

Capacity Planning and Performance Tuning for Environments Using the BlackBerry Enterprise Solution

An Overview for IT Administrators and IT Managers

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Audience

This document is designed for IT administrators and IT managers and assumes a working knowledge of the following areas:

- BlackBerry Enterprise Server™ Software installation, configuration, administration, and architecture
- network management and administration
- performance metrics

Note: The content in this document is likely to have greater significance for small to mid-sized organizations with fewer than 500 BlackBerry® users.

Purpose

The success of the BlackBerry Enterprise Solution is a function of the integrity and performance of the BlackBerry user experience. This paper focuses on how to measure specific elements of the BlackBerry Enterprise Solution to allow success in both periods of stability and growth.

This document discusses the need for your organization to predict and effectively respond to its BlackBerry user needs by taking a proactive approach to managing the BlackBerry Enterprise Server environment. It discusses a methodology for measuring, analyzing, scaling, and tuning your enterprise's BlackBerry Enterprise Server environment. This methodology is summarized in a flow chart on page 6.

Note: See "Appendix A: Capacity planning terminology" on page 13 for a list of capacity planning and performance tuning terms and definitions that are used throughout this document.

Capacity planning: Essential, yet often overlooked

Most IT administrators can envision performance improvements. After all, getting the most from your systems—even as the demands on those systems constantly change and evolve—is a critical part of your job.

Capacity planning, although essential for maintaining an environment that responds to changing user and industry demands, is an activity that is rarely performed in many organizations. Commonly identified reasons for neglecting capacity planning include a focus on day-to-day tasks, a lack of organizational support for planning, and insufficient knowledge about what to measure and analyze.

The wireless environment is unlike other computer networks in that the user experience is critical to its acceptance and success. Users quickly adjust to the benefits of the wireless experience and become frustrated when the system is slower than usual, unreliable, or unavailable.

This document attempts to illustrate how capacity planning can work for your organization, explains why it is an important task, and suggests ideas to consider before getting started. Although you might not have a capacity planning approach in your organization at present, it is never too late to implement one.

Analyze the entire network environment

Although this document discusses the BlackBerry environment, it is essential to understand how capacity planning and performance tuning issues also relate to the network environment as a whole. Changes¹ to the BlackBerry Enterprise Server have the potential to impact the performance of the network environment because of an increased load on the mail servers (for example, Microsoft Exchange or IBM Lotus Domino) with which the BlackBerry Enterprise Server communicates. Often, only a percentage of users on any mail server is also enabled to use BlackBerry. Therefore, any negative impact on mail server performance has the potential to negatively impact both BlackBerry and non-BlackBerry users on any mail server that has been affected.

¹ Changes to the BlackBerry Enterprise Server that can impact the overall network environment include adding more users, enabling services like the BlackBerry Mobile Data Service, or upgrading to a new version of the BlackBerry Enterprise Server.

Identify the performance of your environment

Before you can respond to or even identify changes in your environment, you must be familiar with its current performance. A *performance baseline* provides a snapshot of your network environment, giving you information about how your environment is handling network traffic and allocating resources. Establishing a performance baseline is an essential part of a maintenance plan because it allows you to help predict or react to the following tasks or situations:

- planning for future growth
- implementing hardware and software upgrades only when they are required or beneficial, which cuts down on unnecessary spending
- determining your return on investment from software or hardware upgrades, which enables you to provide better business cases for upgrades to management
- analyzing trends and forecasting changes before they happen
- responding to personnel changes
- adapting and reacting to industry changes more quickly and easily

Documenting the performance baseline of your network environment should be a cornerstone of your maintenance plan.

When to measure your environment

Take monitoring statistics during a consistent, representative time for your environment. For instance, in many network environments, messaging traffic (including BlackBerry Enterprise Server redirection) tends to be heavy between 8:00 AM and 9:00 AM on Monday mornings and may offer an ideal opportunity to monitor the environment to see how the system handles heavy traffic loads. Likewise, messaging traffic in many environments tends to be light on weekends, so measuring the environment during a weekend may not provide a representative view of how the system handles traffic.

When to analyze your environment

It is important to monitor your network's performance baseline by measuring it at regular intervals so that it allows you to identify changes *before* they negatively impact the user. There are, however, significant events that change the environment and necessitate immediate measurement and analysis.

