

How to Improve Observability and Application Performance on AWS

Using code-level insights to achieve your business goals and increase organizational value



Introduction

To excel in today's marketplace, companies must embrace a "customer obsessed" outlook that synchronizes business technology, DevOps, servant leadership, and transparency in the delivery of business value. Since every transaction is defined by code, adopting code level insights can lead to better decision making and stronger alignment between resources and desired outcomes. By implementing observability, automation, and virtuous cycles and data-driven insights, organizations can transform their culture (people, processes, and technology) and reach new performance breakthroughs. In this whitepaper, DevOps Institute Ambassador, Jack Maher demonstrates how code-level insights can help you achieve your business goals while meeting and exceeding customer expectations.

Building on Maher's perspective, AWS Marketplace will share how you can specifically apply these learnings to your AWS environment. You will be introduced to relevant AWS and AWS Marketplace services that can help you achieve optimal business outcomes. Finally, AppDynamics will be featured as an available option for supporting your reliability engineering strategy.

About the Author

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How to achieve your business goals with code-level insights



Introduction

Customer obsession is at the center of any successful business, and that includes maintaining the expected (or better) level of service and responsiveness to rapidly changing market conditions. Everything is driven by software, but do we know how it actually operates?

Understanding how our software works, at 'code level' is critical. The code level is where we find the features, the capabilities, the things we need to do. If we start off in the wrong place (wrong sequence or step) or incorrectly process information (algorithm not operating as expected) the result may be less than desired or even result in unexpected and undesired outcomes.

The way our software operates directly impacts how we create and deliver value, and the specifics of our stakeholder interactions. How our code works is how we work. As Marc Andreessen and Ben Horowitz famously predicted¹, software has "eaten the world." Nothing is untouched. We write software applications that runs on software operating systems deployed via software to software defined networks on software instantiated infrastructure. Our code is our digital DNA, figuratively. Our code is our business' operating system, literally.

¹ <https://quoteinvestigator.com/2018/01/24/software/>

Understanding how your organizational “machine” works and being able to monitor key performance indicators is foundational. Implementing these capabilities, and deep engagement via code-level insights can transform your approach to performance monitoring and observability in a manner that scales with your evolving business demands. Today’s organizations are operated with plans and reports. The plans are what we are thinking to do “next”, based on what we did before to the degree the reports confirm realization of value creation and delivery. The reports (presumably) measure how well we have done in the recent past. Reporting of performance statistics via Key Performance Indicators (KPIs) over time showing historical trends have gotten us here; but it has been like driving a car via the rear-view mirror. It seems like we are headed in the right direction, and we are probably moving based on the activity we can see.

Today, most organizations also use dashboards to watch KPIs associated with various business processes. With this, we can be sure we are moving, and can likely gauge relative speed, effectiveness, and efficiency.

At the speed and complexity of business today we need a more comprehensive dashboard with a heads-up display, ideally with some augmented reality projecting where we are headed. We need to observe what is going on in real time so we can make corrections and adjustments as conditions change. Visibility is enabled by transparently monitored processes.

Observability is the ability to see operational telemetry in context with historical performance and current environment expectations. Better still is if we attain activity modeling with probability bound projections. Observability provides context for decisions and much faster feedback loops via visibility. How we create and deliver value in our ecosystems is evolving very quickly and increasingly drives differentiation in competitive markets.

Cloud capability is a direct application of digital thinking. As Amazon grew, the need to grow and scale differently became increasingly apparent (to them).² With the necessity of what we now think of as cloud and the resulting invention of Amazon Web Services, for most of us this increasingly means that everything is software from “the ground up”, in a cloud.

