Tivoli® software

Quickly isolate, diagnose and fix transaction performance problems within your business-critical applications.

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Summary

Managing today's composite applications — the complex applications on which
a business depends — requires a complete application management solution.
IT organizations should look for an integrated solution that helps them track
transactions from end to end, across multiple system types, then drill down
into problem areas to rapidly diagnose and resolve problems. By deploying a
comprehensive application management solution — including tight integration
between application management and software development tools — an
organization can proactively identify slowdowns, rapidly perform accurate
problem diagnosis and help the appropriate staff correct the problem.

Help address the challenges of managing composite applications

Think about the mission-critical applications on which an on demand business
relies. Today's applications involve a complex series of transaction pathways
that cross multiple run-time environments, including J2EE™, legacy and
back-office systems. In other words, a variety of environments are responsible
for executing business logic and passing message-based transactions between
nodes. We call the applications that utilize these complex transactions and
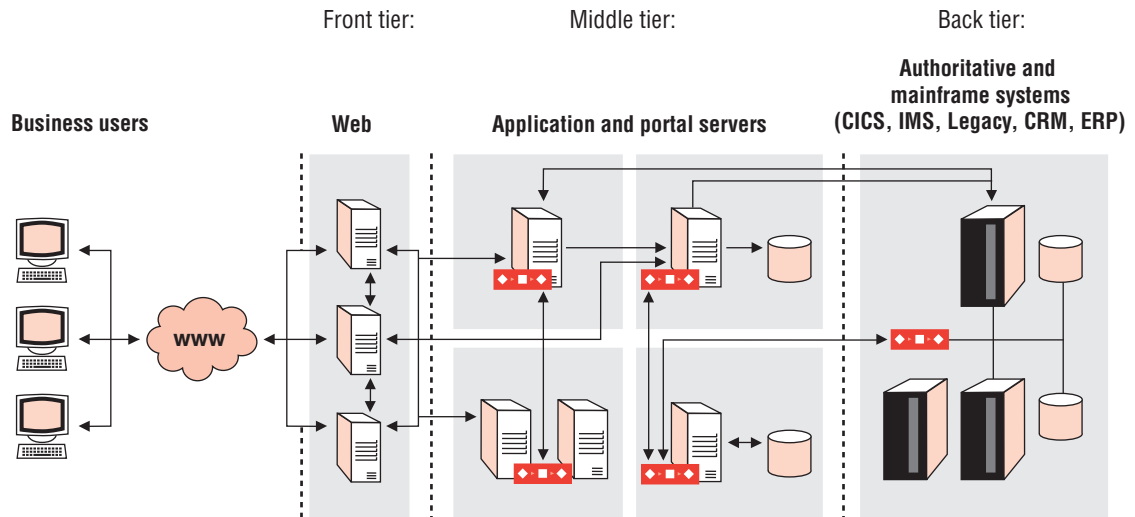multiple environments *composite applications*.

In essence, a composite application:

- *Consists of multiple application logic components distributed over multiple run-time middleware environments.*
- *Links these components together over multiple transports and interface types.*
- *Services customer transactions.*
- *Exhibits one or more of the following properties:*
  - *Multitiered – spans portal, HTTP, J2EE, enterprise application integration, legacy, relational database management systems (RDBMS) and Web services environments.*
  - *Web-accessible – leverages J2EE as the key enabling technology.*
  - *Interacts with legacy or back-office systems (such as IBM CICS®, IBM IMS™ and SAP) that act as authoritative data repositories.*
  - *Relies on business integration middleware such as IBM WebSphere® MQ, IBM WebSphere Business Integration and other enterprise application integration (EAI) solutions to enable connectivity, brokering, transformation and workflow capabilities.*
  - *Spans corporate organizational boundaries, particularly when deployed using service oriented architectures.*

Operators require visibility into all systems and interfaces to optimize performance

IT organizations are responsible for maximizing the availability and performance of the composite applications that are critical to a business. Now that traditional "back-office" applications are increasingly becoming browser accessible, Web and J2EE application servers play an even more critical role in meeting functional and performance objectives. In this composite application paradigm, the ability of multiple tiers to effectively service user requests to the Web browser end point is gated by a potentially large number of failure points. So to maintain customer satisfaction and associated service levels, the performance and availability of each system and interface must be both optimized for performance and fully visible to the operator should outages or slowdowns occur.

