Cloud Infrastructures – Last Call for Boarding

Cloud Computing Ensures Successful Future-Proof IT

Contents/

Executive Summary/

- **Cloud barriers are breaking down or changing –** The debate about the public cloud has changed. IaaS providers have evolved significantly, honed their portfolios and adapted to the needs of all kinds of company. Along with prices, security aspects and entry points, the debate is now also focused on the array of technologies and features in a connected multi-cloud world..

- **The cloud reality means hybrid and multi-cloud –** Integration, connectivity and variability are the new capabilities of a digital infrastructure. Numerous cloud deployments and services are finding their way into companies, enhancing or replacing the existing infrastructures. Orchestrating this diversity and adapting flexibly to new requirements are the essential requirements for corporate IT.

- **Cloud evolution in-house –** Only a few companies are taking the plunge and switching over to cloud excellence at a stroke. Most companies are embracing the cloud gradually and adapting their architectures to the connected hybrid- and multi-cloud architecture over the course of several milestones.

- **It's the provider, stupid! –** There is an increasing focus on choosing a cloud provider. Many companies need not one, but several providers for their architectures. Selection based on criteria relating to complexity, performance, integration and security must be carried out at an early stage, but with due consideration. A partner on an equal footing that is on hand throughout the entire development process is a good choice for many companies.

- **How to start with cloud computing –** Entering the cloud is possible especially with the basic services of the cloud providers. Less complex yet still high-quality infrastructure-as-a-service offerings are a good way of putting initial workloads onto the cloud. Switching to a cloud-hosting model and using the core features of infrastructure as a service (compute, storage, network) can mean significantly improved flexibility and agility for many workloads.

#01

Cloud-Computing Status Check

The Questions That CIOs and Companies Should Really Be Asking Themselves Now
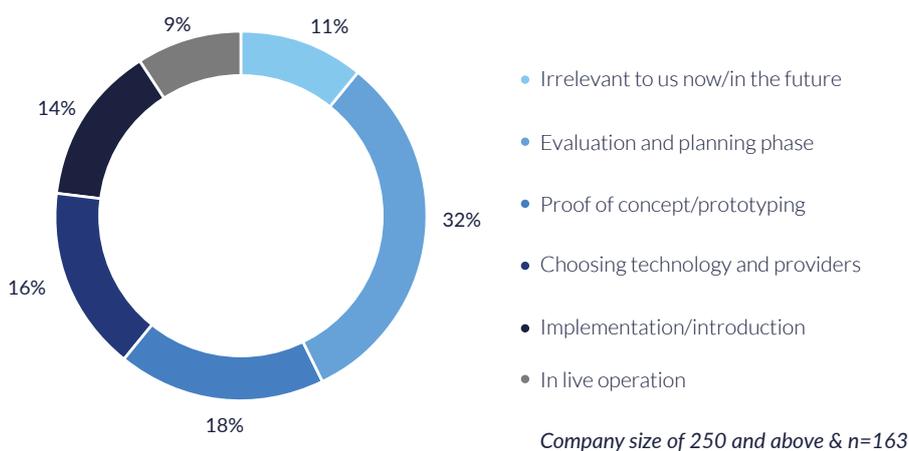
#01

Is cloud computing becoming the norm? As part of the digital offensives by many companies, cloud infrastructures are fast becoming a crucial technology driver and success factor for innovative business models and digital products. The growing interest in the Internet of Things and machine learning sent the adoption rate of the cloud soaring at numerous companies. Now, it is a question of "how" rather than "whether" cloud services can be used successfully at German companies.

It is crucial to find the right path to the cloud for the individual company and to incorporate new technological concepts and opportunities into the strategy. What matters most is identifying the optimum architecture and infrastructure concept for the company. Cloud computing has triggered a process that is defined by numerous features and complementary technologies and is bringing the next-generation digital infrastructure into being. This includes edge computing, hybrid and multi-clouds and new IoT stacks. At the same time, in the context of innovation and enhancement, the IT infrastructures must form a sound basis for meeting the strictest security and data-protection requirements.

// What phase is your company currently in regarding use of "IaaS/PaaS" (Infrastructure-as-a-Service)??

- Irrelevant to us now/in the future
- Evaluation and planning phase
- Proof of concept/prototyping
- Choosing technology and providers
- Implementation/introduction
- In live operation

Company size of 250 and above & n=163

This development is already in full swing at German companies. The number of companies taking a serious and long-term look at cloud computing is constantly rising. Cloud computing is already instrumental in the transformation and operation of the IT infrastructure for around 90 percent of companies. A large number of companies (50 percent) are currently still in the evaluation or prototyping phase and looking for the right providers and operating models.

Digitalization is only fully feasible with cloud computing: This view is already entrenched in the minds of decision-makers. With growing use by companies and continuous enhancement by providers, cloud computing has become much more than a sourcing option for processing power and software as a service. Numerous platform services, deployment and integration options plus new features are really driving a dynamic market, thus playing a key role in digitalization.

