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Information Technology Service Management for Cloud Computing

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The focus of this study is on Information Technology Service Management. The purpose of the theory part is to introduce the relevant concepts and to discuss the importance of IT Service Management in Cloud Computing. The purpose of the case study is to conduct an assessment of the Service Management Systems at the case organization, to create a a Service Improvement Plan based on the assessment results and to identify Critical Success Factors that need to be addresses for the solution to be successful.

The theoretical part of this study introduced the basic terms and concepts of Cloud Computing, IT Service Management and ISO/IEC 20000 certification and discussed the importance of ITSM in a Cloud Computing organization. The requirements for ISO/IEC 20000 certification were identified and an outline for the certification process was presented.

The case study involved the assessment of IT Service Management Systems at the case organization. The assessment was based on the requirements of ISO/IEC 20000 standard. The results showed that although the organization is currently not in compliance with the standard, many of the ITSM related processes are executed well. The largest problems identified were with the lack of evidence that the processes exist and the lack of proper documentation. Additionally deficiencies in configuration and change management, as well as relationship processes were identified. Based on the results of the assessment, a Service Improvement Plan was proposed. Using the plan, the case organization can start the process of improving IT Service Management systems to the level required for passing the ISO/IEC 20000 certification audits.

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Tässä tutkimuksessa keskityttiin tietotekniikkapalveluiden hallintaan ja johtamiseen. Tutkimuksen teoreettisena tavoitteena oli esitellä aiheeseen liittyvät käsitteet ja pohtia IT palveluiden hallinnan tärkeyttä pilvipalveluissa. Käytännön tavoitteena oli kartoittaa kohdeorganisaation tietotekniikkapalveluiden hallinnan nykytaso, luoda kartoituksen perusteella suunnitelma palvelunhallinnan kehittämiseksi ja tunnistaa kriittiset menestystekijät projektille.

Tutkimuksen teoreettisessa osassa avattiin pilvipalveluiden, tietotekniikkapalveluiden hallinnan ja johtamisen, ja ISO/IEC 20000 sertifioinnin käsitteitä. Lisäksi pohdittiin palvelunhallinnan tärkeyttä pilvilpalveluille. ISO/IEC 20000 sertifioinnin vaatimukset käytiin läpi ja lopuksi esiteltiin lyhyt kuvaus mahdollisesta sertifiointi prosessista.

Tutkimuksen käytännön osassa tehtiin kohdeorganisaatiolle tietotekniikkapalveluiden hallinnan ja johtamisen systeemien kartoitus, jonka pohjana käytettiin ISO/IEC 20000 standardia. Vaikka kohdeorganisaatio ei nykymuodossa täytä sertifikaatin vaatimuksia, havaittiin kartoituksessa monia palvelunhallinnan kannalta hyvin toteutettuja asioita. Käytännön toiminta kohdeorganisaatiossa on pääosin hyvien toimintatapojen mukaista. Suurimmat ongelmat havaittiin todistusaineiston ja dokumenttien puutteena. Lisäksi puutteita havaittiin muunmuassa konfiguraation- sekä muutoksenhallinnan, että suhdeprosessien suhteen. Kartoituksen tulosten pohjalta luotiin kehityssuunnitelma, jonka avulla kohdeorganisaatio voi aloittaa tietotekniikkapalveluiden hallinnan ja johtamisen kehittämisen ISO/IEC 20000 standardin vaatimalle tasolle.

Avainsanat: ISO/IEC 20000, ITSM, palvelunhallinta, pilvipalvelut, tietotekniikka, IaaS

Preface

This thesis would not have been possible without my father Pauli, who helped me to establish the first contacts to the case organization. The possibility to continue in the organization after the thesis to work in the project has created a great opportunity to gain an in-depth understanding of the development and characteristics of an organization working in the Cloud Computing ecosystem.

The work done for this thesis has required the effort of numerous people both inside and outside the case organization and I would like to offer my gratitude for their help in this project as well as for creating a very encouraging and supporting atmosphere to work in.

I would like to thank my professor Heikki Hämmäinen for his flexibility as well as the advice and support he has given me. I would also like to thank my instructor Ville Kivelä who had enough confidence in me to arrange this great opportunity and for the constant support he has given.

Finally I want to thank my parents Päivi and Pauli and my brother Juha who have continuously been pushing me in my studies even when I have been struggling and whose support has greatly helped me to endure throughout this project.

Espoo, 28.04.2010

Jaakko Ristola

Contents

Terms and Abbreviations

API	Application Programming Interface
ASP	Application Service Provider
BPM	Business Process Management
BS	British Standard
BSM	Business Service Management
CBDO	Chief Business Development Officer
CCTA	Central Computer and Telecommunications Agency
CEO	Chief Executive Officer
CMDB	Configuration Management Database
CMMI	Capability Maturity Model Integration
CobiT	Control Objectives for Information and related Technology
CRM	Customer Relationship Management
CSF	Critical Success Factor
CSI	Continual Service Improvement
DMS	Document Management System
HaaS	Hardware-as-a-Service
IaaS	Infrastructure-as-a-Service
ICT	Information and Communication Technologies
IEC	International Electrotechnical Commission
IP	Infrastructure Provider
IT	Information Technology
ITIL	Information Technology Infrastructure Library
ITSM	Information Technology Service Management
itSMF	Information Technology Service Management Foundation
IS	Information System
ISO	International Organization for Standardization
OGC	Office of Government Commerce
PaaS	Platform-as-a-Service
PCI/DSS	Payment Card Industry Security Standards Council
PDCA	Plan, Do, Check, Act
QoS	Quality of Service
RCB	Registered Certification Body
ROI	Return on Investment
SaaS	Software-as-a-Service
SLA	Service Level Agreement
SLM	Service Level Management
SP	Service Provider
SSME	Services Sciences, Management and Engineering
TQM	Total Quality Management
VPN	Virtual Private Network

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1 Introduction

1.1 Background

The service orientation in Information Technology (IT) has long roots. In the beginning, the IT services were most commonly offered by in-house IT organization. The outsourcing of IT services began in the mid-90's in Finland. First, the external IT service providers came inside the organizations to take care of the service management needs. This market has been relatively saturated already since the early 2000. Now more and more organizations choose to go even further with complete outsourcing of IT services to large external server farms with external service management. This trend can be seen as natural evolution founded on the popularization of the Internet, and is similar to what has been observed in other industries as well. [31]

The best way to offer outsourced IT services has been subject to some debate and the concepts have evolved considerably over time. The concept of hosting has been around for a long time but one of the big early predecessors to Cloud Computing was the Application Service Provider (ASP) business model. The coupling of infrastructure and software development inside one organization inherent in ASP, although initially gaining lots of interest, was not very successful. Cloud Computing, with separated software and infrastructure entities, offers now a more competitive framework and represents a major shift in the market place.

Cloud Computing companies, however, still face several challenges. Trust in security and data privacy are seen as the biggest concerns in Cloud Computing [16]. Despite whether this lack of trust is warranted or not, nonetheless, these concerns need to be addressed. Satisfying the customer concerns over security and privacy issues can therefore be seen as a driving force behind this study. How to properly satisfying these demands is still not well understood in the industry. Applying for an appropriate security certificate is seen as the best solution in the case company. A project for achieving PCI/DSS (Payment Card Industry Data Security Standard) security certificate has been started and is still continuing. However, PCI/DSS only offers the capability to be certified jointly with a customer system, therefore ISO/IEC 27000 certification, for Information Security Management Systems, has also been considered.

The requirements for ISO/IEC 27000 are very strict and require well documented processes. As the processes in the case organization are mostly informal and have evolved over time based on experience and best practices, some formalization is required before focusing on security. It is generally recommended to first apply for the more light weight ISO/IEC 20000 certification for Information Technology Service Management. When all the service management processes are ISO/IEC 20000 certified, the ISO/IEC 27000 certification is much easier to achieve. The first step in implementing ISO/IEC 20000 is to start with a comprehensive assessment of the level of service management using the standard requirements as a benchmark. Using the assessment, a Service Improvement Plan can be formed to use as a roadmap for implementing changes required to achieve the certificate.

1.2   Problem Description and Objectives

The purpose of this thesis is to conduct an Information Technology Service Management Systems analysis in the case organization. To achieve this objective, the thesis has been divided into two parts: Theory and Case study.

The purpose of the theory part of the study is to first introduce the concept of Cloud Computing, then discuss the importance of Service Management in Information Technology, and finally to introduce the ISO/IEC 20000 certification and identify the requirements set by the standard.

Once the theory part is finished, the purpose of the case study is to conduct an assessment of the Service Management Systems at the case organization with the aim of identifying possible deficiencies related to the ISO/IEC 20000 requirements. Lastly the purpose of the case study is to create a Service Improvement Plan based on the assessment results and to identify relevant Critical Success Factors (CSFs).

The main research question of this thesis is: How to improve the Information Technology Service Management in a Cloud Computing company? This has been further divided into three following sub-questions:

What is the suitability of ISO/IEC 20000 for Cloud Computing?

What is the current level of Service Management Systems at the case organization?

How to improve Service Management at the case organization to fulfill the requirements from ISO/IEC 20000 standard?

1.3   Scope of the Study

The study focuses specifically on the IT Service Management processes as they relate to the case organization. It is important to note that the ISO/IEC 20000 certification is above all about the management systems of the organization, it does not cover how the services should be technically produced. Throughout the study a special Cloud Computing perspective (especially from the infrastructure services point-of-view) is maintained to Service Management.

The assessment is carried out organization wide, with a specific customer in mind, not the whole customer base. Although the end goal for the case organization is the full ISO/IEC 20000 certification and eventually ISO/IEC 27000 certification, the actual process of achieving those is outside the scope of this study. This study concentrates on the initial analysis of the Service Management processes against the specification and outlining the plan of steps to ultimately fulfilling the requirements of ISO/IEC 20000 certification.

1.4   Methods

To address the research question, several research methods are used appropriate to the phases of the study. Literature review of the related underlying theoretical concepts and frameworks will be conducted first. The case study will be based on

the theory part and conducted as a series of open interviews and a review of internal materials.

The theory part of the study will be performed as a literature review in order to gain further insight into Cloud Computing, IT Service Management and ISO/IEC 20000 standard. The Cloud Computing and IT Service Management parts are largely based on relevant scientific publications and surveys by market intelligence organizations. The ISO/IEC 20000 sections are mostly based on the standard documentation and relevant books.

The case study chapters rely on the theoretical background established by the literature review in the General Concepts chapter. The concrete counterweight to the theoretical work brought by the case study provides a real world insight into IT Service Management. In order to assess the capabilities of the case organization in terms of ITSM, a review of internal materials and a set of open interviews of key personnel are used.

1.5   Content of the Thesis

The overview of the structure of the thesis serves as a roadmap, providing a clear picture of how the different parts tie in together. The thesis is divided into two parts: the literature review and the case study. Chapter 2 discusses the literature and theory related to this thesis and Chapters 3 and 4 focus on the Service Management Systems assessment conducted in the case organization. The Chapter 5 finally ties back to the Chapter 1 to present the conclusions of the thesis.

Chapter 1 of this thesis sets the background for the study, introduces the research question and delimits the scope. In the general concepts chapter (Chapter 2), after the introduction, all the main concepts behind the study are defined. The review of concepts related to Cloud Computing and a selection of a suitable definition will provide the required background into the operating environment of the case organization. Understanding of IT Services and the theory behind IT Service Management is crucial in order to fully appreciate the concepts and requirements behind the ISO/IEC 20000 certification.

Chapter 3 first introduces the case organization. In addition to the introduction of the organization, the drivers and the scope for the certification are briefly discussed. Next, an overview of the assessment procedure is given in the form of purpose and assessment methods. Finally, the results of the conducted assessment are presented.

In the Chapter 4 the results from the assessment are analyzed. The chapter begins by discussing the importance of ITSM in Cloud COmputing and continues by outlining the current situation in the case organization in respect to IT Service Management with identification of strengths and weaknesses. Next, an ideal target situation is described based on the ISO/IEC 20000 requirements and the organizations unique qualities. After the target situation has been defined, a Service Improvement Plan is created to identify the steps that need to be taken to move from the current situation to the target. Finally, critical success factors to the improvement process are identified.

The last chapter (Chapter 5) concludes the thesis with an evaluation of the analysis. The results and conclusions are stated. Additionally, the reliability and the possible exploitation opportunities of the study are analyzed. In the end, possible subjects for further development are identified.

2 General Concepts

The Purpose of this chapter is to introduce the basic concepts related to this thesis. The concept of Cloud Computing is defined first. It's characteristics, architectural layers, and stakeholders are introduced. Second, the concept of Service Management is presented, with a deeper look into Information Technology Service Management (ITSM). In addition, different standards and frameworks relating to ITSM are briefly described. Finally, an overview of ISO/IEC 20000 (also referred to as ISO 20000 in the document), an international standard for IT Service Management Systems, is given, together with a look into it's different sections and an outline of typical certification process.

2.1 Cloud Computing

Cloud Computing is a relatively recent "buzzword" that has been described as the next logical step in the evolution of computing [48], as the new paradigm for providing computing infrastructure [46] and as a highly disruptive technology [39]. According to Marin Litoiu, Cloud Computing is an "emerging computational model in which applications, data, and IT resources are provided as services to users over the Web" [9]. It builds on previous research in virtualization, distributed computing, utility computing, networking and web and software services [48]. Although several academic attempts at defining Cloud Computing have been made, some confusion and disagreement as to its exact nature still exists. [15]. Fundamentally, Cloud Computing is a model for service delivery and consumption.

Armbrust et al. [2] outlines three new factors in Cloud Computing that can contribute to its success over previous computing models:

"The illusion of infinite computing resources available on demand"

"The elimination of an up-front commitment by Cloud users"

"The ability to pay for use of computing on a short-term basis as needed"

Characteristics

In order to gain a thorough understanding of Cloud Computing, it is best to start by examining what kind of characteristics are usually associated with it. Vaquero et al. [46] identifies the four major recurrent ideas as:

Virtualization Virtualization refers to the abstraction of higher operating levels from the workings of the lower levels [48]. Traditionally, virtualization has covered data and computing resources. In Cloud Computing, however, virtualization can extend all the way to the software platforms [46]. The level of virtualization can be regarded as a distinguishing feature between different Cloud service offerings. The different virtualization levels can vary from application virtualization to desktop virtualization and server virtualization.

In theory, all the different user groups can use the different virtualization levels. However, in practice, virtualized applications are mainly used by the end users, while virtual servers are used by the application developers to host the applications. Desktop virtualization can be used by both the end users as well as application developers to work on remote servers.

Utility model In contrast to previous grid services, where services were billed by fixed rates, in Cloud Computing the cost is determined dynamically according to the amount of resources the customers consume. The profitability of pay-per-use business model for service providers comes from the benefits of economies of scale in building larger data centers.[2]

Scalability Scalability and flexibility allow dynamic allocation of computing resources according to user needs. The virtual hardware resources are automatically resized in Cloud Computing [46]. Scaling up and down quickly in response to load is important for conservation of resources as well as money. Scalability is closely related to the pay-per-use concept. Scalability together with pay-per-use allows even small companies to gain the advantages of large data processing capabilities without costly investments to own hardware [2]. To the customers, scalability shows as availability of virtually infinite computing resources. In the service providers view, however, the constraints of hardware resources are always fixed and scalability is achieved through extra resources.

Third-party management Means that "consumers make use of resources, platforms, or software without having to possess them or manage the underlying complexity of the technology" [14]. With the rising cost of building and maintaining data centers, this is what makes Cloud Computing attractive. However, giving control over sensitive data over to third-party service providers presents several security and availability issues.[2][28]

In addition to the four characteristics identified above, the literature highlights several others that can be attributed to Cloud Computing. These additional characteristics include: [46][39]

- On-demand
- Quality of Service (QoS) / Service Level Agreement (SLA)
- User friendliness
- Security
- Multitenancy / Resource sharing
- Interoperability
- Standards

– Fault tolerance

– Load Balancing

– Internet centric

Architecture

Since Cloud Computing is a very broad term used to describe a multitude of aspects in computing, it makes the architecture classification complicated. Architecture can be divided to different service levels according to the level of virtualization. These service levels are normally described as "Everything-as-a-Service", or "XaaS". The most common division is into Software-as-a-Service, Platform-as-a-Service and Infrastructure-as-a-Service. In addition, a Hardware-as-a-Service (HaaS) layer is placed below the IaaS layer by some sources. The offered services can be accessed anytime, anywhere in the world over the Internet. Figure 1 shows the layered architecture of Cloud Computing. [29][38][39][46][50]

Figure 1: Cloud Architecture
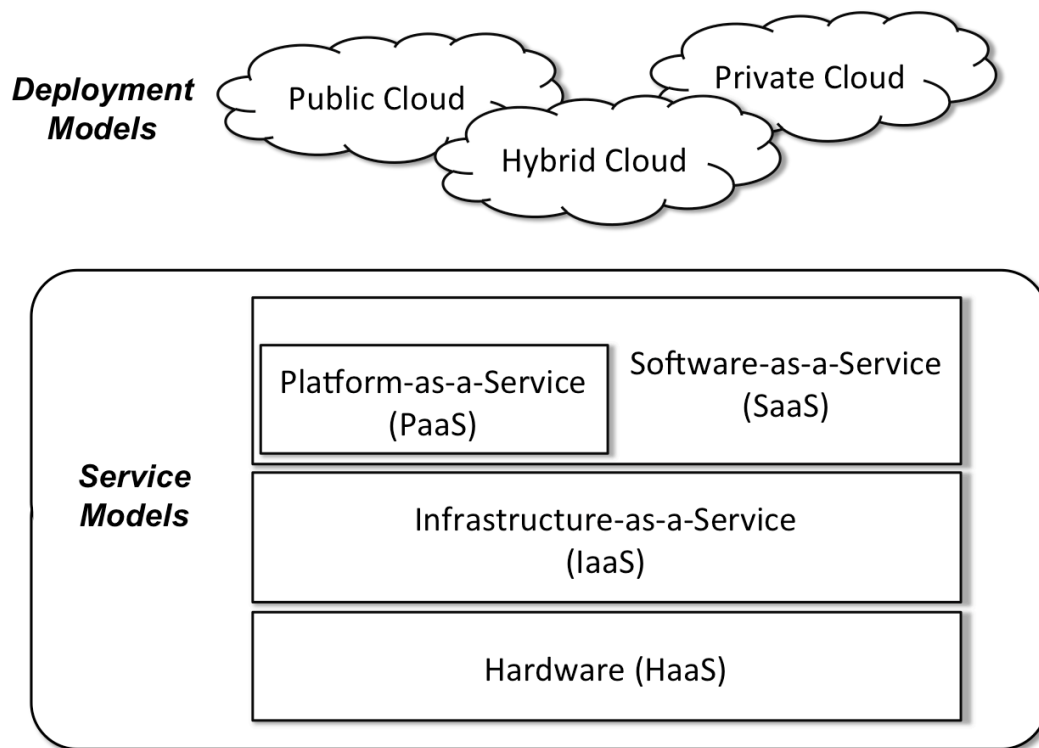
Infrastructure-as-a-Service (IaaS) IaaS provides the core of the Cloud service offerings. It sits directly on top of the hardware layer and provides low-level services. Separating Cloud IaaS services from traditional hardware hosting services, is the virtualization layer, which allows dynamic resizing, splitting and assigning of computational resources according to user needs without the

user's knowledge. These virtual machines are independent of the underlying hardware and can be moved and copied to allow flexibility and stability. The IaaS layer is available to the customers through underlying networks.

