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Application Performance Management Approach for a Large-Scale Project

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Table of Contents

Executive Summary

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Challenge

As the business environment evolves drastically, the application environment tends to become very complex and frequently cause performance problems. Thus, many companies are experiencing significant needs for establishing a monitoring system for application performance so that it can ensure constant service to its users.

Opportunity

By effectively utilizing practice of application performance monitoring, companies can ensure application performance by end-user, perform analysis of complex business transactions, track application mapping analysis, and monitor service transaction

Benefits

This white paper is a guideline for using the APM solutions effectively, providing plans and strategy for handling various application performance monitoring requirements cosby a large scale project, along with the case studies of actual business circumstance.

Today's business environment is experiencing fast-paced changes every day, and companies are spending considerable and continuous efforts in order to anticipate and navigate through changes in order to stay competitive in the volatile market. Such changes are not only calling for quick and innovative adaptation in companies' business process but also renewed standard in governance, regulation and transparency required in times when globalization has become absolute necessity for many organizations regardless of its geographic reach.

However, despite such lively movements in the market, from IT management point of view, many companies are still utilizing aging IT infrastructure rapidly approaching point of being obsolete for the information system, hindering companies from applying sufficient flexibility and scalability to their business. Recent trends indicate that companies are responding to aging IT infrastructure problem by either performing partial system upgrades as seen necessary for the business requirement or by implementing new, 'Next-Generation' technology concepts over existing IT systems if upgrading alone is seen as inadequate. The projects involving next-generation IT system implementation widely performed across companies in banking industry in recent times demonstrates such current trends.

When an organization upgrades its existing web system to "Next-Generation" system, organization must consider and ensure improvement in 3 important areas: efficiency in business process, agility in implementation, and reusability in terms of recycling of existing system components such as source codes. Service Oriented Architecture (SOA) has been highlighted as technology of choice in recently time because it addresses all three of these factors. SOA provides reusability of existing IT systems for the sake of cost-effectiveness. SOA offers business agility by removing the barriers between distributed and separated IT systems. SOA also achieves business efficiency by allowing flexible implementation of business process and easy maintenance of the systems.

Although SOA has many advantages, unfortunately, one of the main features of SOA, modularized business logic and distributed processing for service reusability has the tendency to increases the complexity of application architecture. For this reason, the need for IT operation management to be able to effectively monitor and manage the various business and IT requirements has raised. Specifically, this change entails a move from infrastructure-component-centric IT operation management (using real and virtual servers, networks, and storage farms) to application-centric IT operation management

Take a look at the overview of application-centric IT operation management and application performance monitoring, using the example of a next-generation IT system project.

Section 1

1. Application Management

The phrase 'Application Management' is a phase that is familiar to professionals working in IT fields. Ironically, many people working in IT do not know the accurately the actual definition this word and the word may carries different meanings depending on who uses it and how it is used. Therefore, let's first take a look at the definition of application management to allow for a better understanding of the concept and to avoid confusion.

Application Management is defined on Wikipedia as follows :

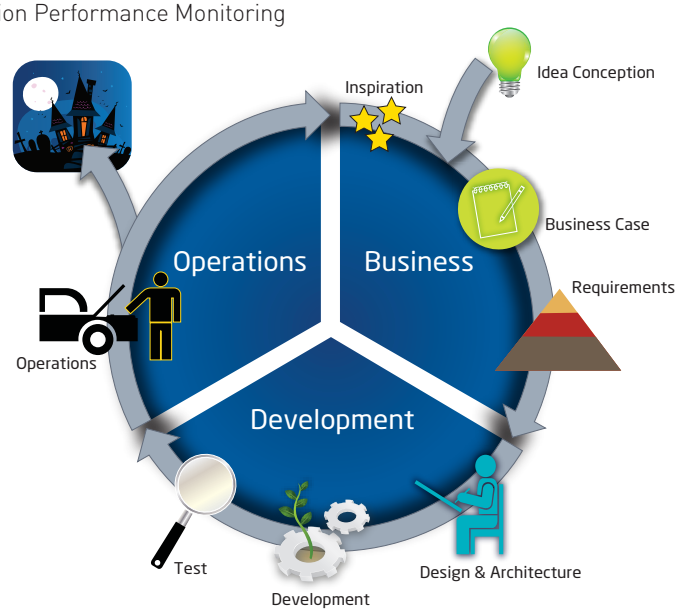
A continuous process of managing the application life cycle across governance, development and maintenance.

