

White Paper

Nine Steps to Migrate to the Cloud

Providing you with:

- ✓ An introduction to the cloud
- ✓ Key steps to take when migrating to the cloud
- ✓ Tips to ensure you get the right solution for your needs



Introduction

Within the IT industry today, cloud computing is an incredibly hot topic - and if you're thinking about moving any part of your business to the cloud, this white paper will help you get there. We'll cover some of the key features of the cloud, along with the most important steps you'll need to take to ensure your migration is a success.

First though, a brief history...

You could say that 'the cloud' dates back as far as the 1950s, when expensive mainframes took up entire rooms. These massive machines were shared between multiple users, who were allowed a 'slice' of computing time each.

Fast forward to today, and we can see parallels between this approach and our modern understanding of the cloud, where multiple virtual servers share the hardware of a single physical server that's managed by a third-party provider (rather than internally). No longer, then, do your teams need to think about predicted capacity years into the future when considering what size and speed storage they'll need, as it's all covered by the cloud provider - along with everything that enables the server to function, from networking and power through to cooling and software.

As a result of these impressive capabilities, the cloud has grown significantly in recent years. As many providers keep details about their operations confidential it's difficult to know the exact size of the cloud and estimates vary, but it's big. Really big. Fortune has even published an article predicting that the global market for public cloud services will grow by 17% this year, to \$204 billion ([source](#)). This market is also comprised of a number of different providers, although the most popular and prominent names in the space include:



Faced with this large and diverse landscape, it's important to make sure that any cloud initiatives you undertake follow a robust and reliable process - starting by understanding why you should (or shouldn't!) be moving to the cloud in the first place. Which brings us straight into step 1 overleaf...





Should I migrate?

While the cloud does offer significant benefits to a whole range of organisations, there are several potential reasons why it mightn't be the best solution for your needs. For example, cloud platforms tend to only support the latest (or at least very new) operating systems - so if your applications aren't compatible with these technologies finding a suitable partner can be close to impossible. And even if you do locate someone who can support your requirements, moving your application is unlikely to be easy, as it was probably never designed for this, and may rely on ageing hardware that cannot be replicated in the cloud.

If you have very specific or customised physical server setups, too, the cloud may again not be the right fit for you. Cloud providers typically only offer 'general' computing power, meaning that key features upon which your infrastructure currently relies - such as particular chipsets, graphics cards, and Central Processing Unit (CPU) features that cannot be provided through the virtualisation layer - may not be readily available should you decide to migrate.

If these issues don't affect you though, the cloud is probably a good fit. Indeed, it would be surprising if your competitors aren't taking advantage of the technology already, regardless of the industry in which you operate. In areas that are traditionally slow to react to new IT trends, for example, organisations are reaping the rewards of embracing the cloud computing revolution early. These organisations include [Investec Asset Management](#), who moved to a cloud-based framework while the majority of investment banks still relied on traditional steel server environments, and achieved annual cost savings of 45% as a result.



Ultimately, if you're experiencing the common IT challenge of trying to scale your internal infrastructure then the cloud is definitely something you should be looking at - but be sure to consider both sides of the argument when making your final decision:

