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# ESTABLISHMENT OF CLOUD ARCHITECTURE VISION

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Master Thesis
MBA, Information Systems
2018

# ABSTRACT

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**Degree programme**

Master's Degree Programme (MBA) in Information Systems

| **Name of thesis work** | **Pages and attachments** |
|---|---|
| ESTABLISHMENT OF CLOUD ARCHITECTURE VISION | 75 + 15 |

Cloud services are holistic approach for to maintain business processes, business data, business applications and infrastructure. There are several models and service forms of cloud on the market, so enterprises have has multiple choices to consider and take in account to find proper way to utilize cloud services for the business.

This master thesis work is using qualitative research approach to investigate cloud services and cloud models using several literature sources and up to date articles to gather valid information about cloud services for the research. Enterprise architecture methodology Togaf, with requirements management forms up the theoretical framework of this research. By using this approach, gathered business objectives, constraints and threads are processed and analysed against cloud adoption initiative for insurance industry, which works as the request for architecture work within this research. These business requirements are based on commercial sources, investigated and described at the beginning of research.

Research is using Togaf's architecture development methodology (ADM) to form up architecture vision, where selected business area for applying it is a insurance industry. Research has boundaries aligned on ADM:s preliminary phase and architecture vision phase which leads to outcome of reference architecture vision. The objective is to build appropriate model for enterprises which intent is to adapt cloud services for its business.

**Keywords**

Cloud Services, Cloud Models, Business Development, Architecture, Togaf, Requirements management.

## Content

# 1 Introduction

This master thesis work is using qualitative research approach using several literature sources and internet sources to gather valid information about cloud services and needed methodologies for a research. Theoretical framework is built up with cloud related technical literature and up to date articles about it. Togaf and business development based on cloud perspective, with requirements management are the frameworks within this research to clarify cloud combinations to be matched with most usual business objectives from different perspectives of architecture.

Cloud services is holistic approach to maintain business processes, business data, business applications and infrastructure and it has several models and service forms on the market. To find proper way to utilize cloud services for the business, enterprises have multiple choices to consider and take in account.

## 1.1 Objectives of research

The aim of research is to produce description of different cloud models and cloud service types usability for companies which objectives is to improve their business and cost effectiveness with cloud services. There is on a market lot of choices when considering it infrastructure development with cloud services. This research is exploring these market offerings of cloud services today, analyzing it and producing a recommendation template as a start point when considering between the several cloud models and services.

Objective based on cloud service and model description is to utilize EA architecture open library methodology TOGAF ADM for to process elicited business objectives, transform them in to proper cloud requirements categorization and to evaluate suitable cloud service model and cloud type based on these. Business objective are gathered by exploring literature sources and articles for to produce set of requirements that basically determines the most relevant business goals for cloud adoption. Outcome of research will be evaluated suitable recommendation about reference cloud services and cloud types aligned for insurance business.

## 1.2 Constraints and assumptions of research

Research boundaries are planned to cover insurance industry business area. Generally outcome of research will serve any larger scale insurance company which business objective is to transform business in to cloud.

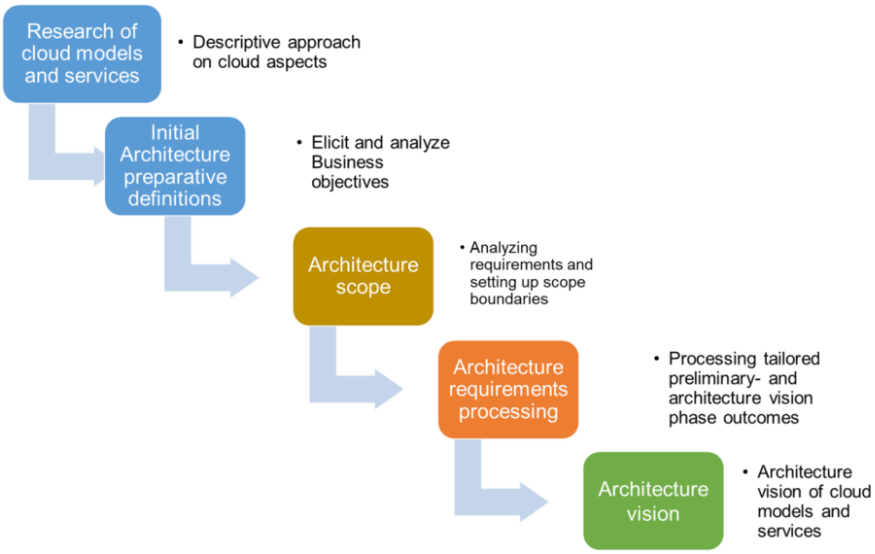
Research is concentrating on business requirements, which are elicited as a example set in relation to basic insurance business needs. For example research is not investigating more detailed national or EU regulations or appointed quality standard demands. This means that there will not be fully covering scale of requirements.

Research method as presented, is to evaluate different cloud types and services with Togaf ADM. Phases of ADM used are preliminary phase and architecture vision. Rest of Togaf frameworks phases are not in the scope of this research.

### 1.3 Research process

Research process is starting with description of business development with cloud. There will be described through the scale of cloud services and models. After that business objectives are gatherer from commercial sources. These are processed to be met basic architecture categories.

Process description of research




When total scale of business objectives are stated and initially categorized, enterprise architecture is described with substantive parts of Togaf ADM process. After that research completes the necessary functions of ADMs preliminary phase and architecture vision phase, establishing the outcomes for cloud initiative. The ADM discusses all the time iteratively with requirements management process. This combination produces the outcome of architecture vision, which is analysed at the end of research.

## 2 Business development with cloud

When company is considering cloud adoption it needs a business architecture model for that. Business architecture model is used to understand the fit of the business and what could be appropriate cloud model for the business.

A business has goals that it is trying to achieve. It will also have multiple facades containing many functionalities or interactions that it presents to the different members of its external supply chain. For example, a business will look different to retail clients versus commercial clients, different to suppliers, and different again to regulatory or governmental bodies. The business has to be internally structured in such a way that all its processes facilitate these facades and interactions, essentially arranged in ways for the business to connect with the community in which it will operate. The business needs to know what the mandatory and appropriate communications are for each of its partners and within its own structure. In addition, a business will have a list of things it needs to know about and manipulate, as well as what the various relationships are between these various things. (Reynolds 2010).

Business architecture gives a holistic model of business which depicts the current state of as well as the future state to achieve. This holistic view gives understanding what business currently has in the way of a model. Business goals usually are searching answers to questions like how architecture interacts with all aspects of its environment, including customers, suppliers and regulatory bodies (Fehling, Leymann, Retter, Schupeck and Arbittter. 2014).

Also it needs to define how the business will operate internally to support its environmental interactions how it will communicate internally and externally and what information it will deal with. The current state of all of these things describes the business current state while the future state gives companies the opportunity to ensure a better fit between the business and its environment (Reynolds 2010).

Cloud computing definition of NIST (National Institute of Standards and Technology) gives some direction of that, what kind of landscape business development with cloud is. Cloud computing's logical level definition has general and essential characteristics, which are the elements what at least cloud usually have to be called as a cloud computing. When getting deeper with cloud computing, there is described most usual service model and deployment model characteristics of cloud. During the research, these are described

more detailed on upcoming chapters. Below on figure 1 is described cloud services and it's element's on high level.

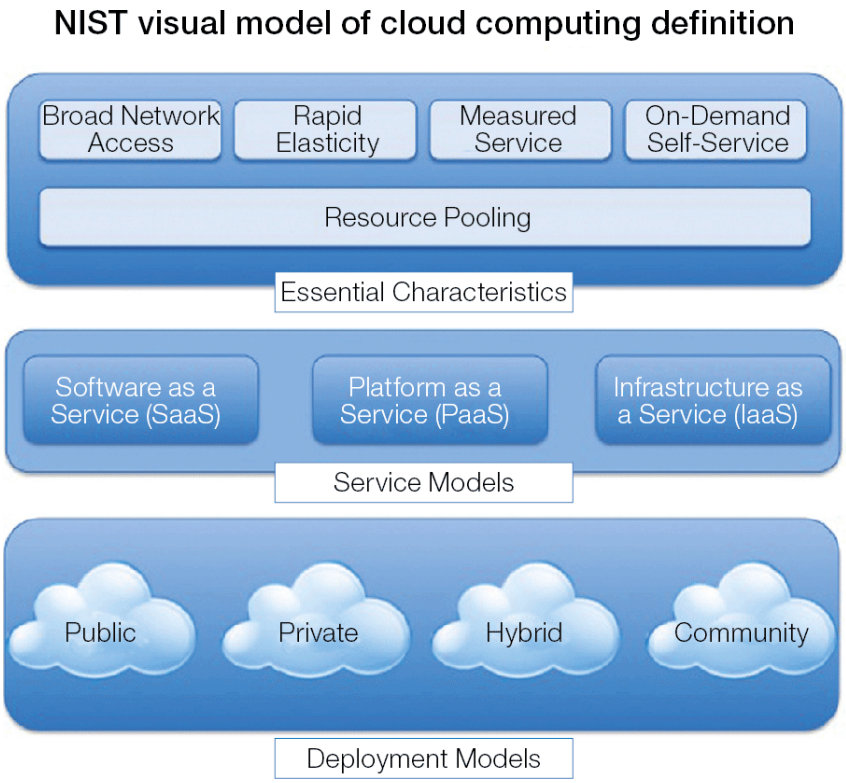



Figure 1. NIST visual model of cloud computing definition (Batavitech.com 2017, 10, 02.)

Cloud computing has become the platform on which enterprises are accelerating digital transformations and modernizing IT. Organizations are increasingly finding business agility or cost savings by renting software through cloud vendors. Cio.com has published website article, '6 trends shaping IT cloud strategies today' is describing holistic trends regarding to cloud strategies (Cio.com, 2017, 3137946.).

Article is stating that the global public cloud market will hit $178 billion this year (2018), up from $146 billion in 2017, according to Forrester Research. Public cloud adoption in enterprises will cross 50 percent for the first time. With so many large organizations offloading compute resources to focus on strategic digital initiatives, the tipping point was inevitable. (Louis Columbus, 2017, 11, 07).

Clinton Boultons article tells about the key trends shaping cloud adoption today and gives following high level viewpoint on those. Article is referring in many phases to Forrester's statements within same context.

Rise of multi-cloud is seemingly true because companies are hedging their bets but dropping applications into two and sometimes three public clouds (Cio.com, 2017, 3137946.). Lauren Nelson, a Forrester Research analyst who tracks the cloud market, says CFOs are encouraging this approach to avoid putting too many apps in a single cloud basket to keep their options open.

Usually compute and storage are similar between providers, conversion tools help companies move data from one cloud to another. This issue gets murkier where networking, application and developer services are concerned. Enterprises would do well to use templates that ensure portability of applications and data between vendors. Forrester recommends companies conduct a thorough lock-in risk or/and reward analysis, and build a risk mitigation plan (Louis Columbus., 2017, 11, 07).

Disaster recovery stands at the moment on very critical place when planning cloud solutions and business continuity. Enterprises traditionally operate multiple data centers that provide redundancy for most critical applications running on premises. That approach has yet to translate to public cloud computing services, increasing the risk of an outage having disastrous consequences to business (Clinton Boulton, 2017, 3137946.).

Jake Burns, vice president of cloud services for Live Nation, says

> "*many companies aren't backing up services they run in the cloud. But that will change in 2018, as more CIOs acknowledge the importance of the virtual safety net."* (Clinton Boulton, 2017, 3137946.).

Companies will adopt multi-cloud strategies, running copies of their software with several cloud vendors, or run applications in more than one data center of their cloud providers. Disaster Recovery costs can soar easily, so budget accordingly. Burns continues:

> *"Understanding this concept and putting in countermeasures to protect against that is going to be a big trend by the end of this year,"*

Security of cloud has rise rapidly on the very important place within cloud computing. For the past several years, data protection, encryption and workload security automation and monitoring have largely been add-on services in cloud systems. Cloud vendors will offer much more integrated alternatives for cloud security that can augment or replace point solutions. (Clinton Boulton, 2017, 3137946.).

Forrester recommends applying a "zero trust" security model within and across cloud platforms. Most trivial thing to clarify how the cloud solutions guarantees the security works

across IaaS, PaaS and SaaS platforms. And on other hand, how these handle IaaS or PaaS native monitoring or SaaS native encryption, with full control of encryption keys, data sovereignty and privacy (Louis Columbus., 2017, 11, 07.).

Companies are in difficult position with Cloud cost containment engaging with multiple cloud providers are likely waist deep in complex cloud vendor management field. Different cloud vendors are making it more difficult by offering various cloud service pricing and consumption plans. For example, one vendor charges customers of some of its cloud services by number of messages sent, or number of messages sent in an hour. (Clinton Boulton, 2017, 3137946.).

Forrester analyst Dave Bartoletti has hired hire a person just to help choose and negotiate cloud contracts. In same breath He states,

> *“Cloud cost management is a huge challenge and it’s only getting more complex,”*

Adoption of containers, which enable developers to manage and easily migrate software code, caught fire in the past few years, underpinning many companies cloud computing and development operations (DevOps) efforts. But as testing and proof of concepts gave way to production, companies found they needed to orchestrate the deployment of containers. This containers orchestration include what need to learn, who need to train, and what outcomes development and infrastructure teams hope to accomplish (Clinton Boulton, 2017, 3137946.).

To fully leverage the value of faster software delivery, many organizations are revamping their developer culture, including instituting agile and DevOps methods to help take advantage of the agility and scalability the cloud offers. Forrester recommends companies to identify help drive culture change around and cloud. This helps break old habits, reinforce desired behaviours, and improve developer focus (Louis Columbus., 2017, 11, 07.).

Forrester wrote in their report:

> *"If cloud objectives depend heavily on developing code quickly, at scale, using the most-innovative new platforms and tools, will need to change development culture first and it’s not easy."*
> (Louis Columbus., 2017, 11, 07.).

Web page digitalistmag.com has published an article regarding on cloud adoption, ‘Moving from cloud adoption to cloud integration’. Article is giving some viewpoints, which could help companies to maximize the efforts invested on cloud.

Article is recommending to develop a solid governance strategy. By establishing policies for cloud integration will ensure that employees follow set standards, particularly as cloud suites become increasingly complex. These guidelines will encourage everyone to use resources responsibly. (Daniel Newman, 2016, 06, 20.)

Adopt cloud analytics by implementing top quality cloud analytics tools. That will allow cloud technologies to operate at maximum efficiency. If a cloud service fails to deliver, it will be reflected in cloud analytics. (Daniel Newman, 2016, 06, 20.)

Popular cloud services have gained widespread adoption, so they’re now a standard for many businesses. Article is recommending to choose cloud services with multi-vendor adoption. Various vendors use the functions on different cloud platforms. If enterprises use these services, it greatly reduces the risk of being locked into one cloud provider. (Daniel Newman, 2016, 06, 20.)

Cloud service providers vary greatly from one to another. Companies have to be sure to work with a managed service partner that offers the reliable services for companies need. On following chapter are defined cloud services from operational service level perspective.

### 2.1 Cloud service models

Each cloud model offers its own specific features and functionalities, and it is crucial for companies to understand the differences. Whether companies are looking for cloud-based software for storage options, a smooth platform that allows companies to create customized applications, or are willing to complete control over entire infrastructure without having to physically maintain it, there is a cloud service for them. No matter which option company choose, migrating to the cloud is the future of business and technology as and it is necessary to be properly informed.

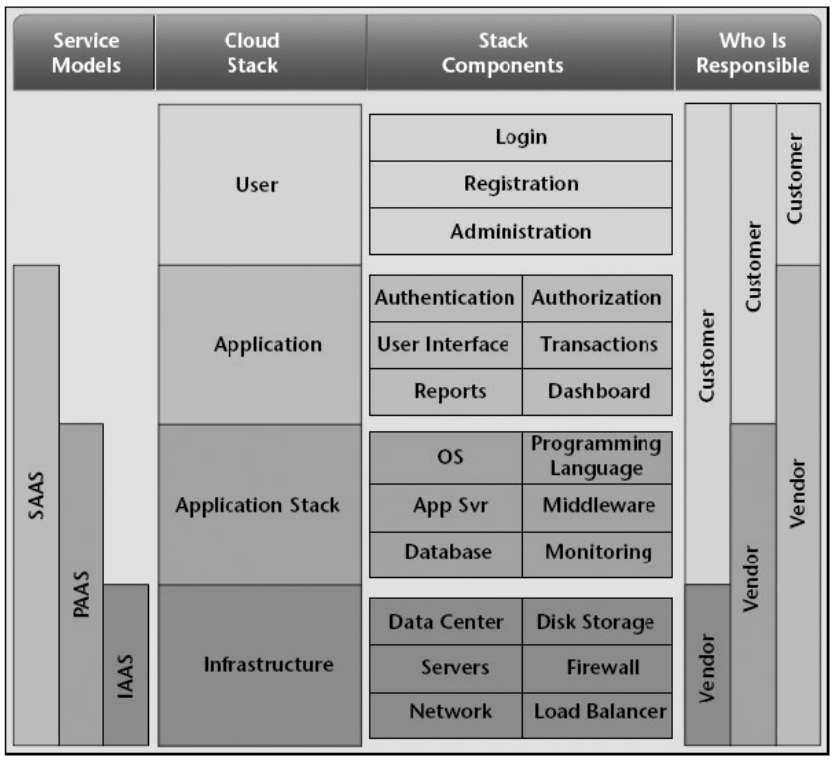



Figure 2. Cloud Stack (M.Kavis. 2014)

Cloud based applications run on distant computers in the cloud that are owned and operated by others and that connect to user's computers via the internet. On following chapters research go through cloud service model, SaaS, PaaS, IaaS and dPaaS, and describes cloud characteristics and benefits.

### 2.1.1 Software as a service

Cloud based applications mean software as a service (SaaS). These applications run on distant computers, in the cloud, that are owned and operated by others and that connect to user's computers through the internet.

Characteristics of SaaS

- Managed from a central location
- Hosted on a remote server
- Accessible over the internet
- Users not responsible for hardware or software updates

Benefits of SaaS

- Develop applications and get to market faster
- Deploy new web applications to the cloud in minutes
- Reduce complexity with middleware as a service
- Reducing the time and money spent on tedious tasks such as installing, managing, and upgrading software.

When to use SaaS

Software as a Service purpose is to deliver complete applications in the cloud that cloud service consumers can access over the Internet with a browser. The SaaS providers have total control over the infrastructure, performance, security, scalability, privacy, and much more. SaaS vendors typically offer two ways for their customers to use their applications. The most common method is a web based user interface that usually is accessible on any device that can connect to the Internet. (Kavis. 2014)

The speed of change in technology is amazingly fast and for example it is huge investment for a company continue to invest precious IT resources upgrading legacy applications to work on the next new phone or tablet. Through cloud services companies can as example quickly react and integrate with the API on to new services from current applications. (Kavis. 2014)

Companies can use SaaS to outsource all applications, features, and services that are not a core competency, assuming it meets its needs and is affordable. For example, if a company is not in the business of writing HR, payroll, customer relationship management (CRM), and accounting software, it should not build these applications. Buying these applications and running them on-premises is not cost effective with the emergence of SaaS alternatives. It is not reasonable buy the software and servers, manage the servers, and pay people to manage, patch, secure, and provide other not value adding tasks to keep services running. (Kavis. 2014)

Most popular SaaS solutions are applications like customer relationships management, enterprise resource planning, accounting, human resources, and payroll. The *data* category includes business intelligence, database as a service, data visualization, dashboards, data mining, and more. The *productivity* category includes collaboration tools, development tools, surveys, e-mail campaign tools, and much more. Because SaaS providers cater to many customers they often do not provide the same level of flexibility that a com-

pany would have if it built its own application. Sometimes companies choose to build their own applications because there is a feature they can't find from the SaaS vendors offering but before a company decides to write the application itself, it should compare the value of the features that the SaaS tools cannot provide against the TCO of building it itself. (Kavis. 2014)

While SaaS vendors manages all infrastructure and data center with database management, capacity planning and backup recovery activities, those usually includes in the services activities like security updates and patches, mobile compatibility, browser compability and as valuable for end users, feature updates. (Kavis. 2014)

### 2.1.2 Platform as a service

Platform as a service (PaaS) provides a cloud-based environment with everything required to support the complete lifecycle of building and delivering web based cloud applications without the cost and complexity of buying and managing the underlying hardware, software, provisioning, and hosting. (Kavis. 2014)

Characteristics of PaaS

- Resources can easily be scaled up or down as business changes
- Provides a variety of services to assist with the development, testing, and deployment of apps
- Numerous users can access the same development application
- Web services and databases are integrated

Benefits of PaaS

- Makes the development and deployment of apps simple and cost effective
- Highly available and scalable
- Gives developers the ability to create customized apps without the headache of maintaining the software
- Greatly reduces the amount of coding
- Automate's business policy
- Allows easy migration to the hybrid model

When to use PaaS

Public PaaS service providers manage the underlying infrastructure, networks, storage devices, and operating systems. Monthly security patching, logging, monitoring, scaling, fail over, and other system administration tasks is included in the service so the developers can focus on building cloud ready applications. The most advanced PaaS vendors support multiple stacks and supports multiple development languages. (Kavis. 2014)

Private PaaS service providers do not provide the abstraction of the infrastructure services like the public PaaS providers do. Private PaaS offers the capability to deploy the PaaS software on both a private and public cloud, which can called also as hybrid cloud. (Kavis 2014)

Platform that is shared by many customers and it is in order to manage the performance, reliability, and scalability and to ensure the heavy loads do not impact the total performance visible for all customers. For solutions where, websites with extremely high volumes or highly distributed applications, that send through huge amounts of data, are typically not so good choice. In this case company can try to break units of work into smaller chunks before calling the database. This method can be for example to design around bandwidth limitations. For some applications, designing around throttles creates unacceptable delays in processing time or it may impact the quality and reliability of the application. In this case PaaS may not be the right service model and IaaS should be used instead. (Kavis 2014).

