IBM Tivoli Netcool Performance Manager Big Data Extension 1.4.3
Document Revision R2E1

Big Data Extension Overview

IBM
Before using this information and the product it supports, read the information in "Notices" on page 25.
## Contents

**About this information** .................................................. v
- Intended audience ......................................................... v
- Service Management Connect ........................................ v
- Tivoli Netcool Performance Manager technical training .......... v
- Support information ..................................................... v

**Chapter 1. Overview** .................................................. 1

**Chapter 2. Tivoli Netcool Performance Manager Big Data Extension architecture** ............................................... 3
- Foundation services ................................................... 5
- Manager ................................................................. 5

**Chapter 3. Platform support** .......................................... 21
- Suggested node and services layout ................................ 21
- Cluster behavior ......................................................... 22

**Notices** ........................................................................ 25
- Trademarks ................................................................. 27
- Terms and conditions for product documentation ................ 28

- Storage ................................................................. 5
- Entity Analytics ......................................................... 6
- UI ................................................................. 7
- Entity Metric services .................................................. 19
- Tivoli Netcool Performance Manager Collector ................. 19

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About this information

This information provides general overview and benefits of IBM® Tivoli® Netcool® Performance Manager Big Data Extension software.

Intended audience

The intended audiences for this information are as follows:

- Managers and others who track wireline network performance metrics and want to take the advantages that the Big Data Extension offers on the existing Tivoli Netcool Performance Manager system.
- Technicians and engineers who use the Tivoli Netcool Performance Manager - wireline software to manage and analyze network performance.

Required skills and knowledge

Readers need to be familiar with the following:

- Hadoop-based Big Data architecture
- IBM BigInsights 4.2
- Tivoli Netcool Performance Manager - Wireline component

Service Management Connect

Connect, learn, and share with Service Management professionals: product support technical experts who provide their perspectives and expertise.


Use Service Management Connect in the following ways:

- Become involved with transparent development, an ongoing, open engagement between other users and IBM developers of Tivoli products. You can access early designs, sprint demonstrations, product roadmaps, and prerelease code.
- Connect one-on-one with the experts to collaborate and network about Tivoli and the Network and Service Assurance community.
- Read blogs to benefit from the expertise and experience of others.
- Use wikis and forums to collaborate with the broader user community.

Related information:

Tivoli Netcool Performance Manager 1.4 community on developerWorks

Tivoli Netcool Performance Manager technical training

For Tivoli Netcool Performance Manager technical training information, see the following Tivoli Netcool Performance Manager Training website at: https://tnpmsupport.persistentsys.com/training

Support information

If you have a problem with your IBM software, you want to resolve it quickly. IBM provides the following ways for you to obtain the support you need:
Online

IBM Support Assistant
The IBM Support Assistant is a free local software serviceability workbench that helps you resolve questions and problems with IBM software products. The Support Assistant provides quick access to support-related information and serviceability tools for problem determination. To install the Support Assistant software, go to [http://www.ibm.com/software/support/isa](http://www.ibm.com/software/support/isa)

Troubleshooting Guide
For more information about resolving problems, see the problem determination information for this product.
Chapter 1. Overview

Big Data Extension for Tivoli Netcool Performance Manager - Wireline component provides comprehensive and scalable visibility on performance data. Big Data Extension is based on simplified microservice orchestration, configuration, and management on Apache Ambari.

Big Data Extension has the following features:

**Hadoop - based Big Data Extension**
It uses IBM Open Platform with Apache Spark and Apache Hadoop free distribution, which is 100 percent Apache Foundation open source components to innovate quickly with Big Data. The IBM Open Platform with Apache Spark and Apache Hadoop has the following features:

- Spark in-memory distributed compute engine for dramatic performance increases over MapReduce.
- Ambari operational framework for provisioning, managing and monitoring Apache Hadoop clusters.

**Enhanced scaling**
Ambari makes Hadoop management simpler with an intuitive, easy-to-use Hadoop management web UI backed by its RESTful APIs. Add or remove nodes from Big Data cluster according to your computing load based on performance entity metric records per hour.

**Lower performance data latency**
You have more flexible access to your performance data with low latency. Data latency at DataChannel stage can be eliminated by extracting the data into Kafka bus. It provides real-time bulk data extraction.

**New storage architecture**
New storage technology based on column-store data warehouse for large capacity and fast access.

**Flexible data retention periods**
Configure to retain your raw and aggregated performance data for flexible periods. Retention periods are computed for any period and granularity by using raw and pre-aggregated values.

**Entity Analytics**
Analytics engine is used for performance data aggregations.

**Tivoli Netcool Performance Manager Collector**
Tivoli Netcool Performance Manager Collector Service collects the metric timeseries data, inventory, and metadata from a configured remote Tivoli Netcool Performance Manager wireline system. The collected data in the form of Binary Object Format (BOF) files from DataLoad are written to a configured Kafka cluster so it can be processed by other services.
Chapter 2. Tivoli Netcool Performance Manager Big Data Extension architecture

The Big Data Extension is Hadoop-based, simplified microservice orchestration, configuration, and management system that is supported on Apache Ambari. The Big Data Extension gives additional capability to the existing Wireline component in providing comprehensive, flexible, and scalable performance data management for complex, multi-vendor, multi-technology networks.

