cegeka

Hybrid Cloud

The cloud has become ubiquitous. It has also become inevitable. Smart organizations are no longer wondering whether they will make the move to cloud. They just want to know what business applications and datasets they should transfer to which cloud solution, and how they should approach this.

Yet you better not rush your journey in the cloud. Central to a cloud sourcing business case is the question: why am I doing this, and what is the added value? And which cloud strategy now fits best?

Keeping focus on the business drivers and prototyping on a small scale are the keys to success.

The use of cloud solutions is well established: almost every company is doing 'something' in the cloud, and some have even built their complete business model around it. There are tangible benefits attached to this: you pay for what you use, it is easy to scale in line with demand and you need little or no upfront investment.

Many companies opt for the hybrid cloud or even multi-cloud model by using a mixture of on premise (Edge computing), public cloud and private cloud. In other words, in a hybrid cloud model, organizations choose which workloads they deploy in which type of cloud platform. The datacenters where these workloads end up can reside at the customer (on premise or at the edge), at known public cloud providers e.g. Microsoft, Amazon or Google, or with the managed services / outsourcing partner (private cloud in datacenters of for instance Cegeka).

Most of the time, it will be a combination of these. Hybrid Cloud actually represents an ecosystem of cloud platforms, where each vendor and datacenter has its own specific added value to the enterprise landscape and the whole is working together seamlessly.

As a trusted cloud managed services provider, Cegeka helps you in its various roles as Cloud Broker, Cloud Consultant and Cloud Integrator to develop, implement and maintain a sustainable hybrid cloud strategy.

In this document, you will find Cegeka's vision on hybrid cloud. We hope it will help you as decision maker to learn what your cloud model of the future might be.

We wish you a lot of reading pleasure,

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Vision

1. Vision

1.1 CLOUD ARCHITECTURES

Let us start by charting the cloud landscape and clarifying a number of concepts and terms.

Cloud Computing, in the broadest sense, means that you no longer invest in classic IT hardware and software which is then placed in your own datacenter. Instead, you use IT infrastructure, platforms and applications (software) as a service. This underlying infrastructure is typically owned by someone else, is usually shared with other consumers and is often not located at your own location. Some examples: instead of buying your own servers, you rent server capacity in a datacenter at a cloud provider. Or: you do not purchase a CRM package, but log in via a web browser in a 'cloud' CRM solution for which you pay a fixed amount per user per month.

So using Cloud actually means a shift from 'product' to 'service': you no longer buy products, but obtain services from a cloud provider.

Model: SaaS, PaaS, IaaS

Exactly what you move to cloud solutions usually falls into one of the following three categories: software, infrastructure or platform. That is what is meant by the terms SaaS (Software-as-a-Service), IaaS (Infrastructure-as-a-Service) and PaaS (Platform-as-a-Service). On premise refers to what you physically operate at your own location.

The best-known form of cloud software is Software as-a-Service or SaaS, with some well-known examples being Microsoft Dynamics CRM online, Microsoft 365, SalesForce, but also e.g. Gmail or G Suite. SaaS is usually aimed at end-users and business owners.

PaaS refers to a platform offered via the cloud on which developers can further build and test cloud applications. Functions-as-a-service (FaaS) offer a new deployment model, but inherently many characteristics are shared with PaaS. Most importantly, they both offer a development framework.

IaaS is the domain of system administrators and DevOps developers, who can deploy and manage server capacity, storage or operating systems via cloud infrastructure. Containers offer more flexibility than traditional infrastructure, supporting and enhancing agile development methodologies. This gives the developers more control, flexibility but also responsibility over the infrastructure platform where the application will reside. By allowing application developers to create and manage compute resources in the cloud environments where the application lives, they will become more aware of factors that are typically neglected in application development, for instance data security, legal compliancy and application performance.

The degree of control and customization is the smallest at SaaS, and the largest for on premise solutions. A SaaS solution can be compared to a public swimming pool: when you use the service, you pay for it; but you also share the facilities with others (except for the private lockers). An on premise solution is more like a private pool at home. You set it up and use it at your own discretion, but as you are the owner, you are responsible for purchase and maintenance.

Location: public, private, hybrid, edge

Besides the 'what', there is also the 'how', or more specifically, the 'where', with the public and the private cloud as two major pillars.

In the **public cloud**, services are offered on external, public data servers, accessible directly over the internet. These providers are also called Hyperscalers. In the case of software (SaaS), this means that every customer buys the same functionality, with limited configuration and customization possibilities. To use the application, only an internet connection is required and the right set of credentials.

At the other end of the spectrum lies the **private cloud**. Where in a public cloud you have virtually no control over the data or the layout of the software and the servers (and sometimes do not even know where the underlying servers are located), that is not the case with a private cloud. The servers, or a protected part of them, are reserved exclusively for one customer and are located on premises or at a datacenter of the customers' choice. Thus offering more flexibility regarding configuration and customization.

A very often heard term is the **hybrid cloud**. As the term suggests, the hybrid cloud is a combination of various models and locations. Most companies have realized that a hybrid form of cloud computing corresponds to the most pragmatic use case. **Multi-cloud** is very similar to hybrid cloud, and very often the terms are used interchangeably. Typically, multi-cloud is used in a context where more than one public cloud provider is sourced, or when no private cloud component is present. Another connotation is that multi-cloud would lack management integration across the different providers, i.e. services are deployed in silo's or in isolation, whereas services in a hybrid cloud environment are offered in an integrated manner. This delivers more functionality, a better price, achieves higher availability and avoids vendor lock-in.

