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DevOps Application Performance Management

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Create a framework for
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Discover best
practices in APM

Judith Hurwitz
Daniel Kirsch
Arun Biligiri



DevOps Application Performance Management

IBM Limited Edition

**by Judith Hurwitz, Daniel Kirsch,
and Arun Biligiri**

**for
dummies[®]**
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Introduction

Welcome to *DevOps Application Performance Management For Dummies*, IBM Limited Edition. Applications are at the core of business innovation in a world dominated by the need for change brought on by digital disruption. To be successful in this shifting business world requires that you think about the performance and user experience of applications differently. There are two key elements in the changing nature of applications.

One, applications are no longer designed as monolithic business processes. Instead, applications are being designed as a modular set of services such as microservices stored in containers. Each service includes a set of well-defined application programming interfaces (APIs) that's used to link these elements together to create new applications based on new customer demands. These applications may be deployed on-premises, in the cloud, or across both resulting in highly dynamic and distributed touch points that need to be monitored. Therefore, what's most important is that the resulting applications behave and operate in a consistent and predictable manner.

Two, these applications need to provide a seamless customer experience that can be optimized so they provide excellent performance. In addition to fast performance, users have to be satisfied with their interactions. If applications perform in a way that meets customer expectations, your company will be successful.

Successful businesses are learning that they need to plan in order to adopt this new model of application creation and management. To create success, organizations have to adopt the DevOps model with the ability to manage the performance of the resulting applications.

About This Book

This book is intended to help you understand the importance of application performance management (APM) to enable a smooth DevOps working culture. In this world, software development

professionals have to collaborate closely with those professionals in IT operations and lines of business, so applications are written in context with the variety of deployment models, including hybrid cloud and mobile environments. In addition, IT operations teams need the tools to allow them to proactively respond to potential issues before they create disruptions.

In this book, you discover what it takes to create an organization that can gain a holistic view over APM. Whether you are a business or a technical leader, a developer or operations engineer, this book provides guidelines for creating an environment that is a collaboration between the business and technical side of your organization. This type of partnership is powerful in ensuring that you're ready when threats and opportunities come your way. This book also helps you understand how to create an applications environment that is predictable and focused on customer outcomes.

Foolish Assumptions

The information in this book is useful to many people, but we have to admit that we did make a few assumptions about who we think you are:

- » You understand the value of emerging technology platforms like cloud and big data in meeting the strategic needs of the business. You are ready to move forward with an approach that keeps up with changing business requirements.
- » You are creating a holistic approach to the way your company approaches computing. You understand that the performance of your applications is central to the success of your business.
- » You understand the value of creating best practices that benefit all stakeholders in the business, including the applications development teams, and the IT operations team.
- » Your organization is beginning to understand that the performance of your applications can have a huge impact on your company's ability to compete in a complex business climate.

Icons Used in This Book

The following icons are used to point out important information throughout the book:



TIP

Tips help identify information that needs special attention.



WARNING

Pay attention to these common pitfalls of the performance of applications.



REMEMBER

This icon highlights important information that you should remember.



TECHNICAL
STUFF

This icon contains tidbits for the more technically inclined.

Beyond the Book

You can find additional information about APM, IBM's approach to DevOps and services available, by visiting the following links:

- » **IBM APM (website):** <http://ibm.biz/ExploreIBMAPM>
- » **IBM APM (demo and trial):** <http://ibm.biz/TryIBMAPM>
- » **IBM DevOps (website):** <http://ibm.com/devops>
- » **Shift APM left in the DevOps cycle (webcast):** <http://ibm.biz/APMDevOpsWebcast>
- » **Transforming APM for DevOps (video):** <http://ibm.biz/APMDevOpsVideo>

- » Understanding the changing anatomy of applications and the need for DevOps
- » Recognizing the need for collaboration
- » Explaining a DevOps methodology
- » Managing in the DevOps world — understanding the role of APM

Chapter 1

Providing a DevOps Methodology

The way organizations are creating and deploying applications is changing dramatically. It is not enough to have developers act in isolation from the customer experience or the way these applications are managed. In this chapter, you gain insight into what it means to provide a DevOps methodology to support a new level of digital experience and customer excellence.

The Changing Landscape of Businesses

New business models are emerging rapidly, fueled by digital services and the API economy. Users are changing too. As the characterization of companies moves to a digital persona, your business will be defined by the way your customers interact with your applications and services. Technology is transforming to keep up with the pace of business change. The new generation of applications brings with it complexity. This complexity includes multiple deployment models, reliance on massive amounts of structured and unstructured data, and a variety of open-source tools that need to be managed.

Applications are at the heart of this changing market landscape and innovation. A business's entire interaction with its customers is through its applications. For example, there was a time when making a reservation with an airline required the help of an experienced agent who understood how to navigate a maze of menus and applications to determine the best flying time and airline to help the customer. Today, individuals very rarely communicate directly with a travel agent. Rather, customers act as their own agents, navigating around an application on their browsers or mobile phones to find a flight that leaves at the right time and is offered at the right price. In addition, customers are able to routinely compare prices and even book hotels and rental cars through the same application. Customers expect to have the same experience and same levels of ease of use and performance no matter where they are located and no matter what type of device they are using.

In order for businesses to address the risk of digital disruption, they need to innovate rapidly. Gone are the days when new ideas and features took months to conceptualize, design, and deliver. Now, if businesses can't prototype and bring an idea to the market within weeks, they are at the risk of someone else implementing that idea. Development needs to be quick, and delivery needs to be continuous to address speed to market and to meet customer expectations.

The Need for Collaboration

It is no longer feasible to have a development team write an application in isolation from those who test them, those who will deploy the application, and the business units responsible for driving success from the application. Collaboration across all stakeholders has become a necessity for successful applications. Each member of the team understands a different aspect of the application but shares common goals. The application owner or line of business (LoB) owner knows what customers expect when they interact with the company. She can also anticipate how the customer would most likely want to interact with the application.

On the other hand, the developer has a strong opinion on how an application should function. Likewise, the user experience

designer will have a strong opinion on how the applications should look and feel for end-users. In addition, deployment teams tasked with making the application operational understand best practices for the deployment environment. Clearly there are many stakeholders in the application processes that all need to work together to deliver an excellent user experience. Many application issues arise because of poor collaboration between different teams in the application life cycle.