### 2.1.3 Infrastructure as a service

Infrastructure as a service (IaaS) provides companies with computing resources including servers, networking, storage, and data center space on a pay-per-use basis. With IaaS, the virtual infrastructure is available on demand and can be up and running in minutes by calling an application programming interface (API) or launching from a web based management console. (Kavis. 2014)

Characteristics of IaaS

- Resources are available as a service
- The cost varies depending on consumption
- Services are highly scalable

- Typically includes multiple users on a single piece of hardware
- Provides complete control of the infrastructure to organizations
- Dynamic and flexible

Benefits of IaaS

- Most flexible cloud computing model
- Easily allows for automated deployment of storage, networking, servers, and processing power
- Hardware can be purchased based on consumption
- Gives clients complete control of their infrastructure
- Resources can be purchased as-needed
- Highly scalable

When to use IaaS

IaaS can be the right solution If an application or service has performance or scalability requirements that require to manage memory, configure database servers and application servers to maximize throughput or specify data distribution. Vice versa, it these issues are on place, then company should consider PaaS, and for another viewpoint cost is considerable factor because PaaS can reduce costs substantially by reducing the amount of work and the number of resources required to build and deploy applications. Anyway, the PaaS pay as  go -model can get very expensive if data delivery volumes gets very high or when the bandwidth or CPU load exceed normal levels. (Kavis. 2014)

One reason for leveraging IaaS over PaaS or SaaS is related to mitigating risks of downtime. When there is an outage with the service, the company can only wait for the provider to fix the issue and get the services back online. With IaaS, the customer can architect for failure and build redundant services across multiple physical or virtual data centers. (Kavis. 2014)

Summarizing the previous is that when companies move up the stack toward SaaS we increase speed to market, reduce the number of human resources required, and reduce operational costs. When moving down the stack toward IaaS, companies get more control of the infrastructure and have a better chance of avoiding or recovering from a vendor outage. (Kavis. 2014)

### 2.1.4 Database as a service

Database as a service (dPaaS) it is not included on figure 2, but in can be compared to operational service levels of PaaS. dPaaS relieves companies with the integrations wide scale, gives them full control over their data and allows them to focus on extracting business insights faster. With its holistic approach to integration and data management, dPaaS is uniquely solving the data quality problem reducing integration complexity and making the process virtually seamless to the end-user, this new approach is finally giving companies the ability to fully capitalize on their data and business intelligence investments to extract maximum value and make revenue-driving decisions. (Kavis. 2014)

Characteristics of dPaaS

- Unification of integration and data management. dPaaS eliminates separation of integration and data management with a unified platform. Workflows can be interlaced between integration and data management functions of the platform.
- Provides agility, reduces errors, improves time to execution, etc.
  A fully managed services model. By moving complexity from the organization to the platform provider empowers organizations to focus solely on extracting actionable insights from data. (Daniel Gutierrez, 2015, 10, 18.)

Benefits of dPaaS

- Data-centric integration. dPaaS creates and persists a central, schema less foundational data layer with the requisite metadata relationships and secure protocols to mesh with unlimited data sources. This allows organizations to easily add new applications and offers business flexibility with a schema-on-read model.
  (Daniel Gutierrez, 2015, 10, 18.)

## 2.2 Cloud types

When starting a cloud initiative is important to create business architecture diagram because it provides insights into the various touchpoints and business functions across the enterprise or at least across the part of the enterprise that is in scope for the initiative. Understand the business requirements and customer expectations of cloud computing before selecting cloud service models and cloud types.
Get clarity on the product definition and requirements, perform a security and regulatory assessment of the requirements, and add the gaps to the overall product backlog. Have a

list of frequently asked questions handy that answers all of the questions and concerns that the typical customer will have for the cloud based solution. (Fehling, Leymann, Retter, Schupeck and Arbittter 2014).

From a perspective of privacy and efficiency, and of course the one variable between these alternatives is the economical aspect. There is three different approaches to the cloud, which are public cloud, private cloud, hybrid cloud and community cloud. (Kavis 2014)

Tenants, which means companies or individuals in this context accessing a cloud and sharing IT resources has a significant impact on the cloud properties displayed by different cloud deployment models. Overall workload subsumes all tenant workloads so a large number of tenants reduces the effects of workload changes experienced by one tenant on the overall workload to be handled by the cloud provider.

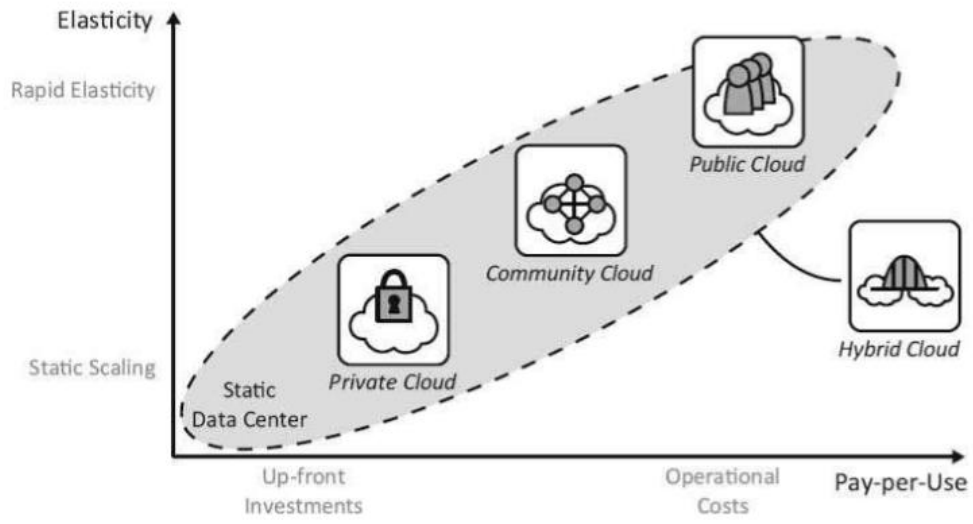



Figure 3. Level of elasticity and pay per use differiation. (Fehling, Leymann, Retter, Schupeck and Arbittter 2014).

In the figure is described how the different cloud deployment models regarding the common level of elasticity and pay per use provide scaling on high level. Most of scaling and cost effectiveness compared per use offers public cloud model and less of it private cloud. The model is directive holistic description and the real cases could be more or less close to each other. (Fehling, Leymann, Retter, Schupeck and Arbittter 2014).

### 2.2.1 Public cloud

Public clouds are owned and operated by companies that offer rapid access over a public network to affordable computing resources. With public cloud services, users don't need to purchase hardware, software, or supporting infrastructure, which is owned and managed by providers. (Peter Mell, Timothy Grance. 2011,9.)

The cloud infrastructure is provisioned for open use by the general public and it exists on the premises of the cloud provider. It may be owned, managed, and operated by any institution registered to using it. (NIST, 2011, 02)

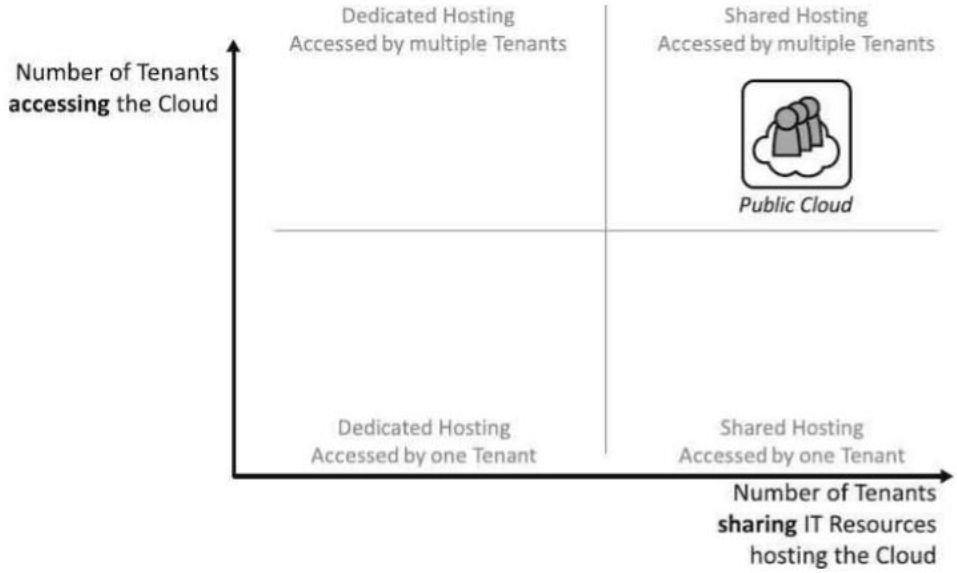



Figure 4. Public cloud hosting (Fehling, Leymann, Retter, Schupeck and Arbittter 2014).

Figure is showing that sharing resources between a large number of customers for example due to geographic customer distribution, it is ensured that the rapid high workloads of customers can be handled, because the size of a public cloud enables dynamic and elastic resource usage. A public cloud shares a provided hosting environment between customers and this environment is accessible by many customers as reducing the costs for an individual customer. This is enabled by a dynamic use of the static environment, because workload peaks of some customers occur during times of low workload while other ones have the occasional peak workloads. (Fehling, Leymann, Retter, Schupeck and Arbittter 2014).

Key aspects of public cloud

- Cloud services are available and consumed by all clous service customers, and resources are controlled by the cloud service provider
- Innovative SaaS business apps for applications ranging from customer resource management (CRM) to transaction management and data analytics
- Flexible, scalable IaaS for storage and compute services on a moment's notice
- Powerful PaaS for cloud based application development and deployment environments

  (Fehling, Leymann, Retter, Schupeck and Arbittter 2014).

### 2.2.2 Private cloud

A private cloud is infrastructure operated solely for a single organization, whether managed internally or by a third party and hosted internally or externally. The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers. Private clouds can take advantage of cloud's efficiencies, while providing more control of resources and steering clear of multi tenancy. (Peter Mell, Timothy Grance. 2011,9.)

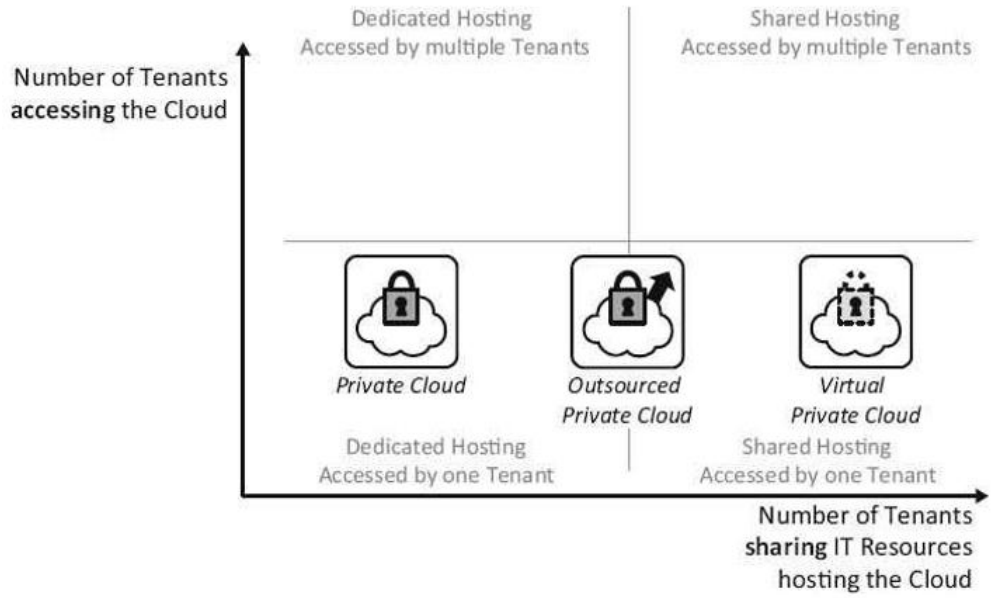



Figure 5. Private cloud, outsourced private cloud, and virtual private cloud (Fehling, Leymann, Retter, Schupeck and Arbittter 2014).

The workloads of different tenants do not bother each other with the workload. With private cloud static IT resources have to be provisioned for peak workloads as the one ten-

ant cannot utilize resources as within public cloud model. Private cloud can be established on premises data center or it can be outsourced when the service related aspects are maintained by second party. As third option, private cloud can be in addition virtualized, which brings public cloud aspects when there is an isolated area from public cloud accessible to only one tenant while cloud environment hosting of IT resources is shared with all other tenants. (Fehling, Leymann, Retter, Schupeck and Arbittter 2014).

Key aspects of private cloud

- Cloud services are consumed exclusively by a single cloud service customer and resources are controlled by the same cloud service customer
- A self service interface controls services, allowing IT staff to quickly provision, allocate, and deliver on demand IT resources
- Highly automated management of resource pools for everything from compute capability to storage, analytics, and middleware
- Sophisticated security and governance designed for a companys specific requirements
  (Fehling, Leymann, Retter, Schupeck and Arbittter 2014).

### 2.2.3 Hybrid cloud

A hybrid cloud uses a private cloud foundation combined with the strategic integration and use of public cloud services. The cloud infrastructure is a composition of two or more distinct cloud infrastructures from combination of private, community or public. IT remain unique entities which are bound together by standardized technology that enables data and application portability.(Peter Mell, Timothy Grance. 2011,9.).

The reality is a private cloud cant exist in isolation from the rest of a companys IT resources and the public cloud. Most companies with private clouds will evolve to manage workloads across data centers, private clouds, and public clouds, which is creating hybrid clouds. (Peter Mell, Timothy Grance. 2011,9.)

Descriptive figure of hybrid cloud is presented on following page on figure 6.

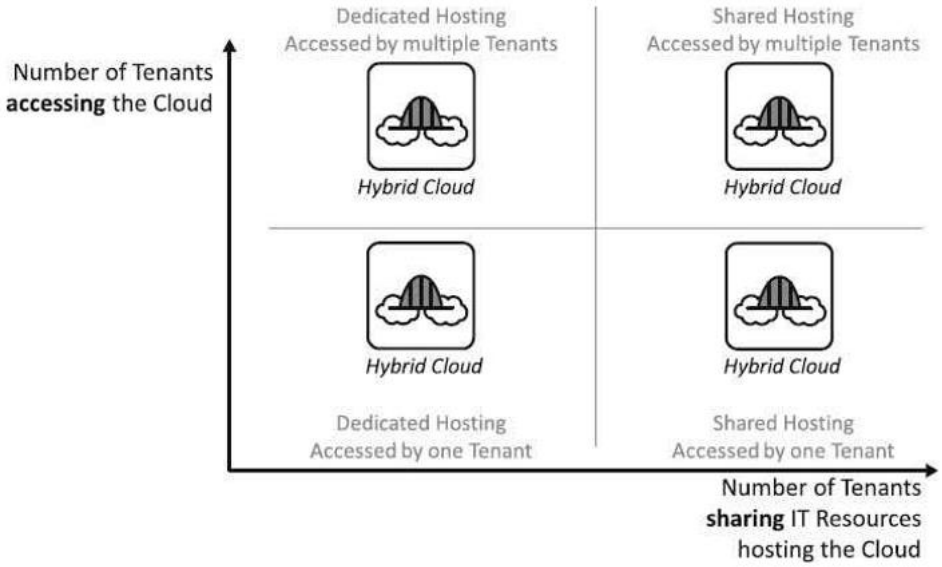



Figure 6. Hybrid cloud in a cloud scope (Fehling, Leymann, Retter, Schupeck and Arbittter 2014).

With hybrid cloud, the applications and their components are hosted in multiple environments. This can be for example to use a private cloud to handle static workload and use additional IT resources in a public cloud to handle possible peak workloads. (Fehling, Leymann, Retter, Schupeck and Arbittter 2014). Figure shows that hybrid cloud solutions can differs from each other, and the approaches could be unique by how leveraging the combination of clouds.

Key aspects of hybrid cloud

- Allows companies to keep the critical applications and sensitive data in a traditional data center environment or private cloud
- Enables taking advantage of public cloud resources like SaaS, for the latest applications, and IaaS, for elastic virtual resources
- Facilitates portability of data, apps and services and more choices for deployment models
  (Fehling, Leymann, Retter, Schupeck and Arbittter 2014).

### 2.2.4 Community cloud

Community cloud environment between these two extremes and is made accessible only to a certain group of companies or individuals that trust each other and often wish to collaborate. It supports a specific community of shared services that support shared inter-

ests. Ownership of the cloud assets might be the organizations or a third party and the services can reside on or off premise. (Peter Mell, Timothy Grance. 2011,9)

The cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns. These can be as example mission, security, requirements, policy or compliance. It may be owned, managed and combination of them, and it may exist on or off premises. (Fehling, Leymann, Retter, Schupeck and Arbittter 2014).

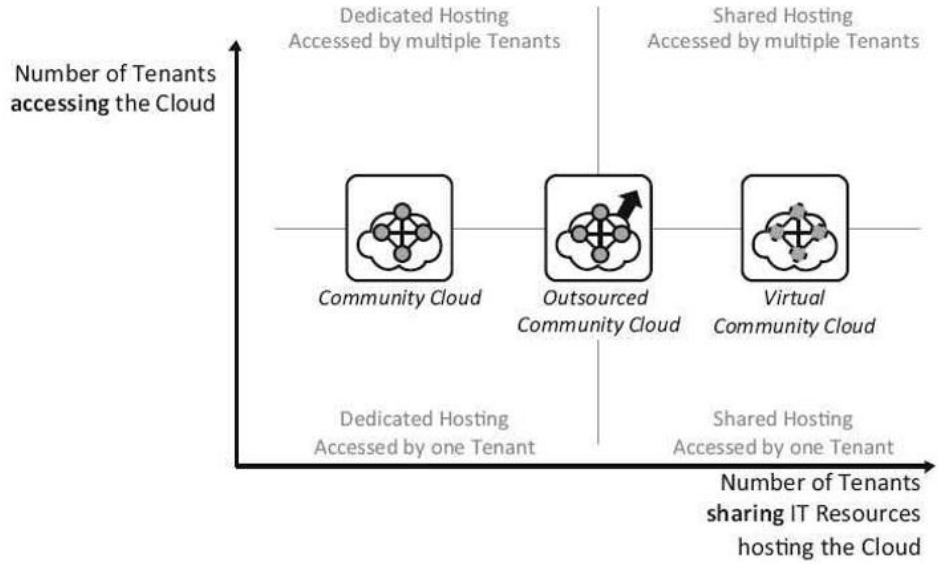



Figure 7. Community cloud, outsourced community cloud, and virtual community cloud (Fehling, Leymann, Retter, Schupeck and Arbittter 2014)

If companies have a central role in collaboration these can establish a *community cloud* hosted by one company or many companies by outsourcing contract. Community cloud can be also virtualized and isolated part of public company, hosted by cloud provider. Within this case there is features and benefits from public cloud elasticity and cost effectiveness, but usage is allowed only for a defined group.

Key aspects of a community cloud

- Cloud services exclusively support and are shared by a specific collection of cloud service customers who have shared requirements and a relationship with one another, and where resources are controlled by at least one members of this collection.
- Accessible to a controlled group of institutions
- Commonly have to access shared applications and data to do business which increases collaboration and cost efficiency. (Kavis 2014)

# 3 Business objectives for cloud adopting

Cloud is opening up choices at cloud in order to fulfill changing computing requirements. Specifically, cloud infrastructures are renowned for effortlessly accomplishing nonfunctional requirements such as scalability, elasticity, high performance, availability, configurability, consumability and so on. The interconnectivity, integration, intermediation, aggregation, and arbitration capabilities of cloud IT clearly indicate and insist that in the future IT is in the safe, secure, and sustainable state. (Pethuru Raj, 2014).

