Supply	515W each (Dual Hot-Swap Redundant Power Supplies)
AC Power	515 W (+ 5 V @ 19 A/+12 V @ 35 A)
DC Power	17 A Max Operating (-42 to -60 VDC)
Operating temperature	10°C to 40°C (50°F to 104°F)
Nonoperating temperature	-40°C to 50°C (-14°F to 122°F)
Space	Description
Dimensions (Height, Width, Depth)	86.1 mm (3.39 in.) x 448.6 mm (17.66 in.) x 540 mm (21.26 in.)
Weight (Fully Populated)	59,55 lbs

Table 7 – ADC storage space requirements

NetGear ProSafe GS724T switches	
Environment	Description
Power Supply	43,2W
AC Power	100-240V AC/50-60 Hz universal input
Operating temperature	32° to 104°F (0° to 40° C)
Nonoperating temperature	-4° to 158°F (-20° to 70° C)
Altitude (operating)	10,000 ft (3,000 m) maximum
Altitude (nonoperating)	10,000 ft (3,000 m) maximum
Space	Description
Dimensions (h x w x d)	43 x 440 x 260 mm
Weight	3.6 kg

Table 8 – ADC switches space requirements

### **3.3 The Tender**

The first part of this project was the tender part; this tender was done in a Request for Quotation mode (RFQ) process, involving different vendors in order to convince Unitel that their solution was the best choice. Ericsson already had a very good presence in the Unitel's network (both in radio access and core), so this inside knowledge of the network, a very good solution and the capability of making a better commercial proposal, were the key ingredients in order to Ericsson received the contract.

In this tender I was appointed as the solution architect, or in terms of the proposal core 3, the CSR (Customer Solution Responsible). So for this tender I was the single point of contact (SPOC) for all the technical raised points of the solution. This included: dimension, design, technical documentation, and technically answer to all the requirements from the customer.

In the previous chapter I just gave an overview of the solution that I was proposing. After winning the contract this designed solution was delivered to Unitel.

In the tender phase, I had already to do some engineering tasks like: designing and dimensioning of the solution based on the first requests of the customer.

At the tender stage different meetings and workshops were held in order to clarify any doubts that the customer could have. I had to prepare different presentations in order to be sure that my designed and dimensioned solution was aligned with the requests of the customer.

The solution needed to be high available and with enough capacity to serve the entire customer's base of Unitel. Also another important point to address was the scalability of the solution, in order to avoid install new hardware in a near future.

### **3.4 The Low Level design**

After winning the contract, our focus, and mainly mine, was to design a more in depth solution integration architecture, which would cope with the existent network details now revealed by the customer.

One important input for this phase is the site survey; this activity is done by the Solution Architect (myself), the System Integration Leader (SI Leader) and the customer. This activity is done in order to assess the site capabilities in terms of IP connectivity, energy and space for the solution rack. And if some issue is spotted at this time it could easily be solved.

The output of this phase is an important document that is the main orientation driver for the integration of the ADC solution in the customer network. This document with the name of Low Level Design (LLD) document was my responsibility. In this document all the requirements and information regarding the solution like the IP diagram and addresses, the power and racks layout, as well as the Sigtran connectivity needed to be included.

In high level, this is the diagram of the Ericsson ADC integrated in the customer's network, for the reason of confidentiality I cannot show the customer's network diagram, so this is just an overview of a possible integrations diagram.