// Public IaaS market volume worldwide

2017	2018	2019	2020	2021	2022
34,7	49,4	65,4	83,2	104,9	130,9

// Source: © crisp research AG, 2018

*billion US dollars
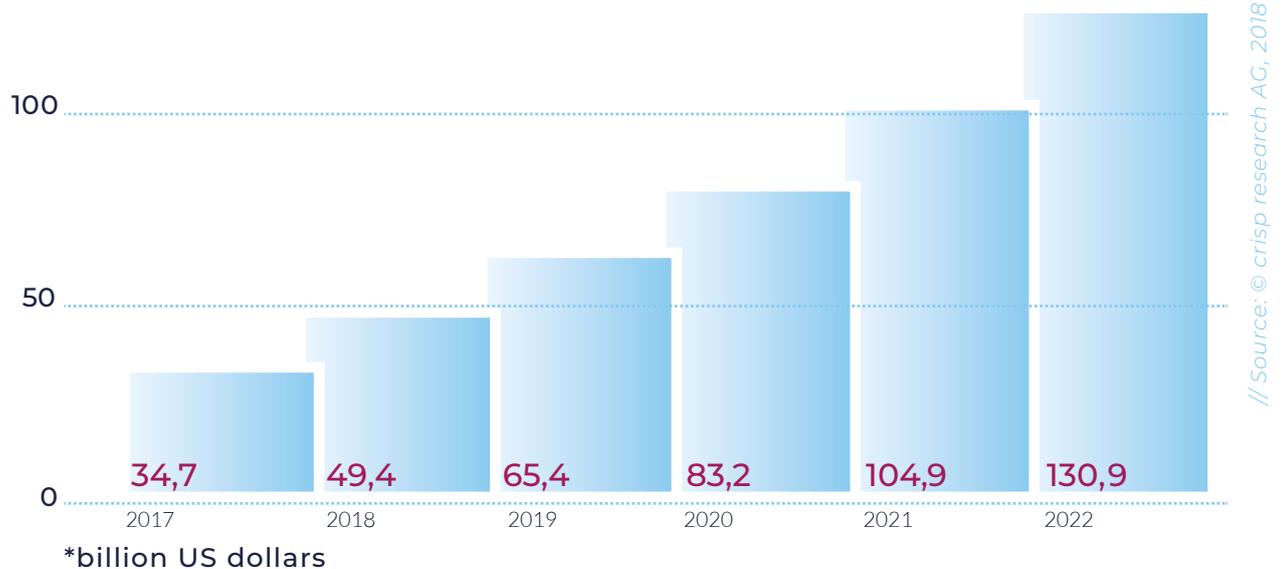
Evolution of the cloud is also progressing at a rapid pace in terms of numbers. With growth rates of well above 25 percent, spending on public infrastructure as a service is showing a clear upward trend. Companies are increasingly investing in cloud resources in order to ensure flexible, agile application operations for current and new workloads. The large number of digitalization projects and swelling coffers mean that more money is also being invested in IT for the first time. German companies are planning to step up IT investment, thus further boosting the growth of cloud providers.

#01

Cloud-Computing Status Check

Therefore, companies should take the time to adapt their cloud strategy to their corporate strategy in this phase.

HYBRID CLOUD: A hybrid cloud integrates a private cloud with the resources of one or more public clouds. In this case, a company operates its own cloud infrastructure and uses the scalability and economies of scale of a public-cloud provider to draw on further resources in the form of processing power, storage space or other services as required or constantly.

When setting up their own digital infrastructure stack for current and future workloads, most companies are mainly only able to align their strategy toward a multi-cloud or a hybrid cloud. However, as many companies still rely on the existing systems in their own data center, e.g. for latency reasons, the path often leads toward a hybrid cloud landscape. A hybrid cloud environment allows companies to combine their existing infrastructures and private cloud environments with the public cloud. Through integration and orchestration solutions, the originally separate infrastructures can form a common operating basis. For instance, business-critical workloads are often operated in a private cloud, and less sensitive applications or modern cloud-native workloads in the public cloud. All infrastructure components and services of the defined IT landscape are then subject to the strictest security standards and protected by joint approaches.