Non-critical resources such as development environments and test workloads are typically resources that are prime candidates for hosting in the public cloud, while (business) critical or sensitive workloads are often still hosted in a private cloud. But keep in mind: the availability for a test/dev environment might not be as critical to the company as the production environment, but if real-life customer data is entered, the security and compliancy processes are equally important as they are in the production environment.

Some other functionalities where most companies tend to use public cloud solutions are standardized "office" functions such as e-mail, messaging, collaboration, mobile device management, and even CRM.

Finally, **edge computing** is a term that starts to appear more often, mostly in conjunction with Internet of Things (IoT). Edge computing is a solution where date processing does not happen centrally (in a datacenter, cloud or mainframe) but rather in a distributed fashion. Computation happens close to or even on the devices where the data is generated. Use cases with very large amounts of unique data generators obviously create a link to IoT.

1.2 CHOICES BASED ON 'VALUE' AND 'TCO'

We expect that more than 85% of respondents indicated that their organization will embrace a cloud-first principle in 2025. (up from about 50% in 2020).

Gartner predicts that by 2021, more than half of global enterprises already using cloud today will adopt an all-in cloud strategy.

In addition, Gartner predicts that by 2026, public cloud spending will account for more than 45 percent of all enterprise IT spending.

The many challenges enterprises face in digitally transforming their business models are the leading contributing factor to cloud computing adoption. According to Microsoft's Chief Executive Officer, Satya Nadella, digital transformation will not happen with another bolted-on cloud app or a giant enterprise resource planning (ERP) implementation.

It will happen with systems that can adapt and grow to fit unique businesses and industries. It is essential to form a deliberate transformation strategy based on the business' unique goals and needs, rather than considering only the latest trends.

Successful adoption of the cloud requires organizations to first draw their strategy and principles. For creating the strategy and defining the principles, the organizations need to understand:

- what is the added value they want to achieve.
- how does the cloud adoption relate to the business goals.
- that the key to a cloud strategy is not to "lift and shift" data center content.
- that a datacenter strategy is not applicable to a cloud strategy
- that managing systems and applications in a public cloud requires additional processes and tooling

To help with the questions, we defined 2 pillars of focus for the enterprises when considering their cloud adoption:

1. Value

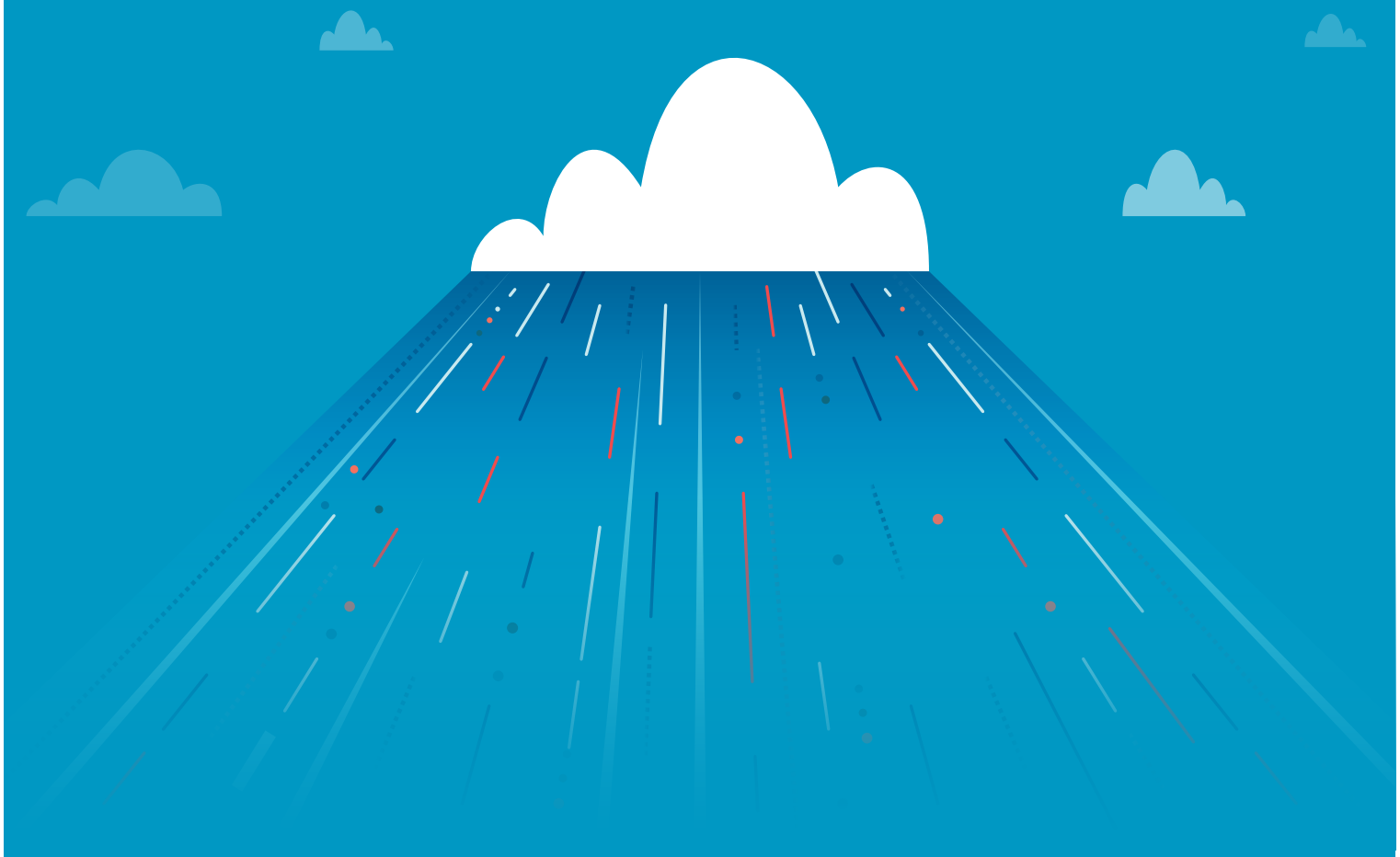
Moving to a cloud model allows companies to realize new business value: reach new markets, new audiences, become more agile, pursue new opportunities, etc.

