THE INCREASING VALUE OF APM

– Enhancements and Differentiators –

Little argument remains regarding the importance of an Application Performance Management (APM) solution to monitor and manage the availability and performance of an organization's software applications. The realm of APM however, has changed over past years moving from simply monitoring an application's components and the user experience, to essentially encompass anything related to the performance of the application. Today, this often includes additional monitoring (e.g., network), log management, and more.

While the APM market has matured and stabilized, there is still evolution within this space and amongst several of the leading providers as they continue to address evolving application architectures and customer requirements. For example, augmenting APM with artificial intelligence (AI) and machine learning (ML) helps to make sense of the vast deluge of data that can be produced by the increasing number of available technology monitoring agents.

The continued addition of AI and ML to APM solutions however, encroaches on AIOps functionality without a requirement to implement a full AIOps platform. The core of AIOps platforms can include machine learning, performance baselining, anomaly detection, automated root cause analysis, and predictive insights. While this functionality is being added to today's APM solutions, it is constrained by the data that is collected; a reason why vendors continue to increase the service, system, network, log, etc., data that is collected.

KEY FINDINGS

Over the course of this assessment, Zibis Group looked at three vendor solutions—AppDynamics, Broadcom, and Dynatrace. The following table and graph represent an aggregated view of how each vendor scored across four key areas. The following pages will dig further into each category, offering insight into how these vendors continue to expand their solutions to meet the diverse and unique business requirements of customers.

Key APM Enhancements			
Category	**AppDynamics**	**Broadcom**	**Dynatrace**
1. **AI and ML to Realize AIOps** (evaluated across four categories)	(81)	(88)	(88)
2. **Implementation and Application Instrumentation** (evaluated across twenty-three categories)	(90)	(92)	(89)
3. **Containerization and Orchestration Platform Support** (evaluated across three categories)	(81)	(98)	(90)
4. **Business Performance Analytics** (evaluated across five categories)	(90)	(95)	(90)

Figure 1: Average of category ratings for each section (1–4)

APM Solution Evaluation
(stack ranked; categories 1-4 in aggregate)

Solution	1	2	3	4
Broadcom	88	92	98	95
Dynatrace	88	89	90	90
AppDynamics	81	90	81	90

Figure 2: Stack rank of category ratings from each section (1-4), showing the aggregate/total ranking for each solution

1 Expanded AI and ML to Realize AIOps

Automated Baselines and Thresholds

Rather than relying on manually configured static thresholds, calculated baselines using historical data have been used for some time to learn what is considered normal application and system behavior. These can then be compared to current application behavior to look for uncontrolled variance (e.g., average response time) in frontend applications and business transaction metrics.

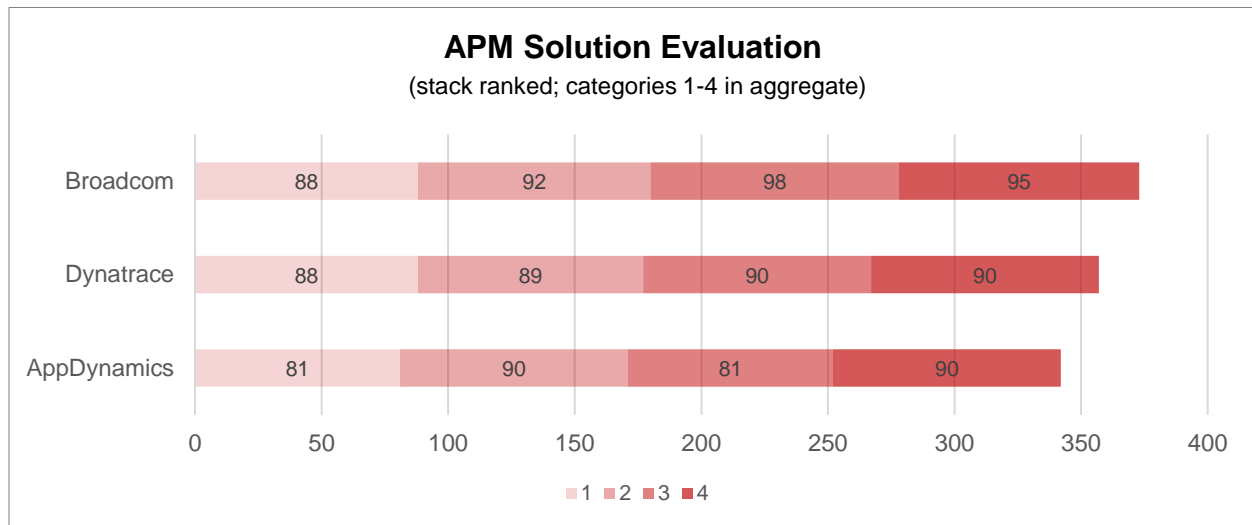These vendor solutions all use a form of ML to automatically learn the baseline performance of applications under load, including response times, error rates, and other behaviors. Measurements for throughput, failure rate and response time are collected over time increasing the sample size and statistical significance. Similarly, over time they develop additional intelligence around what matters within a specific application ecosystem, notifying if changes result in unusual high resource consumption or other abnormal situations.

