HP Operations Manager i

for the Windows® operating system

Software Version: 8.10

Performance and Sizing Guide

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1 Introduction

This document provides performance data about HP Operations Manager i (HP OMi) 8.10 and tips for the fine-tuning of HP OMi installations.

What is HP OMi?

HP Operations Manager i (HP OMi) is an event and performance manager that creates an operations bridge between your business service management and your infrastructure management. HP OMi is the central point where all your IT infrastructure monitoring comes together in one console from which you can manage and resolve the problems in your IT environment.

HP OMi presents an end-to-end view of every event in the IT infrastructure and displays monitoring alerts to HP OMi operators. This information enables you to establish structured processes for solving problems. Using HP OMi, you can deal with most of the events in your infrastructure by running HP OMi tools and HPOM actions on any system where a problem has occurred.

HP OMi increases productivity and efficiency by finding and solving issues before business service quality degrades, allowing subject matter experts to focus on strategic activities.

For a detailed description of HP OMi, see the HP Operations Manager i Concepts Guide located at this web site:

http://h20230.www2.hp.com/selfsolve/manuals

How is this Document Organized

This document is arranged as follows:

Chapter 2, Performance Considerations explains the background to the focus of the performance tests and many attributes that affect the performance of the system.

Chapter 3, Executive Summary contains an outline of the scope of the tests, an overview of the tests executed, and a summary of the sizing and performance recommendations.

Chapter 4, Performance Recommendations contains performance-related tips, and configuration changes that you can follow to improve the performance of your HP OMi installation.

Chapter 5, Test Environment specifies the systems and software used for testing and their arrangement, along with the size of the tested environments, and the pre-test tuning configurations.

Chapter 6, Results details the tests that were executed, with each test description being divided into the following subsections: synopsis, scenario, results, and conclusions.

Audience

This document is intended for people who plan, size, set up, and maintain the HP OMi environment.

Prerequisites

Before applying the recommendations in this guide, make sure that you have knowledge of the concepts, architecture, and acronyms of the following products:

- HP Operations Manager i (HP OMi)
- HP Business Service Management platform (BSM)
- HP Operations Manager (HPOM)

Acronyms

Table 1 lists the acronyms used in this document.

Table 1 Acronyms

Acronym	Explanation
BSM	Business Service Management
CA	Custom Attribute
CI	Configuration Item of UCMDB
ETI	Event Type Indicator
HI	Health Indicator
HPOM	HP Operations Manager
HP OMi	HP Operations Manager i
KPI	Key Performance Indicator

Disclaimer

The results listed in this guide are valid only for the versions of HP OMi, BSM Platform, and HPOM listed in Table 2.

Table 2 Tested Products

Component	Version
HP Business Service Management Platform	8.02
HP Operations Manager i	8.10
HP Operations Manager for Windows	8.10 with patches: • OMW_00006 • OMW_00029 • OMW_00032
HP Operations Manager for UNIX	9.0

2 Performance Considerations

This chapter describes the HP OMi-related areas that have the greatest effect upon performance. These areas include:

- HP OMi UIs
- HP OMi event data processing
- HP OMi deployment arrangements
- Number of Gateway Servers configured
- Number of concurrently available UIs
- Hardware and infrastructure
- HPOM product used to forward events to HP OMi

Areas of Focus

The following three HP OMi areas have a significant effect on the performance of HP OMi experienced by a typical user and were the focus of these tests:

- Event Perspective operator user interface
- Health Perspective operator user interface
- Topology-Based Event Correlation (TBEC)

Event Perspective

The Event Perspective provides a Web-based user interface with a look and feel consistent with other HP BSM Platform software. This enables operations teams and application support staff to work with a single consistent and comprehensive view of the key business services defined in the UCMDB.

The Event Perspective contains the following panes:

- CI Tree View, displaying a list the objects in your monitored environment.
- Event Browser, displaying a list of the active events in your environment.
- Event Details, displaying more detailed information about the selected event.

These panes display information about the events received, filtered by the selected view or by another filter, and details of selected filter. The load on the system as an operator browses events is relatively low as it is only manipulating and displaying data that is directly related to the selected event.

Health Perspective

The Health Perspective provides a Web-based user interface that enables the operations teams to understand the health of the related infrastructure components that are discovered and stored in the UCMDB. The Health Perspective is updated dynamically when the status of the relevant infrastructure component changes or when structural changes take place, for example, as the result of the discovery process.

The Health Perspective contains the following panes:

- CI Tree View, displaying a list the objects in your monitored environment.
- Event Browser, displaying a list of the active events in your environment.
- Top View, displaying a hierarchical overview of the relationships between the different objects that make up the monitored environment and indicating the current health of the displayed objects.
- Health Indicator View, displaying a list of the health indicators that are used to calculate the availability and performance of the selected configuration item.

Health indicators and key performance indicators are used to determine the health of an object. HP OMi calculates how severe the problems directly associated with the selected object are and combines this information with any additional information available about dependent objects. The combined data is passed to calculation rules that evaluate and set the key performance indicators that indicate the overall health of an object. The processing required by the Health Perspective is appreciable and was investigated as part of these performance test.

Topology-Based Event Correlation (TBEC)

HP OMi Topology-based event correlation (TBEC) uses the detailed discovery and relationship information from the UCMDB to determine which event is the most likely cause of the reported problem. Operators are presented with a clear representation of which event they need to investigate and what symptoms can be ignored, eliminating duplicated corrective effort. TBEC provides reliable guidance and direction to operations staff, significantly increasing their productivity and effectiveness, whilst requiring minimal maintenance effort. Topology-based event correlation, if used intensively, can appreciably impact performance.

Main Attributes Affecting System Performance

There are many attributes that affect the performance of the system in different ways. This document describes their impact on the system performance. The following are the most important attributes:

- **HP OMi Deployment**

  As HP OMi is installed on the BSM Platform, its deployment is directly dependent upon the BSM Platform deployment. This deployment is selected automatically during installation, based on the hardware specification and operating system type. The following types of deployment were tested:

  — Enterprise

  — Standard

  There are two main differences between the deployment types:

  — Heap size for running some of the BSM Platform processes

  — 64-bit JRE for running some processes on the Data Processing Server of the BSM Platform

- **HPOM Management Server Hardware and Operating System Support**

  HP Operations Manager (HPOM) monitors the status and health of systems and applications. HPOM is used to receive events about important occurrences in your managed environment. These events are forwarded to HP OMi where they are evaluated.

  For a detailed description of HP Operations Manager and the Smart Plug-ins, see the corresponding documentation available from the HP Software Product Manuals web site:

  http://h20230.www2.hp.com/selfsolve/manuals

  The supported HPOM servers are:

  — HPOM for UNIX (used as the basis for testing the Enterprise deployment)

  — HPOM for Windows (used as the basis for testing the Standard deployment)

  In addition, some tests were executed with HPOM for UNIX for the Standard deployment and with HPOM for Windows for the Enterprise deployment because the type of HPOM server directly affects the event throughput rate in HP OMi. The two HPOM versions use different methods for forwarding events to HP OMi. Generally, HPOM for UNIX can provide a higher throughput than HPOM for Windows.

- **Gateway Servers**

  Increasing the number of Gateway Servers used as UI servers can enable the support of a higher number of concurrent UIs.

- **Concurrent UIs and UI Load**

  The number of concurrent UI users that can be supported is dependent on the type of activities they run and the loads that these activities place on the servers.

- **Usage of Event Type Indicators (ETIs) and Correlation**

  The Custom Attribute (CA) field of an event can be used to set ETI values, which are used in HP OMi to map HIs or calculate KPIs, depending on the deployed content-pack. This processing of the incoming data can impact performance.

Using correlation rules has a more significant impact on performance. The correlation process determines the cause events, which are then displayed in the event browser. Symptom events are identified by the correlation process, and are displayed in the Event Browser's Related Events tab of the associated cause event.

- **Hardware and Infrastructure**

  Host system attributes, including CPU speed, and RAM size, and infrastructure characteristics, including network speed, were monitored during the tests to make sure that the performance tests were not limited by the overloading of the host systems. The client-server network traffic generated by various UI activities was also investigated.

3 Executive Summary

This chapter summarizes the scope of the executed tests, their results, and recommendations for sizing and improving performance.

Test Scope

The main focus of these HP OMi performance tests was to measure the performance of HP OMi 8.10 in terms of event throughput rate, response time of some UI activities, configuration and synchronization of CIs, and client-server network traffic.

The full scope of the tests is summarized in the following list:

- **Events Throughput Rate with Multiple Open UI Sessions**
  - Varying the number of active UIs
  - Applying different Event Type Indicators
  - Handling of correlated events
  - Recovering from event storms
- **User Experience**
  - Varying the events throughput rate
  - Varying the number of active UIs
  - Event Perspective and Health Perspective page performance
  - Impact of the amount of persistent data on the user experience
  - Impact of the Health Perspective Top View size on the overall system performance
- **Configuration**
  - HPOM-UCMDB synchronization
  - Additional CIs and KPIs creation
- **Infrastructure**
  - Network traffic between client and server systems

HP OMi was tested on both Enterprise and Standard deployments. Each type of deployment was tested using both HPOM for Windows and HPOM for UNIX. This resulted in four main configurations for testing. However, some tests were not executed on all possible configurations.

