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How to Unlock the Power of IoT with Real-Time Monitoring

A briefing paper in association with

APPDYNAMICS

With the growth of the Internet of Things, being able to adequately sift through and analyze the deluge of data it creates is a challenge—one that organizations can mitigate with real-time performance monitoring tools that incorporate advanced diagnostics and data correlation capabilities.

The Internet of Things (IoT) has a deep impact on everything we do. Designed to connect myriad devices, applications, onsite servers, databases, and networks to the cloud, IoT provides users with real-time access to data that previously would have been inaccessible.

However, the rapid growth of connected devices in the consumer and business spaces has increased the complexity of infrastructures and ecosystems, raising data management and security concerns. The challenge for IT departments is twofold: to sift through and analyze the massive amounts of data generated by these countless IoT connections; and to enable organizations to identify and correct performance and reliability issues, as well as predict looming problems (such as a generator that is about to fail) in order to take immediate and appropriate action.

The size, scope, complexity, and volume of connected devices far exceed the ability of even the most expert IT departments to independently manage and oversee them. Emerging IoT infrastructures contain technologies with more complex applications, more robust server hardware, new protocols, new security requirements, faster and more efficient wide-area transmission mechanisms, and more backup procedures. All of these new technologies tax the skill sets of IT departments and operations staff. IoT also generates much higher volumes of network traffic, making routine network management and capacity planning tasks more daunting – thus, the need for advanced performance monitoring tools.

This new generation of tools communicates with embedded sensors, is equipped with business intelligence and analytics features, and is capable of overseeing the billions of IoT-connected devices spanning corporate data centers, the cloud, and the network edge.

> "The explosion of devices and people trying to access and transmit information across IoT ecosystems is staggering, even for small firms with 50 employees."
>
> **Andrew Baker, CEO and Founder, BrainWave Consulting Company, LLC**

The Power of Monitoring IoT

Using IoT advanced performance monitoring tools, businesses can track the performance and reliability of their IoT devices, applications, and connections, as well as correlate these findings with their business performance. These solutions enable organizations to accomplish the following:

- Examine the health of the end-to-end network, as well as the performance of all connected devices, applications, servers, network components, and databases, both on premises and in the cloud.
- Identify potential security vulnerabilities and threats.
- Establish the performance measurements of baseline equipment (e.g., servers, switches, and routers).

- Derive detailed insights on IoT transmission and communication patterns to identify the source of existing or potential bottlenecks.
- Correlate the performance of devices, applications, servers, databases, and the network with business performance.

Effectively utilizing IoT monitoring and performance management tools delivers value in real time. Instead of taking hours or even days to identify a performance issue, the monitoring tool can quickly and efficiently locate the problem's source, correlate the data, and enable the business to swiftly implement a fix. This improves reliability, increases customer satisfaction and retention, and lowers overall product support and ongoing maintenance costs.

For example, Nasdaq, the single largest U.S. stock exchange by volume, deploys performance monitoring solutions from AppDynamics, a San Francisco–based application performance management and product analytics firm, to gain visibility into its diverse and complex application ecosystem, identify problems, and accelerate problem resolution. Nasdaq uses AppDynamics' platform to track application health, quickly trace transactions and diagnose issues, and glean performance insights in pre-production scenarios. Prior to this, Nasdaq tracked application status via a variety of monitoring, alerting, and log aggregation tools.

"It can be impossible to put the puzzle together," says Heather Abbott, senior vice president of Nasdaq Corporate Solutions Technology. "There's frustration, especially at the management level, since we are held accountable for application stability, performance, and the ability to get to root causes and resolution quickly."

Visibility and rapid time to resolution are the primary benefits of the AppDynamics solution for Nasdaq. The stock exchange also gains the potential to automatically access new levels of actionable data. Nasdaq administrators, for instance, no longer need to perform the time-consuming task of scouring event logs to find issues. The time to pinpoint and resolve problems has been cut from hours or days down to minutes, Abbott says.

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"A Nasdaq customer who can't make a trade or users watching a program or event on their set-top boxes don't know and don't care who is responsible [for the problem]; they just want the issue resolved – fast – so they can resume their activity. And that's what performance monitoring and management tools do," says Balwinder Kaur, principal software engineer at AppDynamics.

Organizations and consumers expect – and indeed demand – a consistently satisfying user experience across all devices. If and when businesses fail to meet those expectations, customer satisfaction, loyalty, and operations are adversely affected. This, in turn, negatively impacts revenue.

Time Is Money

Intelligent IoT performance monitoring and management capabilities are especially useful in network edge and Industrial IoT (IIoT) use case scenarios. Banks experiencing an outage at a remote branch office or ATM, for instance, traditionally relied on a service person to travel to the site, run diagnostics, and fix the issue, which could take hours. Similarly, an offshore oil rig or mining operation that's "off the grid" with limited or intermittent connectivity would be hard-pressed to fix issues in real time. Onsite IT and/or support technicians are rare, and IoT applications and devices generate huge amounts of data – making it impossible to upload the data to a cellular connection and impractical to send the data to the cloud and back for analysis.

