



Charting a Path from the Network to Multi-Cloud

WHITEPAPER | David S. Linthicum

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Preface

Today's IT infrastructure leaders face some very tough challenges. Beyond the usual mandates to keep systems up and running, modernize aging technology, be the cost-efficiency expert, make technology easier to manage, and standardize processes—you're now also expected to be the change management agent who will reinvent IT as new business incubator. To do this, you have to speed time to market, automate and move workloads to respond faster to customers, rethink the IT culture, retrain workers for new skillsets, and build relationships with business tech buyers to help drive business growth. This is an exhausting "to do" list. And it's hard to strike the right balance between the demands of digital-savvy customers who need instant access to applications and services delivered through the "cloud"—and IT's responsibilities to drive overall systems efficiency, performance, and privacy protections.

Certainly you have a large number of requirements to juggle, and it's a daunting task to try to satisfy everyone's expectations. There is no single, magic formula to achieve all of these objectives. But it doesn't have to be so difficult and frustrating. With the right network infrastructure, it is much easier to connect, secure and speed up delivery of all of the cloud applications and services consumed by your organization.

This paper takes the mystery out of improving your network to enable cloud-based resources in multiple clouds. Beyond the basics, you'll gain a step-by-step approach to consider as you integrate your networking requirements with cloud-based resources. You will also chart a clear path to the right network solutions, and learn how to pick the right network partner to successfully and securely connect people with access to multiple clouds.

What are Multiple Clouds?

As businesses decide to store and deliver more applications, business services, business data, information and content through the “cloud,” it’s no longer logical to talk about one company cloud. The days of a single enterprise cloud are history. Instead, most companies are gravitating to a collection of multiple clouds (or multi- clouds) to meet all of their requirements.

Why the move to multiple cloud environments? The use of multiple clouds has evolved from patterns of architecture. Many business departments seek to use cloud computing within public clouds, outside of the company firewall. Meanwhile, IT historically has created private clouds connected to data centers. Hybrid clouds are a combination of the two models. Today, we also have many different types of public and private clouds that provide security, governance, and management tools to support other clouds, and which get combined to create a composite solution.

Multi-clouds enable cloud computing using best-of-breed technology so that IT clients can get what they need, when they need it, how they need it—*without the need to go outside the network*.

Reasons Why Companies Adopt Multiple Clouds

Enterprises move to multi-clouds for many reasons:

- Single cloud solutions typically don’t provide the breadth and depth of functionality that enterprises require for all of their cloud computing solutions, so they mix and match public and private options.
- The rise of cloud management platforms (CMPs), give enterprises a single interface to help them provision, manage and scale complex environments.
- Usage-based pricing makes it easier for enterprise IT to evaluate the cost of cloud computing, including show-back and charge-back services.
- Companies who want to move applications into public clouds need a range of services, including different database, middleware, development, and compute services, and this drives the use of multiple cloud computing platforms.
- The growing use of platforms, infrastructure and software in the cloud results in multiple forms of clouds. Consequently, IT must often support two or more public clouds for Development and Operations teams who use the cloud to create new business applications and services.

The CompTIA report found that more than six in ten cloud computing users report that they have already moved beyond initial cloud projects and are installing other types of platforms, infrastructure or software services delivered through the cloud.

Research Confirms the Use of Multiple Clouds

A CompTIA¹ survey reveals more about how organizations are using multiple cloud environments.

- More than 90 percent of responding companies already moved some of their processes to the cloud. Furthermore, these same companies expect to expand their IT infrastructure to include multicloud.
- Once businesses become comfortable with their first cloud integration project, they are likely to deploy different cloud platforms for different areas of the business, depending upon their requirements.
- 60 percent of respondents say they already use cloud services for data storage, 48 percent say they use it to improve business continuity and disaster recovery, and 44 percent say it has increased data security.
- More than six in ten cloud computing users report that they have already moved beyond initial cloud projects and are installing other types of platforms, infrastructure or software services delivered through the cloud.

