White paper

A comprehensive guide to cloud migration

All you need to know, in one place

This paper and our blog series on connected cloud migration serve as a knowledge bank to support your cloud journey. As an IT leader, you may have some or all of this knowledge. What we're providing here is a central repository of information on cloud transformation and cloud migration, in a language that all stakeholders can understand.

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Defining the terms that define your cloud journey

Cloud migration has become a process that nearly every business will undertake to become or remain competitive. The cloud, in all of its permutations, is a means to countless opportunities for improved and sustainable business outcomes.

> **93.7% of organizations see cloud as critical to meeting their immediate business needs;** and 88.4% say it's critical to meeting future business needs.
>
> NTT 2021 Hybrid Cloud Report.

With so many options out there, the process can be complex. So can the many terms used to describe it: cloud strategy, cloud transformation, cloud migration and cloud migration services are part of an integrated whole. But what exactly do they mean on and how do they all fit together?

For this article and our related series of blog posts, we're using the following definitions:

- **Cloud strategy** is what you want the cloud to do for your business in terms of operational outcomes.
- **Cloud transformation** is the process of using the cloud to achieve those outcomes over time.
- **Cloud migration strategy** is how you plan to migrate chosen applications, workloads and storage to the cloud to make those operational outcomes real and active.
- **Cloud migration services** and tools facilitate the process of cloud migration through automation that simplifies, organizes and standardizes the steps in the migration progress.
- **Cloud migration managed service providers** act as partners to your business. They bring the experience and expertise in all the above to create, implement, guide, adjust, manage and optimize each aspect of your cloud transformation roadmap. Their goal is to help your organization define and achieve improved operational outcomes with the cloud.
- **Hyperscaler cloud providers** provide the cloud environments, architectural building blocks, services and tools for the planning, migration, management and optimization of applications and workloads in the cloud.

1. Cloud transformation is a journey, not a destination

Cloud transformation needs to continue when you make it into the cloud. The cloud keeps evolving, so you need to keep reviewing and evolving your workloads, too. The dynamics of your multicloud environment have a profound impact on the interaction of people, processes and technology working in concert with applications, data and storage.

Every cloud transformation is unique, but no cloud transformation is a single event with a singular outcome. Rather, it's an ongoing series of events with many defined outcomes. We start with the premise that successful transformation requires an understanding that it is not a destination but a journey that's plotted with a strategy and roadmap.

Your goals define your journey

Cloud transformation represents the continuity, resilience and agility that your organization needs in order to adapt and thrive in the digital era. Your cloud transformation strategy is therefore built on a journey of reaching specific goals by migrating groups of applications and workloads the cloud. These can include cost, operational and security benefits.

Building a strategy and starting the cloud transformation journey to achieve these goals requires significant partnership across the enterprise. We focus the strategy on four stages of ongoing cloud transformation via migration:

1. Planning and design
2. Delivery and migration
3. Management
4. Optimization and evolution

There are very few organizations taking their very first steps to the cloud. There are even fewer that are far down the road with a maturing cloud-native approach in which people, processes and technology are interacting with applications, workloads and storage in different cloud environments.

Get ongoing guidance, wherever you are on the journey.

You're likely on the road but still determining directions and defining targeted outcomes for cloud transformation. This document serves as a reference for defining your constantly developing cloud strategy and roadmap.

Understand your current environment

What you want to accomplish in the cloud starts with understanding your current state. From there, you can plot a course to get to your defined business outcomes through cloud transformation.

Reviewing your current environment (people processes, networking, applications and storage) holds the key to determining what, where and how to move to the cloud. Your business outcomes or objectives are likely some combination of cost savings, scalability, access, security and business agility in the broadest sense. By pairing these objectives with a full view of your current-state environment and a thorough understanding of how cloud will affect your users, you can determine:

- Which applications, workloads, storage and application dependencies will deliver the biggest bang through migration
- Which of these should you move, and when, how and where

You will need cloud expertise to not only get to the answers but also to design and implement your cloud transformation and migration strategy.