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Typical system configuration to support composite applications

The high levels of functionality provided by composite applications – which make them so useful to customers – make them difficult for an IT organization to build and manage. Operations, support and development groups who are collectively responsible for developing and sustaining the complex infrastructure must now work together with an unprecedented degree of coordination. These challenges are compounded by the need to maintain this level of collaboration throughout the application life cycle – from performance testing through availability and event management to, ultimately, business and service level management.

Highlights

Composite application management requires a wide range of integrated capabilities

To successfully realize this, an IT organization needs a composite application management solution that enables the organization to:

- *Visualize any and all business transactions that traverse any pathway through the data center – regardless of the underlying systems and connectivity paradigms.*
- *Detect and report on any discreet event along the pathway that represents an actual or potential point of degradation or failure.*
- *Isolate such events to a specific subsystem.*
- *Leverage integrated diagnostics to drill down into the suspected environment and perform root-cause analysis.*
- *View correlated traces of granular transaction events that span system types – for example, from J2EE to CICS.*
- *Utilize tight integration with developer desktop tools, such as Integrated Development Environments (IDEs), to drive production performance data directly to the software engineer to reduce time and effort of fixing problems and redeploying corrected code.*
- *Consistently execute IT best practices by deploying automation tools throughout the IT life cycle.*

IBM has the breadth of application management solutions that an organization needs to manage composite applications across a wide spectrum of systems. This paper describes how IBM Tivoli® software enables IT organizations to meet their application management needs.

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Highlights

Adopt the end user's perspective

An IT organization can best measure transaction performance and availability when it views application performance from the end user's perspective. By adopting this perspective, the organization is better able to align IT with the business processes that the end user depends on. Furthermore, this approach is a crucial step in adopting standards-based IT processes such as Information Technology Infrastructure Library (ITIL).

Traditional monitoring techniques that focus primarily on measuring the performance of tier-specific IT resources are generally unable to quickly identify specific root causes of problems that directly affect user experience, due to the fact that its hard to see across the tiers. In fact, organizations that use these siloed techniques often find that they cannot identify many performance problems before users or business managers report an application problem — which can hardly be considered proactive application management practices.

Identify performance problems before users or business managers report them

How does Tivoli software help? By providing easy-to-install and easy-to-use technology that delivers the right information that organizations require to evaluate application performance from the end point (such as a browser) all the way across the service topology — thereby determining faster and with greater precision the exact source of performance bottlenecks.

Tivoli software delivers all three dimensions of effective application management

Middleware — such as J2EE application servers in general and WebSphere servers in particular — is a key enabler of composite applications because it instantiates the core linkage across IT transactional systems and environments. Middleware conducts transactions and workflow between multiple business systems while maintaining the integrity of transaction data and interacts with remote business logic from various sources to manage data from across the enterprise. J2EE middleware also contains a significant portion of a company's new business logic and rules, as well as its presentation of content and applications.

In contrast to system-specific point products that cannot provide an end-to-end view for identifying, isolating and resolving problems, Tivoli software enables an organization to deploy a fully integrated application management solution to address all three dimensions of effective application management:

1. Transaction tracking — from end to end and across multiple system types, to quickly isolate problems within a particular run-time environment.
This view starts with the end-user perspective — by providing response time at the client — and then tracks the transaction throughout the entire composite application flow.

2. Root-cause analysis — deep-dive diagnostics and correlation within suspected subsystems to analyze and resolve the root causes of problems.
This view enables the subject matter expert to drill down into the transaction itself and examine the state of the code as it executes in test or production. The expert can then make use of these deeper views to correlate application state with the performance of tightly coupled systems, such as a database or back-office host. This often reveals the source of the performance problem.

3. Resource monitoring — tracking both the infrastructure and resource consumption that result from application load.
This view is pervasive — across all systems in support of each application run-time partition — to enable an organization to view the health of the underlying infrastructure, which is critical to composite application performance and availability.

The following subsections describe how Tivoli software enables organizations to effectively manage all three of these dimensions.