It is essential then, that we can answer fully questions such as, what is this code doing³:

- To and within our infrastructure
- To our systems and overall performance
- Different than any prior version
- By transaction
- Across architectures
- With any 3rd parties
- For users, right now, to accomplish their goals

² <https://www-wsj-com.cdn.ampproject.org/c/s/www.wsj.com/amp/articles/amazon-cto-details-companys-path-to-the-cloud-business-11567551197>

³ Marco Coulter, AppDynamics, *Having New Eyes: The Power of Observability*. August 20, 2020; DevOps Institut

Business goals and code-level insights – the connection of value delivery and outcomes

Business goals and outcomes are the result of our execution of our business model. Contemporary execution now has digital components that are necessary to execute, predict, create, or reflect our performance in the marketplace. To be effective leaders must be able to see results from effort and control alignment of resources and objectives. Many modern tools provide data collection and analytics and focus increasingly on automation of analysis and feedback loops.

Understanding the flow of value through your organization, especially for critical path activities that execute on your business goals is essential. Many value stream mapping exercises over time and across industries have consistently revealed how little we typically know about precisely how, when, and where we create and deliver value to our stakeholders from beginning to end.⁴ Without an ability to see and measure the flow of information, artifacts, and value we cannot improve systemic effectiveness, as described in the Theory of Constraints.⁵

Many of the KPIs we have in place today are sufficient to provide relevant and understandable data of operational metrics. Application and environment monitoring in this context must go far beyond logging. Real time data flow of telemetry that demonstrates application performance adds context that drives toward desired outcomes. The visualization of environmental and application performance of our business model requires data analysis that enables organizational leaders to see direct business outcomes.



The goal of Observability is a visualization representing a real-time view of current value flow measurements, indicators, and rich meta data of business performance with expectations in the context of our business model.

Where do we start? Let's start with why.

Simon Sinek has created a phenomenon through his speaking and writing engagements by advocating the importance of "Start with Why."⁶ This means being super clear on what is essential to the self-definition of your organization. Why do you exist? What happens if you cease to exist?

Today's reality is that nothing happens without software. No part of our lives is untouched. We have unprecedented need for and access to information, capabilities, and resources that are rich with data; all of which has a story to tell, and insights to be gleaned.

Mr. Sinek took things a step further after "Start with Why" with his book "Leaders Eat Last." Modeling this progressive behavior, the US Marine Corp embodied the pivot from a command and control approach to a culture of authentic servant leadership. For the same reasons, similar leadership within your company can unleash customer obsession across your organization with associates that are enabled and empowered. When these concepts are combined, we routinely find the synergy drives highly cohesive, collaborative, and high performing teams.

Connecting the dots from our vision, core mission, and values to how we conduct ourselves at every level is not only possible now, it is essential for optimal performance. And perhaps, in some cases, survival or remaining relevant in an increasingly digital marketplace. Aligning our actions with desired outcomes and key results can only happen when we have defined what we want as outcomes and execute well on our approach in sustainably delivering.

⁴ Standing on Shoulders: A Leader's Guide to Digital Transformation, Maher & DeArdo, Archway Publishing, 2019

⁵ https://en.wikipedia.org/wiki/Theory_of_constraints

⁶ https://en.wikipedia.org/wiki/Simon_Sinek

Recognition of shared value and a commitment to a common cause can directly lead to more effective organizational leadership, especially in generative and collaborative environments. There are many standout examples from history that frequently carry the name of their founder or cause – mostly mavericks from a predominantly waterfall world. Presently, we see most organizations adopting agile software development practices and increasing convergence of concepts across tech domains.

Connecting the dots -- context and breadcrumbs

As we continue to connect the dots in our organizational ecosystems, the more complex and richer our understanding becomes of how value is created and flows through our organization. Ultimately, value is in the eye of the stakeholder.

When we consider, from a stakeholder's perspective, when and how value is created and delivered, this is the starting point for customer obsession. What does our customer want or need? What do they expect? What would be better? What are and how are the activities necessary to create and deliver that value interrelated? What are the KPIs, operational thresholds, and intermediate, secondary or supporting objectives?

There are numerous overlapping and intersecting value streams in every organization that converge and diverge. When integrated, these elements offer an enabling view of synchronization across the enterprise, from the time a need is identified to delivered. What we care about is speed to value or how quickly can we respond to evolving needs.