Results Summary

The test results are divide into the effects of the following areas on performance:

- Effects of Deployment Type on Performance on page 18
- Effects of Event Processing on Performance on page 19
- Effects of User Actions on Performance on page 19

Effects of Deployment Type on Performance

Enterprise and Standard deployment of HP OMi 8.10 supports different UCMDB capacities. The Enterprise deployment was tested with 60000 nodes and the Standard deployment was tested with 12500 nodes in HPOM. For more details, see System Capacity on page 33.

- Enterprise Deployment of HP OMi 8.10
  - The following event throughput rates can be sustainably handled depending on some event parameters, concurrent UI activities and some other characteristics:
    - HPOM for UNIX: Up to 60 event/sec.
    - HPOM for Windows: Up to 20 event/sec.
  - Up to 15 concurrent UI sessions per Gateway server can be sustainably handled, with each session having four open Event Browser tabs in the Health Perspective page.

  For detailed information, see Event Throughput Rate with Multiple Open UI Sessions on page 37 and User Experience on page 40.
- Standard Deployment of HP OMi 8.10
  - The following event throughput rates can be sustainably handled depending on some event parameters, concurrent UI activities and some other characteristics:
    - HPOM for UNIX: Up to 45 event/sec.
    - HPOM for Windows: Up to 12 event/sec.
  - Up to 12 concurrent UI sessions per Gateway server can be sustainably handled, with each session having four open Event Browser tabs in the Health Perspective page.

  For detailed information, see Event Throughput Rate with Multiple Open UI Sessions on page 37 and User Experience on page 40.
- Using HPOM for UNIX to forward events to HP OMi provides a higher event throughput rate than if HPOM for Windows is used. For detailed information, see Event Throughput Rate with Multiple Open UI Sessions on page 37.
- Response time of the HP OMi UI, and network traffic between UI clients and Gateway Servers are independent of the type of HPOM server if you have the same event throughput rate in both types of HPOM. For detailed information, see UI Response Time on page 40.
- Additional Gateway Servers can be added to the system if more concurrent UI sessions are required. The test investigated the inclusion of a second Gateway Server and, as a result, nearly double the number of concurrent UI sessions was supportable for an Enterprise deployment. However, no improvement in the response time of the individual UIs is experienced.

  Note that the real, total workload on the entire HP OMi system depends on the type of activities in the UIs and frequency of these activities (“clicks in UI”).

Increasing the number of the concurrent sessions can lead to a degradation of the event throughput rate. Configurations with 3 or more Gateway Servers is also possible, but such configurations were not part of these tests. Before increasing the number of Gateway Severs, system behavior under typical customer workloads should be measured thoroughly, as adding another entry point for the UI can overload other parts of the system, such as the UCMDB, MAM, the Online Engine and the database. The multiple Gateway Server configuration was tested only for the Enterprise deployment. For detailed information, see Scalability Using Multiple Gateway Servers on page 52.

Effects of Event Processing on Performance

- The maximum event throughput rate of the system becomes lower as more operations are done on events. For example, the throughput for events only mapped to a certain CI in the UCMDB is expected to be higher than for events that are also used for setting ETIs or HIs, and participate in the KPI calculation.
- Correlation between the events decreases the maximum throughput.
- Auto-assignment of the event to a user group does not have any significant performance penalty.
- Topology synchronization and further UCMDB population (monitor CI creation) can take a significant amount of time (up to a number of hours, depending on the population size). Until this process finishes, the event throughput rate can be lower than otherwise expected.

For detailed information, see Event Throughput Rate with Multiple Open UI Sessions on page 37, HPOM - HP OMi Topology Synchronization on page 47.

Effects of User Actions on Performance

- The Health Perspective was used as the main working UI for these tests. Limiting use to only the Event Perspective, which generates a much lighter load on the system, would result in a higher number of concurrent UI sessions being supportable (not measured in tests done for this document).
- Event Perspective performance is good and the response time is usually about 1 sec. when multiple concurrent UI sessions are open. Under heavy load, the response time can extend but rarely exceeds 3-4 seconds.

  The only exception is the CI Tree View, from which you select a view to display the CIs filtered by this view, which also exhibits slow response times. However, the slow loading of the CI Tree View is only an issue when first opening the Event Perspective. After the CIs selected by the view are loaded, the CI Tree View has no perceivable impact on the performance of the Event Perspective.
- Health Perspective performance is strongly depending on the content of the Top View frame. For detailed information, see User Experience on page 40.

Sizing Recommendations

Sizing recommendations can be summarized into three main areas:

- Deployment type
- Dedicate a Gateway Server for HPOM for UNIX
- Apply Gateway Servers to suit the number of concurrent UI required and the way that they are expected to be used.

The following sections describe these recommendations in more detail and introduce the configuration changes that you can also make to optimize the performance of your HP OMi installation.

System Specifications

We recommend that you use the standard deployment for smaller environments up to 12500 CIs. Use the enterprise deployment for all environments larger than 12500 CIs.

For more details, see System Capacity on page 33.

You can start with less memory and disk space, and add additional memory and disks as required. However, if you start with less than 16 GB of RAM, and later add additional memory, you must reconfigure some BAC processes to run as 64-bit applications and make use of the additional memory.

Dedicated Gateway Server for HPOM for UNIX

The host system for the Gateway Server that interacts with the HPOM for UNIX management server should be reserved for this task alone due to the heavy processing demands of the database. HP OMi UIs should not be connected to this Gateway Server. It is preferable to specify faster processors in preference to more cores.

Currently for HPOM for Windows, any of the configured Gateway Servers can be used to connect to HPOM for Windows.

Supported Concurrent UIs

Per Gateway Server in an enterprise deployment, it is possible to support 15 UIs (8 UIs in a standard deployment) displaying the Health Perspective and each UI being updated every 30 seconds, while maintaining the maximum message throughput. If more UIs are used concurrently, the full event throughput can no longer be supported, nor can the Health Perspective UIs be used as intensely, mainly due to the lack of available processing power or memory. It is possible to support 40 UIs per Gateway Server when only displaying the Event Perspective, in conjunction with a reduced event throughput rate.

Additional UIs require the addition of a further Gateway Server. However, no tests have been executed with more than two Gateway Servers, and due to the inner architecture of the BSM platform, it is not recommended to exceed three Gateway Servers per installation (excluding the Gateway Server reserved for the connection to HPOM for Windows).

Configurations to Optimizing Performance

There are a number of performance-related tips, and configuration changes that you can follow to improve the performance of your HP OMi installation. These are described in detail in Chapter 4, Performance Recommendations.

The main areas that can be configured for improved performance are the following:

- Database Configuration
- System and Software Configuration
- HPOM Event Processing

The way in which the HP OMi UI is used also has an effect on performance and recommendations are also included.

4 Performance Recommendations

There are a number of performance-related tips, and configuration changes that you can follow to improve the performance of your HP OMi installation. These are described in detail in the following sections:

- Database Configuration on page 23
- System and Software Configuration on page 24
- HPOM Event Processing on page 26
- UI Usage and Performance on page 27

Database Configuration

For Oracle databases, the following additional indices can be applied in the HP OMi schema for better database performance:

```
<omi_schema>.filter_configurations("id", "version")

<omi_schema>.filter_severities("filter_id")

<omi_schema>.filter_duplicates("filter_id")

<omi_schema>.event_custom_attributes("event_id")

<omi_schema>.event_servers ("event_id")

<omi_schema>.eti_values("eti_id")
```

These are the indices applied during the performance tests, see Post-Installation Tuning on page 34.

Use the Oracle documentation for information about how to apply the indices on your HP OMi schema.

No other database tuning is required provided that it is installed and configured according to the *HP Business Availability Center Database Guide*.

System and Software Configuration

The following sections detail the recommended system and software configurations:

- Memory Expansion for HP OMi on page 24
- Enabling 64-Bit for HP OMi Backend Processes on page 24
- Heap Size Increase for HPOM for UNIX on page 25
- Kernel Parameter Tuning for HPOM for UNIX on page 25
- Virtual Memory Setting for Windows Systems on page 26

Memory Expansion for HP OMi

For large numbers of CIs, topology synchronization requires a 64-bit system with increased memory, for example 8GB for 60000 nodes.

It requires the following changes in the `<HPBAC_Home>\bin\opr-startTopologySync.bat` file of the HP OMi system:

Open the file for editing an change the following two lines from:

```
SET JAVA_HOME=%TOPAZ_HOME%\JRE

SET OPTIONS=%LOGOPTIONS% -Xms64m -Xmx1024m …
```

to:

```
SET JAVA_HOME=%TOPAZ_HOME%\JRE64

SET OPTIONS=%LOGOPTIONS% -Xms64m -Xmx8096m …
```

Enabling 64-Bit for HP OMi Backend Processes

If your system reports frequent out-of-memory (heap size) errors, enable 64-bit for the HP OMi backend processes. These errors are experienced usually if you are managing a large number of CIs, with many associated attributes, and many filters.

The Data Processing Server must have at least 16GB memory to use the 64-bit JRE for some processes.

