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Get more out of cloud with a structured workload analysis

IBM

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Executive summary

The initial promise of cloud computing has rapidly become reality for many early adopters. Organizations that have moved to a cloud environment are seeing greater agility and cost savings through standardization, scalability, automation and self service. For many organizations, cloud has been the catalyst for more flexible infrastructures, competitive innovation and improved growth and profitability.

Potential benefits like these make the decision to move to cloud computing relatively easy. It is the next step—where and how to get the most value from cloud computing—that can be challenging. The standardization, automation and self service associated with cloud can certainly lower costs and unlock innovation, but only if you have a clear idea of the most productive use of cloud computing for your organization.

You start with creating your cloud strategy, answering questions such as:

- Could we utilize cloud services, and how can they benefit us?
- What types of cloud services would be most appropriate for us to provide? To consume?
- How would they support our business and IT objectives?
- For those services, what is the optimal delivery model? Private, public or a hybrid approach? What are my target cloud environments?
- What are my current capabilities relative to the services I want to offer?
- Should I partner, buy or build the necessary competencies for offering the desired cloud services?

After you have defined your cloud strategy, you may want to further analyze the fit of your proposed targeted clouds with your actual workloads before embarking on an in-depth migration planning project. A robust analysis of your workloads can help you identify candidates for your target cloud environment(s) and can help you gain an understanding of the viability, operational cost changes and migration impact. An essential factor for any cloud strategy, workloads represent collections of your key IT system components and the relationships among them. These components can include web servers and application servers, databases and behavioral policies such as availability, security and performance. A comprehensive analysis of your workloads enables you to answer key questions such as:

- Can the workload run in the target cloud environment? Is it compatible with my infrastructure, middleware and operating system image?
- Can the target cloud environment satisfy my performance, availability and other nonfunctional requirements?
- Can the target cloud environment comply with applicable security, privacy and regulatory requirements?
- What benefits can we realize from migration? (For example, can we lower overall operating costs? Improve service levels?)
- How challenging might it be to get to cloud given my current workloads?

You want to ensure that your approach to cloud workload analysis and the tools you use can help you obtain the most accurate and comprehensive results while accelerating the adoption of your cloud strategy. A structured approach to cloud workload analysis based on established methodologies and automated tools can deliver the insights you need to make more strategic decisions about cloud migration.

This paper discusses the importance of workloads when planning for your migration to the cloud. It also describes how a structured approach to cloud workload analysis can help you identify cloud initiatives that offer faster time to value, reduced migration risk and higher potential return.

A workload point of view

Before discussing cloud workload analysis, it is useful to quickly summarize how and where workloads fit within a cloud computing environment. In a cloud computing model, users gain access to a shared pool of configurable applications, data and IT resources that can be rapidly provisioned. These resources are presented to users as business services, which represent a collection of related workloads that enable end users to complete a specific set of business tasks. Table 1 shows examples of common workload categories.

Web serving	Static and dynamic web content serving, streaming media, RSS, mash-ups and SMS
Web applications	Web service-enabled applications, eCommerce, eBusiness, Java application servers, Rich Internet Applications (Adobe Flash, JavaFX, MS Silverlight) and web search engine applications
Business intelligence and data warehouse	Data mining, warehousing, streaming data analytics (for example, fraud detection), text mining, competitive analysis, business intelligence and business decision applications
ERP and CRM	Enterprise resource planning (ERP) and scheduling, engineering and manufacturing planning and scheduling, supply chain management applications, purchase order management, finance applications, customer relationship management (CRM) and HR applications
Analytics	Online analytic processing (OLAP), business optimization, marketing and sales forecasting, management reporting, risk management and analysis applications, credit scoring and portfolio analysis
Numerical and batch	Engineering design and analysis, scientific applications, high performance computing, Monte Carlo-type simulations, medical image processing and floating-point intensive batch computations
Collaboration	Web 2.0 applications for online sharing and collaboration, instant messaging (IMS), mail servers (SMTP) and Voice over Internet Protocol (VoIP)
File and print	Print, file systems, archival and retrieval
Desktop	Desktop-based computing, desktop service and support applications, and desktop management applications
Development and test	Development and test processes and image management

Table 1: Common workload categories.