Advantages

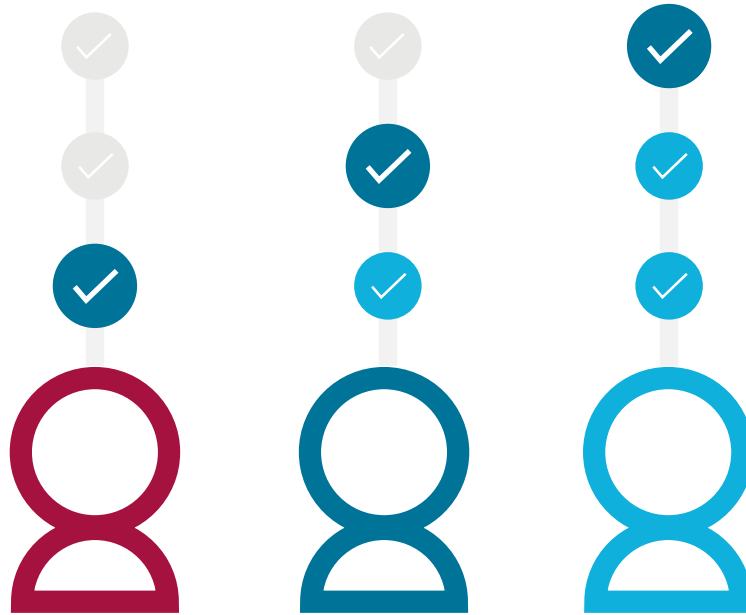
- No upfront costs
- High levels of scalability
- Only pay for what you use

Disadvantages

- On-going costs could be higher than purchasing your own hardware
- Possibility of downtime as you are reliant on external service providers
- Risk of getting locked into a single service provider
- Security/privacy is not totally under your control
- Lack of control/flexibility over the base hardware/software

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Upskill your team



The cloud brings with it a lot of new technology, and with this a lot of new practices that must be learned. Automation, for example, plays an important role in the cloud, and while some organisations have experimented with applying this to their in-house systems it has tended to be on small scale (although this has improved dramatically in recent years with Microsoft Powershell and provisioning systems such as Ansible getting more and more powerful).

There might, therefore, be a demand for skills that your IT staff don't currently possess, especially if cloud capabilities have only recently come onto your radar. Thanks to the pay-as-you-go nature of the cloud though, training can be done on the job if needed though that's not to say there are no issues associated with this approach - learning by doing will inevitably involve making mistakes of course. And while this is fine if those mistakes remain in the test account, you may find that your colleagues are eager to start using real live data; bringing your systems into production earlier than expected, where any slip can have very real ramifications.

Fortunately, however, cloud providers have been quick to provide their own training resources. AWS has training available both online and in person through its partner QA (in the UK), and also provides official certification so you can be sure any activity completed meets the requirements that AWS itself sets out. Microsoft also provides training for its Azure platform through classroom courses or the very good Microsoft Virtual Academy, with certification awarded once certain exams have been completed. There are also many other vendors offering either training on their systems, or focusing on the generic solutions that can be designed and deployed with this new technology (Rackspace, for example, offers its uCloud training for free [here](#)).

