Banking 2.0: Developing a Reference Architecture for Financial Services in The Cloud

Master Thesis

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THESIS

submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE

in

COMPUTER SCIENCE

by

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Abstract

Information technology is the common denominator for all the industries in the 21st century, therefore any important change in this area is prone to have an impact on small and large businesses alike. The latest shock wave storming through IT is Cloud computing. Due to the importance and sensitive nature of applications used by financial institutions, the main goal of this research is to investigate how Cloud computing could change the way services are provided to customers and what is the emerging role of IT consultancy companies for this specific market segment. In order to do so, a proposed reference architecture has been created based on existing models and services in combination with the opinion of various experts from Capgemini and financial institutions. The impact of the proposed model, "Capgemini Immediate for Financial Institutions", has been expressed from a business and an IT perspective. Also, its functionality has been showcased in a scenario meant to underline the impact of the proposed changes on the boundaries of the system and the interaction of the financial institution with other entities. This process has been evaluated and supervised by experts from Capgemini in order to meet the standards used in the industry.

Keywords: Cloud Computing, Software as a Service, Financial Services, Reference architecture

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Acknowledgments

This thesis represents the peak point of my studies, so far, and it incorporates knowledge gathered from different sources, academics and professionals alike. During this project I was privileged to work with good specialists and exquisite people that taught me a lot.

Therefore I would like to express my gratitude and thanks to my supervisors: ir.Rene Zubcevic and dr.ir. Jan Hidders and my supervising professor dr.ir. Geert-Jan Houben. Also from the academic world I would like to thank dr.ir. Jan van der Berg for his helpful comments and contributions to this thesis.

From the industry I would like to thank Capgemini specialists: Arnoud Vons, Bas Schuurmans, Bart Rekers, Henk Holk, Paul van Dommelen, Mark van der Waals and Pieter Hörchner.

Also I would like to add a special thanks to all professionals that helped me better understand the actual situation in the financial services, technological and business markets by participating in the organized survey.

Last, but not least, I would like to thank my family and friends for support during my studies years. This thesis would have not been possible without their help and understanding, so it is dedicated to them.

Ana Bucur
Delft, the Netherlands
June 30, 2011

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Chapter 1

Introduction

1.1 Background and Motivation

Capgemini is one of the world's largest IT services, transformation and management consulting, outsourcing and professional services companies with a staff of over 100,000 operating in 36 countries. In order to keep up with its spotless reputation, it needs a clear view of the market and of how any important changes can influence its opportunities and the goals and operations of its clients.

One of the technological approaches that has the potential to change the way we understand our everyday life and the way we do business is Cloud computing. Some call it "the long–held dream of computing as a utility" [1] while others are more skeptical and state that "this approach can also introduce new vulnerabilities" [2]. No matter the perspective, one thing is for sure: this technological approach is here for the long run and its implications in the business life are going to be argued for time and time again.

Taking this into consideration, the present research topic has been formulated in order to identify the advantages and facilities the latest technological approach can offer to Capgemini as a consultancy company and to its partners.

1.2 Problem Description

For a more complete description of this problem two complementary perspectives have been used: Research goal and Research strategy. The first one states what this paper tends to achieve and the second one describes the methods used to answer the proposed research questions.

1.2.1 Research Goals

This paper is structured around the prerequisite research goals. This can be formulated as :

Find a suitable Reference Architecture to help financial services adjust to the Cloud environment, demonstrate its utility in a showcase scenario and its applicability in the new business environment.

The goal aims at better understanding the impact of the new perspective on the financial institutions and the financial services consultant. Another main interest is to clarify the benefits and drawbacks of Cloud computing in the financial sector.

The main research questions are:

• How do financial institutions operate and why is there a need for change towards Cloud computing?

• How does the Consultant adapt to the new approach?

• What are the main pros and cons of Cloud computing in the financial sector?

• What are the means of architecting Clouds for financial services ?

• What are the transition challenges from the current systems to Cloud?

• What is the business impact of the new Cloud environment from the perspective of the financial institution and the financial consultant?

• How to best illustrate the main benefits with the help of a showcase scenario?

1.2.2 Research Strategy

In order to find relevant and accurate answers to the research questions, different strategies are used. First of all information is selected from the existing literature to paint a concrete image of the financial institutions and consultants. Then theoretical challenges that occur during the transition are identified.

Financial institutions are questioned about their intentions regarding Cloud computing. From this survey important knowledge like what kind of Cloud services are attractive for the market and what are the ways of providing this services result. Based on this knowledge a reference architecture is build to comply with the needs.

The challenges identified earlier and revealed by the survey are used to evaluate examples of architectural implementations indifferent case scenarios and a solution is recommended. Also the business impact of the constructed reference architecture is expressed.

In the end, a showcase scenario is built to underline the functionalities improved by Cloud computing and the interaction between entities like clients, consultants, Cloud providers and financial institution.

Therefore the main research strategies are:

• Literature study

• Questionnaire

• Interviews with specialists

• Simulation

1.3 Report Structure

The findings of the research activity are presented in this thesis within 11 Chapters:

Chapter 1: Introduction presents the research goal and strategy.

Chapter 2: Financial Services presents a short history of financial institutions, how they operate and interact with their customers and consultants. It also explains why is there a need for change in the financial world.

Chapter 3: The Cloud briefly presents the general concepts, benefits of the new perspective, areas of application, main providers and their services. Then it presents the need for Cloud in the financial IT solutions and how consultancy companies are striving to fulfill it.

Chapter 4: Transition Challenges identifies the theoretical challenges in the technological area, organizational area, social challenges and governmental challenges.

Chapter 5: The Opinion of Financial Institutions pinpoints the hesitation of financial institutions to adopt the Cloud perspective according to their previews questioned opinion.

Chapter 6: Architectural Framework resents framework and the analyzed models in order to propose the reference architecture.

Chapter 7: The Reference Architecture is the core chapter that introduces the new Immediate for financial institutions and the reference architecture that is based on it.

Chapter 8: Proposed Solution for ACSI Bank tests the utility of the proposed reference architecture on different scenarios and uses a set of criteria to assist the decision making process.

Chapter 9: The New Business World introduces the business changes implicated by the proposed reference architecture for the financial institutions and consultancy companies like Capgemini.

Chapter 10: A Glimpse Into the Future: explains what is the role of the components chosen for the final architecture and what is the interaction between different entities in a showcase scenario.

Chapter 11: Conclusions chapter underlines the main contributions and recommends future work based on this thesis.

In addition, in order to aid the reader, other miscellaneous are added like: an abstract, a list of figures and appendixes.

Chapter 2

Financial Services

Chapter 2 is the first core chapter of this thesis. It presents the role of financial services in the past and present, the role of the consultancy companies and why there is a need for change in the interaction with the customers.

2.1 Traditional Methods of Delivering Financial Services

2.1.1 A Short Banking History

Banking has undergone many transformations during its long history, going from scarce temples guarded by mysticism and fear of all knowing gods, to the high tech digital world of today where algorithms play the role of stewards to personal valuables.

The first banks were the religious temples of the ancient world, established in the 3rd millennium BC. They would safeguard goods and precious metals, before the invention of any currency. By 1760 BC the first laws governing banking appeared [3]. Ancient Greek temples conducted financial transactions such as loans, deposits, currency exchange, and validation of coinage [4].

Most early religious systems did not forbid interest. This was actually legal and fixed by the state amongst the Mesopotamians, Hittites, Phoenicians and Egyptians [5]. Ancient Rome perfected the administrative aspect of banking, but the development of Roman banks was limited by the preference for cash transactions [4].

After the fall of Rome, banking was abandoned in western Europe and did not revive until the time of the crusades. In other parts of the world, the banking system reached a crisis when confronted with religions and holy books. For instance the Torah and later sections of the Hebrew Bible criticize interest-taking especially from another Jewish person. Also in Islam it is strictly prohibited to take interest by the Quran. This however did not stop the development of credit [6].

By the 9th century, a Muslim businessman could cash an early form of the cheque in China drawn on sources in Baghdad [7].

Beginning around 12th century, the need to transfer large sums of money to finance the crusades stimulated the re-emergence of banking in western Europe. In 1156, in Genoa, occurred the earliest known foreign exchange contract[8].

In 1440, Gutenberg invents the modern printing press although Europe already knew of the use of paper money in China. In 1455 the Turks overran the Serbian silver mines, and in 1460 captured the last Bosnian mine. The last Venetian silver grosso

was minted in 1462. Even the smallest of small change became scarce[9]. This is the point in time where we can trace back the beginning of modern banking.

In 1472 the Monte dei Paschi di Siena bank was founded, the oldest surviving bank in the world. At that time moneychangers were already called bankers, though the term "bank" usually referred to their offices, and did not carry the meaning it does today. In 1565 The London Royal Exchange was established, marking the beginning of a new concept [10].

Also in 1609 the Amsterdamsche Wisselbank (Amsterdam Exchange Bank) was founded which made Amsterdam the financial center of the world until the Industrial Revolution. The banking offices of that period were usually located near centers of trade: Amsterdam, London, and Hamburg.

They facilitated individuals to participate in the East India trade by purchasing bills of credit. The price they received for commodities was dependent on the ships returning and the cargo they carried. The commodities market was very volatile for this reason. Over the Atlantic, the Pennsylvania Land Bank was founded in 1723 and receiving the support of Benjamin Franklin who wrote "Modest Enquiry into the Nature and Necessity of a Paper Currency" in 1729. A few years later, in 1776, a new revolution took place when banks played a key role in moving from gold and silver based coinage to paper money, redeemable against the bank's holdings [10].

In the 20th century the banking system all over the world has seen a rise and fall, in the beginning due to the 1929 Wall Street Crash, when 9,000 banks close, wiping out a third of the money supply in the United States [10], and onwards being heavily influenced by the political situation in the first and second World War.

In the latest quarter of the century a new technology was introduced to aid banks, in the form of computational electronic machines and later on electronic storage and payments, the computer. As a result this generated lucrative years and banks profited during the boom years of the 1990s and into the tech boom and bubble.

When the tech bubble burst, it precipitated a string of new legislation to prevent conflicts of interest within banks. Investment banking research analysts had been actively promoting stocks to investors while privately acknowledging they were not attractive investments. This kind of scandals spread across America in the late 1990s[11].

The 21st century was marked, so far by three major events in the banking world:

- Great adoption of computer networks, that provided new ways of communication, data integration and a larger resource pool;
- Rise to power of developing countries like India, China and Middle east due to an increase international capital flow;
- Washington Mutual collapses (2008), the largest bank failure in history that propagated through market and started the chain reaction of a global recession.

The latest was based on the speculative bubble in housing prices within the American market. In March, 2008, the Federal government began using a variety of bailout measures to prop up other firms from collapsing, but the measurements came too late therefore the crisis manifested at a global level.

2.1.2 Financial Institutions

Taking a look at the modern banking system, finance has been defined as "the science of funds management"[12], therefore the main role of financial institutions is to act as financial intermediaries. There are three major types of financial institutions:[13]

1. Deposit-taking institutions that accept and manage deposits and make loans, including banks, building societies, credit unions, trust companies, and mortgage loan companies

2. Insurance companies and pension funds

3. Brokers, underwriters and investment funds.

This diversity is the result of market needs and the continuous strive of financial institutions to supply the desired services.

The most wide spread form of financial institution is generically known as a bank, but this term accumulates many types of institutions and services, some of them noticeably far from what a bank was initially created to be. In order to present what can be interpreted as banking activities, here is a short classification :

- **Retail banking** is dealing directly with individuals and small businesses. The types of banks under this category are: Commercial banks, Community banks, Community development banks, Credit unions, Postal savings banks, Savings bank, Ethical banks, Direct or Internet-Only banks.

- **Business banking** is providing services to mid-market business;

- **Corporate banking** is directed at large business entities;

- **Private banking** has high net worth individuals and families as main clientele, providing them with wealth management.

- **Investment banking** is related to activities on the financial markets, banks which provide capital to firms in the form of shares rather than loans;

- **Islamic banks** are differentiated by the fact that all banking activities must avoid interest, a concept that is forbidden in Islam. Instead, the bank earns profit (markup) and fees on the financing facilities that it extends to customers [6]

- **Conglomerates** are financial services firm that are active in more than one sector of the financial services market.

- **Financial services companies** are corporate entities that provide both banking and insurance;

- **Central banks**, government-owned banks.

All financial institutions share similar core values and services, but set themselves apart using additional domain specific products.

2.1.3 Services Offered by Financial Institutions

The notion of "financial services" has been in use largely due to the Gramm-Leach-Bliley Act[14] of the late 1990s. This provided financial institutions of U.S. with the opportunity to merge and enlarge their service offer. Due to this type of merge two separate service types emerged:

- **Primary operations** include: keeping money safe and allowing withdrawals; issuance of checkbooks, credit cards and other payment instruments; providing personal loans, commercial loans, mortgage loans and overdraft agreements for the temporary advancement of the Bank's own money to meet monthly spending commitments of a customer in their current account; notary service for financial and other documents. [13]

- **Other services** like: foreign exchange services; wealth and asset management; tax planning; capital market services; hedge fund management; custody services; insurance and annuities, life insurance, retirement insurance, health insurance, property and casualty insurance; reinsurance; intermediation or advisory services and angel investment.[13]

All this types of services have been influenced by countless evolutions in the human society and therefore are highly dependable on customer interaction. For example foreign exchange services have been invented during the colonization times when the need for local currency was more frequent and, as mentioned before, the loan has been invented in the medieval trade fairs of Europe. In more modern times, health insurance phenomenon as it is understood today began during the Civil War (1861-1865) in the United States and offered coverage against accidents related to train or steamboat travel[15].

2.1.4 Financial Institutions Customer Interaction

A bank has no purpose unless the market demands its existence. Also a service provided by a financial institution needs to find its customer niche market so, during time, different channels have been put in place to facilitate customer interaction. The main channels today are:

- Branches, ATMs,

- Call centers, Mail services,

- Telephone banking, Mobile banking, On-line banking, Video banking

- Relationship managers.

This channels demand not only financial, human and technological investment but also the know how. This is why financial institutions needed specialized assistance.

Bankers are good at handling money and predicting the capitalized investments, but there is a gap that needed to be filled: the technical knowledge to make all this complex entity run smooth and flawless. In order to address this consultancy companies are sharing their knowledge and experience.

2.2 Consultancy Companies and Financial Institutions

The 20th century is the defining point of the financial services as we see them today. Back then banks were struggling with the great recession of the 1930s, put under stress by the World War II and, in the last quarter of the century, computers started their ascension in the computational world. Because of all this and the major lifestyle change in the modern world, financial institutions needed assistance.

2.2.1 The Need for Consultancy in the Financial Sector

In all this mist of events in the 20th century Financial Sector needed help and therefore turned to consultants. These entities represented different specializations from management, to help the financial institutions focus their goals, to marketing, that set new customer interaction channels, to technological consultants, that implement and tune the new technologies.

Due to the rapid rise of the computer integration in all markets, consulting companies intertwined their different specialized expertise and focused on the upcoming technologies. In this crossover mix large, multinational consultancy companies, like Capgemini, were created.

2.2.2 The Role of Capgemini Financial Services

In order to understand how consultancy in the financial sector has developed, let us take a look at Capgemini Financial Services division. It specializes in dealing with complex industry challenges while bringing a diverse range of services to help financial institutions capture sustainable business results. It also has the advantage of being part of a company with almost 45 years of experience in consulting, therefore growing up and specializing its offer at the same time as the financial institutions.

Keeping into alignment with the market, a globally standardized frameworks and collaborative tools and methodologies are used for the following financial sectors[16]:

- **Banking** solutions in: core banking, sales and service innovation, mortgage and loans, wholesale banking, cards, leasing and asset finance.

- **Capital Markets** scalable business model, extensive industry expertise, and process and technical knowledge in: trading and order management, asset administration, securities and reference data services, quality and testing, exchanges and executions, investment banking, application management and outsourcing for capital markets.

- **Risk Management and Compliance** breaches the gap between finances and risk offering solutions in: risk management, services regulatory compliance, data management and analytic services.

- **Insurance** is transforming into customer-centric organizations offers in the area of: billing claims, front office optimization, policy administration, sales and service innovation, smart insurance, enterprise/SOA solvency II and testing.

- **Payments** major trends are driving and accelerating the rate of change in the payments landscape using: payment hub, payments analytics, payments sourcing, platform consolidation for payments and project implementation for payments.

- **Wealth Management** has as core solutions accelerated delivery centers, adviser workstations and accelerated solutions environments .

In order for a consultant to be able to offer an extensive range of services it needs to combine a large palette of specialized knowledge and technology. Also the consultant keeps an eye on industry, technology and outsourcing in order to be capable to develop and refine solutions.

This kind of effort would require a large investment and prove to be out of scope for a small size financial institution, requiring a specialized department to investigate, develop and maintain the IT system. At the same time, due to the technological development, it is imperative for any financial institution to take advantage of cutting edge solutions and learn how to better manage its IT system in this dynamic market environment.

2.3 The Need for Change

In the late 20th century and, so far, the 21st century drastic changes took place in customer interaction: after the wide spread of personal computers, the Internet bubble and the utilization of the World Wide Web in marketing strategies, now the user trend is changing towards customer centric products recommended by social network interaction.

2.3.1 Social and Technological Change

The common social denominator for the beginning of this century has been freedom of speech, freedom of expression and access to information. This hole movement has as power engine the Internet and the mobile devices.

The technological advancement allowed for a greater speed of information exchange. This reflected into every day life under the form of web services, multimedia exchange and actually replicating parts of our life and behavior in a virtual environment.

A few years back the user was just a consumer of information, now, on the other hand, the user is converting to the main source of information. This fact changes the entire take on marketing and on creating new products in all industries, and therefore also in the financial sector.

2.3.2 The New Customer

Through the new technology, the customer has been redefined. Things that a decade ago were considered private information are now published open in our virtual replicas.

Web 2.0 presented the general user with the possibility of producing information and social networks allowed the customer to translate its needs and preferences through

links to favorite brands that can be openly discussed with friends and other possible customers, therefore commercialized.

Due to this, institutions changed their marketing strategies from aggressive commercials to quality goods or services. Quality and Trust are the ones that make or break a brand and the situation is similar in the financial sector.

On top of this, the financial sector has to deal with the alert life style and increasing competition on the font of the economic recession. Financial institutions need services that understand the customer, are fast, of the best quality and well priced.

Is common knowledge that fast, good and cheap services are not possible, but financial institutions have an advantage: technology. With the help of consultancy companies, new service packs can be developed that take into consideration the abundance of available information and the latest technological developments.

One of these developments, with large applicability in this sector, is Cloud computing. Therefore, as mentioned previously, the scope of this paper is to present the development of a Reference Architecture in the Cloud computing environment for such a financial service, that takes into consideration the new customer and the market development.

Because this is an important shift in perspective, some consultancy companies have started preparing for the new generation of partnered integration and development.

2.3.3 The New Role of Consultancy

Capgemini has the vintage point and the experience to notice market changes and align fast with the new demands. As a result, two years ago, it implemented Global Service Lines (GSLs) that will insure the increase of speed and better management in the product development.

Also sensing the change in the role of consultancy companies, the new Business Unit Structure (Fig. 2.1) has been implemented starting this year. The new structure divides the company into operational units and reunites some of the old geographical components .

Figure 2.1: Capgemini Business Unit Structure

One very important unit in the new structure is the Infrastructure Services Unit. New infrastructure technologies are analyzed and implemented here with the help of top ranking specialists. As to be expected, one of the major research topic for this unit is Cloud computing and what can financial institutions gain by using the Cloud. The research topic for this thesis was formed in this context and therefore aims at shedding some light on this question, but in order to be able to analyze the interaction between financial institutions and Cloud computing, some basic knowledge of this approach and its areas of application are presented in the next Chapter.

2.4 Summary

During times financial institutions have suffered multiple changes caused by socio-economical factors. Famine, wars, lack of resource and technology emergency changed the way banks interact with their customers and what sort of financial services they offer.

Also, in the last century, financial institutions united their knowledge with consultants in order to better understand what are the needs of the market and the best ways to fulfill them.

Similar actions are required from the financial institutions in the 21st century in order to survive the current global recession and to keep up with the emerging customer interaction. In order to be competitive and to offer the best of services, financial institutions need consultancy companies to help them implement the latest in technological developments and perspectives.

One of the most promising approaches is Cloud computing and, in order to accommodate it, consultancy companies and financial institutions need to establish the requirements for a transitional phase and main areas of influence. This aspects are discussed in further detail in the upcoming chapters.

Chapter 3

The Cloud

Cloud computing is the new perspective that might change the way we perceive Information Technology and its applications. Therefore this chapter presents its main benefits, main players in different sectors and how all this can come together under the perspective of Capgemini and its offer for financial services.

3.1 The New Perspective

3.1.1 Origins

Cloud computing is a long awaited dream of transforming the Internet into an utility as R. Buyya predicts in [17], but in order to make this possible the Cloud is based on well known technologies (such as Virtualization, utility computing or distributed computing) [18][19] and it needed to wait for the infrastructure to be at the right level of availability and performance in order to facilitate provided services.

Except technological development that had to reach this stage, also a different understanding of computing had to evolve. In the classical approach software is a tool running on a machine owned by the company, programmed to perform a specific task for a department, but also with a lot of features never or very rarely used.

"*Today enterprises are enduring a strong pressure on cost reductions and an intensifying market competition forcing them to be more efficient, productive, agile and innovative in order to meet business objectives. Consequently there is increasing demand for technologies that help enterprises increase their customer base while reducing their costs and extending their competitive advantage*" [20] .

This is the main reason why, in time, the idea of Service Oriented Architecture made business analysts and software developers to understand that an architecture where the software is made to fit services and have loosely-integrated nature can be used within multiple business domains. In this vision software was no longer a bulky (one size fits all pack) but a set of functional components. This provided flexibility and the ability for business needs customization.

This new vision combined with the power of Virtualization gave way to the concept of Cloud computing, that describes a new consumption and delivery model for IT services based on the Internet, and it typically involves Internet provision of scalable resources.

3.1.2 Definition and Classification

Although the basics are defined, there is not a clear definition of what exactly can be considered Cloud computing. One of the most accepted definition is given by the National Institute of Standards and Technology:

"***Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction***."[21]

More exactly Cloud computing can be expressed as a combination of:

- **Software as a Service**. This perspective refers to a service delivery model in which remote componentised (business) services are accessible through a software interface and can be combined to create new (business) services delivered via flexible networks [22].
- **Platform as a Service**. Cloud systems can offer an additional abstraction level: instead of supplying a virtualized infrastructure, they can provide the software platform where systems run on. The sizing of the hardware resources demanded by the execution of the services is made in a transparent manner [23]. In other words PaaS is the delivery of a computing platform and solution stack as a service.
- **Infrastructure as a Service**. Infrastructure Providers manage a large set of computing resources, such as storing and processing capacity. Through Virtualization, they are able to split, assign and dynamically re-size these resources to build ad-hoc systems as demanded by customers. They deploy the software stacks that run their services. [23].

3.1.3 Benefits

With any new technology there are lots of expectations and possible applications and Cloud promises much more than technological applications. It promises a new paradigm and a new understanding of what IT is. In order to be accepted by the market it needs a list of good drivers for innovation. Such a list is classified in Fig.3.1 by Kamp[24].

All these drivers represent the sum of characteristics that differentiate Cloud computing from other technologies and promote it as the competitive solution in an accelerated business environment. In short, these can be also understood as:

1. **Infrastructure cost reduction**: due to the fact that the physical computing components are provided by the Cloud, the main infrastructure costs remain the networking and connectivity of the network devices.
2. **Increase speed to market**: because the infrastructure exists in place, any investor can spin up a business much faster, without worrying about the computational needs.