As the cloud theme has empowered IT infrastructures, the enterprise IT is steadily moving towards the cloud concepts. Having understood the significance of cloud, enterprises are busy in cloud assessment, enablement and on boarding activities. Cloud computing has brought in innumerable tectonic and trendsetting shifts for both IT as well as business. Cloud computing implicitly represents a seamless cluster and the convergence of array of proven, potential, and promising enterprise technologies.(Pamela K. Isom, Kerrie Holley, 2012.)

The cloud is enabling businesses to explore, experiment and espouse new business areas with possibility to gain revenues. That's quite far possible because of newer and more agile application deployment, delivery, usage, pricing, integration, collaboration and management models. And even strengthening this trend is faster stability of the cloud concepts and infrastructures. The traditional on premise models has been replaced and substituted with a delivery model that is efficient, centralized, monitored, managed and maintained. This allows more innovation with cloud hosted and maintained applications and services. (Pethuru Raj, 2014).

IT infrastructures have become a dynamic pool of consolidated, centralized, virtualized, automated, and shared entities. With these momentous transitions, IT infrastructures are becoming converged, optimized, dynamic, real time, on-demand, and autonomic. In other words, infrastructures are increasingly and incredibly service enabled, sharable, scalable, and sustainable and thus highly elastic, available, lean, and utilizable for ensuring business agility, autonomy and affordability. (Pethuru Raj, 2014).

Worldwide companies are seriously strategizing their businesses to embark on the cloud journey. The ultimate goal for global organizations is to reposition and rebrand themselves as cloud enterprises. A dazzling array of cloud concepts, technologies, platforms, products, processes, and practices are being recognized and utilized. Although appropriating the path breaking cloud paradigm presents new opportunities and fresh possibilities.

Cloud technology experience is in strong demand with proper education and expertise to create insights to facilitate business transformation. Usually cost and continuity issues are the main forces behind cloud adoption. Among larger organizations, the most popular top goal is replacing on premise legacy technology while the goal for smaller organizations is to enable business continuity, followed by lowering total contract value (TCO). (Christopher Burge, 2016, 06, 28.)

### 3.1 Cloud Implementation Challenges

Different areas of technology brings challenges along with potential benefits. Some of the earlier barriers are beginning to fade as companies and service providers gain valuable experience from early deployments, although security remains the main concern. (Pamela K. Isom, Kerrie Holley, 2012.)

With cloud strategy is needed to weight and analyze how confident company are in the security of the assets that organization has placed in the cloud and what issues does company need to address before it can more fully embrace the cloud. (Pamela K. Isom, Kerrie Holley, 2012.)

Challenges with implementing a cloud strategy are seen as concerns where the security of cloud computing solutions is risk of unauthorized access, data integrity and protection. With this surrounding integration which is making information available to applications outside the cloud, preserving a uniform set of access privileges which need to be noticed on information governance level. (Frank M. Groom and Stephan S. Jones, 2018)

When considering cloud strategy, company has to ensure the security of cloud service providers can meet compliance requirements. Efficiency of existing applications has to be reviewed so problems are just not moved from one location to another. Cloud orchestration tools used for provisioning, scaling and management and offers control of virtual machines. Data sets used by cloud apps can be moved to the cloud by Improving this area of cloud management. (Pethuru Raj 2014.)

### 3.2 Business objectives elicitation and categorization

There are numerous offering of objectives and examples of benefits for a proper cloud adoption. These are willing to cover all the topics companies should be aware when considering or working with cloud migration. Companies should understand the importance of objectives to set for a successful process for cloud adoption. There are many factors that go into choosing the right service model. Decision makers should consider the feasibility

of each cloud service model based on the five categories, which are technical, financial, strategic, organization and risk. (M.Kavis. 2014)

Business objectives are analyzed and shared on these categories as from enterprise architecture perspective during following chapters. Every chapter describes details of category. After that the linked business objectives are listed and described under the category. The output of business objectives are presented on subject and category level on attachment 1.

### 3.2.1 Technical category business objectives

The technical category focuses on areas like performance, scalability, security, regulation, business continuity, disaster recovery, and so on. Performance and scalability requirements are critical for deciding between PaaS and IaaS service models. One of the greatest benefits of PaaS is that platforms abstract the underlying infrastructure from the developer so the developer can focus on business requirements while the platform handles autoscaling. Since PaaS vendors are responsible for scaling all of their tenants, they enforce limitations on the amount of resources that can be requested by a tenant. For most applications, the limitations are set so high they are not a factor, but for applications with an extreme number of transactions, PaaS cannot deliver the performance and scale. Both IaaS and PaaS solutions offer Database as a Service (dPaaS) solutions that automatically manage database management tasks like replication, autoscaling, monitoring, backups, and more. One limitation of dPaaS is the lack of control over the database. (Kavis 2014)

Stop guessing capacity

Eliminate guessing on infrastructure capacity needs. With cloud computing there is not expensive idle resources or dealing with limited capacity when companies make a capacity decision prior to deploying an application. They can access as much or as little as is need to, and scale up and down as required with only a few minutes notice. This scale up and down feature supports objective of being environmentally friendly when companies needs fluctuate server capacity. (Amazon.com 2018).

Access to a variety of inexpensive applications

To support business more effective way, technical category focus with service contracts need to consider the selection of correct information sources that can help solve business problems. (Zach Lanick, 2017, 05, 19.)

The ability to automate manual tasks

One important operational activity related on application maintenance, which need to be landed correctly within cloud model selection. This also gives opportunity for speed up development. (Amazon.com 2018).

Automatic software updates

When servers are off premise, out of sight and out of companies responsibility, cloud vendors take care about services and perform regular software updates including security updates. (Zach Lanick, 2017, 05, 19.)

Disaster recovery

For companies it is very beneficial to invest in disaster recovery readiness. Cloud is helping with this by offering scalable and automated recovery services. This also ensures and enables business continuity. (Zach Lanick, 2017, 05, 19.)

Flexibility

When businesses has growing or fluctuating bandwidth demands cloud based services are ideal for that situation. If company needs increase it’s easy to scale up cloud capacity. This functionality suits also on vise versa situation. This agility feature give businesses using cloud computing a real advantage on the market and on other hand with flexibitly is Improving customer support and services by offering possibility to work flexible and wider scale of tools. (Zach Lanick, 2017, 05, 19.)

Automatic security

A major concern for many businesses, which are considering cloud adoption is security and data security. Now days there is available automatic security systems and security software updates. The benefit for companies is that these features can be included in their plan. (Christopher Burge, 2016, 06, 28.)

The ability to be more productive and Development of new products or services

This feature of cloud services supports of implementation perspective and strengthens possibilities to enhance implementation processes. (Christopher Burge, 2016, 06, 28.)

Replacing on premise legacy technology

This demand points on old complex core systems on industry. There is technical lack behind and some systems needs to be renewed totally or convert to a newer platform to support now days technology. (Christopher Burge, 2016, 06, 28.)

Dynamic workload and resource management

It is critical that management solutions have the ability to create policies around workload and data management to ensure that maximum efficiency and performance is delivered to the system running in the cloud. This becomes even more critical with high demand of services. (Sheng Liang, 2010, 12, 21.)

Heterogeneous systems support

Not only should cloud management solutions leverage the latest hardware, virtualization and software solutions, but they should also support a data center's existing infrastructure. (Sheng Liang, 2010, 12, 21.)

Integration with data center management tools

Most data centers, a variety of tools are used for provisioning, customer care, billing, systems management, directory, security and much more. Cloud computing management solutions do not replace these tools and it is important that there are open application programming interfaces (APIs) that integrate into existing operation, administration, maintenance and provisioning systems because many components of traditional data center management still require some level of integration with new cloud management solutions. (Sheng Liang, 2010, 12, 21.)

### 3.2.2 Financial category business objectives

The financial aspects should focus on total cost of ownership (TCO), which requires a lot more thought than calculating the price per hour or per month of a cloud service. If the project is focused on building new applications, it is much easier to calculate the TCO, but for projects that are migrating solutions to the cloud or are new but are constrained by existing legacy architectures, the TCO is much more complex to calculate. For the latter, decision makers must estimate the cost to change and/or integrate with the legacy architectures. In many cases, moving to the cloud brings costs of retrofitting existing architectures so that they can be integrated with new cloud services. On top of the costs to build new services in the cloud, other costs may include projects to reengineer legacy architectures, employee training, hiring new employees or consultants, acquiring tools or services to assist in reengineering, and much more. (Kavis 2014)

Lower development costs

Adoption of cloud ensures faster time to market and significantly reduces total cost of ownership (TCO) from cost savings associated with application development, maintenance and development of new capabilities.(IT business edge. Read 2018, 9.)

Benefit from massive economies of scale

By using cloud computing, companies can achieve a lower variable cost than get on their own. Usage from hundreds of thousands of customers are aggregated in the cloud, cloud providers can achieve higher economies of scale, which translates into lower pay as go prices. (Amazon.com, Read 2018, 9)

Reduce operational costs

The seamless integration of applications in the enterprise architecture results in low maintenance and support, thereby reducing the overhead costs.
Reduces hardware, software or licensing costs, as cloud services operate in the pay-as--use model. This results in predictable operation expenditures with minimum deployment cost and almost zero capital expenditure. Automatic security and software updates shrink IT infrastructure maintenance costs.
(IT business edge. Read 2018, 9.)

Trade capital expense for variable expense

Instead of having to invest heavily in data centers and servers before companies know how they are going to use them, they can only pay when consuming computing resources only from that how much they consume. (Amazon.com, Read 2018, 9)

Stop spending money on running and maintaining data centers

Focus on projects that differentiate companies business, not the infrastructure. Cloud computing lets companies focus on own customers, rather than on the heavy lifting of racking, stacking and powering servers. (Amazon.com, Read 2018, 9)

Capital expenditure

Cloud computing reduces costs when talking about high cost of hardware. Companies pay as go and have a ease of setup and management of services. (Zach Lanick, 2017, 05, 19.)

Cut the operational costs

Companies can achieve reduction of operational costs by choosing a low-maintenance platform. By migrating data and resource to a cloud storage platform they can benefit from free support, reducing the total costs of maintenance. (Clodtransformation.cio. Read 2018, 9.)

Enhance effectiveness

Cloud storage is to effectively reduce costs and save precious time that companies can dedicate to growing their business and making it stand out from the competition. Companies main objective in case of this is enhancing the effectiveness of business by using all the advantages that cloud storage can offer. (Christopher Burge, 2016, 06, 28)

Enhance employee productivity

A related objective with tools and features choose to cloud service, will gain increase employee productivity. Research thoroughly before choosing the cloud service model that best meets business's needs because cloud services offers many possible alternatives with this also depending on vendor. (Zach Lanick, 2017, 05, 19.)

Rapid time to market

To ensure that cloud adoption is prosperous and beneficial for business, concentrate on reducing time and costs. (Clodtransformation.cio. Read 2018, 9.)

Reduce development cost

When companies are considering the reduction of development costs when they are setting objectives. for cloud adoption, will that help reduce costs in many areas. Focus on not only reducing the total cost of ownership, but also the costs included in maintenance, application development, and new features development. (Clodtransformation.cio. Read 2018, 9.)

Service Management

To productize the functionality of cloud computing, it is important that administrators have a simple tool for defining and metering service offerings. A service offering is a quantified set of services and applications that end users can consume through the provider. (Sheng Liang, 2010, 12, 21.)

### 3.2.3 Strategic category business objectives

Business strategies such as consolidating data centers, reducing costs, being first to market, handling enormous scale, selling product globally 24/7, integrating with partner supply chains, and others all contribute to deciding which cloud service model to select. (Kavis 2014)

Strategic requirements may come into play as well. The more important speed-to-market is for an initiative, the more likely the decision makers will look to leverage SaaS or PaaS over IaaS simply because much of the IT work is being performed by the cloud service providers, as opposed to an IaaS solution where IT still does a lot of the heavy lifting. If control is the most important strategy, it is more likely that the decision makers will gravitate toward an IaaS solution where IT has more control over the underlying infrastructure, whereas with SaaS and PaaS the infrastructure is abstracted from the end user. Business strategies such as consolidating data centers, reducing costs, being first to market, handling enormous scale, selling product globally 24/7, integrating with partner supply chains, and others all contribute to deciding which cloud service model to select. Too often com-

panies pick a cloud vendor solely based on technical preferences without putting enough weight on the business strategies that are driving the cloud initiatives. (Pethuru Raj, 2014)

Faster time to market

Cloud platforms not only provide computing and network resources, but also provide enterprise frameworks such as authentication, authorization, user interface and workflow. Use of these frameworks reduces the overall time-to-market. (IT business edge. Read 2018, 9)

Increase revenue

To increase business's revenue by reducing costs and saving money can be reached if company set clear objectives and thoroughly research the market before choosing a cloud storage provider for the specific requirements of their business. Now day's businesses are moving more and more to cloud-based data storage because it is a proven tool for cost reduction which is the way to get in addition faster return on investment. (Clodtransformation.cio. Read 2018, 9)

Increase business agility

Some cloud platforms empower business users to make effective changes to functionality through configuration. This reduces the dependency on development teams and results in increased business agility. This brings in addition improved ability to serve clients and customers/meet sales goals. (IT business edge. Read 2018, 9)

Competitiveness

Moving to the cloud gives access to enterprise class technology for companies. This allows also for smaller businesses to act faster than larger competitors. Pay as  go -service and cloud business applications allows smaller companies challenge larger companies and disrupt the market. Pay as You go possibility also enables greater flexibility to react to changing market conditions. Another approach is that larger companies can strengthen their position on market if the cloud evaluation and choosing are made properly. (Zach Lanick, 2017, 05, 19.)

Go global in minutes

Companies can easily deploy application in around the world with just a few clicks. This means lower latency and better experience for customers with minimal cost. (Amazon.com, Read 2018, 9.)

Increase development speed and agility

In a cloud computing environment dramatic increase in agility can be get from that new IT resources are only ever a click away. This means reduce the time it takes to make those resources available to developers from weeks to just minutes. This is also the way to gain a competitive edge. (Amazon.com, Read 2018, 9.)

Services focused on business

Realizing the importance of providing services tailored to each business's particular needs, cloud providers are increasingly focusing on business capability and agility. The main idea behind this trend is to focus on the business and leave the rest of the responsibilities to the cloud service provider, which ensures a rapid growth for business while aims for lower total cost of ownership is achieved.

Choose a provider that enables scalability and has a flexible infrastructure to help business evolve. Productivity and revenue will steadily increase if opt for a robust cloud service that allows to focus on business. This allows companies also get savings on capital expenditures. (Cloudtransformation.cio. Read 2018, 9.)

### 3.2.4 Organization category business objectives

Organization need to determine does the IT organization have the skills to build solutions in the cloud. If the company does not have strong IT skills in the areas of distributed computing, web development, and service oriented architectures (SOA), maybe it should lean more toward SaaS and PaaS service models or find a partner that can build cloud services on IaaS. The lower down the cloud stack the company goes, the higher the degree of competence the staff needs. (Kavis 2014)

An assessment of the organization may play a role in what cloud service model to choose. If the company does not have strong IT skills in the areas of distributed computing, web development, and service oriented architectures (SOA), maybe it should lean more toward

SaaS and PaaS service models or find a partner that can build cloud services on IaaS. The lower down the cloud stack the company goes, the higher the degree of competence the staff needs. (Pethuru Raj, 2014.)

Increased focus on business

Organizations often do not include business agility and capability as part of their cloud computing objectives. The ability to focus on the core business while leaving the rest to the cloud service provider ensures business growth
by enabling scalability of resources for business that it needs due to availability of flexible infrastructure. (IT business edge. Read 2018, 9.)

Growth of business agility

To increase business agility, cloud platforms are designed to let companies make rapid changes to functionality. One related aspect with this is need to have Improved access to corporate data which further improves the agility of business and even better it is if access is provided from any location or device. (Cloudtransformation.cio. Read 2018, 9.)

Document control

Companies have gaining need for tight document control because the more employees and partners collaborate on documents. There is a huge benefit because before the cloud, workers had to send files back and forth as email attachments to be worked on by one user at a time. This enables at same time better collaboration with co-workers and other stakeholders. (Zach Lanick, 2017, 05, 19.)

Increased collaboration

Cloud offers for companies a possibility to access, edit and share documents anytime, from anywhere. That’s gives the possibility to do more together, and do it better. Cloud-based workflow and file sharing apps help companies make updates in real time and gives full visibility of collaborations. (Zach Lanick, 2017, 05, 19.)

Reducing resource waste and enabling innovation

Strong support on effectiveness and more gained innovation possibilities is possible to get from cloud with correct adoption strategy and choosing a right cloud model. (Zach Lanick, 2017, 05, 19.)

Work from anywhere

With cloud services, companies are not restricted to work with nay device.
Companies can offer more flexible ways to work for their employees. This is offering to grate work life balance opportunity which gains productivity of the work and gains improved work life balance and offers at same time better time management. (Zach Lanick, 2017, 05, 19.)

Security

For companies lost laptops are huge business problem. Potentially greater problem is the loss of the sensitive data inside laptops. Cloud computing gives for companies greater security because  data is stored in the cloud,  can access it again with no restriction by machine used. There is also opposite objective to consider, there is hig demand of need for real time information to create correct business choices. (Zach Lanick, 2017, 05, 19.)

Reliability, availability and security

Most cloud architectures deal with shared resource pools across multiple groups both internal and external, security and multi-tenancy must be integrated into every aspect of an operational architecture and process. Services need to be able to provide access to only authorized users and in this shared resource pool model the users need to be able to trust that their data and applications are secure. To be fully reliable and available, the cloud needs to be able to continue to operate while data remains intact in the virtual data center regardless if a failure occurs in one or more components. (Sheng Liang, 2010, 12, 21.)

Visibility and reporting

The need to manage cloud services from a performance, service level, and reporting perspective becomes paramount to the success of the deployment of the service. Without strong visibility and reporting mechanisms the management of customer service levels,

system performance, compliance and billing becomes increasingly difficult. (Sheng Liang, 2010, 12, 21.)

### 3.2.5 Risk category business objectives

The cloud-based system does not allow full control over the provision and operations of infrastructure. It has increased the problems for IT to offer the governance, compliance and risk management. How much risk is a company willing to assume? How long can the solution be down? How damaging is a security breach? Can the government seize the data in the cloud with a warrant? There are an endless number of questions to consider when it comes to risk. Risk also is a major determining factor in whether a company chooses to go with a public cloud, a private, or a hybrid of both. Often, areas such as privacy, data ownership, and regulation are very strong factors in the determination of which cloud service model and which deployment model to use. (Kavis 2014)

Every company and even each individual cloud initiative within a company may weight each category differently. Raj Pethuru is telling that

> "For example, a company building a social media site where customers volunteer to post their personal data, like pictures, videos, and so on, will likely put a higher weight on the technical requirements to achieve high scale and uptime and a lower weight on risks, given that nobody dies when favourite social media site goes down. On the other side, a medical company responsible for processing medical claims most likely weights the risk category as high as or even higher than most of the others." (Pethuru Raj, 2014)

Stay secure

One of the main priorities to consider when investing in cloud adoption is security. High security level is often an absolute requirement when business processes are handling sensitive data. But when the data includes more data type where any ones identity or activities are not under thread of theft, the lower level security can be also an alternative. (Zach Lanick, 2017, 05, 19.)

Data security and privacy

When data security and protection is one of the leading concerns, It is important for the service provider to know how important the security is for the end user. The cloud service is hosted by cloud service provider, which transfer user's security and privacy control to the cloud vendor. (Farhan Saeed, 2017, 6, 23.)

### Cyber attacks

The cloud based service provider has to deal with thread of cyber attack. When the data stored online it is always possible with the risk of cyber attack. The size of the data stored in the cloud is vulnerable to the risk of losing data. (Farhan Saeed, 2017, 6, 23.)

### Service quality

One of the biggest factors considered by companies. Usually for this reason, they ignore the cloud adoption so far. Performance, scalability, and availability are some of the other noted factors for the companies. Without proper service quality, the companies will never think of hosting the business infrastructure on the cloud. (Farhan Saeed, 2017, 6, 23.)

### Performance and bandwidth cost

Enterprises can cut down on the cost and save money on acquiring systems, management, and maintenance. It is not commonly a problem with the smaller applications, but the cost can get higher for the data-intensive applications. Delivering and receiving exhaustive and intricate data over the network needs sufficient bandwidth to hold off latency and application timeouts. (Farhan Saeed, 2017, 6, 23.)

### Incorporating with existing Infrastructure

Adopting cloud system could be the biggest challenge with existing infrastructure. A large number of organizations are already facing the challenges of adopting cloud strategy, which should be helpful first at the corporate level and within IT. (Farhan Saeed, 2017, 6, 23.)

