

WHITE PAPER • OCTOBER 2019



A Broadcom Point of View

# Unlocking the Value of the SRE Model

Capitalizing on the Opportunity to Transform the Customer Experience

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# **Executive Summary**

For organizations seeking to pursue digital transformation efforts, site reliability engineering (SRE) models have emerged to take on increasingly strategic significance. When employing SRE models, teams take a software engineering approach to operations. SRE teams focus on developing service level objectives that are closely aligned with the business' most important key performance indicators. Through these approaches, teams can establish the metrics, processes, and capabilities that are needed to improve service levels and business results.

However, in spite of all the promise of SRE, the reality is that the organizations that have been successful with SRE have tended to be digital natives with a wealth of engineering talent. For most mainstream enterprises, the reality is that the success of SRE models is anything but assured. Further, the default tooling approaches that organizations are currently taking—either building capabilities in house or cobbling together disjointed point tools—introduce risk and are fundamentally counter-productive to SRE objectives. This paper examines the key tool requirements that are integral to supporting SRE models, and it reveals how Broadcom offers a unique approach that helps organizations realize more value from the SRE model, and do so more rapidly and securely. Review this paper and discover how Broadcom solutions deliver complete ecosystem observability and AI-fueled intelligence, enabling teams to optimize the customer experience and boost business outcomes.

# Introduction to the Key Principles of SRE Models

While the SRE model has been around for more than ten years, the reality is that some enterprises are just now beginning to pursue this approach. Within these organizations, IT leaders are wrestling with ways to maximize agility, and the SRE model is emerging as a key enabler.

While a lot has been written about SRE, teams are well served by focusing on the key principles below.

#### Set Customer-focused Metrics

SRE models ultimately place a singular focus on what really matters: the customer experience. This must be integral to the approaches, metrics, and tactics teams employ. In an SRE model, teams manage the customer experience by establishing the following metrics:

- Service-level indicators (SLIs): SLIs measure of the level of service provided to a customer. Common SLIs include latency, throughput, availability, and error rate. SLIs more closely tied to customer experience might include page load time, streaming buffer time, successful downloads, transaction completion, and so on.
- Service-level objectives (SLOs): SLOs are a target value or range of values for a service level that is measured by an SLI. For example, an SLO might be that page load times must be under three seconds, search request latency remain under 100 ms, or that a service must deliver 99.999% availability.

IT leaders are wrestling with ways to maximize agility, and the SRE model is emerging as a key enabler.



By employing SLIs and SLOs to manage environments, teams can realize a number of advantages, including more effectively communicating expectations across teams, establishing better role clarity, and more effectively identifying and prioritizing efforts. Through these metrics, teams can more effectively define and communicate the tasks needed to prevent SLA breaches.

In this effort, teams need to determine what specific monitoring data will be used to inform SLIs. This requires identifying and capturing so-called "golden signals" for SLIs. There are four common categories of golden signals: latency, traffic, errors, and saturation. Teams can also establish more business-outcome-based KPIs, such as order processing time, download completion time, and so on.

#### **Establish Error Budgets**

In many ways, the SRE model represents a pragmatic bridge between the "fail-never" mindset of traditional IT operations and the "fail-fast" perspective embodied by DevOps. The concept of "error budgets" is integral in the SRE model. An error budget establishes a clear SLO-based metric for how unreliable a service can be.

Through these error budgets, teams establish an acceptable risk. Effectively, this can be viewed as operating within the gap between 100% availability, and a lower metric that is still acceptable from a customer experience standpoint.

Through error budgets, teams can establish concrete, measurable ways to balance between innovation velocity and reliability. As long as SLOs are met, release frequency can increase. Through this approach, teams can move from risk aversion to risk management. For example, rather than trying to build 100% availability, they can focus on establishing graceful failure handling. In many ways, the SRE model represents a pragmatic bridge between the "fail-never" mindset of traditional IT operations and the "fail-fast" perspective embodied by DevOps.

#### **Reduce "Toil" Through Automation**

When implementing SRE models, teams should be focusing on harnessing automation to reduce toil—those high-volume, low-complexity tasks that inhibit teams. Toward this end, teams can institute automation across several key areas:

- Provisioning and deployment. Teams can employ automated approaches to adding applications and infrastructure capacity in such areas as infrastructure as code, application release orchestration, testing and validation, continuous integration/continuous delivery (CI/CD) pipelines, and cloud resource orchestration.
- **Problem resolution**. Operations teams can use machine learning techniques to recognize common problem patterns and then employ automation to recommend or implement the remediation steps needed to restore services.
- **Resilience and performance management**. In this area, teams can automate digital experience data collection, latency and contention metrics analysis, SLI establishment, SLO reporting, and network traffic analysis.