To enable 64-bit for the HP OMi backend processes, on the Data Processing Server system, make the following configuration changes:

1. In the `%TOPAZ_HOME%\JRE64\bin` directory, make a copy of the `java.exe` file and name it **`opr-backend.exe`**
2. In the `%TOPAZ_HOME%\bin\opr-backend_run.bat` file, add the following line before the last two lines:

   ```
   SET ENABLE_64_BIT=1
   ```

3. Set content of the `%TOPAZ_HOME%\bin\opr-backend_vm_params.ini` file to:

   ```
   -Xms256m -Xmx2000m -XX:NewSize=32m -XX:MaxNewSize=96m
   -XX:PermSize=64m -XX:MaxPermSize=96m
   ```

4. In the **`%TOPAZ_HOME%\conf\opr-deployment.xml`** file, change configuration for the data Processing Server in the following line (9th line from the end of the file):

<process name="opr-backend" nanny="opr-backend" vm-params="...">

to

```
<deployment memory="16" memory-units="GB"
   serverType="Processing-ALL" system-type="amd-64">
   <processes>
     <process name="opr-backend" nanny="opr-backend"
       vm-params="-Xms256m -Xmx1350m -XX:NewSize=32m
       -XX:MaxNewSize=64m -XX:PermSize=48m -XX:MaxPermSize=64m">
     <allowed-services>
        <service name="OPR"/>
      </allowed-services>
    </process>
  </processes>
</deployment>>
```

Heap Size Increase for HPOM for UNIX

When synchronizing a large number of nodes (60000) running with HPOM for UNIX, memory problem on the HPOM for UNIX Tomcat server may be experienced. To prevent this memory problem, the heap size of the Tomcat server on the HPOM for UNIX system should be increased as follows:

```
cd /opt/OV/nonOV/tomcat/b/bin
ovtomcatbctl -setheapsize 1024
ovc -restart ovtomcatB
```

Kernel Parameter Tuning for HPOM for UNIX

The following HP-UX Kernel parameters should be changed on the HPOM for UNIX management server system to achieve maximum events throughput rate. These parameters were applied on the HPOM for UNIX host system for the performance tests.

Table 3 describes the Kernel configuration changes made on the HPOM for UNIX host system.

Table 3 HP-UX Kernel Configuration for HPOM for UNIX Host

Parameter	Used value	Default value	Module
NSTRPUSH	64	16	hpstreams
STRCTLSZ	4096	1024	hpstreams
sysv_hash_locks	512	128	pm_usync
vnode_hash_locks	512	128	fs

Virtual Memory Setting for Windows Systems

Make sure that you have set the Windows virtual memory size for the HPOM for Windows and HP OMi server systems in accordance with Microsoft's recommendation (1.5 x physical memory of the system). Not following this recommendation might cause significant performance degradation of the system.

HPOM Event Processing

The following sections detail the recommended HPOM event processing configurations:

- Max Bulk Size Setting for HPOM for UNIX on page 26
- Skip DCE Forwarding for HPOM for UNIX on page 26
- Gateway Server Selection on page 26

Max Bulk Size Setting for HPOM for UNIX

The HPOM for UNIX bulk forwarding mechanism is configured to send consignments of 20 events to HP OMi. If the rate of incoming events to the HPOM for UNIX management server is high (dozens of event/sec.), it can be advantageous to increase the bulk size to 200. However, in case of low event throughput rate, this increase to the bulk size can cause a significant delay between publishing the event by the HPOM agent and the moment when it can be seen in the HP OMi UI.

The following command on the HPOM for UNIX host system sets the bulk size to 200 events:

```
ovconfchg -ovrg server -ns opc -set OPC_FORWM_MAX_BULK_SIZE 200
```

Skip DCE Forwarding for HPOM for UNIX

By skipping DCE forwarding, a slight increase in forwarding performance from HPOM for UNIX to HP OMi can be achieved and some CPU load on the HPOM for UNIX server can also be reduced.

The following command on the HPOM for UNIX host system skips DCE forwarding:

```
ovconfchg -ovrg server -ns opc -set OPC_SKIP_DCE_FORWARDING TRUE
```

There is no disadvantage in setting this option. It avoids an unnecessary check as DCE forwarding it is not applicable in HPOM for UNIX installations with HP OMi.

Gateway Server Selection

Use strongest gateway server as the target for forwarding events from the HPOM management server if the system includes more than one Gateway Servers and their configuration is not the same.

Alternatively configure a load balancer to reduce the number of UI sessions on those Gateway Servers which handles the incoming traffic from HPOM.

UI Usage and Performance

The following sections detail the recommendations to improve HP OMi UI performance:

- Limit CIs Selected by a View on page 27
- Limit the Number of Open Event Browser Tabs on page 27
- Limit the Number of Open Event Browser Tabs on page 27
- Dashboard Layout Properties on page 27
- Reduce Event Cache Size on page 28

Limit CIs Selected by a View

The Health Perspective performance is highly dependent on the size of the view that appears in the Top View frame, both in terms of response time and the number of concurrent UI sessions that can be supported.

It is recommended to specify views that return a maximum of 3000 CIs. This can be done by modifying an existing view or creating a new view in the UCMDB View Manager. If necessary, define several views for the same CI type and map each view to a subset of the CIs of the relevant CI type. See sections Top View Size Impact - Varying the Event Throughput Rate on page 43 and Top View Size Impact - Varying the Number of UI Sessions on page 45 for detailed information about the impact on performance with different sized views.

You only see a sub-tree in the Top View frame and the full view size can only be seen in the UCMDB View Manager

Limit the Number of Open Event Browser Tabs

You can open up to 10 Event Browser tabs in either the Event Perspective or the Health Perspective in the same Web browser window. However, it is recommended that you open only as many Event Browsers as you need to prevent client performance degradation and excessive usage of system resources on the client system (host where the browser is opened). Internet Explorer can require up to 1GB RAM from the client host when 10 Event Browser tabs are open in the HP OMi UI.

Dashboard Layout Properties

The default maximum size of a view that can appear in the Top View is 10000 CIs. This can be increased up to 20000 CIs by changing the setting in the Admin Infrastructure settings page:

Admin → Platform → Infrastructure Settings → Dashboard Application - Dashboard Layout Properties → Displayed CI limit in Filters tab

However increasing this parameter can significantly reduce the performance of the Health Perspective and can reduce the entire system performance.

Reduce Event Cache Size

Memory problems may be experienced on the Gateway Server (especially in Standard deployments) when a large number of correlated events are received, for example, during an event storm. If memory problems are being experienced, it is recommended to reduce the event cache size (a.k.a. Console Cache) to between 5000 and 10000 events. The default value is 20000.

Admin → Platform → Infrastructure Settings → Operations Management - Event Cache Settings → Max Cache Level

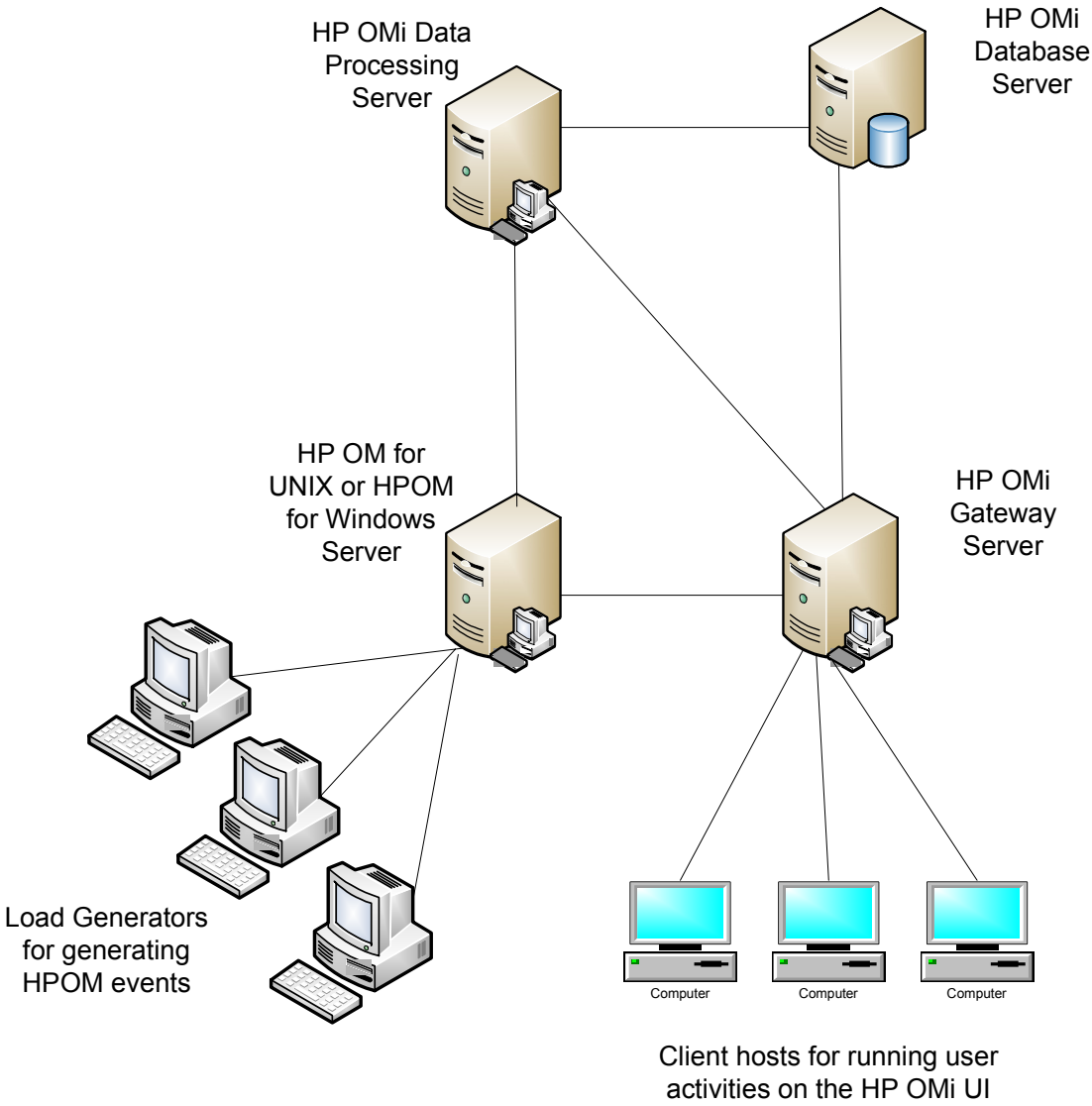
The disadvantage of reducing the cache size is that the database must be accessed to retrieve some events which otherwise would be in memory. The response time of accessing the database is slower than that of accessing data in RAM. However, in practice, the oldest data is removed from the cache first. This older information is usually of least interest, and is, therefore, rarely accessed. It is missing from the cache if the cache size is reduced, but the effect of the reduced response time is rarely experienced by users.