3. **New business models**: Cloud computing brings flexibility and a whole new market niche, so new business models are to be developed for the Cloud users and the providers alike.

4. **Expand existing products:** existing products can be moved to the Cloud and by doing so can benefit of more interoperability, flexibility, higher performance and integrate new interactivity features that the Cloud provides.

5. **Mobile and social capabilities**: the web offers to any application a limitless scale of mobility and accessibility from anywhere, platform independent. Also it offers social interaction facilities to existing applications, therefore making them more client oriented and providing access that our virtual replicas provide.

6. **Application remediation**: existing applications can be moved to the Cloud and enriched with new features.

7. **Collaboration and identity**: the Cloud allows businesses to collaborate with each other easy and to identify themselves in the market perspective. This is one of the major business drivers.

8. **Elasticity and scalability**: new hardware and software can be used at a click of a button. This eliminates any concerns about infrastructure and furthermore everything is scalable, so no matter how many resources are needed the demand will always be met by the supply.

9. **Higher performance computing**: the pool of resources gives the impression of limitless and so the computing performance can be increase using as much resources as needed in order to perform a task in as little time as possible.

10. **Data distribution**: Cloud paradigm is focused on data and its security. The data is distributed in different centers, with multiple backups, so the users will not have to lose data due to any malfunction.

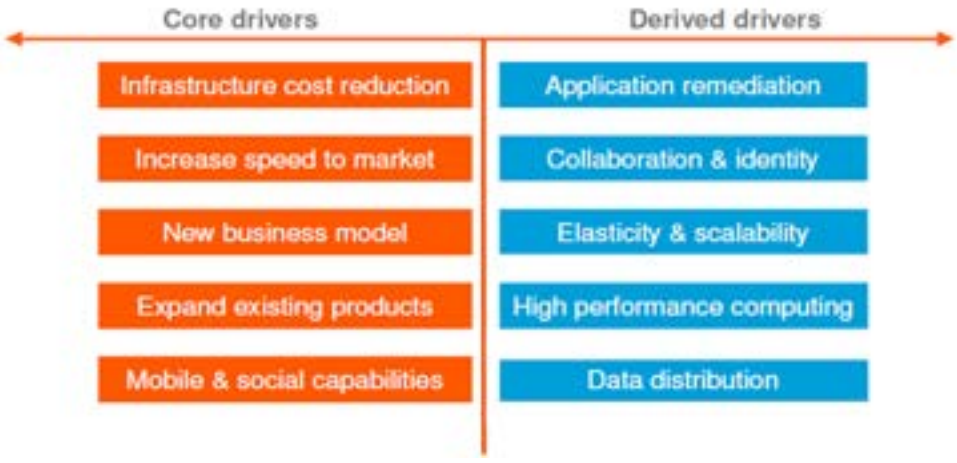

Figure 3.1: Cloud Computing Drivers

If we analyze these drivers from the perspective of a Cloud computing business user, they will convert to some very important benefits that financial institutions can turn into advantages.

First of all **revenue increase.** As long as the costs of setting up or maintaining the IT infrastructure go down and the performance of the services does not decrease, even more, is improved, the revenue can only increase and therefore the business becomes more profitable.

Also **common infrastructure around the world.** Cloud computing facilitates the communication and interaction of businesses and professionals, platform independent, around the world allowing for easy access, communication and sharing of ideas. This also facilitates the development of new business models. Hence it facilitates **focus on the business.** The technological part is implemented by the Cloud provider, so the investor can focus more on the business and on reinvesting the revenue into new areas of business and research.

Another important feature is **technology invisible to the user.** The business user does not need to concern with technology changes, understand the processes behind his applications or invest a lot in training its employees. The technology is just perceived as a "click-and-go" process. It also provides **reliable metrics**, because of the possibility to communicate in real time with the software. Therefore the managers receive fast and reliable metrics from their employees and are able to foreseen better the impact on the business environment and provision a better image for their company.

They also have a seemingly endless **resource pool.** No company can plan in advance for any situation, but any company likes to be able to serve all its customers in time and in budget. That is why an endless resource pool that is paid for as a utility is the best optimization for any investor that wants to be prepared for any situation.

3.2 Areas of Application

Even though in its early market stage and it still needs some technological tuning up and policy clarifications, Cloud computing has been embraced by a lot of companies in different areas of activity. This proves its utility in: software development and testing, production and service industry. Here are some of the ways in which Cloud is used today for this particular market segments and some reasons for adopting it:

3.2.1 Software Development and Testing

Since the first software was created a time gap exists in the software industry, between the creation of new software and the testing. This mismatch consumes a lot of resources. Also it enlarged with time, when new development paradigms have been created and when software become so complicated that it required a lot of human resources spread around the Globe working at the same project.

Cloud computing is a good way to address this problem, due to its real time interaction and its accessibility. On top of that, Cloud brought some advantages for each of the steps implicated in the creation of a new reliable software application.

In **development** Cloud environment provides a stack under the form of a library that encapsulates best practices embedded into an automated process, there is no more time spend on provisioning technology, any platform can be used to deploy software,

fast and customized systems are available with a mouse click, there are great new technology tools provided by the Cloud without supplemented costs and new systems can be created in minutes.

Also the system topology is consistent over the organization and an important change in the role of the system administrator occurred, simplifying it and making it more reliable [25].

Testing experiences advantages like: no "dead" times while waiting for development, no hardware procurement time, resources available for any scenarios and paid per use, simple deployment on the exact same test environment, self help portals to interact with peers, easy mistake eraser and simplified application management [25].

3.2.2 Production (Desktop Cloud)

In the life of any business the maintenance and acquisition of IT resources is an important step, especially for new start up businesses. Here is where Cloud computing eases the situation by providing instant computational resources, reducing the need for technological knowledge, simplifying management and maintenance, improving security, increasing availability, productivity and flexibility. Also tailor made desktop Virtualization for the internal organizational specific needs is possible.

3.2.3 Services

Services are vast and the utilization of Cloud computing can be very different, but here are some important categories that stand out for their very different approach and implementation of Cloud technology, except financial services:

- Sales. Here Cloud makes possible the constant contact with clients, integrated client information, preferences and activities, constant peer evaluation and professional efficiency comparison. Also viable metrics instruments are available, managed complex requirements and customization options can be implemented, adaptive service process and market analyzes instruments integrate with a large data bed [26].

- Education. This is a specific sector with highly dedicated needs like: ease of maintenance, variable resource pool that can be managed according to the variable needs caused by the educational life cycle, seemingly endless hardware resources for research purposes and scientific calculations, easy user management, access and privacy control.

- Web hosting specially favors Cloud computing due to no need for owned resources, no more calibration for peak usage and the most important: server traffic needs meet at any time.

3.3 Main Providers and Their Services

In the new emerging world of Cloud technologies there have been some visionaries that embraced change and therefore managed to transform their businesses. These are the kind of technology providers that a consultancy company is looking for in order to partner and provide technological foundation for new financial services.

3.3.1 Amazon

Amazon has one of the widest range of Cloud computing products. This can be classified as follows [27].

1. Computing Services:

Amazon Elastic Compute Cloud (EC2) provides resizable compute capacity in the Cloud. It is aimed at developers and it is modeled after their needs allowing increased configuration capacity, minimal time to obtain and boot new server instances and scale capacity to meet computing requirements . It also provides the tools to build failure resilient applications, isolated from common failure scenarios.

Amazon Elastic MapReduce enables businesses, researchers, data analysts, and developers to process vast amounts of data, instantly provisioning as much or as little capacity needed to perform data-intensive tasks for applications such as web indexing, data mining, log file analysis, data warehousing, machine learning, financial analysis, scientific simulation, and bioinformatics research.

Auto Scaling: allows you to scale your Amazon EC2 capacity automatically up or down according to conditions you define and is particularly well suited for applications that experience hourly, daily, or weekly variability in usage.

2. Content delivery services:

Amazon CloudFront is a web service for content delivery that integrates with other Amazon Web Services to give developers and businesses an easy way to distribute content to end users with low latency and high data transfer speeds.

3. Database services:

Amazon SimpleDB is a highly available, scalable, and flexible non-relational data store that offloads the work of database administration. Developers simply store and query data items via web services requests.

Amazon Relational Database Service (Amazon RDS) makes it easy to set up, operate, and scale a relational database in the Cloud with full capabilities of a MySQL database, therefore the existing code and tools work seamlessly with Amazon RDS. Also this service makes it easy to use replication to enhance availability and reliability for production databases and to scale out beyond the capacity of a single database deployment for read-heavy database workloads.

4. Deployment and management services:

AWS Elastic Beanstalk is an easy deployment and management service for applications in the AWS Cloud that automatically handles the deployment details of capacity provisioning, load balancing, auto-scaling and application health monitoring.

5. E-Commerce services:

Amazon Fulfillment Web Service (Amazon FWS) allows merchants to programmatically send order information to Amazon with instructions to physically fulfill customer orders on their behalf. When orders are placed, Amazon will pick, pack and ship the products to the merchant's customers. Amazon FWS allows merchants to integrate these capabilities directly into their own web sites and, therefore, automatically store inventory in Amazon's warehouses and ship orders to customers, creating a nearly virtual business.

6. Messaging Services:

Amazon Simple Queue Service (Amazon SQS) offers a reliable, highly scalable, hosted queue for storing messages as they travel between computers, therefore developers can simply move data between distributed components of their applications that perform different tasks, without losing messages or requiring each component to be always available.

Amazon Simple Notification Service (Amazon SNS) is a web service that makes it easy to set up, operate, and send notifications from the Cloud. It provides developers with a highly scalable, flexible, and cost-effective capability to publish messages from an application and immediately deliver them to subscribers or other applications. It is designed to make web-scale computing easier for developers.

Amazon Simple Email Service (Amazon SES) is a highly scalable and cost-effective bulk and transactional email-sending service for businesses and developers.

7. Monitoring services:

Amazon CloudWatch provides monitoring for AWS Cloud resources, starting with Amazon EC2. It provides customers with visibility into resource utilization, operational performance, and overall demand patterns, including metrics such as CPU utilization, disk reads and writes, and network traffic.

8. Networking services:

Amazon Route 53 is a highly available and scalable Domain Name System (DNS), designed to give developers and businesses an extremely reliable and cost effective way to route end users to Internet applications running is AWS or on external infrastructure.

Amazon Virtual Private Cloud (Amazon VPC) is a secure bridge between a company's existing IT infrastructure and the AWS Cloud. It enables enterprises to connect their existing infrastructure to a set of isolated AWS compute resources via a Virtual Private Network (VPN) connection, and to extend their existing management capabilities such as security services, firewalls, and intrusion detection systems to include their AWS resources.

Elastic Load Balancing automatically distributes incoming application traffic across multiple Amazon EC2 instances, detects unhealthy instances within a pool and reroutes traffic to healthy instances until the unhealthy instances have been restored.

9. Payments and billing services:

Amazon Flexible Payments Service (Amazon FPS) is the first payments that provides developers with a convenient way to charge Amazon's customers for goods or services, raise donations, execute recurring payments, and send payments.

Amazon DevPay is an on-line billing and account management service that makes it easy for businesses to sell applications that are built in, or run on top of, Amazon Web Services.

10. Storage services:

Amazon Simple Storage Service (Amazon S3) is storage for the Internet. It is designed to make web-scale computing easier for developers.

Amazon Elastic Block Store (EBS) provides block level storage volumes for use with Amazon EC2 instances and is particularly suited for applications that require a database, file system, or access to raw block level storage.

AWS Import/Export accelerates moving large amounts of data into and out of AWS using portable storage devices for transport, transferring data directly onto and off of storage devices using Amazon's high-speed internal network and bypassing the Internet.

11. Support services:

AWS Premium Support is a one-on-one, fast-response support channel that helps customers of all sizes and technical abilities to successfully utilize the products and features provided by Amazon Web Services.

12. Web traffic services:

Alexa Web Information Service makes Alexa's vast repository of information about the traffic and structure of the web available to developers.

Alexa Top Sites web service provides access to lists of web sites ordered by Alexa Traffic Rank. Using the web service developers can understand traffic rankings.

13. Workforce services:

Amazon Mechanical Turk is a marketplace for work that requires human intelligence. The Mechanical Turk web service enables companies to programmatically access this marketplace and a diverse, on-demand workforce. Developers can leverage this service to build human intelligence directly into their applications.

3.3.2 Google

Google has adopted two very distinctive strategies. One is to market Cloud computing under the form of Google Apps to different categories as shown in Fig 3.2.

Figure 3.2: Google Apps Target Customers

The second one is to provide developers with the needed resources, enabling them to build and host web apps on the same systems that power Google applications with the help of App Engine. This way it offers fast development and deployment; simple administration, with no need to worry about hardware, patches or backups, combined with effortless scalability [28].

3.3.3 Microsoft

Microsoft is aiming at covering a wide range of products in the Cloud. For the moment they can be subdivided into[29]:

1. Productivity

   Microsoft Office 365 the new solution that brings together Cloud versions of our most trusted email, communication and collaboration software like Exchange Online, SharePoint Online and Lync Online with our familiar Office Professional Plus desktop suite

2. Business apps

   Microsoft Dynamics CRM online focuses mainly on Sales, Marketing, and Help Desk sectors, but it is also promoted as a development platform encouraging partners to use its proprietary .NET based framework to customize demands.

3. Management

   Microsoft System Center Cloud solutions help IT professionals manage the physical and virtual environments across data centers, client computers, and devices.

4. Storage

   Microsoft SQL Azure Database is a Cloud based relational database service (RDBMS) built on SQL Server technologies. It is a highly available, scalable, multi-tenant database service hosted by Microsoft in the Cloud. Developers do not have to install, setup, patch or manage any software, as all that is taken care of by Microsoft with this platform as a service (PaaS).

5. Platform

   Windows Azure is a Cloud services operating system that provides developers with on-demand compute and storage to host, scale, and manage web applications on the Internet through Microsoft data centers. It supports multiple languages and integrates with existing on-premises environment. To build applications and services on Windows Azure, developers can use their existing Microsoft Visual Studio and other popular standards, protocols and languages including SOAP, REST, XML, Java, PHP and Ruby.

3.3.4 SalesForce

As the world's first sales application provider, SalesForce specializes in CRM solutions, providing support and development in all 3 layers (IaaS, PaaS, SaaS) of the Cloud [30].

1. Software (**SaaS**)

   Sales Cloud 2 give representants, managers and execs everything they need to focus on selling. This suite of programs integrates: Chatter, Accounts and contacts, Marketing and leads, Opportunities and quotes, Jigsaw data services, Workflow and

approvals, Email and calendaring, Partner management, Analytics, Mobile, AppExchange and Force.com platform.

Service Cloud 2 provide fast, responsive service across every channel from the call center to the social Web. It can do that due to its components that include: Chatter, Call Center, Customer Portal, Social, Knowledge, Analytics, Email, Chat Community, Search, Partners, Mobile, Approvals and Workflow, AppExchange, Contracts and Entitlements.

For a better understanding, a short description of the components is included in Appendix A.

2. Platform (**PaaS**)

Cloud platform for business applications (Force.com) offers an environment to build and deploy business apps never limited by the underlying technology, customizable with real-time changes. This Cloud solution is divided in three main categories depending on the needs of the customers:

- *Force.com Free Edition* can run a Cloud application for up to 100 users, 10 database objects with 1GB of storage, and test sandbox. The package also offers database customization, programmable user interface, programmable Cloud logic, visual process manager, analytics, granular security and sharing.

- *Enterprise Edition* delivers multiple Cloud applications for an expandable number of users, 200 database objects, access to critical CRM data such as Accounts and Contacts, instant mobile deployment, an integrated content library for content management collaboration and sharing, Web site and pre-integrated applications to choose from.

- *Unlimited Edition* provides salesforce.com's 24x7 Premier Support team to customize Force.com app, more storage, lots of custom objects, fully customizable mobile access, an unlimited number of custom tabs and custom apps, and multiple sandbox environments for testing, training, and development.

3. Infrastructure (**IaaS**)

Cloud infrastructure for CRM the highest levels of reliability, security, and performance in the industry. Extra capacity to grow, constant innovation, improvement, and investment in the technology.

3.3.5 IBM

IBM has proved to be one of the most important providers of Cloud computing, having a reach pallet of solutions to fit differed business. It has introduced a smart business portfolio of Cloud computing solutions designed on different levels of the Cloud Stack and a variety of packaged solutions that includes[31]:

- IBM **Lotus Live** *(SaaS)* is a Cloud solution package that offers online collaboration tools, e-mail and social networking services that work together.

- IBM **Blueworks Live** *(SaaS)* is designed with the business user in mind, allowing everyone in the organization to participate in process discovery, mapping and automation from a web browser.

- IBM **Tivoli Live** *(SaaS)* includes two separate services:
  - **service manager** offers a set of capabilities for implementing problem, incident, change, release and asset management processes, leveraging a common data model and a robust change management database.
  - **monitoring services** delivers Tivoli Monitoring and Tivoli Composite Application Management software over the Web, which allow customers to manage the health and performance of their data center's resources – including operating systems, virtualized servers, middleware and applications.
- IBM **Coremetrics** Continuous Optimization Platform *(SaaS)* is a unique system for optimizing marketing across all channels, the gives detailed insight into the behavior of customers and prospects for the development of an automated marketing program that delivers tailored content to the customers through different media types.
- IBM **Sterling B2B** Collaboration Network *(SaaS)* is a Cloud based, B2B solution providing secure connectivity, visibility, collaboration and control over the business processes shared with customers and business partners.
- IBM **SAP Managed Application Services** *(SaaS)* is solution for automated provisioning of SAP environments and easy SAP cloning, refreshes and patching. SAP services on the IBM SmartCloud provide production service levels and optional 24 / 7 DBA and SAP Basis support.
- IBM **Rational** Software *(SaaS)* Cloud based solutions transform software delivery by providing software development and test solutions across multiple platforms, available for private Cloud deployments on the IBM Smart Business Development and Test Cloud and IBM CloudBurst appliance, or as part of IBM's standardized development and test environment - IBM SmartCloud Enterprise.
- IBM **Cast Iron Systems** *(SaaS and IaaS)* provides pre-configured integration solutions built on the IBM WebSphere platform that use "configuration, not coding" approach to solve the entire integration life cycle.
  - UI Mashups: mashup disparate data sources to present a single unified view, without leaving the current application.
  - Process Integration: orchestrate business processes across multiple Cloud and on-premise applications in real-time.
  - Data Migration: access, cleanse and migrate data from legacy systems to new SaaS applications in real-time.
- IBM **Management Backup Cloud** *(IaaS)* provides end-to-end, Cloud based solutions to help protect business data regardless of where it's stored, reduces total cost with a Cloud based data backup infrastructure, enables security-rich protection of critical data on-site or off-site for increased availability and eases management of various industry regulation requirements.

- IBM **Smart Business Storage** Cloud *(IaaS)* helps deploy high-performance, scalable storage-virtualization solution to facilitate growth and innovation at lower operational costs.
- IBM **WebSphere** *(IaaS Packages)* is presented as two sets of solutions aimed at different goals:
  - offerings **delivered via the Cloud**:
    - IBM Blueworks Live,
    - Middleware images on the Cloud
      - WebSphere Application Server on IBM Cloud and Amazon EC2
      - WebSphere eXtreme Scale on Amazon EC2
      - WebSphere sMash on IBM Cloud and Amazon EC2
      - WebSphere Portal Server on IBM Cloud and Amazon EC2
      - IBM Industry Application Platform on IBM Cloud and Amazon EC2 BM WebSphere
  - offerings **for building Clouds**:
    - WebSphere Hypervisor Editions
      - WebSphere Application Server Hypervisor Edition
      - WebSphere Business Monitor HV
      - WebSphere Process Server HV V7.0
      - WebSphere Process Server HV V6.2 for z/Linux
      - WebSphere Portal Hypervisor Edition
      - WebSphere Message Broker Hypervisor Edition
      - DB2 9.7 Data Server Hypervisor Edition
    - IBM Workload Deployer
    - WebSphere Virtual Enterprise
    - Cast Iron
- IBM **Cloud Infrastructure** *(Private IaaS)* is the infrastructure offer that enables private Clouds:
  - IBM **CloudBurst** on IBM **BladeCenter** is an integrated solution designed to help implement and manage a private Cloud environment.
  - IBM **Power Systems** Cloud solutions are designed to help improve service delivery, enable business innovation and reduce costs with extreme scale.
  - IBM **zEnterprise** is the only heterogeneous Cloud solution, enabling customers to build solutions optimized for the right platform.
  - IBM **Systems Director** simplifies management of physical and virtual environments across multiple technologies and hardware platforms.
  - IBM **Scale Out Network Attached Storage** (SONAS) is designed to allow massive amounts of data and scale to multiple petabytes, all in a single flexible, automated system ideal for a range of Cloud applications.

- IBM **Smart Desktop Cloud** *(IaaS)* offers a fully managed, pre-priced subscription service that delivers desktop virtualization in a hosted environment for a reduced total cost of ownership, easier management and enhanced data security.
- IBM **SmartCloud Enterprise** *(IaaS and PaaS)* is a broad spectrum of secure managed services, to run diverse workloads across multiple delivery methods both public and private. It includes customer choice with the potential for end-to-end management of service delivery from the server and operating system to the application and process layer.
- IBM **Smart Business Cloud Enterprise** *(IaaS and PaaS)* is a public Cloud environment that offers a security rich self-service compute infrastructure to extend existing IT environments and deploy SAP workloads for non-production use.
- IBM **Cloudburst** *(PaaS)* is a service delivery platform packaged as Cloud solution that features fully integrated virtualization and system management capabilities, a self-service access portal, built-in metering and accounting, active server power management and redundant hardware layers in a multi-operating system environment.
- IBM **Tivoli Service Automation Manager** *(PaaS)* is capable of supporting heterogeneous environments enabling enables users to request, deploy, monitor and manage Cloud computing services.
- IBM **Workload Deployer** *(PaaS)* is a hardware appliance that provides access to IBM middleware virtual images and patterns to easily, quickly and repeatedly create application environments that can be securely deployed and managed in a private Cloud.
- IBM **Hosting** and application on demand (**AoD**) *(PaaS and SaaS)* services for SAP are provided at fault-tolerant data centers, which have been designed to accommodate a very wide variety of application platforms and networking equipment.

3.4 Financial Services in the Cloud

As previous mentioned, financial institutions in the present socio-economical environment are dependent on computer support and IT innovation, therefore, to a substantial extent, the banking industry today is clear on what the emerging technology will be. Some useful solutions in the Cloud are already adopted in some organizations and these include [32]:

- product catalog, enabling one to manage catalogs of products and services, as well as to access pricing information;
- asset management, permitting one to track the different financial products customers have purchased;
- data quality management, which ensures that customer, product, and pricing data are available, valid, and free of duplicates.
- work flow programs that help in customizing sales and marketing documents;
- collateral management, which provides a valuable repository for the most recent versions of sales and marketing information;
- list management, assisting the private banker in customer leads, contact information, and business handling;
- marketing analytics, which permit studying the impact of marketing campaigns, determining those activities generating the most revenue, and measuring the results of marketing spending.

What is still a puzzle is how to choose and use these products to increase business opportunities, control risks, and better profits. In order to do this, research is necessary in the areas of new business models, new markets, better understanding of client needs, faster interoperability within the organization, CRM systems, client experience, services and obtaining o better time to value ratio.

This is the area where consultancy services prove to be very useful. The consultant is the entity that can design solutions for a specific financial institutions, it also has the expertize to provide and assist the implementation of new technology for innovative distribution channels.

