Today, enterprises rely heavily on applications for nearly all business-critical processes. These applications are delivered via a combination of hardware, software and services, known as the application delivery chain. To make this delivery chain work together effectively, IT must take a new and converged approach to network performance monitoring and application performance management.

**OVERVIEW**

Network and application performance issues are growing dramatically in importance for a variety of reasons (complexity of data centers, number of devices, rising end-user expectations). Consequently, IT organizations need a detailed, quantitative understanding of whether their applications effectively meet their business objectives.

Base-level Network Performance Monitoring (NPM), statistics concerning the protocols and infrastructure that support business-critical applications is certainly helpful, but it does not produce all of the key metrics that are pertinent to application performance and understanding true end-user experience.

Contrarily, an App-centric approach to monitoring performance is incomplete without insight into the underlying architecture and protocols that ensure the successful delivery of the application and allow isolation of performance problems from an end-to-end perspective.

As the performance of the network and the applications it supports deeply intertwine, the market is demanding a new and holistic approach to monitoring and managing performance. Vendors from both ends of the spectrum (the network and application side) are providing solutions that span their initial offerings to accommodate this market change. This accounts for the emergence of terms such as Application-aware NPM and Network-aware APM, neither of which fully correlates data from the network and applications to the expectations of IT and operations managers.

Converged NPM/APM solutions provide an accurate picture of the end-user and performance across the entire application delivery chain by carefully correlating metrics at the network level with rich application performance management data in real-time.
**NETWORK PERFORMANCE MONITORING ALONE IS INSUFFICIENT**

Network Performance Monitoring provides base-level reporting on network operations such as delay, packet loss and throughput. While monitoring network performance is important it is not enough on its own to fully address application performance challenges. To fully understand the performance fluctuations of business applications and end-user experience, it is important to have an accurate representation of what network issues compromise application performance and create poor end-user experiences. Many NPM solutions manually identify applications and users as discrete IP addresses on the network. Data on throughput, latency, jitter and dropped/errored packets will then be ascribed to applications and users in an effort to infer application performance. Given the number of applications, users, transactions and their frequency of change, this manual approach comes with obvious scaling and accuracy issues.

1. **INFERRED APPLICATION PERFORMANCE**

While providing context to the application is easy to imagine, it is much more than simply pairing network addresses to application types and relying on network data as a proxy for application performance. To provide an accurate picture of the impact of the network on the application and, more importantly, on the end-user, specific network and application metrics must be correlated.

NPM provides context to the application by piecing together information about how optimization and QoS mechanisms are being assigned and utilized, various routing and forwarding protocols are operating, coexisting but non-dependent applications and network protocol messengers such as ICMP.

The application performance information is based on packet analysis, or application profiles that are either manually defined or inferred. Monitoring at the session-level (versus application layer) limits knowledge, and application performance information is derived by collecting metrics relevant to the in-flight applications. Mapping NPM data to individual applications provides basic reporting on how the network is performing for these applications but does not extend to what the end-user is experiencing.

Although this approach provides a relatively accurate view in isolation, traffic inference is limited to the least common denominators of application performance. Specific application behaviors might not be detected, resulting in overlooked performance bottlenecks. Business processes are supported by multiple application transactions and are, by nature, multi-step. Understanding which of the thousands of protocol conversations represent a multi-step business process is nearly impossible. This makes common APM functions such as baselining, trending and alerting very difficult in an NPM solution.

2. **A BROKEN VIEW OF END-USER EXPERIENCE**

In the typical network environment, the end-user is a constantly moving piece in the overall network management puzzle. NPM attempts to provide context to the end user by realizing that each component of the network affects the others.

The network and associated infrastructure is the most pervasive part of the delivery chain and only exists to serve and support applications. With the increased complexity of applications and the delivery chain, network and performance metrics need to shift from the traditional infrastructure (speeds and feeds) to the applications and context surrounding them. The problem is that these traditional metrics are concentrated on the first tier, meaning that any back-end interaction or third-party connection is not included in the overall application definition and reporting. This provides a broken view and missing pieces in the end-to-end view of true end-user experience, because it is purely based on network performance statistics and not the true experience delivered by the application.

Today, NPM metrics are increasingly geared toward applications, but they are still displayed in the context of disparate conversations, and the performance data is not naturally correlated to end-user activity. As a result, NPM on its own provides something of a disaggregated picture of the overall end-to-end view.