Continuous delivery and continuous innovation

The critical nature of the application for driving business growth has led to dramatic changes in the application development and deployment process. Emerging, born-on-the-web companies with little to lose are challenging incumbent business leaders as never before. Many startups do not have the legacy systems, governance, and regulatory constraints and the rigid corporate culture that prevent many large enterprises from innovating. To meet the speed of innovation, development and deployment teams need to deliver code continuously in production. In some instances, applications may be updated several times a week or even multiple times in a day depending on the nature of the business. To enable continuous delivery, software development, deployment, and operations have begun to transform from silos of development and deployment into a continuous life cycle model. By enabling developers and deployment specialists to work in collaboration, it is faster and easier to create applications that are flexible and meet customer expectations.

Defining DevOps

DevOps is a term used to describe a cultural practice that emphasizes collaboration and orchestration across the entire organization, including business stakeholders, development, testing, deployment, operations teams, customers, and partners while automating and delivering software. DevOps is not an isolated process; instead, it's a technique that combines the processes of dynamically creating applications in concert with the process of deploying and operating those applications. DevOps supports the requirement to continuously improve, deploy, and monitor new innovative applications to support changing business needs.

DevOps is an organizational and cultural shift that aligns the business, application development, and IT operations teams to quickly take advantage of market opportunities and reduce time to customer feedback. Organizations that have implemented DevOps are able to achieve the following goals:

- » **Continuous innovation:** Employees from across development, operations, business owners, and so on work together to quickly release new software that can delight customers and maximize opportunities.
- » **Continuous delivery:** Automating software delivery processes and eliminating the need for routine tasks eliminates inefficiencies and allows the organization to continually deliver innovation.
- » **Continuous learning:** Creating a feedback loop by monitoring software, customer interactions, and performance of the application allows organizations to adapt applications to meet expectations.



REMEMBER

DevOps requires both a technical change in how applications are developed and delivered and a cultural change in how IT collaborates.



WARNING

Like any new process, adopting DevOps comes with some challenges:

- » Existing culture, process, and organizational structure inhibit innovation, speed, and continuous experimentation.
- » Industry compliance and governance requirements make it difficult to scale successful pilots.
- » Existing legacy systems make it difficult for organizations to successfully adopt DevOps, even though there's a growing desire to use a mix of public, private, and hybrid cloud resources.

A DevOps approach needs to be complemented with additional business process changes that support innovation and rapid customer feedback cycles. You need to establish standardized, consistent, and repeatable processes for managing software quality from requirements definition through to delivery, deployment,

and operations. A good DevOps approach can help businesses rapidly execute on new innovations, but requires three key drivers for success:

- » A consistent innovative method for DevOps that creates a practice routed in success
- » A DevOps platform and tooling that stretches across public, private, and hybrid cloud as well as on-premises systems of record
- » A rich ecosystem of best-of-breed technology and tools that help established organizations quickly innovate like startups but have the predictability and scalability that the enterprise requires



REMEMBER

The end-user doesn't care how an application is developed, deployed, or monitored. Application users want applications that deliver value at the right time. DevOps requires both a technical change in how applications are created and a cultural change in how IT collaborates.

IT'S ALL ABOUT TEAMWORK

Building applications that stand the test of time is not easy — especially in the hybrid cloud era where developers are creating new applications and services on a weekly or even daily basis. The operations team is no longer an isolated group of individuals who can only focus on the underlying servers, networks, and storage elements in their data center. The new applications environment is dynamic. Applications are changed and updated frequently and in some cases multiple times in a single day. Configurations are constantly changing as new cloud services are used for a variety of different workloads. New services are available to balance workloads and ensure that compliance regulations are followed. In this changing climate, application performance falls apart if the developers don't work in collaboration with operations. This is why so many businesses are creating DevOps teams that together gain a deep understanding of the importance of the customer experience.

Bringing DevOps into the enterprise

In small companies and start-ups, it's not unusual for application developers to wear many hats. For these smaller companies, adopting a DevOps culture often comes naturally. Developers at these emerging companies may develop, test, and deploy the application. In addition, these smaller organizations have fewer applications in production and small or non-existent centralized IT teams when compared to large enterprises. The speed of application delivery for these organizations can be very fast. However, large enterprises often have a very different DevOps journey.



TIP

In enterprises, a centralized IT team caters to the needs of various lines of businesses developing different applications. Teams within these different lines of businesses often work together to create DevOps squads. The *DevOps squads* help to rapidly turn ideas into applications and new application features. To speed delivery, DevOps squads often create, deploy, and manage their applications in the cloud or a hybrid cloud environment. The primary mission of the DevOps squads is to create excellent user experiences, fast delivery, and full visibility into the use of web and mobile applications. While the individual LoBs may operate at fast speeds, centralized IT operations teams are often left behind. The central IT organization and IT operations must cater to many LoBs and must ensure that every single internal and external facing application performs as expected. Many of the applications that they are tasked with monitoring are core to the business and are integrated with legacy systems. The demands of these core applications are very different than the fast moving pace of newer applications.

Not all cloud applications are alike

Business leaders are usually quick to demand that their teams develop cloud applications. However, what exactly does a cloud or hybrid cloud application look like? Will a cloud application be fully developed and rely on public cloud resources, or will those applications connect with existing on-premises services? Additionally, many cloud applications use APIs in order to leverage other cloud services. The true value of creating hybrid cloud applications is the ability to combine services from private, public, and on-premises so they act as a single unified environment based on a required service level to support the business. In this section, you discover the two main types of cloud applications: cloud enabled and cloud native, shown in Figure 1-1.

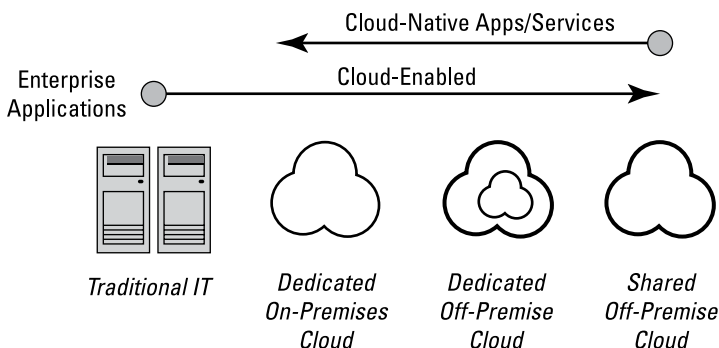


FIGURE 1-1: Cloud-enabled and cloud-native applications.

Cloud-native applications

Cloud-native applications are often built for mobile and web platforms. These new, cloud-first applications have a different set of dependencies to consider in the development process as opposed to traditional applications. Developers compose cloud native applications with a set of web services and microservices to speed up development time. In addition, developers may need to leverage cloud integration services to connect the mobile applications to their back-end services.