With a transparent and visible set of hypotheses of how value flows in our organization, we can observe execution and continually re-evaluate the hypotheses and underlying assumptions. This process most effectively occurs through a deterministic design pattern⁷, leveraging data collected and analyzed based on the current hypotheses that are the organization's operational model.

If we collect all the data flows of environmental logging, application performance monitoring and telemetry into a single, secure repository, we can use any number of tools to divine our own perspective of the truth from that common source. We might look at various perspectives to be value streams; for example, the value of cyber-security is demonstrated via DevSecOps, the value of availability realized with Site Reliability Engineering, and business cycle responsiveness driven by BizDevOps.

DevSecOps, Site Reliability Engineering, and BizDevOps are all examples of value stream thinking from specific outcome alignment for improved responsiveness to evolving conditions. Product teams are a common example of implementation approaches as organizations converge on agile practices and team-based structures.

Through a story wall or user journey, we might use stakeholder narratives to identify the outcomes we desire. We can then define performance or activities that we associate with KPIs and Objectives and Key Results (OKRs) that predictably represent progress and realization of our business goals. Stories communicate how we represent the events and activities that we care about. They describe the outcome, resulting in applications, microservices, and service subscriptions which are made visible via traces, spans, tags, instrumented processes, and events in data.

The measurement of the flow of value via direct monitoring and KPIs enables sophisticated analysis and modeling of current and historical data visually. This includes increasingly sophisticated specific value focus capabilities, such as InfoSec or GRC (Governance, Regulatory, and Compliance).

The ability to collect and rapidly process this information is vital for gaining critical insights into our business capabilities. Automating the collection and analysis of data is necessary to meet demands for continuous streams of more personalized real time information for our stakeholders.

⁷ For more information on this topic, please go to <https://DeterministicProcessDesign.com>

As our IoT-like rich data environments have matured, along with the ability to manage very large data sets, we can now collect and manage sufficient data in a timely manner. Additionally, as we increasingly adopt a microservices approach to architecting our technology landscape, we can evolve our quality assurance practices further. This encompasses outcome or observability driven development through increased transparency of organizational processes and heightened visibility of workflows.



“You can observe a lot just by watching.” - Yogi Berra

Observability is the manifestation of the capability of visibility, enabled by transparency and data.

In his SKILup Day talk “The Subtle Art of Distributed Tracing”, Michele Mancio⁸ shared a look into an “everyday microservice” and how microservices and entire ecosystems of services and applications interact. Distributed Tracing is an approach to understanding your organizational operational performance with data and metadata of the organization’s transactions. When telemetry and monitoring data are collected and correlated, they enable an Internet-of-Things (IoT) type of rich data collection of information about:

1

Current operational state in context with expected and historical data at individual and collective levels within a defined environment or ecosystem.
(one or more systems)

2

Current delivery performance in context of expectations for KPIs, OKRs and shared outcomes along product, service, value stream, etc.
(individually and in concert)

3

In process delivery qualitatively and quantitatively (to serve a request)

This becomes increasingly necessary as distributed work environments become characterized by increasing transaction depth, elasticity of demand and constraints, and meta data availability and quality. We now have an IoT-like environment that can allow for high cardinality with little or no aggregation. In other words, we do not have to work in categories or populations. We can address the single unit or individual level.

At an organizational landscape level, having granular capability with visibility in a real-time environment means visualization for presentation and assimilation of information. Bringing current information into context with its historical backdrop and current expectations creates a feedback loop for near-real time operational management. Managing organizations based on system outcomes becomes increasingly relevant and differentiating. This connectedness enables a more comprehensive and complex view of our operations. This, in turn, enables and requires more people to become collaborative at the system level. Automation must be deployed to manage the explosion of data as instrumentation and telemetry are employed.

Concurrently, as business cycles continue to quicken, and technology adaption to evolving practices and capabilities become available, the more we need resilient systems that reflect our current state of delivering expected outcomes. Automation again becomes necessary to both create and detect lack of continuity.