- As-a-service: new (and potentially disruptive) technologies become easily accessible, through a pay-as-you-go model and limiting the need for upfront investments
- Leveraging external expertise allows you to focus on core activities
- Scalability and Flexibility
- Speed of deployment
- Ubiquitous network access: capabilities are available over the network and accessed through standard mechanisms.
- Cloud services are often more functionally complete, and typically receive functional upgrades first.

2. Cost

Digitally transforming enterprises is the leading factor driving greater public cloud engagement or adoption followed by the pursuit of IT agility. However, cloud adoption entails a number of challenges related to technology, security, change management, etc. Addressing these challenges has an associated cost:

- Cost control & Contract Management. Billing options (pay-as-you go is usually the most flexible model, but also the more expensive one on the long term).
- License management: not all licenses can be reused on every cloud platform, and a license strategy should be part when considering different cloud options.
- Lifecycle management: cloud providers may have different support windows for technology stacks, than those of the vendors themselves. Especially for legacy applications, this can be an important cost factor to consider.
- Compliance with international and local laws and regulations (for example GDPR)
- Vendor lock in: cloud portability remains a complicated and therefore costly challenge
- The need to change the user's way of working with the cloud based solutions, and adapting the business processes to leverage new cloud capabilities.



2

Journey to Cloud

2. Journey to Cloud

The new reality for more and more companies is the transition to a hybrid cloud solution portfolio, where many application workloads run on a mix of private and public cloud systems and integrate with data in on premise systems.

The reasons for this new way of working are diverse. Primary drivers often include cost efficiency and the need for 24/7/365 availability, while both the new business processes and the customers demand speed, flexibility and agility. At the same time, regulators more than ever demand continuous data security, user privacy and process compliancy in this new cloud landscape.

Organizations see multiple valid business reasons to migrate systems to a different cloud platform. It is harder to determine which cloud solution is the best, and what the cost, duration and impact of the transition will be afterwards. Which is the optimal migration path? How to avoid risks in compliancy, security, cost and downtime?

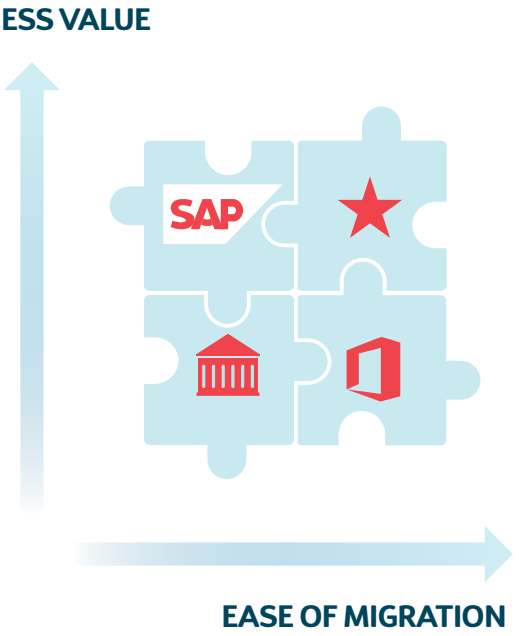
To get a good insight into this, a cloud strategy is crucial. Such a strategy consists roughly of three phases: identification, transformation and management.

2.1 PHASE 1: IDENTIFICATION

The first objective is to get a holistic overview of the application and data landscape, for example during a series of workshops, and determine which systems and applications require a transformation.

The outcome should be an overview of the major business applications, their current TCO, and a good understanding of their added value for the enterprise (their 'reason to be' – which every system, server and applications should have). An overview of the risks and limitations associated with their current operations should also be included.

A key deliverable is the Cost/Value quadrant that will facilitate the decision making process for the roadmap of the application landscape:



The final goal of the identification phase is to create a list of business applications and systems with their business value (e.g. cost efficiency or innovation), their state of 'cloud readiness' (e.g. safety, regulations and technology), and a set of "cloud objectives" for each application. This provides the input to create an enterprise-wide application transformation program aligned with the business strategy and in sync with the costs and risks that the company wants to invest and control.

2.2 PHASE 2: TRANSFORMATION

The aim of this phase is to put the roadmap from phase 1 into practice, tackling the quick wins on the short term and creating a migration program and a supporting business case for the long term transformations.