There will inevitably be differences in the algorithms for calculating deviations from baselines with different statistical approaches. Customers are generally still able to define static thresholds to, for example, maintain SLAs, and in some cases customers can customize dynamic baselines depending on their preference.

Anomaly Detection

Vendors typically include default rules for common problem patterns such as high CPU utilization, slow response times, memory usage, etc. Customers can create custom health rules with conditions that use generated baselines, allowing them to trigger alerts or kick off other types of remedial actions when performance problems occur or are predicated.

This anomaly detection leverages past seasonality and trends in metric values to identify anomalies in real time. More than simply looking for spikes in an otherwise stable data stream, AI and ML help facilitate the discovery of normal ranges of key business transaction metrics, and alerts when these metrics deviate significantly from expected rules, enabling the identification of a wider range of problems than Health Rules alone.

Assisted Triage and Root Cause Analysis	Related to anomaly detection, the AI capabilities that discover trends and predict performance problems can increasingly provide pin point accuracy with respect to the root cause of an issue. Depending on the level of detailed metrics collected, these solutions can monitor the health of all entities in an application and show suspected causes for every anomaly. Users can confirm or negate suspected causes, and drill down into deviating metrics and snapshots as desired.

One such example is Broadcom's DX APM assisted triage, which provides root cause analysis to suggest possible culprits for current performance issues as well as explain how a complex problem developed across app and infra layers. This allows analysts to quickly assess problem scenarios significantly reducing the time to reach and understand an issue when compared to the more cumbersome and error-prone manual analysis of millions of service traces.

Similarly, Davis AI 2.0 is now the default Dynatrace causation engine used to provide root-cause detection and reduction of alert spam. Through its Davis Assistant, Dynatrace provides a conversational interface for the management of monitored environments with interactive alerting and remediation depending on the integrated channel.

AppDynamics has also introduced its new Cognition Engine (based on technology its parent company Cisco acquired from Perspica in 2017), which provides more—compared to previous versions—enhanced anomaly detection and root cause analysis. This enhanced functionality however, is currently only available to its SaaS customers. On-premises customers continue to use the previous anomaly detection based on health rules, thresholds, and deviations from automatically calculated baselines with correlation analysis to help validate root cause hypotheses.

Automated Remediation	AIOps platforms play a critical role in eliminating the manual component of triggering automation to address current or potential issues before they impact business critical systems and applications. The assistance provided by AI facilitates identifying when there is a problem, the business impact of the problem, and the root cause of the problem so that it can be fixed quickly, including automated remediation through integration with automation tools.

AppDynamics is positioning the "Central Nervous System for IT" as its vision for AIOps. Cisco and AppDynamics are integrating more products to help boost monitoring, analytics, and automation across applications, infrastructure, and network. AppDynamics notes that its Central Nervous System for IT is a vision and not a product, but will take years to come to fruition. The primary pillar is the already mentioned Cognition Engine, which provides new anomaly detection and root cause analysis, and will be able to trigger automated remediation whether opening tickets and/or sending messages to third party orchestration systems to initiate action.