Event	Procedure	Comments
Add new BlackBerry users to the environment ²	<ol style="list-style-type: none"> 1. Assess the current performance level of your system. 2. Determine the performance impact of changing the environment. 3. If the performance impact is not acceptable, tune the current configuration for optimal performance, and then perform step 2 again. 4. If performance is still unacceptable, perform a more detailed analysis to determine where the performance bottleneck is occurring. 	You need to predict and then respond to the impact of adding a significant number of new BlackBerry users to the environment. To fully understand this impact, consider the type of BlackBerry user that you are adding to the BlackBerry Enterprise Server environment. See "Profile BlackBerry users" on page 7 for more information.
Add a new feature or features to the BlackBerry Enterprise Server	Complete the same steps outlined in "Add new BlackBerry users to the environment."	You need to identify how a new feature or features use system resources. For example, when you offer wireless applications or enable the BlackBerry Mobile Data Service for certain users, your environment changes. Understanding the impact of new features helps you scale the environment and determine your future requirements.
Upgrade software	Complete the same steps outlined in "Add new BlackBerry users to the environment."	You need to measure and then adjust how the features of the software use additional system resources. You need to analyze and provide justification of how the software upgrade is going to provide the return on investment that you expect.
Upgrade server hardware	Complete the same steps outlined in "Add new BlackBerry users to the environment."	You need to measure and then adjust how the hardware effects the environment. You need to analyze and provide the justification of how the hardware upgrade is going to provide the return on investment that you expect.

Components to analyze

One method to create a performance baseline is to measure server hardware and applications, including those used with the BlackBerry Enterprise Server.

² To establish a performance baseline each time the number of new users grows past a certain specified number, you may wish to take monitoring statistics. For example, a good rule of thumb might be to take monitoring data at 100-user increments.

BlackBerry Enterprise Server

Metric	Area to measure	Settings and considerations
Server hardware	Processor	The percentage CPU usage time should be less than 75%. If greater than 75%, consider adding additional CPUs. A 75% average is high and may indicate that there are spikes slowing down performance throughout the day. The processor queue length should be less than 2.
	Memory	The memory utilization should be less than 85% below total available physical memory.
	Disk	The average disk queue length should be less than the number of spindles in the disk array.
	Network interface	The output queue length should be less than 2. The bytes total per second allows you to determine traffic patterns and how they change as you add new users and features.
Applications	CPU usage of BlackBerryServer.exe	The BlackBerryServer.exe is designed to determine email redirection.
	CPU usage of BlackBerry Attachment Service components: <ul style="list-style-type: none"> • BBAttachServer.exe • BBConvert.exe 	The BBAttachServer.exe can quickly use up system resources. If you have several hundred or more users, this application could be using memory. Consider moving it to a stand-alone server. The BBConvert.exe is the process in the BlackBerry Attachment Service that converts attachments.
	CPU usage of the BlackBerry Mobile Data Service components <ul style="list-style-type: none"> • BMDS.exe 	The BMDS.exe has a significant impact on the BlackBerry Enterprise Server when it is performing a heavy push. In contrast, BMDS.exe does not usually have a large impact when performing a pull. Note: Pull, however, can have a large impact when content needs to be transcoded and there are multiple concurrent users receiving pulled information.