5 Test Environment

This chapter summarizes the hardware and software used, and the post-installation configurations made for the tests. In addition, some information is included about other equipment and settings used in these tests.

Figure 1 illustrates a typical HP OMi system environment.

Figure 1 Typical HP OMi System Environment



Hardware

The following sections detail the deployment configurations used for the performance tests:

- Enterprise Deployment on page 30
- Standard Deployment on page 31

Enterprise Deployment

Table 4 describes the computer systems, operating systems, and software used for testing the Enterprise deployment.

Table 4 Windows-based Systems for Testing Enterprise Deployment

Role	Computer Type	CPU	Memory	Network	Operating System and 3rd Party Software
Gateway Server	HP BL460c	Xeon 2.83 GHz Quad-Core	16GB	1 Gigabit	Windows 2003 Enterprise Edition 64-bit SP2
Data Processing Server					
HP OMi Database			8GB		Windows 2003 Enterprise Edition 64-bit SP2, Oracle 10.2.0.1.0
HPOM for Windows			4GB		Windows 2003 Enterprise Edition SP2, Oracle 10.2.0.1.0
HPOM for UNIX	HP Integrity rx6600 Server	Four Dual-Core, 64-bit Intel Itanium 2 9100 series processors 1.6 GHz/24 MB cache 8 logical processors (2 per socket)	96GB		HP-UX 11.31, Oracle 11.1.0

Standard Deployment

Table 5 describes the computer systems, operating systems, and software used for testing the Standard deployment.

Table 5 Windows-based Systems for Testing Standard Deployment

Role	Computer Type	CPU	Memory	Network	Operating System and 3rd Party Software
Gateway Server	HP BL460c	Xeon 2.66 GHz Dual-Core	4GB	1 Gigabit	Windows 2003 Enterprise Edition SP2
Data Processing Server					
HP OMi Database		Xeon 2.83 GHz Quad-Core	8GB		Windows 2003 Enterprise Edition 64-bit SP2, Microsoft SQL Server 2005 Enterprise Edition 64-bit (ver. 9.00.3042.00)
HPOM for Windows			4GB		Windows 2003 Enterprise Edition SP2, Oracle 10.2.0.1.0
HPOM for UNIX	HP Integrity rx6600 Server	Four Dual-Core, 64-bit Intel Itanium 2 9100 series processors 1.6 GHz/24 MB cache 8 logical processors (2 per socket)	96GB		HP-UX 11.31, Oracle 11.1.0

Software

The results listed in this guide are valid only for the versions of HP OMi, BSM and HPOM listed in Table 6.

Table 6 Tested Products

Component	Version
HP Business Service Management Platform	8.02
HP Operations Manager i	8.10
HP Operations Manager for Windows	8.10 with patches: • OMW_00006 • OMW_00029 • OMW_00032
HP Operations Manager for UNIX	9.0

System Capacity

Enterprise deployments of HP OMi 8.10 are expected to support greater UCMDB capacities than Standard deployments.

The number of nodes in HPOM used for testing each deployment type is as follows:

- Enterprise deployment: 60000 nodes
- Standard deployment: 12500 nodes

The nodes were added to the UCMDB using the Topology Synchronization tool.

An `opr-monitor` CI is created when an event that is associated by the CI resolution process with an existing CI in the UCMDB arrives for the first time. In practice, you may have 50000 CIs in the UCMDB but only 400 `opr-monitor` CIs as a result of receiving events which have resolved to 400 unique CIs.

In the test, for each node, an additional CI with type `opr-monitor` is created in UCMDB because the test involved sending events to each of the unique CIs. As a result, the total capacity in the UCMDB for the Enterprise deployment was 120000 CIs and 25000 for the Standard deployment.

The system capacity used in the tests is summarized in Table 7.

Table 7 System Capacity used in Tests

Parameter	Enterprise Deployment	Standard Deployment	Comment
Number of Nodes	60000	12500	Enterprise deployments support greater UCMDB capacities than Standard deployments.
Number of CIs in UCMDB	120000	25000	50% of total CIs are nodes imported using Topology Synchronization. For each node, HP OMi creates an additional `opr-monitor` CI in the UCMDB.

Post-Installation Tuning

The following sections detail the post-installation configurations used for the performance tests:

- HP-UX Kernel Configuration on page 34
- HP OMi Database Schema Tuning on page 34
- Agent Simulation and Message Generation on page 34

HP-UX Kernel Configuration

Kernel configuration changes were made on the HPOM for UNIX host system. For details of the recommended settings, see Kernel Parameter Tuning for HPOM for UNIX on page 25.

HP OMi Database Schema Tuning

Additional `<omi_schema>.*` indices were used for the Oracle HP OMi schema. For details For details of the recommended settings, see Database Configuration on page 23.

Agent Simulation and Message Generation

HPOM Agents were simulated using HP LoadRunner. HP LoadRunner very accurately simulates an agent connection and can be considered as a real agent. Each simulated agent creates a SSL connection and sends a message using a simple HTTPS call in exactly the same manner as a real agent. All nodes in the node groups are defined as standard HPOM managed nodes with names.

Table 8 describes specification of the LoadRunner hosts used to simulate HOPM for UNIX agents sending events to HPOM and simulating user experience on HP OMi.

Table 8 HP LoadRunner hosts used to Simulate HPOM for UNIX Agents

Role	Computer Type	CPU	Memory	Network	Operating System and 3rd Party Software
HPOM for UNIX	HP BL460x	2.83 GHz Quad Core	6GB	1 Gigabit	Windows 2003 Enterprise Edition SP2

Message Profiles

HP LoadRunner is capable of simulating different message types by defining the specific XML structure of the relevant HTTPS call. Processing within HP OMi, based on the event content was forced by setting a certain custom attribute (CA) values appropriate for the associated Content Pack definitions. The Custom Attribute (CA) field of a message can be used to set ETI values, and this can significantly impact performance. For example, by setting some ETI values you can force HP OMi to map HIs or calculate KPIs, depending on the deployed content-pack.

Another option to impact the system throughput using the message profile is to use the correlation between the events. Correlation was applied in the tests that check its impact on the system throughput and was created by using a dedicated correlation rule created for this purpose. The correlation rate was 1:3 (1 cause : 3 symptoms). The correlation was applied to 20% of events sent during these tests.

Miscellaneous

There are two main differences between Enterprise and Standard deployment configurations:

- More powerful hardware used for the Enterprise deployment (for details, see Hardware on page 30).
- Memory configuration of some HP OMi processes. This configuration is done automatically during the BSM Platform and HP OMi installation and the decision about the configuration is done based on the hardware capabilities.

Table 9 describes the main Max Heap Size configuration differences relevant to HP OMi.

Table 9 Max Heap Size Configurations

Process Name	Server	Max Heap Size, Mb	
		Enterprise deployment	**Standard deployment**
MercuryAS	Gateway Server	1360	1200
	Data Processing Server	1400	800
MessageBroker	Gateway Server	1400	512
	Data Processing Server	512	256
OPR-Backend	Data Processing Server	1350	512
UCMDB		4000 (64-bit JRE)	600
MAM		3000 (64-bit JRE)	512
Online_Engine		4000 (64-bit JRE)	600

6 Results

The following sections describes the executed tests in detail:

- Event Throughput Rate with Multiple Open UI Sessions on page 37
- User Experience on page 40
- HPOM - HP OMi Topology Synchronization on page 47
- Client-Server Network Traffic on page 50
- Scalability Using Multiple Gateway Servers on page 52
- Event Storm on page 54

Event Throughput Rate with Multiple Open UI Sessions

This test measured the system throughput in terms of events handled per second while varying an ETI value in the event passed as a Custom Attribute (CA). The ETI value affects the amount of processing performed by HP OMi, mostly on the Data Processing Server host, and the amount of information that the user receives.

Synopsis

This test measured the following metrics:

- Event throughput rate of the HP OMi database schema
- Event throughput rate of the HP OMi UI event cache (in practice, equal to the event throughput rate of the HP OMi database schema)

> Utilization of system resources was monitored during the tests to make sure that the performance tests were not limited by the overloading of the host system.

The following parameters were varied during the test:

- ETI CA value. Table 10 summarizes the custom attribute values used in this test.