Cloud-enabled applications

Developers working in enterprise hybrid cloud environments need to combine traditional applications (primarily developed to run in the data center and manage systems of record) with new applications developed in the cloud focused on systems of engagement. These applications have more dependencies, require larger teams, and have more advanced processes and tools to automate the delivery pipeline.

Adopting a DevOps Methodology

Companies that adopt a DevOps methodology to build, manage, and run applications are able to produce more predictable and consistent applications. DevOps services provide a platform for managing the delivery life cycle from conception through coding, testing, deployment, monitoring, and gaining intelligence that can be leveraged for future application updates. Adopting

a DevOps approach means that all parts of the organization are committed to the continuous delivery and improvement of software, including the business, development, deployment, and operation teams.

DevOps teams share a common culture focused on creating a smooth transition from design to development to production. In addition, operations staff may share some of the same tools and techniques as developers.



REMEMBER

Think of DevOps as a methodology and a continuous process of improvement. Figure 1-2 illustrates the IBM Bluemix Garage Method. As you can see, it is a loop where the team continually gathers more intelligence on the application and iteratively improves the application and the process. At the heart of the DevOps methodology is your organization's culture. All application stakeholders need to be committed to creating excellent user experiences and helping the business meet key performance indicators. Visit ibm.com/devops/method for more info on the IBM Bluemix Garage Method.

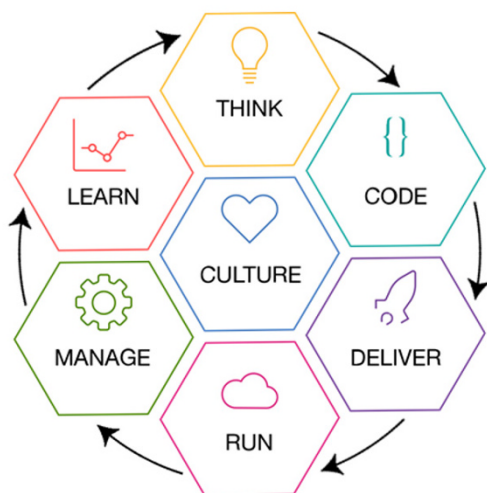


FIGURE 1-2: The IBM Bluemix Garage Method.

The seven key phases of the DevOps methodology shown in Figure 1–2 are detailed below:

- » **Culture:** Transform and innovate with speed. Couple business, technology, and process innovation. Empower small, autonomous teams to make decisions. Experiment in the market and fail fast. Create a flexible team structure and minimize team distractions. Build trust and alignment with better communication and transparency. Take ideas to market with speed and deliver business outcomes fast.
- » **Think:** Incrementally deliver compelling solutions. Create personas and user stories to understand pain points. Prioritize backlogs to deliver the minimum viable product. Build user experience prototypes. Deliver incremental value and validate with sponsor users.
- » **Code:** Create innovative solutions quickly. Explore the practices to build cloud-native applications that scale based on demand. Use techniques, such as pair programming, to reduce errors. Create a strategy around continuous delivery and continuous integration. Release incremental function, gather feedback, and measure results.
- » **Deliver:** Accelerate time-to-market and reduce costs. Accelerate time-to-market by using continuous integration and continuous delivery. Use transparent, repeatable processes. Improve code quality and isolate problems. Use zero-downtime deployment to ensure high availability and reduce deployment risk.
- » **Run:** Leverage services, options, and capabilities to create solutions. Run workloads on a public cloud, a dedicated cloud, a private cloud, or in a hybrid environment. Run on a cloud platform, such as IBM Bluemix, using Cloud Foundry, containers, or virtual machines. Auto-scale resources to match resources with demand. Manage multiple instances across data centers worldwide.
- » **Manage:** Ensure operational excellence. Continuously monitor application status and performance. Ensure high availability and fast recovery. Leverage log data to expedite problem identification and resolution. Shift operational practices to the front of the development cycle to improve reliability.

» **Learn:** Continuously experiment to deliver the right solution.
Formulate hypotheses and design experiments to drive development. Establish clear metrics for decision making.
Drive findings to the backlog and pivot.

The Role of APM in DevOps

DevOps approaches are helping technical professionals to collaborate in order to create and deploy the best customer facing applications. But just implementing DevOps is not enough. Instead, organizations need to have a plan to manage those applications in a unified way that ensures consistency and predictability across development, deployment, and operations.

The DevOps team needs to be armed with the right performance management tools to keep pace with customer requirements. With APM tools, the team is able to monitor an application, evaluating data logs and alerts. The DevOps team is able to leverage the capabilities of shared tools in order to support continuous delivery of applications, delivering code as often as multiple times a week. DevOps services can help to automate the application delivery pipeline from ideation through monitoring. As a result, teams are able to start projects more quickly and stay focused on the task of ensuring that applications meet customer expectations.

DevOps APM has four aspects that are critical to your success.

Continuous delivery

Continuous delivery is a process that enables development teams to deliver secure and tested code to production as quickly as possible. To accomplish continuous delivery, application development teams incorporate automation to deliver updates more rapidly and with fewer errors. Implementing a standardized approach for DevOps is important in order to support consistent APM. This approach to code integration, continuous test, risk evaluation, and application/service deployment is imperative because it enables your DevOps team to proceed with speed, confidence, and compliance.

Continuous security

Security is often understood as the task of a single team or professional. Typically, security is an afterthought for many teams.

However, to keep your company safe you need to think of security as a continuous process. Therefore, you need to implement end-to-end integration of security code scanning, penetration testing, and runtime events/incidents. This end-to-end approach helps ensure that your applications are secure.

Continuous availability

Continuous availability is an approach to application development that ensures that applications don't experience downtime. The goal of continuous availability is to ensure that application users are never negatively impacted by software or hardware faults. Failing to achieve continuous availability can lead to losses in revenue from customers, decreases in employee productivity, distrust from partners and customers, and ultimately a loss of brand reputation.



REMEMBER

To be successful, your applications environment has to meet the service level expectations of all the constituents you serve. Critical operational services must implement acceptable SLAs for your industry and customers. It is important to reduce the meantime to resolution for incidents/problems.

Continuous insights

Insights need to be understood and managed continuously to keep pace with changing customer needs. All applications and their related services provide data about the performance of that application in context with the role they serve. Therefore, providing metrics, dashboards/reports, and analytics based insights help you determine the performance of your environment. Understanding where bottlenecks exist and how all services come together to satisfy the customer are critical for satisfying customers.