Platform-as-a-Service (PaaS) Platform layer provides another layer of abstraction on top of the virtualized infrastructure. It establishes an integrated software platform over the Web for developing, testing, deploying and hosting of user-friendly web applications for application developers. It eliminates the need for direct contact between supplier and consumer as well as hides the complexity of the underlying hardware layer. Traditionally, a strong vendor lock-in for the applications has been prevalent as each PaaS provider uses their own Application Programming Interfaces (APIs), which are not compatible with each other.

Software-as-a-Service (SaaS) SaaS is perhaps the most widely recognized of the Cloud Computing layers. It is normally build on top of either own or foreign IaaS and PaaS environments, utilizing the offered flexibility. SaaS provides an alternative to locally run applications and therefore offers the widest appeal to the end users. The pricing in SaaS is usually based on access basis allowing the users to pay only for what they consume and giving the service providers a steady revenue stream. This differs from the traditional software licensing, where the user has to pay high licensing costs up-front.

In addition to the architectural levels, Cloud Computing services can be classified according to their availability. These modes can be divided into Private, Public and Hybrid Clouds. As we can see from Figure 1, these are not restricted to any one architectural level. [38][39][2]

Private Cloud Private Clouds are evolution from internal datacenters. They are managed within the organization and are not available to the general public. This offers several benefits to the organization, including better control over security, hardware restrictions and legal requirements making them ideal for mission critical systems. However, they might not offer the same scalability and flexibility benefits as Public Clouds do, but still have cost saving benefits. As the definitions are still somewhat unambiguous, some disagreement is evident in the literature on whether Private Clouds should be included in the Cloud Computing definition or not [2]. Virtual Private Clouds can be used to describe the grey zone between Private and External Clouds provided by third-party providers, but with datacenter sharing restricted to the parts of a single organization [1].

Public Cloud As opposed to Private Clouds, Public Clouds are available to the public using the utility model. They offer Cloud Computing services in the mainstream sense. The services are offered by a third-party provider over the Internet on pay-as-you-go, on-demand basis. However, they face many concerns regarding security, privacy, integrity, lock-in and availability that are associated with giving sensitive information to a third-party.

Hybrid Cloud The reality is that neither Private nor Public Clouds on their own can fully support the requirements of enterprise IT services. Therefore, most enterprise IT environments are forms of Hybrid Clouds, consisting of internal and external providers. Mission critical systems can be kept in control in internal datacenters while scalability and elasticity issues can be addressed by Public Clouds.

Stakeholders

The stakeholders in Cloud Computing can be divided into various types, corresponding to the different abstraction levels as shown in Figure 2. These stakeholder types correspond to the previously identified architecture layers. [28][46]

– Cloud infrastructure providers

– Cloud service providers

– Cloud consumers

  – End users
  – Application developers

Cloud infrastructure providers The infrastructure providers function at the back-end of Cloud Computing. They are the ones who control and maintain the actual hardware and systems software on top of which the whole Cloud Computing ecosystem works. These are the providers of the capabilities of Infrastructure-as-a-Service layer. The main customers of the Cloud infrastructure providers are large corporations and Cloud service providers.

Cloud service providers The service providers use the capabilities offered by the infrastructure providers. They provide the front-end of Cloud Computing, offering communication, collaboration and business services such as "high-volume computation, virus scanning, antispam services, desktop management, e-mail, databases, software development platforms and data storage"[28]. These services correspond to the Software-as-a-Service and Platform-as-a-Service architecture layers.

Cloud consumer group has been divided into two parts. These are the end users and application developers.

End users End users are at the front-end of Cloud service-level abstraction. They are the normal consumers, who use the services provided by the lower-level providers. They normally use Web browsers to access the services over the Internet in SaaS and pay-as-you-go manner. End users can be either typical consumers or business enterprise users.

Application developers Application developers are the stakeholders using the capabilities offered by the IaaS and the PaaS layers to remotely design and build software to be consumed by the consumers.
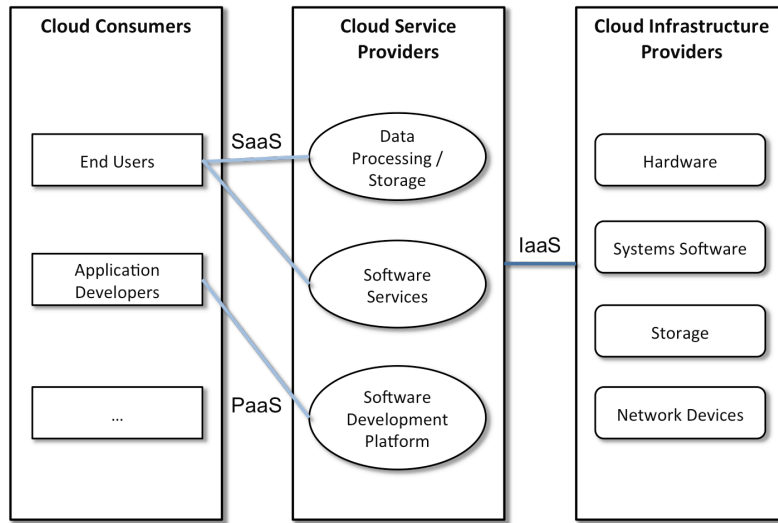
Figure 2: Stakeholders in Cloud Computing [28]

Definition

Since Cloud Computing is such an encompassing term, forming a short and descriptive definition is difficult. Shorter and more vague definitions are easier to understand, but do not give the whole picture, where as more complex definitions are harder to grasp but give a more detailed look at what Cloud Computing contains. Below are definitions by Foster et al. [11] and Vaquero et al. [46] respectively, that offer a descriptive and practical overview of Cloud Computing.

> "A large-scale distributed computing paradigm that is driven by economies of scale, in which a pool of abstracted, virtualized, dynamically-scalable, managed computing power, storage, platforms and services are delivered on demand to external customers over the Internet." [11]

> "Clouds are a large pool of easily usable and accessible virtualized resources (such as hardware, development platforms and/or services). These resources can be dynamically reconfigured to adjust to a variable load (scale), allowing also for an optimum resource utilization. This pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by the Infrastructure Provider by means of customized SLAs." [46]

Benefits and Challenges

The ideal view of Cloud Computing offers several advantages over previous computing paradigms. General advantages include scalability, reliability and security [9]. For the end users, the benefits can be seen as reduced prices through reduced IT staff training costs and smaller operational costs, improved competitive edge, faster time to market and efficiency and flexibility as well as a general ease of deployment.

For the service providers the main advantage is the ease of management and also reduced costs of service delivery, differentiation using SLAs, resource optimization, cheaper service delivery, and broader range of available solutions.[30][7]

In reality, however, Cloud Computing still faces many challenges before it can fulfill all its promises. Improvements are needed in service level agreements, end-to-end management, security integration, enterprise integration and customization [38]. Also issues with trust, privacy and availability highlighted earlier need to be addressed [9].

2.2 IT Service Management

Services contribute more than 75% of the developed nations economies, due to the transition from more traditional agricultural and manufacturing economies to service-based economies. Because the services are more and more dependent on Information and Communication Technologies (ICT), the efficiency and effectiveness of delivering these supporting Information Technology (IT) services has become increasingly important. ICT organizations have become aware of this, which can be seen by the increased interest in the standards and certifications relating to management of services in the recent years. Relatively little academic research has been conducted in services in general and in Information Technology Services Management (ITSM) specifically despite the increased interest inside the industries in recent years. [13]

Services and Services Sciences

Services have been historically thought of in the context of the three economic sectors: agriculture, manufacturing and services. The definition arising from this division seems a bit outdated due to the constant development and the many changes in the overall economic landscape. As a term, service does not have a single definition as it can differ slightly depending on the context.[45] The varying array of the types of existing services makes the creation of an overall definition challenging. However, some common elements, as listed by Chesbrough and Spohrer [6], can be identified to describe the features of different services.

- Close interaction of supplier and customer [41][10]

- Nature of knowledge created and exchanged [33][47]

- Simultaneity of production and consumption [42]

- Combination of knowledge into useful systems [17]

- Exchange as processes and experience points [36]

- Exploitation of ICT and transparency [8][44]

Another way to look at services is as opposed to products. What separates services from products is that services are highly intangible, produced and consumed at the same time, and very variable. In addition, the user normally takes part in the production of the service and the final satisfaction is very subjective.[26] As can be seen in the Figure 3, the differences between services and products are mostly determined by the amount of tangibility. In the context of this paper, a useful definition of a service is given by IBM [21]:

> "A service is a provider/client interaction that creates and captures value."
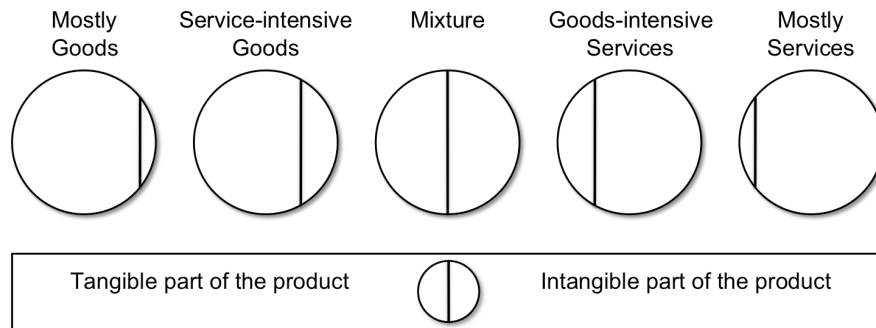
Figure 3: Services and Products [26]

IT Services

The literature offers multiple, slightly varying, definitions for IT services, as was the case for the overall category of services. The following two definitions by OGC, Office of Government Commerce [34] and Braun and Winter [4] respectively, give a good basic idea what is generally meant by IT services.

> "A described set of facilities, IT and non-IT, supported by the IT Service Provider that fulfills one or more needs of the customer and that is perceived by the customer as a coherent whole." [34]

> "A bundle of services provided by an IT system or IT department to support business processes." [4]

Although, giving a good general idea, a deeper look into the characteristics of IT services is needed in order to gain a better understanding. According to itSMF International and van Selm [26], the three elements of IT services are Information Systems (IS), Support, and Quality Specifications. Information systems part can be further divided into people, process and technology. Figure 4 illustrates how these relate to each other. Technology part of IS is traditionally the best understood. However, for the technology to function properly, qualified and well trained staff (people) as well as properly documented processes for procedures and work

instructions are needed. Support functions are required to keep the information systems running to meet the agreed quality constraints. All this would be irrelevant if it was not done to the requirements of the customers. The quality of IT services is usually defined by the critical characteristics set by customer expectations.
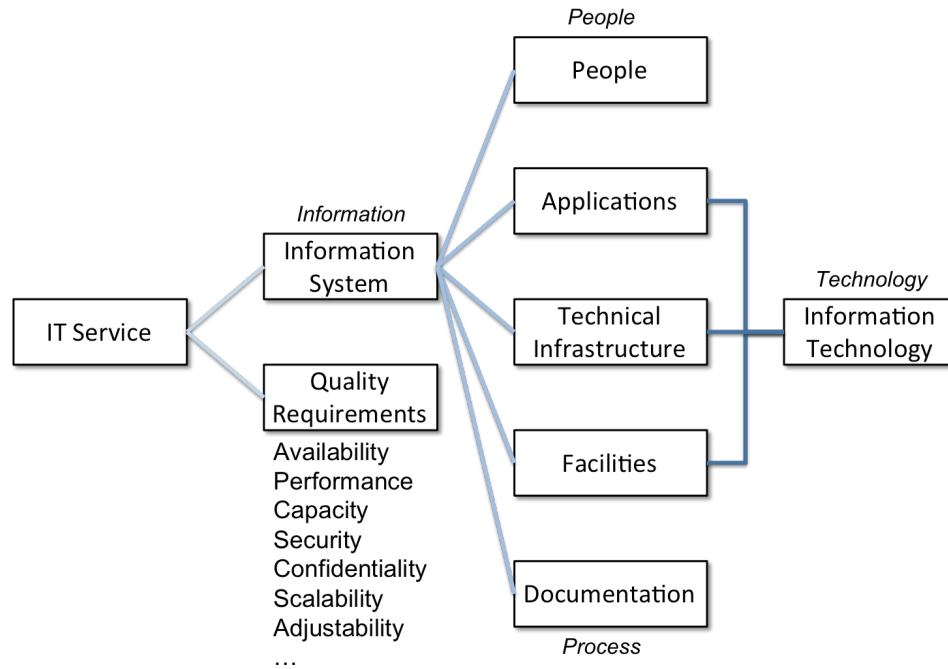
Figure 4: Breakdown of the components of an IT service [26]

Definition of IT Service Management

In order to efficiently and effectively provide these IT services for the organization to support its business, IT Service Management is needed. In short, ITSM is a subsection of Services Sciences that is "concerned with delivering and supporting IT services that are appropriate to the business requirements of the organization" [5]. Galup et al. [13] defines ITSM as:

> "Set of processes that detail best practices based on ITIL standards to enable and optimize IT services in order to satisfy business requirements and manage the IT infrastructure both tactically and strategically."

IT service management is process-oriented as opposed to IT management, which is more technology-oriented. Due to its process-oriented nature, ITSM shares commonalities with the process improvement movement frameworks such as Total Quality Management (TQM), Six Sigma, Business Process Management (BPM) and Capability Maturity Model Integration (CMMI) [13].

The key concerns for managers regarding IT services are the increasing demands for better returns from IT investments, the regulatory requirements for IT control,

the optimization of costs, and the ability to assess performance against standards [32]. In order to successfully fulfill these requirements, ITSM must include "common vocabulary, common approach to ensure stability in the IT environment and a common set of management principles" [13]. These common elements are set in industry best practices described in the Information Technology Infrastructure Library (ITIL) framework. ITSM is very strongly associated with the ITIL best practices framework by the British Government. In addition to ITIL, several other frameworks and standards which are related to IT Service Management can be identified: [49][13][26]

- CobiT

- CMMI

- ISO 9000

- ISO 15504

- ISO 20000

- ISO 27001

- IT Governance

- Service Level Management (SLM)

- Business Service Management (BSM)

ITIL v2 reflected very strongly the process-based view of IT service management. However, the new ITIL v3 is shifting from the process-based framework towards a larger view reflecting the whole life cycle of IT services [32]. The ITSM part of ITIL v2 is divided into two parts, Service Support and Service Delivery. In addition, ITIL outlines other operational guidance including, ICT Infrastructure Management, Security Management, The Business Perspective, Application Management, Software Asset Management and Planning to Implement Service Management [20]. ITIL, v3 on the other hand, has a life cycle perspective including Service Strategy, Service Design, Service Transition, Service Operation and Continual Service Improvement [34] as shown in Figure 5.

Implementing ITSM

A successful implementation of IT Service Management system in an organization will offer various benefits. According to a study on effects of implementing ITIL best practices in six organizations by Hochstein et al. [19], the most widely experienced advantages are:

- Client/service orientation and the quality of IT services

- Efficiency due to standardization, optimizing of processes and process automation
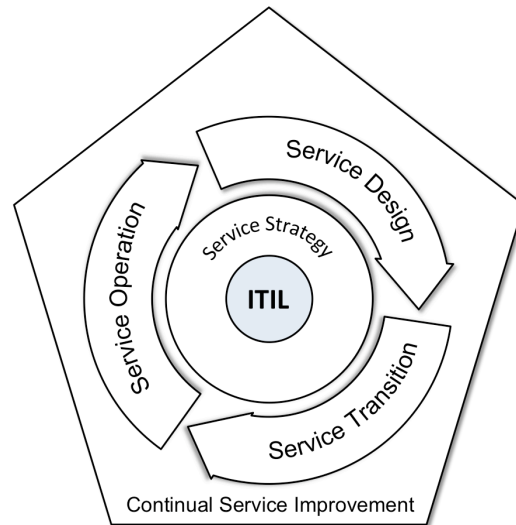
Figure 5: ITIL v3 Framework adapted from OGC, Office of Government Commerce [34]

– Transparency and comparability through process documentation and process monitoring

In addition to these benefits mentioned by the project leaders and project teams, some additional benefits as outlined by itSMF International and van Selm [26] can also be identified. The benefits of ITSM implementation are not only felt inside the organization, but also by its customers and users. Table 1 summarizes the perceived benefits of ITSM implementation.

However, successful implementation of ITSM is not trivial and organizations attempting it face several challenges. The challenges can be divided by type into four categories: Process, People, Technology and Data related challenges [27]. In a study on strategies and critical success factors in successful ITIL implementation projects, Pollard and Cater-Steel [37] raised four challenges that are particularly important to take into consideration. These challenges are:

Dual roles Although ITSM is ultimately supposed to clarify the roles and responsibilities for the employees, during the implementation process, however, many are forced to perform their old duties as well as conform to ITIL processes. This may even lead to an overload and require additional resources and personnel in the short-term [26].

Engaging the right people Especially in the large organizations, the involvement and commitment of personnel at all levels in the organization is necessary. Only having a specialist department working on the implementation may lead to isolation and ultimately to a situation where the direction is not accepted by other departments. [26]

Gaining support from technical staff Related to the previous challenge, it is very important to have the technical staff understand the need to adhere

Table 1: Benefits of ITSM implementation to customers and the IT organization [26]

Stakeholder group	Perceived benefits
Customers	Improved customer-focus
	Improved relationship due to service quality agreements
	Improved service descriptions
	Improved management of quality aspects
	Improved communication with the IT organization
IT Organization	Clearer structure and better focus on corporate objectives
	Better control of the infrastructure and services
	Easier change management
	Provides effective framework for IT service element outsourcing
	Encourages cultural change to offering better services
	Provides coherent frames of reference for internal and supplier communication

      to the new processes and documentations. Therefore, a constant feedback between technical staff and the ITSM implementors is needed.

Measuring ROI Although the costs of implementing ITSM projects can be assessed, measuring the actual benefits of improvements in service provision and cost reductions may be more difficult. This can be the case especially if no baseline data has been gathered or if the targets have been identified poorly [26].

In addition to these four, itSMF International and van Selm [26] lists challenges related to the long introduction time, insufficient design and planning, underestimation of cultural and organizational changes required as well as a lack of understanding about appropriate processes and performance indicators.

To overcome these challenges, it is important to identify the Critical Success Factors. CFSs are the "few key areas that must go right for the business to flourish" [40]. Related to IT services and Service Management, these Critical Success Factors have been identified by Somers and Nelson [43], Hochstein et al. [19] and Pollard and Cater-Steel [37]:

    – Top Management Support

– Training/personnel development

– Virtual project team

– Careful software selection

– Use of consultants

– Interdepartmental communication and collaboration

– Process priority

– ITIL-friendly culture

– Customer-focused metrics

As can be seen, these CSFs are closely related to the previously identified challenges in the implementation process.