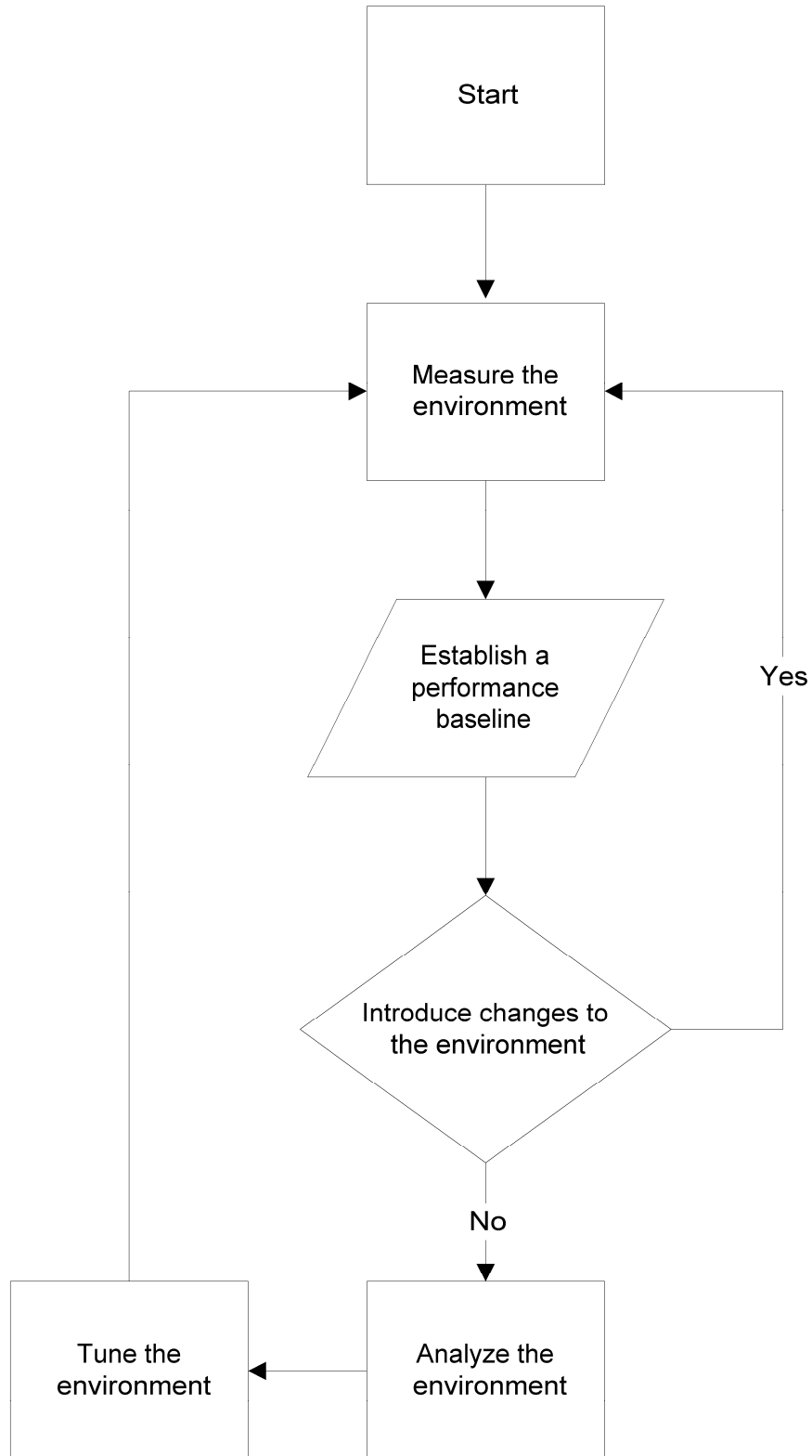
Debug log files

Debug logs are text files that contain information about server transactions, including startup information, operations, errors, and the status of the BlackBerry Enterprise Server. Although originally created for use by developers, debug logs can also help you monitor and maintain the network environment.

Because debug log files have the ability to show all transactions that occur on a particular server, they help you become familiar with the BlackBerry Enterprise Server and provide load profiling information that can be invaluable for capacity planning, business justification, and troubleshooting purposes. Debug log files also contain data that allows you to determine which users are using the organization's BlackBerry wireless devices and in what ways.

Best practices for debug log files

Best practice	Benefit
Although the debug log files are stored on the C: drive by default, move them to a drive that meets the following criteria: <ul style="list-style-type: none"> • does not contain either the BlackBerry Enterprise Server or operating system software • has ample disk space available 	If the circular logging function or the way you are archiving or deleting the log files fails, the disk that contains the operating system and BlackBerry Enterprise Server does not become full and cause a crash.
Do not conduct debug log analysis on the BlackBerry Enterprise Server.	Memory overhead can affect server performance.
Keep logs at level 4 (all events logged).	This gives you a more complete record of system activities.
Keep a running history of the debug log online.	—
Archive your log files instead of deleting them.	This gives you a record of your system in case you need to restore it.