Various perspectives of the value flows can then be modeled based on specific interests with contemporary value management systems that are purposefully architected. This effectively results in a multidimensional model for how our organizational “machine” operates as defined by our value streams.

⁸ Michele Mancio⁸, Instana; *The Subtle Art of Distributed Tracing*; August 20, 2020; DevOps Institute

Organizationally we have many standard value streams when we consider what we do and asking why we do something, or “of what value, to whom.”⁹ Most fundamentally, what are the value streams that address our people and how do they align with our desired outcomes. Examples of this include our HR and payroll systems. These support outcomes or result in attainment of objectives that are part of our shared vision. Increased awareness of contributions in an environment of transparency around process and visibility of results are all components of inherent ways to increase trust.

With cultural support fostered by DevOps’ The Three Ways¹⁰ and CALMS (Culture, Automation, Lean, Measurement, and Sharing)¹¹, we can create an ideal environment for improved performance based upon virtuous cycles of behavior and interactions.



A significant by-product of this is a high trust environment.

With this kind of information, we can maintain a high trust performance through evidence. As the data shows consistent performance of outcomes in alignment with expectations and KPI reporting, organizational friction is reduced, and personal and team confidence builds.

Visibility that enabled by transparency is key, but without the context of how the organization is operating, we fall short of true observability. Representation of this amount of information requires not only visualization, but automated analysis that brings the enormous amount of data together in a meaningful way.

This enables business performance monitoring via environmental and application telemetry to move from historical reporting to real time data visualization. As a result, organizations can better see what is happening, enabling better critical evaluation and more timely decision making.

Paint a clear picture of your vision

When stakeholders “see” where we are going and what we care about, they gain a more intuitive feel for our brand, align themselves with the outcomes we desire.



President John F. “Jack” Kennedy & The Janitor at NASA

During a visit to the NASA space center in 1962, President John F. Kennedy noticed a janitor carrying a broom. He interrupted his tour, walked over to the man and said, “Hi, I’m Jack Kennedy. What are you doing?”

“Well, Mr. President,” the janitor responded, “I’m helping put a man on the moon.”^{12,13}

⁹ <https://standingonshoulders.us/blog/f/value-exchanged---supply-demand>

¹⁰ <https://itrevolution.com/the-three-ways-principles-underpinning-devops/>

¹¹ Keep Calm and Embrace DevOps, AppDynamics, <https://kapost-files-prod.s3.amazonaws.com/published/555271a4c12539dc18000118/ebook-keep-calm-and-embrace-devops.pdf>

¹² <https://www.bizjournals.com/bizjournals/how-to/growth-strategies/2014/12/what-a-nasa-janitor-can-teach-us.html>

¹³ <https://www.inc.com/matt-given/mark-zuckerbergs-ifk-quote-is-a-master-class-on-th.html>

When our team gains a “shared quest” mentality, we begin to see how every role contributes to the goal and we can “buy in.”

What is important to us?

- Shine the light on it. Put it up on your wall.
- Talk about why it matters, and for whom.
- Look at it at least every day.
- Share what and how we are doing.

When we create a common language and behavior around customer obsession, We understand that the words we use matter. What are the implications or connotations of the jargon, culture, and labels that we use in our teams? Language shapes thinking, thinking drives behavior, and behavior becomes culture. We can set and reinforce expectations with our choices of language and messaging.

Customer obsession is the hallmark of breakout and break through successes. It can provide a clear focal point by which we can evaluate and prioritize our resources, activities, and decisions. Customer obsession is not elusive, it can usually be reliably engendered when it is determined to be necessary. A company that is organized around a core mission and operates with clearly defined values thrives best in an environment of transparency and accountability.