Table 10 ETI CA Values

ETI Custom Attribute	CI Resolution	ETI Instantiation	HI Instantiation	KPI Calculation
Not set	✔	-	-	-
BatchJobs	✔	✔	-	-
BatchJobService	✔	✔	✔	-
CPULoad	✔	✔	✔	✔

- Correlation between events.
- The test was run on both Enterprise and Standard deployments. In most of executions, events were provided by HPOM for UNIX for the Enterprise deployment and by HPOM for Windows for the Standard deployment. Some tests were also executed on the Enterprise deployment with HPOM for Windows and on the Standard deployment with HPOM for UNIX.

Scenario

This test was conducted for the following scenario:

- Events generated by the HP LoadRunner hosts were sent to the HPOM management server and then forwarded to HP OMi.
- 20% of events were correlated in test runs, checking the correlation impact on event throughput.
- 5 concurrent UI sessions displaying the HP OMi Health Perspective were opened while running the test. Each session had 4 open Event Browser tabs (20 open tabs in total).
- Events were sent for all nodes registered in the relevant HPOM management servers. See System Capacity on page 33 for the precise capacity values used in the tests.
- The default size of the view that appears in the Top View of Health Perspective was applied. The view used was the `Systems_Infrastructure` view with the default size of 10000 CIs.

Results

Figure 2 illustrates the maximum event throughput rate achieved for Enterprise and Standard deployments of HP OMi connected to an HPOM for UNIX management server.

Figure 2 Maximum Event Throughput Rate from HPOM for UNIX

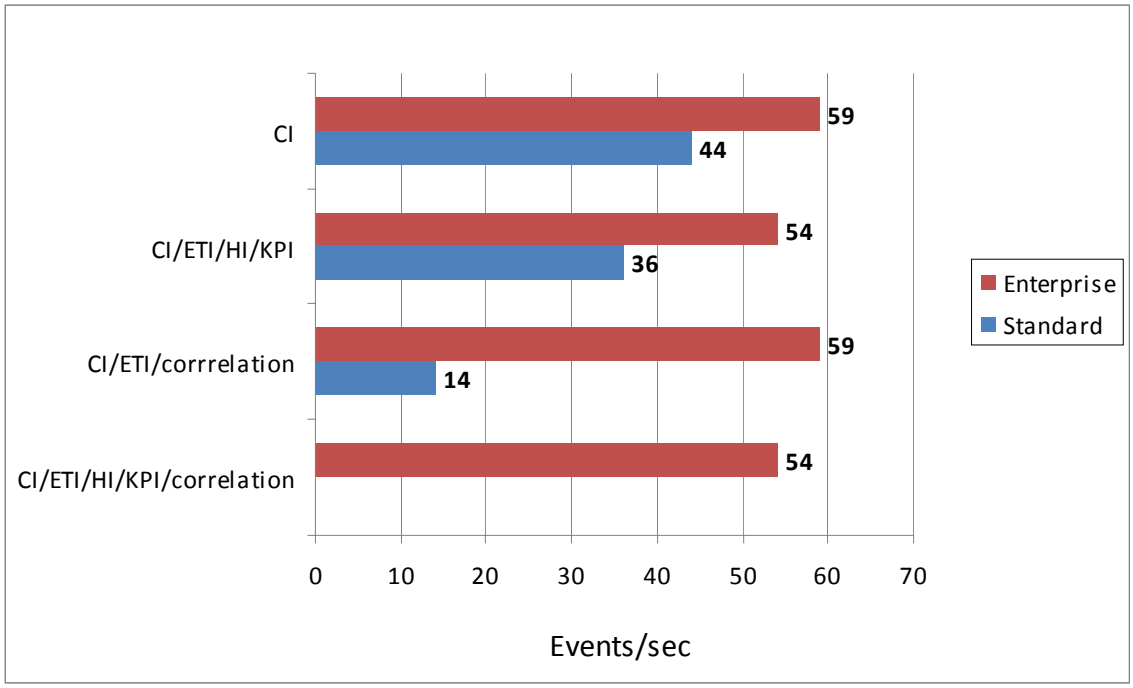
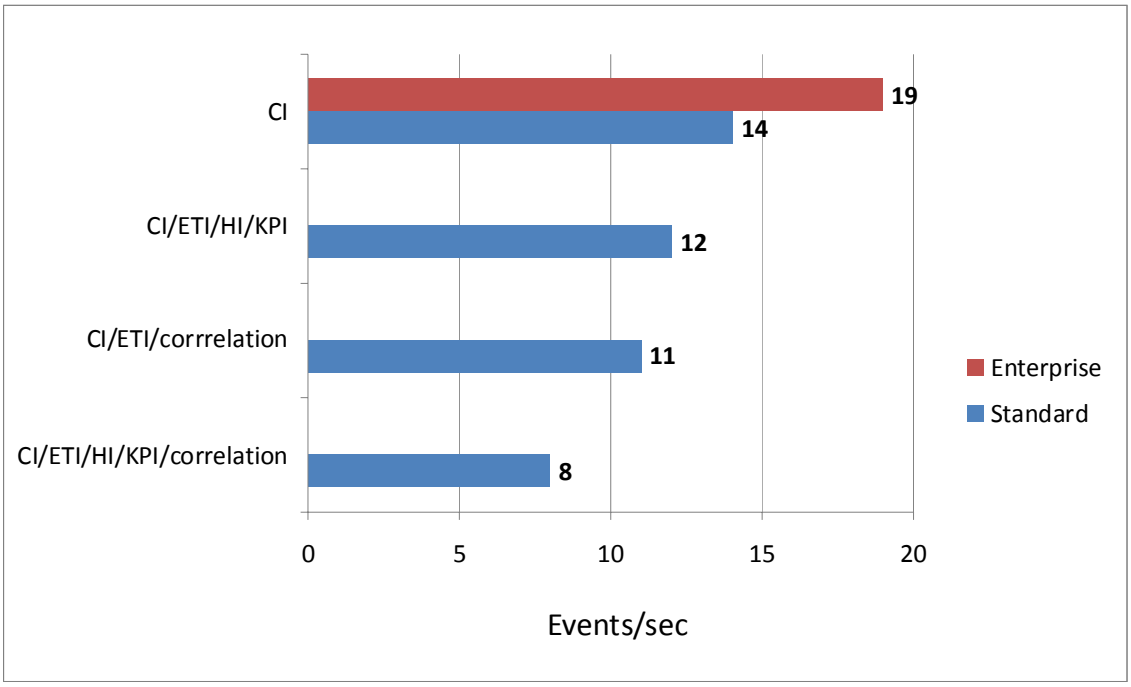


Figure 3 illustrates the maximum event throughput rate achieved for Enterprise and Standard deployments of HP OMi connected to an HPOM for Windows management server.

Figure 3 Maximum Event Throughput Rate from HPOM for Windows



Conclusions

- HPOM for UNIX management servers achieve significantly higher event throughput rates than HPOM for Windows management servers, as a result of using a different (bulking) forwarding mechanism in place of HPOM for Windows forwarding individual events in series.
- HP OMi demonstrates better performance when not required to map ETIs and HIs, and not calculating KPIs for incoming events. The reduction in event throughput rate depends on the specific ETI. Unnecessary mapping of ETIs and HIs, and calculating KPIs should be avoided.
- Event correlation reduces event throughput rate.
- Event throughput rate degradation due to processing of ETIs, HIs, calculating KPIs, and correlating events is much more significant for Standard deployments because such processing requires greater CPU time and memory.

User Experience

The user experience tests measured the HP OMi UI response time under varying event throughput rates with several concurrent open UI sessions. These tests also measured the impact of the view selected in the Health Perspective Top View on the user experience and the maximum number of concurrent UI sessions that can be opened when the size of Top View view changes.

The following sections describes the executed user experience tests in detail:

- UI Response Time on page 40
- Top View Size Impact - Varying the Event Throughput Rate on page 43
- Top View Size Impact - Varying the Number of UI Sessions on page 45

UI Response Time

The test measured the response time of the UI under varying event throughput rates when several concurrent UI sessions opened.

Synopsis

This test measured the following metrics:

- UI response time

> Utilization of system resources was monitored during the tests to make sure that the performance tests were not limited by the overloading of the host system.

The following parameters were varied during the test:

- Event throughput rate sent to the system.
- Amount of events initially stored in HP OMi database schema.
- The test was run on both Enterprise and Standard deployments. In most of executions, events were provided by HPOM for UNIX for the Enterprise deployment and by HPOM for Windows for the Standard deployment.

Scenario

This test was conducted for the following scenario:

- Events generated by the HP LoadRunner hosts were sent to the HPOM management server and then forwarded to HP OMi.
- 5 concurrent UI sessions displaying the HP OMi Health Perspective were opened while running the test. Each session had 4 open Event Browser tabs (20 open tabs in total).
- Events were sent for all nodes registered in the relevant HPOM management servers. See System Capacity on page 33 for the precise capacity values used in the tests.
- The test was executed with the default size of the view that appears in the Top View frame of Health Perspective. The default view was the `Systems_Infrastructure` view with the default size of 10000 CIs.
- HP OMi handled events with CIs, ETIs, HIs, and KPI calculations.

- The test was executed for two volumes of data stored in the HP OMi database schema:
  - Low volume (less than 10000 events)
  - High volume (more than 100000 events)
- The response time for the Health Perspective to update the Top View and the Health Indicator View after selecting a new event in the Event Browser was measured manually using one of the open UI sessions. The operation was assumed to be completed when all the Health Perspective panes were fully refreshed and ready for a subsequent action.