Broadcom and Dynatrace are further along with regard to automated remediation. Broadcom DX APM includes a recommendation engine for suggesting actions to take and a free-of-charge starter kit entitlement to its Automic Automation platform without a requirement for third party solutions—although integration is still supported for those customers with an existing incumbent solution. Automic is an alert channel option within DX APM allowing it to easily trigger the necessary workflow to automate remediation before issues impact end users; much more quickly than when personnel must respond to matters manually. The recommendation engine can also be triggered on application patterns and behaviors based on anomalies detected by the system. Comparatively, Dynatrace requires the use of third-party workflow orchestration platforms (e.g., ServiceNow Orchestration) to trigger automated remediation processes for identified performance anomalies or application errors.

Finally, while APM solutions provide real-time alerts for performance problems, the expansion of AI and ML facilitates predictive insights and alerting of future problems with high probability. These predictions could then be used to resolve potential issues before they ever impact services (i.e., proactive vs. reactive).

2   Easier Implementation and Application Instrumentation

Deployment Options

All three of the discussed vendors can provide customers with deployment via a Software as a Service (SaaS) model or on-premises depending on the needs of the customer. That said, there are various levels of complexity and caveats with regard to installation and maintenance depending on which route customers select. For example, AppDynamics (Cisco) appears to be pushing more towards its SaaS solution. While AppDynamics has been providing its solution through a SaaS model since March 2010, an on-premises option is still available. However, with the acquisition by Cisco customers may see an increased push towards SaaS. For example, the new anomaly detection and root cause analysis provided by the "Cognition Engine" is currently only available to SaaS customers.

While Broadcom DX APM may have been comparatively late to the SaaS delivery model, it has effectively caught up. Additionally, where there was once a functionality gap between the on-premises and SaaS versions, these discrepancies have seen significant narrowing. For example, Broadcom and the DX Platform have moved to a containerized and orchestrated runtime model (i.e. Kubernetes, OpenShift), essentially allowing the same solution with its complex architecture to be easily deployed on-premises. Obversely, AppDynamics and Cisco are essentially widening the on-premises and SaaS functionality gap. AppDynamics still uses a traditional installation and architectural deployment model, which may impact its ability to easily bring the complex backend architecture of the Cognition Engine to an on-premises deployment. This is not to say it can't eventually happen—Broadcom was obviously successful in this regard—just that today prospective AppDynamics customers that require an (offline) on-premises deployment for security reasons may be comparatively handicapped.

Scalability and Availability

As an aside, with its movement to an open orchestrated model based on industry state-of-the-art standards, Broadcom has also reduced the management effort associated with highly available and scalable implementations. More specifically, as implementation sizes grow, Kubernetes allows for easier overall maintenance and management spawning additional services to meet the scalability and availability requirements, instead of requiring customers to implement separate active-passive configurations, master-master database replication, reverse proxies, more powerful hardware, etc., to address availability and scalability.

Broadcom simply provides easier management and scaling through its use of a Kubernetes or OpenShift platform. In the case of a Kubernetes orchestration platform, service pods can be automatically spawned across cluster nodes without intervention required by administrators. This is not to say the others cannot address the scalability and availability needs of larger organizations, just that it is more restrictive (e.g., in Dynatrace all nodes in a cluster must have the same hardware configuration) and requires more management effort to manually add (or remove) nodes to a cluster.

Universal Agent

To further ease implementation and application instrumentation, these vendors now provide "universal" agents for data collection of services, systems, networks, etc., through a single deployment instance; once in place, the monitored environment is covered dynamically forever. This typically includes a single agent to provision dynamically additional runtime agents if desired, but separate agents are often still available.

To illustrate, in Dynatrace OneAgent, code modules are responsible for collecting all performance data within the monitored environment, sending it to the Dynatrace Server. It only requires a single installation per host, and automatically injects the necessary components to collect monitoring data from servers, applications, services, and more.