Capacity planning and performance tuning cycle

Profile BlackBerry users

Establishing a performance baseline on the mail server before you add a BlackBerry Enterprise Server can help quantify the incremental impact associated with a specified group of users. Analyzing the number and usage profile of a group of BlackBerry users can assist in determining the incremental increase down to a profile of user. After the effect is identified, you have the potential to reasonably predict the impact of adding additional users of a particular profile on overall server performance. Likewise, measuring the metrics on the BlackBerry Enterprise Server before adding a group of users can help determine the incremental load of a particular profile of user.

BlackBerry users do not access their organization's environment in exactly the same way. Some BlackBerry users tax the environment more than others. Because your organization's BlackBerry users make different demands on the environment, you need to allocate network resources efficiently and wisely. For example, placing 10 high usage BlackBerry users on the same server might have the same effect as putting 50 low usage BlackBerry users on a BlackBerry Enterprise Server.

To help you understand how to respond to increasing demands on your network, you must analyze your BlackBerry users to determine how they are using their BlackBerry wireless devices by potentially creating categories of use, and then distributing users across servers according to the relative load they place on the server.

Note: You can use the debug log files to gather information about how your organization's BlackBerry users are using their BlackBerry wireless devices. See "Debug log files" on page 4 for more information.

Factors affecting user loads on the network

Factors that affect a BlackBerry user's load on the network include any of the following, either in isolation or in combination:

- the cumulative amount of time the BlackBerry user spends using the BlackBerry wireless device
- the time of day (morning, afternoon, or evening) or day of week (weekdays or weekends) that the BlackBerry user uses the BlackBerry wireless device
- the type of applications that the BlackBerry user uses the BlackBerry wireless device (for example, the use of email or applications that use the BlackBerry Mobile Data Service to access corporate data or browse the Internet)
- the amount of data the BlackBerry user moves across the network as a result of using the BlackBerry wireless device

Categorizing users

It may be advantageous to group users into categories of high, medium, and low levels of use. After users are categorized in this fashion, it could help you better manage your organization's environment when you need to change the BlackBerry Enterprise Server environment, move users between servers, or add new users to the BlackBerry Enterprise Server environment. The definition of high, medium, and low levels of use is a relative concept: what constitutes high use in one environment might not be considered high or even medium use in a different environment. Therefore, you must understand the current capacity of your environment, figure out how your BlackBerry users are using their BlackBerry wireless devices, and then allocate network resources accordingly.

Profile users

Consider profiling your BlackBerry users based on how much load they put on the BlackBerry Enterprise Server. The following steps outline a method for determining the load that a BlackBerry user places on a BlackBerry Enterprise Server:

1. Using the debug log files, calculate the average (or mean) number of messages sent each day for each BlackBerry user.

2. Categorize BlackBerry users who send more than twice as many messages per day based on the value you calculated in step 1 as *high level* users.
3. Categorize BlackBerry users who send less than half as many messages each day based on the value you calculated in step 1 as *low level* users.
4. Categorize the remaining BlackBerry users as *medium level* users.

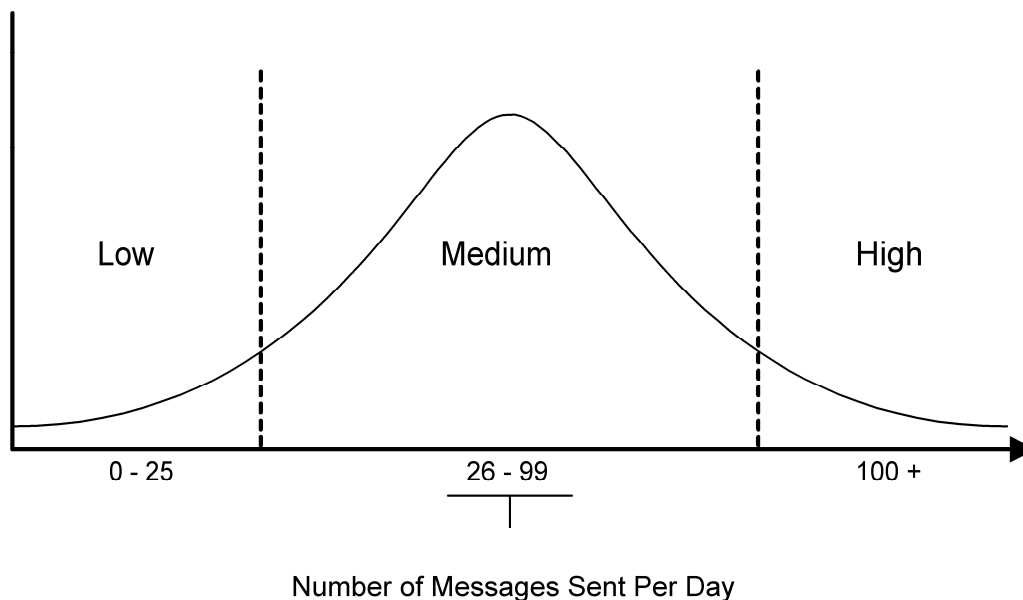
Note: Although dispersing heavy users across BlackBerry Enterprise Servers makes sense to distribute the load, you may also consider grouping BlackBerry users from mail servers that are local to the BlackBerry Enterprise Server on the same BlackBerry Enterprise Server(s), and BlackBerry users on remote mail servers on the same BlackBerry Enterprise Server(s). Grouping BlackBerry users in such a way helps to avoid the threading issues that could arise and compound when remote mail server users are spread across servers with local mail server users. In addition, this consideration should be balanced with a further consideration to group local users. Grouping local and remote BlackBerry users allows for greater environment stability.