2.3 Introduction to ISO/IEC 20000

The roots of ISO/IEC 20000 can be traced to the first version of ITIL developed in 1980s. ITIL was developed by the United Kingdom's Office of Government Commerce (OGC), at the time known as Central Computer and Telecommunications Agency (CCTA), to standardize IT management practices. It was revised in 1990s to modernize it and to make it more accessible, forming what is now ITIL v2. With the introduction of ITIL v3 in May 2007, the older ITIL v2 is scheduled for withdrawal by June 2011 [35]. The British Standard 15000 (BS 15000) was written based on DISC PD0005, the Code of Practice for IT Service Management. DISC PD0005 had been designed to fill in the gaps left by ITIL v1. Due to growing international interest, BS 15000 was promoted to an international standard in 15 December 2005. [26] Figure 6 shows the evolution of ITSM from ITIL to ISO/IEC
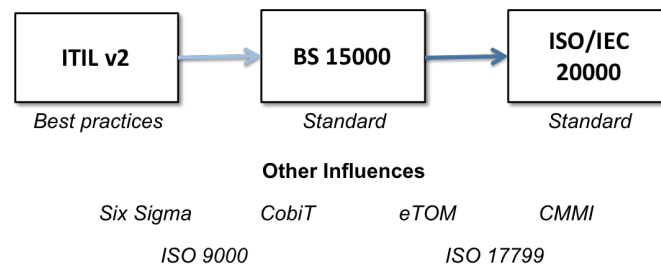
Figure 6: Evolution of ITMS from ITIL to ISO/IEC 20000 [13]

20000 standard. Figure 7 describes the current relationship between ITIL and ISO/IEC 20000. ITIL and ISO/IEC 20000 are not formally related, although they are strongly aligned. ISO 20000 also has roots in the ISO 9000, which is the international standard for quality management. [26]
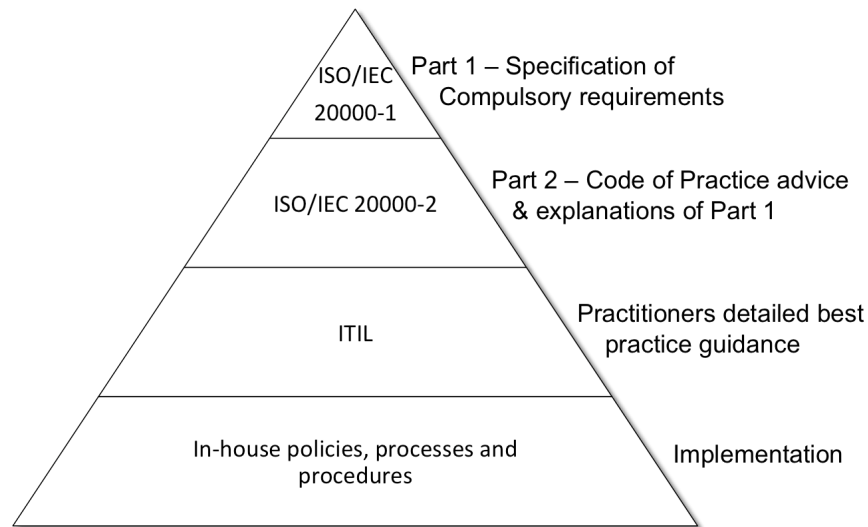
Figure 7: Relationship between ITIL and ISO/IEC 200000 [34]

Overview

ISO/IEC 20000 is an IT Service Management standard. The purpose of ISO/IEC 20000 standard is to promote the adoption of an "integrated process approach to effectively deliver managed services to meet the business and customer requirements" [22]. Its aim is "to provide a common reference standard for any enterprise offering IT services to internal or external customers" [26]. It is written to cover all the mandatory processes for achieving good Service Management. itSMF International and Clifford [25] defines four primary goals for ISO 20000:

- Customer-focused

- Integrated processes

- End-to-end service management

- Continual service improvement

In order to achieve the stated goals, ISO 20000 standard specifies five closely linked service management processes, as shown in Figure 8. These processes will be examined more closely in the section 2.4 about the certification requirements. In practice, ISO 20000 has been divided into two documents:

Part 1 - Specification The first part of the ISO 20000 contains the actual specification. It is a list of objectives and controls, "shalls" that must be met in order to achieve the certification. However, this list is not exhaustive and additional controls might be needed in order to achieve the crucial business needs. [22]

Part 2 - Code of Practice To supplement the high level specification, the second part provides a list of guidelines and suggestions within the scope of the
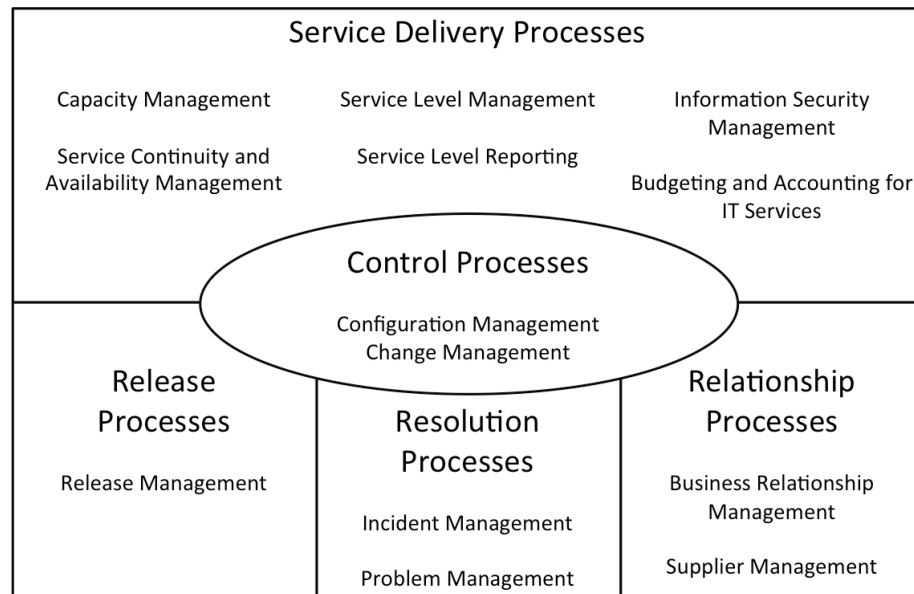
Figure 8: Service management processes [22]

formal standard. These are stated in the form of "shoulds" to be addressed by the IT service provider. The guidance and suggestions in the Code of Practice are based on an industry consensus on quality standards for ITSM processes. [23]

The key characteristics of ISO 20000 are: [25][26]

Demonstrating capability ISO 20000 is based on demonstrating capability. The organization striving for the certification need to show conformity, meaning that they need to be "able to show tangible evidence to confirm that the requirements are being satisfied".

Ongoing responsibility The certification itself should not be seen as the end goal, instead, organizations need to look it as "the side effect of an organization wide Service Management improvement culture"[25]. After achieving the certification, organizations have to go through yearly surveillance audits and re-certification audits to keep the certification.

Focus on Management System It is the management system that is being certified and not, for example, the services themselves. Scoping provides the capability to define the target against what the management system will be tested.

Focus on Organization Unlike ITIL, ISO 20000 focuses on organizations rather than individuals. The certification can be applied for the whole organization or a part of the organization, where as only individual certificates were possible in ITIL.

Communication Effective communication is key in Service Management. The standard improves communication by providing common terminology for service providers, suppliers and their customers.

ISO 20000 standard is meant for all IT service providers wishing to improve or demonstrate their Service Management practices. The ISO, International Organization for Standardization [22] states that the standard may be used:

– "by businesses that are going out to tender for their services;

– by businesses that require a consistent approach by all service providers in a supply chain;

– by service providers to benchmark their IT service management;

– as the basis for an independent assessment;

– by an organization which needs to demonstrate the ability to provide services that meet customer requirements; and

– by an organization which aims to improve the service through the effective application of processes to monitor and improve service quality."

Stakeholders

The ISO 20000 standard specifies three types of parties involved in the process: the service provider, the suppliers and the customers. Suppliers can be further divided into subcontracted suppliers and lead suppliers. Figure 9, adapted from ISO, International Organization for Standardization [22], shows an example of how they can be related. It is important to note that the service provider, who is the party actually applying for the certification, can be either internal or external service provider. Accordingly, the customer using the services provided by the service provider can be either internal business-unit or external customer. In terms of the ISO 20000 standard, however, whether the user is internal or external makes no real difference.
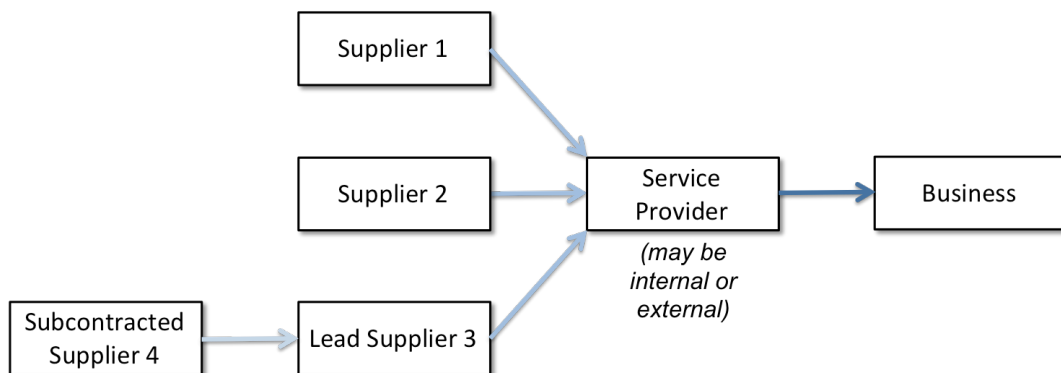

Figure 9: Example relationship between service providers and suppliers [22]

From the perspective of commitment to project, it is useful to divide service provider further into management and staff. In addition, supplier and external regulation views are examined below: [25]

Management The management commitment to the project is probably one of the most important critical success factors. In addition to the normal support and commitment functions like driving the change, assessing cost, and managing time and resources, the ISO 20000 specification outlines clear responsibilities to the senior management. This means that the senior management will need to take action themselves in order to achieve certification.

Staff The required organization for the certification project includes following functions: project board, project manager, design authority, process owner and several support roles. The standard requires that the competencies of the employees are aligned to the requirements of their roles. This means possible changes in role profiles as well as improved awareness and training of the employees.

Supplier Although the suppliers are not required to become certified together with the service provider, a clear Supplier Management process to guarantee the required end-to-end integration is needed. According to the specification, the service provider is expected to retain management control of all processes within the scope of ISO 20000 Part 1.

Customer The customer focus is a fundamental principle of the ISO 20000 standard. The close alignment between the customer and the service provider can be seen throughout the specification.

External regulations Compliance with the standard does not confer immunity from legal obligations

Costs and Benefits

When looking at the perceived benefits from the ISO 20000 certification process, it is sensible to look at them from the points of view of the different stakeholders identified in the previous section. Table 2 summarizes the benefits that can be achieved by customers and suppliers as well as service provider executives and staff. These benefits are very general and may not be realized at every organization striving for the certification. Direct value from the certification should be measured through the gaps identified during capability assessment since these are the actual opportunities for improvement. Although multiple potential benefits can be realized from achieving the certification, measuring those benefits is very difficult as is the case with other ITSM projects [26].

As with the perceived benefits, the costs of the certification vary greatly from service provider to service provider. Unlike the benefits, however, costs are easier to quantify in advance. Some of the factors affecting to costs of the whole process include:

Table 2: Stakeholder analysis matrix. [25]

Stakeholder group	Perceived benefits
Customers	Speed to market of new products improved
	More stable business services
Executive	Improved management information
	Differentiator from competitors leading to generate, retain or increase business (especially for an External Service Provider)
Service provider staff	Consistent and predictable management system
	Improved alignment to agreed customer requirements
	Staff morale improved
Suppliers	Clearer process touchpoints with their customer (the service provider)
	Closer relationship with the service provider on continual service improvement projects
	Access to future planning information, where available

– Scope of certification

– Size of the service provider

– Complexity and criticality of the service provider's services and the business being supported

– Skills and experience available

– Current level of capability

– Certified to ISO 9000 or ISO 27001 already

These factors are only affecting to the one-off costs of the certification. In addition to these, the on-going costs need to be also considered. However, most of the on-going costs are actually part of normal ITSM practices and should not be included to the certification costs. What should be included are the costs arising from surveillance and re-certification audits.

2.4 ISO/IEC 20000 Requirements and Certification Process

Requirements

The ISO 20000 requirements can be divided into two parts. Three overarching management processes can be defined in addition to the previously mentioned Service Management Processes, as shown in the Figure 10. The following numbering of the processes is based on the chapter numbers in the actual standard to ease their reference. The same numbering system is used throughout the study to refer to the sections of the standard.
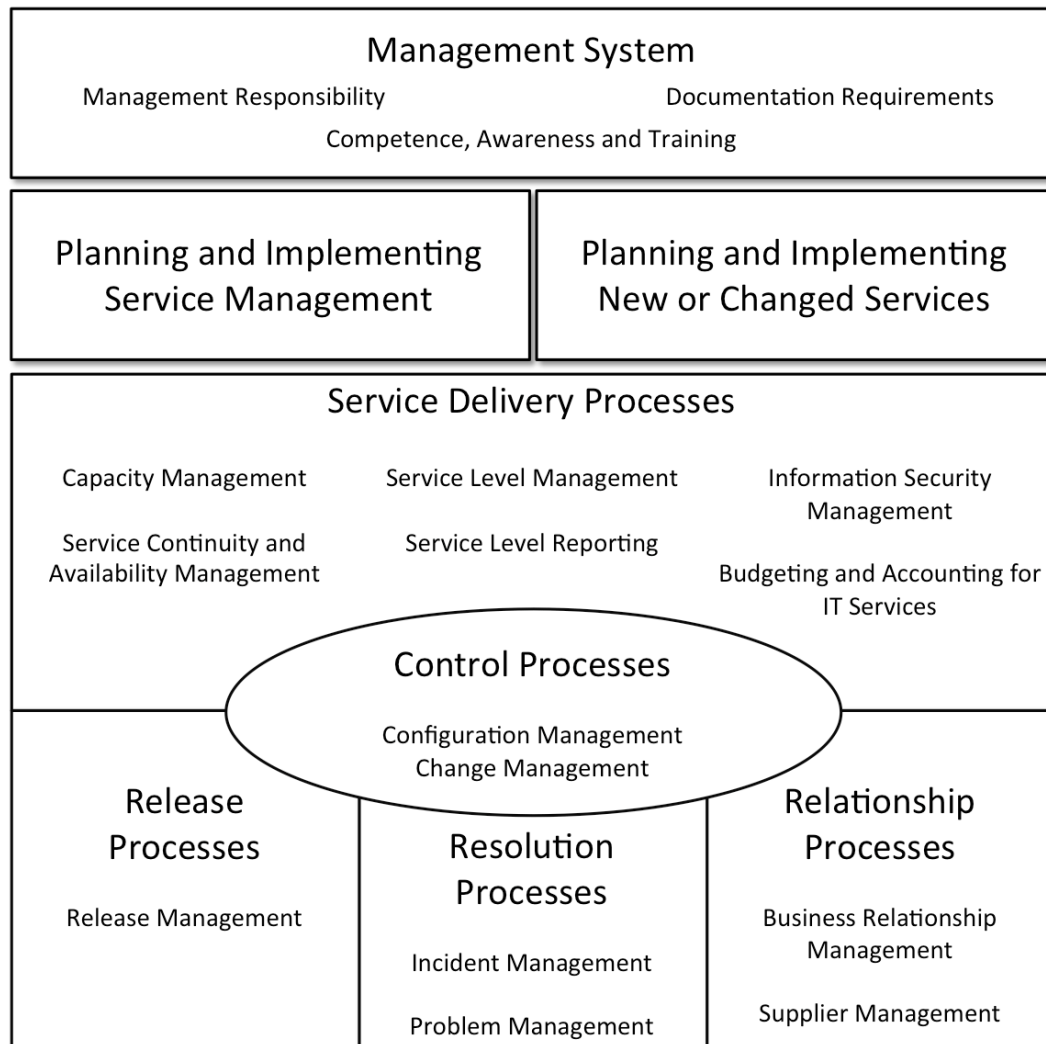

Figure 10: Overview of ISO/IEC 20000 Service Management System [25]

3 - Management system The main objective of the management systems requirements is to "enable effective management and implementation of all IT services" with the help of policies and frameworks. The management system

has been further divided into three parts defining management responsibilities, documentation requirements, and competence, awareness and training requirements. A minimum list of documents and sample evidence required for the certification can be found in Table A1 in Appendix A. [22, Section 3]

4 - Planning and implementing Service Management Planning and implementing follows the Plan-Do-Check-Act (PDCA) methodology. PCDA, from the service management perspective, is depicted in Figure 11. The PDCA methodology covers the activities to provide quality assurance of IT and business alignment. It starts from planning the objectives and processes needed to achieve the results. After the objectives have been established, they need to be implemented. Monitoring and measuring the results against the requirements is essential after the implementation. Finally, possible future actions should be identified based on the measurements to allow continual improvement. [22, Section 4]

5 - Planning and implementing new or changed services Planning and implementing new or changed services is based on the Plan-Do-Check-Act methodology defined in the previous process. The reason that planning and implementing new or changed services have their own process is "to ensure that new services and changes to services will be deliverable and manageable at the agreed cost and service quality". [22, Section 5]

The Service Management Processes, on the other hand, as listed by the ISO 20000 standard, are:

6 - Service delivery process The purpose of the Service delivery processes is to guarantee that all the services are documented in Service Level Agreements (SLAs), that reports are generated to meet the customer requirements, that the commitments over service continuity and availability are met in all circumstances, that the service provision is properly budgeted and accounted, that sufficient capacity to cover the demands of customer's needs is always available, and that all service activities are effectively covered by information security policies. Service delivery process has been divided into Service level management, Service reporting, Service continuity and availability management, Budgeting and accounting for IT services, Capacity management, and Information security management. [22, Section 6]