The following diagram shows how data is flowing through the various components and services in Big Data Extension:
IBM Open Platform with Apache Spark and Apache Hadoop

IBM BigInsights together with IBM Open Platform with Apache Spark and Apache Hadoop (IOP) provide a software platform for discovering, analyzing, and visualizing data from disparate sources. You can use this software to help process and analyze the volume, variety, and velocity of data that continually enters your organization every day. Big Data Extension is a service extension that can be installed on the IBM Open Platform with Apache Spark and Apache Hadoop stack.

The features of IOP that are used in Big Data Extension:

• 100% open source Hadoop through IBM Open Platform with Apache Spark and Apache Hadoop
• Default support for rolling upgrades for individual Hadoop services
• Support for long-running applications within YARN for enhanced reliability
• Integrated with Apache Spark for extra processing power and dramatic performance increase
• Apache Ambari operational framework. Apache Ambari is an open framework for provisioning, managing, and monitoring Apache Hadoop clusters. Ambari provides an intuitive and easy-to-use Hadoop management web UI that is supported by its collection of tools and APIs to simplify the operation of Hadoop clusters.
• Essentially includes the following open source technologies for working with Big Data Extension:
  – Ambari
  – HDFS
  – Kafka
  – Spark
  – MapReduce
  – YARN
  – ZooKeeper

Big Data Extension services

Big Data Extension components run on microservice architecture that has the software application as a suite of independently deployable, small modular services in which each service runs a unique process, and communicates through a well-defined, lightweight mechanism. In this case, Kafka message bus is used for communication.

Related information:

IBM Tivoli Netcool Performance Manager on IBM Knowledge Center
Introduction to IOP and BigInsights 4.2
HDFS Architecture
Foundation services

Foundation services are the basic infrastructure services that are used by multiple other Big Data Extension services.

Manager

Monitors the status and health of all Big Data Extension microservices.

Some salient features of the Manager service:

- Periodically monitors the status of all Big Data Extension services.
- Sends metrics to Ambari.
- Provides the `tnpm-bde-cmd` command line interface to start, stop, and check the status of selected Big Data Extension microservices from Ambari.
- Copies the Spark and Hadoop configuration files to HDFS for the first time after the installation is complete.

Storage

There is a need for advanced database technology to handle high data volumes in large enterprise and service provider infrastructures.

Big Data Extension uses an indigenous columnar storage database that provides a mechanism for well-organized incremental storage of traffic data values with time intervals. The storage service operates as a Cluster Singleton, which provides resiliency capability.

The Big Data Extension uses Hadoop and Spark, which is a fully integrated infrastructure solution with integrated cluster management and analytics software that is optimized for Hadoop and Spark based workloads.

Hadoop comprises two main components: the Hadoop Distributed File System (HDFS), which is distributed Java based file system for storing large volumes of data and a programming paradigm, which is known as Hadoop MapReduce.

Big Data Extension has a built-in database that has the following features:

- Compressed, columnar data storage that manages the data that is collected by Big Data Extension.
- Provides inbound APIs to insert and update data.
- Maintains HDFS file-store, aging data, query coordination.
- Periodically consolidates storage files and purging old data with the help of Storage optimizer.
- Queries are delegated to spark for scalability. All fact data is stored as parquet files in compressed, columnar format, which can be processed by spark efficiently.

Some key benefits of Big Data Extension storage:

- Runs on high-performance columnar storage, which supports high-bandwidth queries and analysis.
- All data that is stored in Big Data Extension storage component that supports high inserts and query rate.
- A fast database with efficient management of memory usage with low latency.
Storage optimization

Big Data Extension database uses storage optimization to improve the overall performance.

Storage optimization is used to ensure that existing storage resources are working in an efficient and cost-effective way. It helps to minimize the data-fetching period and reduces storage hardware and administration costs.

Data storage

The database tables that store specific types of Tivoli Netcool Performance Manager data in Big Data Extension.

The following table lists the types of data that are stored in the database tables:

Table 1. Big Data Extension database schema

<table>
<thead>
<tr>
<th>Database schema</th>
<th>Type of data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inventory</td>
<td>Tivoli Netcool Performance Manager inventory related metadata that is collected from Tivoli Netcool Performance Manager database:</td>
</tr>
<tr>
<td></td>
<td>• Tivoli Netcool Performance Manager properties information.</td>
</tr>
<tr>
<td></td>
<td>• Tivoli Netcool Performance Manager formula or metric names.</td>
</tr>
<tr>
<td></td>
<td>• Tivoli Netcool Performance Manager entity or resource names and parent entity names.</td>
</tr>
<tr>
<td>Entity Metric</td>
<td>Big Data Extension raw data.</td>
</tr>
<tr>
<td></td>
<td>This information is mainly from the parsed BOF data that is enriched.</td>
</tr>
<tr>
<td></td>
<td>Entity Metric aggregated data of 30 minutes, 6 hours and daily.</td>
</tr>
<tr>
<td></td>
<td>Big Data Extension Entity Metric aggregation status.</td>
</tr>
</tbody>
</table>

Entity Analytics

Entity Analytics service is used to perform aggregation of RAW performance data that is collected from Tivoli Netcool Performance Manager Wireline system.