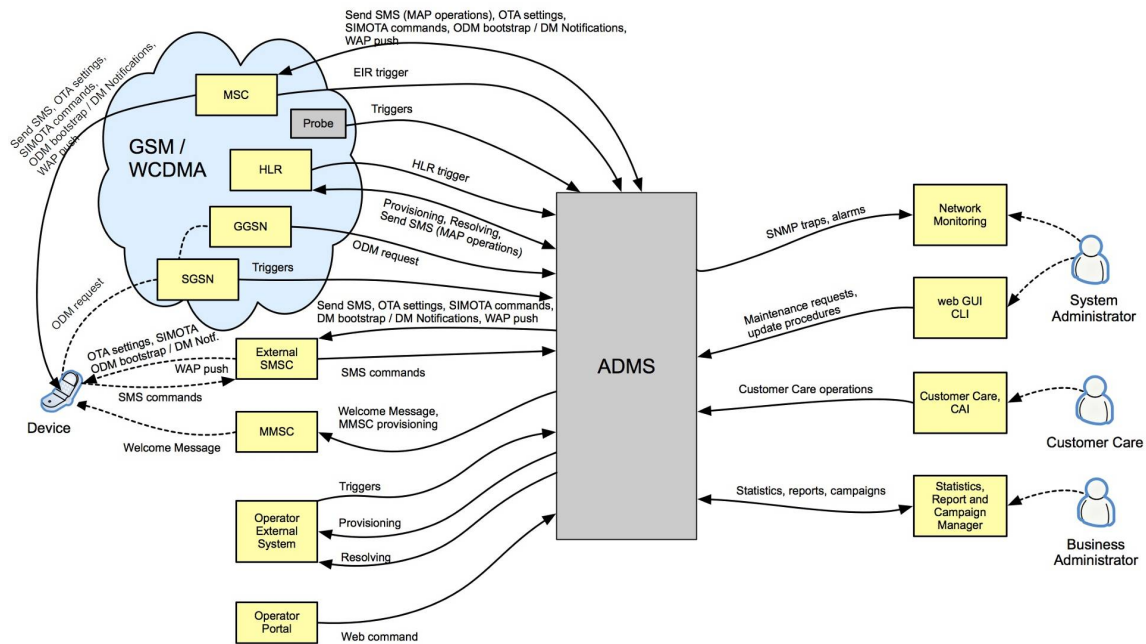


Figure 10 – ADC integration in the network Diagram

A kick off meeting happened at the start of the project, this meeting has the objective of bringing any doubts or questions between the vendor and the customer to the light of discussion. At that meeting all the teams that will be involved in the project were together for the first time, in order as well, to put faces on the names and to clear out who's responsible for what. This is important to not have matters falling between chairs.

As input for the kick off meeting, I needed to close all the information regarding the network integration points. This was important in order that in meeting it could already be displayed some predesign of how the solution will look in the end. This predesign was the first draft of the LLD document that I was producing in parallel.

The first document that I produced was an excel table with all the IP's that the ADC solution had as external connection points. This table was submitted to the IT department of the customer in order to Unitel understand what were our IP needs and what network subnets needed to be open to our solution.

This is important because as its common knowledge, the IP network of a telecom operator is very complex and made of a lot of subnets that are only accessible for some machines. Also it's important to refer that some subnets are only for Operation and Maintenance while others are open to service traffic. When a new solution is going to be integrated in the live network, all the new routes needed to be carefully assigned, or it could make a problem of some IP addresses addressing different machines.

It's also important to refer that some of the IP's that I needed to successfully integrate the ADC in the network, were public, so some of the functionalities needed to be addressed directly from the smartphone in order to work properly. This increases the complexity and the time needed because its well know that the range of public IPs that each operator has is quite limited. Also the Network Address Translation (NAT) policies needed to be discussed.

Another important integration point was the circuit switch core, namely with the MSC and the HLR. These integrations were done throw Sigtran, which is the Signalling System 7 (SS7) protocol encapsulated in IP. For the rest of the network integration points the normal IP protocol was used. With some different flavors of course, for example for Operation and Maintenance, the SNMP protocol was used. I was also in direct contact with the core team in order to receive all the information needed like the Point codes (the main identification address in the circuit switch world) and what were the Signal Transfer Points (STPs) to use for the ADC integration.

All the customizations needed from the standard product were also discussed at this stage. In the case of this particular project the only customizations considered were the normal ones. Some of the customized connectors were, for example, the one to integrate towards the MMSC from other vendor (MM4 interface) or the one used to integrate the SNMP protocol towards the Unitel's O&M server.

As the ADC does auto-provisioning, no integration towards the provisioning layer of Unitel was needed; the main provisioning driver was the Ericsson Multi-activation (EMA). All of these interfaces and connectors needed to be parameterized and configured by a joined team including myself, the project Solution Architect, and the System Integrators (SI).

After the low level design document done, the final design of the network was much more close to final. As matter sake of confidentiality, I can only show an example integration diagram, not the precise customer one, which is the following one:

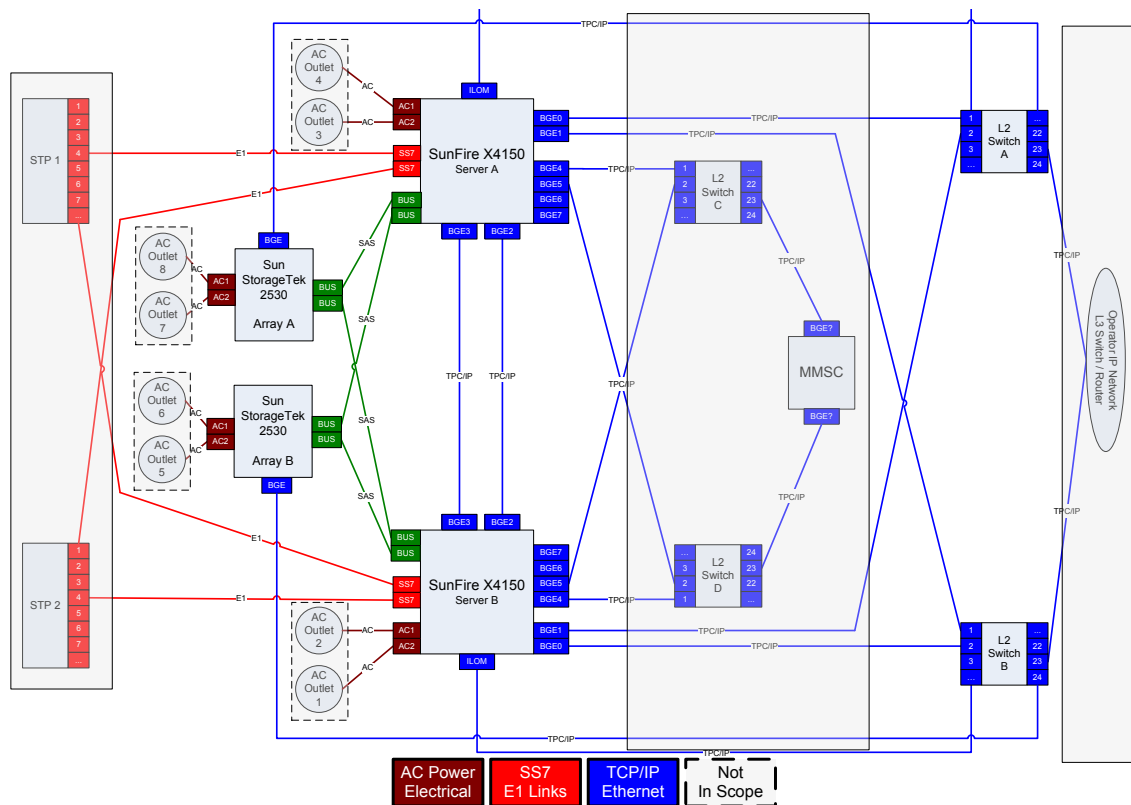


Figure 11 – ADC deployment architecture example (high level)

In the image you can see that the Signal Transfer Points (STPs), two of them for redundancy purposes, are connected towards the ADC solution main servers, two of them also for redundancy. This is done because the trigger signals coming from the MSC need to reach the ADC servers. Also you can see that this connection is performed using the Sigtran protocol, again this is a SS7 standard telecom protocol but encapsulated in IP packets.

As you can see, the rest of the connections are for pure IP traffic. In this solution this type of traffic is transfer through level 2 switches, also always with two of them for each connection in order to ensure the high availability of the system. The MMSC is shown in the figure as is the node responsible for sending MMS welcome messages to the subscribers, after the provisioning and activation of the services in the devices are successfully done.

As it was already said, in order to avoid the broadcast towards the customer’s network, the solution has internal switches to control the “talks” between the two main servers and the outside operator’s network. The configuration of the switches and the design of the LAN’s (only the internal solution switches) was my responsibility but the implementation was again responsibility of the Solution Integrators (SIs).

Another important point is that all the hardware needed for the solution was installed in just one site (one of the main switching sites of the customer). The solution wasn’t implemented in a geographical redundant model as it wasn’t a customer request.

To finish, another point that has high importance in terms of redundancy design is the power. It's important to have two different sources in order to keep the system live even in case of energy outage. This required that some of the power plugs needed to come from the backup energy supply, which was a petrol generator.

### 3.5 The Integration

Just to remind the different integrations points of the solution, please take a look to the figure below:

