

NTT DATA

Cloud transformation roadmap

Cloud strategy trends in Europe

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Reasons that push companies towards Cloud transformation programmes

Over the past 2/3 years, European companies in the IT market have accelerated towards the adoption of Cloud services, either relating to infrastructures, platforms or applications. There are many reasons underpinning this trend and all of them involve wide-ranging company requirements.

For example, companies may want to accelerate the adoption of applications or the provisioning of infrastructure elements. Many are also looking to modernise their legacy applications, which are no longer able to meet business requirements. As a further point, it is clearly mandatory for companies to protect business data, which they can do more effectively with the latest tools that are increasingly embedded in Cloud services.

The chart below, which synthesises a number of surveys carried out by NetConsulting cube on samples of large and medium-large sized enterprises, highlights the main reasons that push companies to adopt Cloud services.

The most popular responses are speed of service implementation and the opportunity to benefit from the scalability of resources, closely followed by the availability of continuous updates (avoiding strong efforts on patching), and having up-to-date infrastructures without making (as in the past years) huge investments to refresh components.

Notably, economic aspects are in last position. The reduction of costs, after being for many years one of the main drivers of Cloud migration, currently does not play an important role at all. Companies understand that Cloud migration does not necessarily mean spending less but, in the first instance, providing in-house services that can meet business requirements.

In conclusion, Cloud transformation cannot be defined by cost elements alone, but by factors that have a positive impact on company profitability.

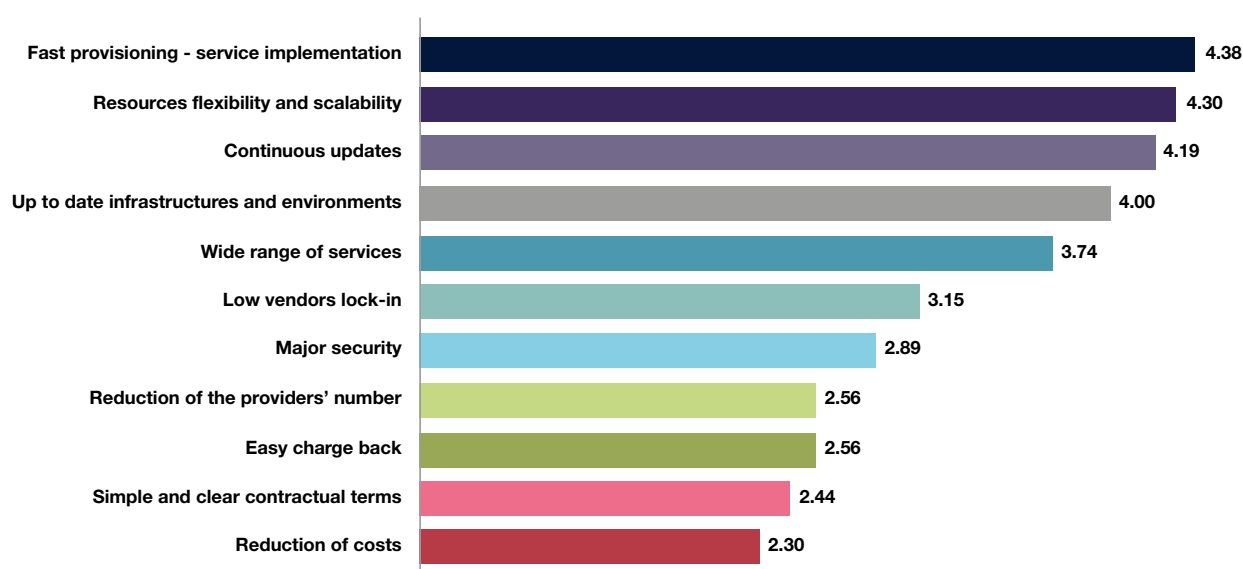


Figure 1: Reasons to adopt Cloud services (scale from 1 to 5, maximum importance)

Source: NetConsulting cube, 2020

Maturity level in the adoption of Cloud services - Different Cloud approaches

Clearly, the maturity level in the adoption of Cloud services depends strongly on factors like company history, active sectors and technological choices. Is a proprietary data centre present, for example?

To a certain extent, the traditional key factor in Cloud migration was the adoption of collaboration and email solutions, which were among the first software tools used in Cloud systems. Thereafter, companies started to adopt infrastructure-related Cloud services, in particular relating to computing power and storage.

The further development of application-related Cloud services was driven by CRM solutions, which were the first business applications used with an "as a service" approach. Coming up to the present day, more Cloud migration for ERP solutions is being witnessed, thanks in part to the commercial strategies of software vendors.