7 - Relationship processes Relationship processes include Business Relationship Management and Supplier Management. Business Relationship Management is concerned with "establishing and maintaining good relationship between the service provider and the customer based on understanding the customer and their business needs". Supplier management, on the other hand, focuses on "ensuring the provision of seamless, quality services" through end-to-end integration with the suppliers. [22, Section 7]
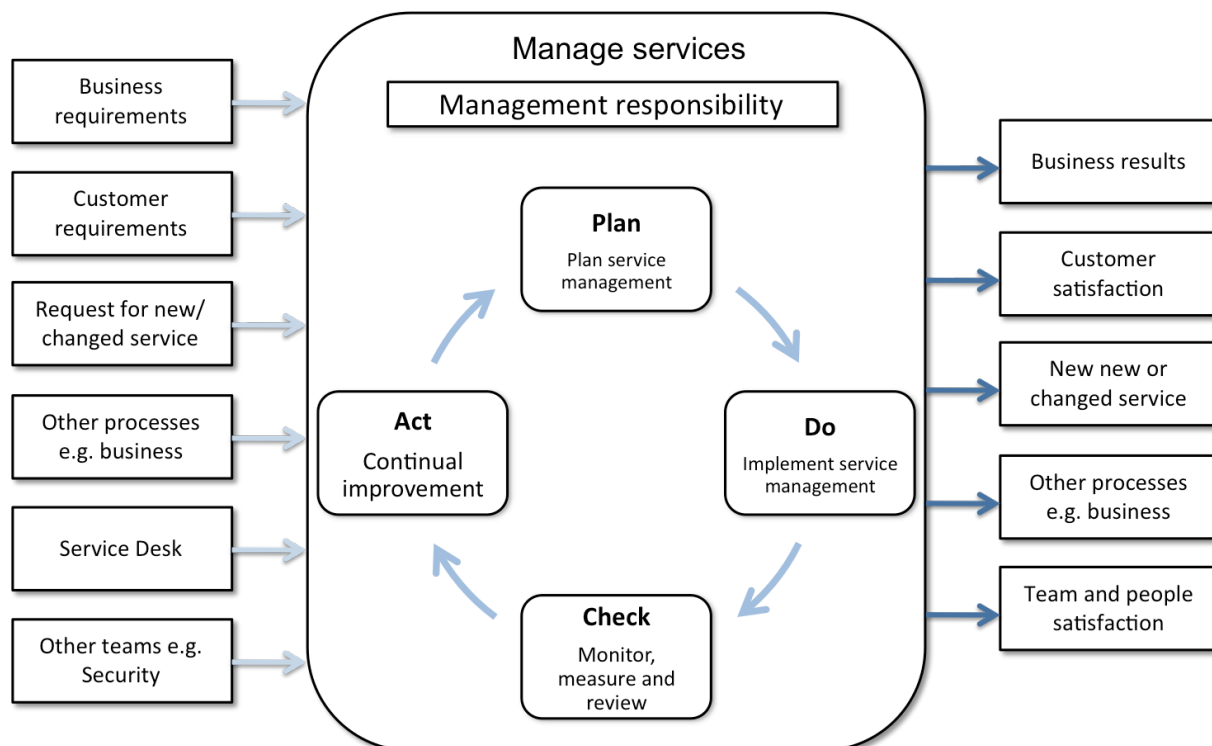
Figure 11: The Plan-Do-Check-Act framework in Service Management Processes [25]

8 - Resolution processes Resolution processes have been divided into Incident Management and Problem Management. Incidents are events which may affect the quality of service negatively. Therefore, the aim of incident management is "to restore agreed services to the businesses as soon as possible or to respond to service requests". Events which are part of standard operation of a service are not incidents. Problems, on the other hand, are "unknown underlying causes of one or more incidents". So problem management deals with trying to pre-emptively identify and analyze the causes of incidents and in that way minimize the impact on business. [22, Section 8]

9 - Control processes Control processes include Configuration Management and Change Management. Configuration management is about defining and controlling the components and the underlying infrastructure that make up the services. Configuration management database (CMDB) is used to keep track of the configurations. Change management deals with managing all changes in a controlled manner. This includes recording and classification of all changes. [22, Section 9]

10 - Release processes Release Management is closely related to the configuration and change management processes. Its objective is to "deliver, distribute and track one or more changes in a release into the live environment." [22, Section 10]

In addition to these eight service management processes, the ISO standard defines the scope of the specification as well as the related terms and definitions.

Certification Process

A project based, structured approach to the ISO/IEC 20000 certification is recommended by itSMF International and Clifford [25]. It classifies the overall certification process into two consecutive processes as shown in Figure 12. Initially the project should focus on determining the current capabilities of the service provider. This baseline capability stage can be further divided into six stages as illustrated by the inner circle in Figure 12.
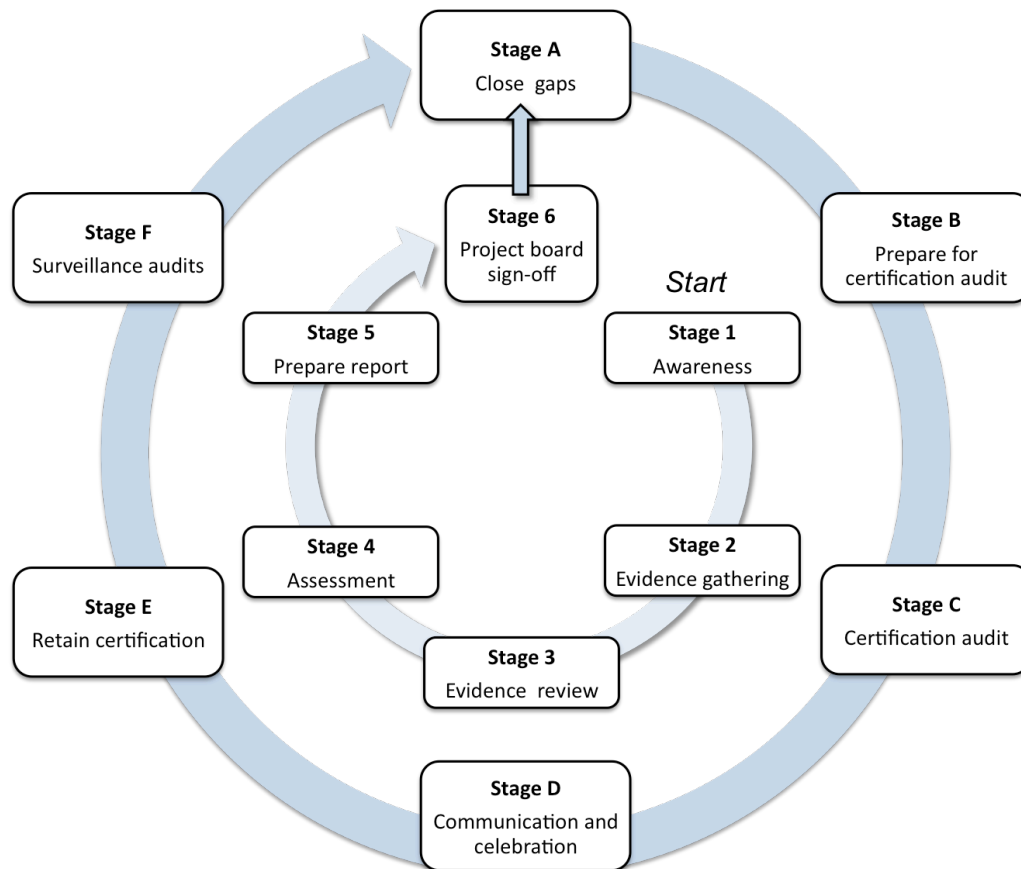
Figure 12: Overview of the staged approach to ISO/IEC 20000 certification process [25]

Stage 1: Awareness The whole certification process begins with the service provider gaining understanding about the reasons for ISO 20000 certification. This means creating a scoping statement, and considering the possible impacts that the certification will have in terms of benefits, costs and timescales. At this point, these considerations can only be done on a generic level to initiate the process. They will be specified more thoroughly in the later stages.

Stage 2: Evidence gathering The second stage, after defining the boundaries, is to find and categorize the existing information and documentation. This can be very challenging, since often the evidence can be scattered throughout the organization. Creation of a catalogue and assigning owners for the different types of evidence will help keep to keep track of them for the later stages.

Stage 3: Evidence review After getting all the existing evidence organized and before conducting the actual assessment, it is important to perform a review in order to gain understanding to how the evidence conform to the certification.

Stage 4: Assessment Due to the initial review of the evidence, the actual assessment can be more focused and less time consuming. The assessment is based on the evidence and complemented by interviews of key parties. To gain a thorough understanding, observational assessments should be performed to accompany the interviews and the evidence.

Stage 5: Prepare report A report detailing the level of conformance and the possible gaps identified should be written based on the assessment.

Stage 6: Project board sign-off The project sign-off is a critical milestone. The project board needs to consider whether sufficient business case can be made to support the proceeding, whether suitable resources to complete the process exist and whether the scope of the specification needs to be adjusted. If these are adequately satisfied, then the project board should give the approval to move forward to the next stages.

After the project board sign-off milestone has been achieved, the project enters the "certification and retention" stages illustrated by the outer circle in Figure 12. These will include the preparation for the audit, the actual audit as well as later surveillance audits in order to retain the certificate.

Stage A: Close gaps The first stage is to plan and implement the actual changes needed to fill in the gaps identified in the assessment. The fist step in this process is making an inventory of the management system. Working document control is recommended to help align the management systems with the management and operation. After the inventory has been assembled, a re-adjustment of the business case should be performed. The business case can be clarified by comparing the inventory of the management systems to the requirements of the standard. Next, a service improvement plan should be detailed with the help of the assessment. With a well laid out plan ready, the last step is to realize the planned improvements.

Stage B: Prepare for certification audit After the improvements have been realized, an internal audit is required to ensure that the requirements have been correctly implemented and maintained. Internal audit can be also performed by an external organization on the behalf of the service provider. If

the management systems are working according to the documentation, no additional preparations are needed for the certification audit other than some logistical ones.

Stage C: Certification audit An external, fully qualified auditor is required for the certification audit. The audit is performed in accordance to the ISO 17021:2006 specification in two parts. In the first phase, the documentation is reviewed and the readiness of the service provider is determined to form a plan for the second phase. The second phase is the actual assessment of the processes and management systems and their implementation and effectiveness against the standard. The auditor will produce a report based on the audit. If everything is successful, the Registered Certification Body (RCB) will provide the certificate.

Stage D: Communication and celebration Achieving the certification is a major milestone and therefore should be properly celebrated. Also the communication about the achievement to customers, service provider staff, internal functions and suppliers should be planned.

Stage E: Retain certification What happens after the certification has been achieved is as important as the work done before the certification. Keeping the certification can be in fact harder than getting it, since now the made changes need to be embedded in the organization. Measuring and analyzing the performance of the management systems is a key part in retaining the certification. The key performance indicators for the measurements should be chosen based on the critical success factors identified earlier.

Stage F: Surveillance audits After the initial certification audit, recurring surveillance audits are needed to ensure that the management systems are kept in accordance to the certificate. The surveillance audits are performed once every 6-12 months and focus on previously identified areas of concerns and they do not go over the whole requirements of the standard. After three years from the initial certification, a repeat certification audit is performed, going over the full requirements of the standard. If some areas are identified that are deemed nonconformant with the standard, a three month period is normally given for the service provider to rectify the situation.

2.5   Summary

Cloud Computing represents a major shift in how Information Technology Services are produced, provided and consumed. Proper IT Service Management is important in ensuring that the services are provided in efficient and effective manner. ISO/IEC 20000 certification is currently the most widely recognized international standard for ITSM. This chapter first introduced the general concept of Cloud Computing with a focus on finding a suitable definition based on discussion of prevalent characteristics, different deployment and service models and stakeholders. Also a brief discussion of possible benefits and challenges was presented. Next,

IT Service Management was presented with introduction of services sciences and IT Services specifically. Finally, the ISO/IEC 20000 certification was introduced with a specific focus into the requirements and the certification process. The purpose of the theory part of the thesis is to provide a clear understanding of the major concepts and how they are closely related, thus forming a strong foundation for the following case study.

3 Case Study: Service Management Systems Assessment

This chapter covers the Service Management Systems assessment conducted in the case organization. It begins with the introduction of the case organization including an added discussion on the drivers and scope for the certification. After the case organization introduction, the purpose of the assessment is stated and the different assessment methods introduced. The chapter concludes with the results from the conducted assessment, organized based on the process division in ISO/IEC 20000.

3.1 Background

Case Organization Introduction

The case organization is a small-sized Finnish, information technology infrastructure services offering company. Its stated objective is to "offer a wide range of managed services for mission-critical hosting environments." The organization has formed around a small number of key specialists and grown steadily over the years. The focus on new customers and resulting fast growth in the client base has led to a situation where the role of service management has grown significantly. The realization of this can be seen not only in the interest in the ISO/IEC 20000 certification but also in the ongoing organizational reform, which turns the focus more towards the existing customers.

The case organization classifies itself as a purely infrastructure services provider. The service production is based on economies-of-scale model, compact production models, clear processes and multiplication. All the services are detailed in a service catalogue, from where the customer can choose the appropriate level of functionality. The main services offered include: Databases; Application servers; Operating systems; System software; Storage systems; Backup systems; Servers; Traffic management; Virtualization technologies; Security; Clustering; and Load balancing.

The service model of the case organization divides the market into three categories: Consumer organizations, eService Providers, and Infrastructure Service Providers as shown in Figure 13. All the services are delivered and consumed through the enabling network structure, which can either be a VPN or the Internet. The consumer organizations are the end users in this model. They consume the offered services increasingly in an "as is"-manner, meaning that their influence on how services are actually delivered and offered is decreasing. This places the burden of understanding of the functional requirements of the consumers to the eService Providers. They are responsible for the development of services to cater for the needs of the consumers. In the same manner how consumers do not need to be aware how the services are provided, the eService Providers do not need to be concerned how the underlying infrastructure is implemented. The Infrastructure Service Providers, like the case organization, are responsible for offering compatible and standards compliant environments for the eService Providers. They need to proactively seek to understand the needs and requirements of the eService

Providers.
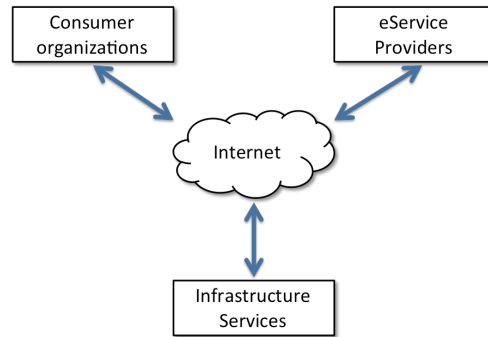
Figure 13: Case company service model

Due to high levels of automation and lean production practices, the organization size has been able to remain relatively small without sacrificing service quality or customer satisfaction. The traditional focus on new customers has meant that the processes for managing the existing customer base have been neglected. The customer management processes are very important in the ISO/IEC 20000 standard framework, but their importance had been identified in the case organization already before the start of the ISO/IEC 20000 project. This realization can be seen in the ongoing structural reform of the organization. The purpose of the change is to shift focus from the new customers to existing customers to strive for even better customer satisfaction. This has been achieved by separating new Customer Service unit from the traditional Sales unit. Another renewal is the separation of service development and service production to ensure better focus of both units. The new organization structure can be seen in Figure 14.

Drivers for Certification

The management in the case organization has been aware of the improvement needs in customer management and information security management. The launch of the organizational structure changes started by the CEO can be thought of as one of the instigating factors for the certification process. The Chief Business Development Officer (CBDO) initiated the certification process in 2009 by starting the first explorations into its suitability for the case organization.

When judging the business case and justifications for the certification, it is important to note both the anticipated benefits as well as the possible costs. The generally accepted benefits and cost factors of ITSM have already been described in the Section 2.2 and for ISO/IEC 20000 certification in Section 2.3. However, each organization is unique and not all of the benefits and costs are applicable in all cases.

For the case organization, the implementation of IT Service Management practices in accordance to the ISO/IEC 20000 certification offer several significant benefits. Probably the biggest driver to the certification is the wish to better satisfy customer requirements. For example, the Finnish Public Administration is moving
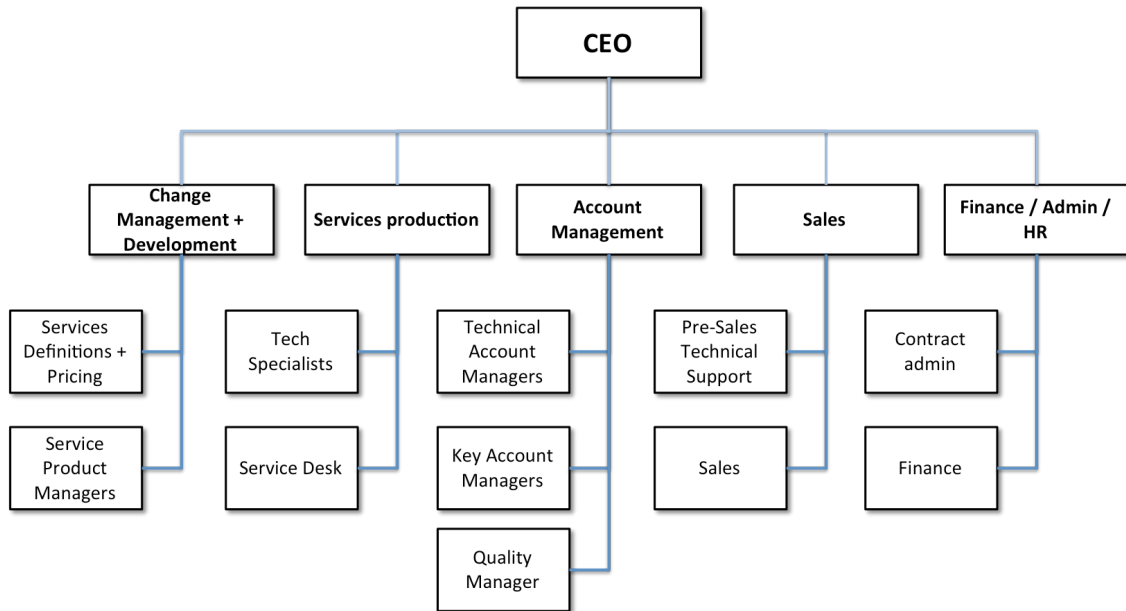
Figure 14: Case company organization chart

towards requiring the certification from all service provider it deals with, making the certification requisite for contracts. Another driver is the internal realization of the limitations of current practices in configuration management, change management and relationship management.

The certification related costs for the case organization can be divided into three categories: *1)* costs associated with gaining the certification; *2)* costs associated with retaining the certification; and *3)* costs of not implementing the certification. Time and resource elements impose the biggest limits for implementing the certification and therefore are the most important cost factors. The human resources in the case organization are already stretched and all the additional work they do for the certification is going to hinder their normal job performance. Also, the consultant and auditor fees need to be factored into the costs of implementing the certification. In terms of both implementing and retaining the certification, the case organization has hired a Quality Manager, to make sure that the organization functions according to the specifications. Costs emerging from not implementing the certification are mainly due to possible loss of sales to clients demanding certification as a prerequisite for doing business.

Scope of the Certification

The scope of the certification in this context refers to the part, or whole, of IT Service Management systems that can be divided by customers, services, geography, or organizational units. The purpose of the scoping statement is to provide a brief, clear and unambiguous idea of what is covered by the certificate. It is normally of the form: "The <service> provided by <name of service provider organizational unit> to <customer organizational name and/or name of organizational

unit> from <geographical area and/or location>" [25][24]. The initial scope of the certification for the case organization is defined as:

> "The Service Management system supporting the services in the service catalogue provided by the case organization to the example customer from specific locations."

3.2   Objectives of the Assessment

The objective of the practical part of this study is to assess the current level of IT Service Management Systems at the case organization and identify how they could be improved to fulfill the requirements of the ISO/IEC 20000 standard. The IT Service Management Systems assessment is designed to realize the first objective and the Service Improvement plan is formed to answer the latter objective.