Above definition closely matches to that which is used in ITIL (IT Infrastructure Library). In another word, application management is management process over the application's entire life cycle, starting from creating business requirements until the final stage of an application's life cycle when it becomes obsolete. In order to try to comprehend the definition in a more practical sense, let's try mapping the definition against the currently available line of solutions which cover the application lifecycle management.

1. Business
- Project and Portfolio Management

2. Development
- Requirements Definition / Management
- Software Change and Configuration Management
- Test Management

3. Operations or Maintenance
- Release Management
- Operations Management
- Application Performance Monitoring



The source of image : "www.netsoltech.com"

In the traditional sense, application management has often been understood in the context of Software Development Lifecycle Management (SDLC) and the coverage of application management was limited to the areas within application development. Thus solutions available for application management was typically point solutions (solutions designed to solving one particular problem without regard to related issues) designed for development phase of SDLC. However, as the interested in application management grew and practice became much more accepted, more and more organizations asked for ways to implement total system management within their IT system, expanding application management scope from development to also include other areas of SDLC. For example, in governance, the business requirement should be set according to target business cases and a business portfolio must be developed based on evidentiary data. In operations organizations need management processes (release, operation management, application performance monitoring) not only for monitoring performance and availability of services, but also for effective transfer of control for implemented IT systems from development to production.

Section 2

2. Application Performance Monitoring

Many enterprise companies have endeavored to monitor application performance since the mid-1990s as part of their IT management strategy. Early form of monitoring application performance involved collecting and analyzing application performance data was typically applied at the local IT system level only, because back then, applications were treated as just a components in IT infrastructure, and not as object deemed importantly to be monitored independently. Typically, performance problems were dealt with via comparisons between the data collected periodically from target IT systems by agents, using such thresholds as local resource consumption and latency, as defined by solution vendors or customers. Such approach yields effective results as long as the application code is monolithic, centralized and static, and have clear boundaries (tier) separating one application from another. But this approach to application performance monitoring had changed as the IT system environment and application architecture became highly modularized and distributed, resulting in exponential increases in the number of agents. Moreover, lack of connectivity and traceability of transaction data collected from each agent became a major concern, such that changes in existing method of application performance monitoring became inevitable.

2.1 End-user experience monitoring

Service performance (response time) and availability from end-users experience perspective are directly linked to the customer satisfaction associated with the implemented application, and these should be defined as non-functional requirements during the requirement analysis phase during application development process. In addition, these target requirements should be established and provided in a measurable format allowing for comparison and analysis against

incumbent or competing IT systems in determining whether or not a target has been achieved.

It is important that adequate discussions between business units be undertaken before retrieving reliable target performance factors, considering both factors, because of the difference in architectures and business logics between one organization to another. For example, consider a project which faces all-too-common difficulties: the requirements for the performance factor (response time) and the availability of primary services were not defined at the analysis phase, nor was a test team set to work on defining requirements analysis and establishing target performance factors at the performance testing phase. During this phase, the test team encountered various kinds of difficulties in establishing performance targets of the IT systems, an incomplete baseline due to the absence of peak performance and availability data for the current IT systems, architectural differences which resulted in difficulties analyzing information concerning competitor IT systems, and a general lack of understanding of the work done in the business departments.

APM monitoring solution to addresses the challenges described above, performance (response) and availability of the primary service, using following 2 methods.

- **Active Agents** – This method reproduces real user transactions by creating synthetic transactions at pre-determined time intervals.
- **Passive Agents** – This method verifies performance by measuring real user transactions from the desktop PC or server side.