Accordingly, businesses are recognizing and capitalizing on the many promises of cloud computing such as lower costs, automation, speed of deployment, agility, economies of scale, and standardization. The move to multi-cloud computing is the choice that most enterprises are making because it offers them:

- best of breed technology
- the flexibility of using whatever types of clouds they need and not limit themselves with a single type of cloud (the “walled garden” problem)
- the ability to extend the reach and flexibility of the cloud and configure and reconfigure it around changing requirements.

So, What’s the Problem with Adopting Multi-Clouds?

While companies race to embrace the cloud in its many forms, what they don’t know could sabotage their cloud experience. The ability to use multi-cloud solutions has huge advantages, but you can only ride a multi-cloud solution on the right network. The network is the glue—quite literally the infrastructure—that holds everything together.

The problem is that most enterprise networks simply aren’t ready to support multi-cloud computing, nor are they capable of auto-responding to the elastic nature of cloud-based platforms. Many enterprises have a tendency to neglect the network when they move to a cloud computing strategy and when they implement cloud computing systems. Do this at your own peril.

¹ “Cloud Adoption Enters a New Phase with Rise of Multi-Cloud Use, CompTIA Research Finds,” from CompTIA® Fourth Annual Trends in Cloud Computing Study, Sept 5, 2013.

Let's take public cloud resources as one example. People usually access web-based cloud services using a public Internet connection. This presents companies with significant risk of exposure because the connection to information and data shared in these cloud environments can be easily compromised.

Also, as more people seek to connect to multiple types of clouds from different locations and devices across the company, it, in essence, saturates the supporting network. As a result, this creates a range of issues that range from transmission delays that lead to poor user experience, to interrupted or inconsistent availability of applications, and to the potential risks of compromising private information.

Networking professionals may invest in their existing network infrastructure, yet soon find that software upgrades delivered over the cloud can quickly create a network traffic jam. And when this happens, enterprises often take a more disruptive and ad-hoc path or they reject the use of cloud computing—thereby delaying any cost efficiencies and strategic advantages of the cloud.

To help resolve all of these issues, companies should align their network capabilities as they plan long-term cloud computing infrastructure. You have to plan how the network will support cloud solutions, and determine your network strategy with the cloud strategy in mind.

Most enterprises that fail to consider the impact on all network infrastructure, including their corporate WAN, may find that the multi-cloud does not have what it needs for complete success.

Where are You in the Move from Traditional to Cloud IT?

There are different levels of maturity around the use of cloud computing technology, and a Cloud Maturity Model helps you determine where you are in that path (Figure 1). Most enterprises are at the entry level, around “Standardize.” At this stage, companies are looking to use cloud to lower costs, reduce complexity, and provide better performance. However, companies quickly build from there to greater stages of maturity.