Vendors offering Network Performance Monitoring solutions have recognized the value and potential in the emerging APM market and have repositioned their tools to be aware of the applications on their infrastructure (Application-Aware NPM). While this approach sounds good on paper, the solutions have a long way to go before they can combine and correlate the many sources of information needed to deliver valuable information.

Application-Aware NPM attempts to bridge the gap into understanding applications by adding context to them from different data sources. Due to the nature of collecting information and then putting it together to provide context to the application, it is often only effective in troubleshooting and does not offer real-time analysis or true application performance monitoring.
APP-CENTRIC APM IS INCOMPLETE

Traditional APM solutions focus solely on application performance and neglect to assess how the underlying infrastructure impacts the application. Application Performance Management (APM) has to be viewed from an application perspective, and must be tracked end-to-end through the entire infrastructure, including client devices, routing protocols, network configurations, switches, servers and associated components. Many solutions focus on the performance of an individual application, and while they measure criteria such as end-to-end transaction time, they do not allow for the troubleshooting that would indicate why a transaction may stall within a particular tier of network infrastructure. This limitation impedes the ability to perform fast fault domain isolation necessary to maintain positive end-user experiences.

1. LIMITED INSIGHT INTO SUPPORTING INFRASTRUCTURE

Poor end-user experience can be caused by poorly executing application code or by an overloaded server, load balancer or both. Most solutions require the use of two or more tools to troubleshoot the many issues affecting end-user experience. If you lack a unified view into apps and infrastructure, you can’t easily determine where the delay is (server, client, network, etc.), and you can’t expect to find the root cause of a performance issue. Subsequently, without the ability to drill down to and isolate performance problems within the end-to-end path, troubleshooting and optimization efforts are simply guesswork.

Converged NPM/APM offers an accurate picture of the end-user and performance across the entire application delivery chain by carefully correlating metrics at the network level with rich application performance management data in real-time.

2. FAULT DOMAIN ISOLATION (FDI) WITHOUT NPM

Not including network performance metrics into the overall FDI process can cause a performance bottleneck to be misinterpreted as network issues, providing very vague responses with no insight or granularity into the network itself, and what is causing the problem. If something other than the application itself (a protocol delivery mechanism, coexisting nondependent application, etc.) is at fault for performance degradation, the lack of insight into network traffic will result in a lengthy mean-time-to-resolve (MTTR) or costly war room scenario. If the root cause of the problem is outside the scope of an application team, a finger tends to be pointed at the network team, who, in turn, will likely find some other area that is to blame; all the time the business is suffering due to the degradation of the applications performance.

Elongated problem resolution timeframes mean significant costs to the organization such as professional staffing expenses required to solve technology issues, potential loss of sales, decreased employee productivity and even a poor company brand image when the results of IT problems have an impact outside of the corporate walls. By including network performance metrics into the FDI, it helps identify potential problems by distinguishing between bandwidth contention, latency and server response time problems.

The ultimate goal of an APM solution is to restore and maintain performance to applications, and as APM vendors recognize the need to quickly identify the source of the problems, regardless of whether it’s the server, application or the network, it is apparent that understanding the relationship between the underlying infrastructure and applications is a requirement. Vendors have positioned their products in a way that it would seem they provide the deep insight into the supporting infrastructure that’s needed (Network-aware APM), but the reality that it is outside the realm of capability for their products.

Network-aware APM tries to provide insight into the supporting infrastructure, but is too heavily focused application-layer transaction analysis and has limited visibility into the network. The lack of combined insight will either lead to a vague determination or misdiagnose of the ultimate root cause resulting in elongated problem resolution timeframes and a view into only a portion of the end-to-end application delivery chain.
CONVERGED NETWORK PERFORMANCE MONITORING AND APPLICATION PERFORMANCE MANAGEMENT

While vendors from both ends of the spectrum are attempting to expand their product portfolios’ reach, either by positioning their products as Application-aware NPM or Network-aware APM, they often fail to successfully correlate data from the network and applications to meet the expectations of IT and operations managers.

Increasing challenges of complex data centers are demanding that corporations take a converged approach to network performance monitoring and application performance management. Converged NPM/APM carefully correlates metrics at the network level with rich application performance management data in real-time. With a true correlation between Network Performance Monitoring and Application Performance Management companies can reduce MTTR, decrease performance management costs and simplify deployments.