The underlying motive for the practical part is to enable the case organization to identify and implement the changes and improvements to the IT Service Management System required by the ISO/IEC 20000 certification in order to improve customer satisfaction and enhance efficiency and effectiveness of related processes. Additionally, the assessment interviews and the final report serve as information sources to the employees of the case organization yielding an better understanding of the certification requirements and benefits.

As previously mentioned, the case organization has already identified improvement needs and started development projects in terms of customer management and security issues. Therefore it is of special interest to the case organization how these ongoing projects conform to the ISO/IEC 20000 specification. Consequently, a special attention is given to the processes related to:

– Information Security Management, and

– Customer Relationship Management.

3.3   Assessment Methods

The assessment is carried out using two primary data acquisition methods: evidence reviews, and interviews. Observational assessment can be used to complement the primary methods where needed. These methods have been chosen because they should provide a comprehensive view of the current situation at the case organization to satisfy the objectives of the assessment. The assessment methods conform to the recommendations by itSMF International and Clifford [25] outlined in Section 2.4 for an structured approach to the ISO/IEC 20000 certification.

Evidence review is a method where the existing documentation and records in the case organization are explored in order to find the materials essential for the study. The key pieces of evidence for the ISO/IEC 20000 requirements are listed in Table A1 in Appendix A. The purpose of the evidence review is to give a preliminary idea of what exists and to form a basis for the discussions in the interviews.

The purpose of the interviews is to discover the tacit knowledge embedded in the staff of the case organization in the context of the IT Service Management systems, as well as to assess their attitude and thoughts regarding the certification process. The interviewees are chosen based on their position in the organization and on the relevance of their job description in the view of the certification. Due to already high workload of several of the key employees, a special attention is given to have the interviews cause as little inconvenience to day-to-day operation as possible.

The interviews are conducted as open interviews, without a predefined list of questions. The lack of a question list should not result in deficiencies in the interviews, instead, it allows a better flexibility to focus on specific issues where necessary. The interviews are structured around the actual ISO/IEC 20000 certification requirements to make sure that all the necessary items are covered. The sections covered in each interview are chosen based on the speciality of the interviewee.

The interviews are conducted in two sections. First is a group interview of the Chief Business Development Officer, Manager of Service Production and Manager of Security Technologies. Whole day is reserved for the group interview, in order to allow time for sufficient discussion and thoroughness. Second interview is shorter, one hour one-on-one, interview with the Chief Executive Officer.

The fact that the interviews are based directly on the certification specifications accomplishes the added purpose of the interviews as a communication medium to the staff of the case organization. By going over all the requirements, the interviewees gain an better understanding into the certification itself.

Observational assessment is used to cover the possible deficiencies in the interviews and the evidence review. Observational assessment means that the interviewer observes the actual daily work methods, approaches and processes of the case organization.

3.4 Results from the Assessment

The following section introduces the results from the assessment. The material in the results section is organized according to the process division in ISO/IEC 20000 as specified in Section 2.4. The results are based on the interviews and the evidence review. According to itSMF International and Clifford [25], the considerations for the evidence during the actual audits include:

D Is the evidence documented?

C Is the evidence communicated appropriately?

U Is the evidence being used?

R Is the evidence being reviewed for being fit for purpose?

I Is the evidence being improved where required?

3 - Management System

> "To provide a management system, including policies and a framework to enable the effective management and implementation of all IT services." [22]

3.1 - Management Responsibility

The case organization does not have a formal IT Service Management policy. This can be seen both in the lack of appropriate documentation as well as from the interview answers. Additionally, a comprehensive and documented plan on how to improve ITSM has not been created mainly because no official objectives for service management have been set. However, the lack of existing formal policies regarding service management does not mean that all the current processes are flawed. Most of the current service management practices in the case organization are based on the industry best practices as well as extensive experience and insight gained through hiring staff with a strong background in IT.

This nonetheless means that the case organization has to rely heavily on individual work ethics since no formal processes have been created to define how things should be done. Good example of this is the lack of an official contract template and forcing each sales person to develop their own style of writing contracts. The individual focus has been possible and in most cases worked well so far for the case organization as the number of employees has remained relatively low, but the continual growth and the resulting increase in number of employees will lead to a situation where formal processes and policies are required.

The interviews clearly demonstrate that the senior management has a strong vision for the future of the business and a clear understanding of the capabilities of the case organization and its position in the overall value chain. Thus, at least the senior management has a good knowledge of what the target market is and what kind of customer needs can and should be satisfied in order to stay within the

focus. Quite often the case is not only whether all the customer requirements can be satisfied but also whether the customer is actually suitable for the case organization in view of the service offerings.

The communication of objectives and policies between the senior management and the employees has been difficult due to lack of formalization. The interviews, however, indicate that the staff has generally a good understanding of the overall vision and operation of the case organization. In terms of IT service management, things are different. The lack of understanding of how ITSM relates to the day-to-day operation of the organization is evident from the interviews. This can be attributed to the lack of any conscious effort from the senior management in this matter.

A lack of resources has also been a factor in the current situation of service management. The workload of existing management and staff prohibits them from proactively improving service management and thus all the previous improvement projects have been reactive in nature. The awareness of the importance of service management is increasing in the case organization and the senior management has become more committed to the improvement of ITSM systems as shown by the appointment of Chief Business Development Officer as the owner of the whole process.

Having an owner at senior level is not enough and this shortcoming had already been acknowledged in the case organization. As no-one in the organization had the required strong background and interest in quality issues, a decision was made to hire a Quality Manager from outside. The new Quality Manager is not only responsible for the IT Service Management system implementation but also for the management of other quality issues. Additionally, the case organization is using a consultant and a student working on Master's thesis to assist in the IT service management improvement process.

In addition to these outside resources, the senior management of the case organization has recognized the need to allocate the existing resources within the company in a more efficient manner. The ongoing organizational change is the first large-scale reform in the company history and no internal processes for it exist. The changes have been planned with the help of an outside consultant and together with the relevant parties. Meetings with the remainder of the staff have been held to keep them informed on the progress. The actual implementation of the organizational change is performed with the help of workshops to discuss and plan all the substantive actions needed.

As with the other management responsibilities, the management of risks and the assessment of effectiveness of current service management practices have been largely informal and subconscious. No comprehensive documentation has been created and no proper evidence exists of quality monitoring, improvement suggestions or complaint handling. The ongoing assessment of the Service Management Systems is the first one conducted at the case organization.

3.2 - Documentation Requirements

The ISO/IEC 20000 standard requires evidence that the management system is in conformity with the requirements. These evidences can be in the form of either documentation or records and must be under the control of a change management processes in a Document Management System (DMS). A detailed list of required and existing key evidence can be found in Appendix A Table A1 as determined by the evidence review.

In theory, the documentation and records in the case organization are in a DMS based on Microsoft Sharepoint. The evidence review and the interviews, however, revealed that not all of the evidence is in the DMS and most of the documents that are in Sharepoint are not updated. Most up-to-date versions of the evidence are normally located on individual computers and several versions of the same document can be in use by different people. A good example of this are the previously mentioned practices for contracts. Additionally, the responsibilities for creation, review, approval, maintenance, disposal, and control of the evidence are not currently assigned to anyone.

Besides to not being effectively managed, a lot of the evidence has not even been produced. The documentation for many of the service management processes is, if not completely missing, then at least lacking. According to the interviews, this has not really been a problem so far, as the staff is quite small and everyone knows at least their own responsibilities. Traditionally the focus has been on creating working processes and not on documenting them. An exception to this are the documentation related to Information Security practices due to the ongoing project for PCI/DSS certification.

The Service Descriptions and Service Level Agreements are also generally well documented and accessible from the DMS. However, several versions for these exist as well because no change management process is used. This creates a lot of additional work as the sales staff need to constantly make enquiries from the technical personnel about the real situation with the service offerings.

3.3 - Competence, Awareness and Training

As the case organization is going through an organizational reform, the issues regarding staff competence, awareness and training are also changing. Each staff member has had an assigned main role in the organization, however, the interviews indicate that many of the employees have had other informal roles in addition to the assigned ones. These informal roles are not documented anywhere and can negatively affect the actual job performance. One purpose of the organizational reform is to further clarify the roles of the employees and to ensure that all the key functions are effectively performed. The process owners related to IT Service Management processes have not been appointed yet.

The case organization maintains a competence matrix of the whole organization with a detailed listing of staff members and their relevant competences. Although it is not in proper change management process, the competence matrix provides a fair estimate of the current competence levels in the case organization. Equally im-

portant to keeping track of current competencies is to ensure that the competencies are up-to-date. Comprehensive training plan with a purpose of continuous improvement of staff skills has not been created. Instead, the training has been mainly been performed when needed and following the wishes and interests of the employees. Currently the performance reviews are very informal and are not recorded.

The staff size has been increasing only moderately over the years and very little outside recruitment has been necessary. Most of the new employees come from known sources through recommendations and acquaintances. As with training, no long term recruitment plan has been necessary, instead new employees have been recruited when needed. An informal recruitment plan has been formed as a part of the organizational reform, when areas with additional resource needs have been identified.

Generally, employees own roles and responsibilities are well understood within the case organization. Familiarity with the roles and responsibilities of other employees is sometimes lacking. The roles and responsibilities as highlighted in the new organizational structure are still under revision. Completely planning the new relations between the employees is difficult and the final roles are probably going to find shape only through repeated use. The discussions and workshops related to the organizational change have provided a good medium to reflect on the current deficiencies and to design a structure with clearer roles.

4 - Planning and Implementing Service Management

> "To plan the implementation and delivery of service management; implement the service management objective and plan; monitor, measure and review that the service management objectives and plan are being achieved; and improve the effectiveness and efficiency of service delivery and management." [22]

The case organization does not currently have a formal, documented process for planning and implementing service management, which is evident both from the evidence review as well as from the interviews. However, the lack of formal documented processes in service management is not necessarily seen as a deficiency inside the company. Instead the act of formal planning and documenting is viewed as something that takes time away from actual productive work. The atmosphere towards planning of service management to the extent described in ISO/IEC 20000 standard has even been slightly hostile. This is most likely result from not fully understanding its reasons and possible benefits as well as a part of the normal resistance to change.

The traditional approach towards planning and service management in general has been very reactive in the case organization. Changes to service management processes are only proposed as a reaction to identified problems and flaws. When problems have been recognized, their causes are determined and consequently corrected and processes improved where possible. This way has worked relatively well in the case organization, mainly due to high expertise and small number of the staff. However, at least the senior management has acknowledged the need to move away

from the reactive mindset towards more proactive view on service management improvement.

As already mentioned in the beginning of this chapter, the case organization does not have a formal improvement plan that encompasses all of service management systems. Plans and processes for smaller parts of the service management systems exists, such as for incident management. However, even these processes are not fully documented to the extent specified by ISO/IEC 20000. Although the senior management holds meetings, both formal and informal, the meeting minutes and decisions are not recorded. The scope for service management in the case organization has been identified in this thesis in Section 3.1.

Some continuous service management improvement has been conducted at the case organization, although little in terms of service management plans exist. This is due to the reactive nature management already identified above. Once the problems have been discovered and a need for change identified, the actual implementation of change follows generally normal project management principles, although it is not formally documented or reported. Budget, as well as the required roles and responsibilities, are allocated for the project.

After the change has been implemented, detailed monitoring, measuring and reviewing is often neglected. Measuring and reviewing is difficult since even the initial state is often not well known due to lack of evidence. Of course, some very general level of reviewing has been done on the projects once they are finished, however the results are not recorded or properly reported. No plans for audits exist and no auditing of the service management is done. Customers can request audits of the data centers, but there are no formal procedures for this. The Continual Service Improvement (CSI) policy has not been created at the case organization.

5 - Planning and Implementing New or Changed Services

> "To ensure that new services and changes to services will be deliverable and manageable at the agreed cost and service quality." [22]

The service portfolio of the case organization has remained relatively static over the years. This is due to the fact that the senior management and the technical managers have a clear vision of what are the key capabilities and therefore what kinds of services can be offered to what customers. Due to the strong focus on the key business, very few new service ideas get actually implemented. Consequently, formal processes for the whole process of planning and implementing new services has not been necessary so far. However, due to relatively large number of new service ideas and the time consuming effect they have on technical staff, the management has seen the need to improve the process for accessing the new ideas.

Currently, most of the new service ideas come from the sales staff, who are strongly influenced by the customer requests for services. The case organization has a formal procedure for proposing new services. In most cases but it is not used properly. Those not using the formal procedures are acting against the guidelines. When a sales person gets a new service idea from the customer, they go directly to senior management with nothing but the idea. Additionally, quite often the sales

is too eager to sell outside of the service portfolio without consulting the technical staff of the feasibility. A "New Product and Services" document has been created by the CBDO for the use of the sales staff to help assess the suitability and the business logic behind the service proposal before taking it to the senior management. This document has formally been taken into use but the actual use may vary.

As very few requests for the development of a new service are accepted, no set processes for the planning and approving of new service implementations or procedures for final acceptance to the service catalogue have been necessary. Currently it is a member of senior management who does the final decision on whether a new service is accepted into the service portfolio. Often the requests go all the way to the CEO, which has already been recognized as being problematic. In normal operation, the decisions for approving new services should no reach the CEO. Additionally, no formal criteria for service acceptance exists and each proposal is handled individually.

Similarly to service management processes, the success of new or changed services is not properly tracked. Generally, no post implementation review is conducted and no formal processes are in use for reviewing the services once they have been implemented.

As the case organization does not have a Change Management process, the service changes and new services are not documented properly. It is normally up to the individual workers to record the changes to services. All of the effects of the change are not always very clear and so very often all the necessary documents are not updated. As the employees do not always update the documents in the DMS, even the Service Descriptions in Sharepoint can be outdated. Portfolio Management system should include analysis of Service Change Requests, formal change management or formal plans including roles and responsibilities, contracts, skills, training requirements, budgets, time-scales and service acceptance criteria. No such Portfolio Management system has been created for the case organization.

6 - Service Delivery Process

6.1 - Service Level Management

"To define, agree, record and manage levels of service." [22]

Service level management should consist of a service catalogue, service level agreements (SLAs) and a service level management (SLM) process. At the case organization all of these three exist to a certain extent, however they are not necessarily in the exactly same format as specified in the ISO/IEC 20000 standard.

The service catalogue is basically currently formed on two levels. On a higher level, all the offered services are documented in the Sharepoint document management system as Service Descriptions. The Service Descriptions provide a written overview of what the service covers and a more detailed technical description of what is included and excluded in the service as well as pricing, service time, setup, security and contact information. The Service Descriptions in Sharepoint are not always up-to-date because the change management process is not in use and no-one

is formally in charge of updating the descriptions. Additionally, several versions of the descriptions might be in use.

On a lower level, the individual service descriptions are available through the Epicor IT Service Management software. Epicor system provides a more detailed technical service description in the form of a basic configuration plan. Epicor, however, does not include a good connection to the business impact of the services as required by the ISO/IEC 20000 standard. The addition of new services and components into the Epicor IT Service Management software is not automatic and all the updates need to be done manually.

The service costs are not properly included in the service catalogue systems. No-one currently owns the process of updating the costs and all the costs need to be gathered from various sources to estimate the absorption costs. An Excel-spreadsheet with updated costs and properly organized services has been in planning, but the staff has not found the time to implement it.

The service level agreements consists of two parts at the case organization: contracts and the previously mentioned service descriptions. SLAs are defined for all services through the inclusion of service descriptions. Service level agreements are agreed and recorded at the beginning of the customer relationship. More specifically, the contract is negotiated and agreed on, the service descriptions remain the same for all the customers. A default SLA format has been created and the details are negotiated on case-by-case manner. However, as each sales person has their own contract style, several slightly varying versions of the SLAs are actually in use.

The service levels are divided into bronze, silver and gold based on the support availability. No automatic sanctions for service level problems are used unless demanded by the customer in the contract. Additionally, regular reviews of the service level agreements between the parties are not held. The suppliers are taken into consideration in the SLAs with a basic supplier contracts which bound their responsibilities and therefore offer a baseline guarantee for the service level.

Service level management (SLM) process at the case organization is very informal and loosely defined. The whole service level management should be a part of the overall change management process, which is completely missing at the case organization. The resulting problems are evident from the interviews. Every SLA needs to be compiled separately increasing the workload of both sales and technical staff.

6.2 - Service Reporting

> "To produce agreed, timely, reliable, accurate reports for informed decision making and effective communication." [22]

The case organization has not had the need for formal service reporting processes. The tools used for incident and problem management as well as for the service production enable the availability of lot of the information and measurements required by the ISO/IEC 20000 certification for successful service reporting. Workload characteristics, performance reports and trend information are all available through different parts of the system, but not effectively used for reporting

purposes. The descriptions and documentation for the measuring processes for collecting the information exist in the form of software and its documentation.

The metrics available to the customers are defined in the service level agreement. SLA is agreed and signed at the beginning of the customer relationship and currently planned meetings afterwards to identify possible changes in the reporting needs and requirements of the customers are not held. Customers have an access to the real-time status of the service level as well as to trend information on the selected metrics through an Internet portal. Automatic sanctions for non-conformance to service levels are not used unless demanded by the customer in the SLA.

The reason why reporting has not been a priority at the case organization is that each SLA non-compliance issue is handled individually and the incidents and problems are normally identified before they are visible in the metrics available for the customer. Service desk does not use the same metrics that are available to the customer. In most cases the events are solved before the percentages seen by the customer drop. In the case of major incident, where customers are directly affected, the reporting is done as needed. No proper guidelines for such cases have been created. Quite often the CEO is involved in the customer communication as well, which has been one factor in the high customer satisfaction.

System for automatic and regular service reports for the management has not been in use at the case organization. Normally senior management only finds out about the service performance in case of major incidents or problems.

6.3 - Service Continuity and Availability Management

> "To ensure that agreed service continuity and availability commitments
> to customers can be met in all circumstances." [22]

The current service continuity and availability management practices are based on previous experiences and on what has been shown to work. However, a service continuity plan has not been created. The formal monitoring and recording of availability is done automatically by Patrol Business Service Management (BSM) software. The mindset at the case organization is that "quality is not sacrificed for flexibility". The services are offered from two server farms, with a third one on the way. The data centers are designed and operated according to industry best practices and with the purpose of conforming to the PCI/DSS certification requirements. Therefore, the technical operation is more than sufficient according to industry standards.

In addition to ISO/IEC 20000, the case organization is in the process of applying for PCI/DSS certification, which also requires a service continuity plan. The service continuity plans and availability management processes will be designed to fulfill the requirements of both certifications and so that they are compatible with the ISO/IEC 27000 standard family. The owner of the PCI/DSS project has not started the work on creating the service continuity plan.

What is lacking is the documentation, connection to the business environment and consideration in change management. The link between customers' business

priorities, service level agreements and assessed risks to the requirements of service continuity and availability management is inadequate in the current system. Documentation needs to be also available on paper and accessible when normal office access is prevented. The service continuity plans and availability management processes need to be considered also in the change management process so that changes in any part of the system are updated in all the relevant places. Additionally missing from the current operation is the testing of the service production and delivery systems in terms of continuity in accordance with the business needs of the customers.