Results

Figure 4 illustrates the average response time of the "Select New Event" operation in the Health Perspective for Enterprise deployments of HP OMi connected to an HPOM for UNIX management server.

Figure 4 HPOM for UNIX - Enterprise HP OMi Health Perspective Response Time

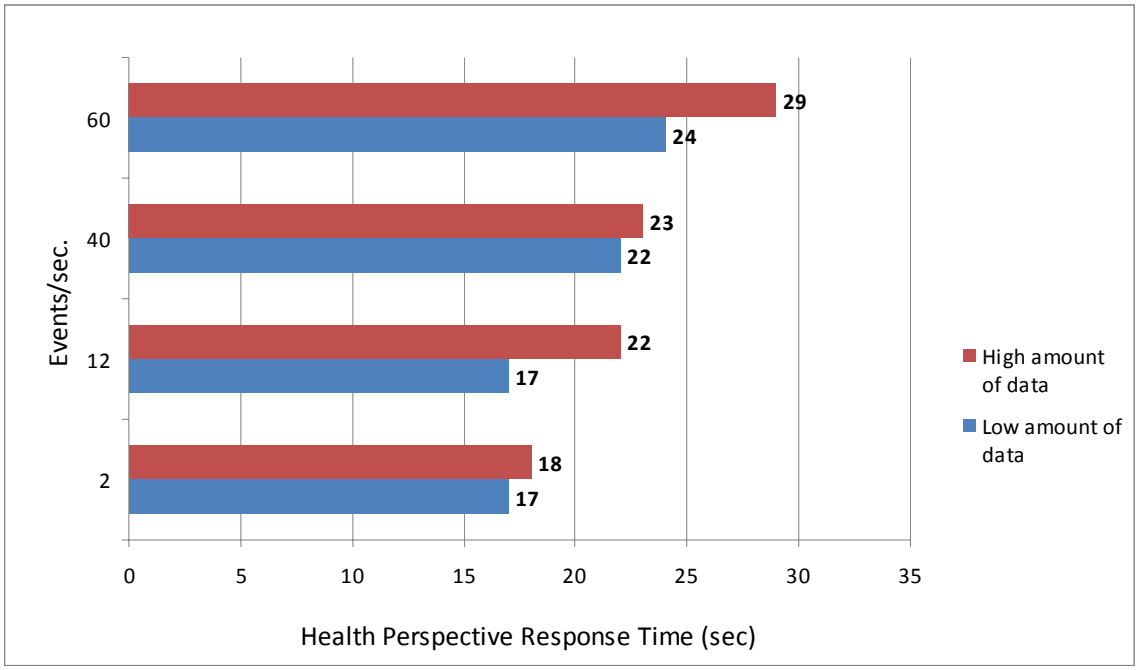
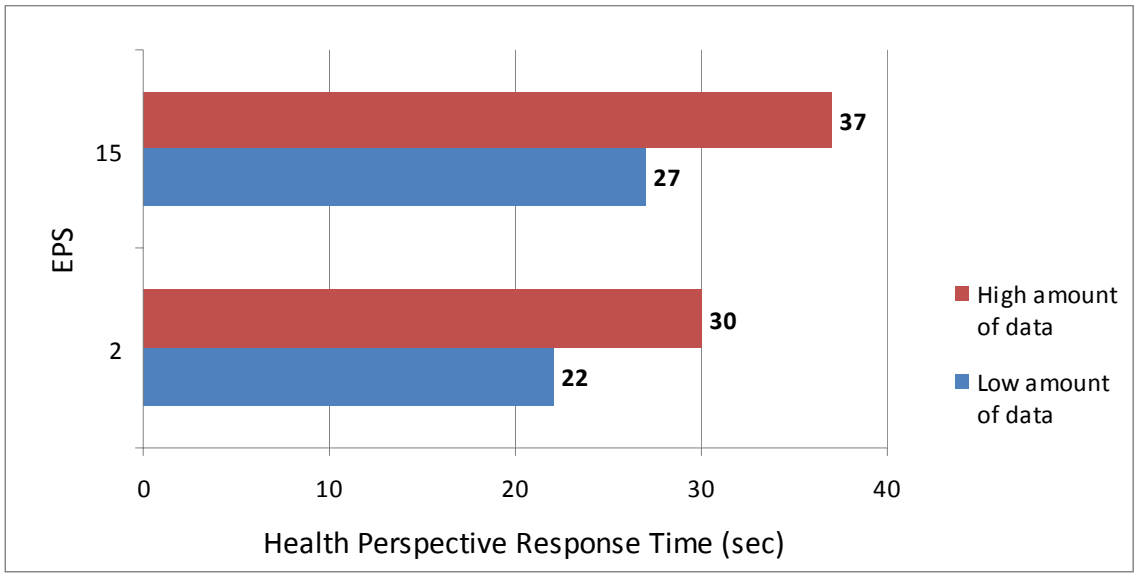


Figure 5 illustrates the average response time of the “Select New Event” operation in the Health Perspective for Standard deployments of HP OMi connected to an HPOM for Windows management server.

Figure 5 HPOM for Windows - Standard HP OMi Health Perspective Response Time



Conclusions

- Increasing the amount of events stored in the HP OMi database schema extends the response time of HP OMi UI. Increasing the number of stored events from 10000 to 100000 resulted in the lengthening of the response time by up to 30%.
- The main contributor to the response time of the Health Perspective is the Top View, the loading of which is dependent upon the size of the selected view.

  The CI Tree View, from which you select a view to display the CIs filtered by this view, also exhibits slow response times. However, the slow loading of the CI Tree View is only an issue when first opening the Health Perspective. After the CIs selected by the view are loaded, the CI Tree View has no perceivable impact on the performance of the Health Perspective.

  All other parts of the Health Perspective are displayed with minimal delay.
- The response time of Event Perspective page is much faster and ranges from 1 sec. (low amount of data in database) to 3 sec. (high amount of data in database). Graphical results are not shown for this use case.
- When using the Event Perspective, the overall load on the system is much lower than when using the Health Perspective.

Top View Size Impact - Varying the Event Throughput Rate

The loading of the Top View was found to be the main contributor to the response time of the Health Perspective. It also directly impacts some internal components of the BSM Platform used by HP OMi, such as the UCMDB, MAM, and the Online Engine.

This test measured the impact of the size of the selected view on the UI response time under varying event throughput rates.

Synopsis

This test measured the following metrics:

- UI response time
- Utilization of system resources

The following parameters were varied during the test:

- Event throughput rate sent to the system
- Number of CIs selected by the view
- The test was run on the Enterprise deployment with events provided by HPOM for UNIX

Scenario

This test was conducted for the following scenario:

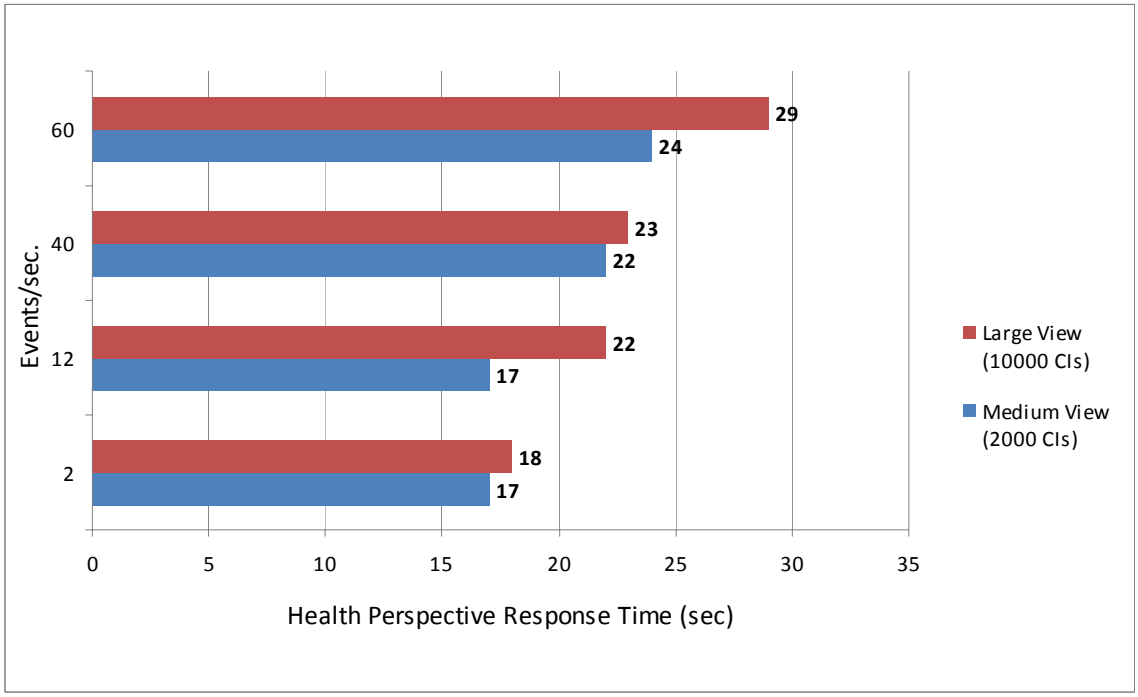
- Events generated by the HP LoadRunner hosts were sent to the HPOM management server and then forwarded to HP OMi.
- 15 concurrent UI sessions displaying the HP OMi Health Perspective were opened while running the test. Each session had 4 open Event Browser tabs (60 open tabs in total).
- Events were sent for all nodes registered in the relevant HPOM management servers. See System Capacity on page 33 for the precise capacity values used in the tests.
- HP OMi handled events with CIs, ETIs, HIs, and KPI calculations.
- The test was executed for two use cases:
  - view size selecting 10000 CIs (default).
  - view size selecting 2000 CIs

  For each use case, the average UI response time for several event throughput rate levels was found.
- The response time for the “Select New Event” operation in the Event Browser was measured manually using one of the open UI sessions.

