



**Universiteit Leiden**

**ICT in Business**

The influence of Cloud based elements on RfP's

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MASTER'S THESIS

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Master Thesis - Thesis Report

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## Abstract

The need for Cloud based IT services has grown significantly over the last couple of years. A Request for Proposal (RfP) is the usual mechanism to request IT services from Service Providers. Traditional IT services and Cloud services are often requested in the same RfP and it is sometimes difficult to ascertain which are traditional services and which are cloud services. Especially distinguishing between business requirements and technical requirements is becoming more challenging, thus making it harder for Service Providers to come up with the proper response to a given customer requirement.

The term "Cloud" is primarily used as a metaphor for Internet and IT services that are location independent. The term "Cloud" is at the moment very much a hype. When searching for Cloud in Google one receives over a billion hits with a range from Wi-Fi to data storage on the Internet and virtual workspaces. Furthermore, there are different Cloud forms, for example Private Cloud and Public Cloud.

There are many definitions for the term "Cloud" and they all differ slightly. As the National Institute of Standards and Technology (NIST) definition (Mell & Grance, 2011) describes cloud computing as a model and not as a technology, this definition is seen as the most relevant definition to be used in this research. NIST describes cloud computing as follows: "Cloud computing is a model for enabling ubiquitous, 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." (Mell & Grance, 2011)

Based upon this definition there are some characteristics that services must meet in order to qualify for the term cloud:

- ▶ On-demand self-service;
- ▶ Broad network access;
- ▶ Resource pooling;
- ▶ Rapid elasticity;
- ▶ Measured service.

This exploratory and qualitative research examines the type of requirements companies state and seeks to find the differences between RfP's with and without Cloud elements.

Based upon the NIST definition and characteristics the requirements from eight RfP's are analyzed, resulting in a total of 5822 requirements. The table below provides a categorized overview of these requirements.

		Cloud requirement			
		Yes	%	No	%
Category	General	961	48%	2216	58%
	Financial	181	9%	196	5%
	Human Resources	0	0%	3	0%
	Legal	6	0%	6	0%
	Governance	335	17%	785	21%
	Transition	121	6%	271	7%
	Technical	396	20%	345	9%
	<b>Totals</b>	<b>2000</b>	<b>100%</b>	<b>3822</b>	<b>100%</b>

These results are subsequently differentiated between Business requirements and Technical requirements. The table below provides a description of the business requirements and technical requirements.

Category	Description
Business requirements	Must be delivered to provide value
Technical requirements	Technical specification (of a business requirement) to assure a correct specification

This differentiation leads to the following outcome.

Category	Cloud requirement	
	Yes	No
Business requirement	648 (32%)	1889 (49%)
Technical requirement	1352 (68%)	1933 (51%)

As the figures in the table above show, the investigated RfP's state more technical requirements than business requirements. Based upon these results the hypothesis - that there is a greater focus on business requirements than on technical requirements in a RFP with cloud elements - must be falsified.

Next to the different requirements in RfP's with and without cloud elements these RfP's have also general impact on the way service providers work.

There are four key differentiators identified that have impact on a RfP which contains cloud elements:

- ▶ **Strength:** Ability to focus on own strengths;  
A service provider can differentiate himself based upon his own strengths, because with cloud based IT services the technical solution is the same for all Service Providers.
- ▶ **Weakness:** Less focus on technology;  
Service providers need to change their commercial approach to focus less on technology and more on business values for example.
- ▶ **Opportunity:** Offers option for consulting services;  
Companies are searching for the right cloud strategy, therefore companies are reaching out for consulting services.
- ▶ **Threat:** Different kind of competition, hardware vendors and (previous) partners.  
With public cloud offerings Datacenter, Hardware, Service Levels, Software and Licenses are included. Therefore a company like Microsoft which is a partner of a lot of Service Providers now also is a competitor.

## Acknowledgement

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# 1 Introduction

In this research a comparative study is performed to determine the difference between traditional and Cloud Request for Proposals (RfP's). RfP's are sent to commercial ICT services providers to make an offer to outsource (parts of) ICT services.

Using desk research a difference analysis is performed providing insight into the requirements being made in RfP's.

The following definition of IT outsourcing is used:

"is an act of delegating or transferring some or all of the IT related decision making rights, business processes, internal activities, and services to external providers, who develop, manage, and administer these activities in accordance with agreed upon deliverables, performance standards and outputs, as set forth in the contractual agreement" (Subhankar Dhar, 2006)

## **Overall purpose:**

A lot of academic research is performed on the vendor selection process when outsourcing services. For example, in article "Evaluation of proposals for BOT projects" (Tiong & Alum, 1997) a typical selection process is mentioned:

- ▶ A Request for Quotation is issued;
- ▶ Pre-qualification is performed;
- ▶ Request for Proposal is issued;
- ▶ Tendering process;
- ▶ Evaluation and Short listing;
- ▶ Detailed Negotiations;
- ▶ Vendor selection.

Furthermore, there are many studies performed on the evaluation process, for example (Cao & Wang, 2007) and (Sucky, 2007). However, these activities do not have the desired effect when the requirements are not correctly gathered. However, this topic has been less researched. One single book has been published (Wijers & Verhoef, 2006) describing the content of the RfP and the requirements that should be included.

## 1.1 Problem description

According to Morgan Stanley's blue paper "Cloud Computing Takes Off" (Morgan Stanley, 2011) it is expected that infrastructure outsourcing will be impacted by Cloud Computing. In this paper it is stated "CIOs will be less likely to sign multi-year outsourcing contracts until they are comfortable that their cloud assessment/IT strategy activities are rigorous and complete."

Analysts from the International Data Corporation (IDC) expect "that cloud IT infrastructure spending will grow at a compound annual growth rate (CAGR) of 15.1% and will reach \$53.1 billion by 2019 accounting for 46% of the total spending on enterprise IT infrastructure. At the same time, spending on non-cloud IT infrastructure will decline at -1.7% CAGR." (IDC, 2015). The study "CSC GLOBAL CIO SURVEY: 2014-2015" performed by CSC (CSC, 2016) and the "Cloud Computing Survey 2015" study performed by (IDG Enterprise, 2015) confirming the growth of cloud computing in the coming years.

Determination of the requirements for outsourcing is difficult, as there are different levels of requirements, for example business requirements and solution requirements. Looking at Cloud computing it is possible for all companies to access computing resources on a pay as you go basis. This enables companies to focus on optimizing their average usage rather than on their

peak usage. This combines business (pay as you go) with solution (ability to withstand a peak load). Joining outsourcing with cloud is a difficult scenario and asks for clear requirements.

Outsourcing starts with the release of a RFP. In this RFP companies state besides guidelines also requirements that the proposal must meet. These requirements may differ ranging from the scope of the solution to financial and legal conditions.