The Active Agents method has the disadvantage of low reliability in measuring results, stemming from differences between the virtual and the real user environment, given that the Active Agents method measures performance (response) and availability by creating virtual transactions as it emulates user transactions. Moreover, overcoming these disadvantages would be costly, because doing so would require that a virtual environment be implemented for each ISP network to which individual users might belong.

In the case of the Passive Agents method, the main disadvantage of the Active Agents method can be addressed by measuring and setting indicators for real user transactions on a desktop, server, or appliance. However, it still carries the problem that mapping between the measured results and the business services can be very difficult.

APM solution monitoring may trend toward using a hybrid method which contains the advantages and supplements the disadvantages of the two monitoring methods. Such a hybrid method can measure and set indicators for service performance and availability by using information from HTTP cookies in users' PCs or by forging connections between the active and passive agent.

2.2 Application component deep-dive monitoring

As discussed above, the business and market environment has become complex and dynamic. For this reason, SOA has been selected as the enterprise application architecture of choice by many companies for its provision of homogenization, efficiency and agility through its thoroughgoing enterprise IT system standards as well as for its benefits with regard to reusability, by allowing connection to existing legacy systems. In this environment, architecture becomes more flexible since application business logic is constructed independent services and exposed components are distributed, but it also becomes more complex. This complexity makes early discovery of performance errors and their root causes more difficult.

With this in mind, most companies have come to require deep-dive monitoring component as part of their application management strategy, and APM solutions providers have begun to develop tools which fulfill this need. APM solutions in the initial period executed deep-dive monitoring by using byte-code instrumentation, which installs agents inside of JAVA EE, .NET middleware only. Over time, APM solutions have been enhanced to employ integrated monitoring

systems which analyze not only the applications in middleware, but the entirety of related business services.

For the purpose of implementing SOA for a telecommunications company, application architecture is implemented based on a distributed computing platform by exploiting such distributed processing technologies as Enterprise Service Bus (ESB) and Business Process Management (BPM). Because of this architectural feature, application deep-dive monitoring is strongly required not only for analyzing the processing status of each business service and catching performance problems, but also to facilitate quick response to those performance problems. In general, monitoring objects in Java EE or .NET middleware, class or package, must be analyzed by profiling using the application deep-dive monitoring. This profiling task should be configured using proper criteria because of the possibility of more than 5% overhead impact on the servers as profiling objects increase unnecessarily.

2.3 Application performance management database

The numbers of servers in a large scale IT systems implemented projects have increased exponentially with growing system sizes and the growing trend of cloud computing. This trend has increased the importance in role of databases used during practice of application performance management due to a significant increase in the amount of data dealt stored and processed by APM solutions during data analysis tasks.

For example, a typical workflow might traverse the data analysis task as follows: An examination of an end-user experience monitoring data determines that a response time slowdown is accelerating, and soon thereafter user-defined transaction profiling will be executed for root cause analysis of the performance issues associated with the problem. The user-defined transaction profiling discovers the bottleneck factor causing the slow response times by conducting transaction tracing from a top-level request included in a specific service. Afterward, a topology view provided by an application component helps further specify the location of the server in the data center that has caused the performance problem. In the last step, the application component deep-dive monitoring is performed to identify that the bottleneck is related to a certain specific method, and the developer receives this information to fix the code.

As shown in the above example, a substantial number of data analysis tasks must be undertaken in performance analysis using APM solutions. It thus becomes all the more important to analyze and process data in efficient manner. Especially given the rapid increase in the number of servers which have to be managed in a cloud environment, a plan which allows for processing large amounts of data should be given high consideration in designing and implementing an APM solutions

2.4 User-defined transaction profiling

Recently, many clients have become interested in Business Transaction Management (BTM), which has the purpose of profiling and monitoring the entirety of business transactions end-to-end. These BTM solutions are variously called Business Transaction Monitoring, Application Transaction Profiling or User-defined transaction profiling, and have been classified as being in separate category from APM solutions. Recently, however, the concept of BTM solutions has been integrated with that of APM solutions, and the differences between BTM solutions and A PM solutions have gradually disappeared.