The data for each sub-channels are aggregated separately. The Entity Analytics Service performs 30 minutes, 6 hours, and 1-day aggregations.

The Tivoli Netcool Performance Manager Collector writes the entity metric RAW records in parquet file format on HDFS every minute and sends an aggregation status message to indicate that a new RAW data is available. It checks and triggers the next aggregation when the data is available.

It refines the raw data, filters the results, and aggregates the KPI values. The values are aggregated by sum, min, max, and count. The results are then stored in Big Data Extension Storage Service.

The Entity Analytics Service operates as a cluster singleton. It delegates queries to Apache Spark to achieve faster query response time. The Entity Analytics Service
maintains a window for each source or feed and submits an aggregation job to the Spark application. Feed identifies the specific FTE that is collecting the performance data.

**Entity Metric Aggregated data**

All Tivoli Netcool Performance Manager raw data is stored up to 90 days as the initial default configuration of Big Data Extension in the Entity Metric raw database table.

The most recent data is available with 30-minutes aggregation. Data are populated from the 30-minutes, 6-hours aggregation or 1-day aggregation table aggregation table depending on the selection of time period and aggregation type from the relevant reports.

**UI**

The UI service operates in cluster load balancing mode. Each instance of UI is fully operational and capable of serving requests.

The UI Service provides the required REST APIs that pull data from the Storage Service for federation. A HTTP/HTTPS load balancer can be deployed between a single instance of Big Data Extension and a cluster of UI instances. The load balancer can be configured to present a single IP address for the pool of UI instances. Load is distributed by the load balancer and if one or more UI instances fail, the others pick up the load.

The configuration settings are available on Ambari server from Services > TNPM BDE > Settings under Web Services pane.

**REST API definitions**

The APIs in Big Data Extension that give access to the database data for constructing the dashboards.

Using Big Data Extension REST API commands requires the same permissions as using the web interface. These REST APIs are available so that you can retrieve the data outside of the web interface.

Each REST resource contains information such as URLs, functions, parameters, descriptions, sample input, and output data.

**Common REST API status codes**

<table>
<thead>
<tr>
<th>HTTP status code</th>
<th>Generic description</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>Success</td>
</tr>
<tr>
<td>400</td>
<td>Failure</td>
</tr>
</tbody>
</table>

**Metric APIs:**

REST APIs that are related to Tivoli Netcool Performance Manager performance metric data that is collected by Tivoli Netcool Performance Manager Collector Service and analyzed by Entity Analytics Service.
**metrics:**

Provides a list of metrics that are available for specified entities and time frame.

**Base URL**

With help of this API, information is queried and retrieved from ENTITY_METRIC.RAW table.

http://[host]:[port]/service/dataset/metrics


**Method**

The supported request type.

HTTP GET

**URL parameters**

<table>
<thead>
<tr>
<th>Name</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>entities</td>
<td>No</td>
<td>Comma-separated list of subelement IDs that are specified as entity ID.</td>
</tr>
<tr>
<td>entityNames</td>
<td>No</td>
<td>Comma-separated list of subelement names. For example, 10.55.239.40_If&lt;994&gt;</td>
</tr>
<tr>
<td>start</td>
<td>No</td>
<td>The start time for which performance metric data must be returned.</td>
</tr>
<tr>
<td>end</td>
<td>No</td>
<td>The end time for which performance metric data must be returned.</td>
</tr>
<tr>
<td>parents</td>
<td>No</td>
<td>Comma-separated list of element node ID.</td>
</tr>
<tr>
<td>parentNames</td>
<td>No</td>
<td>Comma-separated list of element names. For example, 10.55.239.40.</td>
</tr>
<tr>
<td>properties</td>
<td>No</td>
<td>Properties Filter in format '&lt;&quot;propertyName&quot;&gt;='&lt;&quot;propertyValue'&gt;. Not: Property name is case-sensitive. For example, 'DiscardsReported’='true' and 'sysName’='10.55.239.40'</td>
</tr>
<tr>
<td>time</td>
<td>No</td>
<td>Specific time values:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• last-hour</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• last-day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• last-week</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• last-month</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• last-year</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Note:</strong> You need either start/end or time parameters in the URL.</td>
</tr>
<tr>
<td>scope</td>
<td>Yes</td>
<td>Scope of the resource that is ibm-tnpm-wln.</td>
</tr>
</tbody>
</table>
Sample URLs
&time=last-month&scope=ibm-tnpm-wln

Note:
• At least one or more of the following parameters must be provided:
  – entities
  – parents
  – entityNames
  – parentNames
  – properties
• time or a combination of start and/or end must be provided.
• The start and end parameters must be used together. The time parameter
  supersedes start and end if they are all present in the URL.
• Supported operators for properties filter are as follows:
  – ,
  – =
  – IN
  – LIKE
  – AND
  – OR
• For example:
  properties="sysName"='10.55.239.40' AND "If"='897'
  properties="sysName"='10.55.239.40' AND "If" IN ('897','898')
  properties="sysName" like '10.55.239.%25' AND "If"='897'

  Note: “%” is reserved keyword. It must be encoded with %25.