As stated in Cloud computing — The business perspective paper “The evolution of cloud computing over the past few years is potentially one of the major advances in the history of computing. However, if cloud computing is to achieve its potential, there needs to be a clear understanding of the various issues involved, both from the perspectives of the providers and the consumers of the technology. While a lot of research is currently taking place in the technology itself, there is an equally urgent need for understanding the business-related issues surrounding cloud computing.” (Sean Marston, 2011). This is the reason for this explorative research, to determine the type of requirements made by companies and to find the differences between RfP’s with and without Cloud elements.

## 1.2 Theoretical framework

In this research a literature study is performed based upon RFP requirements. The basis for this literature study is the book called “De RfP voor IT outsourcing” (Wijers & Verhoef, 2006). In this book suggestions are made about the type of requirements that should be stated in a RFP.

*According to the article A systematic review on cloud computing (Durao, Carvalho, Fonseka, & Garcia, 2014)“Moreover, cloud has enabled businesses to focus more on their business, and less on the technology required to run it.” Because of this it is to be expected that there are more business requirements than technical requirements specified in RFP’s with cloud elements.*

### **Significance of the research:**

First with the results of this research, it will become clear when an element can be called a cloud element. Secondly, with this research it will become clear what the difference is between the type of requirements in a RFP with and without cloud elements as stated by the outsourcer.

## 1.3 Research questions

The following research questions are drafted:

### Main research question:

- ▶ Is there a greater focus on business than on technical requirements in a RFP with cloud elements?

*According to the article A systematic review on cloud computing (Durao, Carvalho, Fonseka, & Garcia, 2014)“Moreover, cloud has enabled businesses to focus more on their business, and less on the technology required to run it.” Because of this it is to be expected that there are more business requirements than technical requirements specified in RFP’s with cloud elements.*

### Sub research questions:

- ▶ RQ1: When can you call an element a Cloud element?

*The term “Cloud” is used as a metaphor for internet and IT services that are location independent, but not every service that is location independent can be called a cloud service. There are several essential characteristics that must be met before you can officially call an element a Cloud element. So the expected outcome of this question is a kind of flowchart that can be used in order to determine whether an element that is called cloud is actually a cloud element.*

- ▶ RQ2: What are the differences between the requirements of RFP's with and without cloud elements?  
*This research question will lead to the answer whether the hypothesis as stated in the main research question "In RFP's with cloud elements there is a greater focus on business requirements than on technical requirements" is confirmable or falsifiable. The expected answer is that the hypothesis can be confirmed.*
- ▶ RQ3: What is the impact of the choice of Cloud products in the RfP process?  
*The expected impact is that the commercial Service Providers are being driven into a solution instead of being challenged of offering the best solution for the outsourcer.*

## 1.4 Research methodology

This research is an exploratory and qualitative research based on the viewpoint of Service Providers.

The foundation of this research is the RfP's of eight companies and the requirements that are stated in those RfP's. There are three reasons for using RfP's in this research:

1. Companies have specifically written these requirements as part of the service they expect;
2. Service Providers use down requirements to determine if they can provide the requested services;
3. If Service Providers determine they can provide the services, they compose a proposal and calculate a service fee based on these requirements.

The RfP's that were selected for this research are selected because they all have a different background. Three major differences can be distinguished:

- ▶ RfP does (not) contain Cloud components;
- ▶ Companies that issued the RfP's come from multiple branches;
- ▶ Companies are either public sector or a commercial company.

The table below provides the RfP's that are used in this research.

Company name	Cloud Yes/No	Service Model	Branch	Public/Commercial	Year
TenneT	No	n/a	Energy and Utility	Public	2015
PostNord	Yes	SAAS	Logistics	Public	2015
Huawei	Yes	IAAS / PAAS	Telecom	Commercial	2015
Neste Oil	Yes	IAAS / PAAS / SAAS	Oil and Gas	Public	2015
BAM	No	n/a	Manufacturing	Commercial	2012
MN	No	n/a	Financial	Commercial	2013
Sanoma	Yes	IAAS / PAAS / SAAS	Media	Commercial	2013
Sanquin	No	n/a	Healthcare	Public	2013

A total of 5822 requirements is derived from 67 documents. In Appendix A List of RfP documents a complete list of all used documents is given.

### 1.4.1 IAAS / PAAS and SAAS

As shown in the above table, the RfP's that contain cloud elements consists of multiple Service Models. Differentiation based on Service models was not part of the setup of this research.

### 1.4.2 Requirement qualification

The requirements are categorized and determined per type of requirement. The categories used are specified in the book 'De RfP voor IT Outsourcing' (Wijers & Verhoef, 2006). In the book six categories are noted. To determine if there are special technical requirements being made in the RfP's that narrow or dictate the solution, a seventh category is added "Technical requirement"

The following seven categories are used:

Category	Description
General	A general description of what the customer expects to receive as a service e.g. Customer expects to have a solution to send and receive e-mail
Financial	A description about the payment for the service e.g. Customer expects a "pay per use" payment model
Human Resources	A requirement about the transfer of people from customer to supplier e.g. Customer expects supplier to take over the employees that currently support the service
Legal	Legal requirement in relation to the contract between customer and supplier e.g. Customer is entitled to terminate the contract if the supplier does not deliver the service as required
Governance	"IT governance is an integral part of enterprise governance and consists of the leadership and organizational structures and processes that ensure that the organization's IT sustains and extends the organization's strategies and objectives" (ISACA, 2011) e.g. Customer expects supplier to participate in meetings according the agreed meeting structure
Transition	A requirement about how to come to the contracted service e.g. Supplier is responsible for takeover and/or rebuild of required jobs
Technical	A requirement that precisely describes the expected outcome, including the technical details and thereby limiting the possible solution e.g. WAN route utilization = Max. 80% in peak times 30% in average with Latency = $\leq 20\text{ms}$ and Packet loss rate = $\leq 0,05\%$

Beside this categorization also the type of requirement is determined, for a requirement a distinction is made between a functional and non-functional requirement.

Type	Description
Functional	Quantitative requirement that describes what is expected as part of the service
Non-functional	Qualitative requirement that describes the expected quality or performance of the service

### 1.4.3 SWOT analysis

To determine the impact of cloud elements on RfP's a Strengths, Weaknesses, Opportunities & Threats (SWOT) analysis is done. This SWOT analysis is based upon a session held within the Gold for Expert program, a session where Atos employees, facilitated by Experts from the University of Cambridge, made a SWOT analyses on the subject 'Atos in the new technology market'.

## 2 Literature study results of Cloud Computing

In this chapter, the results of the literature study are presented. The term “Cloud” is used as a metaphor for Internet and IT services that are location independent. The term “Cloud” is at the present moment very much a hype. When searching for Cloud in Google you receive over a billion hits with a range from Wi-Fi to data storage on the Internet and virtual workspaces. Furthermore, there are different Cloud forms, for example Private Cloud and Public Cloud.

This chapter covers the definition and the specification of Cloud, such as the characteristics and the service models.

### 2.1 Definition of Cloud Computing

In article “Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility” (Buyya, Yeo, Venugopa, Broberg, & Brandic, 2009) a definition is given for Cloud based on observations of the essence of what Clouds are promised to be.