Keeping your legacy systems under control: within every company, there are applications that work just fine as they are. There are no immediate benefits in transforming these applications. In this case, the main focus should be to keep cost and maintainability under control. Some optimization may be possible by rehosting. Depending on their relevance to the business, the choice will be made to retain or to retire specific functionality.

Flexibility: Replacing legacy systems by repurchasing or upgrading applications offers more flexibility towards the future. It eliminates the risk of technical debt, associated with keeping legacy systems alive. Moving towards a new, open platform can help prevent vendor lock-in. Modern platforms also present new opportunities regarding scalability.

Radical Innovation Path: A more drastic option is to completely refactor the applications. Functionality is re-implemented according to a new, cloud-native paradigm. The Agile methodology and DevSecOps principles are essential on such a journey; two domains where Cegeka has ample experience.

Refactor	**In order to create high added value, while potentially reducing TCO for the application, a radical innovation path might be taken. In this scenario, an application might be refactored to support the new needs of the company and its customers, while at the same time supporting cloud-based infra-structure as the underlying platform.**
Repurchase **Replatform**	**Less transformational is the choice to replatform the applications to a new underlying cloud system (with application modifications to support the migration). Replatforming often makes use of PaaS capabilities. Or one can repurchase a new application system (possibly in SaaS model) to replace the functionality of the legacy systems. These transformations should completely remove legacy risks, and should also lead to more flexibility to integrate with the rest of the enterprise application landscape.**
Rehost **Retain**	**To help getting cost and risks of legacy systems under control, retaining or retiring the application system as-is, or rehosting it to new (supported) hardware and operating systems, can all be valid options.**
Retire	**It is also possible to combine these with the relocation to a new datacenter location in order to guarantee and improve availability.**

2.3 PHASE 3: MANAGEMENT

The goal of this phase is to keep the (cloud) IT landscape functioning optimally, and to ensure that it stays cost-efficient, performant, secure and compliant. In this phase, external cloud providers require periodic evaluation in order to maximize their benefits and minimize the associated risks.

Using multiple cloud providers - also known as cloud sourcing - has an impact on the internal IT organization. The IT department must learn new skills and understand why and how the cloud solutions are selected and implemented. After all, every organization stays responsible for the final governance and design of its application landscape.

In this phase, Cegeka can help with its experience as cloud-managed services provider.

A modern Enterprise IT landscape covers a multitude of architectures. Depending on the application requirements and technical requirements, they are implemented on premise, decentralized or in an external cloud service. This combination of choices makes the integration and management of various IT services complex.

By outsourcing their infrastructure, companies can eliminate a number of risks around the day-to-day IT operations (independently of the cloud platform where they are hosted), and focus on their core business and their customers. After all, a cloud orchestrator has more knowledge and experience in this domain, combined with the staffing to manage a multi-cloud IT landscape.

The integration of different cloud platforms into a single multi-cloud application landscape is becoming increasingly important. Cegeka can help its customers with different expertise and solutions, at every stage of their cloud journey.

A) Cloud Consultant

The consultant helps create an analysis of the existing IT landscape by performing an assessment, including the business and technology risks and pains. This will help answer the essential questions regarding which applications are 'cloud-ready' (and for which cloud platform) and what is the expected cost and the added value of such a migration. The result is a clear roadmap with a vision on how the IT-landscape can transform - for example towards a hybrid multi-cloud environment - and the business case to support the roadmap.

B) Cloud Broker

Cegeka offers most of its services in a cloud model. This means fast and flexible to order, with an as-a-service SLA and on a pay-per-use billing model. This gives our customers maximal agility to support changing business requirements. We use this model both for the internal managed services (solutions that Cegeka fully controls and hosts in its own datacenters) and – as much as possible - for the services of the cloud providers which we have a partnership.

We also try to avoid vendor lock-in by selecting open platforms wherever possible, combined with a data-exit strategy from the moment of engagement.

In summary, the broker is an expert in offering the right cloud solution for every application. We are also responsible for keeping an eye on the market and bring innovation to our customers.

C) Cloud Integrator

There is a lot of technical complexity under the hood of a hybrid cloud environment. The cloud integrator creates and manages a migration program based on the defined vision and roadmap. This determines if, how and when business applications will be transformed, while guaranteeing that all applications remain consistently integrated with each other during this journey. This demands quite some integration expertise when it comes to connecting different cloud models.

D) Cloud Director

After the cloud transformation program, the journey continuous. Managing a hybrid cloud environment is far from trivial. It involves managing various suppliers, contracts, SLAs, preconditions, invoicing schemes, costs and game rules in an ever-changing IT landscape. The director is the 'single point of contact' with the mission of relieving the customer of the operational worries.

E) Cloud Innovator

In a cloud environment, innovation means the ability to continuously align the business processes with the best matching cloud solution. The managed services partner-as-innovator looks at the global picture: he ensures that all pieces of the puzzle are in the right place and fills in the gaps that are created by changes in the market. Vendors may disappear or merge, technology changes faster than ever and due to changing volumes and prices of cloud platforms, the cost of an application can change fast.