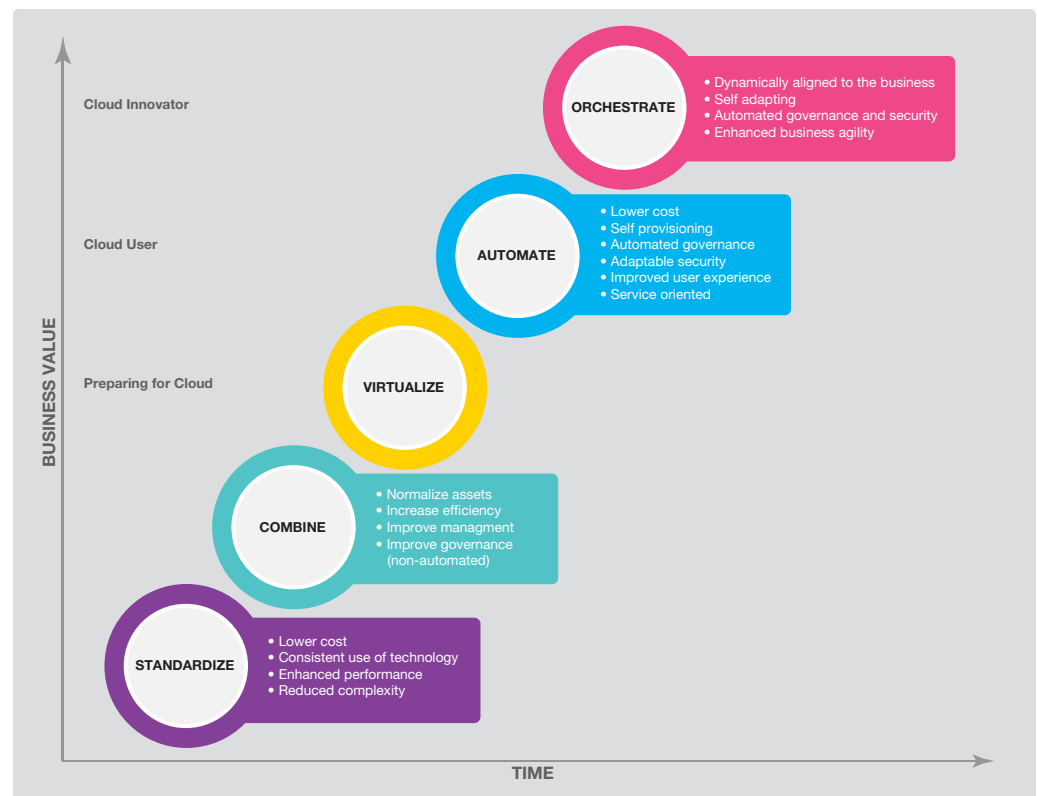


Figure 1: The cloud maturity model.

The cloud maturity model shows enterprises how far companies are in the move from existing IT to cloud-based platforms. The stimulus for adopting each stage ranges from reducing costs and complexity to self-adapting capabilities.²

Moving up the model, enterprises move to “Combine” (normalizing existing assets), to “Virtualize,” “Automate,” and finally to “Orchestrate.” By the time you reach the “Orchestrate” level, you can dynamically align the cloud solution to the business requirements. In this phase, you can make self-adapting solutions, provide automated governance and security, as well as use these capabilities to fuel business agility.

² Linthicum Research, LLC

The use of multi-cloud solutions is systemic to this maturity model, including the use of any number of public and private cloud resources. Additionally, multi-cloud accelerates the path-to-value of cloud computing. Most business needs are met when the company deploys a multi-cloud solution (as examples: scalable public clouds, secure private clouds, massive database support, responsive, cloud-based, business intelligence systems,) instead of a traditional (single cloud) or hybrid cloud (parried public and private) computing architecture, where the resources are much more limited.

Thus, the use of multi-cloud allows the people who need to use platforms that support many types of clouds to mix and match cloud services to meet demand. This means these companies move faster up the cloud maturity model and will thus realize even greater overall value.

Striking the Right Balance Between Network and Cloud

Like all catalysts of change and evolution, problems can surface whenever people attempt to bring opposing yet complementary forces into equilibrium. The growth of multi-clouds dramatically changes network requirements such as performance, governance and management. In many instances, as companies evolve in the maturity model of cloud adoption, they fail to fully understand their network issues until after they've deployed multi-cloud solutions.

- The reality is that **growth in complex cloud implementations has increased the intra- and inter-company network requirements.** What's lacking in the network must be dealt with before implementation of most cloud-based solutions, specifically, multi-cloud.
- **Network performance is a key issue when implementing multi-cloud solutions.** Complex cloud architectures place a much larger load on the network infrastructure. The need for network bandwidth flexibility, priority-based routing for critical cloud-based applications, visibility into what's happening with all applications across the entire network, and the ability to pinpoint, troubleshoot and resolve traffic bottlenecks within the network must be addressed.
- **Network governance, management and security are core concerns in multi-cloud designs.** With many people using public cloud applications without involving IT, it becomes more important than ever to reign in oversight into the entire network as companies move to multi-cloud solutions— this should be done for many reasons, not the least of which are security concerns. Controlled use of the network using pre-defined policies and the ability for the network to work intelligently with cloud-security solutions, such as federated and identity-based security systems, are preferred when dealing with multi-cloud.