Response
The results are returned as JSON data that contains an array of the following
fields:

<table>
<thead>
<tr>
<th>Element Name</th>
<th>Data type</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>metric</td>
<td>string</td>
<td>The metric name</td>
<td>AP^PVLNE^BrixRTT</td>
</tr>
<tr>
<td>metricId</td>
<td>long</td>
<td>The metric id for the associated time and metric value.</td>
<td>2118</td>
</tr>
<tr>
<td>scope</td>
<td>string</td>
<td>Scope of the resource</td>
<td>It is always ibm-tnpm-wln.</td>
</tr>
</tbody>
</table>

JSON code:
```json
[
  {
    "metric":"AP^PVLNE^BrixRTT",
    "metricId":100001497,
    "scope":"ibm-tnpm-wln"
  },
  {
    "metric":"AP^Generic^Universal^Throughput^Outbound Throughput (bps)",
    "metricId":2209,
    "scope":"ibm-tnpm-wln"
  },
  {
    "metric":"AP^Generic^Universal^Throughput^Outbound Throughput (bps)",
    "metricId":2209,
    "scope":"ibm-tnpm-wln"
  }
]
```
"metric":"AP~Specific~SNMP~Cisco~Interfaces~Inbound Ignored",
"metricId":13910,
"scope":"ibm-tpnm-wln"
},
{
"metric":"AP~Generic~Universal~Errors~Inbound Errors (PDUs)",
"metricId":2214,
"scope":"ibm-tpnm-wln"
},
{
"metric":"AP~Generic~Interface~Inbound Unicast (pps)",
"metricId":10087,
"scope":"ibm-tpnm-wln"
},
{
"metric":"AP~Generic~Universal~Throughput~Outbound Volume (octets)",
"metricId":2211,
"scope":"ibm-tpnm-wln"
},
{
"metric":"AP~Generic~Universal~Congestion Discards~Inbound Discarded (PDUs)",
"metricId":2218,
"scope":"ibm-tpnm-wln"
},
{
"metric":"AP~Specific~SNMP~Cisco~Interfaces~Inbound Giants",
"metricId":13909,
"scope":"ibm-tpnm-wln"
},
{
"metric":"AP~Generic~Universal~Congestion Discards~Outbound Discarded (PDUs)",
"metricId":2219,
"scope":"ibm-tpnm-wln"
},
{
"metric":"AP~Generic~Interface~Outbound Multicast (pps)",
"metricId":10090,
"scope":"ibm-tpnm-wln"
}
]

Error Response

{"errorMesg":"Either entities, parents, entityNames, parentNames or properties should be provided"}
{"errorMesg": "Invalid start, end and granularity combination. Granularity : 1 minute StartMs : 1568373360000 endMs : 1468375200000"}

summary:

Provides a summary of metric data.

URL

With help of this API, information is queried and retrieved from the following tables:
- ENTITY_METRIC.RAW
- ENTITY_METRIC.AGG_001DAY
- ENTITY_METRIC.AGG_006HR
- ENTITY_METRIC.AGG_030MIN

http://[host]:[port]/service/dataset/metric/summary
Method

The supported request type.
HTTP GET

URL parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>entities</td>
<td>No</td>
<td>Comma-separated list of entity IDs. For example, 212090374, 212090395.</td>
</tr>
<tr>
<td>entityNames</td>
<td>No</td>
<td>Comma-separated list of subelement names. For example, 10.55.239.40_If&lt;994&gt;</td>
</tr>
<tr>
<td>metrics</td>
<td>Yes</td>
<td>Comma-separated list of metric IDs or metric names and their aggregations.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For example, AP&quot;PVLINE&quot;BrixRTT, AP&quot;Generic&quot;Universal&quot;Throughput&quot;Outbound</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Throughput (bps).</td>
</tr>
<tr>
<td>parents</td>
<td>No</td>
<td>Comma-separated list of element node ID. For example, 212090258</td>
</tr>
<tr>
<td>parentNames</td>
<td>No</td>
<td>Comma-separated list of device names. For example, 10.55.239.42, 10.55.239.4</td>
</tr>
<tr>
<td>Properties</td>
<td>No</td>
<td>Properties Filter in format &quot;&lt;propertyName&gt;=&lt;propertyValue&quot;&gt;. Note: Property</td>
</tr>
<tr>
<td></td>
<td></td>
<td>name is case-sensitive. For example, &quot;DiscardsReported&quot;='true' and &quot;sysName&quot;='10.55.239.40'</td>
</tr>
<tr>
<td>start</td>
<td>No</td>
<td>The start time for which performance data must be returned.</td>
</tr>
<tr>
<td>end</td>
<td>No</td>
<td>The end time for which performance data must be returned. Note: start and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>end parameters must be used together.</td>
</tr>
<tr>
<td>time</td>
<td>No</td>
<td>Specific time values:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• last-hour</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• last-day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• last-week</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• last-month</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• last-year</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note: You need either start/end or time parameters in the URL.</td>
</tr>
<tr>
<td>granularity</td>
<td>No</td>
<td>Granularity for which the data must be aggregated. For example, RAW,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30-minute, 5-days</td>
</tr>
<tr>
<td>sort</td>
<td>No</td>
<td>Metric expression that defines the sort order of the records. Only one</td>
</tr>
<tr>
<td></td>
<td></td>
<td>metric is allowed with the sort expression. For example, +sum(AP&quot;PVLINE&quot;BrixRTT).</td>
</tr>
</tbody>
</table>