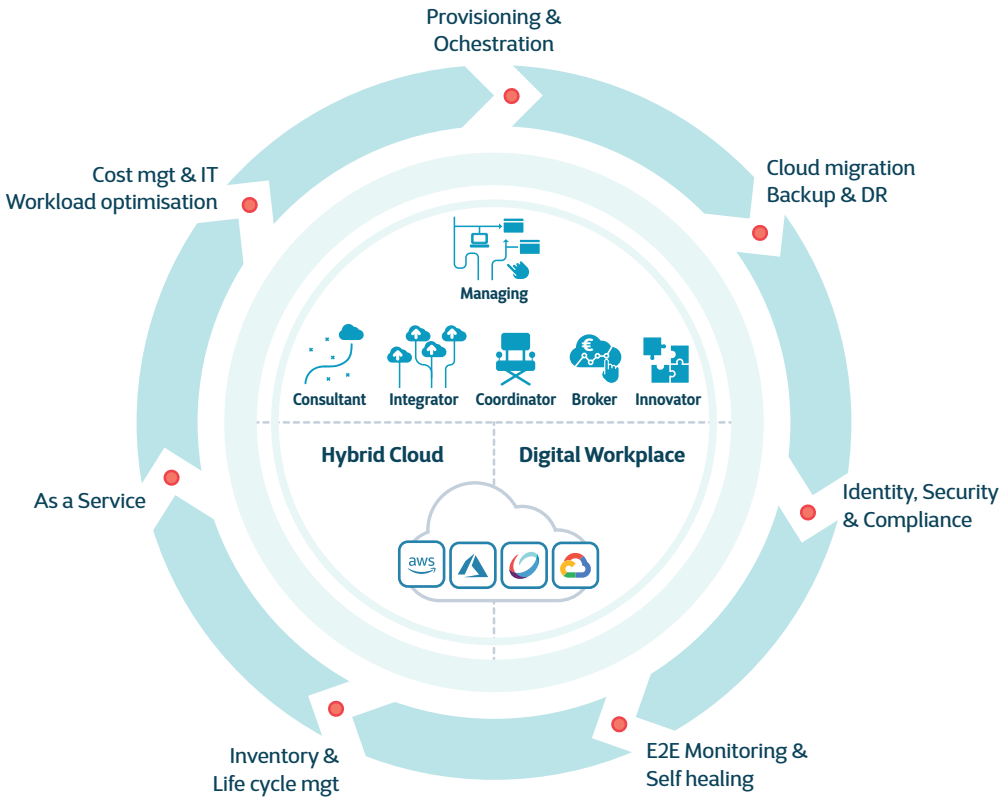
These changes should not come to the business as a surprise, but rather be communicated in advance, together with the mitigating actions to adapt the cloud platforms when required. Therefore, the role of cloud innovator is every bit as important as the other four.

3

Cloud Service Portfolio

3. Cloud Service Portfolio

3.1 FULLY MANAGED HYBRID CLOUD



Although cloud services are already heavily used, the need for local data centers and on premise systems still remains. Most organizations still have plenty of legacy systems that do not fit a public cloud model. These systems need to work in conjunction with new cloud solutions. A hybrid architecture is essential. Cegeka offers a complete hybrid services portfolio and supports flexible hybrid architectures.

Cegeka's solutions manage public cloud resources using the same platform as on premise resources; deploy security monitoring, management and prevention solutions that span both environments. In this way, we create an integrated, fully managed, hybrid ecosystem.

Essential in this approach is the Cegeka cloud, our own datacenters, where we operate private cloud services, and the premier partnerships we have with all major public cloud providers. The linking pin are the low-latency high-speed WAN connections between our datacenters and to the public cloud providers, allowing us to support more flexible hybrid architectures.

On a more high-level basis, it is important to have a proper architecture and approach to a hybrid set-up. Having an auto-scaling front-end in the cloud connected to the database back-end on premise seems like a good design to start with, but it will only work for applications that support some

network latency. Well thought-out architectures and migration paths are important to ensure proper operation of the systems.

When building hybrid solutions, the native tools for monitoring, back-up, identities, security, etc. may not be sufficient. There arises a need for solutions that span both on premise and cloud services to be able to be in line with business continuity processes and information security. Cegeka's solutions bridge that gap, with ability to manage cloud resources with the same platform as on premise resources, deploy security monitoring, management and prevention solutions that span both eco-systems, etc.

A hybrid cloud solution allows the focus to shift from back-up and replication to securing always-on data availability, and from systems monitoring to end-to-end application performance monitoring. Containerization is an excellent example, as it allows you to deploy, manage and scale the same application instance to multiple cloud platforms. These cloud-native deployment methodologies require less supporting infrastructure services such as middleware, back-ups and replicated storage.

Our managed container platform is therefore an essential component of our fully managed cloud proposition. It allows you to modernize your application landscape, to make use of cloud native technologies, and to integrate between on premise legacy environments, and workloads deployed in the public cloud.

3.2 CLOUD RESOURCE OPTIMIZATION

We understand that choosing a single cloud provider can be challenging. Companies must straddle two worlds: the infrastructure that powers the business of today and the innovative cloud technology required for the business of tomorrow.

For the best possible outcome, applications require specialized, fit-for-purpose infrastructure. All cloud providers have unique strengths, models of delivery and pricing strategies. Some workloads can be a perfect match for the offering of a provider while others might better match the offering of another.

Businesses need to choose the right cloud offering for their solutions, but also have to consider the pace at which cloud providers innovate and update their offerings.