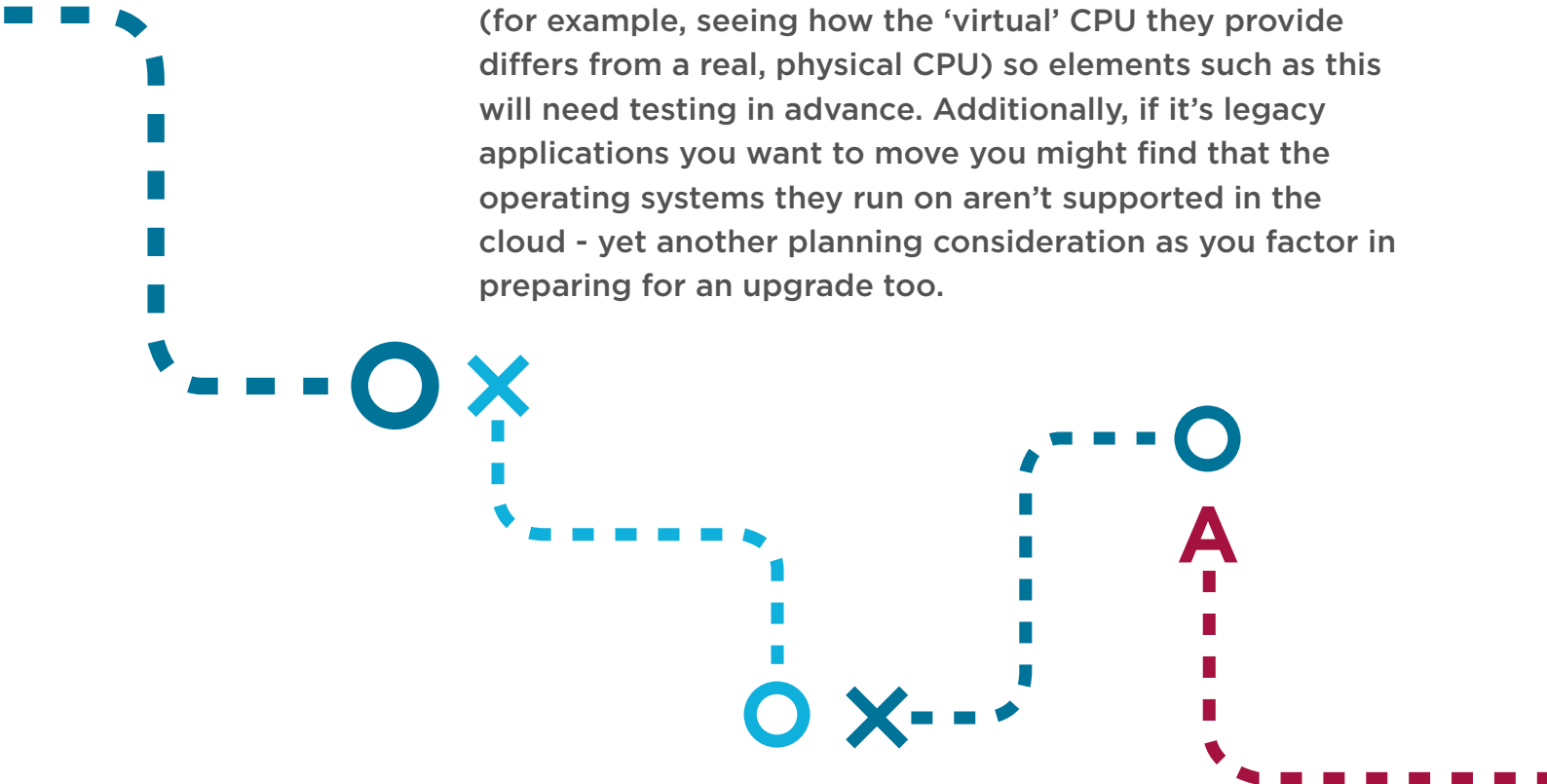
Choosing how you'll implement training within your organisation is an extremely important stage in your journey to the cloud. An effective strategy will enable you to get the very most out of the technology, whereas jumping straight in can have lasting negative effects. For example, if your team doesn't know how to create a clear and coherent naming system you may not be able to identify exactly what your various servers do, making it extremely difficult to maintain them, assign responsibility, or even switch them off!

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Plan, plan, then plan some more

Before making any decision about how you move to the cloud, planning needs to take place. In particular you'll want to think about which elements of your infrastructure will be moved, as it's far from an all-or-nothing decision. Indeed, one of the beauties of the cloud is that you can use it as much or as little as you want to, while only paying for what you actually use. So, as you no longer have to consider capacity planning in the traditional way - if you require additional servers/storage, you simply add it to your solution - it might be that you start with a single application, and see how it fares before going any further.

Of course, this will still require substantial planning, with consideration given to how the application may respond to being based in the cloud. This can be complicated by the fact that cloud providers often don't make it very easy to compare their environments with your current setup (for example, seeing how the 'virtual' CPU they provide differs from a real, physical CPU) so elements such as this will need testing in advance. Additionally, if it's legacy applications you want to move you might find that the operating systems they run on aren't supported in the cloud - yet another planning consideration as you factor in preparing for an upgrade too.