So far, you've read about many of the common issues that businesses increasingly face as they move to multi-clouds, and you've had an opportunity to gauge where your organization fits into the adoption maturity model. Now, it's time to develop a plan that better integrates network and cloud strategies. The next section of this paper focuses on the path to define, deploy, and operate a multi-cloud platform, including details about how to support the network requirements for multi-cloud.

Defining Your Network Strategy with a Cloud Strategy in Mind

Certainly, without the right network infrastructure behind them, cloud resources may not live up to expectations or fail. Factor them both into your planning as part of your cloud computing strategy.

We suggest the following steps:

1. Understand the Business
2. Define the Cloud Infrastructure
3. Define the Network

These steps and their sub-tasks are shown in [Building a Network Strategy with a Cloud Strategy in Mind](#) (Figure 2). In some instances, you may wish to add or delete tasks, based upon your specific enterprise requirements.

Understand the Business

The process of understanding the business means breaking the existing “as is,” and “to be” IT down into a few categories that include:

- Data
- Applications
- Services
- Processes
- Security
- Governance

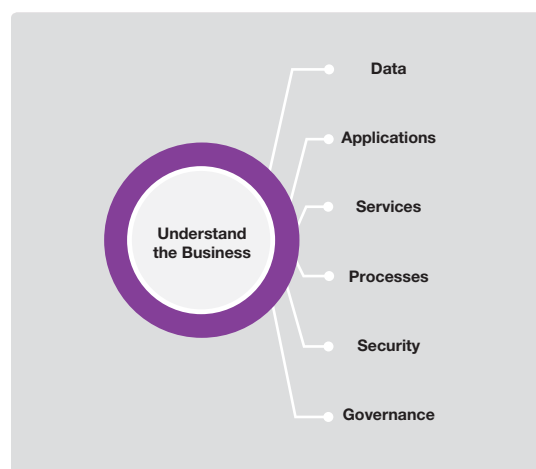


Figure 2.1: Building a network strategy with a cloud strategy in mind.

Understand the business case and the cloud infrastructure requirements, and feed that information into your network solution.

Data refers to understanding the existing and future physical data requirements, including the existing database technology and schemas. This understanding should include knowledge of the amount of data moved on the network. **Applications** refers to understanding all of the existing and future business processes and applications, and how these are bound to the database, as well as the business problems they solve.

Services refers to the Application Programming Interface (API) (or standardized requests, programming instructions or protocols that enable one software application to exchange information with another software application) — or the services currently in use or planned for future use. You must also understand the core business **processes** that may be (or may not be) automated. Finally, you need to understand **security and governance** requirements, including existing and future compliance rules and regulations.

While a detailed discussion of understanding business requirements is beyond the scope of this paper, there are many resources and methodologies you can use to guide you through this process.

Define the Cloud Infrastructure

After you fully understand the business requirements you're going to need to fulfill, it's time to focus on the right cloud technology. We can place these cloud technologies into some key categories:

- Storage
- Compute
- Management
- DevOps
- Security Services
- Cloud Management Platform