Chapter 2. Tivoli Netcool Performance Manager Big Data Extension architecture 11
<table>
<thead>
<tr>
<th>Name</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>count</td>
<td>No</td>
<td>Number of entities summary that must be returned per page. When this parameter is combined with sort, they provide TopN / BottomN functions. Default value -1 returns all available records. For example, count =10.</td>
</tr>
<tr>
<td>page</td>
<td>No</td>
<td>The index of the page for data display. This parameter is supplied with count parameter to indicate page size. By default, it is 1.</td>
</tr>
<tr>
<td>scope</td>
<td>Yes</td>
<td>Scope of the resource. For example, ibm-tnpm-wln</td>
</tr>
</tbody>
</table>

**Sample URLs**


**Note:**

- At least one or more of the following parameters must be provided:
  - entities
  - parents
  - entityNames
  - parentNames
  - properties
- time or a combination of start and/or end must be provided.
- The start and end parameters must be used together. The time parameter supersedes start and end if they are all present in the URL.
- count must be provided with sort.
- The metric that is used in sort parameter must be available in the expression that is used in metrics parameter. If metric ID is used in metrics parameter, sort also must use metric ID and not the metric name and vice versa.
- when sort is not provided, output is sorted by entities and the rank shows as zero.
- Supported operators for properties filter are as follows:
  - ,
  - =
  - IN
  - LIKE
  - AND
  - OR
- For example:

  properties="sysName='10.55.239.40'" AND "If"='897'
  properties="sysName='10.55.239.40'" AND "If" IN ('897','898')
  properties="sysName" like '%10.55.239.%25' AND "If"='897'

**Note:** "%" is reserved keyword. It must be encoded with %25.
Response

The results are returned as JSON data that contains an array of the following fields:

<table>
<thead>
<tr>
<th>Element Name</th>
<th>Data type</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>total</td>
<td>number</td>
<td>Total number of records available</td>
<td>1</td>
</tr>
<tr>
<td>page</td>
<td>number</td>
<td>Current page number</td>
<td>1</td>
</tr>
<tr>
<td>count</td>
<td>number</td>
<td>Number of records in the page</td>
<td>1</td>
</tr>
<tr>
<td>items</td>
<td>list</td>
<td>List of metric values. The entity that is associated with the time and metric value.</td>
<td></td>
</tr>
<tr>
<td>Element Name</td>
<td>Data type</td>
<td>Description</td>
<td>Example</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------</td>
<td>------------------------------------------------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>parent</td>
<td>number</td>
<td>The element ID that is associated with metric value.</td>
<td>200135335</td>
</tr>
<tr>
<td>scope</td>
<td>string</td>
<td>Scope of the resource.</td>
<td>ibm-tnpm-wln</td>
</tr>
<tr>
<td>startTimestamp</td>
<td>number</td>
<td>The start time that is associated with the metric value</td>
<td>1470897984841</td>
</tr>
<tr>
<td>endTimestamp</td>
<td>number</td>
<td>The end time that is associated with the metric value</td>
<td>1470901584841</td>
</tr>
<tr>
<td>rank</td>
<td>number</td>
<td>The rank (1-N) of the record relative to all other entities based on sort. Defaults to 0 if sort parameter is not provided.</td>
<td>0</td>
</tr>
<tr>
<td>entityName</td>
<td>string</td>
<td>Subelement name</td>
<td>10.55.239.4_If&lt;14&gt;</td>
</tr>
<tr>
<td>metricValues</td>
<td>list</td>
<td>The list metric names and their values.</td>
<td></td>
</tr>
<tr>
<td>metric</td>
<td>string</td>
<td>The metric expression for the associated time and metric value.</td>
<td>AP*Generic</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&quot;Universal&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&quot;Availability&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Interface Availability (percent)</td>
</tr>
<tr>
<td>metricId</td>
<td>long</td>
<td>The metric ID for the associated time and metric value.</td>
<td>2955</td>
</tr>
<tr>
<td>value</td>
<td>number</td>
<td>The metric value for the associated time, entity, and metric expression.</td>
<td>100.0</td>
</tr>
<tr>
<td>parentName</td>
<td>string</td>
<td>Element name</td>
<td>10.55.239.4</td>
</tr>
<tr>
<td>entity</td>
<td>number</td>
<td>Entity ID</td>
<td>200135340</td>
</tr>
</tbody>
</table>