So far, the adoption of Cloud services has been addressed mainly with tactical approaches that do not rely on structured Cloud transformation plans. Market trends are currently showing an evolution from models based principally on private Cloud services to models characterised by a major presence of public Cloud services. In other words, hybrid Cloud architectures are emerging. In these architectures, private and public Cloud systems coexist and are mixed with the applications and IT resources that remain on-premise.

As the diffusion of these Cloud services increases, the use of different Cloud providers – for application, platforms and infrastructure environments – gains traction. Companies are placing more and more attention on multi-Cloud models, even if with different intensities (60%, Fig. 2). This strategy will lead to the requirement for support by orchestrators that will allow the optimised management of these IT environments.

The multi-Cloud model will also push companies to invest in software-defined networks, adopt governance tools, and train or recruit skills to manage increasingly complex IT environments.

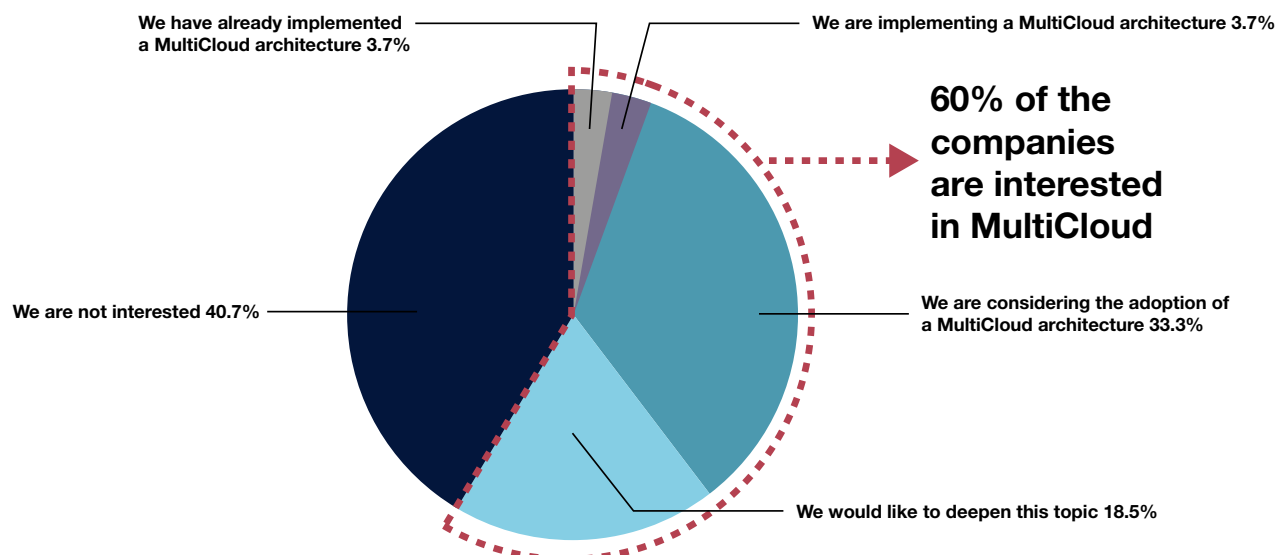


Figure 2: Diffusion on multi-Cloud architectures

Source: NetConsulting cube, 2020

When it comes to the different types of Cloud services, companies responding to the surveys firstly show a major propensity to adopt IaaS services (to create a pool of IT resources to be used if needed). The driver for this decision is the need of companies to replace expensive or industry-standard hardware with services that could help to reduce Capex share in favour of Opex, as well as the opportunity to be more flexible and have the ability to scale with ease and efficiency.

The rapid adoption of email and collaboration services led to the strong growth of application services, which were adopted not only in alignment with the guidelines of IT structures, but autonomously by the business functions. This situation caused some problems for IT divisions, which in fact had to integrate Cloud solutions with other on-premise applications without joint governance or compliance with architecture-related standards.

However, over the time, the adoption of SaaS services became far more visible. To date, the majority of companies follow a “Cloud-first” approach. To clarify, companies first assess the feasibility of Cloud migration or the adoption of SaaS solutions. Only secondarily, if the Cloud does not meet risk, cost and technical requirements, do companies proceed with on-premise implementation.

It should also be noted that the adoption of PaaS services is recovering strongly. Indeed, thanks to the growth and importance of analytics solutions and IoT platforms, PaaS services are about to be adopted significantly more than in the recent past.



Reference market of Cloud advisory services

At the end of 2019, the European Cloud computing market exceeded 28.1 billion Euros, corresponding to a 16.3% increase on 2018.

