Abstract
This guide provides procedures and guidance for monitoring compute nodes in Windows® HPC Server 2008 Beta 2. This guide focuses on cluster monitoring through the HPC Cluster Manager. It does not cover monitoring through System Center Operations Manager.
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This document provides procedures and guidance for monitoring compute nodes in Windows® HPC Server 2008 Beta 2.

Note
This document focuses on cluster monitoring through the HPC Cluster Manager. It does not cover monitoring through System Center Operations Manager.

Overview
A key step in monitoring and maintaining cluster health is to find any deviance from the normal operational state or performance. Windows HPC Server 2008 Beta 2 enables cluster administrators to view cluster and node status, identify problem areas, and drill down into the details for further investigation.

Another monitoring aspect that is critical to administrating a cluster is the status of cluster operations. Cluster administrators need to track the changes that have recently occurred or are still happening to their cluster. Windows HPC Server 2008 Beta 2 archives recent operations and allows the administrator to find the operation of interest and observe its progress.

Requirements
To monitor compute nodes, you need a cluster with Microsoft® HPC Pack 2008 Beta 2 deployed.

Steps for monitoring
This section describes the procedures that are used for monitoring compute nodes:

- Step 1: View cluster status at a glance
- Step 2: Drill down into individual node details
- Step 3: Customize metric collection
- Step 4: Correlate status of nodes, jobs, operations, and diagnostics
- Step 5: Monitoring ongoing operation progress

Step 1: View cluster status at a glance

To view cluster status at a glance
1. In Node Management, in the navigation tree, click Nodes to see all nodes in the cluster. You can click a filtered view to narrow the nodes to a subset of interest.
2. To see the node properties and metric values in List view, in the middle pane, select **List**. To customize the columns that are shown, in the Tool pane, click **Column Chooser**. Click column headers to sort the List view by a specific column.

3. In the List view, icons in each row indicate the Nodes that require administrator attention. There are three icons:
   - A red cross indicates unreachable and failed provisioning
   - A yellow warning sign indicates failed diagnostics tests
   - A blue circle indicates ongoing operations

4. To view a metrics heat map for the nodes of interest, in the middle pane, select **Heat Map**. In the heat map, every cell represents a cluster node, and values for the tracked metrics are represented by depth of color. You can view up to three metrics at a time on the heat map. Current displayed metrics with their color maps are shown at the top of the heat map. In the List view, you can add metrics.

   **Note**
   To customize the range and color of a heat map metrics, on the **Toolbar**, click **Options**, and then click **Customize View**. This opens a dialog box where you can set the **Maximum** and **Minimum** metrics for the heat map, the **Rollup method**, and the **Color map** for each metric.

   **To view status and performance charts**
   1. To view charts that show the aggregated status and performance information for the cluster, in the navigation tree, in **Charts and Reports**, click **Monitoring Charts**.
   2. You can add additional charts by selecting a metric from the list.

**Step 2: Drill down into individual node details**

**To view detailed information for an individual node**
1. In **Node Management**, in the Node List view, click a node to view details in the details pane (for example, hardware, operating system properties, or current metric numbers). You can also double-click the node to open a separate dialog box that shows this information.

   2. To view a node’s performance over time, in the Actions pane, click **View Performance Charts**. On this page, you can select individual metrics to chart.
   3. To view events that are generated by Windows HPC Server 2008 services on a selected node, click **Open Event Viewer**.
   4. To open a remote desktop session to the node(s) that allows you to access the compute node(s) directly, click **Remote Desktop**.

**Step 3: Customize metric collection**

**To add any perfmon counter to the heat map and performance charts**
1. Create an XML file that describes the metric to add. (See MetricsFileFormat.xsd in the Appendix for the XML schema. Also included in the Appendix is a sample XML file that adds the metric CPU % Idle
Time. You can see more examples by exporting an XML file that contains current heat map metrics: Use the Windows PowerShell™ cmdlet `Export-HpcMetric`.

2. Import the XML file that describes the new metric by using the Windows PowerShell cmdlet `Import-HpcMetric`.

3. Within five minutes, the new metric appears in **Heat Map and Performance Charts**.

4. To change an existing metric collection (for example, sampling frequency), import the XML file that describes the metric to overwrite an existing setting.

5. To remove a metric from the collection, use the Windows PowerShell cmdlet `Remove-HpcMetric`.

**Note**

To view usage for the Windows PowerShell cmdlet mentioned above, in the Windows PowerShell, open a Command Prompt window, and type `Get-Help <cmdlet> -Detailed`.

