Workload analysis as a key component of your cloud strategy

An introduction to cloud workloads

By now, the benefits of cloud computing are well known: the ability to better manage IT costs; accelerate new capabilities; and deliver infrastructures, business processes, software and more as a service. Organizations can achieve greater agility through the standardization, scalability, automation and self-service features of cloud. And cloud provides tangible economic benefits, enhancing IT’s value to the business and reducing capital and operational expenses.

As the adoption of cloud computing becomes more prevalent, the focus is evolving beyond economic and operational benefits. Cloud is now viewed as an impetus for innovation and collaboration—in short, for business transformation. A company’s success with cloud is directly tied to the value of its cloud-enabled business and IT solutions.

When talking about cloud, we often use the term workload. As shown in Figure 1, a workload is a collection of IT components (servers, storage, network interconnection, and hosted middleware and applications). Workloads perform a series of transactions and functions that deliver a business solution. They can be hosted on a private cloud, public cloud and/or a traditional IT environment. Each workload has nonfunctional requirements associated with it, such as availability, security and compliance.
A workload perspective

Figure 1. A workload is a collection of IT components (such as network, servers, storage and middleware) that performs a series of functions that deliver a business solution.
Assessing your workloads for affinity and fit for cloud is a critical component of your cloud strategy. On the other hand, not performing a cloud workload analysis can expose you to a long list of issues, including migration difficulties, unrealized business benefits, unanticipated expenses, and quality and support issues.

Evaluating cloud for both new and legacy business solutions

Cloud-enabled business solutions typically fall within three areas:

- **Solutions encompassing analytics, big data, Internet of Things, mobile and social innovations are excellent fits for cloud.** When working with these new solutions, your IT strategy should include a “CloudFirst” initiative that incorporates cloud utilization into the service design. In fact, these types of business solutions are often referred to as “born on the cloud.”

- **New releases of existing business solutions—such as CRM, ERP and collaborative tools—can also be boosted by cloud.** These evolutions can be classified as “new usages” of cloud because of the tremendous shifts in processes and organization required to iterate from their current state.

- **Existing business solutions may also find great benefits in migrating to cloud.** But unlike “born-on-the-cloud” solutions, the benefits of a cloud environment must offset migration costs. Analyzing and prioritizing existing workloads for cloud suitability is a critical step.

Finding the right analysis and prioritization approach is important, because both workloads and cloud capabilities evolve over time. IBM Cloud Professional Services has collaborated with clients on many typical scenarios for workload analysis and prioritization. Depending on where you are in defining or executing your cloud strategy, the extent to which you assess and analyze a workload may differ. For example, when a client has begun to define its cloud strategy but has not identified an actual target service delivery approach, we help to:

- Identify the “art of the possible” for workload cloud affinity
- Portray what cloud could mean in terms of drivers and roadblocks for workload migration

After cloud targets are identified, we can assist with:

- Evaluating workload fit to proposed target clouds through qualitative and quantitative analysis
- Identifying possible migration complexities and impact on return on investment
- Designing application changes for cloud suitability and performance
- Examining specific workloads to understand and optimize the overall transaction performance

To obtain highly accurate data more efficiently, we recommend a structured approach to cloud workload analysis based on established methodologies and automated tools. In this paper, we describe how a structured approach can identify cloud initiatives that offer faster time to value, reduced migration risk, and a higher return on investment.

**A workload point of view**

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 solutions. At an elementary level, these business solutions are a collection of related workloads that enable completion of transactions and functions.
Determining workload suitability for cloud

Some workloads are less suited for migration to cloud than others, as shown in Figure 2. 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. These could also include workloads that are regulatory sensitive, workloads with complex software licensing, workloads that are sensitive to network latency, or workloads with complex and numerous integration points. By contrast, workloads that are easily standardized, are self-contained solutions, or have a service-oriented architecture are more likely to be easily ported to a cloud environment. Examples here include development and test versions of collaboration, web serving, batch and desktop solutions.