We embrace the diversity and help you manage the complexity at every step. We will proactively advise you where it is best to place the workloads, work with you to design and review the on premise environment to allow for Hybrid-cloud connectivity and via the Hybrid-cloud orchestration we will ensure entropy challenges are offset by enabling a common operational framework. We take care of provisioning and workload optimization allowing you to make the most out of the cloud offerings on the market.

3.3 SINGLE PANE OF GLASS FOR HYBRID CLOUD

Every cloud provider offers its own portal where customers can view their asset inventory, check basic performance and availability metrics as well as review the costs. This experience has set the bar regarding customer expectations when managing their cloud environment.

However, when working with a hybrid-cloud setup, some challenges become apparent: portal user interfaces are significantly different and each provider keeps adding features and revamping their portal look and feel; the naming terminology for otherwise similar resources differs between providers; although some providers provide limited options for adding visibility for on premise resources on their portals, there are very little, almost-non-existent options to add visibility for resources running in competing providers' clouds.

Managing a multi cloud environment is obviously more complicated. Despite the fact that a managed services provider can take on this management role, customers still expect to get instant visibility on their environment. In their interaction with their partner, they want to be serviced instantly, and have an experience devoid from difficult choices, or complexity.

Cegeka's Hybrid-cloud enabled customer portal allows the customers end-to-end visibility for all resources running in all supported clouds, key performance metrics and availability as well as a single pane of glass regarding costing.

This way you can always keep track of all assets and easily manage the costs.

3.4 PORTABILITY

According to Gartner, the public cloud worldwide market will experience a compound annual growth rate of 29.2%, by 2027. The cloud providers innovate, review and update their offerings to attract new customers and more business from existing customers, but at the same time they also implement strategies to try and keep the customers using their own offerings.

As the competition for customers grows, so do the strategies of the vendors for locking-in these customers. Sometimes, especially for SaaS, they provide tools and processes to make the intake fast and simple, but data export is obfuscated through proprietary formats, they charge for egress traffic, they obscure access to tools and features required for exporting data, and so on.

Although the risk of lock-in can never be eliminated completely, we recommend to use portability as a guiding principle at all stages of your cloud journey.

We help customers to make the journey towards the cloud with a clear focus on portability and hybrid-cloud deployment of redundant solutions. Besides lock-in avoidance, our customers also get the added benefit of a provider-independent disaster recovery solution.

Standardization on container technology represents a major step in fostering cross-cloud workload deployment and in promoting portability. Cegeka can assist you in implementing managed container platforms in the hybrid cloud, and help you in transforming your application landscape to turn it more agile and more portable.

3.5 DEALING WITH SHADOW IT

Public cloud consumption is often initiated by end-users (mostly SaaS) and internal application developers (mostly PaaS), because it is so easy to procure and start using these services. Day 1 operations (deployment) tend to get priority, whereas day 2 operations (when value is delivered) are often overlooked.

Bypassing corporate IT, or introducing Shadow IT, will therefore occur quite frequently. At the same time critical aspects like Security and Enterprise Architecture fall along the wayside.

This is where Cegeka can help: we will embed the desired (shadow) functionality into the overall architecture while ensuring that day 2 operations remain manageable, and guaranteeing a secure way of working.

We can provide optionally a Lead Architect who takes ownership of the end-to-end infrastructure landscape. He is experienced in managing complex hybrid cloud landscapes, takes care of integration of the platform or service with other business systems by means of Integration Platforms, data exchanges, business intelligence, API gateways, etc.

For Information Security, it is not just ensuring that the solution is properly secured, but equally important is ensuring that access to the platforms is properly governed and that availability and business continuity is sufficiently guaranteed at all times.

As cloud platforms and services easily introduce shadow IT, it is important to embrace these solutions together with Cegeka and the internal IT organization, to ensure that they are embedded in the organization and that costs are properly controlled. This will help shift the efforts from day-1 operations (deployment) to day-2 operations (efficient life cycle management), with benefits in efficiency, cost control, security and compliancy.

3.6 SUPPORTING DEVOPS

Customer expectations are higher than ever, the cost of software development is under pressure and shorter innovation cycles are required. The time to incubate new ideas shortens fast and the organization must be able to cope to deliver compelling solutions that support the businesses.

The transition to a DevSecOps-style of application development and management is closely related to the adaptation of cloud platforms and services, since new cloud solutions typically support DevSecOps deployment pipelines via API interfaces and application connectors. Therefore, any application transition project, even when rehosting or retaining is the chosen business scenario, should bring more flexibility in the supporting systems and platforms to integrate with agile build pipelines. Supporting DevSecOps is not only applicable in application development projects, but can also help managing off-the-shelf applications to run and integrate in a hybrid multi-cloud landscape. More DevSecOps support means more flexibility in moving applications and workloads between clouds when required, easier and better tested upgrades and overall a more agile IT landscape which can quicker and with less costs adapt to new business evolutions and requirements. DevSecOps is not about tooling (alone), it is a state of mind on how to deploy and manage applications in a Hybrid-cloud landscape.

The Cegeka software factory delivers new solutions in an agile way, using lean investment principles, not relying on a backroom strategy but 24/7 in contact with the customer to deliver what is required. The Cegeka managed container platform helps to fully support this strategy.

4

Dealing with Cloud complexity

4. Dealing with Cloud complexity

4.1 INTEGRATION PLATFORM AS A SERVICE (IPAAS)

In an ever-changing world, digitalization of business processes to support the operational reality of companies has come a long way. As many companies assemble an impressive digital landscape of software, solutions and platforms, the need arises to take a step back and look at how these different building blocks are interconnected.