Your planning stage is also the ideal time to produce a proof of concept, to enable you and your team to better understand some of the challenges involved early on (and to use this insight to inform your eventual plans). As, again, you only pay for what you use with the cloud this is a highly cost-effective way to gain additional confidence in your migration plans, especially when you compare it to the equivalent costs if you were to use physical server solutions, whose providers typically lock you into a six-month contract (at least) at the outset.

Of course there are numerous other crucial - yet often overlooked - issues to consider too, such as the location of your chosen cloud services. This could introduce serious legal and security implications, especially if you're working with sensitive information and so need to adhere to specific legislation (such as the UK's Data Protection Act). These issues will have to be addressed before further steps are taken, and in extreme cases it may even affect whether or not you continue to use certain services at all; however, your cloud provider should be aware of any applicable laws and be able to assist you in using their solutions while complying with them.

The licences that may be required for your migrated services is another planning element that must be thought about carefully at the outset. Many cloud providers include licensing as part of their service (for an additional fee) or will allow you to bring your own licence if the terms permit it, but it may be that your current licensing is 'site'-based and so won't cover this new infrastructure. Either way, this is a complex area so it's well worth speaking to the person responsible for licensing within your organisation to understand any potential impact before you make a decision.

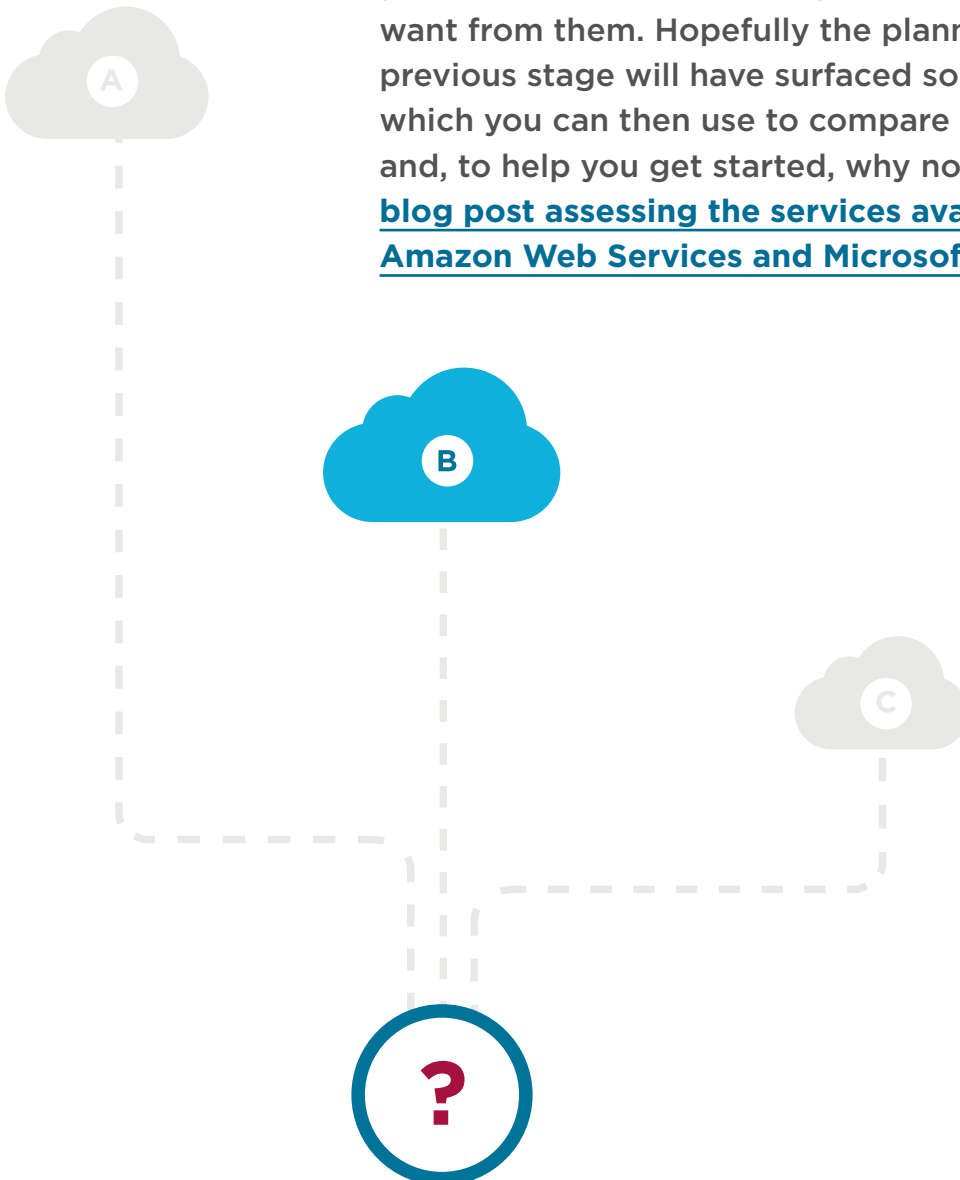
Having factored all these considerations into your plan you can then create a roadmap for your migration, to ensure that all interested parties/stakeholders are aware of, and agree upon, the timescales and milestones involved with the project.