"The explosion of devices and people trying to access and transmit information across IoT ecosystems is staggering, even for small firms with 50 employees," says Andrew Baker, CEO and founder of BrainWave Consulting Company, LLC, an IT services organization in Gassaway, West Virginia. There is no way, Baker notes, for businesses to keep pace with all of these connections without performance monitoring tools, even if they have fully trained IT departments adept at IoT – there is simply too much data. But knowing how to best deploy such tools is a key step in getting the most from IoT – and creating a more nimble organization. The business intelligence and predictive analytics capabilities of application performance management solutions can identify trouble spots and avert service interruptions. They can also resolve performance issues, security problems, and outages much more quickly.

Real-World Benefits

"IoT devices are having a huge impact on the way we do business and in our everyday lives," says Anupam (AJ) Jindal, mobility and IoT product manager at AppDynamics. "CIOs and C-level executives realize they're constructing their IoT infrastructure and applications to build and improve their business. IoT-connected devices and applications should make life easier. Performance monitoring tools ensure smooth configuration, provisioning, deployment, and ongoing maintenance."

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Such tools alert businesses to potential problems, enabling them to proactively address issues in advance of a problem that could result in a disastrous component or network outage.

AppDynamics, recently acquired by San Jose–based Cisco Systems, makes the Business iQ platform that provides companies with specific analysis of key performance indicators (KPIs) and actionable correlations between application performance and business outcomes. AppDynamics enables software teams to troubleshoot and quickly identify the source of problems so they can take fast, remedial action and lower mean time to recovery (MTTR) and repair to minimize or avoid costly service outages.

IoT: Poised for Rapid Growth

Because of the complexity and pervasive nature of IoT, in which devices, applications, and people are increasingly interconnected, the attack vector or surface is potentially limitless. Customers, IT departments, consumers, and third-party service providers all have many more devices to safeguard, track, and manage than ever before. Performance, reliability, and security issues can originate at any point and even at multiple points at one time. This includes everything from the network edge to end-user smartphones, notebooks, and tablets, as well as on-premises data centers and the cloud.

IoT deployments involving resource-intensive connected devices, applications, and people will span geographically disparate on-premises environments and extend to the network edge. And the opportunity and the challenges they present are only expected to grow.

For instance, analyst firm Gartner, Inc., estimates there were 8.4 billion connected "things" in 2017. Gartner predicts that number will increase to 11.19 billion in 2018, and to 25.1 billion by 2021.

Other technology research firms foresee even greater growth. International Data Corporation (IDC) predicts in its Worldwide Internet of Things Forecast 2015–2020 that there will be 30 billion connected devices globally by 2020, representing a revenue opportunity of $1.7 trillion.

The analyst firms attribute IoT's steep growth curve to the surge in deployment of an array of industry devices such as home security systems, connected automobiles, LED lighting, and heating and air conditioning (HVAC) systems.

Consumer, Business, and Industrial IoT Deployments

Currently, there are three classifications or "buckets" for IoT connections:

- **Consumer IoT**, including set-top boxes, connected cars, and airport check-in kiosks: These IoT devices typically have a display and a user interface – an application framework that links consumers.
- **Business IoT**, encompassing vertical-market arenas such as transportation and fleet management, where the IoT devices include trucks, tractors, and railway engines: These IoT deployments have sensors throughout that generate data for analysis. Some, though not all, are equipped with their own power and connectivity to track metrics such as traffic and road conditions.
- **Industrial IoT**, including manufacturing, factory floor machinery equipment, smart cities, equipment used by oil and gas producers, and utility and smart-metered devices: These IoT deployments transmit data through gateways and send the information to the cloud for remote access.

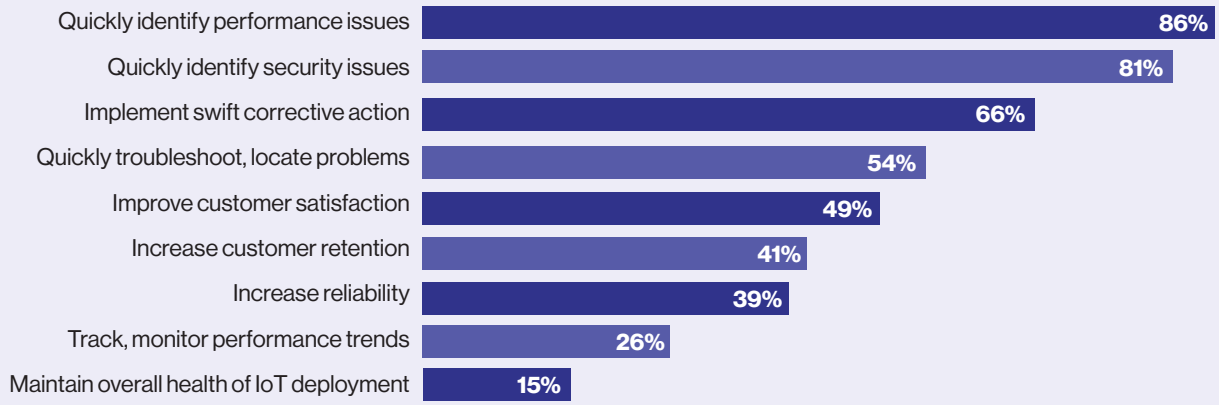
Depending on the specific use case or application, organizations will need to deploy performance monitoring and management tools for IoT data centers, for mobile devices, or at the network edge.