We believe that integration is a strategic cornerstone in today's digital world. You need to manage your solutions end to end, control data streams and connectivity, and be on top of processes with partners and suppliers.

Gartner defines IPaaS as a suite of cloud services enabling development, execution and governance of integration flows connecting any combination of on premises and cloud-based processes, services, applications and data within individual or across multiple organizations.

Put more simply, you can expect:

- IPaaS is like a network router, but for data and applications instead of network traffic
- The managed integration service is comparable to DevSecOps: in DevSecOps a new release is a non-event, within the managed integration service, integrations are a non-event.
- It enables end-to-end process management, by covering the layer inbetween infrastructure and applications

Cegeka has developed a managed integration service, allowing you to integrate applications and partners in a universal and flexible way. Configuration is centralized and integration can be managed from a single location: Integrating becomes a non-event.

On a higher level, your business agility gets a boost while integration costs are reduced. Your organization will be prepared for a digital, heavily connected and data-driven future.

4.2 MANAGING CLOUD ENTROPY

Cloud vendors are releasing new features or improving on the old features at an accelerating pace to meet increasingly stricter and higher demands for security, availability, pricing models and functionality. Limiting to one provider, seems that one would limit themselves. Adopting a multi-cloud strategy is a double edged sword. Businesses will be able to make the most out of what the clouds can provide but at the same time they will add further complexity to their environments. So what is a leader to do when faced with a highly complex organization and a nagging concern that the creeping costs of complexity might start to outweigh the benefits?

Every cloud vendor focuses on their own solutions. They have very few motives to try and align their solutions with the other vendors. Applications, services and database vendors focus on their own products as well. This leaves the organizations with several key challenges in the area of a uniform security model, identity and access management, abiding to laws and regulations with respect to data sovereignty and being able to present a unitary framework to your departments. For example how to make sure that resources are deployed in the

cloud with the best offering for the service and how do we determine which is the right cloud.

We provide our customers with the tools, the processes and the expertise to help them manage the multi-cloud entropy to maintain consistency and accuracy or both vision and security.

- Processes to define and clarify requirements as well as ensure the fulfillment of requests and changes
- Architecture with a focus on consistency and agility
- Infrastructure as a code approach to the delivery of resources
- Orchestration and workflow automation tools
- Single pane of glass portal to view the cloud resources
- Unified monitoring and management solutions

4.3 REMEDIATE CHALLENGES OF CLOUD VENDOR LOCK-IN

With a strong competition in the cloud market, it comes as no surprise that vendors are trying to bind customers to them for the long term and avoid them leaving or downscaling used resources.

Besides innovation and addition of new services or improvement of the existing ones, the vendors also adopt lock-in tactics to make it as complicated and expensive as possible for customers to leave. These range from the usual contractual periods that stretch for many months (or even years) in exchange for bonuses. Other approaches include the use of technical solutions that either limit the output of migration data or make it very expensive (customers pay for retrieving data from storage services and egress traffic or output data format is only compatible with the vendors' solutions).

Even though completely eliminating the lock-in is not technically possible or feasible, we help our customers to mitigate the lock-in challenges by:

- Architecting the environment with portability as a principle
- Designing redundant solutions and services that stretch multiple clouds
- Implementing orchestration and workflow automation tools and processes to migrate data with the least amount of interruption to the business
- Implementing managed container platforms

5

Top 10 Challenges of the CIO

5. Top 10 – Challenges of the CIO

1. Why is a well-considered 'cloud strategy' necessary?

The cloud has a major impact on the IT environment, but in many cases organizations do not have a clear integrated strategy for the cloud. A possible cause for this is a lack of knowledge of cloud architecture and integration standards.

It is also likely that you are already using cloud solutions without being aware of it. Individual employees as well as departments often use low-threshold cloud services such as Dropbox, OneDrive or Evernote and even IaaS and PaaS services without the IT department being aware of it, let alone that a cloud-based strategy has been defined in order to steer this in the right direction.

Although the total cost of a given cloud solution is by far the most decisive factor for (sometimes incorrectly) choosing the cloud, organizations must also consider other aspects. The regulations within the sector, performance, data security and privacy risks, service level agreements, exit strategy and the existing infrastructure can all have an influence on the decision process.

A well thought-out cloud strategy that is included in the IT strategy and that is part of the sourcing strategy will help IT and business make the right cloud choices. It is essential to determine what is necessary to realize future improvements, such as cost control, flexibility, scalability, availability or security.

2. What can be a 'cloud strategy' within my company?

With the specific goals from the cloud strategy it is possible to enter into a long-term partnership with a reliable cloud service provider. A cloud strategy helps a company to make well-founded strategic choices for cloud sourcing a success.

Once this is clear, cloud sourcing can mean cost optimization on the one hand and increase service to the business on the other. A strategic approach will make the risks transparent. It is a logical step for the CIO to achieve optimum cost control, flexibility, scalability and security.

Such a strategy should describe why and how cloud should be leveraged and what benefits should be derived. Making this measurable will allow to verify projects against this strategy and assure that requirements are met.

3. How do I implement a 'cloud strategy'?

A cloud strategy starts with making the objectives clear and concrete. Examples of objectives are more flexibility, pay as you use, capacity on demand, increase the service, reduce the TCO, etc.