App performance and business performance – increasingly intertwined

In her talk on “Observability: A Socio-Engineering-Technology Problem,” Shivagami Gugan¹⁴ shared two examples:

- Walmart found that for every 1 second improvement in page load time, conversions increased by 2%
- Mobity found that each 100ms improvement in page load time resulted in a 1.11% increase in conversion

Performance Impacts the Business

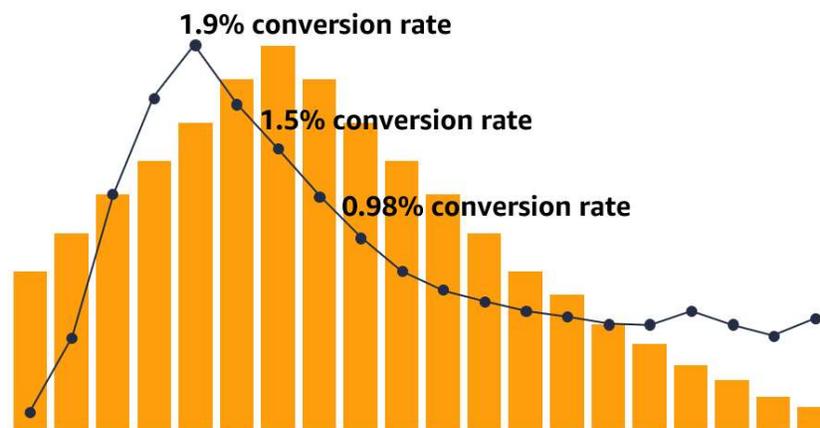


Figure A - Performance Impacts the Business

Additionally, a major insurance and financial services organization found that a 1 star increase in App store ratings resulted in 9x revenue, plus a significant increase in retention rates.

¹⁴ Shivagami Gugan; Observability: A Socio- Engineering- Technology Problem; August 20, 2020; DevOps Institute

Understanding and monitoring our business process requires a more in depth look of how value is created and delivered across the organization. This requires clarity around your culture and the operating principles that characterize your business. These might comprise, for example:

- Your core mission and shared defining values.
- Servant leadership that truly engages associates by focusing on them, removing impediments to their innovation and enabling focus on what they do best. This should be aligned with clear objectives and key results for customer, team, and individual outcomes.
- Outcomes and values are systemically and visibly valued and supported with attention and resources.
- The use of data to measure, monitor, evaluate, and execute on your creation and delivery of value through your organization.

The examples noted above share some common values, such as revenue generated (we need cash to continue to operate) and retention (we want to keep clients with us as long as possible to continue that relationship and shared value realization).

Unless you have a generative culture based on collaboration, teamwork, and continuous improvement, you will need a few capabilities either in place or in development to efficiently apply to your situation.

We know that we need people, process and technology. We need technology to do these things, but the technology is not the difficult or most important part. Process can be addressed in a straightforward and not particularly complication approach. People are the hard part.

Transparency, Visibility, and Observability

Today's workplace has seen a shift in workforce values and expectations over the past decade. This shift involved technology capabilities that required engagement at a micro level in the digital age, versus the macro level of the information age. The way we interact and conduct business is now represented by "app" mentality with capabilities of self-service, ubiquitous availability, and rapid personalized need satisfaction. Those expectations do not stay "at home," even when we did report to "work" every day. High performing companies recognize that gaining the best from their people means treating them like customers within the organization.

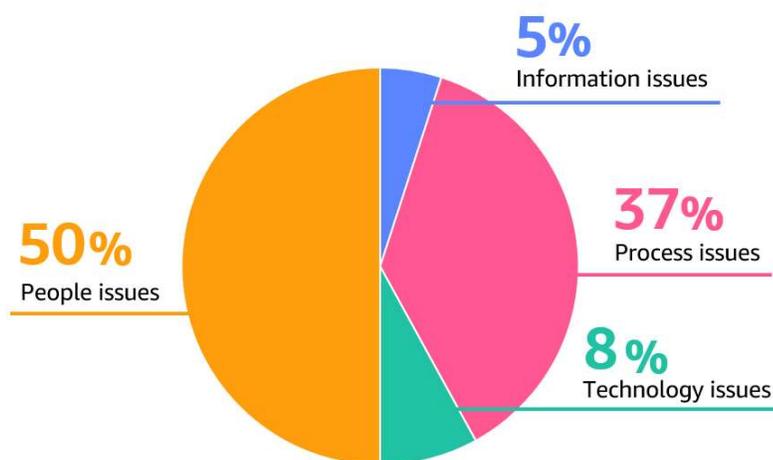


Figure A - Organizational Challenges of Transformation¹⁵

¹⁵ Source - Gartner



What happens when people are no longer interested in trading their precious time for something as common as money, but for ideals and accomplishment?