The single most important challenge faced by IT and operations is to ensure business applications are functioning properly from an end-user perspective. In order to deliver acceptable service levels to the end-user, you must have a converged NPM/APM that provides an end-to-end view of how applications consume system and network resources.

1. DYNAMIC IT ENVIRONMENT

Business and IT environments are in a constant state of flux. Businesses are constantly reinventing themselves in response to new market opportunities (acquisitions, deregulation, etc.) that often force change upon organizations. IT departments must always be prepared to respond to these commercial changes while simultaneously remaining up to speed on new technologies that can enhance business practices. Critical changes that organizations are making to meet the expectations and demands of today’s applications require a new approach to NPM. This new approach involves combining application-specific data with metrics at the network level in order to provide true end-user experience and a view into the performance of the entire application delivery chain end-to-end.

2. EFFECTIVE RESOURCE UTILIZATION

Due to the nature of distributed applications, the network is an excellent source of information for helping explain end-user performance to make informed decisions about IT investments (WAN subscription costs, server consolidation, etc.), resource utilization and allocation.

In order to meet business requirements and service level agreements (SLAs), it’s important to know the network serves business-critical applications first and that non-business activity is not stealing vital resources from those key applications. To demonstrate applications are meeting the business requirements and SLAs, useful quantifiable data can be derived by correlating NPM related metrics with application Transition details. To ensure business requirements and SLAs are continually being met, a baseline of how an application is being delivered can be created to proactively determine irregular behavior or performance degradation. This baseline is something of a moving target, and is constantly updated with production data to adapt to the enterprise environment as it evolves (hardware updates, new versions of operating software, adding users, etc.).

By maintaining an up-to-date baseline, IT and operations is in a position to identify what is possible given the existing system, proactively identify problems, improving the troubleshooting environment, expediting MTTR and making other informed decisions around IT investments, resource utilization and allocation.

3. ACCELERATE TROUBLESHOOTING

It is critical to have enterprise-wide metrics on application performance and network resource consumption to rapidly troubleshoot performance issues. Users expect consistent performance and rapid resolution of problems, yet it is time consuming to pinpoint how the network affects a specific application without performance information from supported infrastructure and protocols (even more challenging to understand overall network performance). Silo-oriented monitoring tools have proven to be ineffective early warning solutions for application service because they don’t measure end-user response time or provide any cross-domain intelligence. Network information must be correlated with application-specific data for targeted troubleshooting and the ability to isolate the fault domain all while understanding the business impact.

Different applications and protocols are monitored with specific relevance with an application or network aware approach, only by combining the two together is a comprehensive APM story created.
CONCLUSION

Network performance has a direct impact on application performance, and it is critical to provide an accurate picture of the performance across the entire application delivery chain, accelerating the understanding and correction of performance problems. It is difficult to pinpoint how the network affects a specific application, but by integrating Network Performance Monitoring into Application Performance Management more effective decisions can be made regarding IT investments, problem resolution and resource utilization and allocation.

Vendors are attempting to boost revenue by entering new markets with slightly modified solutions (Application-aware NPM or Network-aware APM), but they do not suffice when it comes to complex infrastructures and meeting the expectations of IT and operations managers.

With a new and converged approach to Network Performance Monitoring and Application Performance Management, IT and operations managers get an in-depth understanding of the underlying technologies that support applications and a clear picture of the relationship between the network and applications.

Converged NPM/APM arms IT and operations managers with invaluable knowledge about what is possible given their existing system and prepares them to respond to commercial changes while simultaneously implementing new technologies that can enhance business practices.

When performance management is viewed from an application perspective, end-to-end through the entire infrastructure, including client devices, routing protocols, network configurations, servers and associated components, it creates transparency and a common understanding of performance degradation. This allows for targeted troubleshooting and the ability to isolate the fault domain, whether it’s the server, application or network, all while understanding the business impact.

Network Performance Monitoring is a necessary discipline in the context of an APM solution. On its own could be perceived to produce important metrics for reporting. However, to provide context to the overall delivery story, it must be combined, viewed and reported in conjunction with the other elements and data provided by an APM solution. As the performance of the network and the applications it supports deeply intertwine, it is critical to have a truly converged Network Performance Monitoring and Application Performance Management approach for a complete and holistic understanding of end-user experience.

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