Three dimensions of effective application management
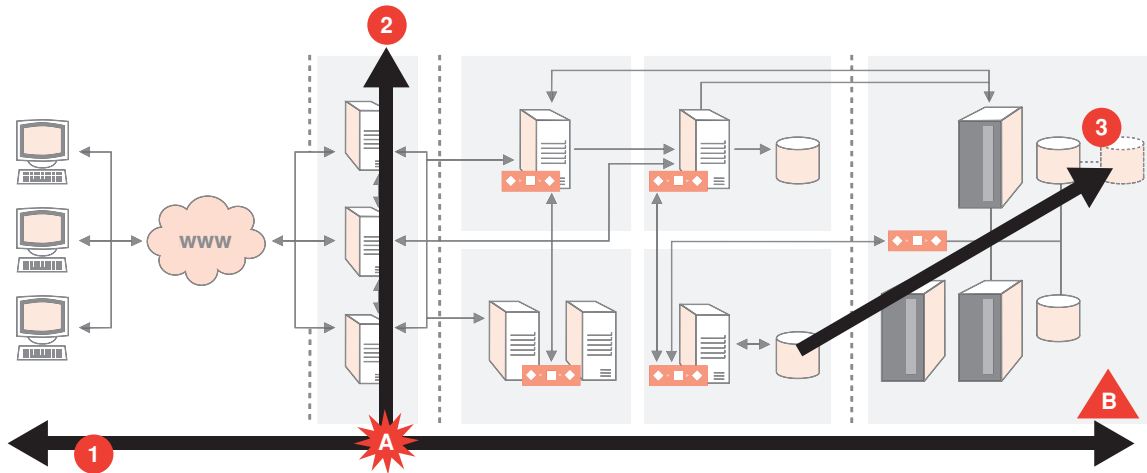
A complete application management solution encompasses integrated tools to address three dimensions:
1. Transaction tracking from end to end
2. Root-cause analysis when problems occur **(A)**
3. Resource monitoring, such as for proactively addressing potential problems when resources become overburdened **(B)**

Transaction tracking

Organizations derive substantial value from Tivoli application management software because it provides the breadth of coverage needed to track and optimize transactions from end to end, across mixed-vendor environments that consist of distributed and mainframe platforms and their subsystems (including J2EE, CICS, WebSphere MQ, IBM WebSphere Business Integration Message Broker and IMS). Tivoli software helps the IT staff adopt the end user's perspective both by monitoring individual transactions as they occur, and by generating synthetic transactions that simulate actual business processes to measure performance. Harnessing the information collected, administrators gain complete visibility into each step the transaction takes as it traverses enterprise systems.

Tivoli software helps an organization isolate problems using an automated discovery process that dynamically detects all transaction paths and automatically sets threshold values based on performance metrics observed in the production environment. When a threshold is exceeded, an alert is

Automate the discovery process and enable users to switch between role-based perspectives

issued and diagnostic data is passed to a business health console that administrators use to visualize performance trends that reveal problems. Once appropriate support personnel for a problem area are alerted, they can begin to remedy the problem immediately, with the context preserved as they move between different views of the data.

When a problem is detected and isolated in the transaction-tracking dimension, users in different support roles can easily switch perspectives. For example, an application support group can initiate the drill-down process in the root-cause analysis dimension directly from where it left off in the transaction tracking dimension — without having to start from scratch. During the problem triage process, the IT staff saves time, effort and resources.

Tivoli transaction tracking software also provides three ways to help an organization proactively prevent problems before they affect users:

1. Accurately measure application performance during both production and testing.
Organizations do not have to rely on educated guesses based on rough observations of throughput and response time. With Tivoli software, measurements are made in the application using "start" and "stop" API calls that conform to the Open Group's Application Response Measurement (ARM) API. If the calls aren't already present, they may be automatically injected into the running code. This response time data can be put into capacity planning models to help an organization precisely forecast infrastructure needs and thus meet variations in future demand economically.

2. Define situations and application-level performance traps and alerts.
Tivoli software enables an organization to detect anomalies related to code efficiency and stability — as well as to server and system resources. By evaluating instance-level events in both code and middleware resource layers, an organization can analyze highly granular performance metrics down to method-level execution — and do so in real time. This can help identify a problem early, before it negatively affects many users.

3. Leverage robotic transactions that simulate end-user experiences.
Using Tivoli software, organizations monitor the results of typical end-user transactions that are synthetically generated by a robot. Transactions are run as a set of discrete steps, each of which forms a part of the end-user business process. Because it monitors the successful completion of the transactions, and the time that each takes, the robot can send alerts about problems that end users might have – enabling organizations to implement fixes before end users experience the problems or need to call the help desk.

Align IT service quality with business needs

By leveraging these and other features of Tivoli software, an organization can implement many capabilities associated with *service delivery* – the ITIL process that aims to align IT service quality with the needs of the business. An organization can achieve these goals by defining requirements jointly with customers and establishing service level agreements (SLAs); developing availability, capacity, financial and IT continuity plans to support the SLAs; monitoring the service levels provided; reporting the results; and taking actions to eliminate problems that prevent the achievement of service level goals.