### Governance and control

It is important to have proper IT governance to ensure that the assets are controlled and maintained, adhering to organization's plans and business goals. The cloud based system does not allow full control over the provision and operations of infrastructure. It has increased the problems for IT to offer the governance, compliance and risk management. (Farhan Saeed, 2017, 6, 23.)

Moving to the cloud without a governance and planning strategy

It’s dead simple to provision infrastructure resources in the cloud, and just as easy to lose sight of the inadvertent policy, security and cost problems that can be incurred. Here, governance and planning are essential. (John Edwards, 2017, 11, 14.)

Believing anything can go into the cloud

Despite a great deal of progress made over the past several years, many applications still aren't cloud ready. A business can seriously damage application performance, user experience and engagement and its bottom line if it sends something to the cloud that isn't fully baked or requires complex integration with legacy systems. (John Edwards, 2017, 11, 14.)

Treating the cloud like on premises data center

A costly mistake many enterprises make is treating their cloud environment like an on-premises data center. While cloud services can deliver dramatic cost savings, they also require an entirely different resource management process or companies might end up wasting. (John Edwards, 2017, 11, 14.)

Believing cloud service provider will handle everything

Cloud service providers are responsible only for what they can control, primarily service infrastructure components. Many tasks like deploying, maintaining and enforcing security measures, are left to the customer to provide and manage.Companies should take the time upfront to read the best practices of the cloud They are deploying to. Companies need to follow cloud design patterns and understand responsibilities. (John Edwards, 2017, 11, 14.)

Assuming that straight simple convertion is the clear cloud migration path

Cloud cost advantages can be loosed quickly when poor strategic or architectural choices are made. Llift and shift term means simply uploading virtualized images of existing in house systems onto a cloud infrastructure. (John Edwards, 2017, 11, 14.)

Failing to monitor service performance

Not regularly evaluating the cloud service actually being received against planned expectations is a quick way to waste money. Company should periodically review the established key performance indicators and take proper actions to handle real and potential deviations from planned results. (John Edwards, 2017, 11, 14.)

Assuming existing IT staff can immediately handle a leap to the cloud

Cloud ignorance can easily lead to a security serious security issue. Companies need to be aware of possible threads of security and handling sensitive data in cloud.
(John Edwards, 2017, 11, 14.)

Blindly trusting automated scripts

One of the primary benefits of moving to a cloud-based environment is the automated provisioning and deprovisioning of computing resources. Automated tests for automated scripts in a controlled environment and training for automation recovery could help mitigate this risk.
(John Edwards, 2017, 11, 14.)

Believing security is no longer a problem

Cloud services offers security management and usually work with every possible type of company. In all case, companies need to concentrate system management and software development processes with proper security approach.
(John Edwards, 2017, 11, 14.)

Neglecting business continuity and disaster recovery planning

Many cloud services offer automatic backup and recovery options. Anything could happen if a malicious hacker or disgruntled system administrator deleted critical data. Companies need to check that appropriate backup mechanisms is in place.
(John Edwards, 2017, 11, 14.)

# 4 Enterprise architecture

Enterprise architecture framework defines how to create and use an enterprise architecture and provides principles and practices for creating and using the architecture description of a system. It structures architects thinking by dividing the architecture description into domains, layers, or views, and offers models for documenting each view, which allows for making systemic design decisions on all the components of the system and making long term decisions. (Cristian Bojinca, 2017)

The enterprise architecture addresses different needs, by providing a strategic context for the evolution and reach of digital capability in response to the constantly changing needs of the business environment. In addition with that Enterprise Architecture often optimizes across the enterprise the fragmented legacy of processes. Usually this is integrated environment which is responsive to change and supports of the delivery of the business strategy as a baseline state. (Wikipedia, read 2018, 11)

Enterprise architecture enables to achieve the right balance between business transformation and continuous operational efficiency. Business transformation needs typically radical infrastructure changes, which initiates an enterprise architecture review or development. The role of the architecture is to address their concerns by identifying and refining the requirements that the stakeholders have and developing views of the architecture that show how the concerns and requirements are going to be addressed. After that it is showing the tradeoffs that are going to be made in reconciling the potentially conflicting concerns of different stakeholders. Without the Enterprise Architecture, it is unlikely that all the concerns and requirements will be considered and met against the business objectives. (Marc Lankhorst, 2017)

The Open Group (established in 1996) is an industry consortium that seeks to "enable the achievement of business objectives" by developing "open, vendor-neutral technology standards and certifications" (Wikipedia, read 2018, 11.)

Open Group is stating on its website that an effective enterprise architecture can bring important benefits to the organization. Specific benefits of an enterprise architecture include based on publication of Open Group, more effective and efficient business operations, more effective and efficient digital transformation and IT operations, better return on existing investment, reduced risk for future investment and faster, simpler, and cheaper procurement.  (Open Group, read 2018, 9.)

### 4.1 The Open Group Architecture Framework (TOGAF)

TOGAF was developed starting 1995 by The Open Group, based on Technical Architecture Framework for Information Management , was a 1990s reference model for enterprise architecture by and for the United States Department of Defense.

Togaf is a framework for enterprise architecture that provides an approach for designing, planning, implementing, and governing an enterprise, information and technology architecture. It relies heavily on modularization, standardization, and already existing, proven technologies and products, and offers high level approach to design and It is dividing design on four levels business, application, data, and technology. (Wikipedia, 2018, 11.)

Following chapters, including this chapter from 4.1 – to 4.4.6 is based on Togaf version 9.2 official websites, published and maintained by The Open Group. Pages are read for research purposes between 2018, 9 – 11. Content is peer reviewed from Open Groups web sites and it is used to describe the methodology within research. (Open Group, 2018, 9.)

An architecture framework is a set of tools, which can be used for developing a broad range of different architectures. Its objective is to describe a method for defining an information system in terms of a set of building blocks. It includes a set of tools and provides a common vocabulary for that, different parties can understand each other. Recommended standards are described within architecture as it includes a list of compliant products that can be used to implement the building blocks.

There are four architecture domains in Togaf that are commonly accepted as subsets of an overall Enterprise Architecture, all of which the Togaf standard is designed to support. Domains which Togaf recognize are architecture capability framework, architecture development method, architecture content framework and enterprise continuum and tools. This is demonstrated on figure 8 below.

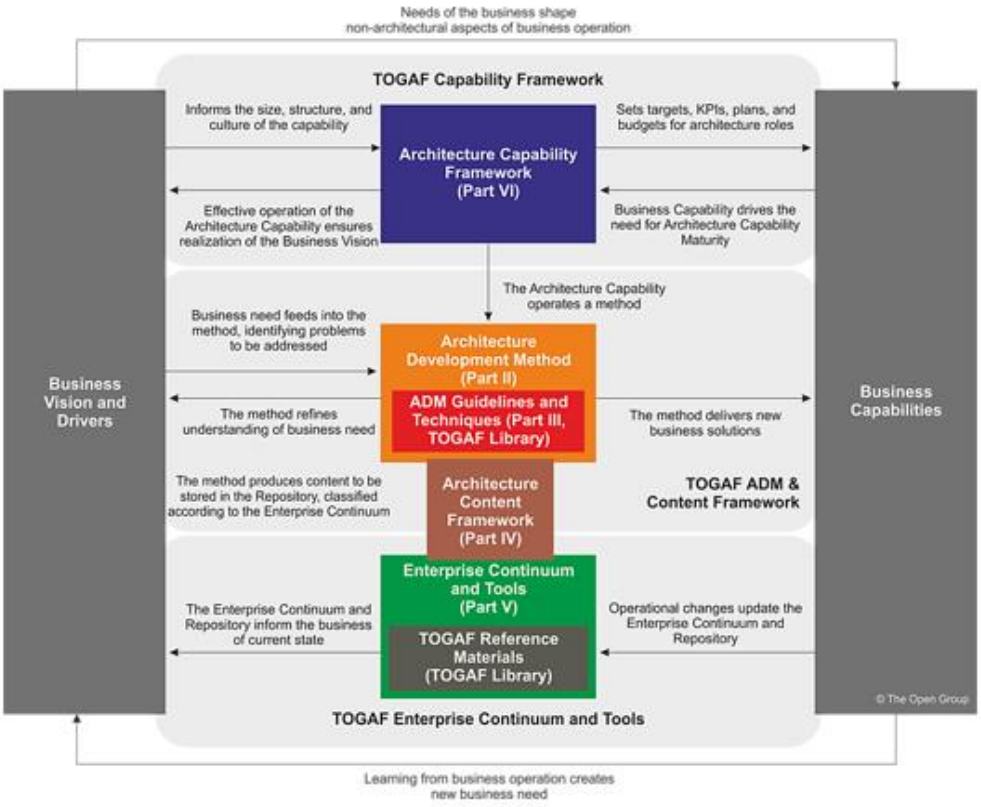



Figure 8. Togaf Capability Framework. (Open Group, 2018, 9)

Architecture capability framework provides a set of architecture materials describing how to establish architecture function and it contains guidelines to support key activities. Architecture capability framework is for to put in place appropriate organization structures, processes, roles, responsibilities and skills.

The content framework provided here is intended to allow the Togaf framework to be used as a only framework for architecture within an enterprise. In all case, other content frameworks exist and it is possible that enterprises may use an external framework in conjunction with the Togaf framework. Content framework provides a useful reference and starting point for Togaf content to be mapped to other content frameworks.

The enterprise continuum describes how architectures can be partitioned and organized within a repository within it describes tools for architecture development. IT provides a view of the architecture repository that shows the evolution of these related architectures from generic to specific, from abstract to concrete, and from logical to physical.

Fourth part of Togaf is architecture development method, which is described more detailed beginning from following chapter as it being a selected methodology within this research.

### 4.2 TOGAF Architecture Development Method

The TOGAF Architecture Development Method (ADM) provides for developing architectures a tested and repeatable process. Process includes establishing an architecture framework, developing architecture content, transitioning architecture, and governing the realization of architectures. The process consists of phases, which cover these objects of architecture development areas.

First architecture planning starts at preliminary phase, which describes the preparation and initiation activities required to create an architecture capability including customization of the TOGAF framework and definition of architecture principles. After initiation activities comes up next phase, where architecture vision is build and it describes the initial phase of an architecture development cycle. It includes information about defining the scope of the architecture development initiative, identifying the stakeholders, creating the architecture vision, and obtaining approval to proceed with the architecture development.
After architecture vision defined, there is several supporting areas, which are processed iteratively through to support the agreed vision. Phases are business architecture, Information systems architectures and technology architecture.

The business architecture defines the business strategy, governance, organization, and key business processes. Information system architecture includes at the same data and application architectures. The data architecture describes the structure of an organization's logical and physical data assets and data management resources. The application architecture provides a blueprint for the individual applications to be deployed, their interactions, and their relationships to the core business processes of the organization.
The technology architecture describes the logical software and hardware capabilities that are required to support the deployment of business, data, and application services. This concerns IT infrastructure, middleware, networks, communications, processing, standards and so on.

When architecture is defined and processed so far that implementation model planning can be started, there comes up opportunities and solutions phase, which conducts initial implementation planning and the identification of delivery vehicles for the architecture defined in the previous phases. Following phase is describing that how to move from the baseline to the target architectures by finalizing a detailed Implementation and migration plan, called migration planning phase.

During the implementation there needs to be some controlling through this phase where planned architectures are taking place from the plans. Implementation governance phase provides here an architectural oversight of the implementation. And during implementation it is sure, that some changes will need to be adhered on architecture, for this there are architecture change management phase, which establishes procedures for managing change to the new architecture.

During the iterative ADM process, the link to business requirements is the requirements management phase, which examines the process of managing architecture requirements throughout the ADM during every phase. All of these activities are carried out within an iterative cycle of continuous architecture definition and realization that allows organizations to transform their enterprises in a controlled manner in response to business goals and opportunities.

### 4.2.1 Iteration cycles of ADM

The suggested iteration cycles for the TOGAF ADM are shown in figure 9, and can be used to effectively group related architectural activities to achieve a specific purpose. Architecture capability iterations support the creation and evolution of the required architecture capability. This includes the initial mobilization of the architecture activity for a given purpose or architecture engagement type by establishing or adjusting the architecture approach, principles, scope, vision, and governance.

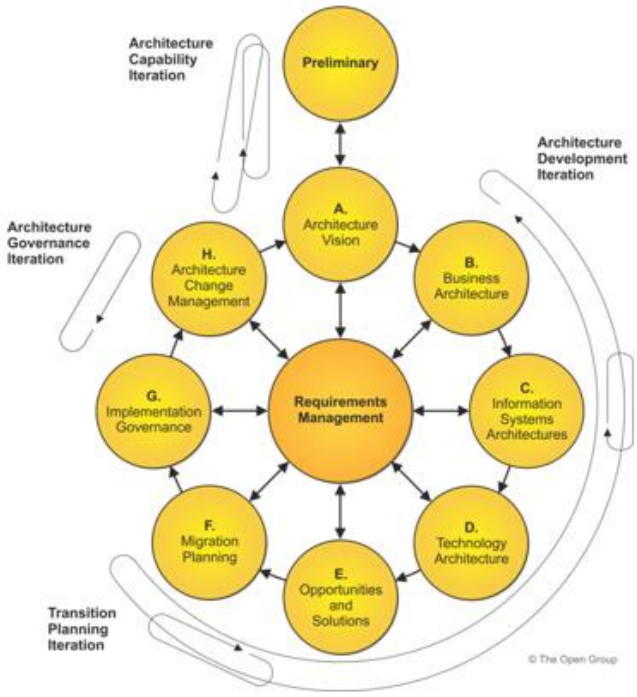



Figure 9. Iteration cycles of ADM. (Open Group, 2018, 9)

Architecture development iterations allow the creation of architecture content by cycling through, or integrating, business, information systems, and technology architecture phases. These iterations ensure that the architecture is considered as a whole. In this type of iteration stakeholder reviews are typically broader. As the iterations converge on a target, extensions into the opportunities & solutions and migration planning phases ensure that the architecture's feasibility is considered as the architecture is finalized.

Transition planning iterations support the creation of formal change roadmaps for a defined architecture. Architecture governance iterations support governance of change activity progressing towards defined target architecture.

### 4.3 Togaf ADM preliminary phase

Preliminary phase describes the preparation and initiation activities required to meet the business directive for a new enterprise architecture. The objectives of the preliminary phase are to determine and establish the architecture capability for the company. The preliminary phase therefore involves doing any necessary work to initiate and adapt the ADM to define an organization specific framework. The level of detail addressed in the preliminary phase will depend on the scope and goals of the overall architecture effort.

Preliminary phase theory, with its subchapters are peer reviewed from Open Groups Togaf websites (Open Group,2018, 9). Content is basing on there to chapter 5, Preliminary Phase, and other suitable being in relation on contents of preliminary phase within the same library.

The order of the steps in the preliminary phase as well as the time at which they are formally started and completed should be adapted to the situation at hand in accordance with the established architecture governance. Preliminary phase of Togaf covers below entities when it is fully covered. The set of entities is case sensitive and can be tailored by the business case.

- Scope the of the company organization levels are impacted
- Governance and support frameworks and establish architecture repository
- Enterprise architecture team and organization
- Architecture principles
- Requirements for architecture work
- Tailoring of the TOGAF framework

The preliminary phase receives input from existing non architectural and architectural frames. Non architectural inputs for preliminary phase include business board strategies and business plans. Business strategy is related on IT strategy, business principles and business goals. Major frameworks which are operating the business with governance and legal frameworks determine the certain starting points to adhere with architecture. Architecture capabilities and partnerships and contracts are needed to get if exists as well.

Architectural Inputs consist of pre existing models for operating an enterprise architecture capability can be used as a baseline for the preliminary phase. These Inputs would include organizational model elements for enterprise architecture like scope of organizations impacted, maturity assessment with gaps and resolution approach, roles and responsibilities for architecture team, budget requirements and governance and support strategy.

### 4.3.1 Scope the Enterprise Organizations

The scope of the enterprise impacted is one of the main challenges and will determine those stakeholders who will derive most benefit from the enterprise architecture capability. It is imperative that a sponsor is appointed at this stage to ensure that the resultant activity has resources to proceed and the clear support of the business management. The enterprise may comprise many organizations and of the stakeholders included in defining, establishing, and using the architecture capability.

For the scope of enterprise need to be defined core enterprise which is most affected and achieve most value from the work and the part of it who will see change to their capability and work with core units but are otherwise not directly affected. There might exists also extended enterprise units outside the scoped enterprise who will be affected in their own enterprise architecture. Besides that communities and stakeholders who will be affected and who are in groups of communities are on group of organization.

In order to make effective and informed decisions about the framework for architecture to be used within a particular enterprise it is necessary to understand the context surrounding the architecture framework. These specific areas include, the commercial models and budgetary plans, stakeholders for architecture in the enterprise with key issues and concerns, intentions and culture of the organization, as captured within board business directives, business imperatives, business strategies, business principles, business goals, and business drivers. In addition it is needed to explore and understand current governance

processes and frameworks that support execution of change and operation of the enterprise.

### 4.3.2 Governance and support frameworks

The architecture framework will form the keystone to the flavor of architecture governance organization and guidelines that need to be developed. Part of the major output of this phase is a framework for architecture governance. Companies need to understand how architectural material like standards, guidelines, models and compliance reports are brought under governance. More detailed these will describe what type of governance repository characteristics are going to be required, what relationships and status recording are necessary to ascertain which governance process has ownership of an architectural artifact.

The existing governance and support models of an organization will need to change to support the newly adopted architecture framework. To manage the organizational change required to adopt the new architectural framework, the current enterprise governance and support models will need to be assessed to understand their overall shape and content. These frameworks are presented on below figure 10.

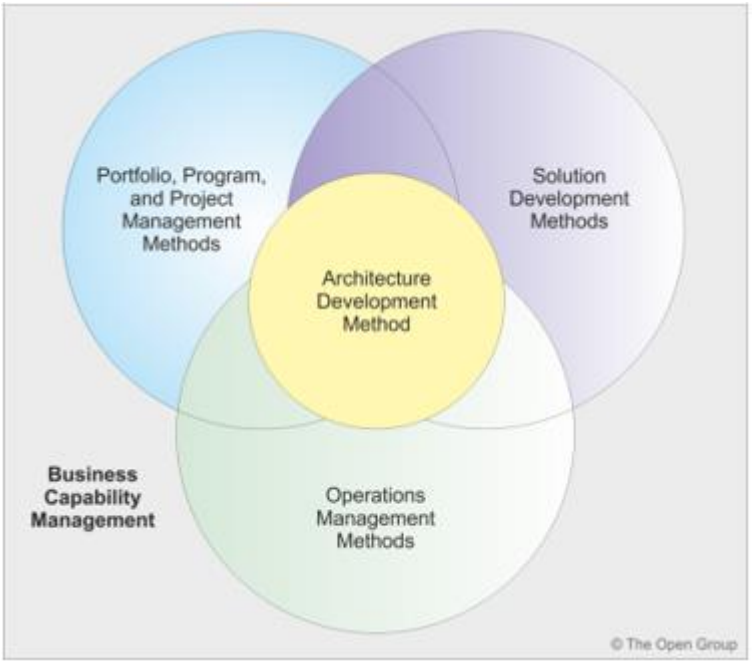



Figure 10. Management Frameworks to Co-ordinate with the TOGAF Framework (Open Group, 2018, 9)

Support frameworks consists of business capability management that determines what business capabilities are required to deliver business value including the definition of return on investment and the requisite control and performance measures, project and port-

folio management methods that determine how a company manages its change initiatives, operations management methods that describe how a company runs its day to day operations, including IT and finally solution development methods that formalize the way that business systems are delivered in accordance with the structures developed in the IT architecture.

### 4.3.3 Establish Enterprise Architecture Team and Organization

For that architecture framework to be used successfully, it must be supported by the correct organization and roles with needed responsibilities within the enterprise. Of particular importance is the definition of boundaries between different enterprise architecture practitioners and the governance relationships that span across these boundaries.

### 4.3.4 Establish Architecture Principles

Architecture principles are based on business principles and these are in critical role in setting the architecture governance. Principles under which the architecture is to be developed need to be reviewed to achieve an confirmation for them.

The good set of principles must be expressed in a way that allows a balance of interpretations and principles should not be contradictory to the point where adhering to one principle would violate the spirit of another. Every word in a principle statement should be carefully chosen to allow consistent yet flexible interpretation. Principles should be enduring and stable, yet able to accommodate changes supporting iterative approach of architecture development method. Principles need to be understandable and consistent for that the underlying tenets can be quickly grasped and understood by individuals throughout the organization.

The intention of the principles need to be clear and unambiguous, so that violations are minimized. Each principle should be sufficiently definitive and precise to support consistent decision making in complex, potentially controversial situations and enable good quality decisions about architectures and plans to be made, and enforceable policies and standards to be created, being robust. Complete principles should consider that every potentially important principle governing the management of information and technology for the organization is defined and the principles cover every situation perceived.