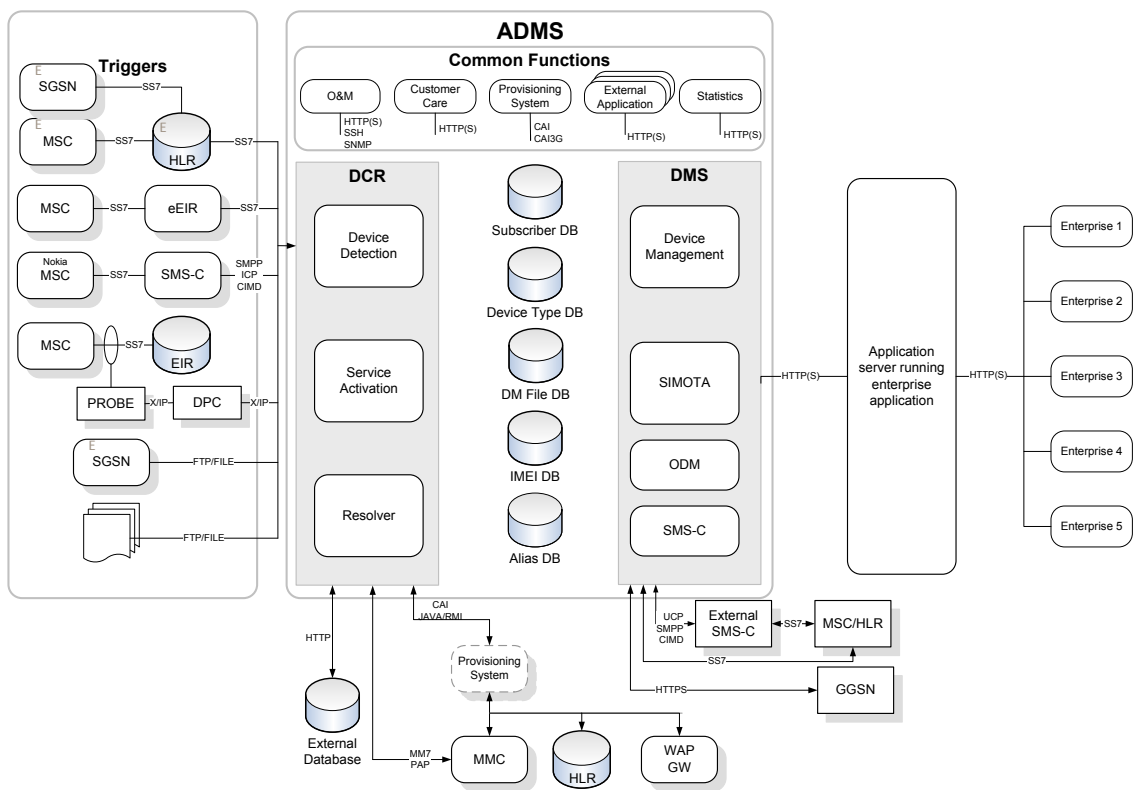


Figure 12 – ADC interfaces with external nodes

After the previous phase of the project finished and the hardware already delivered in the customer warehouse, the integration team went to the customer site in order to start the real implementation work. The integration team had resources from different backgrounds and knowledge, from the telecom core (for the MSC and HLR configurations) to the pure IP protocol. This integration team had a leader (the SI Leader) which reported to me as the main driver for all the technical activities related to the solution.

The first job for the onsite project team was to be sure with another site survey (after the first one done at the low level design phase) that all the conditions of power and connectivity were in place, at

the same time the team accessed whether the place that would receive the rack was a good selection spot.

The next activity was to delivery and to install in the customer site all the needed hardware, this installation needed to be done accordingly with my design and requirements (stated in the LLD document made earlier). It's important to be sure that the hardware is properly powered and installed in the rack. The next phase is start to pass all the Ethernet cables to the right internal and external switches (the customer switches) in order to implement the IP and Sigtran routing layer also defined by me at the LLD phase.

### **3.5.1 Network features**

One important milestone of the project was when the integration towards the core network started, this activity included the deployment and configuration of the network features that needed to be installed in all the MSCs and HLRs present in the customer network. These features are important for the trigger of the ADC solution when a new triplet (MSISDN, IMEI and IMSI) attaches to the network at the first location update. The features were first loaded in a set of HLR and MSC that are less loaded of subscribers. This was done as a test before starting to submit the activation of the features to all the core switching infrastructure of the customer.

This activation was done when the MSC in pool was not yet implemented in the customer network. When the MSC in pool is in place, as the name says, all the MSC are equal in terms of acceptance of traffic turning this testing approach impossible.

The activities for the activation and configuration of the features are not only done at the MSC and HLR level, the configuration needs also to be done at the Signal Transfer Point (STP), as this one needs to be configured to reproduce the triggers towards the ADC server nodes. The STP is the middle man between the core nodes and the ADC solution.

The Ordering of these features was done by me, totally aligned with the design that I made. The installation on the other hand was requested to the core team guys, as the nodes in which these features were going to work were core nodes (MSC and HLR).