3.5 Consultancy in the Cloud

Cloud computing is a challenge and a big opportunity for consultancy companies. Due to the international economic situation all business areas are forced to cut on costs, but without compromising on quality. This is also the case for financial institutions.

On the other hand, Cloud computing is a technological perspective that is on the rise and promises to bring some relieve by cutting costs and revealing new ways to market financial services. This combination signals the start for the knowledge race that consultancy companies need to win. If they hesitate and wait for the economic "fog" to rise, they risk loosing the existing and the future clientele.

3.5.1 The Cloud Cube

In order to cover as many possibilities and scenarios possible, different Cloud cube perspectives are used by consultancy companies, including Capgemini.

The NIST cube (Fig. 3.3 [33]) is basically a representation of the Cloud computing definition, bringing together the service models (IaaS, PaaS, SaaS), the essential characteristics of Cloud computing and models to deploy Cloud. Although the model is self-explanatory, some clarifications might be in order for the deployments models [33]:

- Private Compute Utility: An infrastructure physically dedicated to one organization.
- Community Cloud: An infrastructure spanning multiple administrative domains that is physically dedicated to a specific community with shared concerns.
- Public Cloud: An infrastructure spanning multiple administrative domains that is made available to the general public / businesses, without physical partitioning of resource allocations. (There is arguably only one public Cloud – hence the phrase "host it in The Cloud".)
- Hybrid Cloud: A combination of public and private compute utilities in order to allow "Cloud bursting" for some requirements, or to allow a private compute utility owner to sell their spare capacity into The Cloud.

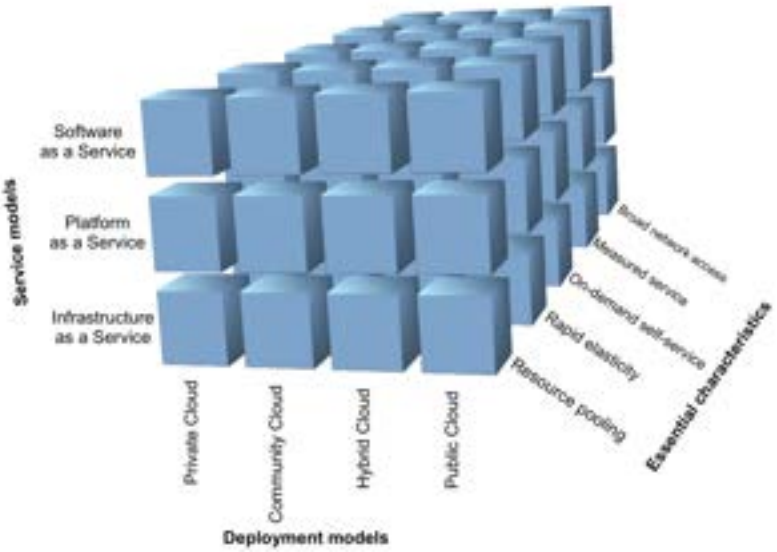

Figure 3.3: The Cloud Cube

Also Capgemini developed in internal Cube model (Fig. 3.4). To help customers decide on the best Cloud solution for their company and get more clarity in the use and provisioning of Cloud services.

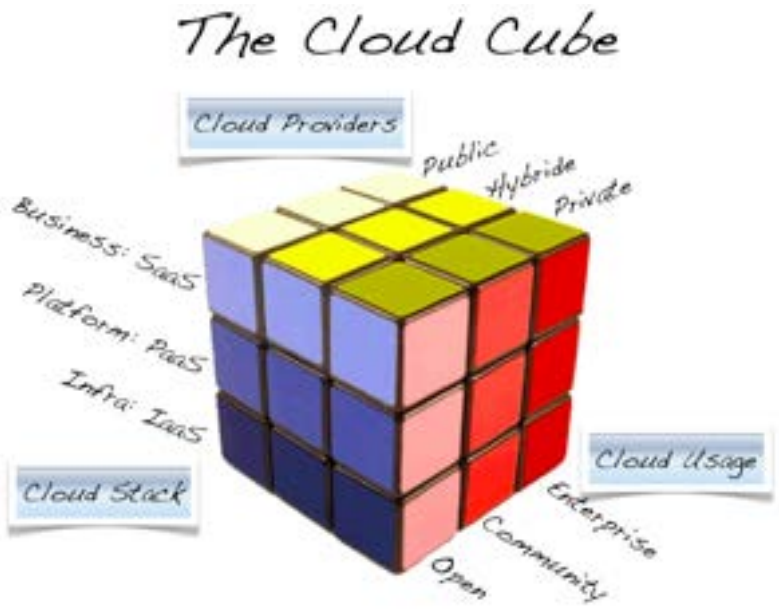

Figure 3.4: Capgemini Cloud Cube

The first dimension of the Cloud cube is the Cloud stack: Infrastructure as a Services (IaaS), Platform as a Services (PaaS) and Business as a Service (SaaS). One can add extra layers on top of this simple stack, layers like Business as a Service (BaaS), Business Process as a Service (BPaaS), Data / Information as a Service (DaaS) and much more, but it would not help the simplicity and functionality of the model.

The second dimension is about the distinction in Cloud provisioning. There are: public Cloud providers (offer services to anyone), private providers (offer Cloud services to their own organization) and hybrid Cloud providers (private providers using temporary public capacity or hosing parties that offer their Cloud services to a limited group).

The third dimension concerns the distinction in the usage of Cloud services. This could be: Enterprise Cloud (Cloud environment available just for a closed group), Community Cloud (can also be used by other parties or a multiple organizations structure), Open Cloud (everyone can start using one or more Cloud services).

At the moment the Cloud Cube is a powerful tool for Capgemini in meetings with customers and colleagues. For the future there is an active project that intends to develop it as a tool for sales, architects and developers.

In order to make the Cloud Cube usable as a tool, the dynamics of all columns, rows and blocks should be defined in terms like:

- Strategy and Journeys (which block could be used for which type of customer),
- Products & Services (per block),
- Best Practices (which structures and solutions are effective),
- Security and Governance (regarding access and maintainability),
- Business Cases (general costs and benefits per block).

3.5.2 Capgemini GIO Private Cloud IaaS

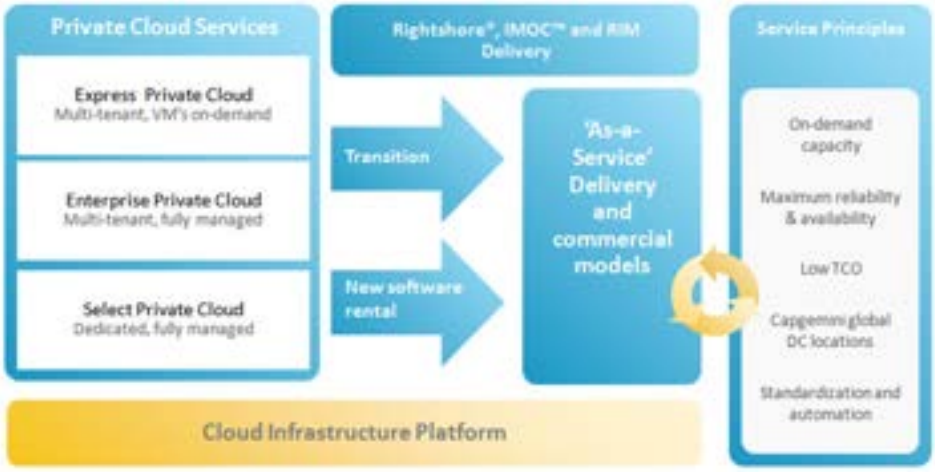

Figure 3.5: Capgemini IaaS

As a consultancy company with an eye on the future, Capgemini is trying to cover as much of the Cloud spectrum as possible. One of its latest initiatives is an IaaS (Fig3.5), GIO (global infrastructure outsourcing) Private Cloud, offering that bridges the gap between traditional on-premise physical architectures and the public Cloud. There are three varieties in order to provide highly flexible commercial and service level terms, as best suited for each company [34]:

Challenges to deal with	**Express Private Cloud**	**Enterprise Private Cloud**	**Select Private Cloud**
Lack of available capacity of data center facilities	✔	✔	✔
Lack of growth capacity of data center facilities	✔	✔	✔
Trust and security threats within the public Cloud	✔	✔	✔
Lack of knowledge, investment and change to develop an internal Cloud	✔	✔	✔
Commercial models,investments and changes to develop internally are challenging	✔	✔	✔
Lack of business agility from cu rent infrastructure provisioning capabilities	✔	✔	
Lack of quality SLA commitment from public Cloud providers		✔	✔
Capital appropriation process , payback periods for short-term requirements	✔		
Data under management requires high levels of protection and isolation			✔

The main difference between the three solution packages is the customization level regarding Capacity, Pricing model, Availability and Workload.

3.5.3 Capgemini Immediate - Cloud Brokerage

The second take on Cloud presented by Capgemini is a very different approach. If for GIO Capgemini is a provider, for Immediate is more in the role of a liaison. Basically this approach is trying to take advantage of all the benefits (presented in Fig. 3.6a [35]) by using a complete solution with ramifications in technology and business (Fig. 3.6b [35]).

(a) Benefits of Cloud

(b) What is Immediate

Figure 3.6: Capgemini Immediate

This new approach is based on the fact that Capgemini Immediate clients need the most up to the minute, market-leading services that exist in the digital marketplace and no single vendor can provide it.

Therefore, Capgemini takes the place of the main contractor and "mixes up a special recipe" for each institution according to its requirements. For this approach the consultancy company scouts the market, creating key partnerships with the leading players across the world, ready to deployed the perfect fit. This strategy is the base of the architecture proposed in Chapter 7.

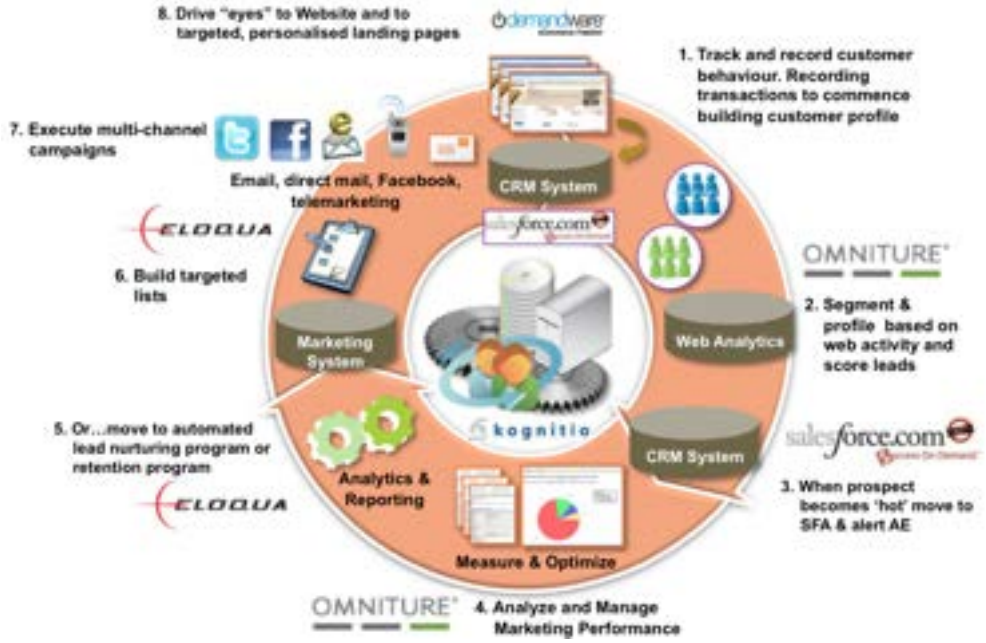

Figure 3.7: Capgemini Immediate Providers Example

This is a short representation of how providers interlock in the Immediate concept. The partners presented in Fig. 3.7 [35] are just a sample of the wide connections, that number more than 200 Cloud suppliers, in different domains, all around the world.

3.6 Summary

In this chapter some main characteristics of Cloud computing have been presented that includes: infrastructure cost reduction, increase speed to market, new mobile and social capabilities, elasticity and scalability.

Also areas where Cloud computing can bring improvements and important changes have been suggested and some of the main Cloud products have been presented: Amazon, Google, Microsoft, SalesForce, IBM.

The last two sections of the chapter include motivation and perspectives on how financial institutions can benefit from Cloud computing and what are some of the offers available from consultancy companies, represented here by Capgemini.

Chapter 4

Transition Challenges

In order to understand what challenges are implicated in the transition to the Cloud for any institution an analysis of literature sources is provided in this chapter.

As a general perspective the National Institute of Standards and Technology (NIST) took a survey [36]and tried to rate challenges anticipated from the adoption of Cloud computing. Here are the results :

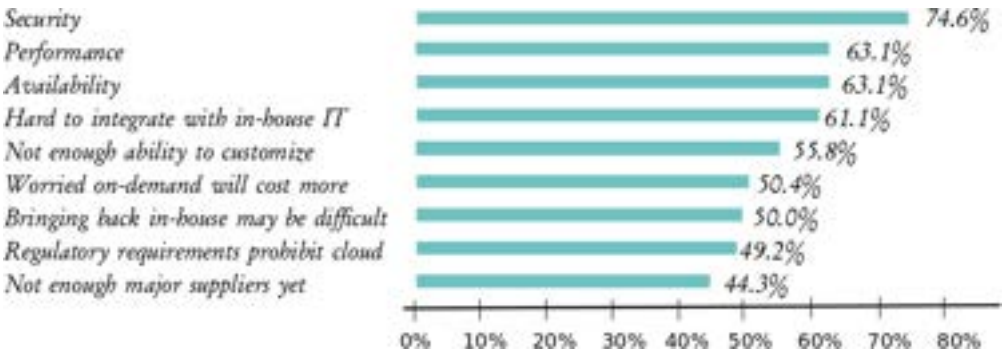

Figure 4.1: Results for NIST Cloud Challenges Survey

In order to cover a wider range of possible transition difficulties, to group them according to their areas of influence and to detail them, in this thesis challenges are classified into:

- Security,
- Technological challenges,
- Organizational challenges,
- Social challenges
- Governmental challenges.

The main purpose of this classification is to pinpoint areas that are to be tackled in the proposed reference architecture, in the future chapters.

4.1 Security

As shown in Fig. 4.1, this aspect tends to be the main concern with many possible Cloud users. Therefore Gartner, a well renowned information technology (IT) research and advisory company, tried to divide Cloud computing security risks into seven specific issues[37]:

1. **Privileged user access**. Sensitive data processed outside the enterprise brings with it an inherent level of risk, because outsourced services bypass the "physical, logical and personnel controls". Therefore any company should ask its providers to supply specific information on the hiring and oversight of privileged administrators, and the controls over their access.

2. **Regulatory compliance**. Customers are ultimately responsible for the security and integrity of their own data, even when it is held by a service provider. Traditional service providers are subjected to external audits and security certifications. Cloud computing providers must be subjected to the same rules.

3. **Data location**. The Cloud does not provide data regarding the location of the processed and stored data, therefore in important to ask providers if they will commit to storing and processing data in specific jurisdictions, and whether they will make a contractual commitment to obey local privacy requirements on behalf of their customers.

4. **Data segregation**. Data in the Cloud is typically in a shared environment alongside data from other customers, therefore the Cloud provider should provide evidence that encryption schemes were designed and tested by experienced specialists. Encryption accidents can make data totally unusable and can complicate availability.

5. **Recovery**. A Cloud provider should be able to know what will happen to your data and service in case of a disaster. For this Replication across multiple platforms is crucial.

6. **Investigative support**. Investigating inappropriate or illegal activity may be impossible in Cloud computing. Cloud services are especially difficult to investigate, because logging and data for multiple customers may be co-located and may also be spread across an ever-changing set of hosts and data centers. Therefore is imperative to get a contractual commitment to support specific forms of investigation, along with evidence that the vendor has already successfully supported such activities.

7. **Long-term viability**. Ideally, the Cloud provider will never go broke or get acquired and swallowed up by a larger company. But you must be sure your data will remain available even after such an event.

4.2 Technological Challenges

This category of transition challenges refers to the maturity of the technological development in Cloud computing and the possible inconveniences that this technology might impose on any user, including financial institutions.

On top of this security risks, that are expressed more from the perspective of a future Cloud user company, there are also core security challenges in the Cloud that must be taken into consideration due to existing technology like:

- **Incidences caused by Insecurity in the Cloud.** There have been a lot of proved security attacks [38] on different Cloud computing providers such as Google (Gmail, App Engine), Amazon Web Services (Amazon S3), Salesforce.com (Salesforce.com). Therefore one might argue that it is only a matter of time and wits until one of them will be hacked and significant damage will be produced.

- **Insecurity from the choice of Cloud provider.** Cloud computing, being a distributed architecture, would imply there being more data in transit than using traditional infrastructures. Images are distributed across multiple physical machines, between Cloud infrastructure and remote web clients. Also some Cloud providers use data center host editing, that is supposed to be implemented in a secure Virtual private network (VPN) connection environment. It can happen in practice that some organizations using different Cloud providers end up with those providers using different security implementation rules that can create a security loophole for the customer data.

- **Vulnerabilities in the Virtual Machine.** The collocation of multiple virtual machines increases the risk of virtual machine-to-virtual machine compromise. Localized virtual machines and physical servers use the same operating systems as well as enterprise and web applications in a Cloud environment, thereby increasing the threat of an attacker or malware exploiting vulnerabilities in these systems and applications remotely.

  An outside attacker could place a malicious VM in Cloud that can pretend to be a valid host machine of the service provider and receive information environments from unsuspecting users. This malvm could also snoop on the traffic within the data center. The hypervisor, for example, has the highest privilege in the system that hosts the virtual machines for users. The threat of a malicious or compromised hypervisor is that it can intentionally disrupt the guest's security mechanisms.

- **Denial of service attacks** Another reason pay special attention to security in the Cloud is the threat to bring down a Cloud system with a Distributed Denial of Service (DDoS) attack, which means attacking a web server with a flood of messages, all at the same time. There are DDoS attack tools, like Agobo and other worms, that, if used creatively, can cause great havoc to the Cloud.

4.2.1 Portability Limitations

Sticky services are services that an end user may have difficulty transporting from one Cloud vendor to another. These services are the biggest fears of any manager. No company wants to be depended on the existence of its providers and get stuck in a Cloud, needing to rewrite its applications or to suffer data losses. The positive aspect is that Cloud portability tends to be a factor related to the type of Cloud one uses. [39]

Here is how these problems could be presented for the three big Clouds on the market (Fig. 4.2 [40]):

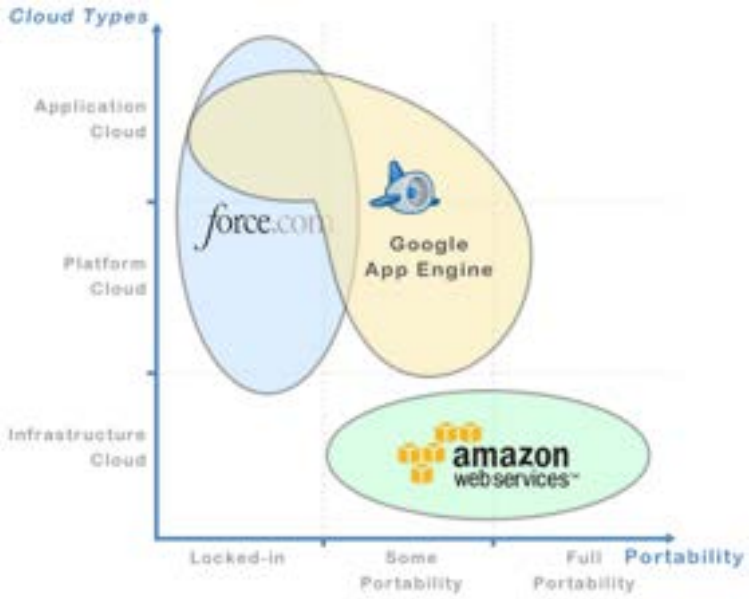

Figure 4.2: Cloud Portability

- **Force.com** has a very powerful and highly integrated platform and application Cloud, but is designed on proprietary technologies. It has a custom language, similar to Java, and its own SQL/ORM layer. This allows the application to take full advantage of Force.com scalable architecture and to integrate deeply with SalesForce.com. However, if you are implementing a standalone application, it is not a portable platform.
- **Google App Engine.** Google supports Java on its platform Cloud, but there are still some restrictions. Most of the common Java libraries and frameworks can be used on the Google App Engine. The only inconvenience might be created by the data layer. Google App Engine uses JDO as a data layer or a subset of JPA. JDO works fine with some applications, but might be hard and costly to adopt for enterprise application. JPA support is not complete yet. Therefore, moving an application from SQL/Hibernate to AppEngine is manageable for a well-architected application, especially with JPA used in both environments.
- **Amazon WS** does not provide any platform Cloud service. Therefore it does not restrict application developers to any technology, but SaaS developers will have to develop their customized, highly-scalable architecture.

4.2.2 Network Limitations

The network is the mechanism that puts Cloud in practice. Any problem on this level can seriously affect and disrupt all Cloud activities. Therefore we encounter inherited risks and emerging ones.

On one hand there is **latency**. Latency has always been an issue on the Internet. Performance within the Cloud doesn't mean much if it takes forever for the results of that performance to show up on the client. This can be dealt with using an intelligently planned infrastructure and smart applications that understand where and how they're running.

On the other hand, technology advancement can impose its own requirements. For instance the new applications must take into consideration **IPv6**. Cloud computing, due to its host capability needs, that can appear by the thousands at once, will guarantee the need for IPv6 address pool and technical flexibility.

4.3 Organizational Challenges

When adopting Cloud, any organization needs to take into consideration challenges generated by its profile, either by special compliance needs or by its existing structure, policies and clients. These aspects are discussed in this section in more detail.

4.3.1 Compliance

An organization needs to make sure it is compliant with internal end external rules and regulations. Because of this, when considering Cloud computing, the first things to understand are regulatory and legislative obligations, depending on industry or geographic location. Some examples include PCI DSS (Payment Card Industry Data Security Standard), NERC (North American Electric Reliability Corporation), NIST (National Institute of Standards and Technology) and ISO (International Organization for Standardization) standards.

The Cloud provider will not explain which are applicable for what type of organization. It is possible that the general rules any Cloud services provider needs to apply in its own data center are enough for the needs of the organization requesting this service, but also it might be the case that not all the requests are meet in a standard offer by the chosen Cloud provider, therefore this is to be clarified since the beginning.

In the case of financial institutions, due to the nature of the transferred data and the environment they operate in, there are specific rules for each institution type. The general term to describe rules and regulations in this context is compliance risk.

Compliance risk is sometimes referred to as integrity risk, because a bank's reputation is closely connected with its adherence to principles of integrity and fair dealing. Banking supervisors must be satisfied that effective compliance policies and procedures are followed and that management takes appropriate corrective action when breaches of laws, rules and standards are identified.[41]One of the main component that insures the compliance is the IT system.

4.3.2 Trust in Provider

trust = control + visibility [42]

Each organization has its own process of choosing partners. This is not different in the case of Cloud providers. On the contrary, trust in the Cloud provider is very important for a good collaboration. In order to ensure that the Cloud provider is a suitable partner, most organizations perform audits that make sure all the agreed requirements are fulfilled.

A Cloud provider is a commitment that an organization takes for a long period of time. Although there is the possibility to change the provider, there are lots of complications with the existing technology and thus is preferable to develop a degree of trust before implementing Cloud into any institution.

Working with a Cloud provider is an every day activity that requires a high degree of integration at the IT level and also at business level, having long term consequences, so trust is a key element this decision. Even so, trust is still an element that needs to be developed. There are some ideas to address this problem like the existence for a Cloud Trust Authority, an independent entity that provides standardized control and visibility services across multiple compatible service providers[42].