Engage your users

Cloud transformation will change the way your business operates and how people do their work. Change management is therefore extremely important when developing a cloud transformation strategy.

It's important that your users understand:

- The nature and timetable of the changes
- If and how these changes will affect the way they work
- How these changes will enhance their efficiency and effectiveness at work

The goal is to make ensure that your users understand and embrace what's in it for them, and how cloud transformation will affect and improve their interaction with business applications.

Factor in security and regulatory considerations

90% of IT leaders say that increasing security and compliance risks are challenging every area of their IT and network operations.

2022 technology strategy research, NTT Ltd.

The usage and access aspects of cloud transformation can be tied to the complexities of data and cloud security and the regulatory compliance demands that often drive them.

> **96% of CIO/CTOs say that the high adoption of cloud solutions** is driving new connectivity and security architecture (SASE).
> 2022 technology strategy research, NTT Ltd.

Access to data and applications, whether on-premises or in the cloud, is part of an integrated whole. You'll need a strong focus on security governance and regulatory compliance for the people, processes, applications, workloads and storage that will be part of your cloud transformation strategy. This requires determining:

- Regulatory compliance needs
- Identity access management (IAM) needs
- Data security needs for data in transit and at rest

Your successful cloud transformation journey hinges on a detailed analysis of sensitive data and where it's stored – today and tomorrow – for the greatest business benefit in the future. As you evolve into a cloud environment, evaluate your security posture and controls and include them in your future planning. Applying on-premises security controls to the cloud rarely work; you need to take a bottom-up approach. This is where understanding the nature and possibilities of cloud transformation fits into the development of your cloud transformation roadmap.

Develop your cloud transformation roadmap

The cloud transformation roadmap deals with everything from detailed design to choosing the right cloud provider, security hardening, and implementation and migration.

Your cloud transformation is likely focused on migrating on-premises applications that include some combination of:

- Enterprise performance management (EPM)
- Enterprise resource planning (ERP)
- Customer relationship management (CRM)
- Financial management
- Human capital management
- Supply chain management
- Transportation management

Your roadmap will encompass hybrid and multicloud architectures that will require application and workload placement across public cloud providers such as Microsoft Azure, Amazon Web Services (AWS) and Google Cloud.

> **What is the multicloud?**
> **Multicloud** is the use of two or more cloud compute services from two or more cloud providers.

Find the right cloud(s)

The applications, workloads and storage you move to the cloud will be based on your understanding of what each major cloud provider offers and matching that to your transformation needs.

You will have different reasons for choosing a hyperscaler cloud provider for a particular application or workload. We recommend basing your decisions on how that hyperscaler makes user tasks and access easier and more efficient, cost effective, agile and fast.

Cloud strategy and cloud transformation are the big picture. They define why your business leverages the cloud – for example, to make applications, workloads and storage adaptive, agile, scalable, resilient and secure for a mobile workforce and global customer base. But it is the cloud migration strategy that defines the what, when, how and where.

2. Cloud migration strategy: your comprehensive action plan

Your cloud migration strategy is the foundation of your short-term and long-term plans for operational efficiency and business innovation. It guides the premigration and postmigration plans that will determine how the cloud will change your current and future business operations and outcomes.

> **97% of CTO/CIOs agree that network functions** such as firewalls and routers will be moving to the cloud.
> 2022 technology strategy research, NTT Ltd.

Start with business needs

Every cloud migration strategy should be about aligning business needs with application, workload and storage migration options that will help to:

- Lower capex
- Increase capacity, elasticity and scalability
- Enable new services and revenue streams
- Improve application access for a remote and global workforce
- Increase security and control
- Make business continuity and disaster recovery (BCDR) more streamlined and adaptable
- Improve compliance, governance, efficiency, operational management and time to market
- Consolidate disparate environments

It's important to understand that your cloud migration strategy is a long-term living document that views current and future application and workload migrations through the lens of your business strategy for cloud migration. The business strategy for cloud migration is a more granular view of your overall cloud strategy and the impact that migration will have on improving business operations and outcomes.