// Digital infrastructure stack
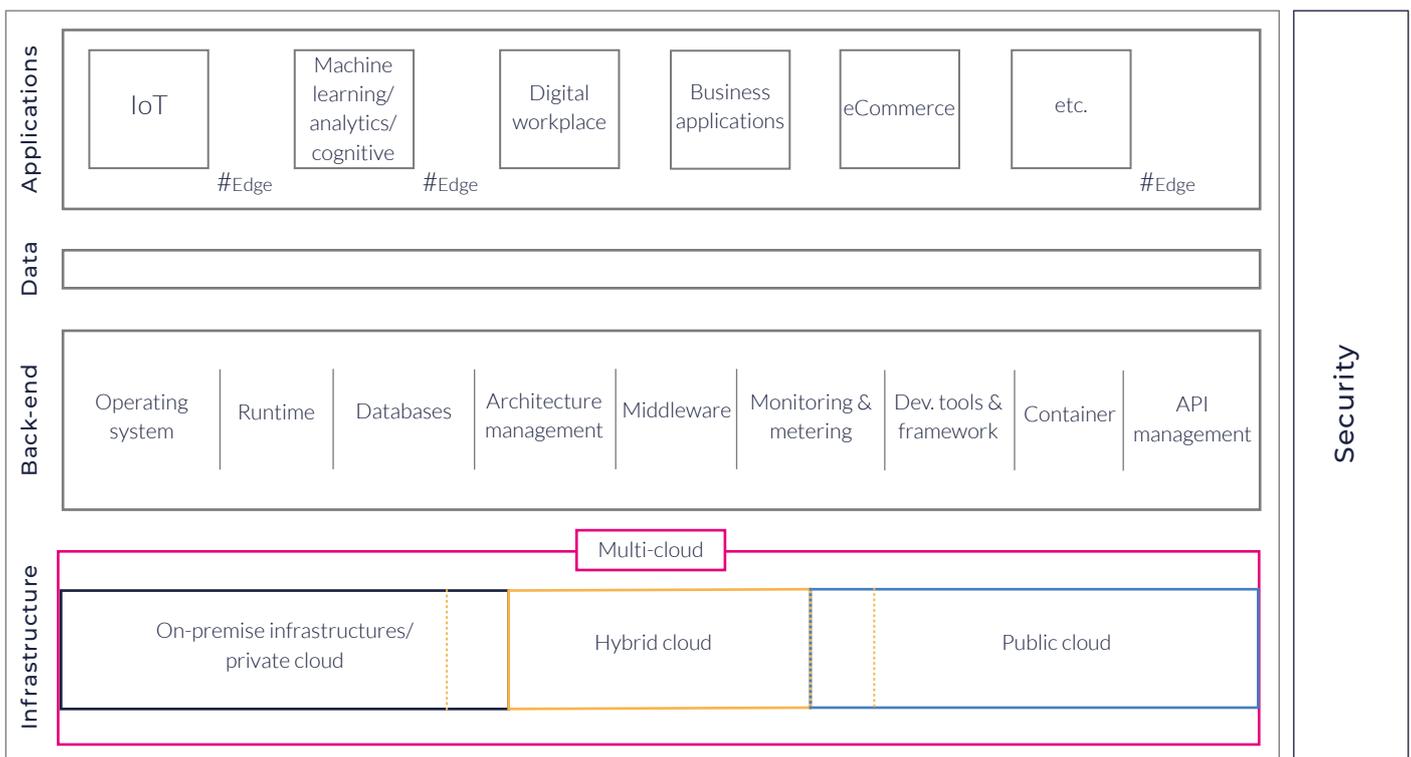
Also, it is increasingly necessary to operate applications with CPU-intensive workloads on devices that are closer to the end customer or product; this is known as edge computing. In addition to the back-end infrastructure, computing processes are performed directly on the respective device at the same time here. For instance, edge devices can directly perform calculations or run applications without first having to communicate with the data center or the cloud. This enables considerable advances in terms of latency and reaction times as well as the implementation of new business models. One example here is autonomous driving, where it is necessary to react to the braking process of the vehicle in front directly and as quickly as possible.

Cloud computing providers and managed service providers have invested a huge amount of effort and development time in minimizing the level of skepticism for companies and reducing barriers to entry. Concerns regarding data protection, technical difficulties with migration and the enterprise compatibility of the cloud are gradually subsiding. Success stories, migration tools, project experience and substantial investment in security and certification have been pivotal factors in this rethink.

Yet with so many providers and the ever-growing number of services, making a choice is also becoming increasingly complex and challenging. For instance, the focus is no longer solely on data protection and billing models: Features, functions, interfaces and the integration capability of the offered services in hybrid- and multi-cloud environments are increasingly coming to the fore. In the future, there will no longer be "one cloud". Providers will be selected according to the requirements profile, level of integration and the nature of the workloads and projects. Corporate IT and data center teams are becoming infrastructure brokers, meaning that in the best-case scenario, the specialist departments no longer have to select the suitable platform themselves.

MULTI-CLOUD: A multi-cloud environment comprises an unspecified number of different cloud providers of all kinds of types (IaaS, PaaS, SaaS) and deployment models (public, private, managed). The respective cloud environments do not necessarily have to be fully integrated with each other if this does not deliver any added value. Instead, they can also be operated independently of each other.

#01

For this reason, the current key questions of decision-makers regarding the cloud are mainly:

- Where is my company in terms of cloud readiness?

- What requirements of the specialist departments will the IT infrastructure have to meet in the future?

- What is the level of migration expense and income from applications in the existing infrastructure?

- By when will I have to provide a connected digital infrastructure?

- What services and features do I need on the platform?

- What are the current and future interfaces and dependencies between the infrastructures?

- What KPIs determine the choice of cloud provider?

- What cloud providers provide the best support for my strategy?