### The Problem

Given its legacy of being developed and employed by so-called digital natives like Google or Facebook, SRE models either implicitly or explicitly assume that large teams of technology experts are available to apply engineering approaches to IT operations and application development. However, that's not the reality for most of the mainstream enterprises that are now seeking to institute SRE models.

As teams seek to pursue SRE initiatives, the tools in place can offer significant support—or pose a massive detriment. The reality is that many organizations looking to adopt SRE models are either employing in-house developed open-source tools or loosely connected toolchains. Quite often, these decisions are made at departmental level. This results in tool sprawl and, due to the ensuing heterogeneity, makes it harder for staff to find a single source of truth for problem solving. In addition, by introducing a multitude of tools, integrations, and administrative privileges that are difficult to monitor and manage, these approaches can pose significant security risks.

While some of the largest technology companies have the internal resources to make do-it-yourself or point-tool approaches work; that doesn't mean it's the optimal approach for most enterprises. On the contrary, these approaches can represent significant efforts that derail SRE adoption, leaving teams taking too long to adopt SRE, and realizing too little value for their efforts.

# How Broadcom Fuels Successful SRE Adoption

#### **Our Vision**

Broadcom's vision is to deliver the innovative technologies and solutions that enterprises need to truly transform not only customer experiences but entire businesses. We are focused on providing an open system that ingests and correlates data and analytics from multiple sources and ultimately ties this intelligence to the impact of the customer experience. Today, Broadcom solutions power the world's largest digital businesses. We help customers innovate faster while improving quality, reliability, security, and transparency.

#### **Our Technology**

automation.ai from Broadcom is an AI-driven software intelligence engine that provides a set of opensource-based machine learning algorithms and a common data lake. With this engine, Broadcom and its partners can deliver intelligent applications and services. automation.ai powers the Broadcom Digital BizOps platform, which delivers the capabilities that fuel improved operations, service levels, and IT and business outcomes.

automation.ai provides advanced, extensive capabilities that enable teams to adopt SRE models with unprecedented ease, speed, and efficiency. automation.ai enables teams to convert data into action by combining comprehensive ecosystem observability, advanced analytics, robust security, and intelligent automation. The engine provides comprehensive insights across the digital delivery chain, from user experiences with mobile applications to backend mainframes, and all points in between.

automation.ai is built on an open architecture composed of leading open source technologies, including Elasticsearch and Apache Spark Machine Learning. The engine correlates and analyzes the industry's most comprehensive data sets, leveraging data on topology, network flow, user journeys, transactions, time-series, security events, and more. This ability to build comprehensive, diverse data sets distinguishes automation.ai from other solutions designed for event or log parsing. The engine's unique ability to correlate these and other datasets and present them in a topographical model helps customers gain timelier and more accurate insights.



automation.ai also applies AI and machine learning to these data sets, using algorithms developed and trained based on extensive deployment expertise and large volumes of digital business data from the world's leading enterprises. The engine's proven machine-learning techniques are applied continuously to ensure the right automated actions are taken to solve customers' most complex IT problems.

#### How We Power Successful SRE Approaches

By delivering the capabilities outlined above, automation.ai addresses the core requirements teams need to implement SRE models successfully. By delivering all these capabilities in an integrated, comprehensive engine, automation.ai enables teams to spend less time on efforts like scripting and tool integration, and more time focusing on those efforts that optimize the customer experience and improve business outcomes.

The following sections look in more detail at SRE requirements, and how Broadcom addresses them.

# 1. Establish Ecosystem Observability that's Aligned with Business Services

#### Requirements

It is vital that the golden signals and SLIs being monitored ultimately track what matters most: the user experience. Having this visibility is essential if teams are to manage their error budgets intelligently. However, in today's environments, determining how to identify and track the right metrics is more easily said than done.

To effectively adopt SRE models, teams need to establish comprehensive coverage that delivers unified visibility of the entire enterprise ecosystem, whether teams are running legacy on-premises technologies, modern services and systems, or a mix of both. They need visibility that spans from mobile applications to networks and mainframes.

With the increasing prevalence of approaches like CI/CD, DevOps, containers, and microservices, environments continue to grow more dynamic, ephemeral, interrelated, and complex. In this type of environment, it's difficult to apply traditional monitoring, virtually impossible to keep it consistently current, and challenging to get the outputs needed to understand performance.

Today, it's no longer enough to monitor a monolithic computing stack or a discrete infrastructure element; it's about making complex, modern ecosystems observable.