Results

Figure 6 illustrates the average response time of the “Select New Event” operation in the Health Perspective for Enterprise deployments of HP OMi connected to an HPOM for UNIX management server when varying the size of the view. The impact of event throughput rate on the Health Perspective response time can be seen for the two use cases described in the test scenario of this test.

Figure 6 Enterprise HP OMi Top View Size Impact on Health Perspective Response Time



Conclusions

- The response time of the Health Perspective is predominantly dependent on the Top View response time, which actually represents the time taken to load the selected UCMDB view.

  The CI Tree View, from which you select a view to display the CIs filtered by this view, also exhibits slow response times. However, the slow loading of the CI Tree View is only an issue when first opening the Health Perspective. After the CIs selected by the view are loaded, the CI Tree View has no perceivable impact on the performance of the Health Perspective.

  All other parts of the Health Perspective are displayed with minimal delay.
- The Top View response time is strongly affected by the size of the view that it contains.
- It is recommended that you keep the view size relatively small (1000 - 3000 CIs). If necessary, define several views for the same CI type and map each view to a subset of the CIs of the relevant CI type using the UCMDB View Manager.
- The effect of increasing the event throughput rate for larger views is low, since the initial response time at the lowest event throughput rate (0 event/sec.) is relatively high.
- Using the Event Perspective instead of the Health Perspective as the default working UI increases the performance of the system significantly because it does not contain the Top View. However, some useful information available in the Health Perspective is not available in the Event Perspective.

Top View Size Impact - Varying the Number of UI Sessions

The loading of the Top View was found to be the main contributor to the response time of the Health Perspective. It also directly impacts some internal components of the BSM Platform used by HP OMi, such as the UCMDB, MAM, and the Online Engine.

This test measured the impact of the size of the selected view, and the number of open sessions on the UI response time under varying event throughput rates.

Synopsis

This test measured the following metrics:

- UI response time
- Utilization of system resources

The following parameters were varied during the test:

- Number of opened UI sessions
- Number of CIs in the view
- The test was run on the Standard deployment with events provided by HPOM for UNIX

Scenario

This test was conducted for the following scenario:

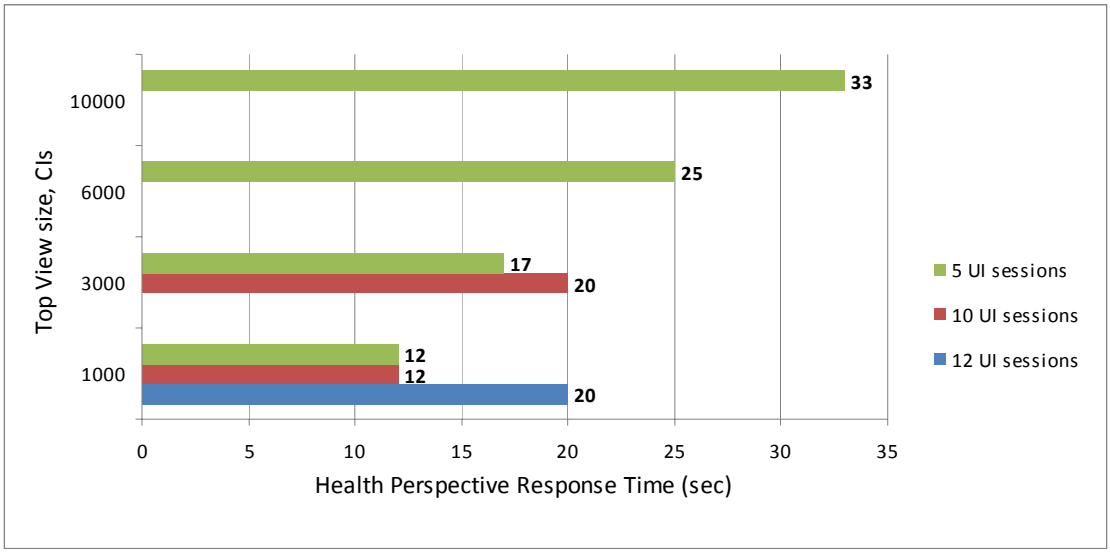
- Events generated by the HP LoadRunner hosts were sent to the HPOM management server and then forwarded to HP OMi.
- Event throughput rate of 40 event/sec. was used.
- Each UI sessions displaying the HP OMi Health Perspective had 4 open Event Browser tabs.
- events were sent for all nodes for which the view was mapped.
- HP OMi handled events with CIs, ETIs, HIs, and KPI calculations.
- The test was executed for four use cases:
  - view size selecting 10000 CIs (default)
  - view size selecting 6000 CIs
  - view size selecting 3000 CIs
  - view size selecting 1000 CIs

  For each use case, the average UI response time and maximum number of UI sessions that can be opened were measured.
- Average CPU utilization of 80% was used as the threshold for limiting the opening of further UI sessions. Heap memory usage and garbage collector activities were monitored to make sure that the garbage collector does not significantly impact performance.
- The response time for the “Select New Event” operation in the Event Browser was measured manually using one of the open UI sessions.

Results

Figure 7 illustrates the impact of the view size on the Health Perspective response time and the maximum number of views that can be simultaneously opened. Results are not shown for instances where the system resource utilization threshold was exceeded (for example, 12 open sessions with view size bigger than 1000 CIs).

Figure 7 Standard HP OMi Top View Size Impact on Health Perspective Response Time



Conclusions

- The response time of the Health Perspective is predominantly dependent on the Top View response time, which actually represents the time taken to load the selected UCMDB view.

  The CI Tree View, from which you select a view to display the CIs filtered by this view, also exhibits slow response times. However, the slow loading of the CI Tree View is only an issue when first opening the Health Perspective. After the CIs selected by the view are loaded, the CI Tree View has no perceivable impact on the performance of the Health Perspective.

  All other parts of the Health Perspective are displayed with minimal delay.
- The Top View response time is strongly affected by the size of the view that it contains.
- It is recommended that you keep the view size relatively small (1000 - 3000 CIs). If necessary, define several views for the same CI type and map each view to a subset of the CIs of the relevant CI type.
- The number of possible concurrent UI sessions is significantly reduced by increasing the Top View size.
- Using the Event Perspective instead of the Health Perspective as the default working UI increases the performance of the system significantly because it does not contain the Top View. However, some useful information available in the Health Perspective is not available in the Event Perspective.

HPOM - HP OMi Topology Synchronization

These tests measured the time required for the initial synchronization of HPOM CIs with the HP OMi servers. The tests included the time required for topology synchronization and assigning KPIs to the CIs created in UCMDB as the result of topology synchronization.

The following sections describes the executed topology synchronization tests in detail:

- Topology Synchronization on page 47
- KPI Creation for HP OMi-Related CIs in the UCMDB on page 48

Topology Synchronization

The test measured the duration of the initial synchronization between HPOM and HP OMi, including the creation of the relevant CIs in the UCMDB for the objects in HPOM.

Synopsis

This test measured the following metrics:

- Topology synchronization duration
- Utilization of system resources

The following parameters were varied during the test:

- The test was run on both Enterprise and Standard deployments. The number of nodes in HPOM was different for each deployment.

Scenario

This test was conducted for the following scenario:

- UCMDB is empty at the beginning of the test.
- Start topology synchronization and measure the time taken for the creation of the expected number of CIs in the UCMDB.
- Measure system resource utilization to discover possible bottlenecks.

Results

Table 11 shows the initial topology synchronization duration for each deployment.

Table 11 Initial Topology Synchronization Duration

Deployment	HPOM Server for Forwarding Events	Number of Nodes or Host CIs in the UCMDB	Topology Synchronization Duration (mins)
Enterprise	HPOM for UNIX	60000	80
Standard	HPOM for Windows	12500	5

Conclusions

- Topology synchronization with 12500 nodes in the Standard deployment was fast and unproblematic.
- To run the topology synchronization for Enterprise deployment successfully, additional configuration of the HPOM for UNIX web server and the HP OMi topology synchronization process was necessary. For details, see System and Software Configuration on page 24.

KPI Creation for HP OMi-Related CIs in the UCMDB

The test measured the performance of the system while it created KPIs for HP OMi-related CIs in the UCMDB. When an event for a certain CI is received by the UCMDB for the first time, an additional CI and the KPIs associated with the event are created automatically by UCMDB and linked with the target CI of the event. This additional CI is of type `opr-monitor`. Next, the KPI is assigned to it by the KPI enrichment service. As a result, some additional information is available for user in the Health Indicator View and Top View of the Health Perspective page.

Synopsis

This test measured the following metrics:

- KPI creation duration
- Duration of `Opr-monitor` CIs creation
- System resources utilization
- Event throughput rate

The following parameters varied during the test:

- The test was run on both Enterprise and Standard deployments. The number of nodes in HPOM was different for each deployment.