JSON code:

```json
{
  "total":1,
  "page":1,
  "count":1,
  "items": [
    {
      "parent":200135335,
```
"endTimeStamp":1490255636864,
"scope":"ibm-tnpm-wln",
"startTimeStamp":1490252036864,
"rank":0,
"entityName":"10.55.239.4_If<14>",
"metricValues": [
  {
    "metric":"AP~Generic~Universal~Availability~Interface Availability (percent)",
    "value":100.0,
    "metricId":2955
  }
],
"parentName":"10.55.239.4",
"entity":200135340
}

Error Response
{"errorMesg":"Either entities, parents, entityNames, parentNames or properties should be provided"}

{ "errorMesg": "Invalid start, end and granularity combination. Granularity : 1 minute StartMs : 1568373360000 endMs : 1468375200000" }

timeseries:

Provides timeseries entity metric data.

Base URL

With help of this API, information is queried and retrieved from following tables:
- ENTITY_METRIC_RAW
- ENTITY_METRIC.AGG_001DAY
- ENTITY_METRIC.AGG_006HR
- ENTITY_METRIC.AGG_030MIN

http://[host]:[port]/service/dataset/metric/timeseries

Method

The supported request type.
HTTP GET

URL parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Required</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>entities</td>
<td>No</td>
<td>Comma-separated list of subelement IDs that are specified as entity IDs. For example, 212090374, 212090395.</td>
</tr>
<tr>
<td>entityNames</td>
<td>No</td>
<td>Comma-separated list of subelement names. For example, 10.55.239.4_If&lt;1&gt;</td>
</tr>
<tr>
<td>Name</td>
<td>Required</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>----------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>metrics</td>
<td>Yes</td>
<td>Comma-separated names of the metric IDs or metric names, and their aggregation. For example, AP~&quot;Generic&quot;<del>Universal</del>&quot;Errors&quot;~Inbound Errors (PDUs)</td>
</tr>
<tr>
<td>parents</td>
<td>No</td>
<td>Comma-separated list of element IDs. For example, 212090258, 212090256.</td>
</tr>
<tr>
<td>parentNames</td>
<td>No</td>
<td>Comma-separated list of element names. For example, 10.55.239.42, 10.55.239.4.</td>
</tr>
<tr>
<td>properties</td>
<td></td>
<td>Properties Filter in format &quot;&lt;&quot;propertyName&quot;&gt;=&quot;&lt;&quot;propertyValue&quot;&gt;. Note: Property name is case-sensitive. For example, &quot;DiscardsReported&quot;='true' and &quot;sysName&quot;='10.55.239.40'</td>
</tr>
<tr>
<td>start</td>
<td>No</td>
<td>The start time for which performance data must be returned.</td>
</tr>
<tr>
<td>end</td>
<td>No</td>
<td>The end time for which performance data must be returned.</td>
</tr>
<tr>
<td>time</td>
<td>No</td>
<td>The name of the time short cut. For example: • last-hour • last-day • last-week • last-month • last-year</td>
</tr>
<tr>
<td>granularity</td>
<td>No</td>
<td>The granularity of the data for aggregation. For example, raw, 30 minutes, 5-days</td>
</tr>
<tr>
<td>sort</td>
<td>No</td>
<td>How the records must be sorted. Prefix + or - to indicate sort direction. + indicates ascending order and - indicates descending order. For example, +sum(AP~&quot;PVLINE&quot;~BrixRTT)</td>
</tr>
<tr>
<td>scope</td>
<td>Yes</td>
<td>Scope of the resource. For example, ibm-tnpm-wln</td>
</tr>
</tbody>
</table>

**Sample URLs**

&metrics=2209&time=last-day&scope=ibm-tnpm-wln


**Note:**
- At least one or more of the following parameters must be provided:
  - entities
  - parents
- entityNames
- parentNames
- properties

- time or a combination of start and/or end must be provided.
- The start and end parameters must be used together. The time parameter supersedes start and end if they are all present in the URL.
- Sorting is supported on metric, entity and timestamp only.
- Supported operators for properties filter are as follows:
  - ,
  - =
  - IN
  - LIKE
  - AND
  - OR

- For example:
  
  properties="sysName"='10.55.239.40' AND 'If'='897'
  properties="sysName"='10.55.239.40' AND 'If' IN ('897', '898')
  properties="sysName" like '10.55.239.%25' AND 'If'='897'

  Note: "%" is reserved keyword. It must be encoded with %25.