A poor set of principles will quickly become disused, and the resultant architectures, policies, and standards will appear arbitrary or self serving. A change process should be established for adding, removing or altering principles after principles are ratified initially.

Within upcoming architecture vision phase needs to be ensured that the existing definitions are current, and clarify any areas of ambiguity. If there is lack on these, issues need to be worked to define these essential items for the first time and secure their endorsement by corporate management.

### 4.3.5 Requirements for Architecture Work

The business imperatives behind the enterprise architecture work drive the requirements and performance metrics for the architecture work. Companies should be sufficiently clear so that this phase may scope the business outcomes and resource requirements, and define the outline enterprise business information requirements and associated strategies of the enterprise architecture work. Appropriate set of requirements categories for insurance industry include business requirements, cultural aspirations, organizations and strategic intents with forecast of financial requirements. These need to be articulated so that all the key decision makers and stakeholders are involved to defining and establishing an architecture capability.

### 4.3.6 Tailoring of the TOGAF Framework

The enterprise architecture can be used to provide a structure for all of the corporate initiatives. The portfolio management framework can be used to deliver the components of the architecture and the operations management framework supports incorporation activities of other components within the corporate infrastructure.

Process tailoring provides the opportunity to remove tasks that are already carried out elsewhere in the organization and to align the ADM process to other process frameworks which usually includes links to portfolio management processes, project lifecycle, operations handover processes, operational management processes and procurement processes.

Content tailoring uses the TOGAF architecture content framework and enterprise continuum for to tailoring content structure and classification approach that allows adoption of third party content frameworks. It also allows customization of the framework to support organization specific requirements

Figure 11, illustrates a detailed set of dependencies between the various frameworks and business planning activity that incorporates the enterprise's strategic plan and direction.

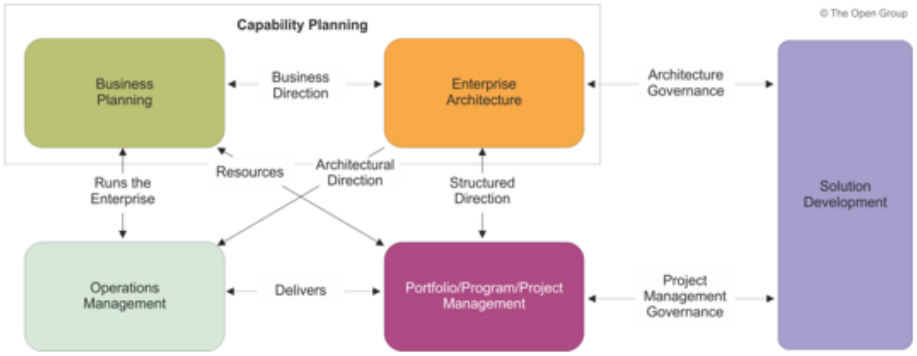



Figure 11. Interoperability and Relationships between Management Frameworks (Open Group, 2018, 9)

### 4.4 Togaf ADM Architecture vision

Architecture vision is initial phase of the architecture development method (ADM). It includes information about defining the scope, identifying the stakeholders, creating the architecture vision, and obtaining approvals. The objectives for a phase are to develop a high level aspirational vision of the capabilities and business value to be delivered as a result of the proposed enterprise architecture. Another main objective is to obtain approval for a statement of architecture work that defines activities to develop and deploy the architecture.

Architecture vision phases theory, with its subchapters are peer reviewed from Open Groups Togaf websites (Open Group,2018, 9). Content is basing on there to chapter 6, Architecture Vision, and other suitable content in relation of architecture vision phase at the same website library.

Details of architecture vision phase will depend on the scope and goals of the request for architecture work. Important non architectural inputs are request for architecture and all defined business principles, business goals, and business drivers. Architectural Inputs for this phase contains an organizational model for enterprise architecture, any tailored architecture frameworks an repository of architecture.

Architecture vision phase defines what is in and what is outside the scope of the architecture effort and the constraints. Scoping decisions need to be made on the basis of a assessment of resource and competence availability, and the value that can realistically be expected to accrue to the enterprise from the chosen scope of architecture work.

The architecture vision provides a high level description of the baseline and target architectures. Landscape is to cover the business, data, application, and technology domains for architecture. Once an architecture vision is defined and documented there is need to build a consensus which is represented the sponsoring organization signing the statement of architecture work.

### 4.4.1 Architecture Project

Enterprise architecture is a business capability where each cycle of the ADM should normally be handled as a project. Architectural activities are a subset of the activities within a larger project and should be managed using accepted practices for the company. Project establishing should focus on defining the stakeholders in the architecture practice. These stakeholders would include the roles and organization units participating in the architecture practice.

Company should conduct the necessary procedures to secure recognition of the project, the endorsement of corporate management, and the support and commitment of the necessary line management including references to other management frameworks in use within the enterprise.

### 4.4.2 Stakeholders

Identify the key stakeholders and their concerns with the key business requirements to be addressed in the architecture. At this stage is intended to identify vision components and requirements with scope boundaries for the architecture. In addition there is mission to identify stakeholder concerns, issues, and cultural factors that will describe how the architecture is presented and communicated.

The major product resulting from this step is a stakeholder map for the engagement, showing which stakeholders are involved with the engagement, their level of involvement, and their key concerns. The stakeholder map is used to support outputs of the architecture vision to identify the concerns and viewpoints that are relevant to this project, stakeholders that are involved with the project and key roles and responsibilities.

### 4.4.3 Business Goals, Business Drivers, and Constraints

This part of architecture vision phase is simply to ensure that the existing definitions of business goals and strategic drivers of the company are on place and any unclear parts of

these are clarified. The constraints for company and for to project are in place. These are architecture principles are developed in the preliminary phase, so If these have already been defined, ensure that the existing definitions are current, and clarify any areas of ambiguity.

### 4.4.4 Scope

Architecture scope defines what is inside and what is outside the scope of the baseline architecture and target architecture efforts, understanding that the baseline and target need not be described at the same level of detail. In many cases, the baseline is described at a higher level of abstraction, so more time is available to specify the target in sufficient detail by the coverage of the enterprise, needed detail required, portioning of the architecture, domains to be covered, like (business, data, application, technology) with the extent of time period aimed and other frameworks, systems models and vertical industry models and so on.

New requirements generated for future architecture work within the scope of the selected requirements need to be documented within the architecture requirements specification. In addition new requirements which are beyond the scope of the selected requirements must be input to the requirements repository through the requirements management process.

### 4.4.5 Development of Architecture Vision

Policy development and strategic decisions need to be captured in this phase to enable the subsequent work to be quantified. An understanding of the required artifacts will enable the stakeholders to start to scope out their decision making which will guide subsequent phases. These decisions need to be reflected in the stakeholder map.

Architecture Vision will provide leadership and direction for the organization in subsequent phases in relation of digital transformation and IT strategy including for example, rationalization decisions and metrics, revenue generation, and targets which meet the business strategy. For the architecture vision it is recommended that first an overall architecture be decided upon showing how all of the various architecture domain deliverables will fit together. Business scenarios are an appropriate and useful technique to discover and document business requirements, and to articulate an architecture vision that responds to those requirements.

There need to be high level view of the baseline and target architectures which basing on the stakeholder concerns, business capability requirements, scope, constraints, and prin-

ciples. The architecture vision typically covers the breadth of scope identified for the project, at a high level. Informal techniques are often employed. A common practice is to draw a simple solution concept diagram that illustrates concisely the major components of the solution and how the solution will result in benefit for the enterprise.
These initial versions of the architecture, which generates the first, very high-level definitions of the baseline and target environments, from a business, information systems, and technology perspective, should be stored in the Architecture Repository.

# 5 Establishing Cloud Architecture

Understand the business objectives first and foremost it all comes down to architecture. Companies need to map the right cloud service models and deployment models in relation of business needs. That is essential to build what is core to the business and leverage PaaS and SaaS solutions for everything else, and with that make sure the architecture addresses the different strategies for auditing, data, security, logging, SLAs, monitoring, disaster recovery, DevOps, and for organizational impacts taken into consideration in architecture. (Pethuru Raj, 2014.)

## 5.1 Cloud Enterprise Architecture

The cloud will seamlessly link with enterprise architecture to result in the emergence and establishment of cloud enterprise architecture (CEA). Through a comprehensive and closer engagement with corporate decision-makers, it is possible to come out with a pragmatic cloud strategy that helps to craft a specific cloud adoption road map with time lines and a migration plan. The engagement comprises several phases utilizing a structured delivery approach. The major architectural modules of CEA are as follows:

- Cloud business architecture
- Cloud application architecture
- Cloud information architecture
- Cloud technology architecture
- Cloud integration architecture
- Cloud security architecture
- Cloud management architecture
- Cloud governance architecture

(Pethuru Raj, 2014.)

Grounding on CEA definition cloud based business requirements are divided on these categories. The elicited business objectives and requirements are categorized under these categories and are processed with Togaf ADM approach (Attachment 1). For to conduct initial planning of the enterprise architecture, for architecture needs to be defined current enterprise capabilities and establish the vision of cloud adoption by grounding on that.

### 5.1.1 Evaluation of business objectives

First we define and analyze the CEA categories within elicited business objectives in chapter 3. Business objectives can be found as attachment (attachment 1). First the business objectives which are categorized already with typing at chapter 3, are categorized with regular enterprise architecture categories including Technical, Financial, Strategic, Organization and Risk.

After that business objectives are conducted to cloud categories of CEA from regular EA categories based on a characteristic and influence of an objective. Basing on categorization enterprise architecture work related steps of Togaf preliminary phase can be conducted against the the objectives.

### 5.1.2 Analyzing of business requirements

As described on chapter 4.3, preliminary phase describes the preparation and initiation activities required to meet the business directive for a new enterprise architecture.

Architects should perform the necessary discovery in relation to EA methodology that most methodologies suggest before starting the cloud based analyzing process can start mode detailed. Very often there is a one mistake done with picking a vendor before doing due diligence. It is easy for a vendor to give straight default to example PaaS service, which might not be the best service model to solve the business challenge.

Other factors that can contribute to the cloud service model and deployment model decisions are whether the project is a greenfield effort being built from scratch from the ground up, a migration of a legacy system, or a combination of these or between these as a brownfield. Legacy systems can create barriers that make it difficult to use certain cloud service models and deployment models. And one critical factor to consider within architecture building is approach on users and data. (Kavis 2014)

Companies should seek answers on what problem are we trying to solve and what are the business goals and drivers. The fundamental questions to be answered when starting the cloud readiness evaluation phase are why, who, what, where, when and how. These question are basically starting from the scratch, and are for to have a meaning for architecture.

Questions for this context are expressed in a questions like, why this cloud solution needs to be build and who are the actors with needs this problem to be solved? What are the

business and technical requirements to consider beside the risks related on this? Is there specific location and industry where these services are consumed and when these services are needed and whit which budget? How the deliveries are done comparing on that what is the readiness of the organization? (Kavis 2014)

After collecting the information for these questions, there is starting point to select the best service models and deployment models for the company. In addition with that factors like time, budget, and organizational readiness can impact the cloud service model decisions just as much as the business and technical requirements. Every piece of the overall architecture should be evaluated independently to ensure that the optimal cloud service and deployment models are selected (Kavis 2014). The answers of these questions are used to analyse elicited business requirements (attachment 1).

## 5.2 Preliminary phase outcomes

As described on chapter 4.3, preliminary phase describes the preparation and initiation activities required to meet the business directive for a initial draft of cloud based enterprise architecture. This context is explored and described through in this chapter.

The preliminary phase gets the input from existing non-architectural and architectural frames. If these drivers are not defined before preliminary phase, architect needs to define these inputs with stakeholders to start proper constructions of preliminary architecture activities. Because of the nature of the research, there exists high level insurance industry related general example inputs of architectural input elements.

### 5.2.1 Request for architecture work

Requests for Architecture Work can be created as an output of the preliminary phase, a result of approved architecture change requests, or terms of reference for architecture work originating from migration planning. Request in this context is question about cloud adoption as described in chapter 1, Introduction and chapter 2, business development with cloud. Generally, all the information in requests for architecture work document is at a high level and includes organization's mission statement, which is cloud adoption assessment as went through on chapter 1 and 2.

Description of developing organization and description of resources of developing organization is described in following chapters as well the current business system description

and IT system description on high level. At the end of chapter 5.2 there described business goals and strategic plans of the business with constraints in a chronological sequence before diving in a architecture vision chapter 5.3.

### 5.2.2 Organizational model and scope of the enterprise impacted

Architecture framework must be supported by the correct organization, roles, and responsibilities within the enterprise. Importance is the definition of boundaries between different EA practitioners and the governance relationships that align across these boundaries.

Objective is to review the organizational context for conducting enterprise architecture and to identify and scope the elements of the enterprise organizations affected by the architecture capability. As outlined at beginning of research, boundaries are scoped generally to the insurance industry enterprise model to evaluate organisational model aspects.

Regular insurance company's line based organization model contains usually following structure described in figure 12 on following page.

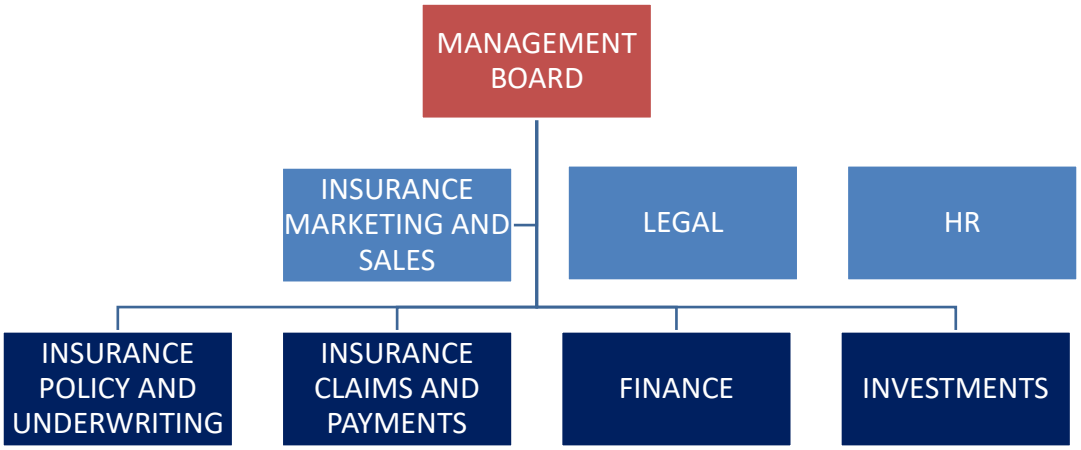



Figure 12. Reference line organization of insurance company

All lines has clear mission in organization, but all lines are anyway tight associated with each other. All lines, of course has business critical IT systems in use, some systems like CRM (customer resource management) and ERP (enterprise resource planning) solutions are interoperability systems within shared use of many lines. Within this research attention

is gave for to CRM solutions which are handled most of lines in the company. Most active lines using CRM in the company are insurance marketing and sales unit with insurance claims and payments unit.

Regular system landscape of CRM system is presented on following page in figure 13 with related system areas within IT-infrastructure.

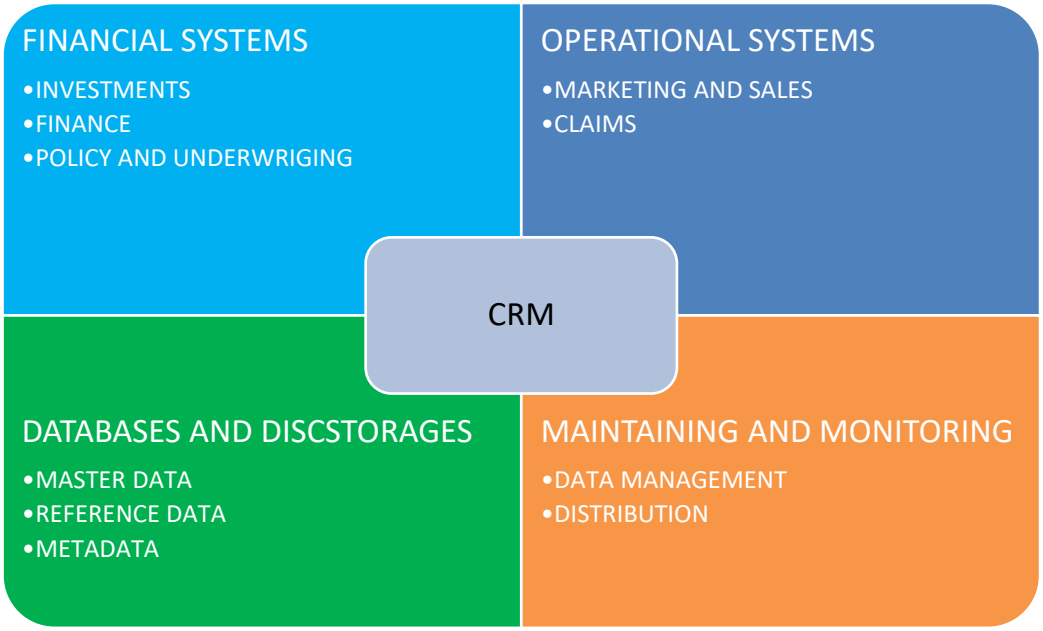



Figure 13. System landscape

Regarding on interoperability landscape, research context for application level approach is attached on CRM system and related systems of it. This context approach from application level is adhered on building of architecture vision.

CRM system is to maintain client information and processes, handled as front office workers as back office workers. Client information is also used by sales and other units within organisation to handle business related client processes. That's why it is critical to understand the data process aligning cross the units. That is important to plan properly when planning business processes to support cloud adoption, as there is critically to consider this within information architecture phase, which concerns more on data layers.

### 5.2.3 Governance and Support Frameworks

This part of preliminary phase is mentioned to identify the established frameworks, methods, and processes regarding on target company of cloud initiative. In addition with that establishing capability maturity target and architecture repository is one steps covered in this part.

Architecture Governance is an approach, a series of processes, a cultural orientation, and set of owned responsibilities that ensure the integrity and effectiveness of the organization's architectures. The split of process, content, and context are key to the support of the Architecture Governance initiative, by allowing the introduction of new governance material without not necessary impacting the processes. This content based approach ensures that the framework is flexible. The processes are typically independent of the content and implement a proven best practice approach to active governance. The key concepts of architecture governance are illustrated in demonstrating figure 14, which is grounding on The Open Groups published figure from Togaf 9.2 library (Open Group,2018, 9).

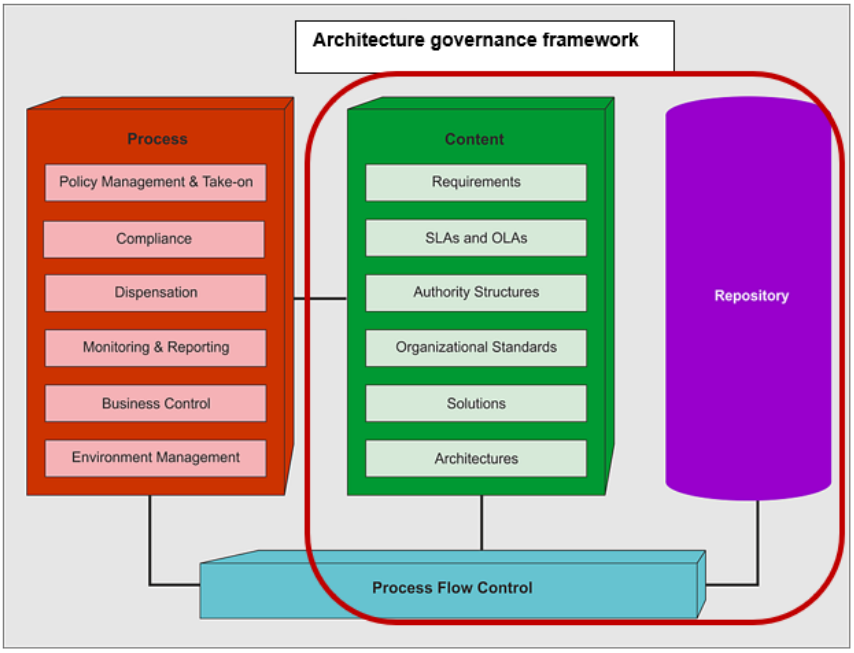



Figure 14. Architecture governance framework structure

Architecture governance covers within this research, as scoped on figure presented above with red container, content entity characteristics from requirements, the intent of solution, organizational aspects from insurance industry, suitable architecture principles and insurance industry specific features described during chapter 5. These elements cover also the architecture capabilities and repository. This set of entities build up the governance model in this research.

### 5.2.4 Enterprise Architecture Team and Organization

Regular insurance company organization model is presented below and works as a stakeholder analysis that distinguishes types of stakeholder in line categories. Chart is considering those roles obviously associated with the architecture project or change and those who must make a real contribution to the architecture project or change for it.