6.4 - Budgeting and Accounting for IT Services

"To budget and account for the cost of service provision." [22]

The financial management of the services in the case organization is mainly defined by and based on the existing legislation requirements. The current asset and configuration accounting is restricted to unit level relations, while customer relations are not available. Although portion of the information is available through the Epicor IT Service Management software, rest are scattered in different places, complicating the formation of a complete picture. Therefore, a proper project portfolio is needed to form a clear relation in case something breaks to customer business impact.

Generally, the return on investment (ROI) of single purchases is not tracked. Additionally, formal processes for recording the costs of the components and using those costs for making cost effectiveness comparisons are in use. It is currently up to the employees to perform these calculations on one's own initiative.

6.5 - Capacity Management

"To ensure that the service provider has, at all times, sufficient capacity to meet the current and future agreed demands of the customer's business needs." [22]

The capacity plan at the case organization is formed in practice around the SLAs. The customer and service specific capacity requirements are defined in the beginning of the customer relationship in the contract and the service descriptions. Process for evaluating and adjusting these plans after the initial agreement does not exist. Often the customers are unaware or do not actively monitor the capacity levels.

Several ways to deal with the situations when capacity is close to its limits and when it is exceeded can be used. It depends on customer needs which method is selected. The simplest situation is when the amount of capacity is fixed and the customer is just notified when it is almost full. The situation becomes more complex when the capacity is about to be full and needs to be increased. The pricing model is adjusted accordingly and taken into account in the contract.

The current system addresses business needs up to a certain extent. The effects of upgrades, change requests, new technologies and techniques on capacity are evaluated on case by case basis but the results of the evaluations are not documented. Different methods and techniques for monitoring the service capacity and performance are used, but these are not documented either. The documentation exists only in the form of software manuals

6.6 - Information Security Management

"To manage information security effectively within all service activities."
[22]

The importance of tight security is known at the case organization and is evident from the interviews. One of the persons interviewed is the current Manager of Security Technologies and is in charge of the ongoing project for achieving PCI/DSS certification. The whole ISO/IEC 20000 certification process is a part of systematic validation and improvement of information security systems initiative at the case organization to dispel customer security concerns. The end goal is to achieve the ISO/IEC 27000 Information Security Management Systems certificate.

The current information security policy, which has been developed for the PCI/DSS project, is adequate and it has been approved in the senior management by an appropriate authority, namely the CBDO. The policy is available through Sharepoint document management system and needs to be signed by all new employees. However, PCI/DSS additionally requires that the policy should be reviewed and signed annually by all employees, which is not enforced currently at the case organization. Also, the effectiveness of the policy is not monitored or recorded, and not many employees are aware where it can be found.

Formal security risk assessments or periodic security audits are not currently held. Customers have the option of auditing the security systems if they wish, but no clear instructions or best practices for the audits are in use. Possible risks to information assets are tracked through Securia Service. All the available services are listed in the Securia Service and alarms are given automatically when risks or vulnerabilities are detected. Automatic updating of resources is possible through the service but is not currently in use at the case organization. Instead, the new or changed services need to be updated manually to the system. The process for the updating is not owned by anyone. Securia Service also allows event management and tracking of events. This feature is not used in case organization either, since the same functionality is available through the Epicor IT Service Management software.

Generally, the security practices follow the industry best practices, and no big security issues can be identified. The current practices for server room visitors need to be revised and enforced more effectively. Although a process for physical access control in the form of signing in and out and checking identity exists, it is not enforced properly in practice. Additionally, current team-specific user identifications used for the services need to be made personal. The case organization currently

does not have any CISSP (Certified Information Systems Security Professional) or CISM (Certified Information Security Manager) certified employees.

Current security practices have been partly documented as a part of the PCI/DSS certification process at the case organization. Most of the documentation required for PCI/DSS certification has been written and is accessible through Sharepoint. How they correspond to and fulfill the ISO/IEC 20000 requirements is covered in Appendix A. The documentation still needs to be adapted to ISO/IEC 20000 on the relevant parts. No change management for the security documentation has been in use and no one is in charge of updating the documentation in case of changes in business needs, processes or configurations.

Security incidents are handled through the same process as all incidents. Additionally, TeliaSonera Incident Report Team service is used to complement internal resources when appropriate. Security incident management functions very well during office hours when Service Desk is in charge of the process. Staff on service desk is aware and uses the correct procedure of isolation, clarification, solution and fix of security incident handling. However, outside the office hours, no guarantee can be given that the person on call is aware of the correct process as the training and instructions for the position is not sufficient. The security incident process needs to be documented so that the person on call has a good understanding of their duties and to demonstrate capability for the customers. It is also important that the person on call contact the relevant parties to resolve security incidents instead of trying to fix things themselves without proper knowledge.

7 - Relationship Processes

7.2 - Business Relationship Management

> "To establish and maintain a good relationship between the service provider and the customer based on understanding the customer and their business drivers." [22]

The business relationship management is currently under revision at the case organization as a part of larger organizational change. The reasons and main changes are already described in the case organization introduction in Section 3.1. The main motive from the customer service perspective is to shift some of the focus from new customers towards managing the existing customer. The new organization chart is shown in Figure 14 and demonstrates how the current sales team is divided into new sales and customer service units. Currently, the processes for managing the existing customer base are not formal, and these processes will be defined as a part of the structural change based on ISO/IEC 20000 requirements and ITIL recommendations. It is important to note that the customer service improvement needs had been identified and the organizational change project had started already before the start of the ISO/IEC 20000 project.

The case organization does not have Customer Relationship Management (CRM) software in use, instead the customer information, contacts and contracts are stored in Sharepoint. The purchase of a CRM system is in planning in order to satisfy

properly the needs of both the new sales and the customer service unit and facilitate the transfer of customer information between the two. The planning for CRM has only started and therefore the requirements for it are still under consideration.

The categorization of customers is currently based on who was responsible for the initial sale. Each sales person is responsible for managing the customers they obtained. The focus on customer service has been on obtaining new customers and managing the few key accounts defined by contract value. As the structure of the sales team changes with the organizational reform, a new categorization of the customers is needed, however the details on how the customers are going to be divided are not defined yet. Most likely is that the categorization will follow some sort of ABC-categorization with only the A-level customers having assigned Key Account Managers (KAM) and Technical Account Manager (TAM) from the customer service unit. Rest of the customers are handled jointly with periodic analysis to identify growth potential customers.

The offered services are specified and described in Service Description documents which form a Service Catalogue stored in Sharepoint. The individual services are thought of as "Lego"-pieces as they are combined to form customized solutions according to customer requirements. The contents of the Service Descriptions are locked but the services themselves are parameterizable so that parameters such as storage capacity, and bandwidth can be selected according to customer needs. The sales personnel or solution designers cannot make changes or decisions about the service catalogue. Current system is that they make demands based on customer needs concerning new services and a business decision is made whether the potential new service is included in to the service catalogue. The process for new services is already described in the results section (Section 3.4) for "5 - Planning and implementing new or changed services". The current system has made it possible for the sales staff to sell services for uses other than what they were intended for complicating the work of the Service Desk.

As already mentioned above, the customer tracking process is completely dependent on the sales staff as formal processes for it have not been defined. The traditional view on customer requirements in the case organization has been very reactive because of the lack of proactive service review discussions. The organizational change, and the process descriptions associated with it, should address the situation. An outline of process documentation for gathering customer requirements and new business ideas has been developed by the CBDO but in practice it is not used yet. It forces the sales to think the ROI, timetables, costs, person in charge and so on, for the service before taking the idea further to the management. Monitoring of the new services after they have been taken into the service catalogue is not formally done.

The service complaints process is currently not formal. Complaints about service quality are normally first taken to the sales person in charge of the customer or to the service desk. Customer complaint situations are relatively rare and usually involve some bigger problem in the service production. The case organization CEO is quite often personally involved in handling these service complaints. The customer satisfaction has been historically very high. This is mainly due the fact

that the interaction between the case organization and the customer is mainly on technical level between specialists.

7.3 - Supplier Management

> "To manage suppliers to ensure the provision of seamless, quality services." [22]

The case organization does not have a formal and documented supplier management process. Due to the nature of its business, the number of suppliers is very low when compared to the number of clients and customers. Therefore, unlike in the customer management where the potential gains are considerable, the work needed to streamline and formalize the processes has not been seen as worthwhile. The case organization does not have subcontracted suppliers.

Although the number of suppliers is small, the existing supplier relationships are very critical for the service production of the case organization. Two crucial supplier groups can be identified: telecommunications companies and data center owners. The telecommunications companies are responsible for the communication lines to and from the data centers while the data center owners are responsible for the physical locations where the data centers are located. Problems in either effect all services by the case organization.

Even though their highly critical nature, no processes for dealing with either types of suppliers exist. Especially, the relationship with the owner of the second data center is very informal and the contract is inadequate given its importance for service continuity and availability. This has an effect for the whole SLA contract chain and reduces the service level guarantees that can be given to the customers.

The contract management for suppliers suffers mainly from similar problems as for customers. SLAs between the case organization and suppliers are at best deficient and in some cases non-existent. They are not properly aligned with the business needs. Whether the business needs and contractual obligations are being met is not monitored and no review process is in use. The contracts do not specify processes for dealing with disputes or the end of service.

Partly due to poor contract management with the suppliers, the interfaces between the processes used by each party are not documented. Severe problems with the communication regarding critical information between the suppliers and the case organization have been identified. The communication problems are related to the lack of agreed operation models during events. Although shortcomings in the supplier management when compared to the requirements of ISO/IEC 20000 certification are evident, they have not directly caused any major problems so far.

The current procurement process starts from sending an invitation for tenders to the suppliers. The suppliers reply with their tenders, after which the most suitable one is selected. An order is placed according to the tender and the supplier replies with a confirmation of the order.

8 - Resolution Processes

The case organization uses the terms related to resolution processes based on definitions in ITIL. All the relevant employees know the definitions of incidents and problems and the difference between the two.

8.2 - Incident Management

> "To restore agreed service to the business as soon as possible or to respond to service requests." [22]

Incident management is principally the responsibility of the Service Desk at the case organization. Additionally, outside the office hours, incident management is handled by the current person-on-call, who can also be a product manager or other technical person outside the service desk. All events (also called Tickets at the case organization), including incidents, security incidents, change requests and service requests are handled through the same Epicor IT Service Management software (Epicor) following ITIL Event Management processes.

The whole incident management process is not described formally in any single document, although parts of the process are already documented in sufficient detail. Part of the documentation exists in the form of manual for the Epicor system. The system enables automatic recording of all incidents. The functionality for prioritizing incidents is not used, although available with the current system. This is because the amount of incidents is normally small and solutions are generally found quickly and therefore prioritization is not needed. Epicor system also enables the classification, updating, escalation into problems when necessary, and finally the resolution and formal closure of the incidents.

The customer notification is often not required as incidents are solved quickly without any noticeable impact to the customer. In case the incident is reported by the customer, then the customer is notified when the incident is resolved. If the incident is part of a larger problem and cannot be resolved quickly, an estimate is given for the time it takes to resolve the issue. For major incidents an announcement server and specifically assigned information officer are responsible for the communication to the customers. During major incidents the company CEO is often also involved in the communications with the customers.

All the staff involved in incident management, including the service desk personnel, person-on-call and product managers have access to all the relevant information through Sharepoint and Epicor systems. What is missing from them, however, is the connection to business impact of the incidents to clients. The configuration information in Sharepoint and Epicor needs to be updated manually, and due to lack of a change management process, might not be up-to-date. Additionally, the case organization has a competence matrix with information on special expertise of all the technical staff for reference on whom to contact for further information.

The escalation point for classifying major incidents has not been predefined. It is the responsibility of the service desk supervisor or his stand-in to identify the

point when incidents need to be escalated to major incidents. Normally this happens when a large number of customers are affected. The contracts do not normally define what is critical for the customers and therefore the customer business criticality cannot be used as an automatic incident escalation criteria.

8.3 - Problem Management

"To minimize disruption to the business by proactive identification and analysis of the cause of incidents and by managing problems to closure."
[22]

The problem management in the case organization is based on the same Epicor IT Service Management system as incident management and follows the same processes. In fact, problems are not currently properly distinguished from incidents although Epicor system allows the distinction between the two. A functional difference exists between the two, even though problems are not formally distinguished from incidents. Problems are defined as recurring incidents and therefore their treatment needs to be slightly different in practice.

The main decisive factor when classifying incidents to problems is when the correction of results of incidents is not enough and underlying cause needs to be found and fixed. The current system works reasonably well when the number of problems stays small. However, the importance of the distinction increases as the number of customers grows and the possibility of problems rises. Currently, no clear distinction between events, service requests, change requests, incidents and problems is available in Epicor, even though each is handled slightly differently from the others.

Most often the recurrence of certain incidents is noticed internally as customers can only notice the incidents related to their service. Therefore, what is actually a problem, might not even be a noticeable incident from the customers point-of-view. Resolution times for problems, as well as incidents, are not specified in the contracts or service descriptions unless requested by the customer. Monitoring of the services is possible and already in use to some extent. More monitoring settings can be taken into use when necessary to provide the functionality required by the customers.

Accountability of the problem resolution at the moment is not always clear. Generally all the work that can be billed is, however some situations are possible when work is done technically for free since no automatic billing takes place. The problem is mainly due to lack of instruction on when the work can be billed separately. Current lapses in the processes are possible because of the small size of service desk, when the volumes grow and organization size increases, deviations from the formal processes lead to problems.

The problem prevention is not currently a separate process from problem management. Prevention is mainly done in the form of properly planning changes, keeping systems updated and generally following best practices. All the previous problems and incidents and their solutions are available through the Epicor system for future reference.

9 - Control Processes

Although configuration and change management are closely related and very important, the case organization does not have an integrated approach for them.

9.1 - Configuration Management

> "To define and control the components of the service and infrastructure
> and maintain accurate configuration information." [22]

The term configuration item is not in use at the case organization as defined by the ISO/IEC 20000 standard. Policy on what would be defined as a configuration item is not formal and therefore no extensive Configuration Management Database (CMDB) exists. However, through the Epicor ITSM software, the case organization has a good foundation for the database. All the physical assets related to service production are documented in the Epicor system. Missing from the Epicor system is all the information about immaterial items such as contracts and customers, as well as relationships between the immaterial and physical items.

The current configuration management with Epicor is deficient in other aspects as well. One of the main shortcomings is that it needs to be updated manually when anything is changed. The Epicor ITSM software contains an inspect option for automatic updates for the configuration system, but it is not in use at the case organization. Another shortcoming is that only hardware or software components are listed in Epicor and not the system configurations they form. What information is recorded for each item is based on what is available and what is needed for Epicor.

The fact that several virtual servers can be located on one physical server somewhat complicates the tracking of all items. The relations between virtual and physical hardware are available through Epicor, although they could be clearer to ease the resolution processes. Even though the connection between the virtual or physical hardware and their respective customers is not outright available, it can also be determined. All the items in Epicor are uniquely identifiable using proper naming conventions.

The processes for handling the configuration changes in Epicor or otherwise at the case organization are not formalized. Adding and removing items from Epicor is quite easy and not properly controlled. The actual physical configuration items are mostly located in data centers with security policies up to industry standards.

Currently very little formal accounting, tracking, reporting and auditing of the configuration items is done. Once the systems, services and infrastructure are in place and working, the responsibility shifts to service desk and the items are mainly under the resolution processes. This means that if everything is working without incidents or problems, testing or auditing is not necessary. The Epicor system is not actively managed and verified with the intent of ensuring its reliability and accuracy. The management is only done in terms of what is needed to perform day-to-day operations.

9.2 - Change Management

> "To ensure all changes are assessed, approved, implemented and reviewed in a controlled manner." [22]

Change management is closely related to all of the previous IT service management processes covered. No changes should be done without proper change management processes. Therefore, many of the issues related to change management have already been covered to some extent in the previous chapters. In general, the case organization does not have centralized change management for services, processes and configurations. The responsibilities and roles for change management have not been clearly defined, resulting in variations in processes, depending on who is involved.

As already described in Section 3.4, 5 - Planning and implementing new or changed services, the service portfolio of the case organization does not change a lot. The requests for the development of a new service and requests for change come usually from the customers. The sales staff or service desk respond to the requests and needs of the customers and initiate the internal process. Currently, very little assessment is done by the sales staff related to suitability, feasibility and business logic behind the requests. Specially designed "new product and services document" will serve as a guideline for the assessment in the future.

The order for the request is done from service desk by issuing a "ticket" in Epicor. So far, the service requests are not properly differentiated from other events, such as incidents, in Epicor, even though the possibility already exists. A manual for Epicor exists, and serves as a crude documentation for the process. Besides the Epicor manual, no other documentation for the ordering and specification processes exists and therefore the actual conventions vary a lot depending on who initially got the service request. In theory, the implementation ticket is required in Epicor before actual work begins. In urgent cases, however, the work can be started even before the ticket is issued.

Larger service requests go through the person responsible for service implementations, the Implementation Manager. This has generally been one of the Product Managers at the case organization. In the new organization, the implementations are handled by the Technical Account Managers (TAMs), not by the Product Managers. Implementation Managers have procedures for actually doing the implementation. The documentation for the procedures are available through Sharepoint.

After the implementation, the success is not formally monitored, the system itself is responsible for the monitoring. Problems are handled through the resolution processes. If customers are affected by the changes, they are kept notified by the person in charge of communications.

The internal change management is often quite well planned. The biggest problems arise from integration with customer and supplier processes. The communication from the customers and suppliers about changes is not always sufficient due to lack of formalization. This makes the risk assessment and planning for reversing unsuccessful changes more difficult. The policies or procedures to control the authorization and implementation of emergency changes have not been developed.

Normally it is either the Manager of Service Production or the CEO who authorizes emergency changes.

10 - Release Processes

> "To deliver, distribute and track one or more changes in a release into the live environment." [22]

The case organization does not differentiate between release management and the management of new or changed services. This is mainly because the concept of release is not really applicable to the services offered. Updates to the software or hardware are not generally part of the contracts. Instead, they are handled as service requests and go through the change management process described in the previous chapter. Implementation Manager is normally in charge of the process. Other issues are handled by the Product Managers on case-by-case basis.

4 Analysis

The previous chapter introduced the case organization and presented the results from the IT Service Management Systems assessment conducted at the company. This chapter first discusses the relationship between Cloud Computing and IT Service Management and considers whether the case organization satisfies the characteristics of Cloud companies. Secondly, the following chapter summarizes the most important results from the IT Service Management Systems assessment and analyses the current situation of IT Service Management at the case organization. Additionally an ambitious target situation is briefly described together with concrete development suggestions based on the ISO/IEC 20000 standard. Finally, a Service Improvement Plan is outlined and organization specific critical success factor are identified.