<table>
<thead>
<tr>
<th>May not be ready for cloud</th>
<th>Possibly ready for cloud</th>
<th>Ready for cloud</th>
<th>New cloud-native workloads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitive data</td>
<td>Information intensive</td>
<td>Analytics</td>
<td>Collaborative care</td>
</tr>
<tr>
<td>Highly customized</td>
<td>Isolated workloads</td>
<td>Infrastructure storage</td>
<td>Medical imaging</td>
</tr>
<tr>
<td>Not yet virtualized third-party software</td>
<td>Mature workloads</td>
<td>Industry applications</td>
<td>Financial risk</td>
</tr>
<tr>
<td>Complex processes and transactions</td>
<td>Preproduction systems</td>
<td>Collaboration</td>
<td>Energy management</td>
</tr>
<tr>
<td>Regulation sensitive</td>
<td>Batch processing</td>
<td>Workplace, desktop and devices</td>
<td></td>
</tr>
<tr>
<td>Complex software licensing</td>
<td></td>
<td>Business processes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disaster recovery</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Development and test</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Infrastructure compute</td>
<td></td>
</tr>
</tbody>
</table>

Note: These lists are intended as examples and do not reflect all possible workloads.

Figure 2. Some workloads are less suited for cloud migration than others, such as workloads that are unusually complex or involve a high degree of customization of legacy systems.
The importance of a defined service catalog to workload analysis

Ideally, creating a service catalog and defining the included business solutions would be accomplished in the earlier phases of your cloud strategy planning. The details of your service catalog play a significant role in analyzing which workloads should migrate to cloud. Figure 3 illustrates examples of service categories and descriptions.

If your business solution targets a private cloud, you can test associated workloads against a defined service catalog and potentially alter the catalog based on your results. If you don’t have a defined service catalog, another option is to perform your analysis against a sample or “strawman” service catalog prototype, and iterate based on analysis results.

For a business solution that targets a public or managed cloud, you would need to understand which workloads fit the technical and nonfunctional requirements of that environment. For all solutions, you will want to consider any service-level agreements and penalties for noncompliance that might influence price or cost.

<table>
<thead>
<tr>
<th>Service categories</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure services</td>
<td>Virtualized CPU, memory, network and storage</td>
</tr>
<tr>
<td>Platform services</td>
<td>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</td>
</tr>
<tr>
<td>Software services</td>
<td>Collaboration, productivity, customer relationship management (CRM) such as IBM LotusLive™</td>
</tr>
<tr>
<td>Business processes</td>
<td>HR, payroll</td>
</tr>
<tr>
<td>Management services</td>
<td>Information services, business-to-business integration, communication services, production support and lifecycle build and maintenance activities</td>
</tr>
<tr>
<td>Other characteristics</td>
<td>Capacity, performance, input and output operations per second (IOPS)</td>
</tr>
</tbody>
</table>

*Figure 3.* The details of your service catalog play a significant role in analyzing which workloads should migrate to cloud.
A structured approach to workload analysis

As you develop a plan for analyzing your workloads, you can choose from several techniques depending on the information available, the required depth of analysis and your stage in the cloud adoption process. (See Figure 4.)

If you are just beginning your cloud journey, you could start with a high-level qualitative analysis of your existing and planned workloads. Based on the category of workload and its characteristics, you can determine the workload’s cloud affinity. This identifies an affinity to cloud in a more general sense, such as private or public, as opposed to analyzing affinity for a specific cloud. Additionally, you will want to perform the same due diligence at the application level by assessing and analyzing applications to ensure they are designed for cloud enablement.

---

**Workload analysis techniques**

<table>
<thead>
<tr>
<th>Cloud Affinity Analysis</th>
<th>Workload Transformation Analysis for Cloud (WTA)</th>
<th>Application Performance Optimization Consulting (APOC) for Cloud</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What it is</strong></td>
<td><strong>What it is</strong></td>
<td><strong>What it is</strong></td>
</tr>
<tr>
<td>Analysis of a workload’s affinity to cloud in general</td>
<td>In-depth analysis of client images and workloads against a specific target cloud</td>
<td>Identification of potential application performance issues prior to migrating to cloud</td>
</tr>
<tr>
<td>5−7 candidate workloads—qualitative, high-level analysis</td>
<td>10−10,000 images and workloads</td>
<td>10−15 applications analyzed in detail</td>
</tr>
<tr>
<td><strong>Proposed deliverables</strong></td>
<td><strong>Proposed deliverables</strong></td>
<td><strong>Proposed deliverables</strong></td>
</tr>
<tr>
<td>Potential migration of workload to cloud mapped on a pain vs. gain grid</td>
<td>Analysis results of images and workloads</td>
<td>Application flows generated for in-scope applications</td>
</tr>
<tr>
<td>Overall cloud affinity scoring</td>
<td>Fit for specific target clouds</td>
<td>Detailed latency and performance analysis</td>
</tr>
<tr>
<td>Affinity scale of workload for public vs. private cloud</td>
<td>Migration complexity</td>
<td>Input to application remediation and migration wave planning</td>
</tr>
</tbody>
</table>