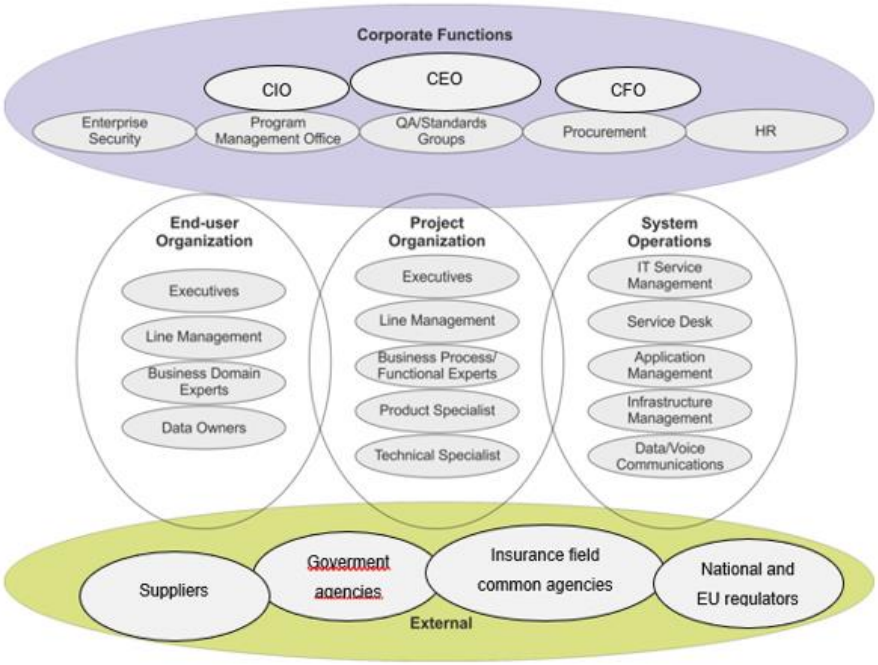



Figure 15. Stakeholders and line categories

Above figure is tailored for research and it is basing to Open Groups publication presenting an reference of needed (Open Group,2018, 9). There is list of stakeholders attached (attachment 2), which provides stakeholder map for a architecture project where stakeholders are identified in. In chart is described main key concerns and related catalogs, metrices and diagrams they are concerned and needs to be work with enterprise architect within architecture creation. There is take in account all parts from stakeholders and line categories (figure 15) presented above with description of key concerns and the interests of those on more detailed level.

### 5.2.5 Architecture principles

Based on architecture principles description on chapter 4.3.4, there was definitions and baselines for principles. Principles worked out for this research is based on Togaf Open

groups example principles with added flavour of insurance industry (Open Group,2018, 9). The set of principles are presented on attachment 3.

Process of establishing principles is basing on recommended practice set.
The criteria that distinguish a good set of principles is notified when establishing a architecture principles. Principles need to be understandable and stable, clear and unambiguous, robust, support consistent decision making, complete, consistent and allow balance of interpretations. Principles give a direction for architecture to follow up with all architecture related activities.

### 5.2.6 Architecture capabilities and repository

Establishing architecture capabilities concerning practise is not only a phase of an architecture project, it is an ongoing practice that provides the context, environment, and resources to govern and enable architecture delivery to the organization. Implementing any capability within an organization requires the design of the four domain architectures like Business, Data, Application, and Technology. These are processed and stated at described at chapter 5.3 at architecture vision phase.

Architecture Repository includes covering set of classes of architectural aspects to be fulfilled during Togaf ADM iterative process as described in chapter 4.3. Within this research is created initial high level architecture repository with covered some parts of it. It includes entities to be processed within further ADM process concerting like architecture landscape and solutions landscape with the architecture metamodel.. Scope is defined below in figure 16 by lining the affected elements from figure basing on Open Groups reference figure (Open Group,2018, 9).

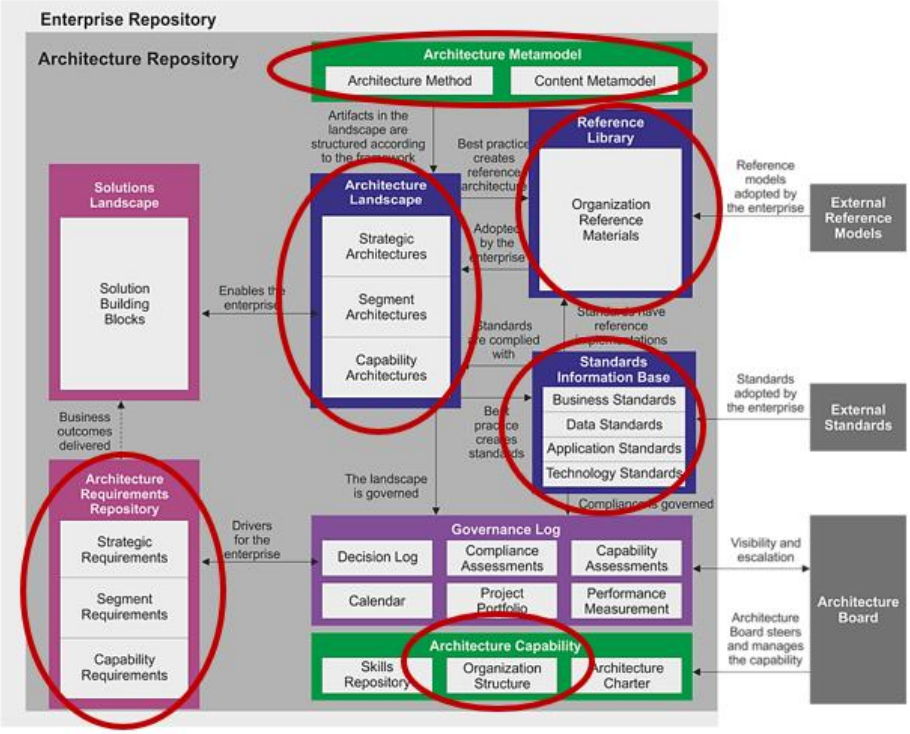



Figure 16. Architecture Metamodel.

Architecture metamodel, which present in a specific view architecture scope, is associated with TOGAF and requirement management practice for to support ADM process. As defined on chapter 5.2.2, content of metamodel is based on insurance industry and scope boundaries are aligned on to central CRM system. In addition with that research is opening the cloud models and services adoption in a view point of insurance companies, which is one essential part of metamodel content.

Architecture capability part includes organisation reference materials like organization structure and associated stakeholders, which were defined on chapter 5.2.4. There is also proper list of stakeholders from to be form the architecture board, which is assessing architecture and giving an approval for the aimed direction. Architecture governance is populated in reference library. This model is defined on chapter 5.2.3. which is essential part when performing capability assessments.

Architecture landscape with architecture requirements repository is at this phase of architecture work including architecture requirements. Architecture landscape with element of standards information phase are initially established during preliminary and architecture vision phase. Information phase element includes in addition the system landscape defined on chapter 5.2.2.

### 5.3 Requirements analysis for cloud adoption

There are many regulations and laws that architects and product owners must be aware of before building cloud based solutions. Knowing the audit requirements up front allows the product team to prioritize tasks on the roadmap so that security, privacy, and other regulatory requirements can be considered at a early phase. Awareness of these requirements should create the awareness of the need to design strategies around security, logging, monitoring, SLA management, disaster recovery, and other critical components of a compliant cloud service. (Pethuru Raj, 2014.)

Every cloud migration has to begin with a deeper analysis of the existing environment, infrastructure. Business centric evaluation must be performed according to the business architecture with the major focus on the business advantages, challenges and potential revenue. The nonfunctional aspects like performance, scalability, criticality, availability and security needs to be evaluated. Approach to the provisioning of an IT platform, are resource utilization, cost, meeting future needs, workload portability and high availability. (Clive Longbottom, 2017)

Regarding to CEA categories suitable cloud adoption is assessed and analyzed during following chapters against processed business requirements (attachment 1).

#### 5.3.1 Application category

According to application category of CEA, research is analysing the most suitable cloud service model and cloud type against the analysed objectives. When analysing business issues from application perspective for research business case, there can be found some key objectives, which are leading certain cloud service model selection.

Benefits stated here in application category leads loosely to consider SaaS here. As opposite, there is thread stated against this thought.  Anyhow, when combing issues with insurance industry characteristics, direction is much more to PaaS solution because it can bring competitiveness with deployment speed, agility, concentrating possibility on business. Another objectives are availability which can be reached PaaS and automatic software update, which can be reached with SaaS.

When remembering what kind of system landscape case has, there is much interoperability with many systems. Some systems can be implemented with PaaS and some with SaaS. And when there exists older type legacy systems when talking about large, architectural complex enterprise, it will bring constraints on the implementation anyway.

CRM system by itself could be ordered as SaaS solution but when considering all interactions between corporate functions, this could be led to PaaS solution because it will be easier to implement CRM application tier by self and handle critical data processes separately with independent solution and use APIs (application programming interfaces) within the solution creation.

When considering cloud model type for this business case from application perspective, there was characteristics within objectives and benefits in relation to competitiveness and rapid time to market need to be covered. That leads thoughts on to hybrid cloud model with some of applications because there is aspects from public cloud, which brings the benefit company wants to achieve, but leaves other part of application to be deployed on a private cloud for example to cover security and challenging integration solutions to be easier maintained. Regarding on analysis, the appropriate outcome for application part is PaaS and hybrid cloud model.

### 5.3.2 Business category

From business category are first raises up a set of objectives stated in relation flexibility, productivity and business continuity. Just taking look from business perspective these objectives are led to consider IaaS service model which covers these objectives. Employee productivity issue refers to SaaS because it includes collaboration tools, development tools, surveys, e-mail campaign tools, and much more. Because SaaS providers cater to many customers they often do not provide the same level of flexibility that a company would have if it built its own application.

In addition requirements like work from anywhere, ability to be more productive, effectiveness, improved work/life balance and all other refers to public PaaS service. It manages the underlying infrastructure, networks, storage devices, and operating systems. Tasks like monthly security patching, logging, monitoring, scaling, fail over, and other system administration related tasks are provided by the vendor so the developers can focus on building cloud ready applications. Grounding on analysis, for most suitable approach fo business category is public PaaS approach.

### 5.3.3 Governance category

There exists objective to adhere on governance level. Visibility and reporting is crucial element for cloud governance and predicting costs. Usually SaaS system offer reporting

and dashboard services itself. This can be managed also with lower stack solution with successful service contract management with demand to get wanted figures from vendors. That's why governance category is not bringing specific demand effect on cloud assessment. This issue has to be addressed with architecture work. Cloud cost advantages can be loosed quickly when poor strategic or architectural choices are made. That's why especially architecture requirements need to be populated with this issue.

### 5.3.4 Information category

Improved access to corporate data, need for deal time infromation with secured services offers better collaboration between units and other stakeholders. This increases collaboration and offers suitable document control. Have to remember there is always security issues living around and this need attention when assessing suitable model. From information perspective PaaS is preferred solution approach than SaaS because unique interface and interoperability issues anyway need much tailoring. Private and hybrid cloud model advantages and distribution of those need to be considered more deeply during proper ADM phases.

### 5.3.5 Integration category

Integration tier is quite near of information category by its requirements. There is easy of implementation and integration and maintenance interface issues most concerned on the tier.

Within management solutions leverages the latest hardware, virtualization and software solutions, those should also support a data center's existing infrastructure. From integration category perspective the IaaS solution will cover these concerns adhered on tier. Anyway combination of PaaS and IaaS solution distributed suitable on application landscape with hybrid cloud model could cover most needs of business.
Data integration is preferred to set in a dPaaS platform to automate as much possible the data security and data maintenance activities. With very sensitive data is preferred to have initial approach to do this in private cloud.

### 5.3.6 Management category

In the category is few important architecture requirements to be adhered. To productize the functionality of cloud computing, it is important that administrators have a simple tool for defining and metering service offerings. In addition Management solutions have the

ability to create policies around workload and data management to ensure that maximum efficiency.

Within the category is stated some challenges to be notified with IT service management practices. Within strategy needs to be stated how vendor management and information governance is landed within organization. There is not clear demand to certain cloud service model in this tier. Tier affects more to the planning and management model creation depending on selected cloud services and model of it.

### 5.3.7 Security category

Security demands are quite simple on high level. Stay secure, be reliable, offer automatic security. First public cloud models could be the border in this tier because of security constraints, it will need hybrid cloud model for to secure sensitive data used between corporation different functions. That why is preferred to store sensitive data with private cloud hosting model with dPaaS offering. Foremost, the security issue needs to be in strict observation in every architecture part build up during ADM process.

### 5.3.8 Technology category

Technology category's biggest challenge is the replacing on premise legacy technology to support new technology and business needs while reducing costs at the same time of IT department. Technology needs to be environment friendly with capacity scaling and with cloud computing, there is not expensive idle resources, or dealing with limited capacity.

With PaaS resources can easily be scaled up or down as business changes. In addition good combination with this service is to select from technology perspective dPaaS with relieves companies with the integrations wide scale, gives them full control over their data and allows companies to focus on extracting business insights faster.

### 5.3.9 Summary of cloud requirements analysis

Here is summarized prevent category base analysis. Each category of CEA received recommended initial service type and cloud type. Governance and Management categories are holistic factors comparing other categories. Usually these categories are noticed during service agreement creation and from other factors from organizational perspective. Evaluation summary by each part is presented in following chart on next page.

| Category of CEA | Service type | Cloud type |
|---|---|---|
| Application | PaaS | Hybrid |
| Business | PaaS | Public |
| Information | Paas | Hybrid, Private |
| Integration | Paas, Iaas | Hybrid |
| Security | dPaaS | Private |
| Technology | PaaS, dPaaS | Hybrid |

This outcome is used within creation of architecture vision on following chapter. Each category has analyzed and preferred solution approach which is the guideline to follow when establishing the architecture vision.

### 5.4 Vision of Cloud Architecture

When creating cloud architecture vision It is important to start with the business architecture with cloud initiative because it provides insights into the various touchpoints and business functions across the enterprise or at least across the part of the enterprise that is in scope for the initiative. When an architecture model is in place, a business knows where it is and where it wants to go. The gaps between the current state and the envisioned future state represent a misalignment of the business with its envisioned future state in a form of roadmap. This roadmap creates a vision that is a very important aspect of the business architecture which is a vision of the future. (Pethuru Raj, 2014)

Research is not stating fully covering architecture vision outputs because objective of it to establish initial architecture vision of cloud adoption. Content of an Architecture Vision contains a set of processed elements, which are compressed during earlier processed outcomes of preliminary phase and requirements management activities.

List of the outcomes is following which is once gathered here on place on a high level during following chapters. Results are based on chapter 3 and 5 outcomes worked out earlier on this research.  Theoretical framework for to work out outcomes of research, is based on chapter 2, Business development with cloud and on chapter 4, Enterprise architecture. One of important deliverables of this research is requirement matrix (attachment 1), which is processed and gained with information during the research in chronological order.

The intention of architecture vision outcomes are architecture requirements analysis, draft architecture definition document including mapped requirements and populated architecture repository, and at last cloud architecture vision which summarize the outcomes of the work.

### 5.4.1 Architecture requirements analysis

Architecture requirements specification is in a strict relation to the architecture definition document. It provides a set of quantitative statements that outline what an implementation project must do in order to comply with the architecture. The architecture definition document provides a qualitative view of the solution and aims to communicate the intent of the architect and quantitative view of the solution, stating measurable criteria that must be met during the implementation of the architecture.

As described definition of requirements for architecture work at chapter 4.3.5, there was mentioned categories for those (Business requirements, cultural aspirations, organization intents, strategic intent, forecast financial requirements). From these categories research is showing out suitable set of architecture work related requirements. These requirements were formed in a cloud based approach as a categories based on CEA.

The architecture requirements specification provides a qualitative view of the solution and aims to communicate the intent of the architect. With that it is a set of quantitative statements that outline which need to be considered during implementation for to comply with the architecture. Architecture requirements specification is a companion to the architecture definition document and it will typically form a major component of an implementation contract or contract for more detailed architecture definition.

Architecture specification supports to build up the architecture vision is processed forward. Architecture specification definition is completed against business objectives chart (attachment 1), in column of requirement tracing.  This categorization of architecture requirements supports further architecture implementation and introduces requirement processing channel in future use.

Architecture requirements are controls the cloud architecture definition on deeper level and helps to make decisions with stakeholders based on CEA category analysis. The rest of requirements are subsets of architecture requirements but having a more detailed purpose to use in mentioned phase. Architecture requirements forms a specific set of artifacts to adhere when architecture work is managed and maintained towards during ADM. All architecture requirements has a own specific place in this process to take account.

Implementation guidelines, specifications and standards are strictly solution construction related requirements that states aspects how the solution building process needs to consider. There is very close interaction with implementation requirements the Interoperability

requirements. Requirements related on integrations drives strongly concerns with surrounding integration and systems support with critical business applications during cloud assessment. Interoperability is a subset of implementation requirements and falls in EA category most on technical layer and this set of requirements are need to address within further solution processing.

The category of it service management requirements requirements has mainly aspects from governance and management category of CEA. Mostly requirements are pointing on that, service management has to asses it's organization, skills, processes and co-operation with vendors and business stakeholders again.

Constraints and assumptions related on architecture creation has important role as well within cloud model and service model selection. Assumptions have quite similar aspect that constraints have, but these are at the end need to be addressed with cloud selection or at last within service contract creation. Within architecture project scoping these two important factors has critical role when defining the scope. Architecture scope creation needs to notify constraints and assumptions to reach common understanding with stakeholders what are expected from the architecture.

Success measures Illustrate that how the management can measure that the service implemented or deployed is according to business objectives. This category is not itself bringing such a strict demand for any type or service or type of cloud selection. It is a formula which from further processing of these is able to define a valuable set of KPI:s (key performance indicators). As success measures, service contract requirements for business and application aspect, are not itself bringing strict demand for selection. Anyway these are critical factors architect need to adhere with stakeholders within service contract planning.

### 5.4.2 Architecture definition document

The Architecture Definition Document is the deliverable container for the core architectural artefacts created during a project and for important related information. As established based on preliminary phase and architecture vision phase, the architecture definition document provides a qualitative view of the solution.

Content architecture definition document includes architecture repository, which is populated with information of business objectives and constraints, architecture principles and

scope description including organization and information systems definitions for cloud initiative which are processed during preliminary phase and architecture vision phase.

Business objectives and constraints, which are processed during architecture implementation, are a part of architecture definition document. Within this research these were processed during chapter 3, where requirements matrix was established and after that analyzed on chapter 5.4.1. Analyzing of requirements did bring needed aspects to be mapped on architecture definition document for further use of working with architecture work.

Architecture principles are defined for cloud initiative regarding to description of principles described in chapter 4.3.4. Principles are conducted from general enterprise architecture principles of Togaf 9.2, published by Open Group. Research is using these principles tailored on the scope of architecture to establish cloud architecture vision. Based on architecture principles gathered, there is analysis regarding on principles and how these align with architecture requirements. Architecture principles are described in attachment 3, from where the description can be read. In this chapter principles are analysed from perspective to support architecture vision.

Principles of information management apply to all organizations within the enterprise. The only way these provide a consistent and measurable level of quality information to decision makers is that all stakeholder organizations are followed by the principles. Principles are mentioned to give holistic guidance for architecture work to reach semantic level for architecture work in every level of the stakeholders. Principles are divided in categories of business, data, application and technology as we have elements in enterprise architecture.

Business principles are for to achieving maximum enterprise wide benefit, and will require changes in the way that information is planned and managed. Principles from 1 to 4 are planned to maximize benefit to the enterprise, ensure business continuity, enable common use of applications and state IT responsibility within organisation.

Application development priorities must be for the entire enterprise and applications components should be shared across organizational boundaries. Information management initiatives should be conducted in accordance with the enterprise plan. Dependency on shared system applications mandates that the risks of business interruption must be established in advance and managed properly. Recoverability, redundancy, and maintainability should be addressed during the design with the proper recovery plans.

Organizations which depend on a capability which does not serve the entire enterprise, must change the use on enterprise wide capability. Data and information used to support enterprise decision making need to be standardized for that organizational capabilities which produce different data will be replaced by enterprise wide capabilities. For that IT organization can take responsibility of effectiveness and total costs reduction, data, application, and technology models have to be created to enable integrated quality solutions and to maximize results that way.

Data category principles from 5 to 7 concerns that data need to be shared with different parties who need it within organisation, data is accessible from different sources, which refers to data management and distribution, and data needs to be secured fulfilling the organisation standards and meets the demands of local and global law and regulations.

Application category principles, from 8 to 9 aligns on application solutions and gives guidelines on that the application solutions need to be technology independent for at there is not achieved a technology steered solution during the architecture process. Another viewpoint is easy to use approach. There need to be integrated environment where is not strict technology knowledge demands for that enterprise is not getting additional costs from technology dependency.