Consumer-based connected devices and applications currently drive much of the IoT market's growth. Gartner predicts that in 2021, 64% of the IoT devices shipped will be for the consumer market. In addition to the aforementioned smart home devices such as set-top boxes, smart TVs, and refrigerators, hot IoT applications include the following:

- Automotive infotainment systems
- IIoT in manufacturing, retail, and utility applications, and in verticals such as smart electric meters (including parking meters)
- Commercial security cameras for office buildings and traffic lights
- Location-monitoring devices for smart grids and smart cities
- Consumer and enterprise health care devices and applications (such as Fitbits)

Tracking IoT Deployments: What Are the Benefits of Application Development Monitoring Tools?

This global survey polled 800 respondents, including C-level executives, IT administrators, application developers and software engineers.



Source: *MIT Technology Review Insights based on data from the* ***ITIC 2018 IoT Deployment Trends, Benefits and Challenges*** *survey, March 2018*

IoT is a disruptive technology, but that does not mean the cost efficiencies, economies of scale, and revenue gains it provides will be automatic.

The true value of IoT lies in how effectively corporate enterprises can utilize and leverage it to achieve business goals such as cutting costs, increasing revenue, and optimizing labor resources. A hospital emergency room, for example, could deploy the tools to determine how many patients receive treatment there on a given day; how long patients wait before being seen; the average length of time spent on patient visits; and which doctors handle the most patients. The solutions can also assist a hospital in reaching its technology goals by highlighting the need to upgrade existing software and purchase new equipment to keep pace with competitors.

IoT Performance Monitoring Solutions Deliver Tangible Results

IoT performance monitoring tools help users overcome the challenges associated with configuring and provisioning complex IoT applications and networks by delivering the following results:

- **Real-time visibility**: These tools provide a deep understanding of all the components across the IoT ecosystem. Is the software working or not? How many and what type of errors occurred? Which version of the software contains the errors? Have devices crashed recently? Which devices are experiencing issues?
- **Information on latency and network performance**: How quickly is the data being transferred from one point to another on the network? Are there delays and bottlenecks, and, if so, where are they located?
- **Usability of features and functionality**: What is the user experience? A streaming content provider, for example, could utilize a performance monitoring tool to quickly identify, troubleshoot, and remediate the source of a customer service outage. This type of detailed information minimizes downtime and improves customer satisfaction. The resulting detailed, granular data also lets companies decide which product features need to be added and which current features/functions may need improvement.
- **Correct provisioning and deployment the first time**: Utilizing performance management and monitoring solutions enables businesses to gain immediate knowledge of performance and to supply and launch the products successfully the first time.
- **Business performance and insights**: Application performance solutions also provide organizations with key metrics on daily, weekly, monthly, and annual business trends to compare and contrast items such as revenue gains or losses, demand for specific products and services, and even employee salaries.

As an emerging technology, IoT is complex and disruptive. Any performance issues or downtime will be costly to the organization as well as its business partners, suppliers, and customers. Organizations can mitigate and minimize the impact of disruption by deploying IoT performance monitoring and management tools that deliver diagnostics and solutions in real time.

Forging partnerships with trusted, experienced IoT performance monitoring providers is critical to achieving successful deployments that lower TCO, accelerate ROI, and improve the overall health of the IoT ecosystem, while also reducing risk and improving reliability. Performance monitoring tools can also help businesses improve customer satisfaction, loyalty, and retention – and better apply data to changing market and industry conditions.

How to Unlock the Power of IoT with Real-Time Monitoring is a briefing paper by MIT Technology Review Insights. It is based on research and interviews conducted between December 2017 and March 2018. We would like to thank all participants in this project as well as the sponsor, AppDynamics. MIT Technology Review Insights has collected and reported on all findings contained in this paper independently, regardless of participation or sponsorship.

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From the sponsor

AppDynamics is the Application Intelligence company. With AppDynamics, enterprises have real-time insights into application performance, user performance and business performance so they can move faster in an increasingly sophisticated, software-driven world. AppDynamics' integrated suite of applications is built on its innovative, enterprise-grade App iQ Platform that enables its customers to make faster decisions that enhance customer engagement and improve operational and business performance. AppDynamics is uniquely positioned to enable enterprises to accelerate their digital transformations by actively monitoring, analyzing and optimizing complex application environments at scale.

To get real-time visibility into the performance of your connected devices, visit **AppDynamics.com**.

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