Why APM?

APM provides a platform of services to monitor the real-time health and user experience of an application. As the role of the application becomes the central element in establishing customer relationships and satisfaction, good end-user experience and the reliable performance of each element that creates an application are critical. An APM platform should provide flexibility in how

the service is delivered, as well as providing the ability to manage both on-premises and cloud applications. The goal of APM is to quickly detect, diagnose, and respond to application issues before they impact availability.

Accordingly, application performance monitoring doesn't simply start after an application is in production. Instead, to achieve a successful APM strategy, the effort must begin when applications are being developed, tested, and deployed and continue through the entire application life cycle.



TIP

Application performance, security, and costs are often important factors when deciding where an application should be deployed. Continuous application monitoring enables smoother deployments and helps quickly spot an issue before it does harm. In this hybrid world, an application might be deployed on-premises, on a private cloud, or on one of the many available public clouds. Adopting an APM strategy and integrating it with your DevOps approach can help to ensure that whatever platform you choose for your workload is a seamless experience for the end-user. Leveraging APM in the early phases of system testing on production-like systems helps to enable smooth deployments and reduces potential surprises.

Learn more about IBM APM solutions at <http://ibm.biz/ExploreIBMAPM>.

APM IN ACTION: IMPROVING THE RETAIL EXPERIENCE

A large retailer was going through a major transition. For more than 30 years, it had experienced consistent revenue growth. However, things had started to change. Suddenly a number of start-ups emerged that were offering similar merchandise at lower prices. Furthermore, these competitors were connecting with mostly millennial customers via mobile apps and offering fast and free delivery services. The retailer was caught off guard.

The company management decided that drastic action was required. A new strategy was put in place to revamp the online store and to offer customers the option of home delivery or reserving and picking

up an item at a store in 20 minutes or less. The company also created an innovative offering where customers could use an online service to virtually “try” clothing on before buying.

To make this new strategy work, the company had to integrate its in-store Point-of-Sale systems with its new online portal and its mobile application. The end result had to provide a seamless end-to-end experience. The company had a much more difficult task at hand than many of its upstart competitors who were free from legacy applications, legacy systems, and stringent compliance and regulatory rules. The retailer adopted a new DevOps approach to creating and updating applications and integrating those applications with backend systems.

Each individual application seemed to perform quite well. However, when the systems were required to interact with each other there was something wrong. Performance would be fine for a few hours and then the performance would slowly begin to lag, finally getting to a point where some customers were not able to access some of the applications. This spelled trouble for the IT team. The IT team was constantly fighting fires and was not able to get ahead of the problem. Where was the problem? Why did it happen suddenly? Why did some customers experience slow performance while other customers had a smooth experience?

In order to solve this problem, the IT leadership team realized that it needed an APM platform that could provide a way to visualize the relationships between the various components and services. The team understood that they needed to make sure that underlying elements such as configurations and APIs were correct. An application management platform was the right companion to the new generation of DevOps tools. In addition, they needed a platform that could correlate application performance with business KPIs. For example, if an application was down or performing slowly, the IT organization needed the ability to quickly understand and mitigate the business impact.

IN THIS CHAPTER

- » Understanding why APM is important for the business
- » Defining the fundamentals of APM in DevOps
- » Choosing the best APM deployment model for your organization
- » Taking a holistic view of business collaboration
- » Looking at a real-world APM example

Chapter 2

Transforming APM for DevOps

The application has become the personification of the business. Poorly performing web or mobile applications will directly result in customers having a negative impression of your company. The consequences of poor performance can be significant: Customers may abandon your company, resulting in loss of revenue. Therefore, it's critical that businesses create applications that are always available, respond well, and perform predictably. Application performance management (APM) ensures that all moving parts of an application are working well in order to avoid failures. In this chapter, we present the fundamentals of APM and how these capabilities are integral to the success of DevOps.

Why APM Is Important to the Business

Before you can understand the value of APM, it's important to understand why applications fail. Applications fail for three reasons:

- » Application dependencies
- » Application delivery and management process
- » Usage pattern

Managing application dependencies

Applications have dependencies on a huge variety of underlying systems infrastructure and application services. For example, an application may leverage multiple types of middleware and various databases. Each of these elements includes configuration files and settings that can impact the performance of the application. In complex application environments, it's common to have to support multiple client operating systems and networks. Many applications run on infrastructure services such as virtual machines, containers, and components running in both public and private clouds. The growing number of application programming interfaces (APIs) and other third-party services, such as payment processing and commerce enablement, are becoming an integral part of the overall APM environment. In addition, because cloud native applications require the use of microservices, it is important to understand dependencies. One poorly behaved microservice can have a dramatic effect on the performance of the overall application.



The complexities of managing these dependencies require that application designers and the operations team collaborate with a DevOps approach so the applications are well managed. The team has to understand all the touch points in the applications environment so all bottlenecks can be effectively monitored and managed. Both teams require a holistic understanding of all the elements that come together to create the best customer experience.

Application delivery and management process

What does it take to create a well-managed applications management process? All the individuals and departments that manage

the elements of the process must work in a collaborative manner. The application developers have to work closely with those testing the code. Then the team must work with the operations department so the code is designed to support the underlying infrastructure components.



WARNING

Most application management failures can be traced to the following issues:

- » Applications are designed without considerations to changing deployment models or changing end points.
- » There are inherent differences between the development, test, staging, and production environments and lack of coordination among the teams.
- » Application functional testing isn't enough. Organizations may fail to include performance testing, pre-production testing, and testing for both staging and production.
- » Applications aren't updated when a new feature or integration is needed to support changing customer needs.

Planning for usage patterns



WARNING

One of the complexities of applications development and deployment is that it is almost impossible to anticipate exactly how an application will be used over time. The assumptions about how new customers will want to interact with a company's website can often be wrong. For example, an existing product that's buried within a website may suddenly become a bestseller while the highly profiled product is no longer of interest. The developer of a new application may not know that there will be a sudden surge of web traffic, and therefore, performance slows. Developers may have not built an application to support a variety of mobile device form factors.

Clearly, DevOps organizations can't anticipate all uses of applications and all changes in the environment. Therefore, it is important to provide the organization with the tools needed to be able to monitor the performance of the overall applications environment. Through this constant monitoring, the organization can react quickly to make the changes needed to support customer expectations.

The Fundamentals of DevOps APM

Many elements have to come together to ensure that applications meet customer expectations. The various teams responsible for the success of the application need to ensure that these elements can be managed with an APM tool. In this section, you look at the key APM capabilities that can enable this and how these elements are being transformed for DevOps.