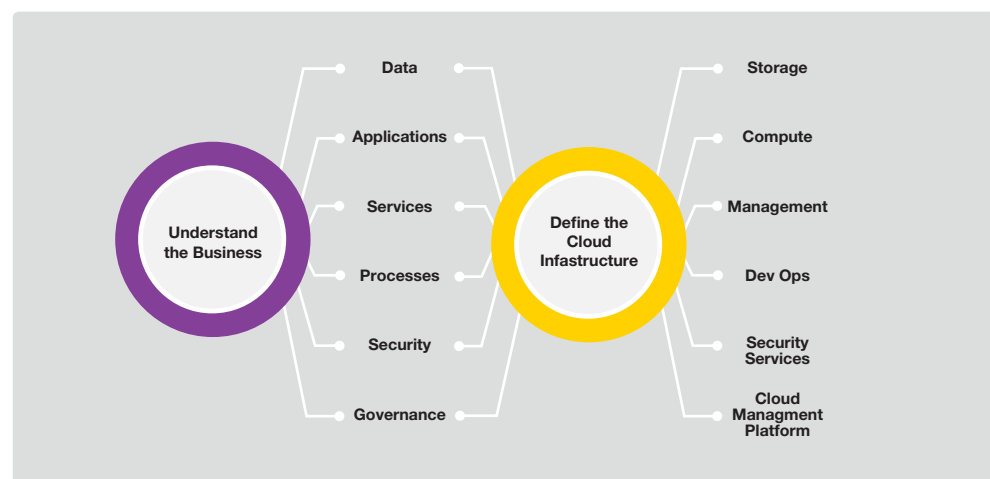


Figure 2.2: Building a network strategy with a cloud strategy in mind.

Understand the business case and the cloud infrastructure requirements, and feed that information into your network solution.

The cloud **Storage** solution(s) should consider how much storage you'll need today and in the future, as well a mapping of what types of storage you'll need (for example, an object or block). Select a cloud storage solution that addresses the performance requirements, security requirements, governance requirements that you need to meet your predefined cloud computing business requirements.

Similarly, the cloud **Compute** solution(s) should provide enough CPU power to address the predefined business requirements. These solutions should work with the selected cloud storage solution(s), and they may be offered by the same cloud provider. The idea is to provide a set of technologies, as well as plan for those technologies to evolve and continue to meet the needs of the enterprise.

When selecting cloud storage and cloud compute solutions, you are likely to select more than one type of cloud to support them. As an example, you may need standard platform computing and storage for enterprise accounting solutions, and super computer-type services for R&D and engineering. You should also consider how the distributed nature of multi-cloud relates to and impacts the wide area network, especially requirements for self-service and automated provisioning to meet short-term needs for storage and compute resources. your network sizing (covered in more detail in the next section, Define the Network).

Select **Management** solutions to provide visibility into all major cloud subsystems, as well as into the cloud technologies that are part of the multi-cloud environment. This includes how you're going to manage operational issues, such as performance, network, storage, etc., and being able to correct issues before they become true problems. These decisions will typically require you to consider both cloud and non-cloud resources.

Development and Operations (DevOps) solutions help enterprises bring new software services to market quickly and reduce time to market through direct deployment and speedy configuration of cloud computing services.

Security Services solutions should support the security requirements of the business, including encryption and identity management designed to help protect a distributed and heterogeneous network of systems.

Cloud Management Platform (CMP) solutions are different in function and purpose from the aforementioned management solutions. CMPs provide resource governance solutions for all of the cloud components listed above, including Storage, Compute, DevOps, Security, and they provide the ability to automate policies that help manage these services. CMPs are a strategic requirement when considering multi-cloud, in that they provide a layer of abstraction above all public and private cloud resources. CMPs can automatically provision and cancel resources using one interface. This gives the people who are responsible for managing a multi-cloud operation easier ways to turn resources on or off for specific teams and to govern how they use the resources.

Define the Network

"Multi-clouds typically strain the network bandwidth, and place increasing expanding, 'bursty' loads on the network"...