### **3.5.2 Customer Care Interface**

The ADC exposes a Graphical User Interface (GUI) for customer care personnel. The GUI is a web based tool possible to use over HTTP/HTTP(S).

It is also possible to use the HTTP API to integrate the operator's existing customer care GUI. This last possibility was used by the customer in order to inject the ADC customer care webpage inside the customer's care general webpage. The idea was to have a single point of access towards the platform. The customer care is important in order to force the sending of the configurations in case of problems with the automatic generated configurations submission.



The integration of the customer care interface was designed between me and the customer, the idea was to embed this GUI inside the already existent customer care. The HTTP API would be used by other operating nodes in the network for essentially Customer Relationship Management (CRM) purposes. No adaptations were done in this component of the solution.

### **3.5.3 SNMP interface**

ADC supports SNMP version 1 and 2c for fault management communication with network management system. The SNMP is used to send alarms that are already configured in the ADC servers like when the link towards the core network is lost or when the memory is starting to be full. These alarms are forward towards the overall alarm platform of the customer. The configuration is done by only configuring in the ADC the IP address of the alarm platform (basically indicating where to send the alarm traps).

The integration of the SNMP interface is done using a list of alarms that needed to be configured in the customer alarms detection infrastructure, this is done because it's important that the customer's alarms infrastructure understands which alarm is being raised by the ADC. This was a very simple integration as I just needed to send this compile alarms files to the customer in order to him to configure on the other side the alarming infrastructure.

### **3.5.4 FTP / SFTP**

Ericsson ADC supports FTP / SFTP protocol for different functionalities like for Backup, Bulk management through a text file input or even export of statistics and other reports. In the customer side both the backup and the statistics platforms are from other suppliers. So this would imply that this standard interface was going to be used to transfer the statistics and reports from the ADC towards the customer platforms.

The FTP was configured by the SI Leader having the information provided by the customer of the server that should be addressed by the ADC.

### **3.5.5 HTTP and HTTPS**

The ADC solution supports HTTP and HTTPS protocols towards the packet core network (GGSN node), the main purpose of this integration is to provide:

- OMA DM sessions
- Application download

Other nodes that need information from the ADC like the devices installed base, use this interface to send commands to the ADC in order to receive answers also in the HTTP format.

The GGSN configuration was an important point in my agenda as it was used as the network exit point to the configurations submitted to the smartphones.

### **3.6 The Acceptance tests**

After the integration of Ericsson ADC was done into the customer's network, a long series of acceptance tests were performed in order to prove and ensure all the involved parties that the node was working properly and with no deviations from the expected behavior.

The acceptance tests were aligned between the solution architect (me) and the customer. The complete list of the tests is jointly defined at the Low Level Design phase. The SI team is the one responsible of performing these tests.

The acceptance tests include end user tests, so the traffic flow between the different nodes in the network, starting from the network triggering and ending in the delivery of the configurations, can be tested. Physical tests are also performed like for example testing when the rack is powered off and then powered on, in order to check if the servers are recovering without any majored failure. Important as well is to test the load-balancing and the redundancy of the end solution, in order to achieve this, physical unplugging of the Ethernet cables is done in order to understand how the solution reacts to connectivity or even a system failure.

Normally these tests are run for an entire week, is also a good time to test if the customizations that were done for the specific environment of the customer are also working, these customizations contrary to the rest of the solution are only tested in real network ecosystem at the customer site. This happens because they are very specific to the customer environment, which sometimes is difficult to reproduce in the test plant of the developers.

In the case something is not working properly, some patches or even customizations are done on the fly in order to redo the specific failed test as soon as possible. The SI team which is performing the tests, immediately reports this situation to the solution architect (me) in order for him to design what are the requirements of these customizations and pass them to the Product Development Unit (PDU). This unit is the one responsible for the development of the required customizations. In this project some customizations were produced at this level but nothing of major relevance.

After the testing is done, the next phase is the babysitting of the solution, at this time, live network traffic is already passing through the solution nodes.

### **3.7 Live**

When the solution is clear for live traffic, one week of babysitting is the next phase, for this last activity just part of the integration resources stay on-site, but the nodes are monitored closely at the peak traffic time, in order to spot whether something out or ordinary happens at this demanding periods. Also some configuration parameters can be changed in the scripts so the node works in a fine tuned way. All this small changes are done at the night when the traffic load in the nodes is quite low.

If nothing strange or blocking happens with the node during this babysitting phase, the node is handover to the support guys and the project is finished.