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Select an appropriate cloud provider

Unless you're going to roll your solution out via a cloud service you've created in-house (the planning of which is certainly not covered within the scope of this white paper!), you're going to need to pick a provider to partner with.

If you already have links with an organisation that offers cloud solutions - or even if you just have somebody in mind - this could be a very simple procedure, although you'll still need to think very carefully about what you want from them. Hopefully the planning you started in the previous stage will have surfaced some key requirements, which you can then use to compare different offerings and, to help you get started, why not take a look [at our blog post assessing the services available from both Amazon Web Services and Microsoft Azure.](#)



It's important, too, to ensure that you are choosing well for the future of your business, as well as the present, as the partner you pick will ultimately determine the products and services that are available to you. You could overcome certain gaps or weaknesses by designing systems that work across multiple cloud providers, but while this is great in terms of disaster recovery (see [this blog post](#) for more details), the benefits are often offset by the amount of effort required to make this setup work. This also wouldn't work if you wanted, for example, to deploy a feature that is only supported by AWS (e.g. Glacier, a long-term data archive product), to another provider such as Azure. While there are comparable services, currently there's nothing that's an exact match, making using more than one cloud provider an inherently risky approach to take.



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Create your migration plan

Yes, planning was covered in step 3, but now that you've officially chosen your cloud provider it's time to confirm the details. If you've created a proof of concept, you'll also want to incorporate any lessons learned into your plan at this stage - and it's a good idea to create a brand-new account in which to build your first live instances, to ensure there's no technical debt (more about which [here](#)).



There are a number of different strategies you can employ to migrate to the cloud and the most suitable approach for you will depend on the nature of the services you're moving, as well as your desired outcomes. Options you may wish to consider include:

Forklift migration

This is an approach that works best for stateless or self-contained applications. While migrating these applications to the cloud may still transform the way in which they work, as they aren't interlinked with other systems it's much easier to 'pick them up' and move them straight across, where you can then address any consequences. Note, though, that applications moved in this way tend not to be able to immediately take full advantage of all the cloud services on offer, so it's a good idea to check that they're operating as effectively as possible as part of your post go-live plans.

Hybrid migration

This can be used when moving an entire application at once may be considered too risky (for example, if it's business-critical). With this approach, the application is

broken up into its constituent parts, which are moved and optimised one at a time into your cloud solution. This enables risk to be mitigated and managed, although as with the forklift strategy you'll still need to review results following the initial migration. It might be that applications moved in this way still require changes to enable them to take advantage of the new features offered by your cloud provider, such as Amazon's EFS (Elastic File System, which provides storage capacity that grows and shrinks automatically) and Route53 (a highly available and scalable cloud domain name system).