Tivoli software supports service delivery because it helps an organization:

- *Obtain performance and availability data from the end-user perspective.*
- *Identify performance and availability problems before service levels are breached, using real-time reporting and alerts.*
- *Feed data to Tivoli service level management tools to facilitate service level reporting.*
- *Perform historical reporting through the data warehouses, and thereby support forecasting of system capacity.*

Root-cause analysis
Tivoli software enables an organization to perform advanced, deep-dive analysis – and facilitate rapid problem resolution – in both mainframe J2EE/CICS/IMS and distributed J2EE environments. On a single screen, administrators can view instance-level data from multiple managed servers:

Highlights

- *Transaction instances that accumulate resident Java™ Virtual Machine (JVM) time with the ability to see deeply into the state of the application and its environment – all in real time and without instrumentation.*
- *Complete views of transactions that span from J2EE into legacy back-end systems, including fully correlated traces of execution steps within CICS and IMS environments – drawing on advanced native transaction collection agents within these middleware systems.*
- *Powerful memory diagnostics with tools that help IT staff quickly spot memory leaks and then determine the specific Java classes responsible.*
- *Historical trends with deep-dive analytical views that can be decomposed by application, transaction and server – down to instance-level method traces.*
- *Detailed information about suspected servers and coupled systems that enable composite applications.*

As a result, administrators don't have to spend time wading through simplistic "red-light/green-light" indicators on a server-by-server tree menu to begin the problem diagnosis process. Such an approach does not scale when administrators must monitor the large numbers of systems (such as distributed clusters connected to mainframes and other systems) that are common to most data centers. In contrast, Tivoli root-cause analysis groups logical systems together by business function – for example, those that support an inventory control system – then summarizes the performance of the systems as a whole. If and when performance delays begin to appear, easy-to-use tools enable administrators to quickly drill down to one or more affected servers in the group. These tools help administrators isolate probable causes to constrained resources or even individual transactions within the application.

Summaries and intelligent detail views help deliver a scalable solution

How do these Tivoli root-cause analysis capabilities work? Tivoli software correlates deep-dive performance data gathered across subsystems – not just J2EE, but also CICS, IMS and IBM WebSphere Portal – to pinpoint hotspots in application code, no matter how deep (or in what run-time

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environment) they might appear. Even administrators who are not familiar with an application's structure can use method-level diagnostics to identify a code problem and pass it on to the appropriate application architect or developer. Tivoli software offers comprehensive J2EE diagnostics and problem determination capabilities to help an organization detect, analyze and fix J2EE and composite application problems.

***Collect data natively, at the
instance level***

With Tivoli software, an organization has the advantage of collecting application data natively at the instance level; as a result, *all* transactions are visible to the application monitor – not merely those that have been instrumented. Tivoli software uses advanced agent-based data collector technology to parse each transaction and evaluate whether there is a performance issue, based on user-defined criteria.

For example, if application support analysts suspect there may be a problem with specific customer "buy" transactions, they can:

- *Monitor the actual elapsed time for every buy transaction.*
- *Clock the CPU consumed by each method invocation.*
- *Quickly narrow down a problem event that takes place within tens of thousands of methods that support the buy transaction.*

In this way, Tivoli software helps an organization minimize the time and effort of resolving problems. Developers can fix problems by viewing granular detail directly without having to recreate the problem on the programmer's desktop.

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Tivoli software enables organizations to enjoy the advantage of seamless linkage and performance visualization across all three dimensions of application management. Here's an example:

1. The organization detects and isolates a bottleneck in a composite transaction that spans J2EE and CICS.

2. An administrator clicks in context to a deep-diagnostics view of a correlated composite application trace, and thus can view each execution within both environments.

3. The software reveals the point at which the application hangs on a specific CICS resource.

4. The administrator clicks on the resource name to launch in context a session of the CICS performance management tool, then drills down into that resource to determine the root cause of the bottleneck.

Resource monitoring

Tivoli software enables an organization to perform comprehensive resource monitoring of all critical systems that support composite applications, such as IBM WebSphere Application Server, WebSphere Portal and WebSphere Business Integration (including WebSphere MQ, WebSphere Business Integration Message Broker and WebSphere InterChange Server), as well as CICS, IMS and data-center infrastructure.