Get the right answers

Our blog on developing a **how to take the first step with multicloud** helps you formulate answers to the many questions about what to move and where, why, how and when to move it.

Build the business case

Your cloud migration strategy helps you to build the business case for migration that enterprise stakeholders and user support require.

That means giving stakeholders a clear vision of what you expect to gain after migration, for example:

- Improved cost management
- Greater accessibility, resilience and scalability
- New services, business lines and markets
- Outstanding customer experience
- Enhanced security
- Improved governance and compliance

Explain compliance and cost expectations

Improved security, governance and compliance are integral to meeting all other business expectations. This adds a layer of complexity to creating the migration strategy and bringing it to fruition. You will need to ensure data security at rest and in transit through encryption, IAM and other tools and frameworks.

A clear understanding of costs, from total cost of ownership (TCO) and return on investment (ROI) to capex and opex will always govern your cloud transformation strategy. Show stakeholders how the TCO of public cloud services is less than that of on-premises alternatives. The good news is that there are many ways to optimize this balance.

However, it's not so easy to determine the costs and ROI of cloud migrations for hybrid or multicloud environments across several cloud providers.

To determine the costs and other outcomes you have defined for your cloud migration strategy, you need a deep understanding of hyperscaler cloud providers and cloud architecture layers.

Assessing cloud providers and architecture layers

Although there are others, it's best to focus on the three major hyperscaler clouds: Microsoft Azure, AWS and Google Cloud Platform (GCP).

These cloud providers have an encyclopedia of common services, tools and methodologies, with proprietary approaches to each. They also have highly specific strengths that set them apart from one another.

Besides supporting detailed pay-as-you-go models, they also provide support for all three cloud architecture layers, including:

- Software as a service (SaaS)
- Infrastructure as a service (IaaS)
- Platform as a service (PaaS)

It's important to understand these cloud architecture layers and how they relate to cloud services and enterprise application hosting. Understanding how each hyperscaler's SaaS, IaaS and PaaS approaches work will help you determine which is right for each application – and inform your choice about which hyperscaler cloud to use, and when, where and how.

The broad strokes of your cloud migration strategy involve decisions about SaaS, PaaS or IaaS cloud architectures, hybrid cloud and multicloud use, application types such as ERP and CRM, and a choice of application providers like Microsoft, and SAP.

Multicloud choices

75% of top-performing organizations* have already implemented multicloud networking, compared with 40% of underperforming organizations.

*Top performers are categorized as having >10% revenue growth and >15% operating profit (as a percentage of revenue) in the last fiscal year.

2022 technology strategy research, NTT Ltd.

89% of organizations currently operate and/or plan to operate multicloud networking within the next two years.

2022 technology strategy research, NTT Ltd.

Your cloud transformation strategy will determine how much you can and want to manage your applications and workloads in the cloud. And the business benefits and outcomes you're hoping to achieve, and each application and its associated workloads and storage, will guide your use of hybrid cloud and multicloud.

Scalability, agility, elasticity, a mobile workforce and customer accessibility, latency and bandwidth concerns, security, application development, BCDR and a host of other potential needs will influence your decisions in this regard.

Hybrid cloud and multicloud adoption brings great agility and flexibility, but it also brings complexity in the form of connectivity needs and hybrid/multicloud management.

Since business outcomes dictate where an application will run, that could mean you use GCP for machine learning, Azure for Active Directory and databases, and AWS for running enterprise apps like ERP. Cloud-native workloads built for the cloud, DevOps needs, and edge computing may point you to other clouds.

These varied clouds require a collective single-pane-of-glass management and control functionality through highly specific cloud services and tools to minimize complexity and costs.

CIO/CTOs rank the complexity of managing cost across multiple cloud environments as the **#1 challenge to optimizing the organization's network infrastructure.**

2022 technology strategy research, NTT Ltd.