SaaS is the main technological segment of the European Cloud computing sector as it accounts for 65% of the total market. At the end of 2019, PaaS registered the fastest growth on 2018 (+22%) and reached a value of 2.8 billion Euros, while the IaaS market exceeded 7.1 billion Euros thanks to 17.7% growth on 2018.

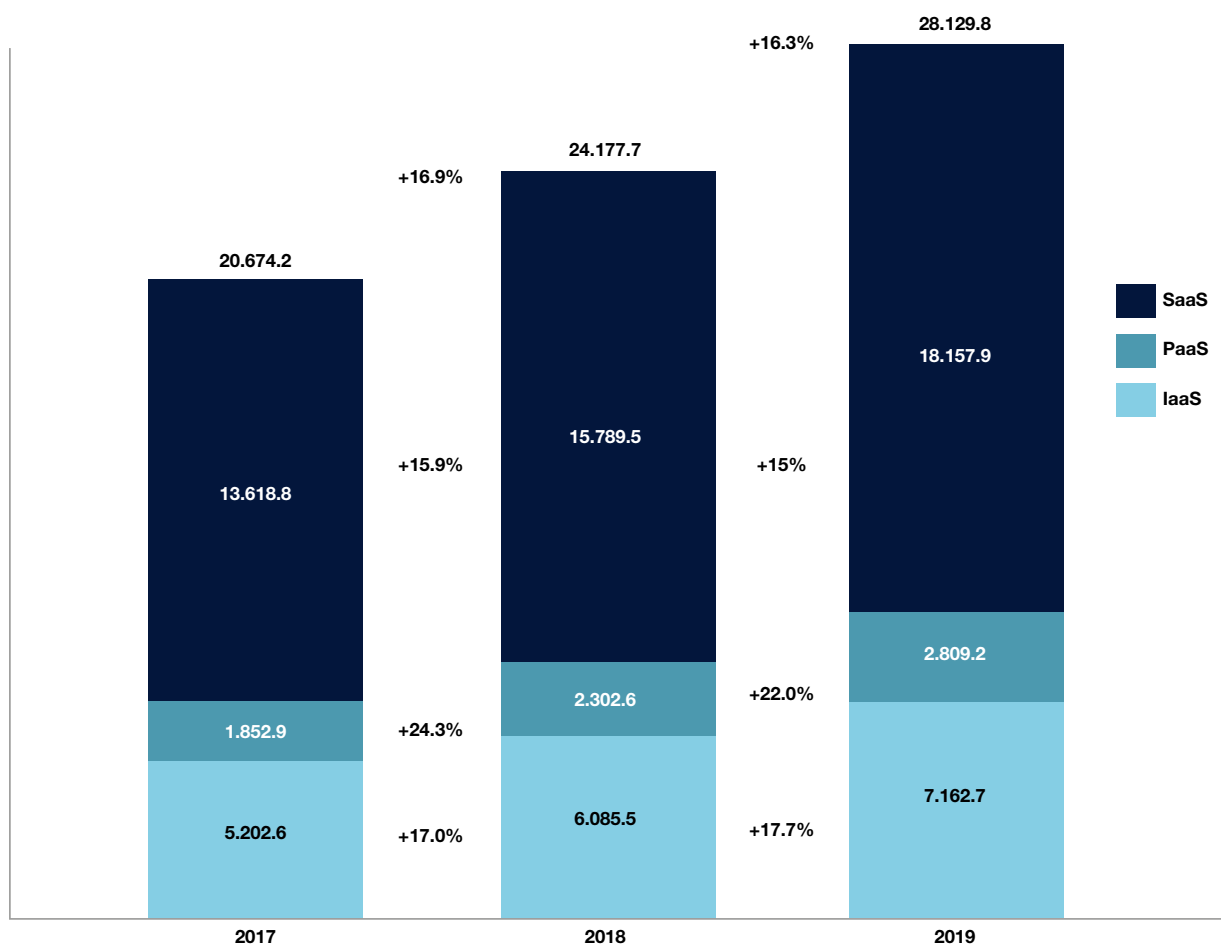


Figure 3: European Cloud computing market (million Euros data and year-on-year growth)

Source: NetConsulting cube on Global Market Insights data



Forecasts for 2020 are uncertain because of the coronavirus outbreak that hit all European countries. However, it is likely that the Cloud computing market will continue to register a positive trend thanks to distinctive characteristics such as the flexibility and agility of Cloud solutions, the easy provisioning and scalability of new resources, and the opportunity to block any IT resources that are no longer necessary and pay only for what is actually used. All these attributes make Cloud computing an appealing IT model, despite the current uncertainty.