Providers of cloud platforms and managed services have done a great deal to reduce concerns regarding data protection, technology and migration paths of the public cloud. This underlines companies' ambitions to create their cloud success stories with the right partners.

www.crisp-research.com

#02

Migration Path

How to Reach the Cloud

#02

The path to the cloud is lined with all kinds of details and influencing factors that make a largely individual strategy essential for every company. The nature of the existing infrastructures, the workloads to be handled and the range of apps significantly shape the path toward the new infrastructure generation and also have a major influence on the choice of technology.

Depending on workload and area of use, highly diverse models are now feasible for infrastructure and application operation. Ultimately, it is about creating the optimum operating basis for the respective area of use. Infrastructure administration and maintenance requirements, performance and economic factors play a key role here. However, the responsibility of the customer and provider along the technology stack is what mainly sets the various deployments apart. Whereas all infrastructure components come under the company's responsibility and control in conventional data-center operation, the numerous cloud models, be they IaaS, container, PaaS, serverless or SaaS, require ever fewer responsibilities on the part of the customer and transfer them to the provider. Along with infrastructure as a service, where only the computing resources, i.e. compute, storage and network, are provided, the other models increasingly have more standard components that allow fast implementation and usability at the expense of customer control.

// Cloud deployment and responsibility models

Data center	Infrastructure as a service	Container	Platform as a service	Serverless	Software as a service
Applications	Applications	Applications	Applications	Applications	Applications
Data	Data	Data	Data	Data	Data
Databases	Databases	Databases	Databases	Databases	Databases
Runtime environments	Runtime environments	Runtime environments	Runtime environments	Runtime environments	Runtime environments
Middleware	Middleware	Middleware	Middleware	Middleware	Middleware
Operating systems	Operating systems	Operating systems	Operating systems	Operating systems	Operating systems
Virtual environment	Virtual environment	Virtual environment	Virtual environment	Virtual environment	Virtual environment
Compute	Compute	Compute	Compute	Compute	Compute
Storage	Storage	Storage	Storage	Storage	Storage
Network	Network	Network	Network	Network	Network

● Management by the customer ● Management by the provider

In practice, these individual deployment variants are combined out of necessity. This is simply because the companies rely on traditional infrastructure resources so that they can ensure application operation, partly for technical reasons but increasingly for cost reasons, too. By contrast, other workloads and projects are predestined for use in a cloud model. As an entry scenario, some can be migrated 1:1 from the in-house infrastructure clusters in a private-cloud or cloud-hosting model to public IaaS resources. Wholly new applications are often implemented directly on one of the numerous cloud variants as cloud-native services. The rising number of cloud-native applications is particularly driving up the popularity of container-based services on the basis of Kubernetes, Mesosphere and their ilk, as well as platform-as-a-service and serverless offerings.

However, all companies also have to go through a very similar transformation process. They reach similar milestones here that determine their IT infrastructure. Over time, the level of integration is changing considerably here, with the result that as many components as possible can ultimately be integrated.

- **On-premise/private cloud paradigm:** Companies rely heavily on their own infrastructures in the data center. Control and responsibility are in the hands of the IT and Infrastructure departments, which can increasingly also operate internal private clouds in the in-house data centers, enabling benefits in terms of infrastructure capacity utilization and performance.

- **SaaS & cloud hosting paradigm:** Many applications in the on-premise sector can be migrated to new cloud environments via the lift & shift method. The nature of the workloads is unchanged here; only the operating basis is new. Instead of the current on-premise software solutions, companies are also increasingly using SaaS models. For example, product updates for office, collaboration, CRM or ERP applications can be obtained direct from the provider's data center in this way.

- **IaaS paradigm:** Along with the current infrastructures and deployment models, companies are also starting to set up their own cloud-native workloads on infrastructure-as-a-service platforms, and are increasingly using IaaS as an operating basis. Consequently, cloud-management tools can also be used to overcome the complexities of shared responsibility. In the transition to the first IaaS resources for the company, special service providers, the managed public-cloud providers, are increasingly coming on board as experts and managers. .

- **Hybrid Cloud paradigm:** The transition to the hybrid-cloud paradigm constitutes a real quantum leap in terms of the level of connectivity and integration. Connection of applications and workloads that run on different infrastructures and deployments and therefore have a "hybrid" operating basis are particularly popular at present, especially among companies.

#02

Migration Path – How to Reach the Cloud

As a result, workloads can be operated selectively in the public-cloud model, while the conventional infrastructures for existing applications are provided alongside them. By means of an extensive API and integration strategy, the components and applications interact with each other so that their functionality and areas of use can be significantly expanded.

● **Multi-cloud paradigm:** The traditional infrastructure resources are gradually giving way to cloud infrastructures. The company has a host of deployment variants and a wide range of providers. Various cloud infrastructures are operated in parallel and are only integrated as required. The main ingredient for success is correct orchestration of the various services and maximum flexibility of the microservices architecture. Agile development concepts such as DevOps or SRE allow fast and flexible development of new applications on the cloud infrastructure, as well as adjustment of existing ones.