Similarly, the Broadcom DX APM agent package comprises several bundles, each representing a piece of agent functionality such as SQL, web services, HTTP backends, servlet, JSP, etc. This allows extensions and add-ons to be optionally included to reduce the overall payload of an agent. Agents extensions are available to monitor applications, application servers, and infrastructure environments and hardware.

Auto Update
Once manually installed, the respective vendor solutions also provide (optional) auto-update functionality to minimize maintenance requirements for deployed agents. For example, in AppDynamics, agents can be updated by putting new distributions in a central repository and updating the configuration (i.e., rulebook) with the latest version. When an AppDynamics Universal Agent finds a new rule for a runtime agent in the rulebook, it retrieves the runtime agent from a shared repository, installs the agent as a local monitor, and starts the agent.

Automated Instrument-ation and Discovery
The respective universal agents can often—depending on the technology and configuration—inject themselves into processes (a restart of the process is required) to begin monitoring without a requirement for manual configuration or editing. For example, while the javaagent parameter can be added manually, the AppDynamics universal agent examines each new process started on the host. If the process is a new JVM, the universal agent injects the javaagent argument into the start-up arguments for the process, eliminating the need for developers to modify Java start-up scripts.

Similarly, the Dynatrace OneAgent will automatically inject itself into supported servers, applications, services, etc. The issue however, is that the OneAgent monitors everything by default requiring users to manually disable monitoring for those processes that shouldn't be monitored (e.g., Server Manager on Windows). Here, Broadcom DX APM provides some additional flexibility with regard to agent packages allowing customers to customize the technology extensions desired for a host installation, and for example, safelist and blocklist Java process injection. Similarly, AppDynamics rule matching can be used to apply different conditions to different JVMs.

Proprietary Agents vs. OpenTracing
Each of these vendors provide their own proprietary agents for the collection of metric data used to facilitate monitoring and performance management. These agents are essentially mandatory otherwise the respective solutions ability to provide pin point performance insights is severely handicapped.

Broadcom however, is moving to adopt more open source in its products. As part of this strategy, rather than mandating the installation of a proprietary agent extension or risk the APM solution being handicapped by a lack of monitoring data, DX APM is moving to support additional third-party sources for metrics and transaction tracing. For example, support for OpenTracing allows DX APM to report on custom applications, libraries, and infrastructure services that have already been instrumented with Jaeger tracing during development, without a requirement to hold up a Jaeger instance in a production environment. This OpenTracing data can be correlated with other infrastructure agent extensions to provide the requisite insights for performance bottlenecks and anomalies, and integrates natively in the transaction correlation with DX APM monitored end-to-end tracing.

3 **Increased Containerization and Orchestration Platform Support**

Cloud Platform Monitoring

Today's applications and services are increasingly componentized meaning that application components rarely exist on the same server anymore. While all application components may exist within the corporate IT infrastructure, it is not uncommon to find application components located in heterogeneous hybrid environments including third party cloud platforms (e.g., Amazon Web Services, Microsoft Azure, Google Cloud Platform, Cloud Foundry, etc.). As such, these vendors provide support for popular cloud platforms including a number of IaaS, PaaS, and DBaaS options.

That said, these vendors continue to increase support in this area, meaning that prospective customers will need to ensure support is available for their particular needs. In some cases, simply installing an agent within virtualized guests may be adequate. Customers also need to be aware of any additional data transfer fees that some third party cloud platform providers may charge, potentially increasing costs.

Container / Orchestration Platform Monitoring

Application development is also seeing heavy movement toward containerization and microservices through the use of Docker technology and orchestration platforms such as Kubernetes and Red Hat OpenShift. As such, these vendors are also following suit to address the needs of customers implementing applications that capitalize on the benefits provided by these platforms. For example, the newer Dynatrace (e.g., the Ruxit-based technology) was designed from the ground up (replacing the older Dynatrace AppMon) to address the needs of dynamic cloud infrastructures. The Dynatrace OneAgent is container-aware and comes with built-in support for out-of-the-box monitoring of Kubernetes.