In these uncertain times, Cloud solutions are also desirable as they enable the evolution towards remote work and smart working models, and the move of many interactions to digital (rather than physical) channels to avoid – or at least slow – the spread of the virus.

According to a recent Eurostat survey, 26% of European companies adopt Cloud services, with the percentage particularly high in Nordic countries.

As far as IaaS is concerned, the most common solutions are Storage as a Service tools, as adopted by 68% of European companies. Enterprises in France and the UK show a particular propensity to use these tools.

Almost 30% of European businesses use ERP, light ERP and CRM Cloud solutions, with greater incidence in the Netherlands, Denmark and Finland. Furthermore, the adoption rates of productivity suites, such as email and Office Automation, still prove high: equal respectively to 69% and 53% in European companies.

| | Use cloud computing | Email SaaS | Office SaaS | Computing Power IaaS | Storage IaaS | Financial accounting SaaS | CRM SaaS | Enterprise Database PaaS |
|--------------------|---------------------|------------|-------------|----------------------|--------------|---------------------------|----------|--------------------------|
| Europe 28 | 26% | 69% | 53% | 23% | 68% | 29% | 29% | 29% |
| Germany | 22% | 48% | 34% | 19% | 61% | 19% | 19% | 19% |
| France | 19% | 65% | 46% | 20% | 77% | 35% | 35% | 35% |
| UK | 42% | 72% | 73% | 28% | 77% | 28% | 32% | 32% |
| Italy | 23% | 82% | 47% | 13% | 60% | 13% | 25% | 25% |
| Spain | 22% | 74% | 48% | 28% | 73% | 28% | 33% | 33% |
| Denmark | 56% | 74% | 58% | 37% | 69% | 52% | 41% | 55% |
| Netherlands | 48% | 67% | 56% | 24% | 72% | 59% | 45% | 70% |
| Finland | 65% | 69% | 65% | 18% | 69% | 56% | 37% | 53% |
| Sweden | 57% | 74% | 53% | 26% | 74% | 51% | 31% | 52% |

Figure 4: Adoption of Cloud solutions in major European countries

Source: Eurostat 2019

Ingredients required for successful Cloud transformation

The management of a Cloud transformation roadmap is not an easy activity. Such a task requires great attention, as well as the availability of a set of ingredients and advisory services without which the risks of not being able to obtain the expected benefits appear very high.

In a Cloud transformation roadmap, the following phases must be considered:

- **Assessment** of the current situation
- **Design** of a different operating model
- **Execution**: migration and services implementation
- Optimisation of implemented services' **management**

Assessment

Cloud migration starts with identifying components that will be migrated and the assessment of respective impacts. These tasks entail the careful evaluation of the following aspects:

- Can the telecommunications network guarantee the desired service levels?
- Can the infrastructure and platform resources facilitate the transfer of workload and computing power to the Cloud?
- Within the installed base of the application, with respect to hybrid architecture, are there are solutions that can be dismissed, solutions that cannot be migrated and others that can absolutely be transformed into Cloud services? In the latter case, it will be necessary to decide if it is appropriate to change or update the operating system and/or the DBs (rather than middleware and application code), in order to use Cloud-native features in alignment with agility, scalability and performance.

Once companies conclude the assessment phase and the analysis of the most suitable approaches and architectures, they should define the strategic goals – in terms of processes, technology and regulatory requirements – that must drive the Cloud transformation project.

Design

The transformation of the IT operating model is fundamental to the successful implementation of Cloud services. Having clear comprehension of which environments must be revised plays a key role in raising the effectiveness of IT and the return achieved on the implementation of Cloud services.

The main fields on which companies must focus and continue their evaluations are:

- **Process and automation** – Companies must evaluate how IT activities should be organised. In more detail, enterprises will have to decide which skills must be put in place, and which activities must be standardised and automated, in order to maximise the recovery of efficiency.
- **Tools and architecture** – In this field, companies must identify which enabling technologies should be used to deliver IT services, and the best tools and architectures that can optimise automation levels and streamline processes and activities.
- **Services catalogue** – Companies must define and regulate a services catalogue to measure consumption levels and make the charge back to users that benefit from the services.

As a final part of the design phase, companies must set up governance, risk and compliance actions relating to the new operating model, including how decisions are made, how adherence to the process is implemented and how the risk level is evaluated. Responsibilities and interfaces across the organisation must be defined.

Execution

In the first two phases, companies define architectures, processes and services that lead the Cloud transformation. In the execution phase, companies must start the Cloud transformation roadmap, putting into action automation methodologies and tools to effectively accelerate and govern the migration process.