Cloud services can be shared across many different layers, including the platform, application, infrastructure and business process layers. Part of developing a cloud strategy is to define which component(s) you will provide and which components will be provided by an associate. Common cloud service models include:

- **Infrastructure as a Service (IaaS)**, where users consume processing, storage, networks and other computing resources with the ability to rapidly and elastically provision and control resources to deploy and run software and services
- **Platform as a Service (PaaS)**, where users consume programming languages, tools and platforms to develop, deploy and manage applications
- **Software as a Service (SaaS)**, where users consume applications such as CRM, ERP and social collaboration tools from multiple client devices through a web browser
- **Business Process as a Service (BPaaS)**, where users consume business outcomes (for example, payroll processing, HR) by accessing business services via web-centric interfaces

Cloud delivery models represent different ways to obtain and organize resources for enabling these services, and they are an important consideration of a target cloud environment. Today, there are three primary delivery models:

- **Private cloud**, where the assets and the consumers are located within a single enterprise
- **Public cloud**, where the assets are located outside of the enterprise
- **Hybrid cloud**, which combines the two models

There are also growing numbers of community clouds, in which the cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (for example, security requirements, policy and compliance considerations).

Some workloads are simply not suited for cloud migration at all. For example, workloads that are unusually complex or involve a high degree of customization of legacy systems are typically more difficult, risky and costly to migrate to cloud computing. By contrast, workloads that are easily standardized, are self-contained applications or have a service-oriented architecture are more likely to be easily ported to a cloud environment.

Table 2 categorizes the relative cost and difficulty of various migration types.

Migration type	Difficulty/cost factor
Like-for-like; single version upgrade	Low
Replatforming; multiple version upgrade	Medium
High availability; software change	High
Database software with high availability disaster recovery	Complex for today's clouds

Application type	Difficulty/cost factor
Web server	Low
Database	Medium
Application server	Medium

Table 2: High-level relative cost and difficulty of various migration types.

Collaboration, web serving, batch, desktop, development and test are typically considered general starting points for cloud migration. Other applications that are regulatory sensitive or applications with complex software licensing would be more complex to migrate. In short, some workloads stand to gain from moving to a cloud and are relatively easy to move.

Part of your earlier cloud strategy planning should have included selecting one or more target clouds, or rather a defined service catalog and the definitions of the services that are being provided by that catalog. The details of your service catalog play a significant role in analyzing which workloads to migrate to cloud. Table 3 illustrates examples of service categories and descriptions.

Service definitions	Descriptions
Infrastructure services	Virtualized CPU, memory, network and storage
Platform services	Databases, application servers, web servers and portals supported such as Microsoft Windows 2008 64-bit, IBM DB2® v9.5 on Windows, and IBM WebSphere® Application Server v7 on Linux
Software services	Collaboration, productivity, customer relationship management (CRM) such as IBM LotusLive™
Business processes	HR, payroll, benefits such as ADP payroll or NetBenefits
Other characteristics	Capacity, performance, input and output operations per second (IOPS)

Table 3: Service definition characteristics.

For a private solution, you can test which workloads fit the service catalog you have defined and potentially alter the catalog based on your results. For a public or managed solution, you would need to understand which workloads fit the technical and nonfunctional requirements of your targeted public or managed cloud. For all services, you will want to consider any service-level agreements and penalties for noncompliance that might influence price or cost.

A structured approach

A key part of an analysis is the ability to analyze your actual workloads, and not just their category. You should closely evaluate the fit, operational cost and migration impact of each individual workload. Taking an individual workload point of view enables you to choose the best workloads to migrate based on your specific business requirements, rather than an arbitrary set of workloads that may not benefit from cloud or may have huge migration impacts.

Many tools for assessing cloud compatibility today are largely qualitative ranking tools, based at most on workload types (for example, “web application,” “online transaction processing,” and “batch”) and do not use granular data for individual workloads or servers. Consequently, they neither consider compatibility details nor operational costs. Virtualization or migration analysis tools and techniques are usually based primarily on application-to-operating-system compatibility of the image(s) that constitute the workload. This is not sufficient for a cloud analysis, because with clouds there are many other factors to consider. Ideally, you will want to map the images, whether they are physical or virtual, to your target cloud service catalog. Just viewing the images does not allow you to understand how they

constitute the workloads (for example, if more than one image makes up a workload). Nor does it enable you to understand whether your target cloud can satisfy the nonfunctional requirements of the workload.

Without the right tools and an experienced partner, however, analyzing workloads can be formidable. How do you determine what criteria are relevant to your target cloud environment? How do you evaluate the captured data without overtaxing your IT resources? Manual analysis can require enormous amounts of time and resources and introduce a greater risk of error and false results. Likewise, without the right methodology, it can be difficult to know where to start, let alone finish. The larger the number of workloads, the more complex the prioritization task becomes.

Table 4 shows a representative sample of typical workload migration factors. As you can see, these range from technical considerations to nonfunctional requirements that are equally important factors in a potential migration.