4.3.3 Structural and Internal Policy Change

When adopting Cloud there are some now policies to be implemented, as with any other third-party management of information resources. This include and are not limited to:

- Security and privacy policies
- Auditing policies
- Software licensing policies
- Acceptable use policies

Some of these might impact the internal policies that the organization implements. For instance the use of Cloud might restrict some rights that the users had previously or might give a different role to the administrator of the system, resulting in the development of new internal policies to deal with this new position. Also some of the existing internal regulation can be made obsolete.

Regarding the structural changes, they might occur if the new software solution integrates different delivery channels in order to provide more coherent offer to the end user. For instance, the customer centric approach reunites multiple product divisions within an institution and thus it might influence the existing structure suitable to such an approach. Although this king of changes must be taken into consideration, they are not a direct consequence of Cloud adoption.

One of the direct consequence of adopting Cloud is the structural change in the internal IT division. If the company is large and already integrates its own data center, as is the case of most financial institutions, the main challenge is to restructure the existing resources and to reuse them in different tasks.

4.3.4 Client Incomprehension

Even though within the organizations the notion of Cloud is getting clarified, from the client perspective this is not the case.

One of the biggest assets of Cloud is that the user does not have to know how every thing is provisioned, but from a client perspective this unknown might cause hesitation.

In order to prevent this, the organization that implements Cloud solutions has to provide the same level of functionality and trust, included in a user friendly interface.

Client incomprehension is also generated by social hesitation and concerns discussed in the next section.

4.4 Social Challenges

As presented in Chapter 2, financial institutions are highly dependent on the socio-economical environment they have to operate in, thus social acceptance and comprehension is a very important factor.

4.4.1 Social Hesitation

The social hesitation is generated by an important difference that exists from the perspective of the client. On one hand, a financial institution is an organization that any client entrusts with its most personal data and expects it to keep it safe and not use it without permission or in any other way then the one agreed upon.

On the other, the clients tend to associate Cloud computing with Social Media and Social Networking.

For instance, if the client of a financial institution is used to input personal data in a local application, even though this data will be transferred to the bank via the Internet, it will find it very difficult to trust a similar application that runs in a browser, even if only due to the fact that the Internet is not to be trusted.

Users seek security in Internet applications because trust is often not justified. The more security is guaranteed, the easier it is to have trust. [43]

4.4.2 Security Concerns

Security concerns are generated by the nature of the data a financial institution exchanges with its customers.

Even though user are generally accustomed with the role of Social Media and Cloud solutions in their daily basic routine, questions like “What do I want others to know ?”[44] and “Who has access to my information ?” [44] are major security concerns when combining Cloud and banking.

These concerns that users express are evidenced also through the large number of compliance regulation a financial institution must respect. Until these concerns will be put to rest, the adoption of Cloud computing by the financial institutions will be hindered.

4.5 Governmental Challenges

In order to facilitate the adoption of Cloud computing by the financial institutions, legislative initiatives must be put in place. Because the technological approach is in its early stage, not all the angles have been explored and legislated. This fact gives way to governmental challenges. Some of the most challenging facts when it comes to Cloud computing legislation are presented in [45] and categorized into:

4.5.1 Legal Obligations in Multiple Jurisdictions

Sharing and transfer of data within the Cloud, the inability for anybody to easily say where the data is or has been, is the key problem that creates legal issues.

An obvious problem is **trans-border data flow**. For example under the EU Data Protection Directive, unless they take certain steps, organizations are prohibited from transferring personal information to countries that do not provide the same level of protection with respect to personal information of EU residents.

Unfortunately, Cloud providers might not be able to make any contractual promises to their clients because in many cases they cannot say which countries data will be transferred to or from. [45]

4.5.2 Security Under the Law.

Also there is the issue of **"reasonable security"** and potential **liability** for security breaches in the Cloud.

Generally speaking a company outsources the handling of personal information to another company, but it is still responsible for the information. Therefore, in order to make sure that the Cloud provider has a sufficient level of security, a multitude of audits and certifications are in place. Even so, it is highly important to establish from the very beginning what liability each company can face when there has been a security breach in the Cloud resulted in the theft or harm of valuable or protected data.[45]

4.5.3 Electronic Evidence and Disclosure

Utilizing the Cloud can be problematic in the litigation context. First off, when litigation ensues and a litigation hold is initiated, the organization will have to deal with a third party Cloud provider in order to get at the information relevant to the litigation.

In addition, considering that multiple copies of data may be created, stored, recompiled, dispersed, reassembled and reused, the idea of what constitutes a "record" or a "document" for evidentiary purposes may be difficult to grapple with in the Cloud.[45]

Another legal reason of concern is the **American Patriot Act** [46]. In the year 2001, this law expanded the powers of the American National Security agencies to aid in their efforts in gathering information in connection with anti-terrorism initiatives. Therefore, if probable cause is established, an American company can be asked by national security agencies to disclose private information hosted in their data centers.

4.6 Summary

This chapter reveals some insight into the transition challenges that institutions might face while adopting Cloud solutions, based on literature study. These are categorized into: Security, Technological Challenges, Organizational Challenges, Social Challenges and Governmental Challenges.

Some of the main challenges presented in the area of security include: privileged user access, regulatory compliance, data location, data segregation, recovery, investigative support and long-term viability.

The perspective of technological challenges includes aspects like: insecurity in the Cloud, insecurity from Cloud provider, Virtual Machine vulnerabilities, denial of service attacks, portability and network limitations.

Organizational challenges are represented by: compliance, trust in provider, policy change and client incomprehension. Social challenges express the social hesitation and concerns. And the governmental challenges incorporate legal aspects that influence Cloud computing.

All this categories have an impact on the future reference architecture and will be investigated in the context of financial institutions in the next chapter.

Chapter 5

The Opinion of Financial Institutions

As shown in Chapter 3, there are lots of Cloud providers and different approaches to the concept. The question is how does their offer map to the specific needs of such demanding users as financial institutions.

5.1 Accessing Opinions

In order to discover what is the perspective on Cloud computing from the point of view of financial institutions a questionnaire has been developed. The main targets of this approach are IT and business architects expressing their experience within a financial institution.

In order to better explain the questions and, therefore, get the desired information, interviews have been set and carried out within different financial institutions on a resource pool represented by one business architect and four IT architects, each with more than five years of experience in dealing with the particularities of financial institutions.

Within the interviews, discussion has been based on the questionnaire presented in the next section.

5.1.1 The Interviews and Results

The questionnaire has been revised and developed with the help of specialists within Capgemini after analyzing the Cloud services available on the market and areas in which they could be applied (see also Chapter 3).

Also, during previous talks with Capgemini specialists, it has been observed that there is a certain hesitance for financial institutions to adopt Cloud solutions at this moment and thus this survey aims at revealing some reasons for these concerns.

The general perspective gathered by the questionnaire is meant to be the base for the future proposed architecture.

In order to obtain as much useful information, the questionnaire is divided in 5 main parts, aimed at different aspects of the financial institution.

- ***General information.***

This section provides insight on the general profile the financial institution and its intentions regarding the existing IT system.

All the questions in this section are multiple answer type of questions. Some allow open answer in order to provide more flexibility to the questionnaire and to gather knowledge about the existing situation that it could not be encapsulated within multiple a choice type of question.

1. *What type of institution are you?*
   - ☐ *Bank*
   - ☐ *Insurance company*
   - ☐ *Pension fund*

Motivation : This question establishes what to type of institution is the gathered data referring to. Different types of institutions might have different needs.

Results :During these interviews representants of two banks and a pension found have been questioned. Also these institutions have branches dealing with insurance.

2. *How fast can the supply chain implement customer oriented changes?*
   - ☐ *In a matter of minutes*
   - ☐ *In a matter of hours*
   - ☐ *In a matter of days*
   - ☐ *In a few weeks*
   - ☐ *Our supply chain is not designed to implement customer centric requests.*

Motivation : There are Cloud solutions (for instance within SalesForce) that implement a good view of the supply chain, therefore allowing for real-time decisions and customer oriented changes, thus better services.

Results : In most of the cases there is a longer period then the stated ones that can be expressed in months, but in 40% of the cases such changes are possible in a short period of time depending on business units and the nature of the changes. These changes can take as little as some minutes or hours in an automated manner (20% of the institutions).

3. *Would you like to integrate some of the IT systems your organization uses into one?*
   - ☐ *Yes*
     - ☐ *As soon as possible*
     - ☐ *This year*
     - ☐ *Next year*
     - ☐ *Long term goal*
   - ☐ *No*
4. *What systems would you like to integrate?*

Motivation : Is there a preference for multiple systems (more or less integrated) or integration within the next period of time. And what might be the intended systems.

Results : In 80% of the cases there is no intention to integrate IT systems and they

are considered sufficient matured and offer the holistic view desired. There are still some problems in 20 % of the cases with data redundancy, but this is currently handled. Although there is not a general intention to integrate components of the exiting IT system, special attention is payed to client data integration (20%) and platform uniformity (20%).

- **Existing IT systems.**

This is the section that addresses the IT system at the moment and inquires regarding some of the most common areas where adopting Cloud computing might have an influence.

5. *Do you have management tools that offer a clear overview of your organization (Management Information Systems)?*
   - ☐ *Yes. We use_____, but it is not integrated with other applications.*
   - ☐ *Yes. We use_____ and is integrated with our _____system.*
   - ☐ *Yes. We use _____, but we would like to add some functionalities like:_____.*
   - ☐ *Yes.*
   - ☐ *No.*

Motivation : Is there a clear view of the organization or is there a wish to improve it (maybe using Cloud solutions).

Results *:* In 60% of the institutions tools exist, but are not integrated. Such tools are considered useful and an ongoing improvement point for all financial entities interviewed.

6. *Does your institution have one or more CRM implementation(s)?*
   - ☐ *Yes. We use_____, but it is not integrated with other systems.*
   - ☐ *Yes. We use_____and it integrates _____.*
   - ☐ *Yes. We use _____, but we would like to add some functionalities like:_____.*
   - ☐ *Yes. We have a complex solution that integrates all our client information from different channels (including: front office, call center, social networks, client portal).*
   - ☐ *No. We do not use a CRM.*

Motivation : Cloud solutions include sophisticated CRM systems that could improve customer interaction (if there is not a complete solution in place already).

Results *:* More CRMs are used, specialized on different customer clusters. This can create confusion and too much integration problems in 40% of the cases. This reason and advancement in CRM ares ace making all interviewed financial institutions to consider a new approach in this area, but it is not clear defined yet (60%).

7. *Does your management have a clear view of their delivery chains and analysis tools to support it?*
   - ☐ *Yes. Our analysis tools integrate all delivery chain information and give relevant feedback in real time.*
   - ☐ *Yes. Our analysis tools integrate all delivery chain information and give relevant feedback after a period of time (monthly, quarterly, etc.).*
   - ☐ *No. We do not use any integrated analysis tools. The analysis is done by specialized people.*

Motivation : Find out if and how overview and analysis of chain could be improved with the help of Cloud solutions.

Results *:* 20% of the respondents are not sure of this, 60% consider that the analysis tools are integrated and offer relevant feedback monthly/quarterly and at the request of the manager. Also 20 % state that this tools do not exist as integrated part of the system, but there are specialized people that create the overview form data stored for specialized processes.

8. *What are the critical IT systems (that you or your customers use all the time and need to be running 24/7) within your company?*

Motivation : This question identifies the critical IT systems.

Results *:* The main IT systems that a financial institution include: all Internet based customer interaction, asset management, trading system, payment system, backup, customer data access and, in 40% of the answers, internal employees systems for flexible work hours.

9. *What kind of information needs to be hosted on the premises of your institution (due to legal concerns)?*

Motivation : If the information needs to be on the premises, a Cloud hosting solution could not be approached.

Results *:* All the interviewed representants are aware of legal constrains, but there is not a consent on what sort of data needs to be hosted on premises. 40% agree that there should not be transaction related information outsourced, but hosted on the premises. Also client information represents a much disputed point for 60% of the cases and is therefore preferred on the premises.

10. *What kinds of applications interact with this sensitive information frequently?*

Motivation : This kind of applications might present a higher risk and require special consideration before moving them to the Cloud.

Results *:* Trading and processing systems interact with this kind of data, but the systems are not necessary on premises according to 40% of interviewees.

11. *What kind of non-banking related applications (but more to marketing, human resources, etc.) your company uses?*

Motivation : These are the areas where Cloud computing can bring significant

improvements.

Results : The systems used that are not related to banking centric activities are: Human Resources, Development and testing, Planing/Research, websites, e-mail systems, payroll/accounting and internal planing.

- **Changes in the IT systems.**

This part of the questionnaire defines past challenges encountered while implementing changes into IT systems, solutions used in the past and the opinion regarding social networking sites (viewed as a changed meant to mitigate client interaction challenges).

12. *Would you like to interact with your customers through social networking sites?*
    - ☐ *We are doing that already.*
    - ☐ *Yes.*
    - ☐ *No.*

Motivation : Social networking sites are a big part of the new user interaction. Cloud solutions can be selected to integrate such features.

Results : Social media is used to promote new products (60%) and to supervise the image of the company by specialized (marketing) people on behalf of the financial institutions (80%). Also there is still the consideration that the client reacts better and trust is created easier in a face to face consultation (60%) .

13. *Please prioritize the following concepts, from the perspective of your institution, regarding a new IT system on a scale from 1 to 5, 1 being the most important (do not repeat priority).*
    - ☐ *User acceptance*
    - ☐ *Cost*
    - ☐ *Performance*
    - ☐ *Flexibility*
    - ☐ *Development and implementation time*

Motivation : These concepts play an important role when considering a new IT system/component and can influence the decision towards Cloud solution/package or an of-the-shelf software.

Results : After the ranking it was obvious that a major difference can set the financial institutions apart from other institutions. The general final order is (from the most important to the least): “User acceptance”, “Performance” is at a tie with “Flexibility”, “Cost” and finally “Development and implementation time”.

14. *What are the main challenges you encountered while adopting a new IT system/ major IT component in the past?*

Motivation : Similar challenges might be encountered when transitioning to Cloud or might be mitigated by the improvements Cloud computing promises.

Results : The general perspective regarding challenges pointed out some of the most common like: insufficient planning(20%), integration (80%), maintenance, difference in security standards(40%), time to market, development time(40%).

15. *How did you mediate them?*
    - ☐ *Policies that addressed:*_____.
    - ☐ *Guidelines regarding:* _____.
    - ☐ *Architectural changes that referred to:* _____.

Motivation : If the mediation methods are not needed while using Cloud, the costs related to such actions might represent a strong point for the new approach.

Results *:* Architecture is the main mediator (80%), followed by policies (40%)

- **Role of third party providers in your institution.**

Third party providers ease the transition to Cloud due to existing policies, facile understanding of service agreements and less anxiety regarding data.

16. *Do you use any third party for your application/data hosting and maintenance?*
    - ☐ *Yes. Our data is hosted by a third party. These data includes:*
      - ☐ *All our data.*
      - ☐ *Other:*_____.
    - ☐ *Yes. Our applications are hosted by a third party. These applications are:*
      - ☐ *All our applications.*
      - ☐ *Our website.*
      - ☐ *Other:*_____.
    - ☐ *No. Our applications and data are hosted on premises.*

Motivation : Assessing the level of external interaction of the financial institution regarding third party providers.

Results *:* In 40% of the cases the applications and date are mostly hosted internally, but all of them consider SaaS as a potential improvement in this area.

17. *What are some of the main criteria you use to evaluate third party providers when considering them your application/data hosting and maintenance?*
    - ☐ *We do not use third party for our systems.*
    - ☐ *We take into consideration:* _____.

Motivation : The most important criteria when choosing external hosting companies will still be valid in the case of Cloud computing.

Results *:* The criteria revealed by the interviews are a mixture of perception that characterize the third party provides and its services including: cost, security, technology standardization, SLA, trust, credential, size of the provider, support for its services and business development strategy of the provider.

18. *Would you consider using third party providers to host your non-banking related applications?*
    - ☐ *Yes, as long as they are hosted on dedicated hardware.*
    - ☐ *Yes, as long as the hosting provider is a trusted one.*
    - ☐ *No, we prefer the applications in our premises.*

Motivation : The non-banking applications might pose less risk and therefore be

easier to host in a different location.

Results : This strategy is already approached in 40% of the cases and all of the interviewed specialists consider that a third party provider is useful as long as it is a trusted one, that respects the regulations and (in 60% of the cases) provides dedicated hardware in an exact location.

19. *Do you use Software as a Service (SaaS) within your company?*
    - ☐ *No.*
    - ☐ *Only for our client interaction.*
    - ☐ *In internal processes like:_____.*
    - ☐ *Other:_____.*

Motivation : SaaS is already part of the Cloud ant its existence might ease the transition and bust confidence in this approach.

Results : All financial institutions use SaaS for internal needs and 60% for customer interaction.

20. *Is the concept of Virtualization implemented in your company (by you or a third party provider)?*
    - ☐ *No.*
    - ☐ *Only for our client interaction.*
    - ☐ *Only for internal needs.*
    - ☐ *Other:_____.*

Motivation : Virtualization is an important part of Cloud and familiarity with it can make it easy to understand the concept of Cloud and how it will manipulate the data provided by the financial institution.

Results : Virtualization is implemented in interviewed institutions especially for internal needs and development.

- **Cloud Computing perspective**

This is the section where you express your opinion about Cloud computing.

21. *Are you familiar with the concept of Cloud computing?*
    - ☐ *Yes.*
    - ☐ *No (skip the last questions).*

Motivation : More or less consultancy might be required in the decision process.

Results : All financial institutions questioned are familiar with the concept of Cloud computing.

22. *Would you use Cloud for your organization?*
    - ☐ *Yes, but on a private Cloud.*
    - ☐ *Yes, but only with dedicated hardware.*
    - ☐ *No. I would like the flexibility, price reduction and scalability, but there are major concerns about:_____.*
    - ☐ *No. The organization does not need the added functionalities of Cloud Computing.*

Motivation : Depending on the trust in the Cloud technology, different approaches might be favorite over others.

Results : From the interviewed institutions, 40% use internal Clouds on dedicated hardware, 40% (20% have already private Clouds) still search for solutions suited for them in the Cloud also 40% still are weary of the risks and do not know if the advantages outweigh the disadvantages.

Motivation : The last three questions are open questions to allow the interviewed to express his/her opinions and experiences regarding Cloud Computing.

23. *What do you consider to be the most important lesson while dealing with Cloud Computing in your type of institution?*

Results : The ideal Cloud is not hosted on premise and helps with software life cycle management, apart from the well known: scalability,flexibility, low time to market and reduced costs . At the same time it is harder to fulfill compliance in the Cloud and it is a much more volatile environment, making traceability an important concern.

24. *What are the most useful Cloud services you are using or want to implement (if any)?*

Results : SaaS is in use within all interviewed financial institutions and it is considered in 60% of the cases that an important contribution could be IaaS for the internal software development and development tools. Also 20% see as a good approach to use Cloud services in order to run processes that require a lot of resources like Risk analysis.

25. *What do you consider to be the main benefits of Cloud computing for your organization (if any)?*

Results : The main benefits are considered to be the hope for better costs, time to market, flexibility, rapid and limitless provisioning. Also some consequences of implementing Cloud are considered to be: continuous software improvement due to automated upgrades, new business initiatives and larger pool for marketing events.

This study has been realized in the months of March and April 2011. The opinions represented by the interviewees might be subjected to change while the Cloud technology reaches a different stage in its maturity. Also the opinions might not represent the complete view of the institutions regarding Cloud computing, but are made to portrait the current perception of the technology by the financial market.

5.2 Highlights

During the interviews the participants helped portray an image of the Cloud and some of their most important observations are included in the following highlights:

- ***Cloud*** is the transformation from doing software to managing software.
- ***Cloud*** is scary, because is new and not fully understood.

- ***Cloud*** is not a solution for all problems, but is promoted in such a manner.
- ***Cloud*** is a new approach that is not meant to replace existing technology, but to fill in gaps in the current approach.
- ***Cloud*** is more suitable for new starting institutions then for large existing ones.
- ***Cloud*** legislation is far behind Cloud technology.

5.3 Summary

This chapter reveals some insight into financial institution and their transitional challenges. A series of interviews has been carried out based on the questionnaire that is presented in the last section of this chapter.

Also the results of the interviews are summarized, generating important information to be used in the construction of a reference architecture for financial institutions.

In general, the results of the interviews reflect the fact that all financial institutions are constraint by legal compliance to keep client and transaction sensitive data in their own data centers. Also 40% of the interviewed financial institutions use internal Clouds on dedicated hardware and 40% still search for solutions suited for them in the Cloud.

Another important fact is that 40% of the institutions still are weary of the risks and do not know if the advantages outweigh the disadvantages .

They also identify as the main benefits the hope for better costs, time to market, flexibility, rapid and limitless provisioning. Also some consequences of implementing Cloud are considered to be: continuous software improvement due to automated upgrades, new business initiatives and larger pool for marketing events.

The architecture will keep in line with the observations made during this interview and the institution profiled. This institution will have to deal with the previously identified challenges.

Chapter 6

Architectural Framework

In this chapter a short overview is given of the architectural framework used, its characteristics, methods and architectural views. This is meant to provide a basic understanding and familiarity with the general concepts included within the models used later to develop the architecture. Also the models analyzed and incorporated in the proposed solution will be presented.

6.1 The Open Group Architecture Framework (TOGAF)

In order to construct an architecture, different concepts and components are used. They are part of an architectural framework. Although Capgemini has developed its own framework, it is based on TOGAF and therefore a short description is included to clarify the general scope and approach within this framework.

The Open Group Architecture Framework (TOGAF) is a detailed method and a set of supporting tools for developing an enterprise architecture. [47]

The original development of TOGAF Version 1 (1995) was based on the Technical Architecture Framework for Information Management (TAFIM), developed by the US Department of Defense (DoD).[47]

Within this framework it was established that the purpose of enterprise architecture is to optimize processes and functionality across enterprise, eliminating fragmented legacy processes (both manual and automated). An integrated environment that is responsive to change and supportive of the delivery of the business strategy generates advantages like [47]:

- A more efficient IT operation: lower software development, support, and maintenance costs, increased portability of applications, improved interoperability and easier system and network management, improved ability to address critical enterprise-wide issues like security, easier upgrade and exchange of system components.

- Better return on existing investment: reduced risk for future investment, reduced complexity in IT infrastructure, maximum return on investment in existing IT infrastructure, flexibility to make, buy, or out-source IT solutions, reduced risk overall in new investment, and the costs of IT ownership.

- Faster, simpler, and cheaper procurement.

In order to standardize the new approach, in 2007 ISO defined architecture as:

The fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution.[48]

TOGAF does not strictly adhere to this terminology and provides two meanings for architecture:

1. A formal description of a system, or a detailed plan of the system at component level to guide its implementation
2. The structure of components, their inter-relationships, and the principles and guidelines governing their design and evolution over time

It also provides four domains as subsets of enterprise architecture[47]:

- **Business Architecture:** defines the business strategy, governance, organization, and key business processes.
- **Data Architecture:** describes the structure of an organization's logical and physical data assets and data management resources.
- **Application Architecture:** provides a blueprint for the individual application systems to be deployed, their interactions, and their relationships to the core business processes of the organization.
- **Technology Architecture** describes the logical software and hardware capabilities that are required to support the deployment of business, data, and application services. This includes *IT infrastructure*, *middleware*, *networks*, *communications*, *processing*, *standards.*

Also TOGAF has integrated an Architecture Development Method (ADM) to provide a tested and repeatable process for developing architectures divided in multiple phases[47]:

- The **Preliminary Phase** describes the preparation and initiation activities required to meet the business directive for a new enterprise architecture, including the definition of an Organization Specific Architecture framework and the definition of principles.
- Phase A: **Architecture Vision** describes the initial phase of an architecture development cycle. It includes information about defining the scope, identifying the stakeholders, creating the Architecture Vision, and obtaining approvals.
- Phase B: **Business Architecture** (to support an agreed Architecture Vision).
- Phase C: **Information Systems Architectures** (including the development of Data and Application Architectures).
- Phase D: **Technology Architecture**.