The working methodology, namely the set of procedures through which the team approaches and manages the analysis, the design and the actual migration of applications to the Cloud, is not only a technological challenge, but constitutes both cultural and process factors. Here, the project team must include all the necessary competencies to execute every migration activity and find solutions during the implementation/execution phase. This cross-functional team must not only possess technical skills, but regulatory, process and communications competencies. More generally, the team must address any main issues that could emerge during the execution of the transformation.

Developers, system administrators and testers must adopt an operating approach that is aligned with DevOps practices in order to guarantee communication, collaboration and integration between development and operations staffs. DevOps enables interdependence between software development and IT operations, and helps companies to rapidly and effectively develop software products and services.

Once Cloud migration commences, it is important to follow a set of precautions that allow the creation of a consistent applications architecture. For this reason, it is necessary to consider and identify the interdependencies between the different applications in order to have a clear comprehension of how applications and infrastructures collaborate, as well as to check if applications are compatible with a possible new version of the operating system.



10 Ingredients required for successful Cloud transformation

When the Cloud migration process is finished it will be necessary to define the test plan to check if the application works properly before any data sets are migrated. Moreover, it will be important to test if the new version of the application can correctly use any new components that have been adopted to replace parts of the on-premise application. The final test regards the correct functioning of the application with migrated data.

Migration can be considered concluded once the assessment of the database is finalised. A major part of a Cloud provider's offer is an assessment tool that supports the creation of a report for data migration. The report includes evaluations about licences, Cloud features, hardware configuration and actions undertaken for the migration process.

During migration to the Cloud, companies will have to consider methods and practices to make their applications:

- Scalable
- Available
- Resilient
- Secure

With regard to the last point, the Cloud platforms, unlike on-premise solutions, are intrinsically characterised by the sharing of resources, placing greater attention on security aspects. Problems such as data leakage (unauthorised transmission of data from within an application to an external recipient), access control, DDoS attacks, data breaches (where sensitive, protected or confidential information is inspected, copied, transmitted, stolen or used by an unauthorised person), the loss of data due to errors or negligence, and the management of identities and privacy, must be carefully considered in a Cloud migration plan.

Management

With Cloud transition complete and the services implemented, focus turns to management. Companies must be in a position to manage the services themselves. This undertaking means structuring a governance of the services, including their provisioning and de-provisioning, to make IT operations effective and efficient.

Service governance structuring occurs through an orchestration of the services according to the SLAs that IT structures (together with the lines of business) have defined in a functional way for the company.

During the management phase, companies must implement a set of KPIs to check the appropriate functioning of the services and facilitate continuous improvement, in alignment with the changed needs that derive from business evolution.



Skills and capabilities needed to manage successful Cloud transformation

It is clear that the implementation and management of such complex architectures requires skills that are able to address transformation processes. From this perspective, there is a significant lack of new professional figures within companies who are able to manage these workloads autonomously. In many cases, the skill shortage regards both strategic/consulting figures who can design the transformation process with an end-to-end approach, and experts in the governance of Cloud architectures.

For this reason, mixed teams are the most successful with regard to Cloud transformation. Mixed teams include both technical figures, coming from IT divisions, and business representatives with professional and management expertise. These figures must be supported by advisory people from consulting companies, who bring both IT and business skills.

The role of consulting companies is fundamental for three main reasons:

1. They have resources that are dedicated and skilled for the delivery of advisory services and the implementation of digital and Cloud transformation programmes. For many consultancies, these services are becoming core business.
2. They have already gained important experience, just like in the past when the development of ERP solutions was top priority.
3. They are independent players that are not subject to the power and position structures that typically characterise end users.

Against this background, companies must check carefully that Cloud transformation advisory service providers have the following characteristics:

- Ability to manage complex and digital transformation transactions.
- Technical skills to interact with the IT functions of companies and steer them towards the most appropriate choices in alignment with their maturity level.
- Business skills that promote the understanding of company priorities and business impacts – also in relation to change management.
- Proven and verifiable success cases showing the solidity of services that have been developed in other companies, possibly active in the same sector.



Viewpoint from NTT Data: Advisory services related to Cloud transformation

To implement the new innovative features and services of Cloud service providers it is a natural consequence to adopt and transform company IT to Cloud at enterprise level. For those yet to broach this topic, now is definitely the time to think about an overall Cloud strategy. The journey of any Cloud migration programme greatly depends on the objectives and challenges currently being faced.