// Cloud migration paths over time

Level of integration

On-premise & private-cloud architecture

Lift & shift/ new workloads

SaaS applications/cloud hosting

Cloud management & cloud-native workloads

IaaS

Integration & API strategy/ hybrid-cloud management

Hybrid cloud

Orchestration & microservices architecture

Multi-cloud

SRE & DevOps-concepts

Time

● Architecture paradigm/deployment model

● Practical initiatives/ new services

Therefore, the existing deployment mix is a double-edged sword for companies. The wide variety of potential uses generates great expectations that can only rarely be met on an ad-hoc basis. The question of which applications are feasible for cloud operation is often harder to answer than some might think. Many applications clearly indicate whether or not they are suitable for cloud operation on account of their business criticality, their load behavior, their performance requirements and their structure (monolith vs. microservices concept). However, in practice, it is also always necessary to consider on a case-by-case basis whether there are dependencies on other applications and whether migration or replacement of an application with a cloud or SaaS service creates new problems and tasks in the stack that need to be solved.

The infrastructures of the future increasingly involve the cloud. In the future, applications will be set up and operated directly in the cloud. Growing numbers of traditional infrastructures are being replaced by cloud infrastructures and connected with each other in order to ensure optimum IT operation.

Yet there are numerous positive examples of highly critical and highly integrated applications running on public-cloud infrastructures. For instance, there are numerous industry clouds that need a ramified logic and a high level of integration for the respective IoT process. More and more frequently, these clouds are run on cloud infrastructures in order to ensure the performance and scalability required by these agile workloads. Many of these industry clouds, such as Siemens Mindsphere, are provided to users as a platform as a service, meaning that the infrastructure is provided by a public cloud and the enablement services by an industrial company.

Here, the companies can also use the cloud's synergy and performance potential in other areas. Based on the nature of the respective application, the aim is to build up a clear decision-making model according to which applications can be identified as "cloud-ready" or not.

#02

Migration Path – How to Reach the Cloud

Key factors for operation on a cloud infrastructure at a glance:

• Variable load behavior

• Performance requirements

• Data criticality/regulation

• Microservices architecture

• Deployment/change requirements

• Temporary workloads

• Existing integrations

• APIs & interfaces

The transformation of the next-generation infrastructure toward a hybrid cloud or multi-cloud is therefore a gradual process. Companies typically go through various levels of maturity and can therefore take successive steps toward cloud operation. Only a small minority use the fast lane and can proceed from the conventional on-premise world to hybrid- and multi-cloud operation to a great extent. Here, the existing corporate IT largely determines the direction the company can embark on in the long term.

Ultimately, successful implementation also requires a little patience. The available resources within corporate IT and the service provider must slowly converge. Training sessions as well as initial tests and academy measures are excellent ways of acquiring cloud skills within IT. Genuine cloud operation can be handled successfully in conjunction with the tools of the trade, namely cloud-management and orchestration solutions as well as the latest innovations from the field of containers, etc.

Looking for a technology provider that accompanies the entire process could be another key factor for companies that have to start out on this path for the first time. Hosting models are also worth considering as a path to the cloud for many existing workloads. Likewise, a provider with its own network can ensure that the interaction of on-premise and private-cloud solutions with the decentralized public-cloud resources runs as smoothly as possible in hybrid-cloud operation .

