The IT industry stands at the cusp of the most significant revolution in 20 years, since client-server architecture and web tier platforms. The convergence of social, mobile, analytics and cloud (SMAC) has created a significant change in the value that enterprise applications can provide to business (figure 1). Various market analysts such as Gartner,1 IDC2 and Ovum3 predict how SMAC is going to drive the future of how business is done and operated.

Today, most organizations are facing the challenge of figuring out how to analyze data and find insights into newer and unconventional data types. As new sources of data continue to grow in volume, variety and velocity, so does the potential of these data to revolutionize decision-making processes in every industry. What are the challenges that typically face large organizations and how can big data analytics help solve those challenges for them?

BIG DATA—THE NEW OPPORTUNITY

Organizations have invested heavily over many years in a variety of applications and systems to automate their business processes. The information from these applications is typically locked in silos or consolidated into a data warehouse for historical analysis and reporting by expert business analysts. Volume and variety of information (structured and unstructured) is exploding. The current economic times require corporations and governments to invest in analytical systems to gain deeper insights into information and make smarter decisions. These systems enable macrooptimization—the analytics designed to support major business decisions such as production planning, sales management and capital investments. While these investments generate many benefits for day-to-day, routine business, in most cases, the majority of the data is not utilized for any kind of predictive analytics.

The next generation of efficiencies can be achieved by providing precise, contextual analytics and insight at the point of impact, answering the questions: Is this a risk or an opportunity and what is the best action to be taken? An analytics-driven approach will drive microoptimization, improving insight into customers, processes and business patterns to drive better real-time decisions and actions in every corner of the organization.

The emergence of SMAC is driving adoption of application modernization strategies in enterprises across the world. How can big data and analytics principles be applied as a modernization strategy to improve the IT operations and help in an organization’s major transformation initiative?

POSSIBILITIES WITH IT OPERATIONS ANALYTICS

With more and more systems talking to each other (the Internet of Things) and deployment of mobile strategy, it can be assumed that data are set to grow by 15 to 20 percent every year. As applications gradually move to the cloud, monitoring the applications is also set to become a complex task due to dynamic provisioning and deprovisioning of IT resources to meet...
applications’ demands. For example, an enterprise of 5,000 servers and 125 business applications typically generates 1.3 terabytes of IT operational data every day—via collection of various metrics, such as events, server monitoring logs, application monitoring logs, endpoint managers, network monitoring and storage monitoring. Enterprises need to adopt analytical solutions that can analyze the terabytes of big data from IT operations and provide relevant insights that can be acted upon immediately. Some of the situations where predictive maintenance may apply are depicted in figure 2.

This new approach of using analytics to resolve IT problems proactively and effectively is called IT operations analytics.4 IT operations analytics solutions have the ability to extract insights from structured and unstructured data and learn about a business’s IT systems over time. The objective is to get from a reactive to a proactive mode as far as regular IT operations are concerned. Self-learning and predictive capabilities enable automatic fixing of recurring issues in maintenance, thus freeing up IT personnel to focus on more important areas.

THE INTELLIGENT APPROACH TO IT OPERATIONS

Enterprises’ risk revenue, customer dissatisfaction when applications and services do not meet consumer expectations, operations focused on individual applications, and infrastructure domains with no end-to-end operational visibility all translate to high maintenance costs and ineffectiveness. The explosion in operational data and the nonadaptability of traditional tools to handle the complexity compounds today’s big data problems.

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**Figure 2—Opportunities With Predictive Analytics**

- **Manage alerts in real time.**
  Reduce time to detect failures through real-time alert management based on sensing abnormalities in data.

- **Resolve quality issues and apply corrective actions.**
  Reduce time to resolve quality issues and apply corrective actions through collaborative data sharing across the extended enterprise.

- **Analyze extreme volumes of information.**
  Manage and analyze high volumes of structured, relational data.

- **Discover and experiment.**
  Predict future failures through superior analytics and correlate and cluster rare events across multiple data sources.

- **Manage and plan.**
  Ensure a single integrated view of “failure incidents” through the integration of multiple data sources into the early-warning system for early alert detection and management.

*Source: Mohapatra, Parisa and Banerjee. Reprinted with permission.*
By adopting IT operations analytics strategies, enterprises can improve operational ability with real-time analytics to identify and resolve problems faster and predict emerging problems (figure 3).

By analyzing historical data, enterprises can quickly identify opportunities to streamline operations and reduce costs by having a single view of end-to-end operational visibility. A proven architecture that underlies predictive maintenance is depicted in figure 4. Advanced analytics powered by products that do predictive analytics (SPSS, COGNOS software) and data integration provided by messaging software (e.g., Websphere Message Broker, Infosphere Master Data Management Collaborative Edition), which feeds a prebuilt database schema (e.g., DB2), are the components that provide the solution.

Full deployment and usage of the IT operations analytics tools as part of an organization’s day-to-day operations will help in integrating business insights with predictive analytics and will result in behavior learning solutions that automatically conform to the environment. It will also resolve problems more efficiently with faster access to all pertinent information, as well as improve service availability by leveraging expert knowledge of applications and infrastructure. Last, but not least, it will reduce administration overhead by reducing the need for static thresholds and application analysis.

**IT Modernization Strategy of the Future**

Another area that benefits from big data analytics is formulating a modernization plan for an enterprise’s portfolio.