**Depth of analysis**

*Figure 4.* IBM’s three approaches to workload analysis include determining a workload’s cloud affinity, evaluating existing workloads to fit for a particular cloud or clouds, and analyzing how a workload will perform on the target cloud.
Your next step is to evaluate your existing workloads for fit to a particular cloud or clouds. This takes a more focused perspective, performing a quantitative analysis on your actual workloads, as opposed to a qualitative analysis based on workload category characteristics. This approach helps you closely evaluate the fit, operational cost and migration impact of each individual workload.

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 provide insight into workload or business implications.

Once you have decided to proceed with migrating your workload to a target cloud, you may want to analyze how the workload will perform on the cloud, especially for highly transactional workloads. In today’s distributed environments, each user request could flow through more than 50 different servers, application containers and databases. Managing and tracking transactions end-to-end helps application performance accommodate user experience and business requirements.

Without the right tools and an experienced partner, analyzing workloads in any of these scenarios can be formidable. How do you begin to assess an overall compatibility for cloud? 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. The larger the number of workloads, the more complex the prioritization task becomes. Without the right methodology, it can be difficult to know where to start, let alone finish. In this section, we will explore three different approaches to analyzing workloads.

Assessing application maturity for cloud

For many companies, application portfolios have become overly complex. These portfolios often contain redundancies, are costly to maintain, and no longer enhance strategic objectives. Relocating applications to the cloud has become the go-to method for companies to streamline their application portfolios and unleash business value. To do this effectively, organizations first need to assess their applications and determine their maturity for cloud enablement.

The Cloud Affinity Analysis—Getting a qualitative feel for your workloads

Before your organization dives into a deeper, quantitative analysis of its workloads, you may find it helpful to start at a higher level. Cloud affinity is an important concept to grasp, because high cloud affinity helps facilitate a successful cloud migration and fulfilled business requirements.
At IBM, we use the **Cloud Affinity Tool (CAT)**, an analysis technique that performs a qualitative analysis of a workload’s characteristics. This tool is appropriate if you are just starting to get a feel for your workloads and may not yet have a specific cloud you are targeting. Typically, you would perform a CAT analysis for a small number of workloads representative of a broader category. This helps you determine which workloads require deeper analysis or workloads that may be obvious candidates for cloud migration. The questions cover a range of workload attributes and include specifics such as scalability requirements, as shown in Figure 5.

---

**Sample CAT question:**

**Question 1**

What are the scalability requirements for this workload?

<table>
<thead>
<tr>
<th>Fit for Cloud</th>
<th>Not a good fit for Cloud</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seasonal</td>
<td>Stable workload</td>
</tr>
<tr>
<td>Temporary</td>
<td>Stable usage</td>
</tr>
<tr>
<td>High elasticity requirement</td>
<td></td>
</tr>
<tr>
<td>Difficult to predict</td>
<td></td>
</tr>
</tbody>
</table>

Generally speaking, cloud services provide elasticity. If the target workload demand varies by season, or if it is a temporary workload, business benefits of cloud are easily gained. If the target workload is stable and does not vary by season, it may not be a good fit for cloud.

---

**Figure 5.** Cloud Affinity Tool includes questions that cover a range of workload attributes and includes specifics such as scalability requirements.

The tool then calculates cloud affinity on a scale of 1 to 10. You will also receive an affinity rating for:

- Private or public cloud affinity
- SaaS or IaaS
- Pain vs. gain of migrating the workload to cloud

These outcomes are depicted through two outputs, the cloud affinity summary report and the workload value vs. effort chart, as shown in Figure 6.
Figure 6. Cloud Affinity Tool results are depicted through two outputs, the cloud affinity summary report and the workload value vs. effort chart.
CAT is a powerful tool to use as you build your overall cloud strategy and roadmap. However, you can also use CAT in a standalone manner to conduct an initial qualitative workload assessment. This can be a precursor to a more in-depth, quantitative approach, such as IBM Workload Transformation Analysis for Cloud, described in the next section.