#03

Choosing
a Cloud Provider
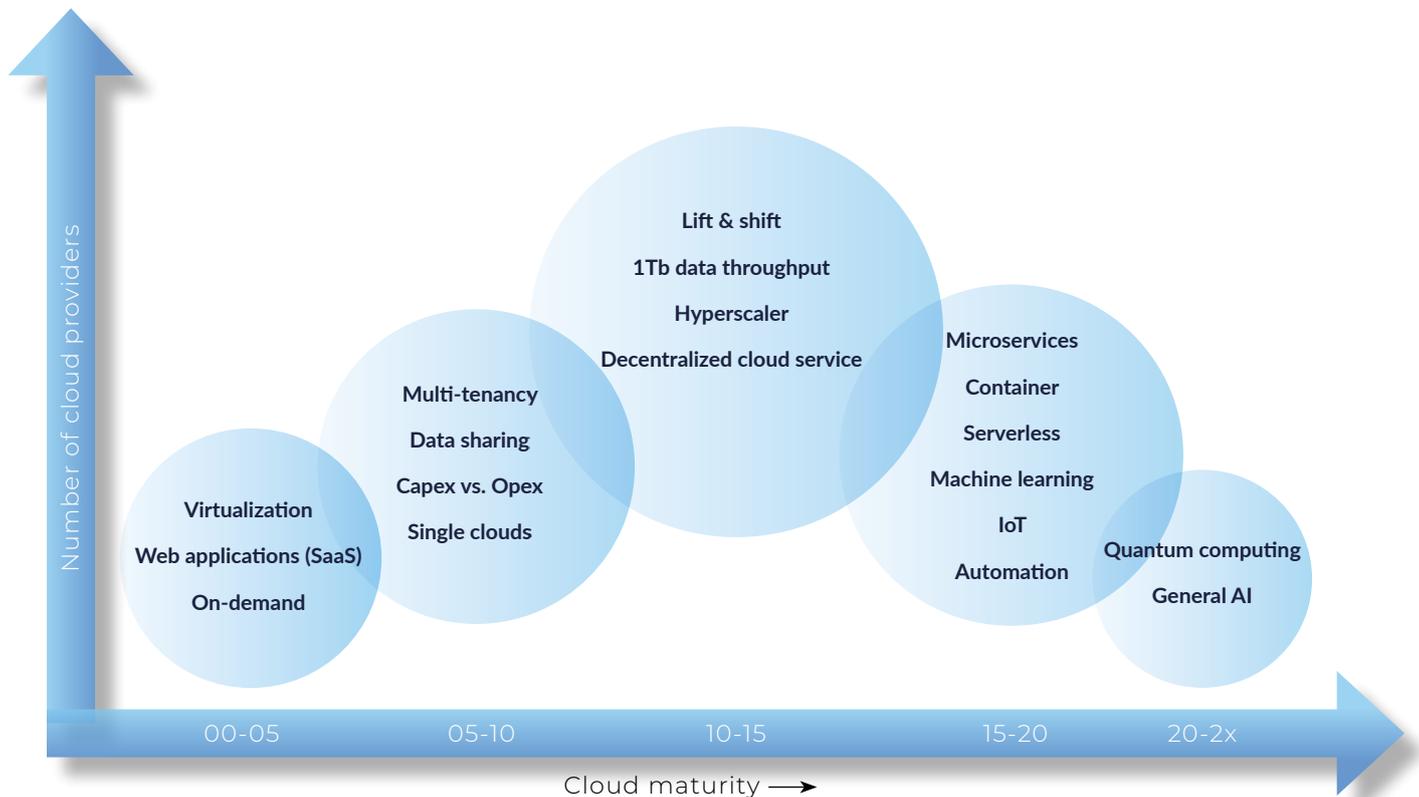
Why Do I Need
to Decide?

#03

In the future, the next-generation infrastructure will be characterized by a technology and deployment mix. Against this background, companies should be aware that setting up multifaceted IT is inescapable when it comes to meeting the current and future requirements of the digital transformation. The cloud providers come into play here.

But finding a cloud provider that offers straightforward, flexible infrastructure resources with a clear billing model is not particularly easy these days. Along with compute, storage and network services, cloud providers can also offer various deployment models, platform services and managed services. These give companies greater freedom and options for optimum operation of their applications. A good mix of cloud providers and services will be essential to future IT infrastructures. At the very least, companies should have evaluated initial providers when taking their first steps toward the cloud, even if they are joined by further cloud providers in the multi-cloud age.

// Development of the public-cloud market from the 2000s into the future

Number of cloud providers

Lift & shift

1Tb data throughput

Hyperscaler

Decentralized cloud service

Microservices

Container

Serverless

Multi-tenancy

Data sharing

Machine learning

Capex vs. Opex

IoT

Quantum computing

Single clouds

Automation

General AI

Virtualization

Web applications (SaaS)

On-demand

| 00-05 | 05-10 | 10-15 | 15-20 | 20-2x |

Cloud maturity ⟶

From a historical perspective, the business of cloud providers has been in existence and growing since around the early 2000s. The crucial advantage of the infrastructures back then was virtualization. In addition, the "pay as you go" on-demand billing model made cloud services increasingly attractive. Initially, the market was geared toward shifting from capex to opex, with companies relying on cost-efficient cloud-based services and no longer necessarily sticking with on-premise infrastructures. As the cloud grew in popularity, numerous providers also rushed onto the market. Competitive pressure became more intense, and was initially increasingly resolved by infrastructure prices and performance. Many providers could not cope with this pressure, and left the market again.

These days, in addition to the price/performance ratio, several other requirements need to be considered when choosing a provider. With many different usage scenarios of the cloud, especially in the field of the Internet of Things and machine learning at present, companies need numerous features and tools in order to operate corresponding applications. This is also bringing start-ups and providers onto the market that aim to occupy a niche between the extensive portfolios of the large and particularly prominent cloud players. Consequently, along with the cloud giants such as Amazon Web Services, Microsoft and Google, regional providers such as 1&1 IONOS should be on companies' shortlists these days.

Core evaluation and decision-making factors in choosing a provider

Although the number of providers of public-cloud infrastructures has fallen rather than risen in recent months, making the right choice of provider is not always easy. Most companies immediately think of the big names that can cover most requirements fairly comfortably, partly because of their wide range of services and high development rate.

However, in the future, companies will need more than one infrastructure provider to actually meet all the requirements of different workloads and provide agile, flexible IT. This means that the workloads to be handled will also be a key determinant in the choice of infrastructure. If the public cloud has been chosen, a company often needs individualized KPIs and priorities so that it can make the right decisions.