“A Cloud is a type of parallel and distributed system consisting of a collection of inter-connected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resource(s) based on service-level agreements established through negotiation between the service provider and consumers.” (Buyya, Yeo, Venugopa, Broberg, & Brandic, 2009)

The National Institute of Standards and Technology (NIST) is part of the United States Department of Commerce. One of the tasks of the Information Technology Laboratory, within the NIST, is to develop “technical, physical, administrative and management standards and guidelines for the cost-effective security and privacy of sensitive unclassified information in Federal computer systems” (Mell & Grance, 2011). In their special publication 800-145 the NIST gives the following definition of Cloud Computing.

“Cloud computing is a model for enabling ubiquitous, 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.” (Mell & Grance, 2011)

Gartner on the other hand has the following definition of Cloud Computing:

“a style of computing in which scalable and elastic IT-enabled capabilities are delivered as a service using Internet technologies.” (Gartner)

As these three definitions show there are a lot of similarities, but also a few differences. For example, the definition used in the article by Buyya, Yeo et al (Buyya, Yeo, Venugopa, Broberg, & Brandic, 2009) states specifically that a cloud consists “of a collection of inter-connected and virtualized computers”. While the NIST and Gartner see a broader capability and not only inter-connected computer. Furthermore the NIST only state “on-demand network access” where Gartner clearly state “Internet technologies”.

For clarity purposes this thesis uses the NIST definition when it talks about Cloud Computing, because it describes cloud computing as a model and not as a technology.

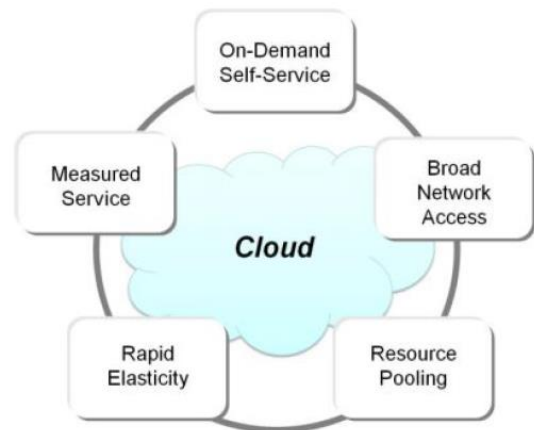
## 2.2 Specification of Cloud

Cloud has some specific characteristics, but also multiple services models and deployment models. In the coming chapters there is a short description of the characteristics, service- and deployment-models.

### 2.2.1 Characteristics

The NIST also describes in her 800-145 article five essential characteristics that cloud computing must contain:

- ▶ On-demand self-service  
The ability to unilaterally provision computing capabilities without the requirement of human interaction
- ▶ Broad network access  
Available via standard mechanisms via network access so heterogeneous client platforms can be used
- ▶ Resource pooling  
The resources are pooled to serve multiple customers, via a multi-tenant model, with different physical and virtual resources dynamically (re)assigned  
Generally a customer does not know, has no control or knowledge about the exact location of the resource. Sometimes it is possible that the customer defines the location on an abstraction level (e.g. Continent, Country or datacenter).
- ▶ Rapid elasticity  
Availability of the resources can be rapidly expanded or decreased, in some cases automatically.
- ▶ Measured service  
Systems control and optimize their resources automatically to maximize the advantage for the customer. Resources usage is monitored, controlled and reported by which it provides transparency for both the provider and the customer.



Also Gartner has defined five attributes of cloud computing (Petty & Goasduff, 2009):

- ▶ Service-Based  
It is about what the service needs to do rather than how the services are being delivered.
- ▶ Scalable and Elastic  
The service must be scaling up and down and this needs to be automated.
- ▶ Shared  
To optimize the efficiency the underlying resources of the services must be shared among multiple consumers and not dedicated for one.
- ▶ Metered by Use  
The services are measured and offered via usage payment models, such as pay-as-you go plans, subscriptions and fixed plans. These payment plans are not based on the cost of the resources but based on the usage of the service. The usage can be measured in hours, amount of data traffic or other measurement methods.
- ▶ Uses Internet Technologies  
The services are offered to consumers via internet connectivity methods, e.g. URLs, HTTP, IP.



## 2.2.2 Service Models

Cloud comes in three different Service Models:

### SOFTWARE AS A SERVICE (SAAS)

"The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through either a thin client interface, such as a web browser (e.g., web-based email), or a program interface. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user specific application configuration settings." (Mell & Grance, 2011)

### PLATFORM AS A SERVICE (PAAS);

"The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment." (Mell & Grance, 2011)

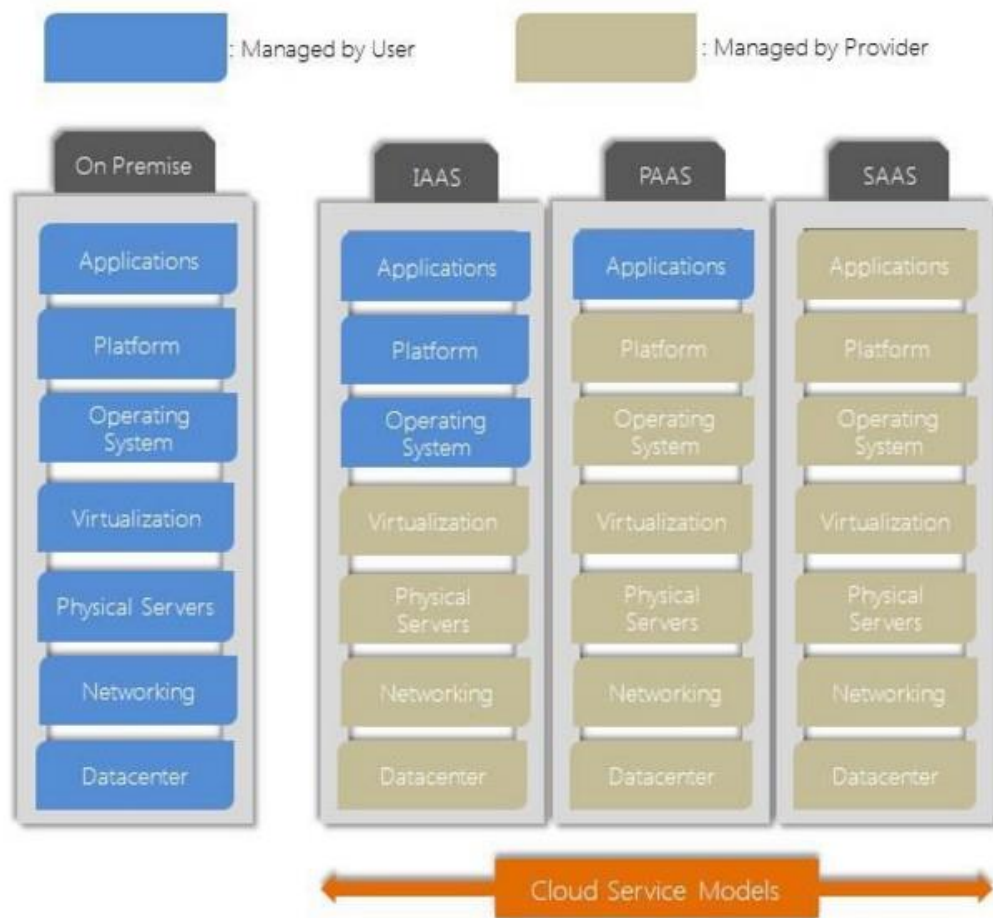
### INFRASTRUCTURE AS A SERVICE (IAAS).