These interconnected choices become all the more apparent as you go through each step in your cloud migration strategy.

3. Key steps to successfully implementing your cloud migration strategy

The success of implementing your cloud migration strategy will hinge on a variety of interconnected factors, including:

- Preparing your people for the cultural change of cloud migration
- Application mapping and infrastructure assessment
- Application migration choices
- Migration timelines (when to migrate what)
- Network modernization and performance considerations
- Bandwidth and latency considerations

97% of CIO/CTOs agree that cloud-based workloads demand greater availability, scale and performance from the network.

2022 technology strategy research, NTT Ltd.

Let's look at some of the main considerations as you progress through the implementation.

1. Understanding and working with your cloud service provider's tools

Your cloud transformation, strategy and the resulting cloud migration roadmap will have many application on-ramps and off-ramps that are specific to your journey.

Cloud providers take different approaches to common tools and services needed for migration, placement, management, optimization and basic security and governance.

The applications you choose to migrate, the way they interact with other applications, users, storage and the network, and the way they can shape user experiences (UX) will play a big role in determining the hyperscaler and its tools and service approach that you choose for migration.

It's also critical to understand how a managed service provider like NTT can reduce your overheads by working with you and centralizing your cloud services.

2. Preparing for business cultural changes

You'll need to prepare everyone affected by cloud migration for the process and the outcome at both a departmental and enterprise-wide level.

This requires a change management process that makes people aware of the upcoming migration and explains what they can expect in terms of how it will improve the way they work.

Education plans and providing contact channels for answering questions or allowing people to give their input can help to facilitate a smooth transition for everyone.

It's this cultural change that will lead to the business outcomes that lower costs, increase the bottom line, and grow the customer base.

3. Application mapping and infrastructure assessment

Preparing your infrastructure for the changes required to implement the cloud migration strategy starts with a detailed understanding of your application portfolio and its dependencies.

This process of application mapping will inform what workloads and applications will move to the cloud. It will also help determine whether you will take a phased or "big-bang" approach to cloud migration, and establish timetables and processes.

The migration process for each application comes down to five approaches:

- **Lift and shift/rehosting:** Move applications to the cloud as-is
- **Replatform:** Move applications to the cloud without major changes but taking advantage of benefits of the cloud environment
- **Refactor:** Change the applications code to better support the cloud environment
- **Rebuild:** Rewrite the application from scratch
- **Replace:** Retire the application and replace it with a cloud-native application

4. Network assessment and management

Your internal network will play a big role in implementation before, during and after migration. It will need to support migration processes, load balancing and other aspects connected to application access, latency, bandwidth and optimization.

This is why we recommend that you first conduct a network assessment. It will help you determine whether you need to make any network updates to accommodate the cloud migration end state.

A network assessment maps application traffic, connections and devices, and includes security tests such as penetration testing and a patch assessment. The goal is to give you a full view of your current state and pinpoint any potential problems before the migration by identifying:

- Network design flaws and inefficiencies that you must correct to maximize network efficiency, agility, flexibility and resiliency
- Bandwidth congestion, bottlenecks and latency challenges
- Security and compliance vulnerabilities

This becomes a foundation for any network update planning to maximize agility, flexibility, and resiliency for your cloud migration strategy. It also helps identify network growth and efficiency options like software-defined networking (SDN) that support hybrid and multicloud distribution strategies along with reliability, security, and compliance in the cloud.

98% of top-performing organizations* currently operate and/or plan to operate software-defined cloud interconnect solutions within the next two years.

2022 technology strategy research, NTT Ltd.

Network optimization is a vital link in cloud migration and computing where application access and security are paramount. SDN and software-defined wide area networks (SD-WAN) are critical to making that happen.

5. Setting up the cloud migration environment

Once you've mapped applications, dependencies, infrastructure and network needs, you're ready to begin designing and setting up the cloud architecture.

- **Estimate the costs**

Start by estimating infrastructure costs based on data storage needs, traffic and CPU memory or resource use.