NTT DATA addresses the following goals and objectives for Cloud migration:

- **Enhance time to value and agility:** Provide higher speed in feature development and thus a faster time-to-market. Increase the frequency of release cycles, from months to days. Provide less latency in handovers between teams.
- **Higher scalability and availability:** Deliver higher scalability for “always-on” interactive and connected services with a very large user base. Enable scaling across regions for optimal geographic coverage.
- **Optimise quality of service:** Provide higher service and application quality through automated provisioning, extended monitoring and logging, and test automation. Keep response times for customers low by handling higher loads and peaks through auto-scaling.
- **Control costs:** Reduce the overall operations cost to invest more in new features. Provide more flexibility for cost models and mix long-term subscriptions with attractive real-time prices from spot markets.
- **Enhance security:** Provide a higher level of security via automated updates/ best-in-class perimeter devices, automated configuration, and extensive monitoring and logging. Enable DevSecOps for more visibility and transparency to reduce risk.

- **Enable new business models:** Provide flexible IT platforms and services for new digital business models. Enable rapid change as business models evolve.

In order to maximise the new possibilities associated with using Cloud solutions, companies are required to not only adopt new technologies, but grasp the related complexity. This task means that new IT skills and tools must be adapted and mastered, just as organisational structures and areas of responsibility have to be reshaped or even integrated. The simplified access to information and resources through Cloud solutions also implies an increased level of due diligence and security measures, along with measures that need to be adopted in the company to heighten employee awareness.

To provide an idea of the complexity involved, consider the case of AWS Cloud services, which in 2017 reached the marker of 100 top level services with additional sub-services. By the beginning of 2020, the amount of AWS services had almost doubled, while the management of continuous enhancements within existing services is ongoing.

AWS stands here as an example, as all other big Cloud providers undergo similar dynamic changes. In general, these new services and features are good news, showing that all cloud providers are prepared to invest and keep up with innovations. On the flip side, customers

have to manage, control and adapt to this huge amount of services and new possibilities, which means a complete new set of management roles and skills is required. Due to the increase in services and the specialisation into vertical-market Cloud solutions such as the IoT, machine learning and analytics, there is even a demand to have dedicated experts for each niche.

As a global innovation partner, NTT DATA supports its customers in all these challenges and requirements with its multi-level Cloud services portfolio and state-of-the-art skill set, thereby increasing the competitiveness and business success of its customers.

The following overview describes how NTT DATA supports customers with ready-to-use and holistic Cloud services that are based on the knowledge and experience gained from a myriad of client engagements across the world in recent years.

Application Cloud strategy and consulting

Based on deep-seated expertise in the development of profitable Cloud strategies, NTT DATA provides consulting that extends from a one-day workshop to detailed and comprehensive Cloud portfolio analyses. The more short-term assessments, such as the Cloud Experience Workshop and Cloud Quick Starter, are designed as kick-starters to narrow the scope and define initial goals.

The **Cloud Experience Workshop** is a one-day, presentation-free workshop designed to accelerate customer transformation with different focus areas. This workshop is customised to the specific requirements, issues and context of the customer. Led by experienced NTT DATA consultants covering all the required competencies (business, architecture, security, governance), key IT and business leaders are brought together in the digital transformation journey.



Cloud Quickstarter is a short assessment (2-4 weeks) that acts as a starting point for customers to get familiar with the Cloud. NTT DATA focuses on an agreed small number of applications (from 5 to 50) that are suitable for easy Cloud migration. This objective enables the customer to find cost-saving opportunities quickly, with concrete proof points of what applications can easily move to the Cloud.

Those completing **Cloud Quickstarter** might want to follow it with a full Cloud portfolio assessment (8-12 weeks) to get a holistic view about the application portfolio and identify initiatives in the right order to start a complete transformation.

The **Cloud Portfolio Analyzer Service** focuses on the complete set of applications and transformation initiatives to improve the portfolio value by either moving it to the Cloud using different treatments, or splitting them into on-premise and Cloud solutions, or even outsourcing them. The result is a single source of truth repository containing data for all business and technical driver-relevant attributes, the scoring of attributes, maps for the identification of initiatives, and an initiative backlog with a first prioritisation about where to start. Alignment with any existing enterprise architecture management (EAM) repositories provides a long-term information base for strategic architecture decisions.

Those opting for the **Cloud Adoption Framework** will learn a full set of methodologies, best practice strategies and tools that have been created thanks to the experience acquired by NTT DATA on many cloud migration projects carried out globally. The framework, suitable for organisations of any size, helps to set IT transformation projects towards Cloud technologies, to choose the most suitable migration strategy among the six R's (retain, retire, re-purchase, re-host, re -platform, re-architect), evaluate TCO and ROI, and establish the governance model best suited to the customer's context.