IBM Workload Transformation Analysis for Cloud

Once you have established cloud affinity at a qualitative level, a next step can be to evaluate your workloads for fit to a specific cloud. IBM Workload Transformation Analysis for Cloud (WTA) is a consulting service that incorporates an automated, objective approach to IT and business workload analysis. With WTA, we help examine, filter and prioritize workloads based on predefined criteria and the workload’s fit to the target cloud environment defined in your cloud strategy. The offering uses a structured approach and tested methodology to perform a series of predefined steps:

Understanding workloads. Using standardized consulting methodology, we work with you to 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 and business data, target cloud 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 methodology and workload analysis tool uses proprietary algorithms and filtering to analyze business applications and infrastructure components against one or more target cloud environments. This can reduce analysis time by up to 66 percent compared to a manual analysis.¹
Recommend candidate workloads. As shown in Figure 7, the resulting output lists:

- Workloads under analysis
- Current cost in a noncloud environment
- Fit or no fit to target clouds
- Operational cost per year of target clouds
- Difficulty of migration

After this filtering, our consultants can apply manual analytic techniques and knowledge based on many cloud implementations—continually refining the data to extract your initial best-fit workload candidates.

Note that the process can be an iterative one. Because technology evolves over time, our methods and tools also support a pragmatic, progressive approach to workload analysis. We start with high-level criteria to define the starting set of workloads to analyze. Then, we proceed with in-depth analysis examining considerations like environment type and technical aspects, as shown in Figure 8. The method can be repeated, when ready, with additional sets of workloads.

Our method is also cloud-agnostic, meaning the WTA provides an independent point of view that is just as effective if your target is a non-IBM cloud.

Figure 7. We help process your workload and business data, target clouds and nonfunctional requirements through a series of analytics, resulting in output describing cost impact, fit to target clouds and difficulty of migration.
## Workload considerations

<table>
<thead>
<tr>
<th>Environment type</th>
<th>For which type of environment will the workload be used (for example, development, test or production)? Are there different requirements for each environment?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical aspects</td>
<td>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?</td>
</tr>
<tr>
<td></td>
<td>• If not, what operating systems, databases or application servers are being consumed or provided?</td>
</tr>
<tr>
<td></td>
<td>• What are the CPU, memory, network and storage in measurable quantities typically used or needed?</td>
</tr>
<tr>
<td></td>
<td>• What commercial and custom software support the workload?</td>
</tr>
<tr>
<td></td>
<td>• What are the dependencies or integration touch points with other workloads?</td>
</tr>
<tr>
<td>Nonfunctional requirements</td>
<td>What are the required service levels, performance, capacity, transaction rates and response time?</td>
</tr>
<tr>
<td></td>
<td>• Are there encryption, isolation or other types of security and regulatory compliance requirements?</td>
</tr>
<tr>
<td>Support and costs</td>
<td>What are the support resources and cost for a given workload? For example, what is the cost for two full-time equivalent employees per server?</td>
</tr>
<tr>
<td></td>
<td>• What are the operational costs for space, power, cooling and so on?</td>
</tr>
</tbody>
</table>

*Figure 8.* A sample of typical workload migration factors, ranging from technical considerations to nonfunctional requirements.
Ultimately, we can work with you to prioritize which workloads would help realize the benefits you want from cloud computing based on cost and difficulty. As well, we help you look at the broader cloud landscape and your organization and processes—helping you to create strategies that shape and integrate your business objectives with cloud capabilities. You can use the resulting data to create a business justification for migrating selected workloads to cloud, demonstrating how cloud technology can reduce costs, improve service delivery and contribute to business transformation.

**Evaluating connections: Application Performance Optimization Consulting for Cloud**

An application that is migrating to a cloud service generally has connections to other applications and systems—and often those applications and systems remain in house. How does this impact overall transaction performance and availability in the cloud? After you perform a WTA, you may want to do a deeper dive on specific workloads to understand and optimize the overall transaction performance.

**Application Performance Optimization Consulting (APOC) for Cloud** includes a specific workload methodology to strategically determine which workloads would be appropriate for further analysis. Generally, this method is most appropriate for workloads with high transactions that cannot afford latency. However, APOC uses a flexible engagement framework based on agreed-to criteria to determine the most critical priorities for your organization.