Just to add that normally during the last two weeks of the project (acceptance tests and babysitting), the customer staff that will be dealing with the node after the project is finished is under training. In this case I, as the solution architect of the project, and the SI Leader were the ones delivering the training.

After this phase is finished, I finish my assignment as solution architect of the project and handover the solution to the support organization that will support the customer in the lifetime of the solution. The handover is done at a meeting where all the important information is passed to the support organization. In most of the cases and this one was not an exception; one element of the support team was already included in the project team, so he was aware of everything related to entire project.

### **3.7 Lessons Learned**

This project was a very intense as the deadline for the delivery was very tight. The customer wanted the solution up and running at Christmas, to help in the launch of the MMS service. This turned this project in a very short delivery without any possibility of losing many time with mistakes.

The project was important as it was my first delivery in this customer, also it was my first delivery in Angola, which is a country not belonging to the European Union and in Africa, so many logistic arrangements needed to be changed from the standard projects in Portugal or Spain (countries in which I had projects before).

Either at tender or at delivery phase, I needed to align myself with the immense information flow coming to me. I was managing a team of technical resources that provided me some answers for some particular questions and also I needed to do the inverse, so provide a big amount of vital technical information in order to the project to progress. Basically I was the single point of contact (SPOC) for the information coming from Product Development Units (PDUs), Business Units and Support Units. And feeding the System Integration team which was onsite, or giving quotations at the proposal phase.

This flow needed to be managed carefully, because all the needs were for yesterday but anyway I needed to manage the time and the deliverables. Also in this project many points of the network required to be “touched”, these points were from the circuit switch core, packet switch core and Business Support Systems (BSS), like for example the charging and the customer care. These integration points needed to be scoped by me in a very short time, resulting that the quickness of my decision making process was highly tested.

At the delivery phase, I needed also to be aware of the internal dependencies of the customer’s departments, from which we needed help to integrate the solution. For example the IT department, which works with all the IP infrastructure of the customer, had a high load of work at the time, so any requirement needed to be addressing to them as soon as possible in order to not be a blocking point later on in the project.

This project had all eyes of the customer on it, as it was seen as a strategic project, so many reports and meetings needed to be done with the customer in order to give them the status and the comfort that everything was going accordingly with the initial plan. If something was out of this plan, it also needed to be addressed quickly in order for the customer to help us solving the blocking issue.

In all the meetings, many of them at the CXO level, I was the speaker for all the technical solution related points. This activity taught me all the required information management techniques in order to be sure that my message was always passing properly.

## 4. The pure IT and the Telecom worlds

In my short career I made a big move from the computer science area towards the telecommunications area. This move was done when I changed from Accenture where I was Software Engineer to Ericsson where I had the role of Solution Architect.

In these roles I was exposed to the IT reality (as Software Engineer) and to the telecom reality (as Solution Architect). The objective of this chapter is just to make some remarks about the differences and similarities between these two realities. These remarks are based in my personal experience and so, they cannot be taken as global laws.

In the IT world I worked with non-critical solutions and with less interoperability requirements. When I changed for the Telecom world, I worked mainly in solutions driven by standards.

The IT world for non-critical solutions is clearly much more open world with many technologies using the open source model. In this model the only thing that is standardized is the programming languages semantics. In the programming world the only goal to achieve is to bring new and innovative solutions even in a vertical approach (in an approach where there is no need of interconnectivity). The main motto is that it's better to have a worse solution in a good timing than a perfect solution in a bad timing. So this implies that the main focus and drive is really to provide good enough solutions but always having in mind the customer's needs, delivering the functionality always when needed.

For example even if in University we learned different subjects like temporal or special complexity, and that we needed to always document all our outputs. The reality in a corporate environment is that what is important is first to provide the capabilities and functionalities asked by the customer and in the time requested than document or be sure that the code is done in the best way possible.

Many times when I worked as a software engineer, I needed to pick up code made by other colleagues, for example to improve some functionality or even to clear out some bugs that recently popped up. The reality was that the documentation explaining this code pieces was very scarce or even none. I spent a huge amount of my time making diagrams of what was the behavior of this piece of code, because this basic knowledge wasn't there. In extreme situations it was clearly better to make a totally new piece of code instead of trying to understand the existing one.

Again this situation happened because the main driver was always the ratio between time and provided functionalities. So the documentation or even achieve the best possible solution were most of the times kicked out of the equation. But the reality is that this industry is much more agile and elastic than the telecommunications world. That's why is easier for startups to address the IT world than the telecommunications world. It's clear that before the internet appearance the startups were not growing as mushrooms as they are now.