TIP

At a fundamental level, an APM tool must be able to proactively detect problems before they impact users, and when a problem does occur and impacts users, it should be able to get to the root cause of that problem with minimum effort. Therefore, any end-to-end APM solution will be able to solve the following three issues:

- » Identifying an application problem proactively
- » Isolating where the problem is
- » Diagnosing the root cause of the problem

Figure 2-1 illustrates some of the key capabilities that APM tools provide to monitor applications end to end.

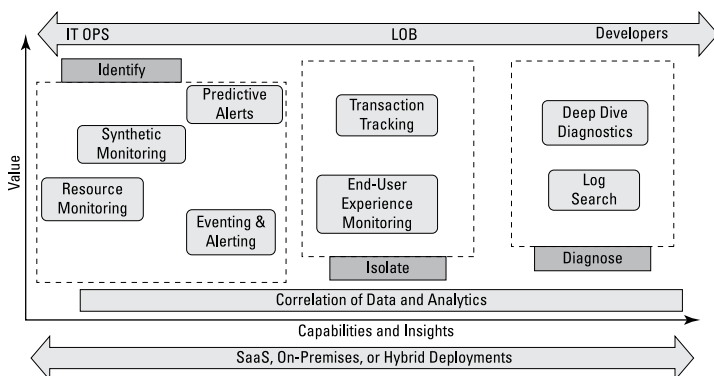


FIGURE 2-1: The APM framework.

Identifying a problem

The best way to identify a problem is to be able to monitor the applications in context with how they are being used by customers.

Depending on where the problem exists, it is important to use the appropriate monitoring tool. The tools in this section can be used to identify problems before they impact users.

Synthetic monitoring

Synthetic monitoring tools measure response time and availability of applications by simulating user behavior across geographies. These tools allow companies to proactively monitor their business critical interactions in real time by recording and playing back user sessions every few minutes from around the world. It is also used to monitor the APIs that enable interaction between the various microservices included in the applications. Synthetic monitoring is often the starting point for monitoring applications in a DevOps environment.

Real-user monitoring

Real-user monitoring provides passive monitoring tools that record user interaction with applications. In this way, applications managers can know the exact behavior during user sessions. APM tools can pinpoint which specific users from which geographies, using what devices and application versions, were experiencing a slowdown on what specific interactions.

Resource and infrastructure monitoring

The ability to monitor key resources that applications depend on is the task of resource monitoring tools. In the DevOps world where containerized applications have become prevalent, it's essential to monitor in real time, capturing metrics from dynamic, highly distributed environments in near real time.

A typical application may include systems, hypervisors, containers, networks, and storage. Key performance indicators (KPIs) may include CPU usage of the virtual machine (VM) or container the application runs on, database disk space utilization, or memory heap size of the Java Virtual Machine (JVM). In addition, applications are designed as cloud-based workloads that have to integrate with data center services.

Events and alerts

While it is important to alert users to problems in their use of an application, it's important that these alerts are meaningful. Too many alerts simply confuse users and interfere with the customer

experience. Providing relevant alerts is one of the key areas in which data correlation and analysis is critical. Correlating and removing duplicate alerts with appropriate filtering and analysis helps reduce alert and event noise and provides the right notification for users.

With environments changing so rapidly, setting static thresholds is almost impossible. By applying machine-learning techniques, APM tools can now study historical patterns, set baselines, monitor thresholds dynamically, and predict when an outage may occur.

Business insights

Correlating business data with performance data is a key to DevOps success. Providing the business with an understanding of the impact and insights of an application's performance to revenue is imperative. For example, understanding the ramification of an application slowdown on shopping carts abandonment helps the DevOps team solve problems.

Isolating a problem

After a problem is detected, it's important to understand under which domain the problem falls. Is it an application code problem or a resource problem or external third-party service problem that was causing the issue? At this point, operations teams usually restore the service temporarily and assign the problem to the right domain expert. The capabilities and tools in this section allow teams to isolate a problem so that it doesn't cause widespread issues.

Automatic discovery and end-to-end transaction tracking

Truly understanding application performance requires the DevOps team to track the way users interact with all components that touch the application. Real-time automating and tracing every single user interaction or transaction from the user's browser all the way to the backend is critical for managing performance. With microservices-based applications running on dynamic containers, discovery of the application dependencies needs to be truly automatic. Additionally, to monitor cloud-enabled applications, discovery and tracing need to span across hybrid workloads.

Deployment analytics

APM tools for DevOps need to detect the impact of code deployments on the application performance to isolate the builds or versions that may have generated issues. When a new version of code is deployed in production, the change should be detected automatically without having to reconfigure the APM tool. APM tools equipped to support A/B testing provides quick comparison views between different versions of applications and helps isolate a performance problem to specific versions.

Diagnosing a problem

After a problem has been isolated, APM helps to diagnose the root cause of the problem. This diagnosis optimizes the technique for presenting all relevant data in context with the issue. At this stage usually developers get involved. The techniques in this section help teams understand why a problem occurred so that they can prevent it from occurring in the future.

Code-level diagnostics

From a single transaction, trace application developers can dive directly into the line of code that may have caused the issue. It is important to conduct deep dive diagnostics to support modern runtimes on which cloud-native and mobile applications are being written.

Log analysis

To quickly diagnose service problems in applications and the supporting infrastructure requires the operations team to analyze both structured and unstructured data in near real time. It's not enough to capture log data for post-incident response. To proactively respond to incidents, you need to understand the log data and correlate log with metrics. Most developers look into logs as a first step for diagnosis. To support the management and analysis of massive amounts of log data, many operations teams are leveraging big data platforms and advanced analytics.

Virtual war rooms and ChatOps

With DevOps, the collaboration during troubleshooting is usually done via virtual team rooms such as virtual war rooms and ChatOps. This team room presents all the APM data needed to

troubleshoot in context of the problem. Everyone in the virtual team room looks at the same data and hence the blame game is substituted by collaborative problem solving. It is absolutely imperative that APM tools can alert on channels of collaboration that DevOps teams use.

Cognitive recommendations

Most APM tools are good at detecting an application problem and providing data to troubleshoot the problem. However, this experience can be improved by leveraging historical data. Cognitive analytics relies on machine learning from data in order to understand patterns in data. This type of advanced analytics can help improve the meantime to recovery for business critical applications.