- Phase E: **Opportunities & Solutions** conducts initial implementation planning and the identification of delivery vehicles for the architecture defined in the previous phases.
- Phase F: **Migration Planning** addresses the formulation of a set of detailed sequence of transition architectures with a supporting Implementation and Migration Plan.
- Phase G: **Implementation Governance** provides an architectural oversight of the implementation.
- Phase H: **Architecture Change Management** establishes procedures for managing change to the new architecture.
- **Requirements Management** examines the process of managing architecture requirements throughout the ADM.

The Architecture Development Method process can be adapted to deal with a number of different usage scenarios, including different process styles (like the use of iteration) and also specific specialist architectures (such as security).

Because TOGAF is a generic framework, it provides a flexible and extensible content framework that underpins a set of generic architecture deliverables. As a result, TOGAF may be used either on its own (with generic deliverables), or these deliverables may be replaced or extended by a more specific set, defined in any other framework.

6.2 Integrated Architecture Framework (IAF)

Because there was place for improvement and customization, Capgemini started developing its architectural approach in 1993 and has steadily evolved a framework around it, called the Integrated Architecture Framework (IAF).

While developing IAF, Capgemini specified the framework based on key requirements and fundamental principles [49]:

- **Value focused**. The approach must be focused on delivering value to clients.
- **Traceable to business**. The architecture and any decisions made as part of the architecture must be clearly justified and traceable back to the needs of the business.
- **Addresses complexity**. Architecture structures complex problems; the way to address this is by using different levels of abstraction.
- **Holistic and integrated**. The architecture approach must integrate the full scope of business and technology issues. Architecture must support different business issues and domains of architecture.
- **Allows special focus**. Developments in business and technology require the capability to provide special attention to specific areas.

- **Stable**. The architecture approach requires a stable content that is easy to handover and easy to communicate.
- **Flexible**. The approach must support architecture work in projects and standalone architectural services. The approach must not contain a prescriptive methodology, but must provide a stable platform for innovation.
- **Scalable**. The approach must scale from Solution to Enterprise level architecture.
- **Fast and efficient**. The market demands that the architecture approach be as fast and efficient as possible.
- Provides a **common language.** Use of a common language improves communication between business and IT, leads to more efficient team working and is crucial to knowledge sharing.

As a result of these requirements, although it has a lot in common with TOGAF, IAF offers a holistic view (Fig. 6.1 [49]) that integrates different types of architecture into one. Thus it enhances the scope of architecture.

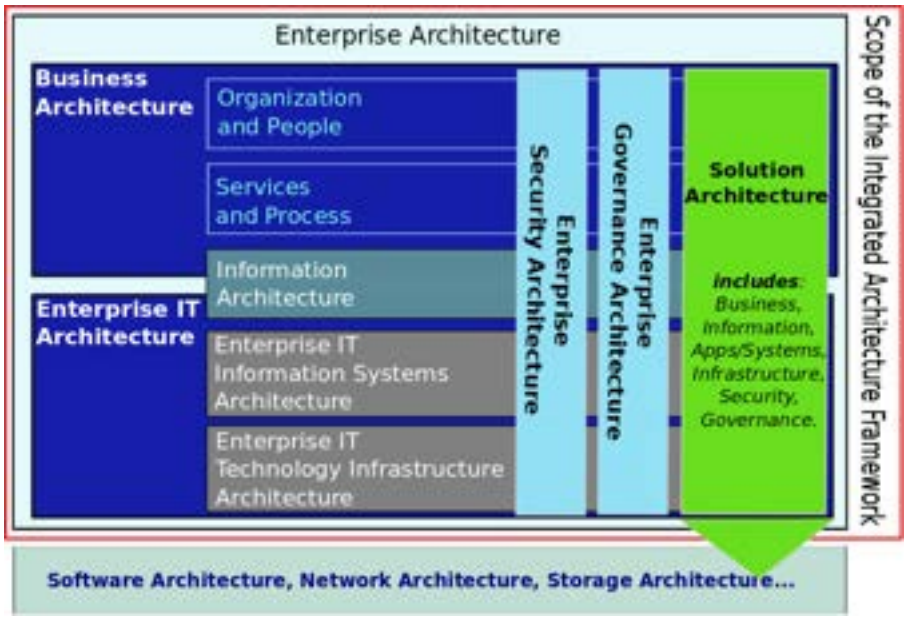

Figure 6.1: IAF Scope

The Integrated Architecture Framework is used to structure and define the architecture content. Within this framework, IAF describes the architecture using two basic constructs:

- **Artifacts:** describe the architecture elements.
- **Views:** used to analyze and present the architecture from different perspectives and to document relationships between Artifacts.

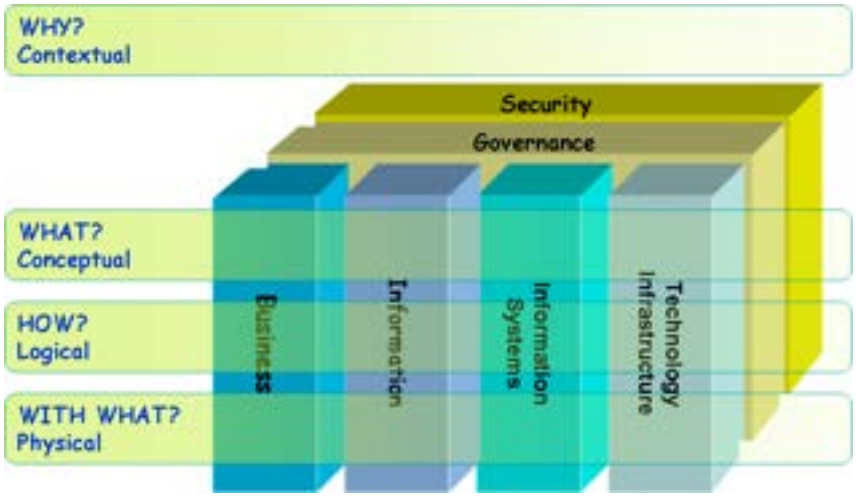

Figure 6.2: IAF Overview

Also IAF defines four levels of abstraction as a basic structure, presented in Fig. 6.2, that can be characterized as [49]:

- **Contextual**: helps to identify boundaries (scope and objectives) for the new architecture and its context.
- **Conceptual:** ensures that all aspects of the scope are explored, relevant issues identified and resolved, without concern over how the architecture will be realized.
- **Logical:** helps to find an ideal solution, independent from implementation, using scenarios.
- **Physical:** helps to determine the real world structure and organization.

6.3 Infrastructure Design Framework (IDF)

The Infrastructure Design Framework (IDF) covers the full development life cycle for generic ICT infrastructure, including: Plan and Organize, Analysis, High level Design, Migration and implementation planing, Implementation and Run.

The Infrastructure Design Framework can be used as a stand-alone method for Infrastructure Solution Development or as follow-up of an Architecture engagement that has used the Integrated Architecture Framework (IAF).

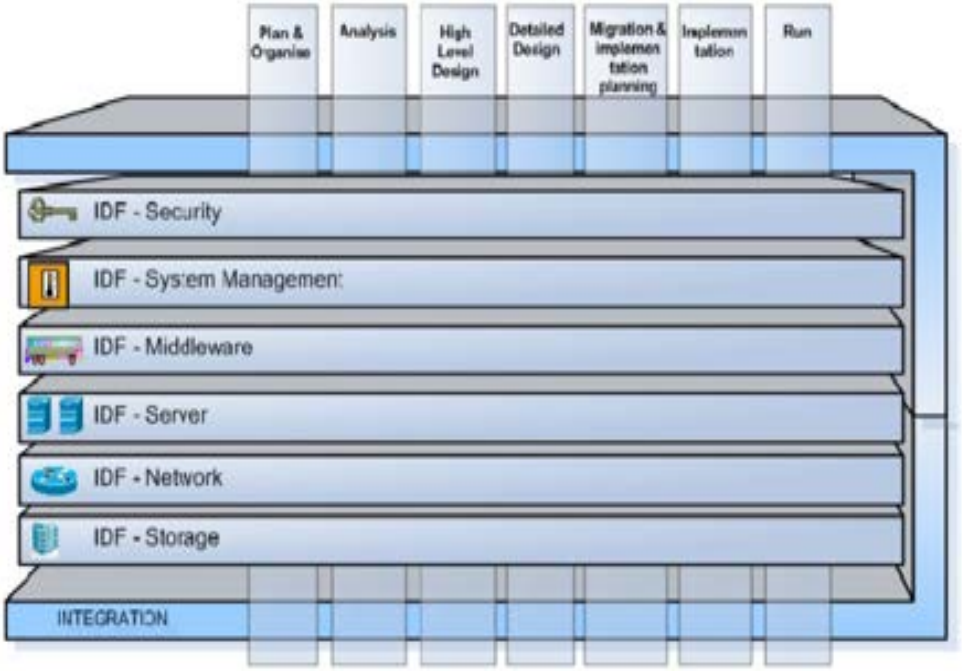

Figure 6.3: IDF Overview

Although having two frameworks might seam redundant, they actually complete each other due to the main differences in approach:

IAF	IDF
Content driven	Process driven
Supports decisions	Supports implementation
Overall view	Based on Technology Domains
Business and Information supporting Business Information Systems and Technology Infrastructure supporting Technology Services	Technology best practices

Table 6.1: Differences Between IAF and IDF

This way Capgemini is able to provide its customers with a complete architecture, in different levels of detail, throughout the life cycle of its proposed solution. In order to standardize the offer different architectural models have been developed and the ones used in this project are detailed further.

6.4 Architectural Models in Use

During the years Capgemini experts developed different architectural models to fit multiple technologies and scenarios. In the last years an important part of this research has been channeled into models that can fit the Cloud computing approach.

The models that have proved to be best suited for this perspective in multiple previous projects cried out by Capgemini and, therefore, used in this paper are: Capgemini Cloud Cube and Capgemini Immediate.

The general theoretic basis of these models has been presented in section 3.5. In this part of the thesis their usability is detailed before applying them in the analyzed case scenario further on.

6.4.1 The Use of Capgemini Cloud Cube

The Cloud Cube is generally used to analyze the best choice of Cloud provisioning for a certain system or component of a system.

In this approach , the tool is used to determine provisioning schema, either in the Cloud or in private data centers, for all the components that make up the proposed IT system for a financial institution.

By doing so components are identified that might be good candidates for the Cloud (Fig. 6.4). This analysis is performed for each major component of the institution presented in section 7.1 and it takes into consideration the specialist opinions revealed during the interviews presented in chapter 5.

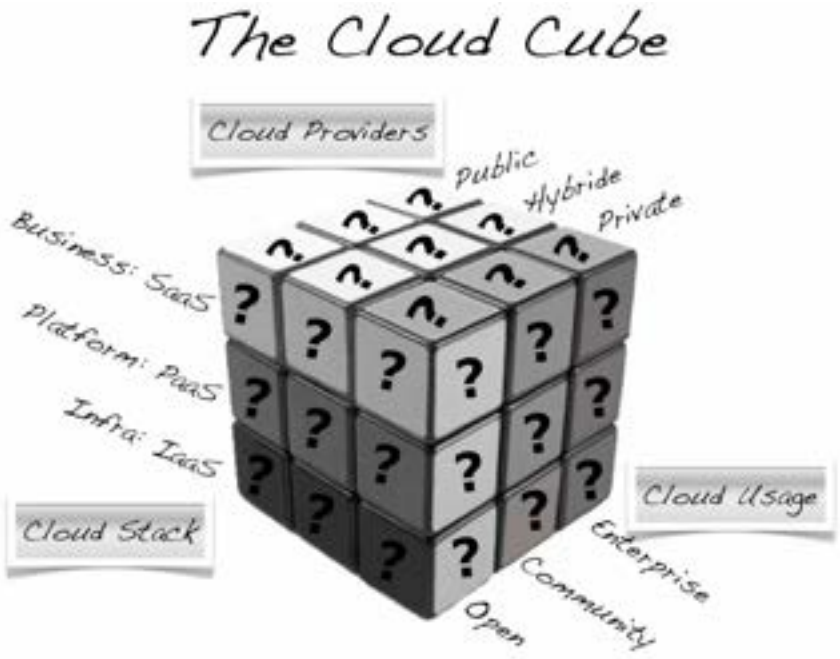

Figure 6.4: Capgemini Cloud Model Usage

6.4.2 The Use of Capgemini Immediate

Capgemini Immediate is a fully integrated service that can be used as an architectural model for different type of institutions in order to integrate and manage a multi-supplier Cloud package to fit the requirements of each institution. This approach is also known as Cloud brokerage.

The model is meant to build bridge between the existing system and new ways of customer interaction, therefore enhancing the continue change and innovation within the marketed services [35].

This model is the base model for the future reference architecture and an example can be viewed in Fig. 6.5. Also previous information has been included in section 3.5.

The main challenge is that this model was not intended for specific use within financial institutions and therefore special constrains need to be taken into consideration while adapting it for such an institution.

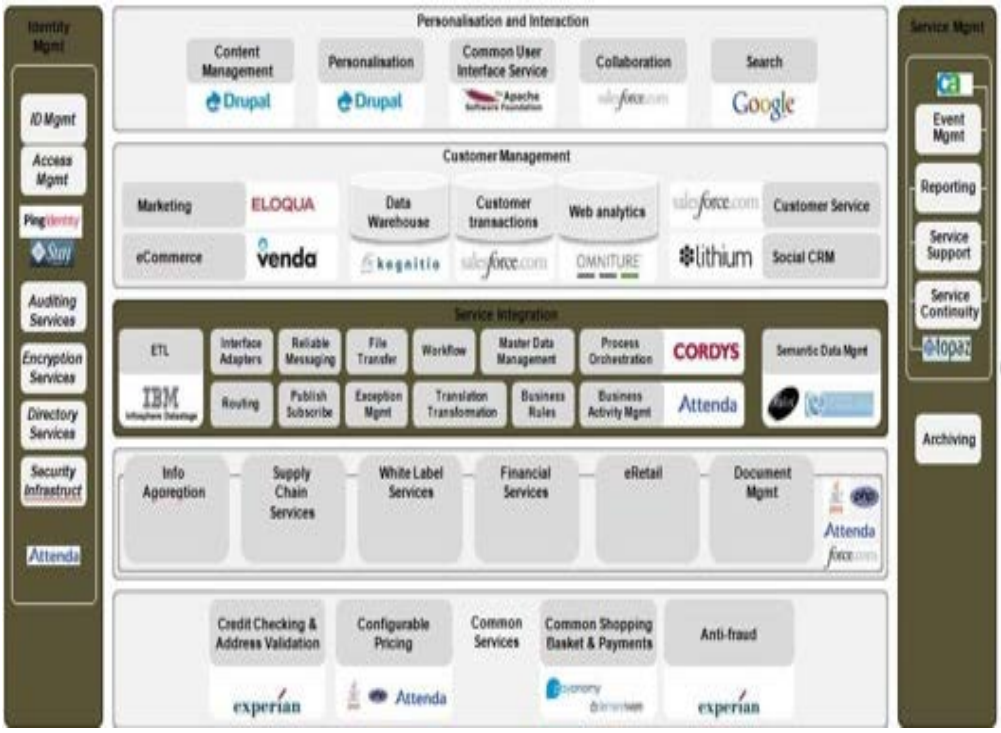

Figure 6.5: Capgemini Immediate Model Usage Example

As it is shown in the previous figure, this model is divided into seven integrated modules: Personalization and interaction, Customer management, Identity management, Service integration, Service management, Specialized services and Common services. This model is also known as the "**H**" model, due to its components and their provisioning.

The first two components can be viewed as Cloud provisioned components, specialized on different areas in customer interaction and management. They can be provided by different Cloud providers, as shown in the example.

The next three components, the dark color ones, are the integration components that Capgemini proposes in order to facilitate a complete solution, flexible, with plug-and-play capabilities, that provides a process orchestration between on-premises systems and SaaS services in the Cloud.

The last two components can be composed of legacy (or new) systems and can unify common services (Cloud or on-premises based).

With this organizational style in mind, although not customized for financial institutions, there are some noticeable improvements that could be useful in this crisis period for any institution. Such advantages are: automated search, integrated pool of services and advantageous payment model that the Cloud offers.

In the next section a case study is proposed in order to analyze how the above mentioned models could integrate Cloud computing within financial services provision.

6.5 Summary

In this chapter the architectural framework has been presented including TOGAF and IAF. Also the use of Cloud cube and Capgemini Immediate has been explained.

The first two have been presented in order to familiarize the reader with the concepts used in the future proposed reference architecture.

The last two are the models that stand as base to the reference architecture. The Cube model will help analyze and categorize the functional areas of the future reference architecture, proposing the best provisioning schema for each. At the same time the Immediate model will help structure the functional areas in a coherent cloud model for the financial institutions.

These models help integrate the information gathered in chapter 4 with the specific needs of a financial institution, presented in chapter 5, resulting in an architecture that bridges the knowledge gap between the classic Immediate model and one that has to be as flexible as possible in order to allow financial institutions to modify their behavior according to the market needs.

Chapter 7

The Reference Architecture

The main goal of this thesis is to propose a reference architecture for financial institutions using Cloud solutions thus, this chapter presents the architectural design and explains the architectural decisions that influence the proposed architectural solution.

7.1 Analyzed Case Study Institution (ACSI)

In order to propose a reference architecture, a case study institution has been created and named ACSI Bank. This institution is presented in this section from a current state, based on previous knowledge that specialists from Capgemini gathered and information acquired thought the questionnaire from chapter 5, to a desired state, represented by the reference architecture.

7.1.1 ACSI Bank as Reference Organization

According to the framework for Business Reference Architecture used by Capgemini, there are four main business domains within a financial institution (represented as IAF logical business components in Fig. 7.1 [50]): Core insurance and pension, Core banking, Financial advice and Shared services. These are also the building blocks for ACSI Bank.

Core Insurances and Pension domains and **Core Banking Services** are clustered around product and target groups. In the case of core banking the groups might differ largely depending on the services offered by the financial institution. Each domain is responsible for [50]:

- Product Management: development, engineering, packaging, pricing and simulation.
- Sales: product group specific sales.
- Contract management: support of the full life cycle: advising, calculations, quotation, contract maintenance, benefit management, claim handling and all back-office processing.

Shared Services steer the core business domains. Services from supporting domains are of highly generic nature and not business specific [50].

Financial Advise Services are aimed at private persons, self employed persons or companies, concerning customers financial advise one or more financial services domains. Financial advise is regulated by the government in order to guarantee objectivity and independence [50].

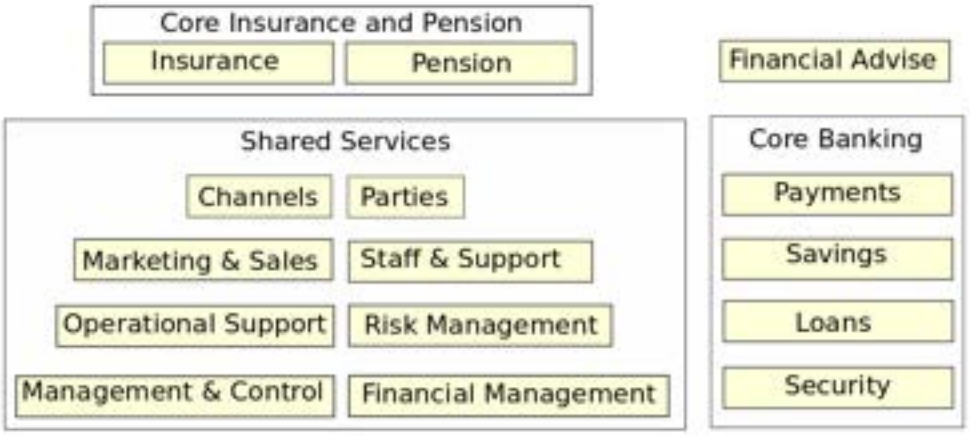

Figure 7.1: ACSI Business Reference Architecture (high level components)

Based on these building blocks and the general profile of the interviewed institutions a short description of the modeled institution can be highlighted as:

- ACSI is a large Bank with multiple offices spread across different countries.
- It is engaged into multiple domain offerings including insurance, pension and core banking services.
- It has its own data storage and infrastructure in place.
- It is struggling to overcome integration and standardization problems generated by legacy systems.
- It wants to offer customized services at best prices to its clients.
- It is looking for an advantage over competitors in order to attract new customers that experience lack of trust in other financial service providers due to existing socio-economical situation.
- It is willing to invest in innovation for a better and more flexible future.
- It shows a keen interest in Cloud computing.

This characterization is made to incorporate the majority of functionalities a bank has, in order to provide a wide coverage for the future reference architecture. This will allow it to be flexible and applicable in any financial institution, indifferent to its specific services or its area of expertise.

7.1.2 ACSI Bank Principles

Operating model requirements are also known as principles and represent a set of statements that define how an organization must operate in order to achieve its ambition. In order to get a clear business case, the requirements are divided into:

- a basic set: the minimal set of requirements on the realization of key improvements to the existing situation.
- an optional set of additional requirements.

Due to the generic nature of our institution the **basic set** can be defined as the cutting edge requirements for a financial institution in order to align with technology in use. Also Cloud computing should be the main technological focus. These requirements include:

1. Self-service via the Internet,
2. Automated reports to regulators,
3. Single point of contact for all customers,
4. Multi-device interaction,
5. Communication via social media,
6. Up to date and complete customer profile,
7. Data protection and regulation compliance,
8. Non-core domains will be outsourced,
9. Flexible architecture to allow plug-and-play approach towards new distribution channels and products.
10. Cloud integrated solutions

Additional requirements:

1. Innovative product delivery channels.

Not all the principles have the same priority and not all can be met at the same time, depending on the institution requirements and available resources, therefore, in general, a ranking of requirements is performed.

In the case of ACSI Bank the full rational behind the business principles can prioritize as follows:

Principle	**Full rational** (motivation and implication)	**Priority** 1 to 5 1=high
Self-service via the Internet	Customers should have access to products, services and application forms via Internet.	1
Automated reports to regulators	Reporting to regulators should be facilitated by the system in an automated manner.	5
Single point of contact for all customers	All customer interaction channels should be centralized in order to offer coherent information and assistance.	2
Multi-device interaction	Provide access to products in a device independent mode (for smart phones and pads).	4
Communication via social media	Social media provides useful marketing channels and user information.	3
Up to date and complete customer profile	Unify customer information from all channels and provide them in an accurate profile.	1
Data protection and regulation compliance	Customer data and transaction information should be protected at all time and hosted in compliance with existing legislation.	1
Non-core domains will be outsourced	All competences related to non core banking and none core insurance ans pension services will be outsourced.	1
Flexible architecture to allow plug-and-play approach towards new distribution channels and products.	Flexibility is one of the most important assets for a financial institution and the architecture should support it. Loosely coupled components are preferred.	2
Cloud integrated solutions	Cloud technology will be used in possible areas.	1
Additional requirements		
Innovative product delivery channels	New ways of using technology should be identified using a futuristic approach.	3

All priority 1 principles have been important discussion points within the questionnaire and have been categorized as highly sensitive areas within a financial institution.