- **Update the code**

Some applications may require developers to code changes to get the best out of the public cloud. To streamline the updating of legacy code or conversion of the application to microservices, it make sense to have a DevOps team define the environment as infrastructure as code (IAC). Implementing a continuous integration/continuous delivery (CI/CD) process for streamlined application updates will improve services, security and flexibility.

- **Monitor updates and changes**

Applications, workloads and associated databases are continually changing because of new data input, updates and user process changes. These are all part of their normal everyday use. You must be able to keep track of these changes and update them in real time, without error, throughout the migration process – particularly in the testing and cutover phases. It can be a nightmare to manually track these subtle changes. An automation tool will enable you to continually track and replicate changes as you move through the migration process.

- **Test the system!**

Applications and workloads that have been migrated to the cloud will exist in tandem with the on-premises workloads before the cutover. Proper load testing with the system running in production will reveal any instance-sizing challenges or bandwidth issues for access that may still exist. At this point, you need to test the system in a way that represents the final production environment.

6. Cutover and post-migration optimization

One of the most important aspects of cloud migration is minimizing or eliminating operational downtime. There are several steps to achieving this.

- **Test your migration before it runs**

You can do this by cloning it to run in the chosen cloud provider environment that you create. The goal is to make sure there are no problems, without disrupting business operations.

- **Switch from on-premises to cloud**

The cutover process is where you switch from the on-premises application environment to the cloud environment. You may want to schedule this process during weekends or overnight to avoid downtime.

- **Monitor postmigration performance**

Using automation to monitor application performance after migration is important to getting the most out of cloud-based applications and workloads. It ensures continual workload optimization to meet changing demands by maximizing the agility, cost-saving and process performance gains of the cloud.

- **Validate server and application functioning**

Check if migrated servers, applications and databases are functioning correctly. If so, you can allow people to use them. You can then run any remaining optimization procedures for the application and workload, based on user needs, and decommission any temporary environments in the cloud, such as sandboxes for testing, and any on-premises servers no longer in use.

> The only way to confirm a project's success is through postmigration validation.

Validation testing and the ability to go back and take an iterative and ongoing approach to data center transformation can assure the success of the initial project while meeting the goal of ongoing optimization and management.

4. Leveraging cloud migration services and tools

Cloud migration services comprise a vast list of services and tools that are delivered by cloud providers, cloud migration managed service providers and third-party vendors. When you choose and use the right combination, you can create an efficient and overwhelmingly automated cloud migration process.

Cloud migration and automation tools play a key role in your cloud migration journey. The three primary hyperscaler cloud providers – Microsoft Azure, AWS and GCP – along with several other major players provide a wide range of migration services and tools.

While these will help you accomplish all combinations and specific needs for your cloud migration, each provider uses different methods and offers different levels of support.

Know what's on offer

The list of software tools, and services from hyperscaler cloud providers, and third-party tools is long. They need to accommodate various needs, from hybrid and multicloud to different cloud architectures. These services become the foundation to quickly, cost effectively and efficiently handle the following:

- Moving data between on-premises and cloud systems
- Placing workloads in the most suitable cloud environment
- Cross-platform operating system migrations
- Hardware migrations because of upgrade or failure
- Delivering scalable, robust and easily managed data-cleansing and replication tools
- Automating the migration process and handling the variety and volume of data that needs to be migrated across on-premises and cloud environments
- Delivering a single point of control and unified view of all relevant activities, including network performance, bandwidth and latency issues
- Avoiding vendor lock-in
- Maximized cost efficiencies, accessibility and security

Get to grips with migration services and tools

For a foundation on each hyperscaler's primary migration and transfer services – as well as their more recent service additions – read our blog on leveraging **cloud migration services** and tools.

It shows how the choosing among the many options will be a key determining factor in reaching specific top- and bottom-line goals through greater operational agility, scalability, security, and resiliency.