Similarly, the former AppDynamics Docker Visibility used to monitor containers has been deprecated in favor of the new Cluster Agent. The Cluster Agent is written in Golang specifically for monitoring the health of Kubernetes and OpenShift clusters (deployed using the AppDynamics Kubernetes Operator) and is supported on major distributions of Kubernetes.

Broadcom DX APM provides an extension for full monitoring into application pods that are scaled and managed by the Kubernetes Service, whether deployed on-premises or via third party providers such as Amazon EKS, IBM Cloud Private, Red Hat OpenShift, etc.

4 **Additional Business Performance Analytics**

Funneling and Journey Mapping

All three of these vendors provide end user analytics, using JavaScript-based browser agents to facilitate the collection about where requests are coming from, what devices/channels users are visiting, code performance on user devices, and other contextual details. It should be no surprise then, that these vendors have also implemented funneling and journey mapping functionality similar to that provided by other third party dedicated analytics platforms, eliminating the requirement for separate solutions and multiple browser agents, which can increase page load times.

Funnel charting helps organizations understand and optimize their users' journeys through applications, by giving them the ability to query and visualize conversion funnels in user session queries. Organizations can see where most users stop their journey, helping focus decisions around improvements. For example, funneling might be used when evaluating A/B testing to compare different journeys to see which is more effective and implement improvements accordingly.

Funneling helps visualize performance metrics for each step in a user journey, the metrics from one step to the next, top incoming and outgoing traffic data for each step, drop off

rates, and additional performance statistics (e.g., AJAX errors, JavaScript errors, Stall, Slow, etc.) to make it easier to understand how the user journey affects user drop off rates and interaction with the application. This can help pinpoint why a user was impacted (e.g., application crash, page, error, slow backend process, etc.), and if there are any patterns related to operating environment, browser, etc. If user behavior seems abnormal, investigators can drill down into the dropped sessions to see if the error was related to app design, app performance or an issue on the back-end.

Full Session Replay

While Funneling allows organizations to find the exact user sessions where a user journey drops off, drilling into those user sessions and analyzing if there were any errors or outages, session replay can be used to see exactly what the users were doing at the moment of the drop-off and hopefully get an understanding of why users are struggling.

Today, both Broadcom and Dynatrace provide multiple visualizations including flow maps, geographical heat maps, various charts, and full session replay allowing organizations to capture, index and visually replay the complete digital experiences for every user; including mouse movements. This includes recording all customer interactions with a web application and replaying each click, user gesture and action in a movie-like experience allowing investigators to review the end user experience for performance or application issues. For Web apps, staff can view page resources in a waterfall representation to help determine which components are causing slow load times. While AppDynamics can also record end user sessions to help facilitate troubleshooting the end user experience, it does not yet provide full session replay, instead providing statistics, page breadcrumbs, and events when digging into granular session details (i.e., animation vs. history list).

Payload Analysis

Funnel analysis help organizations visually understand where most users stop their progression towards a specific outcome and facilitate optimization of the user journey through an application. With the addition of Application Analytics, AppDynamics can add actionable correlations between the customer experience, application performance, and the business bottom line. Providing business performance management, this helps customers visually see the performance of applications from a business metrics perspective (e.g., value, revenue, loss, etc.). This however, requires that Advanced Analytics is already capturing this data as part of a transaction.

Through the new Business Payload Analyzer functionality, Broadcom DX APM has the potential to provide additional business analytics without application changes or more dedicated business intelligence solutions and post processing. Business Payload Analyzer uses advanced ML capabilities to analyze request payload to identify user and business KPIs without a requirement for developers to create custom tags for capture (i.e., no need to modify an application). It collects additional transaction payload details (e.g., items in cart, cart values, etc.) to allow machine learning-based detection, highlighting the most important data values, demographics, and more. Managers can map correlated business context to application transactions and create customized transaction naming based on transaction payload. Business Payload Analyzer continuously learns from sampled data, increasing its accuracy, allowing organizations to optimize business transactions and not just the user journey through an application.