### 5.4.3 Scope of architecture

Scope of architecture is defined during preliminary phase on chapter 5.2, preliminary phase outcomes. One logical level approach on scope is defined on chapter 5.2.6, where is summarized once the architecture capabilities and repository. This gives an high level view on architecture and elements of it inside the enterprise context. During this chapter was done initial architecture information gathering, which aim was to describe industry specific aspects, organizational aspects and information system approach with the flavours of architecture work.

These artifacts gather up the scope of architecture and works as a baseline when starting the architecture vision modelling. Architecture vision needs elements to specify the approach of architecture. These elements are worked out within architecture vision phase. On background is processed requirements elicitation and analysis which forms up a major part of architecture work. When summarizing this all to one, situation is ready for to present the outcome of initial architecture vision.

### 5.4.4 Architecture vision

As went through on chapter 3, there is different available cloud service types and different ways to manage these in practice. In this chapter the research is opening, according to business requirements, how the service type selection conducted from requirement description. Established cloud vision, presented in a graphical form in figure 17 on following page, is based on artifacts of business objectives and constraints (attachment 1), architecture principles (attachment 3), scope of organization and information systems landscape from chapter 5.2 and stakeholders of architecture (attachment 2).

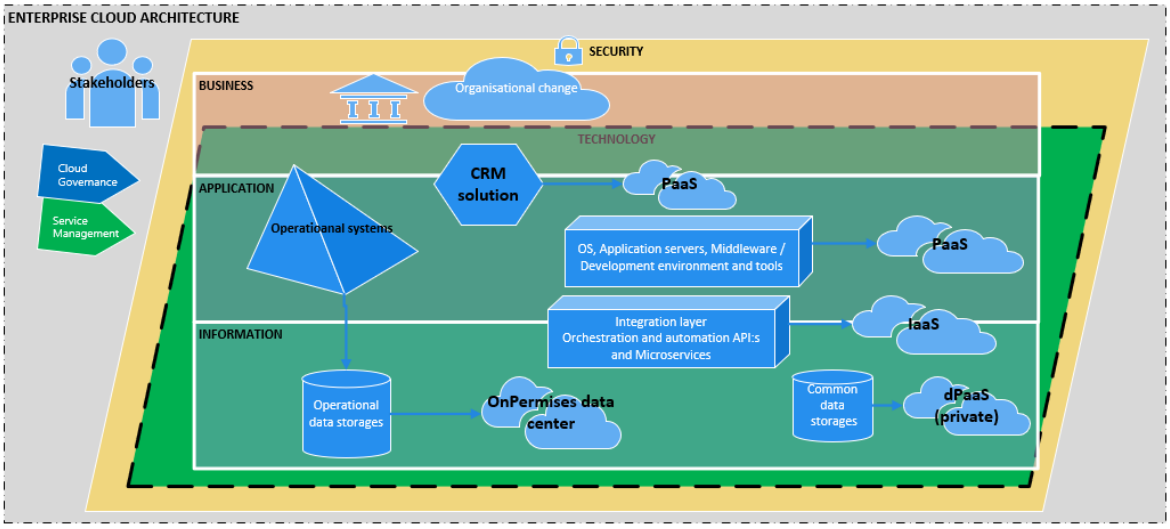



Figure 17. Established cloud vision (Attachment 4).

Architecture vision contains all aspects of CEA. The approach is formalized to regular Enterprise architecture aspect having layers like business, data, application and technology with the rest of elements of CEA. Stakeholders with cloud governance and management approach are the important factors of solution building when stepping forward within ADM process. Security concerns total landscape and technology aspect concerns all selections within architecture starting from business aspect. As presented there is strict cross relation with these factors with solution planning.

Architecture is important everywhere in Our lives. It is important in our houses and offices, in transportation, in military and governments. Whenever we have a system composed of interacting elements following an objective, the architecture is in place. Architecture vision is important because it is mentioned to control and give direction for solution approach on deeper level during iterative Togaf ADM process and it establishes an baseline to start architecture work. It is also important to have common criteria to start up the solution implementation project and sell architecture to stakeholders to achieve approval and funding

for architecture work. Architecture vision is a high level understanding of the capabilities and business value which wanted to be delivered as a result of further target states.

### 5.4.5 Further use of architecture vision

At this point, when the architecture vision is established, the background work is done so far to understand the business case and objectives of it. It is relevant for architecture work to get knowledge for definition on deeper level within a defined scope. Next after architecture vision phase there is faced phases of business architecture, data, application and technology architecture before the rest of ADM parts which concentrates on areas of opportunities and solutions, migration planning, implementation governance and architecture change management without forgetting the core of ADM, which is requirements management.

When considering on high level the upcoming ADM phases the all contextual architecture phases are aiming on same goal, to identify candidate architecture roadmap components based on gaps between the baseline and target architectures.

Business architecture describes how the enterprise needs to operate to achieve the business goals, and respond to the strategic drivers set out in the architecture vision. This part of architecture practice will highlight and define more detailed the architecture governance, architecture processes, architecture organizational structure, architecture information requirements and architecture products and so on.

Information systems and data architecture describes how the enterprises Information systems will enable the business architecture. These phases enables the business architecture and the architecture vision to Identify architecture roadmap components based upon gaps between the baseline and target data architectures. On these layers are also described the scoped information system units with the recommended intention of cloud approach established.

The objective of the application architecture is to develop the target architecture that enables earlier phases architectures to be populated with detailed information of specifying the functionality and applications related services required to enable the architecture practice.

Before opportunities and solution phases comes up the technology architecture phase that depicts the architecture practice's infrastructure requirements and deployment in sup-

port of the architecture applications and enterprise continuum. Technology architecture phase also enables earlier phases outcomes for to building blocks which are delivered through technology components and technology services.

From there the ADM iteration cycle goes on with an objective to gain architecture gradually to keep solution building and implementation in strict direction. As demonstrated, architecture vision shows important role to start the architecture development besides the solution implementation project.

# 6 Final evaluation and conclusion

The objective of research was to define approach for cloud assessment related on most usual cloud related objectives from that perspective, what is possible and reachable with cloud adoption. Qualitative research method, as mentioned at chapter 1, is to describe possible business development ways with cloud. This method approach was decided to support with Togaf methodology, and more detailed with Togaf ADM process, where business requirements are processed iterative to establish initial architecture vision. Requirements management approach is there as one main functions of research for defining and maintaining requirements iteratively for to support architecture work.

As research have several main outcomes, leading to one final outcome, architecture vision. All main artifacts of research with involved chapter are described on below chart.

**Summary of outcomes of research**

| Enterprise architecture artifact | Chapter |
|---|---|
| Business objectives elicitation and categorization against enterprise architecture methodology. | 3.2 with subchapters |
| Evaluation of business objectives | 5.1.1 |
| Request for architecture work | 5.2.1 |
| Organizational model and scope of enterprise | 5.2.2 |
| Governance and support frameworks | 5.2.3 |
| Enterprise architecture team and organization | 5.2.4 |
| Architecture principles | 5.2.5 |
| Architecture capabilities and repository | 5.2.6 |
| Requirement analysis for cloud adoption | 5.3 - 5.3.9 |
| Architecture requirements analyzis | 5.4.1 |
| Architecture definition document | 5.4.2 |
| Scope of architecture | 5.4.3 |
| Architecture vision | 5.4.4 |

As objective was set, research is comparing different cloud models and services according to elicited and processed business requirements. Request for architecture work was to establish architecture vision, which can lead to cloud adoption. Scope boundaries of research were aligned on insurance industry and on information system level on to CRM and other systems area in close relation of it.

In the book of Michal Kavis “Architecting the cloud” is written that with IT systems, validating the process and controls in the through passed areas are important part of establishing cloud. They’re opinion is that with physical environment, especially security and data center controls needs to be considered, from business and application perspective. Research was first eliciting objectives, then analyzing these to form up proper requirement matrix, after that categorization and mapping these requirements in to cloud suitable order, from where the requirement were properly usable for architecture work.

The most critical technology decisions for succeeding with cloud computing is selecting the right cloud service model, which should be based on a combination of business, technology, and organizational requirements. When Cloud computing is designed properly, it can offer huge benefits such as increased speed to market, lower total cost of ownership, and greater flexibility as there was for example stated on business objectives of research.

Choosing cloud service models and deployment models are critical tasks in any cloud initiative. The decisions should be based on business drivers, constraints, and customer impacts as analysed during research in chapters 3 and 5. In chapter 3 research elicited literature and up to date articles based usual business objectives and challenges related on cloud adoption. These objectives were categorized in to EA related fundamental categories like business, strategic, organization, financial and technical.

It is important that all components of the business architecture are considered and understanding of the future state is also achieved before making decisions about further operations of cloud adoption. Related on cloud based development these requirements were categorized in to CEA categorization, which is essential because the research is utilizing these with establishing cloud architecture vision.

At the end of research the evaluation of cloud models and deployment models are finally used within the preliminary phase of Togaf and within established architecture vision. Vision of enterprise cloud architecture is to establish distributed hybrid cloud model based on analysed and processed cloud objectives. There was considered different layers of architecture, where approaches of system and platform with infra were placed on a archi-

tecture vision diagram. This approach supports following architecture roadmap planning with hybrid cloud model approach which is suitable for insurance industry. Following steps to continue from there where research scope is leaving the work done so far, are Togaf frameworks following phases, where business, application, information system and technology architectures are processed forward and so on.

### 6.1 Interview about cloud adoption for insurance company

During the research, there was done supporting interview for development manager of insurance company working on IT-department. Aim for interview was to find out that what is current understanding and impression of cloud computing for industry to compare and support research outcomes. Interview questions are found from attachment 5.

Cloud is ranked at the moment quite high when discussing what cloud concept mean for insurance providers. Grounding on interview, most interesting objectives are at the potential cost savings with operating costs and reduce total costs of ownership. As a barrier between cloud is the lack of proper strategy for cloud adoption. This can indicate from that the IT environment is challenging with a lot of legacy systems. Core insurance business systems are complex, and it is costly renew these systems to be transferable for cloud platforms. And usually these core applications life cycles are typically long in the industry. With this industry specific complexity and long lifecycles there is always question about security, even cloud services security has gained its reliability. This is one reason why cloud adoption is little bit slower than on market approximately. Another reason might be that instead of cloud there have been built on legacy systems layer with specific apps, which are renewing the user experience and work efficiency issue.

Most popular approach for the cloud is at the moment hybrid cloud models, which are the combination of private and public clouds. Service models consist from Infra service level to software service level service agreements, even there is a lot of legacy systems and old servers running on premises at data centers maintained by vendors. Non business critical systems like office tools and content management with collaboration services are some of these found their way to cloud already. This indicates that easiest parts are moved already to be maintained on cloud, bust challenging and time consuming parts are still on the way. Most seemingly investment areas could be found from business support functions like data storages, data base services, HR systems and perhaps ERP and CRM solutions if the proper financial approach is found and usually it means pay as you go model with cloud.

This makes also sense with specific industry feature, which has at some points of time a lot of volumes using the services while other parts of period usage is on limited level. This challenge is supported also by cloud feature “high scalable”. Grounding on interview, there is a lot of potential for cloud adoption in industry, and when the cloud comes more familiar for insurance providers and life cycles comes to end, the building of new applications and systems entities are more preferable and attractive to start on cloud platform. Besides that, cloud adoption for industry needs proper strategy and architecture planning to maintain decent way phased cloud adoption with architecture.

### 6.2 Final words

Enterprise architecture is the process of aligning a business's strategic vision with its information technology. It connects different business units for synergistic communication and collaboration by pursuing a more seamless customer experience. With a proper stack of architecture methodologies with supporting and involved methodologies, which is supporting the enterprises strategic planning, the outcome of delivered artifacts meets the goals more precisely.

Research was assessing the business development with cloud at beginning, as well the challenges which needs to be notify with cloud adoption. There were often mentioned that it is most critical to define how the business will operate internally to support its environmental interactions how it will communicate internally and externally and what information it will deal with. That brought an own effect to architecture vision creation. Challenges which were notified at beginning of research are involved with technology and strategy related issues by not forgetting the security and business continuity are also most critical things to consider within cloud adoption process. This is not only from business perspective of architecture, it is more on all levels of architecture stack.

Because of the nature of research, which was stated within building a vision for enterprise cloud adoption, the possibility to change vision during following ADM processing is possible and true. But this is the normal process when working for architecture with Togaf ADM, change request for architecture is possible to made at any phase of architecture work. As request of architecture work was to establish cloud adoption vision, it is natural that within opportunities and solutions planning phase approach to selected cloud types and service models are assessed again after critical content parts of ADM. These critical parts are bringing to the decision board such critical information from very detailed level, that outcome of architecture vision can be change at once. If there is found such a details,

which needs to be assessed again from architecture perspective, architecture group with pointed stakeholders are deciding about the change in a steering of enterprise architect. The statement of architecture work defines the scope and approach that will be used to complete an architecture development cycle. It contains details and agreements from governance perspective for architecture. This artefact is not established for this research because of holistic approach of research. Architecture definition document is established during architecture vision phase which includes essential parts of architecture definition and covers partially the architecture statement document.

With the scope of CRM system and surrounding system areas of it were under assessing in this research. As interview outcome presents, its outcome does support architecture vision view also. Based on interview outcomes, it advocates the architecture vision with proposed mainly distributed hybrid cloud type with case sensitive service models like PaaS and IaaS. Noncore business applications can use by grounding the research public cloud with SaaS service model.

My own role within this research as having a lot of industry knowledge from insurance sector and from IT industry as well, is giving a support to perform it through. Working several years between business and It have left strong understanding on the layer, where the enterprise architecture is. Architecture reaches the aspects from enterprise planning layer bringing those business strategies, visions and processes to architecture for to work support the solution implementation in align with desired business objectives. And by supporting this, requirements management makes accurate involvements straight on IT layer, reporting the outcomes for architecture governance. That's simply the way processing the intentions to both directions, to IT from business and from there back to business. Working within different roles, as said between business and IT, during My career, has bring the aspects on work.

Finally, at the end of research all it came down to architecture. By the iterative viewpoint and operating model of Togaf ADM research brought out numerous artifacts basing on cloud theory and business objectives which were gathered for to develop business with cloud. Analyzed requirements, preliminary phase outcomes with architecture vision phase outcomes were mapped in to proper architecture elements to be traced and utilized during upcoming phases of Togaf ADM. Grounding on evaluated cloud service models and cloud types the architecture vision was defined and established for to cover insurance industry perspective. This research will offer an opportunity to utilize it for upcoming development cases or other master thesis works.

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## Attachments

# 1 List of business requirements with processed categorization

| Type of issue | Issue subject | EA Category | CEA Category | Requirement tracing |
|---|---|---|---|---|
| Benefits | Access to a variety of inexpensive applications that can help solve their business problems | Technical | Application | Architecture requirements |
| Threads | Assuming that straight simple convertion is the clear cloud migration path | Risk | Governance | Architecture requirements |
| Objectives | The ability to automate manual tasks | Technical | Management | Architecture requirements |
| Objectives | Dynamic Workload and Resource Manage-ment | Technical | Management | Architecture requirements |
| Objectives | Stay secure | Risk | Security | Architecture requirements |
| Benefits | Environmentally friendly | Technical | Technology | Architecture requirements |
| Benefits | Stop guessing capacity | Technical | Technology | Architecture requirements |
| Objectives | Replacing on premise legacy technology | Technical | Technology | Architecture requirements |
| Benefits | Increase business agility | Strategic | Business | Architecture requirements |
| Objectives | Enabling innovation | Organization | Business | Architecture requirements |
| Objectives | Better collaboration with co-workers and other stakeholders | Organization | Information | Architecture requirements |
| Objectives | Reliability | Organization | Security | Architecture requirements |
| Objectives | Work from anywhere | Organization | Business | Architecture requirements |

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|---|---|---|---|---|
| Benefits | Competitiveness | Strategic | Application | Assumption |
| Objectives | Expanding revenue opportunities | Strategic | Business | Assumption |
| Objectives | Faster return on investment | Strategic | Business | Assumption |
| Objectives | Gaining a competitive edge | Strategic | Business | Assumption |
| Objectives | Greater flexibility to react to changing market conditions | Strategic | Business | Assumption |
| Challenges | Employees are not receptive to cloud computing solutions | Risk | Business | Constraints |
| Threads | Believing anything can go into the cloud | Risk | Application | Constraints |
| Challenges | Concerns about the ability of cloud computing solutions to meet enterprise and/or industry standards (compliance) | Risk | Business | Constraints |
| Threads | Assuming existing IT staff can immediately handle a leap to the cloud | Risk | Business | Constraints |
| Threads | Believing your cloud service provider will handle everything | Risk | Business | Constraints |
| Objectives | Growth of business agility | Organization | Application | Implementation |
| Objectives | Improving customer support or services | Technical | Application | Implementation |
| Objectives | The ability to be more productive | Technical | Business | Implementation |
| Objectives | Development of new products or services | Technical | Integration | Implementation |
| Challenges | Concerns about the security of cloud compu- | Risk | Security | Implementation |

| | | | | |
|---|---|---|---|---|
| | ting solutions | | | |
| Objectives | Security meets the standards of business area | Technical | Security | Implementation |
| Threads | Blindly trusting automated scripts | Risk | Technology | Implementation |
| Benefits | Increase development speed and agility | Strategic | Technology | Implementation |
| Challenges | Concerns surrounding integration | Risk | Integration | Interoperability require-ments |
| Objectives | Heterogeneous Systems Support | Technical | Integration | Interoperability require-ments |
| Objectives | Integration with Data Center Management Tools | Technical | Integration | Interoperability require-ments |
| Objectives | Enhance effectiveness | Financial | Business | IT Service Management requirements |
| Challenges | Business leaders are not receptive to cloud computing solutions | Risk | Governance | IT Service Management requirements |
| Challenges | Difficulty measuring ROI/determining accurate economic value of cloud solutions | Risk | Governance | IT Service Management requirements |
| Threads | Moving to the cloud without a governance and planning strategy | Risk | Governance | IT Service Management requirements |
| Threads | Believing security is no longer your problem | Risk | Information | IT Service Management requirements |
| Threads | Treating the cloud like your on premises data | Risk | Information | IT Service Management |

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|---|---|---|---|---|
| | center | | | requirements |
| Objectives | Service Management | Financial | Management | IT Service Management requirements |
| Challenges | Lack of clear strategy or help from key vendors in adapting their applications to cloud computing platforms | Risk | Management | IT Service Management requirements |
| Challenges | Concerns about information governance | Risk | Management | IT Service Management requirements |
| Objectives | Disaster recovery | Technical | Management | IT Service Management requirements |
| Threads | Failing to monitor service performance | Risk | Management | IT Service Management requirements |
| Objectives | Automatic software update | Technical | Application | Service contracts |
| Objectives | Rapid time to market | Financial | Application | Service contracts |
| Objectives | Services focused on your business | Strategic | Application | Service contracts |
| Objectives | Availability | Organization | Application | Service contracts |
| Objectives | Flexibility | Technical | Business | Service contracts |
| Objectives | Enhance employee productivity | Financial | Business | Service contracts |
| Objectives | Enabling business continuity | Technical | Business | Service contracts |
| Objectives | Visibility and Reporting | Organization | Governance | Service contracts |
| Objectives | Improved access to corporate data | Organization | Information | Service contracts |

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|---|---|---|---|---|
| Objectives | Document control | Organization | Information | Service contracts |
| Objectives | Need for real time information | Organization | Information | Service contracts |
| Objectives | Security | Organization | Information | Service contracts |
| Objectives | Administrator, Developer and End User Interfaces available | Technical | Integration | Service contracts |
| Objectives | Automatic security | Technical | Security | Service contracts |
| Benefits | Trade capital expense for variable expense | Financial | Technology | Service contracts |
| Threads | Neglecting business continuity and disaster recovery planning | Risk | Technology | Service contracts |
| Benefits | Benefit from massive economies of scale | Financial | Business | Success measures |
| Benefits | Reduce operational costs | Financial | Business | Success measures |
| Benefits | Increased focus on business | Organization | Business | Success measures |
| Objectives | better time management | Organization | Business | Success measures |
| Objectives | Improved work/life balance | Organization | Business | Success measures |
| Objectives | Improved ability to serve clients and customers/meet sales goals | Strategic | Business | Success measures |
| Objectives | Cut the operational costs | Financial | Business | Success measures |
| Objectives | Reducing resource waste | Organization | Business | Success measures |
| Objectives | Lower total cost of ownership | Strategic | Business | Success measures |
| Objectives | Savings on capital expenditures | Strategic | Business | Success measures |
| Objectives | Increase revenue | Strategic | Business | Success measures |