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**Figure 3—Addressing IT Operations Through Analytics**

<table>
<thead>
<tr>
<th>Predictive Analytics</th>
<th>Rapid Root-cause Analysis</th>
<th>Optimized Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use predictive analytics to identify problems before they occur.</td>
<td>Search application, monitoring, performance and server logs.</td>
<td>Optimize across your IT app infrastructure.</td>
</tr>
</tbody>
</table>

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**Source:** Mohapatra, Parisa and Banerjee. Reprinted with permission.
of business applications. Chief executive officers (CEOs) are worried about IT spending, and maintenance and support costs form a major part of an organization’s IT budget. A modernization strategy that involves moving compatible applications to the cloud may not drive the high return on investment (ROI) that organizations expect. An efficient strategy would be to determine applications that are causing high maintenance costs, then gain an understanding of the root cause and determine if a transformation would help bring down the costs associated with the application. Today, organizations are starting to take the initiative by accelerating their progression along an information-led transformation. These changes are not isolated, but rather interdependent and involve a transformation strategy that incorporates modernization of platforms and technologies with improvements of the portfolio through consolidation, simplification and restructuring of the portfolio components.

As figure 5 shows, the big data approach complements the traditional approach. In the traditional approach, CEOs and chief technology officers (CTOs) intending to rationalize their application portfolio ask business users a multitude of questions while trying to understand which applications are potential candidates for modernization. The business users, in turn, consult their IT division to get answers to these questions. Though this is the present-day scenario at most organizations, there are multiple problems with this process, such as delays in getting answers, starting with a huge application set, and subjective and contradictory responses. Figure 6 shows the big data approach.

In this model, IT delivers a platform that consolidates all sources of available information and enables creative discovery. Then the business users and modernization consultants use the platform to explore the data and create a smaller set of specific questions to ask. In addition to starting with a much smaller set of application candidates, this approach also gives quicker and more accurate results.

**APPROACH TO BIG-DATA-LED APPLICATION MODERNIZATION**

Any large enterprise generally has hundreds of applications that are required to run the business functions with varying
Figure 5—Big Data Vs. Traditional Approach to Business Modernization

**Traditional Approach**
*Structured and Repeatable Analysis*

**CEOs and CTOs**
Ask questions to determine how to modernize their application portfolio.

**IT**
Structure the data to answer those questions.

**Big Data Approach**
*Iterative and Exploratory Analysis*

**IT**
Deliver a platform to enable creative discovery.

**CEOs and CTOs**
Explore how these data can help modernize the application portfolio.

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Figure 6—Big Data Application Modernization Strategy

**Big-Data-based Decision Model for Application Modernization Possibilities**

- Replace Applications
- Relocate Applications
- Retire Applications
- Restructure Applications
- Reprioritize Applications
- Upgrade Applications
- Cloud-enabled Applications
- Rationalize Applications

**Information**

- IT Operations Data
- Application Data
- Infrastructure Data

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service levels. Over a period of time, regular maintenance activities of these applications usually give us a picture of which ones are healthy and which ones are prone to repeated failure. It is prudent to take note of this subset of applications and probe further, since it is likely that some, or all of them, would be probable candidates for future modernization initiatives. This also avoids unnecessary data discovery and analysis of the entire set of applications, as well as installing any discovery software on all the production systems. **Figure 7** explains the approach.

In the first phase, referred to as data gathering, one needs to look at the historical data of service tickets for all the applications in the enterprise. Manual screening of these data would reveal which applications or servers are more troubled. The analysis is done with the intent of finding out which applications have caused more high-severity tickets, which applications have caused system and application outages, and which applications have more tickets because of a server or application failure.

Analyzing tickets will help narrow the huge set of applications for developing a modernization strategy to a smaller set. For example, if one wants to look at the top 10 applications that are troubled, with this limited set of applications with which to start allows for detailed analysis to begin. The process usually follows an iterative and quick deploy, analyze, recommend and exit strategy.

The next phase is the identify phase in which, instead of following a manual approach, one tries to use analytics software to read the unstructured data (every log, maintenance manuals, user guides) of the selected applications one by one, looking for meaningful data in what one finds. There are several IT operations analytics solutions on the market that do this kind of job, but the focus here is on those that perform log analysis.

The next step is to complete the analysis of the produced data and try to identify business applications for IT mapping, while understanding the architecture of troubled business applications. The points to be considered include identifying the range of software that is running on the system and the log details, identifying any existing application performance tools, and identifying any existing server performance and monitoring tools that are running. With the help of log analysis tools, the analysis phase also takes into account the following aspects:

- Locating component error messages from system, configuration or software logs via rapid indexed searches
- Isolating issues across various domains, including customer session, performance and system faults

**Figure 7—Four Steps to a Better Modernization Strategy**

**GATHER**

*Do ticket analysis to identify a set of troubled applications.*

**IDENTIFY**

*Using analytics software, identify applications with high maintenance costs.*

**ANALYZE**

*Search and analyze logs of the applications identified to identify the problem areas.*

**PLAN**

*Establish a modernization plan for the identified application.*

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• Linking support documentation and operations notes dynamically to log warning messages or events to resolve problems quickly
• Visualizing search results with analytic tools to rapidly perform root-cause analysis
• Detecting service issues in unstructured data sets with built-in expert knowledge of software components

The resulting analysis may help provide some insights, such as which operating systems and software stacks have caused more problems or whether the configuration of hardware running these applications needs an upgrade.

These analytical solutions lead to an actionable plan, which is the last step in the process. The plan need not necessarily be a migration of an application to the cloud, but it could include hardware upgrades, application upgrades, database upgrades or application rearchitecture, among other possibilities. For example, an application with constant requests for memory resources should be checked for application configuration, coding logic or its potential as a cloud candidate.

CONCLUSION
The next generation of big data analytics capabilities makes the maintenance of IT operations of an enterprise more streamlined and intelligent. At the same time, the approach also benefits an organization’s need for overall business transformation by providing a quicker and more effective way to rationalize its application portfolio.

ENDNOTES
7 IBM, Video: “How to Diagnose an Application Problem Using SmartCloud Analytics—Log Analysis,” http://youtube/DgnMWfMmMCs