While some of the functionality discussed is either relatively new or in cases has been available for some time, the core capabilities of the respective solutions continue to be enhanced and tuned to provide optimal experiences and value. The overall view is that many of the capabilities provided by these vendors continue to equalize in many respects as these solutions mature. That said, there will inevitably be individual organizational requirements that may heavily influence an organization's purchase, such as mainframe support, the configurability, collaboration, and more.

FEATURES COMPARISON
– AppDynamics/Broadcom/Dynatrace –

Over the course of this assessment Zibis Group looked at three vendor solutions—AppDynamics, Broadcom, and Dynatrace. These vendors were selected for their enterprise readiness (i.e., scalability, security, high availability, etc.), rich functionality, and market-leading position. Here, each vendor also facilitates deployment on-premises and through a Software-as-a-Service (SaaS) model.

As expected in a mature market, all three solutions fully met the defined criteria in several categories and features. However, these solutions continue to evolve to meet the needs of organizations supporting today's modern applications. While this report has focused on areas where these solutions have seen the most advancement in the past couple years, the following provides a more complete picture with regard to areas of differentiation.

○ ◔ ◑ ◕ ●
No Support ————————————————→ Excellent Support
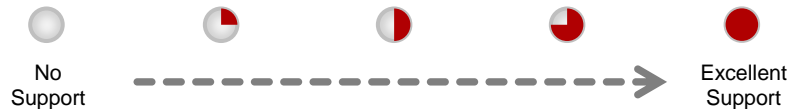
Core Evaluation Factors			
Feature	**AppDynamics**	**Broadcom**	**Dynatrace**
Platform Support			
Server Installation	◕	◕	◕
Agent Installation	◕	◕	◕
Automated Deployment	◕	◕	◕
Client Interface Support	●	◕	◕
Deployment Options	●	◕	◕
Scalability / High Availability	◔	●	◕
Agent and Infrastructure Support			
Platform Support (Host Server Monitoring)	●	●	●
Mainframe Support	◔	●	●
Network Performance Monitoring	●	●	◕
Database Monitoring	◕	◕	◕
SOA Stack and Middleware Monitoring	●	◕	◕
Virtualized Infrastructure Monitoring	◕	●	◕

Core Evaluation Factors			
Feature	**AppDynamics**	**Broadcom**	**Dynatrace**
Cloud Platform Monitoring	◑	●	●
Container / Kubernetes Monitoring	●	●	●
Application Instrumentation / Agent Injection	◕	●	◕
Tracing Transactions / Transaction Monitoring	●	●	●
Log Monitoring / Processing	●	◕	●
End User Analytics	◕	●	◕
Automated Baselines and Thresholds	●	●	●
AI and Machine Learning	◐	◕	●
Internationalization Support	◐	◕	◔
Integration and Extension of Enterprise Assets			
Extension of Solution	◐	●	◐
Automated Remediation	●	●	◕
Service Desk (e.g., Ticket) Integration	◐	◕	●
Other Third Party Integration	◕	●	◕
Administration and Management			
Client UI	◕	◕	●
User Management	●	◕	◕
Dashboards and Reporting	◕	◐	◐
Filtering and Funneling	●	●	●
Visualizations	◕	●	●
Trouble-shooting and Diagnostics	◕	◕	◕
Crash Analytics	●	◕	◕
Usage and User Analytics	●	●	●
Collaboration	●	◕	◕

Note: This assessment was commissioned by Broadcom. Zibis Group does not endorse any vendor solution. This report is provided as a guide to help evaluate products based on several critical areas of consideration when choosing an APM solution.

ABOUT ZIBIS GROUP

Zibis Group Inc. ("Zibis Group") is a leading source for market research and advisory services on the Information and Communications Technology (ICT) industry and related sectors. We assist vendors, government institutions, academia, non-profits and other key industry stakeholders by providing them with the tools they need to make informed decisions.

Zibis Group is a niche play in the marketplace for customized ICT sector research. We understand that all companies have distinct interests and unique business challenges. We thrive on rising to the occasion and in seeing our clients succeed. Technology is changing and we're here to help.

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