### Step 4: Correlate the status of nodes, jobs, operations, and diagnostics

Correlating the monitoring information between nodes, jobs, and other aspects of the cluster has traditionally been difficult for cluster administrators. Windows HPC Server 2008 solves this issue by allowing the administrator to pivot through this information while keeping the same context.

**To correlate the status of nodes, jobs, operations, and diagnostics**

1. In **Node Management**, from the Node List view or Heat Map view, select the nodes you want status on.

2. In the Actions pane, click **Pivot To**, and then choose **Jobs**, **Failed diagnostics**, or **Operations** for the selected nodes. Pivoting paths that are supported include:
   - **Nodes** Jobs, Failed Diagnostics, Operations
   - **Jobs** Nodes
   - **Diagnostics** Failed Nodes, Operations (Progress of the test)

### Step 5: Monitoring ongoing operation progress

**To monitor the progress of ongoing operations**

1. In **Node Management**, in the navigation tree, click **Operations**. A list of all cluster operations from the past seven days appears.

2. Use the filter fields to filter the operations by **Definition**, **Node**, and (last) **Updated**. You can also click the filters in the navigation tree to view operations by **Status**.

3. Click an operation, and in the Details pane, you can see a detailed log of the operation that you selected. If the operation is still in progress, the log is updated in real time.

**Alternatively**

- In Node view, select one or more nodes, and then in the Actions pane, click **Operations for the node**. This takes you to an operations view that is filtered by the selected nodes.
The following table defines the operation status reports:

<table>
<thead>
<tr>
<th>Operation Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archived</td>
<td>Operation is more than 24 hours old or diagnostics test has been cleared. When an operation is archived, it is removed from other status reports.</td>
</tr>
<tr>
<td>Committed</td>
<td>Operation has completed successfully</td>
</tr>
<tr>
<td>Executing</td>
<td>Operation is still in progress</td>
</tr>
<tr>
<td>Failed</td>
<td>Operation has failed to execute, is being reverted, or has failed to revert</td>
</tr>
<tr>
<td>Reverted</td>
<td>Operation has reverted after failure or cancellation</td>
</tr>
</tbody>
</table>

Logging bugs and feedback

To report bugs about monitoring features, send Microsoft the management logs from both the head node and problematic compute nodes.

1. On the head node, and any compute nodes that are experiencing problems, set the tracelevel value under the HKEY_LOCAL_MACHINE\Software\Microsoft\hpc registry key to 4.
2. Restart the service.
3. Copy the management log from the following folder: C:\Program Files\Microsoft HPC Pack\Data\LogFiles\HpcManagement.log.

Appendix

MetricsFileFormat.xsd

```xml
<?xml version="1.0" encoding="utf-8" ?>
<xs:schema id="MetricsFileFormat"


elementFormDefault="qualified"

xmlns:xs=http://www.w3.org/2001/XMLSchema

blockDefault="#all">
```
<xs:element name="Metrics" type="MetricsList" />

<xs:simpleType name="SampleRate">
  <xs:restriction base="xs:string">
    <xs:enumeration value="Second"/>
    <xs:enumeration value="Minute"/>
    <xs:enumeration value="Hour"/>
    <xs:enumeration value="Day"/>
  </xs:restriction>
</xs:simpleType>

<xs:simpleType name="StoreRate">
  <xs:restriction base="xs:string">
    <xs:enumeration value="Never"/>
    <xs:enumeration value="Minute"/>
    <xs:enumeration value="Hour"/>
    <xs:enumeration value="Day"/>
  </xs:restriction>
</xs:simpleType>

<xs:simpleType name="MetricTarget">
  <xs:restriction base="xs:string">
    <xs:enumeration value="ComputeNode"/>
    <xs:enumeration value="HeadNode"/>
    <xs:enumeration value="Cluster"/>
  </xs:restriction>
</xs:simpleType>

<xs:simpleType name="HardwareSensorType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="Temperature"/>
    <xs:enumeration value="FanSpeed"/>
    <xs:enumeration value="Voltage"/>
  </xs:restriction>
</xs:simpleType>
<xs:simpleType name="MetricCalculation">
  <xs:restriction base="xs:string">
    <xs:enumeration value="AveragePerNode"/>
    <xs:enumeration value="AverageAllNodes"/>
    <xs:enumeration value="SumPerNode"/>
    <xs:enumeration value="SumAllNodes"/>
  </xs:restriction>
</xs:simpleType>