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|---|---|---|---|---|
| Benefits | Stop spending money on running and maintaining data centers | Financial | Governance | Success measures |
| Benefits | Faster time to market | Strategic | Governance | Success measures |
| Benefits | Go global in minutes | Strategic | Governance | Success measures |
| Benefits | Capital expenditure | Financial | Governance | Success measures |
| Objectives | Increased collaboration | Organization | Information | Success measures |
| Objectives | Reduce development cost | Financial | Technology | Success measures |
| Objectives | Speed of development | Technical | Technology | Success measures |

# 2 List of stakeholders

| Stakeholder | Key Concerns | Catalogs, Matrices and Diagrams concerned |
|---|---|---|
| (Corporate Functions);<br>e.g., CEO, CFO, CIO, COO, CMO | The high-level drivers, goals, and objectives of the organization, and how these are translated into an effective process and IT architecture to advance the business. | • Business Footprint diagram<br>• Goal/Objective/ Service diagram<br>• Organization Decomposition diagram<br>• Business Capabilities catalog<br>• Capability/Organization matrix<br>• Business Capability Map<br>• Strategy/Capability matrix<br>• Capability/Organization matrix<br>• Business Model diagram<br>• Value Stream catalog<br>• Value Stream Stages catalog<br>• Value Stream/Capability matrix<br>• Value Stream Map |
| Program Management Office (Corporate Functions);<br>e.g., Project Portfolio Managers | Prioritizing, funding, and aligning change activity. An understanding of project content and technical dependencies between projects supports portfolio management decision-making. | • Requirements catalog<br>• Project Context diagram<br>• Benefits diagram<br>• Business Footprint diagram<br>• Application Communication diagram<br>• Functional Decomposition diagram<br>• Business Capabilities catalog<br>• Capability/Organization matrix<br>• Business Capability Map<br>• Strategy/Capability matrix<br>• Capability/Organization matrix<br>• Business Model diagram<br>• Value Stream catalog<br>• Value Stream Stages catalog<br>• Value Stream/Capability matrix<br>• Value Stream Map |
| Procurement (Corporate Functions);<br>e.g., Acquirers | Understanding what building blocks of the architecture can be bought, and what constraints (or rules) are relevant to the purchase. Acquirers will shop with multiple vendors looking for the best cost solution while adhering to the constraints (or rules) derived from the architecture, such as standards. The key concern is to make purchasing decisions that fit the architecture. | • Technology Portfolio catalog<br>• Technology Standards catalog |
| Human Resources (HR) (Corporate Functions);<br>e.g., HR Managers, Training & Development Managers | The roles and actors are required to support the architecture and changes to it. The key concern is managing people transitions. | • Organization Decomposition diagram<br>• Organization/Actor catalog<br>• Location catalog<br>• Application and User Location diagram<br>• Business Capabilities catalog<br>• Capability/Organization matrix<br>• Business Capability Map<br>• Strategy/Capability matrix<br>• Capability/Organization matrix<br>• Business Model diagram |
| Enterprise Security (Corporate Functions);<br>e.g., Corporate Risk Management, Security Officers, IT Security Managers | Ensuring that the information, data, and systems of the organization are available to only those that have permission, and protecting the information, data, and systems from unauthorized tampering. | • Product Lifecycle diagram<br>• Data Dissemination diagram<br>• Data Security diagram<br>• Actor/Role matrix<br>• Networked Computing Hardware diagram<br>• Network and Communications |

| | | |
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| | | diagram |
| QA/Standards Group (Corporate Functions); e.g., Data Owners, Process Owners, Technical Standards Bodies | Ensuring the consistent governance of the organization's business, data, application, and technology assets. | • Process/Event/ Control/Product catalog<br>• Contract/Measure catalog<br>• Application Portfolio catalog<br>• Interface catalog<br>• Technology Standards catalog<br>• Technology Portfolio catalog<br>• Value Stream catalog<br>• Value Stream Stages catalog<br>• Value Stream/Capability matrix<br>• Value Stream Map |
| Executive (End-user Organization); e.g., Business Unit Directors, Business Unit CxOs, Business Unit Head of IT/Architecture | The high-level drivers, goals, and objectives of the organization, and how these are translated into an effective process and architecture to advance the business. | • Business Footprint diagram<br>• Goal/Objective/ Service diagram<br>• Organization Decomposition diagram<br>• Process Flow diagram<br>• Application Communication diagram<br>• Business Capabilities catalog<br>• Capability/Organization matrix<br>• Business Capability Map<br>• Strategy/Capability matrix<br>• Capability/Organization matrix<br>• Business Model diagram<br>• Value Stream catalog<br>• Value Stream Stages catalog<br>• Value Stream/Capability matrix<br>• Value Stream Map |
| Line Management (End-user Organization); e.g., Senior Business Managers, Operations Regional Managers, IT Managers | Top-level functions and processes of the organization, and how the key applications support these processes. | • Business Footprint diagram<br>• Organization Decomposition diagram<br>• Functional Decomposition diagram<br>• Process Flow diagram<br>• Application Communication diagram<br>• Application and User Location diagram<br>• Business Capabilities catalog<br>• Capability/Organization matrix<br>• Business Capability Map<br>• Strategy/Capability matrix<br>• Capability/Organization matrix<br>• Business Model diagram<br>• Value Stream catalog<br>• Value Stream Stages catalog<br>• Value Stream/Capability matrix<br>• Value Stream Map |
| Business Domain Experts (End-user Organization); e.g., Business Process Experts, Business/Process Analyst, Process Architect, Process Designer, Functional Managers, Business Analyst | Functional aspects of processes and supporting systems. This can cover the human actors involved in the system, the user processes involved in the system, the functions required to support the processes, and the information required to flow in support of the processes. | • Business Interaction matrix<br>• Actor/Role matrix<br>• Business Service/ Information diagram<br>• Functional Decomposition diagram<br>• Product Lifecycle diagram<br>• Business Use-Case diagram<br>• Application Use-Case diagram<br>• Application Communication diagram<br>• Data Entity/Business Function matrix |

| | | |
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| | | • Value Stream catalog<br>• Value Stream Stages catalog<br>• Value Stream/Capability matrix<br>• Value Stream Map |
| IT Service Management (Systems Operations);<br>e.g., Service Delivery Manager | Ensuring that IT services provided to the organization meet the service levels required by that organization to succeed in business. | • Technology Standards catalog<br>• Technology Portfolio catalog<br>• Contract/Measure catalog<br>• Process/Application Realization diagram<br>• Enterprise Manageability diagram |
| IT Operations - Applications (System Operations);<br>e.g., Application Architecture, System & Software Engineers | Development approach, software modularity and re-use, portability migration, and interoperability. | • Process/Application Realization diagram<br>• Application/Data matrix<br>• Application Migration diagram<br>• Software Engineering diagram<br>• Platform decomposition Diagram<br>• Networked Computing/ Hardware diagram<br>• Software distribution Diagram |
| IT Operations - Infrastructure (System Operations);<br>e.g., Infrastructure Architect, Wintel support, Mid-range support, Operational DBA, Service Desk | Location, modifiability, re-usability, and availability of all components of the system. Ensuring that the appropriate components are developed and deployed within the system in an optimal manner. | • Platform Decomposition diagram<br>• Technology Standards catalog<br>• Technology Portfolio catalog<br>• Enterprise Manageability diagram<br>• Networked Computing/ Hardware diagram<br>• Processing diagram<br>• Environments and Locations diagram |
| IT Operations - Data/Voice Communications (System Operations);<br>e.g., Network Management | Location, modifiability, re-usability, and availability of communications and networking services. Ensuring that the appropriate communications and networking services are developed and deployed within the system in an optimal manner. | • Network and Communications diagram |
| Executive (Project Organization);<br>e.g., Sponsor, Program Manager | On-time, on-budget delivery of a change initiative that will realize expected benefits for the organization. | • Requirements catalog<br>• Principles catalog<br>• Value Chain diagram<br>• Solution Concept diagram<br>• Functional Decomposition diagram<br>• Application and User Location diagram<br>• Business Capabilities catalog<br>• Capability/Organization matrix<br>• Business Capability Map<br>• Strategy/Capability matrix<br>• Capability/Organization matrix<br>• Business Model diagram<br>• Value Stream catalog<br>• Value Stream Stages catalog<br>• Value Stream/Capability matrix<br>• Value Stream Map |
| Line Management (Project Organization);<br>e.g., Project Manager | Operationally achieving on-time, on-budget delivery of a change initiative with an agreed scope. | • Application Communication diagram<br>• Functional Decomposition diagram<br>• Environments and Locations diagram |

| | | |
|---|---|---|
| | | • Business Capabilities catalog<br>• Capability/Organization matrix<br>• Business Capability Map<br>• Strategy/Capability matrix<br>• Capability/Organization matrix<br>• Business Model diagram<br>• Value Stream catalog<br>• Value Stream Stages catalog<br>• Value Stream/Capability matrix<br>• Value Stream Map |
| Business Process/Functional Expert<br>(Project Organization);<br>e.g., Financials FICO® Functional Consultant, HR Functional Consultant | Adding more detail to the functional requirements of a change initiative based on experience and interaction with business domain experts in the end-user organization. | • Process Flow diagram<br>• Business Use-Case diagram<br>• Business Service/Information diagram<br>• Functional Decomposition diagram<br>• Application Communication diagram<br>• Business Capabilities catalog<br>• Capability/Organization matrix<br>• Business Capability Map<br>• Strategy/Capability matrix<br>• Capability/Organization matrix<br>• Business Model diagram<br>• Value Stream catalog<br>• Value Stream Stages catalog<br>• Value Stream/Capability matrix<br>• Value Stream Map |
| Product Specialist<br>(Project Organization);<br>e.g., Portal Product Specialist | Specifying technology product designs in order to meet project requirements and comply with the Architecture Vision of the solution.<br><br>In a packages and packaged services environment, product expertise can be used to identify product capabilities that can be readily leveraged and can provide guidance on strategies for product customization. | • Software Engineering diagram<br>• Application/Data matrix |
| Technical Specialist<br>(Project Organization);<br>e.g., Application Architect | Specifying technology product designs in order to meet project requirements and comply with the Architecture Vision of the solution. | • Software Engineering diagram<br>• Platform Decomposition diagram<br>• Process/Application Realization diagram<br>• Application/Data matrix<br>• Application Migration diagram |
| Regulatory Bodies - External<br>(Outside Services);<br>e.g., Financial Regulator, Industry Regulator, | Receipt of the information they need in order to regulate the client organization, and ensuring that their information requirements are properly satisfied. Interested in reporting processes, and the data and applications used to provide regulatory return information. | • Business Footprint diagram<br>• Application Communication diagram |
| Suppliers<br>(Outside Services);<br>e.g., Alliance Partners, Key Suppliers | Ensuring that their information exchange requirements are met in order that agreed service contracts with the client organizations can be fulfilled. | • Business Footprint diagram<br>• Business Service/Information diagram<br>• Application Communication diagram<br>• Business Capabilities catalog<br>• Capability/Organization matrix<br>• Business Capability Map<br>• Strategy/Capability matrix<br>• Capability/Organization matrix<br>• Business Model diagram<br>• Value Stream catalog<br>• Value Stream Stages catalog<br>• Value Stream/Capability matrix<br>• Value Stream Map |

# 3 Architecture principles

### Primacy of Principles

These principles of information management apply to all organizations within the enterprise.
The only way we can provide a consistent and measurable level of quality information to decision makers is that all organisation units affected are following the principles.

### Principle 1

Information management decisions are made to provide maximum benefit to the enterprise as a whole. Decisions made from an enterprise wide perspective have greater long term value than decisions made from any particular organizational perspective. Maximum return on investment requires information management decisions to adhere to enterprise wide drivers and priorities. Any minority group will not reduce from the benefit of the total because this principle will not exclude any minority group from getting its job done.

### Principle 2

Enterprise operations are maintained in spite of system interruptions for to achieve business continuity. The reliability has to be considered throughout systems design and use. Business premises throughout the enterprise must be provided with the capability to continue their business functions regardless of external events. Hardware failure, natural disasters, and data corruption should not be allowed to disrupt or stop enterprise activities. The enterprise business functions must be capable of operating on alternative information delivery mechanisms.

### Principle 3

Development of applications used across the enterprise is preferred over the development of similar or duplicative applications which are only provided to a particular organization. Duplicative capability is expensive and increases conflicting data.

### Principle 4

The IT organization is responsible for owning and implementing IT processes and infrastructure that enable solutions to meet user defined requirements for functionality, service levels, cost, and delivery timing. Effectively align expectations with capabilities and costs so that all projects are cost effective. Efficient and effective solutions should have reasonable costs and clear benefits.

### Principle 5

Data is an asset that has value to the enterprise and is managed accordingly.
Data is a valuable corporate resource with measurable value. In simple terms, the purpose of data is to aid decision making. Accurate, timely data is critical to accurate, timely decisions. Most corporate assets are carefully managed, and data is no exception. Data is the foundation of our decision making, so we must also carefully manage data to ensure that we know where it is, can rely upon its accuracy, and can obtain it when and where we need it.

**Principle 6**

Data is accessible for users to perform their functions. Wide access to data leads to efficiency and effectiveness in decision making, and efforts a timely response to information requests and service delivery. Using information must be considered from an enterprise perspective to allow access by a wide variety of users. Staff time is saved and consistency of data is improved.

**Principle 7**

Data is protected from unauthorized use and disclosure. In addition to the traditional aspects of national security classification, this includes, but is not limited to, protection of pre decisional, sensitive, source selection sensitive and differentiated information.

Open sharing of information and the release of information via relevant legislation must be balanced against the need to restrict the availability of classified, proprietary, and sensitive information.

**Principle 8**

Applications are independent of specific technology choices and therefore can operate on a variety of technology platforms. Independence of applications from the underlying technology allows applications to be developed, upgraded, and operated in the most cost effective and timely way. Technology becomes the driver rather than the user requirements itself.

**Principle 9**

Applications have to be easy to use. The technology is transparent to users, so they can concentrate on tasks. Ease of use is a positive incentive for use of applications. It encourages users to work within the integrated information environment instead of developing isolated systems to accomplish the task outside of the enterprise's integrated information environment. Most of the knowledge required to operate one system will be similar to others. As outcome, training is kept to a minimum and the risk of using a system incompletely is low.

**Principle 10**

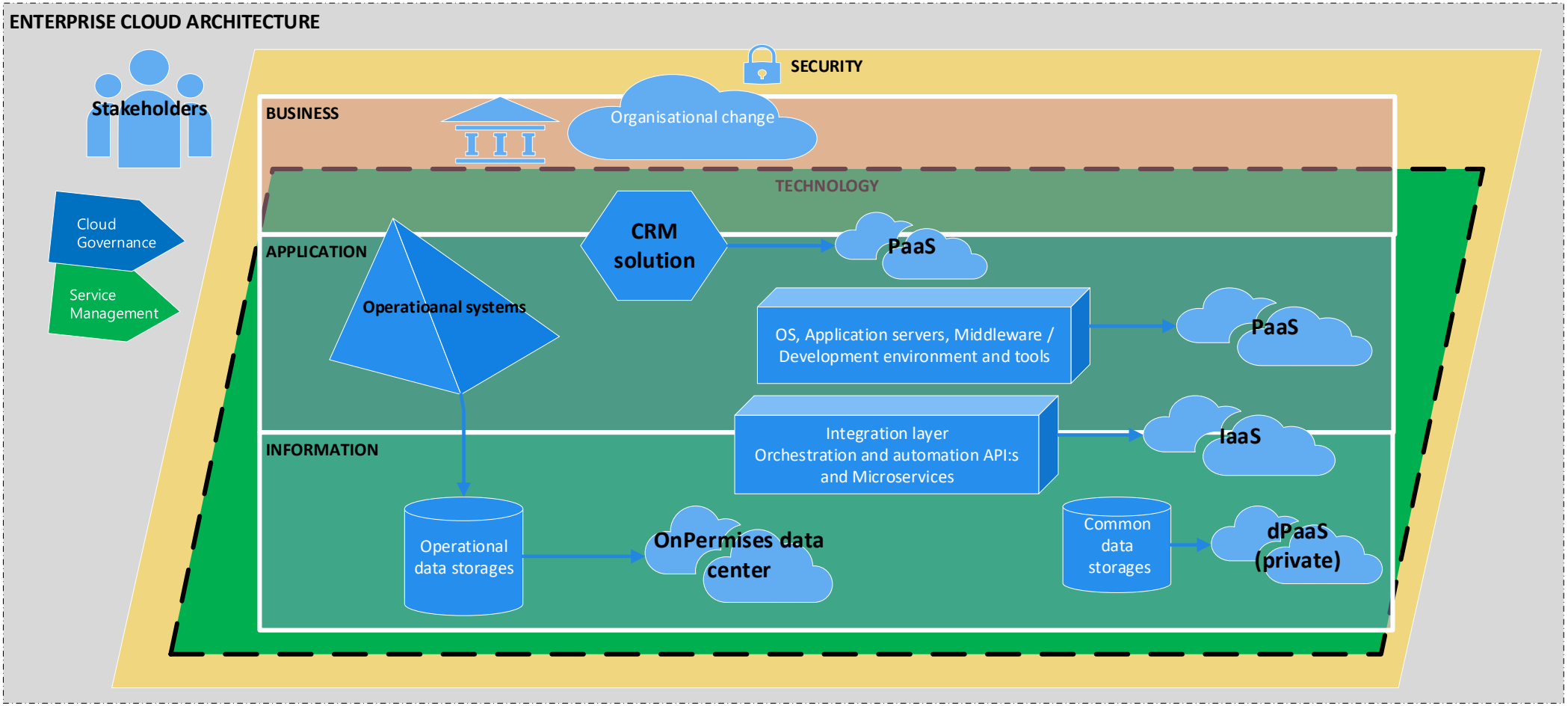
Software and hardware should conform to defined standards that promote interoperability for data, applications, and technology. Standards help ensure consistency but not improving the ability to manage systems and improve user satisfaction which help to protect existing IT investments and maximizing return on investment and reducing costs. Standards for interoperability help to ensure support from multiple vendors for their products, and facilitate supply chain integration.

**Principle 11**

Requirements based change to applications and technology should be done only in response to business needs. This principle will foster an atmosphere where the information environment changes in response to the needs of the business. This is to ensure that the purpose of the information support because the transaction of business is the basis for any proposed change.

A change in technology may provide an opportunity to improve the business process and change business needs. Unintended effects on business have to be minimized.

# 4 Enterprise cloud architecture



# 5 Interview questions and answers

Interview related on Insurance and Cloud performed at 5th of October on 2018.
Interviewee: Development Manager of IT department at Insurance Company

**What does cloud concept mean for insurance providers?**

- Cloud ranked still quite high by insurers.
- There is potential cost savings via utilising cloud which is turned as a challenge for IT to lower the operating costs.
- Generally at the moment on Industry there is not so many decent cloud strategy, the most ones are holding back or are testing the cloud to find out proper approaches
- For example test servers with storage, email, Sharepoint and office tools are the most usually cloud based solutions found from the cloud by companies. But not by all. Examples exist of organisations using SaaS like using SharePoint as a service but for intranet only.
- Majority of the companies have not moved their core business processes to the cloud or are not even considering it yet (e.g. policy admin, claims management)
- The other issue is the question of public, private and hybrid approaches. Reality for the insurance sector is the hybrid model where companies has some services on premises, and some based on the cloud.
- It is somehow unrealistic to expect full cloud models here during next years, even cloud has become more common within the industry.

**How do You think the cloud services can help the insurance business?**

- Usually it is just the cost, but in addition with cost perspective of course highly scalable compute infrastructure. From infrastructure view especially insurers have a 24/7 availability SLA, so here is a good use case for cloud.
- Of course if You might have only a low volume of business at the start, so a possible use case for cloud is for virtual infrastructure at a time in a business lifecycle where you might not want to commit to owning and operating your own infrastructure. And vise versa if You have eventually large volumes, but other major part of periods are more silent., the scalability of cloud can help on that.
- The insurance sector is quite fragmented capability and use old legacy technology. That tells that majority of insurers have not quite understood the value of the Internet for running the businesses

**What are insurance providers most keen to buy in the near future?**

- I can see there is investment in business support functions, noncritical areas such as storages, databases, HR, ERP and perhaps CRM…
- Of course some organisations will be more courage and adopt cloud services for more core apps, such as things like actuarial risk management modelling perhaps..
- Core application life cycles are typically long in this industry, for example with policy admin systems. Anyway, there is limited wiliness for high upfront costs, and an increasing interest in pay as you go model with cloud.

**What are the most important points with cloud to be aware of?**

- Barriers to cloud, because on insurance industry we have highly complex and heterogeneous IT environments and most insurers do not have a SOA enabled infrastructure and some of Us have built web apps on top of their mainframes, which indicates that none are fully cloud ready.
- Anyway, perhaps new applications could be more suitable candidates for the cloud. Even there is not used to remove bits of the business to cloud.
- Regulations prevent storage of client data remotely, privacy and access issues also. Security is always a concern within industry and everywhere.