An example of how to categorize users

Assume that the average number of messages sent each day for each BlackBerry user in your environment is 50. You can now create categories of use as follows:

Number of messages sent each day	Category of BlackBerry user
100 or more	High level BlackBerry user
26 – 99	Medium level BlackBerry user
Fewer than 25	Low level BlackBerry user

These categories are based roughly on the normal curve (also known as the bell curve). You can distribute the values on the normal curve to create your own categories. Note that the majority of your organization's BlackBerry users will likely fit into the medium level of use category.



Use of the normal curve to categorize users

Note: You can further classify your organization's BlackBerry users by job function (for example, executives and non-executives) and then categorize their use of their BlackBerry wireless devices into high, medium, and low levels of use.

Evolution of use

BlackBerry is a technology that is tied to the user experience. A BlackBerry user's usage pattern often evolves over time and can also be affected by the time of day.

New BlackBerry users

Upon obtaining a BlackBerry wireless device, it is not uncommon for a BlackBerry user's usage to spike and then trail off as the user learns about the features that are most beneficial. Adding a group of new BlackBerry users to a BlackBerry Enterprise Server can overload it, as opposed to adding a group of experienced BlackBerry users who have already figured out how to use their BlackBerry wireless device more judiciously in their everyday business activities.

Time of day

The BlackBerry user's use of the BlackBerry wireless device can vary with the time of day. For example, if you have a population of BlackBerry users who commute each day, BlackBerry use is likely to peak during commuting hours. If you can identify these times of day when your organization's BlackBerry users are commuting, you can better understand when to perform upgrades and performance analyses. Also, it may be advantageous to disperse your organization's BlackBerry users who commute onto different BlackBerry Enterprise Servers. Your performance baseline can give you valuable information about spikes in use based on time of day.

Performance monitoring tools

The BlackBerry Enterprise Server Software includes counters that allow you to use the Windows Performance monitoring tool. This tool is also sometimes referred to as *perfmon*. The counters allow you to use standard tools to monitor BlackBerry Enterprise Server statistics for your organization's active BlackBerry users. The server redirection counters show the SMTP connection state, in addition to the performance statistics that are available through the BlackBerry Server Manager.

Note: The performance statistics reflect server activity since the last time the BlackBerry Enterprise Server restarted.

Performance counter	Description
Connection State	Shows whether the BlackBerry Enterprise Server has an active connection to the wireless network.
Messages Expired	Shows the total number of expired messages for the session.
Messages Filtered	Shows the total number of messages to which the BlackBerry Enterprise Server applied filters and did not forward to a user's BlackBerry wireless device during the session.
Messages Queued For Delivery	Shows the total number of messages that are currently pending from a specific BlackBerry Enterprise Server to BlackBerry wireless devices.
Messages Received	Shows the total number of messages that were received by BlackBerry wireless devices from a specific BlackBerry Enterprise Server during the session.
Messages Received/min	Shows the average number of messages that were received each minute from a specific BlackBerry Enterprise Server by BlackBerry wireless devices during the session.
Messages Sent	Shows the total number of messages that were sent from BlackBerry wireless devices associated with a specific BlackBerry Enterprise Server during the session.
Messages Sent/min	Shows the average number of messages that were sent from BlackBerry wireless devices associated with a specific BlackBerry Enterprise Server each minute during the session.