Determining the Best APM Deployment Model

While APM tools were traditionally designed for on-premises applications, things are changing with the growing importance of cloud-based applications. To support changing development practices, APM tools are now moving to the Software as a Service (SaaS) model. APM as a Service enables customers to subscribe to software services instead of buying and supporting a suite of tools. In addition, you don't have to purchase hardware and the related operating system and middleware services. Most APM cloud services provide a dashboard that allows both the IT organization and the business to gain overall insight into the performance of all their applications. The IT department will have a view into technical performance metrics while the business may be provided a visual that ties APM to key business metrics. Having a consistent platform that all IT developers and operations staff can access helps to create a more unified DevOps organization.

In order to monitor highly dynamic and distributed applications, the APM tools need to be more scalable and available than the applications being monitored. Cloud-native APM tools can satisfy these requirements of being highly scalable, highly available, and production ready with low overhead.



At the onset, teams need to determine the best deployment model for an application. Keep in mind that the deployment model may shift based on a variety of factors, including usage patterns, costs, and security and compliance requirements. For example, an application may be developed on the cloud for testing purposes but moved on-premises before production based on security concerns. Likewise, an application may be deployed on-premises but moved to the cloud so resources can be easily scaled up or down. An APM platform must give operations teams visibility into the application's performance no matter where the application resides and must support any model that the team prefers.

Gaining Insights Requires a Holistic View

Now that applications have become central in the way businesses collaborate with customers and partners, the performance of applications is the responsibility of the entire DevOps team. If groups continue to operate in isolation, the performance of the application will suffer, and applications will be difficult to manage. When these teams work together using a common APM platform, they can more quickly build, deploy, and manage quality applications that can be continually updated.

IT operations

The IT operations organization is responsible for maintaining the in-house infrastructure that applications run on and sets the service level agreement (SLA) guidelines that the application development teams need to follow. The IT operations team needs to monitor the use of resources because the same resources can be used across multiple applications.

IT operations rely on alerts generated from APM tools to stay aware of impending problems, track service disruptions, identify bottlenecks, and spot unanticipated activity. Experts with the operations organization use APM dashboards to troubleshoot application problems when they arise. They usually rely on trends on resource metrics such as compute, storage, and network to troubleshoot. They also track data related to which

users are accessing applications for performance, security, and governance.

Line of business

It is common for business units to create and manage their own applications for customer management. These applications have to be able to perform effectively regardless of which deployment model a customer is using. Therefore, these business units serve as their own IT operations unit. They have responsibility to manage all the elements that come together to create the customer experience. Business unit management has to take responsibility for transaction data that resides in the data center, localized security services to protect sensitive customer data, and integration with partners' data. While line of business (LoB) managers may have no control over many of the elements of these applications, they have to be able to provide the customer with a seamless experience.



WARNING

Performance must adhere to the expected service level set by the business. If that service level is not met, customers will seek out other suppliers. This can be especially problematic when customers are using mobile devices to interact with their suppliers. Customers have a very low patience for poor performance, especially on a mobile device. These mobile customers expect fast performance and intuitive applications.

Development organization

The development organization traditionally acted as an independent unit. However, this is no longer acceptable in an era where deployment models and operations are shifting. Developers have to understand the way applications will be used and managed within the operations organization. They need to understand the changes to operations and new applications management techniques. In a perfect world, applications would be stable and fully tested so deployment would be straightforward. However, the real world is quite different. Developers are often required to change code several times a week or even daily.

Seeing APM in Action: A Banking Conglomerate

While every industry has distinct differences, some remarkable similarities exist among companies that are embarking on a digital transformation strategy.



REMEMBER

Companies across industries have to find ways to ensure that they're managing their software assets in a consistent and predictable manner. If software assets across deployment models are well monitored and managed, the customer experience is improved.

What does this mean in the real world? In this section, you take a look at the experience of an operations leader at a major international financial institution.

Many banking institutions had modest beginnings, and this was true for Banking Plus as well (we are calling this company “Banking Plus” in this example). It began a century ago as a small community bank that largely served agricultural communities. The bank was always known for its close relationships with customers. Because of the company's success, it was able to begin expanding into other banking markets, including mortgages, financial planning services, and investment banking. Over the years, the company expanded by buying up other banks in new geographies and in new market segments. Today, the bank has branches and offices in three different countries.

Not surprising, over the years, technology became the linchpin of the banking institution's success. As its services expanded, so did the number of systems and applications that the bank needed to support. In addition, as the bank acquired competitors, the IT team was tasked with integrating newly acquired systems with the existing IT infrastructure.

When the company was smaller, the problem was simpler to manage. However, rapid growth resulted in many applications spread out throughout the bank. For example, today there are multiple back-end transactional systems, mortgage applications, customer relationship management systems, call center applications, and customer-facing mobile and web applications — to name a few. Some applications are deployed and managed on-premises while

other applications are being developed on the cloud. Still other applications are designed to operate both on the web and on a variety of mobile devices.

Focus on the customer experience is key

The executives at Banking Plus understand that the key to its success is the ability to develop close relationships with customers and exceeding their expectations. As the business evolved, many customers now interact with the bank via mobile devices and the web rather than in person. To continue its tradition of excellent customer service, the executives tasked the IT organization with being able to monitor the user experience based on the KPIs for the company.

Creating a consolidated approach to DevOps

The problem for the IT organization was that maintaining this consistent customer experience meant that there needed to be a consolidated approach to DevOps and application monitoring. Traditionally, the IT team was building and then monitoring each application type with a variety of different tools. Determining the overall health of cloud applications required yet another set of tools. The IT operations team had no way to easily get a snapshot of the user experience and lacked the ability to correlate user experience with KPIs. It became clear that the operations team needed a new strategy for monitoring application performance.

Leaders in IT and IT operations looked at a number of options and ultimately decided to use an APM platform that could monitor both its on-premises and cloud applications. In addition, the IT leaders met with colleagues in the business to determine the appropriate KPIs. For example, the online banking portal needed to be available at all times, and customer log-ins needed to take under one second. Other applications, like the company's internal mortgage application program, could perform more slowly but required two-factor authentication.

The APM platform enabled focus on holistic performance

As the IT team gathered feedback from different stakeholders, it leveraged the same APM platform for a number of groups within the business. The IT operations team could quickly track down potential issues and proactively respond to problems before users were impacted. The development and deployment teams were able to be more efficient by using the APM platform to accurately understand how an application would perform before it went into production. Finally, business users had an interactive dashboard that allowed them to understand how users were interacting with applications. Business users could gather data from different application interactions and run business intelligence on the data. For example, business users could better understand the types of interactions that customers had on the web application versus the mobile application. Gaining this sort of information helped steer the direction of new projects and applications.