After you've considered your business and cloud requirements, it's time to take a closer look at the network infrastructure you'll need to power everything at efficient levels. It's time to define the underlying network that will support your multi-cloud solution. To define the network (see Figure 2), you will need to address planning requirements around:

- Bandwidth Capacity and Elastic Planning
- Performance Modeling
- Network Security Planning
- Network Management Planning
- WAN Selection Planning
- VPC Planning
- Network Optimization Planning
- Application Performance Planning
- Business Continuity Planning

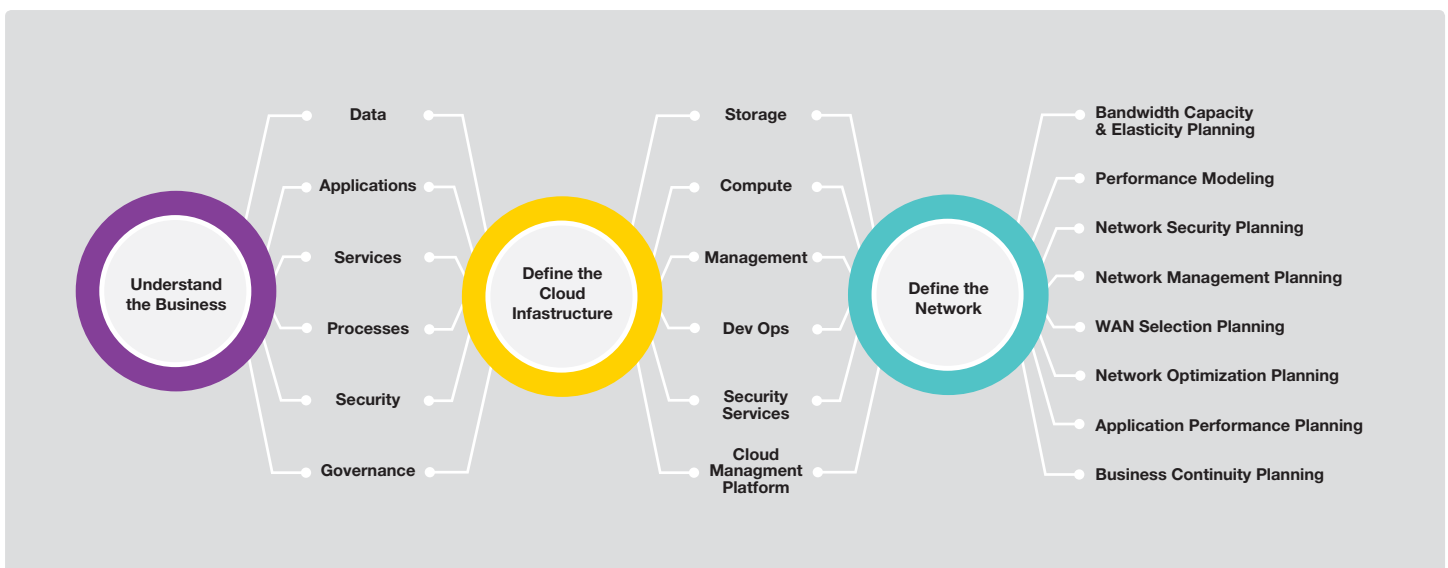


Figure 2.3: Building a network strategy with a cloud strategy in mind.

Understand the business case and the cloud infrastructure requirements, and feed that information into your network solution.

Bandwidth Capacity and Elastic Planning refers to the amount of bandwidth you'll need, as well as the degree to which the bandwidth requirement might fluctuate over time. The ability to provide elastic bandwidth or bandwidth that will automatically expand and contract as network load requirements change without having to set it up in advance, is a clear advantage when supporting a multi-cloud architecture. Multi-clouds typically strain the network bandwidth, and place increasingly expanding, "bursty" loads on the network that support cloud-to-cloud and cloud-to-enterprise communications. You need to understand your requirements for bandwidth capacity and planning and create a plan to address it before you select the right networking partner.

Performance Modeling refers to your process of creating a simulation model that will test how multi-clouds impact different network configurations. Test the capacity of performance under different types of workloads to gain a better picture of your networking requirements before you commit to hardware, software, and network providers.

Network Security Planning is critical, so you can provide the proper level of security for your company. Network security consists of the provisions and policies that your network professionals adopt to prevent unauthorized access, misuse, modification, or denial of the network. Careful planning must go into understanding the precise requirements of the network that supports a multi-cloud deployment, and the right level of security that is necessary for each type of cloud.