4.1 Cloud Computing and ITSM

The classification of IT companies offering Cloud Computing services is currently relatively arbitrary and the relationships between offerings are complicated. Even the division between Cloud Computing companies and traditional IT service companies is not trivial. [18][29] Therefore the decision whether the services offered by the case organization qualify as Cloud services, needs to be based on the comparison to the characteristics of Cloud Computing identified in Section 2.1. Some internal skepticism over the Cloud Computing debate is evident at the case organization, and it is seen more as a question for marketing than a technical issue. However, a separate ongoing investigation of the applicability of Cloud Computing concepts into the business model of the case organization has been started.

Table 3 summarizes the applicability of the different Cloud Computing parameters to the different services offered by the case organization. Additionally, Finnish IT service company Tieto and Amazon EC2, from the United States of America, are taken as comparison targets. The comparisons illustrate the current situation in Cloud Computing. The number of pure Cloud Computing organizations is quite small since the costs related to the initial investments in automatic ordering, commissioning and billing systems are very high. Only big organizations, such as Amazon and Google, have the required resources. In Finland, where the markets are smaller, the organizations do not have the required resources to develop the automatic tools to be classified as pure Cloud Computing Companies. For the case organization, the largest differentiating factors to the more established Cloud Computing companies are the limitations in the utility model and the lack of automatic scalability in the services provided. However, because the actual number of pure Cloud Computing organizations is small, the classification inside the industry is not very strict.

Virtualization The case organization uses virtual machines in order to share the physical hardware between multiple customers, while maintaining the same security and isolation as dedicated physical servers. Customers, however,

Table 3: Cloud Computing analysis matrix.

Parameter	Case Normal	Case OnDemand	Tieto	Amazon EC2
Virtualization	Yes	Yes	Yes	Yes
Utility Model	No	Limited	Limited	Yes
Automatic Scalability	No	Limited	Limited	Yes
Third-party management	Yes	Yes	Yes	Yes
On-demand	No	Limited	Limited	Yes
Service Level Agreements	Yes	Yes	Yes	Yes
Multitenancy	Limited	Yes	Yes	Yes
Network centricity	Yes	Yes	Yes	Yes

have the option to order dedicated servers as well. Dynamic resource allocation and server duplication or replication are available through additional services and can be specified in the contract.

Utility Model The basic services offered by the case organization do not conform to the utility model. The pricing model is not very flexible as it is specified in the contract in the beginning and can be only changed with new contract negotiations. Capacity additions are priced separately as well. The OnDemand service family, on the other hand, is based on the principles of utility model. However, in practice it mostly means that the initial capacity and pricing requirements can be selected in greater detail.

Scalability The current automatic scaling provisions are very limited at the case organization. The service offerings are not truly elastic in terms of capacity as most of the configuration of services for individual customers needs to be done manually. Moreover, all additional capacity requirements need to be processed separately for billing and implementation. Therefore, in practice, the scalability and elasticity of the service offerings do not satisfy the Cloud Computing ideals.

Third-party management The third-party management characteristics of Cloud Computing are easily satisfied by the case organization. The business idea is to offer managed infrastructure services to service providers and customer organizations as shown in the service model in Figure 13. The number of

customers who manage their own hosted servers is decreasing and more and more business is done in the Cloud ecosystem.

While all the characteristics of the Cloud Computing are not adequately satisfied by all the services offered by the case organization, the principles of the service model of the case organization shown in Figure 13 are very similar to the Cloud Stakeholder model shown in Figure 2 in Section 2.1. When compared to the Cloud architecture models depicted in Figure 1 in Section 2.1, the services offered by the case organization conform very closely to the Infrastructure-as-a-Service layer. The virtualization technology used by the case organization enables the level of flexibility and stability discussed in the definition for IaaS.

Furthermore, as the Figure 13 illustrates, the services offered by the case organization form part of those which would traditionally be offered by the internal IT service organization. Same functionality corresponds to the External Private Cloud description in Cloud Computing terminology defined in Section 2.1. Therefore, the case organization seems to correspond to an Virtual Private IaaS provider in the Cloud Computing ecosystem.

Importance of ITSM in Cloud Computing

The interest in formal IT Service Management started growing only relatively recently in the IT industry as a whole after the introduction of ITIL v2 in 1999 and ISO/IEC 20000 in 2005 [12]. As already stated in the Section 2.1, Cloud Computing is a model for service delivery and consumption. Therefore, by definition, the management of those services should be fundamental to Cloud Computing. Although one of the driving ideas of Cloud Computing is to abstract the lower levels from the customers, thus making IT services easier to use, it does not mean that the actual service delivery or production becomes easier as well. Creating seemingly infinite resources to be consumed in ad-hoc manner and paid by pay-as-you-go methods can actually complicate the management of the service production.

The number of business critical IT services, such as production control systems, hosted on the Cloud Infrastructure or based on Cloud Services is increasing. One of the main attractions of Cloud Computing is the abstraction of lower levels to the customers. However, the Cloud Service consumers and service providers still need proof that the underlying systems are reliable without having to know how the systems are actually produced or managed. As the business criticality of the services increases, so do the requirements for building the required trust to alleviate the customer concerns over trust, continuity, privacy and security. Table 4 highlights the difference between ITSM in Cloud Computing and in non-Cloud environments. The non-Cloud environment is used as the baseline in the comparison. However, as the ITSM processes as defined by ISO/IEC 20000 are very broad, all of the Cloud Computing related needs are already covered by them. Therefore, the differences to non-Cloud environment only become evident when comparing the relative importances of the different areas.

Security and service management audits initiated by the customers are currently the only seemingly conclusive ways for the customers to assess the compe-

Table 4: Comparison of the importance of the ITSM requirements in Cloud Computing and non-Cloud environments

ITSM Process	Cloud Computing	non-Cloud
Management Responsibility	Normal	Normal
Documentation Requirements	Normal	Normal
Competence, Awareness and Training	Normal	Normal
Service Level Management	Very Important	Normal
Service Reporting	Important	Normal
Service Continuity and Availability Management	Very Important	Normal
Budgeting and Accounting for IT Services	Normal	Normal
Capacity Management	Very Important	Normal
Information Security Management	Very Important	Normal
Business Relationship Management	Normal	Normal
Supplier Management	Less Important	Normal
Incident Management	Normal	Normal
Problem Management	Normal	Normal
Configuration Management	Very Important	Normal
Change Management	Important	Normal
Release Management Process	Normal	Normal

tence and reliability of the service provider. However, as the audit practices and requirements can vary between customers, this can create a lot of additional work for the service provider. Therefore, using IT Service Management best practices by following ITIL guidelines and obtaining related certificates, such as ISO/IEC 20000, are ways for the service provider to demonstrate in advance their reliability. It is important to remember that the said best practices and certificates do not guarantee service quality, only the quality of the management of service production.

The case organization is not optimal for identifying IT Service Management

issues arising from Cloud Computing. This is because, as shown in the previous section, not all of the Cloud Computing characteristics are properly applicable to the case organization although it operates in the Cloud Computing ecosystem. The current Cloud Computing related characteristics of the service production at the case organization can be mostly seen in the following areas of ISO/IEC 20000:

– Service Level Management requirements

– Capacity Management requirements

– Importance of Change and Configuration Management

– Importance of Incident and Problem Management

The requirements for service level management and capacity management need to be revised to account for the elasticity and scalability of services. How to perform capacity planning in order to consider the elastic capacity requirements needs to be answered. The agreed service levels need to be guaranteed to the customers with proper capacity planning, even when adding new customers. Also, the importance of effective incident and problem management is highlighted when possible incidents and problems affect larger portion of customers as all run on the same underlying hardware.

4.2 Current Situation

The purpose of this chapter is to briefly describe how the current IT Service Management situation at the case organization corresponds to the ISO/IEC 20000 requirements. The Requirements are outlined in Section 2.4 based on the detailed definitions in the standard documents [22], [23] and [24]. The requirements are considered from the point of view of the case organization as defined by the Scope of the Certification in Section 3.1. First some general observations are given about the overall situation of IT Service Management following with a summary of identified strengths and problems. The analysis is based on the results from the IT Service Management Systems assessment from Section 3.4.

General Observations

Based on the IT Service Management Systems assessment, it is clear that the case organization does not currently conform to the requirements of the ISO/IEC 20000 certification. However, the overall operative situation of service production at the case company is relatively positive. The processes work sufficiently well with the current organization structure and current employee capabilities, which is reflected by the high customer satisfaction. Although the processes might not be based on ITIL best practices, the minimum required functionality can be seen in them. Most of the weaknesses identified have already been known at the case organization, but their improvement has not been a priority due to lack of resources to implement them. Some of the bigger issues, such as the improvement of the organizational

structure, are already under revision. The biggest issues come from the loose organization culture that is prevalent in most smaller companies and is evident as a lack of proper documentation and other evidence of processes.

The capability assessment report in Figure 15 is based on similar graph in itSMF International and Clifford [25]. It illustrates the current compliance of the case organization to the ISO/IEC 20000 requirements. The target numbers are illustrated by the top points in the graph and are based on the number of "shalls" in each section of the specification of the standard. The bottom points of the bars indicate the current baseline conformant position, in other words, the number of "shalls" the case organization complies with currently. This means that the blue bars indicate the number of non-conformant items needed to satisfy in each section to achieve the certificate. It is important to note that the figure is only indicative of the situation. It gives more pessimistic view of the situation than what the reality is, since partial fulfillment of the requirements is not taken into account in the figure.

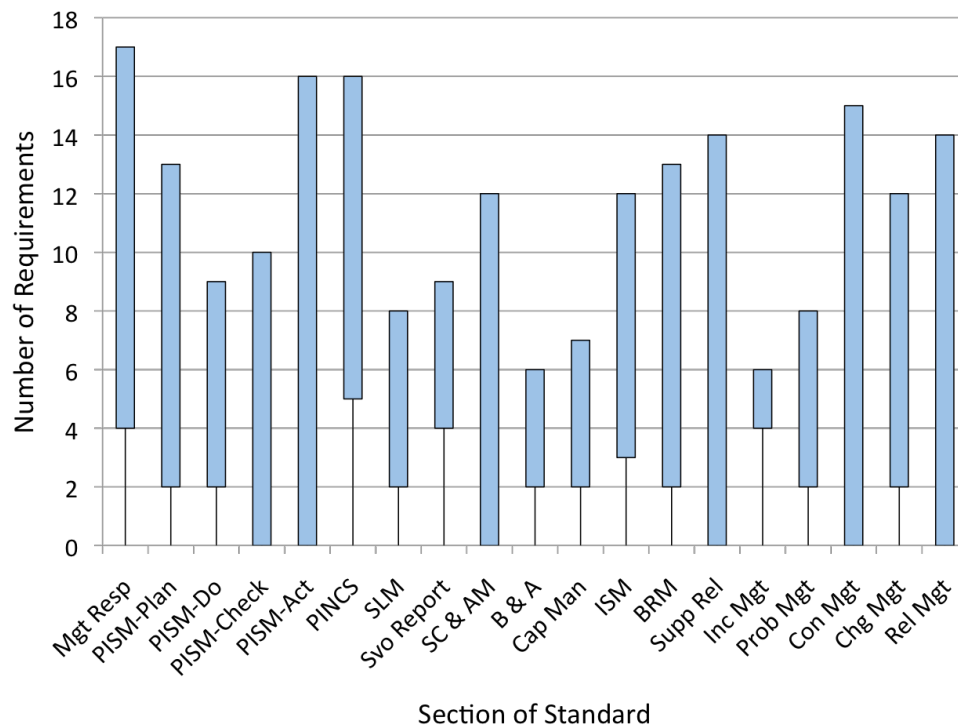
Figure 15: Capability assessment report

Identified Strengths

In order to get a good understanding of the strengths of the case organization, it is useful to divide the identified strengths loosely into two categories. The first category includes all those business areas which already correspond relatively well to the ISO/IEC 20000 requirements. In other words, where only few improvements

are needed to achieve the certificate. The other category includes other factors, which make the process of achieving the certificate easier.

In terms of compliance to the requirements, the best situation is with the service desk and incident and problem management. The actual number of incidents and problems is quite low and they are normally identified and corrected in a timely manner. The routine of handling incidents works generally very efficiently.

Another well functioning part is the implementation of services for new customers. Each implementation project has an owner and the routines are already partially documented. In general, although informal, the processes for day-to-day technical operation work well resulting in a very reliable service.

The sales unit of the case organization, although the largest reason for the organizational change, has also been a huge asset and warrants an acknowledgement. The rate of increase in new customers, as well as the high existing customer satisfaction, indicates the capabilities of the sales team.

The employees of the case organization have demonstrated a good understanding of own weaknesses as well as own capabilities. Coupled with the prevalent culture of analytical and somewhat cautious approach to business as a whole and to improvements specifically, these factors should reinforce the possibility of success in the certification process.

Identified Problems

The identified problems arise mostly from the issues that are not in conformity with the ISO/IEC 20000 requirements. As stated in the previous section, most of the operational processes work well. However, what is missing is the evidence that the processes exist and are followed. In general, the lack of documentation and records is probably the largest problem at the case organization. This includes the process descriptions, minutes of meetings and incident and problem records as well as configuration databases and documentation management systems as whole.

The two parts of control processes as specified in the ISO/IEC 20000 specification, configuration management and change management, in addition to the documentation deficiencies, form perhaps the largest problems at the case organization. In the current configuration management, only hardware relations are available through the system and even those need to be manually updated. Customer relations are not available, meaning that the business impact of technical problems cannot be formed. Without proper business impact analysis, the prioritization of incidents and problems is not effective.

Change management is very closely coupled with the rest of the IT Service Management processes. The case organization does not currently have any consistent processes for managing changes to any parts of the system. All updates and improvements are done in case-by-case manner and often the changes are not reported to all the relevant parties. This results in several concurrent practices even in business critical areas such as in contracts and service descriptions.

The relationship processes, including both business relationship management and supplier management also manifest deficiencies. Although the improvement

projects are already well underway, some areas have still not been addressed. The current customer requirement tracking in the form of service requests needs better processes, as does the new business idea development. Improvements to the service desk are required as well, although it generally works well. Identification of incidents before the customer is aware needs to be improved. Additionally the guidelines for the service desk need to be formalized, especially for those on-call.

4.3   Target Situation

In order to develop the Service Improvement Plan based on the results of IT Service Management Systems assessment, we need to first define the ideal target situation consistent with the company vision. As already identified in the Introduction to the study in Chapter 1, the target for the case organization is to be fully compliant with the ISO/IEC 20000 requirements and achieve the certificate. The drivers behind this goal are first introduced in the background for the study in Section 1.1 and further discussed in Drivers For Certification in Section 3.1.

In practice, achieving this goal means that the Quality and Service Management has to be embedded as part of the organizational culture. The organizational culture is closely related to the new organizational structure that is currently being planned and implemented. In the target situation, the new organizational structure has been successfully implemented and the initial plans have been adjusted to correct any problems identified during the implementation. All employees are aware of their roles and responsibilities under the new organization structure.

Additionally, all the necessary recruitment processes for the new staff as indicated by the organization structure have at least begun. The recruitment policy is crucial in order to maintain and improve the service levels as the number of customers increases. Training plan is used to make sure that all employee capabilities are up-to-date and that the new recruits acquire the necessary skills.

In terms of evidence required by the certification, all the basic documentation for the IT Service Management is collected in a Quality Manual. A Document Management System and a Configuration Management Database are in use. The DMS has proper access and version control mechanisms, so that only authorized personnel can perform changes to the documents. All the configuration items have been defined and catalogued in the CMDB together with the relevant business and customer impact information. Moreover, the employees are aware of the proper documentation and recording procedures.

The operation of service desk is more effective and efficient due to improved information availability and sharing resulting from documented incident and problem recording processes and escalation procedures. The PCI/DSS certification capability has been achieved and the IT security management is ready for ISO/IEC 27000 certification process.

The Plan-Do-Check-Act methodology is used throughout the organization for change management. Periodic audits are carried out according to the requirements to ensure ongoing conformance to the standard and to identify possible areas for improvements.

4.4 Service Improvement Plan

The purpose of the service improvement plan is to outline the steps needed to move from the current situation, identified in Section 4.2, to the target situation of compliance with ISO/IEC 20000 certification described in Section 4.3. In the case organization this mainly entails the formalization of processes, creation of necessary documentation and implementing the proper reporting practices. The plan needs to address the question of what is the best way to implement these changes in practice. Fundamentally, in addition to addressing the problem areas, the improvement process needs to motivate people, teach about the importance of communication and training, and clarify the roles and responsibilities of individuals. The critical success factors for the project are discussed in the next section.

The objectives are best reached through a series of short workshops. Each workshop should focus on a specific problem area, and as a whole ultimately cover all the identified problem areas. The workshops are planned and conducted with the help of an outside consultant, specializing in IT Service Management, to ensure efficiency and effectiveness of the workshops. All the issues not covered in the workshops, including finalization of the documents, can be handled by the core project team lead by the new Quality Manager. The workshop approach and the inclusion of only the key parties in the project should ensure that the proper ways for implementing changes can be decided and carried out with minimal impact to day-to-day operations of the case organization.

As already mentioned, each workshop should focus on a specific problem area. The necessary focus can be achieved by selecting the workshop topics to reflect the different sections of the ISO/IEC 20000 standard. Additionally, identification of the relevant employees to each workshop and restricting the workshop participation to only those is very important in order to minimize the employee workloads. The topics can effectively be divided into four, or possibly five, workshops covering Relationship Processes, Control Processes, Resolution Processes and Service Delivery Processes. The more detailed focus areas of each workshop are given below.

Relationship Processes & SLM The workshop on relationship processes should be the first one since it is closely related to the organizational reform, and needs to be completed in order to speed the adoption of the new organizational structure. The main stakeholders in this workshop are the sales and account management staff. A preliminary internal kick-off day has been held for these organizational units with the aim to start the discussion on relevant processes and role descriptions. The main workshop should continue from the discussion started during the kick-off, with focus on formalizing the actual processes and role descriptions.

Control Processes The change and configuration management processes form the basis for all the other IT Service Management processes, and need to be addressed before other issues. As they affect the whole organization, the participants to the workshop should include representatives from all the organizational units. The focus on the workshop should be on identifying the

requirements for the configuration database, designing proper change management processes and brainstorming ways to motivate employees to use the proper practices once they have been decided.

Resolution Processes As the actual processes for incident and problem management are generally functional, the workshop should focus on formalizing those processes and making sure that everyone is clear on their roles and responsibilities. Additionally, the triggers for problems should be identified and the reporting practices should be clarified. In terms of the service desk operations, the instructions for person-on-call need to also be specified. The main stakeholders in this workshop are the services production unit and the service desk staff.

Service Delivery Processes The workshop on service delivery processes can be divided into two if needed, since it covers such a broad spectrum of topics. Possible division is to have service level and capacity management in one workshop, and the budgeting and accounting and information security management in another workshop. The key stakeholders for the workshops are the staff of change management and development unit and also parts of finance, account management and sales units. The focus should be on defining and formalizing the service level descriptions as well as the capacity management processes. Information security practices and documentation requirements need to be also covered. However, as information security management is related to other ongoing projects as well, it might be more practical to have an entirely own workshop for it.