Make automation work for you

More recent service additions these toolkits have a big impact on automating different aspects of the process across hybrid and multicloud architectures.

Automated services and tools from hyperscalers, cloud migration managed services providers and third-party software vendors can remove the business risk associated with expensive, error-prone and resource-intensive manual migrations. Automation enables live migrations with near-zero downtime and the ability to migrate:

- Multiple sources
- Any virtual workload (Microsoft Hyper-V, VMware Fusion, Oracle VM VirtualBox)
- Any public cloud (Azure, AWS, Google)
- Workloads at a colocation facility or managed service provider, and from any physical data center to a VMware virtualized data center

Find the best way to manage it all

It's more than a full-time job to keep up with all the available cloud migration tools and services, gain the expertise to use them, and determine which are best for every unique situation. To manage them all successfully, your team needs to know how to integrate them into a long-term cloud strategy.

A best-of-breed approach can help you minimize the number of tools and services you use and support a successful cloud journey and future business state. Since this is a heavy burden for even the largest enterprise, you should ask yourself:

1. Does my team have the required skills and expertise in cloud migration and the major cloud providers to handle all aspects of the migration?
2. Do I have enough of these resources to ensure the migration as well as other important IT projects get done without compromising quality, costs and efficiency?

It's nearly impossible for even the largest enterprise and IT organization to answer "yes" to both questions, as doing so requires a deep understanding of your environment from the infrastructure (IT/OT) to interactions with people and processes.

Partner with a cloud migration service provider

The right cloud migration managed service partner can be like the GPS on your cloud transformation journey, helping you to plot the right course at every turn.

78% of organizations say that cloud-based infrastructure (and on-premises data centers) are already outsourced (40%) and/or will be outsourced (38%) to an MSP within two years.

2022 technology strategy research, NTT Ltd.

With a track record of successful enterprise application migrations across major solution providers and your specific industry, they can help you achieve the outcomes you require. The best of these cloud migration service providers become partners who support your customized cloud and migration strategy and ensure it adapt to your ongoing migration and transformation needs.

An ideal cloud migration managed services partner should share their extensive knowledge of and experience in:

- Application optimization, management and security
- Transforming workloads to run in public and multicloud environments and architectures
- The intricacies of all major cloud providers and their strengths that can also deliver managed application services support
- Change management and supporting users in preparing for and transitioning to the cloud
- IT and OT environment assessment, along with application mapping and migration choice assessment
- Cloud security and governance integration

They should be capable of taking on-premises enterprise applications to cloud environments via application and data services that span the most commonly used enterprise applications. And, since every successful cloud migration strategy has security built into every aspect of the cloud journey, having integrated managed security and governance is paramount.

Our Managed Cloud Services focus on you

Our integrated portfolio of Managed Cloud Services is built on the partnerships, experience and expertise that come from understanding your specific goals – and how best to use the available services, tools, processes and platforms to achieve them. We offer cloud assessment, migration and transformation

To recommend the cloud solution that's the best fit for your organization, we take the time to understand your vision, your culture and your people. And we support you in achieving your objectives at every step of your cloud journey.

A trusted Microsoft Azure partner by your side

NTT is an Azure Expert Managed Services Provider with over 25 years of experience, global reach and the highest levels of certification.

Why clients choose us for Azure:

- We have deep Microsoft experience with our 25+ year Microsoft partnership
- NTT is recognized as one of Microsoft's key strategic partners
- We've earned the highest Microsoft certifications, including Azure Expert Managed Services provider status, and have numerous Microsoft specializations
- Over 2,300 certified Azure professionals in our organization hold almost 4,000 Azure-specific certifications

We've helped clients across the globe transform their IT landscapes by leveraging hyperscaler clouds and managing their multicloud environments – and we can do the same for you.

Read our blog on
the key to a successful Microsoft Azure cloud transformation.

Visit our website to learn more about our Cloud Consulting and Advisory Services, and our full Azure capabilities, and let's talk about making your vision for cloud migration a reality.


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