Network Management Planning refers to a deep understanding of network management requirements that will help you define the right network solution and provider to support multi-cloud. Typically, there are different types of network management approaches, and supporting monitoring and management systems, that you need to consider. In some cases, the network monitoring systems will provide proactive capabilities, such as the ability to self-heal to avoid potential failure points or outages.

WAN (Wide Area Network) selection planning includes reviewing all of the requirements for the WAN to support multi-cloud. This includes performance, management, resiliency, security, and other considerations that the WAN provider should have in place to support a multi-cloud deployment.

VPC (Virtual Private Cloud) Planning should include secure links from the VPC into a part of a public cloud shared by multiple companies

Network Optimization Planning applies to how to gain additional performance or resiliency within your existing network, and using those techniques to make your network work harder to support multi-cloud

Application Performance Planning is the practice of evaluating how your network will best support business-critical applications. This may include prioritizing network traffic for specific applications running on multi-cloud platforms

Finally, **Business Continuity Planning** concerns the capability to support a multi-cloud deployment in ways that sustain operations during events that might cause service disruptions. For instance, the wide area network that supports the multi-cloud environment must be elastic enough to support increasing or decreasing load volumes, as well as resilient enough to provide disaster recovery

Selecting a Strategic Network Partner for Your Multi-Cloud Services

Now you've mapped out your business requirements, defined your cloud infrastructure, and defined your network infrastructure to support business and cloud requirement needs. Then what? It's helpful to understand just what to look for in a strategic network partner. Selecting a Strategic Network Partner for Multi-Cloud (Figure 3) outlines what to look for in a strategic network partner that can help your organization enable the cloud.

"The concept of intelligent network connectivity and traffic routing means that the network is capable of adjusting to the changing needs for multiple clouds that ride over the network."

Intelligent Network Connectivity & Traffic Routing

- ✓ Highly scalable IP service
- ✓ Auto-provisioned network capacity
- ✓ Traffic type prioritization
- ✓ Network optimization service
- ✓ Cost sensitivity around usage
- ✓ Bandwidth on-demand in support of complex multi-cloud architecture
- ✓ Bandwidth on-demand including supporting a VPN

Integrated Network Security

- ✓ Integrated policy-driven security
- ✓ Intrusion detection and proactive protections
- ✓ 7/24 monitoring and management
- ✓ Cloud-aware security services

Network & Applications Performance Management

- ✓ Correlation of application with network performance analysis
- ✓ End-to-end visibility of network using single unified console
- ✓ Analyze and predict performance of cloud applications
- ✓ Discover and resolve cloud application performance issues

Figure 3: Selecting a Strategic Network Partner for Multi-Cloud.

Above is a checklist of capabilities to look for when considering a strategic network partner to support multi-cloud deployments.

The concept of intelligent network connectivity and traffic routing means that the network will be able to adjust to changing needs for multiple clouds that ride over the network. This includes the ability to prioritize delivery of network (and cloud) applications and services.

Integrated network security uses defined policies to help control and enforce your company's security requirements, including requirements that are specific to cloud-based platforms. Network and applications performance management provide end-to-end visibility of the network that supports your multi-clouds through one interface, as well as the ability to pinpoint and resolve potential performance issues.

Creating a Master Implementation Plan and Budget

Create a master strategic plan around the definition of your multi-cloud solution, and then define and select your underlying network. To access the funding you'll need, you likely will be asked to provide a detailed plan with your objectives, milestones, and be able to demonstrate the promise and value of the cloud to the business.

Creating a master implementation plan (Figure 4) includes decisions about the budget, selection of vendors and technologies, definition of the underlying network, the selection of a network provider, as well as the implementation, testing and operations of the network.

"If you follow these steps, the chances of successfully moving your enterprise to a multi-cloud solution will increase exponentially."