When you have individuals and teams committed to a common cause?

Who contribute in meaningful ways to something they care about?

When leaders enable and empower, remove obstacles, and keep resources flowing?

The characteristics of a healthy and thriving organization are all too clear. They are evidenced by an allegiance that is almost cult-like and by employees who are in no hurry to leave at the end of the day. It is also a place that is “customer obsessed,” where teams are continually engaged in problem-solving that achieve innovative opportunities.

Making mistakes and dealing with failure in an Observability oriented environment

On the other hand, when people are afraid to make mistakes, little innovation can take place. If a point of failure results in the accusatory “who did that” rather than “what happened,” then we need to change our relationship with failure.

Psychological safety is as essential to a generative and innovation culture as physical safety is to Maslow’s Hierarchy of Needs. Psychological safety is the foundation of trust, and with that in place we can build the structures that enable, reinforce, and grow a trust environment, such as transparency, observability, and resilience.



Figure B - The Three Ways (redux)¹⁶

As we reconsider The Three Ways in this context, we can derive additional understandings of concept applications and the expanded value that abstracted resources such as cloud bring to an organization.

Agile thinking and practices

Agile practices today have largely revolutionized IT and have spread to all parts of our organization. Several years ago, IBM announced their global marketing teams would adopt agile practices. NPR (National Public Radio) uses agile methods to create new programming. John Deere uses agile for new machine development, and C. H. Robinson applies agile methods in their Human Resources.¹⁷ Full organization adoption can help reduce or eliminate the challenge of different groups being out of sync on projects and workflows.

¹⁶ Image copyright © 2020 Standing on Shoulders, LLC, used with permission

¹⁷ <https://hbr.org/2016/05/embracing-agile>

Creating the cohesive environment, and presenting a unified view requires a solid foundation that is flexible, elastic, and available. A cloud environment is ideal for satisfying these needs.

Creating a self-healing, high-trust, and scalable architecture can result in synchronous cycles and data-driven behaviors that better support your objectives and desired outcomes. The harsh reality is that change will continue to come more quickly, and with bigger results. The changes of yesterday will seem minor compared to the transformations ahead. What does that mean for us and how can we prepare for the inevitable? The answer is simple: Automation.

Leverage the cloud and developing technology for continuously evolving capabilities

Organizations must begin by automating as much manual labor as possible, which we call “toil.” This is the kind of work that is routine, detailed, ongoing, and devoid of intrinsic value or redeeming qualities. This is the clarion call for Site Reliability Engineering and DevOps practices that leverage the strengths of cloud, speed of automation, and true empowerment of Observability.

Taken together, these elements provide a synergistic platform that is evolutionary. It is a journey that starts with where you are today. By doing what you can to adopt these practices, where the best opportunity resides, may require a small revolution at the beginning. But each of these are explicitly evolutionary. A “lift and shift” to the cloud is better than living with a fragile in-house infrastructure – for example, “Crawl – Walk – Run.”

As witnessed in countless online resources, there are an infinite number of paths to the truth when it comes to implementing these concepts. We know this because each solution contributes to increased business agility as defined by better responsiveness to changing market conditions and speed to value.

Despite these activities and ongoing conversations, we still face ongoing challenges, such as:

- Lack of commitment or clarity of purpose
- Transforming a “them” and “us” culture
- Blending teams that are geographically dispersed and unfamiliar with each other, which may include suppliers and stakeholders (especially post-COVID19!)
- Lack of education, training, and skills
- Immature service management processes
- Inadequate technologies
- Poor communication

Once we recognize these salient issues, we can begin proactively to create agile, healthy, and unified organizations. These environments can become characterized by customer obsession and driven by an overriding commitment to transparency, trust, and accountability at all levels.