Cloud FinOps (Financial Operations) helps large organisations to understand and control expenditure over complex hybrid and multi-Cloud environments. The Cloud has changed the IT spending model from Capex to Opex, allowing unprecedented ease of shopping and delivery of IT infrastructures. However, this evolution can easily lead to loss of control over financial management. In the same way that DevOps revolutionised development by breaking down silos and increasing agility, FinOps increases the business value of the Cloud by bringing together technology, business and finance professionals with a new set of processes.

The future sourcing for Cloud services is a key decision that is an eminent part of Cloud strategy. Based on the NTT DATA experience in past Cloud migrations, it is always very difficult to take full advantage of the Cloud without getting locked-in with a single provider. Every Cloud provider offers additional features and services, often free-of-charge, which are proprietary and vendor-specific. These services are cheaper, pre-integrated and easier to use, but if companies ever want to change

Cloud provider, it might result in huge migration costs. NTT DATA is able to support companies in shaping the right Cloud strategy to find the optimum balance between agility, vendor lock-in and cost. In most cases, the outcome is a multi-Cloud strategy to reduce dependencies on costs and technology.

Application transformation and modernisation to Cloud

Application transformation, modernisation or optimisations to Cloud environments need a structured journey to start quick and small, but scale up to enterprise level while leveraging the client's specific manageable change rate. Therefore, one major outcome of the previously described application portfolio analyses is a strategic initiative backlog containing prioritised application transformation projects and programmes. NTT DATA provides an established process together with tools and frameworks to help customers start this journey. Within the process, each application that is part of the initiative backlog will be further analysed and grouped into concrete migration strategies. The following figure gives an overview of the treatments for transforming applications to Cloud.

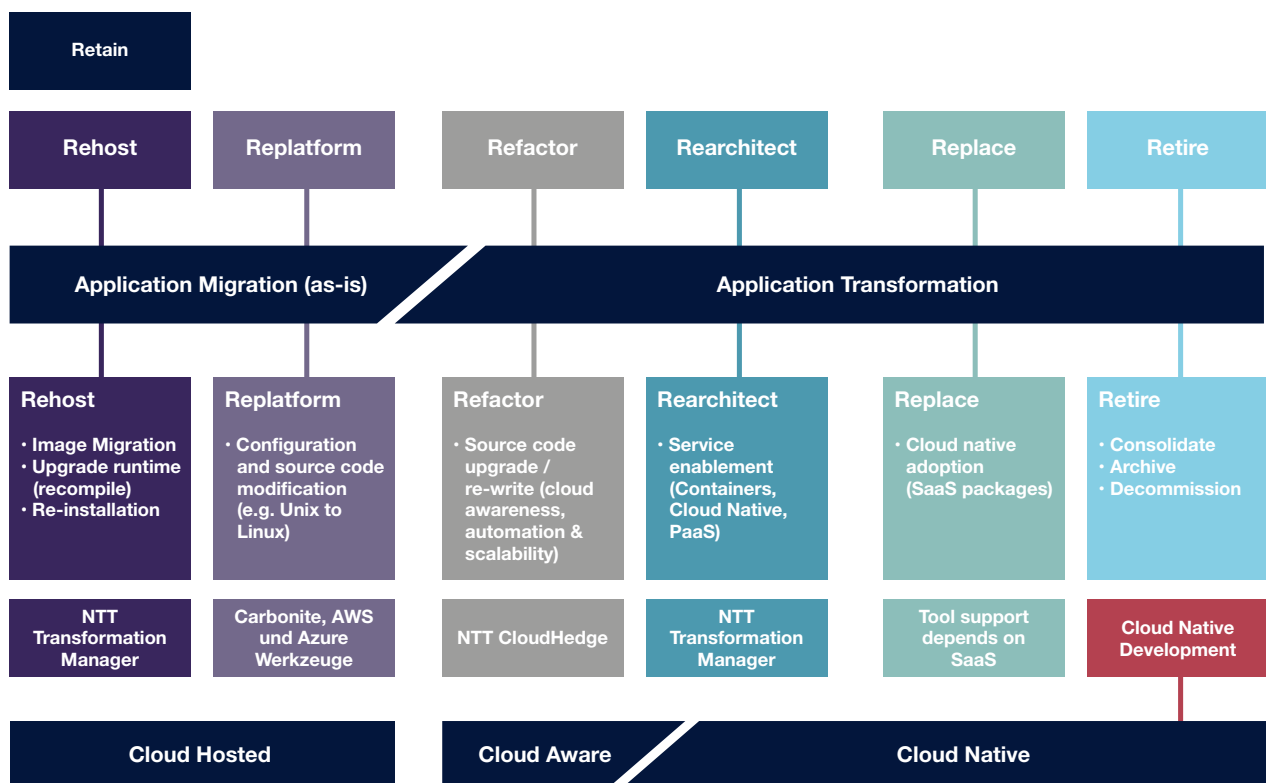


Figure 5: Application to Cloud treatments overview

Source: NTT Data

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New Cloud application architecture