Although "Cloud integrated solutions" it is not considered a priority yet by the financial institutions, it has been priorities as very important for ACSI Bank based on the goals of this thesis.

The priority 2 principles represent areas identified during the interviews as areas that need improvement in real market situations.

Priority 3 includes the innovation element that can create added value through new delivery channels, a constant goal in the real market situation.

"Multi-device interaction" is ranked 4 not because lack of importance, but because it is a non core banking activity that might be combined with new delivery channels and therefore is closely related to the 3rd priority, but not necessary.

Last priority in this list is "Automated reports to regulators" because it involves sensitive information, and even if it is an important matter for a financial institution, it is generally performed through on premises legacy systems and has little to do with the main goal of this thesis and Cloud computing.

As previously presented, the priority for each principle has been established based on the goals of this thesis and the major trends in the industry. Also an important contribution to this classification is attributed to the results of the questionnaire.

This ranking is not to be considered valid for each and any financial institution, but just as a general overview of the most important challenges the reference institution has to overcome at this moment within its technological development.

7.1.3 ACSI Bank Business Perspective

In order to be able to develop a software package and customized it to the requirements of ACSI Bank, it is necessary to understand the business components of a bank in more functional detail then the ones presented in the reference architecture above (Fig. 7.1).

Such a view is developed and used by Capgemini experts to help propose SaaS solutions for the banking sector. This view is a BPM model that is continuously improved, due to the changing nature of financial service.

Even so, a high level view is sufficient for the purpose of these thesis. One such view is presented as an extract based on the existing ongoing project, limiting the detail level in Fig. 7.2.

There are a few differences between the high level Business Reference Architecture (Fig. 7.1) and the generic model of a Bank (Fig. 7.2).

Despite this, components can be mapped according to their functionality, therefore the model only rearranges blocks of the reference architecture in a manner suitable for business and IT strategy alignment. To be more exact:

- Core Insurance and Pension = Insurance
- Core Banking = Core Banking and Capital Markets
- Financial Advice = Financial Advice
- Shared Services = Distribution Channels, FS Institutions, Mid Office (except Financial Advise) and Control & Support.

Based on this Bank model, that is presented as the business architecture of ACSI Bank, the proposed solution will aim at fulfilling the principles presented previous.

Figure 7.2: Bank model - High Level Contextual View

From a Business strategy perspective, the **Mission statement** of ACSI Bank encourages:

- Business and IT alignment,
- Use of Cloud computing technology to reduce costs and allow a flexible development,
- Client interaction through multi-devices,
- Innovation to improve service availability,
- Client centric perspective.

The **Vision statement** expresses that:

- increased attention towards client needs will improve the market share of the ACSI Bank and therefore help it transition this hard economical period even if it will prove to be a double-dip recession. Also it is considered that if technology is used properly, the ACSI Bank will get a big advantage over competitors and has a good chance at becoming the future market leader.

The Mission and Vision statements, basic components of a Business Strategy, have been summarized from various expert opinion during interviews within financial institutions and Capgemini.

For instance, Mr. Henk Holk, Sales Management Capgemini- Push Sales, explained in November 2010 how financial institutions are fearing a **double dip recession**, motivating that this calm period might be just the "eye of the storm" followed by some more economical unrest. In order to prepare for such a scenario, he expressed the necessity of SaaS adoption to facilitate cost reduction and flexibility.

In a different interview, Mr. Bas Schuurmans, International Retail Banking Expert with Capgemini, shared his vision about personal financial advice and underlined the transformation towards a **customer centric** organization that he furthered detailed in his PhD. Thesis [51].

Mr. Paul van Dommelen, business architect within Financial Service Capgemini, shared his experience and highlighted the importance of **business and IT alignment** for optimal results within financial institutions.

Also, throughout the interviews with financial institutions, customer interaction aided by **innovation** and **multi-devices** is a shared topic of improvement and **Cloud** computing represents an important focus of research.

7.2 The New Operating Model

The new operating model expresses improvements needed to fulfill the requirements form the previous section. It is divided into Design Principles, meant to underline core rules reflected in the new architecture, and Operation and IT Strategy, meant to connect the Business view with the future IT architecture.

7.2.1 Design Principles

The design principles have been formulated as a consequence of constrains that a financial institution must respect and the attributes that would give it an advantage over competitors in market today. Some of this design principles are:

1. The proposed solutions must be based on innovation and flexibility.
2. Cloud computing is key component of the future system.
3. Sensitive data must not be outsourced to third party providers.
4. Access to the secure part of the web site requires a combination of knowledge and possession.

5. The primary channels of Internet banking are the Internet and Call center, but also device integration(Pads and Smart Phones) is an important desire.

7.2.2 Operation and IT Strategy

When drafting the IT strategy, some important requirements to keep in mind are: Outsource (pay per use), Standardization and Regulation Compliance.

The development base for a new IT strategy are areas that could benefit from Cloud computing. These have been identified based on their use of sensitive information that could not be outsourced and are depicted in the Strategy Scope (fig. 7.3).

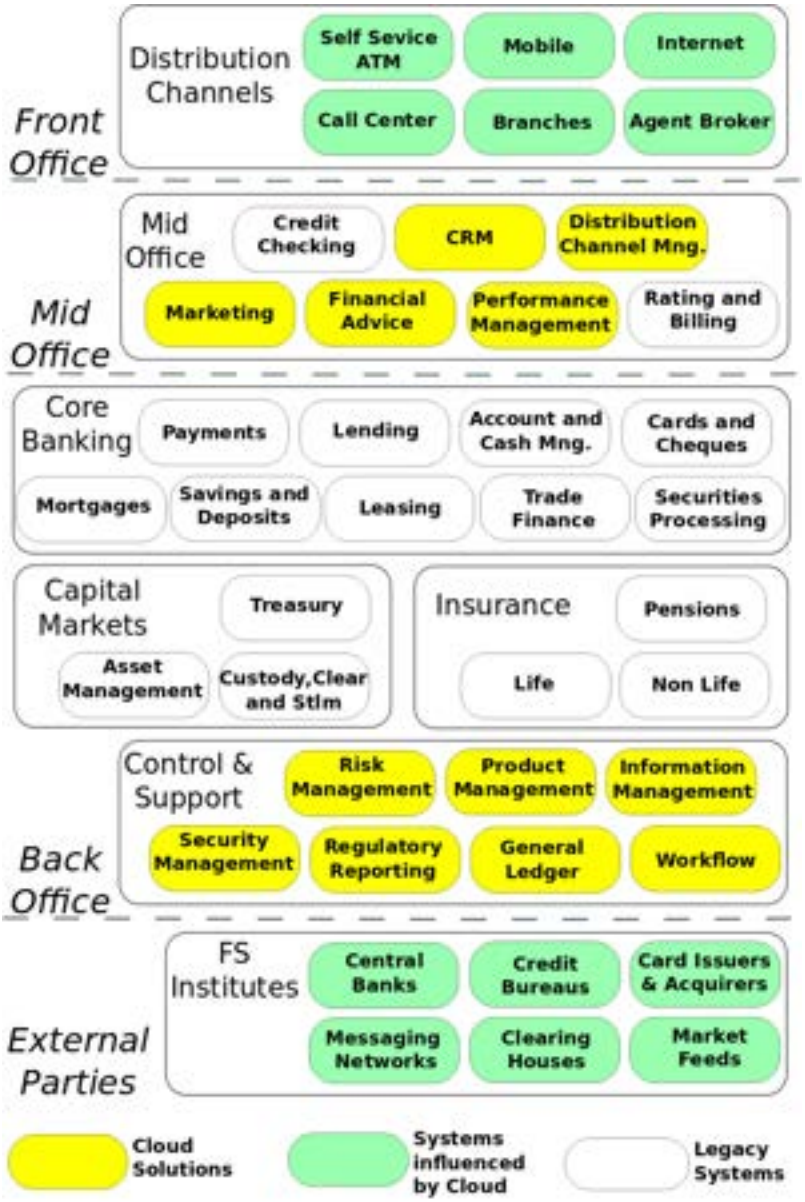

Figure 7.3: Strategy Scope

To be more explicit:

- Cloud solutions are going to be proposed for the IT systems operating in the **yellow** logical business components;
- **Green** logical business components can be influenced and improved by the adoption of Cloud solutions. They do not represent IT systems, but external parties and distribution channels. From an IT perspective, they can be viewed as interaction channels and can benefit greatly from Cloud adoption.
- The **white** logical business components are not in the scope of this strategy because they handle sensitive information that is hosted on premises. This areas can be improved through Virtualization, fact that is practiced in all the interviewed financial institutions.

The next step is to analyze what is the most suitable Cloud provisioning model for each business component and therefore Capgemini Cloud Cube is used. This helps characterize each business component from the perspective of Cloud providers, Cloud usage and Cloud stack level.

CRM solutions benefit from the resource pooling that Cloud provides, but in the case of financial institutions they also handle sensitive data, therefore an *Enterprise Hybrid SaaS* solution is the most suited as long as the interaction with the internal data is done in a secure mode that might also be improved by use of customized cryptography and an intricate set of data access keys to protect customer identity and transaction details.

Distribution Channel Management, **Marketing**, **Financial Advice and** are areas that can be improved by adopting *Open Public SaaS* solutions because they provide customer interaction, but do not handle customer or transaction data, therefore can be hosted in the Cloud and do not require any special platform or infrastructure specification, therefore SaaS.

Also **Performance Management, Risk Management, Product Management, Regulatory reporting, General Ledger** and **Workflow** can be improved through *Enterprise Public SaaS* solutions because they all address only the enterprise, but do not handle customer or transaction data, therefore can be hosted in the Cloud. Also the best level is Software as a Service not requiring any special platform or infrastructure specification.

Information Management includes development and testing of new solutions and therefore can benefit from *Enterprise Public IaaS* that offers scalable infrastructure, tools for development and testing and an easy interaction between testing and development. Also various specialized solutions for backup, data and storage management are the main offers within Infrastructure as a Service.

Security Management is best suited for an *Enterprise Private PaaS* maintaining privacy and control over the system and at the same time improving flexibility.

For **FS Institutions,** a *Community Public SaaS* solution can greatly improve communication and business relations by interlocking all these institutions in a Cloud.

With this general improvement specifications in mind, it is possible to identify the best place in the Capgemini Immediate Model for each component of the Bank model (Fig. 7.4).

This tailored Immediate Model for financial institutions represents the blueprint for the future reference architecture. It is devised according to the assessment of the bank components using the Cube model and therefore three main areas can be distinguished:

- The three upper layers ("Front Office and External Parties", "Mid Office" and "Back Office") will be mapped with Cloud solutions.
- The "H" layer is the integration level between Cloud and in-house systems.
- The last four layers ("Common services", "Insurance","Capital Markets" and "Core Banking") will be mapped on the existing systems.

Also , due to the typical legal issues, customer and transaction data is hosted on the premises, as seen in the model.

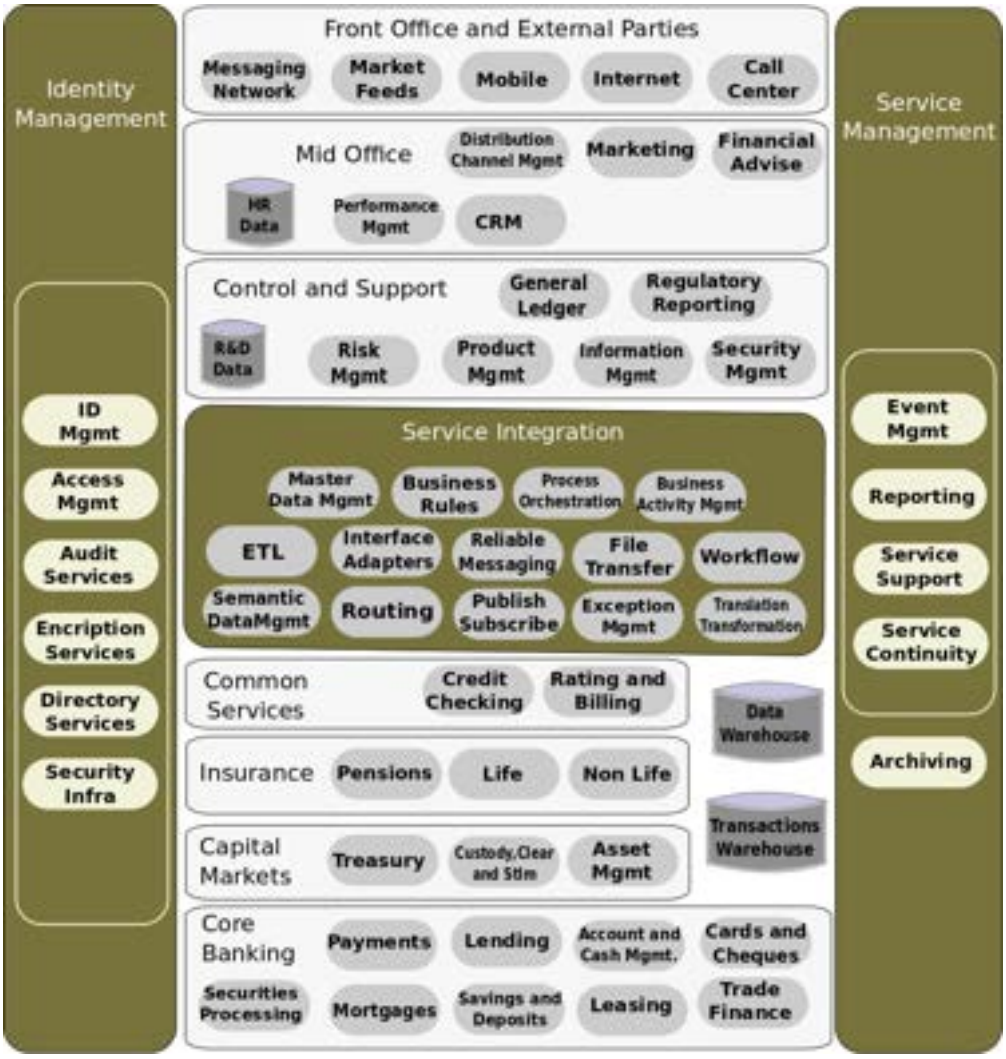

Figure 7.4: Capgemini Immediate for Financial Institutions

7.3 The Reference Architecture

The reference architecture is design according to the target operating model **requirements**. They are represented within different structures of the architecture. Also while designing this reference architecture non-core domains have been outsourced, flexibility has been added to allow plug-and-play approach towards new distribution channels and products through Cloud integrated solutions.

In order to represent the proposed reference architecture, IT components are mapped to the previous Immediate model according to the requirements of ACSI Bank. For this reason the "**Reference Architecture**" (Fig. 7.5) presents component clusters based on their IT functionality.

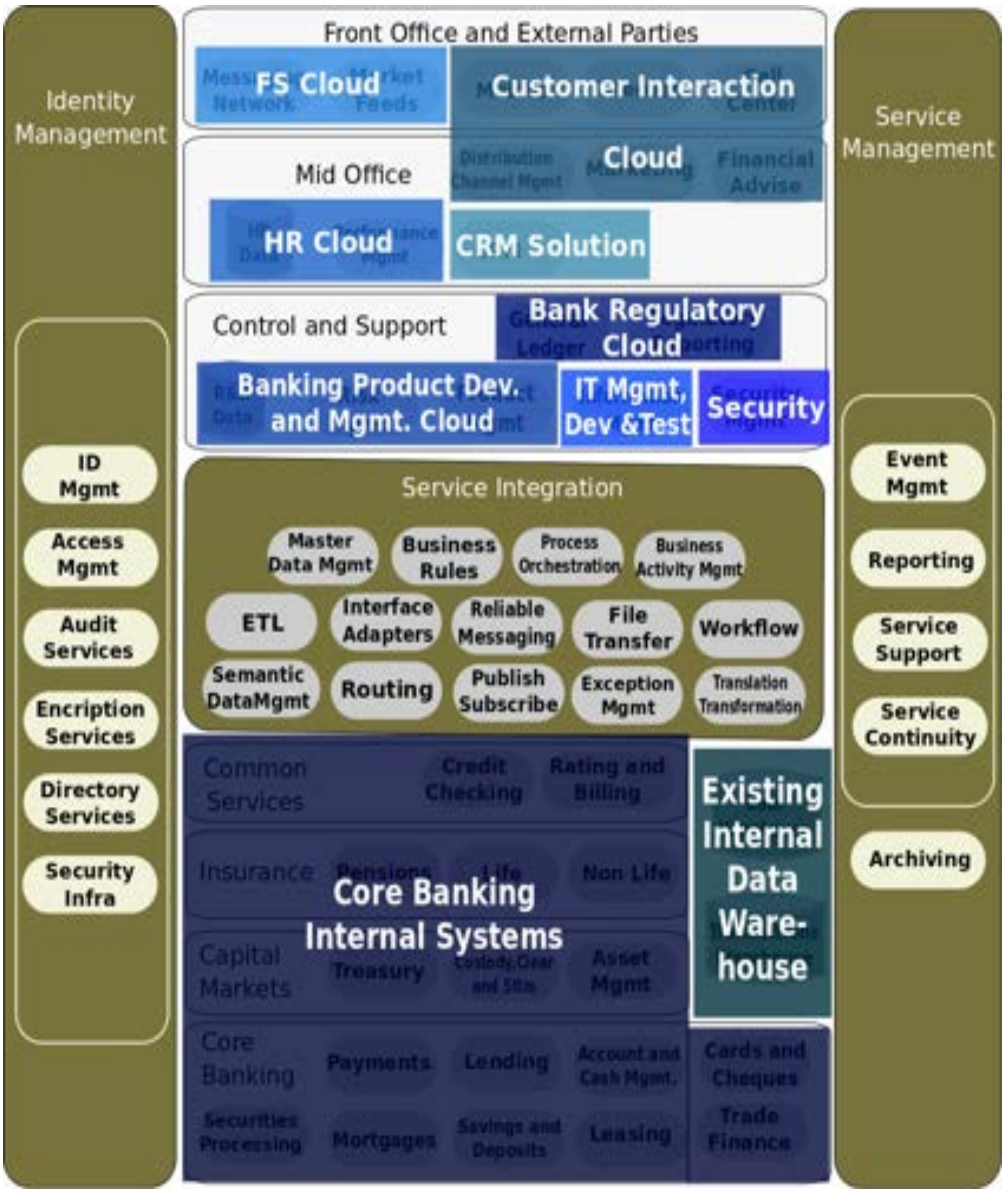

Figure 7.5: Reference Architecture

To be more explicit, the Reference Architecture is composed of:

- Customer Interaction Cloud, a **Open Public SaaS solution package** that handles all customer interaction integrating mobile accessibility, Internet portal and Call Center solution. This solution package should also provide self-service via the Internet, single point of contact for all customers, multi-device interaction and communication via social media.

  Also Marketing and Financial Advise software solutions should be part of this Cloud, thus improving client oriented services and increasing communication capabilities amongst software components.

- FS Cloud is a **Community Public SaaS solution package** that connects messaging and market feed from all banking community (Central Banks and other financial institutions) in order to provide accurate and constant communication.

- a CRM **Enterprise Hybrid SaaS solution** facilitates from the limitless resources and pay-per-use features of the Cloud and should offer an up to date and complete customer profile.

- HR **Enterprise Public Cloud** integrates HR data and software solution.

- Banking Product Development and Management Cloud is and **Enterprise Public SaaS** and required **Data storage** in order to perform risk calculations and predictions.

- Bank Regulatory **Enterprise Public SaaS** that should allow automated reports to regulators and integrate seamlessly with the general ledger application.

- IT management, development and test Cloud is provided via an **Enterprise Public IaaS** in order to allow scalability and instant provisioning of resources.

- an **Enterprise Private PaaS** for security management solution that allows data protection and integrity.

- an **Integration and Orchestration layer,** the Immediate specific "H", is included to provide communication amongst all Clouds and on premises data, identity and service management. It is composed of identity management, service management and service integration components. This layer is hosted by the consultancy company or operated by the consultant on the premises of the financial institution. Also it is the layer that facilitates Cloud brokerage.

- an **on premises Data Warehouse** for all the sensitive information**.**

- multiple packages of **on premises banking software** solutions specialized for different business units.

Also, the system as presented in the Reference Architecture (Fig. 7.5), is a complex solution package that integrates multiple Cloud and on premises applications, therefore in order to establish the boundaries of the system and to exemplify the interaction the following component diagram (Fig. 7.6) is introduced.

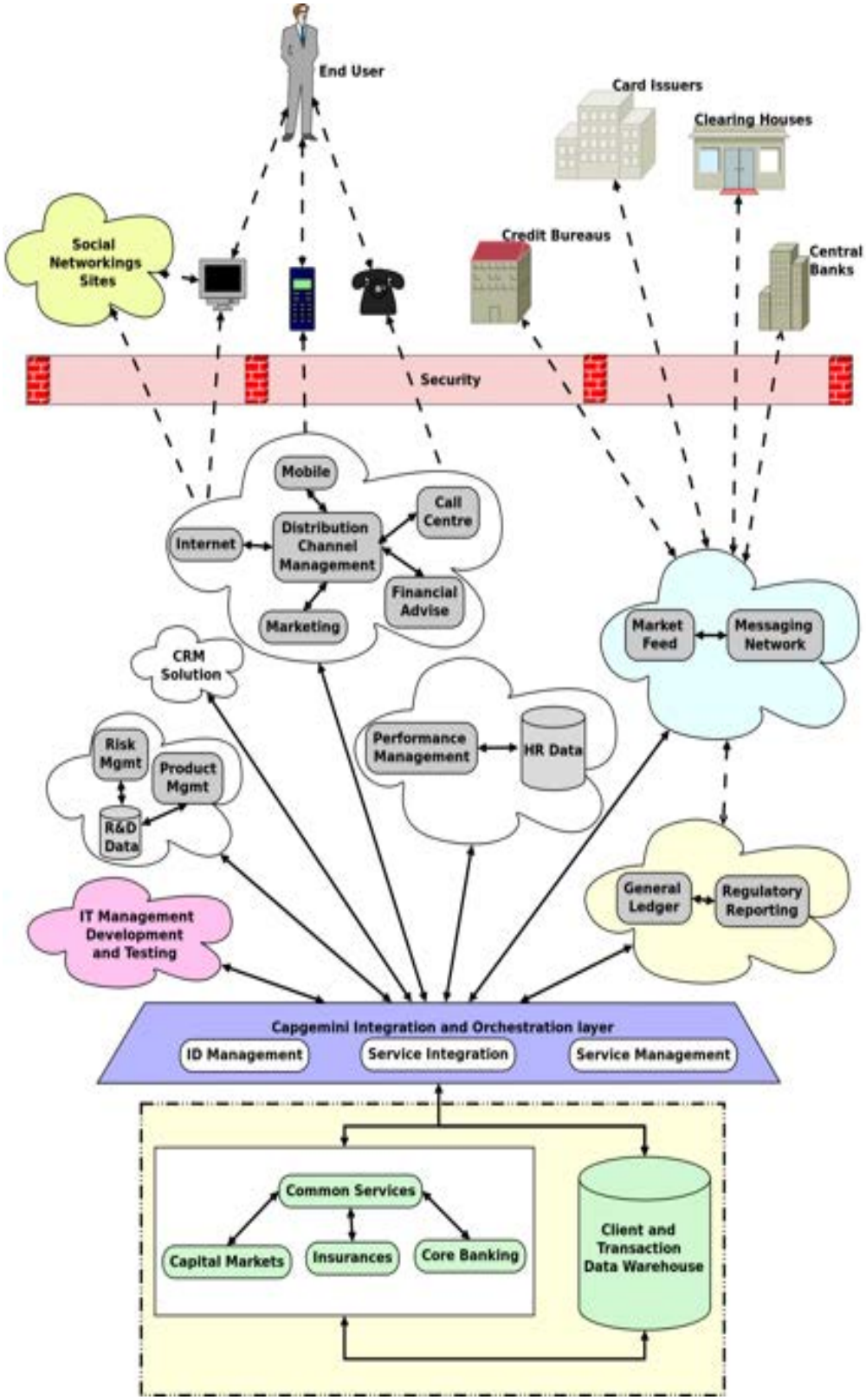

Figure 7.6: System Component Diagram

In order to implement such drastic chances it is considered that the ACSI Bank institution is at the right level of maturity. For these major transformation projects, the existing IT infrastructure and software integration should function at high capacity, quality and performance standards. This is required in order to allow the institution to set **strict SLAs** at a detailed level, avoiding future misunderstandings regarding unforeseen situations.