"The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, and deployed applications; and possibly limited control of select networking components (e.g., host firewalls)." (Mell & Grance, 2011)

These different type of Service Models all have their own characteristics when it comes to flexibility and complexity for the cloud provider. In the following picture, published in article "Applying cloud computing in financial service industry" (Aiwu Shi, 2010), these differences are clearly shown.



The next picture (Kumawat, 10) shows the segregation between the responsibilities within the different Service Models.



### 2.2.3 Deployment Models

The NIST (Mell & Grance, 2011) makes a distinction between four types of deployments models:

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

Also in the article "A systematic review on cloud computing" (Duraó, Carvalho, Fonseca, & Garcia, 2014) multiple types of cloud are mentioned:

- ▶ Public;
- ▶ Private;
- ▶ Hybrid.

But instead of the NIST, the "A systematic review on cloud computing" article does not describe the differences between the different types. Therefore, the definition from the NIST is used to describe the differences between the type of clouds.

#### PRIVATE CLOUD

"The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises." (Mell & Grance, 2011)

#### COMMUNITY CLOUD

“The cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises.” (Mell & Grance, 2011)

#### PUBLIC CLOUD

“The cloud infrastructure is provisioned for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organization, or some combination of them. It exists on the premises of the cloud provider.” (Mell & Grance, 2011)

#### HYBRID CLOUD

“The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds).” (Mell & Grance, 2011)

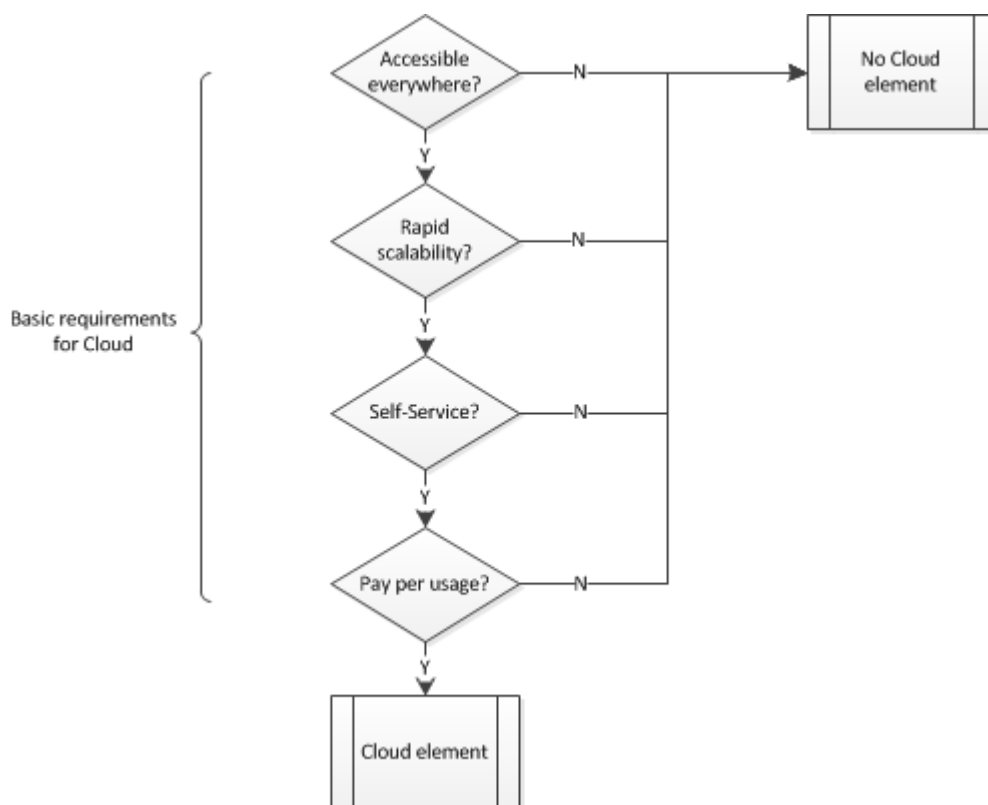
### 3 How to determine Cloud elements

In this chapter the results of the literature study are combined. In chapter 3.1 a model on how to determine Cloud elements in a RfP is introduced and in chapter 3.2 the results of the requirements analyses are given.

As shown in chapter 2.2.2 and 2.2.3 there are different forms of cloud. Therefore it is not possible to say "I want Cloud". Often individual parts of the requested services can be delivered via a Cloud solution and it is therefore important to determine whether an element is a proper cloud element. This is important in the later stage of this research especially for research questions RQ2 and RQ3.

#### 3.1 Model for determining Cloud elements

As stated in chapter 1.4 Research methodology this research is performed from the perspective of the Service Provider. By combining the characteristics of cloud computing from chapter 2.2.1 Characteristics it is possible to create a diagram for Service Providers to determine if a RfP has cloud elements or not. In the diagram below these characteristics are shown in a diagram.



## 3.2 Requirements made in RfP's with Cloud elements

As stated in chapter 1.4.2 Requirement qualification all requirements (5822) are qualified for their type and category.

As described in the above-mentioned chapter the used categories are:

- ▶ General requirements;
- ▶ Financial requirement;
- ▶ Human Resources requirement;
- ▶ Legal requirement;
- ▶ Governance requirement;
- ▶ Transition requirement;
- ▶ Technical requirement.

And the two used types are:

- ▶ Functional;
- ▶ Non-functional.

Out of the grand total of 5822 requirements gathered from the RfP's a total number of 2000 requirements are made in four RfP's that are classified to have Cloud elements as part of their request.

The table below shows how these 2000 requirements are divided in functional and non-functional requirements.

Type	Amount	Percentage
Functional requirement	817	41%
Non-functional requirement	1183	59%

In the table below is it specified how these 2000 requirements are divided over the categories.

Category	Amount	Percentage
General requirements	961	48%
Financial requirement	181	9%
Human Resources requirement	0	0%
Legal requirement	6	0%
Governance requirement	335	17%
Transition requirement	121	6%
Technical requirement	396	20%

## 4 The comparison

In this chapter the difference is determined between RfP's that do not have cloud components and RfP's that do have cloud components.

### 4.1 The difference between RfP's without and with Cloud service elements

In total eight RfP's are analyzed. Based on the requirements stated in these RfP's it can be concluded that there are differences in the requirements. In the table below the requirements are shown per category differentiated between the RfP's with and without cloud elements.