Workload considerations	
Environment type	• For which type of environment will the workload be used (for example, development, test or production)? Are there different requirements for each environment?
Technical aspects	• What are the common aspects across all of the components in the workloads? Do your database, application server and web server run on the same type of platform? • If not, what operating systems, databases or application servers are being consumed or provided? • What are the CPU, memory, network and storage in measurable quantities typically used/needed? • What commercial and custom software support the workload? • What are the dependencies or integration touch points with other workloads?
Nonfunctional requirements	• What are the required service levels, performance, capacity, transaction rates and response time? • Are there encryption, isolation or other types of security and regulatory compliance requirements?
Support and costs	• What are the support resources and cost for a given workload? For example, two full-time equivalent employees per server, and how much does this resource cost? • What are the operational costs for space, power, cooling and so on?

Table 4: A representative sample of typical workload migration factors.

The greater the amount and reliability of the collected data, the more thorough the analysis can be. Similarly, the more granular the cost information, the more precise your operational cost comparison results can be.

A structured approach with a predefined methodology helps you take the right steps in the right order, enabling you to examine the fit and readiness of your workload's cloud deployment as efficiently as possible. Automated, quantitative tools can eliminate the need for manual involvement, reducing analysis time and the burden on resources while producing comprehensive, granular results.

Ideally, you will also want to team with a qualified partner, who has extensive cloud deployment experience and can guide you through the workload analysis process, including:

- Evaluating your current environment, requirements and cloud strategy
- Providing a granular analysis of both business applications and infrastructure components to determine best cloud fit
- Developing a cost-benefit analysis of a given workload on a target cloud
- Identifying potential impacts of each workload to better prepare for the migration
- Prioritizing workloads and delivery models based on potential migration and cost impacts

IBM Workload Transformation Analysis for Cloud

IBM Workload Transformation Analysis for Cloud is a consulting service that employs an automated approach to workload analysis and can provide an objective, quantitative analysis to help you identify and prioritize the most beneficial workloads to migrate. With IBM Workload Transformation Analysis for Cloud, we help examine and filter the workloads based on predefined criteria and the workload's fit to the target cloud environment defined in your cloud strategy. The offering leverages a structured approach and tested methodology to perform a series of predefined steps. The following steps are taken into consideration when identifying and prioritizing workloads suitable for your target cloud:

Understanding workloads. Using standardized consulting methodology, we work with you to help capture your workload data requirements to better understand your challenges and objectives. Workloads are characterized and assessed against one or more target cloud environments.

Analyzing workloads. We help process your workload data and nonfunctional requirements through a series of analytics across multiple dimensions, including feasibility, operational costs and potential migration impacts. Developed by IBM Research, our patent-pending workload analysis tool uses proprietary algorithms and filtering to analyze a variety of data. This can help reduce analysis time by up to 66 percent compared to a manual analysis.[1] The resulting output lists the workloads, their current

cost in a noncloud environment, if it fits your target cloud, the cost per year within that target cloud and the difficulty of migration. Using an iterative approach, our consultants can apply manual analytic techniques after the tools have initially filtered out workloads that do not meet your criteria—continually refining the data to extract your best-fit workload candidates.

Figure 1 shows an example of the various types of data that are analyzed to consider their candidacy for transition to cloud. Six cylindrical blocks stacked up on the left depict the various client data about your infrastructure and workloads. The four cylindrical blocks stacked up on the right represent the data about your target cloud, while five interconnected chain wheels depict various analytics.