A relatively clear distinction can be made between current and new "cloud-native" workloads. Whereas current workloads are usually hosted in the lift & shift method in a very similar way to conventional operation on a public cloud, the cloud-native workloads are mostly trimmed to the specifics of the public cloud.

#03

Choosing a Cloud Provider – Why Do I Need to Decide?

Despite the distinction between these two workload categories, there are central KPIs that should be a high priority for both of them. The primary one is the price/performance factor of the provider. It is advisable for companies to take a close look at the whole market here. Various tests and reports have shown that the major providers are often neither the most affordable nor the best-performing. Rather, the cloud majors charge fees for numerous services that are needed in order to attain high cloud performance. In some cases, other providers that offer IaaS services without larger microservices, e.g. as a bare-metal cloud, achieve much better performance and latency levels at lower prices.

Other generally important KPIs include stability and high availability of the platform as well as global scalability, which depends on the location dependency of the application. Likewise, APIs and interfaces are among the high general requirements that apply almost equally to lift & shift and cloud-native scenarios.

	Current workloads/lift & shift	Cloud-native workloads
APIs/interfaces	3	5
Connectivity	4	3
Container/developer services	2	4
Data-protection level & compliance	5	3
Global scalability	3	4
Open-source	1	3
PaaS	1	4
Platform services	2	5
Price/performance ratio	5	5
Self service	2	4
Serverless computing	1	3
Support/regional contact	4	2
Availability/stability	4	5

1 very low | 5 very high

Lift & shift workloads are chiefly characterized by extremely strict requirements in terms of data protection and compliance. Particularly workloads that map core applications of corporate processes process a huge amount of relevant data, and are therefore subject to particular restrictions. Connectivity, particularly with regard to hybrid cloud operation with multiple connected infrastructures in different locations, plays an even more central role here.

These lift & shift workloads are also usually highly specific and individual to the company or the respective department. Therefore, regional contacts and personal support of the infrastructure platform should be important here.

By contrast, when choosing the right infrastructure for cloud-native workloads, companies should focus more sharply on the available microservices and platform services. As cloud-native workloads usually have higher requirements in terms of user experience, performance and agility, these are hugely important here. Furthermore, there is also the opportunity to operate these workloads on the basis of serverless computing with a large standard stack and container services. As many cloud architects and developer teams are still the app owners here, the requirements also include a higher level of self service.

The more important and individual the applications operated on a public cloud become, the greater the need for a cloud provider on an equal footing that understands the individual requirements and provides support along every step of the development path.

All in all, therefore, the teams responsible in the company play a key role in determining the infrastructure decision. Developer teams and cloud architects often tend to focus more on the cloud-relevant requirements. Agility, variability and configuration options of the services for an ideally coordinated outcome are what matter here. Traditional IT teams with an ITIL background are very process-driven and have strict requirements in terms of straightforward migration, failsafe operation and long-term provision of services on a high-performance yet low-cost infrastructure.

#04

Outlook and Recommendation for CIOs

Cloud computing has now reached the maturity stage for widespread use in companies. Technical advances and rapid innovation mean that the age of the new cloud generation may well be already under way. In the forthcoming age of container services, serverless computing and machine learning, cloud computing will be taken for granted. However, many companies still have lots of basic questions here. Companies face new challenges within the cloud universe, especially regarding the new cloud generation, which is mainly characterized by hybrid- and multi-cloud solutions. Where on-premise systems were predominantly used in recent years, a cloud mix is now more present than ever, and will become increasingly prominent in the years ahead. In this way, high-performance requirements and workloads can be covered with hybrid- and multi-cloud solutions now and in the future.

Entry into the cloud does not have to be complex. With the cloud basics of compute, storage and network with high quality standards, companies can make targeted use of key advantages for their IT infrastructure.

The following recommendations are intended to help company decision-makers and digitalization managers to take the next steps in their cloud strategy:

- **Choice of cloud provider & architecture concept:** Before CEOs and CIOs start to restructure the IT landscape, suitable cloud providers should be evaluated and identified. Particularly in view of the architecture concepts of multi-cloud approaches, it is important to choose the right providers in order to ensure an expanded range of services and the optimum operating basis for the future cloud workloads.

- **Using cloud basics:** Many companies often have great respect for the complexity of the cloud. Yet it does not always have to be a complex container or microservices scenario at the outset. With the basic components of the cloud and the flexible procurement of compute, storage and network as purebred IaaS, many companies can already reap considerable benefits in terms of performance, scalability and management.

#04

Outlook and Recommendation for CIOs

- **Cloud price/performance ratio as a crucial evaluation criterion:** Performance does not always have to be expensive. For users, a high price does not necessarily mean the best range of services. Instead, numerous features and additional solutions make some infrastructures more expensive than they need to be. Consequently, the search for top value for money can also yield surprising results. For instance, price/performance analyses show that when comparing on-demand prices and latency times as performance indicators, the least expensive providers can also deliver good performance.