The reason behind necessity of BTM solutions in the market is that in case of distributed computing environment, traditional performance monitoring solutions such as SMS/NSM, APM, and DB monitoring solution are not able to dynamically map the processing flow of the infrastructure or application and the application topology for purposes of tracking business transactions, thus separate class of solutions were needed.

SOA is similar to BTM in being oriented toward the distributed computing environment. For example, a specific business transaction should be able to proceed through 4 separate business tiers to be processed. If business transaction issues or performance degradation occur during this process, then the information of the business tier causing the problems, including related systems and infrastructure—networks, AP servers, or DB servers—must be examined to determine the root cause of problems. The root cause of the problem can be isolated using this approach, and the time minimized and steps simplified from the onset of a problem to its solution.

BTM solutions have been introduced to the IT industry market under the name of End-to-End Transaction Tracking or Enterprise Application Transaction Management; however it is expected that it will take more time for BTM solutions to become generalized as compared to APM solutions.

2.5 Application component discovery and modeling

In SOA enterprise architecture, the configuration information about service components and infrastructure are needed in order to execute application deep-dive monitoring and user-defined transaction profiling. For example, in the case of analyzing the root cause of log-in transaction performance degradation, information should be provided via an intuitive topology view which makes it clear transactions is processed through which specific application server and/or DB server amongst hundreds of servers, and which components within that server.

There are currently two types of solutions which support application component discovery and modeling in the IT industry as follows :

- **Application Discovery and Dependency Mapping based on CMDB**
- **SOA Topology View**

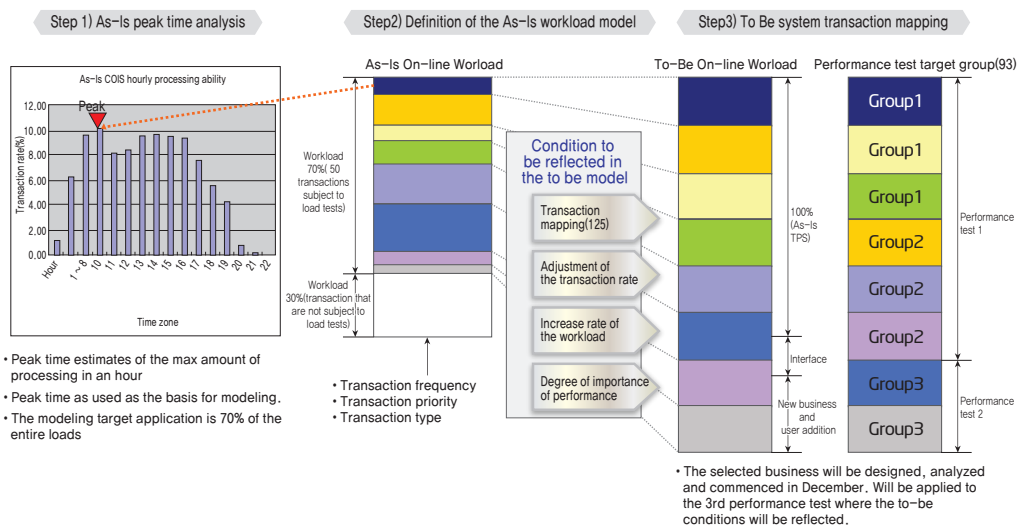
ADDM optimizes business availability and adds the value of quickness to the problem solving process by visualizing the dependency between the basic infrastructure of IT systems and applications from an IT asset management perspective. On the other hand, using SOA meta information, the SOA topology view allows for service flow analysis between each composite by visualizing the correlation among services, references and components of the composite in either a static or dynamic way, along with an assessment of performance issues.

2.6 Application Service Monitoring

Restructured IT systems implemented by the next generation project have to process not only the workload of an existing legacy system, but the expected increase in workload over the next few years considering the expandability of the business. For this reason, whether the previously discussed and determined target performance has been achieved must be verified.

The performance target of the object IT system is defined as the non-functional requirements during the requirement analysis phase in the application development process. However, in many cases, these requirements are subject to low traceability. In other words, it is often difficult to trace a given requirement in the later stages of a project because of additions or changes to the performance targets determined in the early stages of the project. Therefore, the performance target has to be determined in early stages of a project as a result of careful consideration and discussion.