Whichever strategy you use, you'll also need to consider:

Applications and workloads

Some applications will lend themselves to being moved to a cloud environment more readily than others. It makes sense, for example, to start with your lowest-risk applications, as these will show you how the cloud can operate at a small scale and allow you to rectify any mistakes before more critical applications are migrated.

Technical approach and design

Are you going to simply replicate your application/environment in the cloud using virtual servers? If not, you're likely going to need to design new infrastructure for the application to sit on, and this could differ radically from any previous services you may have been using. It may also be the case that individual applications require different technical approaches, all of which will have to be accounted for in your plans.

Integration

How are your newly cloud-based applications going to integrate with any services you're keeping in-house/on existing hardware? To ensure effective communication between these disparate systems you may wish to consider technical solutions such as a Virtual Private Network (VPN) link between your current office's and new cloud infrastructures.

Implementation

Planning how and by whom your migration is going to be carried out is of course crucial. It's important to ensure that everyone closely involved with the project is aware of these plans, make time to put in place appropriate documentation and training, and accurately 'tag' new infrastructure and document this in a central location so that it's immediately clear what it does (as referenced in step 2). And if you don't have the capacity for all the necessary tasks, you may wish to consider outsourcing elements of the [planning and implementation](#) of your IT strategy.

Operating processes

You'll also need to plan for the on-going management and maintenance of your new cloud infrastructure. The administrators of your new system should be provided with enough training to ensure they can take responsibility for this, although you may still require additional support to deliver 24/7 coverage.

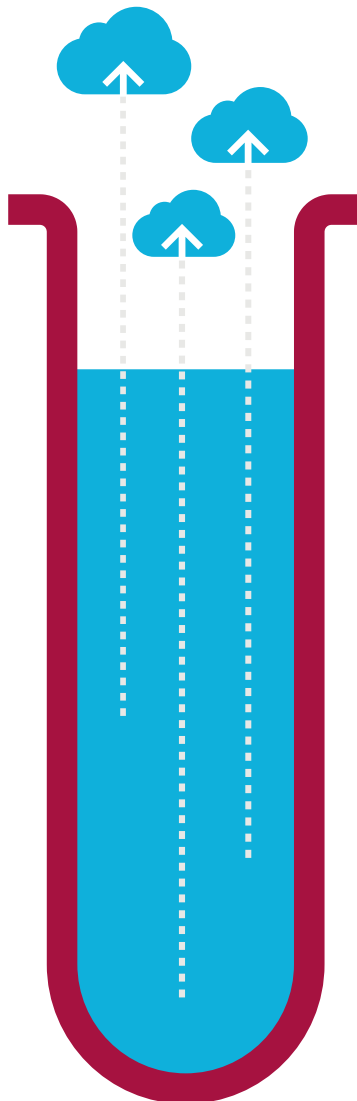
Finally, any new risks that may affect your cloud solution will need to be considered - some of which are covered in step 6: testing.





Test, test, then test some more

Conducting regular testing throughout your cloud migration is vital to safeguard quality. It's often much more straightforward to resolve issues uncovered at an early stage than those having gone unnoticed while changes are being made to the service/application, when the additional steps in the process can make it harder to trace the root cause of the issue. As you would were you testing a locally-based project then, unit tests, feature testing and exploratory testing should all be included in your migration plan where appropriate. Additionally, having a list of features to be tested and documentation on any features or other changes expected during the move will help you further target your efforts, for an even more streamlined and efficient testing process.



With your migration taking you from locally- to cloud-based services, testing all the connections being used by your service or application is crucially important. If any services were previously locked to your original IP address or accessed through a VPN, for example, you'll need to test that these services are still reachable, and that any APIs return the correct results. Remember too that if you do need to make changes to restricted IP addresses or open any APIs this can create security holes - so be sure to conduct security testing on your new build to confirm you haven't introduced any potential vulnerabilities during your migration.