		Cloud requirement			
		Yes	%	No	%
Category	General	961	48%	2216	58%
	Financial	181	9%	196	5%
	Human Resources	0	0%	3	0%
	Legal	6	0%	6	0%
	Governance	335	17%	785	21%
	Transition	121	6%	271	7%
	Technical	396	20%	345	9%
	<b>Totals</b>	<b>2000</b>	<b>100%</b>	<b>3822</b>	<b>100%</b>

Statistically speaking no significant difference in the data can be determined, P-value of 0.4412 when comparing cloud and non-cloud and a P-value of 0.5653 when comparing functional and non-functional. See Appendix B Statistical data chapter 4.1 for the details of the statistical analysis.

#### Expected value:

To determine if there is a relationship between the cloud and non-cloud elements the Chi-square test is used. By determining that the numbers are the same as the statistical expected numbers a relationship can be proven.

The "expected value" is not same as "most probable value", it does not even have to be one of the probable values. For example, in a dice-throw experiment, the expected value, is 3,5. 3,5 is not one of the possible outcomes at all.

When looking at the expected numbers compared with the actual numbers there is a significant difference, a P-value of  $< 2.2e-16$ . Therefore it can be stated that the number of requirements statistically does not meet the expectation. In the two tables below the expected results are shown for the cloud and non-cloud requirements and the functional and non-functional requirements. See Appendix C Statistics Chi-squared test "Cloud" and Appendix D Statistics Chi-squared test "Functional" for the details of the statistical analysis.

Table 1: Statistically expected requirement Cloud vs. Non-Cloud

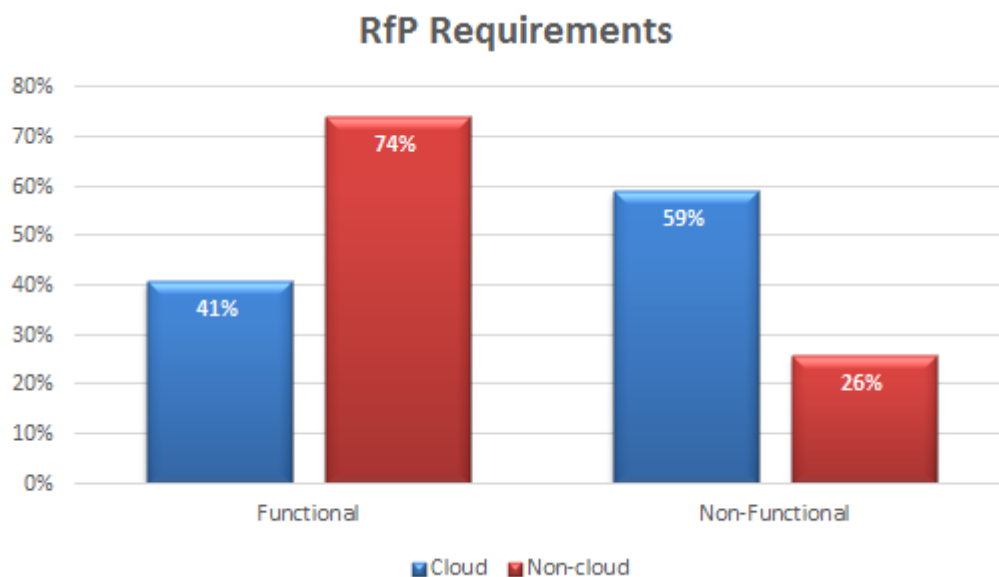
Category	# Cloud	# Non-cloud
General	1091,378	2085,622
Financial	134,6616	257,3384
Human Resources	384,7475	735,2525

Category	# Cloud	# Non-cloud
Legal	1,030,574	1,969,426
Governance	129,5088	247,4912
Transition	4,122,295	7,877,705
Technical	254,5517	486,4483

Table 2: Statistically expected requirement Functional vs. Non-Functional

Category	# Functional	# Non-functional
General	1993,401	1183,599
Financial	245,9595	146,0405
Human Resources	702,7413	417,2587
Legal	1,882,343	1,117,657
Governance	236,5477	140,4523
Transition	7,529,371	4,470,629
Technical	464,9387	276,0613

Also when looking at the differences in the percentage of functional and non-functional requirements, as shown in the picture below, it can be concluded that there is a difference between these types of RfP's.



As shown above there is a difference between RfP's with cloud and without cloud elements. There are four differences that can be pointed out, with more than 5% difference:

1. Less total number of requirements in RfP's with cloud elements;
2. Less general requirements in RfP's with cloud elements;
3. More technical requirements in RfP's with cloud elements;
4. More non-functional requirements in RfP's with cloud elements.

In the chapters below these differences are being detailed.

### 4.1.1 Smaller total amount of requirements in RfP's with cloud elements

The total number of requirements that are stated in the eight RfP's is 5822. In the table below these number are broken down into the number of requirements made in RfP with and without cloud elements.

RfP	Number of requirements	Percentage
With cloud elements	2000	34%
Without cloud elements	3822	66%

#### POSSIBLE EXPLANATIONS

One of the possible explanations for this result is that a lot of the cloud characteristics are set and cannot be changed for individual customers. For example, the service levels for Microsoft Office365 are fixed (Microsoft, 2016). There is no possibility to request a different service level from Microsoft. The same applies for Amazon Web Services (Amazon, 2013). This could be the reason that companies do not put in many requirements when requesting services that consist of cloud elements.

### 4.1.2 Less general requirements in RfP's with cloud elements

As stated in chapter 1.4.2 Requirement qualification a general requirement is a requirement that is:

A general description of what the customer expects to receive as a service  
e.g. Customer expects to have a solution to send and receive e-mail

When looking at this requirement category a notable difference can be seen as depicted in the table below.

RfP	Number of general requirements
With cloud elements	961
Without cloud elements	2216

This outcome is supported when adding the factor of RfP's that need to comply with public tender regulations, because in that case the number of general requirements for RfP's with cloud elements is less than the ones without cloud elements.

RfP	Number of general requirements	
	Public tenders	Non-public tenders
With cloud elements	795	166
Without cloud elements	1722	494

#### POSSIBLE EXPLANATIONS

One of the possible explanations might be that a lot of public cloud services are predefined service descriptions that describe in detail what the customer can expect from the service. For example, the Microsoft Office 365 Service Description (Microsoft, 2016) clearly describes the services that are included in the different offerings that they make.