Performance tuning your environment

Performance tuning has one overall goal: to get the most from your hardware. To optimize your overall network BlackBerry Enterprise Server environment, monitor it regularly and then respond to changes in its performance. The table that follows discusses the four areas to evaluate when tuning the performance of your BlackBerry Enterprise Server environment. Also included are recognized best practices that can help in allowing for return optimal performance in your BlackBerry Enterprise Server environment.

Area to evaluate	Considerations	Best practices
BlackBerry Enterprise Server architecture	The approach that you take to performance tuning depends on whether your network architecture is <i>centralized</i> or <i>distributed</i> .	<p>Make sure that latency is less than 35 milliseconds between the BlackBerry Enterprise Server and the mail server.</p> <p>Stay with a centralized architecture when possible. If your environment is distributed, then <i>regionalize</i> it to allow you to:</p> <ul style="list-style-type: none"> • administer all servers from a single console • simplify licensing processes • manage IT policies from one location
BlackBerry Enterprise Server hardware	<p>Analyze the following areas:</p> <ul style="list-style-type: none"> • memory • processor • disk • network 	<p>Minimize the number of mail servers with which the BlackBerry Enterprise Server communicates.</p> <p>Before upgrading hardware, make sure that performance lags are related to hardware, not latency.</p> <p>Use counters with performance monitor-specific tasks for all BlackBerry services and components.</p>
BlackBerry Enterprise Server management database	<p>With Microsoft Data Engine (MSDE), the BlackBerry Enterprise Server management database size is limited to 2 GB and the presence of the workload governor slows database operations after a specified number of concurrent connections to the database is reached.</p> <p>Microsoft® SQL Server does not have size limitations or a workload governor.</p>	<p>Locate the BlackBerry Enterprise Server management database in close proximity to the BlackBerry Enterprise Server/BlackBerry Mobile Data Service.</p> <p>Use a single BlackBerry Enterprise Server management database when possible.</p>
The BlackBerry Attachment Service	<p>Consider whether to install the BlackBerry Attachment Service locally or on the BlackBerry Enterprise Server.</p> <p>Consider using dedicated hardware for the BlackBerry Attachment Service.</p> <p>Make this decision based on your analysis of BBAttachServer.exe and BBConvert.exe.</p>	<p>If you are using a dedicated BlackBerry Enterprise Server server, gradually increase the cache size if memory is available and attachment rendering seems slow, or add conversion processes.</p> <p>If you decrease the maximum file size, the user experience can be negatively affected for BlackBerry users who download large files.</p>

Return on investment analysis

Business justification can be an important component of capacity planning. After deciding to purchase and implement a BlackBerry Enterprise Server, management or others involved in the decision-making process might

ask you to provide data that shows return on investment. To do so, you need to have a solid understanding, complete with data, of how BlackBerry users are using their BlackBerry wireless devices.

Note: Use the debug log files to gather information about how BlackBerry users are using their BlackBerry wireless devices. See “Debug log files” on page 4 for more information.

BlackBerry usage

One way to show return on investment is to analyze how a user’s message and other application usage (if the BlackBerry Mobile Data Service is enabled) changes upon receiving a BlackBerry wireless device. The table that follows includes examples of measures that you might employ in an analysis to show an increase in productivity or other improvements that are valued by a corporate decision-maker.

Area to measure	Procedure	Potential findings
The level of message use following receipt of BlackBerry wireless device.	<ol style="list-style-type: none"> 1. Profile a sample of BlackBerry users before they received a BlackBerry wireless device. 2. Measure the BlackBerry users message usage before they received a BlackBerry wireless device, and then measure it 30 days later, and again in 6 months. 3. Compare the results. 	Upon receiving a BlackBerry wireless device, BlackBerry users typically increase their messaging activities. In addition, BlackBerry users might decrease their use of mobile telephones or fax machines.
The change in messaging use patterns following receipt of BlackBerry wireless device.	Profile a sample of BlackBerry users to find out when they are using their BlackBerry wireless devices on an hourly and daily basis.	Upon receiving a BlackBerry wireless device, BlackBerry users access their messages at times when they normally would not have, such as on evenings and weekends.
The level of message use when the BlackBerry Mobile Data Service is introduced to the organization’s BlackBerry users (for example, in a sales force automation application).	<ol style="list-style-type: none"> 1. Profile a sample of BlackBerry users using a sales force automation application before it is available via the BlackBerry wireless device. 2. Measure the message usage of the same BlackBerry users 30 days after the BlackBerry Mobile Data Service is introduced, and again in 6 months. 3. Compare the results. 	<p>The BlackBerry user’s usage of the sales force automation application increases.</p> <p>The BlackBerry user’s message usage decreases as enquiries, such as pricing, contact information, current account status, or inventory can be handled by the user, instead of asking others for advice or data. This is a productivity benefit for the entire organization.</p>