The telecommunications world is totally different, the certification and the compliance to standards are the main drivers for this industry. In order to be sure that anyone in any place can for example talk with anyone in any other place, makes the compliance to common standards a must have. These standards, which the IT is not so driven by, are what makes possible that different operators networks can be accessed by anyone.

The free calling services are an example of a vertical world with no interoperability among all the players.

For example we accept the idea that a Bob using Gtalk cannot speak with Alice in Skype, so basically we accept with plenty of normality the advent of verticalization of the IT services. But if Bob is using Vodafone mobile network and wants to talk with Alice, and Alice is roaming in Telefonica Spain, It's not acceptable if the call cannot happen. In order to be sure that this is not the case the standards needed to be fully applied, so it's important to have them always in our mind when delivering new telecom solutions.

The standard oriented solutions, give many headaches to the Solution Architects that need to be always aware of which standards are being involved and how they work. The complexity increases with the number of call cases you have. There are some main institutions making standards for the telecommunications scenarios, like the International Telecommunication Union (ITU), the GSM Association (GSMA) or even the IMS Forum (IMS-F) for the IMS based solutions.

It the standardization that guarantees that everything can properly interwork, so for a telecommunications engineer the RFCs are his best friends in order to be sure that his solutions are working well not only in his customer's network but also if in some call case it can be used by a subscriber using other network when roaming.

In other hand, this standardization takes some valuable time when trying to launch new services, as the telecommunications area is not a "green field" and so, not so open to unlimited innovation. So basically the time to market (TTM) is in many cases superior to what the market demands. That's why today, the OTT players from the Internet world are starting to eat the cake of the telecom operators.

It can also be said that telecom operators for long time worked in monopoly or duopoly, many of them belonging to the countries states, and use this complicated environment approach to close their networks and protect their revenues.

Nowadays because of this, we are facing a big fight between the telecom operators that give access to the internet and also services and the pure internet players like Google, Microsoft and other OTTs that use the operator networks to directly sell their services, but without paying any part of their revenues to the operators.

This battle is reaching a peak with all the free Voice over IP services (VoIP) like skype or gtalk, which are bringing to the smartphones the easy "click to talk" approach of the PCs. This will imply that in a near future the telecom operators can start to be only connection providers or in other words simple bit pipes without any services offering, which is the main driver for revenues.

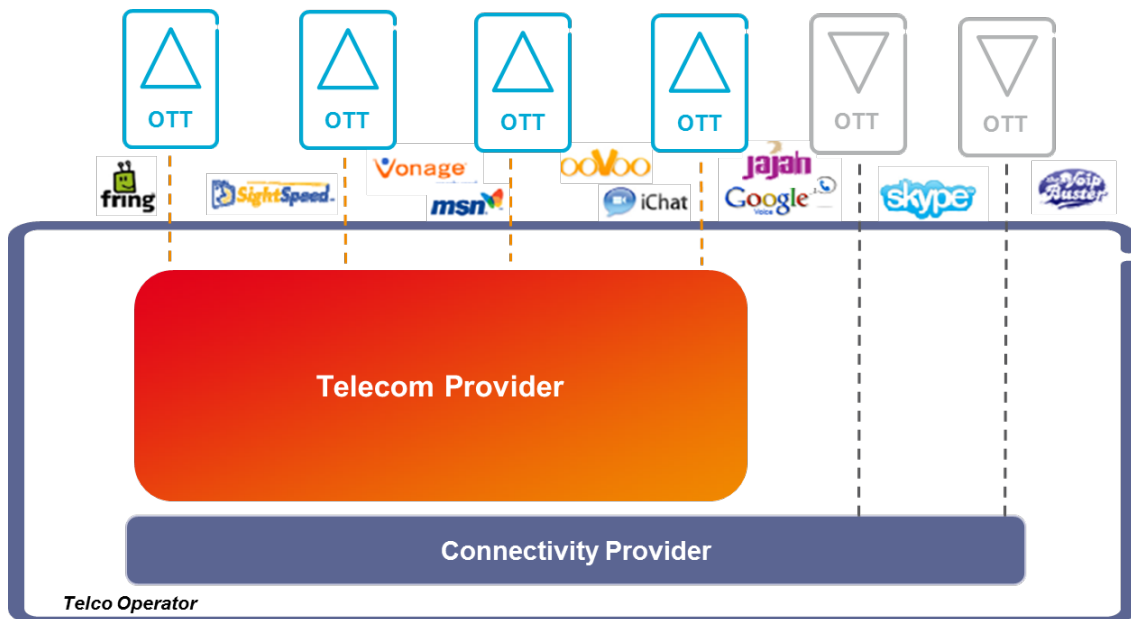


Figure 13 – Business landscape nowadays

The type of services that we use nowadays, many of them are free of charge (FOC) and so we are starting to be used to not pay for add-value services. The FOC services can be for example gmail, youtube or even the google search engine. So for a telecom operator is starting to be difficult to get some money from subscribers that are used to not pay for services.