Scenario

This test was conducted for the following scenario:

- Topology synchronization had finished successfully before this test was started.
- Events generated by the HP LoadRunner hosts were sent to the HPOM management server and then forwarded to HP OMi.
- Event throughput rate of 40 event/sec. was used for the Enterprise deployment HP OMi with HPOM for UNIX and an event throughput rate of 2 event/sec. was used for the Standard deployment HP OMi with HPOM for Windows.
- One event for all registered CIs was sent at the beginning of the test. Next, the system was loaded with the same event throughput rate until the CIs and KPIs creation in UCMDB was completed.
- The test was stopped when all expected objects had been created in the UCMDB.
- The system resources utilization was measured to discover possible bottlenecks.

Results

Table 12 shows how long it took to populate the UCMDB with all `opr-monitor` CIs and KPIs (actual duration). It also shows the expected time to send the same number of events when all these objects are already created (Expected duration - based on the selected event throughput rate).

Table 12 UCMDB Population Time

Deployment	Event Throughput Rate (events/ sec)	Number of Nodes / Host CIs in the UCMDB	Number of opr-monitor CIs	Number of KPIs	Expected Duration - Based on Event Throughput Rate	Actual Duration
Enterprise	40	60000	60000	300000	25 min	5hrs
Standard	2	12500	12500	75000	1hr 35 min	1hr 45 min

Conclusions

- Creating KPIs for HP OMi-related CIs can take a significant time depending on the number of CIs. This creation process is only executed once, when the CI is first created in the UCMDB.
- Until the KPI is created, you cannot see the status of the selected CI in the Health Indicator View and the Top View of the Health Perspective or in the Dashboard.
- System throughput is significantly lower than the possible maximum during KPIs creation, due to additional processing by the UCMDB, the KPI enrichment service, and other BSM Platform components.
- If HPOM forwards events faster to HP OMi than HP OMi can process them, events are stored in the BSM Platform bus (that includes a persistent store, based on the file system). All the events are delivered to HP OMi UI but a significant delay may be experienced before these events are visible in the HP OMi UI.
- The maximum throughput during the KPI creation is hard to accurately estimate. The higher the throughput, the longer the time it takes to create the KPIs, and so there is a bi-directional impact.

Client-Server Network Traffic

This test measured the client-server network traffic for HP OMi application. The client is the host where the UI is running and the server is the Gateway Server host.

Synopsis

This test measured the following metrics:

- Network traffic per user activity in the UI
- Number of requests to the server per activity in the UI

The following parameters varied during the test:

- First and subsequent activity

Scenario

This test was conducted for the following scenario:

- Run the Fiddler Web Debugger, performed the required action, and collected the client-server communication data.
- Both Internet Explorer and Java caches were cleared before running the “First activity” use case.
- The test was executed with HP OMi database schema already containing a large quantity of event data.

Results

Table 13 shows table shows the network traffic for some UI activities.

Table 13 Network Traffic as a Result of UI Activities

Page	Activity	1st Execution	From Client (KB)	To Client (KB)	Total (KB)	Number of Requests
Health Perspective	Open	yes	213	50,638	50,851	283
Health Perspective	Open	no	157	1,113	1,270	187
Health Perspective	Select New Event	n/a	15	471	486	15
Event Perspective	Open	yes	189	49,377	49,566	255
Event Perspective	Open	no	108	440	548	104
Event Perspective	Select New Event	n/a	1	5	6	1

Conclusions

- The first access to the Event Perspective or the Health Perspective downloads many jar files to the client.
- Most of the first-access downloads are required by the CI Tree View, from which you select a view to display the CIs filtered by this view.
- The size of downloaded content and the number of requests to the server adversely impact the user experience when working over a WAN or a slow network.

Scalability Using Multiple Gateway Servers

This test measured the ability to provide more concurrent UI sessions by adding one or more Gateway Servers.

Synopsis

This test measured the following metrics:

- Event throughput rate
- Health Perspective response time
- Number of concurrent open UI sessions
- Utilization of system resources

The following parameters were varied during the test:

- Number of Gateway Servers
- Number of concurrent open UI sessions - to find the maximum

Scenario

This test was conducted for the following scenario:

- Events generated by the HP LoadRunner hosts were sent to the HPOM management server and then forwarded to HP OMi.
- Event throughput rate of 20 event/sec. and 40 event/sec. was used.
- All events were sent to the “primary” Gateway Server.
- UI separations distributed between 2 gateways.
- Each UI sessions displaying the HP OMi Health Perspective had 4 Event Browser tabs open.
- Average CPU utilization of 80% was used as the threshold for limiting the opening of further UI sessions. Heap memory usage and garbage collector activities were monitored to make sure that the garbage collector does not significantly impact performance.

Results

Table 14 represents the Health Perspective response time when using 1 or 2 gateway servers under a constant load of 20 event/sec. and the maximum number of concurrent UI sessions opened.

Table 14 Health Perspective Response Time and Number of Gateway Servers

Number of Gateway Servers	Concurrent UI sessions / Total No. of Views	Top View size (CIs)	Event Throughput Rate (events/ sec)	Health Perspective Response Time (sec)
1	16/64	2000	20	17
2	31/124	2000	20	22

Table 15 shows the maximum event throughput rate achieved when using 1 or 2 gateway servers and the maximum number of concurrent UI sessions opened.

Table 15 Maximum Event Throughput Rate and Maximum Number of Concurrent UI Sessions

Number of Gateway Servers	Concurrent UI sessions / Total No. of Views	Top View size (CIs)	Event Throughput Rate (events/sec)
1	16/64	2000	40
2	31/124	2000	20

Conclusions

- Adding the additional gateway and distributing the UI sessions almost doubles the possible concurrently open UI sessions.
- The response time degrades when using two fully loaded gateway servers.
- Opening the additional UI sessions on the second server reduces the throughput significantly.
- The potential risk of using multiple gateways is to overload the common BSM Platform components when frequently running heavy operations such as the Health Perspective with a large view in the Top View. The components most likely to become overloaded are: the UCMDB, MAM, the Online Engine, and the database. In the tests, the system functioned well with system resources utilization below the selected threshold, but only up to 50% of UI sessions were actively used (selection of incoming events) while the others remained open but inactive.
- Adding further Gateway Servers should only be attempted after thorough monitoring of the HP OMi system under real workloads for the specific customer to avoid overloading the Processing Servers.

Event Storm

This test checks the system's ability to handle an event storm - when a very high number of events are received by the system in a short period of time.

Synopsis

This test measured the following metrics:

- Utilization of system resources
- Time to handle events

The following parameters were varied during the test:

- Event throughput rate

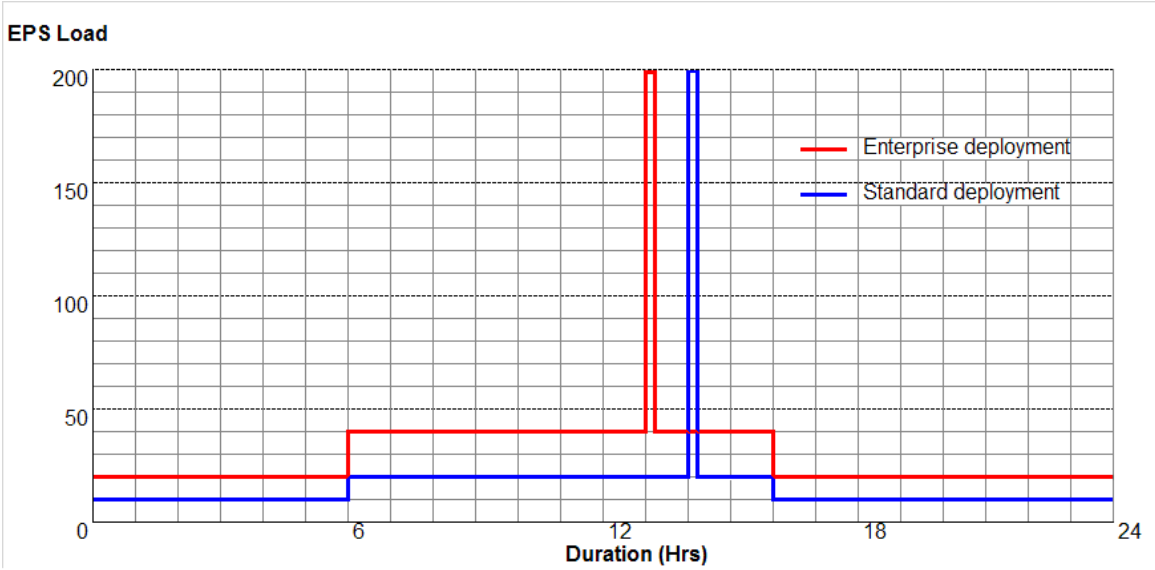
Scenario

This test was conducted for the following scenario:

- Events generated by the HP LoadRunner hosts were sent to the HPOM management server and then forwarded to HP OMi.
- The duration of the test was 72 hours. A 24 hours workload scenario was repeated 3 times. Each 24 hours cycle is represented in Figure 7 and simulates a typical 24 hour period with periods of low event throughput (night), higher event throughput (normal working hours), and an event storm.
- The event storm was applied 3 times during the test. A very high event throughput rate was set for a limited period of time (200 event/sec. for 10 minutes).

Figure 8 illustrates the impact of event storms on the event throughput rate.

Figure 8 Event Throughput Rate during Event Storms



Results

No events loss was experienced. All the events stored on the BSM Platform bus (that includes a persistent store, based on the file system) during the event storm were handled within 20 minutes (Standard deployment) or 30 minutes (Enterprise deployment) after the event throughput rate went back to a “normal” level.