BlackBerry non-usage

In addition to potentially finding out that BlackBerry users are increasing their messaging use via their BlackBerry wireless devices, you might also discover that some BlackBerry users are not using their device. Non-usage of a BlackBerry wireless device has a business cost associated with it. This can also be a part of your return on investment data.

BlackBerry wireless device turned off

If the user’s BlackBerry wireless device is turned off for long periods, server performance is affected because there might be a large number of expired or pending messages for the user and the BlackBerry Enterprise Server needs to scan and re-queue messages.

BlackBerry wireless device not used

If a BlackBerry wireless device is not being used, your organization still incurs a cost because you are charged for airtime even when the device is not used. After you identify unused devices, they can be re-distributed to workers in the organization who intend to use the device.

Summary

In a network environment, the only constant is change. Preparing for change, like adding new BlackBerry users, software or hardware, instead of reacting to it is essential for getting the most out of your BlackBerry Enterprise Server environment. After you measure and document how your network environment as a whole is performing, you can analyze the effect that any new events might have, and take action to help minimize the impact on your organization's users. This approach allows you to use resources wisely for only necessary software and hardware upgrades, illustrate return on investment when upgrades are implemented, and act on industry changes.

The methodology outlined in this document takes a strategic planning approach that helps you move towards being proactive rather than reactive, focusing on the plans of the future instead of the problems of the present. With your maintenance plan in place, and your performance baseline measured and documented, it allows you to be in a better position to react to the inevitable changes that come your way.

Related resources

Visit

<http://www.blackberry.com/knowledgecenterpublic/livelink.exe/fetch/2000/8067/645045/customview.html?func=ll&objId=645045&objAction=browse&sort=name> for information about the BlackBerry Enterprise Server product documentation.

Visit

<http://www.blackberry.com/knowledgecenterpublic/livelink.exe?func=ll&objId=278618&objAction=browse&ort=name> for more information about the performance characteristics of BlackBerry Enterprise Server for IBM® Lotus® Domino®.

Visit

<http://www.blackberry.com/knowledgecenterpublic/livelink.exe?func=ll&objId=278425&objAction=browse&ort=name> for more information about the performance characteristics of BlackBerry Enterprise Server for Microsoft Exchange.

Visit <http://www.blackberry.com/knowledgecenterpublic> for information about the BlackBerry Technical Knowledge Center.

Visit <http://www.blackberry.net/select/roi/index.shtml> to read the Ipsos-Reid study for information about return on investment and the BlackBerry solution. Visit <http://www.blackberry.com> for more information on BlackBerry products and services.

Appendix A: Capacity planning terminology

Capacity planning and performance tuning definitions are included to establish a common understanding of some of the terms and concepts used in this context.

Term	Definition
Business justification	Gathering information to show the worthiness of an investment or the total incurred cost of an expense to business decision-makers.
Capacity planning	The process of monitoring and measuring an environment so that it can respond to future growth and industry changes.
Capacity threshold	The level of CPU utilization that, if exceeded, will require the acquisition of additional CPU resources. Typical capacity thresholds range from 75% to 90%.
Network bottleneck	A network bottleneck affects network performance by slowing down the flow of information transmitted across networks. Network bottlenecks impact the user and should be avoided or minimized when possible.
Perfmon	An abbreviation for the Microsoft Windows® performance monitoring tool.
Performance baseline	A measure that informs the IT administrator how the network environment is performing at a specified point in time. The administrator can use the performance baseline to determine how changes in the environment affect performance.
Performance tuning	The process of adjusting the environment based on changes that are revealed through capacity planning.

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