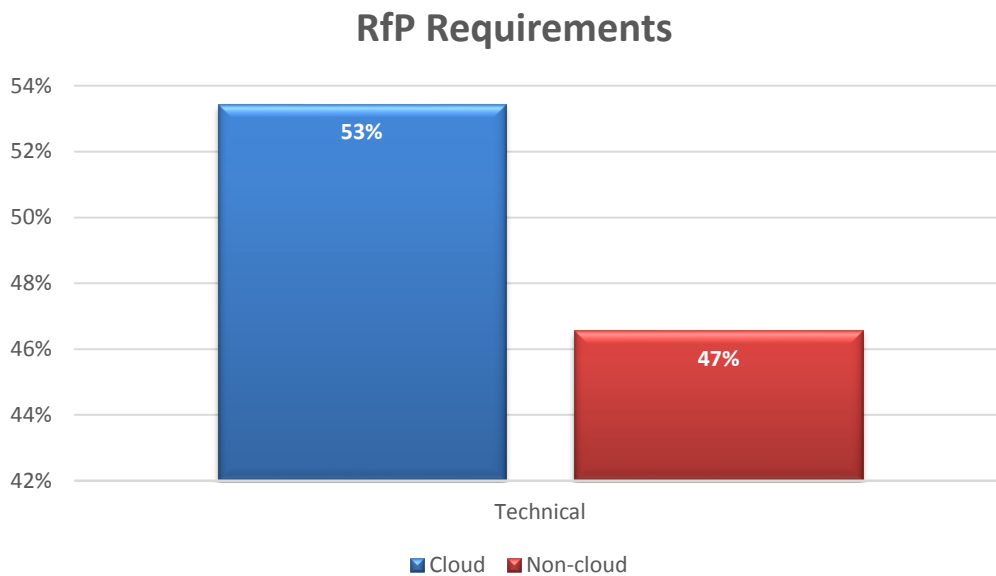


### 4.1.3 More technical requirements in RfP's with cloud elements

When looking at the numbers of the technical requirements there is a difference in the numbers of RfP's with and without cloud elements.

Cloud requirement	Yes	No
Technical	396	345

As shown in the diagram below, the difference is 6%.



However, when drilling down into the data it appears that there is almost no difference between Cloud and Non-cloud when the RfP is coming from a company that must comply with the public tender regulations. In that case 51% of the technical requirements are made in RfP's with cloud elements and 49% in the RfP's without cloud elements.

But companies that do not have to comply with public tender regulations have a bigger difference, namely 38% for RfP's with cloud elements and 32% for RfP's without cloud elements.

#### POSSIBLE EXPLANATIONS

One of the possible explanations for the difference in the number of technical requirements between RfP's with and without cloud elements is that companies that do not have to comply with public tender regulations by to mitigate the possible risks of public cloud elements, like for example connectivity problems.

### 4.1.4 More non-functional requirements in RfP's with cloud elements

When looking at the type of requirements made in RfP's with cloud elements it is noticed that there are more Non-functional requirements made then Functional requirements, as shown in the table below.

Type of requirement	Number
Functional	817
Non-functional	1183

Also when looking at the specific categories of the requirements the same results are obtained, except for the 'general requirements'.

Category	Number of functional requirements	Number of Non-functional requirements
General	630	331
Financial	18	163
HR	0	0
Legal	0	6
Governance	66	269
Transition	9	112
Technical	94	302

#### POSSIBLE EXPLANATIONS

As also explained in chapter 4.1.3 More technical requirements in RfP's with cloud elements can cause this result because companies try to mitigate the possible risks of public cloud elements.

Another possible explanation is that companies have negative Cloud Computing experiences and try to mitigate them by stating explicit requirements, for example the requirement that is stated below.

When it is stated in this document that reporting shall take place monthly (calendar month), this means that – unless otherwise stated or agreed in writing between the Parties – one (1) report per period shall be delivered no later than the fifth (5th) Business Day of the following month by 08:00.

## 5 Business requirements

As stated in the main research question this research aims to justify or falsify the hypothesis "There is a greater focus on business than on technical requirements in a RFP with cloud elements". Therefore it is important to group the seven requirement categories combined with the two types of requirements, as mentioned in chapter 1.4.2 Requirement qualification, into two new categories:

1. Business requirements;
2. Technical requirements.

Category requirement	Description
Business requirements	Must be delivered to provide value
Technical requirements	Technical specification (of a business requirement) to assure a specific specification

In the table below the seven categories are listed in the first column, in the second column the types are listed, and in the third column the respective category as specified above is listed.

Initial category	Functional / Non-functional	Business category
General	Functional	Business requirement
General	Non-Functional	Technical requirement
Financial	Functional	Business requirement
Financial	Non-Functional	Technical requirement
Human Resources	Functional	Business requirement
Human Resources	Non-Functional	Technical requirement
Legal	Functional	Technical requirement
Legal	Non-Functional	Technical requirement
Governance	Functional	Technical requirement
Governance	Non-Functional	Technical requirement
Transition	Functional	Technical requirement
Transition	Non-Functional	Technical requirement
Technical	Functional	Technical requirement
Technical	Non-Functional	Technical requirement

### 5.1 Analysis of the business requirements

When combining the results as stated in chapter 4 (The comparison), with the business requirement categorization as mentioned in the chapter above, the following results are retrieved.

Category	Cloud requirement	
	Yes	No
Business requirement	648 (32%)	1889 (49%)
Technical requirement	1352 (68%)	1933 (51%)

There is no evidence that there is a greater focus on business requirements than on technical requirements in RfP's with cloud elements, so the hypothesis must be falsified.

## 6 Impact of Cloud products

Besides analyzing the differences between RfP's with and without cloud elements there is another aspect to keep in mind; the impact of requesting cloud products.

### 6.1 SWOT analysis

In order to analyze the impact of cloud elements in RfP's a Strengths, Weaknesses, Opportunities & Threats (SWOT) analysis is performed from the view of the ICT Service Provider, in the picture under need the results are shown.

<p style="text-align: center;"><b>Strengths</b></p> <ul style="list-style-type: none"> <li>• Ability to focus on own strengths</li> <li>• Easy Operation</li> <li>• Proven Technologies</li> <li>• European-based (Patriot Act) with private cloud</li> </ul>	<p style="text-align: center;"><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>• Less focus on technology</li> <li>• Business value difficult to prove</li> </ul>
<p style="text-align: center;"><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• Offers option for consulting services</li> <li>• Strategic alliances, partnerships</li> </ul>	<p style="text-align: center;"><b>Threats</b></p> <ul style="list-style-type: none"> <li>• Decrease infrastructure outsourcing</li> <li>• Multi vendor outsourcing</li> <li>• Wrong prediction could increase costs</li> <li>• Different kind of competition, Hardware vendors and (previous) partners</li> </ul>

In the following four paragraphs, the main item from the SWOT quadrant are explained.

#### STRENGTH: ABILITY TO FOCUS ON OWN STRENGTHS

Because all the Service Providers are requested to base the proposal upon a cloud product the technical solution is the same for all Service Providers. Therefore a service provider can differentiate himself based upon his own strengths instead of the technical specifications.

#### WEAKNESS: LESS FOCUS ON TECHNOLOGY

Most ICT service providers have technology at the heart of their DNA. With the arrival of cloud elements as part of the RfP requested services, the technology part is less prominent. Service Providers need to change their commercial approach to focus less on technology and more on business values for example.