Although the topics covered in each workshop vary greatly, they should follow the general outline specified below. Each workshop should be preceded by a preparation session and followed by a recap document and any additional work warranted by the workshop.

Preparation In order to gain the most out of the actual workshop day, sufficient preparation are necessary. The preparations should be done by the certification project team together with the outside consultant. Other relevant parties can be consulted as needed. The preparation session should prepare the necessary background information, set the detailed objective for the workshop, specify what achievements are expected and what issues can be left as homework to be completed afterwards. Additionally, the participants need to be selected, verifying their availability during the workshop and making sure that no-ones time is used unnecessarily. The basic logistics issues need to be resolved, including the selection of location, setting up the room, timing, length of training and length of each activity. The introductory information requirements need to be identified and the materials prepared.

Workshop The full day workshop with all the relevant parties identified in the preparation session should be used mainly for creative problem solving and

brainstorming about how the issues should be solved. Depending on the workshop topic, the focus should be on finding and agreeing on the outlines for best ways to do things. The actual work on creating the documentation might be best to be left for the follow-up phase. The additional purpose of the workshops is to provide information and educate the participants about the certification, their new roles and responsibilities and the target situation.

Outcomes The follow-up of the workshop is as important as the preparation. A summary report of the outcomes of the workshop should be prepared for all the participants. Also a follow-up plan for the next workshop should be detailed, to ensure that all the unclear or unfinished areas are covered. Probably most important follow-up of the workshops is the creation of the actual documentation based on the results.

4.5 Critical Success Factors

The concept of critical success factors has already been introduced in relation to ITSM implementations in Section 2.2. "Critical success factors are those few things that must go well to ensure success for a manager or an organization"[3], but the concept can easily be extended to analyzing individual projects as well. Therefore, identifying and listing the critical success factors is a very useful exercise for the ISO/IEC 20000 certification project at the case organization. As each organization has unique features and the general CSFs listed in Section 2.2 may not all be applicable at the case organization. Furthermore, some additional critical success factors might exist that have not been identified in the general lists.

The critical success factor examination is based on the three project functions of People, Tools and Processes shown in Figure 16.
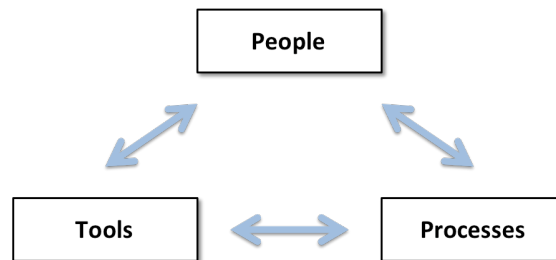
Figure 16: Project Functions: People, Tools, and Processes

People People are perhaps the most important asset at the case organization and therefore gaining their support is a vital factor for the success of the project. Identifying their unique characteristics and determining the right selling points based on those characteristics forms the basis for gaining the support of the whole staff. The support can be achieved through honesty about the reasons for the project and about the expected benefits gained by the certification, as well as by paying attention to their concerns. In addition

to initially selling the project, sustaining the changes is very important. Due to the nature of an expert organization, this can be achieved through recognizing and assigning responsibility, defining clear job and role descriptions, education and communication and establishing the overall culture through senior management involvement. The employees are already very busy with their existing work and have very little time or patience for any additional projects, therefore new employees are needed to fulfill all the responsibilities.

Processes Most of the IT Service Management and Production processes are appropriate to the tasks and work well in practice. Therefore, only the creation of proper documentation is required to satisfy the standard requirements. The use of existing capabilities and processes as much as possible minimizes the need for unnecessary changes and thus also improves the staff morale.

Tools If the tools used are hard or counter-intuitive to use, or do not offer the necessary benefits, then the threshold to use them increases. In the worst case, the tools may become completely obsolete, all the resources used for their implementation will be wasted and the actual productivity might even decrease. Therefore, finding the right tools for customer relationship management (CRM) and the right document management system (DMS) for the documentation and the configuration management database (CMDB) is crucial for the overall success of not only the certification project but the business as a whole. The acquisition of new tools is not always an optimal solution, instead the existing working tools should be used as much as possible. The proper tools should make the documentation control much easier resulting in an increase in productivity.

Based on the previously identified issues related to the people, processes and tools, we can identify the critical success factors for the ISO/IEC 20000 certification project at the case organization as:

- Selling the project

- Personnel training

- Minimizing unnecessary work

- Careful software selection

- Resource management

4.6 Summary

Alleviating the customer concerns over trust, continuity, privacy and security in Cloud Computing is vital for success. Although the case organization does not qualify on all the identified Cloud Computing characteristics, it still operates in the ecosystem and is subject to the same issues. The requisites Cloud Computing

imposes on IT Service Management were discussed in the preceding chapter. In addition, the nature of the case organization in terms of Cloud Computing was briefly evaluated. Next, the summary of the current situation at the case organization based on the IT Service Management Systems assessment from the previous chapter was presented. An optimal target situation in terms of service management was described and an outline of a Service Improvement Plan with the necessary steps to realize the target from the current situation was developed. The plan was based on a workshop approach to allow flexibility in terms of execution. Finally, the case organization specific Critical Success Factors, that need to be addressed for the project to be successful, were identified.

5 Conclusion

The purpose of this chapter is to recapitulate the objectives of the study and assess how well those objectives have been achieved. In addition, the reliability and the applicability of the results are discussed and finally potential further development topics are identified.

5.1 Results

The focus of the study was on Information Technology Service Management systems in the Cloud Computing ecosystem. The premise of the study was the desire of the case organization to satisfy customer requirements and improve the level of IT Service Management. The case organization is a small-sized Finnish, IT infrastructure services offering company. It offers a wide range of managed services for mission-critical hosting environments to eService Providers. The academic objective of the study was to determine the importance of IT Service Management for Cloud Computing. The objective of the case study was to assess the current level of IT Service Management systems at the case organization and to form a Service Improvement Plan with the view of achieving ISO/IEC 20000 certification based on the results of the assessment.

The theory part served as an introduction to the concepts of Cloud Computing, IT Service Management and ISO/IEC 20000 certification. The concepts were defined through identification of main characteristics and revision of existing literature. The ISO/IEC 20000 requirements were outlined in addition to the potential steps required in the certification process. The nature of case organization was examined based on the definition and characteristics of Cloud Computing and it was noticed that the case organization does not fulfill all the characteristics of Cloud Computing although it operates in the same ecosystem. However, the current loose definition of Cloud Computing does not prohibit the description of the case organization as a Cloud Computing company. The case organization can be regarded as a Virtual Private Cloud provider. Finally, the specific focus areas required by the Cloud Computing environment on IT Service Management were identified.

An extensive assessment of the IT Service Management systems was carried out at the case organization based on the ISO/IEC 20000 standard. Special attention was given to Information Security Management and Customer Relationship Management in the assessment as they formed the key areas of interest for the case organization. The case study was mainly conducted by interviews of key stakeholders and supplemented with evidence review and observational assessments where appropriate and needed.

Although the results of the assessment indicated that the case organization does not conform to the specifications of the ISO/IEC 20000 standard, some strengths could be identified. The overall service production was executed well and according to industry best practices and some parts were relatively compliant the the requirements. These were the service desk with incident and problem management and the new customer service implementation unit. Sales unit is very effective, al-

though the relationship processes are not in compliance with the standard. Overall the atmosphere at the case organization is favorable to the changes as required by the certification and the new organizational structure improves compliance further. Most of the problems identified are due to the lack of concrete evidence that the necessary processes exist. The configuration and change management processes and tools are currently insufficient and the relationship processes need improvement.

An outline for a Service Improvement Plan, with the target of addressing the non-compliance issues to achieve the ISO/IEC 20000 certification, was created based on the results of the assessment. A workshop approach to service improvement was proposed and case organization specific Critical Success Factors were identified. The plan divides workshops according to topic into Relationship Processes, Control Processes, Resolution Processes and Service Delivery Processes. The benefits of going through with the proposed improvement plan includes improved customer satisfaction, improved service management processes and the resulting efficiency gains. The plan also forms the foundation for the application for the ISO/IEC 270001 Information Security Management Systems certificate.

The study answered well the research questions defined in Section 1.2 and formed a good overall picture of the current level of IT Service Management at the case organization. The study forms a good foundation for the case organization to start the necessary steps to improve its IT Service Management systems and ultimately achieve the ISO/IEC 20000 certification. The study also demonstrates the clear connection between ITSM and Cloud Computing, and identifies various aspects of Cloud Computing that can be enhanced by application of ITSM principles and by applying for relevant certificates.

5.2   Assessment of the Results

The IT Service Management Systems assessment was conducted using various methods as suggested by itSMF International and Clifford [25]. The methods were selected to achieve as extensive picture of the current situation of ITSM at the case organization as possible and to reduce the potential errors resulting from selection of only one research method. The results demonstrated generally a good congruency between the interviewees, evidence reviews and observations. No fundamental disagreements between the interviewed parties could be identified and the assessment results from different methods support each other well. The assessment was based on the ISO/IEC 20000 standard which is generally accepted as the benchmark for IT Service Management, suggesting that the subject matter has been covered in sufficient detail.

When considering the objectivity of the study, it is important to note that the author of the study had no previous connection to the case organization. While improving the objectivity, it also has slightly hindered the collection of materials and the access to relevant evidence. The author has made a conscious effort to remain objective throughout the study and not let his personal opinions affect the results. The use of outside consultant and the involvement of the new Quality Manager have also helped to retain the objective view on the subject.

Although majority of the results were based on the interviews, and the fact that the interviews are always subject to the personal bias of the interviewer, the fact that the interview questions are closely based on the actual ISO/IEC 20000 standard should improve the reproducibility of the results. The standard is very clear on the requirements leaving very little room for personal interpretations. How the requirements are met, and therefore how the Service Improvement Plan is formed is another matter, since they are outside the scope of the standard. The possible lack of reproducible results limits the situations to which the created models apply.

The scope of IT Service Management is very broad as it influences almost every aspect of the business. As the aim was to assess the current level of the case organization in relation to the whole ISO/IEC 20000 standard, the depth of focus on individual topics has been limited. The methodology of the case study is suitable to be used to evaluate other similar IT organizations as well, however the results gained and the recommendations given are only applicable to the case organization.

The study was conducted as a form of constructive research with the aim to identify the problems in IT Service Management systems at the case organization and to develop suitable solutions for them. Based on the previous considerations, it can be said that the study gives an extensive and reliable picture of the current level of IT Service Management at the case organization. However, the final validity of the results can only be confirmed after the recommended actions have been taken.

5.3   Exploitation of the Results

As already defined in Scope of the Study in Section 1.3, the main focus of the study was on IT Service Management in relation to the case organization. The theory part, however, is more universally applicable. Description of the whole Cloud Computing architecture and the importance of IT Service Management in it is of interest to all the stakeholders in the ecosystem. Although each organization is different, the importance of properly managed IT Services in Cloud Computing cannot be refuted.

The case study part is mainly applicable to the case organization. Nonetheless, the issues that the case organization faces are also seen by other similar organizations as well. Therefore the insights gained from the assessment can be used as reference points for other organizations wishing to improve their own IT Service Management systems. The specific problems, improvement plan and the critical success factors are organization specific and should not be taken as definitive. The increased outsourcing of critical IT services increases the need to focus on the systems for IT Service Management. As Cloud Computing ecosystem is seen as the dominant service delivery and consumption model in the future, ITSM and related standards are the key factors in achieving required trust and confidence of the customers.

5.4 Further Development Possibilities

The scope of the IT Service Management and ISO/IEC 20000 standard are very broad and this study has focused on giving the overall picture from the view of the case organization. However, each of the service management processes detailed in the ISO/IEC 20000 standard could warrant an endless number of possibilities for further research, especially from the point-of-view of Cloud Computing. In this section, some of the research possibilities rising from the study are presented.

As the ISO/IEC 20000 only outlines the requirements to be satisfied in order to achieve the certification, the actual practices for satisfying those requirements are not addressed. Capacity management is an interesting area of ITSM in Cloud Computing due to the automatic scalability requirements. Further research could be conducted to determine what practices are needed to satisfy the certification requirements in the case of automatic scalability of capacity.

One of the purposes of ITSM processes is to monitor and measure the success and relevance of implemented changes. In order to properly assess the success, various controls are needed at the organization. The scope of this study did not allow for closer examination and selection of suitable monitoring and measuring procedures. Further research could be conducted to determine what monitoring and measuring practices would be most successful.

The scope of the study was restricted to performing the assessment and creating the Service Improvement Plan and did not cover the actual implementation of changes nor the certification audits. Therefore, it would be interesting to study what are the actual results of the certification process once the case organization has implemented all the necessary steps and achieved the certification. Are the Service Management systems used in practice and have there been noticeable performance or service quality gains? Has there been a measurable effect on customer satisfaction, which was one of the driving forces behind the project in the first place?

Finally, gaining the trust and confidence of the customers is one of the biggest critical success factors for the service providers in the Cloud Computing ecosystem. The ISO/IEC 20000 certification was seen as one way to improve the situation at the case organization. However, the actual effect of the certification on the customer opinions is still unclear and would be an interesting topic for further research. Additionally, research into what other ways can be found to improve trust and instill confidence is needed.

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A   Inventory of the Management System

The Inventory of Management System includes the evidence required by the ISO/IEC 20000 standard. The list is based on the pieces of evidence identified in itSMF International and Clifford [25] and is not exhaustive. The evidences can be either documents or records. Documents are defined by ISO, International Organization for Standardization [22] as being evidences of intentions while records are defined as being evidences of activities. The evidences are evaluated based on their availability, from not compliant with the standard to full compliance.

Type:

D Document

R Record

Evaluation:

0 Not implemented

1 Partially implemented

2 Fully implemented

Table A1: Key pieces of evidence [25]

3.1 Management responsibility	Type	Evaluation
Objectives	D	0
Policies	D	0
Plans	D	0
ITSM performance reports	R	0
Continual service improvement logs	R	0
Management Review logs	R	0
3.2 Documentation requirements	**Type**	**Evaluation**
Document management system	D/R	1
Document management process	D	0
3.3 Competence, awareness and training	**Type**	**Evaluation**
Organization chart	D	2

Role guides with competencies	D	1
Resource plan	D	1
Performance review schedule	D	1
Education/training plans	D	1
Performance review results	R	0
4 Planning and implementing Service Management	**Type**	**Evaluation**
Service Management Plan	D	0
Service Management Framework	D	0
Cost Model	R	0
Risk Log	R	0
Recruitment plan	D	0
Resource plan	D	1
Process KPIs	R	0
ITSM assessment report	R	0
Service performance reports	R	0
Internal audit plan	D	0
Internal audit reports	R	0
Internal audit procedure	D	0
Continual service improvement (CSI) policy	D	0
CSI communication reports	R	0
CSI log	R	0
CSI process	D	0
5 Planning and implementing new or changed services	**Type**	**Evaluation**
Proposal for new or changed service	D	1
Associated change records	R	0
Implementation plans	D	0
Service acceptance criteria	D	1
Service acceptance criteria assessment report	R	0

New or changed service review	R	0
Change management review	R	0
6.1 Service level management	**Type**	**Evaluation**
Service level agreements	D	2
Service catalogue	D	2
Operational level agreements	D	1
Underpinning contracts	D	1
Service level management processes and procedures	D	1
Service level requirements	D	1
Service catalogue reviews	R	0
Service catalogue communication records	R	0
Change records for amendments to the SLAs	R	0
SLA review meeting minutes	R	0
Service level reports	R	1
Service improvement plan logs for SLM	R	0
6.2 Service reporting	**Type**	**Evaluation**
Service report specification	D	0
Customer service requirements	R	1
Service report catalogue	D	1
Service report	R	0
6.3 Service continuity and availability management	**Type**	**Evaluation**
Record of interpreting business requirements in to availability and service continuity plans	D	0
Availability and service continuity processes and procedures	D	0
Availability plans	D	0
Test plans demonstrating alignment to business needs	D	0
Service continuity plans	D	0
Availability and service continuity plan reviews at least annually	R	0

Interface between change and availability/service continuity plan impact analysis	R	0
Availability monitoring reports	R	1
Including predictive availability trend analysis reports	R	1
Actions from availability monitoring	R	0
RfCs raised as a result of availability actions	R	0
Test results	R	0
Actions from test results, continual improvement	R	0
6.4 Budgeting and accounting	**Type**	**Evaluation**
Accounting policy	D	1
Budgeting policy	D	1
Budget plan	D	0
Accounting reports	R	1
Budget reviews (future)	R	1
6.5 Capacity management	**Type**	**Evaluation**
Capacity plan	D	1
Capacity policy	D	1
Capacity management process and procedures	D	0
Business predictions and workload estimates	R	0
Capacity related RfC	R	1
Capacity reports	R	0
Analytical/simulation models	D	0
Costed options documented for satisfying customer requirements	R	0
6.6 Information security management	**Type**	**Evaluation**
Information security policy	D	1
Security controls	D	1
Security requirements with supplier contracts	D	0

	Type	Evaluation
Security incident management procedures	D	1
Security risk log	R	0
RfCs to apply security controls	R	0
Security incidents	R	1
Security incident reports	R	1
Security costs	D	0
7.2 Business relationship management	**Type**	**Evaluation**
Stakeholder and customer matrix	D	0
Annual service review meeting minutes	R	0
Interim service review meeting minutes	R	0
Change management records	D/R	0
Business requirements/plans	D	0
Complaints process	D	0
Customer satisfaction process	D	1
CSI log	R	0
7.3 Supplier management	**Type**	**Evaluation**
Supplier catalogue	D	1
Supplier management process	D	0
Underpinning contracts	D	1
Contractual review meeting minutes	R	0
Change management records	D/R	0
Contractual disputes process	D	0
Supplier performance reports	R	0
CSI log	R	0
8.2 Incident management	**Type**	**Evaluation**
Incident management procedure	D	1
Incident records	R	1
CSI log	R	0

8.3 Problem management	Type	Evaluation
Problem management procedure	D	1
Problem records	R	1
Trend reports	R	1
Change management records	D/R	0
Problem review records	R	0
Known error records	R	1
CSI log	R	0
9.1 Configuration management	**Type**	**Evaluation**
Configuration management plan	D	0
Change management plan	D	0
Configuration management procedure	D	1
Configuration management policy	D	0
Status accounting reports	R	0
Change management records	D/R	0
Definitive Hardware Store	R	1
Definitive Software Library	R	1
Configuration audit reports	R	0
9.2 Change management	**Type**	**Evaluation**
Change management process	D	0
Change management records	D/R	0
Change management review	R	0
Emergency change process	D	0
Change Advisory Board minutes	R	0
Forward Schedule of Change	R	0
Change schedule assessment	R	0
Change management trend reports	R	0
CSI log	R	0

10.1 Release management	Type	Evaluation
Release policy	D	0
Release plans	D	0
Release management process	D	0
Change management records	D/R	0
Known error records	R	1
Problem record	R	1
Acceptance test environment strategy	D	0
Emergency release procedure	D	0
Release management review notes	R	0
Release incident reports	R	0
	Type	**Evaluation**