Response

The results are returned as JSON data that contains an array of the following fields:

<table>
<thead>
<tr>
<th>Element Name</th>
<th>Data type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>entity</td>
<td>number</td>
<td>The entity that is associated with the time and metric value</td>
</tr>
<tr>
<td>parent</td>
<td>number</td>
<td>The parent entity ID that is associated with the entity.</td>
</tr>
<tr>
<td>entityName</td>
<td>string</td>
<td>The entity name. The value is defaulted to unknown if enrichment fails.</td>
</tr>
<tr>
<td>parentName</td>
<td>string</td>
<td>The entity's parent name. The value is defaulted to unknown if enrichment fails.</td>
</tr>
<tr>
<td>scope</td>
<td>string</td>
<td>Scope of the resource.</td>
</tr>
<tr>
<td>metricID</td>
<td>Number</td>
<td>Metric ID</td>
</tr>
<tr>
<td>metric</td>
<td>string</td>
<td>The metric name for the associated time and metric value</td>
</tr>
<tr>
<td>timestamp</td>
<td>number</td>
<td>The time that is associated with the metric value.</td>
</tr>
<tr>
<td>value</td>
<td>number</td>
<td>The metric value for the associated time</td>
</tr>
</tbody>
</table>

JSON code:
[ 
{
"parent":200135335,
"metricId":2214,
"timestamp":1490257200000,
"scope":"ibm-tnpm-wln",
"entityName":"10.55.239.4_If<1>",
"parentName":"10.55.239.4",
"metric":"AP"~Generic"Universal"Errors"Inbound Errors (PDUs)",
"entity":200135481,
"value":35465.0
},
{
"parent":200135335,
"metricId":2214,
"timestamp":1490255400000,
"scope":"ibm-tnpm-wln",
"entityName":"10.55.239.4_If<1>",
"parentName":"10.55.239.4",
"metric":"AP"~Generic"Universal"Errors"Inbound Errors (PDUs)",
"entity":200135481,
"value":29313.0
},
{
"parent":200135335,
"metricId":2214,
"timestamp":1490256600000,
"scope":"ibm-tnpm-wln",
"entityName":"10.55.239.4_If<1>",
"parentName":"10.55.239.4",
"metric":"AP"~Generic"Universal"Errors"Inbound Errors (PDUs)",
"entity":200135481,
"value":26121.0
},
{
"parent":200135335,
"metricId":2214,
"timestamp":1490257800000,
"scope":"ibm-tnpm-wln",
"entityName":"10.55.239.4_If<1>",
"parentName":"10.55.239.4",
"metric":"AP"~Generic"Universal"Errors"Inbound Errors (PDUs)",
"entity":200135481,
"value":32263.0
},
{
"parent":200135335,
"metricId":2214,
"timestamp":1490256000000,
"scope":"ibm-tnpm-wln",
"entityName":"10.55.239.4_If<1>",
"parentName":"10.55.239.4",
"metric":"AP"~Generic"Universal"Errors"Inbound Errors (PDUs)",
"entity":200135481,
"value":30339.0
}
] 

Error Response

{"errorMesg":"Either entities, parents, entityNames, parentNames or properties should be provided"}

{"errorMesg":"Invalid start, end and granularity combination. Granularity : 1 minute StartMs : 1563733600000 endMs : 1468375200000"}
Entity Metric services

Services that are required for Big Data Extension entity metric data that is collected, aggregated, and monitored.

Tivoli Netcool Performance Manager Collector

Tivoli Netcool Performance Manager Collector is responsible for collecting Tivoli Netcool Performance Manager data in Binary Object Format (BOF) and inventory-related metadata.

Tivoli Netcool Performance Manager Collector handles the data collection as follows:

BOF Collector Service

BOF Collector service collects the BOF data from the Tivoli Netcool Performance Manager DataChannel FTE directories by using SFTP network protocols. The collector service also polls periodically for the BOF data location configurations from DataMart.

BOF Collector service polls the FTE directories periodically and checks for new BOF data since the last poll.

The BOF Collector Service schedules the BOF data collection after these conditions are met:

- If any new metric data is available in the FTE locations.
- If the BOF data must be enriched with metadata.

The collection of metadata is scheduled for every 30 seconds for an update.

The BOF files are pulled by the service if the following conditions are met:

- New files
- Files that comply with BOF file naming convention.
- The file's time stamp is within the configured `collector.tnpm.ftp.look-back-days` parameter.

FTP or SFTP service picks the BOF data that holds the time stamp for the duration that is set with `collector.tnpm.ftp.look-back-days` parameter.

If you want to configure the `collector.tnpm.ftp.look-back-days` parameter apart from the default value, see Configuring TivoliNetcool Performance Manager - BigData Extension.

The individual BOF file is analyzed, validated, and converted into timeseries records with enriched information with fully qualified metric names. These timeseries enriched records are written as parquet files in HDFS and Big Data Extension Storage.

Metadata Collector Service

Metadata Collector Service collects the Tivoli Netcool Performance Manager inventory-related metadata from Tivoli Netcool Performance Manager Database by using JDBC SQL queries.

Metadata represents data such as:

- Tivoli Netcool Performance Manager properties information by using entity ID.
• Tivoli Netcool Performance Manager formula or metric names (MID). The formula names are queried as fully qualified names (FQN).
• Tivoli Netcool Performance Manager entity or resource names and parent entity names.

The individual BOF file is analyzed, validated, and converted into timeseries records with enriched information with fully qualified metric names. These timeseries enriched records are written as parquet files in HDFS and Big Data Extension Storage.

Load Balancing

Tivoli Netcool Performance Manager Collector Service is enabled with an in-built load balancing mechanism and fail-over capability.
Chapter 3. Platform support

All Big Data Extension services and components must be installed on Red Hat Linux, Version 7.2 only.