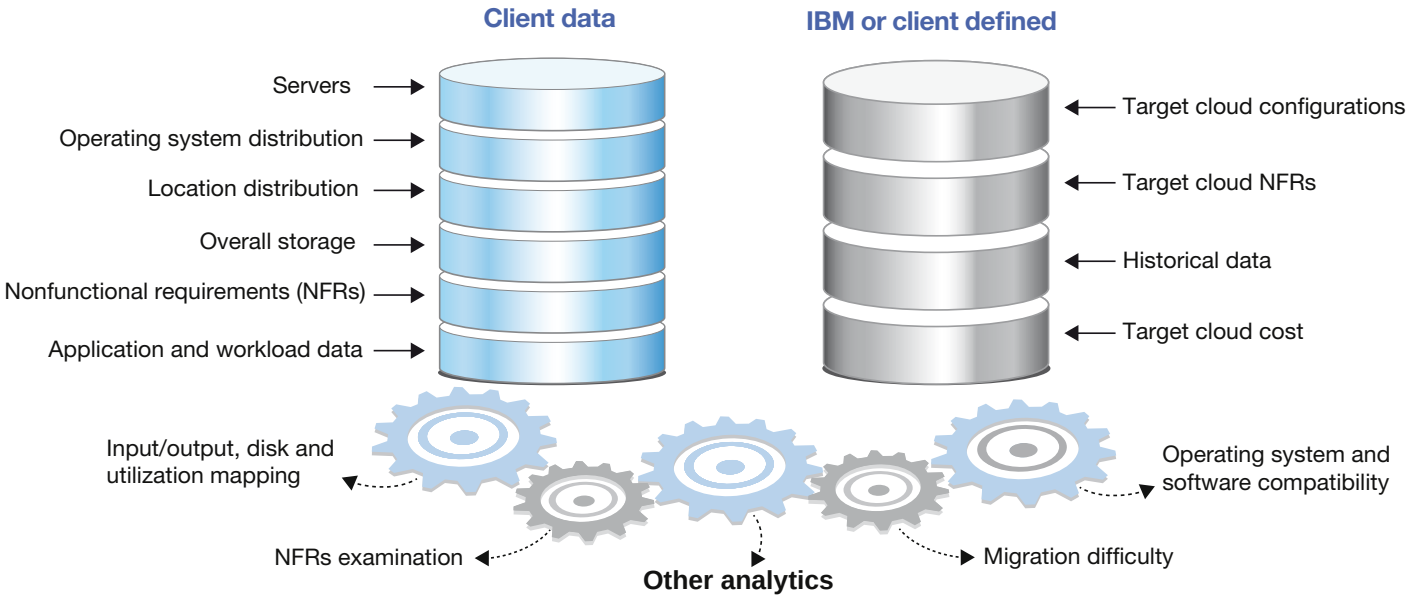

Figure 1: A view of the Workload Transformation Analysis for Cloud transition.

Table 5 shows a representative result of the analyses, including workloads, current costs and target clouds for an example company. The workloads that pass through all of the analysis criteria are considered candidates for cloud delivery.

Recommending candidate workloads. We help review the analytic results and apply cloud architectural experience to produce a list of recommended candidate workloads for cloud delivery within your targeted cloud(s). We can work with you to prioritize which of these workloads would help you realize the benefits you want to gain from cloud computing based on cost and difficulty.

In addition, after you have prioritized the workloads you want to migrate, our specialists can work with you to assess your infrastructure readiness and define the steps needed to achieve your target cloud model. Through a follow-on engagement, we can help you plan the actual placements of your prioritized workloads on your selected target cloud.

Workload	Current cost	Cloud target 1	Cloud target 2
Company A SAP1 application	US$6000 per year	Cost per year US$3000, *Difficulty 23	Cost per year US$3000, Difficulty 10
Company A billing distribution application	US$15000 per year	NO FIT	Cost per year US$6000, Difficulty 50
Company A expense tracking application	US$2000 per year	Cost per year US$200, Difficulty 80	Cost per year US$1000, Difficulty 3

*Difficulty 1-100 (1=easiest and 100=most difficult); Difficulty = normalized sum of qualitative difficulty factors for all the software in each image and then all images in a workload

Table 5: A representative result of a workload analysis.

Conclusion

For countless enterprises and their IT organizations, adopting a cloud model is one path to cost efficiency and a more effective IT-enabled business. The ability to perform a comprehensive analysis of your individual workloads and identify their fit and suitability for a cloud environment is vital to realizing the value of a cloud deployment. IBM Workload Transformation Analysis for Cloud offers a structured and automated approach to workload analysis that can simplify this process and help you optimize your cloud investments.

IBM offers a standardized, patent-pending quantitative analysis, including operating cost and migration impact. We combine our patent-pending analytics with first-hand consulting experience and implementation experience with numerous cloud engagements. IBM has used this same tool and methodology in our own cloud migration initiatives.

Our structured approach combined with rigorous methodologies, proven tools and extensive experience can deliver the insights you need to make more strategic decisions.

When IBM speaks about cloud computing, we speak from experience—we have tackled some of the same problems our clients are faced with every day.

As part of our cloud initiative, we performed several iterations of a workload and application cloud analysis. In our first iteration, with strict nonfunctional requirements, we used our Workload Transformation Analysis for Cloud tools and methodologies to narrow a list of more than 9,500 applications from around the world to just over 200 of those best suited for our target cloud in our initial migration. Through our data, we were able to make educated decisions on which applications to migrate to the cloud. We continue to use this method on additional cloud computing migrations.

Our overall cloud results have been significant and include:

- **Cloud investments over five years have delivered a cumulative benefit yield of approximately $4 billion.**
- **Thousands of servers have been consolidated and virtualized onto approximately 30 IBM System z® mainframes.**
- **Software development and test labs have been reduced from 38 to 5 with increased responsiveness and savings worth $23 million.**
- **We have experienced real-time integration of information and business services such as business analytics for sales and marketing enablement.**

For more information

To learn more about IBM Workload Transformation Analysis for Cloud, please contact your IBM marketing representative, or visit the following website: **ibm.com**/services/itsaconsulting
You can also follow us on Twitter at www.twitter.com/ibmcloud and on our blog at www.thoughtsoncloud.com

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[1] Based on use in IBM's IT transformation project. Time may vary based on availability and extent of client data.

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