The DevOps Institute’s focus is on improving people, processes, and technology and on sharing skills, knowledge, and resources that enhance that effort. As a global community of practitioners, we curate shared content, provide forums for new ideas, share lessons learned, and facilitate communication through a common set of standards and language.

Implementing code-level insights on AWS



Building code-level insights into an organization requires new approaches to software, DevOps, and site reliability engineering. This means migrating beyond a “rear view mirror” approach to logging and KPIs to continuous performance monitoring, observability, and telemetry. The net effect is not only higher trust and happier employees, but also more efficient processes and technologies resulting in increased customer engagement.

AWS and AWS Marketplace can enhance your performance monitoring strategy with end-to-end observability across your organization in a way that is cost-effective, easy, secure, and reliable. Leveraging the AWS Well-Architected Framework can also help organizational and IT leaders with key concepts, design principles, and architectural best practices for achieving optimal business outcomes. The performance efficiency pillar of the framework includes information on managing resourcing and workload requirements, monitoring performance, and optimal decision-making as business needs evolve.

How customers are leveraging AWS Marketplace to achieve their business goals

Solutions in AWS Marketplace such as AppDynamics, Dynatrace, Epsagon, and Instana can accelerate the implementation of your reliability engineering with seamless, real-time performance monitoring from experts in the field.

AppDynamics is a powerful, easy-to-use, unified Application Performance Management (APM) and business performance monitoring solution designed for complex, distributed architectures. AppDynamics has all the resources you need to quickly and seamlessly migrate your applications to AWS. Once there, you get end-to-end monitoring of all cloud native applications, including microservices and Docker. Cloud Auto-Scaling also monitors application capacity and prevents overprovisioning during critical workloads. In addition, AppDynamics offers the following advanced features:

- Application mapping
- Automatic baselining for performance response times and business metrics
- Root cause analysis and anomaly detection powered by machine learning
- Deep Code Insights (DCI) to reduce mean-time-to-resolve code
- Real-time business visualization

Dynatrace is a comprehensive cloud native monitoring solution that helps companies simplify cloud complexity and accelerate digital transformation. With its quick and easy set-up, Dynatrace provides end-to-end monitoring, root cause analysis, and interactive visualization of your entire application environment.

Epsagon provides enterprises with automated, cloud-native application performance monitoring and troubleshooting for modern applications. With Epsagon’s real-time monitoring and debugging features, teams can remediate issues quickly, leading to increased customer satisfaction and reduced operational costs.

Instana is a fully automated APM solution that makes it easy to observe and manage complex microservice architectures. Instana enables teams to automate the migration process, including full root cause analysis, tracing, and visualization of the full application stack as well as all dependencies.

In addition to these solutions specific to your real-time observability and application performance strategy, AWS Marketplace also provides:

- Flexible pricing and payment options: Simplified contracting, speed procurement, and flexible pricing options including a free trial, hourly, monthly, annual, and multi-year contracts; along with a custom payment scheduler.
- Lower TCO: AWS Marketplace provides multiple features that enable procurement teams to reduce their sourcing cycles and continuously improve to create a truly optimized software procurement lifecycle.
- Speed and governance: Quickly deploy pre-configured software; launch directly from AWS Marketplace and run instantly to reduce your purchase cycle.
- Robust Enterprise security: Gain the peace of mind knowing all verified software offerings in AWS Marketplace are continuously scanned to detect and prevent viruses and other vulnerabilities.
- Simplified AWS billing: Consolidate AWS billing and cost analysis using AWS Cost Explorer and subscription management; ensure purchases in AWS Marketplace qualify against your EDP commitment.

[Learn more about the AWS Marketplace>](#)

Why use AWS Marketplace?

AWS Marketplace simplifies software licensing and procurement by offering thousands of software listings from popular categories like Security, Networking, Storage, Business Intelligence, Machine Learning, Database, and DevOps. Organizations can choose from the many independent software vendors in AWS Marketplace to create automated methodologies for code level observability.

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