With APOC, we help application owners understand:

- What protocols do these applications use to talk to each other?
- Can the same connection continue working, assuming the protocol is supported by the cloud service?
- Does the response time remain adequate, given the frequency of transactions, the size of the payload, the bandwidth and latency of the connection to and from the cloud service?

APOC helps you thoroughly assess the performance and response time requirements that these connections support. We deliver insights that help you make better strategic decisions about cloud migration, and determine the best locations for workloads and data.

Additionally, APOC analyzes and maps application integration points to business requirements. It uncovers the true nature of each integration point and its suitability for cloud and determines which multiconnection applications can move to the cloud. By making sure these important integration points are effectively managed, APOC serves as risk mitigation, helping workload migrations to cloud maintain the current performance levels of business critical transactions. This can accelerate adoption of your cloud strategy and help meet performance objectives.
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 robust 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 offers three levels of workload analysis, ranging from a high-level qualitative approach for assessing cloud affinity to a quantitative analysis of individual workloads, including operating cost and migration impact. As well, we offer a solution to help you understand the performance and response time impacts to migrating your workloads to the cloud—helping you maintain current performance levels of business critical transactions.

We combine our patent-pending analytics and industry-leading methodologies with firsthand consulting experience and implementation experience with thousands of cloud engagements. And, IBM has used these same tools and methodologies in our own successful cloud migration initiatives.

Why IBM Cloud Professional Services?

A solid strategy for cloud computing is critical to helping you deliver innovative IT services that can create new business value, and IBM Cloud Professional Services can help. Our structured approach combined with rigorous methodologies, time-tested tools and extensive experience can deliver the insights you need to simplify the workload analysis process, make more strategic decisions, and optimize your cloud investments.

In fact, overall IBM was positioned as a leader in the IDC Marketscape: Worldwide Cloud Professional Services, 2014 Vendor Analysis. According to IDC’s 2014 Global Cloud Professional Services Buyer Perception Survey, clients highlighted IBM as strongest in providing industry insights and competence, creating a more effective business and optimizing ratio of onshore/offshore efforts on a project. And Synergy Research has ranked IBM as the #1 hybrid cloud provider for the enterprise.

At IBM Cloud Professional Services, we take a collaborative approach. We weave together business insight, advanced research and technology to help give you a distinct advantage in today’s rapidly changing environment. Our integrated perspective on cloud consulting, design and implementation can turn strategies into action. With expertise in 17 industries and global capabilities that span 170 countries, we help clients around the world benefit from new opportunities available on the cloud. To learn more, visit: ibm.com/cloud-computing/us/en/learn/consulting
For more information
To learn more about how IBM can help you with workload analysis, please contact your IBM representative, or visit ibm.com/cloud-computing/us/en/learn/consulting

You can also follow us on Twitter at www.twitter.com/ibmcloud and on our blog at www.thoughtsoncloud.com

To learn more about IBM Cloud Professional Services, please contact your IBM representative or visit the following website: ibm.com/cloud-computing

About the authors
Colm Feighoney is a senior cloud advisor with IBM Cloud. He has many years of experience in applying cloud computing to assist both large and small clients, developing strategies for cloud exploitation, assessing workloads to determine strong and early candidates for migration, and assessing and planning improvements to service delivery capabilities.

Bob Freese is a certified consultant with IBM Cloud. He has over 40 years of experience in business and IT strategy consulting and has spent the last seven years performing cloud strategy engagements for clients and training IBM technology consultants worldwide.

Yann Guerin is a consulting architect and a member of the IBM Europe Cloud Professional Services Center of Competency. An infrastructure architect for 25 years, he has developed a specialization in distributed computing optimization. He also served as cloud technical director of the IBM Client Center in Montpellier, France, helping enterprises reap the benefits of cloud adoption.

Beth Layton is an executive consultant and offering manager for IBM Cloud. She has a background in application development, service management, cloud consulting and workload analysis. She is currently the offering manager for the Workload Transformation Analysis for Cloud offering and capabilities.

Mike Reeves is a senior managing consultant with IBM Cloud Professional Services. He helps clients build a blueprint for the right cloud infrastructure by providing workload analysis and performance techniques to optimize their use of cloud while protecting those mission-critical workloads that run the business.