IN THIS CHAPTER

- » Understanding application usage and dependencies
- » Setting common goals and success metrics
- » Implementing common APM tools across the DevOps life cycle
- » Focusing on the user experience
- » Integrating seamlessly with other DevOps tools
- » Managing end to end performance
- » Educating business leaders on APM
- » Making the partnership work

Chapter 3

Creating an Effective DevOps APM Strategy

In the era of the hybrid cloud, the performance of applications has never been more important. In fact, the hybrid cloud has become the trigger for organizations to rethink how they manage the overall performance of applications. Organizational silos make it difficult for the business to have an end-to-end view of an application. With application performance management (APM), you can gain insights into process, application services, and infrastructure as they relate to each other. Therefore, APM provides the feedback loop for all the stakeholders. Adopting APM throughout the application life cycle also allows teams to spot problems more quickly in the development processes and address issues before they cause major problems or delays.

In this chapter, you examine the techniques and best practices for creating an effective APM strategy. We focused on providing you the best practices that create an effective DevOps with APM implementation strategy.

Understand Application Usage and Dependencies

Understanding how an application is used and what code and services it depends on can dramatically impact performance. Therefore, as developers begin the process of planning, designing, and prototyping their applications, they need to collaborate with Operations engineers. The team has to answer the following questions:

- » How will the application be used?
- » Where will it be deployed?
- » How will the application be monitored to ensure good performance?

Working in collaboration during all phases of planning, development, and deployment will ensure success as the broader team follows a DevOps approach.



TIP

To create an environment that performs as expected, focus on three key requirements:

- » Infrastructure, resource, and service dependencies
- » Usage patterns and application loads
- » Data governance and compliance

Infrastructure, resource, and service dependencies

With the advent of hybrid cloud environments, it is more important than ever to understand the underlying infrastructure and the supporting technology stacks and services. When thinking about your infrastructure and its dependencies, consider the following questions:

- » Will the application be hosted on a public IaaS, PaaS, dedicated cloud, or in-house VMs or containers?
- » Are there dependencies on in-house systems and third-party services?
- » Are there dependencies on middleware used by these applications?

Understanding the entire environment of the application helps ensure success.

Understanding usage patterns

It is important to understand how applications will be used. Are the applications used by a small number of internal customers? Are the applications designed for an expanding number of end-users with a variety of end points? Where are the users located and what are the common user flows? It is important to remember that current usage patterns may change based on shifts in the business or in customer expectations.

Data compliance requirements

Data is at the heart of the value of applications management. The new generation of distributed applications has to support data that originates in many different localities, including public and private clouds or mobile devices. To improve performance, data may be cached or placed closer to where processing takes place. Many organizations and governments have very specific rules regarding how data about customers must be stored and managed. While locating data close to the users who need to access it may improve performance, it may also violate governance or compliance mandates. Therefore, your APM tools must support data governance rules.

Set Common Goals and Success Metrics



REMEMBER

The service level agreement (SLA) is important because it is a promise between service providers and a business. Even in the face of change, SLAs must continue to be met. The service level requirements will change as business and customer requirements change. For example, an application with few customer

engagements and no direct tie to revenue may not require continuous availability. However, if the application gains traction or evolves to be a source of revenue, the service expectations must be adjusted to meet the application's importance. Ensuring the optimal SLA is the joint role of both the development and the operations organizations. But it isn't enough to focus only on technical performance. Business metrics, such as conversion rates, shopping cart abandonments, number of users, and usage patterns, should also be tracked.

Implement Common APM Tools Across the DevOps Life Cycle

As development and operations teams have become more disconnected and distributed, many have resorted to using a variety of different tools. This approach has made it difficult to implement a continuous DevOps process. Creating continuity requires a predictable life cycle. Therefore, the DevOps process necessitates the need for using the same tools by all parties for effective collaboration. APM tools that can monitor infrastructure as well as trace business transactions and diagnose down to the line of code are critical and can be used by both development and operations teams. A single set of tools keeps everyone on the same page and reduces confusion.

For traditional applications, performance of applications was usually measured during non-functional testing phases with simulated loads. In the world of ever-changing applications development and delivery, performance has to be monitored and measured continuously from the beginning of development to deployment. Very often monitoring starts with synthetic tests to detect performance problems by simulating user flows and running the tests continuously. It is important to ensure that the development, testing, and staging environments are as close as possible to the same as production so test results are applicable. APM data collectors or agents should be a part of the build process, seamlessly integrated with the continuous integration and continuous deployment tools. This approach ensures that the relevant monitoring data is collected as soon as the application is deployed and throughout the application's life cycle.

Focus on the User Experience



REMEMBER

The user experience is the most important test of your success in APM. Therefore, you have to begin by understanding the context of the customer experience. Digital experience monitoring includes both synthetic and real-user monitoring to detect problems in the common user flows. With end-user monitoring, you can track user sessions in real time to better understand customer experience across geographies and deployment models. Deep transaction analysis allows you to track business transaction in real time to detect failures and proactively improve the user experience.

Analyze the impact of deployments on performance

DevOps teams need to have the ability to detect the impact of code deployments and changes on the application performance in order to isolate which builds or versions may have generated issues. To effectively keep track of code deployment issues, it is critical to correlate analysis and views of application changes, alerts and key performance indicators (KPIs). It is also important to compare pre and post deployment trends during performance testing.

Analyze the impact of performance on business

Applications performance has a direct correlation to how customers perceive your business. End-users have little patience for poorly performing applications. If an application doesn't perform as expected, a customer will likely quickly lose confidence in the company. Even if the business is running Software as a Service (SaaS) applications in a public cloud, end-users will still hold the IT organization responsible for the performance of that application.

Business metrics and customer outcomes

Most APM tools include the ability to analyze the customer experience, including response time, availability, and failures with business outcomes. Tying the type of analysis KPIs helps business

leaders easily interpret the connection between APM and business outcomes.

Integrate Seamlessly with Other DevOps Tools

APM tools are often used in conjunction with several other key DevOps tools. APM data collectors should be a part of the build process, seamlessly integrated with the continuous integration and continuous delivery (CI/CD) tool, to ensure performance and health are being monitored from the first deployment throughout the application's life cycle.



TECHNICAL
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APM should also integrate with alerting and event management systems to ensure the appropriate alerts reach the right people at the right time via the right channel. For faster diagnosis, APM tools are often integrated with log analytics tools to correlate logs and metrics in context of an application problem for faster diagnosis. It is also important to integrate with runbook automation tools to automate common actions on failure. These key integrations ensure broad visibility, control, and action on application problems throughout the application's life cycle.