#### OPPORTUNITY: OFFERS OPTION FOR CONSULTING SERVICES

Companies are still searching for the right cloud strategy (Morgan Stanley, 2011), therefore companies are reaching out for consulting services. Morgan Stanley points out the “following possible positive developments for the consulting market:

- ▶ Near-term assessments and IT strategy projects will generate demand;
- ▶ Consulting demand will continue to increase with cloud adoption and as related technologies evolve; and
- ▶ Once the company establishes a consulting relationship, it is more likely to win follow-on applications development, system integration, and/or outsourcing work.” (Morgan Stanley, 2011)

#### THREAT: DIFFERENT KIND OF COMPETITION, HARDWARE VENDORS AND (PREVIOUS) PARTNERS

To deliver a service as part of ICT outsourcing an ICT service provider previously had to deliver all aspects for this service, without trying to be complete. These aspects are for example:

- ▶ Datacenter;
- ▶ Hardware;
- ▶ Knowledge;
- ▶ Service Levels.

In some cases software and licenses were also part of the requested services.

Now with public cloud offerings the Datacenter, Hardware, Service Levels, Software and Licenses are being delivered by the public cloud provider. Therefore a company like Microsoft which is a partner of a lot of Service Providers now also is a competitor (Gruman, 2015).

## 7 Conclusion and Recommendations

Based upon the performed research some careful conclusions are drawn. Careful because some limitations are applicable to the performed research, these limitations are listed below in section 'Limitations and Problems'.

The first conclusion is that there is no official definition or standard for the term "Cloud". All definitions differ slightly. The NIST definition (Mell & Grance, 2011) describes cloud computing as a model and not as a technology, therefore this definition is seen as the most relevant definition. In order to qualify for the term "Cloud" elements have to meet the following characteristics

- ▶ On-demand self-service;
- ▶ Broad network access;
- ▶ Resource pooling;
- ▶ Rapid elasticity;
- ▶ Measured service.

After researching 5822 requirements extracted from eight RfP's it is concluded that statistically there is no significant difference in the requirements made in RfP's with and without cloud elements. Despite the fact that statistically no significance is proven, there are four remarkable differences:

1. Smaller total amount of requirements in RfP's with cloud elements;
2. Less general requirements in RfP's with cloud elements;
3. More technical requirements in RfP's with cloud elements;
4. More non-functional requirements in RfP's with cloud elements.

Based upon the performed SWOT analysis four key differentiators are identified that have impact on a RfP which contains cloud elements:

- ▶ Strength: Ability to focus on own strengths;
- ▶ Weakness: Less focus on technology;
- ▶ Opportunity: Offers option for consulting services;
- ▶ Threat: Different kind of competition, hardware vendors and (previous) partners.

The main conclusion of this research is that there is no evidence that there is a greater focus on business requirements than on technical requirements in RfP's with cloud elements. The hypothesis must be falsified.

### LIMITATIONS AND PROBLEMS

There are a number of limitations within this research, below a list of these limitations is given:

1. The RfP's used for this research are RfP's that are issued to ICT Service Provider Atos;
2. Limited amount of RfP's;
3. Research is done from the angle of Service Providers;
4. No research is being performed on the rationale of the requested requirements.

During the course of the research some problems were encountered:

1. Customer interview request were denied based on reasons beyond the control of the research;
2. Differentiation based on Service models was not part of the setup of this research. Therefore no conclusions can be drawn if there is a difference in PAAS/SAAS and IAAS requirements.

### RECOMMENDATIONS FOR FURTHER RESEARCH

After performing this research study a few recommendations came to mind about further research possibilities based upon this research topic:

- ▶ Further study with more RfP's included;
- ▶ Including RfP's issued to other Service Providers than Atos;
- ▶ Researching the rationale behind the requested requirements;
- ▶ Differentiation between IAAS / PAAS and SAAS cloud elements.

## Appendix A List of RfP documents

Company	Document name	Document date
TenneT	CONTRACT-H2-L3-D01 - SD Service Management and Governance(3690090)	18-12-2015
	CONTRACT-H3-L1-D01 - Quality Requirements and Reporting(3690915)	18-12-2015
	CONTRACT-H4-L1-D01 - Service Concept Infrastructure Services (requirements)(3698731)	18-12-2015
	CONTRACT-H2-L1-D01 - SD Network Management(3688184)	18-12-2015
	CONTRACT-H2-L1-D02 - SD Datacenter Infrastructure(3688210)	18-12-2015
	CONTRACT-H2-L1-D03 - SD Platform Operation(3688299)	18-12-2015
	CONTRACT-H2-L1-D04 - SD DC Basic Services(3689359)	18-12-2015
	CONTRACT-H2-L1-D05 - SD Technical Operation(3689574)	18-12-2015
	CONTRACT-H2-L1-D06 - SD Functional Application Operation and Support(3689757)	18-12-2015
	CONTRACT-H2-L1-D07 - SD Workplace Services(3689786)	18-12-2015
	CONTRACT-H2-L1-D08 - SD Output Management(3689800)	18-12-2015
	CONTRACT-H2-L1-D09 - SD Collaboration Services(3689822)	18-12-2015
	CONTRACT-H2-L1-D10 - SD Control Center Telephony(3689836)	18-12-2015
	CONTRACT-H2-L1-D11 - SD Service Desk(3689844)	18-12-2015
	CONTRACT-H2-L2-D01 - SD Transitional Services(3689857)	18-12-2015
	CONTRACT-H3-L2-D02 Pricing Agreement_v1-0(3698744)	18-12-2015
	CONTRACT-H3-L3-D04 - Policy - Audit Logging(3690993)	18-12-2015
	CONTRACT-H3-L3-D05 - Policy - Cryptography(3690995)	18-12-2015
	CONTRACT-H3-L3-D06 - Policy - IT logical access Management(3698737)	18-12-2015
	CONTRACT-H3-L3-D07 - Policy - Mobile Devices - Apple iOS and MDM Security(3690997)	18-12-2015
CONTRACT-H3-L3-D10 - Information Protection Guideline(3691003)	18-12-2015	
PostNord	14-IT-524_Appendix_2_1_ServiceDescriptionITWorkplaceServices	7-8-2015
	14-IT-524_Appendix_2_2_ServiceDescriptionManagedPrintService	7-8-2015
	14-IT-524_Appendix_2_3_ServiceDescriptionLanServices	7-8-2015
	14-IT-524_Appendix_2_4_ServiceDescriptionConsultingServices	7-8-2015
	14-IT-524_Appendix_3_GeneralRequirementsForTransitionAndTransformation	7-8-2015
	14-IT-524_Appendix_5_ServiceLevels_REV_B	13-10-2015
	14-IT-524_Appendix_6_1_Reporting	7-8-2015
	14-IT-524_Appendix_6_2_DocumentationManagement	7-8-2015
	14-IT-524_Appendix_6_3_ApprovedSubContractors	7-8-2015
	14-IT-524_Appendix_6_4_ITServiceManagement	7-8-2015
	14-IT-524_Appendix_6_GovernanceAndCoOperation	7-8-2015
	14-IT-524_Appendix_7_1_PostNordGroupWideAndGeneralSecurityRequirementsInContracts	2-2-2015
	14-IT-524_Appendix_7_SecurityRequirements	7-8-2015
	14-IT-524_Appendix_8_PricesAndPayment	7-8-2015
	14-IT-524_Appendix_9_Benchmarking	7-8-2015
	14-IT-524_Appendix_10_ExitManagementServices	7-8-2015
	14-IT-524_Appendix_12_PostNordCodeForSuppliers	7-8-2015