- **Cloud evolution path – What is needed for (multi)-cloud operations?:** Central orchestration and uniform management of the numerous cloud solutions in the company is becoming a core challenge. For companies, seamless management, ease of integration and a straightforward overview are the long-term keys to successfully using different cloud variants for different workloads in line with requirements.

- **Hyperscaler certifications & data protection:** The presence of the major US cloud providers is constantly growing, partly on the basis of local sites. Yet companies should pay close attention to data-protection requirements. Even with compliance with the latest standards (GDPR) and numerous certifications, there are still gaps at US providers in particular due to the Cloud Act. A look at the certifications and potential loopholes, ideally in conjunction with an experienced service provider, can additionally prevent misunderstandings and provide transparency on data protection.

.

About 1&1 IONOS/

With more than eight million customer contracts, 1&1 IONOS is the leading European provider of cloud infrastructure, cloud services, and hosting services. From VPS and bare-metal servers all the way to high-end IaaS solutions: 1&1 IONOS offers SMEs and large companies all the products they need to set up their hybrid or multi-cloud environment and is the only IaaS cloud computing provider that has its own code stack in Germany. 1&1 IONOS operates one of the world's largest and highest-quality IT infrastructures with over 90,000 servers. In the Cloud Vendor Universe from Crisp Research, 1&1 IONOS has repeatedly been named one of the leading providers of cloud platforms.

The Enterprise Cloud by 1&1 IONOS is the "Cloud – Made in Germany" with a data protection-compliant IaaS platform developed in-house for companies, system vendors/integrators, and managed service providers. It is flexibly scalable and provides free 24/7 support by qualified system administrators. During operation, the capacity of all components can be adapted to current requirements through live vertical upscaling.

1&1 IONOS was established in 2018 after the merger of 1&1 Internet and Berlin-based IaaS provider ProfitBricks and is part of the listed United Internet AG.

1&1 IONOS

About Crisp Research/

Crisp Research AG is an independent IT research and consultancy firm. With a team of experienced analysts, consultants and software developers, Crisp Research assesses current and future technology and market trends. Crisp Research helps companies with the digital transformation of their IT and business processes.

The analyses and commentaries of Crisp Research are published and discussed in a host of business and IT journals and on social-media platforms. As contributing editors at leading IT publications (Computerwoche, CIO, Silicon, etc.), committed BITKOM members and sought-after keynote speakers, Crisp Research's analysts actively contribute to debates surrounding new technologies, standards and market trends and are influential figures in the industry.

Crisp Research was established in 2013 by Steve Janata and Dr. Carlo Velten, and focuses its research and consulting on emerging technologies such as cloud computing, analytics and digital marketing and their strategic and operational implications for CIOs and business decision-makers at companies.

About the Authors/

max.hille@crisp-research.com

Maximilian Hille
Senior Analyst & Mobile Practice Lead

Maximilian Hille is Senior Analyst and Practice Lead for Mobility, Collaboration and User Experience at the research and consultancy firm Crisp Research AG. He is responsible for market-research and consulting initiatives, particularly in the fields of digital workplace and mobile business. Previously, he was Research Manager in the Cloud Computing & Innovation Practice of Experton Group AG. His main areas of expertise are digital workplace design, digital business models, unified user experience, mobile back-end & development platforms, mobile management & security, mobile web experience, mobile technologies, mixed reality, chatbots, digital voice assistants and collaboration. Maximilian Hille was a jury member at the Global Mobile Awards in 2016, 2017 and 2018.

jan.mentel@crisp-research.com

Jan Mentel
Analyst

Jan Mentel works as an analyst at the IT research and consulting firm Crisp Research. He specializes in cloud computing, mobility solutions and the Internet of Things, with a particular focus on data protection, compliance and the implications of the EU General Data Protection Regulation. In addition, he helps with background and consultancy work in the context of research and individual customer projects. Jan Mentel studied commercial law at the University of Kassel.

Contact/

Crisp Research AG
Weissenburgstrasse 10
D-34117 Kassel

Tel. +49-561-2207 4080
Fax +49-561-2207 4081
info@crisp-research.com

http://www.crisp-research.com/
https://twitter.com/crisp_research

1&1 IONOS Cloud GmbH
Greifswalder Str. 207
10405 Berlin

Tel +49-30-257700-850
Fax +49-30-57700-598
enterprise-cloud@ionos.com

https://www.ionos.com/
https://twitter.com/ionosCLOUD_IAAS

Copyright/

Design, layout & infographics:
liad - Julia Reuter advertising design
kontakt@liad-design.com
www.liad-design.com

1&1 IONOS Cloud GmbH
Greifswalder Str. 207
10405 Berlin

Tel: +49-30 57700 850
Fax: +49-30 57700 8598
enterprise-cloud@ionos.de

https://www.ionos.com/
https://twitter.com/ionosCLOUD_IAAS

Crisp Research AG
Weißenburgstraße 10
D-34117 Kassel

Tel +49-561-2207 4080
Fax +49-561-2207 4081
info@crisp-research.com

http://www.crisp-research.com/
https://twitter.com/crisp_research