<xs:complexType name="MetricsList">
  <xs:choice maxOccurs="unbounded">
    <xs:element name="PerformanceCounterMetric" type="PerformanceCounterMetric" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="HardwareMetric" type="HardwareMetric" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="CalculatedMetric" type="CalculatedMetric" minOccurs="0" maxOccurs="unbounded"/>
  </xs:choice>
</xs:complexType>

<xs:complexType name="MetricType" abstract="true">
  <xs:attribute name="Name" type="xs:string" use="required"/>
  <xs:attribute name="DisplayName" type="xs:string" use="required"/>
  <xs:attribute name="SampleRate" type="SampleRate" use="required"/>
  <xs:attribute name="StoreRate" type="StoreRate" use="required"/>
  <xs:attribute name="Description" type="xs:string" use="required"/>
  <xs:attribute name="Unit" type="xs:string" use="required"/>
  <xs:attribute name="MetricTarget" type="MetricTarget" use="required"/>
  <xs:attribute name="Minimum" type="xs:float" use="optional"/>
  <xs:attribute name="Maximum" type="xs:float" use="optional"/>
</xs:complexType>

<xs:complexType name="PerformanceCounterMetric">
  <xs:complexContent>
    <xs:extension base="MetricType"/>
  </xs:complexContent>
</xs:complexType>
<xs:attribute name="Category" type="xs:string" use="required"/>
<xs:attribute name="Counter" type="xs:string" use="optional"/>
<xs:attribute name="Instance" type="xs:string" use="optional"/>
</xs:extension>
</xs:complexContent>
</xs:complexType>

<xs:complexType name="HardwareMetric">
<xs:complexContent>
<xs:extension base="MetricType">
<xs:attribute name="SensorType" type="HardwareSensorType" use="optional"/>
<xs:attribute name="SensorInstance" type="xs:string" use="optional"/>
</xs:extension>
</xs:complexContent>
</xs:complexType>

<xs:complexType name="CalculatedMetric">
<xs:complexContent>
<xs:extension base="MetricType">
<xs:attribute name="BaseMetric" type="xs:string" use="required"/>
<xs:attribute name="CounterInstance" type="xs:string" use="required"/>
<xs:attribute name="Calculation" type="MetricCalculation" use="required"/>
</xs:extension>
</xs:complexContent>
</xs:complexType>
</xs:schema>

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Name used to refer to the metric in Windows PowerShell commands.</td>
</tr>
<tr>
<td>DisplayName</td>
<td>Name displayed in heat map and performance charts.</td>
</tr>
<tr>
<td>SampleRate</td>
<td>Rate at which counter is sampled and refreshed on the heat map.</td>
</tr>
<tr>
<td>StoreRate</td>
<td>Rate at which counter is stored and displayed on performance charts.</td>
</tr>
<tr>
<td>Description</td>
<td>Description of the metric.</td>
</tr>
<tr>
<td>Unit</td>
<td>Unit of the metric value.</td>
</tr>
</tbody>
</table>
Attribute | Description
--- | ---
MetricTarget | Where the metric is collected. When the MetricTarget is **Cluster**, it is displayed in the Cluster Overall charts under **Charts and Reports**. When the MetricTarget is **ComputeNode**, it is displayed on heat map and Compute Node performance charts. When the MetricTarget is **HeadNode**, it is still displayed under **Charts and Reports**.
Minimum, Maximum | Metric value range. This is used to define heat map and performance chart ranges.
PerformanceCounterMetric: Category, Counter; Instance | Performance counter definition as shown in perfmon. If **Counter** and **Instance** are not defined, all instances are displayed on performance charts, and the average is displayed on the heat map.
HardwareMetric: SensorType; SensorInstance | Hardware counter definition as defined by WMI. If not defined, all instances are displayed on performance charts, and the average is displayed on the heat map.
CalculatedMetric: BaseMetric; CounterInstance; Calculation | Defines the formula for calculating the counter.

Example: XML file to add percent CPU Idle Time counter to Heat Map and Performance Charts

```xml
<?xml version="1.0" encoding="utf-8"?>
<Metrics xmlns:xsi=http://www.w3.org/2001/XMLSchema-instance
xmlns:xsd=http://www.w3.org/2001/XMLSchema
  <PerformanceCounterMetric
    Name="CPUIdleTime"
    DisplayName="CPU Idle Time (%)"
    SampleRate="Second"
    StoreRate="Minute"
    Description="Percentage CPU Idle Time"
    MetricTarget="ComputeNode"
    Minimum="0"
    Maximum="100"
    Category="Processor"
    Counter="% Idle Time"
  />
</Metrics>
```
Instance="_Total"/>
</Metrics>