One of the main motivations for such an important change should be **lack** of internal resources for a good functionality and growth. Therefore the resources that are freed by outsourcing the non-core applications can to be used to allow expansion of the existing system and future improvements.

7.4 Summary

In this chapter a generalize form of a financial institution has been introduced as ACSI Bank in order to provide a solid base for the reference architecture. Using the Cloud Cube, business reference architecture has been divided into strategically useful functional areas that can be influenced by the Cloud technology taking into account specific regulatory needs of financial institutions.

In the end the results of this process in combination with relevant requirements gathered in interviews with different specialists have been mapped to the Capgemini Immediate model in order to obtain the needed reference architecture for financial institutions.

The new Immediate for financial institutions model has been explained and the interaction between its components has been depicted in fig. 7.6.

Chapter 8

Proposed Solution for ACSI Bank

To test the usability of the reference architecture developed in the previous chapter, a proposed solution for the ACSI Bank will be investigated in this chapter.

8.1 IT Scenarios

Three different scenarios have been chosen that represent the main approaches for implementing SaaS solutions within financial IT. They are also used by Capgemini experts to propose solutions for existing customers. The reference architecture will be applied for each of these scenarios as an assistance tool that will help developers to make the right choice regarding their particular requirements.

In the case of ACSI Bank the technological principles have been identified and used in the questionnaire in order to get a general perception of the importance each principle has in a real financial institution. These principles will also be used as knock out criteria in future steps in order to provide the final proposed solution.

Due to the fact that ACSI Bank is a fictional reference institution, the evaluation is based on previous knowledge gathered in similar projects by Capgemini experts. This evaluation might vary depending on the state of the existing IT system, therefore in the case of a real institution an assessment of the existing IT based on well defined functional parameters is needed.

For ACSI Bank the evaluation of the scenarios is as follows:

	Scenario	**Customer Centric**	**Best of Breed**	**Product Centric**
Principle	User Acceptance	+	+	-
	Cost	-	-	+
	Performance	+	+	+
	Flexibility	-	+	-
	Development and implementation time	-	-	+

In the previous table ”+” represents an advantage that scenario has in comparison with the others and “-” is a disadvantage.

”Proposed Solution” are designed for each scenario in order to map IT solutions to the previous identified functional clusters. By going so, the architectural rational can be explained step by step and traced to any point of misunderstanding or uncertainty. Also this underlines the architectural decisions and makes reuse of existing knowledge from previous Capgemini projects.

This three scenarios are not the only ones that can be formulated. In the case of an actual institution they can differ depending on the situation of the existing IT infrastructure and software solutions. Also specific requirements or preference towards certain third party providers can limit or extend the list of scenarios.

For ACSI Bank it has been considered that there are no favorite third parties, but, as shown by the questionnaire, the institution will favor large and stable Cloud providers. Also existing infrastructure limitations have not been taken into consideration due to the fact that the proposed solutions will not regard existing core systems, that continue running on the same machines, and the integration solutions between the legacy systems and the new systems will not be specifically handled by ACSI Bank, but by Capgemini.

In order to propose the actual software solutions in these scenarios, previous SaaS projects have been considered due to the fact that no evaluation framework has been found. Therefore the main assessment method is based on specialists and their gathered knowledge. In an actual institution an assessment framework might used in order to determine what software would be “best-of-breed” or more “customer centric”. Even though, such a framework is beyond the porpoise of this thesis and can constitute a valuable future research.

Also, even if Capgemini Immediate has some existing preferred providers, the software solutions proposed for these scenarios will not be limited to the existing partners due to the fact that Immediate is not built with financial institutions in mind and therefore some specialized providers might have not been included. The choose providers are part of previous financial SaaS solutions and therefore it is assumed that their credentials and capabilities have been assessed.

8.1.1 Customer Centric

In this scenario the ACSI Bank will adopt the customer centric approach. For this method the software presented in Fig. 8.1 is chosen.

The particularity of this scenario is represented by the fact that in order to provide customer centric products an important system change must be also implemented within ACSI Bank on a business and IT level[51]. This change will implicate software changes that are provided by Temenos, a company specialized in Banking software. Except the IT changes also important business changes must be taken into consideration for this scenario. At this moment in time all financial institutions interviewed are divided into product lines and therefore do not support a customer centric approach.

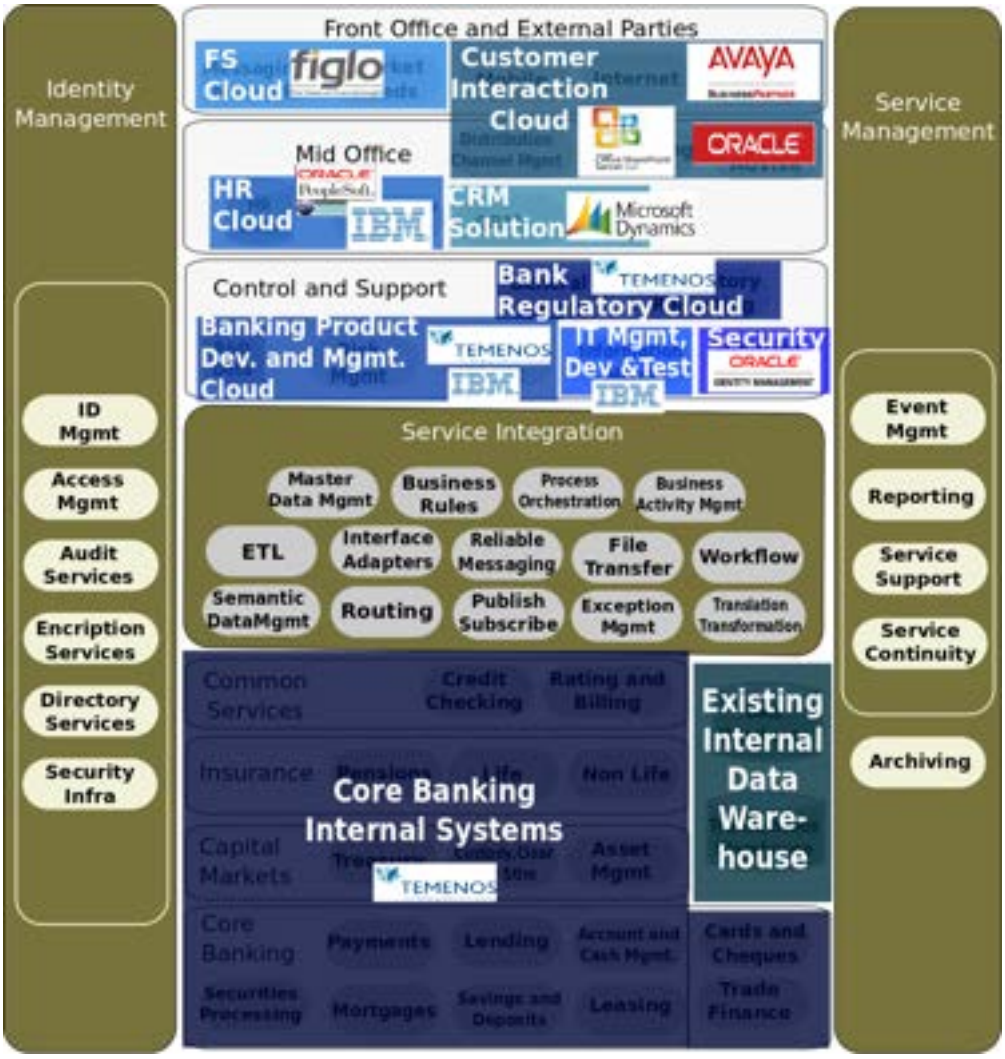

Figure 8.1: Customer Centric Scenario - Proposed Solutions

The external cloud solutions have been selected in order to provide a general customer centric approach and are as follows:

- *Customer Interaction Cloud*: Avaya (business communication solutions) for the call center, Microsoft Office SharePoint for the channel integration and Oracle solutions for financial advice and marketing.
- *FS Cloud*: Figlo (financial platform) to integrate and orchestrate market feeds and messaging.
- *CRM* : Microsoft Dynamics.
- *HR Cloud*: IBM for data storage and Oracle SharePoint solution.
- *Banking Product Development and Management Cloud:* IBM for data storage and Temenos specialized solution package.

- *Bank Regulatory Cloud:* Temenos specialized solution package.
- *IT management, development and test Cloud*: IBM IaaS and Storage.
- *Security SaaS*: Oracle Identity Management.
- Integration and Orchestration layer: Capgemini.

8.1.2 Best of Breed

In this scenario solutions that form the best set mapped to the functional areas as shown in Fig. 8.2. Even if taken individually each of the proposed solutions might not bee the best, but due to its perfect integration within the system, the proposed package is the best of breed for financial institutions at this moment in time.

There are no internal changes for this scenario and in order to create the best solution interaction possible all packages are **Oracle**, this being the best Financial Software provider in the areas of CRM and Human Capital Management and also providing various solutions specialized for financial institutions[52].

- *Customer Interaction Cloud:* Oracle Marketing, Oracle Interaction Center, Advanced Inbound Telephony and e-Business suite.
- *FS Cloud*: Oracle PeopleSoft Financial Gateway.
- *CRM*: Oracle CRM On Demand Wealth Management.
- *HR Cloud*: Oracle Global Core HCM and Workforce Management.
- *Banking Product Development and Management Cloud*: Oracle Lease and Finance Management.
- *Bank Regulatory Cloud*: Oracle Fusion Governance, Risk and Compliance.
- *IT management, development and test Cloud:* Oracle development cloud based on desired environments.
- *Security:* Oracle Identity Management
- *Integration and Orchestration layer:* Capgemini.

Due to the fact that all the software solutions are Oracle packages, the data storage, where needed, will also be done on Oracle platform for SaaS.

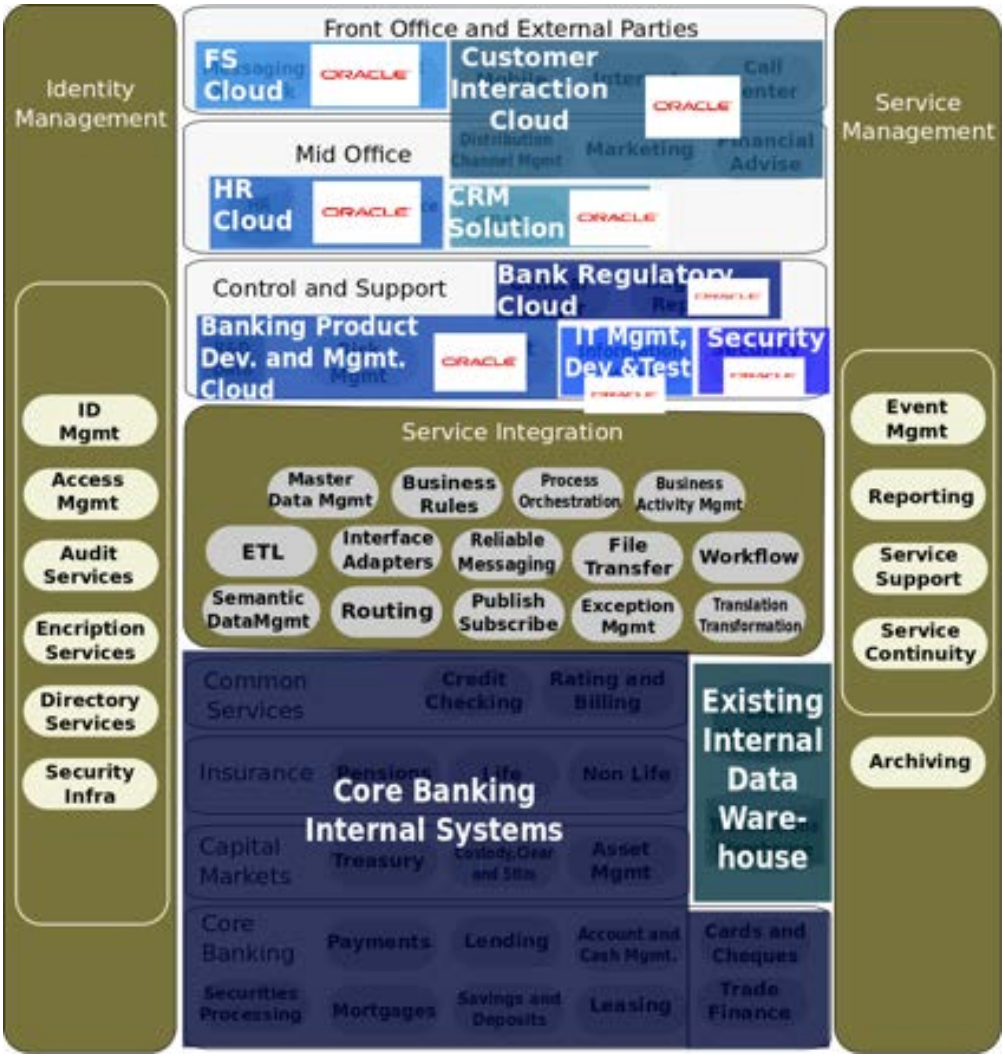

Figure 8.2: Best of Breed Scenario - Proposed Solutions

8.1.3 Product Centric

The product centric scenario (Fig. 8.3) proposes software packages that are based on the existing strategy within a bank: different product lines. Because of this no changes are required in the core banking system.

Also due to the combination of software providers, there might be more integration problems but also a lower cost then in the case of best-of-breed. The chosen solutions are:

- *Customer Interaction Cloud*: Avaya (business communication solutions) for the call center, Matrix five for channel integration, financial advice and marketing.
- *FS Cloud*: Figlo (financial platform) to integrate and orchestrate market feeds and messaging.
- *CRM* : Microsoft Dynamics.

- *HR Cloud*: IBM for data storage and Oracle SharePoint solution.
- *Banking Product Development and Management Cloud:* IBM for data storage and Temenos specialized solution package.
- *Bank Regulatory Cloud:* Temenos specialized solution package.
- *IT management, development and test Cloud*: IBM IaaS and Storage.
- *Security SaaS*: Oracle Identity Management.
- Integration and Orchestration layer: Capgemini.

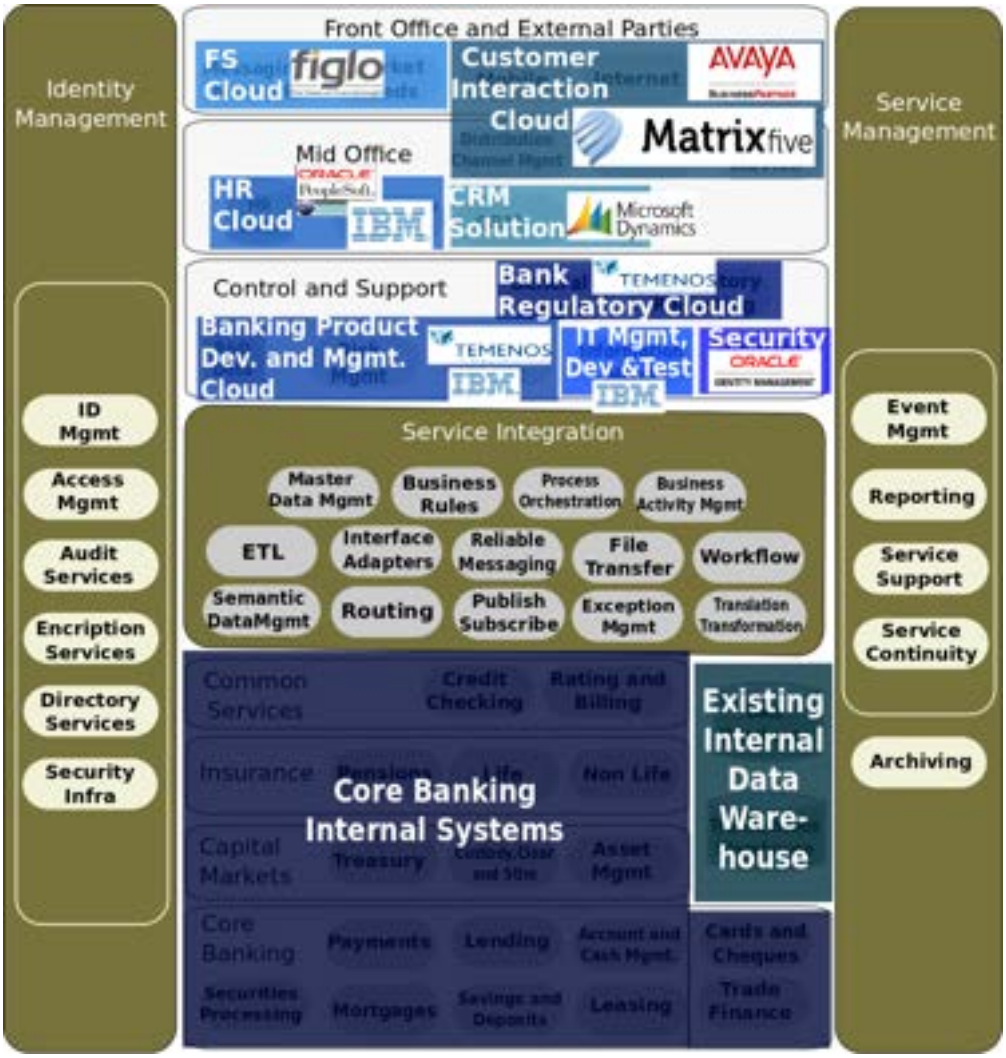

Figure 8.3: Product Centric Scenario - Proposed Solutions

8.1.4 Knock-out criteria

As seen in the previous chapters, the IT world of financial institutions has its particularities and therefore these are reflected in the criteria used for deciding a better set of solutions and providers.

In a different type of institution is most probably to expect as the highest influential criteria "Cost" , but in financial institutions the classification is different. As the questionnaire shows, even if there is a financial crisis, financial institutions can not afford the costs implicated in reducing the service quality or trust. Therefore the main decision factors and therefore knock-out criteria are:

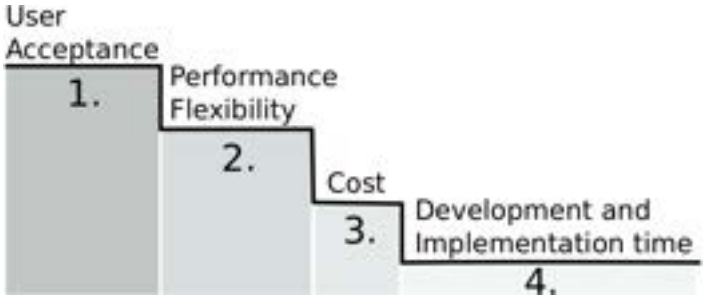

Figure 8.4: Knock-Out Criteria

Therefore by assessing the previous scenarios based on these criteria the following observations can be made:

- Product Centric Scenario does not fulfill the first criteria, the other scenarios having much more emphasis on customer acceptance and usability.
- All three scenarios have high performance, but Best of Breed Scenario offers maximal flexibility.
- Product Centric is the most inexpensive scenario.
- Product Centric has the fastest development time.

So, if we grade the scenarios, allocating points according to the importance of the criteria the following ranking results:

Principle (points)	**Customer Centric**	**Best of Breed**	**Product Centric**
User Acceptance (5)	5 (+)	5 (+)	0 (-)
Performance (4)	4 (+)	4 (+)	4 (+)
Flexibility (3)	0 (-)	3 (+)	0 (-)
Cost (2)	0 (-)	0 (-)	2 (+)
Development and implementation time (1)	0 (-)	0 (-)	1 (+)
Total points	**9**	**12** (most favorite)	**7** (least favorite)

Table 8.1: Scenario Ranking

8.2 Final Solution for ACSI

As shown in the previous section, the final solution depends on the preferences of a certain institution. In the case of ACSI Bank, the most favorite scenario is Best of Breed. This ensures a high standard service and an ease of integration between the proposed Cloud solutions due to the similar development and deployment standards used by the provider.

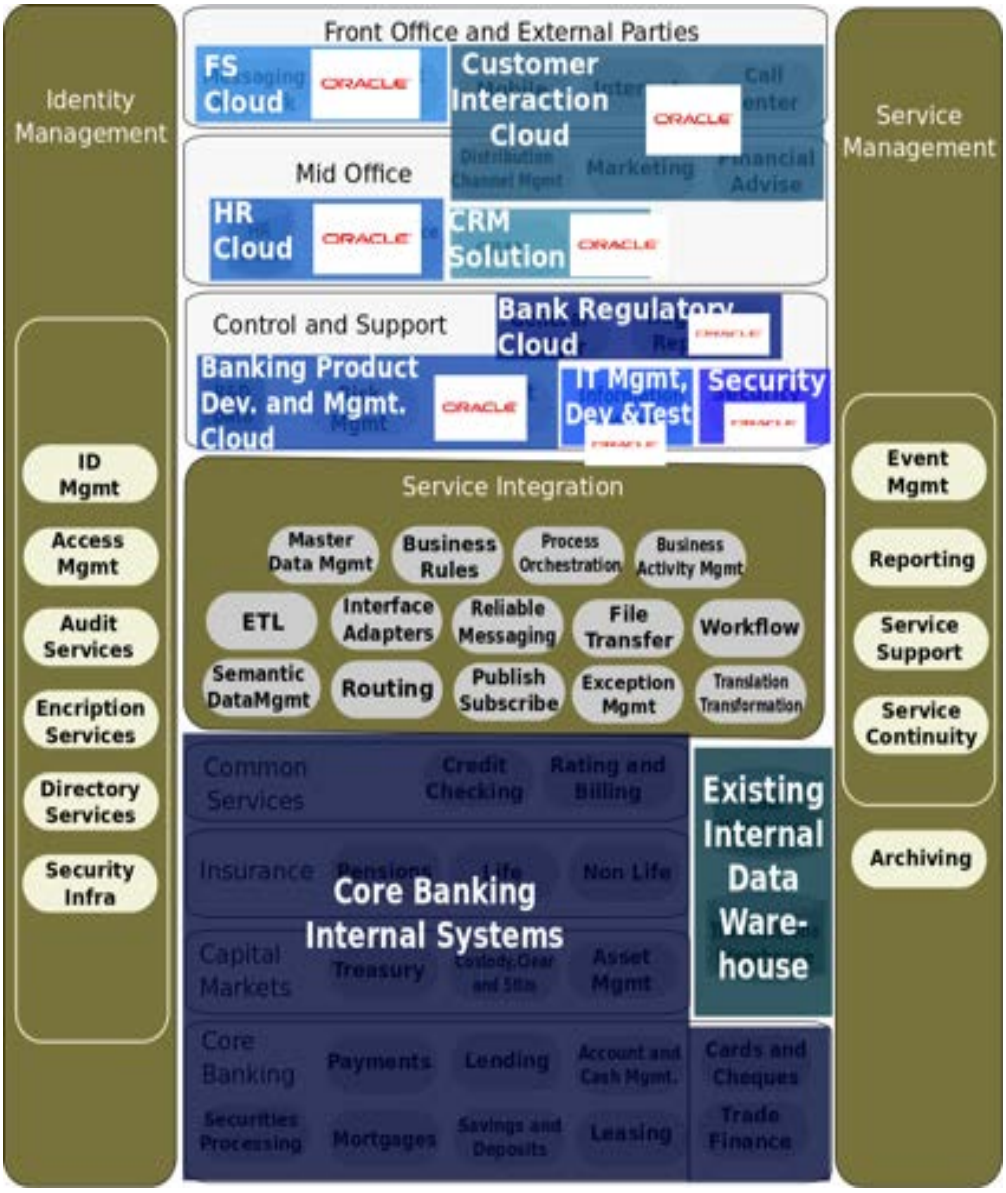

Figure 8.5: Final Architecture

Also this solution insures the fulfillment of the general requirements and regarding the **additional requirements**, integration of the token generator functionality within smart mobile devices is proposed in order to innovate product delivery methods in the

case of ACSI Bank. This can be done with the help of a specialized App.