Company	Document name	Document date
	14-IT-524_Appendix_DD_1_SupportingProcesses	7-8-2015
Huawei	Annex_2-EMUI EU Statement of compliance--Managed Service--15092015	15-9-2015
	Annex_2-EMUI EU Statement of compliance--Privacy--18092015	18-9-2015
	Annex_2-EMUI EU Statement of compliance--Technology--15092015	15-9-2015
	Annex_3-EMUI EU SLA requirements--15092015	15-9-2015
	Annex_5-EMUI EU Roles and responsibilities--15092015	15-9-2015
Neste Oil	Appendix 1. Neste Oil FIT RFP Business Requirements	23-1-2015
	Appendix 1.1 Neste Oil End-user Support and Productivity Platforms	23-1-2015
	Appendix 1.2 Neste Oil ICT Production Platforms	23-1-2015
	Appendix 1.3 Neste Oil Business Application End-end Operation Services	23-1-2015
	Appendix 1.4 Incident Management Process	23-1-2015
	Appendix 1.5 Change Management Process	23-1-2015
	Appendix 3. Neste Oil Service Management Concept and Handbook	23-1-2015
	Appendix 4. Neste Oil FIT RFP Transition and Transformation Requirements	23-1-2015
	Appendix 5.2 Neste Oil ICT Testing Requirements for Software Vendors	23-1-2015
	FIT RFP 2 Pricing Principles v1.0	23-1-2015
BAM	A - RFP End User Support Services BAM - Directives	6-12-2012
	B - RFP End User Support Services BAM - Statement of Requirements	6-12-2012
MN	Schedule 2A - Cross Functional Services SOW_v1-0	11-10-2013
	Schedule 2E - Help Desk Services SOW_v1-0	11-10-2013
	Schedule 2F - End User Computing Services SOW_v1-0	11-10-2013
	Schedule 5 - Transition Plan_v1-0	11-10-2013
	Schedule 6 - Transformation Plan_v1-0	11-10-2013
	Schedule 7 - Pricing_v1-0	11-10-2013
	Schedule 8 - Pricing Reductions_v1-0	11-10-2013
	Schedule 9 - Exit Plan_v1-0	11-10-2013
Sanoma	Schedule 1. End-user Services	29-11-2013
Sanquin	Sanquin_EAITInfrastructuurdiensten_Aanbestedingsdocument_vdef	29-9-2013
	Sanquin_EAITInfrastructuurdiensten_Annex2_Programma_Eisen_Wensen_versi edef	29-9-2013



## Appendix B Statistical data chapter 4.1

```
Cloud <- c(961,181,0,6,335,121,396)
Non_Cloud <- c(2216,196,3,6,785,271,345)
```

```
t.test(Cloud,Non_Cloud)
```

Welch Two Sample t-test

```
data: Cloud and Non_Cloud
t = -0.8098, df = 8.115, p-value = 0.4412
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-999.6961 479.1247
sample estimates:
mean of x mean of y
285.7143 546.0000
```

```
Non_functional <- c(689,328,3,12,520,240,377)
Functional;Non_functional
```

```
t.test(Functional,Non_functional)
```

Welch Two Sample t-test

```
data: Functional and Non_functional
t = 0.6035, df = 6.945, p-value = 0.5653
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-619.9496 1043.9496
sample estimates:
mean of x mean of y
521.8571 309.8571
```

## Appendix C Statistics Chi-squared test "Cloud"

To perform the Chi-squared test the following data is inserted into R:

	General	Transition	Governance	HR	Financial	Legal	Technical
Cloud	961	121	335	0	181	6	396
Non_cloud	2216	271	785	3	196	6	345

To insert the table above the following command is executed in R:

```
Cloud <- read.table("Cloud expected1.csv", sep = ";", row.names = 1, header = TRUE)
```

To execute the test the following command is given into R:

```
Expected <- chisq.test(Cloud); Expected
```

The result that is retrieved from this test is shown in the textbox below.

```
Pearson's Chi-squared test
data: Cloud
X-squared = 189.4222, df = 6, p-
value < 2.2e-16
```

To view the expected results the following command is given into R:

```
Expected$expected
```

This command has the following result.

```
      General Transition Governance      HR Financial  Legal
Cloud  1091.378  134.6616  384.7475  1.030574  129.5088  4.122295
Non_cloud 2085.622  257.3384  735.2525  1.969426  247.4912  7.877705
      Technical
Cloud    254.5517
Non_cloud 486.4483
```

## Appendix D Statistics Chi-squared test “Functional”

To perform the Chi-squared test the following data is inserted into R:

	General	Transition	Governance	HR	Financial	Legal	Technical
Functional	2488	152	600	0	49	0	364
Non_functional	689	240	520	3	328	12	377

To insert the table above the following command is executed in R:

```
Functional <- read.table("Cloud expected2.csv", sep = ";", row.names = 1, header = TRUE)
```

To execute the test the following command is given into R:

```
Expected <- chisq.test(Functional); Expected
```

The result that is retrieved from this test is shown in the textbox below.

```
Pearson's Chi-squared test

data: Functional
X-squared = 949.2812, df = 6, p-
value < 2.2e-16
```

To view the expected results the following command is given into R:

```
Expected$expected
```

This command has the following result.

```
      General Transition Governance      HR Financial  Legal
Functional 1993.401 245.9595 702.7413 1.882343 236.5477 7.529371
Non_functional 1183.599 146.0405 417.2587 1.117657 140.4523 4.470629
      Technical
Functional    464.9387
Non_functional 276.0613
```



## Used abbreviations

Abbreviation	Meaning
CAGR	Compound Annual Growth Rate
IaaS	Infrastructure as a Service
IDC	International Data Corporation
PaaS	Platform as a Service
RfP	Request for Proposal
SaaS	Software as a Service
SWOT	Strengths, Weaknesses, Opportunities & Threats

## Used definitions

Definition	Meaning
Business requirements	Must be delivered to provide value
Cloud Computing	Cloud computing is a model for enabling ubiquitous, 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.
Community cloud	The cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises
Hybrid cloud	The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds)
IT outsourcing	Delegating or transferring some or all of the IT related decision making rights, business processes, internal activities, and services to external providers, who develop, manage, and administer these activities in accordance with agreed upon deliverables, performance standards and outputs, as set forth in the contractual agreement
Public cloud	The cloud infrastructure is provisioned for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organization, or some combination of them. It exists on the premises of the cloud provider
Private cloud	The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises
Service Provider	An organization supplying services to one or more internal customers or external customers. Service provider is often used as an abbreviation for IT service provider. (AXELOS, 2011)
Technical requirements	Technical specification (of a business requirement) to assure a specific specification

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