But this reality is even more aggressive when the telecom operators need to make impressive investments like for example the fiber to the home (FTTH) or 4G wireless access in order to keep being attractive for subscribers that want access to services from which these operators give access but don't receive any money back to amortize their investments. Even having in mind that without the bandwidth increase provided by these massive investments, the OTT services will not have the same level of user experience and so, not have the same massive adoption among their user base.

Maybe the operators are becoming exactly that, pure connection providers, but in the end of the days that's what we want? That's the questions that many are trying to answer.





## **5. Conclusion**

In my short career I have been in different realities and in different countries, always traveling with the purpose of sharing and receiving knowledge. All the different obstacles that I faced in the IT or in the Telecom worlds were surpassed with the help of three different points: solid knowledge of the different engineering challenges and what were the best options and drawbacks inherent to them. The second point is clearly be surrounded by the best professionals in order to be always learning from the best guys in class, this is of an importance that doesn't has a price, only in this way you can have access to the best knowledge and the best way of doing things. And the last but not the least, the capacity of always being open to learn new things, this important capability was firstly taught to me by my university teachers during my engineering degree.

Engineering like any other scientific science is always evolving and making new advances, if you stop in time, without keeping the pace of continuous learning, you will be not only surpassed but also forced to disappear. Nowadays the hot topics in the telecom world are among others: Voice over 4G (VoLTE), WebRTC, Cloud and Machine to Machine, as in the past it was the 3G, the first generation of IPTV or the location services. This proves that only if you are surfing the front wave, you will keep being seen as a front runner in this technological driven wind.

As a final statement I can confidently say that this document clearly states that even with my short career, I already secure all the objectives and requirements that a student of a master's degree needs to accomplish in order to be worthy of this important achievement which is the master's degree.



## 6. Glossary

This section lists the acronyms and terms used in this document.

ADC	Automatic Device Configuration, Ericsson's solution for device management
APN	Access Point Node
CDR	Charging Data Record
CIMD2	Computer Interface to Message Distribution
CSD	Circuit switched data
DCR	Device Configuration Register
DMS	Device Management System
EIR	Equipment Identity Register
FOTA	Firmware Over The Air
FTP	File Transfer Protocol
FUMO	Firmware Upgrade Management Object
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communication
GSMA	GSM Associations
GUI	Graphical User Interface
HLR	Home Location Register
HTTP API	HyperText Transfer Protocol Application Protocol Interface, interface to connect external systems
HTTP(S )	HyperText Transfer Protocol (Secure)
IP	Internet Protocol
IMAP	Internet Message Access Protocol
IMEI	International Mobile Equipment Identification
IMEISv	International Mobile Equipment Identification software version
IMS	IP Multimedia Subsystem
IMS-F	IMS Forum
IMSI	International Mobile Station Identity
ITU	International Telecommunication Union
IVR	Interactive Voice Response
M2M	Machine to Machine
MAP	Mobile Application Part

MMS	Multimedia Messaging System
MMS-C	Multimedia Messaging System center
MSC	Mobile Switching Centre
MSISDN	Mobile Station International ISDN Number
NMS	Network Management System
O&M	Operation and Maintenance
OMA	Open Mobile Alliance
OTA	Over-the-Air protocol, for sending configuration scripts to mobile devices
OTT	Over-the-Top players
PLMN	Public Land Mobile Network
PoS	Point of Sale
ROI	Return on Investment
RPC	Rapid Product Change
SGSN	GPRS Supporting Node
SIM	Subscriber Identity Module
SMPP	Short Message Peer-to-peer Protocol
SMS	Short Message Service
SNMP	Simple Network Management Protocol
SS7	Signalling System 7
SSH	Secure Shell
TAC	Type Allocation Code
TCO	Total Cost of Ownership
TTM	Time to Market
UCP	Universal Computer Protocol also known as EMI
UDCD	Update Device Configuration Data
VLR	Visiting Location Register
VoLTE	Voice over LTE (4G)
WAP	Wireless application protocol
WURFL	Wireless Universal Resource File

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