Co-location rules

While it is possible to deploy all the Big Data Extension and its associated components on a single instance for evaluation purpose. Typically, you must have at least three hosts; one master Ambari server, and two Ambari agent slaves for Tivoli Netcool Performance Manager cluster.

Suggested node and services layout

Use this reference architecture to understand how to configure your IBM Open Platform with Apache Spark and Apache Hadoop and Tivoli Netcool Performance Manager Big Data Extension services in your cluster.

During the cluster deployment, the Big Data Extension service layer and application binaries are deployed to the Ambari agent hosts. The Big Data Extension services are installed in the default location, that is, /opt/IBM/tnpm-bde and the IBM Open Platform with Apache Spark and Apache Hadoop components to /usr/iop/current directory.

Multi-node cluster deployment

It is suggested that you have at least one Ambari server node and the rest of them as Ambari agent nodes. In the diagram, HOST A is the Ambari server and HOST B, C, and D are the Ambari agent nodes.

Note: Make sure that you install Manager Service and Kafka Broker in all Ambari agent nodes.
Note: Because Zookeeper requires a majority, it is best to use an odd number of machines. For example, with four machines ZooKeeper can handle the failure of a single machine; if two machines fail, the remaining two machines do not constitute a majority. However, with five machines ZooKeeper can handle the failure of two machines.

Related information:

Suggested services layout for IBM Open Platform with Apache Spark and Apache Hadoop and BigInsights value-added services

Cluster behavior

Provides the relevance between Big Data Extension and its related services with the node behavior in a cluster.

Big Data Extension supports the following types of node behavior.

Cluster Singleton
A clustered singleton service (also known as an HA singleton) is a service that is deployed on multiple nodes in a cluster, but is providing its service on only one of the nodes. The node that is running the singleton service is typically called the oldest node.

Load Balancing
Load balancing improves the distribution of workloads across multiple nodes where each of the node serves different set of clients that are mutually exclusive.

Managed Load Balancing
Managed load balancing acts as a node to monitor the load balancing activities. The manager node monitors and distributes the Load Balancing among the active nodes.

Data Replication
A replication strategy determines the nodes where data replicas are placed. The replicas on multiple nodes are stored to ensure reliability and fault tolerance. Data Replication requires at least two or more nodes that are configured for the supported services.

Monitoring Nodes
A service that is installed on each node in a cluster to monitor and provide information on the installed nodes.

Single Instance
A service that is installed on a single node in a cluster that provides its service across all nodes.

The following table lists the service components and their node behavior. Use the following information as guidance to set up your environment.
<table>
<thead>
<tr>
<th>Services</th>
<th>Type</th>
<th>Service Components</th>
<th>Cluster node behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big Data Extension</td>
<td>Master</td>
<td>Manager</td>
<td>Monitoring Nodes</td>
</tr>
<tr>
<td></td>
<td>Slave</td>
<td>Entity Analytics</td>
<td>Cluster Singleton</td>
</tr>
<tr>
<td></td>
<td>Slave</td>
<td>Tivoli Netcool Performance</td>
<td>Cluster Singleton</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manager Collector</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Slave</td>
<td>Storage</td>
<td>Cluster Singleton</td>
</tr>
<tr>
<td></td>
<td>Slave</td>
<td>UI</td>
<td>Load Balancing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>For more information, see UI Service in TivoliNetcool Performance Manager - BigData Extension Overview.</td>
</tr>
<tr>
<td>HDFS</td>
<td>Master</td>
<td>NameNode</td>
<td>Single Instance</td>
</tr>
<tr>
<td></td>
<td>Master</td>
<td>SNameNode</td>
<td>Single Instance</td>
</tr>
<tr>
<td></td>
<td>Slave</td>
<td>DataNode</td>
<td>Data Replication</td>
</tr>
<tr>
<td>YARN</td>
<td>Master</td>
<td>Timeline Server</td>
<td>Single Instance</td>
</tr>
<tr>
<td></td>
<td>Master</td>
<td>Resource Manager</td>
<td>Single Instance</td>
</tr>
<tr>
<td></td>
<td>Slave</td>
<td>Node Manager</td>
<td>Managed Load Balancing</td>
</tr>
<tr>
<td>ZooKeeper</td>
<td>Master</td>
<td>ZooKeeper</td>
<td>Data Replication</td>
</tr>
<tr>
<td>Ambari Metrics</td>
<td>Master</td>
<td>Collector</td>
<td>Single Instance</td>
</tr>
<tr>
<td></td>
<td>Slave</td>
<td>Monitor</td>
<td>Monitoring Nodes</td>
</tr>
<tr>
<td>Kafka</td>
<td>Master</td>
<td>Kafka Broker</td>
<td>Data Replication</td>
</tr>
<tr>
<td></td>
<td>Master</td>
<td>Kafka Connect</td>
<td>Single Instance</td>
</tr>
<tr>
<td>MapReduce2</td>
<td>Master</td>
<td>History Server</td>
<td>Single Instance</td>
</tr>
</tbody>
</table>
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