Such an application should acquire the data contained by the Credit Card smart chip using a USB device. Once set, it should generate the access code using frequently updated algorithms in combination with a locally registered key (example: that can be based on the frequency of the card usage). This way access to the secure part of the web site requires a combination of knowledge and possession, but the mobility access is increased. This method is meant to be a good competitor for RFID and allow payments from a single source that is the most convenient to the user: the smart mobile device through a secure Internet connection.

This scenario has as main drawback the increased possibility of vendor locking. This has to be specifically handled in the very first stages of SLA drafting. Also, while choosing this scenario as most favorite, it has been considered that ACSI Bank is an institution that has the will, maturity and possibility to invest in the future and innovation.

The actual cost assessment of such a transition, the long term return on investment and its implications have to be investigated on a case to case basis. Such investigation must be performed for exact, existing software in an actual institution in order to better assess the trade-offs.

Also such evaluation in the case of a large company like ACSI Bank would be an unrealistic task for a master thesis due to the fact that large banks have thousands of applications used at the same time at different levels in the organization and in different geographical locations. Some of these applications are not suitable for Cloud computing, others are not at the level of maturity needed for a Cloud transition and a lot of them are applications that deal with sensitive data or can not be processed in the Cloud due to regulatory requirements.

For these reasons, in the case of ACSI Bank, the final architecture is considered the generic presentation of Bast of Breed scenario, build on the basics of Capgemini Immediate for financial institutions.

8.3 Summary

In this chapter the usability of the reference architecture has been tested for the case of ACSI Bank for three scenarios based on previous solutions implemented by Capgemini.

In the knock-out criteria also relevant information previously gathered in the questionnaires has been used to propose the most favorite scenario for the ACSI Bank and therefore demonstrate how the reference architecture proposed in the previous chapter can be an important decision tool for software developers.

In the end of this chapter, the results of the knock out criteria are presented as a final solution for ACSI Bank and some best practices are explained for a real institution in order to reach the final solution according to the existing requirements.

In the next chapter the business implications of the reference architecture will be discussed based on the solution reached in this chapter for ACSI Bank.

Chapter 9

The New Business World

Cloud computing has a large influence on how the business world can change, if implemented correctly. This change will not influence only the financial institution, but also the partners it interacts with and especially consultancy companies. To exemplify this change we analyze the business model of ACSI Bank and its interaction with a consultancy company, in this case Capgemini.

9.1 The New Business Model for Financial Institutions

In a financial institution, like ACSI Bank, multiple changes are going to occur after implementing Capgemini Immediate for financial institutions and therefore transitioning to Cloud. All these changes are reflected in the new business model.

9.1.1 Key Partners, Activities and Resources

After transitioning to Cloud, ACSI Bank has as key partners the consultant and other financial entities and regulators. There is no need to interact with software providers and maintainers for all its non-core banking applications. These applications form a large part of the actual software within a bank and a lot of times are the ones that generate a very diversify IT environment, hard to maintain and update.

In the Cloud paradigm aided by a consultant, ACSI Bank has only one partner that provides software integration and orchestration. The financial institution now assumes the role of software manager within various solution packages in order to customize and use the Cloud facilities to fit its needs.

Also in this view there is only one point of billing for all the required computational capacity and functionality: the consultancy company.

ACSI Bank in the Cloud can focus on primary banking activities and worry less about non-core banking software and hardware provisioning. This way the Operations and IT can handle larger customer demand and focus on delivering quality to the clients.

The key activities of the bank mainly do not change, but from a business point of view is back to basics, without great concerns regarding IT infrastructure. Cloud provides flexibility and scalability in order to put into practice various needs and because of its model, it is pay per use. This represents a large investment difference in comparison to dedicated on premises software and hardware.

The key resources are converted from technology to knowledge. Technology exists, but putting it to good use, in accordance to regulations, and managing it for best performance is the main focus for any institution adopting Cloud computing.

Also valuable resources are the lessons learned in the past, from the process of maturity within the on premises software. This is the start point of any SLA and therefore is the main guideline regarding what expectations a financial institution can have from a Cloud provider.

While regarding physical resources, the accent shifts towards networking and connectivity. Cloud computing is purposeless in an environment where the networking infrastructure can not allow access to the applications, processing capacity and storage space.

Because a financial institution is taken into consideration, it is worth mentioning that the existing resources are not lost, but just reused in a different scope, for instance to increase the number of customer that can be stored or processed at one time.

9.1.2 Value Propositions

In general, the Value Proposition describes the way in which needs within a specific target market are going to be met. In order to express this certain components need to be addressed as presented in Fig.9.1 .

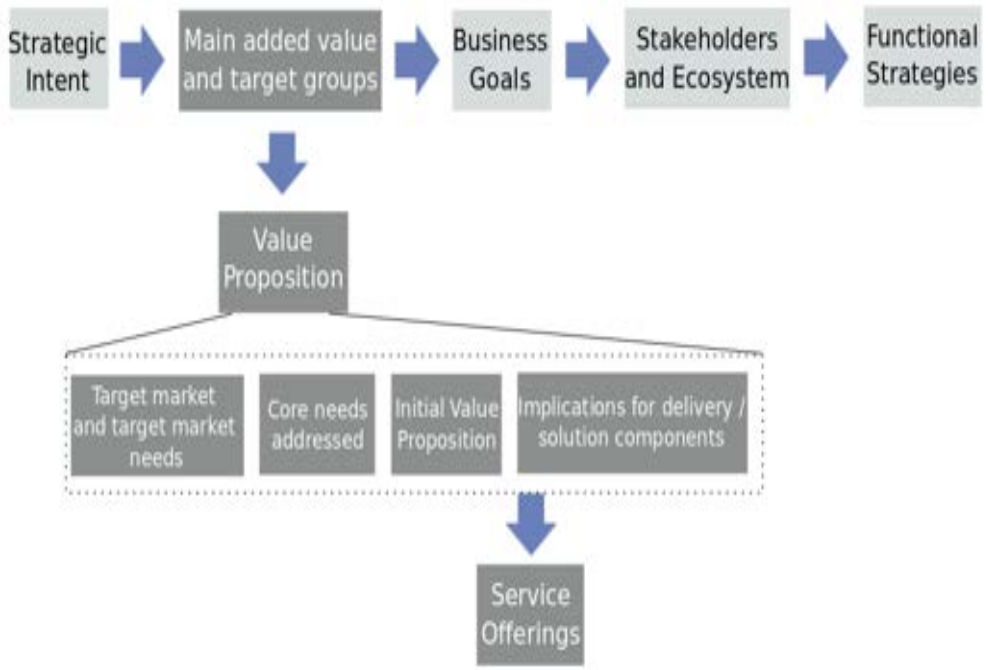

Figure 9.1: Value Proposition

According to the business principles expressed in the previous chapter, the added value provided by the proposed solution regards areas like:

- *Creating a single self-service point via the Internet and other channels with the help of multi-device interaction in order to allow customers non-stop access to*

the bank services and to create an integrated complete customer profile.

  - **Target market**: existing customers.
  - **Core needs addressed**: self-service point, single point of contact, multi-device integration, complete customer profile.
  - **Solution components**: Customer Interaction Cloud.

- *Integrating communication via social media within existing marketing channels in order to promote new products and develop the brand image.*

  - **Target market**: existing and potential customers.
  - **Core needs addressed**: communication via social media.
  - **Solution components**: Customer Interaction Cloud.

- *Automating reports to regulators in concordance with regulation compliance and data protection requirements in order to create a better interaction with partner financial institutions and regulators.*

  - **Target market**:partner financial institution.
  - **Core needs addressed**: automated reports, data protection and regulation compliance.
  - **Solution components**: Bank Regulatory Cloud.

- *Innovating product delivery channels to improve access to financial services for existing customers and attract new ones.*

  - **Target market**:existing and potential customers.
  - **Core needs addressed**: delivery channel innovation.
  - **Solution components**: Mobile App.

For each of the above mentioned added value areas a value proposition can be established based on a review and analysis of the benefits, costs and value that an organization can deliver to its customers, prospective customers, and other target groups. So, the value preposition can be calculated as:

$$\text{Value} = \text{Benefits} - \text{Cost (includes risk)}$$

Due to the fact that ACSI Bank is a generic institution and no project of similar size have been found, such an assessment can not be made for this case, but it can be calculated in the case of a real financial institution that implements the same reference architecture for the previous identified added value areas.

9.1.3 Customer Relationship and Delivery Channels

For ACSI Bank, as for any other financial institution, is important to provide good quality user experience. For this to be the case multiple business areas need to satisfy the same standards. The important steps in customer experience are represented in Fig. 9.2.

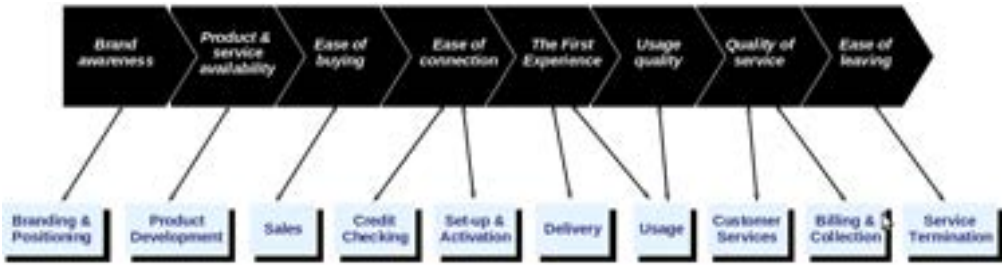

Figure 9.2: Customer Experience

In order to ensure this customer experience, multiple delivery channels are utilized. These include: Internet site, self-service portal, ATMs, mobile banking and banking retail chain (Fig. 9.3 [53]).

Figure 9.3: Delivery Channels

Also in the case of ACSI Bank an innovative system has been proposed to allow payments from smart mobile devices. This brings the banking experience to the customers pocket and integrates different technologies to allow instant payment. A concept presentation of this system, its functionality and its integration with ACSI Bank will be detailed in Chapter 10.

9.1.4 Customer Segments

ACSI Bank is a large financial institution that addresses all sorts of customers, private and corporate alike. The main activity segment is represented by retail banking and thus a large portion of existing customers are individuals.

In marketing there are different strategies to segment customers and within the banking sector one of the most used is relationship revenue (RR - revenue the relationship brings to the financial entity) and relationship cost (RC - price to build and maintain the relationship) segmentation.

By using these dimensions a two dimensional grid can be created and therefore four customer groups are identified [54]:

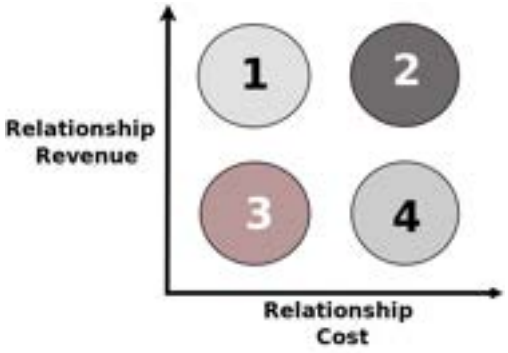

Figure 9.4: Customer Segments Based on Relationship Revenue and Cost

- **Group 1** consist of profitable customers, with high RR and small RC. The customers in this quadrant are customers towards whom the bank needs to adopt a strategy in order to reduce their exiting and switching because of the high impact such actions might have on the ACSI Bank capital.

- **Group 2** consists of customers with high RR and high RC, both profitable and unprofitable customers. The customers are active, with many interactions. As their RC is high, at the same time they represent a major potential: by changing the behavior of the unprofitable customers, the customer base profitability can be greatly improved.

- **Group 3** consists of customer with low RR and small RC. This group also includes profitable and unprofitable customers, but they do not represent the same kind of profitability potential as the customers in Group 2.

- **Group 4** consists of unprofitable customers, with low RR and high RC. These customers are probably not partial customers; more likely the customers in this group are low net worth customers who are still active like younger customers.

The grouping of customers presented above is static and therefore, for a real institution, it requires an additional analysis in which customers are followed over time so that migration patterns can be identified and influenced.

9.1.5 Cost Structure

The transition to Cloud implies a new way of thinking and a different provisioning cost structure. For an actual institution the cost estimates can be estimated after an analysis of the desired situation and the required hardware and software facilities.

For ACSI Bank this transition is a process that includes additional costs related to:

- SLA generation
- Implementation
- System configuration
- Hosting and Infrastructure
- Service management

Even so, by adopting Cloud there are multiple benefits that include according to [55]:

- Freeing up strategic resources (49% of Cloud users),
- Enabling disaster recovery/business continuity planning (46% of Cloud users),
- Increased flexibility and agility (46% of Cloud users).
- Cost savings: capital expenditure reduction between 11-20% and operation expenditure reduction of 21-30%.

Relate to the rest of the costs included in the business model of a financial institution, the changes are not noticeable. Some might reflect into lower Relationship Costs (RC) due to ease of connectivity, but such areas should be further analyzed on an existing institution that is willing to implement similar changes to the one proposed for ACSI Bank.

9.1.6 Revenue Streams

The main revenue stream in ACSI Bank are, as in any other bank:

- lending money
- remittances services (transfer of money by a foreign worker to the home country)
- consultancy
- underwriting (assess the eligibility of a customer)
- securities dealership.

The revenue streams are not influenced by transitioning to Cloud because the core business model of the financial institution does not change. Revenue increases might be observed due to the introduction of new customer interactions and services based on the power of the new technology, but the revenue streams remain the same.

9.2 The New Business Model for Consultancy Companies

In the case of consultancy companies the proposed model is a new method of reaching potential clients and therefore it does not reflect in all areas of the business model. For this reason customer relationship, delivery channels and revenue streams are unchanged compared to the existing situation.

9.2.1 Key Partners, Activities and Resources

In the case of the proposed model, the consultancy company assumes the role of Cloud Broker and therefore the key partners are Cloud service providers.

The main activities are therefore ensuring the quality and trust for the offered Cloud services and providing integration and orchestration between third parties and legacy core banking systems.

For such a role, the main resources of a consultancy company are its employees and their knowledge. Also an IT infrastructure to support connectivity, development and implementation is required.

9.2.2 Value Propositions

Adopting the role of a broker implies a change in optics for the consultancy company that is summarized as:

- *Creating a single entity of contact for financial institutions in order to facilitate implementation and orchestration between legacy systems and Cloud computing solution provided by third party institutions.*

  - **Target market**: existing and potential customers.
  - **Core needs addressed**: provide high tech Cloud solutions in order to satisfy market needs and extend customer base.
  - **Solution components**: the "H" integration and orchestration layer.

The value proposition is dependent on the client and the extend of system modification.

9.2.3 Customer Segments

Capgemini Immediate for Financial Institutions is a model developed for large financial institutions, therefore these will represent the main customer base. The model can also be applied for parts of the banking system in order to update or transition to the Cloud.

A different customer segment is represented by start up banks that are looking to implement the latest technologies. These can implement the proposed model as the main infrastructure base for the new business and customize it according to their needs with the help of the consultancy company.

9.2.4 Cost Structure

Except the usual costs implicated in facilitating other consultancy services, the Immediate for Financial Services model requires a considerable investment in the IT infrastructure that will provide the integration layer to future clients.

Also other costs might increase due to the required development capabilities, but this fact depends on the maturity of the existing solution development department within the consultancy company.

Due to the fact that the financial institution pays for services offered by the consultancy company, such an investment will not reflect in the cost structure of a financial institution.

9.3 Summary

This Chapter presents the influences of the proposed Immediate for Financial Institutions model on the adopting financial institution and facilitating consultancy company.

Even though the assessment can not be pinpointed in numbers due to the generic nature of the ACSI Bank and limited financial institution cases that have undergone similar changes, main changes are identified and future guidelines for assessment are recommended.

Chapter 10

A Glimpse Into the Future

The final chapter of this thesis is reserved for a showcase scenario. Its role and functionality are detailed further.

10.1 Showcase scenario

In previous chapters of this thesis different models have been presented and integrated with opinions from specialists in order to generate a reference architecture refereed to as the Immediate for Financial Institutions. The theoretical way of using this new model has been exemplified in different scenarios in Chapter 7. Also a new way for financial institution to interact with their customers has been proposed.

In order to give a feeling of how all the entities presented would interact in an integrated manner this showcase scenario has been developed. Its main role is to portrait some of the functionalities the new technological implementation can bring to the market and to further underline the roles financial institutions and consultancy institutions have in this paradigm.

10.2 How it works

The showcase scenario is a 5 minutes Flash animation that presents the usability of Capgemini Immediate for Financial Institutions. The main components are presented in Fig. 10.1.

It is divided in different stages:

- **Stage 1**: The Bank Transition presents the interaction between ACSI Bank, the consultancy companies and Cloud providers.
- **Stage 2**: Customer Interaction showcases the usability of the proposed mobile connectivity channel and how this can improve customer relations.
- **Stage 3**: General overview of the other solution packages and their interaction.

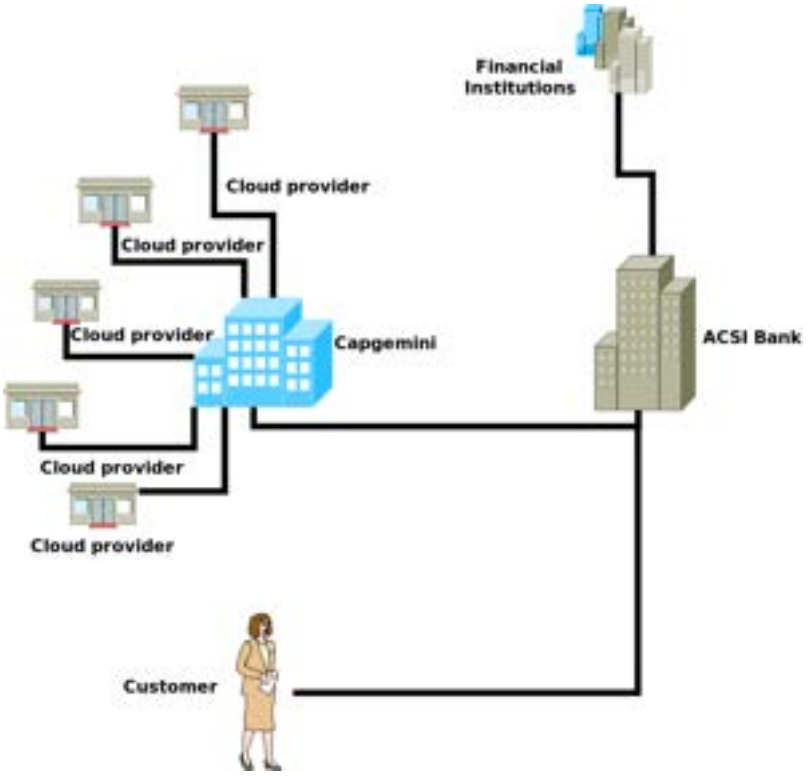

Figure 10.1: Showcase Scenario Entities

10.3 Summary

In this Chapter a short introduction of the showcase scenario, its components and utility has been presented. For further details the animation will be attached to this document.

Chapter 11

Conclusions

The main goal of this thesis, as described in the previous chapters, is to find a suitable Reference Architecture to help Financial Services adjust to the Cloud environment.

In order to achieve this, different topics have been addressed including a general perspective of financial services, an introduction to the Cloud, transitional challenges and a proposed reference architecture based on existing models. In the last three chapters the implications of the proposed architecture have been presented and some of its functionalities have been showcased.

Main Contributions

In order to achieve the goal of this thesis major steps and important contributions have been:

1. Finding out the opinion of financial institutions about Cloud computing.
2. Analyzing existing models and proposing Capgemini Immediate for Financial Institutions.
3. Testing the usability of the reference architecture within the case of a generic bank in order to provide the suitable solution according to the previous identified requirements.
4. Showcasing the influence of implementing the proposed reference architecture on a financial institution and its business environment.

The contributions of this thesis are based on model analysis and expert opinion from financial institutions and Capgemini.

Each of these contributions can be used in future work by Capgemini or by other master students to continue investigating Cloud computing.

Future Work

Cloud computing is a vast area of expertise and this thesis has just touched on some parts. Future improvements are proposed to refine and detail the reference architecture throughout the thesis and here are some possible future works:

- a framework to help characterize Cloud services for financial institutions in order for an accurate scenario build (utilized in solution proposal).

- a more detailed portrait of software solutions within the financial services (based on an actual institution).
- an analysis of costs and return of investment in a large financial institution that has transitioned to Cloud.
- a detailed overview of the software and hardware that are part of the proposed Cloud packages (including orchestration with legacy core banking system)

All these proposed future works can be integrated with the high level view adopted within this thesis and thus generate a more explicit and detailed model that financial institutions can implement or use as a guideline.

To conclude, this thesis has proposed a reference model based on literature study, interviews and model analysis, underlining its functionality and business influences within financial service provisioning. Also methods of improvement for future study have been identified in order to perfect this proposal and prepare it for market adoption with the help of a consultancy company.

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Appendix A

SalesForce Components

In this appendix contains a description of the main items used to formulate the SalesForce offers. The actual offers can be found in Chapter 3.

Chatter	Instant collaboration and messaging.
Accounts and contacts	360-degree view of each customer.
Marketing and leads	Aligned marketing and sales for faster deals.
Opportunities and quotes	Update deal information, record customer interactions, track competitors and create quotes.
Jigsaw data services	Real-time contact info and automated data renewal.
Workflow and approvals	Control over routine activities, eliminate redundant tasks, automate approvals and improve business processes.
Email and calendaring	Combine the desktop apps already in use (Microsoft Office, Lotus Notes, and Google Apps)
Partner management	Real-time visibility throughout partner life cycle, share information, collaborate instantly with partners on leads, accounts, opportunities, and cases
Analytics	A comprehensive, real-time view of the business.
Mobile	Follow customers on mobile devices (Android, BlackBerry, iPad, and iPhone).
AppExchange	Marketplace of cloud computing apps.
Force.com platform	Customize, add any business process, build apps and websites.
Call center	Create and track cases from every channel, automatically route and escalate what's important and integrate with your telephony or back office applications.
Customer Portal	Service customer portal 24 hours a day.
Social	Connect with popular Web communities like Twitter and Facebook.
Knowledge	The right answer the first time, find answers online, capture knowledge from social channels.

Community	Tapping into the wisdom of the crowd to capture the best answers and the most innovative ideas.
Search	Make knowledge base answers accessible through Google, or any search engine, so customers get help.
Contracts and Entitlements	Service contracts and entitlements instantly match customers with the appropriate level of service and manage per-customer service costs.