#### How Broadcom Addresses

Broadcom delivers the capabilities teams need to establish observability of their ecosystems so they can track, manage, and optimize the metrics that matter. automation.ai can harness data sources from across the organization's ecosystem and apply standardization and correlation to fully capitalize on the intelligence being captured.

Through its extensive solutions and third-party integrations, automation.ai delivers the comprehensive coverage that SRE models require. The engine gathers the extensive intelligence needed to understand, manage, and optimize performance in complex, interrelated environments.

automation.ai ingests structured and unstructured data, including time-series metrics, alarms, logs, topology, text, and API data. The engine ingests all these data types and offers metric-driven, rather than just event-driven, anomaly detection. The engine cross correlates intelligence from every component and perspective, including applications, underlying infrastructures, and user experience.



automation.ai employs AI and machine learning to filter through the noise, deliver more targeted insights, and identify patterns that enable more accurate predictions. The engine enables teams to establish automated root cause analysis and remediation, as well as the opening and closing of tickets.

Finally, the engine equips DevSecOps teams with the business service-based views needed to identify which issue is affecting the most important business KPIs. automation.ai features smart service modeling that maps issues to business services. This enables more intelligent prioritization so teams can better ensure the most critical services perform optimally.

## 2. Establish Unified, AI-Driven Intelligence that Spans the Software Development Lifecycle

#### Requirements

"Many people, on first introduction to the SRE concept, think it looks a lot like DevOps because it also focuses on silo breaking, automation, and efficiency. They're not entirely mistaken."<sup>1</sup>

It is true that SRE and DevOps share many fundamental themes. In addition, both SRE and DevOps present a similar challenge: How do previously isolated teams begin to work together seamlessly? This requires a shift in workflows and cultures, and it presents an entirely new set of requirements for tools. If teams simply seek to connect disparate tools, silos will remain.

Ultimately, for SRE models to succeed, DevSecOps teams must have a holistic view of the stack—the frontend, backend, libraries, storage, kernels, and physical machine. The solution is to expand upon the concept of a data lake, and build a "digital river." A digital river enables all teams across the software development lifecycle (SDLC) to gain role-specific views into a unified data model, so they can maximize the utility of data in solving problems and gaining insights.

#### How Broadcom Addresses

By offering advanced management and monitoring capabilities and enabling teams to aggregate and correlate data in a data lake, automation.ai enables teams to gain more unified intelligence. In addition, the engine enables teams to expand upon this data lake and establish a unified digital river for data sharing that enables true collective intelligence, enabling teams to share insights efficiently across the SDLC. As a result, teams can view the SDLC holistically and optimize every phase.

With automation.ai, teams can establish comprehensive, end-to-end testing throughout the SDLC. The engine gives teams multi-dimensional visibility, including:

- Inside out, enabling teams to track how the computing stack is operating.
- Outside in, helping teams track user experiences so they can understand and manage performance.

With the engine, teams can better understand the risks in each release and pinpoint areas in the SDLC that need additional resources or investment. As a result, teams can deliver new releases faster, and with greater confidence.

## 3. Establish Comprehensive, Intelligent Automation

#### Requirements

As referenced above, employing automation to reduce toil is a core tenet of SRE models. Through automation, for example, teams can take a software engineering approach to prevent an incident, for example, preventing an outage, rather reacting to an issue after the fact. However, that doesn't mean teams should work on automation efforts in an ad hoc, one-off fashion.



In many cases, teams have employed limited automation that is based on custom-developed scripts or APIs that are connected to domain-specific tools. These approaches create islands of automation, which presents a number of challenges. First, with these approaches, teams can't pragmatically automate complex workflows that span multiple technology platforms and domains. Second, these integrations don't work well in most cases. For example, an alert from a server monitoring tool can trigger serverrelated remediation, while the actual issue may stem from a network device.

To combat these challenges, teams need platforms that provide scalable, flexible, and easy-to-use automation that can be aligned with complex, dynamic enterprise IT environments and rapidly evolving business requirements.

#### How Broadcom Addresses

automation.ai can orchestrate the delivery of services in business, application, and infrastructure layers, across on-premises, cloud, and hybrid environments. Further, the engine seamlessly supports complex, organization-specific processes. For example, the engine may detect an impending issue that requires an additional AWS EC2 instance to be provisioned. This server provisioning may need an approval or system check, for example from a budgetary, compliance, or business perspective. With automation.ai, these types of approval workflows can easily be accommodated.

Our engine employs AI and machine learning to identify patterns that typically precede service-impacting issues and it triggers automated, proactive execution of remediation workflows as well as automated updating of tickets to reflect steps taken—all before the user experience is affected.

When an issue arises, the engine employs rich machine learning to determine the root cause. This machine learning is combined with our expertise in providing automated fixes or workflows for well-known, commonly occurring issues.