Manage End-to-End Performance

The new generation of applications is designed as a set of components or microservices that are integrated through well-defined APIs. These microservices are linked together at runtime to execute a business function. In addition, it is common for applications to send transactional data to a backend revenue management system.



REMEMBER

In essence, in this distributed computing world you are managing end-to-end processes. To achieve the right level of performance, you have to understand the relationships between all the services that combine to make the user experience viable and predictable.

End-to-end analysis and visualization of performance data requires that data is collected for every dynamic node, every container that may move from one cloud to another, and every API

call that's made to a microservice. In other words, every touch point in the application's user flows or business critical transactions traverses through must be monitored. This type of analysis means that the APM tools must have built-in analytics capable of handling the massive amount and variety of data to make sense of application performance.

Educate Business Leaders on the Importance of APM

How many business leaders spend any time thinking about the performance of the application? The answer is probably very, very few. Business leaders are concerned with creating new products and services that are competitive and will bring results. Improving the bottom line is the primary interest of business leaders. So, why would they care about application performance when many leaders assume that IT will take care of those details?



REMEMBER

Despite their lack of initial interest in this aspect of technology, it is important for IT leaders to educate business leaders on the importance of managing the performance of applications. IT leaders have to explain the connection between the performance and management of applications with the impact on the customer experience. When business leaders understand the impact on revenue they will become more engaged. Here are some of the most important questions that business leaders will want to know about application performance:

- »» How often do customers leverage online sites to complete transactions with the company?
- »» Do customers use your online support sites to solve problems? Does this online support help solve support bottlenecks?
- »» What is the correlation between poor application performance and sales/revenue?
- »» Are there known performance levels that will directly result in customers abandoning applications? How do we ensure that applications perform above those levels?
- »» What procedures are in place to ensure that business critical applications never fail?

Make the Partnership Work

When you begin the process of implementing an effective APM strategy, you are ready to support the business. By understanding that your applications are the embodiment of your company, you can partner effectively with the business by focusing on outcomes. Armed with the right strategy, the right plan, and the right tools, you'll be on your way to business success.

IN THIS CHAPTER

- » Making sure your team collaborates
- » Building security and governance into your processes
- » Monitoring the user experience
- » Understanding dependencies
- » Leveraging all the tools within your company
- » Gaining insight from your performance data
- » Setting common goals

Chapter 4

Ten Best Practices for DevOps APM

Transforming your customer experience requires that you think differently about the ability to continuously build and operate your applications environment. Getting started requires that you approach DevOps and application performance management (APM) with the right level of planning. This chapter gives you ten best practices to help you on your journey.

Collaborate and Transform Your Applications Environment with Teamwork

In an era where your persona of your business is dependent on your applications, your developers have to work as a close-knit team with the operations team. Teamwork is a critical way for

you to transform your organization. There are many different roles on the business side, the software development side, and the deployment side. If these individuals all work in isolation, success will be difficult to achieve. If you collaborate among business leaders, software developers, and operations leaders, you can improve your ability to innovate. Make sure you understand when your customer requirements are changing and when *you* need to change in light of business requirements.

Focus on Best Practices

While you need to innovate, don't start with a blank slate. Make sure that you're leveraging what is working well based on business expectations. You need to have a consistent technique for building and deploying applications to support new platforms and new partners. Predictability of your applications is mandatory.

Build Security into the APM Environment

In the world of continuous development and deployment, silos cause problems. Like testing, security can't be added in at the end of the process. Your teams need to work with security experts early in the development process so that security is part of both the planning and execution plan.

Leverage Your APM Tools to Monitor the User Experience

You need to be able to monitor the health of your applications and the user experience in real time. You must assess your applications in context with how your customers need to collaborate with your company. APM provides the mechanism that enables you to monitor the way customers are interacting with your applications.



If you only focus on the development or deployment of your applications, you may disappoint your customers. For example, if performance is poor, customers might select a different service provider. Ensure that you have customer satisfaction with the flow of your application, and remember that how it performs is key to success. Applications have to perform in ways that are easy for customers to follow with the right level of performance.

Understand Dependencies

Most applications have dependencies for a variety of services on-premises or in the cloud. Therefore, you have to make sure that you understand how code and third-party services will impact performance.

Plan for Governance

In a hybrid environment, you need to plan for governance (the ability to meet governmental and industry requirements for data protection and security). You may have application elements from a variety of sources. Some services may run on-premises while other services will operate in the cloud. Your company has to make sure that all your governance and regulations requirements are followed. You can do this by implementing common APM tools across your enterprise. This allows you to have consistency and predictability no matter where your applications are running.

Implement the Same APM Tools Across the DevOps Life Cycle

Your goal should be to have a consistent and predictable way to manage your DevOps life cycle. Leveraging the same tools across the organization provides consistency and reliability of reporting and monitoring.

Integrate Seamlessly with Other DevOps Tools for Constant Feedback

APM tools should be integrated with other DevOps tools used in the organization. Through this integration, all teams including development teams, testers, and business analysts can take advantage of being able to monitor feedback provided by APM.

Setting Common Goals and Success Metrics

What does success look like in terms of the performance of your applications? To be successful you have to work together with all the stakeholders to set a common set of objectives that define how a well performing collection of applications should behave. Setting goals will ensure that the performance of your applications reflects well on your company's value.

Prepare For Change

The only certainty in the world of application performance management and DevOps is change. You have to be prepared for a world where the business will demand rapidly evolving applications to address new opportunities and competitive threats. With a well-executed strategy for DevOps in the context of applications performance, you will be prepared for whatever comes.

Redefine how customers interact with applications and services

New business models are emerging rapidly, fueled by digital services and the API economy. User requirements are changing dramatically. Users expect that their vendors' applications are innovative, fast, and adaptive to their changing needs. More than ever, your business persona and reputation are dependent on the performance of your applications.

Inside...

- Adopt a DevOps methodology
- Improve the customer experience
- Rethink software development and deployment
- Discover the value of continuous development
- The best ways to manage application dependencies
- The best practices for collaboration



Judith Hurwitz is President of Hurwitz & Associates and is a strategy consultant and thought leader in emerging and disruptive technologies that benefit customer growth. **Daniel Kirsch** is Principal consultant at Hurwitz & Associates and a strategy consultant and thought leader in emerging and disruptive technologies that benefit customer growth. **Arun Billigiri** has over 20 years of experience in technology and is the leader of the APM Offering Management team at IBM.

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