This new style of application architecture is called Cloud-native application (CNA). CNA primarily uses an open-source software stack to be deployed as micro-services and implemented according to the 12-factor pattern. The release and deployment packaging is performed via standardised container technology and dynamically orchestrated frameworks like Kubernetes to optimise resource utilisation. CNA provides the following benefits in combination with Cloud and container orchestration:

- Easy to develop and operate
- Effective use of resources
- Automatic up and downscaling
- Simple and automated provisioning, deployment and configuration
- Standardised application management with monitoring, alerting and configuration
- Faster and less risky development of services, increasing time to value for client customers

This is exactly where IT or - in this case - Cloud technology services provide strategic differentiation. Nearly all big Cloud providers provide highly specialised, industry-specific solutions, including those for: IoT, analytics and machine learning; dedicated high-performance GPU computing used in machine learning; distributed high-speed streaming channels; and on-demand analytics platforms with huge data stores. As an example, in the Industry 4.0 space, a combination of these technologies, together with business domain knowledge, opens a complete new range of business opportunities.

To leverage these Cloud services it is particularly important that existing environments and applications are adapted in readiness.

Most notably, new CNAs enable companies to gain full benefits from the vast array of new services offered by Cloud providers. Innovative features like machine learning and IoT data stream processing allow even small companies to play and proof new business models without high upfront investments. This is an area where NTT DATA helps customers with deep industry and technology knowledge to implement industry-specific CNAs.

Application DevOps and lifecycle management

As already described in the previous agile transformation approach, it is not only a transformation of applications into the Cloud, it is a shift to a new target operating model addressing people, organisations, processes and methods. The primary driver to transform applications to Cloud is driven by the agility and speed-to-market that enables a customer transformation in line with rapid changes in business requirements. Therefore, not only do the platform and the architecture need to be transformed and adapted, it is also how software is created, tested and deployed, denoting another major part of the overall Cloud transformation journey.

NTT DATA provides a dedicated DevOps operating model service so that customers can better enable their delivery units to implement and adapt DevOps processes and tools. The service contains the implementation of a fully automated continuous integration (CI) and continuous deployment (CD) tool chain, and complete automated provisioning of the Cloud infrastructure services (Infrastructure as Code) used. Finally, yet importantly, NTT DATA supports clients in reorganising and adapting agile teams, and in governance and processes.



Conclusion

NTT DATA has significantly accelerated the innovation-driven expansion of services, skills, capabilities and capacities in the Cloud and DevOps area, both globally and locally. This move includes the further development of best practices (summarised in NTT DATA's framework, the so-called "Altemista") as well as the expanded partnership with public Cloud providers such as Amazon, Microsoft and Google. As a result, NTT DATA can offer its customers technological flexibility coupled with methodological and technical independency.

NTT DATA also attaches great importance to the holistic nature of services along the value chain: from industry-specific business consulting in the area of Cloud and DevOps, via Cloud-native software engineering, or migration to Cloud operations on multiple private and public Cloud platforms. These services are flanked by industry-specific and Cloud-based solutions (industry enablement), the embedding of Cloud security aspects, and the integration of several Cloud services and providers (hybrid IT) along DevSecOps.

With the help of NTT DATA skills and competencies, companies can implement application development in a cloud-native context and thus contribute to increased speed and efficiency in addressing new business potential. NTT DATA uses a fully automated assembly platform, or can provide it to customers if the development is to be

carried out independently. The delivery concept and co-operation model of NTT DATA is characterised by the DevOps approach. In this way, companies can fully exploit the strengths of the Cloud without overlooking the necessary governance, access and security guidelines/requirements.

Therefore, NTT DATA is the recommended partner for all enterprises that are currently considering a Cloud transformation programme and seeking the intelligent support of an experienced IT system integrator. Additionally, companies that have already undergone this transformation (perhaps with a lift and shift approach) will find NTT DATA their preferred partner for achieving the desired objectives, especially those looking to exploit and optimise applications – and organisation and governance topics – as well as the Cloud operating environment.



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