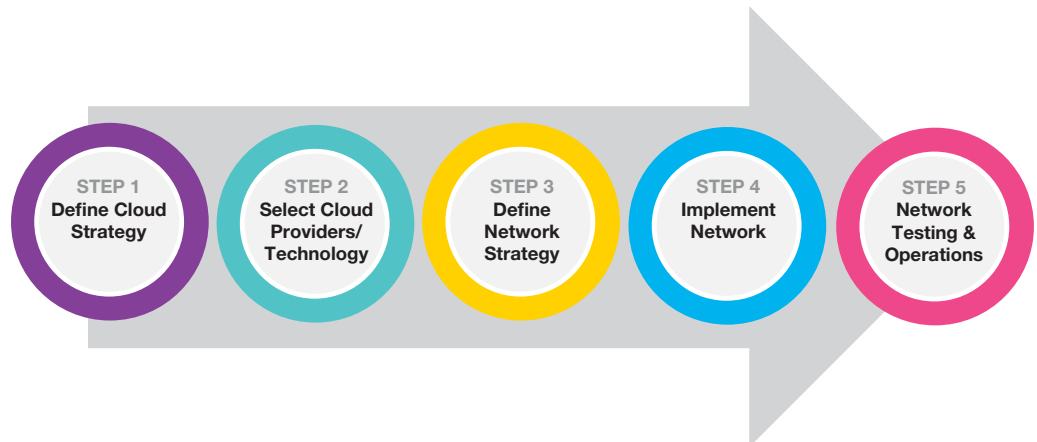


Figure 4: Creating a Master Implementation Plan.

Follow this sequence of five steps to create your master implementation plan and budget.

Although you may want to modify these steps to match your situation, the idea behind this concept is to think through and consider each step, and view them holistically. Defining your cloud strategy tells you what you're going to do, selecting providers and technologies tell you how you're going to do it, and network infrastructure will tell you what you need to run everything at your organization.

If you follow these steps, the chances of successfully moving your enterprise to a multi-cloud solution will increase exponentially—because you will have thought through most of the pitfalls and costly mistakes that typically cause multi-cloud computing implementation projects to fail.

More helpful hints follow:

- Define a multi-cloud platform to provide a foundation for most of your existing applications, as well as applications slated for future development and deployment. This requires is a systemic change in how to approach consumption of IT resources.
- Likewise, design the underlying network, including the corporate WAN, to support existing and future cloud requirements. The load on the network gets increasingly put under pressure with cloud-based platforms and more so with multi-cloud platforms. The distributed nature of multi-cloud means that more information needs to be shared across the network. Thus, the network has to be able to handle the right balance of performance, resiliency and security to support multi-cloud.
- Use networking features that integrate well with cloud-based platforms. Consider features that allow the network to auto-scale to support an increasing bandwidth requirement, or unexpected spikes in network traffic. Networks that can respond intelligently to increasing loading on the network will result in fewer instances of having to upgrade the network to support multi-cloud.

Conclusion

Just as with any other type of complex, distributed system, there are some risks involved. And the best way to alleviate these risks is to:

- Understand the business problem you're looking to solve and the best path to the solution,
- Use the right “best-of-breed” technologies, and all of the different types of cloud environments you will need to meet your business requirements, and
- Design network capabilities that will align with the long-term cloud infrastructure you are going to build.

To chart a path from the network to multi-cloud, you need to plan how to quickly align your network with the needs of new cloud-based platforms, applications and services. Begin by following the step-by-step instructions in this paper, and you will be headed in the right direction. We also recommend that you visit XO's [Build a Smarter Network](#) page to learn about the elements that comprise an intelligent network.

About the Author



Leading technology publications frequently name David S. Linthicum among the top 10 enterprise technologists in the world. He is a true thought leader in the industry, and an expert in complex distributed systems, including cloud computing, data integration, service oriented architecture (SOA), and big data systems. As the author of over 13 books on computing with over 3,000 published articles, as well as radio and TV appearances as a computing expert, he is often quoted in major business and technology publications. In addition, David is a frequent keynote presenter at industry conferences, with over 500 presentations given in the last 20 years.



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