Load and stress testing your build is another vital part of the quality assurance process. Even if the cloud servers you've chosen are the equivalent of your in-house servers on paper, you may need to optimise for any delay introduced by the changes in the way first- and third-party APIs communicate with your solution. When a service accesses a local API from an external source, for example,

it can be a fraction slower than if it were residing on the same server; and if this API is accessed multiple times these fractions can build up to a significant reduction in performance.

A key factor to bear in mind though when conducting load and stress testing in the cloud is the cost that can come from automatic scalability. Virtual servers that automatically scale to meet peak demands can provide many benefits, but these usually come with additional costs - as extra virtual server capacity generally means extra charges. This is something you'll need to think about if you're planning to ramp up the number of simulated 'users' during testing to see how far you can push the service, especially as - if scaling works as it should - there shouldn't be an upper limit that can be easily reached. You may therefore end up building up significant additional costs without achieving any meaningful insight, diminishing the value of your testing.

Finally, penetration testing - which highlights potential ways your solution could be interrupted maliciously - should also be carried out. Even if your cloud provider already offers a certain amount of protection against some types of attack a full range of tests covering all known bases and potential weak points is still highly recommended, as the range of methods used to penetrate a site changes constantly. Because of this there's no way to guarantee that you'll be invulnerable, no matter how much penetration testing is performed, but an open honeypot is a much more attractive target than one with the lid screwed on tight, and with a good set of tests you can minimise the chances of your project being targeted.



Time to go live!

Before you launch your first application or service in the cloud, make sure you've communicated exactly what will be happening (and when) to all your stakeholders, as their support will be crucial to making your project a success. You'll also want a rollback plan so that you're prepared for any mishaps that may occur, although if you followed step 6 then you shouldn't need to use this. With this in place there's nothing to stop you going ahead with your launch - provided you've conducted the appropriate checks beforehand:

Go-live checklist

- Migration plan agreed, with a dry run performed if possible
- Rollback plan in place and tested
- Critical staff available for the entire migration period (or on-call cover scheduled for longer go-lives)
- Monitoring set up for critical services/servers, with alerts in place to inform the correct team members in case of issue
- Any changes documented so that all administrators are aware of what is happening
- Data restore performed to confirm backup systems are working



Of course once your solution is live, you'll want to know if it's been a success. Before the launch then, you should also put in place good acceptance criteria detailing how the service or application will behave in the cloud as well as Service Level Agreements (SLAs) that give users an idea of what to expect, to increase confidence in the solution. If different from current SLAs (for better or worse) the reasons behind this will need to be explained to stakeholders, and you may find that adjustments are required once things are up and running 'in the wild', so ensure you have the flexibility to make changes as needed.



Assess the immediate impact

As soon after the launch as possible, perform a review of your migration. You should be able to use the monitoring and alerting set up as part of your go-live checklist to measure performance against the SLAs you set yourself, and any issues raised here should be quickly identified and resolved. There will undoubtedly be wider opportunities for optimisation and improvement as well, which will need to be fed into any plans you have to move additional services and applications into the cloud.

This review period also provides a chance to look at the immediate benefits you've realised through your migration, and assess whether these match up to your initial targets and goals. Hopefully, for example, you're spending less time worrying about future planning from a hardware perspective, and can instead focus on ensuring that you're making the best use of the new functionality the cloud has given you access to.

Alternatively, you may have decided to move to the cloud because of specific problems with your previous solution. Have these now been resolved? If not, be sure to identify exactly what hasn't worked, and whether it can be fixed, as there isn't much point in moving the rest of your infrastructure if the underlying issues remain.