Ultimately, Tivoli resource monitoring solutions enable the data-center operations staff to perform and automate a number of critical resource management tasks:

- *Optimize MQ configuration:*
  - *To enable administrators to manage configurations for WebSphere MQ queue managers from a central point of control, Tivoli solutions collect configuration information into a central repository.*
  - *Integrated prototyping and automatic propagation features enable multiple, distributed queue managers across multiple systems to maintain identical configurations by matching changes made to a model.*
- *Measure composite application performance over brokers and channels:*
  - *Tivoli software compares message arrival and departure rates for application queues to help an organization measure throughput and predict system behavior under different load profiles.*
  - *By visualizing trends in these rates, IT can accurately quantify scaling requirements for future demand.*
- *Monitor composite application resource metrics across different views:*
  - *Tivoli software preserves important problem context information, such as server, process and application state.*
  - *Leveraging the software's high degree of integration, subject matter experts can launch diagnostics cockpits in context when moving from resource monitors to deep-dive transaction views and even to portal-based views of correlated performance metrics derived from CICS and IMS environments.*

Tivoli software can help organizations effectively manage all three dimensions of application management. Tivoli software provides IT with the information needed to proactively identify performance issues, quickly perform deep-dive diagnostics and rapidly fix the problem.

- *Fine-tune WebSphere Business Integration Message Broker performance – Tivoli software:*
  - *Monitors message broker availability and if necessary, automatically restarts it.*
  - *Tracks the frequency and timing of message flows within the broker to identify changes in the way message flows are executed and helps meet service level agreements.*
  - *Obtains accurate baselines for broker performance during testing of new message brokers to help address offending message flows before they are put into production.*
- *Monitor the WebSphere InterChange Server – accurately track any defined collaborations to obtain early warnings before problems affect business applications.*

Tivoli software includes both supplied and customizable situations that organizations can use to detect and repair problems as they happen. Users can leverage customized displays of the information that's most relevant to them, including business, platform and resource views.

Integrate with application development and testing

Although the capabilities described in the previous sections are at the heart of managing composite applications, a complete application management solution encompasses much more. By integrating the Tivoli application management solution with the IBM Rational® Software Development Platform, an organization can facilitate information flow between production, testing and development teams – and drive the quality of its applications. Developers can leverage production application information to analyze and fix the root causes of problems, including those that are difficult or impossible to reproduce in testing. Testing scripts can be reused for production monitoring to help control operations and development costs.

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Part of a larger solution

Tivoli application management software is part of the larger IBM solution that enables an organization to:

- *Quickly provision new test environments for developers and production environments for operations.*
- *Scale test environments to accurately match production environments.*
- *Deploy applications into production using a repeatable process.*
- *Manage and monitor all data-center resources, such as network, databases, storage, business services and security.*

Importantly, IBM application management solutions and Rational Software Development Platform enable different IT staff members to see the information that matters most for their roles in the application development and management processes (including critical milestones within well-defined ITIL management processes):

- *Capacity planning teams can perform ITIL Configuration Estimates to record transaction data to establish baseline performance indicators and properly size infrastructure.*
- *Developers trace application flows, look for memory leaks and fix broken or inefficient code while working in IDEs and code profilers.*
- *Testers and performance tuners look for bottlenecks and memory leaks, under load and integration test conditions.*
- *Quality assurance and test staff evaluate key ITIL Production Eligibility Checkpoints and run ITIL Performance Regression Tests by comparing key previously quantified application performance benchmarks.*
- *Application support personnel troubleshoot problems throughout the IT life cycle.*
- *Operations support personnel ascertain problem severity and priority, and take an end-to-end view of performance problems.*

Conclusion

IBM Tivoli software offers a high-value solution that helps organizations address all three dimensions of effective application management: transaction tracking, root-cause analysis and resource monitoring. And by going one step further — integrating application management with application test and development tools — IBM enables organizations to automate and manage the entire software life cycle within the context of standard ITIL management processes.

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With IBM Tivoli application management software, an organization can:

- *Track individual transactions from end to end, across multiple system types.*
- *Quickly isolate problems – often before they impact end users.*
- *Leverage deep-dive diagnostics and correlation across subsystems to locate and resolve the root causes of problems.*
- *Monitor application servers and resource consumption to proactively prevent problems.*

For more information

To learn more about IBM Tivoli application management software, contact your IBM sales representative or IBM Business Partner, or visit **ibm.com**/tivoli