The following figure illustrates step-by-step activities to help determine an appropriate performance target

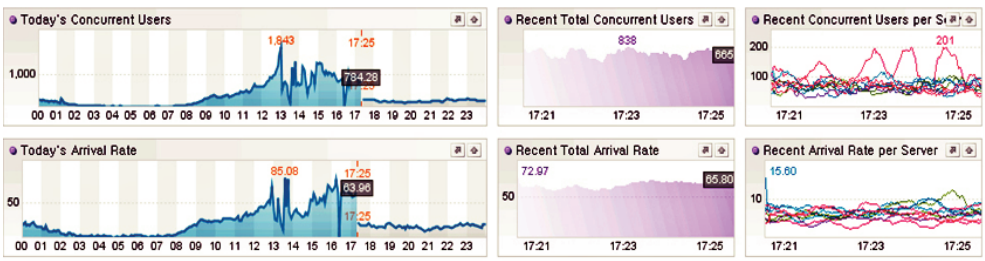


First, a workload model is established by periodically analyzing the workload at peak times, followed by selection of object business transactions occupying the top 70-80% of total transactions by frequency for a performance test.

For transactions excluded from the first selection, these should be reselected according to frequency, importance and the pattern of work, as determined through discussion with a client. Through these steps and by reflecting upon planned ratio adjustments, probable increases in frequency of transactions, and the importance of performance in a To-Be model, the performance target is finally determined for the object business transactions.

A test environment should be established and a performance test executed after the performance target is determined, and both a performance test solution reproducing the real operation environment and an application service monitoring solution are then required to conduct more accurate tests.
It is a simple task to determine whether performance targets have been achieved from the level of Java EE or .NET based middleware, by using the application service monitoring solution to conduct a performance test. The application service monitoring solution also makes it easy to investigate the root causes of any bottlenecks through the application deep-dive monitoring in the event that performance targets are not achieved.

The figure below is a screen shot of the application service monitoring offered by JENNIFER Solutions as used for performance analysis at the service level.



In addition, results obtained from the application service monitoring of the target IT system can be used practically in a number of ways. For example, by applying such statistical techniques as linear regression analysis, the results can be converted to a forecasting model for workload increases or to generate raw data for establishing investment and capacity plans for future IT systems.

Section 3

Conclusion

This paper has provided a brief overview of application-centric IT operation management in a large next-generation IT system implementation project, specifically with regard to the aspect of performance monitoring.
As demonstrated in this paper, an efficient management protocol, such as SOA, for analyzing performance issues and discovering their root causes is becoming a more complex undertaking in the current distributed computing environment as companies seek to deal with a very changeable set of business requirements. The need for application performance monitoring solutions will only expand as companies seek to deal with various changing performance requirements and other issues in an efficient manner given their limited timelines and human resources. In that environment, application performance monitoring solutions will provide reliable guidance down the path to the successful execution of a project.

[Literature]

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Section 4

About The Author

Bruce Park is currently working as a senior consultant in charge of application quality management at a BTO consulting company. For many years, Bruce has been engaged in various positions in area of application management such as performance benchmarking, performance testing, and quality management in enterprise environment settings.
Prior to joining BTO consulting company, he was employed as professional services consultant at HP Korea, Mercury Interactive Korea and other notable firms.

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about JenniferSoft...

JenniferSoft, Inc. is the software vendor company with expertise in application performance monitoring and performance problem resolution, providing Application Performance Management (APM) solutions and services to enterprise companies around the world.
Technology is foremost of what's valued in JenniferSoft, as we strive to bring to the market the latest and best technology available.
We think that software solution should not be just a mesh of form and functions but it should be designed with its user in mind, each component formed with intent to elevate the experience of its user. JenniferSoft combines latest technology in APM with field-tested expertise and experience to bring to our customers a well-balanced solution that is both advanced in features and practical. With vision of combining technology and experience into one, JenniferSoft pledges to continue focuing on R&D to develope world class solution.

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