Remediation can be automatic or users can manually pick the action. The engine presents automated workflows as recommended actions, along with a level-of-confidence score based on previous success. The engine will present the best action first, but in many cases, it will provide alternative actions that might also apply to the issue.

In selecting actions, users can scroll through possible workflows and even modify a workflow, based on their expertise. These modifications are then saved and associated with that issue for future root cause analysis correlation.

Through these activities, the engine learns how the system responds to the fix through a remediation feedback loop, which includes looking at performance changes and user interactions. As the engine learns, it increases the confidence level of successful actions and maps similar issues.

# 4. Establish Frictionless Security Throughout the Software Development Lifecycle

#### Requirements

Security is paramount today, not only in the success of SRE initiatives, but in the success of the business. Seamless yet secure interactions now represent one of the most important facets of the customer's digital experience. To establish the level of trust required, organizations must address security across every facet of the IT infrastructure, from administrative privileges deep within the enterprise to potential vulnerabilities in public APIs, websites, and applications.



As DevSecOps teams rush to accelerate their pipelines through SRE initiatives, security professionals consistently identify three major areas of risk:

- How do you ensure that appropriate levels of security are built into the digital experience—without adversely affecting customer convenience, developer velocity, or operational overhead?
- How do you protect DevOps toolchains and processes, which have elevated access privileges that can easily be exploited?
- How are you governing access to the overall SRE architecture and data to protect user trust and ensure a "least privileged" posture?

At their best, SRE models can enhance security, improve compliance, and reduce the toil of repetitive security tasks by automating risk assessment and threat protection. But the reality for many organizations, especially those in which DevOps teams are isolated from their cybersecurity counterparts, is that SRE fails to adequately address security and itself creates risk via uncontrolled tool, process, and administrative privilege sprawl.

For a team's SRE initiative to truly succeed at the trifecta of optimizing the user experience, reducing IT overhead, and limiting cybersecurity risks, their toolchain and data model must incorporate security events and be capable of automating risk assessment and threat protection actions—without themselves introducing new threat vectors.

#### How Broadcom Addresses

With automation.ai, DevSecOps teams can finally unite and deliver frictionless convenience to customers—without sacrificing security or trust at any stage of the digital experience lifecycle, or at any level of the technology stack. The engine delivers powerful insights into governance, risk and compliance (GRC); configuration issues; incident analytics; unusual API activity; privileged access issues; fraudulent transactions; and more. With these capabilities, cybersecurity and SRE professionals can jointly establish risk metrics and automated workflows to spot potential risks, before security incidents are triggered.

Compared to point solutions or in-house-developed tools, automation.ai offers advanced capabilities and deep integrations that can simultaneously enhance security while streamlining the user experience without unintentionally exposing new threat vectors or significantly adding to operational overhead. For example, teams can quickly deploy complex omnichannel security that leverages tight integrations between our mobile API gateways, advanced authentication, and risk analytics engines.

Combining automation.ai with core security capabilities in our Digital BizOps platform enables teams to employ a range of advanced approaches that minimize the inherent risks of adopting an SRE model. With these capabilities, teams can address the following objectives:

- Ensure secure configuration management across the SDLC, enabling strong support for infrastructureas-code initiatives and highly complex hybrid cloud implementations.
- Automate security testing and auditing to enable more proactive detection and mitigation of known and predicted vulnerabilities.
- Manage, monitor, record, and audit the privileged access needed for SREs to operate effectively.
- Develop automated threat response algorithms that combine risk analytics, identity and access controls, and API security to reduce risk, without negatively affecting the user experience or operational workloads.



## **Conclusion**

For many enterprises, SRE models have the potential to deliver significant improvements in the customer experience. However, most teams won't be able to realize this objective with siloed point tools and custom scripts. With automation.ai, teams can gain the advanced, comprehensive capabilities they need to adopt SRE models pragmatically and securely. By partnering with Broadcom and leveraging the automation.ai engine, customers can gain the intelligence they need to realize their business objectives, scale their digital transformation, and transform the customer experience.

To learn more about how Broadcom is connecting everything, visit us at **automation.ai**.

#### About Broadcom

Broadcom Inc. (NASDAQ: AVGO) is a global technology leader that designs, develops and supplies a broad range of semiconductor and infrastructure software solutions. Broadcom's category-leading product portfolio serves critical markets including data center, networking, enterprise software, broadband, wireless, storage and industrial. Our solutions include data center networking and storage, enterprise and mainframe software focused on automation, monitoring and security, smartphone components, telecoms and factory automation. For more information, go to www.broadcom.com.



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