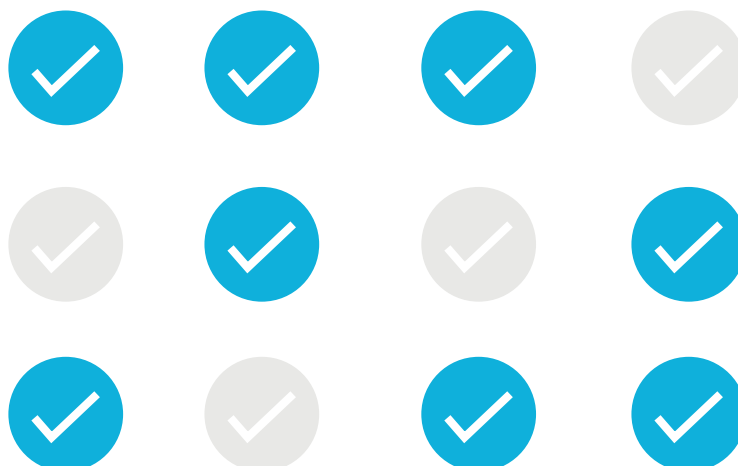
You'll need to involve all stakeholders in this review process, as the ultimate measure of your success will be informed by a range of different viewpoints. While you might have delivered a technically perfect system, for example, it may be that your actual end-users haven't seen the tangible benefits they were promised, or have experienced downtime while the system was being migrated.

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Review again, and again...

Once six to 12 months have passed you should be able to easily see if your success criteria have been met or exceeded - particularly if these were well-defined at the outset - as well as whether or not your initial project budget has been adhered to. Conducting a customer satisfaction survey will also provide qualitative and quantitative insight into how users and administrators feel about the solution after the bedding-in period has passed.

Security is another key area to investigate during your longer-term review. Although you should have considered the security implications of moving to the cloud and put measures in place to protect against these when you planned your migration ensuring compliance in the cloud can be challenging, as firewall rules can be opened and security settings changed by any administrators with the correct permissions. There are tools that can help with this though, such as the AWS Trusted Advisor, which will analyse your account against all the best practices recommended by AWS (the full list of which can be seen [here](#)).



Don't think that your migration ends with this review, however. Moving to the cloud isn't an operation that's carried out once with no further input - you always need to be thinking about the future of your strategy. Even in the few years that the cloud has been running production workloads many things have changed, as evidenced by Amazon's [updates feed](#) which, at the time of writing, featured eight updates in the last week alone. Make sure you're aware of how these releases might impact your strategy, especially if it's a completely new product being launched (as you might find this provides the ideal solution to an issue you've been facing).

Additionally, as more and more services compete for your IT spend, there will be greater opportunities to do more with less. Virtual servers, for example, are often under-optimised, so you may want to consider replacing these with services such as Azure App Service, AWS Lambda or Google Cloud Functions to maximise your margins and so support the on-going growth of your business.

Conclusion

The cloud might not be for you, but the low barriers to entry and potential for significant returns mean it's an opportunity that's almost certainly worth exploring. From the migration of single workloads through to the deployment and operation of entire infrastructures, many organisations have successfully transitioned to the cloud - and if you answer 'yes' to any of the following questions there's a good chance it will help your business thrive too:

- Is standing up new servers/services taking days, weeks or even months, rather than hours?
- Are you finding it difficult to scale either horizontally or vertically?
- Can your current vendor/supplier not provide the capacity you need, in the timeframe you need it?
- Do you feel your IT contract limits what your business can achieve?
- Are you creating services from scratch that are already available from cloud providers?
- Is your capital expense increasing without any value being added to your business?
- Are your IT staff wasting time and money maintaining hardware servers, when they could be focusing on your core business instead?
- Does your change control process make it difficult to implement even simple changes, especially in emergencies?



And even if you remain unconvinced of the benefits of the cloud, remember that other users in your organisation might not be. If you're not listening to your users and providing them with the services they need, they may turn to the cloud to procure the required tools themselves (this is known as the "shadow IT effect", and is covered in more detail in [this article](#) from The Register). As they haven't gone through your organisation's established procurement and implementation channels these solutions can have a serious negative impact on the security and stability of your systems, so you'll need to ensure you're constantly monitoring for, responding to and protecting against this activity - including, potentially, bringing the cloud services being demanded into your core IT operations.

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