Then a vision is formulated with a corresponding policy based on certain starting points and principles. Finally, a cloud roadmap identifies which cloud services are suitable for existing IT services and applications.

Identifying the business applications in a clear cost/value quadrant, taking in account their 'cloud readiness', is the first step in determine the best scenario per application. These vary from retain,

retire or rehost to more ambitious and drastic actions such as replatform, refactor or either repurchase.

Whichever transitions are chosen, the result should be a multi-cloud IT landscape that is easy to operate cost-efficient, performant, secure and compliant.

4. Which components in my lots are eligible for the 'public cloud'. In other words, where do we find a 'mature public cloud'?

In this vision document you can find several reasons for choosing the cloud, but if you want to move applications to the public cloud, it certainly benefits in the following situations:

- Non-production environments that can work in isolation.
- For using IaaS, mainly systems or applications that can benefit heavily from auto-scaling or from being switched off during significant periods of time in a month
- Development and test environments that require a high degree of self-service from developers
- Business applications that can work in isolation or through API's and have no high-bandwidth and/or low-latency link requirements with on premise systems in local data centers.
- Cloud native applications and SaaS solutions

Currently Amazon AWS, Microsoft Azure and Google GCP are the main players that have sufficient maturity to offer cloud services for companies. This is also confirmed by Gartner (2018 Magic Quadrant for Cloud) and by Forrester Wave.

5. What requirements do I impose on my cloud orchestrator?

A cloud orchestrator needs to integrate different cloud services to provide an optimal and flexible solution for the functional and technological needs of your organization.

If few cloud services are purchased, the orchestrator's influence can be limited to the migration project towards the cloud environment. Typical example is a mailbox migration to Office 365. In a more complex landscape, a holistic view is necessary. The focus of a cloud orchestrator should not be on the (technical) orchestration of the various cloud services, but on providing a holistic overview at all IT levels: cloud strategy, architecture, governance, security and compliance.

6. What are the typical 'integration issues' when I choose a mix of 'clouds'?

If you have to manage different suppliers because you have outsourced all sorts of lots in IaaS, PaaS or SaaS, you first have to make sure that everything works together and that the business gets an integrated service with the right service levels.

Today, different technologies and solutions exist to help smoothen the ride to hybrid or multi-cloud and manage orchestration better than before.

If a certain process in the business application does not run smoothly, does this relate to the financial package A or to the logistics package B? Someone must be responsible for giving an answer and directing the solution.

You can place this responsibility with your own IT department that carries out the integration and manages the various suppliers. Practice tells us that the large majority of organizations prefer to do this themselves because they have more control and grip, but this of course also has an influence on the IT department. In addition to knowledge of the business processes, knowledge of service integration, management processes, compliance dependencies, etc. is also required for good cloud management.

Because of the specific skills that are needed, it may be interesting to bring this up to a third party, like Cegeka. One option is to retain the ownership of the architectural choices, but to outsource the operational service integration. Another option is to outsource the architectural process to an external provider like Cegeka as well, in close cooperation

with the local IT department.

7. What are the foundations for a 'cloud architecture'?

Once you have developed a cloud strategy, the next step is the selection and implementation of cloud services and integration into the existing IT landscape. Cloud architecture helps to determine the necessary preconditions for success.

The foundations of a cloud architecture are the same as those of an enterprise architecture: it is about defining architectural principles that relate to the business (the supporting processes), the information (the information supply) and the technical architecture (the IT facilities).

In many cases, the existing cloud services do not differ fundamentally from existing on premises applications, as a result of which the information and technical architecture principles in particular are applicable when deciding whether or not to work via the cloud. However, end-to-end managing the multi-cloud application landscape might require new tooling for deploying, securing, running and monitoring (day 1 and day 2 operations). Choosing the right flexible cloud solutions will help diminish shadow IT and support agile application development in a DevOps framework.

8. Applications are the drivers for the underlying infrastructure. How do you ensure a good connection with the available cloud portfolio?

In the chapter 'Journey to Cloud' we discussed the important identification process of the application landscape. Based on the outcome of the identification, a transformation roadmap is defined for each application.

A good connection of the application requires an overview of the applications that are suitable for a cloud migration or of the initiatives that are needed to prepare them for the cloud, this overview is the result of the identification process.

Cloud strategy, architecture and policy form the context for making decisions.

9. What are the challenges if I want to switch cloud providers?

Although the majority of the services provided are similar in functionality, each cloud vendor employs different technical solutions in order to edge the competition and, in their view, provide an innovative, better, more reliable, secure and cost-efficient service to the customers. Therefore, migrating between cloud providers remains a complicated and costly endeavour, especially when portability and the multi-cloud approach were not included in the cloud adoption strategy of the customer and in the design of the environment.

We help customers to make the journey towards the cloud with a clear focus on portability and multi-cloud deployment of redundant solutions. We also emphasize the standardization on container technology which represents a major step in fostering cross-cloud workload deployment and promotes portability.

10. Different cloud providers all use different price strategies. How do I get transparency in pricing for my resource consumption?

Cloud providers typically offer their own portal with views on asset inventory and resource. Information on other public cloud environments, outside their own offering, is however not included.

A multi-cloud portal will allow customers end-to-end visibility for all resources running in all supported clouds, key performance metrics and availability as well as a single pane of glass regarding costing.

This way you can always keep track of all assets and easily manage the costs.

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